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Professional wildfire mitigation competency: a potential policy gap

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ABSTRACT

Studies show that effective strategies to mitigate the risk of structural damage in wildfires include defensible spaces and home hardening. Structures in the western United States are especially at risk. Several jurisdictions have adopted codes that require implementation of these strategies. However, construction and landscaping professionals are generally not required to obtain credentials indicating their competency in mitigating the risk of structural damage in a wildfire. We discuss the implications of this policy gap and propose a solution to bolster competency of professionals in wildfire protection as communities further expand in fire-prone areas.

Keywords: certification program, contractor, education, landscaper, professional engineer, structure protection, training program, wildfire mitigation, wildfire policy, wildland–urban interface.

Introduction

Home hardening, defensible space and landscape fuel management throughout communities reduce wildfire risk and increase the likelihood of structure survival during a fire (Maranghides and Mell 2011; Syphard *et al.* 2012; Syphard and Keeley 2019). Building codes and property regulations that require exterior fire-resistant construction and maintenance of defensible space effectively reduce ignitions from embers, radiation from adjacent structures and fuels, and therefore subsequent losses (Restaino *et al.* 2020). The three most important protection features are: the 0–5 foot (1.5 m) defensible space zone, Class A (non-combustible) roof coverings and ember-resistant vents. Other protection features such as non-combustible siding and double-paned windows are especially important in communities where proximity to an adjacent home occur (UC Cooperative Extension 2021).

Homeowners in the wildland–urban interface are traditionally responsible for implementing such measures to protect their own homes from wildfires (Thomas *et al.* 2017). While prior studies have focused on efforts to motivate homeowners to invest in structure hardening and defensible space (Schulte and Miller 2010; Absher and Vaske 2011), limited research exists on establishing pathways to ensure that homeowners are (1) living in homes designed to mitigate actual (local) wildfire risk, and (2) retrofitting and maintaining their homes in a manner that adequately bolsters fire resistance.

First, homes in wildfire-prone areas should be designed and constructed to appropriate fire-safe standards based on local fire risk and in accordance with authoritative codes and guidelines (Intini *et al.* 2019). However, stringent wildfire construction and vegetation management codes are fairly recent and frequently apply only to new construction or major retrofits. For example, new homes built in California since 2008 in a local jurisdiction's Very High Fire Hazard Severity Zone (VHFHSZ) must meet fire-resistant construction requirements set forth by the California Building Code Chapter 7A (State of California 2021*b*). Although the vast majority (approximately 95%) of current homes in California were built before 2008 (Kasler and Reese 2019; United States Census Bureau 2019), an estimated additional 645 000 housing units will be developed in VHFHSZs by 2050 (Mann *et al.* 2014). Yet, even if following available code guidance, the use of exterior wildfire-resistant materials and construction methods alone is not enough to protect

a home. Small gaps between roof coverings and siding, components in eaves, window glass and frame, and deck boards can allow ember intrusion and accumulation leading to structure damage or loss (Quarles *et al.* 2010; Manzello *et al.* 2012). Furthermore, according to a study of structure loss during the 2018 Camp Fire in California, the biggest indicators of home destruction include vertical and horizontal clearances, referring to distances and number of other destroyed structures; homes constructed since 1997 had similar survival rates to those built after 2008 to the more stringent Chapter 7A Code (Knapp *et al.* 2021). These findings indicate that it is critical to both address structural vulnerabilities throughout an individual property and those in adjacent properties for overall risk reduction.

Second, while residents from rural communities are typically familiar with wildfire risk factors and take active steps to mitigate property ignition, those in urban or suburban communities are only more recently facing wildfire threats and may not be familiar with wildfire mitigation. Such urban or suburban wildland–urban interface (WUI) residents may have the finances and motivation to reduce fire risk but may lack the knowledge and skills to implement mitigation measures (Carroll and Paveglio 2016). Such homeowners likely turn to design, construction, landscaping and maintenance professionals.

Growing awareness of wildfire risk has prompted new attention and commitment toward wildfire protection at the neighbourhood and homeowner level. For example, participation in the grassroots wildfire mitigation program Firewise, run through the National Fire Protection Association (NFPA), has increased significantly within the last few years, particularly in California following recent wildfires (National Fire Protection Association 2016; Rodriguez 2019). The expansion of the Firewise program reflects a broader trend of WUI residents actively working to protect themselves, their property and their communities.

However, structure protection can quickly become expensive. Some home protection features are quite cheap and easy to install, such as replacing coarse screens on vents with finer screens or flame- and ember-resistant vent options, while others can be very costly and require significant labour (Penman *et al.* 2017). Estimates from Headwaters Economics indicate that retrofitting a home in southwestern Montana can cost tens of thousands of dollars. Based on labour and material costs, replacing siding or a wood-shake roof to meet wildfire-resistant standards can cost US$40 000 and US$22 000, respectively. Establishing defensible space costs US$4000 on average, though removing individual trees can easily cost that much (Gorte 2013). In 2018, the 253 Firewise sites in California each spent an average of US$253 814 on wildfire mitigation, or US$1335 per participating household; although this sum includes volunteer-equivalent hours (valued at US$28.43 in 2018), it also reflects dollars invested in labour and resource costs for home hardening and defensible space (National Fire Protection Association 2019). Homeowners who plan to invest in wildfire mitigation should feel confident that their investment will actually protect their homes.

The correct installation and continued maintenance of exterior fire protection features are critical to reducing widespread destruction from wildfires. Here, we first discuss the issue of insufficient or non-existent wildfire mitigation training for both professional engineers and building contractors, before presenting a potential policy solution in the form of wildfire mitigation training and certification programs designed for engineers and contractors.

Lack of competency requirements

Industry practitioners

Despite the growing risk of wildfire exposure across the western United States and around the world, professionals (or owner-builders) involved in design and construction of wood frame, single-family residential projects rarely need to obtain credentials indicating proficiency of skills and technical knowledge in structure wildfire protection. For example, in California, any person can prepare plans, drawings and specifications for such projects (California State Legislature 1997, 2004). Still, to obtain permits for construction, a plan review and approval of the building and vegetation management by the building code or fire official is generally required. During this process, any non-compliance in the design or vegetation management is flagged and must be corrected. Once approved, there may be no further authoritative oversight of the project depending on local laws and available resources (State of California 2021*a*).

By contrast, construction projects for structures of greater occupant loads (e.g. high-rise buildings) and those containing significant fire hazards (e.g. industrial processing facilities) must be designed by licensed practitioners that have met rigorous competency requirements (Justia 2021). Such projects often involve consulting a licensed fire protection engineer (FPE) to interpret local codes, conduct fire risk assessments, or provide fire safety strategy guidance from concept design through final construction drawings (Society of Fire Protection Engineers 2021).

No such norms exist for structural wildfire protection (California Department of Forestry and Fire Protection 2021). The California state examination and minimum experience requirements to obtain FPE licensure do not include any knowledge related to wildfire exposure (National Council of Examiners for Engineering and Surveying 2020). For comparison, structural engineers seeking licensure in California must take an 8-h exam on wind and earthquake lateral loads and a second 8-h exam on vertical and incidental lateral loads on buildings (National Council of Examiners for Engineering and Surveying 2021*c*).

In addition, while some universities offer professional training opportunities, these primarily cover fire ecology and natural resource management rather than structure

protection (Association for Fire Ecology 2021). Universities that offer classes or certifications on wildfire science do not necessarily focus on the installation and maintenance of home hardening and defensible space features.

Contractors and landscapers

As most homes were constructed prior to the creation of local wildfire-resistant codes, homeowners who are committed to wildfire mitigation need to retrofit their homes and create defensible space. Many urban and suburban WUI residents need professional support for major tasks such as replacing flammable exterior siding, installing vents, or clearing large trees (Paveglio *et al.* 2015). For example, 34% of homeowners surveyed in Colorado cited the physical difficulty of home hardening as a moderate or extreme barrier, and 24% of homeowners did not have adequate knowledge of either wildfire-resistant construction or defensible space to take action (Absher *et al.* 2013).

However, contractors, gardeners, landscapers and other specialists involved in home hardening and defensible space may be unfamiliar with local wildfire ordinances (such as those restricting certain types of flammable vegetation like juniper or cypress), may accidentally exacerbate danger (such as placing wood mulch within the immediate 0–5 foot (1.5 m) home ignition zone), or may incorrectly install wildfire-resistant retrofits (such as leaving gaps in a fire-rated roof that could allow ember intrusion).

Furthermore, contractors who are not knowledgeable about wildfire risk and mitigation may place the entire neighbourhood at risk. Community-wide protection (herd immunity) consisting of widespread individual home protection is the most effective way to protect communities from wildfire impacts (McCaffrey 2015). Homeowners typically learn about contracting or gardening resources from neighbours, either through word of mouth or networks like NextDoor that allow local residents to share recommendations or concerns (López and Farzan 2015; Gardens Illustrated 2020). A homeowner who is satisfied with their wildfire mitigation contractor would likely recommend that individual to other neighbours interested in pursuing wildfire mitigation. However, if a contractor accidentally exacerbates wildfire danger by incorrectly installing wildfire-resistant retrofits or if a landscaper plants vegetation directly next to the siding (as is currently discouraged but not regulated in California), and that contractor is hired at multiple homes in the same neighbourhood, then the overall risk of the community intensifies.

Potential opportunities in training and certification

Industry practitioners

Competently trained and certified professionals should be required to review fire safety of developments in wildfire-prone areas. Such professionals should also understand the purpose and science behind these regulations and their role in holistic fire and life safety strategy (i.e. integrated systems for fire and smoke detection, occupant notification, safe egress, active and passive fire protection, firefighting access). They should consider wildfire risks to structures and the community at large, develop appropriate mitigation strategies where codes fall short and inspect exterior structural fire protection features to reduce the likelihood of structure ignition. Inspections of homes in the WUI during design and construction could ensure wildfire safety was ingrained in the structure's creation, akin to the Leadership in Energy and Environmental Design (LEED) certification process for sustainable green buildings (Bond and Devine 2016). A single person is unlikely to be certified or trained in enough fields to conduct all structural and vegetative inspections, resulting in the need to integrate wildfire mitigation competency across many relevant professions.

The National Council of Examiners for Engineers and Surveying (NCEES) regulates the standardised examinations administered to engineers seeking professional licensure in the United States. Eligibility requirements vary by state but generally include a minimum of several years of relevant experience obtained under the supervision of an already-licensed engineer (National Council of Examiners for Engineering and Surveying 2021*a*). The NCEES already administers tests for specialty engineering knowledge to ensure competency in areas that have unique considerations or hazards such as nuclear, mining and biological engineering (National Council of Examiners for Engineering and Surveying 2021*b*). However, there is no exam that includes questions on wildfire-specific topics. Establishing a wildfire competency evaluation as part of an FPE, civil and/or structural licensure at a national or state level (depending on local and regional wildfire risk), or the adoption of additional training and certification programs aimed at these practitioners could expand awareness of wildfire mitigation opportunities among professional engineers.

Contractors and landscapers

Current certification programs designed to teach wildfire science and mitigation do not specifically target mitigation professionals. The NFPA's Certified Mitigation Specialist Program educates participants on wildland science and structure protection, but it offers a one-size-fits-all approach that does not specifically address installation or landscaping best practices, or require prior knowledge (National Fire Protection Association 2021*a*). The National Volunteer Fire Council and the US Forest Service jointly lead the Wildland Fire Assessment Program, which teaches volunteers how to conduct assessments for homes in the WUI (National Volunteer Fire Council 2021). As of 2021, real estate sales in California must include verification that the property complies with defensible space requirements as

determined by either CAL FIRE or the local fire department, likely requiring new inspectors to meet increased demand (California State Legislature 2019). Certain local organisations, like the Marin Wildfire Prevention Authority, already offer residential property inspections and personalised lists of recommendations or non-compliance for homeowners (https://www.marinwildfire.org/project/defensible-space-and-home-hardening-evaluation-and-inspection-program).

Some construction trade associations, such as the National Roofing Contractors Association and the Fenestration & Glazing Industry Alliance, already offer certifications for professionals, though not on wildfire mitigation (National Roofing Contractors Association 2020; Fenestration & Glazing Industry Alliance 2021). Wildfire versions of these certifications could improve homeowners' confidence in hiring contractors and ensure that retrofits or installations are properly done to mitigate wildfire risk.

Some structure mitigation certification or training programs already exist. FIRESafe Marin and the Northern California Landscape Contractors Association (NCLA) partnered to create a pilot program called 'Fire-Smart Landscaping 101.' The program is a 1-h course designed for landscape professionals that teaches participants about defensible space, fire- and drought-resistant plant options, landscape maintenance and fire-smart landscaping. Graduates earn a certificate of completion recognised by both FIRESafe Marin and NCLA (FIRESafe Marin 2020). Similarly, the University of Nevada Reno Extension's Living with Fire program has offered instruction in 'Firewise Landscaping' (ThisIsReno 2021).

A path forward

A training and certification program specifically for professionals involved in wildfire mitigation, established either through legislation or from a national organisation like NFPA, could improve the protection and defensibility of structures and neighbourhoods. Participation should be free, accessible and not overburdensome so as to encourage widespread participation. Participants could include anyone with responsibility associated with wildfire-resistant construction standards (including original construction and retrofits) and defensible space, including, but not limited to, builders, engineers, contractors, roofers, handypeople, planners, gardeners, landscapers and arborists.

Training should reflect current fire science and engineering knowledge and debates and could offer credits for continuing education requirements for professional engineers. For example, contractors should be able to explain to homeowners the limitations in the current understanding of ignition of homes by firebrands, thus allowing homeowners to make informed choices based on available science (UC Cooperative Extension 2021). But contractors should also provide clear guidance to homeowners regarding well-recognised structure protection dangers like wood shake roofs or woody mulch within the 0–5 foot (1.5 m) home ignition zone (Quarles *et al.* 2010; Manzello *et al.* 2012). In addition, greater confidence in wildfire-resistant contracting and landscaping services could encourage more homeowners to invest in mitigation.

California is a potential pilot site for a certification program for three reasons. First, California has past precedent for establishing state-sponsored training and certification programs through legislation. In 2018, California law S.B. 1260, 'Fire prevention and protection: prescribed burns' established a new training and certification program for prescribed burns specifically for private landowners (Jackson 2018); the first training occurred in 2021, following several years developing a curriculum (Kan-Rice 2021). In 2019, California law A.B. 1516, 'Fire prevention: wildfire risk: defensible space and fuels reduction management' established a statewide program under the Department of Forestry and Fire Protection (CAL FIRE) to create a training and certification program for third-party assessors to support CAL FIRE's 'defensible space and home hardening assessment and education efforts' (Friedman 2019).

Second, documenting and sharing records of retrofits or defensible space inspections conducted by certified professionals could help homeowners maintain their fire insurance, possibly at reduced costs because of mitigation efforts. Hundreds of thousands of insurance policies have not been renewed in the wake of recent wildfire seasons (Chiglinsky and Chen 2020). Home hardening and defensible space are critical contributors to insurance pricing and availability (California Department of Insurance 2021*b*). Thirteen percent of California's housing insurance market is covered by nine insurers that offer discounts based on home and neighbourhood mitigation efforts, with calls from the Insurance Commissioner for participation by other insurance companies (California Department of Insurance 2021*a*). Similarly, Wildfire Partners in Boulder County, Colorado, has trained homeowners in the area in wildfire mitigation. Homeowners who pass their mitigation inspection receive a certificate from Wildfire Partners that ensures that major insurance companies like Allstate, State Farm and USAA Insurance will not issue non-renewals based on wildfire hazard (https://wildfirepartners.org/our-program/).

Our proposed program could be designed as a public–private partnership among the state government, insurance companies and manufacturers and resellers who provide fire-safe materials. Contracts with certified professionals could be presented to insurance companies to provide greater assurance of effective fire protection, potentially reducing reliance on public insurance programs like the FAIR (Fair Access to Insurance Rates) Plan in California. Similarly, documented purchases and installations of fire-safe materials from manufacturers and resellers could improve insurers' confidence in a structure's protection. The Insurance Institute for Business & Home Safety (IBHS) currently offers a Disaster Dynamics Academy to train

insurance industry representatives – but not on-the-ground inspectors or adjusters – on wildfire mitigation (Insurance Institute for Business & Home Safety 2021). Insurance inspectors who check on individual homes each year to determine insurance prices may not be familiar with wildfire mitigation measures. Inspectors or adjusters could separately earn a certification that would teach them how to inspect a home for wildfire mitigation.

Third, California has committed to investing nearly US$1 billion in wildfire resilience in its 2021–2022 budget in addition to US$200 million per year over the next 6 years, including dedicated funding for defensible space and home hardening retrofits following recent destructive wildfire seasons (Rodd 2021). Taxpayer dollars committed toward protecting the most at-risk communities in California should be spent on high-quality retrofits and defensible space; a training and certification program could help develop a workforce that is familiar with state and local structure protection codes and ordinances. In addition, California has more Firewise sites than any other state in the country, indicating strong local interest in wildfire mitigation efforts already (National Fire Protection Association 2021*b*).

Jurisdictional differences in wildfire-related codes for home hardening and defensible space (Haines *et al.* 2008; Intini *et al.* 2019) may present a significant logistical challenge in creating a training program. Adhering to the International Wildland–Urban Interface Code (IWUIC) as a nationwide model code provides overarching requirements, but individual states and local jurisdictions may adopt more stringent or differing provisions. Contractors or engineers trained in one jurisdiction may accidentally violate more restrictive local regulations in another. Thus, a training program for wildfire mitigation professionals should expound on the nuance of code applicability and provide guidance on obtaining relevant codes to ensure that the retrofits or defensible space meet local requirements. Alternatively, if trainings are implemented statewide, each local jurisdiction could produce a summary document describing the specific wildfire-related code requirements that differ from the most comprehensive compliance options, such as the Chapter 7A Code in California.

Other areas with preexisting extensive construction and defensible space standards, such as Australia or Canada, may also benefit from such a program (Intini *et al.* 2019). Institutions like NFPA (which produces WUI standards) or the International Code Council (which produces the IWUIC) could similarly support the creation of a training program.

Such a training program should be affordable, accessible, quick and scientifically sound, while providing information and training specific to the jurisdiction and particular structure features. Shorter, concentrated trainings that provide relevant wildfire mitigation certifications for landscapers and contractors will likely result in more widespread participation and education. Rather than create more barriers to expensive retrofits or maintenance, a training program should ensure that practitioners know how to properly identify, install and retrofit wildfire-resistant structural features or defensible space. This proposed program could follow a similar model for design and implementation to 'Fire-Smart Landscaping 101' or California's new certification program for prescribed burning.

Recent wildfire seasons have demonstrated the critical need to protect homes and communities through adequate structure protection. New construction in the WUI should be certified as wildfire-resistant by professional engineers or appropriate officials. In addition, structures in jurisdictions that do not require wildfire-resistant materials for major retrofits may benefit from a professional engineer's review. Homeowners who are motivated to pay for hardening their homes and creating defensible space should feel confident that their investments are effectively protecting their homes. Here, we propose a new training and certification program specifically for engineers, contractors, gardeners and other home improvement professionals designed to teach them both the science behind structure protection as well as the local wildfire-related ordinances. A workforce of home improvement and construction professionals who are trained and familiar with wildfire mitigation techniques could improve structure and community protection to avoid future significant structure losses.

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