WILDERNESS, WATER, AND CLIMATE CHANGE

BY

SANDRA ZELLMER*

As the nation searches for climate mitigation and adaptation strategies, the pressure to develop water resources within wilderness areas and to exploit the timber, forage, wildlife, fish, and other virtually untapped components of wilderness will become more acute. This Article makes the case that managers and legislatures should not yield to this pressure and argues that, if anything, the need to preserve untrammeled wilderness characteristics is just as imperative today as it was in 1964 when the Wilderness Act was passed. The Article examines the potency of the Wilderness Act and a trio of federal water law doctrines—federally reserved water rights, the Wild and Scenic Rivers Act, and the Clean Water Act—and finds that, while no single one of these doctrines can accomplish the task alone, if implemented in a more complementary fashion, together they can be effective in protecting the wild.

* Robert B. Daugherty Professor of Law, University of Nebraska College of Law. Thanks go to John Anderies for his contributions to a chapter on a related topic: *Wilderness Preserves: Still Relevant and Resilient After All These Years*, *in* RESILIENCE AND LAW (forthcoming 2012), and Robert Glicksman for his insights on antidegradation, and for the invitation to speak about adaptation and wilderness at a Center for Progressive Reform workshop at George Washington University National Law Center. The author also thanks Michael Blumm for the invitation to discuss this topic at the Twenty-First Century Water Law Symposium at Lewis & Clark Law School.

I. INTRODUCTION

Federally designated wilderness areas provide substantial benefits to society, including beauty, quiet, and peaceful sanctuary. Unparalleled opportunities for low-impact, personally challenging recreational opportunities are found in wilderness areas as well. The ecological benefits and services provided by wilderness areas are at least equally compelling: watershed protection, high quality habitat, migration corridors for climate-threatened species, and carbon sequestration by intact vegetation and soils, just to name a few.

Although preserving wilderness areas has served the nation well in the past, it is not clear that preservation will continue to be an appropriate conservation strategy in the face of rapid and dramatic changes in climate. Scientists and policy makers are beginning to embrace more adaptive land management approaches in hopes of promoting sustainable local, regional, and global responses to a range of potential climate scenarios.[1] In some places, adaptation plans will include active intervention to foster transitions to more resilient watersheds and ecological communities. Meanwhile, the pressure to develop water resources within and near wilderness areas and to exploit the timber, forage, game species, fish, and other virtually untapped components of wilderness will become more acute as the nation searches for viable climate mitigation and adaptation strategies.

For wilderness, climate change raises a compelling question: Does it still make sense to protect wilderness areas from all deliberate forms of human intervention and development? More specifically, what if anything should be done to preserve headwaters, streams, lakes, wetlands, and aquifers within wilderness areas as temperatures, seasons, and other climate-affected characteristics change?

This Article focuses on the continuing relevance of preserving intact wilderness areas and the watersheds and stream flows within them. It concludes that the importance of protecting wilderness and its "community of life"[2] from intervention and development will only increase as the climate changes. Wilderness areas provide large blocks of contiguous habitat and

[1] *See, e.g.*, Melinda Harm Benson, *Adaptive Management Approaches by Resource Management Agencies in the United States: Implications for Energy Development in the Interior West*, 28 J. ENERGY & NAT. RESOURCES L. 87, 89 (2010) (arguing that adaptive management is "gaining influence" and is a "positive step" in natural resource management, and recommending adaptive management be applied to energy leasing on federal lands).

[2] Wilderness Act, 16 U.S.C. § 1131(c) (2006) (defining wilderness partially as a "community of life").

undisturbed migration corridors for climate-threatened species.[3] Wilderness watersheds sustain fish and wildlife populations, provide exceptional recreational opportunities, shield downstream communities from flooding, and supply high quality freshwater for a broad range of human uses.[4] Wilderness areas also provide a baseline where ecological lessons can be learned and used to test more intensive adaptation strategies implemented in other areas.[5] In addition, untrammeled wilderness areas offer a spiritual balm for humans and a respite from the noise-ridden, traffic-laden, fully "wired" urban society.

The Article progresses as follows. Part II explores the origins and purposes of the Wilderness Act,[6] and explains why protecting wildness and preventing deliberate manipulation of wilderness characteristics are not only appropriate but also essential in the twenty-first century. In Part III, climate-related threats to wildness, particularly threats to wilderness waters and water-dependent resources, are addressed. Part IV chronicles how climate change is increasing the pressure to alter wilderness components and processes in the name of climate adaptation or mitigation. Part V assesses the efficacy of the Wilderness Act and a trio of federal water law doctrines—federally reserved water rights, the Wild and Scenic Rivers Act,[7] and the Clean Water Act (CWA)[8]—for protecting wilderness watersheds. It finds that no single one of these doctrines can accomplish the task alone, and argues that they should be implemented in a more synergistic, complementary fashion to protect the wild.

Finally, Part VI details the conservation implications of *not* manipulating wilderness characteristics and components. It grapples with the complexities of preserving wilderness watersheds that are already degraded due to climate change or other human-induced impacts. In the end, the Article concludes that although some minimal restoration activities may be appropriate in some wilderness areas where necessary to counteract previous or present human interventions, wilderness areas ought to be left largely "untrammeled," even if other important values are diminished over time. Admittedly, the call for deliberate nonintervention is an extreme stance, but it is precisely the stance that Congress adopted in the Wilderness Act and it is one that is becoming all the more imperative under the forces of climate change.

---

3 *See* Wilderness Soc'y, *Frequently Asked Questions About Wilderness*, http://wilderness.org/content/frequently-asked-questions-about-wilderness (last visited Feb. 18, 2012).

4 *Id.*

5 *See* Stephen F. McCool & David N. Cole, *Wilderness as a Place for Scientific Inquiry*, *in* 3 WILDERNESS SCIENCE IN A TIME OF CHANGE CONFERENCE 1, 1 (U.S. Dep't of Agric. et al. eds., 2000) (article is one of a series published in several volumes stemming from the Wilderness Science in a Time of Change Conference, held in Missoula, Mont., from May 23–27, 1999).

6 16 U.S.C. §§ 1131–1136 (2006 & Supp. IV 2010).

7 16 U.S.C. §§ 1271–1287 (2006).

8 Federal Water Pollution Control Act, 33 U.S.C. §§ 1251–1387 (2006).

II. WILDERNESS, NATURALNESS, AND WATERSHEDS

The Wilderness Act is widely known as one of the nation's preeminent preservation statutes.[9] Today, federally designated wilderness areas are found within each major category of the federal public lands—national forests, national parks, wildlife refuges, and public lands managed by the Bureau of Land Management (BLM).[10] There are over 700 federally designated wilderness areas in forty-four states, covering more than 107 million acres of land, or around 5% of the United States land base.[11] The vast majority of wilderness in the lower forty-eight states—about 75%—is located within only five ecoregions: one desert ecoregion—the Mojave Desert of California—and four high elevation ecoregions—the southern and middle Rocky Mountains, the Sierra Nevada Mountains, and the Cascade Mountains of the Pacific Northwest.[12]

Over the years, the Wilderness Act has been remarkably stable and robust, with few legislative revisions to its requirements.[13] The Act is so well loved that, as Professor Rodgers notes, it is "virtually repeal-proof."[14] During almost every congressional session since 1964, new wilderness areas have been added to the system or existing areas have been expanded.[15] Once established, Congress rarely un-designates wilderness areas.[16]

A. Wilderness Characteristics

The Wilderness Act specifies that only those lands retaining a "primeval character and influence" qualify as wilderness.[17] For an area to be designated, it must meet the following criteria:

---

9 *See* William H. Rodgers, Jr., *The Seven Statutory Wonders of U.S. Environmental Law: Origins and Morphology*, 27 LOY. L.A. L. REV. 1009, 1009–12 (1994).

10 Bradley C. Karkkainen, *Biodiversity and Land*, 83 CORNELL L. REV. 1, 40 (1997).

11 ROSS W. GORTE, CONG. RESEARCH SERV., RL 31477, WILDERNESS: OVERVIEW AND STATISTICS, at CRS-Summary (2008). Excluding Alaska, wilderness areas comprise only 3% of the United States. *Id.* at CRS-4.

12 Wilderness Soc'y, *supra* note 3.

13 *See* Rodgers, *supra* note 9, at 1013.

14 *Id.* Support for new wilderness areas, however, is less universal. *See, e.g.*, Complaint at 2, Utah v. Salazar, No. 2:11-cv-00391-DB (D. Utah Apr. 29, 2011) (arguing the "Wild Lands" policy violates the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4347 (2006); the Administrative Procedure Act, 5 U.S.C. §§ 551–559, 701–706, 1305, 3105, 3344, 4301, 5335, 5362, 7521 (2006); and the Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701–1785 (2006)).

15 Wilderness Soc'y, *A Timeline of Wilderness History and Conservation*, http://wilderness.org/content/timeline-wilderness-history-and-conservation (last visited Feb. 18, 2012).

16 DOUG SCOTT, THE ENDURING WILDERNESS 124 (2004). However, Congress occasionally authorizes land exchanges that release land from wilderness study. *See, e.g.*, Northern California Coastal Wild Heritage Wilderness Act, Pub. L. No. 109-362, § 5, 120 Stat. 2064, 2069–2070 (2006) (authorizing the release of several wilderness study areas in northern California).

17 Wilderness Act, 16 U.S.C. § 1131(c) (2006).

> (1) [G]enerally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.[18]

Small areas that are "of sufficient size as to make practicable its preservation and use in unimpaired condition" include the Rocks and Islands Wilderness in California, which encompasses nineteen acres of coastal shoreline, reefs, and islands situated within the Pacific flyway for migratory birds, and Pelican Island Wilderness, which covers six acres of lagoon within the Indian River in northern Florida, set aside as a "bird haven" by President Theodore Roosevelt in 1903.[19] By contrast, immense swaths of land are included in some of the wilderness designations within Alaska—the largest, Wrangell–St. Elias, has more than 9 million acres—and in the Rockies—Idaho's Frank Church–River of No Return Wilderness has over 2 million acres.[20]

The protection of water resources and water-dependent species featured highly in the congressional debates favoring passage of the Wilderness Act. Senator Frank Church, widely known for his legacy of conservation initiatives, stated that "wilderness not only is important to those who love the outdoor life and the sportsmen who hunt and fish there; it is equally needed for nature studies and general scientific inquiry, and for wise watershed and wildlife conservation."[21] Church added, "one of the purposes of the proposed legislation is to prevent a further opening up of the area . . . so that the scenic and wilderness values, which are the predominant values, can be preserved, and so that the wildlife and the watershed can be preserved as well."[22]

The absence of roads is a hallmark of federally protected wilderness areas, distinguishing these areas from all other categories of federal as well as state and private land.[23] Motorized or mechanized means of transportation are quite common, even prevalent, in national parks, national forests, BLM

---

18 *Id.*

19 Wilderness.net, *Fast Facts About America's Wilderness*, http://www.wilderness.net/index.cfm?fuse=nwps&sec=fastfacts (last visited Feb. 18, 2012). *Compare* Lands Council v. Martin, 529 F.3d 1219, 1230–31 (9th Cir. 2008) (holding that Forest Service improperly failed to consider wilderness characteristics of two roadless areas of 4284 and 966 acres, respectively, which together with adjacent roadless expanse of 13,000 acres were of sufficient size to make practicable their preservation in unimpaired condition), *with* Alliance for Wild Rockies v. Tidwell, 623 F. Supp. 2d 1198, 1207 (D. Mont. 2009), *aff'd*, 385 F. App'x 732 (9th Cir. 2010) (small units checker-boarded with private land did not qualify as wilderness).

20 Wilderness.net, *supra* note 19.

21 109 CONG. REC. 5942 (1963) (statement of Sen. Frank Church (D-Idaho)).

22 *Id.* at 5895.

23 *See* Sandra Zellmer, *A Preservation Paradox: Political Prestidigitation and an Enduring Resource of Wildness*, 34 ENVTL. L. 1015, 1021 (2004).

lands, and many wildlife refuges.[24] "Roadless" is a term of art in wilderness lexicon. Congress required the Department of Interior to make wilderness recommendations on all "roadless" areas of at least 5000 or more acres within parks, wildlife refuges, and BLM lands.[25] BLM defines roadless as "the absence of roads which have been improved and maintained by mechanical means to insure relatively regular and continuous use. A way maintained solely by the passage of vehicles does not constitute a road."[26] The Forest Service's definition is more specific: a road is "[a] motor vehicle travelway over 50 inches wide, unless designated and managed as a trail."[27] Trails, by contrast, are those passageways "established for travel by foot, stock, or trail vehicle."[28]

The National Forest System alone is home to around 390,000 miles of roads.[29] Although this figure represents just 10% of the total road length in the United States,[30] it is enough to circle the globe *fourteen times*.[31] Conservative estimates indicate that over 20% of the total land base in the contiguous United States is affected by roads, from jeep trails to interstate highways,[32] although only 1% of the land is physically covered by roads.[33] This is because the "edge effects"—erosion, poor water and air quality, noise, and invasive species—extend well beyond the road corridor, with distances varying depending on road type, slope, and other physical factors.[34]

---

24 *Id.* at 1023.

25 Wilderness Act, 16 U.S.C. § 1132(c) (2006); 43 U.S.C. § 1782(a) (2006).

26 BUREAU OF LAND MGMT., U.S. DEP'T OF THE INTERIOR, WILDERNESS INVENTORY HANDBOOK 5 (1978) (citing H.R. REP. NO. 94-1163, at 17 (1976), *reprinted in* 1976 U.S.C.C.A.N. 6191). "Improved and maintained" means "[a]ctions taken physically by man to keep the road open to vehicular traffic," while "[r]elatively regular and continuous use" means "[v]ehicular use which has occurred and will continue to occur on a relatively regular basis," such as "access roads for equipment to maintain a stock water tank or other established water sources; access roads to maintained recreation sites or facilities; or access roads to mining claims." *Id.* Because the presence of roads disqualifies an area from eligibility for wilderness designation, the concept is highly controversial. *See, e.g.*, Barnes v. Babbitt, 329 F. Supp. 2d 1141, 1155 (D. Ariz. 2004); Wilderness Soc'y v. Kane Cnty., Utah, 581 F.3d 1198, 1225 (10th Cir. 2009).

27 Final Rule Protecting Inventoried Roadless Areas in the National Forest System, 66 Fed. Reg. 3244, 3272 (Jan. 12, 2001) (to be codified at 36 C.F.R. pt. 294).

28 *Id.* at 3251. Trail vehicles include all-terrain or off-road vehicles and mountain bikes. *Id.*

29 U.S. FOREST SERV., ROADLESS AREA CONSERVATION RULEMAKING FACTS, *available at* http://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5137368.pdf.

30 Radley Z. Watkins et al., *Effects of Forest Roads on Understory Plants in a Managed Hardwood Landscape*, 17 CONSERVATION BIOLOGY 411, 412 (2003).

31 DYAN ZASLOWSKY & T.H. WATKINS, THESE AMERICAN LANDS 101 (1994).

32 *See* Richard T. T. Forman, *Estimate of the Area Affected Ecologically by the Road System in the United States*, 14 CONSERVATION BIOLOGY 31, 33–34 (2000) (concluding that 22% of the United States' land base is affected by roads based on edge effects ranging from 100 meters near secondary roads to 810 meters near major roads); Kurt H. Riitters & James D. Wickham, *How Far to the Nearest Road?*, 3 FRONTIERS IN ECOLOGY & THE ENV'T 125, 127 (2003) (presenting results supporting "that 22% is a minimum estimate of land area affected by roads").

33 Forman, *supra* note 32, at 31.

34 Sari C. Saunders et al., *Effects of Roads on Landscape Structure Within Nested Ecological Units of the Northern Great Lakes Region, USA*, 103 BIOLOGICAL CONSERVATION 209, 210 (2002) (stating that habitat degradation extends, on average, 50 meters from the road, given a road

Roads are credited as a primary source of soil and water disturbances in forested environments.[35] Roads and activities facilitated by roads—such as logging, grazing, mining, and recreation—cause chemical pollutants to enter the water as well as increased sediments from storm events and changes to water temperatures and nutrient cycles.[36] Thus, stream channels are more likely to function naturally when they are protected from landslides and other disturbances caused by roads and associated activities.[37]

By remaining roadless, wilderness areas provide critical ecosystem services such as clean water. Healthy watersheds help maintain viable fish and wildlife populations.[38] They also protect downstream communities from flooding by storing water and releasing it slowly over time, and they provide opportunities for many forms of outdoor recreation.[39] Last but not least, functioning wetlands, streams, rivers, lakes, and groundwater aquifers provide high quality freshwater for domestic, agricultural, and industrial uses.[40] The Forest Service estimates that "[r]oadless areas within the National Forest System contain all or portions of 354 municipal watersheds contributing drinking water to millions of citizens. Maintaining these areas in a relatively undisturbed condition saves downstream communities millions of dollars in water filtration costs."[41] It concludes, "Careful management of these watersheds is crucial in maintaining the flow and affordability of clean water to a growing population."[42]

Wilderness areas also provide undisturbed migration corridors and large blocks of contiguous habitat for climate-threatened species. Outside of wilderness and other roadless lands, roads—both paved and unpaved—have significant adverse effects on wildlife. Ecologists believe that "no single feature of human-dominated landscapes is more threatening to biodiversity (aquatic and terrestrial) than roads."[43] Roads criss-cross natural boundaries, altering pre-existing patterns of movement and communication within and between ecosystems.[44] The abundance and diversity of native species is

width of 10 meters); Forman, *supra* note 32, at 33 (concluding that effects can be seen up to 810 meters from the road).

35 Final Rule Protecting Inventoried Roadless Areas in the National Forest System, 66 Fed. Reg. 3244, 3246 (Jan. 12, 2001) (to be codified at 36 C.F.R. pt. 294).

36 *Id.* at 3246–47.

37 *Id.* at 3247.

38 *Id.*

39 *Id.* at 3245.

40 *Id.* at 3246.

41 *Id.* at 3245.

42 *Id.*

43 Reed F. Noss, *Wilderness Recovery: Thinking Big in Restoration Ecology*, *in* THE GREAT NEW WILDERNESS DEBATE 521, 523 (J. Baird Callicott & Michael P. Nelson eds., 1998).

44 Riitters & Wickham, *supra* note 32, at 125; Donald M. Waller, *Getting Back to the Right Nature: A Reply to Cronon's "The Trouble with Wilderness"*, *in* THE GREAT NEW WILDERNESS DEBATE 540, 553 (J. Baird Callicott & Michael P. Nelson eds., 1998) ("Many species are [] incapable of dispersing across open or inhospitable habitats such as clear-cuts or roads, which dissect their populations into smaller subunits that are increasingly vulnerable to genetic and demographic hazards.").

diminished near roads, while opportunistic invasive species thrive in and near the clearings created by roads.[45] Roads provide greater access for humans, contributing to direct death or injury to wildlife species from roadkill and hunting, as well as indirect effects due to air and water pollution and noise.[46] According to biologist Reed Noss, "Experience on every continent has shown that only in strictly protected [roadless] areas are the full fauna and flora of a region likely to persist for a long time."[47]

High altitude wilderness areas also provide essential elevation gradients in landscapes that have become increasingly fragmented by roads and other development. Increasing connectivity by protecting wildlife corridors, reducing human-made barriers such as roads and fences, and increasing the number of reserves, especially large protected areas connected by smaller reserves, are among the top climate change adaptation priorities recommended in the scientific literature.[48]

Given the rapid changes occurring on the landscape as temperatures, seasons, precipitation patterns, and other climate-affected features change, however, some land managers and scholars have debated whether the idea of wilderness is an anachronism, doomed to extinction.[49] For one thing, from the outset, many wilderness areas were chosen for reasons other than their ecological amenities. Unlike the National Wildlife Refuge System and some other types of preserves, the wilderness system was not designed to ensure that areas with the most biodiversity potential are included; rather, Congress and wilderness advocates like Aldo Leopold were more concerned with recreational and aesthetic virtues.[50] "[C]onsequently, the wilderness system generally protects scenic areas of 'rock and ice' rather than wetlands, grasslands and other more biologically productive but less visually spectacular areas."[51] Another criticism is that wilderness designations "lock up" federal lands by making them off-limits to all but low-impact recreational uses.[52] Finally, the characteristics of wilderness areas are

45 Jonathan L. Gelbard & Jayne Belnap, *Roads as Conduits for Exotic Plant Invasions in a Semiarid Landscape*, 17 CONSERVATION BIOLOGY 420, 421 (2003); *see* Watkins et al., *supra* note 30, at 415 (studying effects of unpaved forest roads); Saunders et al., *supra* note 34, at 221 (studying effects of paved roads); Rebecca A. Reed et al., *Contribution of Roads to Forest Fragmentation in the Rocky Mountains*, 10 CONSERVATION BIOLOGY 1098, 1101–04 (1996) (comparing vegetative responses to roads and clearcuts).

46 Noss, *supra* note 43, at 523–24.

47 Reed F. Noss et al., *Core Areas: Where Nature Reigns*, *in* CONTINENTAL CONSERVATION: SCIENTIFIC FOUNDATIONS OF REGIONAL RESERVE NETWORKS 99, 99 (Michael E. Soulé & John Terborgh eds., 1999); *see* Daniel Rohlf & Douglas L. Honnold, *Managing the Balances of Nature: The Legal Framework of Wilderness Management*, 15 ECOLOGY L.Q. 249, 251 & n.17 (1988).

48 Nicole E. Heller & Erika S. Zavaleta, *Biodiversity Management in the Face of Climate Change: A Review of 22 Years of Recommendations*, 142 BIOLOGICAL CONSERVATION 14, 18 tbl.1, 23 (2009).

49 *See* Zellmer, *supra* note 23, at 1020, 1042.

50 Dave Foreman, *Wilderness: From Scenery to Nature*, *in* THE GREAT NEW WILDERNESS DEBATE, *supra* note 43, at 568, 570–71; J. Baird Callicott, *Should Wilderness Areas Become Biodiversity Preserves?*, *in* THE GREAT NEW WILDERNESS DEBATE, *supra* note 43, at 585, 588.

51 Zellmer, *supra* note 23, at 1041–42.

52 Jan G. Laitos & Rachael B. Gamble, *The Problem with Wilderness*, 32 HARV. ENVTL. L. REV. 503, 507, 531–32 (2008).

inevitably and inexorably changing due to human impacts, causing some to believe that it is no longer appropriate to avoid deliberate interventions. An expert on the ecology of the Boundary Waters Canoe Area Wilderness in Minnesota argues that the "old model of wilderness management" must give way to more active interventions to control invasive species, voracious and prolific herbivores like white-tailed deer, and blow-downs and other effects of intensified storm events; otherwise, he posits, the boreal forest may end up looking like the Great Plains.[53]

Arguably, the failure to prioritize scientific criteria in designating wilderness areas and to adapt wilderness management and even wilderness boundaries in the face of changing conditions has resulted in an "artificial human construct" that provides "a cursory snapshot of wild lands frozen in time."[54] This circa-1960 mindset plays out in the management directives expressed in the Act, which assume that a preserved ecosystem will remain in a desired, steady state condition.[55] We have since learned that disturbance and change is not only inevitable, but also elemental in maintaining ecological integrity. Does it follow, then, that wilderness managers should employ active adaptive management interventions to promote resilience rather than wild, untrammeled characteristics?

There are good reasons to say no. Scientists within the United States Forest Service—an agency that was once the most outspoken opponent of wilderness designations—recognize that protected wilderness areas will play an even more critical role in the future.[56] Not only are wilderness areas ecologically important because they remain roadless,[57] but wilderness areas also provide "baseline" places where ecological lessons can be learned and used to test more intensive adaptation strategies implemented in other areas. In a sense, wilderness areas serve as "barometers"[58] or "natural archives."[59] In 1941, Aldo Leopold called wilderness "a base-datum of normality, a picture of how healthy land maintains itself."[60]

---

53 Kate Tyler, *The Forest of the Future: Ecologist Lee Frelich on the Fate of the Boundary Waters*, IMPRINT MAGAZINE, Jan. 2007, at 2–4 (quoting Dr. Lee Frelich); Susan Galatowitsch et al., *Regional Climate Change Adaptation Strategies for Biodiversity Conservation in a Midcontinental Region of North America*, 142 BIOLOGICAL CONSERVATION 2012, 2016, 2020 (2009) (arguing that management should shift from "keep out" strategies to facilitation and resilience strategies).

54 Zellmer, *supra* note 23, at 1042; *see* Alejandro E. Camacho, *Transforming the Means and Ends of Natural Resources Management*, 89 N.C. L. REV. 1405, 1407 (2011) (arguing that "climate change makes the significant costs and ultimate unsuitability of . . . the Wilderness Act's passive management goals particularly evident").

55 *See infra* Part II.B.

56 Zellmer, *supra* note 23, at 1036–37.

57 *See supra* notes 18–32 and accompanying text.

58 Final Rule Protecting Inventoried Roadless Areas in the National Forest System, 66 Fed. Reg. 3244, 3245 (Jan. 12, 2001) (to be codified at 36 C.F.R. pt. 294).

59 Lisa J. Graumlich, *Global Change in Wilderness Areas: Disentangling Natural and Anthropogenic Changes*, *in* 3 WILDERNESS SCIENCE IN A TIME OF CHANGE CONFERENCE, *supra* note 5, at 27, 27.

60 Aldo Leopold, *Wilderness as a Land Laboratory*, LIVING WILDERNESS, July 1941, at 3,3.

The more that the climate and climate-impacted variables change outside of protected wilderness areas, the more important it is to collect and maintain data about the baseline conditions within wilderness. Data collected in wilderness areas can guide future management decisions for lands within and outside of wilderness areas.[61] According to forest ecologists, "Research in wilderness areas plays a critical role in disentangling natural and anthropogenic changes in ecosystems by providing a network of sites where local impacts are minimized relative to adjacent, more intensely managed areas."[62] By comparing an undisturbed physical setting with more intensively managed areas, researchers will be better able to attribute changing conditions to human versus natural causes, and better able to adapt their management strategies to achieve sustainable outcomes. Within wilderness areas, scientists have found "rich repositories of paleoclimate and paleoecological data (for example, tree rings, sediment cores, macrofossil deposits)," which foster greater understanding of climate–ecosystem interactions under conditions that are novel compared to current conditions.[63] The continued preservation of networks of wilderness and other large, undisturbed natural areas can "facilitate cross-site comparisons and cross-scale analyses necessary to elucidate the complex interactions between global changes and local response."[64] Thus, scientific research based on conditions in wilderness areas will continue to be "critical to detecting the impact of climate change," discerning cause-and-effect relationships between human activities and environmental responses, and choosing among future management options for surrounding or similar areas.[65]

B. Wilderness Management—Naturalness, Wildness, and Public Use

First and foremost, the Wilderness Act prohibits activities that would detract from the wildness of wilderness areas.[66] Specifically, the Act forbids

61 *See* Peter M. Vitousek et al., *Global Change and Wilderness Science*, *in* 1 WILDERNESS SCIENCE IN A TIME OF CHANGE CONFERENCE 5, 8 (U.S. Dep't of Agric. et al. eds., 2000), *available at* http://www.fs.fed.us/rm/pubs/rmrs_p015_1.pdf (analyzing studies where wilderness ecosystems were used to provide a baseline for evaluating anthropogenic changes, focusing on the concentrations of fixed nitrogen in streams that drain forested watersheds, and finding that such comparative studies are the "best way" of evaluating some but not all components of human-caused global change).

62 Graumlich, *supra* note 59, at 27, 31 ("[O]pportunities created by the presence of natural areas amid more heavily managed lands allow us to more fully characterize the imprint of human activity on natural ecosystems.").

63 *Id.* at 27.

64 *Id.* at 31.

65 *Id.* at 27.

66 Wilderness Act, 16 U.S.C. § 1133(c) (2006); *see* Californians for Alts. to Toxics v. U.S. Fish & Wildlife Serv., No. CIV. S-10-1477 FCD/CMK, 2011 WL 3915966, at *18–19 (E.D. Cal. Sept. 6, 2011) (noting that agencies managing wilderness are "responsible for preserving [] wilderness character" and that "the Act is intended to enshrine the long-term preservation of wilderness areas as the ultimate goal," while the "sometimes conflicting" conservation purpose is more

permanent and most temporary roads, as well as commercial activities.[67] It also precludes motor vehicles, motorized equipment, mechanical transport, aircraft landings, structures, and installations.[68] In addition, the Act directs that wilderness areas be "protected and managed so as to preserve its natural conditions."[69]

Neither "natural" nor "wild" is specifically defined in the Act. "Natural" is commonly understood as "existing in or produced by nature," as opposed to artificial or human made.[70] "Wild"—free, untamed, and autonomous—is a related concept, but it is not synonymous. The principal author of the Wilderness Act, Howard Zahniser, defined the term "wild" as "untrammeled"—"not being subjected to human controls and manipulations that hamper the free play of natural forces."[71]

Not only are the two terms not synonymous, they can be outright contradictory.[72] When surveyed about their ability to implement climate adaptation policies to preserve *natural* characteristics and processes, federal land managers indicated that the Act's directive to keep wilderness areas wild and untrammeled could act as a potential barrier to adaptive management interventions.[73] Because wilderness areas are to be free of human manipulation, wilderness designations impose the most restrictive management directives in federal law, far more so than the directives that apply to national parks, national forests, wildlife refuges, and other federal land categories.[74]

At least one court—the Ninth Circuit Court of Appeals—has taken note of a related set of potentially conflicting directives embedded in the

ambiguous) (citing Wilderness Watch, Inc. v. U.S. Fish & Wildlife Serv., 629 F.3d 1024, 1033 (9th Cir. 2010)).

67 16 U.S.C. § 1133(c) (2006); *see Barnes*, 329 F. Supp. 2d 1141, 1155 (D. Ariz. 2004) (invalidating a plan that allowed repairs and maintenance of access routes in wilderness as unlawful road construction); Wilderness Soc'y v. U.S. Fish & Wildlife Serv., 353 F.3d 1051, 1069–70 (9th Cir. 2003) (en banc), *as amended in part on reh'g en banc*, 360 F.3d 1374, 1374 (9th Cir. 2004) (enjoining salmon enhancement project introducing hatchery-reared salmon fry into lake within wilderness as an unlawful commercial enterprise).

68 16 U.S.C. § 1133(c) (2006). Exceptions to these prohibitions are addressed *infra* Part V.A.

69 16 U.S.C. § 1131(c) (2006).

70 WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 1506–07 (Philip Babcock Gove ed., 2002).

71 SCOTT, *supra* note 16, at 2 (quoting letter from Howard Zahniser to C. Edwards Graves (Apr. 25, 1959)); Wilderness Soc'y, *Howard Zahniser*, http://wilderness.org/content/howard-zahniser (last visited Feb. 18, 2012).

72 *See Californians for Alts. to Toxics*, No. CIV. S-10-1477 FCD/CMK, 2011 WL 3915966, at *23 (E.D. Cal. Sept. 6, 2011) (finding that a plan to "conserve" Paiute cutthroat trout by killing competitive species with Rotenone applications in the Carson-Iceberg Wilderness "would *impede* progress towards preserving the overall wilderness character" by eradicating primitive endemic species).

73 Lesley C. Jantarasami et al., *Institutional Barriers to Climate Change Adaptation in U.S. National Parks and Forests*, 15 ECOLOGY & SOC'Y, 2010, at 1, 9, *available at* http://www.ecologyandsociety.org/vol15/iss4/art33/ES-2010-3715.pdf.

74 16 U.S.C. § 1133(c) (2006).

Wilderness Act.[75] On one hand, Congress directed the land management agencies to "*preserve*" wilderness character,[76] but on the other it required that wilderness areas be *used*,[77] i.e., "devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use."[78] The court concluded that, though the Act's *conservation use* purpose is relatively ambiguous, "Congress intended to enshrine the long-term *preservation* of wilderness areas as the ultimate goal."[79] However, as the Ninth Circuit observed, by making wilderness areas accessible for various types of use, "Congress did not mandate that the Service preserve the wilderness in a museum diorama, one that we might observe only from a safe distance, behind a brass railing and a thick glass window."[80] Implementing the dual directives of preserving untrammeled characteristics as well as natural conditions while also promoting various types of public uses, without engaging in manipulative or extrinsic perturbations, has never been a simple affair, and climate change promises to make it all the more challenging.

The preservation versus conservation, and wild versus natural, conflict came to the fore when the United States Fish and Wildlife Service (FWS) and the Arizona Game and Fish Department decided to build two permanent water tanks in the Kofa Wilderness in the Sonoran Desert of southwest Arizona.[81] The Kofa Wilderness was designated in 1990.[82] It makes up 80% of the Kofa Wildlife Refuge, which was created by an executive order in 1939.[83] The executive order explicitly declared that the Refuge was being set aside for "*conservation* and *development* of *natural* wildlife resources," with an understood intent to preserve desert bighorn sheep (*Ovis canadensis nelsoni*).[84] The area is extremely arid, averaging only around seven inches of rain a year.[85] During a period of extended drought,[86] the FWS, in partnership with the State of Arizona, constructed water tanks and pipes in the wilderness to augment water supplies for bighorn sheep.[87] Wilderness Watch

75 Wilderness Watch, Inc. v. U.S. Fish & Wildlife Serv., 629 F.3d 1024, 1033–34 (9th Cir. 2010).

76 16 U.S.C. § 1133(b) (2006) (emphasis added).

77 *Id.* § 1131(c).

78 *Id.* § 1133(b).

79 *Wilderness Watch*, 629 F.3d at 1033 (quoting High Sierra Hikers Ass'n v. Blackwell, 390 F.3d 630, 647–48 (9th Cir. 2004)) (emphasis added).

80 *Id.* at 1033.

81 *Id.* at 1027, 1032.

82 *Id.* at 1027.

83 *Id.*; Exec. Order No. 8039, 4 Fed. Reg. 438 (Jan. 27, 1939).

84 Exec. Order No. 8039, 4 Fed. Reg. 438 (Jan. 27, 1939) (emphasis added); *Wilderness Watch*, 629 F.3d at 1026.

85 *Wilderness Watch*, 629 F.3d at 1026.

86 *Id.* at 1047 (Bybee, J., dissenting) (noting that the drought from 2000 to 2006 was the principle cause of the decline in bighorn sheep populations); U.S. FISH & WILDLIFE SERV. & ARIZ. GAME & FISH DEP'T, INVESTIGATIVE REPORT AND RECOMMENDATIONS FOR THE KOFA BIGHORN SHEEP HERD 7, 28 fig.2 (2007), *available at* http://www.fws.gov/southwest/refuges/arizona/kofa/docs/031479%20attachment.Kofa%20NWR-AGFD%20Bighorn%20sheep%2004-17-2007.pdf (noting extended drought conditions during the last 10 years).

87 *Wilderness Watch*, 629 F.3d at 1027.

successfully sued, claiming that, while the facilities might be useful to the conservation of sheep threatened by drought and high temperatures, they were "installations" that unlawfully trammeled the wilderness, contrary to the explicit terms of the Act.[88] The Kofa water tanks might be perfectly acceptable to achieve biodiversity conservation purposes in the nonwilderness portion of the wildlife refuge,[89] but that does not mean they are acceptable in wilderness areas.[90]

III. CLIMATE THREATS TO NATURALNESS AND WILDNESS

In the mid-twentieth century, when the Wilderness Act was passed, preventing active manipulation of land and natural resources within this one special category of federal lands made good sense. The human population was growing, and Americans were becoming more affluent and had more free time and the means to travel to remote areas and to recreate with all sorts of mechanical or motorized devices.[91] Meanwhile, industrialization—large-scale mining and a range of other activities resulting in pollution—was becoming more widespread and, in many cases, more destructive.[92] In 1964 and in the next few decades, creating and maintaining a system of untrammeled, natural preserves seemed desirable and even critical. In the twenty-first century, however, the changes wrought by climate change are making some question whether maintaining wilderness areas will be possible in the future, and whether devoting resources to such an effort makes any sense. Moreover, even if the effort is made, it is not at all clear that it will be possible to keep something both wild—untrammeled and unmanipulated—and natural—exhibiting only those processes and functions that would be found in nature absent human influence.

For some if not most areas, a dramatically warming climate creates a "no-analog" future.[93] Although land managers might look to historic ecological conditions, processes, and functions in southern or low elevation areas to predict future conditions, processes, and functions in northern or

88 *Id.* at 1040–41.

89 *See* National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. § 668dd(a)(4)(A) (2006) (instructing the Secretary to "provide for the conservation of fish, wildlife, and plants, and their habitats within the [National Wildlife Refuge] System").

90 See *infra* Part V for an analysis of wilderness restrictions and exceptions as played out in *Wilderness Watch* and other cases.

91 Wilderness Act, Pub. L. No. 88-577, § 2, 78 Stat. 890 (1964) (codified as amended at 16 U.S.C. § 1131(a) (2006)) (noting that the purpose of the Wilderness Act was to "assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition").

92 *See id.*

93 *See, e.g.*, John W. Williams & Stephen T. Jackson, *Novel Climates, No-Analog Communities, and Ecological Surprises*, 5 FRONTIERS IN ECOLOGY & ENV'T 475, 475 (2007); *see also* J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1, 11 (2008); Robin Kundis Craig, *"Stationarity is Dead"—Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 37 (2010).

high elevation areas and to plan future scenarios and management responses,[94] the science of bringing climate models down to the fine-scale level needed to make timely on-the-ground decisions may seem little better than reading tea leaves. Precipitation patterns, vegetative shifts, species migration and invasions, wind, and soil composition are likely to change in unpredictable ways.[95]

Temperature increases in the American West—where most wilderness areas exist—may be even greater than the projected three- to ten-degree Fahrenheit worldwide increase by the end of the century.[96] Storms, floods, drought, disease, insect infestation, fire, and species invasions are likely to become more severe and widespread.[97] The effects may be most intense at higher elevations, including alpine and sub-alpine wilderness areas.[98] Given their relative geographical isolation and idiosyncratic environmental adaptations, montane species are "especially susceptible" to climate change.[99] As a result, the primeval characteristics that set an area apart and qualify it for wilderness designation will almost certainly change over time as glaciers melt and precipitation patterns shift. Examples include the following:

Diminished Snowpack and Earlier Snowmelt. Higher temperatures and longer summers are causing glaciers to melt and snowpack to diminish. In the mid-twentieth century, Glacier National Park had 150 glaciers.[100] Today, there are twenty-six.[101] Within the next decade or so, the glaciers for which this park was named will likely be gone.[102]

Meanwhile, more winter precipitation will fall as rain instead of snow, the periods of snowpack accumulation will be shorter, and earlier

94 *See, e.g.*, Galatowitsch et al., *supra* note 53, at 2013 (describing use of isopleth lines and historical weather data to predict future climate conditions).

95 NEIL ADGER ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE: SUMMARY FOR POLICYMAKERS 8–9, 18 (M.L. Parry et al. eds., 2007).

96 STEPHEN SAUNDERS & MAUREEN MAXWELL, LESS SNOW, LESS WATER: CLIMATE DISRUPTION IN THE WEST 1 (2005).

97 ADGER ET AL., *supra* note 95, at 11–12, 14, 18.

98 *See* J. Alan Pounds et al., *Biological Response to Climate Change on a Tropical Mountain*, 398 NATURE 611, 611 (1999); *see also* Aníbal Pauchard et al., *Ain't No Mountain High Enough: Plant Invasions Reaching New Elevations*, 7 FRONTIERS IN ECOLOGY & ENV'T 479, 485 (2009) (highlighting the threat that climate change-induced plant invasion poses for alpine environments). Coastal areas are also especially vulnerable to rising sea levels and other impacts of climate change. *See* Massachusetts v. U.S. Envtl. Prot. Agency, 549 U.S. 497, 521–22 (2007) (noting that sea-level rise caused by climate change has already begun to engulf coastal areas in the United States).

99 Frank A. La Sorte & Walter Jetz, *Projected Range Contractions of Montane Biodiversity Under Global Warming*, 277 PROC. ROYAL SOC'Y B, 3401, 3401 (2010).

100 Wendee Holtcamp, *Silence of the Pikas*, 60 BIOSCIENCE 8, 8 (2010).

101 *Id.*

102 *Id.* Over 90% of the Park is managed as wilderness, although it has yet to be officially designated. *See* NAT'L PARK SERV., GENERAL MANAGEMENT PLAN OVERVIEW: DRAFT GENERAL MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT 8 (1998), *available at* http://permanent.access.gpo.gov/lps2464/summary.pdf.

springtime warming will melt snowpacks earlier in the year.[103] Peak flows will occur sooner than the current pattern of early to mid-summertime peak flows, causing adverse effects downstream in the spring.[104]

Changes in the timing and velocity of snowmelt and runoff will also adversely affect the capacity of water storage infrastructure. Existing dams and reservoirs may be overwhelmed by earlier, faster snowmelt runoff, causing soil erosion and severe flooding downstream. In 2011, snowmelt from the Rockies filled the Gallatin, Jefferson, Madison, Yellowstone, and Platte Rivers, surged down the Missouri River, exceeded the capacity of the six massive mainstem reservoirs on the Missouri, and destroyed downstream communities, farms, and even interstate highways in South Dakota, Iowa, and Nebraska in a record-breaking flood.[105] Nationwide, record floods "strained dams, eroded riverbanks, filled harbors with silt and ripped football field-sized holes in some earthen levees protecting farmland and small towns."[106] The United States Army Corps of Engineers estimates it will cost more than $2 billion to repair the damage to the nation's levees, dams, and riverbanks, a sum that far exceeds the $150 million that had been allocated for flood-related efforts for the fiscal year.[107]

Dust storms can exacerbate these effects. Higher temperatures will cause greater evaporation from reservoirs, lakes, and streams, and will also cause soil dryness, loss of vegetation, and erosion.[108] The heat-trapping properties of dust have caused snowpacks in Colorado to melt weeks earlier

103 SAUNDERS & MAXWELL, *supra* note 96, at 2, 6.

104 *Id.* at 6; FREDERIC H. WAGNER & THOMAS J. STOHLGREN, THE ROCKY MOUNTAIN/GREAT BASIN REGION: ASSESSMENT OF THE POTENTIAL EFFECTS OF CLIMATE CHANGE AND VARIABILITY, http://www.usgcrp.gov/usgcrp/nacc/education/rockies-greatbasin/default.htm (last visited Feb. 18, 2012) (click on the "Water Resources" link).

105 Andy Malby, *Snowpack Still Melting at Glacial Pace: Area Rivers, Streams Expected to Keep Flooding This Week*, BELGRADE NEWS, June 14, 2011, http://www.belgrade-news.com/news/article_6f82be5a-963b-11e0-9c42-001cc4c002e0.html (last visited Feb. 18, 2012); MSNBC.com, *Flood Surge Could Spread Yellowstone River Oil Spill*, http://www.msnbc.msn.com/id/43638507/ns/us_news-environment/t/flood-surge-could-spread-yellowstone-river-oil-spill/# (last visited Feb. 18, 2012); Algis J. Laukaitis, *Platte River Floods Still Threaten; Half of Record Snow Pack Has Yet to Melt*, LINCOLN J. STAR, June 17, 2011, http://journalstar.com/news/local/article_bd869646-e218-56da-a1d5-a99424be8d53.html (last visited Feb. 18, 2012); Lauren Morello, *'Unprecedented' Summerlong Flood Threatens Missouri River Dams and Levees*, N.Y. TIMES, June 7, 2011, http://www.nytimes.com/cwire/2011/06/07/07climatewire-unprecedented-summerlong-flood-threatens-mis-68968.html?scp=1&sq=flood%20missouri%20river&st=cse (last visited Feb. 18, 2012); Andrew J. Nelson, *I-680 Is 'Obliterated . . . Gone'*, OMAHA WORLD-HERALD, Aug. 31, 2011, http://www.omaha.com/article/20110831/NEWS01/708319910 (last visited Feb. 18, 2012) (reporting that I-680 between Omaha, Neb., and Council Bluffs, Iowa, is "a crumpled, massive jigsaw puzzle of concrete and asphalt, with massive chunks turned over by Missouri River floodwaters that channeled under the road bed, then collapsed it").

106 Heather Hollingsworth, *Corps Pegs 2011 Flood Damage at $2 Billion*, SALT LAKE TRIB., Sept. 16, 2011, http://www.sltrib.com/sltrib/world/52594650-68/corps-damage-missouri-flood.html.csp (last visited Feb. 18, 2012).

107 *Id.*

108 Seth M. Munson et al., *Responses of Wind Erosion to Climate-Induced Vegetation Changes on the Colorado Plateau*, 108 PROC. NAT'L ACAD. SCI. 3854, 3854 (2011).

than normal, forcing huge volumes of melt water to pulse down mountain streams at abnormal times and velocities.[109] It becomes a vicious cycle:

> [T]he warming climate at lower elevations creates conditions that exacerbate pollution problems in the snow-topped mountain peaks, reducing the snow's reflective capacity and soaking up more heat.
>
> . . . .
>
> Meanwhile, warming temperatures at lower elevations prompted plants to bloom before they had sufficient water, and the resulting dead vegetation exposed the parched soil underneath, creating more dust.[110]

When runoff occurs earlier than anticipated and at volumes and velocities that exceed the capacity of existing infrastructure, the water cannot be stored and delivered to those who need it, and usable water supplies to cities, farmers, and others are diminished.[111] Moreover, snowpack runoff can be essential for replenishing groundwater aquifers at the mountain front.[112] Although detailed scientific knowledge is lacking, climate change may adversely affect the mechanisms and rates of groundwater recharge, further exacerbating fresh water shortages.[113]

Disease, Infestation, and Fire. Heat and drought tend to stress and overwhelm the physiological capability and structural integrity of plants, making them more vulnerable to disease, parasites, and insects. In turn, plant diseases and infestations are strongly influenced by weather and climate. Warm, dry conditions facilitate the spread of beetles, wood borers, blister rust, needle blight, and other destructive insects and diseases.[114] In a

---

109 *Id.*

110 Scott Streater, *Climate Change, Water Shortages Conspire to Create 21st Century Dust Bowl*, N.Y. TIMES, May 14, 2009, http://www.nytimes.com/gwire/2009/05/14/14greenwire-climate-change-water-shortages-conspire-to-cre-12208.html?pagewanted=all (last visited Feb. 18, 2012).

111 *See* Robin Kundis Craig, *Adapting Water Law to Public Necessity: Reframing Climate Change Adaptation as Emergency Response and Preparedness*, 11 VT. J. ENVTL. L. 709, 723 (2010); P.C.D. Milly et al., *Stationarity Is Dead: Whither Water Management?*, 319 SCIENCE 573, 573 (2008).

112 Craig, *supra* note 111, at 724.

113 D. Viviroli et al., *Climate Change and Mountain Water Resources: Overview and Recommendations for Research, Management and Policy*, 15 HYDROLOGY & EARTH SYS. SCI. 471, 486 (2011), *available at* http://www.hydrol-earth-syst-sci.net/15/471/2011/hess-15-471-2011.pdf. A better understanding of recharge processes would help improve the assessment of climate change impacts on aquifers and provide an important step toward more sustainable management of groundwater resources. *Id.*

114 Stephen Speckman, *Bark Beetles Are Feasting on Utah Forests*, DESERET NEWS, Sept. 8, 2008, http://www.deseretnews.com/article/700257110/Bark-beetles-are-feasting-on-Utah-forests.html (last visited Feb. 18, 2012); Craig Welch, *Climate Change, Beetle May Doom Rugged Pine*, SEATTLE TIMES, Nov. 5, 2011, http://seattletimes.nwsource.com/html/localnews/2016699269_barkbeetle06m.html (last visited Feb. 18, 2012); Susan J. Frankel, *Forest Plant Diseases and Climate Change*, CLIMATE CHANGE RES. CTR., May 20, 2008, http://www.fs.fed.us/ccrc/topics/plant-diseases.shtml (last visited Feb. 18, 2012); U.S. Forest Serv., *Western Forest Insects and Diseases: Publications and Links*, http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPyhQo

study that tracked nearly eighty undisturbed tree stands in wilderness and other protected federal areas since 1955, scientists found that 87% had experienced an increase in the rate of tree mortality due to insects; in the interior West, the dieback rate has doubled.[115]

Sudden Aspen Decline (SAD) is one example. Warming temperatures and droughts have enabled parasitical insects, otherwise rarely observed in western aspen stands, to flourish.[116] The most susceptible trees grow on south-facing sides of mountains and foothills.[117] In 2004, scientists in Colorado observed that aspens were dying in unprecedented numbers and that regeneration was not occurring.[118] SAD has affected one-fifth of the state's aspen groves.[119] The loss of the aspens destroys the lush grasses that sprout under them, which in turn trap, filter, and release clean water into streams, rivers, and lakes.[120] Without the aspens, these services are greatly diminished.

Forests are also being ravaged by the bark beetle—another insect that thrives under hotter, drier conditions.[121] On the Colorado Plateau of Colorado, Utah, Arizona, and New Mexico, sustained heat and an extended drought during the past decade have facilitated the spread of the piñon bark beetle (*Ips confuses*).[122] Ninety percent of the piñon pines (*Pinus edulis*) in study areas within Mesa Verde National Park are dead—far more than were killed during an even drier period in the 1950s.[123] Most of the wilderness areas in Bandelier National Park are also at high risk.[124] In higher elevations at more northern latitudes, lodgepole pines (*Pinus contorta*) are suffering

Y6BdkOyoCAGixyPg!/?ss=1106&navtype=BROWSEBYSUBJECT&cid=stelprdb5300513&navid=140000000000000&pnavid=null&position=Not%20Yet%20Determined.Html&ttype=detail&pname=Region%206-%20Forest%20&%20Grassland%20Health (last visited Feb. 18, 2012) (providing links to more information on various forest pests and diseases); *see* Federico Cheever, *The Phantom Menace and the Real Cause: Lessons from Colorado's Hayman Fire 2002*, 18 PENN. ST. ENVTL. L. REV. 185, 188 (2010).

115 STEPHEN SAUNDERS ET AL., NATIONAL PARKS IN PERIL: THE THREATS OF CLIMATE DISRUPTION 21 (2009), *available at* http://www.rockymountainclimate.org/website%20pictures/National-Parks-In-Peril-final.pdf.

116 James J. Worrall et al., *Rapid Mortality of* Populus Tremuloides *in Southwestern Colorado, USA*, 255 FOREST ECOLOGY & MGMT. 686, 694 (2008), *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_038982.pdf.

117 *Id.* at 689–90.

118 SAUNDERS ET AL., *supra* note 115, at 21.

119 Nicholas Riccardi, *Climate Blamed for Aspen Deaths*, L.A. TIMES, Oct. 18, 2009, http://articles.latimes.com/2009/oct/18/nation/na-aspen-death18 (last visited Feb. 18, 2012).

120 *Id.* (noting that healthy aspen stands can support up to 2000 pounds of native grasses per acre, which may provide much needed water to metropolitan areas).

121 *Id.*

122 SAUNDERS ET AL., *supra* note 115, at 13.

123 *Id.*; *see also* A. Park Williams et al., *Forest Responses to Increasing Aridity and Warmth in the Southwestern United States*, 107 PROC. NAT'L ACAD. SCI. 21,289, 21,289, 21,291 (2010), *available at* http://www.pnas.org/content/107/50/21289.full.pdf (predicting decreasing growth in piñon and other pines as temperatures rise).

124 *See* Williams et al., *supra* note 123, at 21,292–93; David N. Cole & Laurie Yung, *Park and Wilderness Stewardship: The Dilemma of Management Intervention*, *in* BEYOND NATURALNESS: RETHINKING PARK AND WILDERNESS STEWARDSHIP IN AN ERA OF RAPID CHANGE 1, 2–4 (David N. Cole & Laurie Yung eds., 2010).

from bark beetle infestations. For the first time in recorded history, beetles are able to proliferate in high elevation forests that historically were too cold to sustain them.[125] Rocky Mountain National Park is well "on its way to losing most of its large lodgepole pines," which will substantially change the Park's mixed-conifer forest ecosystem.[126]

Healthy aspens do not burn easily, so they create natural firebreaks.[127] Healthy ponderosa (*Pinus ponderosa*) and other types of pines need occasional ground fire to propagate their seeds and generate regrowth.[128] The loss of these tree species due to climate change, coupled with historic fire suppression practices by land managers, higher temperatures, and changing precipitation patterns, creates conditions conducive for more frequent and more devastating crown fires and other high intensity forest fires.[129]

Scientists with the United States Forest Service Climate Change Resource Center believe that temperature changes will lead to substantial increases in area burned.[130] For a mean temperature increase of eleven degrees Fahrenheit, annual area burned by wildfire is expected to increase as much as five-fold.[131] Ponderosa pine forests at mid- to high elevations are already facing much harsher fire regimes due to fire suppression and

125 *See* U.S. Forest Serv., *Threats to High Elevation White Pines: Bark Beetles*, http://www.fs.fed.us/rm/highelevationwhitepines/Threats/bark-beetle.htm (last visited Feb. 18, 2012).

126 ROCKY MOUNTAIN CLIMATE ORG., NATIONAL PARKS IN PERIL: THE THREATS OF CLIMATE DISRUPTION 3 (2009), *available at* http://www.rockymountainclimate.org/website%20pictures/ParksInPeril_COFacts.pdf. Ninety-five percent of the Park is designated as wilderness. Nat'l Park Serv., U.S. Dep't of the Interior, *Rocky Mountain National Park: Research Assistance*, http://www.nps.gov/romo/parkmgmt/research_assistance.htm (last visited Feb. 18, 2012).

127 Riccardi, *supra* note 119.

128 STEPHEN A. FITZGERALD, U.S. FOREST SERV., PSW-GTR-198, FIRE ECOLOGY OF PONDEROSA PINE AND THE REBUILDING OF FIRE-RESILIENT PONDEROSA PINE ECOSYSTEMS 198 (2005), *available at* http://www.fs.fed.us/psw/publications/documents/psw_gtr198/psw_gtr198_n.pdf.

129 *See* Emily K. Heyerdahl et al., *Multi-Season Climate Synchronized Historical Fires in Dry Forests (1650–1900), Northern Rockies, USA*, 89 ECOLOGY 705, 714 (2008) (concluding that changes to warming could lead to continued changes in forest structure, resulting in more frequent severe fires with "broad ecological implications"), *available at* http://www.fs.fed.us/rm/pubs_other/rmrs_2008_heyerdahl_e002.pdf; Ron Neilson, *Vegetation Distribution and Climate Change*, CLIMATE CHANGE RES. CTR., http://www.fs.fed.us/ccrc/topics/vegetation.shtml (last visited Feb. 18, 2012) (explaining that, with further warming, "[d]rought and fire are expected to increase in both the western and eastern forests of the United States" (citations omitted)).

130 Neilson, *supra* note 129 ("This widespread temperature-induced drought stress is expected to cause dramatic increases in the amount of biomass consumed by fire throughout much of the boreal forest, especially in continental interior regions.").

131 Donald McKenzie et al., *Climatic Change, Wildfire, and Conservation*, 18 CONSERVATION BIOLOGY 890, 897 (2004).

drought.[132] Crown fires in these forests will cause extensive tree mortality, severe soil erosion, water quality degradation, and nutrient losses.[133]

Shifting Ranges, Extinctions, and Invasions. Scientists have begun to observe significant and unprecedented shifts in the ranges of plant and animal species. Some species have climbed upward in elevation or migrated toward the North or South Pole as they seek areas within their temperature tolerances.[134] New species have colonized cooler regions, for example, sea anemones in Monterey Bay and lichens and butterflies in northern Europe.[135] Studies of over 1700 species revealed "highly significant, nonrandom patterns of change in accord with observed climate warming in the twentieth century, indicating a very high confidence (>95%) in a global climate change fingerprint."[136]

Some species, such as the Arctic fox (*Vulpes lagopus*), are occupying a smaller range—they have nowhere cooler to go.[137] In a 2004 paper in *Nature*, scientists concluded that climate change could shrink the ranges of 15% to 37% of all species so drastically that they would be "committed to extinction."[138] It is not possible to place the blame solely on climate change because other variables such as development-related habitat destruction also play a role, but it seems more likely than not that a warming climate is a substantial factor in these rapid shifts.

Climate change is also likely to increase invasions by nonnative, noxious plant and animal species.[139] In Florida, record-breaking droughts have enabled melaleuca (*Melaleuca quinquenervia*)—an invasive tree species also known as punk trees or paperbark tea trees—to spread

---

132 Melissa Savage & Joy Nystrom Mast, *How Resilient Are Southwestern Ponderosa Pine Forests After Crown Fires?*, 35 CANADIAN J. FOREST RES. 967, 967–68 (2005).

133 *See* McKenzie et al., *supra* note 131, at 897–98 (concluding that warmer, drier summers will lead to more frequent and extensive forest fires, causing increased mortality in isolated stands of ponderosa pine).

134 *See, e.g.*, Camille Parmesan et al., *Poleward Shifts in Geographical Ranges of Butterfly Species Associated with Regional Warming*, 399 NATURE 579, 579–80 (1999) (examining evidence of warming induced, poleward shifts of species' ranges).

135 Camille Parmesan & Gary Yohe, *A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems*, 421 NATURE 37, 39 (2003).

136 *Id.* at 41.

137 *See* Camille Parmesan, *Biotic Response: Range and Abundance Changes*, *in* CLIMATE CHANGE AND BIODIVERSITY 41, 43 (Thomas E. Lovejoy & Lee Hannah eds., 2005) (describing how the Arctic fox's range has "contracted" toward the Arctic Ocean, in part due to the warming-induced expansion of the range of the red fox (*Vulpes vulpes*)).

138 Chris D. Thomas et al., *Extinction Risk from Climate Change*, 427 NATURE 145, 145 (2004).

139 *See* Susan A. Mainka & Geoffrey W. Howard, *Climate Change and Invasive Species: Double Jeopardy*, 5 INTEGRATIVE ZOOLOGY 102, 104 (2010) ("The traits of species that make them invasive (i.e. ability to survive in adverse conditions, rapid growth rates and wide dispersal) will often help them succeed in competition with native species under climate change."); BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, RECLAMATION: MANAGING WATER IN THE WEST: SECURE WATER ACT SECTION 9503(C)—RECLAMATION CLIMATE CHANGE AND WATER 2011, at 153–54 (2011), *available at* http://www.usbr.gov/climate/SECURE/docs/SECUREWaterReport.pdf (predicting warmer water, impaired water quality, and aquatic invasive species in California's Central Valley).

throughout the Everglades.[140] Melaleuca trees produce immense quantities of seeds and grow rapidly, crowding out native plants and dependent wildlife.[141] Dense stands of melaleuca burn easily and with high intensity, potentially altering the area's hydrology by impacting soil composition, building land, and increasing transpiration rates.[142] Over 85% of Everglades National Park has been designated as the Marjory Stoneman Douglas Wilderness—the largest eastern wilderness area and the only subtropical wilderness in the United States.[143] The herculean efforts undertaken by land managers to eradicate melaleuca in and around the wilderness are described in the next Part.[144]

IV. HUMAN THREATS TO NATURALNESS AND WILDERNESS

Climate change is not only changing the endemic composition of wilderness, but it is also increasing human pressure to intervene and alter ongoing processes in wilderness areas in hopes of mitigating adverse effects or adapting to them. Examples discussed in this Part include the construction of water infrastructure, such as dams, to regulate and enhance water supplies; cloud-seeding; providing artificial water supplies to drought-stricken species; logging and spraying forests to contain fire, disease, and infestation; eradicating invasive species with mechanical, biological, or chemical treatments; reintroducing native species into historic ranges that they no longer occupy; translocating nonnative imperiled species to cooler, higher elevations; and allowing renewable energy development in wilderness. All of these initiatives involve deliberate manipulations. Some of these activities are under consideration and, in some regions, are already underway.

New or Expanded Dams and Other Water Infrastructure. Snow pack and the headwaters of many streams in the United States are found in mountains, many of which are situated in or near wilderness areas.[145] Mountains are essential sources of freshwater supplies.[146] Hydrologists have found that, "[o]n a global scale, mountains contribute disproportionately

140 John Platt, *Record Droughts in Florida Fuel Spread of Invasive Plant Melaleuca*, MOTHER NATURE NETWORK, Sept. 1, 2011, http://www.mnn.com/earth-matters/climate-weather/stories/record-droughts-in-florida-fuel-spread-of-invasive-plant-melal (last visited Feb. 18, 2012).

141 *Id.*

142 *See* FRANK J. MAZZOTTI ET AL., SSWEC123, ECOLOGICAL CONSEQUENCES OF INVASION BY *MELALEUCA QUINQUENERVIA* IN SOUTH FLORIDA WETLANDS: PARADISE DAMAGED, NOT LOST 4 (1997) (reviewed 2001), *available at* http://edis.ifas.ufl.edu/pdffiles/UW/UW12300.pdf.

143 Marjory Stoneman Douglas Wilderness and Ernest F. Coe Visitor Center Designation Act, Pub. L. No. 105-82, § 3(a), 111 Stat. 1540, 1541 (1997); Nat'l Park Serv., *Everglades: Lichens*, http://www.nps.gov/ever/naturescience/lichens.htm (last visited Feb. 18, 2012).

144 *See infra* text accompanying notes 195–200.

145 *See* THOMAS C. BROWN & PAMELA FROEMKE, ESTIMATED MEAN ANNUAL CONTRIBUTION TO WATER SUPPLY FROM DESIGNATED WILDERNESS IN THE COTERMINOUS UNITED STATES 2 (2009), *available at* http://www.fs.fed.us/rm/value/docs/water_supply_from_wilderness.pdf; ADGER ET AL., *supra* note 95, at 11.

146 Viviroli et al., *supra* note 113, at 2831–32; ADGER ET AL., *supra* note 95, at 11–12.

high runoff, provide a favourable [sic] temporal redistribution of winter precipitation to spring and summer runoff and reduce the variability of flows in the adjacent lowlands."[147] But these contributions could be significantly altered by climate change.

Seasonal snowfall, snow pack, and the timing of snowmelt have tremendous implications for the water balance of many watersheds.[148] Enhanced snowmelt results in rapid, intensified runoff, which perversely decreases reliable water yields in the long term.[149] As a result, current management strategies based on historic data and variability will no longer be adequate.[150] Researchers at the Rocky Mountain Climate Organization concluded that the already overallocated Colorado system is "at the brink of failure, wherein virtually any reduction in precipitation over the Basin, either natural or anthropogenic, will lead to the failure to meet mandated allocations."[151]

Manmade dams are designed to store and redistribute seasonal maximum flows to make water available at times of maximum demand, especially high agricultural demands during summer, and to stabilize water supplies throughout the year.[152] In effect, by storing water, dams assume a role similar to that of glaciers, snow, and ice. So to some extent it may appear feasible to compensate for climate-induced shifts in the snowmelt–runoff cycle by building additional dams or expanding existing ones.[153]

In other mountainous, wild areas of the world, proposals to build new dams are moving forward. Pakistan has proposed damming the headwaters of the Indus, which flows from the Himalayas southwest across Pakistan to the Arabian Sea.[154] The Spanish National Hydroelectric Plan contemplates the construction of 120 new dams, many of which would be situated in the

147 Viviroli et al., *supra* note 113, at 2831 (citations omitted).

148 *See* Tim Barnett et al., *The Effects of Climate Change on Water Resources in the West: Introduction and Overview*, 62 CLIMATIC CHANGE 1, 6–7 (2004) (discussing the potential effect of reduced snowpack and earlier spring runoff on various watersheds); Viviroli et al., *supra* note 113, at 2853.

149 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE AND WATER: TECHNICAL PAPER OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 22, 44, 63 (Bryson Bates et al. eds., 2008); *see supra* notes 103–04 and accompanying text.

150 Viviroli et al., *supra* note 113, at 2832; *see* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 149, at 30 (positing a "very robust finding [] that warming would lead to changes in the seasonality" of snowmelt-dominated rivers and that snow-dominated regions are particularly sensitive to changes in temperature); Iris T. Stewart, *Changes in Snowpack and Snowmelt Runoff for Key Mountain Regions*, 23 HYDROLOGICAL PROCESSES 78, 80–82 (2009) (providing a comprehensive overview of trends observed in mountain regions in North America and other areas of the Northern Hemisphere).

151 SAUNDERS & MAXWELL, *supra* note 96, at 18.

152 *See* Viviroli et al., *supra* note 113, at 2844.

153 *Id.*

154 William MacNamara, *China Proposes $15bn Indus Dam Scheme*, FIN. TIMES, June 7, 2011, http://www.ft.com/intl/cms/s/0/15385b38-9133-11e0-9668-00144feab49a.html#axzz1doy9aQI9 (last visited Feb. 18, 2012); Earth Snapshot, *Indus River Flowing Across Pakistan*, http://www.eosnap.com/tag/indus-river/ (last visited Feb. 18, 2012).

Pyrenees Mountains.[155] In Chile, demonstrators have protested a government plan to construct dams on two rivers in a wild part of Patagonia.[156] Brazil is planning as many as seventy new dams in the Amazon basin, including the gargantuan Belo Monte dam in the remote State of Para.[157] China is engaging in a dam-building frenzy throughout the country.[158]

Although the United States has not expressed quite the same zeal for new dams as China, Brazil, and some other countries, former California Governor Arnold Schwarzenegger's executive order on climate change called for increased hydropower production and enhanced water storage capacity to cope with the reduced snowpack in the Sierra Nevada, Cascade,

155 *See* European Rivers Network, *Spanish National Hydrological Plan*, http://www.rivernet.org/Iberian/planhydro.htm (last visited Feb. 18, 2012); Press Release, Saren Starbridge, 18.08.04: Spain: A Turnaround in Water Management (WWF) (Aug. 18, 2004), http://www.rivernet.org/prs04_04.htm#180804 (last visited Feb. 18, 2012) (describing resistance to interbasin transfers from the Ebro River in the north to cities in the southeast). The European Union (EU) weighed in against the plan, and as a matter of policy the EU places "water savings and water efficiency . . . ahead of any planning of new water supply." COMM'N OF THE EUROPEAN COMTYS., SEC (2007) 993/3, COMMISSION STAFF WORKING DOCUMENT: ACCOMPANYING DOCUMENT TO THE COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT: ADDRESSING THE CHALLENGE OF WATER SCARCITY AND DROUGHTS IN THE EUROPEAN UNION 4 (2007).

156 Kate Galbraith, *Hydropower's Resurgence and the Controversy Around It*, N.Y. TIMES, May 15, 2011, http://www.nytimes.com/2011/05/16/business/global/16iht-green16.html?pagewanted=all (last visited Feb. 18, 2012).

157 Sarah Anne Hughes, *Brazil Approves Belo Monte Dam, Despite Fierce Opposition*, WASH. POST, May 1, 2011, http://www.washingtonpost.com/blogs/blogpost/post/brazil-approves-belo-monte-dam-despite-fierce-opposition/2011/06/01/AG18YdGH_blog.html (last visited Feb. 18, 2012). *Avatar* film director James Cameron compares Para to the fictional world *Pandora*, featured in that film. Ken Rapoza, *Belo Monte and Brazil's 'Pandora'*, IN THESE TIMES, Feb. 14, 2011, http://www.inthesetimes.com/article/6929/belo_monte_and_brazils_pandora/ (last visited Feb. 18, 2012) (noting that James Cameron created the short anti-Belo Monte film documentary, A MESSAGE FROM PANDORA (20th Century Fox Nov. 16, 2010)). When completed, the Belo Monte will be the third largest hydroelectric dam in the world. *Brazil Judge Halts Work on Belo Monte Amazon Dam*, BBC NEWS, Sept. 28, 2011, http://www.bbc.co.uk/news/world-latin-america-15102520 (last visited Feb. 18, 2012).

158 Some of China's new dams are designed primarily as water supply structures while many others are hydroelectric facilities designed in large part to market carbon credits under the Clean Development Mechanism of the Kyoto Protocol. Joe McDonald & Charles J. Hanley, *China Dams Reveal Flaws in Climate-Change Weapon*, HUFFINGTON POST, Jan. 25, 2009, http://www.huffingtonpost.com/2009/01/25/china-dams-reveal-flaws-i_n_160692.html (last visited Feb. 18, 2012); David Biello, *The Dam Building Boom: Right Path to Clean Energy?*, YALE ENV'T 360, Feb. 23, 2009, http://e360.yale.edu/content/feature.msp?id=2119 (last visited Feb. 18, 2012) (noting that the Chinese government is planning a dozen large dams on the Jinsha River on the Tibetan Plateau). Ironically, according to scientists at Brazil's National Institute for Space Research, submerged trees and vegetation inundated by the world's dams produce 104 million metric tons of methane a year, "making dams the single largest source of human-caused methane." *Id.* Further, as temperatures warm, more evaporative losses will occur from reservoirs impounded behind the dams. *See* Terry D. Prowse et al., *Dams, Reservoirs, and Flow Regulation*, *in* THREATS TO WATER AVAILABILITY IN CANADA 9, 9, 15 (Nat'l Water Research Inst. Ed., 2004), *available at* http://www.ec.gc.ca/inre-nwri/0CD66675-AD25-4B23-892C-5396F7876F65/ThreatsEN_03web.pdf.

and Klamath Mountains.[159] An $11 billion water bond slated for the 2010 ballot would have funded several high altitude dams in the Sierra Nevadas, including the proposed Garden Bar Dam, which would have flooded a significant portion of the Bear River north of Auburn, California, and the Temperance Flat Reservoir, which would have flooded the San Joaquin River Gorge.[160] Although these plans were ultimately removed from the 2010 ballot, the Federal Energy Regulatory Commission (FERC) endorsed Nevada Hydro Company's plan to obtain a permit for the construction of a 240-foot-tall dam to flood Decker Canyon, situated in the Santa Ana Mountains within the Cleveland National Forest in southern California, and to pump the water upward to an elevated reservoir, where the water will be run through generators to produce electricity for California and Nevada.[161] Just three years before the proposal was approved, the National Forest Service had included Decker Canyon in its recommendations for wilderness designation.[162] Meanwhile, the East Bay Municipal Utility District (MUD) continued to push for an expansion of the Pardee Dam on the Middle Bar of the Mokelumne River, a popular rafting and fishing spot at the edge of the Sierra Nevadas, until a state court put an end to its plans.[163]

California is not alone in its dam-building aspirations. Colorado is considering a proposal to build two new reservoirs on the Yampa River on the western slope of the Rocky Mountains, with water delivery tunnels

159 *See* Cal. Exec. Order No. S-3-05 (June 1, 2005), http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm (last visited Feb. 18, 2012); Felice Pace, *How Schwarzenegger Is Trying to Finagle More Big Dam Construction: California Governor Schwarzenegger Is Using Global Warming as an Excuse for More Massive Dam Construction*, ALTERNET, May 14, 2008, http://www.alternet.org/water/85420/?page=entire (last visited Feb. 18, 2012). For a discussion of Schwarzenegger's environmental legacy, see Sarah Krakoff, *Arnold Schwarzenegger and Our Common Future*, 53 BUFF. L. REV. 925 (2005).

160 *See* Lance Williams, *Despite Dam-Building, Enviros Pump Money into Governor's Water Bond*, CAL. WATCH, Aug. 5, 2010, http://californiawatch.org/dailyreport/despite-dam-building-enviros-pump-money-governors-water-bond-3713 (last visited Feb. 18, 2012); *see, e.g.*, Sierra Watch, *New Dam Threatens Sierra's Bear River*, YUBANET.COM, July 1, 2011, http://yubanet.com/regional/New-Dam-Threatens-Sierra-s-Bear-River.php#.TsBuk2DN6bJ (last visited Feb. 18, 2012). (explaining that the South Sutter Water District is moving forward with the Bear River dam proposal); *see also* John Lindt, *Temperance Flat Cost Pegged at $3.3 Billion*, VALLEY VOICE NEWSPAPER, http://www.valleyvoicenewspaper.com/vv/stories/2009/vv_temperanceflat_0164.htm (last visited Feb. 18, 2012) (explaining that the project would be reliant on funds from a state water bond, though the bond was not yet official).

161 Sara Lin, *Hydro Project Site Is Favored by Feds*, L.A. TIMES, Feb. 1, 2007, http://articles.latimes.com/2007/feb/01/local/me-reservoir1 (last visited Feb. 18, 2012); Alex Cruden, *Southern California Set to Build New Dam in National Forest: Cleveland National Forest Will See the Building of Net-Loss Dam in Decker Canyon*, YAHOO! VOICES, Feb. 10, 2007, http://www.associatedcontent.com/article/139095/southern_california_set_to_build_new.html (last visited Feb. 18, 2012).

162 Cruden, *supra* note 161.

163 Kelly Zito, *EBMUD Set Back by Pardee Reservoir Ruling*, SFGATE.COM, Apr. 19, 2011, http://articles.sfgate.com/2011-04-19/bay-area/30226942_1_water-agency-water-supply-utility (last visited Feb. 18, 2012). The Sacramento Superior Court ruled that MUD's 2009 environmental report failed to adequately describe and weigh the project's harm to important environmental and historic resources, including whitewater rafting runs and a black willow (*Salix negra*) stand used by members of the Miwok Tribe. *Id.*

situated beneath the Mount Zirkel Wilderness Area.[164] Washington State is contemplating the enlargement of an existing dam at Bumping Lake adjacent to the William O. Douglas Wilderness Area.[165] If the Bureau of Reclamation agrees with Washington's proposal, Bumping Lake would be *thirteen times* larger.[166] Washington State and the Bureau also recently considered, but ultimately rejected, constructing the $7 billion, 760-foot-high Black Rock Dam in the Yakima River basin.[167] In Idaho, pressure is mounting to rebuild the Teton Dam, a federally constructed earthen dam on the Teton River that collapsed in 1976, killing eleven people.[168]

Cloud Seeding. California and Nevada are likely to ramp up their efforts to seed clouds with silver iodide and dry ice—frozen carbon dioxide—in hopes of increasing winter snowfall in the mountains, including mountains within wilderness areas, and augmenting spring runoff.[169] The estimated volume of augmented water created by one active cloud seeding program in

164 N. COLO. WATER CONSERVANCY DIST., MULTI-BASIN WATER SUPPLY INVESTIGATION: EXECUTIVE SUMMARY 1, 6, 12 (2006), *available at* http://www.nwo.usace.army.mil/html/od-tl/eis/nisp.alts.AttachmentI2_NISPConcepts_TransMountainProjects(YampaProjectExecutiveSummary).pdf.

165 YAKIMA RIVER BASIN WATER ENHANCEMENT PROJECT (YRBWEP) WORKGROUP: INTEGRATED WATER RESOURCE MANAGEMENT PLAN: SUMMARY SUPPORT DOCUMENT 5–6 (2010), *available at* http://www.ecy.wa.gov/programs/wr/cwp/images/pdf/yrbwepsumsupprt.pdf; Wilderness.net, *William O. Douglas Wilderness*, http://www.wilderness.net/index.cfm?fuse=NWPS&sec=wildView&WID=652 (last visited Feb. 18, 2012). The plan would increase water storage for the Yakima Valley through an expansion of the existing reservoir and the construction of a new reservoir near Wymer, Washington, and includes water conservation measures, fish passages, and additional wilderness designations around Bumping Lake. David Lester, *Conservation Groups Could Back Water Storage Plan*, YAKIMA HERALD-REPUBLIC, Mar. 9, 2011, http://www.yakima-herald.com/stories/2011/03/09/conservation-groups-could-back-water-storage-plan (last visited Feb. 18, 2012). The Wilderness Society and several other environmental groups support the plan; the Sierra Club opposes it. *Id.*

166 *See* BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, NO. TS-YSS-8, RECLAMATION MANAGING WATER IN THE WEST: YAKIMA RIVER BASIN STORAGE ALTERNATIVES APPRAISAL ASSESSMENT, at ES-3 (2006), *available at* http://www.usbr.gov/pn/programs/storage_study/pdf/alternatives-appraisal/fullreport-yakima_alternatives_appraisal_assessment.pdf.

167 *See* WASH. STATE DEP'T OF ECOLOGY, NO. 09-12-009, FINAL ENVIRONMENTAL IMPACT STATEMENT: YAKIMA RIVER BASIN INTEGRATED WATER RESOURCE MANAGEMENT ALTERNATIVE 2-66 (2009), *available at* http://www.ecy.wa.gov/pubs/0912009.pdf (rejecting the Black Rock project due to high economic and social opportunity costs); 1 BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, RECLAMATION MANAGING WATER IN THE WEST: FINAL PLANNING REPORT/ENVIRONMENTAL IMPACT STATEMENT: YAKIMA RIVER BASIN WATER STORAGE FEASIBILITY STUDY xvii, 2-51 (2008), *available at* http://www.usbr.gov/pn/programs/storage_study/reports/eis/final/volume1.pdf.

168 Francisco Tharp, *Return of the Teton Dam?*, HIGH COUNTRY NEWS, Apr. 7, 2008, http://www.hcn.org/articles/17631 (last visited Feb. 18, 2012); Arthur Gibbs Sylvester, *Teton Dam Failure Narrative*, http://www.geol.ucsb.edu/faculty/sylvester/Teton_Dam/narrative.html (last visited Feb. 18, 2012). The dam was situated near Rexburg, Idaho, west of the Targhee National Forest and Teton National Park. Bureau of Reclamation, U.S. Dep't of the Interior, *The Failure of Teton Dam*, http://www.usbr.gov/pn/about/Teton.html (last visited Feb. 18, 2012).

169 Desert Research Inst., *DRI Cloud Seeding Program: Synopsis of DRI Cloud Seeding Program*, http://www.dri.edu/synopsis (last visited Feb. 18, 2012) (describing ongoing activities in the mountains of the Lake Tahoe, Truckee, Carson, Humbolt, Owyhee, Reese, and Upper Colorado river basins). The cost of augmented water ranges from about $7 to $18 per acre-foot. *Id.*

Nevada ranges from 20,000 to 80,000 acre-feet annually, a percentage increase of 2% to 10%.[170] The United States has provided $2.5 million in federal grants to a company in Nevada to establish the scientific basis for cloud seeding and to develop the tools with which to conduct cloud seeding and to evaluate its impacts.[171]

Artificial Water Deliveries and Water Quality Interventions. As precipitation patterns change and droughts become more persistent, wilderness managers may resort to artificial delivery systems to provide water to imperiled species. When bighorn sheep populations began to decline in southwest Arizona, FWS built two water structures in the Kofa National Wildlife Refuge and Wilderness.[172] FWS personnel, in partnership with the Arizona Game and Fish Department, maintain the tanks.[173] Comprised mostly of aerated PVC pipe buried underground and designed to catch rainwater and channel it into concrete weirs or troughs, each system is capable of holding approximately 13,000 gallons of water.[174] During droughts, water is transported to the structures.[175] FWS and other federal wilderness managers will face increasing pressure to authorize the installation and maintenance of such devices, along with stock-watering tanks and related infrastructure for grazing permittees, throughout the wilderness system.[176]

Another type of intervention involves efforts to restore water quality in wilderness areas. To diminish acidity caused by air pollution, Forest Service managers used helicopters to dump 140 tons of limestone into streams within the St. Mary's Wilderness in Virginia.[177] The agency recognized, "The question is whether to allow continued loss of the aquatic biota while preserving the wilderness concept or ideal of 'untrammeled', or compromise the wilderness ideal, to preserve the aquatic resource?"[178] The intervention worked—albeit briefly—to enhance the wilderness area's aquatic resources.[179] Within a few months, stream pH had returned to desirable

170 *Id.* The efficacy of cloud seeding is gauged through trace chemical analyses of snowfall. DESERT RESEARCH INST., CLOUD SEEDING: FACT SHEET (2010), *available at* http://www.dri.edu/images/stories/research/programs/cloud-seeding/DRICloudSeedingFactSheet2010.pdf.

171 DESERT RESEARCH INST., *supra* note 170.

172 Wilderness Watch, Inc. v. U.S. Fish & Wildlife Serv., 629 F.3d 1024, 1026 (9th Cir. 2010); *see supra* notes 81–90 (describing the area and the plan).

173 *Wilderness Watch*, 629 F.3d at 1027.

174 *Id.* at 1031.

175 *See id.* at 1027, 1040 (remanding because FWS did not provide sufficient evidence that its construction of water tanks in the wilderness area was necessary to conserve the bighorn sheep population); *see also* discussion *infra* notes 280–82.

176 *See Barnes*, 329 F. Supp. 2d 1141, 1153, 1155 (D. Ariz. 2004) (reversing BLM and the Interior Board of Land Appeals, which had allowed ranchers to use vehicles and mechanized equipment to repair and maintain their range developments, respond to emergencies in grazing allotments, and repair and maintain 15.5 miles of access routes in the Arrastra Mountain Wilderness).

177 U.S. FOREST SERV., U.S. DEP'T OF AGRIC., DECISION NOTICE AND FINDING OF NO SIGNIFICANT IMPACT: PROPOSED ST. MARY'S AQUATIC RESTORATION PROJECT, at DN-1 to -2 (1998), *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_000366.pdf.

178 *Id.* at DN-2.

179 *Id.* at DN-3 to -4.

levels and macroinvertebrate and fish populations began to improve.[180] Within six years, however, the streams were once again experiencing high acidity and the limestone treatment is being repeated, with no end in sight.[181]

Logging and Other Vegetation Management. Some wilderness managers and owners of adjacent lands are seeking more logging and other measures to "fire proof" forests and to inhibit the spread of disease and insect infestation.[182] Even in national park wilderness areas, where mechanical and chemical interventions are atypical, the Park Service has begun spraying thousands of acres of trees a year with insecticides and removing dead and dying trees by mechanical means, particularly in high-value areas such as visitor centers.[183]

One such intervention involves Bandelier National Monument, most of which was designated as wilderness in 1976,[184] where overgrazing and fire suppression has caused "unprecedented change" in the piñon–juniper woodlands.[185] Studies in the late 1990s indicated that thinning small-diameter trees and using the cut branches as a slash "erosion blanket" on exposed soils would generate a two- to seven-fold increase in understory cover and reduce soil erosion.[186] With these studies in mind, in 2007, the Park Service prepared an Environmental Impact Statement and adopted a broad-scale restoration plan for about 4000 acres of wilderness.[187] To do the thinning, the Park Service opted to use chainsaws, which are generally prohibited in wilderness.[188] It concluded that "treatment of such a large area would be infeasible without the use of motorized equipment."[189] While the use of hand tools would be less intrusive on wilderness values than chainsaws, the Park Service found that it would take twenty times longer to accomplish the restoration.[190] After the work is completed, the agency plans to use prescribed fire to maintain mechanically thinned areas.[191]

Other proposals include the removal of riparian vegetation, such as invasive tamarisk (*Tamarix ramosissima*)—salt cedar—in order to increase

180 Cole & Yung, *supra* note 124, at 4.

181 *Id.* at 5.

182 *Id.* at 5–6.

183 SAUNDERS ET AL., *supra* note 115, at 20.

184 Act of Oct. 20, 1976, Pub. L. No. 94-567, § 1(a), 90 Stat. 2692.

185 Charisse A. Sydoriak et al., *Would Ecological Landscape Restoration Make the Bandelier Wilderness More or Less of a Wilderness?*, WILD EARTH, Winter 2000/2001, at 83, 85, 87.

186 *Id.* at 88.

187 NAT'L PARK SERV., U.S. DEP'T OF THE INTERIOR, BANDELIER NATIONAL MONUMENT: FINAL ECOLOGICAL RESTORATION PLAN AND ENVIRONMENTAL IMPACT STATEMENT i, 10 (2007).

188 *See infra* text accompanying notes 298–304.

189 NAT'L PARK SERV., U.S. DEP'T OF THE INTERIOR, BANDELIER NATIONAL MONUMENT NEW MEXICO: ECOSYSTEM RESTORATION PLAN RECORD OF DECISION 3 (2007), *available at* http://parkplanning.nps.gov/document.cfm?parkID=27&projectID=10977&documentID=20655 (click "Signed ROD 9.18.07" to download PDF file).

190 *Id.* at 4.

191 *Id.* at 3; *see* Sandi Zellmer & John M. Anderies, *Wilderness Preserves: Still Relevant and Resilient After All These Years*, *in* RESILIENCE AND LAW (forthcoming 2012), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1871317 (click on "One-Click Download" link to download PDF file; article describes criteria to be used to determine whether restoration activities in wilderness areas should be undertaken).

water yield from wilderness and other protected areas.[192] In the Grand Canyon, for example, work crews are acting aggressively to remove tamarisk through a combination of mechanical and chemical controls, including pulling, cutting to stump level, girdling, and herbicide applications.[193] Tamarisk, however, provides habitat for a variety of endangered and threatened bird species, and tamarisk removal could jeopardize those species, in addition to trammeling the wild characteristics of the area.[194]

Eradicating Invasive Species. Management agencies have engaged in shooting, trapping, poisoning, burning, using biological control agents, and other types of invasive species eradication measures throughout the wilderness system. Tamarisk removal, described above, is just one example. The melaleuca initiative in the Florida Everglades is another even more intensive eradication program.[195] It deploys measures worthy of a horror movie. First, state and federal land managers have begun "mass rearing" and releasing biological agents, such as the melaleuca leaf weevil (*Oxyops vitiosa*) and the aphid-like psyllid (*Boreioglycaspis melaleucae*), both natives of Australia.[196] Next, chemical herbicides are sprayed from aircraft over large areas where melaleuca is hard to reach by other means.[197] The final assault involves a "brontosaurus"—a "monster of a machine that chips a standing tree from the top down to the ground using a grinder attached to the machine's head."[198] This leaves behind mulch, which contains melaleuca seedlings, but more biological agents can be released to attack the new growth.[199] Critics argue persuasively that these strategies are not aimed at

192 NAT'L PARK SERV., U.S. DEP'T OF THE INTERIOR, TAMARISK MANAGEMENT AND TRIBUTARY RESTORATION (2011), *available at* http://www.nps.gov/grca/naturescience/upload/TAMRAM bulletin20110304.pdf.

193 *Id.*

194 Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher, 60 Fed. Reg. 10,694, 10,698 (Feb. 27, 1995) (to be codified at 50 C.F.R. pt. 17) (discussing the increase in use of tamarisk as a habitat by the southwest willow flycatcher (*Empidonax traillii extimus*)); *see* Robert W. Adler, *Restoring the Environment and Restoring Democracy: Lessons from the Colorado River*, 25 VA. ENVTL. L.J. 55, 78 (2007) ("[W]hile invasive species often have devastating effects, . . . tamarisk in Grand Canyon . . . hosts huge populations of insects, which provide food for a wide range of birds, including the largest population of endangered southwestern willow flycatchers in Arizona. Black-chinned hummingbirds appear to prefer tamarisk for nesting sites." (footnote omitted)).

195 William E. O'Brien & Jennifer A. McIvor, *Is There Anything "Good" About Everglades Restoration?*, 35 ENV'TS J., 2007, at 1, 13, *available at* https://jps.library.utoronto.ca/index.php/ejis/article/view/14274/11266; *see supra* notes 140–44 and accompanying text (describing melaleuca).

196 *Id.* at 13; *Florida Battles Invasive Melaleuca Acre by Acre*, ENV'T NEWS SERV., Nov. 2, 2004, http://www.ens-newswire.com/ens/nov2004/2004-11-02-01.html (last visited Feb. 18, 2012).

197 *Florida Battles Invasive Melaleuca Acre by Acre*, *supra* note 196.

198 *Id.*

199 *Id.* Another piece of equipment in the maleleuca arsenal is a "feller buncher," a multifaceted machine with pinchers and a saw, which cuts the trunk, applies herbicide to the stump, picks up multiple trees with its pinchers, carries them to a collection site "like a flower bunch," and piles them into stacks for disposal. *Id.*; *see also* U.S. ARMY CORPS OF ENG'RS JACKSONVILLE DIST., MELALEUCA ERADICATION AND OTHER EXOTIC PLANTS: IMPLEMENT BIOLOGICAL CONTROLS (2009), *available at* http://www.evergladesplan.org/docs/fs_melaleuca_feb_2009.pdf.

wilderness preservation but are instead "a water supply program aimed at satisfying the human population growth demands along Florida's southern coasts [and] accommodating the demands of powerful economic interests."[200]

Invasive aquatic species have been a recurring target for Rotenone applications in wilderness streams and lakes.[201] In both the Carson-Iceberg Wilderness of California and the Bob Marshall Wilderness of Montana, federal agencies, in cooperation with state fish and game managers, are engaging in full-scale chemical eradication programs to remove introduced, nonnative trout in wilderness streams.[202] Chemical treatments, which are planned for up to three years,[203] utilize outboard motors, aircraft, and pumps to apply Rotenone.[204] In California, the plan involves application of Rotenone through hand spraying and mechanical drip stations.[205] The area downstream of the treated stream segment will be "neutralized" with potassium permanganate dispensed by a gas-powered generator and auger.[206] The agency determined that "chemical removal of hybridized trout with the piscicide Rotenone and the use of motorized equipment . . . is the minimum activity within Wilderness needed" to eradicate undesirable species and accomplish cutthroat trout restoration.[207] But Rotenone kills not only the targeted species, but also all other fish, amphibians, insects, and any other creatures that absorb oxygen through gills.[208] These types of efforts are likely to increase as wilderness-managing agencies attempt to mitigate or adapt to the effects of climate change on biological communities.

Reintroducing Native Species. Reintroductions of species that historically occupied wilderness areas but that no longer persist in those areas have already occurred and may be expected to continue as climate change threatens the viability of sensitive plant and animal populations. Examples include aerial stocking of cutthroat trout in wilderness lakes and streams, including those that have been cleared of invasive species

200 O'Brien & McIvor, *supra* note 195, at 14 (citation omitted); *see also* MICHAEL GRUNWALD, THE SWAMP 316–17 (2006) (describing the Comprehensive Everglades Restoration Plan as "an effort to expand the water pie").

201 *See, e.g.*, U.S. FOREST SERV., RECORD OF DECISION FOR THE PAIUTE CUTTHROAT TROUT RESTORATION PROJECT 1 (2010), *available at* http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/54914_FSPLT2_030233.pdf; Notice of Availability of Final Environmental Impact Statement for Paiute Cutthroat Trout Restoration Project, 75 Fed. Reg. 18,235, 18,236 (Apr. 9, 2010).

202 U.S. FOREST SERV., *supra* note 201, at 1–2; U.S. FOREST SERV., U.S. DEP'T OF AGRIC., SOUTH FORK FLATHEAD WATERSHED WESTSLOPE CUTTHROAT TROUT CONSERVATION PROGRAM: RECORD OF DECISION 1 (2006), *available at* http://efw.bpa.gov/environmental_services/Document_Library/South_Fork_Flathead/forest_service_rod2.pdf.

203 *See, e.g.*, U.S. FOREST SERV., *supra* note 201, at 5.

204 U.S. FOREST SERV., *supra* note 202, at 1.

205 U.S. FOREST SERV., *supra* note 201, at 5.

206 75 Fed. Reg. at 18,236; U.S. FOREST SERV., *supra* note 201, at 11.

207 U.S. FOREST SERV., *supra* note 201, at 11.

208 Alaska Dep't of Fish & Game, *What Is Rotenone?*, http://www.adfg.alaska.gov/index.cfm?adfg=rotenone.main (last visited Feb. 18, 2012); *see also* Californians for Alts. to Toxics v. U.S. Fish & Wildlife Serv., No. CIV. S-10-1477 FDC/CMK, 2011 WL 3915966, *26 (E.D. Cal. Sept. 6, 2011) (discussed *infra* notes 286–88 and accompanying text).

through the use of chemicals and other eradication measures.[209] In the Bob Marshall wilderness, the agencies are engaging in an intensive stocking program for westslope cutthroat trout (*Oncorhynchus clarki lewisi*)—the official state fish—in nearly twenty high elevation lakes, some of which were historically fishless.[210]

One of the most controversial reintroductions involves the Rocky Mountain gray wolf (*Canis lupus irremotus*), which had been extirpated from the Rockies by human depredation in the early twentieth century.[211] Pursuant to an Endangered Species Act (ESA)[212] recovery plan, gray wolves were captured from Canada and released into the Greater Yellowstone Ecosystem in the mid-1990s.[213] Federal courts rejected challenges brought by both ranchers and environmentalists who alleged violations of the National Environmental Policy Act,[214] the ESA, and other federal statutes.[215] In the latest round of litigation related to the reintroduction, a federal district court in Idaho upheld a decision to authorize the use of intrusive monitoring techniques—helicopters—to inventory and track reintroduced wolves and their offspring in wilderness areas.[216]

Assisted Migration of Nonnative Species. Climate-sensitive species may be moved to more suitable locations under assisted migration—or "managed relocation"—initiatives.[217] Potential climate refugees include the American pika (*Ochotona princeps*), bighorn sheep, red wolves (*Canis lupus rufus*), San Bernardino flying squirrels (*Glaucomys sabrinus californicus*), white-tailed ptarmigans (*Lagopus leucura*), coldwater trout and other fish species, arroyo toads (*Bufo californicus*), Quino checkerspot butterflies (*Euphydryas editha quino*), and white bark pine (*Pinus albicaulis*).[218] Pika, for example,

209 *See* U.S. FOREST SERV., *supra* note 201, at 3 (describing the use of Rotenone in the planned removal of invasive species and restocking with native trout); *see also* U.S. FOREST SERV., *supra* note 202, at 18.

210 U.S. FOREST SERV., *supra* note 202, at 2, 19 tbl.2-1; MT.gov, *Montana Field Guides: Westslope Cutthroat Trout*, http://fieldguide.mt.gov/detail_AFCHA02088.aspx (last visited Feb. 18, 2012) (stating that the cutthroat trout has been designated Montana's state fish).

211 U.S. FISH & WILDLIFE SERV., NORTHERN ROCKY MOUNTAIN WOLF RECOVERY PLAN 1–2 (1987), *available at* http://www.fws.gov/mountain-prairie/species/mammals/wolf/NorthernRockyMountainWolfRecoveryPlan.pdf.

212 Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544 (2006 & Supp. IV 2010).

213 U.S. FISH & WILDLIFE SERV. ET AL., ROCKY MOUNTAIN WOLF RECOVERY 2010 INTERAGENCY ANNUAL REPORT 5 (2011), *available at* http://www.fws.gov/mountain-prairie/species/mammals/wolf/annualrpt10/FINAL_2010_Northern_Rockies_Summary_and_Background_3_9_11.pdf.

214 National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4347 (2006).

215 Wyo. Farm Bureau Fed'n v. Babbitt, 199 F.3d 1224, 1241 (10th Cir. 2000).

216 Wolf Recovery Found. v. U.S. Forest Serv., 692 F. Supp. 2d 1264, 1269 (D. Idaho 2010).

217 Alejandro E. Camacho, *Assisted Migration: Redefining Nature and Natural Resource Law Under Climate Change*, 27 YALE J. ON REG. 171, 173 (2010).

218 *See, e.g.*, Holtcamp, *supra* note 100, at 8–9 (discussing the effects of temperature on the American Pika); Clinton W. Epps et al., *Effects of Climate Change on Population Persistence of Desert-Dwelling Mountain Sheep in California*, 18 CONSERVATION BIOLOGY 102, 103 (2004) (bighorn sheep); Camacho, *supra* note 217, at 175, 203 (red wolves and coldwater trout); Ctr. for Biological Diversity, *Mammals: San Bernardino Flying Squirrel*, http://www.biologicaldiversity.org/species/mammals/San_Bernardino_flying_squirrel/index.html (last visited Feb. 18, 2012) (San Bernadino flying squirrel); Sara J. Oyler-McCance et al., *Effects of Climate Change*

historically resided at around 5700 feet elevation in certain areas of the Southwest, but in recent decades they have crept uphill an additional 1000 feet.[219] They seek higher elevations because rising summer temperatures threaten them with heat stress and reduce their ability to gather food, while diminished snowpack in winter reduces the available shelter, making them more vulnerable to cold snaps.[220] In California and Nevada, pika are running out of room to climb.[221] The high peaks, cooler temperatures, and undisturbed habitat features of wilderness areas in the northern Rockies of Colorado, Wyoming, Montana, and Canada may seem like an attractive new home,[222] but the pika would need human help to get there.

Renewable Energy Development. At no other time in the nation's history has the pressure to develop new—particularly renewable—energy sources been more acute.[223] To reduce the potential effects of climate change, both the Bush and Obama administrations have prioritized the development of geothermal, wind, and solar power on the federal public lands.[224]

on Nutrition and Genetics of White-Tailed Ptarmigan, *in* 39 STUDIES IN AVIAN BIOLOGY: ECOLOGY, CONSERVATION, AND MANAGEMENT OF GROUSE 283, 283–94 (Brett Sandercock et al. eds., 2011), *available at* http://www.fort.usgs.gov/Products/Publications/23309a/23309a.pdf (white-tailed ptarmigan); U.S. FISH & WILDLIFE SERV., ARROYO TOAD (BUFO CALIFORNICUS (=MICROSCAPHUS)): 5-YEAR REVIEW: SUMMARY AND EVALUATION 16 (2009), *available at* http://www.biologicaldiversity.org/species/amphibians/arroyo_toad/pdfs/5_year_review_5-21-10.pdf (stating climate change is a newly identified threat following the arroyo toad listing); David Biello, *Deporting Plants and Animals to Protect Them from Climate Change*, SCI. AM., July 17, 2008, http://www.scientificamerican.com/article.cfm?id=deporting-plants-and-animals-to-protect-from-climate-change (last visited Feb. 18, 2012) (Quino checkerspot butterfly); Press Release, Comm. on the Status of Endangered Wildlife in Can., Species at Risk in Canada Increase in 2010 - The International Year of Biodiversity (May 3, 2010), *available at* http://www.cosewic.gc.ca/rpts/sct7_3_15_e.pdf (white bark pine).

219 *See, e.g.*, Holtcamp, *supra* note 100, at 9; SIERRA NEV. ALLIANCE, SIERRA CLIMATE CHANGE TOOLKIT 18 (2010), *available at* http://www.sierranevadaalliance.org/programs/db/pics/1298596515_7886.f_pdf.pdf; Nat'l Park Serv., U.S. Dep't of the Interior, *Pikas in Peril*, http://science.nature.nps.gov/im/units/ucbn/monitor/pika/pika_peril/index.cfm (last visited Feb. 18, 2012).

220 Holtcamp, *supra* note 100, at 9.

221 *See id.*

222 *See, e.g.*, *id.*; Stuart L. Pimm, *High-Living Pika Can Help Us Understand Our Climate Fate*, NAT'L GEOGRAPHIC NEWS WATCH, Feb. 5, 2010, http://newswatch.nationalgeographic.com/2010/02/05/pika_habitat_climate_risk/ (last visited Feb. 18, 2012); Robert L. Fischman & Jeffrey B. Hyman, *The Legal Challenge of Protecting Animal Migrations as Phenomena of Abundance*, 28 VA. ENVTL. L.J. 173, 179 (2010) ("Any successful strategy for protecting migration will need to address habitat destruction, human-created obstacles, overexploitation (i.e., hunting and fishing), and climate change.").

223 World Nuclear Ass'n, *Renewable Energy and Electricity*, http://world-nuclear.org/info/inf10.html (last visited Feb. 18, 2012) ("There is unprecedented interest in renewable energy, particularly solar and wind energy, which provide electricity without giving rise to any carbon dioxide emission.").

224 *See, e.g.*, Hil Anderson, *High Renewable Energy Potential in West*, UNITED PRESS INT'L, Feb. 21, 2003, http://www.upi.com/Top_News/2003/02/21/High-renewable-energy-potential-in-West/UPI-11941045870103/ (last visited Feb. 18, 2012) (discussing how the Department of Energy and Department of the Interior, during the Bush Administration, conducted studies concerning the large potential that existed in the West for renewable energy); Ken Salazar, *Standing Up Renewable Energy on America's Lands and Oceans*, WHITE HOUSE BLOG (Jan. 18,

The desire to develop renewable energy sources, like solar or wind plants, is clashing with the desire to preserve untrammeled landscapes and primeval wilderness characteristics. Some environmental groups fear that "an army of mirrors, generators and transmission towers [will] transform[]. . . [d]esert vistas" in the Mojave and other southwestern deserts of the public lands.[225]

In recent years, Congress has passed several bills supporting renewable energy development on public lands and elsewhere.[226] In the Energy Policy Act of 2005,[227] Congress directed the Department of the Interior to install 10,000 megawatts of renewable energy projects on the public lands by 2015.[228] In 2008, BLM and the Department of Energy (DOE) initiated a process to develop a program for utility-scale solar energy projects on BLM lands.[229] The American Recovery and Reinvestment Act of 2009[230] provides federal loan guarantees to secure financing for renewable energy projects that commenced construction by September 30, 2011.[231] In addition, as of 2011, twenty-nine states and the District of Columbia have imposed renewable energy standards, requiring electrical utilities to produce a certain percentage of their power from renewable resources.[232] The Obama Administration expected thirty-eight additional large-scale solar facilities to come on-line by the end of 2010, which would generate another 613 megawatts of renewable energy.[233]

Some of these technologies are terribly thirsty.[234] Concentrated solar power (CSP) facilities require water for cooling and steam generation.[235]

2011, 4:25 PM), http://www.whitehouse.gov/blog/2011/01/18/standing-renewable-energy-america-s-lands-and-oceans (discussing efforts of the Obama Administration in 2010 to increase wind, solar, geothermal, and transmission on public lands).

225 Felicity Barringer, *Environmentalists in a Clash of Goals*, N.Y. TIMES, Mar. 24, 2009, at A17.

226 *See, e.g.*, Debbie Leonard, *Doctrinal Uncertainty in the Law of Federal Reserved Water Rights: The Potential Impact on Renewable Energy Development*, 50 NAT. RESOURCES J. 611, 631–32 (2010) (citing, *inter alia*, American Clean Energy Leadership Act of 2009, S. 1462, 111th Cong. (2009)).

227 Pub. L. No. 109-58, 119 Stat. 594 (codified primarily in scattered sections of 42 U.S.C.).

228 *Id.* § 211, 119 Stat. at 660.

229 Notice of Intent to Prepare Programmatic Environmental Impact Statement, 73 Fed. Reg. 30,908, 30,908–09 (May 29, 2008).

230 Pub. L. No. 111-5, 123 Stat. 115 (codified as amended in scattered sections of 26 U.S.C.).

231 *Id.* § 1101, 123 Stat. 319; *id.* § 1603(a)(1)–(2), 123 Stat. 364.

232 Fed. Energy Regulatory Comm'n, *Renewable Power & Energy Efficiency Market: Renewable Portfolio Standards* (2011), *available at* http://www.ferc.gov/market-oversight/othr-mkts/renew/othr-rnw-rps.pdf; U.S. Dep't of Energy Office of Energy Efficiency & Renewable Energy et al., *Database of State Incentives for Renewables & Efficiency: RPS Policies*, *available at* http://www.dsireusa.org/documents/summarymaps/RPS_map.pptx. Of these states, "only sixteen [] have specific goals or incentives for solar power." Robert Glennon & Andrew M. Reeves, *Solar Energy's Cloudy Future*, 1 ARIZ. J. ENVTL. L. & POL'Y 91, 93 n.7 (2010).

233 Glennon & Reeves, *supra* note 232, at 94.

234 Todd Woody, *Alternative Energy Projects Stumble on a Need for Water*, N.Y. TIMES, Sept. 30, 2009, http://www.nytimes.com/2009/09/30/business/energy-environment/30water.html.

235 U.S. DEP'T OF ENERGY, CONCENTRATING SOLAR POWER COMMERCIAL APPLICATION STUDY: REDUCING WATER CONSUMPTION OF CONCENTRATING SOLAR POWER ELECTRICITY GENERATION 4–5, *available at* http://www1.eere.energy.gov/solar/pdfs/csp_water_study.pdf.

Technologies that employ a steam cycle, where the sun's heat is used to boil water to create steam to spin a turbine to generate electricity, place tremendous demands on water supplies.[236] Not surprisingly, large-scale solar facilities are typically located in areas of the Southwest with the greatest solar intensity—the very same region where the demand for water is most pressing.[237] In Arizona alone, BLM has received over thirty proposals for solar plants to be located on federal land, twenty-eight of which intend to use CSP technology.[238]

Several statewide and individual wilderness acts explicitly allow climatological equipment,[239] but as yet none have authorized renewable energy installations such as solar panels, wind turbines, or affiliated transmission lines. It is conceivable, however, that new wilderness packages proposed to Congress might exempt newly designated areas from the Wilderness Act's prohibitions on installations, motor vehicles, and mechanized equipment to promote renewable energy development. Congress could also authorize nonconforming projects in existing wilderness areas through special appropriation riders attached to congressional budget bills.[240]

---

236 Glennon & Reeves, *supra* note 232, at 97–98.

237 *See id.* at 96, 117–23, 128 (describing the pressure to develop CSP facilities on federal lands, but recommending that, other than federal lands with a history of high-impact use that can no longer provide high-quality habitat, developers should focus on fallowed farmlands or other private or tribal lands with access to secure water rights).

238 *Id.* at 102.

239 *See* ROSS W. GORTE, CONG. RESEARCH SERV., RL 33827, WILDERNESS LAWS: PERMITTED AND PROHIBITED USES 7–9 (2010). The Utah and Arizona Acts of 1984 and the Nevada Act of 1990 authorize the installation and maintenance of hydrological, meteorological, and climatological equipment in wilderness areas, as does the Omnibus Public Land Management Act of 2009. *Id.* (citing Utah Wilderness Act of 1984, Pub. L. No. 98-428, § 305, 98 Stat. 1657, 1661–62; Arizona Wilderness Act of 1984, Pub. L. No. 98-406, § 101(a)(13), 98 Stat. 1485, 1486; Nevada Wilderness Protection Act of 1989, Pub. L. No. 101-195, § 10, 103 Stat. 1784, 1788; and Omnibus Public Land Management Act of 2009, Pub. L. No. 111-11, §§ 1903(c), 1972(b)(8), 123 Stat. 991, 1070, 1079); *see also* Caribbean National Forest Act of 2005, Pub. L. No. 109-118, § 3(d), 119 Stat. 2527, 2528 (authorizing the installation and maintenance of hydrological, meteorological, climatological, or atmospheric facilities in certain areas if they "are essential to the scientific research purposes of the Luquillo Experimental Forest"); Northern California Coastal Wild Heritage Wilderness Act, Pub. L. No. 109-362, § 4(g), 120 Stat. 2064, 2068 (2006) (authorizing hydrological, meteorological, or climatological equipment—snow sensors and stream gauges—to "further the scientific, educational, and conservation purposes").

240 *See, e.g.*, Sandra Beth Zellmer, *Sacrificing Legislative Integrity at the Altar of Appropriations Riders: A Constitutional Crisis*, 21 HARV. ENVTL. L. REV. 457, 486–89 (1997) (describing environmental exemptions enacted by modern Congresses through riders); Earthjustice, *Congress v. The Environment: The 2012 Appropriations Rider Tracker*, http://earthjustice.org/print/news/press/2011/congress-v-the-environment-the-2012-appropriations-rider-tracker (last visited Feb. 18, 2012) (describing riders included in the 2012 Interior and EPA bill, H.R. 2584, which would open wilderness study areas to drilling, mining, and off-road vehicles, as well as exempt border patrol activities in wilderness areas from environmental laws).

V. PROTECTING WILDERNESS WATERS THROUGH FEDERAL LAW

The Wilderness Act prohibits construction of structures, motorized and mechanized access, and other types of activities that adversely affect water quality and stream flows, but it exempts some intrusive activities from these prohibitions, thereby allowing degradation of wilderness values.[241] There are several additional federal statutes that could be utilized effectively to preserve water bodies within wilderness areas. The ESA, which prohibits anyone from taking listed species and also requires federal agencies to consult to avoid jeopardy to listed species or the adverse modification of their critical habitat, is one of the most potent tools in the federal arsenal when a listed species is present.[242] Many other scholars—including this author—have devoted significant attention to the ESA as it applies to water-dependent species,[243] but the ESA is an imperfect tool for preserving wilderness characteristics because it elevates listed species over all other federal management missions, including wilderness preservation.[244] The needs of listed species are sometimes, but not always, aligned with wilderness preservation.[245]

This Part focuses on the Wilderness Act itself, plus three water law regimes that have received somewhat less attention in the literature, and which could be especially powerful in the wilderness preservation context:

---

241 Wilderness Act, 16 U.S.C. § 1133(d)(1)–(2) (2006); *see also* Daniel Rohlf & Douglas L. Honnold, *Managing the Balances of Nature: The Legal Framework of Wilderness Management*, 15 ECOLOGY L.Q. 249, 260–61 (1988) (noting the exceptions that Congress placed in the Wilderness Act and that the multiple goals of the Act can lead to internal conflicts within the law).

242 Endangered Species Act of 1973, 16 U.S.C. §§ 1536(a)(2), 1538(a)(1) (2006); *see also* Amy Sinden, *In Defense of Absolutes: Combating the Politics of Power in Environmental Law*, 90 IOWA L. REV. 1405, 1491 (2005).

243 *See, e.g.*, Robin Kundis Craig, *Climate Change, Regulatory Fragmentation, and Water Triage*, 79 U. COLO. L. REV. 825, 880 (2008) (stating that courts have most insistently demanded "that the relevant agencies consider the effects of climate change in their ESA decisions . . . for aquatic and marine species"); *see generally* Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279 (2003) (discussing the 2001 drought in the Klamath Basin and the use of the ESA to protect endangered fish species); Sandra B. Zellmer, *A New Corps of Discovery for Missouri River Management*, 83 NEB. L. REV. 305 (2004) (analyzing the legal, ecological, and statutory conflicts that surround management of the Missouri River); Craig N. Johnston, *Salmon and Water Temperature: Taking Endangered Species Seriously in Establishing Water Quality Standards*, 33 ENVTL. L. 151 (2003) (arguing that the CWA may be a better vehicle than the ESA to protect salmon).

244 Tenn. Valley Auth. v. Hill, 437 U.S. 153, 184–85 (1978) ("The plain intent of Congress in enacting this statute was to halt and reverse the trend toward species extinction, whatever the cost. . . . The pointed omission of the type of qualifying language . . . reveals a conscious decision by Congress to give endangered species priority over the 'primary missions' of federal agencies.").

245 *See supra* notes 72, 201–08, 216 and accompanying text (describing judicial responses to agency efforts to restore threatened Paiute cutthroat trout by eradicating competitive species with chemical pesticides, and to monitor reintroduced grey wolves with helicopters in wilderness areas); *infra* note 308 and accompanying text (describing judicial responses to agency efforts to protect endangered woodpeckers by spraying infested trees).

the federal reserved water rights doctrine; the Wild and Scenic Rivers Act; and the antidegradation provisions of the CWA.

A. The Wilderness Act's Prohibitions and Exceptions

To preserve the natural conditions and wild, untrammeled characteristics of designated wilderness areas, the Wilderness Act imposes some of the most restrictive management constraints found in federal law.[246] Although the Act's prohibitions against roads, motors, and other activities sweep broadly, the Act recognizes several categories of exceptions, some of which are relevant to water resources management. First, the development of water resources infrastructure may be authorized in certain limited circumstances.[247] Second, agencies may allow motor vehicles, motorized equipment, mechanical transport, aircraft landings, structures, and installations "as necessary to meet minimum requirements for the administration of the area."[248] Third, the Act authorizes "such measures . . . as may be necessary in the control of fire, insects, and diseases."[249] The parameters of these exceptions and their implications for climate-related manipulations in wilderness areas are addressed in turn below.

1. Water Resources Development

The first exception gives the President the power to authorize water resources development in certain wilderness areas:

> Within wilderness areas in the national forests . . . the President may . . . authorize prospecting for water resources, the establishment and maintenance of reservoirs, water-conservation works, power projects, transmission lines, and other facilities needed in the public interest, including the road construction and maintenance essential to development and use thereof, upon his determination that such use or uses in the specific area will better serve the interests of the United States and the people thereof than will its denial . . . .[250]

To date, this exception has not been invoked.[251] It is an unusual provision in that it places the onus on the President rather than the Secretary of Agriculture; perhaps the greater level of public scrutiny that comes with presidential action is one reason why it has never been utilized.

Another more practical reason for its nonuse is that Congress tends to include explicit language in individual wilderness acts to either grandfather existing water infrastructure or to allow new infrastructure when it

246 *See supra* Part II.B.

247 Wilderness Act, 16 U.S.C. § 1133(d)(4) (2006).

248 *Id.* § 1133(c), (d)(4) ("[G]razing of livestock . . . shall be permitted to continue subject to such reasonable regulations as are deemed necessary . . . .").

249 *Id.* § 1133(d)(1).

250 *Id.* § 1133(d)(4).

251 Michael C. Blumm, *Reversing the* Winters *Doctrine?: Denying Reserved Water Rights for Idaho Wilderness and Its Implications*, 73 U. COLO. L. REV. 173, 193 n.104 (2002).

designates new wilderness areas in water-stressed areas.[252] But one can imagine that the President might wield this authority in the future when diminishing water supplies are no longer adequate to meet growing demand. If he or she does so, presidential action is virtually unstoppable in court because it is not subject to judicial review under the Administrative Procedure Act.[253] And with dams and other water infrastructure development will come motorized and mechanized equipment.[254]

Even without new construction, there are already some 200 preexisting dams situated in wilderness areas.[255] The most famous of these is the O'Shaughnessy Dam in the Hetch Hetchy Valley of Yosemite National Park.[256] Constructed in 1923, the dam and its reservoir supply the City of San Francisco with water and power.[257] The decision to build the dam is widely recognized as "one of the great natural resource fights of the Conservation Era."[258] Utilitarians, including former Forest Service Chief, Gifford Pinchot, challenged the preservationists' position—articulated most forcefully by

252 *Compare* Act of Dec. 22, 1980, Pub. L. No. 96-560, § 102(a)(5), 94 Stat. 3265, 3266 (creating the Holy Cross Wilderness area and providing "no right, or claim of right, to the diversion and use of existing conditional water rights for the Homestake Water Development project by the cities of Aurora and Colorado Springs shall be prejudiced, expanded, diminished, altered, or affected by this Act"), *and* H.R. REP. NO. 96-617, at 9 (1979) ("[W]ater diversion facilities exist within a portion of the proposed [La Garita] [W]ilderness additions, and it is the Committee's intention that wilderness designation not interfere with necessary operation, maintenance or repair of such facilities."), *and* California Wilderness Act of 1984, Pub. L. No. 98-425, §101(a)(25), 98 Stat. 1619, 1622 (protecting rights for water diversion and use, including construction, operation, maintenance, and repair in one area), *and* Wyoming Wilderness Act of 1984, Pub. L. No. 98-550, § 201(c), 98 Stat. 2807, 2809–10 (protecting rights for water diversion and use, including construction, operation, maintenance, and modification in four areas), *with* Omnibus Public Land Management Act of 2009, Pub. L. 111-11, § 2405(h)(3), 123 Stat. 991, 1104 (prohibiting the development of new water structures in the Dominguez Canyon Wilderness of Colorado).

253 *See* Administrative Procedure Act, 5 U.S.C. §§ 701, 704 (2011); Sisseton-Wahpeton Oyate v. U.S. Dep't of State, 659 F. Supp. 2d 1071, 1080–82 (D.S.D. 2009) (rejecting the Tribes' challenge to a presidentially authorized oil pipeline); Franklin v. Massachusetts, 505 U.S. 788, 800–01 (1992) (holding that the President's actions in calculating the number of representatives to which each state would be entitled after decennial census and in transmitting that apportionment to Congress are not "final agency actions" subject to review under the Administrative Procedure Act).

254 *See* George Nickas, *Preserving an* Enduring *Wilderness: Challenges and Threats to the National Wilderness Preservation System*, 76 DENV. U. L. REV. 449, 458 (1999).

255 *Id.* at 457.

256 Wandering Lizard, *Wandering Lizard History: Biographical Notes: Michael Maurice O'Shaughnessy*, http://www.inn-california.com/articles/biographic/oshaughnessybio.html (last visited Feb. 18, 2012).

257 *See* Gerald H. Meral, *Beyond and Beneath O'Shaughnessy Dam: Options to Restore Hetch Hetchy Valley and Replace Water and Energy Supplies*, 2 GOLDEN GATE U. ENVTL. L.J. 22, 22 (2008).

258 A. Dan Tarlock, *Water Demand and Energy Production in a Time of Climate Change*, 5 ENVTL. & ENERGY L. & POL'Y J. 325, 358 n.165 (2010). John Muir's vision of a "wild Tuolumne River ecosystem and free-flowing Tuolumne River" within Yosemite Park became a "beacon" for the passage of the Wilderness Act. Brian E. Gray, *Hetch Hetchy and the Paradoxes of Restoration*, 13 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 211, 217 (2007).

John Muir—that the dam would irreparably impair the Park.[259] Dam proponents argued "a high mountain 'lake' would be equally (if not more) beautiful than the little used, 'mosquito-infested' valley."[260] John Muir countered: "Everybody needs beauty as well as bread, places to play in and pray in, where Nature may heal and cheer and give strength to body and soul alike."[261] Although Muir and the other dam opponents lost the battle over Hetch Hetchy, an environmental movement was born; as Professor Brian Gray explains:

> Hetch Hetchy was lost because Muir and his cohorts in the fledgling preservationist movement were unable to persuade Congress . . . . Yet, they planted a seed from which blossomed the modern environmental era.
>
> Two years later, the Hetch Hetchy debacle led Congress to enact the National Park Service Act, which created a national park system for the fundamental purposes of protecting and preserving . . . the parks and their natural resources [and leaving them] "unimpaired for the enjoyment of future generations."[262]

The California Wilderness Act of 1984[263] designated about 95% of Yosemite National Park as wilderness, including the entire watershed above the high water mark of Hetch Hetchy Reservoir.[264] The Hetch Hetchy area is more remote and less crowded than the immensely popular Yosemite Valley, and hikers can find isolation and a sense of wildness there, but the loss of the wild, free-flowing river has left an indelible mark on its sound-scape, aesthetics, and ecological integrity.[265]

Other wilderness areas within Yosemite contain dams as well, although none are as notorious as O'Shaughnessy.[266] Outside of the Park, in the

259 Gray, *supra* note 258, at 214; Forest History Soc'y, *U.S. Forest Service History: Gifford Pinchot (1865–1946)*, http://www.foresthistory.org/ASPNET/people/Pinchot/Pinchot.aspx (last visited Feb. 18, 2012).

260 Gray, *supra* note 258, at 214.

261 *Id.* at 216 (quoting John Muir, *Hetch Hetchy Valley*, *reprinted in* NATURE WRITINGS 810, 814 (William Cronon ed., 1997)).

262 *Id.* (emphasis omitted) (quoting National Park Service Organic Act, 16 U.S.C. § 1 (2006)) Gray adds, "The memory of Hetch Hetchy Valley was invoked to defend Dinosaur National Monument and the Grand Canyon against the Bureau of Reclamation's proposals to dam the Green and Colorado Rivers in the 1960s." *Id.* at 216–17.

263 Pub. L. No. 98-425, § 101(a)(25), 98 Stat. 1619, 1622.

264 DEP'T OF WATER RES. & DEP'T OF PARKS & RECREATION, STATE OF CAL. RES. AGENCY, HETCH HETCHY RESTORATION STUDY 14 (2006), *available at* http://www.water.ca.gov/pubs/environment/hetch_hetchy_restoration_study/hetch_hetchy_restoration_study_report.pdf (describing area history and assessing options for restoring Hetch Hetchy); *see also* NAT'L PARK SERV., U.S. DEP'T OF THE INTERIOR, YOSEMITE: HETCH HETCHY VALLEY (2007), *available at* www.nps.gov/yose/planyourvisit/upload/hetchhetchy-sitebull.pdf.

265 *See* Gray, *supra* note 258, at 218–19.

266 For example, Gem Lake Dam, completed in 1916, and Rush Meadows Dam, completed in 1925, are both situated in Yosemite's Ansel Adams Wilderness. John C. Stoessel et al., *Keeping an Aging Dam Performing in the 21st Century*, *in* COLLABORATIVE MANAGEMENT OF INTEGRATED WATERSHEDS 533, 537 (U.S. Soc'y on Dams 2010), *available at* http://ussdams.com/proceedings/USSDproceedings2010.pdf (describing the challenges of operating an aging dam when "the

Emigrant Wilderness Area, which contains the headwaters of the Tuolumne and Stanislaus Rivers, the Forest Service planned to repair several small, stone dams, constructed in the early twentieth century, to preserve their historical values and to enhance fisheries by augmenting downstream flows.[267] The court found that the dams violated the prohibition on any "structure or installation," and that the proposal was not necessary to meet the minimum requirements for the administration of the area, and thus was not permitted under the Wilderness Act.[268] The court noted, "What would be lost is some enhancement of a particular use of the area (fishing), but that use, while perhaps popular, is not an integral part of the wilderness nature of that area."[269] The dams did not have to be dismantled, however; they were left to "decay naturally."[270]

A few dams in wilderness areas have in fact been removed. Four high-elevation dams on the headwaters of the Platte River were constructed in the backcountry of Rocky Mountain National Park prior to the Park's establishment in 1915, primarily for water storage for the city of Longmont, Colorado.[271] In 1982, Lawn Lake Dam failed, and 22 million cubic feet of water crashed into the Roaring River and downstream through the town of Estes Park.[272] Damages were estimated at $31 million, and three lives were lost.[273] Subsequent inspection of the other three dams revealed severe deterioration.[274] In 1987, the Park Service purchased the easement for the three dams from Longmont, and began to remove the dams.[275] The work was completed in 2002, and since then Lawn, Sandbeach, and Pear Lakes and their outlet streams have reestablished populations of native greenback

Wilderness Act requires that work be done in the most primitive way possible, thus minimizing the impact on the wilderness environment, life, and experience"); John C. Stoessel & John A. Wilkes, *Dams and Civil Structures: Geomembrane Installed to Control Leakage at Gem Lake Dam*, HYDROWORLD.COM, http://www.hydroworld.com/index/display/article-display/1496452956/articles/hydro-review/volume-29/issue-5/articles/dams-and_civil_structures.html (last visited Feb. 18, 2012).

267 High Sierra Hikers Ass'n v. U.S. Forest Serv., 436 F. Supp. 2d 1117, 1121–23 (E.D. Cal. 2006).

268 *Id.* at 1131 (citing Wilderness Act, 16 U.S.C. § 1133(c) (2006)).

269 *Id.* at 1137.

270 Dave H. Johnson, *The Battle Over Fish Check Dams in the Emigrant Wilderness*, EZINEARTICLES.COM, Mar. 29, 2010, http://ezinearticles.com/?The-Battle-Over-Fish-Check-Dams-in-the-Emigrant-Wilderness&id=4018575 (last visited Feb. 18, 2012).

271 Mont. Water Ctr., *Wild Fish Habitat Initiative: High Elevation Dam Removals in Rocky Mountain National Park*, http://wildfish.montana.edu/Cases/browse_details.asp?ProjectID=50 (last visited Feb. 18, 2012). The area was first recommended for wilderness protection in 1974, but was not officially designated until 2009. Press Release, Nat'l Park Serv., U.S. Dep't of the Interior, Salazar Joins Congressional Delegation, Local Leaders to Dedicate Rocky Mountain National Park Wilderness Area (Apr. 9, 2009), http://www.nps.gov/romo/naturescience/wilderness.htm (last visited Feb. 18, 2012). Several areas were designated in adjacent national forests in the Colorado Wilderness Act of 1980. Act of Dec. 22, 1980, Pub. L. No. 96- 560, § 102, 94 Stat. 3265, 3266–67.

272 Mont. Water Ctr., *supra* note 271.

273 *Id.*

274 *Id.*

275 *Id.*

cutthroat trout (*Oncorhynchus clarki stomias*) and the lakes have returned to pre-impoundment water levels.[276]

2. Activities "Necessary to Meet Minimum Requirements" and Control Fire, Insects, and Disease

Two additional exceptions in the Wilderness Act may encompass certain types of water management structures or installations and attendant vehicles, motorized equipment, mechanical transport, and other nonconforming uses. The first, section 4(c), authorizes these types of intrusions "as necessary to meet minimum requirements for the administration of the area for the purpose of this chapter (including measures required in emergencies involving the health and safety of persons within the area)."[277] The second, section 4(d), authorizes "such measures . . . as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable."[278]

Courts have generally construed the first of these two exceptions narrowly.[279] In the *Wilderness Watch* case, the Ninth Circuit enjoined the construction and maintenance of water tanks that were intended to augment water supplies for bighorn sheep.[280] The court found that, while sheep conservation was undoubtedly a legitimate purpose within the Kofa wilderness area, the tanks were "installations" that unlawfully trammeled the wilderness, contrary to the explicit terms of the Act.[281] Although such installations might be useful to sheep threatened by drought and high temperatures, the FWS had failed to establish that they were a necessary minimum requirement for wilderness administration.[282] The Eleventh Circuit reached a similar conclusion in *Wilderness Watch v. Mainella*,[283] where it enjoined the Park Service's practice of transporting tourists in a passenger van across the Cumberland Island Wilderness in order to provide public access to historical structures.[284] It rejected the Park Service's argument that such services were "necessary" just because they made access more convenient and had "no net increase" in impacts to the land.[285] Likewise, in *Californians for Alternatives to Toxics v. United States Fish & Wildlife Service*,[286] a federal district court rejected the Forest Service's argument that

276 *Id.*

277 Wilderness Act, 16 U.S.C. § 1133(c) (2006).

278 *Id.* § 1133(d)(1).

279 *See* Peter A. Appel, *Wilderness and the Courts*, 29 STAN. ENVTL. L.J. 62, 96 (2010); *see also* Peter A. Appel, *Wilderness, the Courts, and the Effect of Politics on Judicial Decisionmaking*, 35 HARV. ENVTL. L. REV. 275, 277–78 (2011) (finding that courts are more likely to uphold wilderness-protective decisions than they are wilderness-impacting decisions).

280 Wilderness Watch, Inc. v. U.S. Fish & Wildlife Serv., 629 F.3d 1024, 1032, 1036–37 (9th Cir. 2010).

281 *Id.*; *see supra* notes 81–90 and accompanying text.

282 *Wilderness Watch*, 629 F.3d at 1040.

283 375 F.3d 1085 (11th Cir. 2004).

284 *See id.* at 1089–90, 1096.

285 *Id.* at 1089–90, 1095–96.

286 No. CIV. S-10-1477 FCD/CMK, 2011 WL 3915966 (E.D. Cal. Sept. 6, 2011).

motorized equipment use and Rotenone application were necessary for restoring the Paiute cutthroat trout (*Oncorhynchus Clarki Seleniris*), a threatened species.[287] The court found that the agencies improperly elevated the conservation of the Paiute cutthroat trout over the preservation of other endemic species, and enjoined the eradication program because it would "impede progress towards preserving the overall wilderness character."[288]

Conversely, in *Wolf Recovery Foundation v. United States Forest Service*,[289] a federal district court in Idaho upheld a Forest Service decision to authorize the Idaho Department of Fish and Game to use intrusive monitoring techniques—helicopters—to inventory and monitor reintroduced wolves and their offspring in the Frank Church–River of No Return Wilderness.[290] The court upheld the Forest Service's special use permit that allowed Idaho Fish and Game to use low-flying helicopters and helicopter landings to track, pursue, dart, and collar wolves.[291] Although the Wilderness Act generally precludes helicopters, the court approved the permit as "necessary" because it would "improve the understanding 'of the character of the wilderness prior to man's intervention' and 'the predator/prey relationship that existed in the past.'"[292] The plaintiffs suspected that the primary reason for monitoring was to aid a wolf-hunting program initiated by Idaho.[293] Although the court did not reach this issue, it did recognize the paradox posed by the monitoring program:

> Helicopters carry "man and his works" and so are antithetical to a wilderness experience. It would be a rare case where machinery as intrusive as a helicopter could pass the test of being "necessary to meet minimum requirements for the administration of the area."
>
> However, this case may present that most rare of circumstances. Here, the helicopters are used to collect data on wolves. The wolves were released in the Frank Church Wilderness to restore the area's wilderness character.
>
> . . . .

287 *Id.* at *23, *26–28; *see supra* notes 201–08 and accompanying text.

288 *Californians for Alts. to Toxics*, 2011 WL 3915966, at *26, *28.

289 692 F. Supp. 2d 1264 (D. Idaho 2010).

290 *Id.* at 1266, 1268; *see also supra* text accompanying note 216.

291 *Wolf Recovery Found.*, 692 F. Supp. 2d at 1266–68.

292 *Id.* at 1268 (quoting Wilderness Act, 16 U.S.C. § 1133(c) (2006)); U.S. FOREST SERV., U.S. DEP'T OF AGRIC., DECISION MEMO: SPECIAL USE AUTHORIZATION TO IDAHO FISH AND GAME FOR HELICOPTER LANDINGS AND AERIAL DARTING TO SUPPORT GRAY WOLF CAPTURE AND COLLARING IN THE FRANK CHURCH-RIVER OF NO RETURN WILDERNESS 2, 5 (2009), *available at* http://www.wildernesswatch.org/pdf/dm_heli_landings_122209.pdf.

293 *See* Press Release, W. Watersheds Project, Conservation Groups Challenge Wolf Hunting (Aug. 21, 2009), http://www.westernwatersheds.org/news-media/news-release/2009/08/21/conservation-groups-challenge-wolf-hunting (last visited Feb. 18, 2012) (describing legal challenges to scheduled wolf hunts in Idaho and Montana); Idaho Dep't of Fish & Game, *Wolf Hunting and Trapping Seasons*, http://fishandgame.idaho.gov/public/hunt/?getPage=266 (last visited Feb. 18, 2012) (providing information about the ongoing wolf hunting program in Idaho).

> . . . Wilderness must "retain its primeval character and influence" and provide "outstanding opportunities for solitude." . . . A helicopter ruins these opportunities. At the same time, the helicopter can be necessary to restoring the wilderness character of the area.[294]

The court added a cautionary note, stating that its decision did not represent a "stamp of approval" on helicopters in wilderness:

> First, [this] decision is limited by its facts: This proposed activity is designed to aid the restoration of a specific aspect of the wilderness character . . . that had earlier been destroyed by man. The use of helicopters for any other purpose would be extremely difficult to justify . . . .
>
> Second, the next helicopter proposal . . . will face a daunting review because it will add to the disruption and intrusion of this collaring project. The Forest Service must proceed very cautiously here because the law is not on their side if they intend to proceed with further helicopter projects in the Frank Church Wilderness.[295]

If agencies and courts believe that reintroduced wolves warrant intensive monitoring, the introduction of climate-threatened native or nonnative species might open the door to equally intensive monitoring and potentially manipulative management measures as well, even within wilderness.

As for the reference to "measures required in emergencies" in section 4(c), most courts have construed this caveat narrowly, requiring *imminent* threats to human health and safety—"matters of urgent necessity"—before structures, installations, or vehicles can be deployed in wilderness.[296] As such, the provision may not be terribly relevant to latent or long-ranging threats posed by climate change compared to the other exceptions discussed here. Some courts, however, have been more lenient in authorizing broad interpretations of what constitutes an emergency, including search and rescue training exercises in wilderness areas.[297]

---

294 *Wolf Recovery Found.*, 692 F. Supp. 2d at 1268, 1269 (quoting Wilderness Act, 16 U.S.C. §§ 1131(c), 1133(c) (2006)).

295 *Id.* at 1270.

296 *See* Olympic Park Assocs. v. Mainella, No. C04-5732FDB, 2005 WL 1871114, at *5–6 (W.D. Wash. Aug. 1, 2005) (quoting Wilderness Act, 16 U.S.C. §1133(c) (2006)) (enjoining the National Park Service from using helicopters to replace collapsed hiker shelters and rejecting the argument that the new shelters were necessary to prevent emergencies).

297 *See* Wilderness Watch, Inc. v. U.S. Bureau of Land Mgmt., No. 2:09-CV-00302-KJD-GWF, 2011 WL 2600430, at *2, *4 (D. Nev. June 29, 2011). There, the court deferred to BLM's decision that allowing helicopter landings in a wilderness area for search and rescue training exercises was "necessary" because "helicopter search and rescue training is so closely linked with performance of helicopter rescue services that the provision of one involves the provision of the other." *Id.* at *4. Without analyzing whether a true "emergency" existed, the court noted that similar training had taken place in the area for over four decades and remarked: "Mountain flying . . . presents special challenges that cannot be replicated in flight simulators or elsewhere[] . . . where aircraft are working close to the terrain and with narrow margins." *Id.* at *4, *6. "In no other Wildernesses in the country are aircraft allowed to land as part of search and rescue training." Wilderness Watch, *Recent Issues: Court Upholds Helicopter Training in*

The exception in section 4(d) for otherwise nonconforming activities in wilderness areas authorizes "such measures . . . as may be necessary in the control of fire, insects, and diseases."[298] The term "necessary" should be construed the same as it is for the "as necessary to meet minimum requirements" exception described above.[299] The cases, however, are mixed. The only published opinions directly on point involve the Forest Service's efforts to control the southern pine beetle (*Dendroctonus frontalis*). In *Sierra Club v. Lyng* (*Sierra Club I*),[300] the first of two related cases, the district court remanded a proposal for extensive chemical spraying and harvesting thousands of acres of trees by chainsaw, "accompanied by noise and personnel in a continuing process unlimited in scope."[301] It found that the Sierra Club had "amply demonstrated" that the eradication program was "wholly antithetical to the wilderness policy established by Congress."[302] According to the court, the proposal was "hardly consonant with preservation and protection of these [wilderness] areas in their natural state;" moreover, it had been selected primarily to promote commercial timber harvest on adjacent lands.[303] As for the term "necessary," the court explained, "[o]nly a *clear necessity* for upsetting the equilibrium of the ecology could justify this highly injurious, semi-experimental venture of limited effectiveness."[304]

When the Forest Service went back to the drawing board and scaled down its beetle eradication proposal, the court gave the Forest Service's amended decision relatively light judicial scrutiny. In *Sierra Club v. Lyng* (*Sierra Club II*),[305] the court upheld a decision to use "spot-control" cutting to combat insect infestations in and around a wilderness area.[306] Far from demanding "clear necessity," as it had in *Sierra Club I*, the court in *Sierra Club II* construed the term "necessary" quite liberally, as allowing measures that "fall short of full effectiveness" so long as those measures are "reasonably designed" to limit the threatened spread of infestation.[307] It was careful to note, however, that the Forest Service had significantly scaled back its initial plan and had adopted several preservation-oriented

Wildernesses in Nevada, http://www.wildernesswatch.org/issues/index.html#Helicopter (last visited Feb. 18, 2012) (originally posted February 2009).

298 Wilderness Act, 16 U.S.C. § 1133(d)(1) (2006).

299 *Id.* § 1133(c)–(d)(1); *see* Powerex Corp. v. Reliant Energy Servs., Inc., 551 U.S. 224, 232 (2007) ("[I]dentical words and phrases within the same statute should normally be given the same meaning.").

300 662 F. Supp. 40 (D.D.C. 1987).

301 *Id.* at 43.

302 *Id.*

303 *Id.* at 42–43.

304 *Id.* at 43 (emphasis added).

305 663 F. Supp. 556 (D.D.C. 1987).

306 *Id.* at 558, 560–61.

307 *Sierra Club I*, 662 F. Supp. at 43; *Sierra Club II*, 663 F. Supp. at 560 ("The pertinent section of the statute is therefore most reasonably construed as allowing the Secretary to use measures that fall short of full effectiveness so long as they are reasonably designed to restrain or limit the threatened spread of beetle infestations from wilderness land onto the neighboring property, to its detriment.").

safeguards to ensure that control efforts would be made only to protect established colonies of endangered woodpeckers and other "high value" resources.[308] In addition, the court was reassured by the Service's commitment to a monitoring program to ensure the effectiveness of its control measures at each site.[309]

Going forward, it is possible that agencies will be more eager to authorize nonconforming tools and activities to control or minimize the threat of forest fires, disease, and infestations in and around wilderness. One can easily imagine the pressure that will be exerted on federal land managers to intervene when warming temperatures, drought, and longer summer seasons heighten the risk of devastating wildfires, particularly in the wildland–urban interface, and exacerbate the spread of bark beetles, parasites, and other destructive insects and diseases.[310] In turn, at least some courts may be willing to give agencies wide latitude to define terms like "necessary" when it comes to technical management decisions related to climate change mitigation and adaptation.[311] Thus, the Wilderness Act alone may not be enough to stand up against activities that would impair wilderness values.

B. Federal Reserved Water Rights

The United States Supreme Court established the federal reserved water rights doctrine in 1908 in *Winters v. United States*.[312] The Court held that the Fort Belknap Indian Reservation had implied reserved water rights in an amount necessary to fulfill the purpose of the reservation, with a priority dating back to the treaty that established the reservation.[313] Decades later, the Court extended reserved water rights to non-Indian federal reservations. In *Arizona v. California*,[314] the Court held that the United States was entitled to reserved water rights from the Colorado River sufficient for the future requirements of Havasu Lake National Wildlife Refuge, Imperial National Wildlife Refuge, and the Lake Mead National Recreation Area, as

308 *Sierra Club II*, 663 F. Supp. at 557–58. The Forest Service also assured the court that the activities would not "unnecessarily sacrifice" wilderness values and were not aimed at promoting commercial timber harvest. *Id.* at 560. The court had found that the primary purpose of the Agency's previous plans for a large-scale eradication program were commercial in nature rather than preservation oriented. *Sierra Club I*, 662 F. Supp. at 42.

309 *Sierra Club II*, 663 F. Supp. at 560.

310 *See* DAVID C. SHAW ET AL., MANAGING INSECTS AND DISEASES OF OREGON CONIFERS 16 (2009); *see also* Cheever, *supra* note 114, at 186–87 (describing the detrimental consequences when policy makers and the law treat fire as either "a rare, unpredictable calamity—unique in its every appearance—unforeseeable" or "a curable disease like polio," rather than an inevitable, natural condition).

311 *See, e.g.*, Hapner v. Tidwell, 621 F.3d 1239, 1242–45 (9th Cir. 2010) (upholding the Forest Service's decision to thin trees and prescribe burns on 1100 acres of forest lands near residential areas to slow the spread of wildfires and diminish their intensity).

312 207 U.S. 564, 577 (1908).

313 *Id.* at 575–77.

314 373 U.S. 546 (1963).

well as for several Indian reservations.[315] Just a few years later, in *Cappaert v. United States*,[316] the United States sought reserved water rights for Devil's Hole National Monument, a forty-acre parcel within Death Valley National Park.[317] The Supreme Court enjoined groundwater pumping outside of the monument in order to fulfill the federal water right and preserve the scientific value of a pool that contained a unique species of desert pupfish (*Cyprinodon diabolis*). It found that water rights were implicitly reserved by the Proclamation[318] that created the monument, which stated that the area was being set aside "for the preservation of the unusual features of scenic, scientific, and educational interest therein contained."[319] The Proclamation made reference to the importance of water to the monument by describing the "remarkable underground pool" within the monument.[320]

In *United States v. New Mexico*,[321] however, the Court restricted non-Indian federal reserved water rights to only those reservations where water is necessary to fulfill the "principal" purposes of the reservation.[322] *New Mexico* held that national forests had water rights only as necessary to fulfill two primary purposes of the Organic Administration Act of 1897[323]—securing timber supplies and favorable water flows for utilitarian purposes—but not "secondary" purposes expressed in subsequent statutes, such as wildlife preservation and recreation.[324] The Court's opinion set the stage for future battles over whether water is "primary" or merely "secondary" to the purpose of any given federal reservation. Going forward, there is little doctrinal certainty as to how courts will decide these types of claims.[325]

315 *Id.* at 551, 600–01.

316 426 U.S. 128 (1976).

317 *Id.* at 131, 135. In 1970, the United States lodged a protest with the State Engineer to prevent the Cappaerts from changing the use of water from their nearby wells in such a way as might adversely affect water levels in the pool. *See id.* at 134. The State Engineer granted the Cappaert's application under Nevada state law, and the United States filed a complaint in federal district court in 1971. *Id.* at 134–35.

318 Proclamation No. 2961, 3 C.F.R. 19 (Supp. 1952), *reprinted in* 66 Stat. c18 (1952).

319 *Cappaert*, 426 U.S. at 131–32 (quoting Proclamation No. 2961, 3 C.F.R. 19 (Supp. 1952), *reprinted in* 66 Stat. c18 (1952)).

320 *Id.* at 132 (quoting Proclamation No. 2961, 3 C.F.R. 19 (Supp. 1952), *reprinted in* 66 Stat. c18 (1952)).

321 438 U.S. 696 (1978).

322 *Id.* at 715.

323 Act of June 4, 1867, ch. 2, 30 Stat. 11 (codified as amended at 16 U.S.C. §§ 473–482, 551 (2006)).

324 *New Mexico*, 438 U.S. at 711–13, 715 (citing 16 U.S.C. §§ 481, 528 (2006)). Congress assured "the waters which flow through national forests are available for use by state appropriators by authorizing rights-of-way for ditches to carry the water to agricultural, domestic, mining, and milling uses." *Id.* at 712 n.20. Forests play an important role by "exert[ing] a most important regulating influence upon the flow of rivers, reducing floods and increasing the water supply in the low stages. The importance of their conservation on the mountainous watersheds which collect the scanty supply for the arid regions of North America can hardly be overstated." *Id.* at 712 (quoting S. DOC. NO. 55-105, at 10 (1897)).

325 Leonard, *supra* note 226, at 619.

Is water necessary to fulfill the primary purpose of federal wilderness areas?[326] According to *Sierra Club v. Block*,[327] a decision from the federal District Court of Colorado, there can be no doubt that the answer is yes: "It is beyond cavil that water is the lifeblood of the wilderness areas. Without water, the wilderness would become deserted wastelands. In other words, without access to the requisite water, the very purposes for which the Wilderness Act was established would be entirely defeated."[328]

According to the court, Congress intended each of the purposes specified in the Wilderness Act—preservation, recreation, scenic, scientific, education, conservation, and historical protection—as primary, rather than secondary, purposes.[329] Thus, it found "watershed protection and conservation of water flows to be an important and primary purpose of the wilderness areas."[330] It also noted that, far from impairing water flows for other downstream uses, "[b]y protecting the natural state of the watersheds, rather than destroying their potential yield by allowing commercial development or other similar intrusions, wilderness areas improve the availability, as well as the purity, of the water for downstream users."[331] On appeal, the Tenth Circuit dismissed the complaint and vacated the district court's determination that the Wilderness Act created federal reserved water rights, because the Forest Service's decision *not* to seek federal reserved rights for Colorado wilderness areas was a nonreviewable decision "committed to agency discretion by law."[332] It also concluded that the claims

326 *See* Karin P. Sheldon, *Water for Wilderness*, 76 DENV. U. L. REV. 555, 555–56, 588–90 (1999) (arguing that wilderness areas would be sterile, lifeless places without secure water rights); Robert H. Abrams, *Water in the Western Wilderness: The Duty to Assert Reserved Water Rights*, 1986 U. ILL. L. REV. 387, 395–99 (1986) (asserting that federal officials have a duty of stewardship that encompasses a duty to seek reserved water rights for wilderness areas); Janice L. Weis, *Federal Reserved Water Rights in Wilderness Areas: A Progress Report on a Western Water Fight*, 15 HASTINGS CONST. L.Q. 125, 149–52 (1987) (asserting that Congress should expressly define federal water rights in order to effectively protect the natural character and habitats of wilderness areas which are essential to their purposes).

327 622 F. Supp. 842 (D. Colo. 1985).

328 *Id.* at 862. The district court, however, rejected the Sierra Club's arguments that the United States had a public trust responsibility to protect the wilderness by affirmatively claiming reserved water rights. *Id.* at 866. *But see* High Country Citizens' Alliance v. Norton, 448 F. Supp. 2d 1235, 1245–46 (D. Colo. 2006) (holding that federal agencies may not permanently relinquish and delegate National Park Service Organic Act and Wilderness Act responsibilities for preserving necessary peak and shoulder flows in the Black Canyon of the Gunnison to state agencies).

329 *Block*, 622 F. Supp. at 858 (citing Wilderness Act, 16 U.S.C. §§ 1131(a), (c), 1133(b) (2006)).

330 *Id.* at 862. The Colorado Wilderness Act provided further evidence of Congress's intent to give effect to *all* of the purposes of the Act: "Not only do opportunities for primitive recreation and wildlife habitat protection abound in these areas, but perhaps more importantly, their natural production of invaluable supplies of high quality water provide a compelling reason for preserving them in their natural state." *Id.* at 860 (citing H.R. REP. NO. 96-617, at 4 (1979)).

331 *Id.* at 859 (citing S. REP. NO. 88-109, at 15 (1963), which was quoted as stating that wilderness areas "provide watershed protection and clear, pure water for users below them").

332 Sierra Club v. Yeutter, 911 F.2d 1405, 1414, 1418, 1421 (10th Cir. 1990). The court also noted that judicial review of the Service's refusal to act was inappropriate because the Wilderness Act lacks meaningful standards for the management of water resources, allowing

were not ripe for review because the plaintiff had failed to allege that the wilderness values were imminently and directly threatened:

> [T]here is no guarantee that the point of any diversion will be above or within the wilderness areas, where the direct impact of such change in water rights status would be the greatest. Absent a diversion within or above the wilderness area, it is difficult to see what harm might befall the wilderness water values that a wilderness water right could prevent . . . . [Further,] there is no guarantee that any diversion which might occur in or above a wilderness area would even have a noticeable impact on wilderness water values.[333]

The court recognized, however, that there may be circumstances when an agency's refusal to seek reserved rights would be reviewable—"in those situations where the agency's conduct cannot be reconciled with the Act's mandate to preserve the wilderness character of the wilderness areas."[334]

Twenty years passed before another opportunity arose by which to consider whether and when a federal agency must assert federal reserved rights for a wilderness area. In 2005, the District Court of the District of Colorado concluded that the National Park Service could not abdicate its responsibilities for protecting wilderness water rights for the Black Canyon of the Gunnison National Park.[335] There, the agency entered into a settlement with the State of Colorado whereby it agreed to permanently relinquish its reserved water right for peak and shoulder flows in the Black Canyon to state agencies. Instead of a 1933 priority date for the federal reserved water right, the negotiated state right would have a priority date of 2003, which would have little value and provide little or no water for the Canyon under prior appropriation law.[336] The Park Service also ceded its ability to enforce the state water right to the state water conservation board.[337] The court set aside the settlement as a violation of the Service's duty to protect the Black Canyon's resources.[338] It explained that protecting reserved water rights was not a discretionary option but rather a legal obligation under the National Park Service Organic Act[339] and the Wilderness Act:

---

only review of agency land management practices that are "irreconcilable with the statutory preservation mandate imposed by the Wilderness Act." *Id.* at 1414; *see also* Norton v. S. Utah Wilderness Alliance, 542 U.S. 55, 63, 65–67 (2004) (holding that BLM's failure to prevent adverse impacts from off-road vehicle use was not a reviewable "agency action").

333 *Yeutter*, 911 F.2d at 1419.

334 *Id.* at 1414; *see also supra* note 328 (describing treatment of the Wilderness Act preservation mandate in *High Country Citizens' Alliance*, 448 F. Supp. 2d 1235, 1248–53 (D. Colo. 2006)).

335 *High Country Citizens' Alliance*, 448 F. Supp. 2d 1235, 1246–47 (D. Colo. 2006).

336 *See id.* at 1242, 1252.

337 *Id.* at 1241–42.

338 *Id.* at 1248–53. The court also found that the settlement agreement constituted an unlawful disposition of federal property, which can only be accomplished by Congress. *Id.* at 1248.

339 16 U.S.C. §§ 1–4 (2006 & Supp. II 2008 & Supp. IV 2010).

> [T]he canyon was entitled to a quantity of water necessary to conserve and maintain in an unimpaired condition the scenic, aesthetic, natural, and historic objects of the monument, as well as the wildlife in the monument, in order that the monument might provide a source of recreation and enjoyment for all generations of citizens of the United States. This purpose included water necessary for the preservation of the wilderness uses, wildlife and fish.[340]

The only other court to rule explicitly on the issue—the Idaho Supreme Court—refused to acknowledge reserved wilderness water rights, insofar as they affect water rights outside wilderness areas, in a decision issued in 2000 on a general stream adjudication for the Snake River Basin.[341] The case is at least as notable for its tortured political history as it is for its disposition of wilderness water rights. In its initial decision in the case, which was issued in 1999, the court concluded that the "minimum amount" of water reserved for the federal lands, including wilderness, required all unappropriated water in the basin.[342] Because diverting water "necessarily impairs the natural state of the wilderness lands, Congress must have intended to reserve all unappropriated water."[343]

This decision stood for little more than a year.[344] Professor Blumm chronicled what happened in the aftermath of the 1999 decision: "The court agreed to rehear the case in response to petitions from the state, several mining and irrigation companies, and upstream cities—and no doubt the public protest, which included sharp criticism from Idaho Governor Dirk Kempthorne."[345] In 2000, a new "3–2 decision was handed down only after the author of the earlier decision upholding federal water rights for wilderness

---

340 *High Country Citizens' Alliance*, 448 F. Supp. 2d at 1247 (citation omitted). For a discussion of the National Park Service Organic Act and the Wilderness Act, and whether they provide a "meaningful standard" by which to judge the agency action, see *id.* at 1250 (citing 16 U.S.C. §§ 1, 410fff(1) (2006); and 16 U.S.C. §§ 1131(a), 1133(b) (2006)). The court also held that entering into a settlement that abdicated responsibility for protecting reserved water rights for the Canyon was a "discrete agency action" subject to judicial review. *Id.* at 1249 (emphasis omitted) (citing *S. Utah Wilderness Alliance*, 542 U.S. 55, 63 (2004)).

341 Potlatch Corp. v. United States, 12 P.3d 1260, 1266–68 (Idaho 2000). The Snake River Basin Adjudication (SRBA) is a lawsuit created by statute in order to inventory all surface and groundwater rights in the Snake River Basin system, which required a special court to deal with the complexity and number of government, private, and tribal claims at issue. Idaho Water Adjudications, *Information Brochure*, http://www.srba.state.id.us/DOC/BROCH1.HTM#SEC1 (last visited Feb. 18, 2012) (click on the "background" link to access the information in "Background Information on the Snake River Basin Adjudication"). As one of many SRBA adjudications, the *Potlatch* decision alone affected over 3000 claims of upstream junior water diverters in Idaho. *See* Blumm, *supra* note 251, at 180–98, 203–05 (describing the *Potlatch* case, its history, and its political implications); Kelly J. Latimer, *Federal Reserved Water Rights Doctrine Under the Wilderness Act: Is It Finally Here to Stay?*, 20 J. LAND RESOURCES & ENVTL. L. 335, 354 (2000).

342 *In re* SRBA, No. 24546, 1999 WL 778325, at *8–9 (Idaho Oct. 1, 1999), *abrogated by Potlatch*, 12 P.3d 1260 (Idaho 2000).

343 *See id.* (pointing to language in the Wilderness Act calling for wilderness areas to be managed "unimpaired for future use and enjoyment," thus "wilderness preservation is incompatible with human development").

344 The case was reversed and vacated in relevant part by *Potlatch*, 12 P.3d at 1266–68.

345 Blumm, *supra* note 251, at 188.

areas was defeated for reelection in a controversial judicial campaign in which her wilderness water rights opinion became a centerpiece of her opponent's election strategy."[346]

There was no legal justification for the Idaho Supreme Court's change of heart. Ignoring *Arizona* and *Cappaert*, and stretching *New Mexico* well beyond its bounds, the court found that, because "Congress did not define a water right as a specific purpose of the Wilderness Act," it was free to draw a "contrary inference" that there was no reserved right.[347] The court construed the purpose of the Wilderness Act extraordinarily narrowly: the Act simply "sets aside land and prohibits its development, nothing more."[348] The 2000 opinion also ignored the plain language of the statutes that created two of the wilderness areas in question—one described "*watershed preservation*" as a wilderness purpose, and the other gave protection to "lands *and waters*" for "wilderness-dependent wildlife and the resident and anadromous *fish*."[349]

Professor Blumm agrees that, besides political pressure, "[t]he chief reason the Idaho Supreme Court rejected reserved water for wilderness was the court's extremely narrow construction of the purpose of the Wilderness Act."[350] He notes, however, that the expectations of other water users in Idaho likely played a role in the outcome of the case as well:

> Even when a Colorado district court in 1985 ruled that wilderness areas possessed water rights [in *Sierra Club v. Block*], Idaho continued to issue water rights upstream of its wilderness areas. The state's oblivious attitude put the rights of the upstream junior diverters, numbering up to three thousand at the time of the court's decision, and the downstream federal wilderness on a collision course.[351]

Despite the setback in the Idaho court, the United States does occasionally assert water rights for wilderness areas outside of Idaho, along with national parks, national forests, and other federal reservations that require water to fulfill their purposes. Federal water rights cases are ongoing in Arizona and in Nevada. In Nevada, the United States has asserted reserved water rights for national forest, BLM, and military lands.[352] In Arizona, the

346 *Id.* at 177. In the 2000 decision, "Chief Justice Trout—scheduled to face reelection—switched her position and provided the necessary vote to deny the existence of federal wilderness water rights. Justice Silak, who remained on the court until her term expired at the end of 2000, wrote now in dissent instead of for the majority." *Id.* at 189.

347 *Potlatch*, 12 P.3d at 1264.

348 *Id.* at 1266.

349 *See* Endangered American Wilderness Act of 1978, Pub. L. No. 95-237, § 1(b), 92 Stat. 40 (emphasis added) (addressing watershed protection); Central Idaho Wilderness Act of 1980, Pub. L. No. 96-312, § 2(a)(2), 94 Stat. 948 (emphasis added) (addressing resident and anadromous fish).

350 Blumm, *supra* note 251, at 188–89, 213.

351 *Id.* at 187–88.

352 *See, e.g.*, Leonard, *supra* note 226, at 619 & n.54.

United States has asserted water rights for wilderness areas in the Gila River basin, a basin which provides nearly 20% of all water used in Arizona.[353]

The United States has a distinct advantage in the Arizona case—it does not have to rely on implied rights because Arizona's statewide wilderness act expressly includes federal reserved water rights. The Arizona Desert Wilderness Act of 1990,[354] which designated the Kofa Wilderness and several others, specifies as follows:

> (1) With respect to each wilderness area designated by this title, Congress hereby reserves a quantity of water sufficient to fulfill the purposes of this title. The priority date of such reserved rights shall be the date of enactment of this Act.
>
> (2) The Secretary and all other officers of the United States shall take steps necessary to protect the rights reserved by paragraph (1), including the filing by the Secretary of a claim for the quantification of such rights in any present or future appropriate stream adjudication . . . .[355]

Even where explicit reservations of rights are provided, as in the Arizona Act, the evidentiary challenge of securing and quantifying water rights as necessary to fulfill the purposes of any given wilderness area is tremendous. The ongoing Gila River adjudication "is among the longest and most complex litigations in the history of Arizona, costing millions of dollars in attorneys' fees."[356] According to Arizona water lawyer Michael Brophy, "[O]ne does not 'get out' of the Gila adjudication. It is a sort of judicial black hole into which light, sound, lawyers, water . . . indeed, whole forests of paper, will disappear."[357] The Adjudication was initiated nearly four decades ago, in 1974, when the Salt River Valley Water Users Association sought an adjudication of water rights to the Salt River.[358] The case was subsumed within a general adjudication of all water rights in the Salt, Gila, Verde, Agua

353 Case Initiation Order and Designation of Initial Issues for Briefing at 2–4, *In re* General Adjudication of All Rights to Use Water in the Gila River System and Source, No. W1-11-3342 (Ariz. Sup. Ct. Aug. 17, 2009), *available at* www.superiorcourt.maricopa.gov/SuperiorCourt/Adjudications/_schade/acwacio081709.pdf; Allison Evans, *The Groundwater/Surface Water Dilemma in Arizona: A Look Back and a Look Ahead Toward Conjunctive Management Reform*, 3 PHOENIX L. REV. 269, 283 (2010).

354 Arizona Desert Wilderness Act of 1990, Pub. L. No. 101-628, 104 Stat. 4469.

355 *Id.* § 101(g)(1)–(2), 104 Stat. at 4473.

356 Evans, *supra* note 353, at 272.

357 Joseph M. Feller, *The Adjudication that Ate Arizona Water Law*, 49 ARIZ. L. REV. 405, 405 (2007) (quoting Michael J. Brophy, Presentation to American Water Resources Association: The Gila Adjudication from the Perspective of Irrigation Districts, *in* Proceedings of the Symposium on Adjudication of Water Rights: Gila River Watershed, Arizona 139, 144 (Ariz. Section, Am. Water Res. Ass'n Oct. 28, 1998)).

358 *Id.* at 417.

Fria, Upper Santa Cruz, and San Pedro River watersheds.[359] The petitions were then consolidated before the Maricopa County Superior Court.[360]

Although the quantification of wilderness water rights has yet to be resolved, the Arizona Supreme Court has ruled that federal reserved water rights extend to both groundwater and surface water.[361] It explained why:

> [F]ederal reserved rights law declines to differentiate surface and groundwater—[] it recognizes them as integral parts of a hydrologic cycle . . . .
>
> [I]f the United States implicitly intended, when it established reservations, to reserve sufficient unappropriated water to meet the reservations' needs, it must have intended that reservation of water to come from whatever particular sources each reservation had at hand. The significant question for the purpose of the reserved rights doctrine is not whether the water runs above or below the ground but whether it is necessary to accomplish the purpose of the reservation. . . .
>
> . . . .
>
> A reserved right to groundwater may only be found where other waters are inadequate to accomplish the purpose of a reservation.[362]

The reservation and protection of groundwater supplies are particularly important in areas like the Kofa Wilderness, where native species—including bighorn sheep—rely on seeps and springs fed by groundwater aquifers, and where few surface water bodies exist.[363]

C. The Wild and Scenic Rivers Act

Another potentially powerful tool for protecting stream flows in wilderness areas is the Wild and Scenic Rivers Act (WSRA), which creates a nationwide system of wild, scenic, and recreational rivers.[364] There are now

---

359 Evans, *supra* note 353, at 283.

360 *Id.* For orders issued in the case, *see* Judicial Branch of Ariz., Maricopa Cnty., *Gila River Adjudication Pending Cases and Decisions*, http://www.superiorcourt.maricopa.gov/SuperiorCourt/Adjudications/gila.asp (last visited Feb. 18, 2012).

361 *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, 989 P.2d 739, 748 (Ariz. 1999) (en banc).

362 *Id.* at 747–48. By curtailing groundwater pumping that adversely impacted the federal reserved water right for the pool in Devil's Hole National Monument, the *Cappaert* decision supports the inclusion of groundwater within the reserved rights doctrine, although the Court did not address federal groundwater rights specifically. Cappaert v. United States, 426 U.S. 128, 142–43 (1976).

363 *See supra* notes 81–90, 172–76 and accompanying text (describing the Kofa Wilderness litigation).

364 Portions of this section are derived from Ch. 14.III.C in JAN G. LAITOS ET AL., NATURAL RESOURCES LAW AND POLICY (2d ed. forthcoming 2012) (manuscript at 60–63) (on file with author).

over 100 river segments, encompassing thousands of miles, in the Wild and Scenic Rivers System.[365]

In the WSRA, passed just four years after the Wilderness Act, Congress declared that "the established national policy of dam and other construction . . . needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes."[366] Thus, designated rivers must be freeflowing and must also have "outstandingly remarkable" scenic or recreational values.[367]

The WSRA authorizes two methods of adding rivers to the system: by congressional designation and by state initiative with federal concurrence.[368] In the former, Congress identifies "potential additions," and then directs the Secretaries of Interior and Agriculture to study them and report to the President, who in turn makes a recommendation to Congress for permanent inclusion in the system.[369] Agencies consider whether rivers may be eligible during their planning processes.[370]

Upon designation, rivers will be classified as wild, scenic, or recreational. A wild river is "free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted."[371] A scenic river is also "free of impoundments, with shorelines or watersheds still largely primitive" and undeveloped, but accessible in some areas by road.[372] Recreational rivers are "readily accessible by road or railroad, [] may have some development along their shorelines, and [] may have undergone some impoundment or diversion in the past."[373] A river that does not qualify as wild because of shoreline development may still be protected as a scenic or recreational river.[374]

Wild river segments, which like wilderness areas are "essentially primitive," are highly protected.[375] A river classified as recreational or scenic

365 *Id.* (manuscript at 60).

366 Wild and Scenic Rivers Act, 16 U.S.C. § 1271 (2006).

367 *Id.* §§ 1271, 1273(b).

368 *Id.* § 1275(a)–(b).

369 *Id.* § 1275(a).

370 *See id.* §§ 1275(a), 1276(a), 1276(d)(1); Ctr. for Biological Diversity v. Veneman, 394 F.3d 1108, 1109–10 (9th Cir. 2005) (citing *S. Utah Wilderness Alliance*, 542 U.S. 55, 64 (2004), and dismissing a challenge to the Forest Service's failure to consider 57 Arizona rivers as potential additions to the Wild and Scenic Rivers System because the failure to consider was not a discrete agency action that would permit review).

371 16 U.S.C. § 1273(b)(1) (2006). Like wilderness areas, wild rivers "represent vestiges of primitive America." *Id.*

372 *Id.* § 1273(b)(2).

373 *Id.* § 1273(b)(3).

374 Sierra Club N. Star Chapter v. Pena, 1 F. Supp. 2d 971, 982 (D. Minn. 1998); *see also* Sierra Club N. Star Chapter v. LaHood, 693 F. Supp. 2d 958, 962–63 (D. Minn. 2010) (issuing an injunction preventing the National Park Service from building a bridge because the Environmental Impact Statement was found to be arbitrary and capricious for failing to consider negative impacts upon the Lower St. Croix River).

375 *See* Wilderness Watch v. U.S. Forest Serv., 143 F. Supp. 2d 1186, 1190–91 (D. Mont. 2000) (holding that hunting and fishing lodges were prohibited on wild river segments because such rivers "represent vestiges of primitive America") (emphasis omitted) (quoting 16 U.S.C.

may be afforded more lenient management standards so long as the "outstandingly remarkable" values (ORVs) are protected.[376] Regardless of classification, dams and certain federal undertakings are prohibited on designated rivers.[377] In addition, the WSRA reserves enough water within designated river segments to fulfill the Act's purpose of preserving free-flowing conditions.[378] The right to unappropriated flows is limited to the minimum amount necessary for that purpose.[379]

In addition, once designated, river management agencies must identify "detailed boundaries" of the river or segment and prepare a comprehensive management plan that will protect the river's values, including "esthetic, scenic, historic, archaeologic, and scientific features."[380] The ORVs of the river must be identified in the plan, and the river is to be administered in a manner to "protect and enhance" those values.[381] No federal department or agency may assist in the construction of any "water resources project" that would have an adverse effect on a river's values, including water diversions and reservoirs, watershed enhancement projects, bridges, dredging, bank stabilization, levees, and recreational facilities such as boat ramps and fishing piers.[382]

The WSRA's protections can restrict timber sales, ranching, and other activities in the river corridor.[383] In a series of Oregon cases decided in the late 1990s, courts found that the BLM's management of grazing practices fell short of the WSRA's requirements. In *Oregon Natural Desert Ass'n v. Green*,[384] the court found the BLM's management plan violated the WSRA by

§ 1273(b)(1) (2006))); Or. Natural Desert Ass'n v. Singleton, 75 F. Supp. 2d 1139, 1151, 1153 (D. Or. 1999) (permanently enjoining grazing in the "wild" river corridor).

376 *Compare* Friends of Yosemite Valley v. Norton, 348 F.3d 789, 797–99, 803 (9th Cir. 2003) (remanding the Merced River management plan for failure to protect and enhance the river's geological, biological, and cultural ORVs, for failing to address impacts of visitor use, and for setting the river area boundaries too narrowly), *with* Sierra Club v. United States, 23 F. Supp. 2d 1132, 1133, 1140 (N.D. Cal. 1998) (rejecting the Sierra Club's effort to enjoin the Park Service from rebuilding a lodge and rerouting a road near the Merced River, portions of which are designated as scenic while others are recreational, and affirming the Service's conclusions that the project would not impinge ORVs, but instead would improve visitor accessibility and environmental conditions by moving buildings further from the river).

377 16 U.S.C. §§ 1273(b), 1276(d), 1278(a), 1284(c) (2006); *see* Swanson Mining Corp. v. Fed. Energy Regulatory Comm'n, 790 F.2d 96, 102–04 (D.C. Cir. 1986) (finding WSRA prevents the Federal Energy Regulatory Commission (FERC) from licensing hydroelectric projects on designated rivers even if FERC believes there would be no adverse effects on ORVs).

378 16 U.S.C. § 1284(c) (2006); *see id.* § 1271 (declaring congressional purpose).

379 *See id.*; *Potlatch*, 12 P.3d 1256, 1260 (Idaho 2000) (recognizing federal reserved water rights for the Salmon and Rapid wild and scenic river segments); *supra* notes 341–49 and accompanying text.

380 16 U.S.C. §§ 1274(b)–(d), 1281(a) (2006); *see* Friends of Yosemite Valley v. Kempthorne, 520 F.3d 1024, 1039 (9th Cir. 2008) (holding that the WSRA requires that a comprehensive management plan be in the form of one single comprehensive document, which addresses all the required elements).

381 16 U.S.C. § 1281(a) (2006).

382 *Id.* § 1278(b).

383 Newton Cnty. Wildlife Ass'n v. Rogers, 141 F.3d 803, 806 (8th Cir. 1998) (upholding an injunction of a timber sale based on a claim under WSRA).

384 953 F. Supp. 1133 (D. Or. 1997).

failing to consider excluding cattle from the river corridor as necessary to "protect and enhance" vegetative ORVs.[385] And in *Oregon Natural Desert Ass'n v. Singleton*,[386] the court stated that BLM had a duty to ban cattle from the corridor when the BLM's own management plan showed the negative impacts of grazing on scenic and recreational values.[387] BLM was ultimately enjoined from allowing grazing in "areas of concern" to prevent further degradation of environmental conditions.[388]

WSRA designations, plans, and management restrictions are complementary to wilderness preservation.[389] These seem to be underutilized tools, however, and federal agencies and advocates could employ the WSRA more extensively to accomplish wilderness preservation and ward off threats posed by development and manipulative intervention proposals.[390]

D. The Clean Water Act

The CWA expresses an overarching goal "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[391] To achieve this goal, the CWA regulates discharges of pollutants from point sources and it also requires states to develop and implement water quality standards.[392] States must submit their proposed water quality standards to the Environmental Protection Agency (EPA) for review and approval; if a state fails to satisfy the requirements of the Act, EPA must step in and promulgate appropriate standards for the water bodies within that state.[393] By the same token, if a state issues a permit that allows discharges that will violate water quality standards, EPA may veto the permit.[394]

---

385 *Id.* at 1143–46.

386 47 F. Supp. 2d 1182 (D. Or. 1998).

387 *Id.* at 1195. *But see* Nat'l Wildlife Fed'n v. Cosgriffe, 21 F. Supp. 2d 1211, 1222 (D. Or. 1998) (finding the plaintiff failed to show that facts linked grazing directly to the degradation of a river's values).

388 Or. Natural Desert Ass'n v. Singleton, 75 F. Supp. 2d 1139, 1150, 1153 (D. Or. 1999) (finding that certain rivers possess "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values" and should be "preserved in free-flowing condition," and that the "immediate environments" of these rivers should also be protected (quoting 16 U.S.C. § 1271 (2006)).

389 Brian E. Gray, *No Holier Temples: Protecting the National Parks Through Wild and Scenic River Designation*, 58 U. COLO. L. REV. 551, 552–58 (1988); John W. Ragsdale, Jr., *The Buffalo River: A Jurisprudence of Preservation*, 21 B.C. ENVTL. AFF. L. REV. 429, 439 (1994) ("The Wild and Scenic Rivers Act and resultant system of protected streamways provide a spectrum of protection that can overlap with or exist independently of the measures afforded by . . . Wilderness Act status." (footnotes omitted)).

390 Congress provided that, in cases of conflict between the WSRA and other land management statutes like the Wilderness Act, "the more restrictive provisions shall apply." Wild and Scenic Rivers Act, 16 U.S.C. § 1281(b)–(c) (2006).

391 Federal Water Pollution Control Act, 33 U.S.C. § 1251(a) (2006).

392 *Id.* §§ 1251(b), 1313(c), 1342(a)–(b).

393 *Id.* § 1313(c)(2)–(4).

394 *Id.* § 1342(d); *see* Champion Int'l Corp. v. U.S. Envtl. Prot. Agency, 850 F.2d 182, 187 (4th Cir. 1988) (stating that EPA has the discretion to veto a permit if discharges may violate water quality standards); *see also* Arkansas v. Oklahoma, 503 U.S. 91, 113–14 (1992) (stating that it is

The CWA has been most successful in reducing pollutants from industrial discharges and other point sources.[395] Yet many of the nation's water bodies are still impaired.[396] The culprit: nonpoint source pollution from "dispersed activities over large areas that is not traceable to a single, identifiable source or conveyance."[397] Nonpoint sources include runoff from road construction, logging and other types of soil disturbance, grazing, mining, water diversions, and dams.[398] In wilderness areas, where no commercial activities are allowed and where few point sources exist,[399] controlling nonpoint source pollution is critical to maintaining water quality and the overall chemical, physical, and biological integrity of watersheds.[400]

Nonpoint source pollution, however, has been treated primarily as a land-use issue best left to state and local programs.[401] The CWA provides some funding for nonpoint source planning and for "best management practices,"[402] but this program has been underfunded and under-enforced.[403] On the other hand, the CWA's requirements for water quality standards, particularly the antidegradation component of water quality standards, can be a useful tool for protecting wilderness waters.

Water quality standards include designated uses of water bodies, numeric or narrative criteria as necessary to protect those uses, and the

within the EPA's discretion to determine whether water quality standards will be violated by a discharge, reviewable according to an arbitrary and capricious standard).

395 *See* Sandra B. Zellmer, *The Virtues of "Command and Control" Regulation: Barring Exotic Species from Aquatic Ecosystems*, 2000 U. ILL. L. REV. 1233, 1235 (2000); ROBERT W. ADLER ET AL., THE CLEAN WATER ACT: 20 YEARS LATER 14 (1993).

396 *See* Robert W. Adler, *Priceline for Pollution: Auctions to Allocate Public Pollution Control Dollars*, 34 WM. & MARY ENVTL. L. & POL'Y REV. 745, 746, 818 (2010); William L. Andreen, *Water Quality Today—Has the Clean Water Act Been a Success?*, 55 ALA. L. REV. 537, 543–44 (2004); David Zaring, *Agriculture, Nonpoint Source Pollution, and Regulatory Control: The Clean Water Act's Bleak Present and Future*, 20 HARV. ENVTL. L. REV. 515, 528 (1996).

397 Sierra Club v. El Paso Gold Mines, Inc., 421 F.3d 1133, 1140 n.4 (10th Cir. 2005) (noting groundwater seepage that travels through fractured rock in a mine shaft qualifies as nonpoint source pollution).

398 *See* Nw. Envtl. Def. Ctr. v. Brown, 640 F.3d 1063, 1087 (9th Cir. 2011) (holding that storm water runoff alongside logging roads in a forest became a point source when it was channeled through ditches); Nat'l Wildlife Fed'n v. Gorsuch, 693 F.2d 156, 161, 167 (D.C. Cir. 1982) (treating a dam as a nonpoint source); *see also* S. Fla. Water Mgmt. Dist. v. Miccosukee Tribe of Indians, 541 U.S. 95, 104–05 (2004) (pumping water between canals and other distinct water bodies could add pollutants from a point source).

399 Wilderness Act, 16 U.S.C. § 1133(c) (2006).

400 *See supra* text accompanying notes 395–96; *see also* Wilderness.net, *Threats to Wilderness from Pollution*, http://www.wilderness.net/index.cfm?fuse=NWPS&sec=threatsPollution (last visited Feb. 18, 2012).

401 *See* Robert W. Adler, *Resilience, Restoration, and Sustainability: Revisiting the Fundamental Principles of the Clean Water Act*, 32 WASH. U. J.L. & POL'Y, 139, 159 (2010) ("Congress believed . . . states and localities were better suited to address land use and other nonpoint source pollution problems that varied widely with different local geography, climate, topography, economies, and other factors . . . .").

402 *Id.* at 154 (quoting Federal Water Pollution Control Act, 33 U.S.C. § 1329(b)(2)(A) (2006)).

403 *See* Andreen, *supra* note 396, at 543–46.

prevention of degradation of the existing condition of water bodies.[404] Water bodies that do not meet water quality standards must be identified and TMDLs of pollutants must be established for them.[405] The TMDLs are typically implemented through point source discharge permits, which may be made more stringent to ensure that TMDLs are not exceeded, but TMDL allocations can be imposed on nonpoint sources as well.[406]

Water bodies that meet water quality standards are protected by antidegradation requirements designed to maintain water quality and support existing uses.[407] "Outstanding National Resource Waters" (ONRWs), which include "waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance," receive the most stringent antidegradation protections under the CWA.[408] Although some changes in the quality of some protected waters may be allowed to accommodate important economic uses, only "temporary and short-term changes" in water quality can be permitted in ONRWs.[409]

A number of western states have begun to use the ONRW designation to preserve wilderness waters.[410] Montana automatically designates all "surface waters located wholly within the boundaries of designated national parks or wilderness areas" as outstanding resource waters to be given the highest priority under its antidegradation policies.[411] In Oregon, wilderness waters are treated as "priority water bodies for nomination" in the state's biennial review process.[412] Colorado law includes water bodies that constitute "a significant attribute" of wilderness areas.[413] In Washington, to be eligible as

404 40 C.F.R. § 131.6 (2011). EPA may also reject revisions to states' total maximum daily load (TMDL) allocations that cause degradation. 33 U.S.C. § 1313(d)(4)(B) (2006).

405 33 U.S.C. § 1313(d)(1)(A), (C).

406 *See infra* notes 429–38 and accompanying text.

407 40 C.F.R. § 131.12 (2011). For details on the origins of the antidegradation program and a related program in the Clean Air Act—Prevention of Significant Deterioration—see Robert L. Glicksman, *The Justifications for Nondegradation Programs in U.S. Environmental Law*, *in* Le Principe de Non-Régression en Droit de l'Environnement 471, 476–83 (M. Prieur & G. Sozzo eds., 2012) (manuscript on file with author).

408 40 C.F.R. § 131.12(a)(3) (2011); *see* Michael C. Blumm & Thea Schwartz, *Mono Lake and the Evolving Public Trust in Western Water*, 37 ARIZ. L. REV. 701, 716–20 (1995) (describing the implications of the ONRW designation in *In re* Amendment of the City of Los Angeles' Water Right Licenses for Diversion of Water from Streams Tributary to Mono Lake, Decision No. 1631 (Cal. Water Res. Control Bd. Sept. 28, 1994), *available at* http://www.swrcb.ca.gov/waterrights/board_decisions/adopted_orders/decisions/d1600_d1649/wrd1631.pdf.

409 Water Quality Standards Regulation, 48 Fed. Reg. 51,400, 51,403 (Nov. 8, 1983) (to be codified at 40 C.F.R. pts. 35, 120, 131); OFFICE OF WATER, U.S. ENVTL. PROT. AGENCY, EPA 823-B-94-005, WATER QUALITY STANDARDS HANDBOOK: SECOND EDITION 4-10 (2d ed. 1994).

410 *See* C. Mark Hersh, *The Clean Water Act's Antidegradation Policy and Its Role in Watershed Protection in Washington State*, 15 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 217, 222–29 (2009); Judith M. Brawer, *Antidegradation Policy and Outstanding National Resource Waters in the Northern Rocky Mountain States*, 20 PUB. LAND & RESOURCES L. REV. 13, 20–27 (1999) (discussing designation of ONRWs in Montana, Idaho, and Wyoming).

411 MONT. ADMIN. R. 17.30.617(1) (2006).

412 OR. ADMIN. R. 340-041-0004(8)(a)(E) (2011).

413 5 COLO. CODE REGS. § 1002-31:31.8(2)(a)(ii)(A) (2007); *see id.* § 1002-31:31.28(C)(3) (explaining that ONRW designations apply in wilderness areas despite the fact the wilderness areas already have other types of protections in place; to conclude otherwise "would prevent

ONRWs, water bodies within wilderness areas must be "relatively pristine" or possess exceptional water quality.[414]

Protection of wilderness waters as ONRWs is not limited to the western United States. Some eastern states with federally designated wilderness within their boundaries have also included wilderness water bodies as ONRWs and have given them the highest level of protection from degradation.[415]

There are few cases involving ONRW designations in wilderness areas, but New Mexico's experience demonstrates just how controversial these designations can be. In 2010, the New Mexico Water Quality Control Commission adopted a rule designating its headwater streams in federally designated wilderness areas as ONRWs and requiring the State to protect those streams from degradation.[416] The designation covers 700 miles of 195 perennial rivers and streams, 29 lakes, and 1405 wetlands in 12 wilderness areas.[417] According to the New Mexico Environment Department, "These waters represent the State's most valuable headwater streams. Protection of these headwaters will help maintain a clean water supply for uses in Wilderness and for downstream uses by municipalities, agriculture, and recreational interests, and will help maintain healthy ecosystems, preserve habitat, and protect vulnerable and endangered species."[418] Environmental groups applauded the State's efforts to provide "a sense of water security in a time of climate uncertainty."[419]

Although the new ONRW rule exempts existing grazing practices from state law restrictions imposed by the ONRW designation, the New Mexico Cattle Growers Association fears that the rule opens an avenue for environmental groups to bring lawsuits against the United States Forest Service over grazing on public lands.[420] There is good reason for this concern. When the Forest Service reviews a grazing permit on an allotment with a

application of the outstanding waters designation to waters that may be among those most deserving of protection").

414 WASH. ADMIN. CODE § 173-201A-330(1)(a) (2003).

415 *See, e.g.*, FLA. ADMIN. CODE ANN. r. 62-302.700(2)(a) (2006); W. VA. CODE R. § 60-5-3.5.a (2008).

416 Press Release, Office of the Sec'y, N.M. Env't Dep't, Water Quality Control Commission Adopts Petition that Protects Headwater Streams in Wilderness Areas of New Mexico (Dec. 1, 2010), *available at* http://www.nmenv.state.nm.us/OOTS/documents/PR-ONRWPassesFinal-12-1-10.pdf; *see* N.M. CODE R. § 20.6.4.9.B, D (LexisNexis 2011) (providing criteria for ONRW designation, including waters with "significant attribute[s] of a state special trout water, national or state park, national or state monument, national or state wildlife refuge or designated wilderness area," and providing an extensive list of ONRW designated waters "from their headwaters" downstream).

417 Order and Statement of Reasons, *In re* Petition to Nominate Surface Waters in Forest Service Wilderness Areas as Outstanding National Resource Waters, WQCC 10-01(R), ¶ 7–8 (Water Quality Control Comm'n Dec. 2010), *available at* ftp://ftp.nmenv.state.nm.us/www/HearingOfficer/ONRW/WQCCOrder+SOR20.6.4NMAC.pdf.

418 Press Release, Office of the Sec'y, *supra* note 416.

419 Susan Montoya Bryan, *NM Regulators Approve Outstanding Waters*, ASSOCIATED PRESS, Dec. 1, 2010, *available at* ftp://ftp.nmenv.state.nm.us/www/swqb/News/AP12-01-2010Article.pdf (quoting Bryan Bird of WildEarth Guardians).

420 *See* Order and Statement of Reasons, *supra* note 417, at ¶ 31.

designated ONRW stream, the Service will have to ensure that there are no changes in the grazing practices that would degrade the water.[421] The Association has filed a motion to stay the implementation of the rule, and has urged the Water Quality Control Commission to vacate it and to consider designating smaller watersheds on a case-by-case basis rather than in one blanket rule.[422] Despite political pressure, it appears that the Commission is standing pat on its rule.[423]

The prevention of nonpoint source pollution and the preservation of instream flows in wilderness areas may be necessary to prevent violations of the state's water quality standards and, in particular, its antidegradation requirements.[424] It is not entirely clear, however, that states can be *forced* to extend their antidegradation requirements to nonpoint sources in ONRWs and other "clean" water bodies.[425] A few courts have upheld the EPA's approval of water quality standards that exempted nonpoint source discharges from antidegradation requirements.[426] Montana exempted nonpoint sources in Tier II waters (but *not* in ONRW waters) "when reasonable land, soil, and water conservation practices are applied and

421 *See id.* at ¶ 29(e); Staci Matlock, *New Rule Under Fire from N.M. Cattle Growers Association*, SANTA FE NEW MEXICAN, Jan. 10, 2011, http://www.santafenewmexican.com/localnews/outstanding-waters-New-rule-under-fire-from-cattle-growers (last visited Feb. 18, 2012).

422 Matlock, *supra* note 421; Brief of NMCGA, In the Matter of Petition to Nominate Surface Waters in Forest Service Wilderness as Outstanding National Resource Waters, Appeal from Water Quality Control Commission, WQCC Case No. 10-01(R), Ct. App. No. 31,191 (Aug. 22, 2011).

423 *See* Surface Water Quality Bureau, N.M. Env't Dep't, *Water Quality Standards: Outstanding National Resource Waters*, http://www.nmenv.state.nm.us/swqb/ONRW/ (last visited Feb. 18, 2012) (showing January 2011 as the effective date of the final amendments to New Mexico's antidegradation policy).

424 *See* State Dep't of Ecology v. PUD No. 1 of Jefferson Cnty., 849 P.2d 646, 649–53 (Wash. 1993) (en banc), *aff'd*, 511 U.S. 700 (1994) (upholding the State's imposition of a minimum streamflow requirement in its 401 certification of a diversion into an offstream hydroelectric facility as a lawful component of the State's antidegradation policy); Robert L. Glicksman, *Pollution on the Federal Lands II: Water Pollution Law*, 12 UCLA J. ENVTL. L. & POL'Y 61, 70–73 (1993) (explaining that a great deal of water pollution comes from nonpoint sources and that states must regulate some of these resources to reduce pollution).

425 *See* Kent Modesitt, *Antidegradation: A Lost Cause or the Next Cause*, 2 U. DENV. WATER L. REV. 189, 193–94 (1998) (assessing the application of Colorado's antidegradation programs to both nonpoint source pollution and the balancing of water quality protection with future economic development).

426 Am. Wildlands v. Browner, 260 F.3d 1192, 1197 (10th Cir. 2001) (citing Kennecott Copper Corp. v. U.S. Envtl. Prot. Agency, 612 F.2d 1232, 1243 (10th Cir. 1979)) (holding that EPA lacks authority to regulate nonpoint sources of pollution); Appalachian Power Co. v. Train, 545 F.2d 1351, 1373 (4th Cir. 1976) ("Congress consciously distinguished between point source and nonpoint source discharges, giving EPA authority under the [Clean Water] Act to regulate only the former."); *see also* Defenders of Wildlife v. U.S. Envtl. Prot. Agency, 415 F.3d 1121, 1124 (10th Cir. 2005) ("[T]he CWA does not require states to take regulatory action to limit the amount of non-point water pollution introduced into its waterways."); Or. Natural Desert Ass'n v. Dombeck, 172 F.3d 1092, 1094, 1099 (9th Cir. 1998) (holding the Forest Service's issuance of a grazing permit, which would result in nonpoint source pollution, did not require state 401 certification). *Dombeck* and *American Wildlands* are critiqued in Michael C. Blumm & William Warnock, *Roads Not Taken: EPA vs. Clean Water*, 33 ENVTL. L. 79, 104, 106–09 (2003).

existing and anticipated beneficial uses will be fully protected."[427] The Tenth Circuit concluded that "[b]ecause the Act nowhere gives EPA the authority to regulate nonpoint source discharges, the EPA's determination [of approval] . . . is a permissible construction of the Act."[428]

Despite this ruling, persuasive arguments can be made that EPA has a duty to ensure that state programs for nonpoint source pollution—including antidegradation programs—do not defeat the CWA's objectives.[429] The CWA supports state efforts to control nonpoint source pollution through antidegradation requirements. The water quality standard-setting process applies to waters polluted by both point source and nonpoint source pollution.[430] And states are required to "assure that there shall be achieved . . . cost-effective and reasonable best management practices for nonpoint source control."[431] In addition, the antidegradation policies adopted by the states as a part of their water quality standards must be consistent with federal antidegradation policies.[432] As for parks, refuges, and designated wilderness areas, EPA has interpreted the requirement that ONRWs be maintained and protected as imposing "a nearly absolute ban on new or expanded point source discharges."[433]

---

427 *Am. Wildlands*, 260 F.3d at 1195 (quoting MONT. CODE ANN. § 75-5-317(2)(b) (2011)). Tier II protection provides that, where water quality exceeds that necessary to support aquatic life and recreation in a particular water body, that level of water quality shall be maintained unless the state determines that "allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located." 40 C.F.R. § 131.12(a)(2) (2011). However, "[i]n allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully." *Id.*

428 *Am. Wildlands*, 260 F.3d at 1198. *But see* Mont. Envtl. Info. Ctr. v. Dep't of Envtl. Quality, 988 P.2d 1236, 1237–38, 1249 (Mont. 1999) (finding a Montana statute exempting an open-pit gold mine's discharges of arsenic-laced water into rivers that provided habitat for endangered species from the antidegradation review process violated the State's constitutional provision guaranteeing its citizens a right to a clean and healthy environment).

429 Blumm & Warnock, *supra* note 426, at 104.

430 *See* Federal Water Pollution Control Act, 33 U.S.C. § 1313 (2006) (drawing no distinction between pollution from point sources and nonpoint sources); Nw. Envtl. Advocates v. City of Portland, 56 F.3d 979, 986 (9th Cir. 1995) ("[N]owhere does Congress evidence an intent to *preclude* the enforcement of water quality standards that have not been translated into effluent discharge limitations.").

431 40 C.F.R. § 131.12(a)(2) (2011); *see* David Zaring, *Best Practices*, 81 N.Y.U. L. REV. 294, 326–27 (2006) ("[B]est practices regulation is currently the *only* form of federal regulation of runoff, or 'nonpoint source' pollution.").

432 40 C.F.R. § 131.12(a)(2) (2011); Ky. Waterways Alliance v. Johnson, 540 F.3d 466, 471 (6th Cir. 2008); *cf.* Pennaco Energy, Inc. v. U.S. Envtl. Prot. Agency, 692 F. Supp. 2d 1297, 1314–16 (D. Wyo. 2009) (holding that EPA erred in approving Montana's revisions to its water quality standards—which regulated electrical conductivity and sodium adsorption ratio from coal bed methane development for certain rivers—without fully analyzing relevant technical and scientific data).

433 *See* Christie C. Morgan, *Challenges and Opportunities in Protecting Outstanding National Resource Waters*, NAT. RESOURCES & ENV'T, Spring 1991, at 30, 33; *see also* League to Save Lake Tahoe v. Tahoe Reg'l Planning Agency, 739 F. Supp. 2d 1260, 1267 (E.D. Cal. 2010) (addressing allegation that agency improperly failed to consider impact of development near Lake Tahoe on an ONRW). Some states have adopted their own variations of this policy. In Florida, for example, new discharges are allowed if they will *enhance* the water quality of ONRWs. FLA. ADMIN. CODE ANN. r. 17-4.242(3)(b) (2002).

EPA has also set a precedent for federal involvement in nonpoint source pollution control by setting a TMDL for a river polluted solely by logging and other nonpoint sources.[434] When the State of California failed to adopt its own TMDLs for the Garcia River, EPA stepped in and identified the maximum load of pollutants that can enter the river from several broad categories of nonpoint sources while attaining water quality standards. In *Pronsolino v. Nastri*, the Ninth Circuit upheld the EPA's inclusion of nonpoint sources.[435] It reasoned:

> Water quality standards reflect a state's designated *uses* for a water body and do not depend in any way upon the source of pollution. . . .
>
> . . . .
>
> [Section] 303(d) is structurally part of a set of provisions governing an interrelated goal-setting, information-gathering, and planning process that, unlike many other aspects of the CWA, applies *without regard to the source of pollution*.[436]

The *Pronsolino* court also concluded that, although the CWA provided for TDML determinations by the states, EPA had not violated the CWA's balance of federal–state control.[437] The EPA's TDML plan expressly required the states to implement and monitor effluents and to include adequate implementation provisions, including schedules of compliance for revised or new water quality standards, in their continuing planning processes for nonpoint source pollution control.[438]

Dean William Hines was on to something back in 1977 when he called the CWA's antidegradation policy "the pollution control analogue to wilderness preservation in public lands management."[439] Ironically, today the antidegradation policy is becoming an important component of public lands and wilderness management. The jury may still be out with respect to the

---

434 Pronsolino v. Nastri, 291 F.3d 1123, 1129 (9th Cir. 2002). At the time, EPA had issued a final rule that required the inclusion of waters polluted only by nonpoint sources on the CWA section 303(d)(1) water quality impaired, or TMDL, list. 65 Fed. Reg. 43,586 (July 13, 2000) (to be codified at 40 C.F.R. pts. 9, 122, 123, 124, 130). After Congress passed an appropriations rider prohibiting the implementation of the rule, H.R. 4425, 106th Cong. (2000) (enacted), EPA withdrew its final rule. 68 Fed. Reg. 13,608 (Mar. 19, 2003) (to be codified at 40 C.F.R pts. 9, 122, 123, 124, 130).

435 *Pronsolino*, 291 F.3d at 1137–38.

436 *Id.* at 1137–38 (emphasis added). A subsequent opinion from the Eighth Circuit cited *Pronsolino* with approval but distinguished it from a controversy over Iowa's TMDLs and held that "[a]lthough § 303(d) may allow the EPA to include all impaired waters on a state's § 303(d) list, it does not require the EPA to include impaired waters where the EPA has determined the impairment is due to something other than a pollutant." Thomas v. Jackson, 581 F.3d 658, 666–67 (8th Cir. 2009). "Pollutant" is a legal term of art related to point source discharges. Federal Water Pollution Control Act, 33 U.S.C. § 1362(6) (2006).

437 *Pronsolino*, 291 F.3d at 1140.

438 *Id.*

439 N. William Hines, *A Decade of Nondegradation Policy in Congress and the Courts: The Erratic Pursuit of Clear Air and Clean Water*, 62 IOWA L. REV. 643, 645 (1977).

on-the-ground efficacy of antidegradation policies and, in particular, ONRW designations in wilderness and other protected areas.[440] Overall, however, it is clear that the CWA cannot be overlooked as an important tool for protecting wilderness waters. As the Forest Service acknowledged:

> Protecting the remaining healthy components of a watershed provides multiple benefits and a strong base to anchor future restoration in unprotected portions of these watersheds. Rivers, streams, lakes, and wetlands within a watershed are the circulatory system of ecosystems, and water is the vital fluid for inhabitants of these ecosystems, including people.[441]

VI. CONSERVATION IMPLICATIONS

There are a variety of statutory provisions and common law doctrines that empower the federal agencies to protect and preserve wilderness watersheds from degradation and development. The question remains—*should* they protect and preserve wilderness watersheds that already are, or within the foreseeable climate-altered future will become, altered or degraded.

Moral and spiritual reasons suggest that they should, and that the public and the courts should support preservation-oriented policies and decisions. There is something inherently good about wilderness preservation that should not be lost.[442] As Professor Jan Neuman argued, "[R]aised in a society where the government provides and regulates all the water we use, luxury has outpaced ancestral understanding."[443] Making the choice of deliberate nonintervention in wilderness areas is one important means of kindling the fires of ancestral understanding of the world around us, and deepening our awareness and respect for nature's autonomy. In at least one category of land holdings, people ought not be a dominating force over nature.[444]

The law supports a noninterventionist stance as well. The Wilderness Act itself is the most restrictive statute in federal land management law, bar none, and it was intentionally designed to favor preservation over intervention, however well-meaning such intervention may be.[445] Letting nature take its course—evolutionarily and climatically—in wilderness areas, which comprise such a small slice of the United States land base, is still a

---

440 This issue is the subject of a work-in-progress by the author and Robert L. Glicksman, *Antidegradation Policies: Do They Work?*, to be published in a forthcoming issue of GEO. WASH. J. ENERGY & ENVTL. L. (2012).

441 66 Fed. Reg. 3244, 3246 (Jan. 12, 2001) (to be codified at 36 C.F.R. pt. 294) (citation omitted).

442 John Copeland Nagle, *The Spiritual Values of Wilderness*, 35 ENVTL. L. 955, 981–82 (2005); Peter Landres, *Let It Be: A Hands-Off Approach to Wilderness and Protected Areas*, *in* BEYOND NATURALNESS: RETHINKING PARK AND WILDERNESS STEWARDSHIP IN AN ERA OF RAPID CHANGE, *supra* note 124, at 88, 93–94 (arguing that a hands-off approach to preservation provides "spiritual, psychological, and philosophical benefits").

443 Troy L. Payne & Janet Neuman, *Remembering Rain*, 37 ENVTL. L. 105, 106 (2007).

444 Landres, *supra* note 442, at 93.

445 *See supra* Part V.A.

valid and even imperative approach to land management.[446] Other categories of land holdings may be and often are manipulated in deliberate ways to achieve higher resource outputs or greater biological diversity; wilderness provides a contrast and a baseline against which to measure and understand the effects of activities elsewhere.[447]

There are also compelling practical reasons that weigh against overt human manipulation of natural characteristics and processes of wilderness areas. Our current track record for "ecosystem engineering" has been less than stellar. Even when decision makers have had the best of intentions and generous funding, their efforts to restore ecological features and functions that were degraded or destroyed by development have been spotty. There have been at least as many missteps as successes in the Florida Everglades, the Missouri River, and the late successional reserves and key watersheds of the Pacific Northwest forests.[448] When it comes to translocating aquatic species into novel habitats or employing manipulative strategies, such as chemicals and biological agents, to eradicate nondesired species in wilderness areas, ecosystem engineering is even trickier and less likely to succeed. Selecting or designing new habitats that will be viable for communities of fish, animal, and plant species that have never lived together

446 *See* Joshua J. Lawler, *Climate Change Adaptation Strategies for Resource Management and Conservation Planning*, 1162 ANNALS OF N.Y. ACAD. OF SCIS. 79, 79 (2009) ("To successfully manage for climate change, a better understanding will be needed of . . . how to preserve and enhance the evolutionary capacity of species."); McCool & Cole, *supra* note 5, at 1 *Wilderness as a Place for Scientific Inquiry*, 3 USDA Forest Service Proceedings RMRS-P-15-VOL 3 at 1, 1 (1999), *available at* http://www.fs.fed.us/rm/pubs/rmrs_p015_3.pdf (noting the value of wilderness as a "cauldron of evolution" (quoting Dave Foreman)).

447 *See, e.g.*, National Forest Management Act of 1976, 16 U.S.C. § 1604(e)(1) (2006) (amending Forest and Rangeland Renewable Resources Planning Act of 1974, Pub. L. No. 93-378, 88 Stat. 476) (forests to be managed for sustained yields and multiple uses); Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1701(a)(7) (2006) (BLM lands to be managed for sustained yields and multiple uses); National Wildlife Refuge System Improvement Act of 1998, 16 U.S.C. § 668dd–668ee (2006) (amending National Wildlife Refuge System Administration Act of 1966, Pub. L. No. 91-135, 83 Stat. 283 (1969)) (stating that wildlife refuges are to be managed for wildlife conservation and biological diversity).

448 Sandra Zellmer & Lance Gunderson, *Why Resilience May Not Always Be a Good Thing: Lessons in Ecosystem Restoration from Glen Canyon and the Everglades*, 87 NEB. L. REV. 893, 913–23, 934–42 (2009) (discussing restoration efforts in the Florida Everglades); O'Brien & McIvor, *supra* note 195, at 6–8 (discussing the same); Robert B. Keiter, *Breaking Faith with Nature: The Bush Administration and Public Land Policy*, 27 J. LAND RESOURCES & ENVTL. L. 195, 225–28 (2007) (discussing the Pacific Northwest Forest Plan); League of Wilderness Defenders v. U.S. Forest Serv., 549 F.3d 1211, 1216–20 (9th Cir. 2008) (reviewing an intensive logging proposal for a forest covered by the President's Northwest Forest Plan). The California Bay Delta Accord (CALFED) is another example of a watershed restoration initiative that at least some analysts characterize as a failure. *See* Holly Doremus, *CALFED and the Quest for Optimal Institutional Fragmentation*, 12 ENVTL. SCI. & POL'Y 729 (2009) (assessing CALFED's successes and failures). *See generally* Dave Owen, *Law, Environmental Dynamism, Reliability: The Rise and Fall of CALFED*, 37 ENVTL. L. 1145 (2007) (discussing the reasons for CALFED's failure); JUDITH A. LAYZER, NATURAL EXPERIMENTS: ECOSYSTEM-BASED MANAGEMENT AND THE ENVIRONMENT 137–71 (2008) (describing ecological drawbacks of CALFED's consensus-based approach). On adaptive watershed management more generally, see Craig Anthony (Tony) Arnold, *Adaptive Watershed Planning and Climate Change*, 5 ENVTL. & ENERGY L. & POL'Y J. 417 (2010).

before and that have incredibly complex life-cycle needs would seem to require god-like knowledge and foresight. Our record for ensuring that intentionally translocated species do not themselves become invasive nuisance species is at least as poor as our ecological restoration track record.[449] By the same token, waging war on invasive species that have already come to be located in wilderness areas can have profound unintended, adverse consequences.

Dramatic changes in climate will make the predictive challenges even greater. Despite the most careful planning and modeling, surprises are inevitable, especially in an increasingly climate-altered world.[450] Consider poor Prometheus, who stole fire from the gods and gave it to mortals, and who was punished for his hubris by being chained to a rock for eternity, with eagles swooping down to feast on his liver, day after miserable day.[451] Active management interventions that manipulate natural functions and processes in wilderness areas might just as surely result in doom. According to ecologist Daniel Doak, "the extent and frequency of major 'surprises' in ecological systems argue for substantial humility about our predictive abilities."[452] Deliberate nonintervention—restraint—goes hand in hand with humility.

VII. CONCLUSION: DELIBERATE NONINTERVENTION

As Howard Zahniser famously said, we should be guardians of wilderness, not gardeners.[453] A federal judge carried Zahniser's analogy forward into caselaw: "Nature may not always be as beautiful as a garden but producing gardens is not the aim of the Wilderness Act."[454] Rather, the aim is to protect the wild, untrammeled characteristics of wilderness while letting endemic, unmanipulated processes and functions within wilderness take their course.

Although historic characteristics and variability can no longer be the primary reference points for decision making, learning more about how ecological systems have adapted and are adapting to stressors such as heat, drought, fire, and floods, will be essential in planning for the future. Unless

449 *See* David Pimentel et al., *Environmental and Economic Costs of Nonindigenous Species in the United States*, 50 BIOSCIENCE 53, 53 (2000) (analyzing the costs of a fraction of nonindigenous species in the United States).

450 Landres, *supra* note 442, at 94; Daniel F. Doak et al., *Understanding and Predicting Ecological Dynamics: Are Major Surprises Inevitable?*, 89 ECOLOGY 952, 958 (2008) ("[E]cological surprises reinforce the need for management plans that are highly precautionary . . . .").

451 John S. Applegate, *The Prometheus Principle: Using the Precautionary Principle to Harmonize the Regulation of Genetically Modified Organisms*, 9 IND. J. GLOBAL LEGAL STUD. 207, 259–60 (2001).

452 Doak et al., *supra* note 450, at 953; *see id.* at 958 ("[M]ost management strategies . . . will not work as planned . . . [and] sometime[s] not just less than perfect in achieving some desired outcome, but totally wrong.").

453 Howard Zahniser, *Guardians Not Gardeners*, LIVING WILDERNESS, no. 83, 1963 at 1.

454 Minn. Pub. Interest Research Grp. v. Butz, 401 F. Supp. 1276, 1331 (D. Minn. 1975), *rev'd*, 541 F.2d 1292 (8th Cir. 1979).

we understand a system perfectly—an impossible task—interventions aimed at increasing the stability of the system in a particular historic state may, in fact, increase the fragility of the system and do more damage than the perturbations that caused the degradation in the first place. Adaptive management experiments outside of wilderness areas will be more meaningful, and we can learn more from them, if wilderness is left alone to provide a baseline and a contrast to areas that are manipulated. To the extent that human interventions occur, they should be limited to those interventions minimally necessary to remove previously or presently imposed human impediments to essential ecosystem processes that structure the area and enable wilderness watersheds to self-organize into a sustainable and wild regime—a resilient collection of mutually reinforcing ecological processes.

This does not mean that wilderness managers must or even should turn their backs to wilderness threats; quite the opposite. Managers and wilderness advocates must use all of the legal tools available to them—the Wilderness Act, the antidegradation provisions of the CWA, the federal reserved water rights doctrine, and the Wild and Scenic Rivers Act—in a more holistic and vigilant fashion than they have in the past. The CWA and the federal reserved water rights doctrine, in particular, warrant more attention and utilization as preservation tools.

Rather than acting as gardeners or, worse yet, curators of museum-like areas where managers struggle to keep historic features in place, we can be humble yet strategic stewards—guardians—of wilderness areas and the watersheds that sustain them.