

## Reducing Wildfire Risk in the Wildland-Urban Interface: Policy, Trends, and Solutions

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## REDUCING WILDFIRE RISK IN THE WILDLAND-URBAN INTERFACE: POLICY, TRENDS, AND SOLUTIONS

KIMIKO BARRETT, PH.D.

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# REDUCING WILDFIRE RISK IN THE WILDLAND-URBAN INTERFACE: POLICY, TRENDS, AND SOLUTIONS

KIMIKO BARRETT, PH.D.\*

## ABSTRACT

*Increasing home development in wildfire-prone areas, coupled with climate change, are exacerbating wildfire risks to many communities. Better land use planning can work with other mitigation measures to reduce wildfire risks to people and homes. There are a variety of land use planning tools available, such as community plans, regulations, building codes, and incentive-based programs, to better manage development in the wildland-urban interface (WUI) and other high-wildfire-risk areas. The Community Planning Assistance for Wildfire (CPAW) program provides communities with resources and services to mitigate wildfire risks through improved land use planning.*

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## I. INTRODUCTION

Wildfires in 2018 cost an unprecedented \$3 billion for federal suppression efforts.<sup>1</sup> In California alone, nearly 20,000 structures were damaged or destroyed, hundreds of thousands of people were evacuated, and 85 people died as a result of

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1. *Federal Firefighting Costs (Suppression Only)*, NAT'L INTERAGENCY FIRE CTR., [https://www.nifc.gov/fireInfo/fireInfo\\_documents/SuppCosts.pdf](https://www.nifc.gov/fireInfo/fireInfo_documents/SuppCosts.pdf) (last visited Mar. 15, 2019).

wildfires and post-wildfire impacts.<sup>2</sup> Insured losses from California's historic wildfire seasons in 2017 and 2018 are estimated to exceed \$20 billion.<sup>3</sup> Other short and long-term costs related to ongoing landscape rehabilitation, infrastructure repairs, degraded ecosystem services, and depreciated property values have yet to be accounted for but will invariably add billions of dollars to the overall costs of recent wildfires.<sup>4</sup>

The rising costs of wildfires have paralleled rising trends in home development and climate change. Since the 1960s, housing patterns have increasingly favored areas adjacent to forests, public lands, and the unbuilt environment.<sup>5</sup> More homes burn and are at risk in the wildland-urban interface (WUI) than in any other land use type.<sup>6</sup> Drawn by the appeal of scenic amenities and open space, people are building in the WUI faster than in other parts of the country.<sup>7</sup> From 1990 to 2010, the WUI grew in terms of both the number of new homes (increasing 41%) and converted land area (increasing 33%).<sup>8</sup> At the same time, more people are building in areas with known wildfire history.<sup>9</sup> In 1990, 177,000 homes were located within the perimeter of a recent wildfire. By 2010, 286,000 homes were located within a recent wildfire perimeter, corresponding to a growth rate of 62%.<sup>10</sup> In other words, despite the recognized risks to homes and people, development in wildfire-prone lands is outpacing growth relative to the rest of the country.

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2. *Insurance Commissioner Reports Over \$9 Billion Insured Losses From Deadly 2018 Wildfires*, CAL. DEP'T OF INS. (Dec. 12, 2018), <http://www.insurance.ca.gov/0400-news/0100-press-releases/2018/release142-18.cfm>.

3. *California Statewide Wildfire Insurance Claims Nearly \$12 Billion*, CAL. DEP'T OF INS. (Jan. 1, 2018), <http://www.insurance.ca.gov/0400-news/0100-press-releases/2018/release013-18.cfm>. According to Dave Jones, Insurance Commissioner for the State of California, the wildfires of 2017 resulted in 45,000 insurance claims totaling more than \$11.79 billion and destroyed 32,000 homes, 4,300 businesses, and more than 8,200 vehicles and equipment. *Id.* According to an Insurance Commissioner report released in December, 2018, insured losses from 2018 were over \$9 billion. Combined insured losses from 2017 and 2018 have exceeded \$20 billion. A report by Core Logic estimated insured losses from California's 2018 wildfires will cost as much \$19 billion (see *The Camp and Woolsey Wildfires in California Cause Devastating Losses Between \$15 Billion and \$19 Billion According to Core Logic*, CORE LOGIC (Nov. 27, 2018), <https://www.corelogic.com/news/the-camp-and-woolsey-wildfires-in-california-cause-devastating-losses-between-15-billion-and-19-billion-according-to-corelogic.aspx>).

4. Kimiko Barrett, *The Full Community Costs of Wildfire*, HEADWATERS ECON. (May 2018), <https://headwaterseconomics.org/wildfire/homes-risk/full-community-costs-of-wildfire/>. Analysis from this study indicated wildfire suppression costs comprise 9% of total wildfire costs, with other short- and long-term costs comprising the bulk of wildfire expenses and damages. *Id.*

5. Volker C. Radeloff et al., *Rapid Growth of the U.S. Wildland-Urban Interface Raises Wildfire Risk*, 115 PROC. NAT'L ACAD. SCI. 3314 (2018), [https://www.fs.fed.us/nrs/pubs/jrnl/2018/nrs\\_2018\\_radeloff\\_001.pdf](https://www.fs.fed.us/nrs/pubs/jrnl/2018/nrs_2018_radeloff_001.pdf).

6. David E. Calkin et al., *How Risk Management Can Prevent Future Wildfire Disasters in the Wildland-Urban Interface*, 111 PROC. NAT'L ACAD. SCI. 746, 746–51 (2014), <http://www.pnas.org/content/pnas/111/2/746.full.pdf>.

7. Radeloff et al., *supra* note 5, at 3314.

8. *Id.*

9. *Id.* at 3316.

10. According to Radeloff et al., from 1990 to 2010, 109,000 homes were built in areas burned by wildfires in the past twenty-five years—an increase of 62% compared to a national growth rate of 29%. *Id.*

In parallel with increasing home development in the WUI are rising trends in wildfire activity. Exacerbated by changes in the climate—such as warming air temperatures, variable precipitation patterns, decreasing moisture levels, and earlier snowmelt—wildfires are bigger and lasting longer than in previous years.<sup>11</sup> In generating warmer, drier, and windier environmental conditions, climate change increases the likelihood of extreme wildfire events. Compared to the 1970s, the frequency of large wildfires (>1,000 acres) has increased by 140%; and in the West, the area burned has grown by nearly 400%.<sup>12</sup> In addition, wildfires are starting earlier in the spring and burning longer into the fall.<sup>13</sup> Compared to the 1970s, the wildfire season has been extended by nearly three months, and large wildfires burn more than seven times longer.<sup>14</sup>

Wildfire suppression is widely successful with more than 95% of all wildfires contained at initial attack.<sup>15</sup> For the most part, wildfires are only a concern when homes, resources, and people are threatened—a wildfire burning where there is no development or infrastructure is generally not a concern.<sup>16</sup> However, under extreme wildfire conditions and when a wildfire escapes initial attack, multiple homes can simultaneously burn and quickly overwhelm firefighting protection efforts.<sup>17</sup> Relatively small ignitions can rapidly escalate into uncontrollable urban conflagrations where suppression is no longer an effective or viable option.<sup>18</sup> We must therefore ask ourselves, are there other options beyond wildfire suppression in preventing a wildfire disaster?

This article argues that better land use planning can work in tandem with suppression efforts and other mitigation measures to reduce wildfire risk to homes and communities. Within the wildfire management discourse, principles of defensible space, landscape treatments, and vegetation control are well-known mitigation

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11. Anthony LeRoy Westerling, *Increasing Western U.S. Forest Wildfire Activity: Sensitivity to Changes in the Timing of Spring*, 371 PHIL. TRANSACTIONS ROYAL SOC. B. 1, 1 (June 5, 2016), <http://rstb.royalsocietypublishing.org/content/royptb/371/1696/20150178.full.pdf>; see also John T. Abatzoglou & A. Park Williams, *Impact of Anthropogenic Climate Change on Wildfire across Western U.S. Forests*, 113 PROC. NAT'L ACAD. SCI. 11770, 11770–75 (2016), <http://www.pnas.org/content/pnas/113/42/11770.full.pdf>.

12. Westerling, *supra* note 11, at 5–6. The author found a significant trend in the increasing frequency of large forest wildfires since the 1970s in the West, with an average of twenty additional large fires per decade. *Id.*

13. *Id.* at 8.

14. *Id.* Westerling found wildfire activity strongly correlated with warming and earlier spring snowmelt, with the largest fire years occurring in years with warm spring and summer temperatures and early spring snowmelt dates. *Id.* Fire seasons between 2003–2012 averaged more than eighty-four days longer than in 1973–1982. *Id.* In addition, “the average large wildfire burn time grew from nearly six days in 1973–1982 to nearly twenty days in 1983–1992, nearly thirty-seven days in 1993–2002, and over fifty days in 2003–2012.” *Id.*

15. Scott L. Stephens & Lawrence W. Ruth, *Federal Forest-Fire Policy in the United States*, 15 ECOLOGICAL APPLICATIONS 532, 539 (2005), <https://esajournals.onlinelibrary.wiley.com/doi/epdf/10.1890/04-0545>.

16. See Jack Cohen, *The Wildland-Urban Interface Fire Problem*, FOREST HIST. TODAY at 20 (Fall 2008), [https://www.fs.fed.us/rm/pubs\\_other/rmrs\\_2008\\_cohen\\_j002.pdf](https://www.fs.fed.us/rm/pubs_other/rmrs_2008_cohen_j002.pdf). In addition to protecting homes and people, the federal government will suppress wildfires that threaten key environmental resources and infrastructure such as watersheds and utility lines. *Id.* at 21.

17. *Id.* at 22.

18. *Id.*

strategies. Research has shown that managing the space immediately surrounding the home—known as the home ignition zone (HIZ)—can significantly reduce the potential for a structure to ignite.<sup>19</sup> Viewing wildfire mitigation in the context of maintaining the HIZ centers responsibility for reducing structure losses and preventing urban conflagrations on the homeowner.<sup>20</sup> There are opportunities for land use planning to play an enhanced role in wildfire mitigation by requiring homeowners to implement and maintain HIZ principles to reduce home ignitability. Similarly, land use planning can equip local governments with the authority and tools to better manage new and old developments in the WUI and other areas at high risk to wildfires. By regulating where and under what conditions local governments permit development in wildfire-prone lands—including the layout of subdivisions, placement of roads and infrastructure, and requirement of ignition-resistant building materials—land use planning can direct development to occur safely and responsibly.

The next section provides a brief history of federal policy and response to the growing wildfire problem in the West.<sup>21</sup> Over time, the federal government has shifted forest management practices based on current understanding of wildfire risks. The following section introduces the concept of the wildland-urban interface (WUI) and describes characteristics defining the WUI as it relates to wildfires. Given the trajectory of current and projected growth in the WUI, it is imperative that local governments become more involved in the planning of WUI development to prevent urban conflagrations and disasters. The fourth section of this article describes a diverse set of land use planning tools to reduce wildfire risks and provides examples of best practices applied in communities. The article concludes with a solutions-oriented approach and describes how the Community Planning Assistance for Wildfire (CPAW) program is providing local communities with land use assistance and technical resources to mitigate wildfire risk in the WUI.

## II. HISTORY OF WILDFIRE POLICY

Wildfire plays a key role in ecosystem functioning, including the recycling of nutrients, promoting forest succession, and reducing fuel loads.<sup>22</sup> For centuries, Native Americans used wildfires to modify the landscape for hunting, travel, and cultivation purposes.<sup>23</sup> During the homesteading era of the 1800s, wildfires were used

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19. See Jack D. Cohen & Bret W. Butler, *Modeling Potential Structure Ignitions from Flame Radiation Exposure with Implications for Wildland/Urban Interface Fire Management*, 13 FIRE & FOREST METEOROLOGY CONF. 81, 81 (1996), [https://www.fs.fed.us/rm/pubs\\_other/rmrs\\_1998\\_cohen\\_j001.pdf](https://www.fs.fed.us/rm/pubs_other/rmrs_1998_cohen_j001.pdf); see also Steve L. Quarles et al., *Home Survival in Wildfire-Prone Areas: Building Materials and Design Considerations*, 8393 U.C. DAVIS AGRIC. & NAT. RES. 1, 1 (2010), <https://escholarship.org/content/qt4vt8w5qk/qt4vt8w5qk.pdf>.

20. Calkin et al., *supra* note 6, at 746.

21. The West was highlighted in this article because a majority of wildfires burn in this region compared to the rest of the country, with more than 74 million acres burned since 2000, or 64% of the total area burned (106 million acres or 92% of the total area burned if Alaska is included). In this context, the West is considered Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming. See, e.g., KATIE HOOVER, CONG. RESEARCH SERV., RL 75700, WILDFIRE STATS. (2018), <https://fas.org/spp/crs/misc/IF10244.pdf>.

22. See, e.g., ANDREW C. SCOTT ET AL., FIRE ON EARTH: AN INTRODUCTION (2014).

23. See generally STEPHEN PYNE, AMERICA'S FIRES: A HISTORICAL CONTEXT FOR POLICY AND PRACTICE (2010). See also Juli G. Pausas & Jon E. Keeley, *A Burning Story: The Role of Fire in the History of Life*, 59

to advance the western migration of European settlers.<sup>24</sup> By burning large swaths of timber and prairie and through slash-and-burn techniques, land was cleared for agriculture, development, and railroad construction.<sup>25</sup> Sometimes the intended fires would burn out of control and result in extensive, and at times deadly, wildfires. For example, in 1871 the Peshtigo Fire in northeastern Wisconsin started from high winds fanning smaller fires being used to clear timber.<sup>26</sup> Killing more than 1,500 people and burning 1.2 million acres, the Peshtigo Fire remains America's worst wildfire tragedy.<sup>27</sup>

As more people began moving to the West, the federal government soon recognized the resource value of the region's vast timbered lands. In 1891, Congress passed the Forest Reserve Act which set aside forests as part of the public domain, nominally closing these lands to settlement and resource extraction.<sup>28</sup> Reversing a tradition of generous land disposal, the Forest Reserve Act set precedent for the federal protection of public lands and secured government ownership over much of the lands in the West.<sup>29</sup> To better administer the use and management of the forest reserves, the National Forest Service was established in 1905.<sup>30</sup> At this time, the Forest Transfer Act formally shifted control of the forest reserves from the General Land Office in the Department of Interior to the Bureau of Forestry in the Department of Agriculture.<sup>31</sup>

That same year, in 1905, Gifford Pinchot was appointed as the first Chief of the Forest Service; his main concern was to ensure the sustained yield, multiple use, and protection of the forest resources for local communities.<sup>32</sup> Under Pinchot's direction, the Forest Service sought to promote the efficient use of natural resources through coordinated, centrally directed decisions made by forestry professionals.<sup>33</sup> An early focus of this strategy was to protect natural resources from damages caused by wildfire.<sup>34</sup> To fund these efforts, Congress passed an appropriations bill in 1908 allowing the Forest Service to request advance funds to cover emergency

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BIOSCIENCE 593, 598 (2009), <http://www.bioone.org/doi/pdf/10.1525/bio.2009.59.7.10>; Hutch Brown, *Wildland Burning by American Indians in Virginia*, 60 FIRE MGMT. TODAY 29 (2000), [https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/fsbdev3\\_000385.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_000385.pdf).

24. Michael P. Dombeck et al., *Wildfire Policy and Public Lands: Integrating Scientific Understanding with Social Concerns Across Landscapes*, 18 CONSERVATION BIOLOGY 883, 884 (2004), <http://fpf.forestry.oregonstate.edu/system/files/Dombeck%20Williams%202004.pdf>.

25. *Id.*

26. STEPHEN PYNE, *FIRE IN AMERICA: A CULTURAL HISTORY OF WILDLAND AND RURAL FIRE* 206 (1982); see also Dombeck et al., *supra* note 24, at 884.

27. PYNE, *supra* note 26. See also Dombeck et al., *supra* note 24, at 884.

28. JOHN ISE, *THE U.S. FOREST POLICY* 109 (1920).

29. Glen Robinson, *The Forest Service: A Study of Public Land Management* 155 (1975).

30. ISE, *supra* note 28, at 191.

31. Terry West, *Forestry Minihistories: Forest Transfer Act of 1905*, 90 J. FORESTRY 44 (1992), <https://academic.oup.com/jof/article-abstract/90/6/44/4635580?redirectedFrom=PDF>.

32. *Id.*

33. George Busenberg, *Wildfire Management in the US: The Evolution of a Policy Failure*, 21 REV. POL'Y RES. 145, 149 (2004), <http://faculty.washington.edu/stevehar/Busenberg2004.pdf>.

34. *Id.*

firefighting costs.<sup>35</sup> If the agency overspent its budget, Congress would pass supplemental appropriations to cover the deficit.<sup>36</sup> With this provision, the Forest Service was provided the financial flexibility to pursue aggressive wildfire suppression.<sup>37</sup> The early custom of overspending on firefighting costs would continue to shape administrative practices well into the twenty-first century.

In 1910 the National Forest Service was still a fledgling agency when large wildfires scorched much of the Northwest. That year, multiple small wildfires burning in Washington, Idaho, and Montana merged into one massive firestorm that became known as the Great Blowup, or the Great Fires.<sup>38</sup> Sweeping through the northern Rockies and fueled by especially dry and windy conditions, the Great Blowup destroyed several towns in its path, including much of Wallace, Idaho.<sup>39</sup> Within 36 hours, 86 people were dead, more than 3 million acres were burned, and the entire fire protection front was overwhelmed.<sup>40</sup> Smoke from the wildfires was seen as far away as Boston to the east and 500 miles west into the Pacific Ocean.<sup>41</sup>

The wildfires of 1910 contributed to early forest policy and management in two significant ways. First, the Forest Service was reaffirmed as the government's main arm in responding to wildfires. The Great Fires became a defining moment for the Forest Service.<sup>42</sup> The three Forest Service chiefs following Pinchot were all former firefighters who were personally involved with the Great Fires.<sup>43</sup> Well acquainted with the potential devastation wrought by uncontrolled wildfires, the chiefs and the agency they led made it their primary mission to extinguish all wildfires upon initial attack.<sup>44</sup> As Chief Forester Henry Graves remarked in 1913, "the necessity of preventing losses from forest fires requires no discussion. It is the fundamental obligation of the Forest Service and takes precedence over all other duties and activities."<sup>45</sup>

Secondly, the wildfires of 1910 tested the performance and fire protection capacities of the Forest Service. Fighting the wildfires required 10,000 men, most of the Army reserves based in the Northwest, and a substantial amount of resources.<sup>46</sup> When the wildfires were finally extinguished in late fall, the Forest Service had accrued a \$1.1 million deficit and an estimated \$25 million in lost timber revenue.<sup>47</sup> Recognizing the need for improved wildfire protection, Congress substantially in-

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35. *Id.*

36. *Id.*

37. *See generally* STEPHEN PYNE, *YEAR OF THE FIRES: THE STORY OF THE GREAT FIRES OF 1910* (2001).

38. PYNE, *supra* note 23, at 26.

39. *See generally* PYNE, *supra* note 23.

40. *See generally* TIMOTHY EGAN, *THE BIG BURN: TEDDY ROOSEVELT AND THE FIRE THAT SAVED AMERICA* (2009).

41. John James Little, *1910 Forest Fires in Montana and Idaho: Their Impact on Federal and State Legislation* 75 (1968) (M.A. thesis, University of Montana), <https://scholarworks.umt.edu/cgi/viewcontent.cgi?article=2474&context=etd>.

42. PYNE, *supra* note 23, at 26–30.

43. *Id.*

44. *Id.*

45. Cohen, *supra* note 16, at 21.

46. PYNE, *supra* note 23, at 26. *See also* Busenberg, *supra* note 33, at 149.

47. Busenberg, *supra* note 33, at 149. DAVID E. CONRAD, AM. RES. GRP., LTD, *THE LAND WE CARED FOR...A HISTORY OF THE FOREST SERVICE'S EASTERN REGION* 28 (1997).

creased Forest Service appropriations the following year to provide funding for fire-fighting and permanent improvements such as transportation routes, communication lines, and lookout towers.<sup>48</sup> An additional \$1 million was also appropriated for “extraordinary emergenc[ies].”<sup>49</sup> Financially backed by Congress and with high public expectations, the Forest Service considered wildfire prevention their priority directive.<sup>50</sup>

For the following sixty years, wildfire suppression dominated the federal government’s outlook on forest management.<sup>51</sup> With unforeseeable long-term implications, the zero-tolerance approach toward wildfire significantly altered the structure, density, and composition of the country’s forests.<sup>52</sup> Focused almost exclusively on preventing wildfire damages to natural resources and communities, the suppression policy neglected to consider the accumulation of hazardous fuels and forest regeneration.<sup>53</sup> As a result, decades of wildfire suppression created a cyclical process of fuel buildup leading to larger and more severe wildfires in the long-term—what is referenced today as the “wildfire paradox.”<sup>54</sup>

Early legislation further enabled the ubiquitous suppression of wildfires by expanding the administrative reach of the National Forest Service. For instance, the Weeks Act (1911) and the Clarke-McNary Act (1924) allowed the federal government to work cooperatively with state and private landowners on forest management.<sup>55</sup> By entering into cooperative agreements, the Forest Service provided states with matching funds for wildfire protection which mainly came in the form of fire control.<sup>56</sup> Essentially nationalizing the Forest Service’s “no-burn” policy, the cooperative agreements compelled landowners to suppress any ignitions on their lands if they were to receive federal funding.<sup>57</sup> Despite critics of the no-burn policy and research suggesting the long-term benefits of prescribed (light) burning, the Forest Service’s main agenda of wildfire exclusion persisted well into the post-World War II era.<sup>58</sup>

During the 1930s, the establishment of the Civilian Conservation Corps (CCC) provided the manpower and means to implement widespread wildfire suppression.<sup>59</sup> The CCC was broadly deployed to construct the nation’s wildfire protection

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48. 1911 DEP’T OF AGRIC. ANN. REP. 15, at 368–72.

49. CONRAD, *supra* note 47, at 28.

50. Stephens & Ruth, *supra* note 15, at 533.

51. *Id.*

52. Geoffrey H. Donovan & Thomas C. Brown, *Be Careful What You Wish For: The Legacy of Smokey Bear*, 5 FRONTIERS ECOLOGY & ENV’T 73, 73 (2007).

53. Busenberg, *supra* note 33, at 146–48.

54. Calkin et al., *supra* note 6, at 747.

55. See generally Lincoln Bramwell, *1911 Weeks Act: The Legislation that Nationalised the US Forest Service*, 30 J. ENERGY & NAT. RESOURCES L. 325 (2012); Busenberg, *supra* note 33, at 151.

56. Busenberg, *supra* note 33, at 150.

57. PYNE, *supra* note 23, at 30.

58. Donovan & Brown, *supra* note 52, at 75.

59. Charles Davis, *Western Wildfires: A Policy Perspective*, 23 REV. POL’Y RES. 115, 117 (2006).

infrastructure, including trails, roads, communication lines, fuel breaks, and observation posts.<sup>60</sup> The CCC was also organized into firefighting crews and was important in monitoring wildfires igniting in the backcountry.<sup>61</sup> With much of America's forests now under observation, wildfire suppression soon overshadowed all other land management options.

Popular opinion regarding extinguishing all wildfires was solidified by the Tillamook Fire in 1933. Burning nearly 300,000 acres, the Tillamook Fire was fueled by warm temperatures and windy conditions.<sup>62</sup> At the time, it was the largest wildfire in the Northwest, and its rapid spread across the Oregon forest renewed pressure on the Forest Service to control wildfires as soon as they started.<sup>63</sup> In response, the agency adopted a "10 a.m. policy" which sought to extinguish all wildfires by the following morning.<sup>64</sup> According to the policy, "the National Forest calls for fast, energetic, and thorough suppression of all fires in all locations, during possibly dangerous fire weather . . . . Failing in this effort, the attack each succeeding day will be planned and executed with the aim, without reservation, of obtaining control before ten o'clock the next morning."<sup>65</sup>

Wildfire prevention came to the forefront of popular culture in 1944 when the Forest Service unveiled Smokey Bear. One of the most successful public awareness campaigns ever, Smokey Bear was more recognizable than the President of the United States at the time.<sup>66</sup> Following World War II, wildfire suppression efforts were heavily bolstered by the addition of equipment surplus from the war.<sup>67</sup> Applying similar military tactics on wildfires as in combat, wildfire suppression became mechanized by the use of airplanes, trucks, and tanks.<sup>68</sup> By the late 1940s, America had some of the most equipped and proficient wildfire protection crews in the world.<sup>69</sup>

Not until the late 1960s did a gradual paradigm shift emerge regarding the role of wildfire on the landscape. A growing body of literature demonstrated the ecological benefits of wildfire in revitalizing vegetation, reducing fuels, and preventing future high-intensity wildfires.<sup>70</sup> In 1971, the 10 a.m. policy was slightly

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60. Busenberg, *supra* note 33, at 151; *see also* LA VAUGHN VANDERBURG KEMNOW, FIRE LOOKOUTS: CIVILIAN CONSERVATION CORPS (2018).

61. Davis, *supra* note 59, at 117.

62. Charles I. Dague, *The Weather of the Great Tillamook, Oregon, Fire of August 1933*, U.S. WEATHER BUREAU MONTHLY WEATHER REV. at 227 (July 1934), <ftp://ftp.library.noaa.gov/docs.lib/htdocs/rescue/mwr/062/mwr-062-07-0227.pdf>. For reference to the 300,000 acres burned, *see* PETER D. A. TEENSMAN, ET AL., BUREAU LAND MGMT., PRELIMINARY RECONSTRUCTION AND ANALYSIS OF CHANGE IN FOREST STAND AGE CLASSES OF THE OREGON COAST RANGE FROM 1850 TO 1940 2 (1991).

63. Davis, *supra* note 59, at 117.

64. *Id.*

65. JULIE K. GORTE & ROSS W. GORTE, USDA FOREST SERVICE, APPLICATION OF ECONOMIC TECHNIQUES TO FIRE MANAGEMENT — A STATUS REVIEW AND EVALUATION (1979), [https://www.fs.fed.us/rm/pubs\\_int/int\\_gtr053.pdf](https://www.fs.fed.us/rm/pubs_int/int_gtr053.pdf); *see also* Donovan & Brown, *supra* note 52, at 75.

66. Dombeck et al., *supra* note 24, at 884.

67. John W. Chambers, *The Evolution of Wildland Fire Management and Policy*, 48 FIRE MGMT. NOTES 5, 5–6 (1987); *see also* Davis, *supra* note 59, at 117–18.

68. Chambers, *supra* note 67, at 5–6.

69. Dombeck et al., *supra* note 24, at 884.

70. Geoffrey H. Donovan, et al., *Incentives and Wildfire Management in the United States*, in THE ECONOMICS OF FOREST DISTURBANCES 323–30 (Thomas Holmes, et al. eds., 2008).

amended to containing all wildfires to 10-acres or less, and shortly after, the policy was dismissed entirely.<sup>71</sup> In some national parks, like Sequoia and Yosemite National Parks, natural wildfires were allowed to burn under certain conditions.<sup>72</sup> Under the auspices of “Natural Fire Management Programs,” a let-it-burn policy was applied to natural wildfires occurring in the wilderness during specific times of the year.<sup>73</sup>

The prescribed natural fire approach soon came under heavy public and political scrutiny. In 1978, the Ouzel Fire was allowed to burn in Rocky Mountain National Park for more than a month before it came dangerously close to a neighboring community.<sup>74</sup> A review of the event later concluded the natural burn fire plan was not properly implemented and was lacking important ecological knowledge.<sup>75</sup> As a result, prescribed natural burning was temporarily suspended in Rocky Mountain National Park.<sup>76</sup> Ten years later, the Yellowstone Fires of 1988 ushered in a new era of wildfire awareness.<sup>77</sup> That summer, ten individual fires—both natural and human-ignited—burned nearly 1.4 million acres in and around Yellowstone National Park.<sup>78</sup> As a result, the Secretaries of Agriculture and Interior convened a policy review team to evaluate wilderness wildfire policies.<sup>79</sup> Although the review team reaffirmed the value of wildfire, they encouraged more accountability and inter-agency cooperation in wildfire response.<sup>80</sup> Pending the approval of new wildfire plans, all prescribed natural burning was suspended in national parks and wilderness areas.<sup>81</sup>

In 1994, Colorado’s South Canyon Fire triggered another joint review of wildfire policy. Although suppression action was taken two days after ignition, the wildfire eventually killed fourteen firefighters.<sup>82</sup> As an outcome of the South Canyon incident, Congress launched a comprehensive review and update of federal wildland fire policy, the first in decades.<sup>83</sup> In 1995, the Federal Wildland Fire Management Policy and Program Review recognized wildfire was part of a larger problem and considered the role humans were playing in influencing wildfire behavior.<sup>84</sup> The report prioritized the protection of firefighters, public safety, resources, and community while also acknowledging there was a place for nature to take its

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71. *Id.*

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

73. Donovan et al., *supra* note 70, at 326.

74. Wagtenonk, *supra* note 72, at 8.

75. *Id.*

76. *Id.*

77. *Id.*

78. *Id.*

79. *Id.*

80. Wagtenonk, *supra* note 72, at 8.

81. *Id.* at 8–9.

82. *Id.* at 9.

83. *Id.*

84. U.S. DEP’T OF INTERIOR ET AL., REVIEW AND UPDATE OF THE 1995 FEDERAL WILDLAND FIRE MANAGEMENT POLICY 7–8 (2001), [https://www.nifc.gov/PIO\\_bb/Policy/FederalWildlandFireManagementPolicy\\_2001.pdf](https://www.nifc.gov/PIO_bb/Policy/FederalWildlandFireManagementPolicy_2001.pdf).

course.<sup>85</sup> Challenges related to previous years of wildfire suppression were integrated into a current understanding of landscape-level resource management and collaborative landowner decision-making.<sup>86</sup> The report read: “[A]gencies and the public must change their expectation that all wildfires can be controlled or suppressed. No organization, technology, or equipment can provide absolute protection when unusual fuel build-ups, extreme weather conditions, multiple ignitions, and extreme fire behavior come together to form a catastrophic event.”<sup>87</sup>

The 1995 policy review was also one of the first widely circulated government documents to identify the challenges associated with wildfires in the wildland-urban interface (WUI).<sup>88</sup> According to the review, the problem with wildfire response in the WUI involved mixed private and public landownership as well as an increasing number of homes.<sup>89</sup> Further, public perception of wildfire in the WUI was low despite the high values at risk.<sup>90</sup> The review went on to identify several locally-based solutions including hazard mitigation and fuels reduction through zoning regulations, federal-state fire protection agreements, improved fire response apparatuses, and involving insurance companies in rating wildfire-prone properties.<sup>91</sup> Recommendations from the 1995 policy review established the guiding principles and legislative framework for wildfire management over the next twenty years.<sup>92</sup>

Following the severe wildfire season of 2000, President Clinton directed the Secretaries of Agriculture and Interior to develop an improved strategy to manage and reduce the impacts of wildland fires.<sup>93</sup> The report, entitled *Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000*, was released in 2001 and was referred to as the National Fire Plan (NFP).<sup>94</sup> Aligning with the 1995 policy review, the NFP focused on firefighter safety and ensuring sufficient future resources, forest rehabilitation, suppression, fuels reduction, and rural community assistance.<sup>95</sup> At the same time the NFP was released, Congress passed the Interior and Related Agencies Appropriations Act, PL 106-291, which directed the secretaries of Agriculture and Interior to coordinate with the Western Governors’ Association (WGA) on a national 10-Year

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85. U.S. DEP’T OF INTERIOR & U.S. DEP’T OF AGRIC., FEDERAL WILDLAND FIRE MANAGEMENT POLICY AND PROGRAM REVIEW iii (1995), [https://www.forestsandrangelands.gov/strategy/documents/foundational/1995\\_fed\\_wildland\\_fire\\_policy\\_program\\_report.pdf](https://www.forestsandrangelands.gov/strategy/documents/foundational/1995_fed_wildland_fire_policy_program_report.pdf) [hereinafter 1995 POLICY REVIEW].

86. *Id.* at 2.

87. *Id.* at iv.

88. *See id.* at 23.

89. *Id.* at 21–23.

90. *Id.* at 23.

91. 1995 POLICY REVIEW, *supra* note 85, at 24.

92. For similar principles outlined in the original 1995 policy, *see* U.S. DEP’T OF AGRIC. & U.S. DEP’T OF INTERIOR, NATIONAL COHESIVE WILDLAND FIRE MANAGEMENT STRATEGY (2014), <https://www.forestsandrangelands.gov/documents/strategy/strategy/CSPPhaseIIINationalStrategyApr2014.pdf>.

93. U.S. DEP’T OF AGRIC. & DEP’T OF INTERIOR, MANAGING THE IMPACT OF WILDFIRES ON COMMUNITIES AND THE ENVIRONMENT: A REPORT TO THE PRESIDENT IN RESPONSE TO THE WILDFIRES OF 2000 1 (2000), <https://www.doi.gov/sites/doi.gov/files/migrated/pmb/owf/upload/2000-Report-to-the-President.pdf>.

94. FORESTS & RANGELANDS, WILDLIFE FIRE MANAGEMENT: THE NATIONAL FOREST PLAN 1 (2007), [https://www.forestsandrangelands.gov/documents/resources/reports/2007/nfp2007\\_budget\\_justification.pdf](https://www.forestsandrangelands.gov/documents/resources/reports/2007/nfp2007_budget_justification.pdf).

95. *Previous Wildland Fire Management Initiatives*, FORESTS & RANGELANDS, <https://www.forestsandrangelands.gov/resources/overview/> (last visited Mar. 15, 2019).

Comprehensive Strategy for implementing the NFP.<sup>96</sup> Both the NFP and the 10-Year Comprehensive Strategy recognized severe wildland fires and associated suppression costs would increase if alternative methods, like fuels reduction projects, were not implemented.<sup>97</sup>

In 2003 the NFP was augmented with the Healthy Forest Restoration Act (HFRA) signed by President Bush.<sup>98</sup> The HFRA sought to restore the ecological benefits of wildfires by establishing programs of aggressive thinning, prescribed burning, and replanting to create open conditions in forests.<sup>99</sup> Despite protests from conservationists, the HFRA expedited the approval of proposed fuels reduction projects and stymied litigation by altering permissible activities regulated by the National Environmental Policy Act (NEPA).<sup>100</sup> In effect, the HFRA streamlined the environmental review process by trimming down “bureaucratic red tape” and widely granting fuels reduction projects on public lands.<sup>101</sup>

Recognizing suppression costs were consistently depleting the Forest Service budget, Congress passed the Federal Land Assistance, Management and Enhancement (FLAME) Act in 2009.<sup>102</sup> FLAME reconfigured the method for allocating the Forest Service’s wildfire budget to better reflect recent trends in wildfire costs.<sup>103</sup> Until then, the allocation of the agency’s budget was based on an ineffective and disruptive system of a rolling ten-year average.<sup>104</sup> Under this model, the Forest Service requested funds for their upcoming season based on the average wildfire costs for the previous ten years.<sup>105</sup> Under the new legislation, future suppression funding was calculated based on the most recent data and methods from the previous year.<sup>106</sup>

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96. Toddi A. Steelman & Caitlin A. Burke, *Is Wildfire Policy in the U.S. Sustainable?*, 33 J. FORESTRY 67, 68 (2007).

97. Stephens & Ruth, *supra* note 15, at 534.

98. Cathy Whitlock, *Forests, Fires and Climate*, 432 NATURE 28 (2004), <https://www.nature.com/articles/432028a>.

99. *Id.*

100. Charles Davis, *Western Wildfires: A Policy Perspective*, 23 REV. POL’Y RES. 115, 124 (2006).

101. Toddi A. Steelman & Melissa Elefante DuMond, *Serving the Common Interest in U.S. Forest Policy: A Case Study of the Healthy Forests Restoration Act*, 43 ENV’T MGMT. 396, 397 (2009), <https://link.springer.com/content/pdf/10.1007%2Fs00267-008-9264-6.pdf>.

102. *The Federal Land Assistance, Management and Enhancement (FLAME) Act of 2009 Report to Congress* 3 (2009), [https://www.forestsandrangelands.gov/documents/strategy/reports/2\\_ReportToCongress03172011.pdf](https://www.forestsandrangelands.gov/documents/strategy/reports/2_ReportToCongress03172011.pdf).

103. Caitlyn Pollihan & Cecilia Clavet, *Briefing Paper on the Federal Land Assistance, Management and Enhancement (FLAME) Act*, COUNCIL OF W. STATE FORESTERS 1 (2009), [http://www.thewflc.org/news\\_pdf/344\\_pdf.pdf](http://www.thewflc.org/news_pdf/344_pdf.pdf).

104. *Id.*

105. *The Rising Costs of Wildfire Operations: Effects on the Forest Service’s Non-Fire Work*, U.S. FOREST SERV. & U.S. DEP’T OF AGRIC. 3 (Aug. 4, 2015), <https://www.fs.fed.us/sites/default/files/2015-Fire-Budget-Report.pdf>.

106. *Obama Signs Bill to Help Agencies Manage Skyrocketing Wildfire Suppression Costs*, WILDERNESS SOC’Y (Nov. 2, 2009), <https://wilderness.org/press-release/obama-signs-bill-help-agencies-manage-skyrocketing-wildfire-suppression-costs>.

To guide the directives outlined in FLAME, a National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) was developed.<sup>107</sup> Released in 2014, the Cohesive Strategy took a holistic view of wildfire on the landscape with a mission to both safely extinguish wildfires when required while allowing others to burn when no homes, people, or values are threatened.<sup>108</sup> Orienting the approach were the three themes of restoring resilient landscapes, creating fire-adapted communities, and improving wildfire response.<sup>109</sup> Coordinated by the Wildland Fire Leadership Council, recommendations from the Cohesive Strategy continue to inform current federal wildfire policy.

At the time, the Cohesive Strategy was one of the most comprehensive efforts to address the seemingly insurmountable task of abating wildfire suppression costs while also protecting communities from escalating wildfire risks. By 2017, federal wildfire suppression appropriations were more than \$2 billion a year—more than six times the average amount spent on suppression activities during the 1990s.<sup>110</sup> At this rate, estimated wildfire suppression costs would consume nearly 70% of the Forest Service budget by 2021.<sup>111</sup> Traditionally, a shortfall in the Forest Service budget required “borrowing” funds from other land management programs.<sup>112</sup> During severe wildfire seasons, wildfire borrowing drained agency budgets and compromised important outdoor and recreational services such as watershed management, infrastructure repairs, and forest treatment projects.<sup>113</sup>

To end the cycle of deficit spending and wildfire borrowing, a massive appropriations bill was passed in 2018.<sup>114</sup> Captured as a provision in the omnibus bill, the “wildfire fix” treats wildfires similar to other natural disasters and establishes a reserve fund to use during extreme wildfire seasons. Starting in 2020, a wildfire disaster fund of \$2.25 billion will be created and gradually added to over the following ten years.<sup>115</sup> When suppression costs exceed annual appropriations, based on FY2015 levels, funds can be withdrawn from the reserve budget rather than borrowing from non-fire programs.<sup>116</sup> The spending bill also increases funding for fuels-reduction projects, grants environmental review exemptions for projects meeting

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107. *A National Cohesive Wildland Fire Management Strategy*, U.S. DEP’T OF INTERIOR & U.S. DEP’T OF AGRIC. (2014), [https://www.fs.fed.us/rm/pubs\\_other/rmrs\\_2011\\_usda\\_fs001.pdf](https://www.fs.fed.us/rm/pubs_other/rmrs_2011_usda_fs001.pdf). This National Strategy was jointly released by the U.S. Department of Interior and Agriculture. The National Strategy was developed over three separate phases, with the final document released in 2014. *Id.*

108. *Id.*

109. GORTE & GORTE, *supra* note 65.

110. *Federal Firefighting Costs*, *supra* note 1.

111. Cecilia Clavet, *Wildfire Funding in the Omnibus Bill: What You Need to Know*, FIRE ADAPTED CMTYS. LEARNING NETWORK (April 26, 2018), <https://fireadaptednetwork.org/wildfire-funding-omnibus-bill-need-know/>.

112. *Id.*

113. *Id.*

114. H.R. 1625, 115th Cong. (2018), <https://www.congress.gov/bill/115th-congress/house-bill/1625/text>.

115. *Id.*

116. *FY2018 Omnibus Appropriations Act: Summary of Appropriations Provisions*, U.S. HOUSE REPRESENTATIVES, <https://www.congress.gov/resources/display/content/Appropriations+for+Fiscal+Year+2018#AppropriationsforFiscalYear2018-omnibusappropriations>.

categorical exclusion, extends land stewardship programs, and initiates the process of wildfire risk mapping.<sup>117</sup>

The 2018 wildfire fix was widely applauded by non-governmental organizations, industries, and policymakers for stabilizing agency budgets and ending wildfire borrowing.<sup>118</sup> While the new legislation provides the Forest Service with the financial flexibility to accommodate soaring suppression costs, it reaffirms the government's prioritization of fire control and the protection of people and homes at any price. In an era of megafires and increasing volatility in climate, continued reliance on firefighting to suppress wildfires is unsustainable and dangerous. As wildfires continue to grow in size and severity, and as more people build homes in wildfire-prone areas like the WUI, other wildfire mitigation methods will have to supplement suppression efforts to make communities truly fire-adapted.

### III. TRENDS IN THE WILDLAND-URBAN INTERFACE

The wildland-urban interface (WUI)—defined as “the area where [structures] and other human development meet or intermingle with undeveloped wildland”<sup>119</sup>—is the fastest growing land use type in the conterminous United States.<sup>120</sup> Often boasting high levels of natural amenities such as forests and open space, the WUI is appealing for its recreational and scenic opportunities.<sup>121</sup> As a result, the WUI has experienced consistent residential growth in recent decades with 25 million more people living there in 2010 compared to 1990.<sup>122</sup> During this time period, 12.7 million new homes were added—a 33% increase.<sup>123</sup> Despite the WUI covering less than 10% of the country's land area, 41% of all new home development occurred there from 1990 to 2010.<sup>124</sup>

The growing presence of people in the WUI is a concern because the highest number of homes burn in the WUI.<sup>125</sup> Structures in the WUI are often dispersed and occur on relatively large lots. Protecting these homes from wildfire is more difficult

117. H.R. 1625, 115th Cong. (2018), <https://www.congress.gov/bill/115th-congress/house-bill/1625/text>.

118. See, e.g., Kate Irby, *Spending Bill That Just Passed Includes Long-Sought Funding Fix for Fighting Wildfires*, IDAHO STATESMAN (March 25, 2018), <https://www.idahostatesman.com/news/nation-world/article206781114.html>; *Secretary Perdue Applauds Fire Funding Fix in Omnibus*, U.S. DEP'T OF AGRIC. (Mar. 23, 2018), <https://www.usda.gov/media/press-releases/2018/03/23/secretary-perdue-applauds-fire-funding-fix-omnibus>; Gregory Scruggs, *Wildfire Funding Fix Will Take 'A Period of Years' to Protect U.S. Forests*, REUTERS (March 26, 2018), <https://www.reuters.com/article/us-usa-fires-forests/wildfire-funding-fix-will-take-a-period-of-years-to-protect-u-s-forests-idUSKBN1H21AT>.

119. There are many definitions of the wildland-urban interface. The definition used in this article comes from the U.S. Department of Agriculture, as cited by Volker Radeloff et al., *The Wildland-Urban Interface in the U.S.*, 15 *ECOLOGICAL APPLICATIONS* 799 (2005), [https://www.nrs.fs.fed.us/pubs/jrnl/2005/nc\\_2005\\_radeloff\\_001.pdf](https://www.nrs.fs.fed.us/pubs/jrnl/2005/nc_2005_radeloff_001.pdf).

120. Sebastián Martinuzzi et al., *The 2010 Wildland-Urban Interface of the Conterminous U.S. (Research Map NRS-8)*, USDA FOREST SERV. N. RES. STATION (2015); Radeloff et al., *supra* note 119, at 800–05.

121. See Patricia Gude et al., *Potential for Future Development on Fire-Prone Lands*, 106 *J. FORESTRY* 198 (2008).

122. Radeloff, *supra* note 5.

123. *Id.*

124. *Id.*

125. *Id.*

and costly due to terrain, evacuation procedures, and the amount of resources required.<sup>126</sup> In addition, an increase in the number of people living in the WUI correlates with a rise in the frequency of human-ignited wildfires.<sup>127</sup> Humans are responsible for starting a majority of wildfires, “accounting for 84% of all wildfires and 44% of total area burned.”<sup>128</sup> In other words, as more people relocate to the WUI and the number of homes increases, so does the likelihood of more wildfires starting.

More housing in the WUI makes it challenging for the Forest Service and other state and federal agencies to manage wildfire on nearby public lands. Differences in perceived wildfire risk, concern over the degradation of natural amenities, and smoke impacts discourage agencies from allowing natural wildfires to burn and to reduce fuels through thinning and prescribed management.<sup>129</sup> For example, the Forest Service manages 193 million acres of land, and 62 to 82 million acres need forest treatment.<sup>130</sup> In recent years, the agency has treated between three to five million acres annually or around 5% of the amount of land requiring treatment.<sup>131</sup> Even if treatment efforts increase, climate change is altering historic wildfire regimes and exacerbating extreme wildfire conditions.<sup>132</sup> Unable to keep up with the pace and scale of increasing wildfire risk, forest treatments alone cannot effectively mitigate wildfire risk to homes and communities.<sup>133</sup>

Coexisting with wildfire requires a cultural shift in public and agency expectations regarding the risks of living in wildfire-prone areas. When wildfires occur in the WUI, there is tremendous public, media, and political pressure on federal agencies to ensure that wildfires do not harm private property, endanger lives, or threaten socially valued resources.<sup>134</sup> The persistence of these assumptions places exceedingly high standards on firefighters and transfers sole responsibility of home or property protection from the individual to the government.<sup>135</sup> Since the late 1990s, research has shown the value and overall effectiveness of reducing fuels

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126. Gude et al., *supra* note 121.

127. Jennifer Balch et al., *Human-Started Wildfires Expand the Fire Niche Across the U.S.*, PROC. NAT'L ACAD. SCI. 4 (2017), [https://www.researchgate.net/publication/316680573\\_Human-started\\_wildfires\\_expand\\_the\\_fire\\_niche\\_across\\_the\\_United\\_States](https://www.researchgate.net/publication/316680573_Human-started_wildfires_expand_the_fire_niche_across_the_United_States).

128. *Id.*

129. See Evan Hjerpe et al., *Forest Density Preferences of Homebuyers in the Wildland-Urban Interface*, 70 FOREST POL'Y ECON. 56 (2016), <https://www.sciencedirect.com/science/article/pii/S1389934116300995>.

130. Marilyn Buford et al., *From Accelerating Restoration to Creating and Maintaining Resilient Landscapes and Communities Across the Nation*. U.S. DEP'T OF AGRIC. 4 (2015), <https://www.fs.fed.us/sites/default/files/accelerating-restoration-update-2015-508-compliant.pdf>.

131. *Id.*

132. Tania Schoennagel et al., *The Interaction of Fire, Fuels, and Climate Across Rocky Mountain Forests*, 54 BIOSCIENCE 661, 673 (2004), <http://spot.colorado.edu/~schoenna/images/Schoennagel2004BioScience.pdf>.

133. *Id.*

134. Scott Stephens et al., *U.S. Federal Fire and Forest Policy: Emphasizing Resilience in Dry Forests*, 7 ECOLOGICAL SOC'Y AM. 1 (2016), <https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.1584>.

135. See Mark Finney & Jack Cohen, *Expectation and Evaluation of Fuel Management Objectives*, 29 USDA FOREST SERV. PROCEEDINGS 353, 353–54 (2003), [https://www.fs.fed.us/rm/pubs/rmrs\\_p029/rmrs\\_p029\\_351\\_366.pdf](https://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_351_366.pdf).

within the home ignition zone (HIZ).<sup>136</sup> The exterior materials of a home and the design and location of combustible materials within 100 feet of the home greatly determine a structure's vulnerability to wildfire.<sup>137</sup> Wildfires spread and quickly become disasters through home-to-home ignitions and by releasing embers (firebrands), which can easily ignite rooftops, decks, and siding.<sup>138</sup> By addressing conditions within the HIZ—such as using ignition-resistant building materials, managing vegetation, and maintaining defensible space around the home—extreme wildfires can spread to residential areas without incurring a WUI wildfire disaster.<sup>139</sup>

Many public education programs have embraced principles of reducing home ignition potential within the HIZ. Programs such as the Fire Adapted Communities Network, Firewise, and Ready, Set, Go! work with individual homeowners and local fire departments to prepare properties for wildfires.<sup>140</sup> Voluntary homeowner education programs are effective in raising awareness of wildfire risks and encourage homeowners to implement mitigation measures on their homes and properties.<sup>141</sup> Homeowners who participate in wildfire prevention programs can be influential in encouraging other homeowners and neighbors to similarly protect their properties.<sup>142</sup> Due to their voluntary nature, however, homeowner wildfire prevention programs lack compulsory mechanisms to obligate aggressive mitigation at the parcel level.<sup>143</sup> Public education programs are therefore one part of the solution but must be complemented with other wildfire mitigation measures.<sup>144</sup>

In summary, two general mitigation-based approaches are customarily used to address wildfire risk to communities. First, forest treatments, such as thinning and prescribed burns, mitigate wildfire risks at the landscape-scale.<sup>145</sup> Through forest thinning projects and reintroducing wildfire into the ecosystem, the buildup of fuels is reduced and the potential for future wildfires is curtailed.<sup>146</sup> Second, public education programs enhance community awareness and acceptance of wildfire

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136. Cohen, *supra* note 16, at 19.

137. *Id.*

138. *Id.* at 17.

139. Cohen, *supra* note 16, at 19–22. *See also* Calkin, *supra* note 6, at 747. Syphard et al. has shown defensible space is most effective within 16–58 feet (3–20 m) of the home and less effective 100 feet (30 m) or more away. Alexandra D. Syphard et al., *The Role of Defensible Space for Residential Structure Protection During Wildfires*, 23 INT'L J. WILDLAND FIRE 1165 (2014).

140. *See* FIRE ADAPTED COMTYS. LEARNING NETWORK, <https://fireadaptednetwork.org/> (last visited Mar. 15, 2019); *Firewise USA*, NAT'L FIRE PROT. ASS'N, <https://www.nfpa.org/Public-Education/By-topic/Wildfire/Firewise-USA> (last visited Mar. 15, 2019); *About Us*, READY, SET, GO!, <http://www.wildlandfirersg.org/> (last visited Mar. 15, 2019).

141. Patricia A. Champ, Geoffrey H. Donovan, & Christopher M. Barth, *Living in a Tinderbox: Wildfire Risk Perceptions and Mitigating Behaviours*, 22 INT'L J. WILDLAND FIRE 832, 832–40 (2013).

142. Patricia A. Champ & Hannah Brenkert-Smith, *Is Seeing Believing? Perceptions of Wildfire Risk over Time*, 36 RISK ANALYSIS 816, 816–30 (2016).

143. *See id.* at 819–21.

144. Ray Rasker, *Resolving the Increasing Risk from Wildfires in the American West*, 6 SOLUTIONS J. 55, 55–62 (2015), <https://www.thesolutionsjournal.com/article/resolving-the-increasing-risk-from-wildfires-in-the-american-west/>.

145. *See* Hjerpe et al., *supra* note 129, at 56.

146. *See* Schoennagel et al., *supra* note 132, at 673.

risks.<sup>147</sup> Through collaboration and outreach among homeowners, fire departments, and agencies, wildfire preparedness programs address wildfire mitigation at the parcel-scale.<sup>148</sup> When multiple homeowners collectively organize to mitigate wildfire risks on individual lots, the community as a whole is better protected.<sup>149</sup> Yet there is a third, often overlooked, approach that works at multiple scales to mitigate wildfire risk: land use planning can reduce wildfire risk by regulating where and under what conditions development is permitted in wildfire-prone lands.

#### IV. LAND USE PLANNING TO REDUCE WILDFIRE RISKS

Land use planning can address wildfire risk by considering wildfire impacts in the design, layout, and placement of proposed developments.<sup>150</sup> In preparing for a potential wildfire disaster, land use planning applies an anticipatory perspective and envisions a scenario where wildfires occur alongside communities without resulting in the loss of homes. The land use planning toolkit includes plans, regulations, building codes, incentives, and other development standards addressing wildfire risk at the parcel scale, up to neighborhoods and beyond. In integrating some of these planning measures into the development process, a community can consider how and where they would like to grow in relation to potential wildfire risks.

##### A. Community Plans and Policies

A community's vision for growth is guided by a variety of development plans. The comprehensive plan, or master plan, provides the foundation for long-term development with other plans providing guidance on specific objectives. Wildfire risk can be factored into the process of community development through growth policies and strategies identified in the comprehensive plan. Because the comprehensive plan is the political framework for future growth in the community, integrating wildfire into the document reaffirms the legal basis for protecting community assets, values, and resources from wildfire impacts. For example, Boulder County, Colorado's comprehensive plan was amended in 2017 and dedicates an entire section of the natural hazards chapter to wildfires.<sup>151</sup> While the document acknowledges the importance and environmental benefits of wildfires, it also outlines several policies to minimize impacts to homes and communities.<sup>152</sup> Specifically, the comprehensive plan stipulates that during the review of proposed developments in areas at high wildfire risk, site elements such as location, building construction and design, landscaping, fuel management, access, and water availability have to be adequately addressed.<sup>153</sup> The comprehensive plan also identifies the need to educate

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147. Champ, Donovan, & Barth, *supra* note 141, at 832–40.

148. Champ & Brenkert-Smith, *supra* note 142, at 819–21.

149. *Id.*

150. HEADWATERS ECON., LAND USE TO REDUCE WILDFIRE RISK: LESSONS FROM FIVE WESTERN CITIES 22 (2016), [https://headwaterseconomics.org/wp-content/uploads/Planning\\_Lessons\\_Full\\_Report\\_Print.pdf](https://headwaterseconomics.org/wp-content/uploads/Planning_Lessons_Full_Report_Print.pdf).

151. BOULDER CTY. LAND USE DEP'T, BOULDER COUNTY COMPREHENSIVE PLAN (2017), <https://assets.bouldercounty.org/wp-content/uploads/2017/07/bccp-comprehensive-plan-amended-2017.pdf>.

152. *Id.*

153. *Id.*

the public and homeowners about wildfires, including accepting wildfires as an essential and natural process, and using forest treatments and prescribed burns to manage fuel buildup.<sup>154</sup>

Implementation of the wildfire protection policies outlined in Boulder County's comprehensive plan are addressed through the land use code.<sup>155</sup> Within the land use code, a set of regulations require that certain development standards are satisfied prior to approval of proposed homes and subdivisions.<sup>156</sup> The review process requires that proposed development and site plans be submitted to the county planning department.<sup>157</sup> At this time, the county is allowed to impose additional conditions for wildfire mitigation, such as potential site relocation, maintained defensible space, guaranteed water supply, and constructed pullouts and turn-arounds for long driveways.<sup>158</sup> Any mitigation conditions placed on a site plan review are subsequently placed on the building permit.<sup>159</sup> Completed developments are inspected and verified to have fulfilled required wildfire mitigation measures.<sup>160</sup>

A Community Wildfire Protection Plan (CWPP) is a planning document addressing wildfire risk, and is built on the values of public safety and community welfare outlined in the Comprehensive Plan.<sup>161</sup> Authorized by the Healthy Forests Restoration Act (HFRA 2003), CWPPs must contain three elements: (1) partnerships among agencies, public organizations, and private citizens; (2) identification of fuel treatments to mitigate hazardous fuels; and (3) recommended strategies to reduce the ignitability of structures.<sup>162</sup> Developing a CWPP provides a unique opportunity for collaboration among a broad range of stakeholders and catalyzes discussion around shared wildfire concerns. Communities that successfully complete CWPPs are eligible for federal funding to reduce hazardous fuels in their areas.<sup>163</sup>

A CWPP also serves as a valuable public outreach tool. For example, Missoula County, Montana updated its CWPP in 2018.<sup>164</sup> Involving citizens, private organizations, and local, state, federal, and tribal agencies, the CWPP demonstrates Missoula County's common goal of managing wildfire risk in the WUI, restoring a more resilient landscape, and learning to live alongside wildfires in the future.<sup>165</sup> The CWPP identifies areas of high wildfire risk in the community and prioritizes fuel

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154. *Id.*

155. BOULDER COUNTY, COLO., LAND USE CODE ART. 4 (2017).

156. *Id.*

157. *Id.*

158. *Id.*

159. *Id.*

160. HEADWATERS ECON., *supra* note 150, at 22.

161. Healthy Forests Restoration Act of 2003, 16 U.S.C. § 6511(3) (West 2018).

162. *Id.*

163. 16 U.S.C. § 6512 (West 2018).

164. MOLLY MOWERY & KELLY JOHNSTON, MISSOULA CTY., MONT., COMMUNITY WILDFIRE PROTECTION PLAN 57 (Feb. 2018), <https://www.missoulacounty.us/home/showdocument?id=30120>.

165. *Id.* at 59.

treatment locations.<sup>166</sup> An action table is included to guide the implementation process and monitor accountability between different stakeholders.<sup>167</sup> The successful adoption of Missoula County's CWPP was a result of strong local partnerships and political will to organize around community wildfire risk reduction.<sup>168</sup>

Although community plans are non-regulatory, they are a demonstration of a town or city's intentions for growth, safety, and sustainability. The comprehensive plan provides the political framework for community growth and guides decision-making on wildfire mitigation measures. Requiring forward-thinking principles, community plans empower communities to protect critical infrastructure, assets, and resources. In considering wildfire risk within this context, other synergies and areas of interest are identified, such as preservation of open space, adequate transportation services, ensuring water quality, and protecting other scenic and natural values.

### B. Regulations

Key components identified in the comprehensive plan are implemented through regulatory tools such as subdivision ordinances, zoning, and building codes. A variety of regulatory measures allows city and county governments to select options that best reflect site specific wildfire concerns while remaining aligned with broader community objectives.

Zoning is one of the more robust and common land use planning tools regulating development over time.<sup>169</sup> Zoning stipulates the type of land use permitted and the intensity of development that occurs within individual districts, such as commercial, residential, and agricultural.<sup>170</sup> While there are many different types of zoning districts, an overlay zoning district can be used to mitigate wildfire risk by identifying and placing additional regulations within an area of special concern.<sup>171</sup> Overlay zones can be applied to ensure public safety is maintained, such as around airports or floodplains, and to preserve the aesthetic character of a place, such as a historic building or neighborhood.<sup>172</sup> Specifications within the overlay district often supersede the existing zoning standards.<sup>173</sup>

In Santa Fe, New Mexico, an overlay district applies to the city's escarpment zone.<sup>174</sup> The original intent of the overlay zone was to limit future development along the ridgetops and foothills.<sup>175</sup> More recently, the overlay zone also mitigates

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166. *Id.* at 68.

167. *Id.*

168. *Id.* at 61.

169. *Understanding the Basics of Land Use and Planning: Guide to Local Planning*, INST. LOCAL GOV'T 21 (2010), [https://www.ca-ilg.org/sites/main/files/file-attachments/2010\\_-\\_landuseplanning.pdf](https://www.ca-ilg.org/sites/main/files/file-attachments/2010_-_landuseplanning.pdf).

170. *Id.* at 22.

171. *Id.* at 25.

172. *Id.*

173. *Id.*

174. HEADWATERS ECON., *supra* note 150, at 45. Santa Fe's escarpment zone is considered the geographic area where the foothills climb sharply into the neighboring plateaus. *Id.* at 43.

175. *Id.* at 45.

wildfire risks through enforced home design standards and landscaping requirements.<sup>176</sup> For example, homeowners living in the overlay district are only allowed to landscape with fire-resistant vegetation, and the city is permitted to routinely thin trees to reduce potential fuels.<sup>177</sup> To ensure compliance, individual site assessments are conducted by the city's land use planning department, which works closely with the local fire department and WUI mitigation specialist on enforcement.<sup>178</sup> The overlay district is also mapped and updated to reflect changes in land cover, land ownership, and new housing.<sup>179</sup>

Subdivision regulations are another land use planning tool to reduce wildfire risk.<sup>180</sup> By regulating the pattern and layout of new developments, subdivision regulations can mitigate wildfire impacts by requiring multiple accesses, sufficient water supply, vegetation control, and setback distances among other risk-reduction measures.<sup>181</sup> Fire protection standards can be incorporated into the design of new subdivision developments, ensuring every home and property is prepared and can survive a wildfire.<sup>182</sup> For example, subdivision regulations can require clustered development of homes and direct them away from high-wildfire-risk areas and toward safer low-wildfire-risk areas.<sup>183</sup> While this pattern of land development preserves open space, it also provides a fuel break and makes evacuation and response easier for firefighters.<sup>184</sup>

In addition, subdivision regulations can specify the type of materials used in home construction.<sup>185</sup> Also addressed through building codes, the construction and design of homes in high-wildfire-risk areas can be required to include ignition-resistant building materials.<sup>186</sup> Key components of the home that are traditionally vulnerable to wildfires can be constructed with ignition-resistant materials, including

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176. *Id.* at 45–46.

177. *Id.*

178. *Id.* at 46.

179. *Id.* at 45.

180. Jack Cohen, Nan Johnson & Lincoln Walther, *Saving Homes from Wildfires: Regulating the Home Ignition Zone*, ZONING NEWS 2 (May 2001), <http://idahofirewise.org/wp-content/uploads/2017/04/zoningXnewsXcohen.pdf>.

181. *Id.* at 5.

182. *Id.* at 2.

183. Clustered developments discourage dispersed housing developments and can redirect growth away from high wildfire-risk areas, such as the forest boundary, to safer low-wildfire-risk areas. However, in the case of an urban conflagration and if homes are not built to wildfire-resistant standards, clustered developments can promote the spread of ignitions from home to home. To effectively reduce wildfire risks, clustered developments situated near the WUI must also require wildfire mitigation measures such as defensible space, multiple access, and using wildfire-resistant construction materials. *See generally* Alexandra D. Syphard et al., *Land Use Planning and Wildfire: Development Policies Influence Future Probability of Housing Loss*, PLOS ONE 8 (Aug. 2013) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3743760/pdf/pone.0071708.pdf>.

184. Open space containing trees, grasses, and shrubs can also provide fuel for a wildfire if the vegetation is not maintained.

185. Stephen L. Quarles et al., *Home Survival in Wildfire-Prone Areas: Building Materials and Design Considerations*, 8393 U.C. AGRIC. & NAT. RESOURCES PUB. 1 (2010), <https://anrcatalog.ucanr.edu/pdf/8393.pdf>.

186. *Id.* at 15.

the roof, decking, windows, doors, and siding.<sup>187</sup> Constructing a home with ignition-resistant building materials is especially important in reducing structure vulnerability to embers, which are responsible for igniting a majority of homes during a wildfire.<sup>188</sup> While higher costs are often cited as a reason for not constructing a home to ignition-resistant standards, recent studies suggest these costs are not as prohibitive as commonly thought.<sup>189</sup> Ignition-resistant home construction can greatly increase home survivability during a wildfire.

### C. Building and WUI Codes

Building codes are regulations that govern the design, construction, and maintenance of structures. Local jurisdictions commonly adopt model building codes maintained by the International Code Council (ICC) and then amend the codes to better fit the needs of the city, county, or state.<sup>190</sup> In 2003, the ICC released the first International WUI Code (IWUIC) with the aim of mitigating wildfire hazard to life and property and preventing structure fires from spreading to wildland fuels.<sup>191</sup> Every three years, IWUIC is updated and amended based on recent wildfire science and knowledge.<sup>192</sup> The WUI code works with other building and fire codes as well as public education programs to implement wildfire risk-reduction strategies.<sup>193</sup>

In 2008, Flagstaff, Arizona adopted the IWUIC with local amendments.<sup>194</sup> Wildfire risk in Flagstaff is prevalent due to its location amid one of the world's largest contiguous ponderosa pine forests.<sup>195</sup> For instance, in 2010, the Schultz Fire devastated the community and resulted in suppression and post-fire costs totaling more than \$130 million.<sup>196</sup> Consequently, city residents and staff are keenly aware of wildfire impacts, and several collaborative partnerships and projects focus on

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187. *Id.*

188. See Alexander Maranghides et al., *A Case Study of a Community Affected by the Witch and Guejito Fires*, NAT'L INST. STANDARDS & TECH. 18 (2009), <https://nvlpubs.nist.gov/nistpubs/technical-notes/nist.tn.1796.pdf>.

189. See Trent Penman et al., *How Much Does It Cost Residents to Prepare Their Property for Wildfire?* 16 INT'L J. DISASTER RISK REDUCTION 88, 90 (2016), <https://www.sciencedirect.com/science/article/pii/S2212420915300893>. In a forthcoming study by Headwaters Economics and the Insurance Institute for Business and Home Safety (IBHS), building material costs for wildfire-resistant products in the roof, exterior walls, deck, and near-home landscaping did not increase the overall costs of new home construction. *The Full Community Costs of Wildfire*, HEADWATERS ECON. 1 (2018), <https://headwaterseconomics.org/wp-content/uploads/full-wildfire-costs-report.pdf>.

190. *2015 International Wildland-Urban Interface Code Preface*, INT'L CODE COUNCIL, <https://codes.iccsafe.org/public/document/IWUIC2015/preface> (last visited Mar. 15, 2019) [hereinafter *IWUIC Preface*].

191. *Id.* A report by the National Institute of Building Sciences determined adoption of the IWUIC resulted in a national benefit of \$4 for every \$1 invested. See *Mitigation Saves: Federal Grants Provide \$6 Benefit for Each \$1 Invested*, NAT'L INST. BLDG. SCI. (2017), [https://cdn.ymaws.com/www.nibs.org/resource/resmgr/docs/MS\\_FactSheets\\_Set.pdf](https://cdn.ymaws.com/www.nibs.org/resource/resmgr/docs/MS_FactSheets_Set.pdf).

192. *IWUIC Preface*, *supra* note 190.

193. *Id.*

194. HEADWATERS ECON., *supra* note 150, at 31.

195. *Id.* at 30.

196. *Id.* at 29. Many of the costs related to the Schultz Fire were due to post-fire flooding, which resulted in one fatality and more than \$60 million in flood mitigation and response. *Id.*

wildfire prevention.<sup>197</sup> The process of Flagstaff's adoption of a WUI code occurred over eighteen months and involved a wide range of stakeholders including agencies, researchers, nonprofit organizations, and residents.<sup>198</sup> Due to these extensive outreach efforts and the realization that wildfire mitigation needed to go beyond forest treatments, the WUI Code was adopted without opposition.<sup>199</sup> The code covers nearly the entire city of Flagstaff.<sup>200</sup> It regulates the type of building materials used in home construction and establishes landscaping standards, adequate water supply, and sufficient road access for properties within city limits.<sup>201</sup> Unlike traditional defensible space parameters limited to 100 feet of the home, Flagstaff's WUI code defines defensible space as the entire property.<sup>202</sup> All homeowners are therefore required to maintain vegetation across the extent of their defensible space.<sup>203</sup> The local fire department enforces vegetation management requirements outlined in the WUI code.<sup>204</sup> Additionally, many neighborhood associations incorporate and enforce the WUI code through the association's covenants, conditions, and restrictions.<sup>205</sup>

Similarly, the City of San Diego, California, applies an aggressive brush management policy to reduce hazardous fuels within its WUI.<sup>206</sup> While not explicitly considered a building code, San Diego's brush management policy is part of the city's landscaping code and is supported by both the city's comprehensive building code as well as the state's building code.<sup>207</sup> The purpose of the brush management policy is to regulate and enforce vegetation management around homes situated along the city's nearly 500-mile-long WUI.<sup>208</sup> Containing more than 40,000 parcels, San Diego's WUI is one of the highest wildfire-risk areas in the country.<sup>209</sup> Properties in the city often abut native vegetation and are situated along narrow canyons and

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197. *Id.* at 30.

198. *Land Use Planning & Wildfire Forum*, CMTY. PLAN. ASSISTANCE FOR WILDFIRE, [http://planningfor-wildfire.org/wp-content/uploads/2018/01/WUI\\_Regulations\\_LUPlanning\\_Wildfire\\_Forum\\_2018.pdf](http://planningfor-wildfire.org/wp-content/uploads/2018/01/WUI_Regulations_LUPlanning_Wildfire_Forum_2018.pdf) (last visited Mar. 15, 2019).

199. *Id.*; see also Paul Summerfelt & Jim Wheeler, *Wildland-Urban Interface Code Adoption: How to Avoid the Agony*, FLAGSTAFF FIRE DEP'T., <https://www.flagstaff.az.gov/DocumentCenter/View/15342/FFD-WUI-Code-Adoption-Process?bidId> (last visited Mar. 15, 2019).

200. HEADWATERS ECON., *supra* note 150, at 31.

201. *Id.*

202. Emery Cowan, *Flagstaff Code Helps Fortify Structures Against Wildfire*, ARIZ. DAILY SUN (June 26, 2018), [https://azdailysun.com/news/local/flagstaff-code-helps-fortify-structures-against-wildfire/article\\_c52b063c-3792-541e-98fb-30287f4c472e.html](https://azdailysun.com/news/local/flagstaff-code-helps-fortify-structures-against-wildfire/article_c52b063c-3792-541e-98fb-30287f4c472e.html).

203. *Id.*

204. *Id.*

205. *Id.*

206. HEADWATERS ECON., *supra* note 150, at 36.

207. *Id.* at 38. In 2005, California's Building Standards Commission adopted Chapter 7A which applies to homes in very high wildfire severity zones and regulates materials and construction methods for reducing wildfire exposure to homes. See CAL. ST. BLDG. CODE § 701A (2016), <https://codes.iccsafe.org/public/chapter/content/9997/>.

208. HEADWATERS ECON., *supra* note 150, at 36.

209. *Id.*; GREGORY K. DILLION ET AL., WILDLAND FIRE POTENTIAL: A TOOL FOR ASSESSING WILDFIRE RISK AND FUELS MANAGEMENT NEEDS 63–71 (modeling outputs); see also Bill Gabbert, *Wildfire Activity by County*, WILDFIRE TODAY (May 1, 2017), <https://wildfiretoday.com/2017/05/01/wildfire-activity-by-county/>.

other open space.<sup>210</sup> Fueled by the Santa Ana winds and dry conditions, wildfires can rapidly spread across the WUI and into the city.<sup>211</sup>

As a result of its extensive wildfire history,<sup>212</sup> San Diego incorporated landscaping regulations into the city's municipal code to minimize risk to homes and properties. The landscaping regulations have multiple objectives, including mitigating erosion on steep slopes, conserving energy, and reducing wildfire risk through site design and the management of flammable vegetation.<sup>213</sup> The city's comprehensive brush management regulations apply to any property containing a habitable structure and native or naturalized vegetation.<sup>214</sup> These properties are required to control weeds, thin plants, and trim trees within 100 feet of structures.<sup>215</sup> The San Diego Fire Marshal's office inspects properties to ensure they are in compliance with brush management requirements.<sup>216</sup> If an inspection reveals that the property does not meet the requirements, the landowner is given a seventy-day compliance notification.<sup>217</sup> After that time, if the property owner still fails to comply, then the city will hire a private contractor and send the bill to the property owner.<sup>218</sup> "Failure to pay may result in a lien . . . being placed on the property."<sup>219</sup>

San Diego's brush management policy has evolved over the years and heavily relies on homeowner education for implementation. Supported by wildfire hazard maps and outreach materials, the city stresses the importance of maintaining defensible space within the HIZ. In doing so, homeowner education programs facilitate understanding and acceptance of land use planning regulations protecting neighborhoods and the community from wildfire risk.

#### D. Incentives

Land use tools can incentivize local governments and developers to steer new home construction away from high-wildfire-risk areas and toward low-wildfire-risk areas. For instance, Transfer of Development Rights (TDR) is a zoning technique redirecting development away from an undesirable or restricted area to a location

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210. HEADWATERS ECON., *supra* note 150, at 36.

211. Gary Robbins, *Wildfires: The Scourge Known as the Santa Ana Winds*, SAN DIEGO UNION-TRIB. (July 8, 2018), <http://www.sandiegouniontribune.com/sd-me-disaster-santana-winds-20180619-story.html>; Shekar Viswanathan et al., *An Analysis of Effects of San Diego Wildfire on Ambient Air Quality*, 56 J. AIR & WATER WASTE MGMT. ASS'N 56 (2006), <https://www.tandfonline.com/doi/pdf/10.1080/10473289.2006.10464439>.

212. In 2003, the Cedar Fire burned nearly 275,000 acres, destroyed 2,820 structures and killed 15 people in San Diego County—it remains one of the largest recorded wildfires. Four years later, the Witch Fire also occurred in San Diego County and burned nearly 200,000 acres, destroyed 1,640 structures, and left two people dead. See *Top 20 Largest California Wildfires*, CALFIRE (Sep. 5, 2018), [https://www.fire.ca.gov/communications/downloads/fact\\_sheets/Top20\\_Acres.pdf](https://www.fire.ca.gov/communications/downloads/fact_sheets/Top20_Acres.pdf)

213. SAN DIEGO, CAL., MUN. CODE § 142.0401 (2018).

214. HEADWATERS ECON., *supra* note 150, at 38–39; SAN DIEGO, CAL., MUN. CODE § 142.0401 (2018).

215. SAN DIEGO, CAL., MUN. CODE § 142.0401 (2018).

216. *Id.*

217. HEADWATERS ECON., *supra* note 150, at 38–39.

218. *Id.*

219. *Id.* at 38.

where development is encouraged.<sup>220</sup> By applying a TDR, landowners sell development rights from their land to a developer or other interested party who uses these rights to develop another designated location.<sup>221</sup>

Closely associated with TDRs are density bonuses. Density bonuses encourage certain types of development within a site, and in return, the number of homes allowed to be built in the site is increased.<sup>222</sup> In considering wildfire risks, density bonuses can be used to promote wildfire-resistant home construction, adequate ingress and egress, reliable water supply, and defensible-space standards. Density bonuses also improve evacuation and response procedures by clustering homes together and away from high-wildfire-risk areas. Commonly used to conserve open space, wildlife habitat, and other sensitive areas, density bonuses can address multiple community objectives together with wildfire risk.

Incentive-based programs that work with individual homeowners to endorse broader wildfire-risk-reduction measures can reduce vulnerability of an entire neighborhood. For instance, Community Rating Systems (CRS) are frequently used to manage and reduce flood risk for homes situated in floodplains.<sup>223</sup> CRS provides a framework and a variety of technical resources to help participating communities reduce home damage from floods.<sup>224</sup> Insurance policyholders who successfully perform and implement the flood reduction activities outlined in the CRS receive a discount on their home insurance.<sup>225</sup>

Boulder County, Colorado developed the Wildfire Partners program to apply a similar incentive-based CRS model to wildfire risk reduction. Established in 2014, Wildfire Partners assists landowners in preparing their home and property for wildfires.<sup>226</sup> As part of the program, a hazard mitigation specialist performs an on-site assessment of the parcel and develops a personalized report identifying priority risk-reduction measures.<sup>227</sup> The program also offers financial subsidies to offset the costs for wildfire mitigation and provides a suite of resources and contacts to facilitate implementation of priority actions.<sup>228</sup> After one year, a follow-up inspection is

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220. See generally Ctr. FOR LAND EDUC., PLANNING IMPLEMENTATION TOOLS TRANSFER OF DEVELOPMENT RIGHTS (TDR) (2005), [https://www.uwsp.edu/cnr-ap/clue/Documents/PlanImplementation/Transfer\\_of\\_Development\\_Rights.pdf](https://www.uwsp.edu/cnr-ap/clue/Documents/PlanImplementation/Transfer_of_Development_Rights.pdf)

221. *Id.*

222. See, e.g., *Density Bonus Model Code Language and Commentary*, PLANNING FOR HAZARDS, <https://www.planningforhazards.com/density-bonus-model-code-language-and-commentary> (last visited Mar. 15, 2019); Brian Wolshon & Emile Marchive III, *Emergency Planning in the Urban-Wildland Interface: Subdivision-Level Analysis of Wildfire Evacuations*, 133 J. URB. PLAN. & DEV. 73 (2007).

223. See *National Flood Insurance Program Community Rating System*, FEMA, <https://www.fema.gov/national-flood-insurance-program-community-rating-system> (last updated Mar. 7, 2019).

224. *Id.*

225. *Id.*

226. Wildfire Partners was established in 2014 as a private-public partnership between individual homeowners, Boulder County, Colorado Department of Natural Resources, and FEMA. More information can be found on the Wildfire Partners website. See WILDFIRE PARTNERS, <http://www.wildfirepartners.org/> (last visited Mar. 15, 2019).

227. *Our Program*, WILDFIRE PARTNERS, <http://www.wildfirepartners.org/our-program/> (last visited Mar. 15, 2019).

228. *Id.*

performed and if the proposed mitigation is completed, the landowner receives a certificate of compliance that can be submitted to participating insurance companies for a discounted rate on home and property coverage.<sup>229</sup>

Incentive-based programs come in a variety of forms and can be customized to local circumstances. When implemented correctly, incentives offer a cooperative approach toward wildfire risk reduction and encourage action supporting goals identified in the comprehensive plan. Incentives rely on homeowner reciprocation and therefore complement broader public education and outreach efforts around wildfire risk reduction. When aligned with regulatory tools such as ordinances and building codes, incentive-based programs reaffirm a community's commitment to becoming fire-adapted.

#### E. Community Planning Assistance for Wildfire

To break the cycle of building and rebuilding in the same wildfire perimeters and to the same minimal development standards, local governments need additional resources to better plan their WUI. In response, the Community Planning Assistance for Wildfire (CPAW) program was launched in 2014 by Headwaters Economics, a nonprofit organization, and Wildfire Planning International.<sup>230</sup> CPAW works with the local fire and land use planning departments to jointly address wildfire risk in the community.<sup>231</sup> In partnership with the Forest Service Rocky Mountain Research Station, and funded by the Forest Service and private foundations, CPAW provides communities with professional consulting and technical assistance to reduce wildfire risk through improved land use planning.<sup>232</sup> Services and resources come at no cost to the communities.<sup>233</sup> As of 2019, thirty communities were participating in the CPAW program.<sup>234</sup> During the course of a year or more, a team of land use planners, foresters, wildfire risk modelers, researchers, and policy analysts collaborate with local land use planners, fire chiefs, WUI mitigation specialists, and elected officials to plan for wildfire risk in the community.<sup>235</sup> CPAW assistance includes reviewing key community plans to identify opportunities for wildfire risk mitigation to be integrated into the development process, assessing local wildfire hazard to identify areas of high concern, generating outreach materials and online tools to educate homeowners about HIZ principles, and providing scientifically-based research products to inform understanding and dialogue on wildfire impacts in the community.<sup>236</sup> An important part of CPAW also focuses on enhancing local capacity and knowledge on local wildfire risks. To expand understanding on how land use

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229. *Id.*

230. Kelly Pohl, *Communities Reduce Wildfire Risk Through Land Use Planning*, HEADWATERS ECON. (Nov. 2017), <https://headwaterseconomics.org/wildfire/solutions/cpaw-communities-reduce-wildfire-risk/> (last updated Dec. 2018). More information on Headwaters Economics and its Community Planning Assistance for Wildfire is available at <https://headwaterseconomics.org/>.

231. *Id.*

232. *Id.*

233. *Id.*

234. *Id.*

235. *Id.*

236. Pohl, *supra* note 230.

planning can reduce wildfire risks to communities, CPAW hosts local workshops, training opportunities, and peer-to-peer learning events.<sup>237</sup>

Given the diversity of WUI geographies and wildfire conditions, CPAW resources are tailored to meet the unique needs of every community—there is no one-size-fits-all.<sup>238</sup> Engaging with local fire experts and stakeholders on wildfire risks is therefore essential to the CPAW process and in prioritizing practical and applicable land use planning options for the community. By integrating wildfire mitigation into the initial stages of building review and approval, CPAW emphasizes wildfire risk reduction from the start of development design through to completion.

## V. CONCLUSION

As development grows within wildfire-prone areas and as wildfires increase in size and severity, we must expand our traditional thinking to envision a future living alongside wildfires. Land use planning offers a unique opportunity to mitigate wildfire risks because it is predicated on a scenario where homes and neighborhoods are designed to survive a wildfire disaster.

Few communities have the capacity, authority, or political will to implement rigorous land use planning tools to reduce wildfire risk in the WUI. As suppression costs are largely paid by federal agencies, there is little incentive or fiscal accountability for local governments to discontinue approving developments in high-wildfire-risk areas.<sup>239</sup>

Efforts like CPAW and other programs working with local communities and homeowners on wildfire mitigation stress the importance of anticipating wildfire occurrence rather than relying exclusively on wildfire suppression. Wildfires are crucial to ecosystem functionality and in revitalizing forests and landscapes. Attempting to extinguish all wildfires is costly, dangerous, and unrealistic. Homes and communities need to be conceived ahead of time to withstand a wildfire. Application of land use planning tools is one option for communities to become better fire-adapted and resilient in the face of increasing wildfire potential.

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237. *Id.*

238. Jack Cohen, a former fire scientist with the U.S. Forest Service Rocky Mountain Research Station, wrote about the need for improved regulations and land use planning to enforce wildfire mitigation measures in high wildfire risk areas. His seminal work on the home-ignition zone (HIZ) led to defensible space standards, Firewise principles, and other wildfire prevention efforts. See Cohen et al., *supra* note 180, at 3.

239. Stephens et al., *supra* note 134, at 13.