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PRACTICE **WILDFIRE ADAPTATION**

An aerial photograph of a residential area with a large, intense wildfire in the background. Thick, dark smoke billows from the fire, partially obscuring the sky. In the foreground, several houses and trees are visible. A large, white, stylized number '9' is overlaid on the left side of the image, partially covering the houses and trees.

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Zoning and Land-Use Tools in the Wildland-Urban Interface

By Anna Read, AICP, and Molly Mowery, AICP

From wine country in California to suburban homes in Colorado to small towns in Tennessee, large wildfires threatening homes and communities are in the headlines more often than ever. As development increasingly spreads into areas that border or commingle with forests, grasslands, and other open spaces—an area known as the wildland-urban interface, or WUI—more communities are taking steps to proactively address the risks associated with wildfire.

WUI regulations have traditionally been administered and enforced by local fire or building departments. As a result, many of these regulations focus on fire protection standards (such as access and water supply), structural vulnerabilities, and public and firefighter safety. These are critical issues that are essential for reducing loss of life and property. However, as concern about and awareness of the WUI grows, communities are also recognizing the need to look at a broader range of strategies to address and mitigate wildfire risk to the built and natural environments. This provides an opportunity for planners to play an active role in addressing and mitigating wildfire risk through local land-use and development regulations.

THE WILDLAND-URBAN INTERFACE

The wildland-urban interface is defined as the area where human development meets or intermingles with wildlands, such as forests, grasslands, and shrub lands. The WUI is further defined in two primary typologies:

- Intermix WUI—Development is interspersed with wildland vegetation, such as forested areas.
- Interface WUI—Development borders but is not interspersed with wildland vegetation. This may appear as a clear edge between the wildlands and the WUI development.

The WUI has expanded rapidly over the last several decades and WUI conditions exist in all 50 states. WUI growth can happen

in two ways: the expansion of development into wildlands and the revegetation of wildlands in proximity to homes (such as the reforestation of formerly agricultural lands). The former accounts for the vast majority of WUI growth (Radeloff et al., 2018).

Recent research by the SILVIS Lab at the University of Wisconsin and the U.S. Department of Agriculture Forest Service (USFS) found that between 1990 and 2010, the WUI (as defined in terms of housing density and vegetation) increased in area by 33 percent (from 581,000 to 770,000 km², an area larger than the state of Texas). Additionally, the number of housing units in the WUI grew by 41 percent (from 30.8 million to 43.4 million homes), with dwellings in the WUI accounting for 43 percent of new home construction over this period. One-third of homes and nearly one-third of the U.S. population are located in the WUI, which accounts for just less than 10 percent of the land area in the conterminous U.S. (Radeloff et al., 2018).

The WUI is often spatially defined in terms of the relationship of developed land to wildlands. However, the WUI can also be thought of as a set of conditions where the relationship between development and wildlands increases the risk of or exposure to wildfire. These include both natural conditions and conditions of the built environment. Natural conditions include topography, hydrology, and climate, while conditions of the built environment include lot size, road construction, the flammability of structures, the proximity of structures to other structures and vegetation, and the type and location of vegetation. Essentially, the WUI does not become a problem until these conditions combine to create heightened wildfire risk.

Multiple trends have driven growth in the WUI. These include development expanding outward as people search for more affordable housing in suburban and exurban communities, the development of second homes in communities with scenic or recreational resources, and the desire to live in proximity to nature.

WUI Challenges

When human development comes into proximity with wildlands, it poses multiple challenges. These include habitat fragmentation, spread of invasive species or diseases, and impacts on water quality (a significant concern given that National Forests are the drinking water source for 66 million Americans). Wildfire, however, is one of the primary concerns due to the scope of potential impacts it can have on communities, including local air and water quality issues, damage to property, threats to public safety, damage to critical infrastructure and interruptions in services, loss of views and aesthetic values, postfire erosion concerns, impacts to tourist-based economies, and more.

Unlike other hazards, wildfires are often started by human activities. Wildfires ignited by humans, including those that spread from homes to surrounding wildlands, account for 84 percent of all wildfires and add an estimated 40,000 wildfires per year. They have tripled the length of the fire season and expanded the geography of wildfire (Balch et al. 2017).

The Rising Costs of Wildfire

As the WUI has grown, so too have the costs associated with fighting wildland fire. The costs of fire suppression have been consuming an increasing share of the USFS budget, accounting for more than half of it in FY2015, compared to 16 percent in 1995. And in FY2017, the USFS fire suppression costs exceeded \$2 billion. As more funds are directed to fighting fires, fewer resources are available for other activities, including those that reduce wildfire risk.

The costs of fire suppression, which also impact state and local agency budgets, do not represent the full economic impacts of wildfire on WUI communities. Communities face a range of direct and indirect economic impacts from wildfire, including property loss and damage, loss of working lands (e.g., timber and agriculture), and disruptions to the tourism industry. The economic impacts

of the 2017 California wildfires are estimated to have been \$10 billion (Cal Fire).

Living with Wildfire

In many landscapes, wildfire is a natural ecological process. It plays an important role in maintaining native plant species, controlling pest populations, and providing habitat. However, following an intense fire season in 1910, which burned through millions of acres of forests and devastated frontier towns in Idaho and Montana, the recently formed U.S. Forest Service began to focus on rapid suppression of wildfires. This soon evolved into use of a “least-cost-plus-loss” model, which focused on suppression levels that accounted for the economic losses caused by

the WUI. As the wildfire risk has grown—for reasons including both a changing climate and the long-term impacts of past fire management practices—more people now live in areas that are at risk from wildfire.

It’s also important to understand that response and suppression continues to serve an essential role in community protection. Fire response agencies are 97 to 99 percent effective; although only a small percentage of wildfires escape initial attack, under the right conditions these escaped fires pose significant challenges to communities when they burn into developed areas by overwhelming resources and leading to WUI disasters (Cohen, 2008). Communities therefore should not rely on wildfire suppression

alone and must plan for scenarios where structures and other assets are prepared for wildfires.

Fire Adaptation

Because wildfire exclusion is increasingly recognized as having contributed to the wildfire management challenge, and there is growing awareness that wildfire plays an important role in many ecosystems,

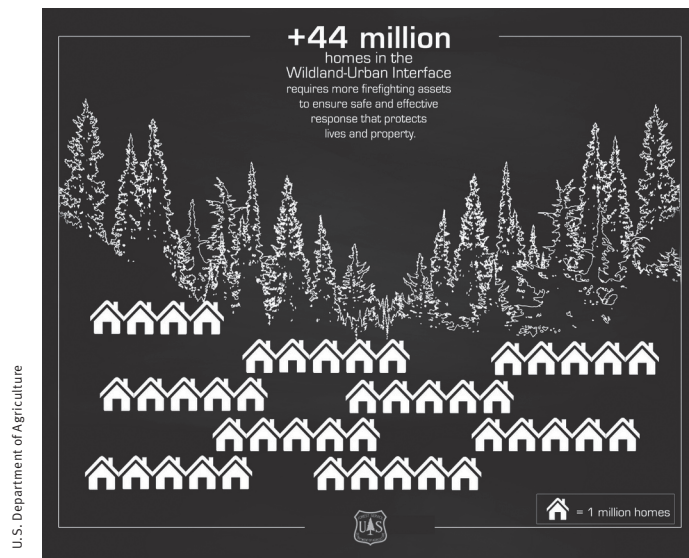
communities are working to adapt to living with wildfire. Becoming

that while many communities have undertaken activities to reduce their wildfire risk, these rarely include a comprehensive application of land-use planning tools. This may be the case for multiple reasons, including lack of staff capacity, lack of political will, or because wildfire issues have traditionally been addressed by staff in other departments (Rasker et al. 2015).

As a result, land-use and development regulations are both important tools for communities to consider as part of their strategy for addressing and living with wildfire, and many communities have yet to realize the full potential of these tools for addressing wildfire risk.

Planners should consider a number of factors of how and where development is located in the WUI, beyond whether or not development is sited in areas of high wildfire hazard. Although the list below is not exhaustive, it does include considerations likely to be addressed through land-use and development regulations:

- Spatial pattern and extent of development in the WUI, including whether the development is intermix or interface WUI, and the density of the development
- Siting of structures on the lot, with considerations for topography, spacing between structures, and setbacks
- Ingress/egress for fire-fighting equipment and evacuations, including standards for minimum width or maximum grade of roads and driveways, as well as requirements for secondary access for emergency response or evacuation
- Hazardous materials or land uses, including the storage of hazardous or combustible materials, such as fuel storage facilities
- Landscaping and vegetation maintenance, including creating and maintaining defensible space around homes and using native plants and drought- or fire-resistant landscaping, reducing aesthetic features such as vegetative buffers, as well as maintenance of community parks, trails, or open spaces
- Water supply and water storage, including on-site storage
- Land uses that allow for large congregations of people, such as outdoor mass gatherings such as summer festivals, weddings, and concerts



➡ This infographic from the USDA helps to illustrate the national scale of the wildland-urban interface.

wildfires. By 1935, response and suppression tactics had been codified into the so-called 10 a.m. policy, which called for fires to be contained by 10 a.m. on the day after they were reported (Donovan and Brown, 2005). While these policies were designed to protect towns and timber resources from wildfires, the active suppression or exclusion of wildfire from landscapes with natural fire regimes interrupted the natural ecosystems and led to an accumulation of understory, which provides additional fuel for fires and helps them move more quickly. These fire management practices coincided with the growth of development and population in

fire adapted—or acting to improve a community’s ability to live with wildfire—is an ongoing process that involves multiple tools and strategies. Effective land-use and zoning regulations can be a key part of a community’s strategy for reducing risk and more effectively living with wildfire.

LAND-USE AND DEVELOPMENT REGULATIONS FOR THE WILDLAND-URBAN INTERFACE

Where and how development is located in the WUI plays an important role in mitigating wildfire risk. However, previous research by Headwaters Economics, Wildfire Planning International, and Clarion Associates found

The factors outlined above can be addressed through a range of land-use and development regulations, from wildfire hazard overlay zones to landscape standards, which are further described in the section that follows. These tools apply to different scales, from the community or district scale to the site scale (where there is most likely to be overlap with issues addressed in the building or fire codes). These tools may be incorporated into zoning ordinances and land-use and development codes, or may be adopted as stand-alone ordinances, as is generally the case with a WUI code. Others, such as wildfire overlay zones, require that the community have a zoning ordinance. This may be a challenge in communities that do not have zoning authority.

It's important to note that land-use controls are not meant to eliminate the risk of wildfire, but to be a tool for communities to locate and regulate development in ways that mitigate risk and help them more effectively live with wildfire. It's also important to note that there are different considerations for existing development in the WUI, where structures are unlikely to be relocated and where nonconforming uses are likely to exist, than there are for new development that can be planned and built to current codes and standards.

In practice, implementation of land-use and zoning regulations to reduce wildfire risk and moderate impacts to the natural environment has taken a variety of forms. Douglas County, Colorado, located between Denver and Colorado Springs on Denver's Front Range, adopted a Wildfire Hazard Overlay District in 1999. The overlay district applies to all areas that have been mapped and any areas that have been field-verified as potential hazard areas based on an adopted hazard rating system. Development and the various measures used to regulate development such as building permits, exemptions, rezoning, site improvement, and subdivisions, must mitigate hazards and comply with standards for road and street design, signage, and emergency water supply (Douglas County).

Flagstaff, Arizona, is located in the largest contiguous ponderosa pine forest in the world. The majority of the city is located within the WUI. In 2008, the city adopted the International Code Council's International Wildland Urban Interface Code (IWUIC)—a

model WUI code for local governments—as part of their International Fire Code update. The initiation of their WUI code followed the adoption of a *Community Wildfire Protection Plan* and extensive public outreach, which was incorporated into local amendments to the code (Summerfelt and Wheeler).

Following the 2003 fire season, which included the Cedar Fire—California's largest wildfire up to that time—San Diego County adopted a defensible space ordinance for the unincorporated areas of the county (San Diego County). The ordinance prohibits the accumulation of combustible materials or other vegetative waste, as well as flammable materials within 100 feet of the exterior perimeter of a property and within 30 feet of a property line. It further prohibits the accumulation of such materials within 10 feet on either side of driveways and private roads. It also allows the fire warden to determine if more extensive zones of clearance are necessary (SEC. 68.404. A-D).

The regulatory interventions pursued by these three municipalities represent just a small subset of the potential paths that cities and counties may want to pursue. The following codes, mechanisms, standards, and practices provide a more complete

menu of options that can be useful in addressing the challenges faced by municipalities in the WUI.

Wildfire Hazard Overlay Zones

Overlay zones are a tool to apply a supplemental designation to the base zoning provisions of a zoning district. Overlay zones, which are used for a broad range of purposes, can be an effective tool for communities in the WUI because they modify the base zoning provisions of the district, creating area-specific standards. Creating a wildfire hazard overlay zone can therefore be used to apply additional standards aimed at mitigating wildfire risk.

A community may limit development of certain uses, such as critical facilities, within the wildfire overlay zone. Or it may require additional review for development, or specific mitigation practices, such as defensible space or fire-resistant landscaping. Implementation of a wildfire hazard overlay zone requires technical mapping of the wildfire hazard area.

One important note in using overlay zones is that wildfire hazard areas can be extensive across communities and may not fit neatly within an easily defined area; in all



Eglin Air Force Base



This photo from Fort Walton Beach, Florida, illustrates the often sharp delineation between wildland and urban areas, and the risk of wildfire. No structures were damaged in this June 2011 fire.



➡ Los Angeles's Sayre Fire of 2008 destroyed 489 residences, including 480 homes in the Oakridge Mobile Home Park pictured here. Damage to local infrastructure and utility services made even the surviving homes uninhabitable.

cases, communities should tie the delineation of hazard zone to a wildfire hazard map.

Transfer of Development Rights

Transfer of Development Rights (TDR) programs designate "sending areas" and "receiving areas." The sending areas preserve and protect open space or other ecologically important areas in perpetuity in exchange for higher density development in the receiving areas, or areas of the community where development is encouraged. Because TDR programs permanently protect open space and ecologically important areas, they can be designed to include designated areas of wildfire concern as sending areas or to prohibit the inclusion of areas of wildfire concern in the designated receiving areas. Designating areas of wildfire concern as sending areas permanently conserves these areas as open space, which reduces development in higher hazard areas. Prohibiting the inclusion of areas of wildfire concern in receiving areas can limit

additional growth in existing development in high-hazard areas or further expansion of development in the WUI. Both structures encourage development in areas of the community with lower wildfire hazard.

WUI Code

A WUI code is designed to promote safer building and development within a wildland-urban interface area. WUI codes are often adopted as stand-alone codes that work in conjunction with the local fire and building codes. WUI codes address a broad range of considerations, including establishing minimum regulations related to the density and location of structures and defining allowable building materials and vegetation management practices. WUI codes also address access for emergency vehicles and water supply. WUI codes may apply to all new construction, as well as modifications to existing structures or properties. The IWUIC provides a model for municipalities that are interested in pursuing a WUI code.

Municipalities should also check with their state building councils to determine whether additional locally adopted WUI requirements within the building envelope do not conflict with state building code authority.

Subdivision Regulations and Cluster Subdivisions

Because subdivision regulations address a range of conditions on the parcel, they can be an effective tool for addressing a number of issues of concern for communities in the WUI. These include access (ingress/egress), roads, water supply, landscaping and vegetation management, street signage, and areas of refuge. Subdivision regulations also define the allowable density of development and address siting of structures on the parcel. They may also enumerate requirements for open space within the development. Subdivision regulations may address clustering of buildings on the site (cluster subdivisions), often in conjunction with the provision of open space.

Cluster subdivision standards (also referred to as conservation subdivisions), can be another tool for addressing development location to reduce wildfire risk in the WUI. These standards can be mandatory or optional and are generally included in and implemented through subdivision regulations. They cluster development on a site without increasing the overall density on that site. This can protect and preserve open space on the site and can also create fuel breaks or defensible space that help protect homes from wildfire (and wildlands from homes). These standards can be used to cluster development outside of high-risk areas.

A University of Wyoming study examined fire suppression expenditures across 291 wildfires in three western states and found that the cost of protecting a small number of homes in a dispersed development pattern exceeded the cost of protecting a larger number of homes in a clustered development pattern by up to \$620,000 (Scofield et al. 2015). Cluster subdivision standards can be an important tool for mandating or encouraging development outside of high-risk areas, creating fuel breaks between homes and wildlands, and reducing the costs of fire suppression. It is important to note that even in cluster subdivisions, minimum setbacks between homes should still be required in high-density areas where wildfire is a concern to allow for the management of vegetation surrounding homes and reduce the risk of home-to-home ignitions.

Defensible Space Regulations

Defensible space regulations are a common and important type of regulation in the WUI. Defensible space regulations define zones for the treatment, maintenance, and removal of vegetation and debris around the structure. Defensible space is often defined in two zones—an inner zone where all combustible material must be removed, and an outer zone, where vegetation must be carefully spaced and maintained.

These regulations serve three purposes. First, they protect homes from wildfire by creating a buffer between the home and the surrounding wildlands to reduce the likelihood of structural damage from flames or radiant heat; second, they reduce the risk that a structural fire will spread from the building to the surrounding wildlands; and third, they enable

firefighters to more safely protect homes from wildfires.

Landscape Standards

Defensible space regulations may address landscaping; however, communities may also want to more comprehensively address landscaping in areas of wildfire risk through more specific landscape standards. These standards address the landscaping on a site, specifying the types of plants allowable, the amount and location of landscaping, and required maintenance. Landscape standards can be used to encourage or require the use of drought-tolerant and fire-resistant plants in areas of wildfire risk.

They can also address the spacing and maintenance of trees and shrubs on a site to make it more difficult for fire to spread between landscape elements and to the home or other structures.

Use-Specific Standards

Use-specific standards apply a supplemental set of conditions or regulations applied to specific land uses. They can be applied to all zoning districts, or to specific subareas, such as a community's mapped WUI or areas of high wildfire risk. They can address specific issues related to wildfire hazards, such as hazardous materials or fuel storage. Use-specific standards can be subject to discretionary review to determine whether the proposed use complies with the standards.

Code Enforcement

WUI regulations cannot be effective without ongoing enforcement. This can be a challenge in resource-limited communities or where multiple departments are involved and lines of responsibility are not clearly delineated. For example, a study by the National Fire Protection Association, highlighted in the May 2012 issue of *Zoning Practice*, found that the foremost maintenance challenge cited by 12 case study communities was ongoing maintenance of defensible space (Mowery and Anthony 2012). Regulations that are not implemented or enforced will not result in a reduction of wildfire risk to the community. As a result, it is important that communities clearly define the responsibility for enforcement and designate the necessary staff and resources to enforce the adopted regulations.

Understanding Existing WUI Regulations

This article outlines multiple planning tools that communities can use to address challenges in the WUI. However, the regulatory steps that communities have taken to address wildfire risk in the WUI are most often concentrated in the fire and building codes. The building code can be used to address construction and materials to mitigate wildfire risk, including use of ignition resistant materials for roofs, decks, and patios. The fire code may contain provisions related to water supply and on-site water storage, as well as standards related to fire equipment access to the site. It is important for planners working in the WUI to be aware of and understand wildfire and WUI-related provisions in other adopted codes and build relationships with their colleagues in other departments who have responsibility for enforcing these regulations.

Addressing Conflict Between Regulations and WUI Management Goals

Another consideration for communities in the WUI is potential conflict between existing regulations and WUI management goals. For example, if a community has landscaping standards that promote vegetative buffers, these could be at odds with defensible space requirements or fuel reduction goals. Sign code regulations that seek to minimize signage may be at odds with WUI code regulations that require signs to direct firefighters in rural or remote areas. And urban design guidelines may conflict with access measures for fire-fighting equipment.

Planners can play an important role in identifying and addressing areas where there may be conflict between existing land-use and development regulations and goals or priorities for WUI management, and can facilitate conversations across departments to help resolve these conflicts.

CONCLUSION

The WUI has grown rapidly over the last several decades and, given current development trends, is expected to continue to expand over the next several decades. Past wildfire management practices combined with decades of rapid growth in the WUI and changing climate patterns have made wildfire a real and growing concern for communities across the country.

Where and how development is located in the WUI has an impact on a community's

resilience to wildfire. As communities take steps to mitigate their wildfire risk and become more resilient to wildfire, land-use and development regulations, including wildfire overlay zones, subdivision regulations, landscaping standards, and defensible space regulations, are an important part of the toolbox.

This creates a more active role for planners in WUI management, which has traditionally been the purview of the fire and building departments.

It is important to consider land-use and development regulations as one part of a community's strategy for addressing wildfire risk in the WUI. The regulations should be

used in conjunction with other tools and strategies, such as community wildfire protection plans, fuel treatments, and home owner outreach and education.

Although many of the country's largest and most destructive wildfires have recently occurred in the West, wildfire is not just a western issue. WUI conditions exist in all 50 states, and the challenges faced by communities within the WUI are considerable.

As WUI development continues and more people live in proximity to areas that are at risk for wildfire, planners can play an active role in working to address and mitigate wildfire risk through their community's land-use and development regulations.

REFERENCES

Balch, Jennifer, et al. 2017. "Human-started wildfires expand the fire niche across the United States." *Proceedings of the National Academy of Sciences* 114 (11): 2946–2951. Available at <https://bit.ly/2NCHxGV>.

Cal Fire. "Top 20 Largest California Wildfires." Available at <https://bit.ly/2LiZwpd>.

City of Flagstaff, Arizona. "City Code." Available at <https://bit.ly/2uIS5NB>.

Cohen, Jack. 2008. "The Wildland Urban-Interface Fire Problem." *Forest History Today*. Fall. Available at <https://bit.ly/2JSJ49L>.

County of San Diego, California. "Code of Regulatory Ordinances." Available at <https://bit.ly/2Le4dAJ>

County of Douglas, Colorado. "Douglas County Zoning Resolution, Section 17—Wildfire Hazard Overlay District." Available at <https://bit.ly/2JMdF8T>.

Donovan, Geoffery, and Thomas Brown. 2005. "Wildfire Management in the U.S. Forest Service: A Brief History." *Natural Hazards Observer* 29 (6). Available at <https://bit.ly/2JJj9kJ>.

International Code Council. 2015 International Wildland-Urban Interface Code. Available at <https://bit.ly/2hFzVoN>.

Mowery, Molly and Anthony, Paul. 2012. "Limiting Wildfire Risk Through Land Use Controls." *Zoning Practice*, May. Available at <https://bit.ly/2Lh1TJa>.

Radeloff, Volker, et al. 2018. "Rapid growth of the U.S. Wildland Urban Interface exacerbates wildfire problems." Published ahead of print March 12. *Proceedings of the National Academy of Sciences*. Available at <https://bit.ly/2NzLeo2>.

Rasker, Ray, et al. 2015. "Integrating Wildfire into the Land Use Planning Process: A Case Study on Summit County, Colorado." Available at <https://bit.ly/2uGaZFc>.

San Diego County Planning and Development Services. "Fire, Defensible Space, and You. . ." Available at <https://bit.ly/2JMGNg4>.

Scofield, Anna, et al. 2015. "Residential Development Effects on Firefighting Costs in the Wildland-Urban Interface." Ruckelshaus Institute, University of Wyoming. Available at <https://bit.ly/2uRmME>.

Summerfelt, Paul, and Jim Wheeler. "Wildland-Urban Interface Code Adoption: How to Avoid the Agony." Available at <https://bit.ly/2uYt5RU>.

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DOES YOUR CODE ENCOURAGE
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