FIREWISE: The Value of Voluntary Action and Standard Approaches to Reducing Wildfire Risk

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INTRODUCTION

Regionally, nationally and globally, threats to life, property and resources from wildfire are growing. Changing climate conditions, growth of vulnerable communities into high-hazard areas, and limited governmental and financial resources available to cope with this threat all mean that wildfire losses are expected to continue and expand. It is not possible to find a single and simple solution to all of the problems that the scenario of larger, damaging wildfire presents. However, when focusing on how to prevent wildland/urban interface (WUI) fire disasters—the destruction of dozens or hundreds of structures during significant wildfire events—researchers and safety advocates have discovered solutions in the form of voluntary community action to reduce wildfire risks around homes and neighborhoods, and in sound design and construction standards that can be adopted and applied by state and local governments.

National Fire Protection Association's (NFPA) Firewise program provides a sustainable solution to the growing trend of home losses during wildland fires.[1] The Firewise Communities/USA® Recognition Program provides the process for WUI residents and a model for behavior change that effectively reduces the risk of home—and thus community—ignitions.[2] The program has been growing steadily since its inception fifteen years ago.[3] In this paper, we will examine the development of Firewise communities and how they have expanded nationally and in the state of Arizona. We will also

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1. *About Firewise*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/ (last visited Mar. 10, 2016).

2. *Firewise Communities/USA Recognition Program*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/usa-recognition-program.aspx (last visited Mar. 10, 2016).

3. *Firewise at NFPA: A Brief History*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/about/history.aspx (last visited Mar. 10, 2016).

examine Arizona-based success stories resulting from the embrace of Firewise principles at the community level.

To understand how to prevent WUI disasters, one must understand how homes ignite and burn during a wildfire. This paper will cover the most current research and evidence on this topic, and the surprisingly simple techniques that can be used by property owners to prevent home ignitions.

Finally, we will examine why regulation and zoning ordinances are also an important component in the equation to find a solution to this growing wildfire "menace." A helpful study produced by the Fire Protection Research Foundation, *Community Wildfire Safety through Regulation*,[4] will be explored. We will introduce information on NFPA design and construction standards that can be adopted in whole or in part by communities as components of local building and fire codes. We will conclude by demonstrating how planning and zoning tools have great potential to be effective in risk reduction in the event of a wildfire.

I. THE SCOPE AND MAGNITUDE OF THE WUI DISASTER PROBLEM

Wildland fire in Arizona and the United States is increasingly a problem of home destruction when nature's fire moves from grasses, brush, and trees into settlements and subdivisions, igniting urban conflagrations. When homes are at risk from destruction due to wildfire, they are said to exist in "the wildland/urban interface."[5] An imperfect descriptor, the wildland/urban interface (WUI) is the name our society gives to try to indicate the risk of homes in or near areas where the natural vegetation is prone to burning from wildfire.[6] A better definition of this problem focuses less on the "where," and more on the "how" homes ignite and burn.

The National Fire Protection Association's Firewise program[7] has long described the WUI home destruction phenomenon as "a set of conditions under which a wildland fire reaches beyond trees, brush and other natural fuels to ignite homes and their immediate surroundings."[8] The set of conditions that allow homes to burn can exist almost anywhere in the nation,

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4. NAT'L FIRE PROT. ASS'N, COMMUNITY WILDFIRE SAFETY THROUGH REGULATION (2013), http://www.nfpa.org/~/media/Files/Wildland/WildfireBestPracticesGuide.pdf.

5. Jack Cohen, *The Wildland-Urban Interface Fire Problem: A Consequence of the Fire Exclusion Paradigm*, 2008 FOREST HIST. TODAY 20, 22, http://foresthistory.org/Publications/FHT/FHTFall2008/Cohen.pdf.

6. *Id.*

7. *About Firewise*, *supra* note 1.

8. NAT'L FIRE PROT. ASS'N, COMMUNITIES COMPATIBLE WITH NATURE 1 (2008), http://www.firewise.org/~/media/firewise/files/pdfs/booklets%20and%20brochures/brochurecommunitiescompatiblenature.pdf.

and is certainly prevalent in the Western U.S. Property loss due to this set of conditions is on an exponential growth trend both nationwide and in Arizona due to a number of factors.[9]

Of the 2.3 billion acres of land in the U.S., 1 billion acres are categorized as government (federal, state and local) and privately owned wildlands, or areas essentially without structures.[10] In addition to these 1 billion acres of "wildlands," each state forester has designated developed areas at high risk from wildfire, totaling more than 220 million acres, or twice the area of California.[11]

> This is not a static figure. Increased development near wildlands is ever-accelerating the continued growth of the wildland/urban interface. Since 1990, the U.S. has experienced an unprecedented conversion-growth rate of 3 acres per minute, 4000 acres per day and close to 2 million acres per year of conversion from undeveloped "wildlands" to wildland/urban interface.[12]

Population growth and migration to the south and west is driving the growth of the WUI. "The population growth of 32.7 million people between 1990 and 2000 represents the largest census-to-census increase in American history," with the highest growth rates in the West.[13] The first decade of the new millennium saw a slower rate of growth at 9.7 percent, but this still represented 27.3 million more people, with much higher growth rates in the South (14.3) and the West (13.8) than other regions.[14] Arizona was the second-fastest growing state during both decades (following Nevada), adding more than 2.7 million people over twenty years.[15]

Much of this new development has taken place and continues to flourish in areas of historic fire occurrence and within ecosystems in which plant and animal species are fire-adapted or fire-dependent. Ongoing drought

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9. INT'L ASS'N OF WILDLAND FIRE, WUI FACT SHEET 1–3 (2013), http://www.iawfonline.org/pdf/WUI_Fact_Sheet_08012013.pdf.

10. *Id.* at 1.

11. *Id.*

12. *Id.*

13. U.S. CENSUS BUREAU, POPULATION CHANGE AND DISTRIBUTION 1990 TO 2000: CENSUS 2000 BRIEF 1 (2001), http://www.census.gov/prod/2001pubs/c2kbr01-2.pdf.

14. U.S. CENSUS BUREAU, POPULATION CHANGE AND DISTRIBUTION 2000 TO 2010: 2010 CENSUS BRIEFS 1 (2011), http://www.census.gov/prod/cen2010/briefs/c2010br-01.pdf.

15. *Id.* at 2; U.S. CENSUS BUREAU, *supra* note 13.

conditions,[16] overgrown forests and rangelands,[17] as well as changing climatic conditions[18] all contribute to fire conditions and the potential for more damaging wildfires than in past decades. In addition to population growth and migration pressures, there is little disincentive for development in wildfire-prone areas.[19] In fact, the rugged, rural nature of many fire-prone locales is what attracts many residents in the first place.[20] Risk mapping and regulation have not been applied in most jurisdictions, at least not at a level where development decisions are seriously affected. Wildfire risk maps comparable with floodplain maps are virtually non-existent outside of California, and few jurisdictions take steps to limit or even require conditions on development due to wildfire risk.[21]

The growth of residential development in areas at risk from wildfire is starting to be reflected in the data on destroyed structures during wildfires. Wildfire management statistics[22] indicate that even though the number of wildfires has not increased much since 1984, the number of total acres and homes destroyed has increased greatly.

16. Natasha Geiling, *The Beginning of Wildfire Season Means More Bad News for Drought-Stricken West*, THINKPROGRESS (June 3, 2015, 8:00 AM), http://thinkprogress.org/climate/2015/06/03/3665076/2015-wildfire-preview/.

17. Chris Topik, *Ask the Conservationist: Forest Conservation Policies and Forest Fires*, NATURE CONSERVANCY (June 2013), http://www.nature.org/science-in-action/science-features/ask-the-conservationist-june-2013.xml.

18. *Is Global Warming Fueling Increased Wildfire Risks?*, UNION CONCERNED SCIENTISTS, http://www.ucsusa.org/global_warming/science_and_impacts/impacts/global-warming-and-wildfire.html#.VoQ6NRUrLIU (last visited Feb. 13, 2016).

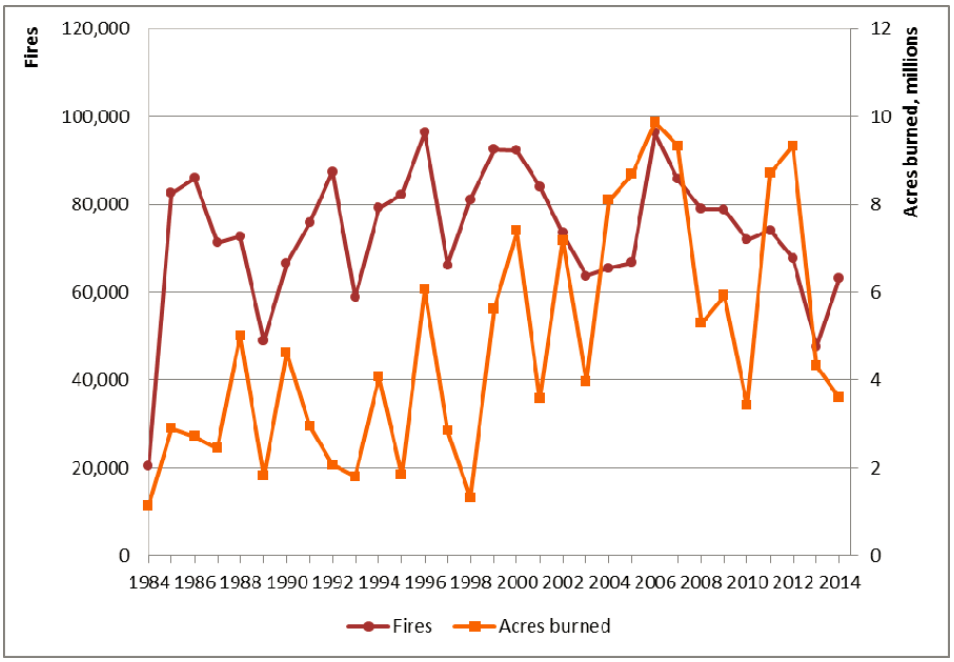
19. HEADWATERS ECON., SOLUTIONS TO THE RISING COSTS OF FIGHTING FIRES IN THE WILDLAND-URBAN INTERFACE 15–17 (2009), http://www.iawfonline.org/HeadwatersFireCosts.pdf.

20. Megan Verlee, *Despite Wildfires, More Homes Built in Forests*, MARKETPLACE (July 2, 2013, 8:28 AM), http://www.marketplace.org/2013/07/02/sustainability/despite-wildfires-more-homes-built-forests.

21. *California Fire Hazard Severity Zone Map Update Project*, CAL FIRE, http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones_maps (last visited Feb. 13, 2016).

22. KATIE HOOVER & KELSI BRACMORT, CONG. RESEARCH SERV., WILDFIRE MANAGEMENT: FEDERAL FUNDING AND RELATED STATISTICS 3 (2015), http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R43077.pdf.

Figure 1. Annual Trends in Wildfires and Acres Burned, 1984–2014[23]



According to a 2015 report on estimated residential wildfire risk exposure for the Western United States, more than 1.1 million homes with a total reconstruction cost of $268 billion are considered at the highest rated risk.[24] In Arizona, much of the southeastern and central parts of the state have high to moderately high risk and most of the northern part of the state also has moderate risk from wildfire.

The state's hazard mitigation plan and risk assessment notes that wildfires burn thousands of acres in Arizona annually. The report cites statistics for the period of 1990–2011, when Arizona had an annual average of 3,068 wildfires affecting an average of 213,302 acres each year.[25] On average, 57% of the wildfires were human caused, while 43% were lightning caused.[26] "A combination of extended drought, unhealthy forest conditions, and expanding population centers support the likelihood of increased wildfire occurrence

23. National Interagency Fire Center (NIFC).

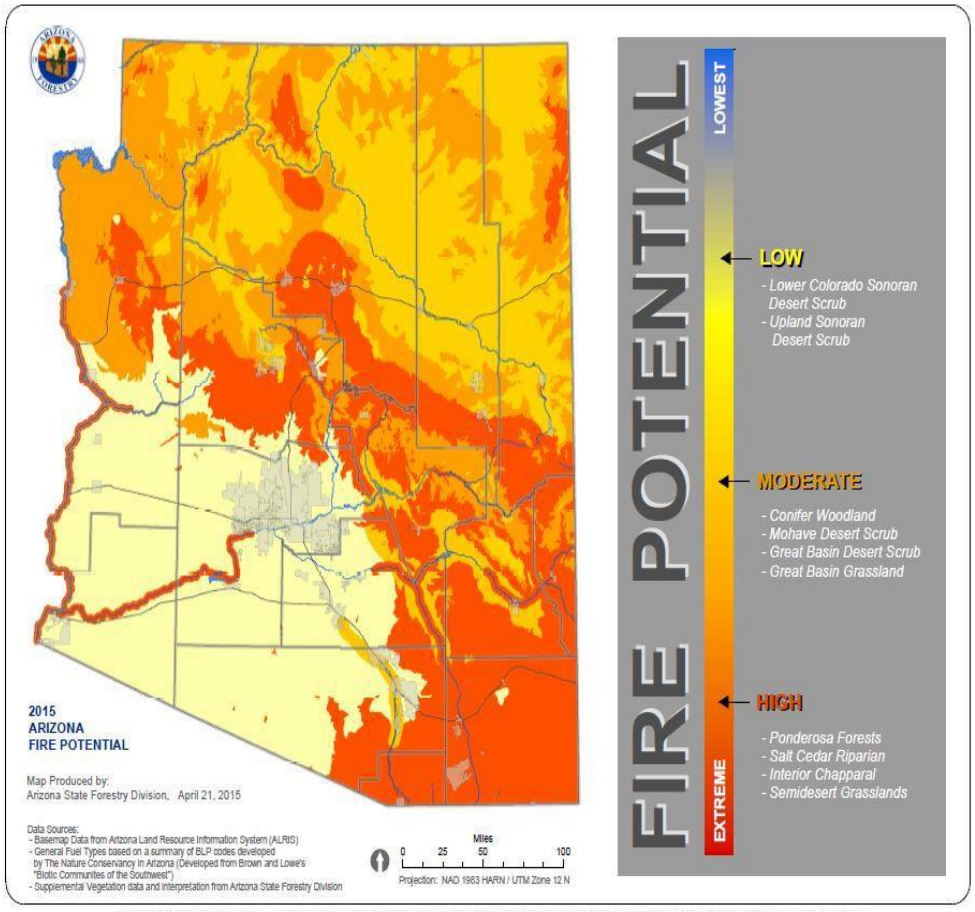
24. HOWARD BOTTS ET AL., CORELOGIC, WILDFIRE HAZARD RISK REPORT: RESIDENTIAL WILDFIRE EXPOSURE ESTIMATES FOR THE WESTERN UNITED STATES 4 (2015), http://www.corelogic.com/research/wildfire-risk-report/2015-wildfire-hazard-risk-report.pdf.

25. ARIZ. DEP'T OF EMERGENCY & MILITARY AFFAIRS, 2013 STATE OF ARIZONA HAZARD MITIGATION PLAN AND RISK ASSESSMENT: WILDFIRES 296 (2013), http://www.dem.azdema.gov/preparedness/docs/coop/mitplan/33_Wildfires.pdf.

26. *Id.*

and more severe impacts over the coming years."[27] Community leaders, forestry officials, fire departments and residents will all be significantly impacted by these conditions in the State of Arizona in the future.

Figure 2. Arizona Fire Potential Map[28]



Recent Arizona wildfire losses across the spectrum of life, property and environmental resources are well documented.[29] Most fresh in the public's mind is the devastating loss of nineteen firefighters in the 2013 Yarnell Hill

27. *Id.*
28. Produced by Arizona Department of Forestry (Apr. 21, 2015).
29. *Arizona Wildfires: 10 of the Biggest Since 2002*, AZ CENT. (Jan. 30, 2013, 11:41 PM), http://www.azcentral.com/news/arizona/articles/20130621arizona-wildfires-biggest-prog.html.

fire.[30] This lightning-caused fire that eventually burned 8,400 acres by early July 2013 originated 3.5 miles west of the community of Yarnell.[31]

> On Sunday, June 28th, the fire rapidly grew in size and intensity. Strong erratic winds pushed the fire in several directions at the same time. Nineteen members of the Granite Mountain Hotshot Crew lost their lives battling this fire on June 30, 2013. Residents of the communities of Yarnell and Peeples Valley were forced to evacuate. 108 homes in Yarnell were destroyed, with another 25 damaged.[32]

In the same year, two other major fires burned more than 12,000 acres total.[33] During the same time as the Yarnell Hill fire, the Dean Peak Fire burned approximately 5,400 acres.[34] It was a lightning-caused fire in the Hualapai Mountains, ten miles southeast of Kingman, leading to evacuation of the communities of Pine Lake and Pinion Pine Estates.[35] No structures were destroyed.[36] A month earlier in June, the Doce fire began burning in the Prescott National Forest, eight miles northwest of Prescott.[37] Believed to be human-caused, the fire required 781 personnel to bring it under control.[38] Residents of Williamson Valley were forced to evacuate 465 homes.[39] Fortunately, no homes were destroyed in this fire, in spite of the burning of 6,732 acres.[40]

According to the InciWeb Incident Information System website operated by the National Wildfire Coordinating Group, summer and early fall of 2015 continued to see high wildfire activity.[41] In August and September 2015 alone, more than 41,000 acres were consumed by wildfire.[42]

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30. ARIZ. DEP'T OF EMERGENCY & MILITARY AFFAIRS, *supra* note 25.
31. *Id.*
32. *Id.*
33. *Id.*
34. *Id.*
35. *Id.*
36. *Id.*
37. *Id.*
38. *Id.*
39. *Id.*
40. *Id.*
41. Nat'l Wildfire Consulting Grp., *Current Incidents*, INCIWEB INCIDENT INFO. SYS., http://inciweb.nwcg.gov/ (last visited Mar. 11, 2016) (showing a total of 124,573 acres burned for June through September).
42. Nat'l Wildfire Consulting Grp., *Arizona Incidents*, INCIWEB INCIDENT INFO. SYS., http://inciweb.nwcg.gov/state/3/ (last visited Mar. 11, 2016) (showing the acreage consumed by fourteen active fires in Arizona during August and September 2015).

Table 1

Incident	Type	Unit	Status	Acres	Updated
Tusayan Ranger District Rx Fire	Prescribed Fire	Kaibab National Forest	Active	6,000	12/31/15
North Kaibab Ranger District Rx Fire	Prescribed Fire	Kaibab National Forest	Active	50	11/23/15
Williams Ranger District Rx Fire	Prescribed Fire	Kaibab National Forest	Active	12,500	12/21/15
Potato Patch	Wildfire	Apache-Sitgreaves National Forests	Inactive	646	9/23/15
High Meadow Fire	Wildfire	Arizona Strip District	Inactive	1,312	10/23/15
Mt. Emma Fire	Wildfire	Arizona Strip District	Inactive	4,200	10/23/15
AZ-Cra-Willow Fire	Wildfire	Colorado River District	Inactive	6,780	10/23/15

Even though, over time, the number of wildfires on average each year has not dramatically increased, the acreage burned shows a significant upward trend.[43] In many large fire events, greater intensity of burning has also been documented.[44] Trends point to a growing risk from wildfire in Arizona and throughout the United States at the same time as federal funding to help fight the fires as well as assist with pre-fire mitigation efforts is decreasing.

According to a recent paper by the Congressional Research Service, the federal funding for wildfire management provided in the Interior, Environment, and Related Agencies appropriations bill, which funds wildfire management at the Forest Service and the Department of the Interior (the two principal entities tasked with federal wildfire management) have decreased rather than increased over the last two fiscal years.[45] The funding for federal wildfire response activities involve preparedness, suppression, fuel reduction, site rehabilitation, and more.[46] Some $3.4 billion was appropriated for wildfire management in federal fiscal year 2015,[47] down from 2014 appropriations of more than $3.9 billion.[48] This also included $600 million for the Forest Service to reimburse wildfire transfers that occurred in fiscal

43. *Wildfire Safety Principles*, FIREWISE COMMUNITIES, http://www.iawfonline.org/westernlandswebinar_firewise%202.pdf (last visited Mar. 5, 2016).
44. *Id.*
45. HOOVER & BRACMORT, *supra* note 22, at 5.
46. *Id.* at 2.
47. *Id.* at 1.
48. *Id.*

year 2013.[49] The budget for fire prevention has fallen steadily, from $350 million in 2010 to $301 million in 2013.[50]

II. KEEPING THE FOCUS ON THE COMMUNITY

Knowing the scope and magnitude of the wildland fire problem as it impacts homes and communities, and acknowledging that the outlook for a federal government solution to mounting losses is hazy, what then are effective solutions, and at what scale? NFPA's Firewise program has sought, since 1997, to bring fire science research on home ignition during wildfires directly to residents, community officials, local fire departments, and state agencies engaged in forest and fire management.[51] The research indicates that homes burning down during wildfires is a solvable problem, if we keep the focus on the home and community.

III. HOW DO HOMES IGNITE?

The research that demonstrates what causes a home to ignite during a wildfire event is the basis for risk assessments that NFPA requires of communities as they begin the process of becoming recognized in the Firewise program. Knowing the factors that make a home vulnerable to ignition during a wildfire helps individuals and communities take effective action to change those factors.

There are many myths about how homes burn down during a wildfire. News media and even firefighters may talk about the fire as a sentient being that "chooses" homes to burn and "spares" others.[52] People assume that a "wave" of fire will destroy everything in its path.[53] Many people believe that homes "explode" from heating up from the large flames of a wildfire.[54] However, post-fire research, models and experiments starting as early as

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49. *Id.*

50. Daniel Trotta, *U.S. Fights Growing Wildfire Threat with Shrinking Budget*, INS. J. (July 2, 2013), http://www.insurancejournal.com/news/national/2013/07/02/297369.htm.

51. *Firewise at NFPA: A Brief History*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/about/history.aspx (last visited Mar. 5, 2016).

52. CNN Wire, *13,000 Evacuated as California Firefighters Fight Flames to Save Homes*, FOX 31 DENVER (Aug. 6, 2015, 5:33 AM), http://kdvr.com/2015/08/05/13000-evacuated-as-california-firefighters-fight-flames-to-save-homes/.

53. Laura Parker, *How Megafires are Remaking American Forests*, NAT'L GEOGRAPHIC (Aug. 9, 2015, 8:00 AM), http://news.nationalgeographic.com/2015/08/150809-wildfires-forest-fires-climate-change-science/.

54. NSW Rural Fire Serv., *Bush Fire Myths*, BUSH FIRE SAFETY (2012), http://www.rfs.nsw.gov.au/__data/assets/pdf_file/0010/3115/Bush-Fire-Myths-Factsheet.pdf.

1961 have demonstrated the inaccurate assumptions about wildfire and home destruction.[55]

Post-fire investigation findings from the Bel Air-Brentwood WUI fire in Los Angeles in 1961 were groundbreaking in that the investigators examined the homes that survived within the fire perimeter.[56] They found that 95% of homes that had nonflammable roofs and between thirty to sixty feet of modified vegetation around the home survived this devastating fire.[57] This finding was reinforced in a similar investigation in 1990 of the Paint Fire in Santa Barbara,[58] where 86% of homes with nonflammable roofs and modified landscaping survived within the fire perimeter.[59] These findings indicated that if the home itself was ignition-resistant—especially the roof—and the immediate surroundings were clear of most fuel for the fire, homes were unlikely to ignite.

The emphasis on "how homes ignite," vs. "how homes burn," is an important distinction in discussing WUI fire disasters. During a major wildfire event, with dozens or hundreds of homes exposed to wildfire's flames and embers, there are almost never enough fire suppression resources—people, vehicles, water—to conduct structure fire protection on every home. Often, no firefighters are present in neighborhoods where embers and flames encroach because they are fighting the fire in another location. Thus, it matters very much that homes do not ignite—because there is usually no way to extinguish the small ignition in the midst of a major event. It matters less "how homes burn," since once they have ignited, they inevitably will burn unless there is intervention with fire suppression resources.

Pre-eminent fire science researcher, Dr. Jack D. Cohen with the United States Department of Agriculture Forest Service Fire Research Lab in Missoula, Montana, coined the term "home ignition zone" to describe the area of focus for treatment and modification to minimize ignition during

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55. Jack D. Cohen, *Preventing Disaster: Home Ignitability in the Wildland-Urban Interface*, 98 J. FORESTRY 15, 17 (2000), http://www.firewise.org/~/media/firewise/files/pdfs/research/cohenpreventingdisaster.pdf.

56. L.A. Fire Dep't, *The Los Angeles Brush Area Conflagration, November 6–7, 1961*, LA FIRE (1999), http://www.lafire.com/famous_fires/1961-1106_BelAirFire/1961-1106_LAFD-Report_BelAirFire.htm.

57. *Wildfire Safety Principles*, *supra* note 43.

58. Ethan I. D. Foote, Structure Survival on the 1990 Santa Barbara "Paint" Fire: A Retrospective Study of Urban-Wildland Interface Fire Hazard Mitigation Factors (1994) (unpublished M.S. thesis, University of California, Berkeley) (on file with the University of California, Berkeley Libraries).

59. *Id.*

wildfires.[60] His research strongly supports the notion of keeping the focus of fire mitigation efforts on the home and community in order to solve the problem of homes burning down during wildfires.[61] According to Dr. Cohen:

> Wildland-urban fire occurs when a fire burning in wildland vegetation fuels gets close enough with its flames and/or firebrands (lofted burning embers) to potentially create ignitions of the residential fuels. Residential fire destruction is the principal problem during wildland-urban fires, but homes that do not ignite do not burn. Recognizing the potential for wildland-urban home ignitions and preventing home ignitions is the principal challenge.[62]

Cohen's research results showed that the condition of the home and its immediate surroundings located with 100 to 200 feet are the main cause for home ignitions.[63] Research has determined that fire is an important part of the ecosystems across the United States.[64] This understanding about the fire adapted ecosystems that residents live in along with an understanding about where the ignition points of the home are will help homeowners and communities determine what they need to do to reduce their risk to loss.[65] This understanding will enable them to build and maintain communities that are compatible with wildfire in Fire Adapted Communities rather than working on preventing fire from encroaching into the community.

Cohen's groundbreaking research included home ignition experiments during the International Crown Fire Experiment series in 1998.[66] He demonstrated that radiant heat from the large flames of a stand of burning trees failed to ignite wood walls as close as ten meters (thirty-three feet) from the flame exposure.[67] By shifting the focus from the large crown fire (wildland fire in forests that reach the crowns of the trees) to the home ignition zone, his research helped NFPA and other safety advocates effectively reach residents with the message that home survival in a wildfire was a possibility and a matter that was largely within their control as property owners.[68]

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60. *The Jack Cohen Files*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/wildfire-preparedness/wui-home-ignition-research/the-jack-cohen-files.aspx (last visited Mar. 5, 2016).

61. JACK D. COHEN, WILDLAND-URBAN FIRE—A DIFFERENT APPROACH, http://extension.oregonstate.edu/sorec/sites/default/files/urban_wildfire_diff_approach.pdf.

62. *Id.* (citation omitted).

63. *Id.*

64. *Id.* at 3.

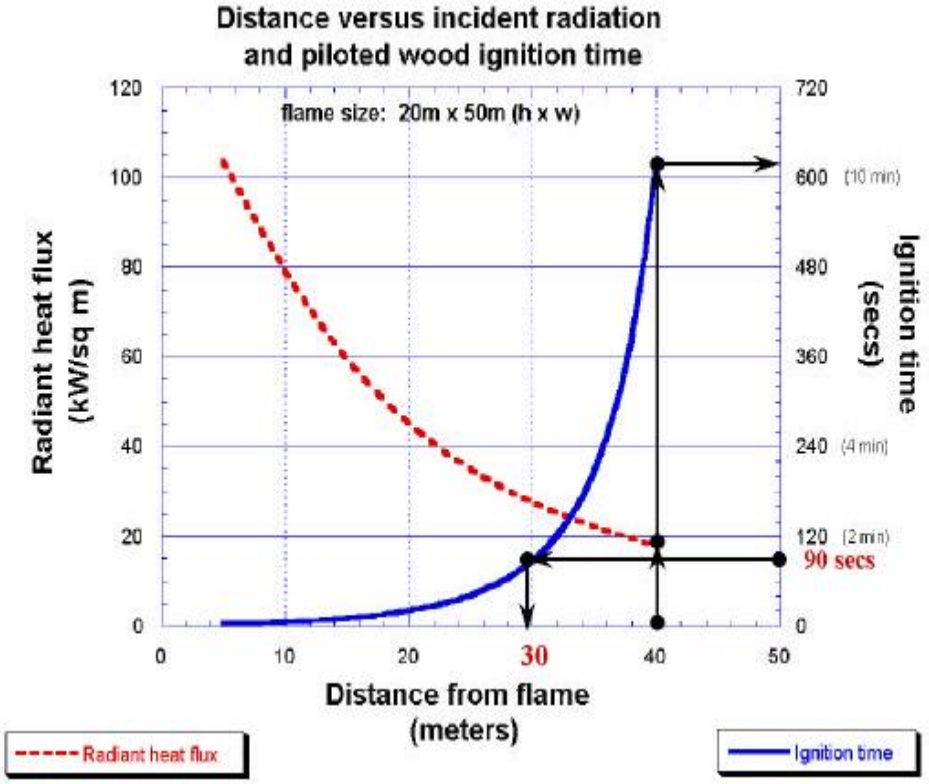
65. *Id.* at 4.

66. JACK D. COHEN, WHAT IS THE WILDLAND FIRE THREAT TO HOMES? 5 (2000), http://www.firewise.org/~/media/firewise/files/pdfs/research/cohenwildlandfirethreat.pdf.

67. *Id.* at 5–7.

68. *Id.* at 11.

Figure 3



Further research by Cohen and his colleagues pointed to the need for property owners to work collectively to reduce ignition risks in neighborhoods because of the impact of embers and the potential for structure-to-structure ignition once the community is exposed to a wildfire's flames and embers.[69]

The holistic view reinforces the notion that the hazard and the solution are "owned" by the property owner, and that traditional thinking about fire suppression is not helpful in the wildland fire exposure scenario. Cohen wrote:

> If the extreme wildfire spreads close enough to residential development with its flames and firebrands (lofted burning embers), hundreds of ignitable homes can be simultaneously exposed. Although protection may be effective for some homes, an extreme wildfire's high intensities and high rate of area growth (rapid spread

69. Cohen, *supra* note 5, at 20, 25.

> and spot ignitions) ignites too many houses and threatens firefighters' safety, preventing them from protecting all structures.[70]

It is important for homeowners to take actions to protect their own homes because there will not be enough fire trucks available to protect every home during a wildfire disaster. With the impact of embers, it is the little things that can make a difference to home survivability. Cohen's research strongly indicates the potential for an extreme wildfire event to occur without triggering a WUI disaster with large-scale home loss.[71] Thus, disasters in the WUI mainly depend on the ignition potential of homes and that ignition potential can be reduced with effective modifications made by homeowners.

Figure 4

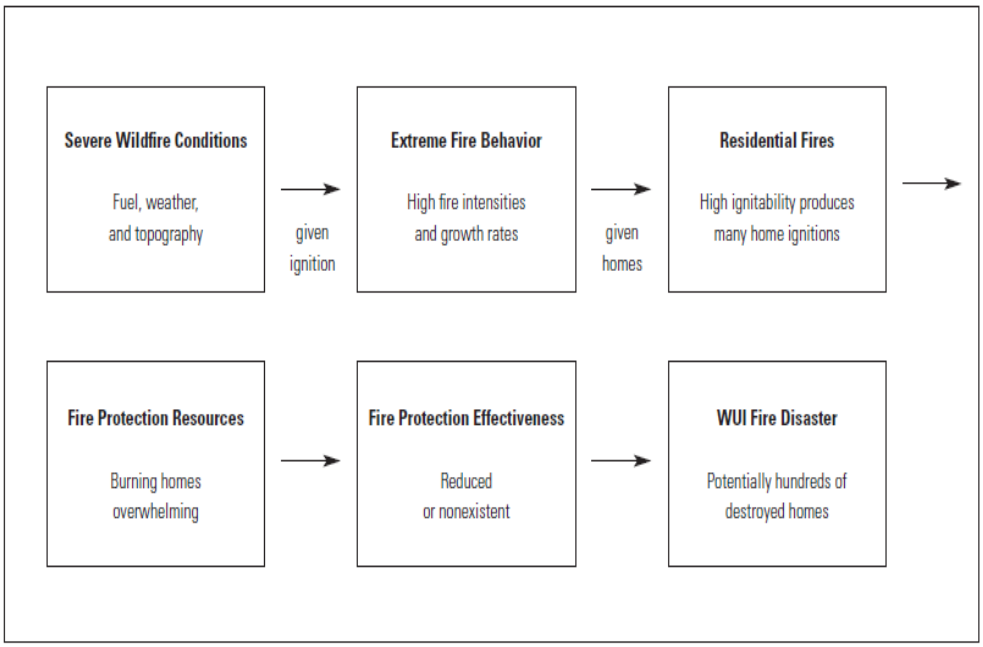


Chart 1. *The WUI fire disaster context depends on exposure of vulnerable homes to uncontrollable, extreme fire behavior. If the number of burning and vulnerable homes overwhelms the fire protection capability, fire protection effectiveness is reduced, and many homes are left without protection. If homes are ignition-resistant then many homes do not ignite and fire protection is not overwhelmed by the ignitions that do occur. Thus, an extreme wildfire can occur without a WUI fire disaster.*

More recent research reinforces and adds nuance to the argument for attention to the home ignition zone. The Insurance Institute for Business & Home Safety (IBHS) has engaged in experiments on how embers ignite

70. *Id.* at 22; *see infra* Figure 4.
71. *Id.* at 24.

homes.[72] As part of its research effort to study and understand the vulnerabilities of buildings subjected to wildfire exposures, IBHS developed the capability of simulating ember and radiant heat exposures on building components and assemblies at its Research Center in Richburg, South Carolina. The primary objective of this research is to reduce the likelihood of wildfire-caused building ignitions in communities located in wildfire-prone areas.

Dr. Stephen Quarles, senior research scientist at IBHS and an expert on building durability, wildfire and moisture exposures, looks at ember exposure to homes during a wildfire event by recreating those conditions in the lab.[73] A growing body of research and evidence from post-fire investigations in the last research emphasize the importance of the threat of ember exposure, and strongly indicate that the majority of structure ignitions during wildfires have been caused by embers.[74] Embers can ignite combustible building components and contents directly, or ignite vegetation and other combustible items located adjacent to or near a building.[75] Once ignited, this material can expose a home or business to radiant heat and direct contact with flames.

These findings have prompted practical advice for property owners to modify the home ignition zone.[76] According to Dr. Quarles, "By creating a noncombustible zone in the 5 feet immediately next to your home or business you will remove most things that could be ignited by wind-blown embers during a wildfire. Consider using rock or stone mulch instead of bark, pine needles or other combustible mulch products."[77]

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72. Stephen Quarles & Anne Cope, *IBHS Research Center Report: Ember Storm Testing*, 2 DISASTER SAFETY REV. 12, 12 (2011), http://disastersafety.org/wp-content/uploads/disaster-safety-review-ibhs-2011-2.pdf.

73. *Id.*

74. *Id.* at 15.

75. *Id.* at 14.

76. *Id.* at 15.

77. *IBHS Offers Guidance on Protecting Properties from Wildfire-Related Damage During California Wildfire Awareness Week*, INS. INST. FOR BUS. & HOME SAFETY, http://disastersafety.org/ibhs-news-releases/ibhs-offers-guidance-on-protecting-properties-from-wildfire-related-damage-during-california-wildfire-awareness-week-2/ (last visited Mar. 5, 2016).

Figure 5

A series of ember experiments clearly showed the potential for embers to ignite vegetative debris that can either accumulate on the roof, in a gutter, or at the base of a wall, and combustible mulch products that can be placed adjacent to the home or business.[78] Ignition of these combustible materials will result in a flame contact exposure to adjacent materials, including siding, windows, materials at the edge of the roof, and even nearby vegetation.[79]

The repeated conclusion of models, experiments, and post fire investigations is that if homes do not ignite, they will not burn.[80] Homeowners can do a lot to reduce their risk from wildfire by making changes to the home itself and the area immediately surrounding the home to prevent ignition.[81]

78. *Id.*

79. *Wildfire Demonstration*, INS. INST. FOR BUS. & HOME SAFETY, http://disastersafety.org/ibhs-risks-wildfire/research-center-demo-wildfire-2011/ (last visited Mar. 5, 2016).

80. *Id.*

81. *Id.*

IV. WHY FIREWISE? THE NEED FOR COLLECTIVE VOLUNTARY ACTION

As discussed, the WUI is not a place but a set of conditions present during a wildfire that create elevated risk to damage and destruction.[82] These conditions can be lessened or mitigated with collective voluntary action based on sound science—Firewise principles—to lessen the potential for homes to ignite.[83] These conditions are oftentimes shared neighbor to neighbor due to the close proximity of homes to one another which creates overlapping or shared ignition zones.[84] It is therefore not just the responsibility of individual homeowners to implement Firewise principles but the community at large. This is the foundation of a Firewise Community: neighbors helping neighbors reduce risk collectively in a voluntary grass roots program.

The Firewise process has been proven to be effective at lessening wildfire risk.[85] The work of Firewise Communities and their success has been recognized nationally by the insurance industry, with one major company to date (USAA) providing discounts to their policyholders that reside in Firewise Communities in selected states.[86]

The Firewise process is simple and relies on the community to engage and take action. In order to achieve recognition, the community must undertake a community-wide wildfire risk assessment, usually performed by a state forestry staffer or fire department specialist.[87] With an understanding of the specific fire risks in the community, volunteers come together to form a board or committee to manage the process.[88] They create a simple plan of action that responds to the findings in the risk assessment. They then conduct a public event, known as a Firewise Day, to engage neighbors in activities such as trimming brush, clearing debris, or chipping up material that people have cleared on their properties.[89] They document their volunteer time, any in-kind services, and any grants they may have used within the community on this effort.[90] They must demonstrate that at least $2 per capita has been devoted

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82. NAT'L FIRE PROT. ASS'N, *supra* note 8, at 1.

83. *FAQs*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/wildfire-preparedness/be-firewise/home-and-landscape/faqs.aspx#8 (last visited Mar. 5, 2016).

84. *The Basics of Defensible Space and the "Home Ignition Zone"*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/wildfire-preparedness/be-firewise/home-and-landscape/defensible-space.aspx (last visited Feb. 10, 2016).

85. *FAQs*, *supra* note 83.

86. *USAA Offers Insurance Discounts for Living in Firewise Communities*, USAA (Oct. 6, 2015, 8:54 AM), https://communities.usaa.com/t5/Press-Releases/USAA-Offers-Insurance-Discounts-for-Living-in-Firewise/ba-p/75543.

87. *Firewise Communities USA/Recognition Program*, NAT'L FIRE PROT. ASS'N, http://firewise.org/usa-recognition-program.aspx (last visited Feb. 10, 2016).

88. *Id.*

89. *Id.*

90. *Id.*

to Firewise work during the year.[91] This requirement means that residents have a stake in the process and it also indicates that this process is easier to employ in a small community such as a neighborhood or subdivision. Finally, the committee fills out a simple form, has it verified by the state forestry agency, and sends it to NFPA.[92] In return, NFPA provides recognition materials including signage, a plaque and publicity.[93] Each year, communities document their Firewise Day activity and their annual investment in order to renew their status. More than 1,200 communities currently participate in this program across 40 states.[94] In Arizona, there are notable examples of Firewise successes. One such example is the Prescott area community of Forest Highlands.[95]

Forest Highlands is a 1,100-acre private residential community nestled at 7,000 feet among majestic pines and groves of mature oaks and aspens; it is five miles south of Flagstaff, Arizona in Coconino County.[96] The development consists of 825 home sites, with 655 homes constructed to date.[97] The majority of the homes are second residences for the homeowner association's 877 members.[98] Forest Highlands has its own 24-hour security staff, public works department, water and wastewater companies, two golf courses and all the normal amenities of a fully self-contained residential and recreational Community.[99] The Highlands Fire District provides fire protection, with the fire department 1/4 mile from the community boundary.[100]

Forest Highlands is a young community whose development started in January 1987 with the sale of the first home site.[101] The first home was completed in early 1988.[102] The vision for Forest Highlands was a pristine mountain wilderness community in perfect harmony with its dramatic natural environment.[103] Ownership and management responsibilities transferred from

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91. *Id.*
92. *Id.*
93. *Id.*
94. *Id.*
95. *Firewise Communities List*, NAT'L FIRE PROT. ASS'N, http://www.firewise.org/usa-recognition-program/firewise-communities-list.aspx (last visited Feb. 14, 2016).
96. *Forest Highlands*, NAT'L FIRE PROT. ASS'N, http://firewise.org/wildfire-preparedness/be-firewise/success-stories/Arizona/Forest-Highlands (last visited Feb. 14, 2016).
97. *Id.*
98. *Id.*
99. *Id.*
100. *Id.*
101. *Id.*
102. *Id.*
103. *Id.*

the developer to a homeowners association (HOA) in January 1996.[104] The HOA manages, controls and protects its community resources through a board and standing committees comprised of HOA members.[105] The top priority for the HOA is—and has been—the protection of its members, their homes and of course home values. Because of its location within the largest stand of Ponderosa pines in the world, the number one threat to Forest Highlands is forest fire.[106] Accordingly, the HOA has focused its protection and risk management initiatives on fire risk, protection, and safety.[107] The Board of Directors and the Firewise, Security, Public Works and Design Review Committees have led this effort.[108]

From information residents shared with the NFPA in order to renew their Firewise Community Recognition status for 2014,

> Approximately 988 residents observed or participated in our Firewise Day activities. The Forest Highlands Fire Department in conjunction with the Forest Highlands Recreation Department and Safety and Compliance Department set up a day of public events with the "Firewise" theme in mind. During the Forest Highlands community-wide BBQ on July 4, 2014 the fire truck was brought out and an Educational Firewise booth was set up to inform the members of the communities about being Firewise. The booth was equipped with Firewise materials and a display, showing varies elements of how the community is and remains a Firewise community. Additionally, we held our first "Chipper Days" on Aug 3–5 and over 63 residents participated by thinning their properties in advance of the event and had their branches and limbs at the street for the community chipper. Note: the above "Current Year Investment for 2014 also includes $378,000 invested by residents who replaced their roofs with fire safe materials on 21 homes."[109]

The successive years of work on the landscape and homes in Forest Highlands, and the lasting dedication of their volunteer efforts, is a Firewise success story. From the beginning of 2000 to the end of 2014, Forest Highlands has invested $1,940,083 into fire prevention and mitigation efforts in their community, much of which is sweat equity.[110] The success of their

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104. *Id.*
105. *Id.*
106. *Id.*
107. *Id.*
108. *Id.*
109. Interview by Faith Berry with Jerry Borgelt, Highland Pines Firewise Cmty. (June 24, 2015).
110. *Id.*

willingness to invest this kind of money and time into these efforts is something that can and should be emulated by other communities in the WUI.

V. IF VOLUNTARY PROGRAMS WORK, WHY REGULATE?

The story of Forest Highlands is but one narrative of successful Firewise actions among hundreds across the nation. The value of applied Firewise principles can be quantified with such measures as the Firewise investment criteria described above, but becoming Firewise also reaps qualitative benefits for communities. Testimony from places such as the Anthem Firewise community in Phoenix, Arizona says it all.

> The impressive aspect to Anthem's Firewise community is that it was initiated by Anthem residents, and they continue to spearhead efforts to keep our community safe. Firewise Days, held in conjunction with Autumnfest, is volunteer-driven by individuals and local partners who are committed and dedicated to preserving our community. Through their efforts, we are able to keep the message fresh, reach new audiences, broaden our e-news subscriber base, and share valuable reminders about fire safety.[111]

If so much progress and goodwill can be generated from voluntary community engagement in wildfire mitigation, then why should communities explore the option of regulation? The evidence of application of enforceable measures such as building codes, zoning ordinances and other wildfire safety rules that apply to private property is scant across the United States. The relatively few jurisdictions with formal regulations typically have passed them in reaction to a significant fire event. While California's defensible space laws are an exception, national experience shows that these, like similar rules in other areas of the country, are difficult to enforce.[112] In spite of the status quo, however, there is a strong case to be made for the need for sound building, design and development standards that take the wildfire hazard into account.

The need for Firewise is driven by the sheer magnitude of homes and communities that already exist in harm's way. The significant population growth and concomitant development over the last several decades means that there are hundreds of thousands of structures in tens of thousands of communities that need immediate attention for maintenance and retrofit in

111. Interview with Michele DeMichele, Dir. Special Events & Civic Bldg. Operations, Anthem Cmty. Council.

112. *100 Feet of Defensible Space is the Law*, CAL FIRE, http://www.fire.ca.gov/communications/communications_firesafety_100feet (last visited Mar. 16, 2016).

order to be safer from wildfire.[113] This is not to imply, however, that new and future development should be exempt from consideration when it comes to sensible siting, design and construction. NFPA has produced guidelines including a primer for developers titled *Safer from the Start: A Guide to Firewise Friendly Developments* with the premise that a community designed and built with the fire hazard in mind is a cost-effective way to gain a safety edge from the very beginning of a new development or new home.[114]

Such guidance is not simply guesswork about what concepts and practical steps will make homes and communities safer from wildfire. NFPA's primary business is a consensus codes and standards process that uses volunteer expert committees and public input to develop minimum safety standards across a range of fire, electrical and related hazards. NFPA's technical committees are comprised of individuals from diverse disciplines, including first responders, insurance professionals, special experts, manufacturers, industry leaders, enforcers, researchers, government officials, and independent contractors.[115] These technical committees, under the guidance of NFPA staff, develop consensus standards that can be adopted as enforceable codes or ordinances.[116] In the field of wildland fire safety, NFPA standards have been developed to address design and construction, among other issues.[117] The most pertinent standards to this discussion include NFPA 1141, *Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas*,[118] and NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*.[119]

NFPA 1141

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113. The U.S. loses approximately 1,000 structures annually due to wildfire. NAT'L FIRE PROT. ASS'N, *supra* note 4, at 4; Erin McClam, *California Wildfire: Firefighters Gain Ground but Thousands of Buildings Threatened*, NBC NEWS (Sept. 16, 2015), http://www.nbcnews.com/storyline/western-wildfires/california-wildfire-firefighters-gain-ground-thousands-buildings-threatened-n428286.

114. NAT'L FIRE PROT. ASS'N, SAFER FROM THE START: A GUIDE TO FIREWISE FRIENDLY DEVELOPMENTS (2009) http://www.firewise.org/~/media/firewise/files/pdfs/booklets%20and%20brochures/bookletsaferfromthestart.pdf.

115. *Technical Committees*, NAT'L FIRE PROT. ASS'N, http://www.nfpa.org/codes-and-standards/standards-development-process/technical-committees (last visited Feb. 12, 2016).

116. *Id.*

117. *Id.*

118. *NFPA 1141: Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas*, NAT'L FIRE PROT. ASS'N (2012) http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=1141 [hereinafter *NFPA 1141*].

119. *NFPA 1144: Standard for Reducing Structure Ignition Hazards From Wildland Fire*, NAT'L FIRE PROT. ASS'N (2013) http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=1144 [hereinafter *NFPA 1144*].

> provides requirements for the development of fire protection and emergency services infrastructure to make sure that wildland, rural, and suburban areas undergoing land use changes or land development have the resources and strategies in place to protect people and property from fire dangers, and allow fire fighters to do their jobs safety and effectively.[120]

"Provisions in this document cover means of access including roadways, fire lanes and parking lots; building access and separation; fire protection and fire warning systems; water supply, fire protection during construction; capacity of fire protection services; and community safety and emergency preparedness."[121]

NFPA 1144 "provides a methodology for assessing wildland fire ignition hazards around existing structures and provides requirements for new construction to reduce the potential of structure ignition from wildland fires."[122] "Provisions specify how to perform a hazard assessment of each structure ignition zone to determine relative risk, the extent of wildland fire hazard, and appropriate mitigation measures."[123] "NFPA 1144 also presents design, construction, and landscaping criteria for fires agencies, land use planners, architects, developers, and local government for planning development in areas that might be threatened by wildfire."[124]

These two standards are examples of tools that can be used and adopted by legislators and government entities to create enforceable ordinances, community codes and regulations. They can insure that residents are adhering to science-based standards to make changes to their homes and the landscape immediately surrounding their homes to reduce the risk of loss due to a wildfire event. Regulation can encourage residents who are not participating voluntarily to engage in Firewise efforts, thereby helping to make the community as a whole safer. This is due in part to many homes in WUI communities and neighborhoods being in close proximity to each other and having what is called an overlapping home ignition zone. This means the condition of one home can affect the survivability of the next door neighbor's home.

Sound regulation that has been institutionalized into a state's or community's way of doing business has the added benefit of addressing wildfire safety in design and development and making it easier for future buyers of real property to maintain that property in a relatively Firewise

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120. *NFPA 1141*, *supra* note 118.
121. *Id.*
122. *Id.*
123. *NFPA 1144*, *supra* note 119.
124. *Id.*

condition. Standardized approaches to safer development also serve to level the playing field for developers and builders and provide a measure of equity and fairness with regard to requirements for new construction.

The primary challenge to such regulation—aside from overcoming perceptions that it is unnecessary or costly to builders and owners—is the ability and capacity for enforcement on private property.[125] The Fire Protection Research Foundation funded a study in 2011 on whether and how communities adopted standards on wildland fire safety for new and existing development. Even among the communities that could serve as models for the regulatory approach, the chief obstacle to be overcome is the ability to enforce on the laws that are on the books.[126]

Regulatory approaches can also relieve the tremendous burden on the private property owner who may not realize when building or purchasing a home in the WUI all that is implied by their responsibility for fire safety. While Jack Cohen and others rightly rail against the longstanding culture of fire suppression that have created the widespread misconception that WUI protection is solely a fire service concern,[127] it is not entirely fair that all of the responsibility for fire safety in WUI areas rest on the shoulders of homeowners. If state and local governments undertake reasonable measures to address known risk through safety standards for new development, the homeowner has some measure of built-in safety to rely on and a more affordable and sustainable basis from which to begin in the maintenance and enhancement of Firewise practices.

CONCLUSION

We have learned what works to prevent home ignitions and thus eliminate the WUI disaster problem. It is with a combination of voluntary behavior change, incentives and sound planning and regulation, that communities can embrace and will change the outcomes during future large wildfires. NFPA's mission seeks to eliminate loss due to fire, electrical and related hazards. Firewise Communities, a program of the NFPA, provides science based guidance that creates opportunity for residents in communities to engage in

125. CHRIS DUERKSEN ET AL., ADDRESSING COMMUNITY WILDFIRE RISK: A REVIEW AND ASSESSMENT OF REGULATORY AND PLANNING TOOLS 48 (2011), http://www.nfpa.org/research/fire-protection-research-foundation/projects-reports-and-proceedings/for-emergency-responders/fire-prevention-and-administration/addressing-community-wildfire-risk.

126. *Id.* at 52.

127. Timothy Inglesbee, *Key Points of Cohen's Paper*, SAVE AM.'S FORESTS, http://www.saveamericasforests.org/congress/Fire/Cohen.htm (last visited Mar. 12, 2016).

grass roots efforts to lessen their risk to a wildfire event. Over the course of time, efforts of Firewise Communities to improve the condition of their homes and the landscape immediately surrounding their homes have proven effective in reducing losses of property and lives.

Standards developed by the NFPA can also provide a template for a safer future. When such standards are adopted to create enforceable ordinances and regulations, there is a clearly- defined method for governments and residents to make effective changes based upon scientific principles. With these elements in place, it becomes possible for communities at risk for WUI disaster to adapt to the reality of nature's fire sustainably.