# Perverse Incentives: The Case of Wildfire Smoke Regulation

*Kirsten H. Engel*∗

*Wildfire is on the rise. The United States is witnessing a spectacular increase in acres lost to catastrophic wildfires, a phenomenon fed by the generally hotter and dryer conditions associated with climate change. In addition to losses in lives, property, and natural resources, wildfires contribute thousands of tons of air pollution each year. Ironically, one of the most effective tools to reduce the incidence and severity of unplanned wildfires is fire. Prescribed, or controlled, burning reduces the buildup of vegetation resulting from years of wildfire-suppression policy. At present, the number of acres subject to prescribed burns falls far short of burning the optimal number needed to restore natural ecosystems and reduce damages from unplanned wildfires. Air-pollution law and policy is an important factor contributing to the under-provision of prescribed fire that has so far escaped in-depth treatment in the law and policy literature. After setting forth the relevant air quality framework, this Article argues that decisions regarding planned wildfire are marred by an anachronistic and inaccurate distinction between "natural" and "anthropogenic" fire. Rationalizing that unplanned wildfires are "natural," the federal government excludes pollutants from such fires from air quality compliance calculations at the same time it encourages states to vigorously control pollutants from "anthropogenic," prescribed fires. The result contributes to an undervaluation of necessary, planned wildfire. Wildfire air pollution policy is also hindered by governance structures that place air quality and resource agencies at odds with each other, and by state nuisance*



∗ Professor of Law, University of Arizona College of Law. The author wishes to especiallythank Dan Duerr, who analyzed the air pollution data presented in this Article, and also Adam Babich, Christopher Robertson, Andrew Reeves, Janice Peterson (U.S. Forest Service), Mark Evangelista (U.S. EPA), Tom Moore (Western Regional Air Partnership), and the many other current and former state and federal officials who offered their time and perspectives on this topic through interviews and emails. Caylin Goldey Barter and Brian Tedder provided excellent research assistance. I am grateful for the feedback I received at a joint University of Chicago/University of Arizona symposium on the law and economics of wildfire policy. Financial and research support provided by the University of Queensland TC Beirne College of Law and the University of Arizona's Law College Association were critical in facilitating the completion of this manuscript.

*authorities that enable narrow local interests to shut down prescribed fire, all of which trump the broader public interest in reduced wildfire risk and healthier forests. This Article suggests several solutions to remove these distortions, including adopting a default rule whereby all wildfire smoke, of whatever origin, "counts" for purposes of air quality compliance. Together with adopting mechanisms to require air pollution and resource agencies to both participate in planned burning decisions and de-emphasize the influence of nuisance standards, this "smoke is smoke" rule will ensure that the air pollution policy better reflects the true costs and benefits of prescribed fire.*

## INTRODUCTION

Throughout history, differential treatment of similar outcomes according to whether the cause is natural or man-made has posed profound dilemmas for the law. This dilemma is particularly true where the harm is the result of either human or natural causes. On the one hand, no one wants to excuse human culpability because it mimics or intermingles with natural causes. There is an understandable urge to isolate the human-caused from the naturally caused and to control (or blame) only the former.[1] But doing so often proves difficult, as does ignoring the harm wrought by what is reputedly "natural." Law has evolved toward eliminating the legal significance of the natural versus human origins of particular acts.[2] Modern environmental law generally follows this trend—for the most part, it dispenses with the distinction between natural and human-made and addresses the harmful impacts of particular activities upon the environment, regardless of whether their cause is natural, man-made, or some combination of the two.[3]

1. For example, historically, the necessity defense to criminal prosecution was available only where the cause of the necessity was considered natural or of divine origin. MATTHEW HALE, THE HISTORY OF THE COMMON LAW OF ENGLAND 26 (Charles M. Gray ed., 1971) (1713); *see also* United States v. Bailey, 444 U.S. 394, 410 (1980) ("[T]he defense of necessity, or choice of evils, traditionally covered the situation where physical forces beyond the actor's control rendered illegal conduct the lesser of two evils.").

2. Shaun P. Martin, *The Radical Necessity Defense,* 73 U. CIN. L. REV. 1527, 1534–35 (2005) (explaining that the necessity defense is generally available today regardless of whether a cause is natural or man-made); Lawrence M. Friedman & Joseph Thompson, *Total Disaster and Total Justice: Responses to Man-made Tragedy,* 53 DEPAUL L. REV. 251, 284–85 (2003) (describing sea-change in late twentieth century according to which relief was expected for natural as well as for human-made disasters).

3. *See* Clean Water Act, 33 U.S.C. §1362(6) (2012) (defining a "pollutant" as "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water"); Sierra Club v. Abston Constr. Co., 620 F.2d 41, 45 (5th Cir. 1980) (holding that the surface runoff collected or channeled by the defendant mine operators may constitute a "point source" discharge requiring a permit under the Clean Water Act regardless of the fact the pollution was conveyed to a navigable water by gravity); Lead Indus. Ass'n, Inc. v. EPA*,* 647 F.2d 1130, 1135–36, 1152–55 (D.C. Cir. 1980) (upholding EPA restriction upon ambient lead concentrations based upon reducing individual exposure to all lead, including natural sources, to safe levels).

An important exception to this trend is the regulation of air pollution from wildfires. Caught in the middle of this definitional tension are controlled (or "prescribed") burning and the use of wildfire for resource benefits (collectively referred to as "planned wildfire"). Planned wildfire is a potent source of air pollution. Each year, prescribed fires contribute 818,000 tons of particulates,[4] 700,000 of which are considered fine particulate matter,[5] an air pollutant associated with severe health effects. Prescribed fires are also a plentiful source of smog, hazardous air pollutants like benzene, methyl chloride and polycyclic organic matter, and the greenhouse gases methane and carbon dioxide.[6] Therefore, prescribed fire is an important air pollution regulatory target. Superficially, at least, reducing prescribed fire smoke means cleaner air.

Or does it? Prescribed fire is a proven method for reducing the severity of catastrophic, "unplanned" wildfires[7] and hence the number of premature deaths and incidences of cardiac and respiratory disease associated with catastrophic wildfires.[8] Together with ongoing management (rather than suppression) of wildfires for resource benefits, prescribed fire eliminates the buildup of vegetation and enhances the fire resiliency of forest ecosystems. This approach reduces the smoke from unplanned wildfires, arguably a greater net

4. *See Technology Transfer Network: Clearinghouse for Inventories and Emissions Factors, The National Emissions Inventory*, U.S. EPA, http://www.epa.gov/ttn/chief/net/2008inventory.html (last updated Aug. 29, 2013) (derived by manipulating "Sector Summaries—Criteria and Hazardous Air Pollutants by 60 EIS Emission Sectors" on cited webpage by inputting "National" under "National / State / County or Tribe," highlighting all regions under "Geographic Aggregation," "CAP-PM10 Primary (Filt + Cond)" for "Pollutant" and "Fires—Prescribed Fires" for "Sector"). Supporting files for *Technology Transfer Network* citations are on file with the Ecology Law Quarterly.

5. *Id.* (derived by by manipulating "Sector Summaries—Criteria and Hazardous Air Pollutants by 60 EIS Emission Sectors" on cited webpage by inputting "National" under "National / State / County or Tribe," highlighting all regions under "Geographic Aggregation," "CAP-PM25 Primary (Filt + Cond)" for "Pollutant" and "Fires—Prescribed Fires" for "Sector").

6. *Id.*

7. *See, e.g.*, Mark A. Finney et al., *Simulation of Long-Term Landscape-Level Fuel Treatment Effects on Large Wildfires*, 16 INT'L J. WILDLAND FIRE 712, 712 (2007). *See also infra* text accompanying notes 91–113.

8. *See* Antonis Analitis et al., *Forest Fires Are Associated with Elevated Mortality in a Dense Urban Setting,* 69 OCCUPATIONAL & ENVTL. MED. 158, 160–61 (2012) (finding that forest fires burnt around the greater Athens area between 1998 and 2004 were associated with a large increase in the number of cardiovascular and respiratory deaths in the nearby urban population); Fay Johnston et al., *Extreme Air Pollution Events from Bushfires and Dust Storms and Their Association with Mortality in Sydney, Australia 1994–2007*, 111 ENVTL. RES. 811, 814 (2011) (stating that smoke events associated with a five percent increase in non-accidental mortality); Ana G. Rappold et al., *Peat Bog Wildfire Exposure in Rural North Carolina Is Associated with Cardiopulmonary Emergency Department Visits Assessed Through Syndromic Surveillance*, 119 ENVTL. HEALTH PERSP. 1415, 1415 (2011) (finding that exposure to smoke from 2008 peat bog fires in North Carolina increased emergency department visits for asthma, chronic obstructive pulmonary disease, pneumonia, acute bronchitis, and heart failure in rural communities). *See also* Sarah B. Henderson & Fay H. Johnston, *Measures of Forest Fire Smoke Exposure and Their Associations with Respiratory Health Outcomes*, 12 CURRENT OPINION ALLERGY & CLINICAL IMMUNOLOGY 221, 226 (2012) (summarizing recent studies on the association between forest fire smoke and health effects); Martine Dennekamp & Michael J. Abramson, *The Effects of Bushfire Smoke on Respiratory Health*, 16 RESPIROLOGY 198, 207 (2011) (summarizing recent studies on the association between forest fire smoke and health effects).

environmental menace than prescribed-fire smoke. Overall, scientific studies suggest that, as compared to wildfires, prescribed fires produce smaller smoke plumes, pollute urban airsheds less frequently, and thus may result in lower population exposures to smoke-related pollution.[9]

Prescribed fire is therefore something of a "good" environmental "bad." It pollutes while at the same time reducing pollution. Studies demonstrating the effectiveness of prescribed fire in reducing the risk of catastrophic wildfires suggest that we would be better off with more prescribed fire and fewer catastrophic wildfires. Therefore, prescribed fire is an environmental "bad" that we should want *more of*. Nevertheless, the number of acres subject to prescribed burning falls far below that which land managers believe necessary to meet the objectives of wildfire hazard reduction and ecosystem management and restoration.[10] Today, an estimated 1.25 billion acres are at risk of ecological damage from wildfire in the United States due to excessive fuel levels; of this figure, 181 million acres are considered to be at high risk.[11] An aggressive increase in the use of prescribed fire, together with other fuel treatment methods, could reduce this risk.

The role of air pollution policy in contributing to the growing health and environmental threat from wildfire smoke has received essentially no attention in the legal literature.[12] This Article is an attempt to repair this gap. In particular, I discuss three aspects of air quality policy that either explicitly or implicitly discourage the use of prescribed fire. The first concerns the potential

9. Grant J. Williamson et al., *Satellite-Based Comparison of Fire Intensity and Smoke Plumes from Prescribed Fires and Wildfires in South-Eastern Australia*, INT'L J. WILDLAND FIRE 121, 128 (2013) (concluding that plumes from wildfires are six times larger than plumes from prescribed fires).

10. Lenya N. Quinn-Davidson & J. Morgan Varner, *Impediments to Prescribed Fire Across Agency, Landscape and Manager: An Example from Northern California*, 21 INT'L J. WILDLAND FIRE 210, 213 (2012) (stating that the percentage burned of all areas to achieve objectives is only 38.37 percent). For a further discussion of this study, see *infra* text accompanying notes 132–134.

11. ROSS W. GORTE, CONG. RESEARCH SERV., FEDERAL FUNDING FOR WILDFIRE CONTROL AND MANAGEMENT 17 tbl.5 (2011), *available at* http://www.fas.org/sgp/crs/misc/RL33990.pdf.

12. In general, the regulation of wildfire remains underexplored and under-theorized in the legal literature. Important exceptions include Robert H. Palmer III, *A New Era of Federal Prescribed Fire: Defining Terminology and Properly Applying the Discretionary Function Exception*, 2 SEATTLE J. ENVTL. L. 279, 279 (2012) (asserting that recent policy changes expose the federal government to claims for damages resulting from prescribed burning practices); Karen M. Bradshaw, *Backfired! Distorted Incentives in Wildfire Suppression Techniques*, 31 UTAH ENVTL. L. REV. 155, 159 (2011) (demonstrating that the incentives facing firefighters to use backfire as a wildfire suppression technique can be poorly aligned with that of landowners and environmentalists interested in protecting timberlands); Karen M. Bradshaw, *A Modern Overview of Wildfire Law*, 21 FORDHAM ENVTL. L. REV. 445, 477 (2010) (discussing the differing incentives guiding the actions of institutions and groups with roles in fighting fires: government firefighting suppression agencies, wildland urban interface owners, and private institutional landowners); Jonathan Yoder et al., *Liability, Incentives, and Prescribed Fire for Ecosystem Management*, 2 FRONTIERS ECOLOGY & ENV'T 361 (2004) (examining the implications of various legal liability regimes for escaped prescribed fire upon the incentives to use prescribed fire as a vegetation management tool). A prior attempt to tackle the important issue of air quality policy and wildfire smoke regulation was made recently by the author and her co-author, Andrew Reeves. Kirsten H. Engel & Andrew Reeves, *When 'Smoke Isn't Smoke': Missteps in Air Quality Regulation of Wildfire Smoke*, *in* WILDFIRE POLICY: LAW AND ECONOMICS PERSPECTIVES 127 (2011).

to exclude air pollution measurements attributable to unplanned wildfires from air quality compliance calculations.[13] Reasoning that unplanned wildfires are "natural" events, EPA frequently grants state requests to exclude air pollution readings attributable to wildfires when determining a state's compliance with national air quality standards. At the same time, reasoning that they are man-made sources of pollution, states vigorously regulate the ignition of prescribed fires under state smoke management plans. The exemption of smoke from unplanned wildfires at the same time that prescribed fire is strictly regulated undercuts a primary environmental benefit of prescribed fire: its capacity to reduce wildfire smoke emissions. Second, the governance regime for air quality decision-making invites strategic behavior and the suboptimal use of planned wildfire by allocating the burning and air pollution regulation decisions to different government agencies who, more likely than not, also work at different levels of government. Finally, because prescribed fire imposes large upfront costs to nearby communities and only diffuse long-term benefits to those same communities, the practice in many states provides the public with a de facto veto over prescribed fire.[14]

This Article offers several recommendations designed to eliminate these regulatory distortions so that air quality-related decisions better reflect the value of planned wildfire in reducing smoke from catastrophic wildfires. First, I suggest that regulators abandon the unhelpful and inaccurate regulatory distinctions between "natural" and "anthropogenic" fire that currently undermines the incentive to use prescribed fire to reduce the incidence and severity of wildfires. Instead of excluding wildfire smoke from the compliance and planning aspects of the air quality regulatory framework under the mistaken pretense that such smoke is "natural", I suggest that policymakers adopt precisely the opposite tact. In the absence of a demonstration that state or tribal governments are taking affirmative measures to encourage prescribed fire or other land management actions that reduce the incidence and severity of wildfire, the pollution from wildfires should "count" in determining compliance with air quality standards. Including smoke from wildfires in the air quality framework will provide air quality regulators with incentives to consider the potential for prescribed fire to reduce the risk of unplanned fire and thus to make intelligent trade-offs between more certain, but lower risks attributable to prescribed fire and less certain, but higher risks attributable to uncontrollable wildfire. Finally, I recommend revisions to the governance of air quality decisions related to wildfire smoke.

Considering the health and environmental threats posed by wildfire are only growing, understanding and addressing the contribution that air pollution law and policy make to the insufficient use of prescribed fire demands increased attention. The past decade has witnessed a spectacular rise in the

13. *See infra* text accompanying notes 182–91.
14. *See infra* text accompanying notes 212–29.

number and severity of wildfires.[15] Fire experts predict a continuing upward trend with the total annual acreage burned in the United States increasing from more than 9 million acres today[16] to between 10 and 12 million acres in the next decade.[17] More and larger fires mean more smoke, and more smoke means more deaths and instances of smoke-related disease. The fires of recent memory are consistent with this trend. In the summer of 2012 alone, wildfires in Wyoming, Utah and Colorado sent flames and smoke across Colorado's Front Range. In the course of burning 26 square miles near Colorado Springs, the "Waldo Canyon" fire damaged or destroyed 350 homes, and prompted over 30,000 persons to evacuate their homes.[18]

The remainder of this Article proceeds in three parts. Part I provides a background on the legacy of wildfire suppression and the use of fire to improve ecosystem health and reduce the risk of future catastrophic wildfires.[19] Part II explains the dilemma of planned wildfire—how it constitutes a "good" environmental "bad" and accordingly, how air pollution policy is structured in a manner so as to discourage the use of planned wildfire.[20] Finally, Part III proposes revisions to air quality regulation to remove the distortions contributing to the insufficient use of planned wildfire to fight unplanned wildfire.[21]

## I. BACKGROUND

### *A. A Short History of Wildfire Suppression Policy*

Wide-scale wildfire suppression was official U.S. policy for most of the past century. Beginning in the early 1900s and extending through the 1970s, federal agencies, led by the U.S. Forest Service, aggressively suppressed all wildfires, effectively removing wildfire from forest ecosystems. As early as 1886, officials instituted an all-out human-caused wildfire suppression policy in Yellowstone National Park, tempered only by shortages in the staffing

15. *See* NAT'L ASS'N OF STATE FORESTERS, QUADRENNIAL FIRE REVIEW 1, 3, 6 (2009), *available at* http://www.iafc.org/files/wild_QFR2009Report.pdf. The quadrennial fire review summarizes the current and projected status of fire management by the five federal natural resource management agencies and their state, local, and tribal counterparts. The five federal agencies are the Forest Service within the Department of Agriculture and the Bureau of Indian Affairs, the Bureau of Land Management, the Fish and Wildlife Service, and the National Park Service within the Department of Interior. *Id.*

16. *Total Wildland Fires and Acres (1960–2012)*, NAT'L INTERAGENCY FIRE CTR., http://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html (last visited Aug. 16, 2013). The NIFC reports that more than 9.3 million acres were subject to wildfire in 2012. *Id.*

17. NAT'L ASS'N OF STATE FORESTERS, *supra* note 15, at 9.

18. Mead Gruver, *"Unreal": Residents Tour Colorado Blaze Devastation*, ASSOCIATED PRESS, July 1, 2012, *available at* http://www.aspentimes.com/article/20120701/NEWS/120709994.

19. *See infra* text accompanying notes 22–127.

20. *See infra* text accompanying notes 128–269.

21. *See infra* text accompanying notes 270–299.

necessary to suppress all fires.[22] This policy was extended to Sequoia, General Grant (now incorporated into Sequoia-Kings Canyon National Park), and Yosemite national parks in the 1890s, and its application to federally owned forest lands was a primary mission of the Forest Service when it was established in 1905.[23] While the role of fire in forests continued to be the subject of debate within some circles, with some commentators advocating "light burning" to reduce forest fuel loads,[24] the large wildfires in 1910 renewed the Forest Service's commitment to a suppression-only policy and the role of the Forest Service as the chief fire-suppression agency.[25] A 1908 appropriations bill, which enabled the Forest Service to receive advances in firefighting funds, provided the Forest Service with the budgetary flexibility it needed to aggressively pursue wildfire suppression.[26]

The federal government's suppression-driven policy dominated the first half of the twentieth century. In 1926, the Forest Service developed its "Ten Acre" policy—"all wildfires should be controlled before they reached 10 acres in size."[27] By 1935, the Forest Service added its "10 a.m. policy," which mandated that fires exceeding ten acres should be placed under control before 10 a.m. the following morning.[28] Both policies were justified in the belief that wildfires should be stopped when they were small so as to avoid the costs of suppressing a large and destructive wildfire.[29] By this time, the Forest Service had developed the most effective wildfire-fighting capacity in the world.[30] Following World War II, the availability of heavy construction equipment, smoke jumpers, and aerial tankers reinforced the illusion that a suppression-only policy could be successful.[31] In 1968, a national advertising agency documented that "Smokey Bear," whose slogan entreated the public to take care not to start a forest fire, was the most popular symbol in the United States and better known than the president.[32]

It was not until the 1960s that the Forest Service began to reconsider its all-out suppression policy. In 1972, under the Forest Service's "Wilderness

22. *See* Jan W. van Wagtendonk, *The History and Evolution of Wildland Fire Use*, 3 FIRE ECOLOGY 3, 4 (2007).

23. *Id.*

24. *See id.*; George Busenberg, *Wildfire Management in the United States: The Evolution of a Policy Failure*, 21 POPULATION RES. POL'Y REV. 145, 149 (2004).

25. *See* STEPHEN J. PYNE, FIRE IN AMERICA: A CULTURAL HISTORY OF WILDLAND AND RURAL FIRE 250–51 (1982).

26. Busenberg, *supra* note 24, at 149.

27. ROSS W. GORTE & KELSI BRACMORT, CONG. RESEARCH SERV., FOREST FIRE/WILDFIRE PROTECTION 2 (2012), *available at* http://www.fas.org/sgp/crs/misc/RL30755.pdf.

28. *Id.*

29. *See id.*

30. Michael P. Dombeck et al., *Wildfire Policy and Public Lands: Integrating Scientific Understanding with Social Concerns Across Landscapes*, 18 CONSERVATION BIOLOGY 883, 884 (2004).

31. *See id.*

32. *Id.*

Prescribed Natural Fire Program," some wildfires were allowed to burn.[33] In 1978, the Service's "10 a.m. policy" was abandoned in its entirety.[34] The National Fire Management Analysis System, a computerized fire management system created in 1979, was the result of a new protocol that the Forest Service conduct a cost-benefit analysis for all pre-suppression budget requests, such as the purchase of a new fire engine or other suppression equipment.[35]

A better understanding of the tremendous financial costs of the all-suppression policy and attention to the growing number of studies pointing to the ecological and wildfire risk-reduction benefits of low-intensity fires eventually led land managers to reduce their reliance upon suppression as the sole strategy for reducing wildfire risk.[36] Nevertheless, even today suppression continues to be the dominant governmental response to wildfire. Currently, the Forest Service suppresses over ninety percent of all wildfire ignitions.[37] The total federal agency budget for wildfire suppression rose from $276 million in 1999 to $1.4 billion in 2011, though it more recently dropped back somewhat in 2012 to $809.3 million.[38] Further, for the past decade, agency expenditures on wildfire suppression have exceeded these appropriated amounts.[39] This outcome is possible because provisions in the Department of Interior appropriation acts authorize the Department and the Forest Service "to borrow unobligated funds from other accounts to cover the costs of emergency firefighting."[40]

### *B. The Escalating Wildfire Risk*

The all-out suppression policy has been unmasked as a failure. Rather than protecting lives, property, and timber resources, wildfire suppression has contributed to an increase in the incidence and severity of catastrophic wildfires due to the buildup of dead wood and brush.[41] In addition, excluding fire from

33. *Id.*

34. Geoffrey H. Donovan & Thomas C. Brown, *Wildfire Management in the U.S. Forest Service: A Brief History*, 29 NAT. HAZARD OBSERVER 1, 2 (2005), *available at* http://www.colorado.edu/hazards/o/archives/2005/july05/july05.pdf.

35. *Id.*

36. *See id.*; Busenberg, *supra* note 24, at 152.

37. U.S. FOREST SERV., ROCKY MOUNTAIN REGION, COLORADO SMOKE MANAGEMENT PLAN EVALUATION: A QUESTION OF BALANCE 1 (2011), *available at* http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251805052085&ssbinary=true.

38. GORTE, *supra* note 11, at 5–6 tbls.1& 2.

39. *Id.* at 15.

40. *Id.*

41. *See* U.S. FOREST SERV., PROTECTING PEOPLE AND SUSTAINING RESOURCES IN FIRE-ADAPTED ECOSYSTEMS: A COHESIVE STRATEGY 23 (2000) *available at* http://www.fs.fed.us/publications/2000/cohesive_strategy10132000.pdf; U.S. GOV. ACCOUNTABILITY OFFICE, WESTERN NATIONAL FORESTS: A COHESIVE STRATEGY IS NEEDED TO ADDRESS CATASTROPHIC WILDFIRE THREATS 6 (1999) *available at* http://www.gao.gov/assets/160/156559.pdf; STEPHEN J. PYNE, FIRE IN AMERICA: A CULTURAL HISTORY OF WILDLAND AND RURAL FIRE 302 (1982).

the ecosystems in which it historically played a role alters ecosystems in profound ways by decreasing biodiversity of plants and animals and changing the tree species composition such that it reflects a decreased number of fire-tolerant species and an increase in the density, biomass, and number of woody species.[42]

Data confirms an escalating wildfire risk in our nation's forests. In the past four decades, the incidence of wildfires has risen four-fold, and the total number of acres burned has increased six-fold in the Western United States alone.[43] Despite recent improvements in wildfire policy, such as incorporating fire into management regimes, the wildfire problem appears to be getting worse. Since 2000, the total annual acreage burned by wildfires each year has exceeded 3 million acres, and in six of those thirteen years, the acreage has exceeded 8 million acres.[44] In comparison, from 1983 to 1999, the total annual acreage burned generally hovered between 1 and 2 million acres.[45] Notably, the estimated annual acreage burned by wildfires is expected to increase up to 10 to 12 million acres within the next decade.[46] Experts believe that wildfire activity will escalate[47] and occur in areas, such as the Midwestern, Eastern and Southeastern parts of the country, that are generally strangers to such events.[48]

Some scientists believe that climate change is contributing to the upward trend in the incidence and severity of wildfires.[49] Climate change is expected to worsen the effects of extended droughts in various parts of the United States, especially the Southwest and Southeastern regions.[50] The warming and drying effects of climate change will increase the amount of time during the year in which weather conditions are ripe for wildfires.[51] Studies show that climate change will cause wetter and warmer winters followed by a faster snowmelt in the West.[52] These changes potentially lengthen the fire season by up to a month or more on each end.[53] An increase in wildfires also has a feedback effect upon

42. *See* ROBERT E. KEANE ET AL., U.S. FOREST SERV., CASCADING EFFECTS OF FIRE EXCLUSION IN ROCKY MOUNTAIN ECOSYSTEMS: A LITERATURE REVIEW 8–9 (2002), *available at* http://www.fs.fed.us/rm/pubs/rmrs_gtr091.pdf. .

43. *Press Release 11-193: Scorched Earth: The Past, Present and Future of Human Influences on Wildfires*, NAT'L SCI. FOUND. (Sept. 14, 2011), http://www.nsf.gov/news/news_summ.jsp?cntn_id=121644&org=NSF&from=news.

44. *Total Wildland Fires and Acres (1960–2012)*, *supra* note 16.

45. *Id.*

46. NAT'L ASS'N OF STATE FORESTERS, *supra* note 15, at 9.

47. *See id.* at 10 (predicting worsening drought conditions caused by climate change); DAVID V. SANDBERG ET AL., U.S. FOREST SERV., NATIONAL STRATEGIC PLAN: MODELING AND DATA SYSTEMS FOR WILDLAND FIRE AND AIR QUALITY 1 (1999) *available at* http://www.fs.fed.us/pnw/pubs/pnw_gtr450.pdf.

48. NAT'L ASS'N OF STATE FORESTERS, *supra* note 15, at 10.

49. *See* A.L. Westerling et al., *Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity,* 313 SCI. 940, 940 (2006).

50. NAT'L ASS'N OF STATE FORESTERS, *supra* note 15, at 10.

51. *Id.*

52. *Id.*

53. *Id.*

climate change, since wildfires contribute an estimated 213 million metric tons of carbon dioxide per year in the continental United States,[54] or the equivalent of the annual carbon dioxide emissions of sixty coal-fired power plants or 44 million automobiles.[55]

### *C. Health Risks from Wildfire Smoke*

Emerging evidence demonstrates that wildfire smoke is comprised of toxic elements harmful to human health and in amounts similar to anthropogenic sources regulated under air and water pollution statutes. The major pollutants of concern from wildfires are particulate matter—both coarse ($PM_{10}$) and fine ($PM_{2.5}$)—and ozone precursors.[56] Fine particulate matter, responsible for roughly eighty to ninety percent of particulate matter from wildfires,[57] is considered the most hazardous, as it can be inhaled deep into the lungs and has been associated with increased mortality, heart disease, and the exacerbation of chronic diseases such as asthma.[58] Ozone, which forms "smog" or haze, is not directly emitted by wildfires but forms when combustion products, namely nitrous oxides and volatile organic compounds emitted by burning vegetation, are exposed to sunlight.[59] Forest fires are a source of ozone precursors that contribute to elevated ozone levels.[60] While concentrations of pollutants from wildfires are greatest near the location of the fire, impacts can be measured thousands of miles away.[61]

54. Christine Wiedinmyer & Matthew D. Hurteau, *Prescribed Fire As a Means of Reducing Forest Carbon Emissions in the Western United States,* 44 ENVTL. SCI. & TECH. 1926, 1926 (2010).

55. *See Greenhouse Gas Equivalency Calculator*, U.S. EPA, http://www.epa.gov/cleanenergy/energy-resources/calculator.html (last updated April 2013).

56. NAT'L WILDFIRE COORDINATING GRP., SMOKE MANAGEMENT GUIDE FOR PRESCRIBED AND WILDLAND FIRE 29, 63 (2001).

57. *Id.* at 98.

58. D.W. Dockery et al., *An Association Between Air Pollution and Mortality in Six U.S. Cities,* 329 NEW ENG. J. MED. 1753, 1753–59 (1993).

59. *See* ZACK PARSONS & STEVEN ARNOLD, WESTERN STATES AIR RESOURCES COUNCIL, OZONE TRANSPORT IN THE WEST: AN EXPLORATORY STUDY 2, 6 (2004), *available at* http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Ozone+Transport+in+the+West.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251808871845&ssbinary=true.

60. *Id.* at 6–7 (discussing episodes in Utah where forest fires were recognized by EPA as a large contributor to elevated ozone levels); Haiganoush K. Preisler et al., *Estimating Contribution of Wildland Fires to Ambient Ozone Levels in National Parks in the Sierra Nevada*, 158 ENVTL. POLLUTION 778, 786 (2010) (detecting a "small but significant effect of fires on ozone variation").

61. *See, e.g.*, Thomas J. Duck et al., *Transport of Forest Fire Emissions from Alaska and the Yukon Territory to Nova Scotia During Summer 2004*, J. GEOPHYSICAL RES., May 19, 2007, D10S44, at 1, *available at* http://nature.berkeley.edu/ahg/pubs/transport.pdf; Dan Jaffe et al., *Long-Range Transport of Siberian Biomass Burning Emissions and Impact on Surface Ozone in Western North America*, GEOPHYSICAL RES. LETTERS, Aug. 20, 2004, L16106, at 2–4 (showing that smoke from fires burned in Siberia was transported to North America); A.C. Lewis et al., *Chemical Composition Observed Over the*

Every year, wildfires contribute large quantities of harmful air pollution to the country's air. In 2008, wildfires emitted almost 1 million tons of fine ($PM_{2.5}$) particulate matter.[62] This total exceeds the total amount of fine particulate matter emitted from all fuel-combustion sources and is three times the amount emitted by the electricity sector.[63] Wildfires also cause the formation of ozone by releasing volatile organic compounds embedded in vegetation. In 2008, wildfires emitted 420 million pounds of volatile organic compounds to the atmosphere,[64] twice the total contributed by all fuel-combustion sources combined.[65] Wildfire pollution is not distributed evenly, with the Western United States bearing the brunt of these pollution loads. For example, in 2008, three states (California, Nevada and Arizona) contributed approximately 600,000 tons of fine particulate matter, or half of the U.S. total,[66] while the New England states and the Southeastern states each contributed only 160,000 tons.[67]

In addition, the fine particulate matter emitted by wildfires contains hundreds of different compounds, many of them toxic.[68] In fact, one study claims that wildfire particulate-matter emissions in concentrations present in California's Central Valley during a wildfire outbreak in 2008 were ten times more damaging to lung function than similar concentrations of particulate matter found in urban ambient air.[69] The study, based upon animal lung bioassays, reflects the significant inflammatory response triggered in the lung

*Mid-Atlantic and the Detection of Pollution Signatures far from Source Regions*, 112 J. GEOPHYSICAL RES., Feb. 13, 2007, D10S39, at 2.

62. The exact amount of fine particulate matter contributed by wildfires in 2008 is 998,604 tons. *Technology Transfer Network, supra* note 5 (derived by manipulating "Sector Summaries—Criteria and Hazardous Air Pollutants by 60 EIS emission sectors" on cited webpage by inputting "National" under "National / State / County or Tribe," highlighting all regions under "Geographic Aggregation," "CAP-PM25 Primary (Filt + Cond)" for "Pollutant" and "Fires—Wildfires" for "Sector"). The electricity sector contributes 309,315. *Id.* (derived from same inputs but substituting, under "Sector," fuel combustion for the production of electricity for all sources of fuel combustion).

63. The 998,604 tons of fine particulate matter from wildfires in 2008 compares to 814,215 tons from all sources of fuel combustion. *Id*. (derived from same inputs but substituting all fuel combustion sources for "Fires—Wildfires" under "Sector"). The 998,604 tons of fine particulate matter from wildfires in 2008 is roughly three times the 309,315 tons of fine particulates produced by the electricity sector. *Id.* (derived from same inputs, but substituting all options for fuel combustion for the generation of electricity under "Sector").

64. *Id.* (derived from same inputs, but substituting "HAP–VOC" for "Pollutant" and "Fires—Wildfires" for "Sector").

65. *Id.* (derived from same inputs but substituting all fuel combustion options for "Sector").

66. *Id.* (derived from same inputs but substituting all Region 9 states for "Geographic Aggregation," "CAP-PM25 Primary (Filt + Cond)" for "Pollutant" and "Fires—Wildfires" for "Sector").

67. *Id.* (derived from same inputs but substituting all Region 1 states for "Geographic Aggregation").

68. *See* Célia A. Alves et al., *Emission of Trace Gases and Organic Components in Smoke Particles from a Wildfire in a Mixed-Evergreen Forest in Portugal*, 409 SCI. TOTAL ENV'T 1466, 1466 (2011); *id.* at 1474 (describing the breakdown of particulate matter found in smoke).

69. Teresa C. Wegesser et al., *California Wildfires of 2008: Coarse and Fine Particulate Matter Toxicity*, 117 ENVTL. HEALTH PERSP. 893, 896 (2009).

by the toxic components of wildfire smoke.[70] These toxic constituents include acrolein, formaldehyde, 1,3-butadiene, benzene, and acetaldehyde.[71]

In smaller quantities, wildfires are responsible for the emission of hundreds of other pollutants, many of them toxic.[72] For example, a recent study traces isocyanic acid to wildfire smoke.[73] Isocyanates are toxic at high concentrations; indeed, the death toll in Bhopal, India in 1984, when thousands died after exposure to isocyanic acid from a Union Carbide pesticide factory, highlights the possibility.[74] Scientists contend that the impacts of isocyanates upon the health of firefighters and populations adjoining wildfires could be significant.[75] Furthermore, studies document wildfire as a source of particulate-bound mercury in levels comparable to what is found in industrial emissions.[76] Wildfires recirculate metals from anthropogenic sources absorbed by vegetation; for example, an analysis of the ash from a 2009 California wildfire traced lead found in the ash to leaded gasoline used in Southern California from the 1960s to the 1980s.[77]

### *D. Non-Suppression Methods of Minimizing Wildfire Risk*

Suppression continues to be the dominant governmental response to the wildfire risk. Nevertheless, federal wildfire policy also emphasizes non-suppression alternatives to wildfire management. These alternatives consist of mechanical treatments to remove built up vegetation, prescribed fire, and the management of unplanned wildfire for resource benefits. To place these methods in perspective, the U.S. Forest Service and the Department of Interior together treat approximately 4.6 million acres of forest each year. Of this total, over half, or 2.6 million acres, are treated with prescribed fire, 1.5 million acres with mechanical treatment, and approximately 475,000 with other treatment

70. *Id.* at 895–96.

71. NAT'L WILDFIRE COORDINATING GRP., *supra* note 56, at 29.

72. *Id*.

73. *See* James M. Roberts et al., *Isocyanic Acid in the Atmosphere and Its Possible Link to Smoke-Related Health Effects*, 108 PROC. NAT'L ACAD. SCI. U.S. 8966, 8966 (2011).

74. *Bhopal Trial: Eight Convicted Over India Gas Disaster*, BBC NEWS, June 7, 2010, *available at* http://news.bbc.co.uk/2/hi/8725140.stm. Of course, the Bhopal disaster followed the release of a massively large amount of methyl isocyanates—forty tons—as opposed to the minute quantities found in wildfire smoke. Still, the disaster is a potent reminder of the dangerous nature of this chemical.

75. *See* Roberts et al., *supra* note 73, at 8966.

76. *See* B.D. Finley et al., *Particulate Mercury Emissions in Regional Wildfire Plumes Observed at the Mount Bachelor Observatory*, 43 ATMOSPHERIC ENV'T 6074, 6082 (2009) (Particulate-bound mercury released from wildfires is a source of mercury comparable to that from anthropogenic sources.); Jerome O. Nriagu, *A Global Assessment of Natural Sources of Atmospheric Trace Metals*, 338 NATURE 47, 47 (1989).

77. Kingsley O. Odigie & A. Russel Flegal, *Pyrogenic Remobilisation of Historical Industrial Lead Depositions*, 45 ENVTL. SCI. & TECH. 6290, 6291–92 (2011).

methods.[78] Thus, prescribed fire continues to be the dominant treatment method.

*1. Mechanized Treatments*

Mechanical treatments consist of the harvesting of timber and the removal of trees and brush, often referred to simply as "thinning."[79] Such treatment may be done alone, but is much more effective when paired with prescribed fire.[80]

In 2003, mechanical treatments were given a boost when Congress passed the Healthy Forest Restoration Act (HFRA),[81] establishing a streamlined process for the environmental review, public involvement, and judicial review of mechanical treatment proposals under the National Environmental Policy Act (NEPA). Additionally, the Forest Service and the Department of Interior established a categorical exclusion from NEPA for timber sales up to 1000 acres and prescribed fire operations up to 4500 acres. Both the HFRA and the NEPA exclusion have come under criticism. For example, opponents charged that the HFRA was a veiled mechanism to provide private logging companies with access to protected timber stands,[82] and in 2007, a federal appeals court ruled the categorical exclusion violated NEPA.[83]

Removing small trees and brush can be an effective method of reducing wildfire risk[84] and is an important fuel treatment option in the "wildland-urban interface"[85] where prescribed fire may pose safety risks[86] or where the amount

78. NAT'L ASS'N OF STATE FORESTERS, *supra* note 15, at 12 tbl.2 (U.S. Forest Service & Department of Interior Fuels Treatment Acres 2004–2008).

79. *See* James K. Agee & Carl N. Skinner, *Basic Principles of Forest Fuel Reduction Treatments*, 211 FOREST ECOLOGY & MGMT. 83, 87 (2005) (distinguishing different types of thinning).

80. Susan J. Prichard et al., *Fuel Treatments Reduce the Severity of Wildfire Effects in Dry Mixed Conifer Forest, Washington, USA*, 40 CANADIAN J. FOREST RES. 1615, 1624 (2010) (providing strong quantitative evidence that, without reducing surface fuels, thinning alone does not reduce tree mortality during a large wildfire).

81. 16 U.S.C. §§ 6501–91 (2012).

82. Michael P. Dombeck et al., *Wildfire Policy and Public Lands: Integrating Scientific Understanding with Social Concerns Across Landscapes*, 18 CONSERVATION BIOLOGY 883, 887 (2004) (stating that the timber industry calls for more aggressive logging to restore forest health interpreted by conservation community as ploy to increase timber cutting).

83. Sierra Club v. Bosworth, 510 F.3d 1016, 1034 (9th Cir. 2007).

84. Jolie Pollet & Philip N. Omi, *Effect of Thinning and Prescribed Burning on Crown Fire Severity in Ponderosa Pine Forests*, 11 INT'L J. WILDLAND FIRE 1, 8 (2002) (stating that fuel treatments are effective in reducing severity in short fire-return interval ecosystems but may be less effective in long fire-return interval ecosystems). *But see* Agee & Skinner, *supra* note 79 (presenting empirical results limiting the effectiveness of thinning to circumstances where thinning is performed in tandem with prescribed burning).

85. The wildland-urban interface has been defined as areas where "urban development presses against private and public wildlands." David M. Theobald & William H. Romme, *Expansion of the U.S. Wildland-Urban Interface*, 83 LANDSCAPE & URB. PLAN. 340, 340 (2007). The wildland-urban interface, which continues to grow, was estimated to include thirty-nine percent of all housing in the continental United States. *Id.*

86. *See infra* text accompanying note 157.

of fuel reduction needed exceeds the number of available days for which meteorological conditions render prescribed burning feasible.[87]

However, mechanical treatments are not always feasible in all locations. Many forested areas are not accessible by road or by the heavy equipment needed to carry out forest thinning.[88] In addition, mechanical thinning alone may not adequately reduce wildfire risk, though it can be very effective when combined with prescribed fire.[89] For these reasons, as well as the special air pollution law and policy issues raised by prescribed fire, this Article focuses on prescribed fire.[90]

*2. Prescribed Fire*

Prescribed fire, also called "controlled burning," is an intentionally ignited fire designed to achieve the results that would naturally occur if wildfires were allowed to burn unsuppressed. [91] In 2011, an estimated total of 20.2 million acres were subject to prescribed fire in the United States,[92] including 2 million acres held by the federal government.[93] This amount has remained relatively constant over the past ten years, varying between 2 and 3 million acres per year.[94] More than half (sixty-one percent) of the acreage subject to prescribed fire are agricultural crops, while the remaining thirty-nine percent, or 7.8 million acres, are devoted to commercial timber operations.[95] Within the forestry sector, the great majority of acreage burned is located in the Southeast,

87. FORESTS AT THE WILDLAND-URBAN INTERFACE: CONSERVATION AND MANAGEMENT 219 (Susan W. Vince et al. eds., 2005) (stating that resource managers must use mechanical and herbicide treatments to reduce fuel build up where the number of days on which burning is acceptable is insufficient).

88. RESTORATION OF BOREAL AND TEMPERATE FORESTS 571–72 (John A. Stanturf & Palle Madsen eds., 2005).

89. Susan J. Prichard et al., *Fuel Treatments Reduce the Severity of Wildfire Effects in Dry Mixed Conifer Forest*, 40 CANADIAN J. FOREST RES. 1615, 1621 (2010) (providing "strong quantitative evidence" that tree thinning in the absence of reducing surface fuels "does not reduce tree mortality during a large wildfire"). *See also* RESTORATION OF BOREAL AND TEMPERATE FORESTS, *supra* note 88, at 570 (stating that in absence of mechanized treatment, dense understory of trees in some forests renders prescribed fire too likely to escalate into a catastrophic fire).

90. U.S. FOREST SERV., *supra* note 37, at 2.

91. According to guidance documents for federal wildfire officials, a "prescribed fire" or a "prescribed burn" is a fire intentionally lighted by managers to meet specific resource management objectives. NAT'L FIRE & AVIATION EXEC. BD., DIRECTIVES TASK FORCE BRIEFING PAPER #03 (2005), *available at* http://www.nwcg.gov/branches/ppm/fpc/archives/fire_policy/general/3_kinds_of_wildland_fire_BP3_1_19_05.pdf.

92. COAL. OF PRESCRIBED FIRE COUNCILS, INC., 2012 NATIONAL PRESCRIBED FIRE USE SURVEY REPORT ii (2012), *available at* https://docs.google.com/viewer?a=v&pid=sites&srcid=cHJlc2NyaWJlZGZpcmUubmV0fGNvYWxpdGlvbi1vZi1wcmVzY3JpYmVkLWZpcmUtY291bmNpbHN8Z3g6Mzg2ZDQxODg5NmJjMzM3Yg.

93. *Total Wildland Fires and Acres (1960–2012)*, *supra* note 16.

94. *Prescribed Fires and Acres by Agency*, NATIONAL INTERAGENCY FIRE CENTER, http://www.nifc.gov/fireInfo/fireInfo_stats_prescribed.html (last visited Aug. 29, 2013).

95. *See id.* fig. 3.

where prescribed fire is a popular tool used by private silviculture operators to maximize timber yields.[96] The American West, where prescribed fire is carried out primarily by federal land managers on public lands, occupies a smaller proportion (thirteen percent) of overall acreage burned.[97]

Prescribed fire reduces the incidence and severity of wildfires by decreasing fuel quantity and the likelihood that the wildfire will travel through a forest.[98] Prescribed fires are generally set to burn at low levels and are designed to remove fallen branches, kill small trees and shrubs, and scorch lower limbs to reduce the vertical continuity of the forest so that fires are prevented from reaching the top branches.[99] Breaking up the forest's vertical continuity minimizes the risk of "crown" fires, or the most destructive type of wildfires in which flames reach into the uppermost canopy of trees, torching the leaves and needles and spreading quickly from tree to tree through the canopy layer.[100] Studies demonstrate that prescribed fire substantially decreases the potential and actual fire intensity in Western forests in the United States[101] and in European pine stands by mimicking the periodic fires that once occurred on a regular cycle in many forest ecosystems prior to the adoption of more drastic fire-suppression policies.[102] As stated by a forest fire expert, "[e]ither wait for the big one, or burn fuels under moderate conditions where the fire behavior can be controlled."[103]

96. *Id.* at 5 fig. 5.

97. *Id.* at 6 fig. 8.

98. Mark A. Finney et al., *Stand- and Landscape-Level Effects of Prescribed Burning on Two Arizona Wildfires,* 35 CANADIAN J. FOREST RES. 1714, 1714 (2005).

99. Paulo M. Fernandes & Herminio S. Botelho, *A Review of Prescribed Burning Effectiveness in Fire Hazard Reduction*, 12 INT'L. J. WILDLAND FIRE 117, 117 (2003); Richard Monastersky, *Burning Questions*, 138 SCI. NEWS 264, 265 (1990) (reporting that most forest researchers contend that crown fires did not occur in the Sierran mixed-conifer forests until white settlers adopted a practice of extinguishing the smaller periodic "caretaker" fires that burned close to the ground, cleaning the forest floor and killing small understory firs and cedars).

100. *See* Monastersky, *supra* note 99, at 265.

101. *See* Alan A. Ager et al., *A Comparison of Landscape Fuel Treatment Strategies to Mitigate Wildland Fire Risk in the Urban Interface and Preserve Old Forest Structure*, 259 FOREST ECOLOGY & MGMT. 1556, 1563 (2010). *See also* Finney et al., *supra* note 98, at 1719; Scott L. Stephens & Jason J. Moghaddas, *Experimental Fuel Treatment Impacts on Forest Structure, Potential Fire Behavior, and Predicted Tree Mortality in a California Mixed Conifer Forest*, 215 FOREST ECOLOGY & MGMT. 21, 26 (2005); Craig Loehle, *Applying Landscape Principles to Fire Hazard Reduction*, 198 FOREST ECOLOGY & MGMT. 261, 265 (2004); PHILIP N. OMI & ERIK J. MARTINSON, U.S. FOREST SERV., PSW-GTR-193, EFFECTIVENESS OF THINNING AND PRESCRIBED FIRE IN REDUCING WILDFIRE SEVERITY 89 (2004); Jolie Pollet & Philip N. Omi, *Effect of Thinning and Prescribed Burning on Crown Fire Severity in Ponderosa Pine Forests*, 11 INT'L J. WILDLAND FIRE 1, 1 (2002); Mark A. Finney, *Design of Regular Landscape Fuel Treatment Patterns for Modifying Fire Growth and Behavior*, 47 FOREST SCI. 219, 220 (2001).

102. *See* Paulo M. Fernandes et al., *Empirical Modelling of Surface Fire Behaviour in Maritime Pine Stands*, 18 INT'L J. WILDLAND FIRE 698, 698–99 (2009); P. Fernandes & H. Botelho, *Analysis of the Prescribed Burning Practice in the Pine Forest of Northwestern Portugal*, 70 J. ENVTL. MGMT. 15, 19 (2004).

103. Bruce Finley, *Colorado Fire Experts Defend Prescribed Burns*, DENVERPOST.COM, Mar. 29, 2012, http://www.denverpost.com/environment/ci_20278071 (quoting Dr. Frederick "Skip" Smith,

Not only does prescribed fire reduce the number and severity of wildfires, but it also minimizes the quantity of smoke produced per acre. Wildfires typically burn during hotter, drier conditions than those usually planned for prescribed fires, resulting in the more complete consumption of forest fuels and, therefore, more pollution emissions.[104] Wildfires often occur during times when the air is stagnated, trapping smoke close to the ground where it is less likely to be carried away by higher-altitude transport winds.[105] In contrast, prescribed fires can be planned for conditions when smoke emissions can be minimized.[106] Emissions from prescribed fires also can be minimized by adopting smoke-reduction techniques, choosing optimal dispersion conditions for burning, and increasing the combustion efficiency of the fire.[107]

Prescribed fire has important ecosystem benefits, many of them the same as those accompanying wildfire. Prescribed fire is associated with higher levels of nutrients in soil.[108] For some species, fire assists—and in some instances is necessary for—a tree to release its seeds. For instance, lodgepole pine trees produce "seratonous," or resin-filled, cones that remain dormant until fire melts the resin and the seeds are released from the cone.[109] The fire also burns leaf litter on the ground, creating rich and well-drained soil conditions for the new seeds to grow.[110]

Yet, prescribed fire also has environmental drawbacks, as it too is a significant source of air pollution. In 2008, prescribed fires emitted over 1.5 million tons of particulate matter nationally (823,701 tons of $PM_{10}$ and 700,000 tons of $PM_{2.5}$).[111] Similarly, in 2008, prescribed fires emitted 420 million pounds of VOCs nationally,[112] more than all industrial sources combined.[113]

---

Department Head and Professor, Department of Forest, Rangeland and Watershed Stewardship, Colorado State University).

104. *See* OR. ADMIN. R., 629-048-0020 (3) (2012) (**"**When areas do not experience fire or other means of reducing forest fuels for extended periods, there is a greater wildfire hazard and the likelihood increases that if unplanned ignitions occur, through whatever means, that the resulting wildfire will burn at greater intensity and be more difficult to suppress.").

105. *Id.* at 629-048-0020 (4) ("[W]ildfires often occur during periods of atmospheric stability and thus air stagnation, trapping smoke close to the ground where it is more likely to impact humans and less likely to be quickly carried away by higher altitude transport winds.").

106. WILDLAND FIRES AND AIR POLLUTION 528 (Andrzej Bytnerowicz et al. eds., 2009) (discussing smoke prediction systems used to model the smoke impacts of a prescribed burn prior to authorizing the burn).

107. Di Tian et al., *Air Quality Impacts from Prescribed Forest Fires Under Different Management Practices,* 42 ENVTL. SCI. & TECH. 2767, 2767 (2008).

108. FOREST SOILS RESEARCH: THEORY, REALITY AND ITS ROLE IN TECHNOLOGY TRANSFER 179 (Margaret R. Gale & Robert F. Powers eds., 2005).

109. James E. Lotan, *Cone Serotiny—Fire Relationships in Lodgepole Pine*, *in* TALL TIMBERS FIRE ECOLOGY CONFERENCE PROCEEDINGS 14 267, 267 (1976), *available at* http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1010&context=barkbeetles.

110. Kenneth W. Outcold, *Prescribed Burning for Understory Restoration*, *in* THE LONGLEAF PINE ECOSYSTEM: ECOLOGY, SILVICULTURE, AND RESTORATION 326 (Shibu Jose et al. eds., 2006).

111. See *supra* text accompanying note 5.

112. See *supra* note 64.

*3. Unplanned Wildfire Managed for Resource Benefits*

A third nonsuppression method of minimizing wildfire risk is to manage an unplanned wildfire to achieve many of the same resource benefits of a prescribed fire: a reduced fuel load and fire resiliency. The idea is to exploit the opportunity to reap these benefits presented by the happenstance of the ignition of an unplanned wildfire occurring in a location for which burning vegetation for resource benefits is an approved land use in the applicable land and resource management plan or fire management plan.[114] Under this management response, an unplanned wildfire is treated much like a prescribed fire, only the authorization for this response is made by land managers after the fire is already ignited as opposed prior to that time, as with prescribed fire.

While federal land managers have permitted this management response for many years, prior to 2009 it was given a special name, "wildland fire use fire."[115] In addition, its use was impeded by several restrictions federal land managers placed upon its use, the most significant of which was that the entire fire could be managed according only to a single response: the entire fire must be surpressed *or* be managed for resource benefits.[116] Moreover, federal fire response guidelines dictated that whatever that response might be—suppression or management for resource benefits—it could not change over the lifetime of the fire; once chosen, that response controlled management of the fire during the life of the fire.[117]

In 2009, finding this framework both confusing[118] and unduly restrictive,[119] federal wildland fire managers adopted a revised policy

113. *Id.* (derived by manipulating "Sector Summaries—Criteria and Hazardous Air Pollutants by 60 EIS Emission Sectors" on cited webpage by inputting "National" under "National / State / County or Tribe," highlighting all regions under "Geographic Aggregation," inputting "HAP–VOC" for "Pollutant," and all of the industrial sources listed under "Sector").

114. NAT'L WILDFIRE COORDINATING GRP., WILDLAND FIRE USE: IMPLEMENTATION PROCEDURES REFERENCE GUIDE 3 (2005) (referring to the use of unplanned wildfire in this manner as "[t]he application of the appropriate management response to naturally-ignited wildland fires to accomplish specific resource management objectives in predefined designated areas outlined in fire management plans").

115. *Id.* at 4. *See also* NAT'L FIRE & AVIATION EXEC. BD., *supra* note 91 (stating that the federal land agencies determined that there are three types of wildland fires, "wildfire," "wildland fire use," and "prescribed fire").

116. U.S. DEP'T OF INTERIOR ET AL., MODIFICATION OF FEDERAL WILDLAND FIRE MANAGEMENT POLICY GUIDANCE: COMMUNICATION PLAN 4 (2008) (referring to the "current direction" as that where "[o]nly one management objective will be applied to a wildland fire. Wildland fires will either be managed for resource benefits or suppressed. A wildland fire cannot be managed for both objectives concurrently"). *See also* Richard Lasko, *Implementing Federal Wildland Fire Policy—Responding to Change,* 70 FIRE MGMT. TODAY 5, 6 (2010) (The 2003 wildland fire response policy defined the alternative strategies to manage unplanned natural ignitions as "manage a fire to achieve resource benefits *or* manage a fire to reduce losses and minimize suppression costs.") (emphasis added).

117. U.S. DEP'T OF INTERIOR ET AL., *supra* note 116, at 4 (stating that, under the "current direction," "[o]nce a wildland fire has been managed for suppression objectives, it may never be managed for resource benefit objectives.").

118. NAT'L WILDFIRE COORDINATING GRP, REVIEW AND UPDATE OF THE 1995 FEDERAL WILDLAND FIRE MANAGEMENT POLICY 9, 13 (2001), *available at* http://www.nwcg.gov/branches/

framework to facilitate the management of unplanned wildfires for resource benefits.[120] Under the revised framework, a fire is either planned (as in a prescribed fire) or unplanned, and both can be managed for resource benefits.[121] Moreover, a single fire could now be concurrently managed for more than one objective at a time (e.g., suppression and resource benefits) and those objectives could change as the fire moves across the landscape.[122] The new policy simplified the terminology for wildfires as well by eliminating the confusing category of "wildland fire use fire."[123] Since 2009, there are only wildland fires (unplanned or prescribed) that are managed for resource benefits, and wildland fires that are managed for suppression.[124]

The change in policy followed two influential governmental reports that criticized federal land managers for their underutilization of unplanned wildfires for resource benefits.[125] The 2006 Department of Agriculture audit report criticized land-management agencies for policies that predisposed the agencies to implement costly suppression responses to unplanned wildfires rather than, where appropriate and consistent with land-management plans, manage the fires to benefit the ecosystem and reduce accumulated fuel. [126]

Management of unplanned wildfires for resource benefits can be a cost-effective means of obtaining some of the same resource benefits provided by prescribed burning. It can also result in less predictable impacts on air quality.[127] Whereas federal fire managers can schedule a prescribed burn so as to minimize air-quality impacts, delay is not an option with respect to unplanned wildfires, placing fire managers in the situation of choosing either to reap the resource benefits of an unplanned wildfire under perhaps less-than-

ppm/fpc/archives/fire_policy/docs/chp2.pdf (finding the use of a variety of terms such as "wildland fire," "wildfire," "fire use," "wildland fire for resource benefit," and "prescribed fire" to have "caused confusion and misunderstanding within the agencies and among cooperators, partners, and the public").

119. U.S. DEP'T OF INTERIOR ET AL., *supra* note 116, at 3 (finding that the pre-2009 policy guidance "may have unnecessarily narrowed the interpretation of the Federal Wildland Fire Policy and restricted the application of a full spectrum of suppression and management strategies commensurate with risk, public and firefighter safety, values to be protected, and land management objectives").

120. U.S. DEP'T OF AGRIC. & U.S. DEP'T OF INTERIOR, GUIDANCE FOR IMPLEMENTATION OF FEDERAL WILDLAND FIRE MANAGEMENT POLICY 7 (2009), *available at* http://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf.

121. *Id. See also* Tom Harbour, *Managing Wildfire for Resource Benefits*, 70 FIRE MGMT. TODAY 4, 4 (2010).

122. U.S. DEP'T OF AGRIC. & U.S. DEP'T OF INTERIOR, *supra* note 120, at 7.

123. *See id.* at 17.

124. *See id. See also* Tom Harbour, *supra* note 121, at 4.

125. U.S. GOV'T ACCOUNTABILITY OFFICE, WILDLAND FIRE MANAGEMENT: LACK OF CLEAR GOALS OR A STRATEGY HINDERS FEDERAL AGENCIES' EFFORTS TO CONTAIN THE COSTS OF FIGHTING FIRES (2007) [hereinafter GAO 2007 Report]; U.S. DEP'T OF AGRIC., OFFICE OF INSPECTOR GEN., W. REGION, AUDIT REPORT: FOREST SERVICE: LARGE FIRE SUPPRESSION COSTS 14 (2006).

126. U.S. DEP'T OF AGRIC., *supra* note 125, at 14.

127. *See* Don McKenzie, *The Effects of Climatic Change and Wildland Fires on Air Quality in National Parks and Wilderness Areas*, 70 FIRE MGMT. TODAY 26, 27 (2010) (noting that the dispersal of wildfire smoke restricts land managers' ability to manage fires for resource benefits).

optimal conditions, or suppress the fire and forego the opportunity to reap such benefits.

## II. THE DILEMMA: PRESCRIBED FIRE AS A "GOOD" ENVIRONMENTAL "BAD"

Because prescribed fire is a significant source of air pollution in its own right, it may be described as an environmental "bad." Nevertheless, because it is effective in reducing the even-larger quantities of air pollution generated by unplanned wildfires, it is also an environmental "good." Prescribed fire reduces the incidence and severity of wildfires, regenerates native vegetation and habitats, and strengthens the fire resiliency of ecosystems. Consequently, prescribed fire might best be described as a "good" environmental "bad": it pollutes at the same time it combats wildfire smoke, an even-larger "bad."

The complex relationship between wildfire and air pollution should perhaps not be surprising. Many interventions into the environment display this Janus-faced quality. Take, for example, nuclear energy. Deriving electricity from nuclear fission avoids the emission of greenhouse gases produced through the burning of fossil fuels and hence might be considered a "good" for the environment.[128] On the other hand, nuclear power creates radioactive waste that must be isolated from human societies and allowed to decay for thousands of years.[129] Even recycling, long the rallying cry of environmentalists, has its dark side. Recycling conserves natural resources and reduces waste, but it also excuses rampant consumption of disposal goods, as demonstrated by the dominance of packaging interests as its largest proponents and financial backers.[130] This dualism with respect to the benefits of human interventions in the natural environment might be explained by the very complexity of ecosystems. Increasingly, biologists are given to understand ecosystems as nonlinear, dynamic systems where distributions follow "power laws" as opposed to the bell-curve distributions.[131]

What does all this mean for our preferred policy with respect to "good" "environmental bads"? Above all, it would tend to support a careful, nuanced approach so as to avoid over-deterrence of a "good" activity due to its "bad" properties and thereby eliminate the "bad's" propensity to do "good." Unfortunately, with respect to the "good-bad" of prescribed fire, air pollution policy shows no such care. As a result of the combination of federal and state

128. Matthew Stepp, *Fighting Climate Change with Nuclear Energy,* THE CHRISTIAN SCIENCE MONITOR (June 18, 2013), http://www.csmonitor.com/Environment/Energy-Voices/2013/0618/Fighting-climate-change-with-nuclear-energy.

129. *Backgrounder on Radioactive Waste*, U.S. NUCLEAR REG. COMMISSION (Apr. 2007), http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/radwaste.html.

130. Amy Westervelt, *Can Recycling Be Bad for the Environment?*, FORBES (Apr. 25, 2012), http://www.forbes.com/sites/amywestervelt/2012/04/25/can-recycling-be-bad-for-the-environment/.

131. Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty,* 37 U.C. DAVIS L. REV. 145, 152–53 (2003).

air pollution policies, prescribed fire has not yet reached the optimal levels needed to reduce wildfire-generated air pollution.

Many experts opine that the amount of prescribed fire currently being performed in the United States is considerably below levels needed to maintain healthy ecosystems.[132] A recent study reports that federal agencies uniformly failed to conduct prescribed burning on the number of acres that they had themselves stated was necessary to meet the management objectives of their prescribed fire programs.[133] According to this study, between 2006 and 2008, the U.S. Forest Service treated just thirty-two percent of its needed area, the Bureau of Land Management just fourteen percent, the U.S. Fish and Wildlife Service just seventy-four percent, the National Park Service just seventy percent, the California Department of Forestry and Fire Protection just seventy-eight percent, and the California Department of Parks and Recreation just 0.8 percent.[134] For the past decade, federal land managers have sought a several-fold increase in prescribed burns to sustain ecosystems.[135] Regardless of the benchmark, estimates of acreage that federal land managers believe should be subjected to prescribed burns for ecosystem management far surpass current levels.[136]

The inadequacy of current levels of prescribed fire is underscored by other studies suggesting that expanding prescribed burns, in conjunction with mechanical thinning and other fuel treatment methods, would significantly reduce wildfire risk. Recently, the National Forest Service estimated that 65 to 82 million acres of National Forest System lands are in need of fuels and forest health treatments (which would include prescribed burning), a total of forty-two percent of the entire system of National Forest lands.[137] Another recent Forest Service study, focused specifically on the need for more prescribed burning in Colorado, recommended a drastic increase: from the 17,900 acres actually subject to prescribed burning within the state in 2010 to 1 million acres per year.[138]

Yet another approach to determining the degree to which the current amount of prescribed burning falls short of what would be considered optimal

132. *See* Quinn-Davidson & Varner, *supra* note 10, at 213.

133. *See id.*

134. *Id.*

135. DAVID V. SANDBERG ET AL., U.S. FOREST SERV., PNW-GTR-450, NATIONAL STRATEGIC PLAN: MODELING AND DATA SYSTEMS FOR WILDLAND FIRE AND AIR QUALITY 1 (1999), *available at* http://www.fs.fed.us/pnw/pubs/pnw_gtr450.pdf.

136. Janice Peterson et al., Estimating Natural Emissions from Wildland and Prescribed Fire 1–12 (June 16, 1998) (unpublished manuscript), *available at* http://www.westar.org/Docs/Fire/emissions.PDF (projecting air pollution emissions from the use of prescribed fire at levels equivalent to historic frequency, to those needed to sustain desired ecosystem characteristics, as determined by the scientific community and by land managers, and to reduce damages from wildfires).

137. *Wildfire and Forest Management: Hearing Before the Subcomm. on Public Lands & Envtl. Regulation of the H. Comm. on Natural Res.*, 113th Cong. (2013) (statement of James Hubbard, Deputy Chief, State and Private Industry, U.S. Forest Service).

138. U.S. FOREST SERV., *supra* note 37, at 3.

from a resource perspective is to estimate the difference between acres burned annually today and the number burned prior to widespread human settlement. Looking at select "ecoprovinces" in the United States, one study finds that historical burn rates vary from, at the low end, more than two times current rates,[139] to, at the high end, more than 1000 times current rates.[140] Comparing the number of acres subject to prescribed burns to the number of acres currently considered to be at risk of ecological damage due to wildfire also shows current prescribed burning rates to be insufficient.[141] This approach estimates that 181 million acres of federal lands are at "high risk."[142] Yet over the past ten years, between just 2 and 3 million acres of forests under federal control are subject to prescribed burning.[143] Presumably, expanding the use of prescribed fire would reduce the magnitude of the wildfire risk facing these forests.

Air pollution policy is only one of several factors that serve to explain the insufficient use of prescribed fire. Several of these other impediments, in no way undermined in the present Article, have been studied in detail.[144] For example, the cost of prescribed fire can be significant, with one study estimating a mean cost of $78.13 per acre for management-ignited prescribed burns.[145] This mean figure obscures significant regional variation, from $223.38 per acre in the Pacific Southwest Region to just $22.80 in the Southern Region.[146] These differences are attributable to the number of acres burned and the cost of labor (generally, the greater the acres burned, the lower the cost per acre).[147] Variations are similarly found across federal lands depending upon the agency conducting the prescribed burns.[148] However, prescribed burns are dramatically less expensive than wildfire suppression.[149] Hence, the cheaper cost of prescribed burns relative to wildfire suppression suggests that noneconomic incentives are at work.

139. U.S. DEP'T OF INTERIOR & U.S. DEP'T OF AGRIC., A NATIONAL COHESIVE WILDLAND FIRE MANAGEMENT STRATEGY 32 tbl.1 (2009).

140. *Id.*

141. *See* GORTE, *supra* note 11, at 17–18 tbls.5 & 6.

142. *Id.* at 17 tbl.5.

143. *Prescribed Fires and Acres by Agency*, *supra* note 94.

144. *See generally* Quinn-Davidson & Varner, *supra* note 10.

145. DAVID A. CLEAVES ET AL., U.S. FOREST SERV., PSW-GTR-173, PRESCRIBED BURNING COSTS: TRENDS AND INFLUENCES IN THE NATIONAL FOREST SYSTEM 277, 283 (1999), *available at* http://www.fs.fed.us/psw/publications/documents/psw_gtr173/psw_gtr173_06_cleaves.pdf.

146. *Id.*

147. *Id.* at 281.

148. PHILIP N. OMI, U.S. FOREST SERV., PSW-GTR-208, EVALUATING TRADE-OFFS BETWEEN WILDFIRES AND FUEL TREATMENTS, PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON FIRE ECONOMICS, PLANNING, AND POLICY: A GLOBAL VIEW 485, 490 (2004), *available at* http://www.fs.fed.us/psw/publications/documents/psw_gtr208en/psw_gtr208en_485-494_omi.pdf ("Estimates vary from a low of $41.69/ha for the Fish and Wildlife Service in 1998 to a high of $200.76/ha for the National Park Service in 1998, with an average $96/ha across all agencies.").

149. *See id.* at 489–90 (While prescribed burning cost at most $200 per hectare, wildfire suppression is estimated at $375 to $571 per hectare.).

Another explanation for suboptimal prescribed-burn levels is the priority placed upon funding suppression efforts when budgets for wildfire response are tight. Federal land managers must cover the costs of resource protection measures, such as prescribed burning, out of their operating budgets, but paying for wildfire suppression efforts has first priority upon these funds.[150] While fire-suppression efforts are better funded than ecosystem restoration and management efforts,[151] recent years have witnessed dramatic increase in fire-suppression costs and the inadequate funding of suppression efforts.[152] Thus when the Forest Service in 2012 ran out of money to cover the costs of fighting forest fires, it took money out of its other programs to cover these costs. Those other programs included those aimed at removing forestry fuel build-up so as to reduce the risk of more forest fires.[153]

Yet another disincentive to prescribed burns is the risk that the fire may escape and threaten loss of life, property, or natural resources.[154] The consequences of escaped prescribed fires can be deadly. In March 2012, a fifty-acre prescribed fire in Colorado burned out of control, resulting in the tragic deaths of three persons, the loss of twenty-three homes, and the unintentional destruction of 4140 acres.[155] One analysis suggests that changes in federal policy with respect to prescribed fire now expose federal land managers to personal liability for damages associated with prescribed fires that later escape.[156] Concern over such liability may over-deter land managers and depress the current rates of prescribed fire.

All of these factors that serve to discourage prescribed fire are accentuated in the "wildland-urban" interface. Conducting prescribed fire in the wildland-

150. *See* Darryl Fears, *U.S. Runs Out of Funds to Battle Wildfires,* WASH. POST (Oct. 7, 2012), http://www.washingtonpost.com/national/us-runs-out-of-funds-to-battle-wildfires/2012/10/07/d632df5c-0c0c-11e2-bd1a-b868e65d57eb_story.html (noting that in 2012, the Forest Service ran out of money allocated to wildfire suppression and was thereby forced to raid its fire prevention budgets for funds).

151. Kurt Menning, *Practical and Institutional Constraints on Adopting Wide-Scale Prescribed Burning: Lessons from the Mountains of California*, *in* LIVING ON THE EDGE: ECONOMIC, INSTITUTIONAL AND MANAGEMENT PERSPECTIVES ON WILDFIRE HAZARD IN THE URBAN INTERFACE (ADVANCES IN THE ECONOMICS OF ENVIRONMENTAL RESOURCES, VOLUME 6) 73, 86 (2007).

152. *Id.*

153. *Id. See also* Jennifer Weeks, *Managing Wildfires,* 22 CQ RESEARCHER 941, 955 (2012) (Because the Forest Service was likely going to overspend its $948 million fire suppression budget for fiscal 2012, it was making plans to transfer $400 million from other agency accounts to cover the shortfall.).

154. *See* Yoder, Engle & Fuhlendorf, *supra* note 12, at 361 ("Legal liability as a result of property damage due to escaped fires remains an important concern for prescribed burning on private and public land.").

155. Leslie Jorgensen, *Lower North Fork Fire Victims Want Answers*, COLO. OBSERVER (Aug. 21, 2012), http://thecoloradoobserver.com/2012/08/lower-north-fork-fire-victims-want-answers/. The incident prompted a temporary ban on all prescribed burning in Colorado pending a formal review of the incident, which appears to have been caused by unexpected high wind conditions and a corresponding lack of sufficient monitoring of the burn by state officials. COLO. STATE UNIV., LOWER NORTH FORK PRESCRIBED FIRE: PRESCRIBED FIRE REVIEW 1–2 (2012), *available at* http://dnr.state.co.us/SiteCollectionDocuments/Review.pdf.

156. *See* Palmer, *supra* note 12, at 279.

urban interface presents special challenges. Given the proximate dense population, the health dangers from prescribed fire smoke are greatest in this area, as are the consequences should prescribed fire escape. The consequences of smoke in the wildland-urban interface include resident anxiety over fire risks; nuisances in the form of flying and settling ash and disrupted traffic flow; and the more serious public health and safety issues related to smoke inhalation, including the aggravation of existing respiratory ailments and traffic accidents related to reduced visibility.[157] State and public land managers, with the resources and expertise to conduct prescribed burns, do not have jurisdiction over much of the wildlife-urban interface, as almost ninety percent of the wildland-urban interface is privately owned.[158] The federal government manages only about seven percent of the wildland-urban interface.[159] It is perhaps not surprising, therefore, that a recent study found that only three percent of the fuel treatments conducted in the Western United States by federal land managers between 2004 and 2008 has occurred in the wildland-urban interface and only another eight percent in the 2.5 kilometer buffer around the interface.[160]

The significance of air pollution policy vis-à-vis these other factors in deterring prescribed fire eludes easy estimation. Nevertheless, air pollution policy is a sufficiently important factor that federal and state land managers have identified it as a major barrier to conducting prescribed fires.[161] Its notable absence from the legal and policy literatures underscores the importance of additional analysis. Below, I explain how air pollution policy provides perverse incentives to federal land managers to *not* engage in prescribed burning.

### *A. Air Quality Compliance: Distortion Through Regulatory Exclusion*

The differential regulatory treatment accorded air pollution generated by wildfires (unplanned fires) versus prescribed fires (planned fires) presents a

157. *See* DALE WADE & HUGH MOBLEY, USFS SOUTHERN RESEARCH STATION, MANAGING SMOKE AT THE WILDLAND-URBAN INTERFACE 1 (2007).

158. *See* David M. Theobald & William H. Romme, *Expansion of the Wildland-Urban Interface,* 83 LANDSCAPE & URB. PLAN. 340, 348 (2007).

159. *Id*.

160. *See* Tania Schoennagel et al., *Implementation of National Fire Plan Treatments Near the Wildland-Urban Interface in the Western United States,* 106 PROC. NAT'L. ACAD. SCI. 10,706, 10,706 (2009).

161. *See* Quinn-Davidson & Varner, *supra* note 10, at 214 tbl.3 (In survey, district-level fire managers across northern California ranked air pollution regulations second out of thirteen impediments to prescribed burning, just behind the presence of a narrow burn window.); COAL. OF PRESCRIBED FIRE COUNCILS, INC., *supra* note 92, at 16–19 (summarizing a national survey of state forestry agency personnel, ranking air quality/smoke management the third most major impediment limited prescribed fire use behind concerns over capacity, ranked number one, and weather concerns, ranked number two). *See also* U.S. FOREST SERV., *supra* note 37, at 2 ("Increased tightening of national air quality standards, combined with more restrictive state permit requirements, have made prescribed fire increasingly difficult to implement in Colorado.").

potentially significant distortion in regulatory policy. In brief, while states may ask federal regulators to exclude wildfire smoke pollution from regulatory limits, smoke pollution from prescribed fire is tightly regulated. A likely (though not empirically documented) consequence of this differential treatment is a suboptimal level of prescribed fire. This is because the scientifically documented capacity of prescribed fire to reduce pollution from unplanned and often-catastrophic wildfires has little regulatory significance, since air quality officials can essentially ignore the wildfire pollution readings. In other words, the regulatory scheme is such that air pollution regulation (though not necessarily other social and financial structures) fails to provide air quality officials with an incentive to reduce levels of smoke from unplanned wildfires through, for example, encouraging the greater use of prescribed fire. This irrational scheme of incentives plays out in three air pollution regulatory "arenas": (i) compliance determinations designed to protect health and welfare; (ii) visibility protection programs; and (iii) state-level smoke management programs. Below, I first outline the basic regulatory scheme for each arena and then explain the manner in which pollution from unplanned wildfires enjoys more lenient treatment than that generated by prescribed fires.

*1. Regulatory Background*

*a. Federal Air Quality Regulation*

(1) The Clean Air Act's National Ambient Air Quality Compliance Program

The first arena where wildfire smoke pollution enjoys more lenient treatment than prescribed-fire smoke pollution is the regulatory apparatus for state compliance with the federal Clean Air Act's national health-based ambient air quality standards (NAAQS).[162] This lenient treatment results from the EPA's "exceptional events" policy, which is explained below following an overview of the NAAQS compliance framework.

Pursuant to the Clean Air Act, EPA has established health-based ambient standards for six common pollutants, including fine and coarse particulate matter and ozone.[163] With respect to each of these pollutants, EPA classifies each air quality control region in the United States (a state is divided into several air quality control regions) as in attainment or nonattainment with the standard. To determine this compliance status, EPA uses a formula to determine whether, based upon actual on-the-ground air quality readings, each geographic region within each state either meets or does not meet the standard

162. Under the Clean Air Act, regions of each state are classified as in attainment, nonattainment, or unclassifiable with respect to compliance with the NAAQS. 42 U.S.C. § 7407 (2012).

163. *See id.* § 7409 (requiring EPA establish NAAQS); 40 C.F.R. § 50 (2013) (promulgated standards).

or is "unclassifiable" because it is impossible to tell whether it meets the standard.[164] Where on-the-ground measurements result in a determination that the air quality of a given area does *not* demonstrate compliance with the standard, the agency designates the area as a "nonattainment area" for that particular pollutant.[165] Under the Clean Air Act and EPA's implementing regulations, a nonattainment classification triggers the applicability of a host of stringent requirements applicable to a variety of mostly large sources of the same pollutant.[166] Such requirements are designed to reduce pollutant levels to attainment levels.[167] Moreover, their very existence operates as a powerful incentive for state air quality regulators, as well as the owners and operators of large sources of the subject air pollutant, to keep pollution levels low.

The incentive for keeping pollution levels low that is inherent in the Clean Air Act area designation process exists even where on-the-ground air quality levels measure below the applicable national standard. Due to regulatory limits upon the degradation of even healthy air,[168] owners of operators of sources of a pollutant for which the on-the-ground air quality measurements demonstrate attainment with the standards also possess an incentive to keep emissions low. Their failure to do so, and the subsequent degradation of healthy air quality beyond the permitted "increments," subjects sources of that pollutant located within the area to a different suite of mandatory emissions controls.[169]

An important characteristic of the pollution-reducing incentive system incorporated into the Clean Air Act provisions just discussed is that they reflect (or at least are supposed to reflect) real life air quality on the ground. Whether a given geographic region is, for regulatory purposes, in attainment or nonattainment, or in attainment but close to the line triggering the status of nonattainment, is a function of the real-life readings of ambient pollution levels and the EPA formula.

164. *See* U.S. EPA, APTI COURSE 452: PRINCIPLES AND PRACTICES OF AIR POLLUTION CONTROL 5-4–5-5 (2003), *available at* http://www.4clean air.org/apti/452combined.pdf.

165. *See id.*

166. *See* 42 U.S.C. § 7502.

167. *See id.* The regulatory requirements applicable to nonattainment areas are much more onerous than those applicable to areas in attainment. Within a nonattainment area, the state must submit a plan demonstrating that it will attain the NAAQS by the statutory deadline, making reasonable further progress each year. *Id.* Major sources of nonattainment pollutants are subject to stringent technology standards. *Id.* Finally, any federal approval of a major source of pollutants must demonstrate "conformity" to the state implementation plan. *Id.*

168. *See id.* §§ 7470–92 (Prevention of Significant Deterioration provisions of Clean Air Act).

169. *See id.* § 7475. For instance, a major new or modified source of the attainment pollutant must install "best available control technology" to control the emissions of any pollutant the source emits that is regulated under the Clean Air Act. *See id.*

(2) EPA's Exceptional Events Policy

EPA's policy for what are known as "exceptional events"[170] represents a departure from this "real world" grounding of the air quality compliance determinations. The more-lenient treatment afforded unplanned versus prescribed fire in turn results from the application of the EPA's exceptional events policy to wildfire smoke.

Since the 1980s, EPA has had in place policies that allow for the exclusion of data demonstrating an exceedance of a NAAQS due to a natural event or to a human-caused, but "exceptional," event.[171] EPA's current exceptional events policy was promulgated pursuant to a 2005 amendment to the Clean Air Act.[172] In this amendment, Congress required EPA to promulgate regulations "governing the review and handling or [sic] air quality monitoring data influenced by an exceptional event."[173]

In general, an exceptional event is either a naturally caused event or an unusual human-caused event. The statutory definition provides that an "exceptional event" is

> an event that—(i) affects air quality; (ii) is not reasonably controllable or preventable; (iii) is an event caused by human activity that is unlikely to recur at a particular location or a natural event; and (iv) is determined by the Administrator . . . to be an exceptional event.[174]

Congress's purpose was to give relief to those states whose air quality control regions would otherwise be considered in compliance with the NAAQS were it not for events considered largely out of the state's control.[175] EPA's rule incorporates wholesale the statutory definition of an exceptional event.[176] EPA has given specific examples of exceptional events, including air quality exceedances attributable to structural fires, pollution transported from outside the United States, terrorist attacks, high wind events, unplanned wildfires and, where they meet specific criteria, prescribed fires.[177]

170. This terminology derives from the exceptional events provision added to the Clean Air Act by Congress in amendments enacted in 2005: Section 319 of the CAA, as amended by section 6013 of the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA–LU) of 2005. *See id.* § 7619.

171. *See* Treatment of Data Influenced by Exceptional Events*,* 72 Fed. Reg. 13,560, 13,562 (Mar. 22, 2007) (to be codified at 40 C.F.R. pts. 50, 51) (describing history of EPA's exclusion policies).

172. *See* 42 U.S.C. § 7619.

173. *See id.*

174. *See id.* § 7619(b).

175. *See* 72 Fed. Reg. at 13,568. The process a state must follow to obtain a data exclusion by EPA is a several-stage process. *See id.* at 13,571. Following an exceptional event, a state requests that EPA "flag" the air quality measurements that it believes were affected by the event. *See id.* This flagging is a placeholder; it has no regulatory significance. *See id.* At its discretion, the state may follow up the request to flag the data with a formal request to exclude the data. *See id.* This request is usually supported by extensive documentation. *See id.* Using the criteria set forth in the rule, EPA makes a determination to either approve or disapprove the request. *See id.*

176. *See* 40 C.F.R. § 50.1 (2013).

177. *See* 72 Fed. Reg. at 13,564–67.

The process for excluding data influenced by an exceptional event is somewhat convoluted. Under the rule, the first step is for a state to request that EPA "flag" the air quality measurements for which it may wish, at a later date, to submit a formal petition to have excluded. There are essentially no criteria governing this process other than that the state "believe" the data to have been influenced by an exceptional event.[178] In order for the data to actually be excluded from the dataset used to make air quality status determinations, the state must follow up with a demonstration that, among other criteria, there exists a clear causal relationship between the measurement petitioned for exclusion and the alleged exceptional event, and there would have been no exceedance or violation in the absence of the event.[179] The latter is known as the "but for" test.[180] The flagged data is formally excluded when the applicable regional EPA office concurs in the state's demonstration.[181] EPA openly acknowledges that the relatively simple criteria may lead states to flag many more readings than that for which they ultimately submit documentation to support exclusion.[182] With respect to the latter, unless exclusion of the data will make a difference in terms of the status of a given area, for example, by preventing an attainment area from being redesignated nonattainment, or preventing the exhaustion of an air-quality deterioration "increment," there is no real reason for the state to go through the time and resource-intensive process of submitting a formal demonstration for exclusion. As a result, the number of formal demonstrations submitted by the states is likely to be far fewer than the data would support.

Under its current policy, EPA does not condition the exclusion of air quality monitoring data upon the state's adoption of mitigation measures to reduce the public health or environmental impacts of the exceptional event. This is an about-face from the agency's prior policies under which states were required to submit a "Natural Events Action Plan" in order to qualify for data exclusion.[183] Importantly, a required element of such a plan with respect to particulate emissions was measures to abate or minimize contributing controllable sources of particulates.[184] In the case of wildfires, "steps to minimize fuel loadings in areas vulnerable to fire" was specifically mentioned.[185] EPA's policy asserts that "natural versus an anthropogenic fire has particular significance when considering the impacts of wildland fires

178. *See id.* at 13,567–68.
179. *See id.* at 13,570.
180. *See id.*
181. *See id.* at 13,571.
182. *See id.* at 13,568.
183. *See* Memorandum on Areas Affected by PM-10 Natural Events from Mary D. Nichols, Assistant Adm'r, Office of Air & Radiation, to U.S. Envtl. Prot. Agency Reg'l Admins. 7–8 (May 30, 1996).
184. *See id.*
185. *See id.*

(wildfire, wildland fire use fire and prescribed fire) on air quality and how these impacts should be regarded under this rule."[186]

*2. Wildfire Smoke Pollution*

*a. Applicability of EPA's Exceptional Events Policy*

The clearest example of the differential and more lenient treatment of smoke pollution from wildfire, as opposed to prescribed fire, is found in EPA's exceptional events policy. The basis for this more lenient treatment is the determination that unplanned wildfires are "natural" whereas prescribed fires are anthropogenic. Thus, presumably referring to the statutory criteria for an exceptional event as one "caused by human activity,"[187] EPA's policy asserts that "natural versus an anthropogenic fire has particular significance when considering the impacts of wildland fires (wildfire, wildland fire use fire and prescribed fire) on air quality and how these impacts should be regarded under this rule."[188]

In using the "natural" versus "anthropogenic" distinction to classify the smoke from what types of fire events will qualify for exclusion as exceptional events, however, EPA looks only at the origin of the fire, and not entirely consistently. Thus EPA determined that unplanned wildfires managed for suppression and those allowed to burn for resource benefits fall within the meaning of a "natural" event subject to the policy.[189] In doing so, EPA overlooks the inconsistencies inherent in this determination—that unplanned wildfires can be caused by negligent human acts, such as an escaped campfire, and that once a wildfire, ignited by a natural trigger such as lightning, is purposefully allowed to burn for resource benefits, it could just as easily be considered anthropogenic as natural.

In contrast to unplanned wildfires, however, EPA's policy labels prescribed fire as anthropogenic.[190] As a result, air pollution readings attributable to prescribed fire smoke are ineligible for exclusion except where they meet the additional criteria for an exceptional event of ''affect[ing] air quality,'' being ''unlikely to recur at a particular location'' and being ''not reasonably controllable or preventable.''[191]

186. *See* 72 Fed. Reg. at 13575–76.

187. *See* 42 U.S.C. § 7619(b) (2006).

188. 72 Fed. Reg. at 13,566.

189. *Id.* ("[W]e believe that both wildfires and wildland fire use fires fall within the meaning of 'natural events' as that term is used in section 319 . . . .").

190. *Id*.

191. *Id*. One oft-stated purpose of prescribed fire is to apply fire to an ecosystem at a regular interval that mimics the natural fire cycle. *See, e.g.*, *Prescribed Burning*, NAT'L PARK SERVICE, http://www.nps.gov/natr/parkmgmt/prescribed-burning.htm (last updated Aug. 18, 2013) ("Prescribed fires attempt to replicate and reintroduce this [natural fire] cycle and restore forest communities to historical conditions.").

While the question is subject to debate, EPA does not entertain the argument that, because prescribed fire is usually designed to mimic the natural fire cycle in a given ecosystem, prescribed fire might actually be considered "natural."[192] The upshot of EPA's manipulation of the definition of what is "natural" is that wildfire-smoke-influenced air pollution measurements whose incidence is subject to mitigation through the use of prescribed fire are considered "natural" and hence *per se* excludable under EPA policy, while air quality measurements influenced by prescribed fire itself are subject to exclusion only upon satisfaction of a set of difficult-to-satisfy criteria.

While complete and up-to-date data are not available, available data indicates that, since the 2007 exceptional events policy was promulgated, EPA has concurred in dozens of state petitions to exclude air quality readings influenced by unplanned wildfire events. While not all of the exclusions would seem to make a difference in terms of the compliance status of a particular air quality control region—i.e., prevent a region from shifting from attainment to nonattainment—it appears that some could. A more thorough analysis would be required to pinpoint the effect of the exclusion of wildfire smoke-influenced readings from the dataset used by EPA to compute attainment status. In contrast, during this same time frame the agency did not concur in a single petition to exclude a prescribed-fire-influenced air quality reading, nor does it appear that any state petitioned to have a prescribed-fire-influenced air quality reading excluded.

These findings are the result of comparisons performed for this Article using data supplied by EPA on its publicly available "Air Trends" website.[193] The analysis[194] involved the comparison of two datasets and the resulting differences in the air quality compliance "design values."[195] The first dataset included all fine particulate matter ($PM_{2.5}$) air quality measurements recorded on an hourly basis between 2007 and 2012 in the fourteen states within this five-year time period that received EPA concurrence on a petition for the exclusion of wildfire-related data as an exceptional event. These fourteen states

Yet in order to qualify as an exceptional event, states must demonstrate that prescribed fire influencing the data is "unlikely to recur at a particular location." 72 Fed. Reg. at 13,566. Similarly, the event must be "not reasonably controllable or preventable," which the agency has reasoned could apply to prescribed fire where it is demonstrated that the buildup of forest fuels risks the outbreak of a catastrophic fire. *Id.* Even in this latter case, the state must demonstrate the need for prescribed fire, as opposed to an alternative method, such as mechanical treatments, to reduce the wildfire risk. *Id*.

192. *See infra* text accompanying notes 287–88.

193. *See Design Values*, EPA, http://www.epa.gov/airtrends/values.html (last updated Aug. 9, 2013).

194. The findings and conclusions presented in the ensuing paragraphs were made possible by the data analysis performed by Daniel Duerr, Department of Sociology, University of Arizona. In performing this analysis, we received invaluable assistance from Mark Evangelista, U.S. EPA.

195. A design value is a statistical value that reliably captures the highest pollution level observed in a given air quality control region over a given span of time. Design values are used in determining a region's compliance with the NAAQS. *See Air and Radiation, Air Trends, Design Values*, EPA, http://www.epa.gov/airtrends/values.html (last updated Aug. 9, 2013).

were Arizona, Alabama, Arkansas, California, Georgia, Indiana, Kentucky, Montana, North Carolina, South Carolina, Tennessee, Texas, Utah, and Wyoming. The second dataset was identical to the first except that it omitted all air quality readings for fine particulate matter influenced by a wildfire event on which the EPA concurred with the state's petition to have the reading excluded. The number of readings requested by states for exclusion varied widely.[196]

When the two datasets are compared, the design values are significantly higher in the file that includes the later-excluded wildfire exceptional events data. EPA compares a region's design value for each criteria pollutant to determine whether the area records a NAAQ exceedance. For each pollutant, an exceedance threshold determines whether an area is considered attainment or nonattainment for that pollutant.[197] In many cases, the readings that were excluded are many times the usual level for regions in that particular location.[198] Given the extreme nature of this jump, it has significant substantive effects on the overall design value for a region. Although the analysis was not sufficiently precise to pinpoint the exact number of exceedances, it did reveal that the inclusion of the excluded data led to a substantive increase in the design values. Because the number of exceedances determines whether an area is in attainment or nonattainment, including the excluded data is consistent with the conclusion that a number of areas currently considered to be in attainment would be out of attainment were these values considered.

*b. Visibility Regulation*

In the 1977 amendments to the Clean Air Act, Congress declared "the remedying of any existing impairment of visibility in [156 parks and wilderness] areas which impairment results from manmade air pollution" as a national goal.[199] These 156 parks and wilderness areas include many of the

196. For example, in 2007, Montana excluded 5005 hourly observations, Alabama excluded 1844, South Carolina excluded thirty-seven, and Wyoming excluded four. *See Design Values*, *supra* note 193.

197. National Primary and Secondary Ambient Air Quality Standards, 40 C.F.R. pt. 50 (2013).

198. To give a couple of examples drawn from the Air Trends data, the threshold levels for a $PM_{2.5}$ NAAQS violation are fifteen ug/$m^3$ on an averaged annual basis, and thirty-five ug/$m^3$ averaged on a daily basis. Immediately prior to September 5, 2007, Butte, California was in violation of the daily $PM_{2.5}$ NAAQS, and close to violating the annual measurement as well with a yearly value of 12.4 ug/$m^3$. It is possible that wildfire smoke would have pushed Butte over the line into a violation of the yearly value as well, had a reading of 116 ug/$m^3$ on that September 7 not been excluded as a wildfire-influenced exceptional event reading. Another example is the exclusion of a daily $PM_{2.5}$ reading of 116 ug/$m^3$ in Bibb, Georgia on May 12, 2007. At the time, Bibb fell within target values, but again they were close to the line. On the day the 116 reading was excluded, Bibb's yearly value was 13.5 ug/$m^3$ (slightly below the NAAQS violation threshold of fifteen ug/$m^3$) and their daily value was twenty-eight (below the NAAQS of thirty-five ug/$m^3$, but not by much). *See Design Values*, *supra* note 193.

199. 42 U.S.C. § 7491 (2006). The parks included are those designated by the Act as mandatory Class I Federal Areas and consist of national parks exceeding 6000 acres, wilderness areas and national memorial parks exceeding 5000 acres, and all international parks that were in existence on August 7, 1977. 42 U.S.C. § 7472(a). EPA, in consultation with the Department of Interior, promulgated a list of 156 areas where visibility is identified as an important value. Identification of Mandatory Class I Federal

United States' best-known national parks, parks such as the Grand Canyon, Yosemite, Yellowstone, and the Great Smoky Mountains.[200] In the late 1990s, EPA reported that the average visual range in many parks in the Western United States is between 100 and 150 kilometers, or about one-half to two-thirds of the visual range that would exist without man-made air pollution, and in the East, thirty kilometers, or about one-fifth of the visual range that would exist in the absence of man-made pollution.[201] Visibility in these areas is marred by emissions of fine particulate matter and their precursors from a variety of sources.[202]

Under the Clean Air Act's regional haze regulatory program, states must either submit their own plans for addressing sources within their state that threaten visibility in national parks and wilderness areas, or join a regional planning organization and demonstrate reasonable further progress in implementing the organization's haze-reducing strategies.[203] In the Western United States, the regional organization addressing regional haze issues is the Western Regional Air Partnership, a voluntary organization formed in 1997 and consisting of the governors of thirteen Western states as well as federal agencies and tribal governments.[204] In addition, each state must submit implementation plans and schedules for compliance for the installation of "best available retrofit technology" (BART) by certain older industrial sources of visibility-impairing pollutants, such as fine particulates, nitrogen oxides, sulfur dioxides, and volatile organic compounds.[205] In the West, the greatest potential for reducing sulfur dioxide and nitrous oxide emissions will come from applying BART at power plants.[206]

Areas Where Visibility Is an Important Value, 44 Fed. Reg. 69,122, 69,122 (Nov. 30, 1979) (codified at 40 C.F.R. pt. 81).

200. *List of 156 Mandatory Class I Federal Areas*, EPA, http://www.epa.gov/visibility/class1.html (last updated May 31, 2012).

201. Regional Haze Regulations, 64 Fed. Reg. 35,714, 35,715 (Jul. 1, 1999) (codified at 40 C.F.R. pt. 51).

202. *Id*. (noting that, when legislating to address regional haze in the 1977 Clean Air Act Amendments, Congress specifically recognized that the "visibility problem is caused primarily by emission into the atmosphere of $SO_2$, oxides of nitrogen, and particulate matter, especially fine particulate matter, from inadequate[ly] controlled sources") (alteration in original).

203. *Id*. at 35,724–25.

204. Sara Elizabeth Jensen, *Policy Tools for Wildland Fire Management: Principles, Incentives, and Conflicts*, 46 NAT. RESOURCES J. 959, 997 (2006); *see also* W. REGIONAL AIR PARTNERSHIP, http://www.wrapair2.org (last visited Aug. 20, 2013).

205. 42 U.S.C. § 7491(b)(2)(A) (requiring state implementation plans include best available retrofit technology for certain older sources that impair visibility in national parks and wilderness areas); 40 C.F.R. § 51.308(e) (EPA BART-implementing regulations).

206. 64 Fed. Reg. at 35,740–41; Patricia Brewer & Tom Moore, *Source Contributions to Visibility Impairment in the Southeastern and Western United States*, 59 J. AIR & WASTE MGMT. ASS'N. 1070, 1074 (2009).

Parks protected by the Clean Air Act's regional haze provisions can also be the subject of, or impacted by, devastating wildfires.[207] As discussed above, emissions from wildfires—natural as well as planned—are a potent source of fine particulate matter and thus can impair visibility in protected areas.[208] Natural (unplanned) wildfires and windblown dust are considered "significant contributors" to total light extinction on the 20 percent of the haziest days of the year.[209]

*c. Wildfire Smoke and Visibility Regulation*

The differential treatment of air pollution from unplanned wildfire versus prescribed fire is duplicated with respect to visibility regulation. As with the potential for exclusion from NAAQS compliance determinations, whether a wildfire is considered "natural" or "anthropogenic" is a key determinant in how the fire's emissions are regulated under the regional haze regime.[210]

Under policy guidelines issued by the Western Regional Air Partnership, regulators distinguish the visibility impairment produced by wildfires as opposed to prescribed fires.[211] According to a Western Regional Air Partnership guidance document, "[w]ildfire that is suppressed by management action is a 'natural' source [of air pollution]."[212] This result holds true even when the suppression action is limited in nature, due to safety or financial considerations.[213] Hence, none of the Western states are under an obligation to reduce emissions from wildfire to comply with federal visibility requirements; much like wildfire-emissions monitoring data, wildfire smoke does not "count" for purposes of the program for reducing regional haze.[214] This policy dramatically reduces the effectiveness of the visibility-protection regime since, according to one commentator, "[u]ncontrollable emissions are a significant portion of the total visibility impairment in the Western [national parks and wilderness] areas."[215]

In contrast, the exemption for unplanned wildfire smoke from visibility-impairing sources does not extend to prescribed fire. Hence prescribed-fire emissions in the West *are* generally subject to the regional haze regulatory

207. *See, e.g.*, Liane Hansen & Laura Krantz, *Remembering the 1988 Yellowstone Fires,* NAT'L PUB. RADIO (Aug. 29, 2008, 5:17 PM), http://www.npr.org/templates/story/story.php?storyId=94126845.

208. *See* Jensen, *supra* note 204, at 996.

209. Brewer & Moore, *supra* note 206, at 1073.

210. 64 Fed. Reg. at 35,737.

211. NATURAL VS ANTHROPOGENIC TASK TEAM, W. REG'L AIR P'SHIP, GUIDANCE FOR CATEGORIZING NATURAL VS ANTHROPOGENIC FIRE EMISSIONS 8 (2005), *available at* http://www.wrapair.org/forums/fejf/documents/nbtt/WRAPFEJFNAGuidance.pdf.

212. *Id*. at 6.

213. *Id*.

214. *See id*.

215. Brewer & Moore, *supra* note 206, at 1075.

regime.[216] This is because the Western Regional Air Partnership Guidance considers "prescribed fire" to be "an 'anthropogenic' source [of air pollution], except where it is utilized to maintain an ecosystem that is currently in an ecologically functional and fire resilient condition . . . ."[217] Only in the latter case is prescribed fire considered a "natural" source of pollution exempt from the mitigation mandate.[218] Therefore, only prescribed fire that is used to "maintain" an ecosystem already in a healthy and fire-resilient condition is considered "natural"; all other uses of prescribed fire, including those to restore ecosystems, are anthropogenic.[219]

*3. State and Federal Regulation of Planned Wildfire Activities*

A separate regime of state and federal laws and regulations, independent of the Clean Air Act requirements discussed above, potentially apply to prescribed burns and the decision to continue to allow a wildfire to burn for resource benefits. These consist of state smoke management plans, federal public lands planning requirements, and more specialized federal environmental requirements.

*a. State and Tribal Smoke Management Plans*

Many states and tribes have in place a smoke management plan that sets forth procedures and requirements for minimizing the smoke-related impacts of prescribed fires and fires managed for resource benefits.[220] These plans apply to burning activities within the state's or tribe's boundaries regardless of whether the lands subject to burning are located on federal, state, or private lands.[221] At least nineteen states have in place a smoke management plan.[222]

216. *See generally* NATURAL VS ANTHROPOGENIC TASK TEAM, *supra* note 211.

217. *Id*. at 4.

218. *Id*.

219. *Id*. (discussing distinction under section 2.4).

220. *See* NAT'L WILDFIRE COORDINATING GRP., *supra* note 114, at 75.

221. In California, for instance, prescribed burning is governed by Title XVII of the California Administrative Code, which reads, in part, "No person shall knowingly set or allow agricultural or prescribed burning unless he or she has a valid permit from a district or designated agency. No burning shall be conducted pursuant to such permit without specific district approval." Further, California has codified procedures for determining whether any given day will be an allowable burn day, a no-burn day, or a "marginal burn-day" reliant upon present meteorological conditions. CAL. CODE REGS. tit.17, §§ 80110, 80120 (2013). Thus, a number of factors, from the bureaucratic (getting permits approved) to the natural (appropriate weather being present), must come together for any prescribed burn to occur, ensuring that prescribed burns are heavily regulated.

222. *See* Rebecca Battye et al., *Features of Prescribed Fire and Smoke Management Rules for Western and Southern States* 1 (U.S. Envtl. Prot. Agency Office of Air Quality Planning & Standards, Air Quality Strategies & Standards Div., Working Paper No. 1−12, 1999), *available at* http://www.wrapair.org/forums/fejf/documents/woodard.pdf (summarizing the features of the smoke management plans and programs of the nineteen states where fire is used most often to achieve resource benefits).

While the criteria incorporated in state smoke management plans vary, a core component is that all plans for prescribed burning be submitted to an authorizing agency and that that agency approve or disapprove each burn proposal on a daily basis.[223] Several state smoke management plans are extremely strict, imposing a host of conditions that must be satisfied prior to permitting prescribed fire or allowing an unplanned wildfire to be managed for resource benefits. For example, in Washington, all prescribed fire proposals with the potential to contribute 100 or more tons of pollutants are subject to multiple approvals.[224] One approval must be obtained from the Smoke Management Section, which works with a smoke meteorologist to determine whether weather conditions will enable sufficient smoke dispersion so that there is no "likelihood" of smoke intrusions into designated or "sensitive" (populated) areas, including the air space above the ground.[225] In fact, Washington denies burn requests frequently due to the failure to meet the no-likelihood-of-smoke intrusion criteria.[226]

The majority of the states with smoke management plans provide some remedy if the prescribed fire is considered a nuisance.[227] Where it interferes with the use of public lands for recreational purposes or public roads for travel, prescribed fire smoke may be considered a nuisance.[228] Loss of visibility, odors, and falling ash are all complaints made about prescribed fire smoke.[229]

Several states (namely Alaska, Arizona, Oregon, and Washington) use public complaints as the basis for a determination that a nuisance exists; if a nuisance exists, the proposed prescribed fire must be delayed or shut down.[230] For instance, Washington provides that "[i]f the fire creates a nuisance from smoke or flying ash, it must be extinguished."[231] The Washington law further provides that "a nuisance exists when emissions from any open fire cause physical discomfort or health problems to people residing in the vicinity of the burning or physical damage to property."[232] In other states (notably Colorado, Florida, Montana, Tennessee, and Texas), a complaint from a member of the

223. NAT'L WILDFIRE COORDINATING GRP., *supra* note 114, at 75.

224. This criterion incorporates virtually all prescribed burn proposals. STATE OF WASH. DEP'T OF NATURAL RES., SMOKE MANAGEMENT PLAN 7–8 (1998), *available at* http://www.dnr.wa.gov/Publications/rp_burn_smptoc.pdf.

225. *Id*.

226. *See Daily Smoke Management Approvals for Large Burn Silvicultural Prescribed Fires*, WASH. DEP'T OF NAT. RESOURCES, http://fortress.wa.gov/dnr/burnrequests/ (last visited Aug. 20, 2013) (providing interactive information on location of burn requests, acreage and tons of pollutants estimated from burn activity and whether the request was approved or denied).

227. *See generally* Battye et al., *supra* note 222.

228. NAT'L WILDFIRE COORDINATING GRP., *supra* note 114, at 41.

229. *Id*.

230. *Id*. A review of this summary of state smoke managing plans reveals that Arizona, Alaska, Oregon, and Washington use complaints from the public as a basis for a finding that prescribed fire constitutes a public nuisance. Other states indicate prescribed burning can constitute a public nuisance, but are silent as to the conditions under which this could occur.

231. WASH. ADMIN. CODE § 332−24−205 (West 2013).

232. *Id*.

public may prompt a state agency to investigate, which provides the basis for any order requiring a prescribed burn be extinguished.[233] The Forest Service has labeled Colorado's smoke management program a "complaint based program," and notes that, because the state lacks quantitative information linking prescribed fire to violations of a public health standard, state officials respond to any smoke complaints by tightening prescribed-fire smoke permit conditions statewide.[234]

Interestingly, states' air quality planning processes and smoke management processes are only minimally connected. Most state smoke management plans make compliance with the Clean Air Act a requirement of a prescribed burn authorization.[235] Under the Clean Air Act's air quality planning process, states develop state implementation plans in which they essentially allocate permission to emit amounts of the pollutant among the region's sources to ensure that that the amount will not exceed that required to stay in attainment with the national ambient air quality standards.[236] Nevertheless, while state smoke management plans may be incorporated into a state implementation plan, wildfires are not a source of pollution that states plan for in advance by allocating "room" within the SIP-mandated budget for particular NAAQ pollutants.[237]

233. Battye et al., *supra* note 222. States that use public complaints as the basis for an investigation and response by state authorities as to whether the smoke endangers public health or welfare or causes unacceptable odors are: Colorado, COLO. REV. STAT. ANN. § 25–7–106(7) (West 2013) ("[A]fter an investigation initiated either independently by the division or upon the request of an affected member of the public . . . the division shall . . . issue a written cease-and-desist order; or . . . apply to any district court of this state . . . for a temporary restraining order . . . or . . . both."); Florida (prompting a state agency investigation; while certified burners cannot be shut down for causing a nuisance, they can be shut down for threats to health or safety), Battye et al., *supra* note 222, at 41; Montana (prohibiting any person from causing or allowing any emissions of gases, vapors or odors beyond his property line in such a manner as to create a public nuisance), Battye et al., *supra* note 222, at 81 (citing MONT. ADMIN. R. 17.8.315 (repealed 2001)); Oregon (protecting other areas sensitive to smoke), Battye et al., *supra* note 222, at 108 (citing OR. ADMIN. R. 629−043−043(2)(q) (2007)); Texas ("TNRCC has a welfare-based nuisance rule which precludes any person from discharging an air contaminant in such concentration and of such duration as to interfere with the normal use and enjoyment of ones property. Nuisance conditions are established by the investigator and the investigator must document that the observed conditions were of sufficient concentration and duration as to constitute a nuisance condition."), Battye et al., *supra* note 222, at 128; Washington ("A nuisance exists when emissions from any open fire cause physical discomfort or health problems to people residing in the vicinity of the burning, or physical damage to property."), Battye et al., *supra* note 222, at 148.

234. U.S. FOREST SERV., *supra* note 37, at 28.

235. NAT'L WILDFIRE COORDINATION GRP., *supra* note 114, at 21–23.

236. *See* John P. Dwyer, *The Practice of Federalism Under the Clean Air Act*, 54 MD. L. REV. 1183, 1193 (1995).

237. EPA, AIR QUALITY POLICY ON WILDLAND AND PRESCRIBED FIRE 2, 17-18 (1998), *available at* www.epa.gov/ttn/oarpg/t1/memoranda/firefnl.pdf.2 (discussing how state Smoke Management Plans, which contain procedures and regulations governing the management of wildland fires permitted to burn for resource benefits as well as prescribed burns, are the primary vehicle used by states to prevent the deterioration of air quality and NAAQS violations); Battye et al., *supra* note 222, at 1 (same).

*b. Federal Land Use Planning*

Additionally, at the federal level, land managers must have in place a series of planning tools in order for wildfire to be included among the methods available to the land manager to accomplish various land use objectives (such as ecosystem restoration) of a given ecosystem. Planning requirements may include long-term authorization to use fire, but also a shorter-term "Fire Management Plan" that describes how wild and prescribed fire will be used to meet land use objectives.[238]

*c. Conclusions*

Air pollution policy provides for different treatment of the smoke from wildfire versus prescribed fire and wildfire managed for resource benefits. Under the rationale that unplanned wildfires are "natural," EPA asserts the authority to exclude polluting emissions from such wildfires from calculations of a state's compliance with air quality standards. Available data demonstrates that the policy likely results in the exclusion of many air quality standard exceedances.[239] Accordingly, this regulatory exclusion for unplanned wildfire smoke diminishes the value of prescribed fire and wildfire managed for resource benefits in reducing the incidence and severity of unplanned wildfires.[240]

In addition to reducing the value of prescribed fire, air quality regulation at the state and federal levels imposes stringent requirements, or "costs," on prescribed fire. Reasoning that prescribed fire is "anthropogenic" as opposed to "natural," EPA criteria render it much more difficult for states to obtain EPA's exclusion of air quality exceedances attributable to prescribed fire.[241] Due to state and federal smoke management planning processes, prescribed-fire proposals must navigate a host of requirements designed to prevent any intrusion of smoke into populated and sensitive areas.[242] Furthermore, given the proximity to populated areas, these restrictions are especially difficult to

238. U.S. DEP'T OF AGRIC. & U.S. DEP'T OF INTERIOR, *supra* note 120, at 16; EPA, *supra* note 237 at 12.

239. *See supra* text accompanying notes 197−202.

240. Of course, states must still perform the arduous task of officially requesting EPA's exclusion of the data, which requires the states to make the oftentimes difficult demonstration that given exceedances were caused by the wildfire. Claiming that preparation of an official exclusion request for a single high wind event can take 400 staff hours to prepare, Congressman Jeff Flake has introduced H.R. 5381, Common Sense Legislative Exceptional Events Reforms Act of 2012, which requires EPA to act upon requests within a ninety-day time period, requires the agency to promulgate new criteria for exclusions, and subjects EPA's decisions to judicial review. *To Amend the Clean Air Act with Respect to Exceptional Event Demonstrations, and for Other Purposes: Hearing on H.R. 5381 Before the H. Comm. on Energy and Commerce*, 112th Cong. 1–5 (2012) (statements of Sen. Jeff Flake).

241. *See* Treatment of Data Influenced by Exceptional Events, 72 Fed. Reg. 13,560, 13,566 (Mar. 22, 2007) (codified at 40 C.F.R. pts. 50 & 51).

242. *Id*.

satisfy in forests located within the increasingly expansive wildland-urban interface.

With respect to visibility impairment resulting from wildfires in the Western United States, air quality policy requires that states reduce the visibility-impairing impacts of most prescribed fire, but not for wildfires.[243] As with EPA's exceptional events policy, this policy removes any incentive otherwise provided by the regional haze rules to prevent wildfires, and it further discourages states from mitigating the wildfire risk with the use of prescribed fire.[244] Similarly, the regional haze rule rests upon the distinction that wildfires are "natural" while prescribed fires are anthropogenic in origin.[245]

### *B. Wildfire Governance: Distortions in Incentives*

Prescribed fire concerns two different areas of environmental management: forestry resource management and air quality. Because different government agencies—some of which are located at different levels of government—are responsible for each, and each face a different set of incentives, prescribed fire often faces inconsistent obligations. The end result is strategic behavior and suboptimal use of prescribed fire.

Prescribed fire is a forest management tool. It is used in order to prevent unplanned wildfires and improve and maintain the health and ecological diversity of species within the forest habitat.[246] Therefore, the expected proponents of prescribed fire are land managers who appreciate the value of fire in maintaining healthy ecosystems and staving off catastrophic wildfires. The land manager's affiliation depends upon the ownership of the forests—whether it is held in state, federal, or private hands. Four agencies are responsible for the large tracts of public lands in the Western United States, where wildfire is an ever-present risk—the Forest Service in the Department of Agriculture, and the Bureau of Land Management, National Park Service, and Bureau of Indian Affairs in the Department of Interior.

On the other hand, because prescribed fire produces air pollution, it is subject to regulation by air pollution control officials. In the United States, implementation of air pollution control standards lies primarily within state control.[247] Although the federal EPA is responsible for establishing national standards and overseeing state progress in achieving those standards, it is the states that are ultimately responsible for meeting air quality and visibility

243. NATURAL VS ANTHROPOGENIC TASK TEAM, *supra* note 211, at 6.

244. *See id*.

245. *Id*.

246. *See supra* text accompanying notes 98–110.

247. *See* Union Elec. Co. v. EPA, 427 U.S. 246, 256−57 (1976) ("The [Clean Air] Amendments place the primary responsibility for formulating pollution control strategies on the States, but nonetheless subject the States to strict minimum compliance requirements.").

standards.[248] In certain instances, regional governing bodies (made up of states) establish and administer air quality policies; the Western Regional Air Partnership is an example of such a regional governing body.[249] Similarly, in many states, the development and implementation of state smoke management plans is overseen entirely by state air pollution control officials.[250]

Different agencies are constrained by different incentives for prescribed-fire pollution. Under this division of responsibility, land managers have strong incentives to perform prescribed fires and to manage an unplanned wildfire for resource benefits. Land managers reap benefits in the form of reduced wildfire risk and healthier forests overall. Land managers' incentive to avoid air pollution, while present, is considerably weaker. Whereas land managers must deal with the ire of state air quality officials should prescribed-fire smoke impact pollutant levels, this ire is a small price when compared to the budget hit and political fallout associated with a major wildfire, especially one that in hindsight could have been avoided with prescribed fire.

Conversely, the opposite incentives face state air quality control officials. Such officials do not reap benefits from prescribed fire and wildfire managed for resource benefits. While prescribed fire may reduce the risk of a future wildfire, such a wildfire may also occur anyway; in any case, whether the avoided wildfire would occur during the tenures of the air quality officials in charge is largely unknown. The uncertainties attendant to the size and timing of an avoided-wildfire payoff from prescribed fire and wildfire managed for resource benefits are likely to reduce their value to air quality control officials.

The theoretical consequence of the different ordering of incentives facing land managers and air quality control officials is strategic behavior. Anticipating an abundance of denials of their prescribed–fire proposals, land managers would be expected to "over-propose" prescribed fire; or, they will request more prescribed fires than actually needed so as to end up with a sufficient amount of prescribed fire after air quality officials evaluate their proposals. On the other hand, air quality control officials could be expected to develop overly stringent regulations for approving prescribed fires and process proposals using overly stringent criteria so as to minimize the amount of prescribed-fire smoke generated. Such strategic behavior theoretically is possible because land managers and air quality control officials are housed in different government agencies,[251] and they are often working at different levels of government as well. With respect to the latter, with respect to large tracts of federal public lands in the Western United States, the land manager will be a

248. *See id*.

249. *See supra* text accompanying notes 209–210.

250. For example, in Arizona and Colorado, it is the state environmental department that oversees prescribed burning permits. *See* Battye et al., *supra* note 222, at 10, 27.

251. The applicable land manager for federal public lands is the head of the agency owning or controlling the land, such as the Department of Agriculture for U.S. Forest Service lands and the Department of Interior for National Park Service lands.

federal official while the air quality control manager will be a state official.[252] While it is possible that each group's strategic behavior will "cancel out" (i.e., over-proposals of prescribed fire will be cancelled out by applying overly-stringent air quality regulations), this cannot be assumed.

Some empirical evidence of such strategic behavior exists, though more research is needed to verify the existence of such behavior. Land managers are known to request permission to burn in several different areas, knowing that the agency only has the resources to burn in one location. [253] A land manager will act this way to increase the chances that at least one of the requests will be approved.[254] Indeed, records maintained by the Washington Department of Environmental Resources (the state agency that must approve prescribed-fire proposals) are consistent with this practice, though other explanations of the data are possible.[255] At the same time, conditions that states include in smoke management plans make it all but impossible for land managers to obtain approval of prescribed-fire projects.[256] Furthermore, the Forest Service notes that some states use an extremely conservative approach when forecasting the smoke impacts from prescribed fires, with the result that the atmospheric capacity to absorb prescribed-fire smoke remains underutilized.[257]

252. Thus in the Gunnison National Forest, prescribed burning will be overseen by Forest Service officials in the Department of Agriculture while the air quality impacts of the prescribed burning will be authorized and monitored by the Colorado Air Pollution Control Division. *See* Battye et al., *supra* note 222, at 27.

253. E-mail from Janice Peterson, Acting Region 6 Smoke Program Manager, U.S. Forest Serv., to author (Mar. 8, 2012) (on file with author).

254. *Id*.

255. *Daily Smoke Management Approvals for Large Burn Silvicultural Prescribed Fires*, *supra* note 226 (demonstrating that on occasional days none of the proposed and approved burning actually took place).

256. *See, e.g.*, U.S. FOREST SERV., *supra* note 37, at 2 ("The Colorado Smoke Management Program (SMP) permit conditions for these areas are often so restrictive that it is neither practical nor cost-effective to implement prescribed fire treatments in the very areas where they are needed most."). In this document, the Forest Service requests that the Colorado Air Quality Control Commission meet the intent of a Colorado statute requiring that the Commission evaluate its existing prescribed fire permit program so as to support and increase where prescribed burning by "assessing the current SMP and its implementation methods to determine if smoke permit conditions are objective, verifiable, and tied directly to the NAAQS." *Id*.

257. *Id*. at 26 ("[The Colorado Air Pollution Control Division] has developed a very conservative permit system that ensures the NAAQS will not be exceeded. However, this conservative approach often leaves the significant capacity for additional prescribed burning underutilized."); *see also id*. at 27 ("[P]ermit conditions have become a system of layered filters which each prescribed burn project must sift through in order to be approved by the APCD. Individual layers may not appear overly restrictive; however, when combined, these layers create a significant burden to successfully implementing a prescribed fire project."); *id.* at 23 (finding that the forty-acre-per-day limit upon prescribed burning means that "many [prescribed burning] projects are never planned and smoke permits are never requested").

### C. Nuisance: Distortions from NIMBY Reactions

Air quality policy includes not only the health protections embodied in the NAAQS and the visibility protections embodied in the regional haze rules, but also the general prohibitions of public nuisance law. In general, a nuisance is any activity that threatens or endangers health or welfare or which unreasonably interferes with the use or enjoyment of property.[258] In many jurisdictions, nuisance authorities operate as a fail-safe, enabling officials to stop even an officially authorized activity where the conduct at issue constitutes a danger or an annoyance to the public.[259] Nuisance regulatory bodies can create an additional impediment to prescribed fire. In many jurisdictions, nuisance law requires that prescribed fires be extinguished if there are public complaints about the smoke. In at least one known instance, a state agency sought to fine federal land managers for allegedly creating a nuisance from prescribed fire.[260]

In at least two instances, state or local officials have attempted to cite or fine land managers who employ prescribed fire.[261] In one such instance in 2009, a local air control agency in Washington state fined the Forest Service $12,000 for conducting a prescribed fire that allegedly caused detrimental emissions.[262] The local agency eventually withdrew the citation, but one commentator notes that federal land managers can be liable for any damages associated with prescribed fire.[263]

Enabling the public to influence when and where prescribed fire occurs with nuisance law arguably distorts fire policy; it emphasizes the burdens of prescribed fire over its benefits in potentially reducing the likelihood and extent of an unplanned wildfire. All of the dynamics of the "not in my backyard" (NIMBY) syndrome[264] are present. For residents living nearby, prescribed fire causes smoke, a short-term but certain cost. Prescribed-fire smoke is localized; because of the smaller smoke plume generated by prescribed fires in comparison to wildfires, smoke from a prescribed fire will primarily affect

258. *See* RESTATEMENT (SECOND) OF TORTS § 821D (1977) ("A private nuisance is a nontrespassory invasion of another's interest in the private use and enjoyment of land.").

259. NAT'L WILDFIRE COORDINATING GRP., *supra* note 114, at 47.

260. *See infra* text accompanying notes 267−268.

261. *See* Melissa Sanchez, *Where There's Smoke There's Ire,* YAKIMA HERALD-REPUBLIC, Jan. 5, 2010 (describing two instances where a state environmental agency initiated enforcement actions against the U.S. Forest Service for smoke intrusions from prescribed burning).

262. Notice of Violation No. 6134, Yakima Clean Air Agency, to Randall D. Shepard, U.S. Forest Serv. (Dec. 10, 2009) (on file with author).

263. Palmer, *supra* note 12, at 279.

264. *See, e.g.*, Barak D. Richman & Christopher Boerner, *A Transaction Cost Economizing Approach to Regulation: Understanding the NIMBY Problem and Improving Regulatory Responses*, 23 YALE J. ON REG. 29, 37 (2006) ("A NIMBY is defined as a socially desirable land use that broadly distributes benefits, yet is difficult or impossible to implement because of local opposition.").

local communities in the vicinity.[265] At the same time, the benefits of prescribed fire to the local communities impacted by prescribed-fire smoke are uncertain. It is difficult to say with certainty whether wildfire would occur in the same locality as the prescribed fire in the absence of the prescribed fire or whether, if it did, the wildfire would make anyone worse off than they are as a result of their exposure to the smoke of prescribed burning. Hence, local residents are apt to overestimate the burdens of prescribed fire and underestimate its benefits.

Moreover, nuisance law is a "one-way ratchet"—it responds only to negative public input. Nuisance law provides a mechanism only to those persons who complain about prescribed-fire smoke.[266] As a consequence, nuisance law does not reflect the sentiments of the myriad persons who may benefit from the effect of prescribed fire in reducing future wildfire risk. Such persons presumably include those individuals who live outside the geographic areas impacted by prescribed fire but within locations that benefit from the wildfire-risk reduction and other ecosystem benefits. Furthermore, future generations also benefit, as the benefits of burning—whether from prescribed fire or an unplanned wildfire that is allowed to burn for resource benefits—extend many years into the future.[267] In fact, prescribed burning can be viewed as a trade-off between the health and comfort of the present generation, who must put up with the smoke from prescribed burning, for the health and comfort of future generations.[268] Even if nuisance law were to reflect the prescribed-fire preferences of such geographically and temporally distant persons, the diffuse and uncertain nature of their benefit renders it highly unlikely that these persons would be compelled (or, in the case of future generations, technically able) to voice these preferences.[269] As a result, state nuisance law operates as an additional hindrance to prescribed fire.

265. *See* Yongqiang Liu et al., *Smoke Plume Height Measurement of Prescribed Burns in the South-Eastern United States*, 22 INT'L J. WILDLAND FIRE 130, 130 (2012) ("Smoke plume heights range from hundreds of metres for prescribed fires to thousands of metres for wildfires.").

266. *See, e.g.*, Thomas J. Miceli, *Property*, *in* THE ELGAR COMPANION TO LAW AND ECONOMICS 246, 250 (Jürgen G. Backhaus ed., 2d ed. 2005) ("The principal common law remedies for externalities are . . . the laws of trespass and nuisance.").

267. *See, e.g.*, Kristin L. Shive et al., *Pre-Wildfire Management Treatments Interact with Fire Severity to Have Lasting Effects on Post-Wildfire Vegetation Response*, 297 FOREST ECOLOGY & MGMT. 75, 78 (2013) (finding persistent impacts upon post-vegetation impacts from prior wildfires, especially high-severity wildfires).

268. *See generally* Daniel A. Farber, *From Here to Eternity: Environmental Law and Future Generations*, 2003 U. ILL. L. REV. 289 (2003).

269. *Cf.* Agee & Skinner, *supra* note 79, at 94 ("The probabilities of wildfire in space and time are not well defined: wildfire may not occur here this year, or there next year, but at some scale the spatial loss per time period can be defined. It may be quite difficult to point to a particular stand and define its probability of burning in some given future period, but the probability that substantial areas of dry forest will continue to be burned by severe wildfire is known, and it is high.").

## III. RECOMMENDATIONS

Currently air pollution regulation distorts incentives in a manner that biases decisions against the use of prescribed burning to reduce the incidence and severity of wildfires. This outcome is not beneficial. Given the escalating risk of wildfires, officials should be vigorously using prescribed fire. The following are recommendations designed to remove these distortions from air quality policy.

### *A. Adopt a "Smoke Is Smoke" Default Rule with Built-In Incentives*

Rather than excluding data from unplanned wildfires from air quality compliance determinations, state and federal officials should adopt a default rule that all wildfire smoke-related data (i.e., data from unplanned wildfire, prescribed fire, and wildfire managed for resource benefits) "counts" for purposes of air quality compliance. Only through the adoption of such a default policy can it be assured that states will take the capacity of prescribed fire to reduce the incidence and severity of unplanned wildfires into account when implementing air quality and smoke management rules. Accordingly, the smoke from unplanned wildfires should be excludable only upon a demonstration that the state is actively engaged in a program to reduce wildfire risk, such as through cooperative programs between air quality and land managers to encourage vegetation reduction through prescribed fire and mechanical thinning.

Adoption of a "smoke is smoke" default policy requires that state and federal officials make numerous other policy changes, each of which are discussed below.

#### *1. Abandon the Distinction Between "Natural" Wildfires and "Anthropogenic" Prescribed Fires*

Excluding wildfire smoke and including prescribed-fire smoke in air quality compliance determinations are each rooted in the fiction that wildfires are "natural" and that prescribed fires are "anthropogenic" events. Because these fictions support policy decisions that undervalue the wildfire-prevention aspects of prescribed fire, regulators should abandon this distinction.

#### *2. Unplanned Wildfires Are Not "Natural" Events*

Given the past century of aggressive wildfire-suppression policy, it is disingenuous to label the unplanned wildfires that do result as a "natural" phenomenon.[270] The high number of severe wildfires today is, in part, an effect

270. *See* Peterson et al., *supra* note 136, at 1 ("[A]ggressive fire suppression (including the use of prescribed fires to reduce fire hazard) and land use changes have made the current pattern of wildland fires anything but natural.").

of the long-standing, deliberate policy on behalf of federal and state land managers to suppress wildfires on public lands. The unraveling of this suppression policy, initiated in the late 1800s, is a comparatively recent phenomenon.

This legacy of wildfire suppression has largely contributed to the accumulation of forest fuels and a consequent increase in the incidence and severity of wildfires. For instance, research on a ponderosa pine forest in Arizona found that average tree density increased more than eightfold under a wildfire-suppression regime.[271] Density increases like these are now commonly observed in the ponderosa pine forests common to the Western United States.[272] Open, park-like stands of ponderosa pine trees have diminished while smaller tree species, like Douglas fir and true firs, have increased.[273] Because these smaller-tree species provide "ladder fuels" that allow fire to reach the upper branches of the larger-tree species, torching and killing them, these density increases greatly increase the risk of large, high-intensity fires.[274] A 1999 government study concluded that the over-accumulation of trees present a severe wildfire risk to approximately 16 million hectares in the Intermountain West.[275]

EPA's treatment in its exceptional event policy of wildfires as *per se* natural events is inconsistent with EPA's own definition of wildfire, adopted from federal land agencies. Under this definition, a wildfire is any unplanned ignition of a wildland fire, including "unauthorized and accidental human-caused fires" and "escaped prescribed fires."[276] Most wildfires are human-caused, though humans are the cause of a smaller percentage of the backcountry wildfires that are responsible for the most acreage burned.[277] Of the 63,591 to 96,386 fires that burned each year between 2001 and 2010, humans caused between eighty and ninety percent.[278] Humans are the source for twelve to sixty-five percent of the annual acreage burned during that time

271. Peter Z. Fulé et al., *Determining Reference Conditions for Ecosystem Management of Southwestern Ponderosa Pine Forests*, 7 ECOLOGICAL APPLICATIONS 895, 895 (1997).

272. STEPHEN A. FITZGERALD, U.S. FOREST SERV., PSW-GTR-198, FIRE ECOLOGY OF PONDEROSA PINE AND THE REBUILDING OF FIRE-RESILIENT PONDEROSA PINE ECOSYSTEMS 197, 209–10 (2005) (finding that, as compared to the start of Euro-American settlement 140 years ago, stand densities in ponderosa pine ecosystems have increased from a range of 49–124 trees ha$^{-1}$ (20–50 trees acre) to a range of 1235–2470 trees ha$^{-1}$ (500 to 1000 stems acre)).

273. SARAH E. GREENE & ANGELA EVENDEN, U.S. FOREST SERV., THE ROLE OF FIRE IN RESEARCH NATURAL AREAS IN THE NORTHERN ROCKIES AND PACIFIC NORTHWEST 32, *available at* http://www.fs.fed.us/rm/pubs_int/int_gtr341/int_gtr341_032_033.pdf.

274. FITZGERALD, *supra* note 272, at 210.

275. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO/RCED-99-65, WESTERN NATIONAL FORESTS: A COHESIVE STRATEGY IS NEEDED TO ADDRESS CATASTROPHIC WILDLAND FIRE THREATS 3 (1999), *available at* http://www.gao.gov/assets/160/156559.pdf.

276. U.S. DEP'T OF AGRIC. & U.S. DEP'T OF INTERIOR, *supra* note 120, at 17.

277. *Lightning Fires (by Geographic Area)*, NAT'L INTERAGENCY FIRE CTR., http://www.nifc.gov/fireInfo/fireInfo_stats_lightng.html (last visited Aug. 20, 2013).

278. *See id*.

period.[279] The number of human-caused fires in forested areas is expected to increase as people continue to move into residential areas adjoining forests, or the wildland-urban interface.[280]

EPA's determination that wildfire smoke is "natural" and hence *per se* excludable under the exceptional events policy is not statutorily required. Nothing in the legislative history of the statutory source for the exceptional events rule—the amendment to the Clean Air Act by section 6013 of the Safe Accountable, Flexible, Efficient Transportation Equity Act of 2005 (SAFETEA-LU)—requires that the agency provide a regulatory exclusion of air quality pollution measurements influenced by wildfires.[281] Similarly, nowhere in section 6013 of SAFETEA-LU did Congress specify the definition of a "natural event," nor did Congress identify wildfires as "natural events." If anything, excluding wildfire smoke from air quality considerations seems inconsistent with at least one of the principles governing EPA's exceptional event rulemaking set forth in section 6013—that "each State must take necessary measures to safeguard public health regardless of the source of the air pollution."[282]

Finally, the label "natural" gives the impression that smoke from unplanned wildfires is somehow less harmful to health and to visibility values than smoke originating from prescribed fires. Nothing could be further from the truth. Smoke is smoke. From the perspective of risks to human health and the environment, it makes no difference whether the pollution originates from fire from lightning, from a negligent camper, or from Forest Service personnel.

### *3. Prescribed Fires Are Not "Anthropogenic"*

Just as the assumption that unplanned wildfires are natural events is an unhelpful fiction, so too is the blanket assumption that prescribed burning wildfires managed for resource benefits are entirely anthropogenic. While a prescribed fire is ignited by human means, in many other respects such fires are natural phenomena. Both the purpose and the effect of prescribed fire and wildfire managed for resource benefits are to mimic the natural fire cycle.[283]

279. *See id*.

280. NAT'L ASS'N OF STATE FORESTERS, *supra* note 15, at 6.

281. *See* Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, Pub. L. No. 109-59, § 6013(b), 119 Stat. 1144 (2005), *available at* www.gpo.gov/fdsys/pkg/PLAW-109publ59/pdf/PLAW-109publ59.pdf.

282. *Id*. at § 6013(b)(3)(iv).

283. Admittedly, studies demonstrate that this purpose may fail. Managed fire regimes have not been entirely successful in returning ecosystems to their pre-fire-suppression state. Studies show that artificial fire regimes lag behind the natural fire regimes in terms of the amount of fire. *See* James K. Brown et al., *Comparing the Prescribed Natural Fire Program with Presettlement Fires in the Selway-Bitterroot Wilderness*, 4 INT'L. J. WILDLAND FIRE, 157, 165 (1994) ("Presettlement stand replacement fire was greater than during the recent period for all fire regime types by nearly 1.7 times."). Also, even intensive programs of annual prescribed burning can fail to restore an ecosystem to the types and diversity of species that existed prior to the time that fires were actively suppressed. *See* Alan S. White,

According to official Forest Service policy, the purpose of prescribed fire is to "approximate the natural vegetative disturbance of periodic fire occurrence" and to "maintain fire dependent ecosystems and restore those outside their natural balance."[284] By mimicking the effect of natural, recurring fire regimes, prescribed fire can be considered "natural."[285] In fact, given that EPA considers "natural" wildfires to include those negligently ignited by humans, the natural-versus-anthropogenic distinction does not entirely fit the EPA's policy narrative.

In short, the labels of "natural" and "anthropogenic," as used by EPA and the states to justify regulatory distinctions between wildfire and prescribed fire, lacks merit. These labels should be abandoned and, with them, the air pollution related regulatory distinctions between them.

*4. Provide States with Incentives to Reverse Default Policy*

Under the default policy outlined above, EPA would not exclude smoke from wildfires when determining a state's compliance with air quality standards. This policy would provide air quality regulators with an incentive to authorize prescribed fire. Prescribed fire would constitute not just a source of fire smoke emissions, but also a means to reduce potentially catastrophic wildfires, a larger source of fire smoke emissions. The default policy's rationale is that smoke *is* smoke, a source of health-threatening air pollution, regardless of its source. Fine particulate matter and ozone have deleterious effects upon health and visibility, regardless of whether they derive from a raging unplanned wildfire (currently eligible for *per se* exclusion under EPA's exceptional events policy)[286] or prescribed fire (barely eligible for exclusion

*The Effects of Thirteen Years of Annual Prescribed Burning on a Quercus Ellipsoidalis Community in Minnesota*, 64 ECOLOGY 1081, 1081 (1983). Part of the reason for this is that differences in the intensity and occurrence of fire from that which would occur naturally alters the native plant regime. *See* Matthew L. Brooks et al., *Effects of Invasive Alien Plants on Fire Regimes*, 54 BIOSCIENCE 677, 677 (2004). This lack of success, however, does not undermine the overall benefits that result from prescribed and wildland fire use fire in bringing ecosystems closer to their status under an undisturbed fire regime.

284. *Prescribed Fires*, *Daniel Boone Nat'l Forest*, U.S. FOREST SERV., http://www.fs.usda.gov/detail/dbnf/home/?cid=fsbdev3_032591 (last visited Sept. 1, 2013); *see also Prescribed Burn Terminology,* BUREAU OF LAND MGMT., http://www.blm.gov/or/resources/fire/prescribedburns/burn_terminology.php (last visited Sept. 1, 2013) (describing prescribed burning as a vegetative management tool "to maintain fire dependent ecosystems and restore those outside their natural balance"); Kevin E. Shaffer, *Fire and At-Risk Species*, *in* FIRE IN CALIFORNIA ECOSYSTEMS 520, 530 (Neil G. Sugihara et al. eds., 2006) ("Fundamentally, use of fire restores fire back to natural communities; at-risk species have existed in fire-adapted ecosystems, and the long-term viability of these species is tied to ecological processes such as the fire cycle.").

285. *See* Jonathan C.B. Nesmith et al., *A Comparison of Effects from Prescribed Fires and Wildfires Managed for Resource Objectives in Sequoia and Kings Canyon National Parks*, 261 FOREST ECOLOGY & MGMT. 1275, 1281 (2011) (finding that the similarity in fire affects prescribed fires and managed wildfires indicates that prescribed fires appear to be creating post-fire conditions that approximate natural fires).

286. *See supra* text accompanying note 193.

under EPA's policy)[287] or a coal-fired utility (not excludable because burning coal for electricity is neither a natural event nor an "exceptional" event).

The potential consequence of the default rule is that, during the annual fire season, more air quality control regions in the United States would measure levels of particulate matter and ozone in excess of air quality standards. This result could mean the redesignation of many more areas as "nonattainment" under the Clean Air Act, a status that triggers the mandatory application of more stringent technology-based standards for large sources of the nonattainment pollutant.[288] It will also add to the regulatory burdens of federal land managers carrying out prescribed fires, as the nonattainment designation will mean that they will be required to carry out a conformity analysis under the Clean Air Act.[289]

The prospect of more nonattainment areas might tempt regulators to adopt an opposite approach—a "smoke is not *pollution*" policy. Under this alternative approach, regulators would provide for the total exclusion of all wildfire and prescribed fire smoke for air quality compliance purposes. Such an approach would, in theory, enable land managers to carry out prescribed fires by alleviating any concern with the regulatory implications of the resulting smoke.

The problem with the "smoke is not pollution" policy is that it replaces the current fiction embodied in the exceptional events rule with another: that wildfire smoke, of whatever origin, does not contribute to air pollution. Moreover, under such an alternative policy, states and land managers would then have no incentive to reduce air pollution from wildfire smoke.

Rather than adopting a "smoke is not pollution" policy, regulators should respond to the prospect of potentially more smoke-caused nonattainment areas by providing states with incentives to carry out programs to reduce forest fuel build-up through planned fire—prescribed fire and the management of unplanned wildfires for resource benefits—as well as mechanical thinning. Such measures might include greater reliance on prescribed fire and other fuel treatments in existing smoke management plans and the institution of prescribed fire councils.[290]

287. *See supra* text accompanying note 196.

288. The regulatory requirements applicable to a nonattainment area are much more onerous than those applicable to an area in attainment. Within a nonattainment area, the state must submit a plan demonstrating that it will attain the NAAQS by the statutory deadline, making reasonable further progress each year. *See* 42 U.S.C. § 7502 (2006). Major sources of nonattainment pollutants are subject to stringent technology standards. *Id*.

289. Under the Clean Air Act, a federal agency proposing any action in a nonattainment area must carry out an analysis prior to performing the action that the action conforms to the state implementation plan. 42 U.S.C. § 7506. Under EPA's general conformity rule, conformity requires that the federal activity not interfere with the state's ability to attain and maintain compliance with national ambient air quality standards and that it not cause or contribute to a new violation of these standards. Determining Conformity of General Federal Actions to State or Federal Implementation Plans, 63 Fed. Reg. 63,213, 63,214 (Nov. 30, 1993) (codified at 40 C.F.R. pts. 6, 51, 93).

290. *See* NAT'L COAL. OF PRESCRIBED FIRE COUNCILS, GUIDE TO SMOKE MANAGEMENT 1 (2007), *available at*

### *B. Revamp Smoke-Related Governance Structures to Encourage Prescribed Fire and the Management of Wildfire for Resource Benefits*

Among the explanations for the insufficient use of prescribed fire and wildfire managed for resource benefits is the current structure of state and federal regulatory authorities governing burn decisions. While responsibility for resource management and fire suppression is lodged within federal and state land management agencies, responsibility for air quality compliance is lodged within state and federal pollution control agencies.[291] This sets up a dynamic in which resource agencies advocate for greater use of prescribed fire and managing wildfires for resource benefits while pollution agencies oppose them. Neither group of agencies believes the other is taking sufficient account of the others' concerns. The result is a buildup of mistrust, strategic decision making, and a continuation of the insufficient use of fire.

One solution is that decisions concerning the use of prescribed fire and wildfire managed for resource benefits receive input from both the resource and the air quality agencies at the state and federal level. Only by making air pollution a responsibility of the land management agencies and the risk of wildfire a responsibility of the air pollution agencies will distortions in decision making be corrected.

One method to ensure a joint decision-making process is to require that the prescribed-fire authorizations at the state level be the joint product of both state air quality officials and state resource managers, rather than the unilateral product of either agency. A review of the state smoke management plans of the nineteen states with the greatest amount of prescribed fire reveals a sharp divide between states in the manner in which they allocate decision-making authority. In Western states, it is usually the state environmental agency, or the locus of the state's air pollution control officials, that are authorized to permit prescribed fire.[292] On the other hand, states in the Southeast tend to delegate this decision to a state natural resource agency.[293] Given that a much greater number of acres is annually subject to prescribed fire in the Southeast as opposed to the West, the inclusion of resource agencies in the decision-making process theoretically could result in more prescribed fire.[294]

Another method to address the governance distortions is for states to encourage the development of "Prescribed Fire Councils." These councils represent a forum for federal, state, and tribal officials, as well as private

http://www.garxfire.com/pdf%20files/The_National_Coalition_of_Prescribed_Fire_Councils_Guide_to_Smoke_Management.pdf.

291. *See supra* text accompanying notes 167−169.

292. Battye et al., *supra* note 222, at 10−11, 27, 51, 75, 91, 139.

293. *Id*. at 36, 43, 66, 83, 110.

294. *See* U.S. FOREST SERV., *supra* note 37, at 31 (claiming that Florida's success in performing vastly greater number of acres of prescribed burning than Colorado is attributable to the fact that Florida's Smoke Management Plan is managed by the state Division of Forestry).

parties, to discuss and cooperate around issues related to prescribed fire. [295] At present, twenty-five prescribed-fire councils exist in twenty-three states.[296] Critically, Western states are the least represented states among those with prescribed fire councils; no such council exists in Alaska, Idaho, Montana, Nevada, Oregon, Texas, Utah, or Wyoming.[297] Although California has a prescribed fire council, its jurisdiction is limited to the northern half of the state.[298]

### *C. Presume Authorized Prescribed Fire Does Not Constitute a Nuisance*

Yet another factor discouraging prescribed fire and wildfire managed for resource benefits is the intrusion of state nuisance law. In short, in many states, complaints by the public—often disgruntled inhabitants of the wildland-urban interface—can delay or shut down prescribed fire as a nuisance. Protection of public health and the environment is of critical importance, but prescribed fire is an important method of providing that protection. Unfortunately, providing community members experiencing the discomfort and health threats of wildfire smoke with a veto over prescribed fire threatens to subordinate the protection of the public and the health of large ecosystems through a reduced wildfire risk to the whims of the smaller group of citizens living in close proximity to prescribed fire.

For society overall, this subordination is not good policy. Protection of the health and welfare of those living nearby prescribed fire projects can be accomplished through careful planning and, where necessary, the relocation of those residents to safe areas during prescribed fire or prior to authorizing the management of a wildfire for resource benefits. Such measures cannot be provided to the large number of persons whose health and well-being may be threatened by an unplanned wildfire which may have been prevented, or its threats reduced, by a more aggressive policy of prescribed fire and resource management burning. When wildfire hits, temporary relocation is often not an option; residents are lucky to escape with their lives.[299]

295. An example is the Georgia Prescribed Fire Council, which is made up of sixteen federal, state, and county representatives together with private industry representatives. The council provides input to smoke management and air quality issues on the Oconee National Forest and across the state generally and specifically to encourage the use of a promote the public understanding of the use of prescribed fire. *See Prescribed Burning Chattahoochee-Oconee National Forests, Georgia*, U.S. FOREST SERV., http://www.fs.usda.gov/detail/conf/landmanagement/planning/?cid=fsm9_029220 (last visited Aug. 20, 2013).

296. COAL. OF PRESCRIBED FIRE COUNCILS, INC., *supra* note 92, at 15 fig. 18.

297. *Id*.

298. *Id*.

299. *See* Christine Kenneally, *The Inferno*, THE NEW YORKER, Oct. 2009, at 46.

## CONCLUSION

Wildfire is on the rise. The United States, together with many other nations, is witnessing a spectacular increase in acres lost to catastrophic wildfires, a phenomenon tied to the generally hotter and drier conditions associated with climate change. In addition to the lives, property, and natural resources lost, wildfires are a plentiful source of air pollution, contributing thousands of tons of particulate matter, ozone precursors, and carbon dioxide to the atmosphere. Ironically, one of the most effective tools to reduce the incidence and severity of unplanned wildfires is planned wildfires—prescribed fire or wildfire managed for resource benefits—which work by reducing the buildup of vegetation and restoring the natural fire resiliency of a given ecosystem by eliminating fire-prone plant species.

At present, the number of acres burned annually falls far short of the number considered optimal for purposes of restoring ecosystems and reducing damages from unplanned wildfires. While many social and economic factors contribute to this shortfall in the use of prescribed fire, one group of factors has so far escaped in-depth analysis: air pollution law and policy. Yet, as discussed in this Article, pollution policy contributes in numerous ways to discouraging prescribed fire and the management of unplanned wildfires for resource benefits. These regulatory distortions include undervaluing the wildfire-reducing capacity of prescribed fire by enabling states to exclude wildfire smoke from air quality compliance determinations, governance structures that place air quality and resource agencies at odds with each other, and nuisance authorities that enable more narrow local interests to trump the broader public interest in reduced wildfire risk and healthier forests.

The status quo is not inevitable. Solutions are available. This Article has suggested several, including the adoption of a default rule whereby all wildfire smoke "counts" for purposes of calculating air quality unless states can demonstrate a working program to encourage prescribed fire and the management of wildfires for resource benefits. This rule would ensure that the state takes the wildfire-reducing properties of prescribed fire into account when making air quality determinations. Other solutions include joint decision making over prescribed fire by state officials in both air quality and natural resource agencies, eliminating the rivalries and strategic decisions that now characterize some state smoke management regimes, and imposing a presumption that the authorized use of prescribed fire or management of unplanned wildfire for resource benefits does not constitute a nuisance. The latter will ensure the responsiveness of smoke management planning to local interests and ensure that the general public interest in reduced wildfire damages

and healthy forests are not subsumed to the local interests in reduced smoke impacts.