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Wildfire Policy, Climate Change, and the Law

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WILDFIRE POLICY, CLIMATE CHANGE, AND THE LAW

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I. INTRODUCTION

In recent years, wildfires have grown in size and intensity across the western United States. In 2011, Texas experienced the worst fire season in its history, as more than 30,000 fires consumed over 3.9 million acres and 3,000 homes, wreaking more than $500 million in damages.[1] Meanwhile, Arizona, California, Utah, Colorado, New Mexico, and Oregon have each also recorded historic wildfire seasons during the past decade. The root causes for this wildfire explosion are not hard to pinpoint: prolonged drought, elevated temperatures, high winds, an extended fire season, and plentiful fuel. By many estimates, these conditions are likely to continue for awhile in the Southwest.[2] Most scientists also agree that this notable uptick in catastrophic fire events is linked to climate change, a reality that virtually ensures fire-prone conditions will only worsen as temperatures continue to rise.[3] Though climate-related changes in environmental conditions will vary by location, any increase in temperatures will almost certainly spawn more

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1. *See* TEXAS A&M FOREST SERVICE, *Current Texas Wildfire Situation*, http://texasforestservice.tamu.edu/main/popup.aspx?id=12888 (last visited Apr. 6, 2012); Press Release, INSURANCE COUNCIL OF TEXAS, *Bastrop Wildfire Losses Rise,* (Dec. 8, 2011), http://www.insurancecouncil.org/news/2011/Dec082011.pdf, (last visited Apr. 6, 2012).

2. John W. Nielsen-Gammon, *The 2011 Texas Drought: A Briefing Packet for the Texas Legislature*, 41–42, (October 31, 2011), http://climatexas.tamu.edu/files/2011_drought.pdf.

3. *See* Anthony L. Westerling et al., *Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity*, 313 SCIENCE 940, 940–43 (2006); Steven W. Running, *Is Global Warming Causing More, Larger Wildfires?*, 313 SCIENCE 927 (2006).

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frequent and larger wildfires with their accompanying human and environmental costs.

The policies governing wildfire have changed over the years, reflecting a maturing and more enlightened view of the role that fire plays on the landscape. Until the late twentieth century, federal fire policy was directed toward extinguishing wildfires in order to protect threatened resources and nearby communities. Fire was viewed as a destructive force that should be promptly suppressed; few people regarded it as an important ecological process that shaped the landscape. But as our knowledge of fire and its role in the ecosystem evolved, so too did federal fire policy, which since the late 1960s has acknowledged that fire has a place in our forests and rangelands.[4] Yet years of fire suppression have altered conditions on the ground, creating an extensive fuel build-up that portends even larger, more massive fire events. As a result, federal fire policy is now focused on reducing these hazardous fuels, minimizing the legal hurdles involved in such efforts, and increasing protection for the growing wildland-urban interface zone.[5]

Not surprisingly, climate change does not yet factor significantly into fire policy, even though scientists have concluded that a warmer climate portends more fire across the landscape. This essay will first briefly review the evolution of federal wildfire law and policy. It will then examine the relationship between climate change and wildfire, including potential legal and policy implications. Next, it will identify and explore how adaptation and mitigation strategies might be employed to address the growing climate-related wildfire risk. This entails reviewing the wildland-urban interface problem and risk reduction policies designed to protect human lives and property. It also entails examining the impact climate change and enhanced fire regimes will have on natural resource management policy and strategy. The essay concludes with brief observations on how law and policy might better address and accommodate the fire-related challenges that loom as the climate continues to warm.

II. The Evolution of Wildfire Policy and Law

During the settlement of the American West, fire was part of the landscape that the new settlers encountered. Whether set by Native Americans for hunting and agricultural purposes or ignited by light-

4. For an overview of wildfire and fire management history, *see generally* Stephen J. Pyne, Fire In America: A Cultural History of Wildand And Rural Fire (1982); David Carle, Burning Questions: America's Fight with Nature's Fires (2002); Rocky Barker, Scorched Earth: How the Fires of Yellowstone Changed America (2005).

5. *See* Robert B. Keiter, *The Law of Fire: Reshaping Public Land Policy In an Era of Ecology and Litigation*, 36 Envtl. L. 301, 308–13 (2006) [hereinafter Keiter, *Law of Fire*].

ning strikes, fires regularly blackened the area's forests and grasslands. And the early settlers themselves regularly used fire to clear fields and revitalize the vegetation. At the same time, as new communities sprung up and confronted the threat of runaway wildfires, local leaders sought to control fire to minimize the threat to these new settlements, but few towns had sufficient resources to fight a blazing inferno.[6] If anyone were to play that role, it would have to be the federal government. In 1905, the newly created U.S. Forest Service stepped forward to take on that responsibility,[7] and Congress gave its blessing by creating an essentially open-ended funding process to support the agency's firefighting efforts.[8]

Following the devastating 1910 fire season, when flames roared out of control across the northern Rocky Mountains,[9] the nascent Forest Service adopted an all-out fire suppression policy. But the policy proved difficult to implement given the new agency's limited resources and the difficulty of accessing remote backcountry areas where fires often burned. Yet once the Civilian Conservation Corps started constructing roads and trails into the backcountry during the Great Depression and once surplus military aircraft, jeeps, and other equipment became available following World War II, the Forest Service and the other federal land management agencies finally had the capacity to begin fighting fires across the countryside.[10] Adhering to an all-out suppression policy, the agencies soon managed to cut the acreage burned annually by half, reducing it from two million acres to less than one million acres by mid-century.[11]

At the same time, however, scientists were changing their view of fire and its ecological role. Not only were they beginning to see fire as an important regenerative process, but they also began to realize that intermittent fires helped reduce wildfire intensities.[12] Cost factors associated with fighting fires in remote locations where neither lives nor property were at risk also factored into a policy re-examination. By the late 1960s, both the National Park Service and the U.S. Forest Service were shifting their full suppression approach to wildfire and

6. *See* Keiter, *Law of Fire*, *supra* note 5, at 304–05.

7. FOREST SERV., U.S. DEP'T OF AGRIC., THE USE OF THE NATIONAL FOREST RESERVES: REGULATIONS AND INSTRUCTIONS 63–64 (July 1905), *available at* http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/12514/ForestServiceUseNationalForestReserves.pdf?sequence=1.

8. *See* PYNE, *supra* note 4, at 263–64; MARK HUDSON, FIRE MANAGEMENT IN THE AMERICAN WEST: FOREST POLITICS AND THE RISE OF MEGAFIRES 57–58 (2011).

9. *See generally* STEPHEN J. PYNE, YEAR OF THE FIRES: THE STORY OF THE GREAT FIRES OF 1910 (2001); TIMOTHY EGAN, THE BIG BURN: TEDDY ROOSEVELT AND THE FIRE THAT SAVED AMERICA (2009).

10. *See generally* PYNE, *supra* note 4, at 272–77.

11. STEPHEN F. ARNO & STEPHEN ALLISON-BUNNELL, FLAMES IN OUR FOREST: DISASTER OR RENEWAL 20–21 (2002).

12. *See* CARLE, *supra* note 4; *see also* ASHLEY SCHIFF, FIRE AND WATER: SCIENTIFIC HERESY IN THE FOREST SERVICE (1962).

allowing some fires to burn unabated in backcountry locations, even utilizing controlled burning to restore some fire-adapted ecosystems.[13] Despite the political uproar that accompanied the explosive 1988 Yellowstone fires, the agencies remained committed to reintroducing fire to the landscape, while tightening their let-burn policies.[14] But scientists were growing increasingly concerned about the fuel loads that had accumulated, which portended potentially even more catastrophic fires.

The deadly 1994 fire season prompted another federal fire policy review, one that also addressed the problem of growing urban encroachment next to fire-prone forested areas. The 1995 Federal Wildland Fire Management Report, while acknowledging that wildfire was "a critical natural process [that] must be reintroduced into the ecosystem," endorsed better coordination among federal, state, and local authorities, particularly in at-risk wildland-urban interface zones, called for more public engagement in designing fire management plans, and gave top priority to protecting human life with property and resource protection denominated secondary priorities.[15] It was clear, though, that the focus of federal fire policy would be on reducing the fuel build-up that had accumulated over time under the earlier suppression policy and that was now putting communities at risk.[16]

As the twenty first century unfolded, more catastrophic fire seasons ensued. In 2002 alone, more than 7 million acres burned, as Colorado, New Mexico, Arizona, and Oregon experienced their worst fire seasons in modern history.[17] Both Congress and the Bush administration responded with new legislation and policies that instituted a much more aggressive federal approach to controlling wildfire. The Bush administration conceived the Healthy Forests Initiative ("HFI") in an effort to expedite the Forest Service's fuel removal efforts, including forest thinning, controlled burning, and salvage logging projects.[18]

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13. *See* PYNE, *supra* note 4, at 295–315; ALFRED RUNTE, AMERICA'S NATIONAL PARKS: A HISTORY, 201–08 (2d ed. 1987).

14. *See* Keiter, *Law of Fire*, *supra* note 5, at 308–10; *see generally* BARKER, *supra* note 4.

15. U.S. DEP'T OF THE INTERIOR & U.S. DEP'T OF AGRIC., FEDERAL WILDLAND FIRE MANAGEMENT POLICY AND PROGRAM REVIEW: FINAL REPORT iii (1995).

16. *See generally* U.S. DEP'T OF AGRIC. & U.S. DEP'T OF THE INTERIOR, MANAGING THE IMPACT OF WILDFIRES ON COMMUNITIES AND THE ENVIRONMENT: A REPORT TO THE PRESIDENT IN RESPONSE TO THE WILDFIRES OF 2000, (Sept. 2000), *available at* http://clinton4.nara.gov/CEQ/firereport.pdf.

17. H.R. REP. NO. 108–96, pt. 1, at 2 (2003); ROCKY BARKER ET AL., A CHALLENGE STILL UNMET: A CRITICAL ASSESSMENT OF THE POLICY RESPONSE TO WILDLAND FIRE 2 (2004); U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-05-147, WILDLAND FIRE MANAGEMENT: IMPORTANT PROGRESS HAS BEEN MADE, BUT CHALLENGES REMAIN TO COMPLETING A COHESIVE STRATEGY 3 (2005).

18. OFFICE OF THE PRESIDENT, HEALTHY FORESTS: AN INITIATIVE FOR WILDFIRE PREVENTION AND STRONGER COMMUNITIES (2002); U.S. DEP'T OF THE INTERIOR & U.S. DEP'T OF AGRIC., THE HEALTHY FORESTS INITIATIVE AND HEALTHY FORESTS

Congress passed the Healthy Forests Restoration Act of 2003,[19] which also focused on expediting hazardous fuel reduction projects in order to protect at-risk wildland-urban communities. These legal reforms represented the first time in decades that the federal law related to fire was the subject of any serious reform effort.

Before then, the legal framework governing federal fire policy consisted of a few early statutory provisions vesting the land management agencies with broad authority to control wildfires and promoting collaboration with state and local officials.[20] Over the years, key federal environmental laws, principally the National Environmental Policy Act ("NEPA") and the Endangered Species Act ("ESA"), had come to play an increasingly more important role in dictating how the federal land management agencies approached their fire-related responsibilities.[21] Under NEPA, the agencies were obligated to prepare an environmental analysis before undertaking any fire control projects, such as fuel thinning, controlled burning, or post-fire logging,[22] while the ESA obligated them to consult with the U.S. Fish and Wildlife Service ("FWS") before such projects could proceed if any federally protected species might be affected.[23] Drawing upon existing precedent, the courts were rigorously enforcing these laws, issuing numerous injunctions that blocked allegedly ill-conceived fuel reduction or salvage logging projects.[24] Seeing its project proposals regularly called into question, the Forest Service concluded it confronted a "process predicament" that was disabling it from addressing the growing fire threats.[25]

RESTORATION ACT: INTERIM FIELD GUIDE 8 (2004); *see infra* notes 26–32 for further discussion of the Healthy Forests Initiative.

19. Pub. L. No. 108–148, 117 Stat. 1887 (2004) (codified at 16 U.S.C.A. §§ 6501–6591); *see infra* note 34 and accompanying text for further discussion of the Healthy Forests Restoration Act.

20. For an account of these early fire-related laws, *see* Keiter, *Law of Fire*, *supra* note 5, at 322–25.

21. *See id.* at 332–37.

22. 42 U.S.C.A. § 4332(2)(C) (2007); *see also* Keiter, *Law of Fire*, *supra* note 5, at 332–45.

23. 16 U.S.C. § 1536(a)(2) (2007); *see also* Keiter, *Law of Fire*, *supra* note 5, at 339.

24. *See, e.g.*, Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1216 (9th Cir. 1998); Sierra Club v. Bosworth, 199 F. Supp. 2d 971 (N.D. Cal. 2002); *see generally* Keiter, *Law of Fire*, *supra* note 5, at 334–37; More recent decisions enjoining timber salvage or fuel reduction projects include: Earth Island Inst. v. United States Forest Service, 442 F.3d 1147, 1178 (9th Cir. 2005), *abrogated by* Winter v. Natural Res. Def. Council, 55 U.S. 7 (2008); Ecology Ctr., Inc. v. Austin, 430 F.3d 1057, 1071 (9th Cir. 2005), *overruled by* Lands Council v. McNair, 537 F.3d 981 (2008); Utah Envtl. Cong. v. Bosworth, 372 F.3d 1219 (10th Cir.2004); Nw. Ecosystem Alliance v. Rey, 380 F. Supp. 2d 1175 (W.D. Wash. 2005).

25. *See generally* FOREST SERV., U.S. DEP'T OF AGRIC., THE PROCESS PREDICAMENT: HOW STATUTORY, REGULATORY, AND ADMINISTRATIVE FACTORS AFFECT NATIONAL FOREST MANAGEMENT (June 2002), *available at* www.fs.fed.us/projects/documents/Process-Predicament.pdf.

In the aftermath of the devastating 2002 fire season, the political reaction was swift and designed to unshackle the agencies from these asserted onerous legal requirements. As part of its Healthy Forests Initiative,[26] the Bush administration promulgated several new rules designed to change agency administrative appeal processes, along with NEPA environmental analysis and ESA consultation requirements.[27] The HFI eliminated administrative appeal options for thinning, salvage, and other fire-related agency decisions,[28] introduced multiple NEPA categorical exclusions for fire-related projects,[29] and reduced the FWS's ESA section 7 consultation role to further expedite such projects.[30] Although a series of court challenges blocked several of these reforms,[31] some of the changes initially survived, most notably the ESA revisions.[32] Congress got into the act too when it adopted the Healthy Forests Restoration Act of 2003, which also altered NEPA compliance requirements and administrative appeal opportunities to expedite hazardous fuel reduction projects.[33] Significantly, the HFRA states that forest ecosystems are important "to enhance . . . carbon sequestration," which represents a brief congressional acknowledgment that healthy forests play a vital role in addressing the

26. *See* HEALTHY FORESTS, *supra* note 18.

27. *See* Keiter, *Law of Fire*, *supra* note 5, at 337–41; *see also* JACQUELINE VAUGHN & HANNA J. CORTNER, GEORGE W. BUSH'S HEALTHY FORESTS: REFRAMING THE ENVIRONMENTAL DEBATE (2005); Jesse B. Davis, *The Healthy Forest Initiative: Unhealthy Policy Choices in Forest and Fire Management*, 34 ENVTL. L. 1209 (2004).

28. 36 C.F.R. pt. 215 (2012); *see generally* Dep't of Agric., Forest Service, Notice, Comment and Appeal Procedures for National Forest System Projects and Activities, 68 Fed. Reg. 33, (June 4, 2003); 43 C.F.R. § 4.410(b), § 5003.1 (2011); Special Rules Subject to Public Land Hearings and Appeals, 67 Fed. Reg. 77,011 (proposed Dec. 16, 2002) (to be codified at 43 C.F.R. pt. 4); *see* Keiter, *Law of Fire*, *supra* note 5, at 339–40.

29. Forest Serv., U.S. Dep't of Agric. & U.S. Dep't of the Interior, National Environmental Policy Act Determination Needed for Fire Management Activities; Categorical Exclusions; Notice, 68 Fed. Reg. 33,814 (June 5, 2003); *see* Keiter, *Law of Fire*, *supra* note 5, at 338.

30. 50 C.F.R. pt. 402 (2007); Joint Counterpart Endangered Species Act Section 7 Consultation Regulations, 68 Fed. Reg. 68, 254-02 (Dec. 8, 2003) (to be codified at 50 C.F.R. pt. 402); *see* Keiter, *Law of Fire*, *supra* note 5, at 339.

31. Earth Island Inst. v. Ruthenbeck, 490 F.3d 687, 699 (9th Cir. 2007), *rev'd on other grounds*, Summers v. Earth Island Inst., 555 U.S. 488 (2009) (administrative appeal reforms and NEPA categorical exclusions); Sierra Club v. Bosworth, 510 F.3d 1016 (9th Cir. 2007) (NEPA categorical exclusions). *But see* Wildlaw v. U.S. Forest Serv., 471 F. Supp. 2d 1221 (M.D. Ala. 2007) (sustaining new NEPA categorical exclusions); Heartwood, Inc. v. U.S. Forest Serv., 73 F. Supp. 2d 962 (S.D. Ill. 1999), *aff'd*, 230 F.3d 947 (7th Cir. 2000) (enjoining earlier NEPA categorical exclusions).

32. Defenders of Wildlife v. Kempthorne, 2006 WL 2844232, at *21 (D.D.C. 2006); But in 2012, in response to a motion for reconsideration, the district reversed itself and enjoined the ESA revisions. Defenders of Wildlife v. Salazar, 842 F. Supp. 2d 181, 186, 190 (D.D.C. 2012).

33. Healthy Forest Restoration Act, 16 U.S.C.A. §§ 6501–6591 (West 2010); *see* Keiter, *Law of Fire*, *supra* note 5, at 344–50.

effects of climate change.[34] But the net effect of the HFI and HFRA reforms has been to redirect federal wildfire policy toward controlling fires and reducing hazardous fuels.

At the state level, fire law and policy is relatively straightforward. State law mostly focuses on suppression, though several western states recognize that fire plays an important role in forest ecosystems and permit prescribed burning as a management tool. A few states, including California, which has adopted some of the most extensive laws governing fire, establish strict zoning, building, and property maintenance standards for the wildland-urban interface ("WUI") zone.[35] In Texas, the law denominates the Texas Forest Service as the lead state agency for overseeing wildfire control efforts, mandates a state-wide wildfire protection plan,[36] authorizes prescribed burning under supervised conditions,[37] and approves the state's involvement in the South Central Interstate Forest Fire Protection Compact.[38] Under the Clean Air Act, the states have legal primacy over air quality and smoke management, both very real concerns when controlled burning is proposed or when a wildfire is allowed to burn.[39] None of the states have yet instituted legal changes that address wildfire or forest management as an element of climate change.

III. Climate Change and Wildfire

Fire represents an important disturbance factor in most forest and grassland ecosystems, serving as a cyclical source of ecological renewal. Pre-settlement, fires regularly scorched the North American continent, sometimes rampaging across the landscape during periods of drought and when abundant fuel sources were available. Fire intervals and intensity generally depended on the affected ecosystem type: Lodgepole pine forests like those found in the Yellowstone area tended to burn intensely in stand-replacing fires at 100-300 year intervals, while the Ponderosa pine forests found in the Southwest usually experienced less intense, short interval fire events that consumed the understory but rarely affected the large trees.[40] While Native Americans routinely used fire for their own purposes, once European set-

34. 16 U.S.C. § 6501(6)(C) (2011).

35. *See generally* Keiter, *Law of Fire*, *supra* note 5, 358–65.

36. Texas Education Code Ann. §§ 88.101–102, § 88.124 (West 2002 & Supp. 2012).

37. Texas Natural Resources Code Ann. §§ 153.001–104 (West 2011).

38. Texas Education Code Ann. §§ 88.112–116 (West 2002 & Supp. 2012).

39. *See* Keiter, *Law of Fire*, *supra* note 5, at 361–62; Kirsten Engel & Andrew Reeves, *When "Smoke Isn't Smoke": Missteps in Air Quality Regulation of Wildfire Smoke*, in Wildfire Policy: Law and Economics Perspectives 127 (Karen M. Bradshaw & Dean Lueck, eds., 2012); Laura Sweedo, *Where There Is Fire, There Is Smoke: Prescribed Burning in Idaho's Forests*, 8 Dick. J. Envtl. L. & Pol'y 121, 135–136 (1999).

40. Arno & Allison-Bunnell, *supra* note 11, at 68–70.

tlers arrived the focus shifted to extinguishing fires to protect the new communities as well as valuable timber and grass resources.[41] Gradually, this emphasis on suppression gave way to a renewed appreciation for the role of fire as a vital ecological process, but by then fuel accumulations presented a major new obstacle in any effort to reintroduce fire to the landscape.

With the recognition that global climate change is altering ecological conditions as well as weather patterns across the United States, fire management will become an even greater challenge. In many locations, including the American Southwest, a rise in temperatures presages a warmer and drier climate that is conducive to larger and more destructive fire events. According to the Intergovernmental Panel on Climate Change ("IPCC"), we can expect much higher global temperatures, most notably in the northern latitudes, due primarily to greenhouse gas emissions that have grown since pre-industrial times and increased a remarkable 70% from 1970-2004.[42] Between the years 2040-2069, the IPCC forecasts a temperature increase of 1.5-5.8°C, much greater than the 0.9°C temperature increase that the western United States has experienced over recent decades.[43] As the climate warms, more precipitation is falling as rain rather than snow, and spring green-up is beginning 10-14 days earlier, particularly in the northern temperate latitudes. Consequently, the IPCC expresses "very high confidence" that in North America "disturbances such as wildfire and insect outbreaks are increasing and are likely to intensify in a warmer future with drier soils and longer growing seasons."[44]

These global warming phenomena will impact the incidence and severity of fire on the landscape. The IPCC projects that "warmer summer temperatures are expected to extend the annual window of high fire ignition risk by 10-30%," representing a significant increase in fire activity on landscapes that are already experiencing extreme fire events.[45] During the last three decades, according to one study, the wildfire season in the western United States has already increased by 78 days, while the burn duration of larger fires has increased from 7.5 days to 37.1 days.[46] Another study reports that since 1980 wildfires

41. *Id.* at 12–19; CARLE, *supra* note 4, at 11–36.

42. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE FOURTH ASSESSMENT REPORT, CLIMATE CHANGE 2007: SYNTHESIS REPORT, SUMMARY FOR POLICYMAKERS 2, 5 (2007), *available at* www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf.

43. Westerling et al., *supra* note 3, at 943; *see also* Running, *supra* note 3, at 928.

44. IPCC FOURTH ASSESSMENT REPORT WORKING GRP. II, *supra* note 42, at 619. These general findings closely track those reached by the IPCC in its Third Assessment Report, which predicted the fire season was likely to lengthen and the area burned was likely to increase significantly. *Id.* at 620.

45. *Id.* at 619.

46. Westerling et al., *supra* note 3, at 941; CLIMATE CENTRAL, THE AGE OF WESTERN WILDFIRES 4 (2012); *see also* B.J. Stocks et al., *Large Forest Fires in Canada,*

have annually burned 22,000 square kilometers, compared to an annual average of 13,000 square kilometers consumed from 1920-1980, thus nearly doubling in size the area affected.[47] Knowledgeable observers agree that these trends in the number and size of fires correspond closely to rising spring and summer temperature patterns over the past thirty-five years.[48]

Of course, wildfire regimes have historically varied in response to different regional ecological and climatic conditions. The West and Southeast tend to have more severe fire seasons than the Northeast and Midwest, where extensive settlement and forest cover removal have limited wildfires. The western fire season occurs mostly during summer months,[49] while the southwestern and southeastern fire seasons are usually springtime occurrences. Already several western states—particularly in the Southwest where extreme drought conditions have recently prevailed—have experienced the largest wildfires in recent history, including Arizona and Colorado in 2002, Utah in 2007, and Texas in 2006 and then again in 2011.[50] In fact, several climate change studies predict that the area burned across the western United States will at least double by the year 2100.[51] And scientists expect western ecosystems to change in response to warming tempera-

1959–97, 107 J. GEOPHYSICAL RES. 8149 (2002) (noting a similar annual increase in Canadian burned area since 1990); E. S. Kasischke & M. R. Turetsky, *Recent Changes in Fire Regime across the North American Boreal Region—Spatial and Temporal Patterns of Burning across Canada and Alaska*, 33 GEOPHYSICAL RESEARCH LETTER L09703 (2006) (finding that burned area in the North American boreal region increased from 6500 square kilometers annually during the 1960s to 29,700 square kilometers annually during the 1990s).

47. *See generally* Tania Schoennagel, et al., *The Interaction of Fire, Fuels, and Climate across Rocky Mountain Forests*, Vol. 54 No. 7 BIOSCIENCE 661 (2004); s*ee also* Westerling et al., *supra* note 3, at 941 (finding that the forested area burned in the western United States since 1986 is 6.5 times larger than the area burned from 1970–86); CLIMATE CENTRAL, *supra* note 46, at 1–3 (reporting that since the 1970s, the number of annual wildfires exceeding 1,000 acres has doubled in eight western states and quadrupled in Arizona and Idaho).

48. *See Climate Change on Wildfire Activity: Hearing on Consider Scientific Assessments of the Impacts of Global Climate Change on Wildfire Activity in the United States Before the Comm. on Energy and Natural Res. United States Senate,* 110th Cong. 22 (2007) (statement of Thomas W. Swetnam) [hereinafter *Swetnam Testimony*]; Westerling et al., *supra* note 3, at 943.

49. In the Southwest, the fire season usually arrives during the spring months, and then moves northward following the rising temperatures. Summer monsoon rains often help dampen southwestern fires, though sometimes not in bad drought years. PYNE, FIRE IN AMERICA, *supra* note 4, at 517–18.

50. *Swetnam Testimony*, *supra* note 48.

51. Donald McKenzie et al., *Climatic Change, Wildfire, and Conservation*, 18 CON. BIO. 890, 897 (2004); Running, *supra* note 3, at 928; *See also* YONGQIANG LIU ET AL., CO2 EMISSIONS FROM WILDFIRES IN THE U.S.: PRESENT STATUS AND FUTURE TRENDS 11 (available from author) (concluding that "wildfire emissions of CO2 in the contiguous U.S. are expected to increase by 50 percent by 2050 and be doubled by 2100 due to the greenhouse effect").

tures, even in extremely arid areas like the Mojave Desert ecosystem, precipitating more frequent and more intense fire events.[52]

Other natural phenomena, such as ocean water temperatures and related El Niño events, are also known to influence regional climatic patterns and wildfire behavior. These ocean-atmosphere oscillations—which include El Niño-Southern Oscillation ("ENSO"), the Pacific Decadal Oscillation ("PDO"), and the Atlantic Multi-decadal Oscillation ("AMO")—operate on a variable multi-year time scale, producing long lasting atmospheric high and low pressure systems that have been positively correlated to the frequency and severity of regional wildfire seasons.[53] In the Southwest and Southeast, for example, the ENSO generally produces wetter conditions and less fire activity during cooler, rainier El Niño events, while the drier La Nina events will ordinarily produce more fire activity, much like Texas experienced during the 2011 fire season.[54] Although these oscillation cycles appear responsible for drought conditions and more fires in parts of the West, the historical evidence derived from similar periods in the past do not correspond with the large-scale fire events of recent years. Scientists therefore believe that global warming trends are playing an increasingly important role in recent large-scale wildfire patterns, which cannot be explained solely by La Niña and similar atmospheric events.[55]

The likely effect that climate change will have on Texas has been extensively studied and documented. In the second edition of *The Impact of Global Warming on Texas*, the authors conclude that the state can expect the following: "temperatures will rise, heat waves will occur more frequently, it will be drier west of the Interstate 35 corridor, severe weather will become more frequent, in-stream flows will fall, biodiversity will decline, and the sea level will rise."[56] Another knowledgeable observer, commenting on the likely impact of climate change on Texas, observes that "future droughts will almost certainly be warmer than the Texas droughts of the past and consequently will tend to be more severe even if precipitation is unchanged."[57] In the case of wildfire, more springtime precipitation in some locations will mean more fuel build-up, which is then available to feed later wild-

52. *See* Keiter, *Climate Change and Wildfire Policy*, *supra* note *, at 481.

53. *See* Thomas Kitzberger et al., *Contingent Pacific-Atlantic Ocean Influence on Multi-century Wildfire Synchrony over Western North America*, 104 PROCEEDINGS NATL. ACAD. SCIENCES 543 (2007).

54. Nielsen-Gammon, *supra* note 2, at 3, 41–42.

55. *See* Westerling et al., *supra* note 3, at 943; *Swetnam Testimony*, *supra* note 48; *Climate Change on Wildfire Activity: Hearing Before the S. Comm. on Energy and Natural Res.*, 110th Cong. (2007) (statements of Ann Bartuska, Deputy Chief, U.S. Forest Service, and Susan Conrad, National Program Leader, U.S. Forest Service, Fire Ecology Research); *see also* Kitzberger et al., *supra* note 53, at 9.

56. JURGEN SCHMANDT, *Policy*, *in* THE IMPACT OF GLOBAL WARMING ON TEXAS 257 (Jurgen Schmandt et al. eds., 2d ed. 2011).

57. Nielsen-Gammon, *supra* note 2, at 42.

fires and increase their intensity. Drier, drought-like conditions, especially when accompanied by high wind events linked to severe weather conditions, are ready made for large fire events that can endanger communities and devastate forest, range, and aquatic ecosystems. Already the 2006 and 2011 Texas fire seasons have demonstrated just how destructive and costly runaway wildfires can be. By any measure, a warmer climate presages more severe wildfires with the attendant ecological and economic consequences, though the impacts will vary across the state's geographically diverse landscape.

Any substantial increase in the incidence and severity of wildfires will generate corresponding environmental impacts with important natural resource management policy implications. A warmer climate and more fires will alter wildlife habitat and displace some species, which could prove harmful or even fatal for those species with specific habitat needs. Wildlife displaced from national parks or other nature reserves may not find suitable habitat on adjoining lands, many of which have been intensively developed or badly fragmented, leaving the creatures stranded and subject to possible extinction.[58] More severe fire events can adversely impact water supplies, as the devastating 2002 Hayman fire did to Denver's municipal water system, prompting extensive post-fire erosion and silt laden run-off attributed to the loss of vegetation near critical water sources.[59] As fires intensify, they will inevitably impact forest structure, reshaping the composition of tree and shrub species and altering the prevailing ecological conditions. Although ecosystems are always in a state of dynamic flux, such compounded changes can push an ecosystem outside its natural range of historic variability and thus undermine its resiliency.[60] In short, ecosystem integrity is at real risk in a warming world, along with the manifold ecosystem services and resource values that we now take mostly for granted.

These same enhanced wildfire regime changes will also generate related economic and social impacts that likewise have important policy implications. Hotter temperatures and more intense fire events will put more WUI zone communities and homes at risk, prompting a corresponding increase in firefighting costs. Any proactive response, such as perimeter vegetation thinning, will be costly and require broad scale cooperation to be effective. Major fire events can have quite negative economic impacts on local businesses, disrupting normal

58. *See* McKenzie et al., *supra* note 51, at 898–99.

59. *See* Eryn Gable, *Forests: Life Renews in Hayman Fire Area, but Full Recovery Will Take Centuries*, LAND LETTER, June 7, 2007, http://www.eenews.net/public/Landletter/2007/06/07; Federico Cheever, *The Phantom Menace and the Real Cause: Lessons from Colorado's Hayman Fire 2002*, 18 PENN ST. ENVTL. L. REV. 185 (2010).

60. *See* David L. Peterson & Don McKenzie, *Understanding and Adapting to New Stress Complexes in Forest Ecosystems*, in CLIMATE CHANGE: A READER, *supra* note *, at 441; Michelle M. Nijhuis, *Forest Fires: Burn Out*, 489 NATURE 352 (2012).

commercial patterns and increasing insurance expenses.[61] Those involved in private forestry or agriculture are in danger of seeing their cash crops destroyed, or incurring additional expense in an effort to minimize the likelihood of a destructive fire event. Local businesses built on tourism or recreation could be forced to shut down, especially if a runaway fire destroys the very natural attractions that they depend upon to draw visitors.[62] A charred landscape with little wildlife or greenery is rarely attractive to visit. And when funds are devoted to firefighting efforts, these same funds are not available for fuel removal or other fire control efforts. Thus, as higher temperatures increase the wildfire risk, the usual way of living and doing business will become ever more complicated and expensive.

IV. Adaptation and Mitigation Strategies

According to climate scientists, the antidotes to global warming are adaptation and mitigation. Adaptation represents the principal strategy for addressing the increased wildfire risks associated with warming temperatures; it will involve adjusting management of our forests and grasslands in ways that protect vulnerable communities, valuable resources, and forest ecosystems from devastating fire events. Mitigation involves reducing carbon emission levels, which entails maintaining our forested landscapes as critical carbon storage sites and utilizing bio-fuels to replace fossil fuels. To achieve these adaptation and mitigation goals, the basic approach is to restore ecological integrity and resiliency to our fuel-loaded forests and grasslands.[63] As we shall see, the current legal structure is sufficiently flexible so we can pursue both adaptation and mitigation objectives simultaneously.[64] And federal wildfire policy is also largely compatible with these objectives and strategies.[65]

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61. *See* John D. Varley & Paul Schullery, *Reality and Opportunity in the Yellowstone Fires of 1988*, in The Greater Yellowstone Ecosystem: Redefining America's Wilderness Heritage 115 (Robert B. Keiter & Mark S. Boyce, eds., 1991).

62. IPCC Fourth Assessment Report Working Grp. II, *supra* note 42, at 634.

63. *See* Constance I. Millar et al., *Climate Change and Forests of the Future: Managing in the Face of Uncertainty*, 17 Ecological Applications 2145 (2007); Peterson & McKenzie, *supra* note 60, at 450–53; *See generally* Stephen F. Arno & Carl E. Fiedler, Mimicking Nature's Fire: Restoring Fire-Prone Forests in the West (2005).

64. For an overview of climate change, the law, and natural resources policy, see Robin Craig, *"Stationarity is Dead"—Long Live Transformation: Five Principles for Climate Change Adaptation Law,* 34 Harv. Envt'l L. Rev. 9 (2010); John D. Leshy, *Federal Lands in the Twenty-First Century*, 50 Nat. Resources J. 111 (2010); Robert L. Glicksman, *Ecosystem Resilience to Disruptions Linked to Global Climate Change: An Adaptive Approach to Federal Land Management*, 87 Neb. L. Rev. 833 (2009).

65. *See* U.S. Dep't of the Interior & U.S. Dep't of Agric., Federal Wildland Fire Management Policy and Program Review: Final Report 31–32 (1995); U.S. Dep't of the Interior et al., Review and Update of the 1995 Federal Wildland Fire Management Policy 25 (2001); U.S. Dep't of Agric., Gui-

A. *On Protecting Communities and Property*

As recent history has demonstrated, the current conditions are conducive to extreme fire events with often devastating effects on communities and homeowners. A rise in temperatures associated with global climate change will only exacerbate an already challenging fire situation in many areas unless we begin to reduce the risk by enhancing ecological resiliency. One paramount goal of any climate-based adaptation strategy must be to reduce the likelihood of catastrophic fire in the WUI zone and at other critical sites, such as vital domestic water sources, commercial timber lands, and agricultural operations. This will require a bifurcated strategy directed toward the hazardous fuel-load problem as well as the burgeoning WUI zone itself. The federal government—through community wildfire plans, thinning programs, and the like—is already collaboratively addressing the fuel reduction problem,[66] but state law has yet to meaningfully confront the problems associated with WUI expansion.

The primary concerns regarding federal fuel reduction policies are where and how to implement them. The federal Healthy Forests Restoration Act identifies the WUI zone as the initial target for these efforts in order to reduce the growing wildfire threat to human life and private property.[67] Given the present excessive fuel loads, most observers believe WUI fuel reduction efforts should utilize mechanical thinning rather than prescribed burn treatments.[68] This preference for mechanical thinning reflects concern that controlled burning under existing forest conditions could endanger nearby communities, as occurred during summer 2000 when a prescribed fire escaped containment in Bandelier National Monument and consumed part of Los Alamos, New Mexico.[69] Outside the WUI zone, most observers agree that fuel reduction efforts should be directed toward restoring fire-

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DANCE FOR IMPLEMENTATION OF FEDERAL WILDLAND FIRE MANAGEMENT POLICY, (Feb. 2009), *available at* www.nifc.gov/policies/policies_documents/GIFWFMP.pdf.

66. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-877, WILDLAND FIRE MANAGEMENT: FEDERAL AGENCIES HAVE TAKEN IMPORTANT STEPS FORWARD, BUT ADDITIONAL, STRATEGIC ACTION IS NEEDED TO CAPITALIZE ON THOSE STEPS (2009); U.S. DEP'T OF THE INTERIOR & U.S. DEP'T OF AGRIC., THE FEDERAL LAND ASSISTANCE, MANAGEMENT AND ENHANCEMENT ACT OF 2009: REPORT TO CONGRESS 8 (2011), *available at* http://www.forestsandrangelands.gov/strategy/documents/reports/2_ReportToCongress03172011.pdf.

67. *See supra* note 19 and accompanying text.

68. *See* THE ASS'N FOR FIRE ECOLOGY, THE SAN DIEGO DECLARATION ON CLIMATE CHANGE AND FIRE MANAGEMENT (2006), *available at* http:// fireecology.org/docs/AFE -The San Diego Declaration on Climate Change and Fire Management.pdf; Testimony of John A Helms, Scientific Assessment of Effects of Climate Change on Wildfire, before S. Comm. on Energy and Natural Resources, Sept. 24, 2007, *available at* http://www.forestry.ok.gov/Websites/forestry/Images/SAF%20Effects%20of%20climate%20change%20on%20wildfire.pdf.

69. *See* ROGER G. KENNEDY, WILDFIRE AND AMERICANS: HOW TO SAVE LIVES, PROPERTY, AND YOUR TAX DOLLARS 88–104 (2006); *see generally* HUDSON, *supra* note 8, at 134–48.

adapted ecosystems to minimize the danger of runaway fires.[70] In these non-WUI settings, prescribed burning is a viable option, though high fuel levels and runaway fires are still a concern.[71] It has also been suggested that the enhanced fire danger attached to climate change may force a shift in fuel reduction priorities away from the WUI zone to more fire-prone parts of the forest, where the strategy would be to construct fuel breaks to steer future fires away from settled areas and toward fuel-choked areas.[72] In the WUI zone, the long term goal would be to restore ecological integrity to the nearby forest to ensure resiliency and thus reduce the likelihood of future disastrous fire events.

Another important question is what role federal resource management and environmental laws should play in addressing fuel reduction in the WUI zone. In the aftermath of the Healthy Forests Initiative and the Healthy Forests Restoration Act,[73] the official answer was to reduce legal compliance requirements in order to expedite these projects and curtail the threat of catastrophic fire. The basic organic legislation governing the Forest Service and BLM provides authority for both agencies to adopt fire management plans consistent with NEPA's procedural requirements,[74] which should ensure that these plans are calibrated to specific local conditions that can vary widely across the landscape. In fact, the HFRA contemplates the adoption of community wildfire management plans based on extensive public input into the shape and content of these plans.[75] These public input provisions provide an opportunity to forge a local consensus on how to address WUI fuel reduction issues and thus reduce the likelihood of later litigation over implementation of specific fuel reduction projects. Moreover, both the HFRA and HFI scale back the level of NEPA compliance required to pursue hazardous fuel reduction projects,[76]

70. *See* ARNO & ALLISON-BUNNELL, *supra* note 11, at 169–82; *but see* Mark A. Williams & William A. Baker, *Spatially Extensive Reconstructions Show Variable-Severity Fire and Heterogeneous Structure in Historical W. U.S. Dry Forests*, 21 GLOBAL ECOL. BIOGEOGR. 1042 (2012) (concluding that high-severity fires were historically a normal part of western dry forest dynamics).

71. *See* ARNO & FIEDLER, *supra* note 63, at 29–36.

72. Richard Manning, *Our Trial by Fire*, ON EARTH (Winter, 2008), at 44, 49; *see also* ARNO & ALLISON-BUNNELL, *supra* note 11, at 127–30, 144-45, 177–78.

73. *See supra* notes 18–19, 26–34 and accompanying text for a description of these laws and policies.

74. *See infra* notes 93–97 and accompanying text for a brief description of these organic acts.

75. 16 U.S.C. § 6513 (2011); *see generally* COMMUNITIES COMMITTEE ET AL., PREPARING A COMMUNITY WILDFIRE PROTECTION PLAN: A HANDBOOK FOR WILDLAND-URBAN INTERFACE COMMUNITIES (2004), *available at* http://www.stateforesters.org/sites/default/files/publication-documents/cwpphandbook.pdf; COMMUNITIES COMMITTEE, COMMUNITY GUIDE TO PREPARING AND IMPLEMENTING A COMMUNITY WILDFIRE PROTECTION PLAN (2008).

76. 16 U.S.C. § 6514 (2011); *see supra* notes 29, at 33 and accompanying text. *See also* Keiter, *Law of Fire*, *supra* note 5, at 338, 346–47; Davis, *supra* note 27.

though the HFRA includes limitations on the size of trees that can be thinned for ecological reasons and to avoid the spectacle of commercial logging in the guise of fire control.[77] Although it would be wise to integrate climate change data into these community-level plans, most global climate change models are currently only useful at the national or regional scale, with much less predictive capacity at localized levels where conditions can vary greatly.[78]

One mechanical thinning issue that has arisen is how to pay for this expensive fuel treatment process. For the most part, such thinning operations do not involve the removal of merchantable timber, making it difficult to attract bids from commercial timber companies.[79] To address this problem, the Forest Service has experimented with stewardship contracts that credit bidders on the sale price for the ecological restoration and other resource management objectives the project meets.[80] But even then, commercial mill facilities are often not available to process the removed biomass, much of which is brush or small diameter logs with little market value. To address this problem, the HFRA established a biomass grant program to help develop commercial facilities to utilize the removed forest materials.[81] In the case of climate change, some funds might be derived from taxes or fees imposed on greenhouse gas emission sources, a solution that was contemplated in the Waxman-Markey climate bill that passed on the House side during the 112th Congress.[82] Or rather than subsidize fuel removal projects, homeowners who have chosen to reside in the WUI zone might be expected to shoulder the costs.

Indeed, the burgeoning WUI zone clearly aggravates the wildfire risks faced by communities. As ex-urban growth and second home developments have spread across the landscape, more and more people are building in attractive but hazardous mountain and forest ve-

77. 16 U.S.C. § 6512(e)–(f) (2011).

78. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-07-863, CLIMATE CHANGE: AGENCIES SHOULD DEVELOP GUIDANCE FOR ADDRESSING THE EFFECTS ON FEDERAL LAND AND WATER RESOURCES 41 (2007); *see* ANTHONY L. WESTERLING ET AL., CLIMATE CHANGE, GROWTH, AND CALIFORNIA WILDFIRE (2011) (modeling future fire-climate scenarios for California).

79. *See* Keiter, *Law of Fire*, *supra* note 5, at 317–19.

80. For an overview of stewardship contracting, *see* THE PINCHOT INSTITUTE, THE ROLE OF COMMUNITIES IN STEWARDSHIP CONTRACTING: FY 2011 PROGRAMMATIC MONITORING REPORT TO THE USDA FOREST SERVICE 5–12 (2011), *available at* www.pinchot.org/uploads/download?fileId=1114.

81. 16 U.S.C. § 6531 (2011). The available federal grant funds are intended to offset the costs involved in purchasing the necessary biomass for the facility. *Id.* at § 6531(a).

82. *See generally* American Clean Energy and Security Act of 2009, H.R. 2454 111th Cong. (1st Sess. 2009); *see also* Leshy, *supra* note 64, at 130–34 (promoting a linkage between green energy project revenues and adaptation research and strategies).

nues.[83] Fire management officials regularly lament that they must frequently divert firefighting equipment and effort away from where it is really needed in order to safeguard WUI zone homes that are at risk.[84] One obvious means to address this problem is for state and local government officials to take the fire risk into account in their land use planning and zoning policies.[85] Under state law, these officials can utilize their authority to designate no-building zones, impose fire-proof construction standards, and set landscaping requirements designed to reduce the risk of property loss in the WUI zone. Several states, including California and Oregon, have adopted enlightened fire management laws, including provisions that regulate construction and landscape standards in highly hazardous zones— even going so far as to impose liability for suppression costs should a fire event occur.[86] In addition, given the mounting threat associated with climate change, we should consider conditioning federal disaster assistance funds to homeowners for fire losses by setting rigorous fire-proof reconstruction standards, adjusting tax rates and deductions, and providing mortgage insurance options for those who choose to build in high fire danger areas.[87]

Within the private sector, the insurance industry can use its financial power to require fire-proof home construction in the WUI zone along with fire-safe landscaping before making coverage available to homeowners. In fact, the industry has responded with several such measures in the face of mounting wildfire loss claims, including homeowner fire-proofing education and inspection programs, rate increases and policy cancellations in high risk areas, upgraded risk assessments using new satellite imagery technology and computerized fire hazard maps, and public relations initiatives encouraging the responsible agencies to alter their forest management practices.[88] However, because the insurance industry's fire-related losses represent less than 3% of its total losses and the major impacts associated with climate change are not imminent, the WUI-wildfire danger problem does not garner a lot of industry attention, at least as compared with hurricanes, earthquakes, and other large-scale disaster claim concerns.[89]

83. *See generally* HOWARD BOTTS ET AL., WILDFIRE HAZARD RISK REPORT: RESIDENTIAL WILDFIRE EXPOSURE ESTIMATES FOR THE WESTERN UNITED STATES (CoreLogic, 2012); Jamison Colburn, *The Fire Next Time: Land Use Planning in the Wildland/Urban Interface*, 28 J. LAND, RESOURCES & ENVTL. L. 223, 240–42 (2008); Cheever, *supra* note 59, 193–94.

84. *See* Karen M. Bradshaw, *A Modern Overview of Wildfire Law*, 21 FORDHAM ENVTL L. REV. 445, 455–58 (2010).

85. *See* Kennedy, *supra* note 69, at 223–34; Colburn, *supra* note 83, at 246–55.

86. *See* Keiter, *Law of Fire*, *supra* note 5, at 363–65.

87. *See* KENNEDY, *supra* note 69, at 235–47; *see also* HEADWATERS ECONOMICS, SOLUTIONS TO THE RISING COSTS OF FIGHTING FIRES IN THE WILDLAND-URBAN INTERFACE (2009).

88. Keiter, *Law of Fire*, *supra* note 5, at 356–57.

89. KENNEDY, *supra* note 69, at 246.

And when insurance companies have sought steep rate increases to address the wildfire danger, they have often faced stiff political resistance generated by the real estate and banking industries, thus practically insuring construction will continue in the at-risk WUI zone.[90] When coordinated with related governmental initiatives designed to address the WUI problem, however, these market-based strategies could help reduce economic losses significantly, which would then make more resources available to ameliorate the impact of climate change on forest and grassland ecosystems.

In sum, protecting communities and homeowners from the escalating wildfire threat as the climate warms will require an even more concerted effort at both the federal and state level to address the WUI-hazardous fuel problem on multiple fronts. The related strategies of limiting further growth in the WUI area and of imposing new fire-proof building and landscaping requirements to reduce the danger will likely require changes to state law, testing local political will on these matters. Absent further federal legal reforms, the strategy of reducing the existing fuel loads to minimize the threat of runaway wildfires and to improve forest health will require the agencies to continue taking account of related environmental concerns and laws. If pursued simultaneously, WUI growth limitations and forest restoration efforts would help restore forest cover and, in turn, enhance our carbon sequestration abilities, thus also advancing important climate mitigation goals.

B. *Natural Resources Management Challenges*

Over the millennia, wildfires have been an important ecological process that has helped to shape forest, grassland, and other landscapes. But the all-out fire suppression policies that prevailed for much of the past century have significantly altered these landscapes, resulting in the fuel build-up problem that currently poses major resource management challenges. In the face of more atmospheric heating, present fuel load levels augur even more future catastrophic fire events with even greater adverse impacts on existing timber, water, wildlife, and other resources. Land managers have therefore begun to take fire into account in an effort to restore fire-adapted ecosystems and to protect vital resources. Indeed, in its so-called FLAME Act of 2009, Congress has directed the agencies to "provide for . . . assessing impacts of climate change on . . . wildfire,"[91] while the Secretary of the Interior has instructed his agencies to "consider and analyze potential climate change impacts when undertaking long-range planning exercises . . . developing multi-year management plans, and making major

90. *See* Keiter, *Law of Fire*, *supra* note 5, at 356–57; KENNEDY, *supra* note 69, at 243–47.

91. FLAME Act of 2009, 43 U.S.C.A. § 1748b(b)(6) (West Supp. 2012).

[resource use] decisions."[92] To meet these obligations, key issues confronting the agencies include the future role of fire on the landscape, the relative merits of mechanical thinning versus controlled burning, and the use of salvage logging to recover fire-damaged timber.

For the federal land management agencies, the most evident mechanism for addressing climate-induced wildfire concerns is the multi-year resource planning process. Under laws like the National Forest Management Act ("NFMA") and the Federal Land Policy and Management Act, the agencies are required to develop integrated, multi-disciplinary land use plans that effectively zone their lands for different purposes, such as energy exploration, recreation, wildlife habitat, and watershed protection.[93] The above-noted secretarial order directs the Interior Department agencies to address climate change in their future plans.[94] The Forest Service does the same in its revised NFMA planning rules, which instruct forest managers to consider "system drivers, including . . . disturbance regimes, and stressors, such as . . . wildland fire . . . and climate change."[95] While it may be quite difficult to predict where wildfires will occur, these resource planning directives nonetheless require the agencies to identify at-risk areas and resources and to begin managing to restore ecological resiliency. Because wildfires are demonstrably indifferent to jurisdictional boundaries, these planning efforts should be undertaken at the landscape scale,[96] utilizing the various cooperative planning provisions embedded in current law.[97]

For resource management purposes, the primary climate adaptation goal is to restore resilience to altered ecosystems to ensure that wildfires behave more in accord with historical burning patterns. Two familiar questions are at the forefront in this effort, namely where and how should land managers undertake such ecological restoration efforts. There is little debate, as noted, that the WUI zone is a principal ecological restoration target to improve ecosystem resiliency as a means of reducing the fire risk to nearby communities.[98] In remote backcountry areas, there is also little debate over current federal policies generally allowing wildfires to burn unchecked so long as they remain within predefined parameters designed to safeguard distant

92. Secretary of the Interior, Order No. 3289 (2009).

93. 16 U.S.C.A. § 1604 (West 2010 & Supp. 2012) (national forest plans); 43 U.S.C. § 1712 (2011) (BLM resource management plans).

94. *See supra* note 92 and accompanying text.

95. 36 C.F.R. § 219.10 (2012) (effective May 9, 2012); 77 Fed. Reg. 21162, 21265–66 (Apr. 9, 2012) (to be codified at 36 C.F.R. pt. 219).

96. *See* Peterson & McKenzie, *supra* note 60, at 452; Colburn, *supra* note 83, at 247–55; Craig, *supra* note 64, at 53–63.

97. Coordinated planning provisions can be found in the NFMA at 16 U.S.C.A. § 1604(a) (West 2010), and in the FLPMA at 43 U.S.C. § 1712(c)(9) (West 2007); *see also* 36 C.F.R. § 219.4 (2012), 77 Fed. Reg. 21162, 21261–62 (April 9, 2012) (requiring national forest plans to be coordinated with other public planning efforts).

98. *See supra* notes 15-16, 19, 35 and accompanying text.

human communities and valuable natural resources. On the lands that lie between the WUI zone and the backcountry, however, conflict has persisted over mechanical thinning proposals in these areas, particularly in the absence of important resource values, such as endangered species habitat or domestic water sources.[99] On occasion, thinning has been justified to create fuel breaks to protect against possible runaway wildfires or to restore wildlife habitat, but some of these projects have looked like commercial timber harvests in disguise.[100] But debate persists over the efficacy of thinning and other fuel management approaches to controlling future fire events in different types of forests other than dry ponderosa pine forests.[101] Nonetheless, because NEPA and other environmental laws generally attach to these projects,[102] the agencies are forced to address the likely environmental impacts and to entertain public comment on the proposal, which also means that managers can be held accountable for the final decision in court.

Given the uncertainties associated with climate change and its forecasted impacts, most knowledgeable observers also endorse the use of adaptive management to reduce the risk of wrong decisions that could exacerbate wildfire conditions. Adaptive management involves measuring the effect of management decisions against the desired outcome and then adjusting the approach as necessary to achieve the desired conditions. This ordinarily entails establishing baseline conditions, monitoring changes in these conditions, assessing why observed changes occurred, and then readjusting management strategies as necessary.[103] By law or policy, the federal land management agencies are each obligated to inventory and monitor their resources,[104] and the courts have proven willing to enforce these requirements.[105] At a minimum, then, the agencies should utilize adaptive management strategies to assess whether thinning or burning strategies are working and to make necessary adjustments to ensure the primary wildfire control objectives are being achieved. This is particularly important in

99. *See* Keiter, *Law of Fire*, *supra* note 5, at 320, 367, 379.

100. *See, e.g.*, Sierra Club v. Bosworth, 465 F. Supp. 2d at 941.

101. *See* Williams & Baker, *supra note* 70; *See generally* Schoennagel, et al., *supra* note 47.

102. *See supra* notes 24–31 and accompanying text.

103. *See generally* J.B. Ruhl & Robert L. Fischman, *Adaptive Management in the Courts*, 95 MINN. L. REV. 424, 427–43 (2010) (describing the theory and practice of adaptive management).

104. 16 U.S.C.A. § 1604(g)(3)(B), (C) (West 2010) (national forests); 16 U.S.C. § 668dd (2011) (national wildlife refuges); 43 U.S.C. § 1711(a), § 1712(c)(4) (BLM lands); NATIONAL PARK SERVICE, MANAGEMENT POLICIES 4.1.2, 4.2.1 (2006) (national parks).

105. *See, e.g.*, Nw. Ecosystem Alliance v. Rey, 380 F. Supp. 2d 1175 (W.D. Wash. 2005); *see generally* Ruhl & Fischman, *supra* note 103, at 444–45 (noting that the federal government lost more than half of 31 cases addressing the legality of adaptive management).

the face of climate change, because an adaptive management approach will enable managers to test specific pre- and post-fire management strategies and to alter them as needed to accomplish defined objectives.

One issue that has proven quite difficult to resolve is the salvage question. Once a fire has rampaged through a forest, the fire-scorched timber often retains some commercial value if it can be removed quickly. According to some observers, removing the downed timber contributes to the ecological restoration effort, essentially accelerating the forest rejuvenation process by removing material that would otherwise take decades to decompose and reducing the likelihood of insect infestations and invasive species outbreaks.[106] But in the eyes of others, salvage logging has significant negative environmental impacts, not only reducing habitat values and precipitating stream erosion events but also causing soil compaction from the use of heavy logging equipment.[107] Not surprisingly, an array of lawsuits have been litigated over salvage projects, with the courts occasionally finding error in the Forest Service's NEPA assessments, NFMA compliance, or administrative appeals process.[108] Because climate change threatens even more devastating fire events, these salvage logging pressures are not likely to recede, further supporting the need for a robust pre-fire forest restoration program to minimize such events and pressures.

Two additional fire control issues with resource management overtones merit noting. First, to combat large wildfires, the Forest Service has regularly used aerial fire retardants as a suppression tool, but without undertaking any environmental analysis of the impact these chemical retardants have on aquatic and other ecosystems. Confronted with evidence that the impacts could be profound, a federal court has ordered the Forest Service to comply with NEPA and the Endangered Species Act before deploying this fire suppression strategy.[109] Second, although controlled burning is frequently used for ecosystem restoration purposes, prescribed fires inevitably produce smoke that affects air quality, often to the consternation of nearby homeowners and communities.[110] Because the states have primacy under the Clean Air Act for regulating particulate emissions, whether from controlled burning or uncontrolled wildfires, these regulatory

106. *See* Keiter, *Law of Fire*, *supra* note 5, at 320–21.

107. *Id.*

108. *See, e.g.*, *Blue Mountains Biodiversity Project*, 161 F.3d at 1216; Sierra Club v. Bosworth, 199 F. Supp. 2d 971; Lands Council v. Martin, 479 F.3d 636 (9th Cir. 2007); Alliance for the Wild Rockies v. Cottrell, 632 F.3d 1127, 1138 (9th Cir. 2011). *But see* League of Wilderness Defenders Blue Mountain Biodiversity Project v. Allen, 615 F.3d 1122 (9th Cir. 2010).

109. Forest Serv. Emps. for Envtl. Ethics v. United States Forest Serv., 726 F. Supp. 2d 1195, 1232 (D. Mont. 2010).

110. *See* ARNO & FIEDLER, *supra* note 63, at 198–99.

limitations can be invoked to limit the use of controlled burning in or near the WUI zone.[111] Thus, notwithstanding the increased wildfire risks associated with climate change, the law imposes some constraints on how the agencies mount suppression efforts on future large-scale fires and on how they employ prescribed burning as an ecological restoration tool.

But over the long term, concerted ecological restoration efforts should pay dividends in the ongoing effort to minimize the impact of climate change on our fire adapted ecosystems. Not only will healthier, more resilient forests help to reduce the impact of wildfires on the landscape, but these same forests will serve as important carbon sequestration sites. An adaptive natural resource management policy designed to address climate-related wildfire impacts will therefore also serve as a mitigation strategy to help control the prevalence of greenhouse gases in the atmosphere.

V. CONCLUSION

In the face of climate change, the current wildfire problem will only worsen absent a comprehensive strategy designed to reduce the risk of catastrophic blazes and to restore fire-adapted ecosystems. Indeed, the experiences with recent devastating wildfire events should serve to strengthen the political will to begin addressing the problem at an appropriate scale. The fact that the adaptive strategies required to protect communities, sustain ecosystems, and safeguard resources are largely complimentary to one another over the long term should help to fortify our collective resolve. The basic strategies must address both the growing fuel-load concern and WUI zone expansion problem, which present very real cross-jurisdictional challenges that require a coordinated federal, state, and local response. While the short range goal necessarily entails protecting at-risk communities and critical resources, the long range goal must focus on restoring ecological resilience to our forests and grasslands in order to curtail the likelihood of even more disastrous wildfires. At the federal level, the existing law does not present an insurmountable hurdle to fashioning the necessary strategies for pursuing these policy goals. But at the state level, new laws and policies are required to better control construction in the WUI zone, to establish appropriate insurance requirements, and to address smoke abatement concerns.

As we have learned, the question is not whether wildfire events will occur, but whether we are prepared for them—a question that is becoming more important as climate change is felt on the landscape. With the necessary policy adjustments and legal reforms, we can significantly reduce the risks and costs associated with wildfires while also taking critical steps to address the carbon problem itself. Though

111. *See supra* note 39 and accompanying text.

this will not mean a world without fire, it can mean a world where wildfires are largely controlled within historic levels, thus reducing the risk to our communities and vital natural resources. At the same time, effective adaptation policies can serve important restoration purposes, not only helping to sustain existing ecosystems, but also further reducing the threat of catastrophic fire events. Another critical question, then, is not whether we need to take the necessary steps, but whether we have the will to do so.