

The logo for the American Planning Association (APA) Hazard Mitigation & Disaster Recovery Planning Division. It features the letters 'APA' in a large, white, serif font on a grey background. Below this, the word 'Hazard' is written in a smaller, white, sans-serif font. A yellow horizontal bar is at the bottom of the logo area.

APA

Hazard

American Planning Association
**Hazard Mitigation & Disaster
Recovery Planning Division**

Building planners' knowledge base to make communities safer before, during, and after disasters.

- 767 members
- 12 countries
- All 50 states and 2 territories
- Public, private, non-governmental, and academic sectors

For more information or to join, visit <https://hazards.planning.org/> or contact us at apa.hmdr@gmail.com

Designing for Wildfires

Information for Planners



FEMA

Today's Speakers

Stacy Wright, FAICP, PMP, CFM



- Senior Technical Manager at AtkinsRéalis (STARR II JV)
- Post-disaster response/recovery support for over 130 federally declared disaster events since 1997

Daniel Bass, RA, CFM



- FEMA Building Science Disaster Support Program Manager
- 18 years of experience in disaster resistant design, construction and resilience
- 25+ years practicing Architect in the private sector prior to joining FEMA

Darlene Rini, PE



- Leads the wildfire risk mitigation service line at Jensen Hughes (STARR II JV)
- 23 years of experience in fire engineering and wildfire risk mitigation



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Outline

- Introduction
- Marshall Fire Mitigation Assessment Team (MAT)
- Guidance and Recommendations
 - Community-Scale Wildfire Planning
 - Neighborhood-Scale Wildfire Planning
- Additional Resources



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Acronyms

- AHJ – Authority Having Jurisdiction
- APA – American Planning Association
- BSDS – Building Science Disaster Support
- CBC – California Building Code
- CWPC –Community Wildfire Planning Center
- IBHS – Insurance Institute for Business & Home Safety
- ICC – International Code Council
- IWUIC – International Wildland Urban Interface Code
- MAT – Mitigation Assessment Team
- NFPA – National Fire Protection Association
- NIST – National Institute of Standards and Technology
- NWCG – National Wildfire Coordinating Group
- SME – Subject Matter Expert
- UCNAR – University of California Agriculture and Natural Resources
- WUI – Wildland Urban Interface



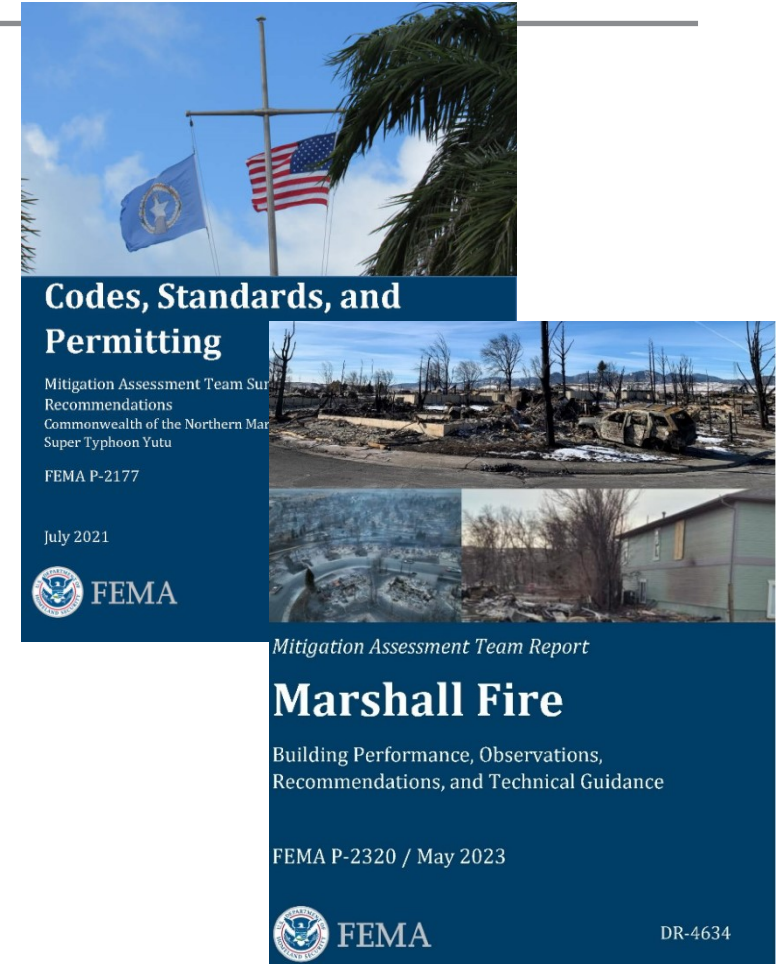
Introduction



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Building Science Disaster Support Program (BSDS)

- Provide building science technical support to Federal, State and Local disaster recovery operations
- The Mitigation Assessment Team (MAT)
 - Perform the work of the BSDS
 - Consist of building performance assessment SMEs
 - Study building performance through a forensic A/E lens following natural disaster events
 - Evaluate what worked and what failed in the built environment to inform recovery, rebuilding and hazard mitigation
- Reinforce what works and develop improved design and construction techniques for what didn't



Typical Outcomes of FEMA BSDS / MATs

- Recovery Advisories specific to the disaster
- Recommendation to improve codes and standards, guidance documents, and programs
- Recommendation to Code adoption and enforcement
- Regulatory guidance and support
- Disaster Risk Reduction Minimum Codes and Standards policy implementation support
- Public education and awareness
- Technical Report
- Mitigation guidance and best practices

Flood Protection for Backup and Emergency Power Fuel Systems



IOWA FLOODS OF 2016 RECOVERY ADVISORY R.A.S., April 2017

Purpose and Intended Audience

The Federal Emergency Management Agency (FEMA) deployed a Mitigation Assessment Team (MAT) to examine damage in Linn County and Black Hawk County, Iowa after the Midwest floods of 2016. The area experienced a precedent setting flood of record in 2008 and in 2016. The area has 100-year flood level in many low, but the depth and extent not of the same magnitude as 2008. Fortunately, the mitigation measures after the 2008 floods performed in the impacted areas to protect infrastructure providing for rapid allowing residents to return to much more quickly than in 2008. This Recovery Advisory provides operators, facility managers, a information on mitigation specific protect power systems, and fuel flood damage. Protecting these impact of flooding enabling be be restored at facilities shortly needs.



Disaster Risk Reduction Minimum Codes and Standards FEMA Policy 204-078-2

POLICY STATEMENT

FEMA will encourage and, to the extent permitted by law, require the integration and use of nationally recognized voluntary consensus-based building codes and standards¹ consistently across FEMA programs.²

SCOPE

This policy applies to all FEMA non-disaster grant programs obligations on the public; it is regarding minimum codes a

PRINCIPLES

Integration of nationally recognized into Agency activities will:

- Protect Lives and Property and territorial government building codes and standards by increasing the safety.
- Support the Efficient Use recognized voluntary consensus vulnerability to new consensus need for future Federal c
- Inform Development of Codes and Standards: FEMA's standards will result in re informing consensus-based reduction related to building and standards.

¹ Voluntary consensus-based building codes, however, once these codes are adopted, required to be followed by the laws and regulations.
² Minimum design standards are consistent with Technology Transfer and Advancement Act Federal initiatives related to the effects of.
³ This policy does not apply to the individual.



Marshall Fire Mitigation Assessment Team:

Best Practices for Wildfire-Resilient Subdivision Planning

April 2023 FINAL DRAFT



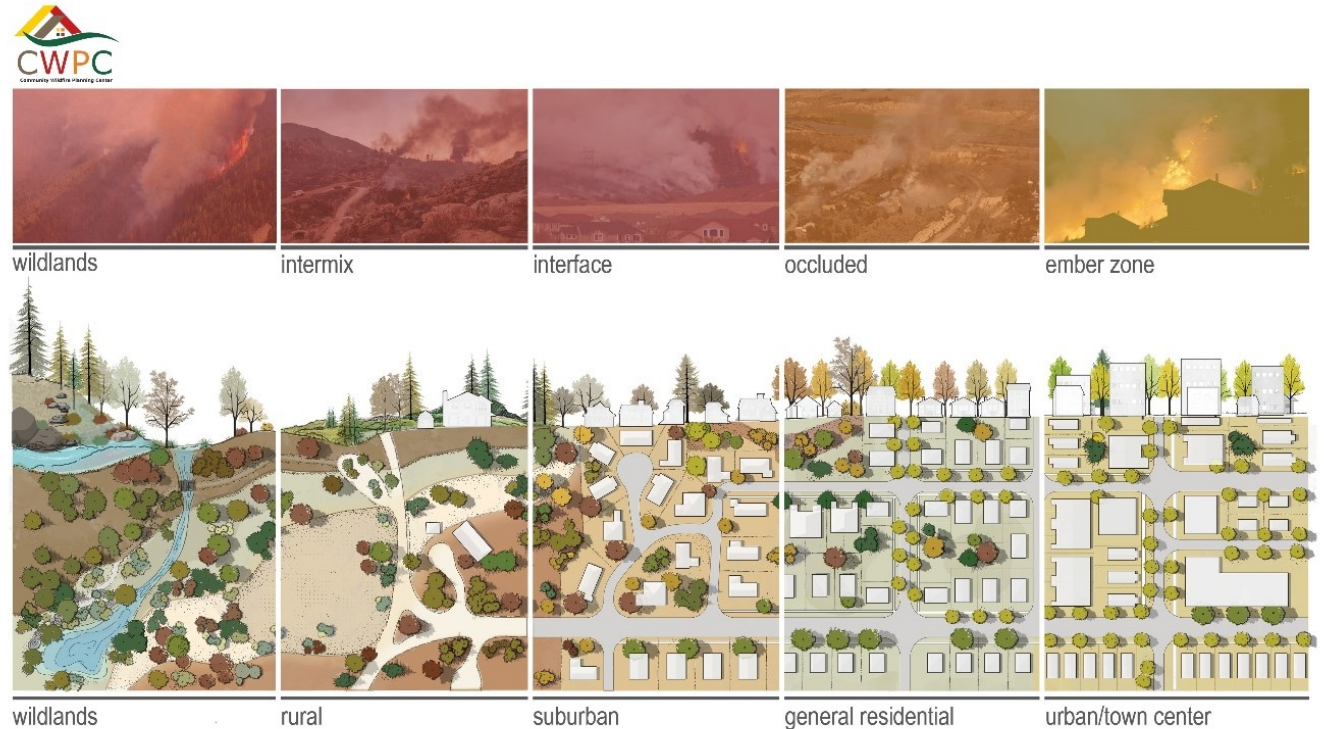
DR-4634



What is the WUI?

The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels. An area where mitigation actions can assist in preventing damage or loss from wildfire.

*National Wildfire Coordinating Group
(NWCG)*

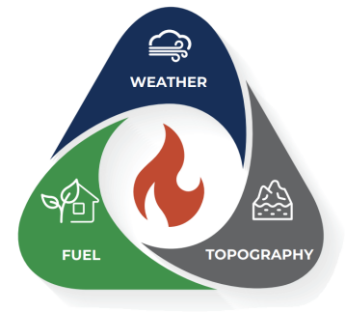


Source: Community Wildfire Planning Center



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Key Components of WUI Problem



- Weather – Temperature, relative humidity, precipitation, wind, and atmospheric stability
- Vegetation – Fuel type (timber, shrubs, grasses), amount, arrangement, moisture
- Topography – Slope, aspect, terrain features, elevation
- **Interaction with Built Environment** – People, building typology, interface/intermix, urban fuels



Images from USFS



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The Marshall Fire



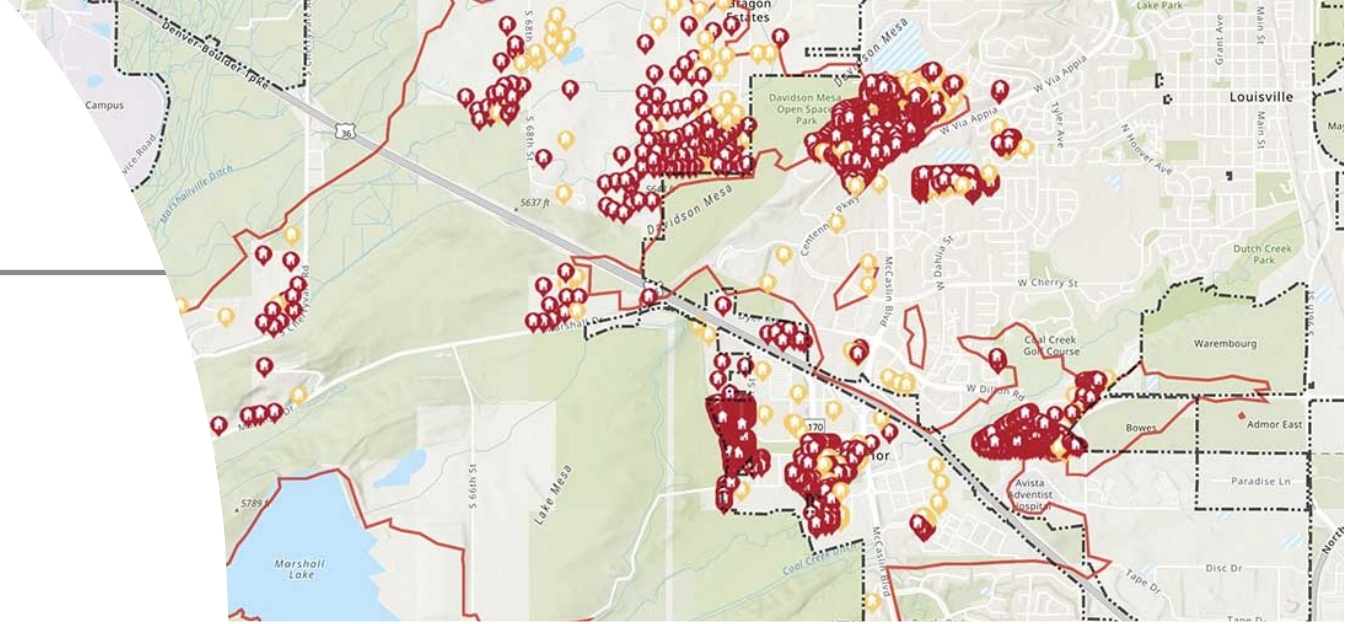
Image from NOAA Marshall Fire Story Map



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Marshall Fire

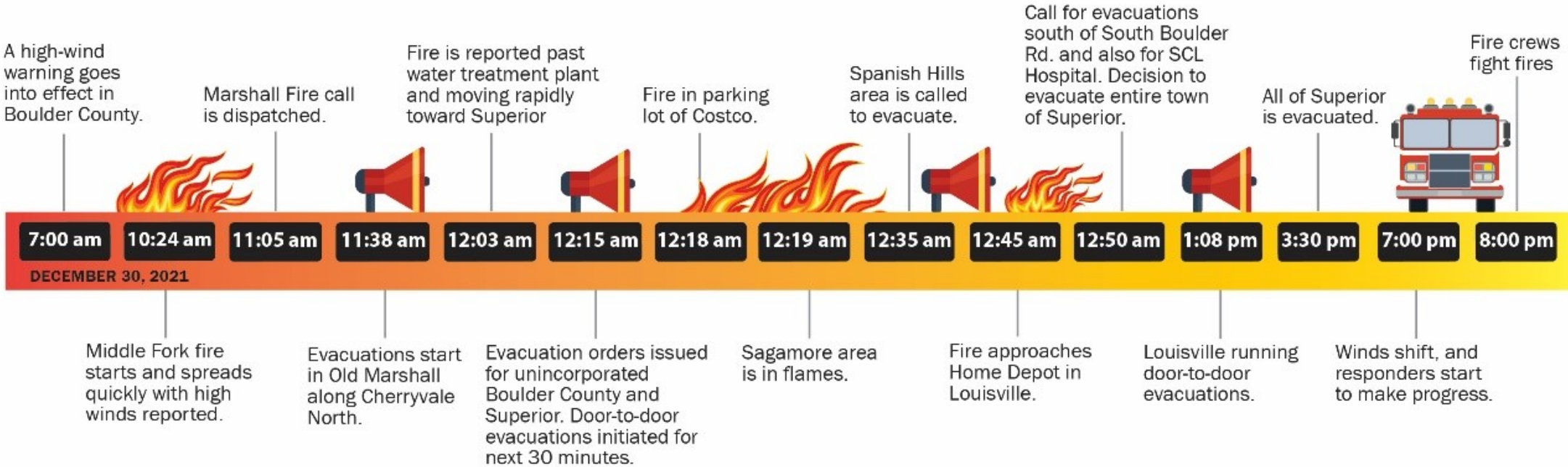
- **Event Date:** December 30, 2021
- **Affected Areas:** Louisville, Superior and unincorporated Boulder County, CO
- **Most destructive fire in CO**
 - ~6,219 acres burned
 - ~1,084 buildings destroyed (~98% residential, ~2% commercial)
 - ~ 127 buildings damaged
 - Primarily residential
 - Multiple wildfire incidents simultaneously



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Marshall Fire

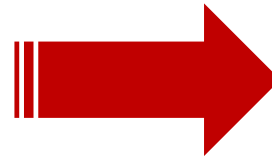
Marshall Fire Timeline



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Key Factors for Impacts and Motives for MAT

- Extreme winds (100mph+ gusts)
- Long-term drought
- Unseasonably high temperatures (60-70°F)
- Primarily a fast-moving grassland fire
- Limitations in WUI code adoption
- Limitations in WUI planning



Motives 1st FEMA wildfire MAT:

- Better understand wildfire-built environment interactions
- Better inform wildfire resiliency planning and implementation for planners, developers, government officials, and the public-at-large

MAT Partners

- FEMA Headquarters
- FEMA Region VIII
- U.S. Fire Administration
- State of Colorado
- STARR II
- IBHS
- ICC
- Oregon State University
- University of Colorado Boulder



COLORADO



Key Observations by the Marshall Fire MAT

1. Structure/House Density and Separations (structure-to-structure fire spread)
2. Competing multi-hazard mitigations
3. Unmanaged or poorly maintained common and public open spaces



Key Observations by the Marshall Fire MAT

4. Insufficient parcel-level vegetation management (e.g., mulch, trees, hedges)
5. Non-structural combustible attachments or “wicks” (e.g., decks, fences, outbuildings, vegetation)
6. Lack of ember protection for vents (attics, crawl space/basement, soffits)



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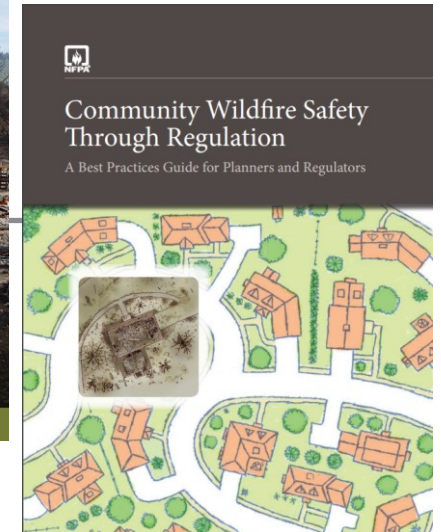
Guidance and Recommendations



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Sample Resources for Planners

- APA
 - Planning the Wildland-Urban Interface (594, 2019)
 - Limiting Wildfire Risk Through Land-Use Controls (2012)
 - Planning the WUI in Hillsborough County, FL (2020)
 - Multi-hazard Planning Framework for Communities in the Wildland-Urban Interface (2018)
 - Zoning and Land-Use Tools in the Wildland-Urban Interface (2018)
 - Models for Mitigating Wildfire Hazards Through Zoning (2005)
- NFPA
 - Community Wildfire Safety Through Regulation (2013)



Sample Resources for Planners

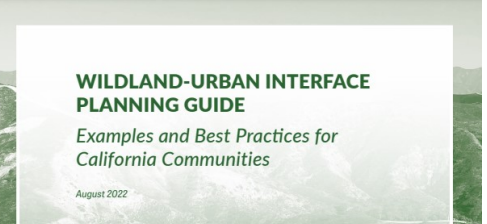
- National Wildfire Coordinating Group
 - NWCG Standards for Mitigation in the Wildland Urban Interface, PMS 052 (2023)
- Community Wildfire Planning Center (CWPC)
 - Land Use Planning Approaches in the Wildland-Urban Interface (2021)
 - Introduction to Land Use Planning for Wildfires in California (CAL FIRE and CWPC, 2023) – Free Training
- California Governor’s Office of Planning and Research
 - Fire Hazard Planning Technical Advisory (2022)
 - Wildland-Urban Interface Planning Guide (2022)



The following training presentation was delivered at multiple locations in CAL FIRE and the Community Wildfire Planning Center in 2023. The purpose of the trainings was to:

- Increase foundational understanding of California state requirements for land use planning in fire hazard areas, including the General Plan Safety Element, F. Regulations, Subdivision Review Program, and applicable chapters of Cal Building and Fire Codes
- Expand knowledge of wildfire vulnerabilities in the built environment at different scales, including subdivision and lot scales
- Learn about best practices and resources for proactive planning in the wildland-urban interface based on recent guidance issued by the Office of Planning and Research, CAL FIRE, Community Wildfire Planning Center, and other organizations
- Interact with peers to exchange perspectives on fire mitigation and planning exercises and facilitated discussions

More information about the trainings can be found at www.communitywildfireplanningcenter.org. Trainings were co-sponsored by the American Planning Association, California Chapter to provide Certificate Maintenance for AICP planners. Funding for this project was provided by the California Department of Forestry and Fire Protection as part of the California Climate Investments Program.



UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

UC ANR Publication 9680 | April 2020
<https://doi.org/10.3733/ucanr.9680>
<http://anrcatalog.ucanr.edu>

Building to Coexist with Fire: Community Risk Reduction Measures for New Development in California

MAR MORITZ, University of California Cooperative Extension Wildfire Specialist in the Bren School of Environmental Science and Management at UC Santa Barbara

VAN BUTSIC, University of California Cooperative Extension Assistant Land-Use Specialist in the Department of Environmental Science, Policy and Management at UC Berkeley

Drawn imagery of a post-fire neighborhood in Paradise, California. The 2018 Camp Fire was the deadliest in California's modern history, destroying most of the towns of Concow and Paradise. To live on the post-fire landscapes, better guidance on where and how we build our communities is urgently needed.

What matters most is how well you walk through the fire.
Charles Bakowski, 1920-1994

Abstract
Where communities are built on the landscape, and how they are designed, are very important issues in determining how vulnerable they will be to wildfire-related losses. Despite this fact, there is currently little codified guidance for where and how to build our communities in California, aside from building codes for individual structures and a few requirements for road access and water supplies. We therefore surveyed the literature and drew from the professional experience of both firefighters and planners to compile this series of community-scale risk reduction measures (RRMs). This document includes guidance on the following:

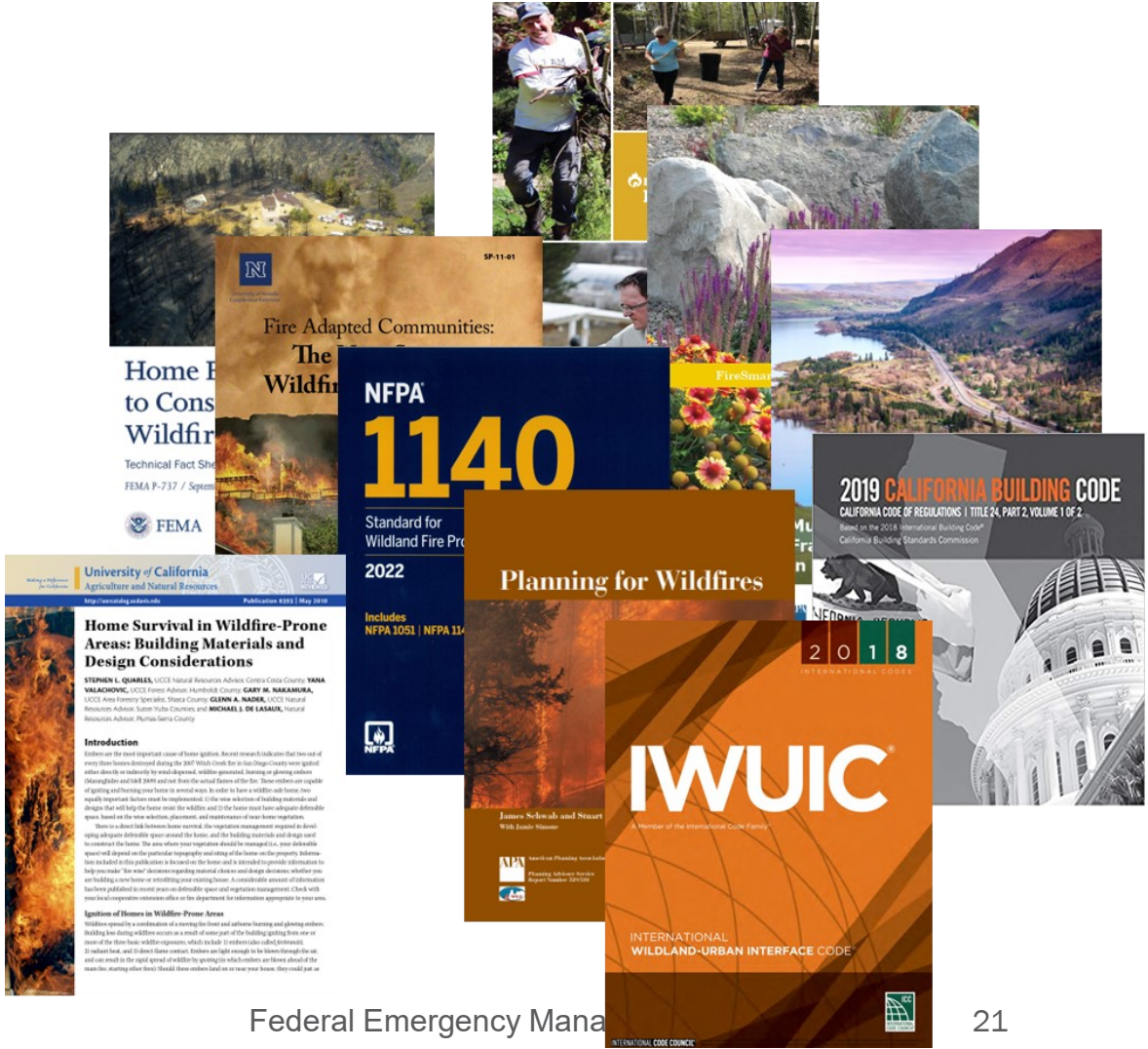
Inclusion of fire professionals in the planning process; the spatial placement of communities; how communities are laid out to minimize exposure; and key defensibility, ignition, and evacuation concerns. Examples are provided for each RRM, along with some consideration of challenges associated with their implementation. Our hope is that this guidance will be helpful for agency personnel involved in evaluating and approving future development in California. Because there is a pressing need for additional housing in California, communities must be built with design principles that make them safer to inhabit and less vulnerable to inevitable wildfire.



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Existing WUI Codes, Standards and Guidance

- Building codes and standards (e.g., IWUIC, CBC Chapter 7A, NFPA 1140)
- Guidance documents (e.g., NIST Hazard Mitigation Methodology)
- Research (e.g., IBHS)
- Academic institutions (e.g., UCANR)
- Programs = Firewise, Ready-Set-Go
- Planning and policies documents (e.g., APA)
- Local ordinances, guidance, and tools

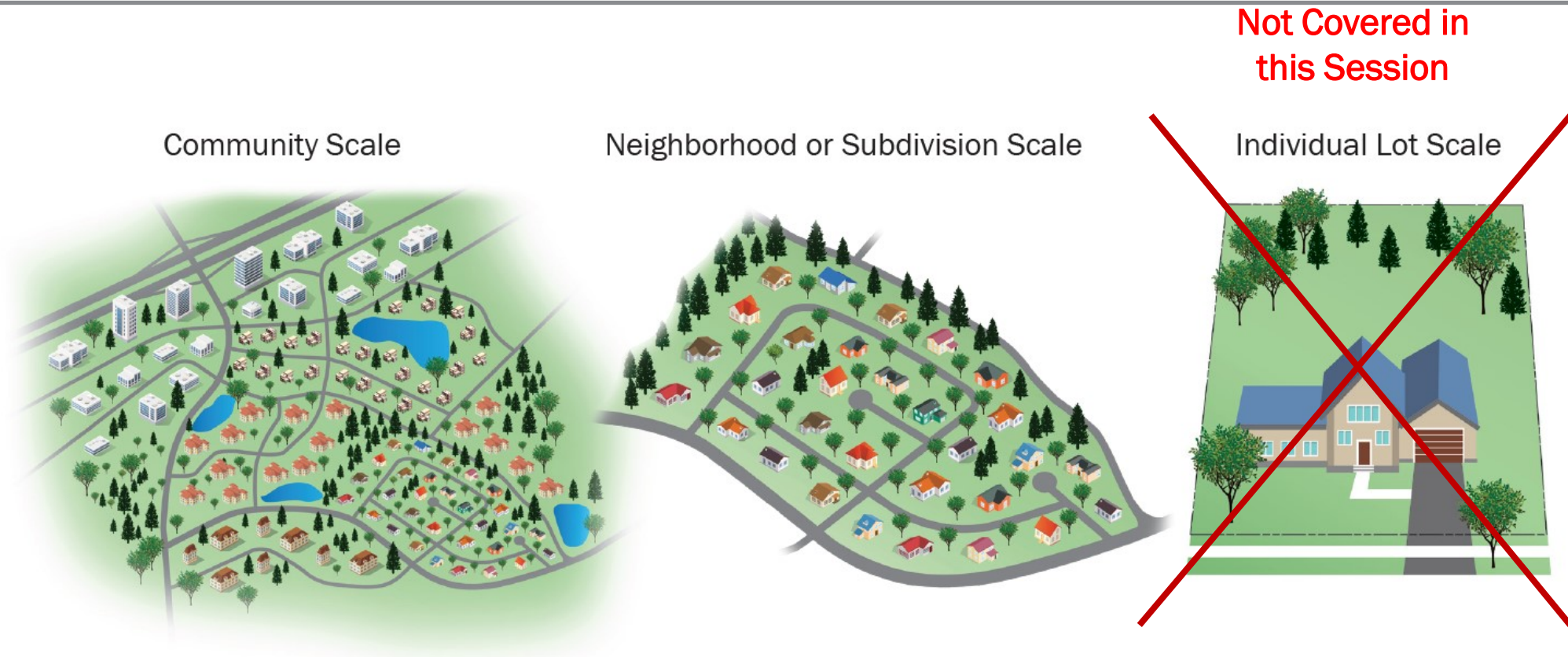


Planning Elements – Where Wildfire Resiliency Fits?

- Comprehensive, General or Master Plans
- Local Hazard Mitigation Plans
- Open Space Management Plans
- Urban Forestry Management Plans
- Capital Improvement Plans (CIPs)
- Community Development Plans
- Housing
- Infrastructure
- Transportation Plans
- Zoning and Land Use Planning
- Environmental Impact Reports (EIRs)
- Regional Planning
- Climate Action Plans
- Sustainability Plans



Wildfire Planning and Mitigation at Scales

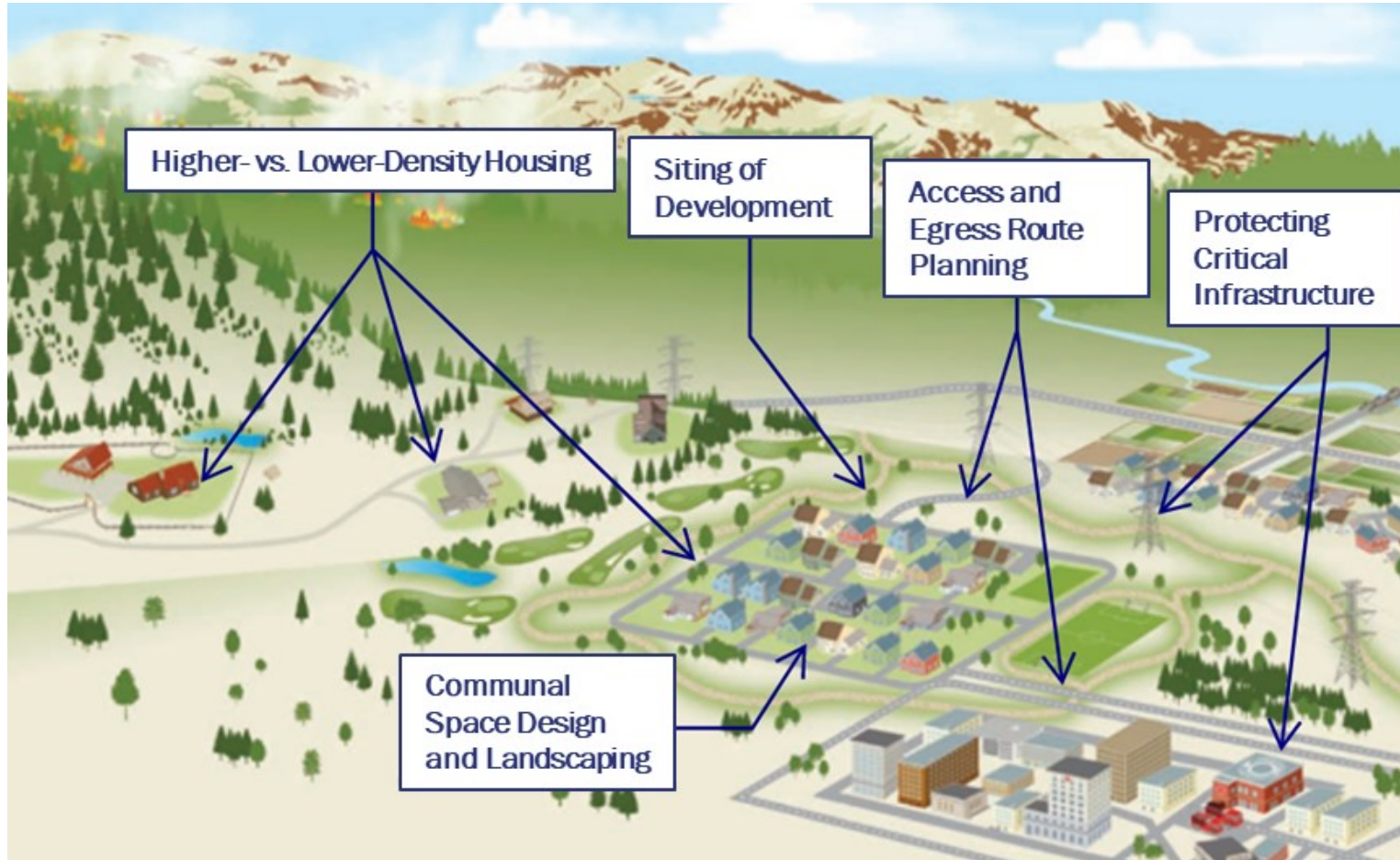


Note: Regional scale not explicitly addressed, but many concepts for other scales may be relevant



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Community Wildfire Planning



*Image adapted from
Wildfire Planning
International, 2016*

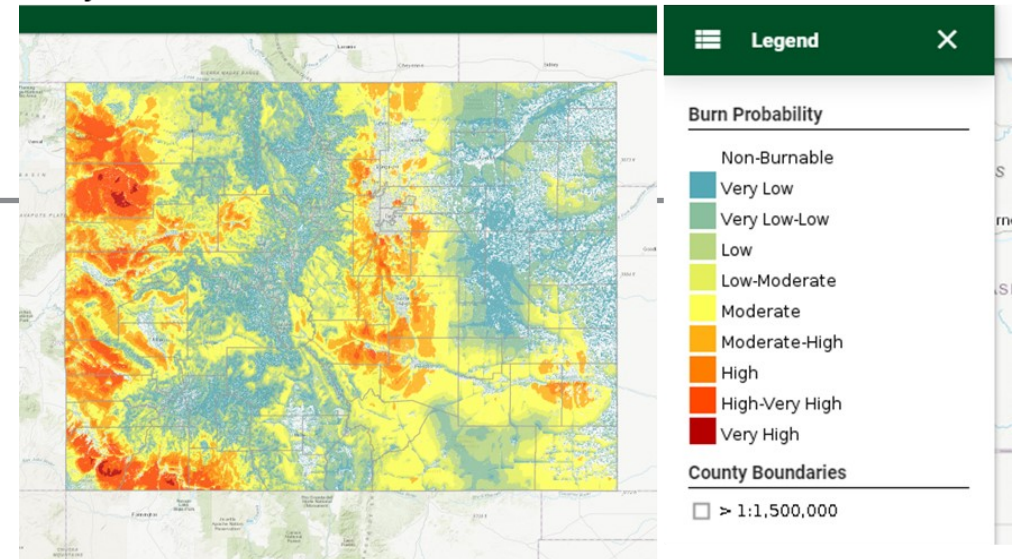


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Hazard & Risk Assessment

- Evaluate all relevant state and local wildfire hazard maps (e.g., FRAP, Colorado Forest Atlas). **Note: Typical hazard and “risk” maps do not identify community assets at risk or vulnerabilities.**
- (For EIRs) - Consult with wildfire/fire safety and environmental specialists to balance fire public safety and environmental concerns.
- Evaluate all relevant local level community planning documents (e.g., General plans, zoning, CWPPs, LHMPs, Emergency operations, Unit Strategic plans, Evacuation plans)

Wildfire Risk Public Viewer



Colorado State Forest Service

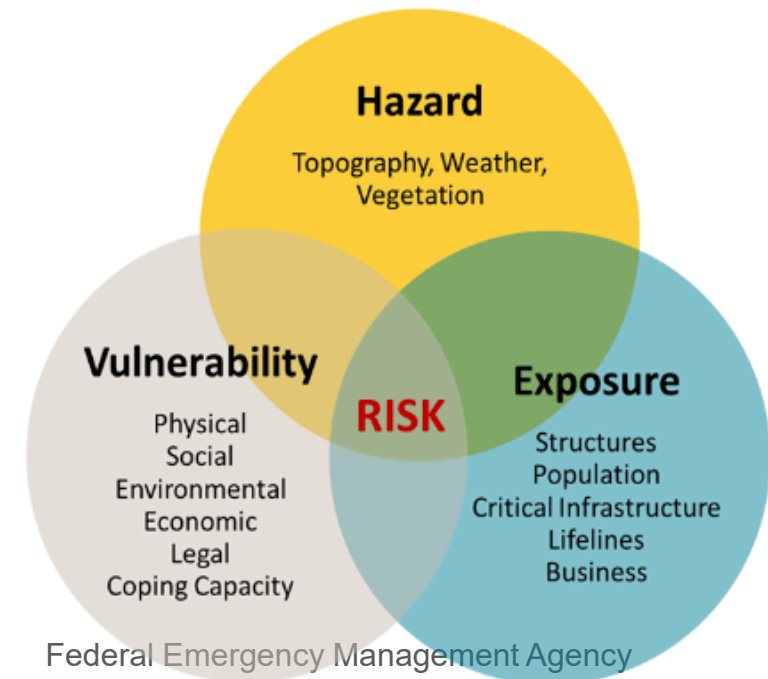


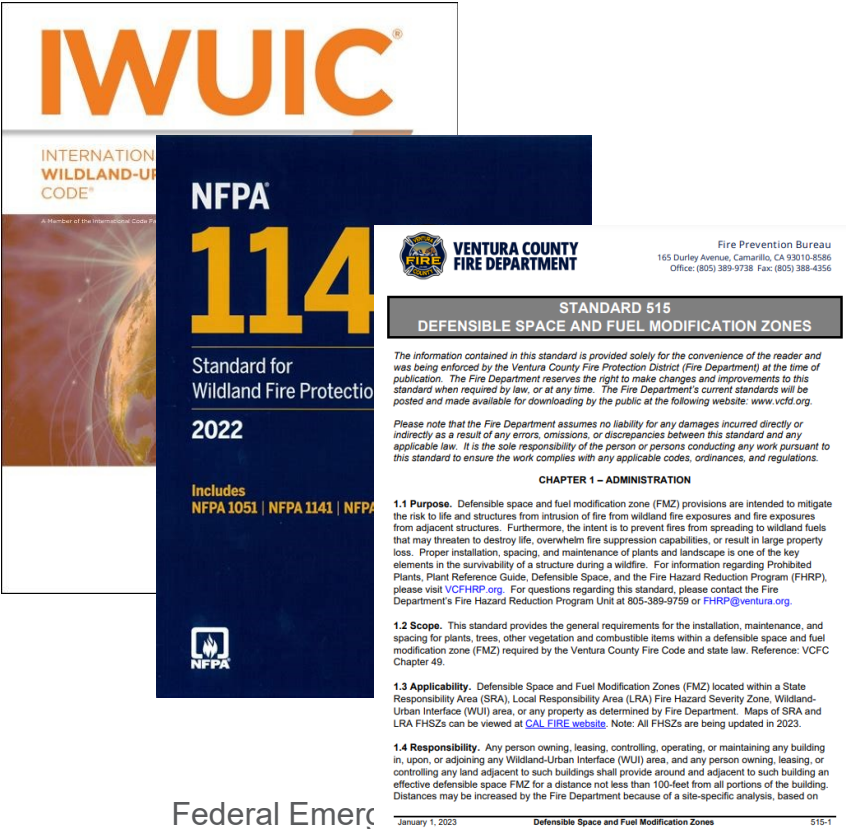
Image:
Darlene Rini



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Hazard & Risk Assessment

- Consult state and local wildfire building and fire codes. Otherwise, IWUI Code and NFPA 1140
- Consult with the local fire department for:
 - Any local requirements,
 - Additional guidance documents
 - Wildfire planning processes and reviews,
 - Pre-approved alternative mitigation measures



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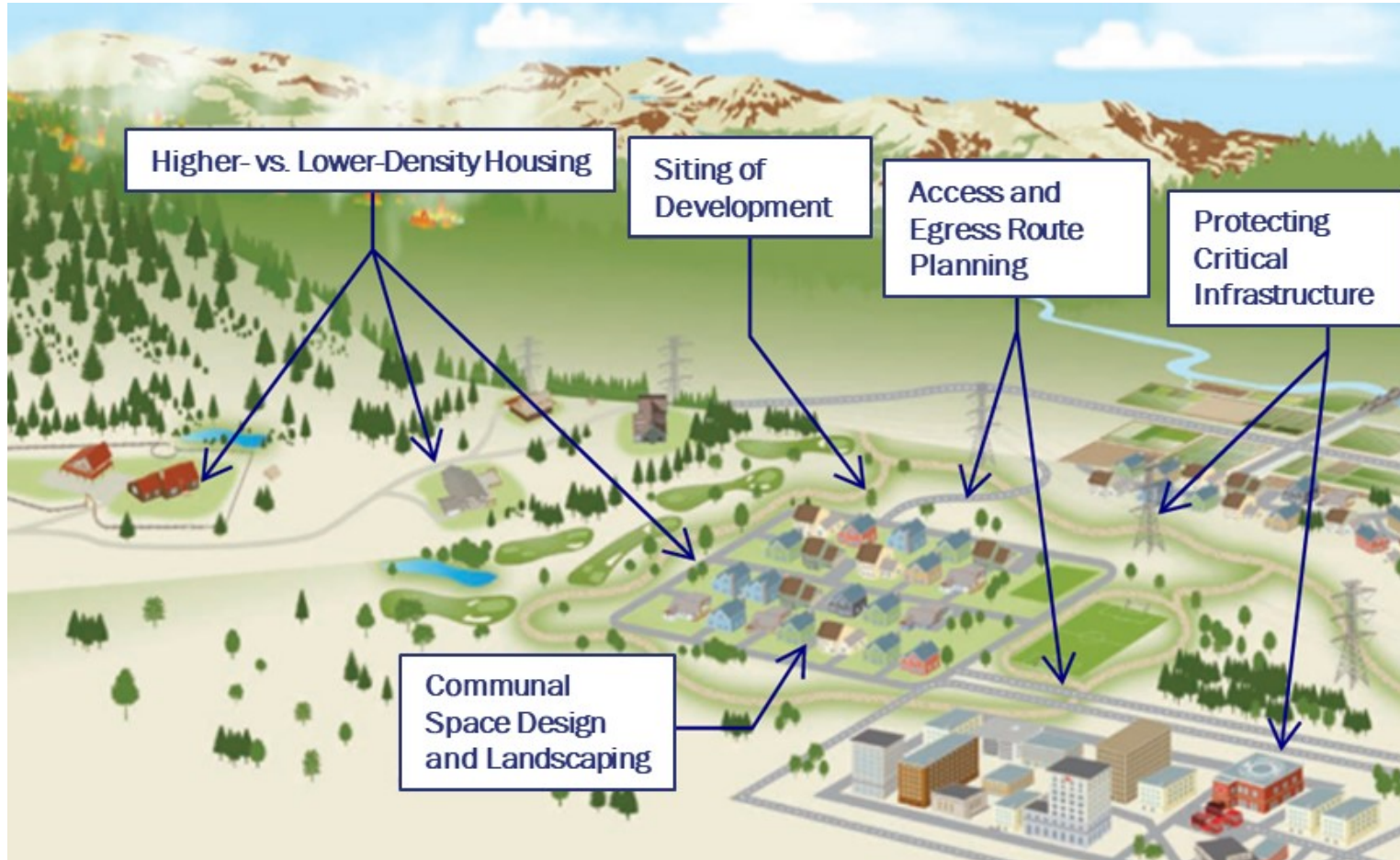
Multi-Hazard Considerations



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https://www.fema.gov/sites/default/files/documents/fema_marshall-fire-mat-mitigation-strategies-address-multi-hazard-events.pdf

Subdivision Wildfire Planning



*Image adapted from
Wildfire Planning
International, 2016*

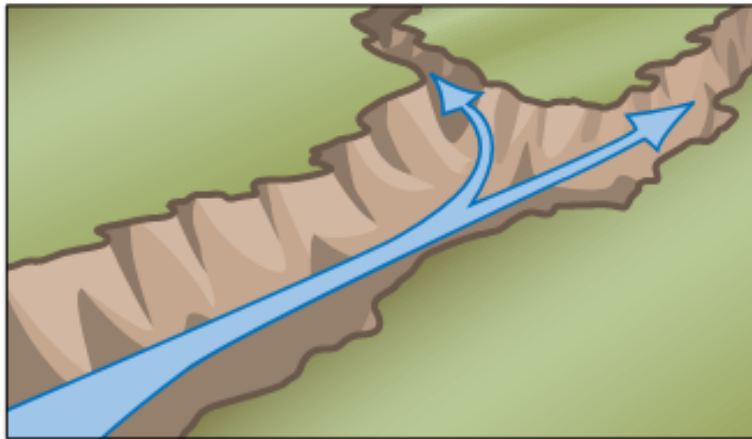


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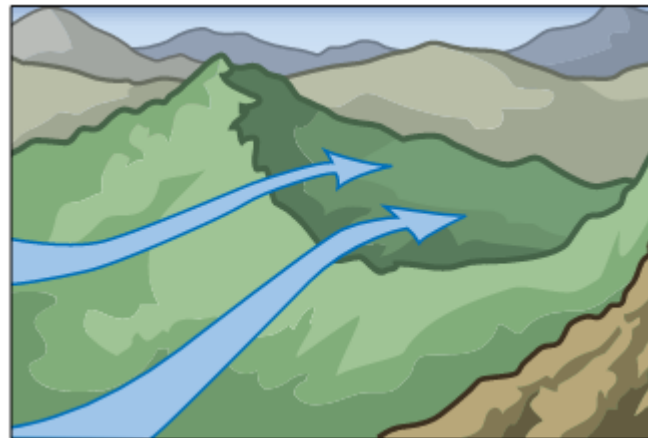
General Topographic Fire Hazards

General siting guidance:

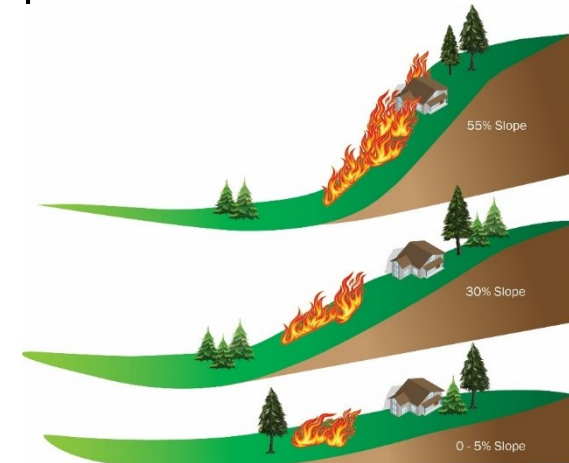
- Avoid selecting a construction site along a gully or in a narrow canyon
- Avoid selecting a construction site in or adjacent to a saddle or narrow mountain pass
- Avoid constructing a new development adjacent to or on a steep slope.



Gully / Narrow Canyon



Saddle



Steep Slope

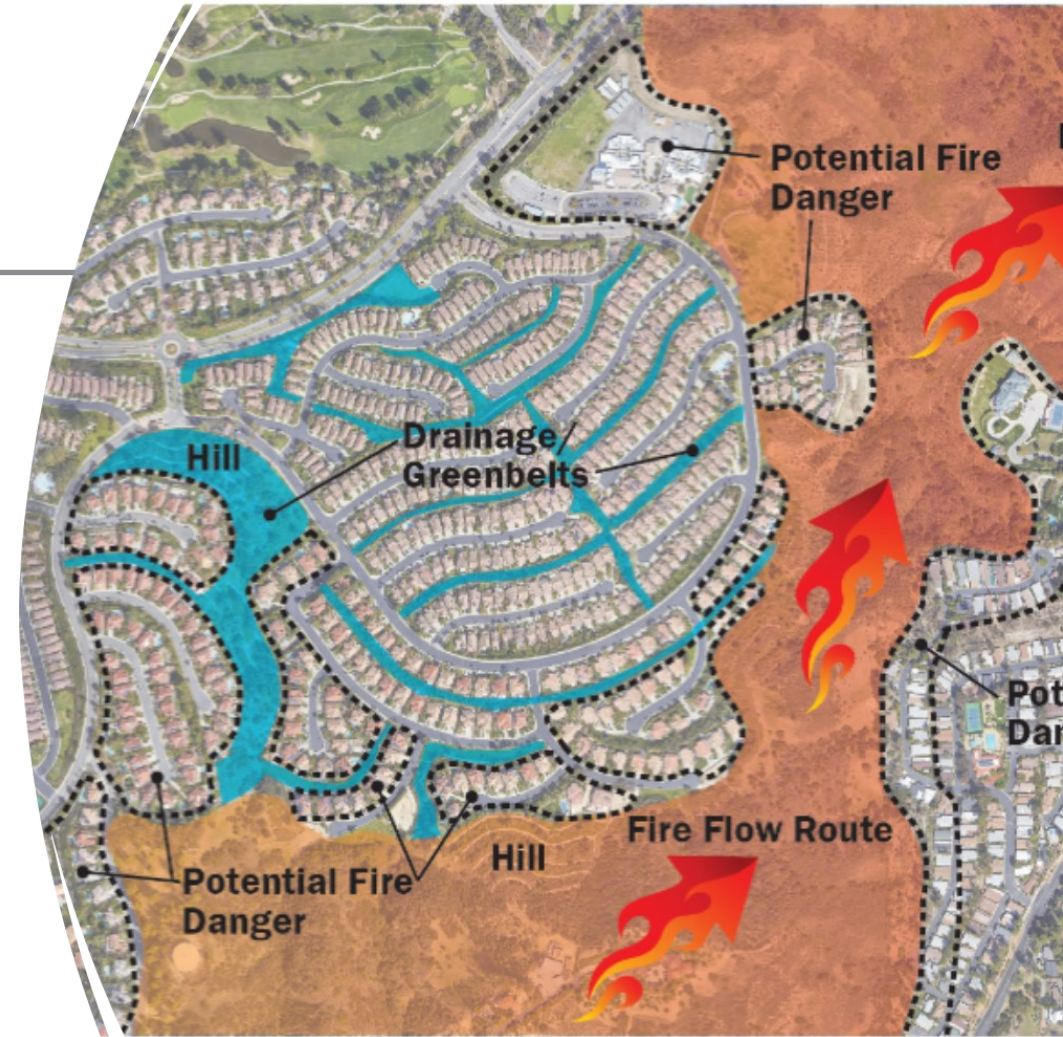


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Site Specific Hazards and Risks

Recommend undertaking a site-specific wildfire hazard and risk assessment

- Provide a higher level of granularity of anticipated wildfire behavior (intensity, rate of spread)
- Highlight potential fire flow paths from neighborhood- or community-level features such as greenbelts, open spaces, or drainages
- Highlight areas of higher localized fire intensity due to local topographic conditions (e.g., hilltops, ridges, steep slopes) and influence of built environment design on vulnerability (e.g., perimeter structures, structures perpendicular to flow)



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Detailed WUI Planning for Challenging Sites

1. Ridgetop Developments:

- Provide minimum 30–100 feet setback from downslope side
- Increase the setback at sites with steep slopes and high hazard fuel types (e.g., > 30% slope, forested environment, dense chaparral). Consult with local fire and other WUI fire experts.
- Provide defensible space and long-term vegetation management plan per NFPA Firewise and other local WUI fire ordinances

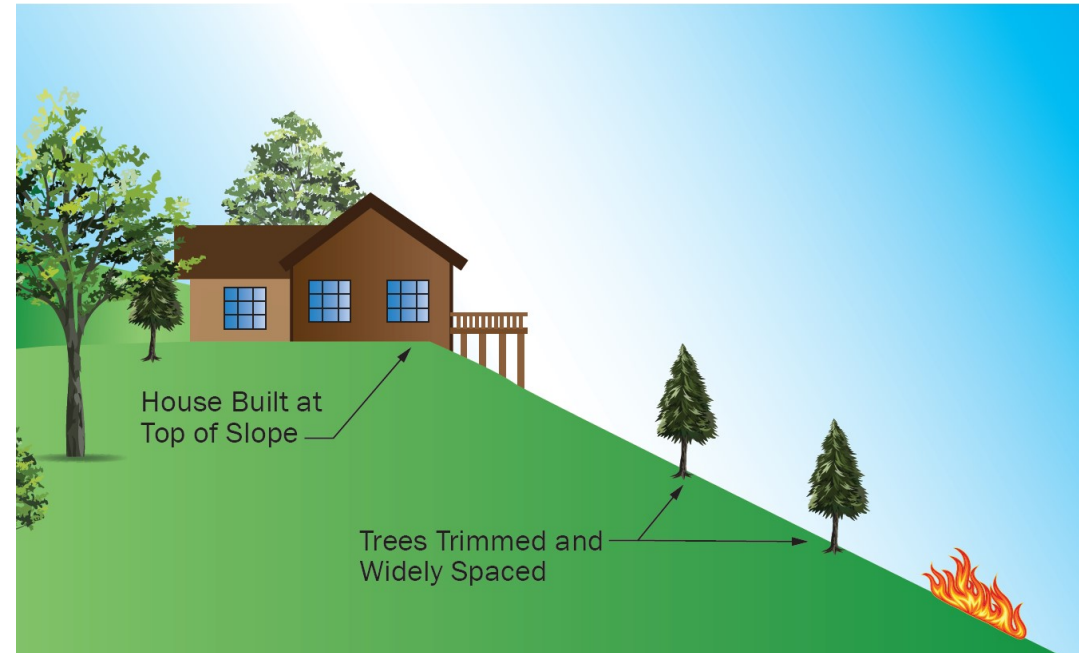


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Detailed WUI Planning for Challenging Sites

If 30-100 feet setbacks are not feasible:

- Provide 30-100 feet of fuel modification on proximate slopes
- Consult local fire department or other AHJ for site-specific guidance and local requirements
 - Can be as much as 200+ feet (e.g., Los Angeles County, Orange County in CA)
 - Implement all structural hardening measures in WUI codes plus additional provisions (e.g., 1-hour fire resistant exterior walls). See "Higher Density" Slides



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Detailed WUI Planning for Challenging Sites

2. Sites along interface of large wildlands / unmanaged open space (Recall Slide 30):

- Provide "fire resistant" fuel breaks (e.g., fruit orchards, irrigated landscaping, golf course)
- Provide 6-foot, solid, noncombustible property line wall or fence (e.g., brick, masonry, or CMU). Note: More effective for grass and shrubland landscapes
- Prioritize localized structural-hardening measures for building(s) fronting the wildlands. ***Will need to coordinate with design team.*** See next slide for examples.



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WUI Planning for Challenging Sites

Sample structural hardening upgrades

- Exterior walls, windows, vents, etc. of the home to be non-combustible, fire resistance rated (e.g., 1-hr)
- 5-10 feet of noncombustible landscaping (e.g., pavers, gravel) around home. Must also integrate drainage and flooding mitigations



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WUI Planning for Challenging Sites

3. Proximate to non-WUI development (i.e., < 30ft):

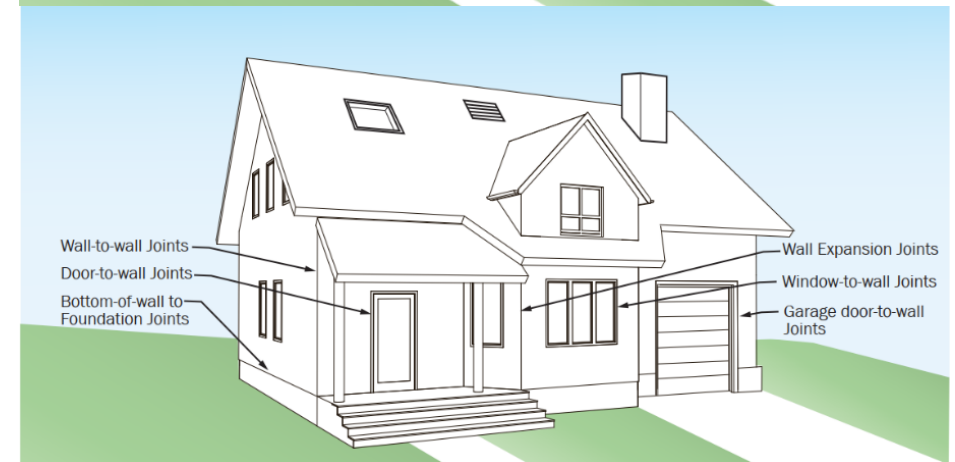
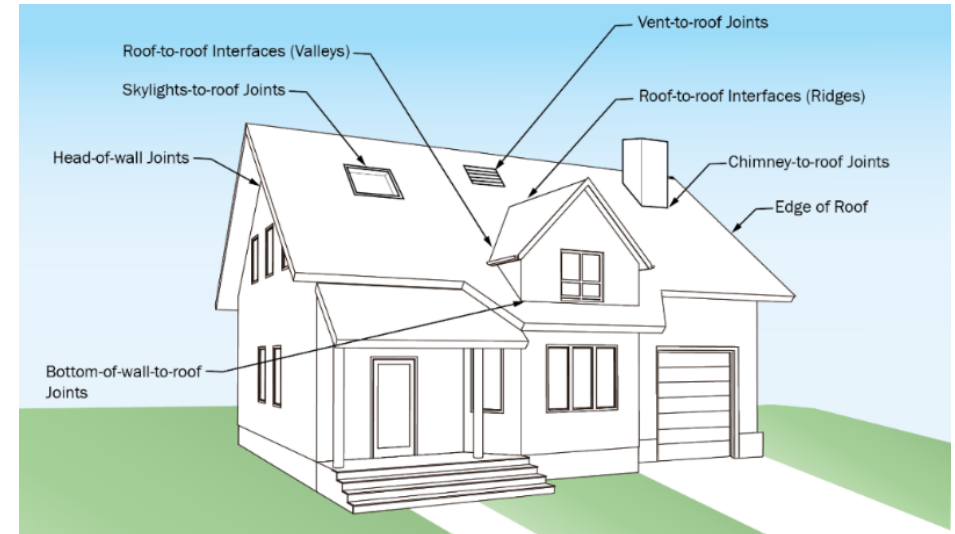
- Oftentimes gets overlooked as a fire threat to new developments
- **Similar rules to Condition #2.** Evaluate specific hazards and proximity of existing developments and potential source of causing urban conflagration
- Recommend:
 - Install a six-foot, solid, noncombustible property line wall
 - Prioritize structural-hardening perimeter buildings with < 30 feet of setback (e.g., provide 1-hour fire-resistance rating of exterior building envelop, reduce # of windows)



Building Wildfire Resiliency – Two Key Concepts

1) Structural Hardening – Fire resistive construction materials, details and systems that help limit ignition and fire spread

- Top of roof down to foundation
- Examples: Class A roof covering, vent protection, non-combustible facade materials
- Refer to existing WUI codes and guidance documents for details. (***MAT guidance highlighted new considerations such as joint detailing.***)



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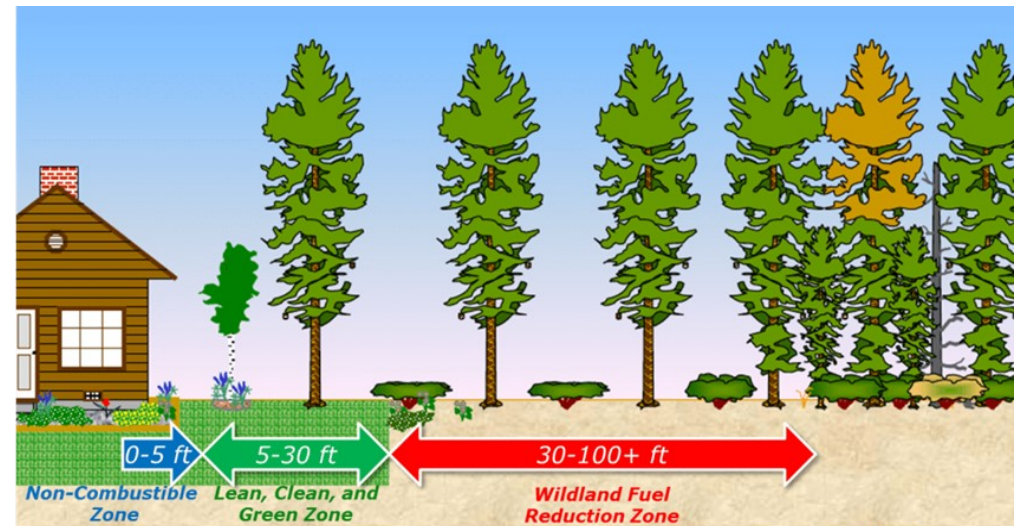
Building Wildfire Resiliency

2) **Defensible Space** – Area around building where the location, selection, and maintenance of vegetation and other man-made fuels are restricted to limit fire spread to building.

- Several resources available, but local guidance can be limited:
 - Fuel modification zones (e.g., Zone 0-2)
 - Prohibited and approved plant lists
 - Landscape strategies (e.g., mosaic)
 - Best management practices



Credit: WILL MCDONALD / Yakima Herald-Republic



Living With Fire  University of Nevada Cooperative Extension



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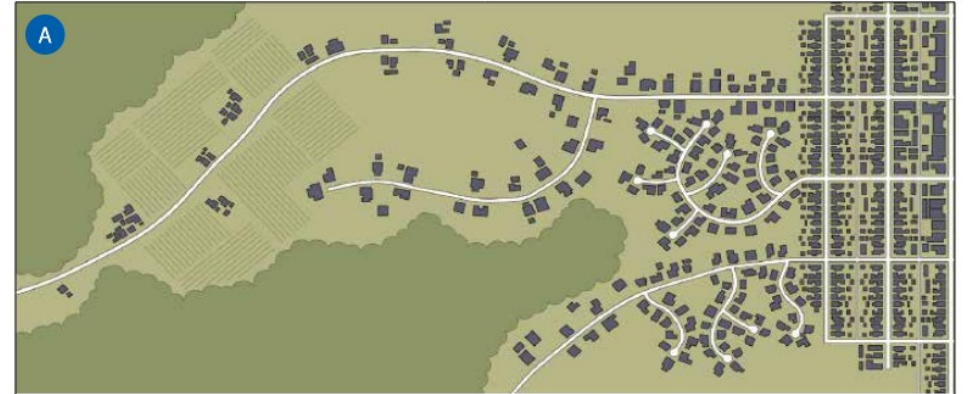
Housing Density Considerations for Fire Safety

A. “Traditional” or Lower-Density Building Footprint

- Sub-urban style housing
- More than 30 feet of separation to building

B. “Clustered” or Higher-Density Building Footprint

- Less than 30 feet of separation to buildings
- Can be single family residences that are close together



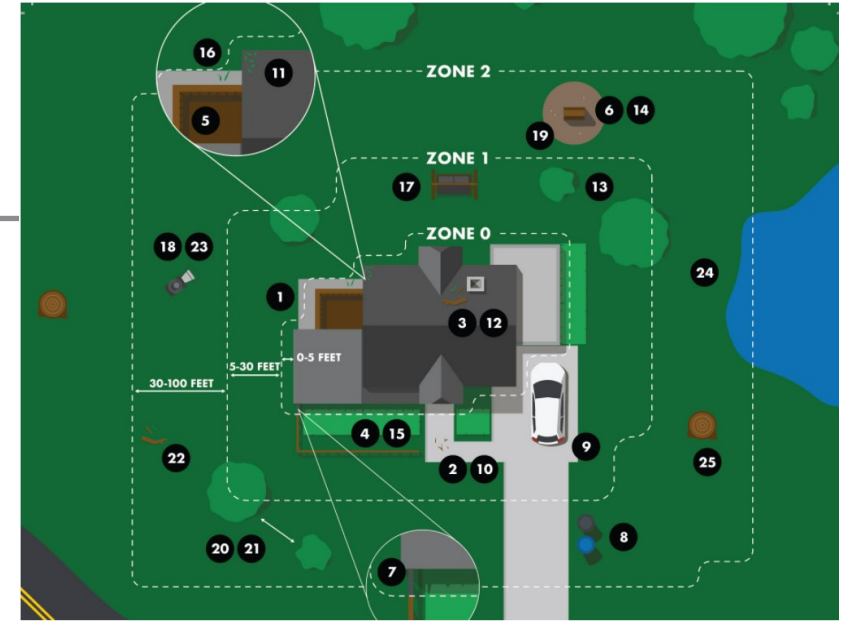
Source: Martin Dreiling [Smart Code Module](#)



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A. Lower Density Housing Footprint

- Current WUI codes and standards are designed to provide guidance for the "ideal" parcel
- "Ideal" Parcel = 100 feet of space around building; 60 feet separation to other buildings
- However:
 - Not all yards provide 100 feet of defensible space
 - Not all aspects provide 30 feet of separation to property line or 60 feet to proximate buildings



Source: IBHS



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A. Lower Density Housing Footprint – Defensible Space < 100 feet

If a building(s) does not have 100 feet of defensible space within its property lines, use **communal defensible space concept**:

- Proximate buildings must share a "common" defensible space zone
- Ensure communal plants and landscape design meets fire-resistance guidance of local area
- Design long-term maintenance plans to require minimal upkeep



Source: [NFPA Firewise](#)



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A. Lower Density Housing Footprint – Building Setback < 30 feet

- Less than 30' setback to property line or 60 feet between structures
- Key vulnerability in WUI fires = structure-to-structure fire spread
- Mitigations:
 - Structural-hardening (e.g., 1-hour fire-resistance rating of exterior building envelop, reduced # of windows, 5-10 feet of non-combustible landscaping, 6-foot tall solid non-combustible wall)



Example of single-family-residences with 5–8 feet to property lines and significant overgrown vegetation. Both homes are vulnerable to spot fires from embers or structure-to-structure fire spread



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B. Higher Density Housing Footprint

- Design Strategy – Treat entire development as “one building” for defensible space. Provide a minimum 100-foot around the entire development.
- Integrate "fire resistant" land-uses, such as:
 - Fruit orchards
 - Irrigated landscaping and greenbelts
 - Golf courses
 - Roads



Source: Klaus Leidorf and BN-Archive.



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B. Higher Density Housing – Structural Hardening

To limit structure-to-structure fire spread, provide:

- Class A roofing, bird-stopping, **metal drip edge**
- Vent covers with **1/16” wire mesh** or an approved and flame-resistant vent throughout
- **1-hour fire resistant exterior wall assemblies**, where separation < 30 ft to property line. Otherwise, noncombustible or ignition-resistant siding materials (e.g., fiber cement, stucco) with use of non-combustible insulation.
- **Minimize openings** (e.g., windows, glazed doors) in aspects with < 30 feet separation



B. Higher Density Housing – Structural Hardening

- Double-paned or tempered-laminated glazing
- **Noncombustible decking**, patios and balconies
- **5-10 feet ember-resistant zone around structures** (e.g., pavers, gravel). Must also integrate drainage design
- Noncombustible fences (e.g., concrete, masonry, metal), particularly where attached to adjacent homes or structures. Provide 6-foot, solid, noncombustible party wall
- **Noncombustible construction for outbuildings** (e.g., sheds, pergolas, gazebos); otherwise, locate more than 30 feet away from homes, provide noncombustible enclosure (e.g., CMU, masonry)

**Refer to Marshall Fire MAT document
“Homeowner’s Guide to
Reducing Risk of Structure Ignition
from Wildfire.”**



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Access, Egress and Evacuation

Key Issues:

- Most road networks not designed for
 - Total evacuation
 - Simultaneous egress and first responder
- Typical vulnerabilities
 - # of exits from development or neighborhood
 - Separation or independency of exits
 - Travel distance or time to Primary Routes
 - Capacity of exits or roads



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Wildfire Evacuation Challenges



Source: 2023 Maui Wildfires



2018 Woosley Fire



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Planning for Access, Egress and Evacuation

Access/Egress Planning Needed at Different Scales:

Community Scale



Neighborhood or Subdivision Scale



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Neighborhood Scale – Planning for Access/Egress

Some prescriptive guidance exists:

- Number of access/egress points (IFC Appendix D)
 - Two exits where # of dwelling units > 30
- Separation of access/egress points (IFC Appendix D)
 - Not less than $\frac{1}{2}$ the length of the max. overall diagonal dimension of the area

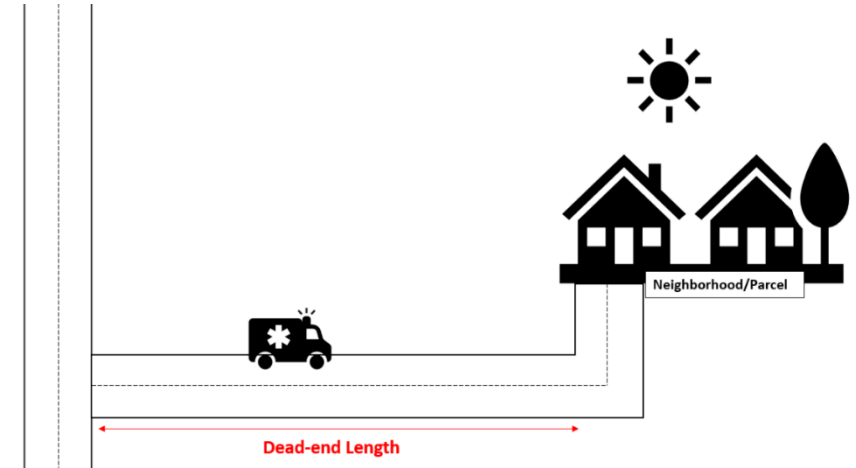


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Neighborhood Scale – Planning for Access / Egress

Dead End Travel Distances:

- How far to travel from subdivision to a primary road?
 - If > 60 dwelling units = 800 ft.
 - If 40- 60 dwelling units = 2,640 ft.
 - If < 40 dwelling units = 5,280 ft.
 - All others < 800 ft
- Where two or more routes are needed, space sufficiently so that both routes are not blocked simultaneously by a single fire (e.g., min. 1000ft separation)
- Will depend on wildfire settings, surrounding terrain. Consult with the local fire authority.



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Community-Scale – Capacity of Transit Network for Evacuation

- Currently there is no Prescriptive Guidance (at any scale)
- Wildfire evacuation modelling typically needed to evaluate:
 - Impact of total- and phased-evacuation scenarios
 - Various wildfire scenarios (intensity, duration, wind direction)
 - Impact on broader community road network and capacity
 - Social behaviors and vulnerable populations in models
 - Potential need for shelter-in-place or temporary evacuation points
- Crucial to prepare for sufficient evacuation capacity or alternative people management strategies.



Image: Smartsign

Typical Fire Department Access Guidance

Consult with local fire authorities for fire vehicle access requirements.

Sample requirements:

- Min. width = 20 feet
- Min. clear height = 13 feet 6 inches.
- Refer to Appendix D of the Local IFC Edition as amended for further requirements



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Vegetation Management for Egress Routes

Road-side vegetation to reduce roadside fire intensity and limit "burn-over"

- Min. 10 feet horizontal buffer (upwards of 50 to 100 depending on fuel) on either side of all major access/egress routes
- Consult with a wildfire specialist for detailed guidance, best management practices and healthy landscapes



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Sample Road-side Treatments

Depending on fire hazards, topography and ecological needs, one or a combination of treatments may be needed (e.g., canopy thinning, clearing of surface and ladder fuels)



Shrublands and grasslands in steep terrain



Treatment in timbered forest along ridgeline

Federal Emergency Management Agency

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Images: Jensen Hughes

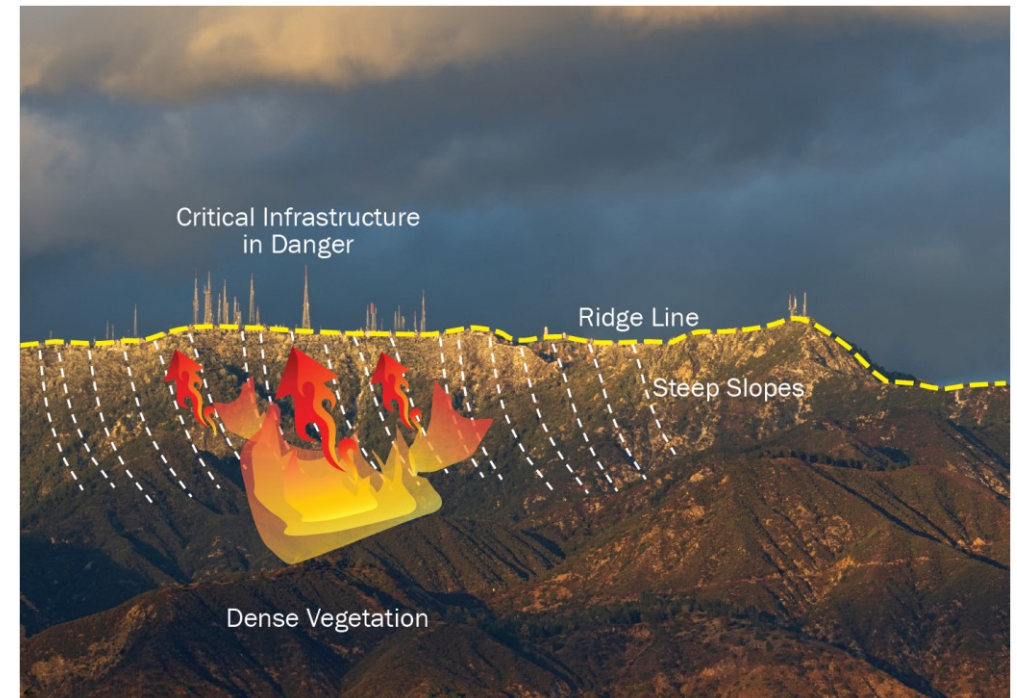
Protecting Critical Infrastructure

Issues:

- Short- and long-term wildfire impacts (operations, health, \$\$\$, livelihoods, economy)
- Vulnerable to wildfire and potential ignition sources
- Limited codes and standards for wildfire resiliency

Key Components:

- Electrical utilities and equipment
- Water resources
- Communication towers/systems



Electrical T&D and Equipment

Main Issues

- Main sources of wildfire ignitions
- Vulnerable to damage wildfire
- Limited codes and standards for wildfire resiliency (CA leading)

Many ways to increase resiliency:

- Grid hardening, Undergrounding
- Vegetation clearance and management
- Grid operations (e.g., fast-trips, monitoring faults)
- Planned power outages

References: NFPA 1, CPUC, Energy Safety (CA)



Example of 10ft clearance around distribution pole

Image: Jensen Hughes

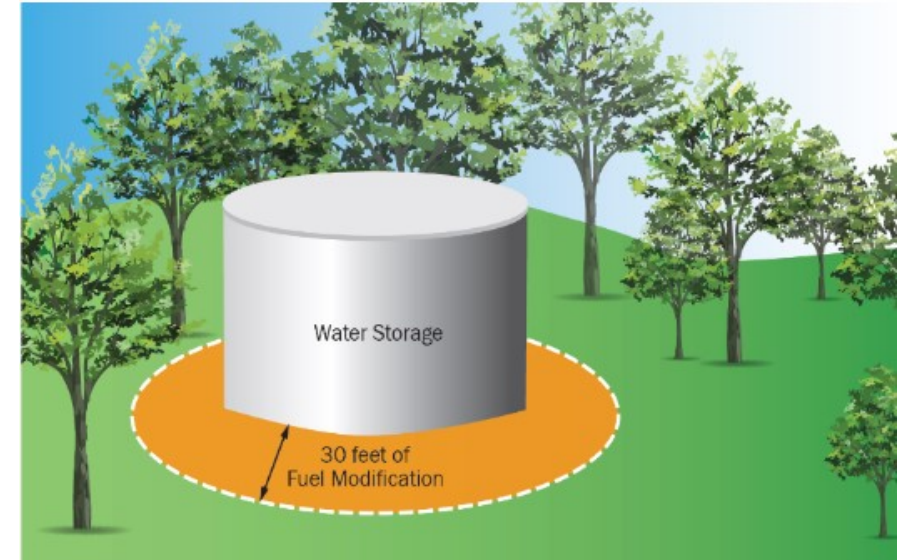
Water Supplies and Infrastructure

Main Issues:

- Oftentimes lost or incapacitated during a wildfire
- No water for firefighting
- Long-term recovery challenges

Ways to increase resiliency:

- Min. 30 feet of brush clearance (e.g., water tanks, water supply pumps, pump houses). NFPA 1
- Design independent water supplies and systems
- Coordinate with local fire department(s) to determine water supply requirements and hydrant placement (APA, 2018a).



Communication Towers/Systems

Main Issues:

- Typically lost early on in fires
- Main source for public communication in an event

Ways to increase resiliency:

- 30-100+ feet of hardscaping or brush clearance for communication towers and equipment (NFPA 1, NFPA 1140)
- Consult with local fire authorities for any local requirements, guidance, and best practices.



Example of ridgetop communication towers with no brush clearance

Image: Jensen Hughes

Additional Resources



FEMA

MAT Products

Mitigation Assessment Team Report

Marshall Fire

Building Performance, Observations, Recommendations, and Technical Guidance

FEMA P-2320 / June 2023

Marshall Fire Mitigation Assessment Team: Best Practices for Wildfire-Resilient Subdivision Planning

June 2023

DR-4634

Marshall Fire Mitigation Assessment Team: Mitigation Strategies to Address Multi-Hazard Events

June 2023

DR-4634

Marshall Fire Mitigation Assessment Team: Homeowner's Guide to Reducing Wildfire Risk Through Defensible Space

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DR-4634

Marshall Fire Mitigation Assessment Team: Homeowner's Guide to Reducing Risk of Structure Ignition from Wildfire

June 2023

DR-4634



<https://www.fema.gov/emergency-managers/risk-management/building-science/mitigation-assessment-team>

Marshall Fire Mitigation Assessment Team: Wildfire-Resilient Detailing, Joint Systems, and Interfaces of Residential Building Components

June 2023

DR-4634

Marshall Fire Mitigation Assessment Team: Decreasing Risk of Structure-to-Structure Fire Spread in a Wildfire

June 2023

DR-4634

Marshall Fire Mitigation Assessment Team: Homeowner's Guide to Risk Reduction and Remediation of Residential Smoke Damage

June 2023

DR-4634



Other Resources

- Insurance Institute for Business & Home Safety (IBHS) Full-Scale Fire Testing <https://ibhs.org/risk-research/wildfire/>
- Fire Safety Research Institute (FSRI) <https://fsri.org/about>
- National Institute of Standards and Testing (NIST) <https://www.nist.gov/fire>
- Quarles, S. et. al. “Home Survival in Wildfire-Prone Areas: Building Materials and Design Considerations”. May 2010. <https://anrcatalog.ucanr.edu/pdf/8393.pdf>
- CAL FIRE Building Materials Listings <https://osfm.fire.ca.gov/divisions/fire-engineering-and-investigations/building-materials-listing/bml-search-building-materials-listing/>
- CAL FIRE Fire and Resource Assessment Program. <https://www.fire.ca.gov/what-we-do/fire-resource-assessment-program>
- NFPA Firewise – <https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA>
- University of California, Agriculture and Natural Resources. <https://ucanr.edu/sites/fire/>
- SFPE Foundation Virtual Handbook on WUI Risk Assessments <https://www.sfpe.org/wuihandbook/home>
- NFPA “Assessing Structure Ignition Potential from Wildfire” training. <https://nfpa.org>
- Fire Adapted Communities Learning Network. <https://fireadaptednetwork.org/>



Questions?



Building Science Disaster Support Program:

<https://www.fema.gov/emergency-managers/risk-management/building-science/disaster-support>

Building Science Branch:

<https://www.fema.gov/emergency-managers/risk-management/building-science>



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Thank you



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