WUI VEGETATION CODE WORKGROUP

REGULAR MEETING

OCTOBER 1, 2025

9:00 AM

Cypress Room – 2180 Milvia St. 1st Floor

Fire Chief's Representative – Asst. Chief Colin Arnold

Assistant Chief David Winnacker
Richard Illgen
George Perez-Velez
Eric Weaver
Margit Roos-Collins

AGENDA

Preliminary Matters

Call to Order

Approval of the September 24 Minutes

Public Comment on Non-Agenda Matters

AGENDA MATTERS *All Regular agenda matters are for discussion and possible action.*

1. **Action:** **Discussion of existing local code amendments to ensure clarity, and review of Item 43c of the Annotated Agenda from the June 17th Council Meeting**

   Written Materials:
   Vegetation Ordinance, Annotated
   Clean Copy of Vegetation Ordinance
   Item 43c of the Annotated Agenda from the June 17th Council Meeting
   Gov. Code 51175-51189
   Summary of Proposed State Changes
   General Guidance for Creating Defensible Space
   Review of Nearby City and District Zone 0 Policies

Summary of Zone 0 Requirements and Guidance from Nearby Cities and Districts
Draft language on approved materials.

2. Action: Identify and Clarify AMMR Process, clarify modification process (including local conditions and evidence to support the same practical effect

Written Materials: COB Workgroup AMMR PPT
State Appendix A1-A5
BMC 1.28

3. Action: Discussion on the definition of combustible materials.

4. Action: Discussion and possible action on suggestions for the Resident Guide.

5. Action: Discussion regarding citations, penalties, and appeals process.

Written Materials: EMBER Enforcement, Page 3 (modified).
Email regarding internal Administrative Citation Progress.
Proposed Modifications of Berkeley Fire Code for WUI Appeals and Violations

6. Action: Agenda topics submitted by a member for consideration and discussion:
State Fire Regulations
Excerpts from the Government Code on Fire Zones
Soils and Geology
Fire-resistant Vegetation
Eucalyptus and Other Dangerous Trees
Building Composition and Compliance
Compliance Costs
Review and Discussion of Submitted Reference Materials on Wildfire Preparedness and Zone 0 Regulations

Written Materials: State Fire Regulations
Excerpts from the Government Code on Fire Zones
Firewise: How To Prepare Your Home For Wildfires
Elsevier, Landscape and Urban Planning article
NFPA Preparing Homes for Wildfire
Reducing the Vulnerability of Buildings to Wildfire
Science Summary by Dr. Travis Longcore

Brentwood HOA Comments on Proposed Zone 0 Regulations
Zone 0 Won't Save Your Home from Wildfire

WORK GROUP REPORTS

Adjournment

This meeting will be conducted in accordance with the Brown Act, Government Code Section 54953. Any member of the public may attend this meeting. Questions regarding this matter may be addressed to the Wildland Urban Interface Division of the Berkeley Fire Department, wildfire@berkeleyca.gov 510-981-5620. Communications to Berkeley boards, commissions or committees are public record and will become part of the City's electronic records, which are accessible through the City's website. Please note: E-mail addresses, names, addresses, and other contact information are not required but, if included in any communication to a City board, commission, or committee, will become part of the public record. If you do not want your e-mail address or any other contact information to be made public, you may deliver communications via U.S. Postal Service or in person to the secretary of the relevant board, commission, or committee. If you do not want your contact information included in the public record, please do not include that information in your communication. Please contact the secretary to the relevant board, commission, or committee for further information.
Any writings or documents provided to a majority of the commission regarding any item on this agenda will be made available for public inspection at Berkeley Fire Department located at 2100 Martin Luther King Jr. Way Berkeley, CA.

COMMUNICATION ACCESS INFORMATION:
This meeting is being held in a wheelchair-accessible location. To request a disability-related accommodation(s) to participate in the meeting, including auxiliary aids or services, please contact the Disability Services specialist at 981-6418 (V) or 981-6347 (TDD) at least three business days before the meeting date. Please refrain from wearing scented products to this meeting.
~~~~~~
I hereby certify that the agenda for this regular/special meeting of the Berkeley City's Disaster and Fire Safety Commission was posted at the front of the Division of Training, 997 Cedar Street, as well as on the City's website, three days prior to the scheduled Commission meeting.

SECRETARY SIGNATURE
Colin Arnold
~~~~~~

ATTACHMENT 1

Chapter 49 of the California Fire Code is adopted in its entirety subject to the modifications thereto which are set forth below.

CHAPTER 49 – REQUIREMENTS FOR WILDLAND-URBAN INTERFACE FIRE AREAS

SECTION 4902 DEFINITIONS

Section *4902.1 General.* *For the purpose of this chapter, certain terms are defined as follows:*

BOLES OF A TREE. A bole of a tree ist its main trunk, specifically the part extending from the roots up to the first branches and canopy.

~~**DIRECTOR.** Director of the California Department of Forestry and Fire Protection (CAL FIRE).~~

FIRE PROTECTION PLAN. A document prepared for a specific premises, project or development, either existing or proposed for a Wildland-Urban Interface (WUI) area. It describes ways to minimize and mitigate potential for loss from wildfire exposure.

FIRE HAZARD SEVERITY ZONES. Geographical areas designated pursuant to California Public Resources Codes, Sections 4201 through 4204 and classified as Very High, High, or Moderate in State Responsibility Area or as Local Agency Very High Fire Hazard Severity Zones designated pursuant to California Government Code, Sections 51175 through 51189, and locally amended and adopted under ordinance 7958-N.S.

The California Code of Regulations, Title 14, Section 1280 entitles the maps of these geographical areas as "Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California."

FLATLANDS MITIGATION AREA ~~(ZONE 1)~~ encompasses the entire City of Berkeley except for areas in the Hills Mitigation Area, Panoramic Mitigation Area and Grizzly Peak Mitigation Area.

FORBS. Forbs are herbaceous, non-woody flowering plants that are not grasses, sedges, or rushes

~~**FUEL BREAK.** A natural or human caused change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled (NWCG PMS 205).~~

~~**FIRE-RESISTANT VEGETATION.** Plants, shrubs, trees and other vegetation that exhibit properties, such as high moisture content, little accumulation of dead vegetation, and low sap or resin content, that make them less likely to ignite or contribute heat or spread flame in a fire than native vegetation typically found in the region.~~

~~[Note: The following sources contain exam~~

Commented [A1]: Remove?

Commented [A2]: Delete?

Commented [A3]: Remove?

Commented [A4]: New code language is "Fire Smart" to avoid confusion regarding whether plants will burn in accordance with UC Agriculture and Natural Resources Publication 8695

Commented [A5]: Also defined in the new code

Commented [A6]: Workgroup concerned that this term may be needed later, so maintain the record here

~~ples of types of vegetation that can be considered fire resistant vegetation (Fire-resistant Plants for Home Landscapes, A Pacific Northwest Extension publication; Home Landscaping for Fire, University of California Division of Agriculture and Natural Resources; Sunset Western Garden Book)].~~

GRIZZLY PEAK MITIGATION AREA ~~(ZONE 4)~~ encompasses those areas of the city ~~east of~~from parcels addressed on the west side of Grizzly Peak Boulevard to the eastern city boundary.

Homes addressed on, or with a structural frontage on either side of Grizzly Peak Boulevard are included in the area.

The Grizzly Peak Mitigation Area is designated as a Very-High Fire Hazard Severity Zone.

~~**HILLS MITIGATION AREA (ZONE 2)**~~**HIGH FIRE HAZARD SEVERITY ZONE** encompasses those areas designated as ~~Very High or~~ High Fire Hazard Severity Zones, adopted and locally amended pursuant to California Government Code, Sections 51175 through 51189. ~~that are not included in the Grizzly Peak Mitigation Area or Panoramic Mitigation Area.~~

This area includes areas of the City east / north east of the line formed by these roads. Homes addressed on, or with a structural frontage on either side of these road segments are included in the zone:

a. The Arlington Avenue from the Kensington Border to Marin Avenue

b. ~~Sutter Street from the Southern portal of the Northbrae Tunnel to Eunice Street~~ Fountain Walk from Marin Avenue to Sutter Street

~~b.~~c. Sutter Street from the southern portal of the Northbrae Tunnel to Eunice Street.

~~c.~~d. Eunice Street from Sutter Street to Spruce Street

e. Spruce Street from Eunice Street to Hearst Avenue

~~d.~~f. Hearst Ave from Spruce Street to Gayley Road

~~e.~~g. Gayley Road from Hearst Avenue to Piedmont Ave~~Stadium Rim Way~~

~~f.~~h. Piedmont Avenue from Gayley Road~~Stadium Rim Way~~ to Bancroft Way. ~~Dwight Way~~

~~g.~~i. Piedmont Crescent from Piedmont Ave to Warring Street.~~Warring Street from Dwight Way to Derby Street~~

j. Warring Street from Dwight Way to Derby Street.~~Belrose Avenue from Derby Street to Garber Street~~

k. Derby Street from Warring Street to Belrose Avenue.

~~h.~~l. Belrose Avenue from Derby Street to Garber Street

~~i.~~m. Claremont Boulevard from Garber Street to Claremont Avenue

~~j.~~n. Claremont Avenue from Claremont Boulevard to the Oakland Border

Commented [A7]: Clarify the numbers associated with zones, see if we can eliminate

Commented [A8]: Confusing with two state maps contained within this zone

Commented [A9]: Lopez, David Can we move the numbered zone out of the title and into the body of the definition to reduce confusion with the public, but still allow the crossover to B&S?

Commented [A10]: Call out the definitions further and identify boundaries

~~Tunnel Road from Ashby Avenue to the Oakland Border~~

IGNITION-RESISTANT MATERIAL. A type of building material that complies with the requirements in Section 704A.2 in the ~~California~~ Berkeley Building Code.

LOCAL RESPONSIBILITY AREAS (LRA). Areas of the state in which the financial responsibility of preventing and suppressing fires is the primary responsibility of a city, county, city and county, or district.

PANORAMIC MITIGATION AREA (ZONE 3) encompasses those areas of the city bounded by the line formed by these roads and by the City Limit to the east.

The entirety of the Panoramic Mitigation Area is designated as a Very High Fire Hazard Severity Zone. Homes addressed on, or with a structural frontage on either side of these road segments are included in the zone:

a. ~~Canyon Road from the Oakland border to Stadium Rim Way~~Centennial Drive from the Oakland border to Stadium Rim Way
b. Stadium Rim Way from Centennial Drive to Canyon Road ~~to Bancroft Way~~
c. Canyon Road from Stadium Rim Way to Bancroft Way
d. Bancroft Way from Canyon Road to Bancroft Steps
~~c. Bancroft Way from Stadium Rim Way to Prospect Street~~
~~d.~~e. ~~Prospect Street from Bancroft Way to~~ Bancroft Steps from Bancroft Way to Bancroft Way
~~e. Bancroft Steps from Prospect Street to Warring Street~~
f. Bancroft Way from Bancroft Steps ~~Warring Street~~ to Piedmont Avenue
g. Piedmont Avenue from Bancroft Way to Dwight Way
h. Dwight Way East from Piedmont Avenue to ~~the Oakland border~~the eastern terminus of Dwight Way.
~~h.~~i. A straight line extending East from the terminus of Dwight Way to the Oakland border.

STATE RESPONSIBILITY AREA (SRA). Lands that are classified by the Board of Forestry pursuant to Public Resources Code Section 4125 where the financial responsibility of preventing and suppressing wildfires is primarily the responsibility of the state.

VERY HIGH FIRE HAZARD SEVERITY ZONE. Encompasses those areas identified by CalFIRE as Very High Fire Hazard Severity Zones pursuant to California Government Code 51175-51189 and locally amended and adopted under ordinance 7958-N.S.

WILDFIRE. Any uncontrolled fire spreading through vegetative fuels that threatens to destroy life, property, or resources as defined in Public Resources Code, Sections 4103 and 4104.

WILDFIRE EXPOSURE. One or a combination of radiant heat, convective heat, direct flame contact and burning embers being projected by vegetation fire to a structure and its immediate environment.

WILDLAND-URBAN INTERFACE (WUI). A geographical area identified by the state as a "Fire Hazard Severity Zone" in accordance with the Public Resources Code, Sections 4201 through 4204, and Government Code, Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires.

SECTION 4903 PLANS

Section 4903.3 Submittal, approval and fees. When required to submit a Fire Protection Plan or Vegetation Management Plan for any reason the responsible party shall prepare or cause to be prepared a Fire Protection Plan in accordance with the latest standards of the Berkeley Fire Department. The Fire Protection Plan shall be submitted to, reviewed and approved by the Berkeley Fire Department and shall be enforced and maintained by the responsible party or their designated agent. The Berkeley Fire Department may charge an appropriate fee for the review, approval and processing of the Fire Protection Plan in accordance with the hourly rate established by City Council resolution.

SECTION 4905 WILDFIRE PROTECTION BUILDING CONSTRUCTION

Section 4905.2 Construction methods and requirements within established limits. Within the limits established by law, construction methods intended to mitigate wildfire exposure shall comply with the wildfire protection building construction requirements contained in the ~~California Building Standards Code~~ Berkeley Building Code and Berkeley Residential Code, including the following:

1. ~~California Building Code, Chapter 7A.~~Chapter 7A of the Berkeley Building Code (B.B.C), Berkeley Municipal Code Section 19.28.030.
2. ~~California Residential Code~~ Section R337 of the Berkeley Residential Code (B.R.C.), Berkeley Municipal Code Section 19.29.050.
3. California Referenced Standards Code, Chapter 12-7A.

SECTION 4907 DEFENSIBLE SPACE

Property owners are not required or authorized by this code to enter the properties of another person to implement the requirements of this Section.

Section 4907.3 Adjacent Property Requirements.

~~5.~~ The Fire Code Official may require a property owner to perform hazardous vegetation and fuel management on their land to maintain defensible space up to 100 feet from structures located on adjacent properties.

Section 4907.4 Mitigations Required.

Commented [A11]: Can this be more clear to reflect the expectations in 4707.4

Commented [A12]: Added

Commented [A13]: Does this apply to VMPs during new construction

Commented [A14]:

Commented [A15]: Sprague This language creates a challenge for property owners when a neighbor builds an ADU that then affects the veg. mgmt on the ajoining property, and this process should be further evaluated.

Commented [A16]: For plan review

~~Within the Hills Mitigation Area, Grizzly Peak Mitigation Area, and the Panoramic Mitigation Area, a~~Within the locally adopted Very High Fire Hazard Severity Zone~~A~~ a person who owns, leases, controls, operates, or maintains lands shall at all times ~~maintain~~:

1. Remove all branches within 10 feet of any chimney or stovepipe outlet.
2. Maintain the roof and roof gutters of any structure, and the surface of any attached deck, porch, landing, or stairs free of leaves, needles, or other deposited vegetative materials.
3. Maintain 6 feet of vertical clearance between branches and all other parts of trees or other vegetation overhanging the roof or other portion of any Structure or attached deck.
4.
5. Zone 0: 0-5 feet from any structure: The requirements of 4907.4.5 below apply to this zone.
6. ~~1.~~5. Zone 1: 5 to 30 feet from any structure:
   a. Remove ~~any privacy hedges, or contiguous vegetation, or contig~~nuous vegetation without adequate fuel separation to prevent spread to the ~~a~~the structure.~~, that will create a pathway for fire to reach a sStructure.~~
   ~~b.a. Maintain 6 feet of vertical clearance between branches and all other parts of trees overhanging the roof or other portion of any Structure or attached deck.~~
   ~~c.~~b. Maintain any tree, shrub, or other plant adjacent to or overhanging any Structure or attached deck free of dead or dying wood.~~dead branches, dead limbs, or other Combustible Material.~~
   ~~d. Maintain the roof and roof gutters of any structure, and the surface of any attached deck free of leaves, needles, or other vegetative materials.~~
   ~~e.~~c. Maintain trees to remove Ladder Fuels so that foliage, twigs, or branches are greater than 6’~~8~~ feet above the ground or surface fuels.~~:~~
   ~~f.a. Remove all branches within 10 feet of any chimney or stovepipe outlet.~~
   ~~g. Storage of firewood, lumber, or other Combustible Material is not permitted.~~

Commented [A17]: This needs limiting language to make clear it does apply throughout the city.

Commented [A18]: Moved the structure specific sections out of Zone 1 and 2.

Commented [A19]:

Commented [A20]: Required for clarity.

Commented [A21]: Fire Chief discussion regarding whether requirements cross property lines.

Commented [A22]: Additional specifics or clarity on what constitutes a pathway for fire given that ZZ is established

Commented [A23]:

Commented [A24]: Add a reference to horizonal slope spacing section

Commented [A25]:

Commented [A26]: Changed to match state language in Gov Code 51182.

Commented [A27]: Move this out of Zone 1 requirements.

Commented [A28]: Is 8’ consistent throughout the code?

Commented [A29]: This is an established standard: IBHS https://wildfireprepared.org/wp-content/uploads/WPH-How-To-Prepare-My-Home-Checklist.pdf

Commented [A30]: This needs to be combined with g and clarified.

h.d. Keep low-growing shrubs and trees, no higher than 6 feet in height, spaced apart or in small groupings of no more than 3 shrubs or trees with a maximum aggregate diameter of 10 feet. Shrub or tree groupings must be separated from other shrubs or shrub groupings by 15 feet such that no continuous path of vegetation is created. Where shrubs or small trees are located below or within a tree's drip line, the lowest tree branch shall be a minimum of three times the height of the understory shrubs or 610 feet, whichever is greater.

e. If there are multipleNew structures on the same property, new structures accessory such as a shed, hot tub, and playset, ensure these structures are spaced at least 10 feet apart. Have at most three (3) of these structures within 30 feet of a building or structure-.

i. Existing moveable structures shall comply with the above.

i.f. Relocate storage of exposed firewood piles or, lumber , or other Combustible Material outside of Zone 1 unless they are completely covered in a fire-resistant covering approved by the State Fire Marshal's Building Material Listing Service. material.

2.6. Zone 2: 30 to 100 feet from any structure:

a. All exposed wood piles must have a minimum of ten feet (10 ft.) of clearance, down to bare mineral soil, in all directions.

.a. Create horizontal and vertical spacing among shrubs and trees using the "Fuel Separation" method, the "Continuous Tree Canopy" method or a combination of both to achieve defensible space clearance requirements. Further guidance regarding these methods is contained in the State Board of Forestry and Fire Protection's, "General Guidelines for Creating Defensible Space, February 8, 2006," incorporated herein by reference.

4.7. For both Zones 1 and 2:

a. Remove vegetative and combustible material capable of transmitting fire to a structure as determined by the Fire Code Official.

b. Dead and dying woody surface fuels and aerial fuels shall be removed. Loose surface litter, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches, shall be permitted to a maximum depth of three inches (3 in.).

c. Cut annual grasses and annual forbs down to a maximum height of four inches (4 in.) prior to, or upon reaching the senescent or ripening phase when the preponderance of vegetative material is cured or dead. -

d. Non-irrigated brush is not permitted.

Commented [A31]: Review for clarity, include small trees in definition, and review separation distance science. Consider defining drip line

Commented [A32]: Added small trees.

Commented [A33]: Delete first sentence, this is in conflict with other areas and deleting brings into standard with IBHSWPH

Commented [A34]: Do we need to include the 10', or the language "whichever is greater. 10' seems drastic

Commented [A35]: Is 3x sufficient

Commented [A36]: Clarification on property lines

Commented [A37]: [Mention was removed] define combustible material to clarify this

Commented [A38]: [Mention was removed] pull state language on approved material

Commented [A39]: Should this language be moved to 3 as it applies to both zones. Discuss the conflict between Fuel Separation and Continuous Tree Canopy methods. Consider adding the reference as an appendix

Commented [A40]: New proposed language. Could also remove grass and forbs and replace with "annual vegetation".

Commented [A41]: Clarify timing here or elsewhere as forbs are defined. Consider clarifying forbs in definitions

Commented [A42]: Revisit to clarify what this means in our jurisdiction.

Commented [A43]: Recommend striking as the requirements of Item 1A address the issue.

c. ~~Vertical Spacing: Limb trees by removing hanging bark, debris and branches that are within six feet (6 ft.) of the ground, or three times the height of the understory vegetation, whichever is greater.. Where a tree is not adaptable to limbing to the height described above, use a combination of limbing and/or modify and remove fuels adjacent to and underneath the tree to provide clearance above grade that is equivalent to three times the height of the tallest understory fuel.~~

d. Vertical Spacing: Limb trees by removing hanging bark, debris and branches that are within six feet (6 ft.) of the ground.

e. Create horizontal and vertical spacing among shrubs and trees using the "Fuel Separation" method, the "Continuous Tree Canopy" method or a combination of both to achieve defensible space clearance requirements. Further guidance regarding these methods is contained in the State Board of Forestry and Fire Protection's, "General Guidelines for Creating Defensible Space, February 8, 2006," incorporated herein by reference.

~~e.~~f. Maintain horizontal spacing between shrubs. Consistent with fuel management objectives, steps should be taken to minimize erosion, soil disturbance, and the spread of flammable, non-native grasses and weeds. ~~,~~:

i. Flat or mild slope (less than 20%): Two times the height of the shrub.

ii. Mild to moderate slope (20-40%): Four times the height of the shrub

iii. Moderate to steep slope (greater than 40%): Six times the height of the shrub

iv~~V~~. Shrubs maintained as trees shall comply with requirements for trees, and not this section.

Commented [A44]: In conflict with the 8' standard that precedes this. Have an informal conversation about what inflorms the vertical spacing standard.

Commented [A45]: Changed to 6' throughout.

Commented [A46]:

Commented [A47]: Removed second sentence for clarity.

Commented [A48]: Need to capture invasive perennial forbs

Commented [A49]: In conflict with the 8' standard that precedes this. Have an informal conversation about what inflorms the vertical spacing standard.

Commented [A50]: Changed to 6' throughout.

Commented [A51]:

Commented [A52]: Should this language be moved to 3 as it applies to both zones. Discuss the conflict between Fuel Separation and Continuous Tree Canopy methods. Consider adding the reference as an appendix

Commented [A53]: Do we need to call out that ground cover is allowed

~~f. Maintain space between tree canopies:~~

~~. Flat or mild slope (less than 20%): 10 feet.~~

~~. Mild to moderate slope (20-40%): 20 feet.~~

~~. Moderate to steep slope (greater than 40%): 30 feet.~~

Commented [A54]: In conflict with Continuous Tree Canopy section

~~j.~~g. New trees shall be planted and maintained so that the tree's drip line at maturity is a minimum of 10 feet from any structure or the canopy of other trees.

Section 4907.6 Specific requirements. Effective January 1, 2026 the Grizzly Peak Mitigation Area and Panoramic Mitigation Area shall be subject to 4907.6 ~~instead in addition to of~~ 4907.4.

Commented [A55]: Carry over the changes in 4907.4 if the group does not object.

A person who owns, leases, controls, operates, or maintains lands shall at all times ~~maintain~~:

1. Zone 0: 0 to 5 feet from any structure:
    a. Maintain all areas within five (5) horizonal feet of any structure, outbuildings, attached deck or stairs, and the area under attached decks and stairs free of vegetative and non-vegetative combustible material.

Commented [A56]: Clarify vegetation types

        i. This includes but is not limited to shrubs, vegetative ground cover, climbing vines, combustible boards, timbers, firewood, debris, synthetic lawn, wood mulch products, playsets, plastic trash and recycle cans, trellises, pergolas, shade coverings, planters, attached window boxes, privacy walls, boats, RVs, and other material that could be ignited by embers, radiant heat, or direct flame.
        ii. Hardscape materials, such as gravel, pavers, concrete, and other noncombustible ~~mulch~~ materials, including bare mineral soil, are permitted.
        iii. Exception: Plants in pots are allowable if they are in areas that are not directly beneath, above, or adjacent to a window or eave; are kept in an unaffixed, non-combustible pot or container that is no larger than 5-gallon capacity; and set apart by 1.5 times the height of the plant or 12 inches, whichever is greater, from the structure and each other. These plants shall be no greater than 18 inches in height. Dead or dying material on, around and under the plants shall be removed.
        iv. Exception: Hot tubs may be installed within five (5) horizontal feet of a structure, provided they comply with all Zone 0 clearance requirements applicable to structures.
    ~~b.~~ Trees: ~~No (new) trees are permitted in Zone 0 unless .~~

Commented [A57]: Consider a recommendation back to council to maintain awareness of BoF reccomendations, and direct the Fire Department not enforce parameters under active discussion with the BoF

Commented [A58]: Consider adding "unless"

~~c.~~b. ~~Exception: If the bole of a tree is present within Zone 0, that tree is permitted if it is the canopy base is above taller than the adjacent Building or Structure's roof ridgeline, does not have and is maintained free of any dead and dying branches; (~~Existing s~~Single specimens of trees are permitted in Zone Zero if:

i. Maintained free of dead material.

~~i.~~ii. ~~All live tree branches shall be kept:~~The canopy is maintained to create:

1. Six~~Ten~~ feet (~~6~~10') above the adjacent building or structure's roof ~~(when reaching above the roofline)ridgeline;~~
2. Ten~~SixTen~~ feet (10~~610~~') away from chimneys and stovepipe outlets; and
3. Five feet (5') ~~away~~ of horizontal clearance from the sides of any Building, Structure, attached deck, porch, landing or stairs, and hot tubs within five (5) feet of a structure.

~~3.~~4.6' of vertical clearance above attached decks, attached, landing or stairs, and hot tubs within 5' of a structure.

Commented [A59]: Edited for clarity.

Commented [A60]: Track BOF language about single specimen and consider science that informs that decisions. Bole

Commented [A61]: Added landing

Commented [A62]: Suggested language for trees that needs review and discussion. Suggestion is to replace (b) with the language in parentheses.

d.c. The roof and rain gutters of a Building or Structure shall be kept clear of leaves, needles, and vegetative material.

e.d. Existing fences that are directly attached to a Building or Structure shall have a five foot (5 ft) non-combustible span at the point of attachment. After the effective date of this regulation, no new or replacement sections ~~, or replaced sections~~ of combustible fence (parallel or perpendicular) are permitted within 5 feet of a building or structure including an attached deck.

f.e. Outbuildings are not permitted in Zone 0, unless constructed according to the standards in Chapter 7A (commencing with Section 701A.1) of Part 2 of Title 24 of the California Code of Regulations. Outbuildings that meet these standards shall be considered part of the Building or Structure for the purpose of measuring Zone 0.

Commented [A63]: Issues with fences and sections of fence

Commented [A64]: Added limiting language to avoid requiring sprinklers etc.

~~Zone 1: 5 to 30 Feet from any structure:~~

~~Remove any privacy hedges or contiguous vegetation that will create a pathway for fire to reach a Structure.~~

~~Keep low-growing shrubs, no higher than 6 feet in height, spaced apart or in small groupings of no more than 3 shrubs with a maximum aggregate diameter of 10 feet. Shrub groupings must be separated from other shrubs or shrub groupings by 15 feet such that no continuous path of vegetation is created. Where shrubs are located below or within a tree's drip line, the lowest tree branch shall be a minimum of three times the height of the understory shrubs or 10 feet, whichever is greater.~~

~~If there are multiple structures, such as a shed, hot tub, and playset, ensure these structures are spaced at least 10 feet apart. Have at most three (3) of these structures within 30 feet of a building or structure.~~

~~Relocate exposed firewood piles outside of Zone 1 unless they are completely covered in a fire-resistant material.~~

~~Zone 2: 30 to 100 feet from any structure:~~

~~All exposed wood piles must have a minimum of ten feet (10 ft.) of clearance, down to bare mineral soil, in all directions.~~

~~Create horizontal and vertical spacing among shrubs and trees using the "Fuel Separation" method, the "Continuous Tree Canopy" method or a combination of both to achieve defensible space clearance requirements. Further guidance regarding these methods is contained in the State Board of Forestry and Fire Protection's, "General Guidelines for Creating Defensible Space, February 8, 2006," incorporated herein by reference.~~

~~For both Zones 1 and 2:~~

~~Remove vegetative and combustible material capable of transmitting fire to a structure as determined by the Fire Code Official.~~

- ~~Dead and dying woody surface fuels and aerial fuels shall be removed. Loose surface litter, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches, shall be permitted to a maximum depth of three inches (3 in.).~~
- ~~Cut annual grasses and forbs down to a maximum height of four inches (4 in.).~~
- ~~Non-irrigated brush is not permitted.~~
- ~~Vertical Spacing: Limb trees by removing hanging bark, debris and branches that are within six feet (6 ft.) of the ground, or three times the height of the understory vegetation, whichever is greater. Where a tree is not adaptable to limbing to the height described above, use a combination of limbing and/or modify and remove fuels adjacent to and underneath the tree to provide clearance above grade that is equivalent to three times the height of the tallest understory fuel.~~
- ~~Maintain horizontal spacing between shrubs:~~
- ~~Flat or mild slope (less than 20%): Two times the height of the shrub.~~
- ~~Mild to moderate slope (20-40%): Four times the height of the shrub~~
- ~~Moderate to steep slope (greater than 40%): Six times the height of the shrub~~
- ~~Maintain space between tree canopies:~~
- ~~Flat or mild slope (less than 20%): 10 feet.~~
- ~~Mild to moderate slope (20-40%): 20 feet.~~
- ~~Moderate to steep slope (greater than 40%): 30 feet.~~
- ~~New trees shall be planted and maintained so that the tree's drip line at maturity is a minimum of 10 feet from any structure or the canopy of other trees.~~

Commented [A65]: This is in conflict with the Continuous Tree Canopy. Consider to strike.

Chapter 49 of the California Fire Code is adopted in its entirety subject to the modifications thereto which are set forth below.

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BOLE OF A TREE. A bole of a tree is its main trunk, specifically the part extending from the roots up to the first branches and canopy.

FIRE PROTECTION PLAN. A document prepared for a specific premises, project or development, either existing or proposed for a Wildland-Urban Interface (WUI) area. It describes ways to minimize and mitigate potential for loss from wildfire exposure.

FIRE HAZARD SEVERITY ZONES. Geographical areas designated pursuant to California Public Resources Codes, Sections 4201 through 4204 and classified as Very High, High, or Moderate in State Responsibility Area or as Local Agency Very High Fire Hazard Severity Zones designated pursuant to California Government Code, Sections 51175 through 51189, and locally amended and adopted under ordinance 7958-N.S.

The California Code of Regulations, Title 14, Section 1280 entitles the maps of these geographical areas as "Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California."

FLATLANDS MITIGATION AREA encompasses the entire City of Berkeley except for areas in the Hills Mitigation Area, Panoramic Mitigation Area and Grizzly Peak Mitigation Area.

FORBS. Forbs are herbaceous, non-woody flowering plants that are not grasses, sedges, or rushes

GRIZZLY PEAK MITIGATION AREA encompasses those areas of the city from parcels addressed on the west side of Grizzly Peak Boulevard to the eastern city boundary. Homes addressed on, or with a structural frontage on either side of Grizzly Peak Boulevard are included in the area. The Grizzly Peak Mitigation Area is designated as a Very-High Fire Hazard Severity Zone.

HIGH FIRE HAZARD SEVERITY ZONE encompasses those areas designated as High Fire Hazard Severity Zones, adopted and locally amended pursuant to California Government Code, Sections 51175 through 51189.

This area includes areas of the City east / north east of the line formed by these roads. Homes addressed on, or with a structural frontage on either side of these road segments are included in the zone:

a. The Arlington Avenue from the Kensington Border to Marin Avenue
b. Fountain Walk from Marin Avenue to Sutter Street
c. Sutter Street from the southern portal of the Northbrae Tunnel to Eunice Street.
d. Eunice Street from Sutter Street to Spruce Street
e. Spruce Street from Eunice Street to Hearst Avenue
f. Hearst Ave from Spruce Street to Gayley Road
g. Gayley Road from Hearst Avenue to Piedmont Ave
h. Piedmont Avenue from Gayley Road to Bancroft Way.
i. Piedmont Crescent from Piedmont Ave to Warring Street.
j. Warring Street from Dwight Way to Derby Street.
k. Derby Street from Warring Street to Belrose Avenue.
l. Belrose Avenue from Derby Street to Garber Street
m. Claremont Boulevard from Garber Street to Claremont Avenue
n. Claremont Avenue from Claremont Boulevard to the Oakland Border

IGNITION-RESISTANT MATERIAL. A type of building material that complies with the requirements in Section 704A.2 in the ~~California~~ Berkeley Building Code.

LOCAL RESPONSIBILITY AREAS (LRA). Areas of the state in which the financial responsibility of preventing and suppressing fires is the primary responsibility of a city, county, city and county, or district.

PANORAMIC MITIGATION AREA (ZONE 3) encompasses those areas of the city bounded by the line formed by these roads and by the City Limit to the east. The entirety of the Panoramic Mitigation Area is designated as a Very High Fire Hazard Severity Zone. Homes addressed on, or with a structural frontage on either side of these road segments are included in the zone:

a. Centennial Drive from the Oakland border to Stadium Rim Way
b. Stadium Rim Way from Centennial Drive to Canyon Road
c. Canyon Road from Stadium Rim Way to Bancroft Way
d. Bancroft Way from Canyon Road to Bancroft Steps
e. Bancroft Steps from Bancroft Way to Bancroft Way
f. Bancroft Way from Bancroft Steps to Piedmont Avenue
g. Piedmont Avenue from Bancroft Way to Dwight Way
h. Dwight Way East from Piedmont Avenue to the eastern terminus of Dwight Way.

i. A straight line extending East from the terminus of Dwight Way to the Oakland border.

STATE RESPONSIBILITY AREA (SRA). Lands that are classified by the Board of Forestry pursuant to Public Resources Code Section 4125 where the financial responsibility of preventing and suppressing wildfires is primarily the responsibility of the state.

VERY HIGH FIRE HAZARD SEVERITY ZONE. Encompasses those areas identified by CalFIRE as Very High Fire Hazard Severity Zones pursuant to California Government Code 51175-51189 and locally amended and adopted under ordinance 7958-N.S.

WILDFIRE. Any uncontrolled fire spreading through vegetative fuels that threatens to destroy life, property, or resources as defined in Public Resources Code, Sections 4103 and 4104.

WILDFIRE EXPOSURE. One or a combination of radiant heat, convective heat, direct flame contact and burning embers being projected by vegetation fire to a structure and its immediate environment.

WILDLAND-URBAN INTERFACE (WUI). A geographical area identified by the state as a "Fire Hazard Severity Zone" in accordance with the Public Resources Code, Sections 4201 through 4204, and Government Code, Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires.

SECTION 4903 PLANS

Section 4903.3 Submittal, approval and fees. When required to submit a Fire Protection Plan or Vegetation Management Plan for any reason the responsible party shall prepare or cause to be prepared a Fire Protection Plan in accordance with the latest standards of the Berkeley Fire Department. The Fire Protection Plan shall be submitted to, reviewed and approved by the Berkeley Fire Department and shall be enforced and maintained by the responsible party or their designated agent. The Berkeley Fire Department may charge an appropriate fee for the review, approval and processing of the Fire Protection Plan in accordance with the hourly rate established by City Council resolution.

SECTION 4905 WILDFIRE PROTECTION BUILDING CONSTRUCTION

Section 4905.2 Construction methods and requirements within established limits. Within the limits established by law, construction methods intended to mitigate wildfire exposure shall comply with the wildfire protection building construction requirements contained in the ~~California Building Standards Code~~ Berkeley Building Code and Berkeley Residential Code, including the following:

1. ~~California Building Code, Chapter 7A.~~Chapter 7A of the Berkeley Building Code (B.B.C), Berkeley Municipal Code Section 19.28.030.
2. ~~California Residential Code~~ Section R337 of the Berkeley Residential Code (B.R.C.), Berkeley Municipal Code Section 19.29.050.
3. California Referenced Standards Code, Chapter 12-7A.

SECTION 4907 DEFENSIBLE SPACE

Property owners are not required or authorized by this code to enter the properties of another person to implement the requirements of this Section.

Section 4907.3 Adjacent Property Requirements.

The Fire Code Official may require a property owner to perform hazardous vegetation and fuel management on their land to maintain defensible space up to 100 feet from structures located on adjacent properties.

Section 4907.4 Mitigations Required.

Within the locally adopted Very High Fire Hazard Severity Zone a person who owns, leases, controls, operates, or maintains lands shall at all times:

1. Remove all branches within 10 feet of any chimney or stovepipe outlet.
2. Maintain the roof and roof gutters of any structure, and the surface of any attached deck, porch, landing, or stairs free of leaves, needles, or other deposited vegetative materials.
3. Maintain 6 feet of vertical clearance between branches and all other parts of trees or other vegetation overhanging the roof or other portion of any Structure or attached deck.
4. Zone 0: 0-5 feet from any structure: The requirements of 4907.4.5 below apply to this zone.
5. Zone 1: 5 to 30 feet from any structure:
    a. Remove contiguous vegetation without adequate fuel separation to prevent spread to the structure.
    b. Maintain any tree, shrub, or other plant adjacent to or overhanging any Structure or attached deck free of dead or dying wood.
    c. Maintain trees to remove Ladder Fuels so that foliage, twigs, or branches are greater than 6’ feet above the ground or surface fuels.
    d. Where shrubs or small trees are located below or within a tree's drip line, the lowest tree branch shall be a minimum of three times the height of the understory shrubs or 6 feet, whichever is greater.
    e. New structures on the same property, such as a shed, hot tub, and playset, ensure these structures are spaced at least 10 feet apart. Have at most three (3) of these structures within 30 feet of a building or structure.
        i. Existing moveable structures shall comply with the above.
    f. Relocate storage of exposed firewood piles or lumber unless they are completely covered in a fire-resistant covering approved by the State Fire Marshal’s Building Material Listing Service.

6. Zone 2: 30 to 100 feet from any structure:
   a. All exposed wood piles must have a minimum of ten feet (10 ft.) of clearance, down to bare mineral soil, in all directions.
7. For both Zones 1 and 2:
   a. Remove vegetative and combustible material capable of transmitting fire to a structure as determined by the Fire Code Official.
   b. Dead and dying woody surface fuels and aerial fuels shall be removed. Loose surface litter, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches, shall be permitted to a maximum depth of three inches (3 in.).
   c. Cut annual grasses and annual forbs to a maximum height of four inches (4 in.) prior to, or upon reaching the senescent or ripening phase when the preponderance of vegetative material is cured or dead.
   d. Vertical Spacing: Limb trees by removing hanging bark, debris and branches that are within six feet (6 ft.) of the ground.
   e. Create horizontal and vertical spacing among shrubs and trees using the "Fuel Separation" method, the "Continuous Tree Canopy" method or a combination of both to achieve defensible space clearance requirements. Further guidance regarding these methods is contained in the State Board of Forestry and Fire Protection's, "General Guidelines for Creating Defensible Space, February 8, 2006," incorporated herein by reference.
   f. Maintain horizontal spacing between shrubs. Consistent with fuel management objectives, steps should be taken to minimize erosion, soil disturbance, and the spread of flammable, non-native grasses and weeds.
      i. Flat or mild slope (less than 20%): Two times the height of the shrub.
      ii. Mild to moderate slope (20-40%): Four times the height of the shrub
      iii. Moderate to steep slope (greater than 40%): Six times the height of the shrub
      iv. Shrubs maintained as trees shall comply with requirements for trees, and not this section.

g. New trees shall be planted and maintained so that the tree's drip line at maturity is a minimum of 10 feet from any structure or the canopy of other trees.

Section 4907.6 Specific requirements. Effective January 1, 2026 the Grizzly Peak Mitigation Area and Panoramic Mitigation Area shall be subject to 4907.6 in addition to 4907.4.

A person who owns, leases, controls, operates, or maintains lands shall at all times:

1. Zone 0: 0 to 5 feet from any structure:
    a. Maintain all areas within five (5) horizonal feet of any structure, outbuildings, attached deck or stairs, and the area under attached decks and stairs free of vegetative and non-vegetative combustible material.
        i. This includes but is not limited to shrubs, vegetative ground cover, climbing vines, combustible boards, timbers, firewood, debris, synthetic lawn, wood mulch products, playsets, plastic trash and recycle cans, trellises, pergolas, shade coverings, planters, attached window boxes, privacy walls, boats, RVs, and other material that could be ignited by embers, radiant heat, or direct flame.
        ii. Hardscape materials, such as gravel, pavers, concrete, and other noncombustible materials, including bare mineral soil, are permitted.
        iii. Exception: Plants in pots are allowable if they are in areas that are not directly beneath, above, or adjacent to a window or eave; are kept in an unaffixed, non-combustible pot or container that is no larger than 5-gallon capacity; and set apart by 1.5 times the height of the plant or 12 inches, whichever is greater, from the structure and each other. These plants shall be no greater than 18 inches in height. Dead or dying material on, around and under the plants shall be removed.
        iv. Exception: Hot tubs may be installed within five (5) horizontal feet of a structure, provided they comply with all Zone 0 clearance requirements applicable to structures.
    b. Trees: Existing single specimens of trees are permitted in Zone Zero if:
        i. Maintained free of dead material.
        ii. The canopy is maintained to create:
            1. Six feet (6') above the adjacent building or structure's roof
            2. Ten feet (10') away from chimneys and stovepipe outlets; and
            3. Five feet (5') of horizontal clearance from the sides of any Building, Structure, attached deck, porch, landing or stairs, and hot tubs within five (5) feet of a structure.

4. 6’ of vertical clearance above attached decks, attached, landing or stairs, and hot tubs within 5’ of a structure.

c. The roof and rain gutters of a Building or Structure shall be kept clear of leaves, needles, and vegetative material.

d. Existing fences that are directly attached to a Building or Structure shall have a five foot (5 ft) non-combustible span at the point of attachment. After the effective date of this regulation, no new or replacement sections of combustible fence (parallel or perpendicular) are permitted within 5 feet of a building or structure including an attached deck.

e. Outbuildings are not permitted in Zone 0, unless constructed according to the standards in Chapter 7A (commencing with Section 701A.1) of Part 2 of Title 24 of the California Code of Regulations. Outbuildings that meet these standards shall be considered part of the Building or Structure for the purpose of measuring Zone 0.

Action Calendar – Old Business

43b. Adoption of CALFIRE Map and Additional Areas Designated as the City of Berkeley Fire Hazard Severity Zones *(Continued from May 6, 2025)*
From: City Manager
Recommendation: Adopt second reading of Ordinance No. 7,958-N.S. to designate Fire Hazard Severity Zones (FHSZ) within the Local Responsibility Area as recommended by the California Department of Forestry and Fire Protection (CALFIRE) pursuant to Government Code Section 51178.
First Reading Vote: All Ayes.
Financial Implications: See report
Contact: David Sprague, Fire, (510) 981-3473
Action: See the action listed under Item 43.a.

Council Action Items

43c. EMBER Implementation Plan, Vegetation Management Working Group, and Clarifying Fire Code Language
From: Councilmember Blackaby (Author), Councilmember O'Keefe (Co-Sponsor)
Recommendation:
1. Refer to the City Manager to develop a comprehensive roll-out and implementation plan for EMBER; then return to City Council before September 9, 2025
2. Refer to the City Manager to create a working group of Berkeley residents and stakeholders to review the vegetation management portion of the Fire Code to ensure that it is clear, reflects unique local conditions, and incorporates the best available fire science (inclusive of any more conservative code adopted by the California Board of Forestry); then return with additional amendments to the City Council before December 31, 2025 as part of the Fire Department's Triennial Fire Code Update Process
3. Refer to the City Manager to incorporate additional clarifying language listed in this report; then return amendments to the City Council before December 31, 2025 as part of the Fire Department's Triennial Fire Code Update Process
Financial Implications: None.
Contact: Brent Blackaby, Councilmember, District 6, (510) 981-7160
Action: See the action listed under Item 43.a.

Information Reports

44. Landmarks Preservation Ordinance Notice of Decision: 2845 Woolsey Street/#LMIN2025-0001
From: City Manager
Contact: Jordan Klein, Planning and Development, (510) 981-7400
Action: Received and filed.

GOVERNMENT CODE - GOV

TITLE 5. LOCAL AGENCIES [50001 - 57607] *(Title 5 added by Stats. 1949, Ch. 81.)*

DIVISION 1. CITIES AND COUNTIES [50001 - 52203] *(Division 1 added by Stats. 1949, Ch. 81.)*

PART 1. POWERS AND DUTIES COMMON TO CITIES AND COUNTIES [50001 - 51298.5] *(Part 1 added by Stats. 1949, Ch. 81.)*

CHAPTER 6.8. Moderate, High, and Very High Fire Hazard Severity Zones [51175 - 51189] *(Heading of Chapter 6.8 amended by Stats. 2021, Ch. 375, Sec. 2.)*

51175. The Legislature hereby finds and declares as follows:

(a) Wildfires are extremely costly, not only to property owners and residents, but also to local agencies. Wildfires pose a serious threat to the preservation of the public peace, health, or safety. The wildfire front is not the only source of risk since embers, or firebrands, travel far beyond the area impacted by the front and pose a risk of ignition to a structure or fuel on a site for a longer time. Since fires ignore civil boundaries, it is necessary that cities, counties, special districts, state agencies, and federal agencies work together to bring raging fires under control. Preventive measures are therefore needed to ensure the preservation of the public peace, health, or safety.

(b) The prevention of wildland fires is not a municipal affair, as that term is used in Section 5 of Article XI of the California Constitution, but is instead, a matter of statewide concern. It is the intent of the Legislature that this chapter apply to all local agencies, including, but not limited to, charter cities, charter counties, and charter cities and counties. This subdivision shall not limit the authority of a local agency to impose more restrictive fire and public safety requirements, as otherwise authorized by law.

(c) It is not the intent of the Legislature in enacting this chapter to limit or restrict the authority of a local agency to impose more restrictive fire and public safety requirements, as otherwise authorized by law.

(Amended by Stats. 2008, Ch. 366, Sec. 1. Effective January 1, 2009.)

51176. The purpose of this chapter is to classify lands in the state in accordance with whether a very high fire hazard is present so that public officials are able to identify measures that will retard the rate of spread, and reduce the potential intensity, of uncontrolled fires that threaten to destroy resources, life, or property, and to require that those measures be taken.

(Added by Stats. 1992, Ch. 1188, Sec. 1. Effective January 1, 1993.)

51177. As used in this chapter:

(a) "Defensible space" means the area adjacent to a structure or dwelling where wildfire prevention or protection practices are implemented to provide defense from an approaching wildfire or to minimize the spread of a structure fire to wildlands or surrounding areas.

(b) "Director" means the Director of Forestry and Fire Protection.

(c) "Fuel" means any combustible material, including petroleum-based products, cultivated landscape plants, grasses, and weeds, and wildland vegetation.

(d) "Fuel management" means the act or practice of controlling flammability and reducing resistance to control of fuels through mechanical, chemical, biological, or manual means or by fire, in support of land management objectives.

(e) "Local agency" means a city, county, city and county, or district responsible for fire protection within a very high fire hazard severity zone.

(f) “Single specimen tree” means any live tree that stands alone in the landscape so as to be clear of buildings, structures, combustible vegetation, or other trees, and that does not form a means of rapidly transmitting fire from the vegetation to an occupied dwelling or structure or from an occupied dwelling or structure to vegetation.

(g) “State responsibility areas” means those areas identified pursuant to Section 4102 of the Public Resources Code.

(h) “Vegetation” means all plants, including trees, shrubs, grass, and perennial or annual plants.

(i) “Very high fire hazard severity zone” means an area designated as a very high fire hazard severity zone by the State Fire Marshal pursuant to Section 51178 that is not a state responsibility area.

(j) “Wildfire” means an unplanned, unwanted wildland fire, including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to extinguish the fire.

(Amended by Stats. 2021, Ch. 382, Sec. 1.5. (SB 63) Effective January 1, 2022.)

51178. The State Fire Marshal shall identify areas in the state as moderate, high, and very high fire hazard severity zones based on consistent statewide criteria and based on the severity of fire hazard that is expected to prevail in those areas. Moderate, high, and very high fire hazard severity zones shall be based on fuel loading, slope, fire weather, and other relevant factors including areas where winds have been identified by the Office of the State Fire Marshal as a major cause of wildfire spread.

(Amended by Stats. 2021, Ch. 382, Sec. 2.5. (SB 63) Effective January 1, 2022.)

51178.5. Within 30 days after receiving a transmittal from the State Fire Marshal that identifies fire hazard severity zones pursuant to Section 51178, a local agency shall make the information available for public review and comment. The information shall be presented in a format that is understandable and accessible to the general public, including, but not limited to, maps.

(Amended by Stats. 2021, Ch. 382, Sec. 3.5. (SB 63) Effective January 1, 2022.)

51179. (a) A local agency shall designate, by ordinance, moderate, high, and very high fire hazard severity zones in its jurisdiction within 120 days of receiving recommendations from the State Fire Marshal pursuant to Section 51178.

(b) (1) A local agency may, at its discretion, include areas within the jurisdiction of the local agency, not identified as very high fire hazard severity zones by the State Fire Marshal, as very high fire hazard severity zones following a finding supported by substantial evidence in the record that the requirements of Section 51182 are necessary for effective fire protection within the area.

(2) A local agency may, at its discretion, include areas within the jurisdiction of the local agency, not identified as moderate and high fire hazard severity zones by the State Fire Marshal, as moderate and high fire hazard severity zones, respectively.

(3) A local agency shall not decrease the level of fire hazard severity zone as identified by the State Fire Marshal for any area within the jurisdiction of the local agency, and, in exercising its discretion pursuant to paragraph (2), may only increase the level of fire hazard severity zone as identified by the State Fire Marshal for any area within the jurisdiction of the local agency.

(c) The local agency shall transmit a copy of an ordinance adopted pursuant to subdivision (a) to the State Board of Forestry and Fire Protection within 30 days of adoption.

(d) Changes made by a local agency to the recommendations made by the State Fire Marshal shall be final and shall not be rebuttable by the State Fire Marshal.

(e) The State Fire Marshal shall prepare and adopt a model ordinance that provides for the establishment of very high fire hazard severity zones.

(f) Any ordinance adopted by a local agency pursuant to this section that substantially conforms to the model ordinance of the State Fire Marshal shall be presumed to be in compliance with the requirements of this section.

(g) A local agency shall post a notice at the office of the county recorder, county assessor, and county planning agency identifying the location of the map provided by the State Fire Marshal pursuant to Section 51178. If the agency amends the map, pursuant to subdivision (b) or (c) of this section, the notice shall instead identify the location of the amended map.

(Amended by Stats. 2022, Ch. 574, Sec. 10. (AB 211) Effective September 27, 2022.)

51180. For the purposes of Division 3.6 (commencing with Section 810) of Title 1, vegetation removal or management, undertaken in whole or in part, for fire prevention or suppression purposes shall not be deemed to alter the natural condition of public property. This section shall apply only to natural conditions of public property and shall not limit any liability or immunity that may otherwise exist pursuant to this chapter.

(Added by Stats. 1992, Ch. 1188, Sec. 1. Effective January 1, 1993.)

51181. The State Fire Marshal shall periodically review the areas in the state identified as very high fire hazard severity zones pursuant to this chapter, and as necessary, shall make recommendations relative to very high fire hazard severity zones. This review shall coincide with the review of state responsibility area lands every five years and, when possible, fall within the time frames for each county's general plan update. Any revision of areas included in a very high fire hazard severity zone shall be made in accordance with Sections 51178 and 51179.

(Amended by Stats. 2021, Ch. 225, Sec. 7. (AB 9) Effective January 1, 2022.)

51182. (a) A person who owns, leases, controls, operates, or maintains an occupied dwelling or occupied structure within a very high fire hazard severity zone designated by the local agency pursuant to Section 51179, shall at all times do all of the following:

(1) (A) Maintain defensible space of 100 feet from each side and from the front and rear of the structure, but not beyond the property line except as provided in subparagraph (B). The amount of fuel modification necessary shall consider the flammability of the structure as affected by building material, building standards, location, and type of vegetation. Fuels shall be maintained and spaced in a condition so that a wildfire would be unlikely to ignite the structure. This subparagraph does not apply to single specimens of trees or other vegetation that are well-pruned and maintained so as to effectively manage fuels and not form a means of rapidly transmitting fire from other nearby vegetation to a structure or from a structure to other nearby vegetation or to interrupt the advance of embers toward a structure. The intensity of fuels management may vary within the 100-foot perimeter of the structure, with more intense fuel reductions being used between 5 and 30 feet around the structure, and an ember-resistant zone being required within 5 feet of the structure, based on regulations promulgated by the State Board of Forestry and Fire Protection, in consultation with the Office of the State Fire Marshal, to consider the elimination of materials in the ember-resistant zone that would likely be ignited by embers. The regulations may also alter the fuel reduction required between 5 and 30 feet to integrate the ember-resistant zone into the requirements of this section. Consistent with fuels management objectives, steps should be taken to minimize erosion, soil disturbance, and the spread of flammable nonnative grasses and weeds.

(B) A greater distance than that required under subparagraph (A) may be required by state law, local ordinance, rule, or regulation. Fuel modification beyond the property line may only be required by state law, local ordinance, rule, or regulation in order to maintain 100 feet of defensible space from a structure. Fuel modification on adjacent property shall only be conducted following written consent by the adjacent landowner. Any local ordinance related to fuel modification shall be in compliance with all applicable state laws, regulations, and policies. Any local ordinance may include provisions to allocate costs for any fuel modification beyond the property line.

(C) An insurance company that insures an occupied dwelling or occupied structure may require a greater distance than that required under subparagraph (A) if a fire expert, designated by the fire chief or fire official from the authority having jurisdiction, provides findings that the fuel modification is necessary to significantly reduce the risk of transmission of flame or heat sufficient to ignite the structure, and there is no other feasible mitigation measure possible to reduce the risk of ignition or spread of wildfire to the structure. The greater distance may not be beyond the property line unless allowed by state law, local ordinance, rule, or regulation.

(2) Remove that portion of a tree that extends within 10 feet of the outlet of a chimney or stovepipe.

(3) Maintain a tree, shrub, or other plant adjacent to or overhanging a building free of dead or dying wood.

(4) Maintain the roof of a structure free of leaves, needles, or other vegetative materials.

(5) Before constructing a new dwelling or structure that will be occupied or rebuilding an occupied dwelling or occupied structure damaged by a fire in that zone, the construction or rebuilding of which requires a building permit, the owner shall obtain a certification from the local building official that the dwelling or structure, as

proposed to be built, complies with all applicable state and local building standards, including those described in subdivision (b) of Section 51189, and shall provide a copy of the certification, upon request, to the insurer providing course of construction insurance coverage for the building or structure. Upon completion of the construction or rebuilding, the owner shall obtain from the local building official, a copy of the final inspection report that demonstrates that the dwelling or structure was constructed in compliance with all applicable state and local building standards, including those described in subdivision (b) of Section 51189, and shall provide a copy of the report, upon request, to the property insurance carrier that insures the dwelling or structure.

(b) A person is not required under this section to manage fuels on land if that person does not have the legal right to manage fuels, nor is a person required to enter upon or to alter property that is owned by any other person without the consent of the owner of the property.

(c) (1) The State Board of Forestry and Fire Protection, in consultation with the Office of the State Fire Marshal, shall develop, periodically update, and post on its internet website a guidance document on fuels management pursuant to this chapter. The guidance document shall include, but not be limited to, regionally appropriate vegetation management suggestions that preserve and restore native species that are fire resistant or drought tolerant, or both, minimize erosion, minimize the spread of flammable nonnative grasses and weeds, minimize water consumption, and permit trees and shrubs near homes for shade, aesthetics, and habitat; and suggestions to minimize or eliminate the risk of flammability of nonvegetative sources of combustion such as woodpiles, propane tanks, decks, and outdoor lawn furniture.

(2) On or before January 1, 2023, the State Board of Forestry and Fire Protection, in consultation with the Office of the State Fire Marshal, shall update the guidance document to include suggestions for creating an ember-resistant zone within five feet of a structure based on regulations promulgated by the State Board of Forestry and Fire Protection, in consultation with the Office of the State Fire Marshal, to consider the elimination of materials in the ember-resistant zone that would likely be ignited by embers. Existing and new structures shall meet the same standard for the ember-resistant zone, but regulations shall allow the staging of work for existing structures to support implementation of the ember-resistant zone and address the costs of compliance.

(d) For purposes of this section, a structure for the purpose of an ember-resistant zone shall include any attached deck. This section does not limit the authority of the State Board of Forestry and Fire Protection or the Office of the State Fire Marshal to require the removal of fuel or vegetation on top of or underneath a deck pursuant to this section.

(Amended by Stats. 2024, Ch. 982, Sec. 1. (SB 504) Effective January 1, 2025.)

51183. (a) The local agency may exempt from the standards set forth in Section 51182 structures with exteriors constructed entirely of nonflammable materials, or conditioned upon the contents and composition of the structure, and may vary the requirements respecting the management of fuels surrounding the structures in those cases. This subdivision does not authorize a local agency to vary a requirement that is a building standard subject to Section 18930 of the Health and Safety Code, except as otherwise authorized by law.

(b) An exemption or variance under subdivision (a) shall not apply unless and until the occupant of the structure, or if there is no occupant, then the owner of the structure, files with the local agency a written consent to the inspection of the interior and contents of the structure to ascertain whether Section 51182 is complied with at all times.

(Amended by Stats. 2008, Ch. 366, Sec. 5. Effective January 1, 2009.)

51183.5. (a) A transferor of real property that is located within a very high fire hazard severity zone, designated pursuant to this chapter, shall disclose to any prospective transferee the fact that the property is located within a very high fire hazard severity zone, and is subject to the requirements of Section 51182.

(b) Disclosure is required pursuant to this section only when one of the following conditions is met:

(1) The transferor, or the transferor's agent, has actual knowledge that the property is within a very high fire hazard severity zone.

(2) A map that includes the property has been provided to the local agency pursuant to Section 51178, and a notice is posted at the offices of the county recorder, county assessor, and county planning agency that identifies the location of the map and any information regarding changes to the map received by the local agency.

(c) In all transactions that are subject to Section 1103 of the Civil Code, the disclosure required by subdivision (a) of this section shall be provided by either of the following means:

(1) The Local Option Real Estate Disclosure Statement as provided in Section 1102.6a of the Civil Code.

(2) The Natural Hazard Disclosure Statement as provided in Section 1103.2 of the Civil Code.

(d) If the map or accompanying information is not of sufficient accuracy or scale that a reasonable person can determine if the subject real property is included in a very high fire hazard zone, the transferor shall mark "Yes" on the Natural Hazard Disclosure Statement. The transferor may mark "No" on the Natural Hazard Disclosure Statement if he or she attaches a report prepared pursuant to subdivision (c) of Section 1103.4 of the Civil Code that verifies the property is not in the hazard zone. Nothing in this subdivision is intended to limit or abridge any existing duty of the transferor or the transferor's agents to exercise reasonable care in making a determination under this subdivision.

(e) Section 1103.13 of the Civil Code shall apply to this section.

(f) The specification of items for disclosure in this section does not limit or abridge any obligation for disclosure created by any other provision of law or that may exist in order to avoid fraud, misrepresentation, or deceit in the transfer transaction.

(Amended by Stats. 1999, Ch. 876, Sec. 7. Effective January 1, 2000.)

51184. (a) Section 51182 shall not apply to any land or water area acquired or managed for one or more of the following purposes or uses:

(1) Habitat for endangered or threatened species, or any species that is a candidate for listing as an endangered or threatened species by the state or federal government.

(2) Lands kept in a predominantly natural state as habitat for wildlife, plant, or animal communities.

(3) Open space lands that are environmentally sensitive parklands.

(4) Other lands having scenic values, as declared by the local agency, or by state or federal law.

(b) This exemption applies whether the land or water area is held in fee title or any lesser interest. This exemption applies to any public agency, any private entity that has dedicated the land or water areas to one or more of those purposes or uses, or any combination of public agencies and private entities making that dedication.

(c) This section shall not be construed to prohibit the use of properly authorized prescribed burning to improve the biological function of land or to assist in the restoration of desired vegetation.

(d) In the event that any lands adjacent to any land or water area described in subdivision (a) are improved such that they are subject to Section 51182, the obligation to comply with Section 51182 shall be with the person owning, leasing, controlling, operating, or maintaining the occupied dwelling or occupied structure on the improved lands. All maintenance activities and other fire prevention measures required by Section 51182 shall be required only for the improved lands, not the land and water areas described in subdivision (a).

(Added by Stats. 1992, Ch. 1188, Sec. 1. Effective January 1, 1993.)

51185. (a) A violation of Section 51182 is an infraction punishable by a fine of not less than one hundred dollars ($100) nor more than five hundred dollars ($500).

(b) If a person is convicted of a second violation of Section 51182 within five years, that person shall be punished by a fine of not less than two hundred fifty dollars ($250) nor more than five hundred dollars ($500).

(c) If a person is convicted of a third violation of Section 51182 within five years, that person is guilty of a misdemeanor and shall be punished by a fine of not less than five hundred dollars ($500).

(Added by Stats. 1992, Ch. 1188, Sec. 1. Effective January 1, 1993.)

51186. (a) The local agency having jurisdiction of property upon which conditions regulated by Section 51182 are being violated shall notify the owner of the property to correct the conditions. If the owner fails to correct the conditions, the local agency may cause the corrections to be made, and the expenses incurred shall become a lien on the property that is the subject of the corrections when recorded in the county recorder's office in the county in which the real property is located. The priority of the lien shall be as of the date of recording. The lien shall contain the legal description of the real property, the assessor's parcel number, and the name of the owner of record as shown on the latest equalized assessment roll.

(b) (1) Each local agency having jurisdiction of property upon which conditions that are regulated by Section 51182 apply shall make reasonable efforts to provide notice to affected residents within the jurisdiction of the local agency describing the requirements added by the amendments to paragraph (1) of subdivision (a) of Section 51182 made in Assembly Bill 3074 of the 2019–20 Regular Session before the imposition of penalties for violating those requirements.

(2) (A) The requirement for an ember-resistant zone pursuant to Section 51182 shall not take effect for new structures until the State Board of Forestry and Fire Protection updates the regulations, pursuant to paragraph (1) of subdivision (a) of Section 51182, and the guidance document, pursuant to paragraph (2) of subdivision (c) of Section 51182.

(B) The requirements for an ember-resistant zone pursuant to Section 51182 shall take effect for existing structures three years after the effective date for the new structures.

(Amended by Stats. 2024, Ch. 982, Sec. 2. (SB 504) Effective January 1, 2025.)

51187. Any violation of Section 51182 may be considered a public nuisance pursuant to Section 38773.

(Added by Stats. 1992, Ch. 1188, Sec. 1. Effective January 1, 1993.)

51188. In the instance of conflict between this chapter and any provision of state law that allows a regional planning agency to regulate very high fire hazard severity zones, this chapter shall prevail.

(Added by Stats. 1992, Ch. 1188, Sec. 1. Effective January 1, 1993.)

51189. (a) The Legislature finds and declares that site and structure defensibility is essential to reduce the risk of structure ignition as well as for effective fire suppression by firefighters. This need to establish defensibility extends beyond the site fuel management practices required by this chapter, and includes, but is not limited to, measures that increase the likelihood of a structure withstanding ignition, such as building design and construction requirements that use fire resistant building materials, and standards for reducing fire risks on structure projections, including, but not limited to, porches, decks, balconies and eaves, and structure openings, including, but not limited to, attic, foundation, and eave vents, doors, and windows.

(b) No later than January 31, 2020, the State Fire Marshal, in consultation with the director and the Director of Housing and Community Development, shall, pursuant to Section 18930 of the Health and Safety Code, recommend updated building standards that provide for comprehensive site and structure fire risk reduction to protect structures from fires spreading from adjacent structures or vegetation and to protect vegetation from fires spreading from adjacent structures, based on information learned from the 2017 wildfire season.

(c) (1) No later than January 31, 2020, the State Fire Marshal, in consultation with the director and the Director of Housing and Community Development, shall develop a list of low-cost retrofits that provide for comprehensive site and structure fire risk reduction to protect structures from fires spreading from adjacent structures or vegetation and to protect vegetation from fires spreading from adjacent structures. The Department of Forestry and Fire Protection shall incorporate the list in its fire prevention education and outreach efforts.

(2) In addition to the requirements of paragraph (1), the list shall include a guidance document, including regionally appropriate vegetation management suggestions that preserve and restore native plant species that are fire resistant or drought tolerant, or both.

(d) (1) The Office of the State Fire Marshal shall develop a model defensible space program that shall be made available for use by a city, county, or city and county in the enforcement of the defensible space provisions of Section 51182 of this code and subdivision (a) of Section 4291 of the Public Resources Code. In the development of this program, the State Fire Marshal shall consult with representatives from local, state, and federal fire services, local government, building officials, utility companies, the building industry, insurers and insurance research organizations, and the environmental community. Components of the program shall include, but not be limited to, all of the following:

(A) General guidelines for creating and maintaining defensible space around specified structures, including appropriate guidelines and definitions for vegetation management.

(B) Provisions for fuel modification beyond the property line, including on unimproved lots, in order to maintain 100 feet of defensible space from a structure.

(C) Suggested minimum qualifications needed for enforcement personnel.

(D) Enforcement mechanisms for compliance with and maintenance of defensible space requirements, including, but not limited to, the following:

(i) Site inspections.

(ii) Procedures for notifying a property owner of a violation.

(iii) Timelines for corrective action by a property owner and for reinspection.

(iv) Citations requiring abatement of a violation and subsequent removal of a fire hazard within the defensible space boundaries.

(v) Suggested administrative procedures that allow for appeal of the citation by the property owner.

(2) If a defensible space program is adopted, the local agency for enforcement of this program may recover the actual cost of abatement and may cause a notice of abatement lien to be recorded in the county in which the real property is located. The notice shall, at a minimum, identify the record owner or possessor of the property, set forth the last known address of the record owner or possessor, set forth the date upon which abatement was ordered by the local agency and the date the abatement was completed, and include a description of the real property subject to the lien and the amount of the abatement cost.

(3) The model defensible space program required pursuant to this subdivision shall be updated whenever the State Board of Forestry and Fire Protection substantially updates the guidance documents created pursuant to subdivision (c) of Section 51182 of this code and subdivision (e) of Section 4291 of the Public Resources Code.

(4) In order to develop and implement this subdivision and support any required update of the guidance documents identified in subdivision (c) of Section 51182 of this code and subdivision (e) of Section 4291 of the Public Resources Code, the Office of the State Fire Marshal is authorized to expend funds from the Building Standards Administration Special Revolving Fund, upon an appropriation by the Legislature, pursuant to Section 18931.7 of the Health and Safety Code.

(Amended by Stats. 2021, Ch. 382, Sec. 5. (SB 63) Effective January 1, 2022.)

Staff Overview: Revisions to Proposed Rule Text Defensible Space Zone 0 for July 24, 2025

I. Overview

AB 3074 (Friedman) of 2020 required the Board of Forestry and Fire Protection to develop regulations adding an ember-resistant zone to the state's defensible space regulations. The statute called for this new "Zone 0" to require more intensive mitigations within the first five feet of a home or other building to reduce the potential for structure ignition.

Following passage of AB 3074, Board staff began working with various stakeholders to develop a proposal for Zone 0. Since March 2025, the Board of Forestry's Zone 0 Committee has held four public workshops to gather input and comments on draft regulatory text to establish the new ember-resistant zone, consistent with AB 3074, SB 504 of 2024 and the Governor's Executive Order N-18-25.

The Zone 0 Committee's most recent version of the draft rule text reflects revisions made in response to public input. The Committee's goal is to propose regulations for Board adoption that will create a safer, less fire-prone environment, thereby reducing the likelihood and vulnerability of structures and neighborhoods to fires. The Committee recognizes, however, the need to balance numerous potentially competing interests, including the benefits of residential landscaping such as providing shade, habitat, and aesthetics.

Through public comment feedback and the best available science, the Committee also recognizes that local and regional differences exist in California, including variations in topography, climate, plant ecology, lot sizes, and structure density. These variations make it important to provide flexibility for local jurisdictions to develop alternative methods for compliance with Zone requirements, and these revisions reflect this need.

The Zone 0 committee encourages stakeholders and the public to provide feedback and propose revisions at the July 24 workshop or in writing at PublicComments@bof.ca.gov. Information on the workshop can be found here.

II. Summary of Key Revisions

Trees: The updated draft text clarifies that individual trees are allowed in Zone 0 provided they are well-pruned and maintained so as to effectively manage fuels and fuel ladders, consistent with Public Resources Code Section 4291. (**See Page 4, lines 1-25 of draft rule plead**)

Alternative methods of compliance: The updated draft text provides for alternative methods of compliance in both the State Responsibility Area and the Local Responsibility Area that take into account location variation. **(See Page 7, lines 21-24 of draft rule plead.)**

General Guidelines for Creating Defensible Space

State Board of Forestry and Fire Protection (BOF)
California Department of Forestry and Fire Protection

Adopted by BOF on February 8, 2006
Approved by Office of Administrative Law on May 8, 2006

Contents

A. Purpose of Guidelines

Effective defensible space

Recent changes to Public Resources Code (PRC) 4291 expand the defensible space clearance requirement maintained around buildings and structures from 30 feet to a distance of 100 feet. These guidelines are intended to provide property owners with examples of fuel modification measures that can be used to create an area around buildings or structures to create defensible space. A defensible space perimeter around buildings and structures provide firefighters a working environment that allows them to protect buildings and structures from encroaching wildfires as well as minimizing the chance that a structure fire will escape to the surrounding wildland. These guidelines apply to any person who owns, leases, controls, operates, or maintains a building or structure in, upon, or adjoining any mountainous area, forest-covered lands, brush-covered lands, grass-covered lands, or any land that is covered with flammable material, and located within a State Responsibility Area.

The vegetation surrounding a building or structure is fuel for a fire. Even the building or structure itself is considered fuel. Research and experience have shown that fuel reduction around a building or structure increases the probability of it surviving a wildfire. Good defensible space allows firefighters to protect and save buildings or structures safely without facing unacceptable risk to their lives. Fuel reduction through vegetation management is the key to creating good defensible space.

Terrain, climate conditions and vegetation interact to affect fire behavior and fuel reduction standards. The diversity of California's geography also influences fire behavior and fuel reduction standards as well. While fuel reduction standards will vary throughout the State, there are some common practices that guide fuel modification treatments to ensure creation of adequate defensible space:

- Properties with greater fire hazards will require more clearing. Clearing requirements will be greater for those lands with steeper terrain, larger and denser fuels, fuels that are highly volatile, and in locations subject to frequent fires.

- Creation of defensible space through vegetation management usually means reducing the amount of fuel around the building or structure, providing separation between fuels, and or reshaping retained fuels by trimming. Defensible space can be created removing dead vegetation, separating fuels, and pruning lower limbs.

- In all cases, fuel reduction means arranging the tree, shrubs and other fuels sources in a way that makes it difficult for fire to transfer from one fuel source to another. It does not mean cutting down all trees and shrubs, or creating a bare ring of earth across the property.

- A homeowner's clearing responsibility is limited to 100 feet away from his or her building or structure or to the property line, which ever is less, and limited to their land. While individual property owners are not required to clear beyond 100 feet, groups of property owners are encouraged to extend clearances beyond the 100 foot requirement in order to create community-wide defensible spaces.

- Homeowners who do fuel reduction activities that remove or dispose of vegetation are required to comply with all federal, state or local environmental protection laws and obtain permits when necessary. Environmental protection laws include, but are not limited to, threatened and endangered species, water quality, air quality, and cultural/archeological resources. For example, trees removed for fuel reduction that are used for commercial purposes require permits from the

California Department of Forestry and Fire Protection. Also, many counties and towns require tree removal permits when cutting trees over a specified size. Contact your local resource or planning agency officials to ensure compliance.

The methods used to manage fuel can be important in the safe creation of defensible space. Care should be taken with the use of equipment when creating your defensible space zone. Internal combustion engines must have an approved spark arresters and metal cutting blades (lawn mowers or weed trimmers) should be used with caution to prevent starting fires during periods of high fire danger. A metal blade striking a rock can create a spark and start a fire, a common cause of fires during summertime.

Vegetation removal can also cause soil disturbance, soil erosion, regrowth of new vegetation, and introduce non-native invasive plants. Always keep soil disturbance to a minimum, especially on steep slopes. Erosion control techniques such as minimizing use of heavy equipment, avoiding stream or gully crossings, using mobile equipment during dry conditions, and covering exposed disturbed soil areas will help reduce soil erosion and plant regrowth.

Areas near water (riparian areas), such as streams or ponds, are a particular concern for protection of water quality. To help protect water quality in riparian areas, avoid removing vegetation associated with water, avoid using heavy equipment, and do not clear vegetation to bare mineral soil.

B. Definitions

Defensible space: The area within the perimeter of a parcel where basic wildfire protection practices are implemented, providing the key point of defense from an approaching wildfire or escaping structure fire. The area is characterized by the establishment and maintenance of emergency vehicle access, emergency water reserves, street names and building identification, and fuel modification measures.

Aerial fuels: All live and dead vegetation in the forest canopy or above surface fuels, including tree branches, twigs and cones, snags, moss, and high brush. Examples include trees and large bushes.

Building or structure: Any structure used for support or shelter of any use or occupancy.

Flammable and combustible vegetation: Fuel as defined in these guidelines.

Fuel Vegetative material, live or dead, which is combustible during normal summer weather. For the purposes of these guidelines, it does not include fences, decks, woodpiles, trash, etc.

Homeowner: Any person who owns, leases, controls, operates, or maintains a building or structure in, upon, or adjoining any mountainous area, forest-covered lands, brush-covered lands, grass-covered lands, or any land that is covered with flammable material, and located within a State Responsibility Area.

Ladder Fuels: Fuels that can carry a fire vertically between or within a fuel type.

Reduced Fuel Zone: The area that extends out from 30 to 100 feet away from the building or structure (or to the property line, whichever is nearer to the building or structure).

Surface fuels: Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branches and downed logs.

C. Fuel Treatment Guidelines

The following fuel treatment guidelines comply with the requirements of 14 CCR 1299 and PRC 4291. **All persons using these guidelines to comply with CCR 1299 and PRC 4291 shall implement General Guidelines 1., 2., 3., and either 4a or 4b., as described below.**

General Guidelines:

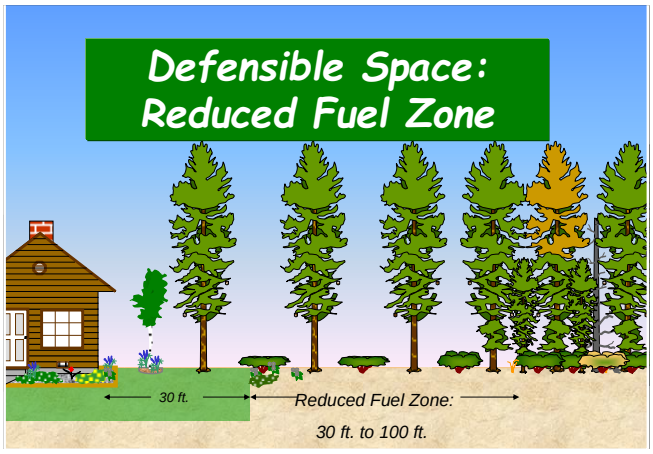
1. Maintain a firebreak by removing and clearing away all flammable vegetation and other combustible growth within 30 feet of each building or structure, with certain exceptions pursuant to PRC §4291(a). Single specimens of trees or other vegetation may be retained provided they are well-spaced, well-pruned, and create a condition that avoids spread of fire to other vegetation or to a building or structure.

2. Dead and dying woody surface fuels and aerial fuels within the Reduced Fuel Zone shall be removed. Loose surface litter, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches, shall be permitted to a depth of 3 inches. This guideline is primarily intended to eliminate trees, bushes, shrubs and surface debris that are completely dead or with substantial amounts of dead branches or leaves/needles that would readily burn.

3. Down logs or stumps anywhere within 100 feet from the building or structure, when embedded in the soil, may be retained when isolated from other vegetation. Occasional (approximately one per acre) standing dead trees (snags) that are well-space from other vegetation and which will not fall on buildings or structures or on roadways/driveways may be retained.

4. Within the Reduced Fuel Zone, one of the following fuel treatments (4a. or 4b.) shall be implemented. Properties with greater fire hazards will require greater clearing treatments. Combinations of the methods may be acceptable under §1299(c) as long as the intent of these guidelines is met.

4a. Reduced Fuel Zone: Fuel Separation

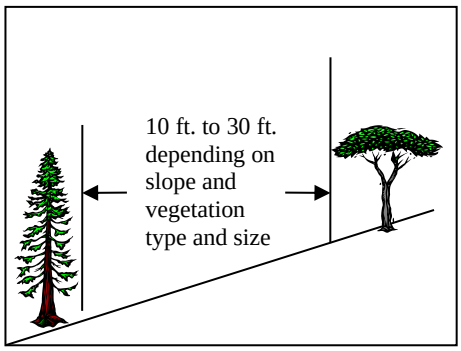


In conjunction with General Guidelines 1., 2., and 3., above, minimum clearance between fuels surrounding each building or structure will range from 4 feet to 40 feet in all directions, both horizontally and vertically.

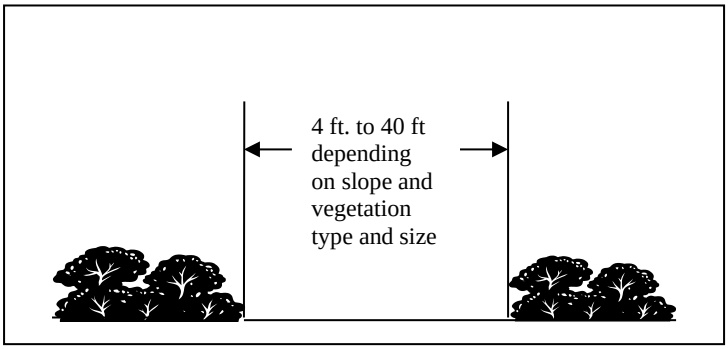
Clearance distances between vegetation will depend on the slope, vegetation size, vegetation type (brush, grass, trees), and other fuel characteristics (fuel compaction, chemical content etc.). Properties with greater fire hazards will require greater separation between fuels. For example, properties on steep slopes having large sized vegetation will require greater spacing between individual trees and bushes (see Plant Spacing Guidelines and Case Examples below). Groups of vegetation (numerous plants growing together less than 10 feet in total foliage width) may be treated as a single plant. For example, three individual manzanita plants growing together with a total foliage width of eight feet can be “grouped” and considered as one plant and spaced according to the Plant Spacing Guidelines in this document.

Grass generally should not exceed 4 inches in height. However, homeowners may keep grass and other forbs less than 18 inches in height above the ground when these grasses are isolated from other fuels or where necessary to stabilize the soil and prevent erosion.
Clearance requirements include:

- Horizontal clearance between aerial fuels, such as the outside edge of the tree crowns or high brush. Horizontal clearance helps stop the spread of fire from one fuel to the next.



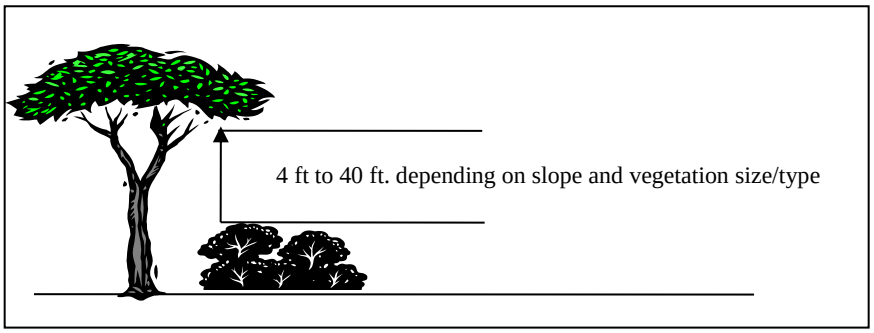
Trees



Shrubs

Horizontal clearance between aerial fuels

- Vertical clearance between lower limbs of aerial fuels and the nearest surface fuels and grass/weeds. Vertical clearance removes *ladder fuels* and helps prevent a fire from moving from the shorter fuels to the taller fuels.



Vertical clearance between aerial fuels

Effective vertical and horizontal fuel separation
Photo Courtesy Plumas Fire Safe Council.

Plant Spacing Guidelines Guidelines are designed to break the continuity of fuels and be used as a “rule of thumb” for achieving compliance with Regulation 14 CCR 1299.		
Trees	**Minimum horizontal space from edge of one tree canopy to the edge of the next**	
	Slope	Spacing
	0% to 20 %	10 feet
	20% to 40%	20 feet
	Greater than 40%	30 feet
Shrubs	**Minimum horizontal space between edges of shrub**	
	Slope	Spacing
	0% to 20 %	2 times the height of the shrub
	20% to 40%	4 times the height of the shrub
	Greater than 40%	6 times the height of the shrub
Vertical Space	**Minimum vertical space between top of shrub and bottom of lower tree branches:** 3 times the height of the shrub	

Adapted from: Gilmer, M. 1994. California Wildfire Landscaping

Case Example of Fuel Separation: Sierra Nevada conifer forests

Conifer forests intermixed with rural housing present a hazardous fire situation. Dense vegetation, long fire seasons, and ample ignition sources related to human access and lightning, makes this home vulnerable to wildfires. This home is located on gentle slopes (less than 20%), and is surrounded by large mature tree overstory and intermixed small to medium size brush (three to four feet in height).

Application of the guideline under 4a. would result in horizontal spacing between large tree branches of 10 feet; removal of many of the smaller trees to create vertical space between large trees and smaller trees and horizontal spacing between brush of six to eight feet (calculated by using 2 times the height of brush).

Case Example of Fuel Separation: Southern California chaparral

Mature, dense and continuous chaparral brush fields on steep slopes found in Southern California represents one of the most hazardous fuel situations in the United States. Chaparral grows in an unbroken sea of dense vegetation creating a fuel-rich path which spreads fire rapidly. Chaparral shrubs burn hot and produce tall flames. From the flames come burning embers which can ignite homes and plants. (Gilmer, 1994). All these factors results in a setting where aggressive defensible space clearing requirements are necessary.

Steep slopes (greater than 40%) and tall, old brush (greater than 7 feet tall), need significant modification. These settings require aggressive clearing to create defensible space, and would require maximum spacing. Application of the guidelines would result in 42 feet horizontal spacing (calculated as 6 times the height of the brush) between retained groups of chaparral.

4b. Reduced Fuel Zone: Defensible Space with Continuous Tree Canopy

To achieve defensible space while retaining a stand of larger trees with a continuous tree canopy apply the following treatments:

- Generally, remove all surface fuels greater than 4 inches in height. Single specimens of trees or other vegetation may be retained provided they are well-spaced, well-pruned, and create a condition that avoids spread of fire to other vegetation or to a building or structure.

- Remove lower limbs of trees ("prune") to at least 6 feet up to 15 feet (or the lower 1/3 branches for small trees). Properties with greater fire hazards, such as steeper slopes or more severe fire danger, will require pruning heights in the upper end of this range.

Defensible Space retaining continuous trees

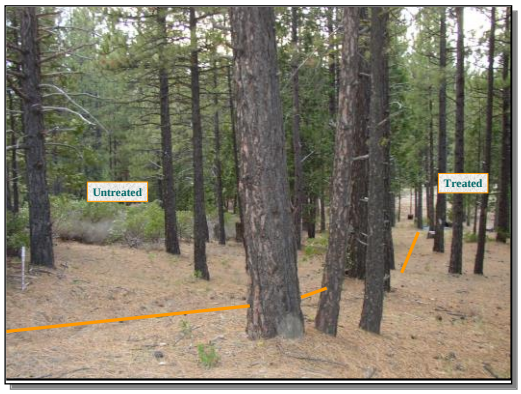


Photo Courtesy Plumas Fire Safe Council.

Defensible space with continuous tree canopy by clearing understory and pruning

Authority cited: Section 4102, 4291, 4125-4128.5, Public Resource Code. Reference: 4291, Public Resource Code; 14 CCR 1299 (d).

Review of Nearby City and District Zone 0 Policies

Summary of Zone 0 Requirements and Advice From Nearby Cities and Districts

Oakland Fire Safe Council

- No easily combustible materials within 5’ of any structure
- Replace jute or natural fiber doormats with heavy rubber or metal grates, remove/replace combustible outdoor furniture
- Use crushed stones or gravel instead of fine bark mulch
- Well-watered and green plants and small bushes can be ok
- Remove flammable materials on and underneath decks, patios or porches
- Remove tree limbs that extend into this zone and that hang over the roof or chimney closer than 10’
- Remove dry leaves and debris from the roof and rain gutters.

Moraga Orinda

- Remove all combustible ground cover, such as mulch and bark, within 2 feet of all structures.
- Create a 1-foot vertical clearance from foliage to ground for any plants within 2
- feet of the structure. Remove ALL dead or dying trees and/or rubbish.
- Remove ALL non-irrigated brush.Remove or cut grasses and weeds to a height of less than 3 inches or less. ****Must be cut no later than June 1 of every year.**
- Remove any Monterey Pine or Eucalyptus located within 5 feet of a
- structure or attached decks.

  Remove all tree branches that are within 6 vertical feet of the roof.
- Trim trees to create 10 feet of clearance from the chimney outlet.
- Remove ALL dead or combustible material from trees or any other plantings.
- Remove all material, such as branches, leaves, and needles, from the roof and gutters. This needs to be redone on a periodic basis.
- Trim trees to create 6 feet of vertical spacing between branches or foliage and ground.

San Rafael.

[t}following shall apply to the immediate zone (zero to five feet (0—5') from any structure) on all properties owned, leased, controlled, operated, or maintained within the City of San Rafael.

1. Maintain the roof, gutters, decks, porches, and stairways of any structure on the property free of accumulated leaves, needles, or dead vegetative growth.
2. All vegetation within five feet (5') of structure shall be well-irrigated and maintained to eliminate any dead or dying material build-up and trimmed to prevent contact with the structure.
3. Vines and ivy shall be well-irrigated and maintained to eliminate any dead or dying material build-up.
4. Single specimen trees shall be permitted when well-irrigated, limbed over five feet (5') or one-third (⅓) of the tree height and have five feet (5') between other tree canopies. Dead and dying branches shall not overhang any structure.
5. Remove any combustible vegetation under the eaves, decks, or other components of the structure on the property.
6. Ensure that vegetation is not continuous or able to serve as a fire bridge or ladder between other vegetation and the structure.
7. Vegetation directly under windows or encroaching within two (2) feet of windows, may not include fire hazardous species as identified by FIRESafe Marin, National Fire Protection Association or local fire officials.
8. No vegetation shall make direct contact with combustible elements of a structure. Well maintained vegetation may contact Class A and non-combustible materials such as, but not limited to concrete, brick, and stucco.

4.12.030 Vegetation management standards.

A. Any person owning, leasing, controlling, operating or maintaining a property containing a structure in the City of San Rafael, and any person owning, leasing controlling, operating or maintaining a property that is adjacent to another property containing such a structure, shall at all times maintain defensible space within one hundred feet (100') of the structure as follows:

1. Raise the crown of all trees by removing growth less than three inches (3") in diameter, from the ground up to a maximum height of 5 feet (5'), as identified by the National Fire Protection Association, provided that no crown shall be raised to a point so as to remove branches from more than the lower one-third (⅓) of the tree's total height;

2. Cut and remove all dry grasses (by means other than discing, tilling or other soil manipulation) so that their height does not exceed three inches (3").

3. Remove or chip the wood of all dead trees and other dead vegetation from the ground that is less than three inches (3") in diameter, provided that the stump of a dead tree does not need to be removed. Chipping materials left upon the surface of the ground shall not exceed a depth of three inches (3").

4. Remove all combustible vegetation, provided that single specimens of combustible vegetation are permitted if separated by a distance equal to two (2) times the height of the next adjacent combustible or noncombustible bush on slopes zero (0) to twenty percent (20%), four (4) times the height of the next adjacent combustible or noncombustible bush on slopes twenty-one (21) to forty percent (40%), and six (6) times the height of the next adjacent combustible or noncombustible bush on slopes exceeding forty percent (40%) as measured from the most outer edge of both bushes.

5. Remove any portion of trees or brush on the property that overhang any roadway and reach within thirteen feet six inches (13'6") vertically above the roadway surface, regardless of proximity to structure.

6. Remove combustible vegetation on the ground of the property within ten feet (10') of any highways, city streets, or private streets used for vehicle traffic or egress from the property, regardless of proximity to structure.

B. In addition, any person owning, leasing, controlling, operating, or maintaining property in the City of San Rafael shall, at all times, within the intermediate zone (five to thirty feet (5—30') from any structure):

1. Maintain an effective firebreak (a strip of land in which vegetation has been modified rather than completely removed) by thinning and clearing away flammable vegetation and combustible growth from areas within thirty feet (30') of any structures.

2. Remove all vegetation within ten feet (10') of a chimney or stovepipe outlet.

3. Maintain woodpiles a minimum of ten feet (10') and two (2) times the height of the woodpile away from any component of the structure on the property.

4. Mulch and other combustible ground coverings are only permitted when no contact is made with combustible exterior walls or plants. Rocks, pavers, and similar are encouraged.

5.) Remove all Junipers (genus Juniperus), Bamboo (genus Bambusa), Acacia (genus Acacia), and Italian Cypress (genus Cupressus sempervirens).

C. In addition, the following shall apply to the immediate zone (zero to five feet (0—5') from any structure) on all properties owned, leased, controlled, operated, or maintained within the City of San Rafael.

1. Maintain the roof, gutters, decks, porches, and stairways of any structure on the property free of accumulated leaves, needles, or dead vegetative growth.
2. All vegetation within five feet (5′) of structure shall be well-irrigated and maintained to eliminate any dead or dying material build-up and trimmed to prevent contact with the structure.
3. Vines and ivy shall be well-irrigated and maintained to eliminate any dead or dying material build-up.
4. Single specimen trees shall be permitted when well-irrigated, limbed over five feet (5′) or one-third (⅓) of the tree height and have five feet (5′) between other tree canopies. Dead and dying branches shall not overhang any structure.
5. Remove any combustible vegetation under the eaves, decks, or other components of the structure on the property.
6. Ensure that vegetation is not continuous or able to serve as a fire bridge or ladder between other vegetation and the structure.
7. Vegetation directly under windows or encroaching within two (2) feet of windows, may not include fire hazardous species as identified by FIRESafe Marin, National Fire Protection Association or local fire officials.
8. No vegetation shall make direct contact with combustible elements of a structure. Well maintained vegetation may contact Class A and non-combustible materials such as, but not limited to concrete, brick, and stucco.

D. Single specimen exemptions to these regulations, including for erosion control, may be granted at the discretion of the fire chief or their designee.

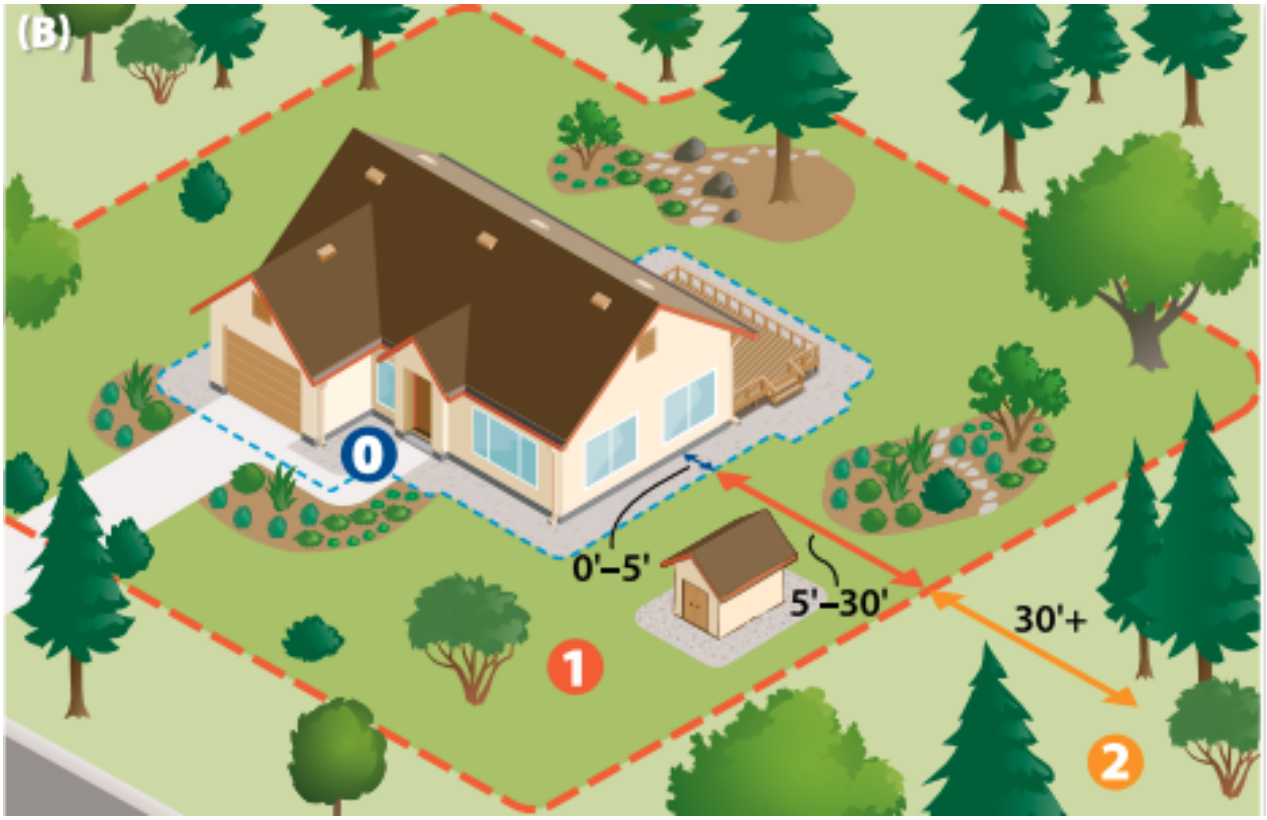
E. To the extent there is any conflict, the vegetation management standards in this section shall supersede the property development standards for protecting the natural state of property as contained in Sections 14.12.030(C) and 14.12.040 of this Code.

(Ord. 1856 § 1 (part), 2007; Ord. No. 1988, § 1, 2-16-2021)

EXTERIOR WILDFIRE HAZARD ABATEMENT REQUIREMENTS

printable pdf

All property owners are required to comply with exterior hazard requirements.
It's YOUR responsibility, and it's the LAW.



All requirements shall be maintained year-round, with the exception for cutting grasses and weeds to a height of 3 inches or less no later than June 1 of every year.

ZONE 0. The Ember Resistant Zone or Home Ignition Zone extends from 0 to 5 feet from any structure, attached deck, or outbuilding on the parcel. Zone 0 requires the most stringent wildfire fuel reduction. This Zone is designed to prevent fire or embers from igniting materials that can spread to the structure..

ZONE 1. The Lean, Clean, and Green Zone extends from 5 feet to 30 feet from any structure or attached deck.

ZONE 2. The Reduced Fuel Zone extends from 30 feet to 100 feet from any structure or attached deck.

THESE REQUIREMENTS ARE TO BE COMPLETED AND MAINTAINED YEAR-ROUND*

MOFD ORDINANCE 23-03 FUEL MITIGATION & EXTERIOR HAZARDS APPLIES TO:

ZONE 0: (0-5 feet)

- Remove all combustible ground cover, such as mulch and bark, within 2 feet of all structures.
- Create a 1-foot vertical clearance from foliage to ground for any plants within 2 feet of the structure.
- Remove ALL dead or dying trees and/or rubbish.
- Remove ALL non-irrigated brush.
- Remove or cut grasses and weeds to a height of less than 3 inches or less. ****Must be cut no later than June 1 of every year.**
- Remove any Monterey Pine or Eucalyptus located within 5 feet of a structure or attached decks.
- Remove all tree branches that are within 6 vertical feet of the roof.
- Trim trees to create 10 feet of clearance from the chimney outlet.
- Remove ALL dead or combustible material from trees or any other plantings.
- Remove all material, such as branches, leaves, and needles, from the roof and gutters. This needs to be redone on a periodic basis.
- Trim trees to create 6 feet of vertical spacing between branches or foliage and ground.

ZONE 1: (5-30 feet)

- Remove ALL dead or dying trees and/or rubbish.
- Remove or cut grasses and weeds to a height of less than 3 inches or less. ****Must be cut no later than June 1 of every year.**
- Trim trees to create 6 feet of vertical spacing between branches or foliage and ground.
- Remove ALL non-irrigated brush.
- Maintain 10 feet of bare mineral soil around Liquid Propane Gas (LPG) storage tanks, firewood, lumber, or other Combustible Material.

ZONE 2: (30-100 feet)

- Remove ALL dead or dying trees and/or rubbish.
- Remove or cut grasses and weeds to a height of less than 3 inches or less. ****Must be cut no later than June 1 of every year.**
- Trim trees to create 6 feet of vertical spacing between branches or foliage and ground.
- Remove ALL non-irrigated brush.
- Coverings over a pile of lumber or firewood must be constructed or made of fire-resistant material.
- Maintain 10 feet of bare mineral soil around liquid propane gas (LPG) storage tanks, firewood, lumber, or other combustible material.

FENCES

- No screen, fence or other structure made of bark, mulch, or wood chips is allowed within 100 feet of a Structure or within 10 feet of the paved edge of the road.

ROADSIDE VEGETATION

- Maintain tree foliage, branches, and trunks to provide a minimum 15-foot vertical clearance above the entire roadway or driveway.
- Remove all Juniper and Bamboo from within 10 feet of the roadway or driveway.
- Remove any hazardous vegetation located within 3 horizontal feet of the roadway.

FUEL BREAK MOFD ORDINANCE 23-08 APPLIES TO:

PARCELS OF 1 ACRE OR LESS: Require the entire parcel to be maintained.

PARCELS OVER 1 ACRE:- A Fuel Break of 100 feet shall be created and maintained around the entire perimeter of a parcel over 1 acre in size.

FUEL BREAKS STANDARDS

- Grasses and weeds cut to less than 3".
- Non-irrigated brush removed such that the minimum space between shrubs is as follows:

  a. On flat or mild slopes (less than 20%): Two times the height of the shrub
  b. On mild to moderate slopes (20-40%): Four times the height of the shrub
  c. On moderate to steep slopes (greater than 40%): Six times the height of the shrub.

- Removal of all Combustible Material.
- Removal of dead, diseased, or dying trees.
- Trim trees to create 6 feet of vertical spacing between branches or foliage and ground.

WHEN CONDUCTING FUEL MITIGATION AND DEFENSIBLE SPACE WORK,
THE FOLLOWING STANDARDS ARE TO BE APPLIED:

1. The volume and arrangement of vegetation shall be managed to limit fire intensity, fire severity, rate of spread, crown fire potential, and/or ember production.
2. The work shall be performed using the most ecological and site appropriate treatment options, such as, but not limited to, prescribed burning, manual treatment, mechanical treatment, prescribed herbivory, and targeted ground application of herbicides.
3. The work shall not impact any environmental resources of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies. This includes, but is not limited to, designated historic resources and state scenic highways.
4. The work shall be conducted in a manner to avoid (1) the taking of endangered, rare or threatened plant or animal species, (2) causing significant erosion and sedimentation of surface waters, and (3) removing healthy, mature, scenic trees, in accordance with the California Environmental Quality Act and Fish and Game Code.

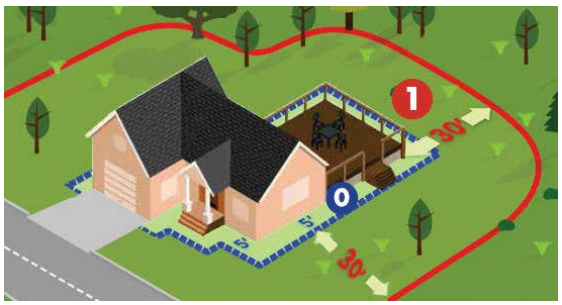
If you plan on conducting work near, adjacent to, or within any creek, channel, stream, or watercourse, or if you believe your property may contain habitat for sensitive species, please contact the California Department of Fish and Wildlife (CDFW) by email - AskBDR@wildlife.ca.gov or by phone (707) 428-2002; prior to initiating any activities associated with this notice. Please copy and inform MOFD when contacting CDFW.

Oakland Firesafe Council

Guide #13

OAKLAND FIRESAFE COUNCIL

DEFENSIBLE SPACE & LANDSCAPING FOR FIRE SAFETY - FIRESCAPING



Creating defensible space and following fire-smart landscaping (Firescaping) principles will greatly improve your home's chance of surviving a wildfire. The overall approach is aimed at the **reduction and separation of combustibles** in order to protect structures from embers, radiant heat and direct flames. These steps should also include implementing home hardening measures: **Guide #09 – Home Hardening for Wildfire**

Defensible space strategy **creates a buffer** between buildings and surrounding grass, shrub, trees or wildland area. In addition to helping slow or stop the spread of wildfire, it also provides a **safer place for firefighters** to defend the property and allows more time for **evacuation**.

ZONE 0
EMBER-RESISTANT

Zone 0 extends from 0' - 5' around your house and is the **most critical area** to ensure no easily combustible materials are present. Remove/reduce all fire hazards in this space!

- ❖ No easily combustible materials within 5' of any structure
- ❖ Replace jute or natural fiber doormats with heavy rubber or metal grates, remove/replace combustible outdoor furniture
- ❖ Use crushed stones or gravel instead of fine bark mulch
- ❖ Well-watered and green plants and small bushes can be ok
- ❖ Remove flammable materials on and underneath decks, patios or porches
- ❖ Remove tree limbs that extend into this zone and that hang over the roof or chimney closer than 10'
- ❖ Remove dry leaves and debris from the roof and rain gutters

ZONE 1
LEAN, CLEAN, & GREEN

Zone 1 extends approximately 5' - 30' out from buildings, decks and other structures. Maintain this area to be as fire-resistant as possible **throughout the year**!

- ❖ Remove all dead plants, grass and weeds
- ❖ Remove fire-prone vegetation and landscape using firescaping guidelines: **Guide #14 – Fire-Smart Planting**
- ❖ Limb tree branches 6' or more up from ground level and 10' away from other trees and flammables
- ❖ Create a separation between vegetation and items that can catch fire, such as patio furniture, sheds and play areas
- ❖ Cut or mow grasses and weeds down to a maximum height of 4 inches

BEYOND ZONE 1
REDUCED-FUEL AREA

Many sources recommend creating a defensible zone 30' - 100' away from structures, but in urban and residential areas this may not be possible. **Do all you can** within the boundaries of your property.

- ❖ Space trees apart depending on the ground slope, from 10' minimum on flat ground to 30' minimum on steep slopes
- ❖ Remove fallen leaves, needles, cones and small branches that are deeper than 3 inches on the ground
- ❖ Ensure that vegetation adjacent to roads and driveways is maintained in the same manner as Zone 1, and **keep roads firesafe for evacuation and first responder access**
- ❖ Work with your neighbors to reduce combustibles along your property lines
- ❖ Maintain your property year-round

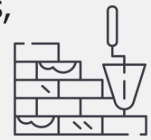
DESIGN YOUR LANDSCAPE FOR FIRE SAFETY

FIRESCAPING is landscape design that reduces house and property vulnerability to wildfire. A carefully Firescaped design will **reduce the chance of ignition**, lower a fire's intensity and slow the spread of fire – all to help your home survive and to give you more time to safely escape if necessary.

DESIGN your landscaping plan with plants and elements that provide the best possible fire protection. Use non-flammable hardscaping such as rocks and bricks for walls and paths. Create open areas to provide a buffer to help prevent flames spreading. Understand that **fire-smart plant selection is influenced by multiple factors** (**Guide #14 – Fire-Smart Planting**). Simple landscaping features that protect from flying embers, heat and flames can significantly improve your home's ability to survive a wildfire.

OTHER FIRESCAPING TECHNIQUES that help increase fire safety on your property include:

- Create **fuel breaks** with walkways, driveways, patios, islands, etc.



- Construct fences with **non-flammable materials** such as brick, rocks, metal or concrete
- Use a drip irrigation system tailored to individual plant's needs to **keep plants healthy** during the dry season and to save water

- Use a fire-resistant compost, mulch or thick bark to **maintain moisture** in the soil

PLANNING & MAINTENANCE are the two key factors in creating a fire-smart landscape.

MAINTAIN YOUR PROPERTY THROUGHOUT THE YEAR

PRUNING – As vegetation grows, the spacing between plants, bushes and trees is reduced. Regular pruning helps **maintain spacing and removes the dead foliage** that enables even a fire-resistant plant to burn. Larger bushes and shrubs should be pruned up to reduce the chance that they can become ladder-fuels for trees and structures.

RAKE & CLEAN – Many bushes and trees drop their leaves regularly, especially in the fall when the fire season is at its peak. Rake and clean the ground as often as needed, and **pay special attention to the area around the foundation of your home** to keep it free of leaf litter and dry plant debris.

WHEN USING POWER TOOLS such as weed-whackers, chain saws and lawn mowers, be very careful not to create sparks or spill fuel, which can start a wildfire. Make sure that these machines are maintained properly and that exhaust spark-arrestors are installed. Always use caution and **never use power tools during Red Flag Warning** days!

TACKLE VEGETATION ISSUES AS A COMMUNITY

REMEMBER your community is only as firesafe as its least properly maintained area.

- Consider Oakland's **Adopt-a-Spot** program to work on City lots that aren't maintained: **oaklandca.gov/services/apply-for-adopt-a-spot-online**
- If a resident is unable to work on their own property, you can come together as neighbors and create a **Firewise USA® community** to help everyone be more firesafe: **Guide #12 – Firewise USA®**
- If funds are needed to tackle large vegetation issues or to haul away debris, contact the Diablo Firesafe Council to inquire about possible matching grants: **diablofiresafe.org**

Visit OFSC's Firescaping page for more info and in-depth resources

oaklandfiresafecouncil.org/programs/#firescaping

Thanking Firesafe Marin and UC ANR for their contribution to this content. Version 1.5 4/19/23

www.oaklandfiresafecouncil.org | 510.575.0916 | info@oaklandfiresafecouncil.org

Draft Enforcement and Appeals re City of Berkeley Fire Code Chapter 49 – Requirements For Wildland-Urban Interface Fire Areas

This Chapter only applies to enforcement and appeals for Berkeley Fire Code Chapter 49 – Requirements For Wildland-Urban Interface Fire Areas

Section 1- Notice of Non-compliance.

(a) A Notice of Non-Compliance is issued by the City notifying a Property Owner that the Property Owner's property is not in compliance with Chapter 49.

(b) Prior to issuing a Notice of Non-Compliance, the City shall make reasonable efforts to review with the Property Owner the ways in which the property is not in compliance with Chapter 49. The purpose of enforcement is to encourage Property Owners to come into compliance with Chapter 49. To that extent, enforcement efforts should be informative and lenient, so as to gain compliance without the need for fines and other enforcement measures.

(c) Service. A Notice of Non-Compliance may be served on the Property Owner by personal service or by mail, mailed to the Property Owner at the Property Owner's address set out in the Alameda County Assessor's records. A Notice served by mail shall add five days to any compliance period.

(d) Time to Comply. A Property Owner shall comply with a Notice of Non-Compliance within the following time periods:

    (1) 90 days to comply before notice of violation is issued.

    (2) Exceptions. The following categories of Property Owners have 120 days to comply:

        (A) Senior (65 or older);

        (B) Low-to moderate income (120 percent of the area median income);

        (C) Disabled (state definition of disability)

    (3) Monetary exception. All work in excess of $2,000 as estimated by a responsible professional is carried over to the next year, unless assistance is available to pay for work required in the Notice of Non-Compliance.

(e) Time to complete work pursuant to Notice of Non-Compliance may be extended further or the length of the compliance period if the property owner shows reasonable, good faith in proceeding to comply with the work required by the notice.

(f) The compliance period may also be extended for good cause. For example, the infirmity of the Property Owner, the unavailability of contractors or others to perform the work.

(g) At any time in this process, the Property Owner may give the City permission to enter the property to cure the Non-Compliance. In which case, the City will invoice the Property Owner for the costs, and if not paid within 6 months, the City may place a lien on the property, which lien may include all costs of curing the Non-Compliance and the costs of placing the lien on the Property.

Section 2 Administrative Citation for violation.

(a) A Notice of Violation notifies a Property Owner that a Notice of Compliance has not been fully complied with and that the Property Owner will be issued an Administrative Citation as a penalty for non-compliance.
(b) Property Owner failing to comply with a Notice of Non-compliance within the time frames set forth in Section 1 is considered in violation of Chapter 49 and may be given an administrative citation of $100 for a first violation and given 90 (or 120 if an exception applies) days to comply with the Notice of Violation.
(c) A Property Owner who fails to comply with a first notice of violation after the time permitted may be given an administrative citation of $250, and 90 (or 120 if an exception applies) additional days to comply with the work required in the notice of non-compliance.
(d) A Property Owner who fails to comply with a second notice of violation after 60 days may be given an additional administrative citation of $500 and given 90 (or 120 days if an exception applies) additional days to comply with the work required in the notice of non-compliance.
(e) The time frames to complete work after a Notice of Violation is issued may be extended for good cause.
(f) If a Property Owner who has been given three Notices of Violation for the same non-compliance and has failed to complete the work required by the Notice of Non-Compliance within the allowed time, the City may seek permission from the Property Owner or a warrant to enter the property to complete the work. If the warrant is granted, permitting the City to enter the property to complete the work, the Property Owner may be charged for the cost of the corrective work and the cost of obtaining the warrant.

Section 3. Appeal.

(a) Board of Appeals. There shall be a Board of Appeal consisting of three members. One member shall be qualified as a Hearing Officer, one shall be qualified by experience and training to pass on the hazards of fire, and one shall be a resident of the City. None of the Board Members may be current or former employees or contractors of the City, except for the Hearing Officer, who may have been a former contractor of

the City as a Hearing Officer. The Hearing Officer shall serve as the presiding officer of the Board. The members of the Board shall be hired or appointed by the City Manager. The resident member shall serve without compensation.

(b) A Property Owner may appeal a Notice of Compliance or a Notice of Violation to the Board of Appeals within 30 days after a Notice of Non-Compliance or a Notice of Violation is served. The Appeal document shall set out all grounds for Appeal and provide any supporting documents.

(c) Basis for Appeal. A Property Owner may appeal a Notice on the following grounds:
   (1) The intent of Chapter 49 or any rules applying or interpreting the Chapter have been incorrectly applied or interpreted,
   (2) Chapter 49 does not apply to the property or circumstances of the Notice of Non-Compliance or Notice of Violation;
   (3) An equally good or better form of construction for Chapter 49 is proposed;
   (4) The facts of the Notice are in error,
   (5) City denied an Alternate Means and Measures Request,
   (6) Compliance with a Notice may cause substantial harm to the property or neighboring properties (such as mudslides)
   (7) Such other good cause (such as incapacity or lack of financial resources to comply).

(d) The Board shall not have the authority to waive requirements of Chapter 49 or to interpret the administration of this Chapter.

(e) Stay. The filing of an Appeal stays any action on the Notice until the Appeal is decided by Board, except in the case of an immediate danger.

(f) Final City Decision. The Board's decision is the final decision of the City.

(g) Open hearing. All proceedings of the Board shall be publicly noticed and open to the public.

(h) City support. The City Clerk shall provide support for the Board as the Board shall require. The City Attorney shall provide such legal support for the Board as the Board shall require.

(i) City Review of Appeal. Prior to the Board hearing an Appeal, the City may review the Appeal and may address the issues raised in the Appeal and rescind or modify the Notice at issue. The City and the Property Owner may also engage in negotiations or mediation to seek to resolve the issues in the Notice informally.

(j) City response. The City shall have 30 days to respond to an Appeal.

(k) Property Owner Reply. The Hearing Officer may permit a Property Owner to reply to the City's appeal response, if good cause is shown, and set the time frame for the reply.

(l) Extensions of Time. The Hearing Officer may grant such extensions of time for good cause that either the Property Owner or the City may seek.

(m) The Board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this Chapter and applicable law. The procedures shall not require compliance with strict rules of evidence, and shall follow those rules commonly applicable to administrative hearings.

(n) Decision. The Board may affirm, modify, or reverse a decision of the City with a majority vote.

(o) Final Decision. The Board's decision is the final decision of the City.

Section 3. Right of Judicial Review.

(a) Any person aggrieved by an administrative decision of the Board may obtain review of the Board's decision by filing a petition seeking review in accordance with Government Code Section 53069.4.

(b) The City is prohibited from seeking review of Board's decision pursuant to Government Code Section 53069.4.

Section 4. Right to Request Review by the California Fire Marshall.

(a) Whenever an Appeal implicates an application or interpretation of the California Fire Code, the Property Owner or the City may appeal the Board's decision to the California Fire Marshall pursuant to [state code citation].

Alternate Means and Measures

Purpose

The purpose of an Alternative Means and Methods Request (AMMR) is to permit alternatives to requirements in the code when substantiated with supporting evidence (including but not limited to tests, reports, engineering analysis). An AMMR is intended to be used when technical or physical limitations prevent code requirements from being met or to allow performance-based alternatives with evidence justifying the proposal meets or exceeds the intent of the code, it is not meant to be a waiver of code requirements without providing equivalent alternative

Basis in Code

1.11.2.4 *Request for Alternate Means of Protection*

Requests for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the enforcing agency by the owner or the owner's authorized representative and shall be accompanied by a full statement of the conditions. Sufficient evidence or proof shall be submitted to substantiate any claim that may be made regarding its conformance. The enforcing agency may require tests and the submission of a test report from an approved testing organization as set forth in California Code of Regulations, Title 19, to substantiate the equivalency of the proposed alternative means of protection.

When a request for alternate means of protection involves hazardous materials, the authority having jurisdiction may consider implementation of the findings and recommendations identified in a Risk Management Plan (RMP) developed in accordance with Title 19, Division 2, Chapter 4.5, Article 3.

Approval of a request for use of an alternative material, assembly of materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to these provisions shall be limited to the particular case covered by request and shall not be construed as establishing any precedent for any future request.

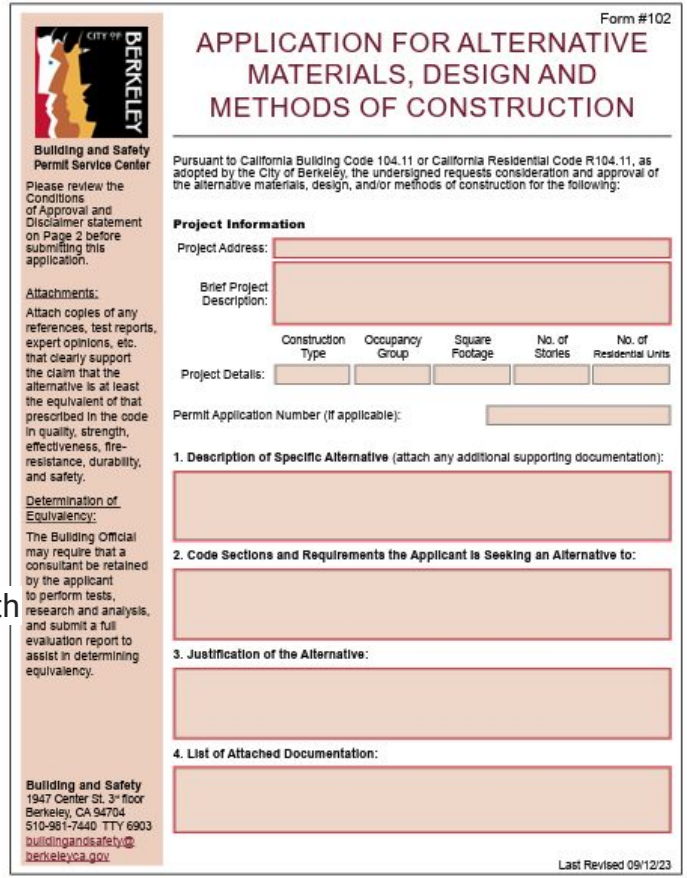
Existing Process

BMC 19.48.010

Adoption of the California Fire Code.

A. The California Fire Code, 2022 edition, as adopted in Title 24, Part 9 of the California Code of Regulations, including Chapter 1 (excluding Section 103), Chapter 3, Section 503 of Chapter 5, Sections 1103.5.6 through 1103.5.6.3 (new sections as created by BMC 19.48.020, Amendments to the California Fire Code), Appendix Chapters D, E, F, L (as amended by BMC 19.48.020, Amendments to the California Fire Code) and O published by the International Code Council not included in the California Building Standards Code, are adopted by this reference into this Chapter, and are hereby adopted and made a part of this Chapter as though fully set forth herein, subject to the modifications thereto which are set forth this ordinance. One copy of this Code is on file in the office of the City Clerk of the City of Berkeley.

B. This chapter shall be known as the "Berkeley Fire Code" and shall be referred to in this chapter as "this code."



Form #102

CITY OF BERKELEY

Building and Safety Permit Service Center

Please review the Conditions of Approval and Disclaimer statement on Page 2 before submitting this application.

Attachments:

Attach copies of any references, test reports, expert opinions, etc. that clearly support the claim that the alternative is at least the equivalent of that prescribed in the code in quality, strength, effectiveness, fire-resistance, durability, and safety.

Determination of Equivalency:

The Building Official may require that a consultant be retained by the applicant to perform tests, research and analysis, and submit a full evaluation report to assist in determining equivalency.

Building and Safety
1947 Center St, 3rd floor
Berkeley, CA 94704
510-981-7440 TTY 6903
buildingandsafety@berkeleyca.gov

APPLICATION FOR ALTERNATIVE MATERIALS, DESIGN AND METHODS OF CONSTRUCTION

Pursuant to California Building Code 104.11 or California Residential Code R104.11, as adopted by the City of Berkeley, the undersigned requests consideration and approval of the alternative materials, design, and/or methods of construction for the following:

Project Information

Project Address:

Brief Project Description:

	Construction Type	Occupancy Group	Square Footage	No. of Stories	No. of Residential Units
Project Details:					

Permit Application Number (if applicable):

1. Description of Specific Alternative (attach any additional supporting documentation):

2. Code Sections and Requirements the Applicant is Seeking an Alternative to:

3. Justification of the Alternative:

4. List of Attached Documentation:

Last Revised 09/12/23

Modifications

Purpose

Modifications to the California Fire Code serve to adapt the code's application to individual situations where strict adherence would be impractical, ensuring the spirit and intent of the code are upheld without compromising public health, life, and fire safety. Modifications are granted for special individual reasons, allowing for alternative solutions that meet or exceed the code's safety objectives while addressing unique circumstances, such as those involving existing buildings or specific site conditions.

Basis in Code

[A] 104.9 Modifications

Where there are practical difficulties involved in carrying out the provisions of this code, the fire code official shall have the authority to grant modifications for individual cases, provided that the fire code official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, life and fire safety requirements. The details of action granting modifications shall be recorded and entered in the files of the department of fire prevention.

SECTION A101
GENERAL

A101.1 Scope.

A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 111. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the fire code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal.

Any person shall have theright to appeal a decision of the fire code official to the board.An application for appeal shall be based on a claim that theintent of this code or the rules legally adopted hereunder havebeen incorrectly interpreted, the provisions of this code donot fully apply or an equally good or better form of construction is proposed. The application shall be filed on a formobtained from the fire code official within 20 days after thenotice was served.

A101.2.1 Limitation of authority.

The board shall nothave authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement.

Appeals of notice andorders, other than Imminent Danger notices, shall stay theenforcement of the notice and order until the appeal isheard by the board.

A101.3 Membership of board.

The board shall consist offive voting members appointed by the chief appointingauthority of the jurisdiction. Each member shall serve

Appeals

The board shall consist offive voting members appointed by the chief appointingauthority of the jurisdiction. Each member shall serve for**[NUMBER OF YEARS]** years or until a successor has beenappointed. The board member's terms shall be staggered atintervals, so as to provide continuity. The fire code officialshall be an ex officio member of said board but shall not voteon any matter before the board.

A101.3.1 Qualifications.

The board shall consist ofmembers who are qualified by experience and training topass on matters pertaining to hazards of fire, explosions,hazardous conditions or fire protection systems, and arenot employees of the jurisdiction.

A101.3.2 Alternate members.

The chief appointingauthority is authorized to appoint two alternate memberswho shall be called by the board chairperson to hearappeals during the absence or disqualification of amember. Alternate members shall possess the qualifications required for board membership, and shall beappointed for the same term or until a successor has beenappointed.

A101.3.3 Vacancies.

Vacancies shall be filled for anunexpired term in the same manner in which originalappointments are required to be made.

A101.3.4 Chairperson.

The board shall annually selectone of its members to serve as chairperson.

A101.3.5 Secretary.

The chief appointing authority shalldesignate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.5 Secretary.

The chief appointing authority shalldesignate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed re of all proceedings, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and failure of a member to vote.

A101.3.6 Conflict of interest.

A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain f participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members.

Compensation of members shall be determined by law.

A101.3.8 Removal from the board.

A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence f regular meetings of the board may be removed at the discretion of the chief appointing authority.

1.4 Rules and procedures.

board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applic e law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant informatio sented.

1.5 Notice of meetings.

A101.5 Notice of meetings.

The board shall meet uponnotice from the chairperson within 10 days of the filing of anappeal or at stated periodic intervals.

A101.5.1 Open hearing.

All hearings before the board shall be open to the public. The appellant, the appellant's representative, the fire code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum.

Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing.

When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel.

The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision.

The board shall only modify or reverse the decision of the fire code official by a concurringvote of three or more members.

A101.6 Legal counsel.

The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters befor consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service scope of their duties.

A101.7 Board decision.

The board shall only modify or reverse the decision of the fire code official by a concurringvote of three or more members.

A101.7.1 Resolution.

The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the fire c within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the representative and to the fire code official.

A101.7.2 Administration.

The fire code official shall take immediate action in accordance with the decision of the board.

A101.8 Court review.

Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of c correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the deci office of the chief administrative officer.

➡

Chapter 1.28
ADMINISTRATIVE CITATIONS

Sections:

1.28.010 Purpose and applicability.

A. This chapter provides for administrative citations as provided in Government Code Section 53069.4.

B. The remedies provided by this chapter are in addition to all other legal remedies, criminal or civil, which may be pursued by the City to address any violation of this code.

C. Use of this chapter shall be at the sole discretion of the City. (Ord. 6710-NS § 2, 2002)

1.28.020 Enforcement officer--Defined--Authority.

A. For purposes of this chapter, "enforcement officer" shall mean any City employee or agent of the City with the authority to enforce any provision of this code.

B. Enforcement officers shall have authority to issue administrative citations pursuant to this chapter. (Ord. 6710-NS § 2, 2002)

1.28.030 Administrative citation.

A. Whenever an enforcement officer charged with the enforcement of any provision of this code determines that a violation of that provision has occurred, the enforcement officer may issue an administrative citation to any person responsible for the violation.

B. Each administrative citation shall contain the following information:

1. The date of the violation;

2. The address or a definite description of the location where the violation occurred;

3. The section of this code violated and a description of the violation;

4. The amount of the fine for the code violation;

5. A description of the fine payment process, including a description of the time within which and the place to which the fine shall be paid;

6. An order prohibiting the continuation or repeated occurrence of the code violation described in the administrative citation;

7. An order to correct the code violation described in the administrative citation if said violation is correctable as described in Section 1.20.030;

8. A description of the administrative citation review process, including the time within which the administrative citation may be contested and the place from which a request for hearing form to contest the administrative citation may be obtained and an advance deposit waiver; and

9. The name and signature of the citing enforcement officer.

C. In addition to the administrative citation and penalty authorized by this chapter, an order to correct a violation under subdivision B.7 of this section may be enforced as set forth in the chapter applicable to that violation.

D.

1. In cases involving a continuing violation pertaining to building, plumbing, electrical, or other similar structural or zoning issues that do not create an immediate danger to health or safety, a reasonable time not to exceed six months shall be provided to remedy or correct the violation prior to imposition of fines or penalties. In determining what is a reasonable time, the City may consider the estimate of local professionals including licensed contractors. In the case of such violations, the time within which the violation must be corrected in order to avoid a fine shall also be specified on the administrative citation.

2. In cases where a citation is based solely on a person's failure to have obtained a permit or license from the City other than for a regulated business activity, and the person has not previously been cited for the same violation, the citation shall specify a reasonable time to obtain the permit or license, and the penalty shall not exceed $50.00 if the cited person shows proof of correction to the enforcing officer within the time established for obtaining the permit or license. This subdivision shall apply to violations of Title 23 only at the option of the enforcement officer. (Ord. 6836-NS § 1 (part), 2005: Ord. 6710-NS § 2, 2002)

1.28.040 Amount of fines.

A. The amounts of the fines for code violations imposed pursuant to this chapter shall be set forth in the schedule of fines established by resolution of the City Council.

B. The schedule of fines shall specify any increased fines for repeat violations of the same code provision by the same person within 36 months from the date of an administrative citation.

C. The schedule of fines shall specify the amount of any late payment charges imposed for the payment of a fine after its due date. (Ord. 6710-NS § 2, 2002)

1.28.050 Payment of the fine.

A. The fine shall be paid to the City within 30 days from the date of the administrative citation.

B. Payment of a fine under this chapter shall not excuse or discharge any continuation or repeated occurrence of the code violation that is the subject of the administrative citation. (Ord. 6710-NS § 2, 2002)

1.28.060 Hearing request.

A. Any recipient of an administrative citation may contest the existence of a violation of the code, that they are the responsible party or any order issued under Section 1.28.030.B by completing a request for hearing form and returning it to the City within 21 days from the date of the administrative citation, together with an advance deposit of the fine or notice that a request for an advance deposit hardship waiver has been filed pursuant to Section 1.28.070.

B. The person requesting the hearing shall be notified of the time and place set for the hearing at least ten days prior to the date of the hearing.

C. If the enforcement officer submits an additional written report concerning the administrative citation to the hearing officer for consideration at the hearing, a copy of this report also shall be served on the person requesting the hearing at least five days prior to the date of the hearing. (Ord. 6836-NS § 2 (part), 2005: Ord. 6710-NS § 2, 2002)

1.28.070 Advance deposit hardship waiver.

A. Any person who intends to request a hearing under Section 1.28.060 and who is financially unable to make the advance deposit of the fine as required in Section may file a request for an advance deposit hardship waiver.

B. The request shall be filed with the City on an advance deposit hardship waiver application form within ten days of the date of the administrative citation.

C. The requirement of depositing the full amount of the fine as described in Section 1.28.060.A shall be stayed unless or until the City makes a determination not to grant the advance deposit hardship waiver.

D. The City may grant the advance deposit hardship waiver only if the cited party submits a sworn declaration, together with any supporting documents or materials, which demonstrates their financial inability to deposit with the City the full amount of the fine in advance of the hearing.

E. If the City determines not to issue an advance deposit hardship waiver, the cited party shall remit the deposit to the City within ten days of the date of that decision or 30 days from the date of the administrative citation, whichever is later.

F. The City shall issue a written determination of its reasons for granting or denying an advance deposit hardship waiver. This written determination shall be final.

G. The written determination shall be served upon the applicant for the advance deposit hardship waiver by first class mail. (Ord. 6710-NS § 2, 2002)

1.28.080 Hearing officer.

The City Manager shall designate the hearing officer for administrative citation hearings. (Ord. 6710-NS § 2, 2002)

1.28.090 Hearing procedures.

A. No hearing to contest an administrative citation before a hearing officer shall be held unless the fine has been deposited in advance in accordance with Section 1.28.060 or an advance deposit hardship waiver has been granted in accordance with Section 1.28.070.

B. A hearing before the hearing officer shall be set for a date that is not less than 15 days and not more than 30 days from the date that the request for hearing is filed in accordance with the provisions of this chapter.

C. At the hearing, the party contesting the administrative citation shall be given the opportunity to testify and to present evidence concerning the administrative citation.

D. The failure of any recipient of an administrative citation to appear at the administrative citation hearing shall constitute a forfeiture of the fine, a failure to exhaust their administrative remedies and consent to any order issued pursuant to Section 1.28.030.B.6 and B.7.

E. The administrative citation and any additional report submitted by the enforcement officer shall constitute *prima facie* evidence of the respective facts contained in those documents. If the party contesting the citation presents evidence to the contrary, the burden of proof shall shift to the enforcement officer.

F. The hearing officer may continue the hearing and request additional information from the enforcement officer or the recipient of the administrative citation prior to issuing a written decision. (Ord. 6836-NS § 3 (part), 2005: Ord. 6710-NS § 2, 2002)

1.28.100 Hearing officer's decision.

A. After considering all of the testimony and evidence submitted at the hearing, the hearing officer shall issue a written decision to uphold, reduce or cancel the administrative citation and shall list in the decision the reasons for that decision. The decision of the hearing officer shall be final.

B. If the hearing officer determines that the administrative citation should be upheld, then the fine amount on deposit with the City shall be retained by the City.

C. If the hearing officer determines that the administrative citation should be upheld and the fine has not been deposited pursuant to an advance deposit hardship waiver, the hearing officer shall set forth in the decision a payment schedule for the fine.

D. If the hearing officer determines that the administrative citation should be canceled or reduced and the fine was deposited with the City, then the City shall promptly refund the amount of the deposited fine or the amount paid in excess of the reduced fine, together with interest at the average rate earned on the City's portfolio for the period of time that the fine or excess fine amount was held by the City.

E. The recipient of the administrative citation shall be served with a copy of the hearing officer's written decision.

F. The employment, performance evaluation, compensation and benefits of the hearing officer shall not be directly or indirectly conditioned upon the amount or number of administrative citation fines upheld by the hearing officer. (Ord. 6710-NS § 2, 2002)

1.28.110 Late payment charges.

Any person who fails to pay to the City any fine imposed pursuant to the provisions of this chapter on or before the date that fine is due also shall be liable for the payment of any applicable late payment charges set forth in the schedule of fines, as well as interest at the legal rate. (Ord. 6710-NS § 2, 2002)

1.28.120 Recovery of administrative citation fines and costs.

The City may collect any past due administrative citation fine or late payment charge by use of all available legal means, including, but not limited to, means available for the collection of judgments, liens and actions for recovery of money. The City also may recover its collection costs. (Ord. 6710-NS § 2, 2002)

1.28.130 Right to judicial review.

A. Any person aggrieved by an administrative decision of a hearing officer on an administrative citation may obtain review of the administrative decision by filing a petition seeking review in accordance with Government Code Section 53069.4.

B. The City is prohibited from seeking review of an administrative decision of a hearing officer on an administrative citation pursuant to Government Code Section 53069.4.

C. No administrative decision of a hearing officer on an administrative citation shall estop the City Council or any other board or commission or officer or employee of the City from exercising their independent authority and judgment in any other forum within or outside the City. (Ord. 7081-NS § 1, 2009: Ord. 6710-NS § 2, 2002)

1.28.140 Notices.

A. Whenever a notice or report is required to be given or provided under this chapter, unless different provisions herein are otherwise specifically made, such notice may be given either by personal delivery thereof to the person to be notified or by deposit in the United States Mail, in a sealed envelope postage prepaid, addressed to such person to be notified at their last-known business or residence address as the same appears in the public records or other records pertaining to the matter to which such notice is directed. Service by mail shall be deemed to have been completed at the time of deposit in a U.S. mail box.

B. Failure to receive any notice specified in this chapter does not affect the validity of proceedings conducted hereunder.

C. Proof of giving any notice may be made by the certificate of any officer or employee of the City, or by affidavit of any person over the age of 18 years, which shows service in conformity with this code or other provisions of law applicable to the subject matter concerned. (Ord. 6710-NS § 2, 2002)

The Berkeley Municipal Code is current through Ordinance 7957-NS, passed April 15, 2025.

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C. No administrative decision of a hearing officer on an administrative citation shall estop the City Council or any other board or commission or officer or employee of the City from exercising their independent authority and judgment in any other forum within or outside the City. (Ord. 7081-NS § 1, 2009: Ord. 6710-NS § 2, 2002)

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B. Failure to receive any notice specified in this chapter does not affect the validity of proceedings conducted hereunder.

C. Proof of giving any notice may be made by the certificate of any officer or employee of the City, or by affidavit of any person over the age of 18 years, which shows service in conformity with this code or other provisions of law applicable to the subject matter concerned. (Ord. 6710-NS § 2, 2002)

The Berkeley Municipal Code is current through Ordinance 7977-NS, passed July 8, 2025.

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City Website: www.berkeleyca.gov

Hosted by General Code.

the City as a Hearing Officer. The Hearing Officer shall serve as the presiding officer of the Board. The members of the Board shall be hired or appointed by the City Manager. The resident member shall serve without compensation.

(b) A Property Owner may appeal a Notice of Compliance or a Notice of Violation to the Board of Appeals within 30 days after a Notice of Non-Compliance or a Notice of Violation is served. The Appeal document shall set out all grounds for Appeal *,* ~~and~~ *Any documents supporting the appeal shall be due within 30 days after filing the appeal, unless the time is extended by the Hearing Oficer.* ~~.provide any supporting documents.~~

(c) Basis for Appeal. A Property Owner may appeal a Notice on the following grounds:
  (1) The intent of Chapter 49 or any rules applying or interpreting the Chapter have been incorrectly applied or interpreted,
  (2) Chapter 49 does not apply to the property or circumstances of the Notice of Non-Compliance or Notice of Violation;
  (3) An equally good or better form of construction for Chapter 49 is proposed;
  (4) The facts of the Notice are in error,
  (5) City denied an Alternate Means and Measures Request,
  (6) Compliance with a Notice may cause substantial harm to the property or neighboring properties (such as mudslides)
  (7) Such other good cause (such as incapacity or lack of financial resources to comply).

(d) The Board shall not have the authority to waive requirements of Chapter 49 or to interpret the administration of this Chapter.

(e) Stay. The filing of an Appeal stays any action on the Notice until the Appeal is decided by Board, except in the case of an immediate danger.

(f) Final City Decision. The Board's decision is the final decision of the City.

(g) Open hearing. All proceedings of the Board shall be publicly noticed and open to the public.

(h) City support. The City Clerk shall provide support for the Board as the Board shall require. The City Attorney shall provide such legal support for the Board as the Board shall require.

(i) City Review of Appeal. Prior to the Board hearing an Appeal, the City may review the Appeal and may address the issues raised in the Appeal and rescind or modify the Notice at issue. The City and the Property Owner may also engage in negotiations or mediation to seek to resolve the issues in the Notice informally.

(j) City response. The City shall have 30 days to respond to an Appeal*, unless extended by the Hearing Officer*.

Gmail Eric Weaver <ericmartinweaver@gmail.com>

Citation Process

2 messages

Winnacker, Dave <DWinnacker@berkeleyca.gov> Thu, Sep 18, 2025 at 9:29 AM
To: Eric Weaver <ericmartinweaver@gmail.com>

Eric,

Following up our conversation following the workgroup meeting yesterday, I reviewed the internal Administrative Citation process. In relevant part:

BEFORE ISSUING A CITATION--

GIVE THE VIOLATOR A CHANCE TO CORRECT THE VIOLATION

Before issuing a citation, give the violator a reasonable chance to correct the violation-- remember, this may be the first time he or she has heard about it.

Note: From here on out, everything should be in writing.

A. First Notice

Send a "first notice and order to correct" to the violator. The purpose of this letter is to **politely**:

1. Notify the violator of the specific violation;
2. Explain how it must be corrected (*i.e.*, removal of brush, obtaining a building permit, getting a dog license, etc.);
3. Set a reasonable deadline for doing so.

B. Penalties

Maximum administrative penalties, well beyond those permitted for infractions, have been established by Council resolution. **However, until we have gained experience with administrative citations, penalties should be the same as for infractions:**

$100 for the first violation

$200 for the second violation

$500 for the third and subsequent violations.

In the case of exceptional violations that have serious consequences, a higher penalty may be imposed. **You should consult with the City Attorney's office before imposing any penalty higher than $500.00.**

Please let me know if this answers your questions. I am available for a call to discuss as needed.

Best,

Dave

510.684.3021

From: Arnold, Colin
Sent: Thursday, September 18, 2025 8:54 AM
To: Winnacker, Dave <DWinnacker@berkeleyca.gov>
Subject: Citations

Internal

Colin Arnold • Interim Assistant Fire Chief
Wildland Urban Interface Division
carnold@berkeleyca.gov • 510-981-5620

Eric Weaver <ericmartinweaver@gmail.com> Thu, Sep 18, 2025 at 10:00 AM
To: "Winnacker, Dave" <DWinnacker@berkeleyca.gov>

Hi Dave. So this is great. But it needs to be made clear to the public. In my opinion at a mimimum it should be in the information sheet the BFD is developing. In advance of the completion of the sheet we should try to think of another way to publish it.

Thanks for looking into this for me.

Eric

Eric Weaver
ericmartinweaver@gmail.com
[Quoted text hidden]

Colin Arnold • Interim Assistant Fire Chief
Wildland Urban Interface Division
carnold@berkeleyca.gov • 510-981-5620

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Proposed Modifications of Berkeley Fire Code for WUI Appeals and Violations

Section 111 Means of Appeal

111.5 This Section 111, Means of Appeal, shall not apply to appeals arising from Section [] Wildland Urban Interface Regulations. Appeals from Wildland Urban Interface notices or violations shall be in accordance with Section [] Enforcement and Appeals from Wildland Urban Interface Decisions.

Section 112 Violations

112.5 This Section 112, Violations, shall not apply to enforcement arising from Section [] Wildland Urban Interface Regulations. Appeals from Wildland Urban Interface notices or violations shall be in accordance with Section [] Enforcement and Appeals from Wildland Urban Interface Decisions.

EQUIREMENTS FOR WILDLAND-URBAN INTERFACE AREAS

User note:

About this chapter: *In addition to the building construction requirements in the California Building Code and California Residential Code, this chapter contains requirements for development and construction in Local Responsibility Areas (LRA) designated as Very High Fire Hazard Severity Zones and areas designated by the Board of Forestry and Fire Protection as State Responsibility Areas (SRA). While many of these provisions are found in Title 14 and Title 19 of the California Code of Regulations, they are replicated here for the code user. The local jurisdiction has the authority to apply the same regulations to LRA when the regulations are adopted by local ordinance.*

The requirements in this chapter reference the process for adoption of Very High Fire Hazard Severity Zones in the LRA; criteria for evaluating existing subdivisions that are at significant fire risk and are without an adequate secondary egress; and criteria for fire safety provisions required in the Safety Element of a city or county General Plan.

The chapter includes mitigation strategies to reduce the hazards of fire originating within a structure spreading to wildland and fire originating in wildland spreading to structures. These strategies are included in the following requirements:

1. *Development of fire protection plans.*
2. *Development of landscape plans and long-term vegetation management.*
3. *Creation and maintenance of defensible space to protect structures and subdivisions.*

ECTION 4901

ENERAL INSIGHTS

SECTION 4901
GENERAL INSIGHTS

> INSIGHTS (1)

4901.1 Scope.

This chapter contains minimum requirements to mitigate conditions that might cause a fire originating in a structure to ignite vegetation in the Wildland-Urban Interface (WUI) area, and conversely, a wildfire burning in vegetative fuels to transmit fire to buildings and threaten to destroy life, overwhelm fire suppression capabilities or result in large property losses.

4901.2 Purpose.

The purpose of this chapter is to provide minimum standards to reduce the likelihood of life and property loss due to a wildfire through the use of performance and prescriptive requirements for construction and development in State Responsibility Area (SRA) and Local Responsibility Areas (LRA) designated as a Very High Fire Hazard Severity Zone.

SECTION 4902
DEFINITIONS INSIGHTS

> INSIGHTS (1)

SECTION 4902
DEFINITIONS INSIGHTS

> INSIGHTS (1)

4902.1 General.

For the purpose of this chapter, certain terms are defined as follows:

DIRECTOR. Director of the California Department of Forestry and Fire Protection (CAL FIRE).

FIRE PROTECTION PLAN. A document prepared for a specific project or development proposed for a Wildland-Urban Interface (WUI) area. It describes ways to minimize and mitigate potential for loss from wildfire exposure.

FIRE HAZARD SEVERITY ZONES. Geographical areas designated pursuant to California Public Resources Codes, Sections 4201 through 4204 and classified as Very High, High or Moderate in State Responsibility Area or as Local Agency Very High Fire Hazard Severity Zones designated pursuant to California Government Code, Sections 51175 through 51189.

The California Code of Regulations, Title 14, Section 1280 entitles the maps of these geographical areas as "Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California."

FIRE-RESISTANT VEGETATION. Plants, shrubs, trees and other vegetation that exhibit properties, such as high moisture content, little accumulation of dead vegetation, and low sap or resin content, that make them less likely to ignite or contribute heat or spread flame in a fire than native vegetation typically found in the region.

[Note: The following sources contain examples of types of vegetation that can be considered fire-resistant vegetation. (Fire-resistant Plants for Home Landscapes, A Pacific Northwest Extension publication; Home Landscaping for Fire, University of California Division of Agriculture and Natural Resources; Sunset Western Garden Book)]

IGNITION-RESISTANT MATERIAL. A type of building material that complies with the requirements in Section 704A.2 in the California Building Code.

LOCAL RESPONSIBILITY AREAS (LRA). Areas of the state in which the financial responsibility of preventing and suppressing fires is the primary

IGNITION-RESISTANT MATERIAL. *A type of building material that complies with the requirements in Section 704A.2 in the California Building Code.*

LOCAL RESPONSIBILITY AREAS (LRA). *Areas of the state in which the financial responsibility of preventing and suppressing fires is the primary responsibility of a city, county, city and county, or district.*

STATE RESPONSIBILITY AREA (SRA). *Lands that are classified by the Board of Forestry pursuant to Public Resources Code Section 4125 where the financial responsibility of preventing and suppressing wildfires is primarily the responsibility of the state.*

WILDFIRE. *Any uncontrolled fire spreading through vegetative fuels that threatens to destroy life, property or resources as defined in Public Resources Code, Sections 4103 and 4104.*

WILDFIRE EXPOSURE. *One or a combination of radiant heat, convective heat, direct flame contact and burning embers being projected by vegetation fire to a structure and its immediate environment.*

WILDLAND-URBAN INTERFACE (WUI). *A geographical area identified by the state as a "Fire Hazard Severity Zone" in accordance with the Public Resources Code, Sections 4201 through 4204, and Government Code, Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires.*

SECTION 4903

PLANS INSIGHTS

INSIGHTS (1)

Key Changes

4903.1 General.

The fire code official is authorized to require the owner or owner's authorized agent to provide a fire protection plan. The fire protection plan shall be prepared to determine the acceptability of fire protection and life safety measures designed to mitigate wildfire hazards presented for the property under consideration.

4903.2 Contents.

The fire protection plan shall be based on a project-specific wildfire hazard assessment that includes considerations of location, topography, aspect, and climatic and fire history.

The plan shall identify conformance with all applicable state wildfire protection regulations, statutes and applicable local ordinances, whichever are more restrictive.

The plan shall address fire department access, egress, road and address signage, water supply in addition to fuel reduction in accordance with Public Resources Code (PRC) 4290; the defensible space requirements in accordance with PRC 4291 or Government Code 51182; and the applicable building codes and standards for wildfire safety. The plan shall identify mitigation measures to address the project's specific wildfire risk and shall include the information required in Section 4903.2.1.

4903.2.1 Project information.

The final fire protection plan shall be reviewed and approved prior to start of construction.

4903.2.1.1 Preliminary fire protection plan.

When a preliminary fire protection plan is submitted, it shall include, at a minimum, the following:

1. *Total size of the project.*
2. *Information on the adjoining properties on all sides, including current land uses, and if known, existing structures and densities, planned construction, natural vegetation, environmental restoration plans, roads and parks.*
3. *A map with all project boundary lines, property lines, slope contour lines, proposed structure foundation footprints, and proposed roads and driveways. The map shall identify project fuel modification zones and method of identifying the fuel modification zone boundaries.*

4903.2.1.2 Final fire protection plan.

4903.2.1.2 Final fire protection plan.

The final fire protection plan shall include items listed in Section 4903.2.1.1 and the following:

1. *A map identifying all proposed plants in the fuel modification zones with a legend that includes a symbol for each proposed plant species. The plan shall include specific information on each species proposed, including but not limited to:*
   a. *The plant life-form;*
   b. *The scientific and common name; and*
   c. *The expected height and width for mature growth.*
2. *Identification of irrigated and non-irrigated zones.*
3. *Requirements for vegetation reduction around emergency access and evacuation routes.*
4. *Identification of points of access for equipment and personnel to maintain vegetation in common areas.*
5. *Legally binding statements regarding community responsibility for maintenance of fuel modification zones.*
6. *Legally binding statements to be included in covenants, conditions and restrictions regarding property owner responsibilities for vegetation maintenance.*

SECTION 4904
FIRE HAZARD SEVERITY ZONES INSIGHTS

> *INSIGHTS (1)*

4904.1 General.

Lands in the state are classified by the State Fire Marshal in accordance with the severity of wildfire hazard expected to prevail in those areas and the responsibility for fire protection, so that measures may be identified which will reduce the potential for losses to life, property and resources from wildfire.

FIRE HAZARD SEVERITY ZONES INSIGHTS

> INSIGHTS (1)

4904.1 General.

Lands in the state are classified by the State Fire Marshal in accordance with the severity of wildfire hazard expected to prevail in those areas and the responsibility for fire protection, so that measures may be identified which will reduce the potential for losses to life, property and resources from wildfire.

4904.2 Classifications.

The State Fire Marshal classifies lands into fire hazard severity zones in accordance with California Public Resources Code, Sections 4201 through 4204 for State Responsibility Areas and accordance with Government Code, Sections 51175 through 51189 for areas where a local agency is responsible for fire protection.

4904.3 Local agency requirements.

> Within 30 days after receiving a transmittal from the State Fire Marshal that identifies Fire Hazard Severity Zones, a local agency shall make the information available for public review. The information shall be presented in a format that is understandable and accessible to the general public, including, but not limited to, maps. A local agency shall post a notice at the office of the county recorder, county assessor and county planning agency identifying the location of the map provided by the State Fire Marshal pursuant to Government Code, Section 51178. If the agency amends the map, pursuant to subdivision (b) or (c) of Section 51179, the notice shall instead identify the location of the amended map.

4904.3.1 Local agency ordinances.

> A local agency shall designate, by ordinance, Fire Hazard Severity Zones in its jurisdiction within 120 days of receiving recommendations

4904.3 Local agency requirements.

> *Within 30 days after receiving a transmittal from the State Fire Marshal that identifies Fire Hazard Severity Zones, a local agency shall make the information available for public review. The information shall be presented in a format that is understandable and accessible to the general public, including, but not limited to, maps. A local agency shall post a notice at the office of the county recorder, county assessor and county planning agency identifying the location of the map provided by the State Fire Marshal pursuant to Government Code, Section 51178. If the agency amends the map, pursuant to subdivision (b) or (c) of Section 51179, the notice shall instead identify the location of the amended map.*

4904.3.1 Local agency ordinances.

> *A local agency shall designate, by ordinance, Fire Hazard Severity Zones in its jurisdiction within 120 days of receiving recommendations from the State Fire Marshal pursuant to Section 51178. The local agency shall transmit a copy of an ordinance adopted pursuant to Section 51179 (a) to the State Board of Forestry and Fire Protection within 30 days of adoption, as specified in Title 14, Division 1.5, Chapter 7, Subchapter 3, Article 1. See Section 4911 for the state model ordinance.*

4904.3.2 Local agency discretion.

> *A local agency may, at its discretion, include areas within the jurisdiction of the local agency, not identified as Fire Hazard Severity Zones by*
> *the State Fire Marshal, as a Fire Hazard Severity Zone following a finding supported by substantial evidence in the record that the requirements of Government Code Section 51182 are necessary for effective fire protection within the area.*

SECTION 4905
WILDFIRE PROTECTION
BUILDING CONSTRUCTION INSIGHTS

> *INSIGHTS (1)*

SECTION 4905
WILDFIRE PROTECTION
BUILDING CONSTRUCTION INSIGHTS

> *INSIGHTS (1)*

4905.1 General.

Materials and construction methods for exterior wildfire exposure protection shall be applied within geographical areas where a wildfire burning in vegetative fuels may readily transmit fire to buildings and threaten to destroy life, overwhelm fire suppression capabilities or result in large property losses.

4905.2 Construction methods and requirements within established limits.

Within the limits established by law, construction methods intended to mitigate wildfire exposure shall comply with the wildfire protection building construction requirements contained in the California Building Standards Code, including the following:

1. *California Building Code, Chapter 7A,*
2. *California Residential Code, Section R337,*
3. *California Referenced Standards Code, Chapter 12-7A.*

4905.3 Establishment of limits.

> *The establishment of limits for the Wildland-Urban Interface (WUI) area's required construction methods shall be designated pursuant to the California Public Resources Code for State Responsibility Area (SRA) and California Government Code for Local Responsibility Areas (LRA) in Very High Fire Severity Zones or by a local agency following a finding supported by substantial evidence in the record that the requirements of this section are necessary for effective fire protection within other designated areas.*

4905.3 Establishment of limits.

> *The establishment of limits for the Wildland-Urban Interface (WUI) area's required construction methods shall be designated pursuant to the California Public Resources Code for State Responsibility Area (SRA) and California Government Code for Local Responsibility Areas (LRA) in Very High Fire Severity Zones or by a local agency following a finding supported by substantial evidence in the record that the requirements of this section are necessary for effective fire protection within other designated areas.*

SECTION 4906
VEGETATION MANAGEMENT INSIGHTS

> *INSIGHTS (1)*

4906.1 General.

Planting of vegetation for new landscaping shall be selected to reduce non-fire-resistant vegetation in proximity to a structure and to maintain vegetation as it matures.

4906.2 Application.

> *All new plantings of vegetation in State Responsibility Areas (SRA) and Local Responsibility Areas (LRA) designated as a Very High Fire Hazard Severity Zone shall comply with Sections 4906.3 through 4906.5.3.*

4906.3 Landscape plans.

Landscape plans shall be provided when required by the enforcing agency. The landscape plan shall include development and maintenance requirements for the vegetation management zone adjacent to structures and roadways, and to provide significant fire hazard reduction benefits for public and firefighting safety.

4906.3.1 Contents.

Landscape plans shall contain the following:

1. *Delineation of the 30-foot (9144 mm) and 100-foot (30.5 m) fuel management zones from all structures.*
2. *Identification of existing vegetation to remain and proposed new vegetation.*
3. *Identification of irrigated areas.*
4. *A plant legend with both botanical and common names, and identification of all plant material symbols.*
5. *Identification of ground coverings within the 30-foot (9144 mm) zone.*

4906.4 Vegetation.

All new vegetation shall be fire-resistant vegetation in accordance with this section.

***Exception:** Trees classified as non-fire-resistant vegetation complying with Section 4906.4.2.1.*

To be considered fire-resistant vegetation, it must meet at least one of the following:

1. *Be identified as fire-resistant vegetation in an approved book, journal or listing from an approved organization.*
2. *Be identified as fire-resistant vegetation by a licensed landscape architect with supporting justification.*
3. *Plants considered fire-resistant vegetation and approved by the local enforcing agency.*

4906.4.1 Shrubs.

All new plantings of shrubs shall comply with the following:

1. *Shrubs shall not exceed 6 feet (1829 mm) in height.*
2. *Groupings of shrubs are limited to a maximum aggregate diameter of 10 feet (3048 mm).*
3. *Shrub groupings shall be separated from other groupings a minimum of 15 feet (4572 mm).*
4. *Shrub groupings shall be separated from structures a minimum of 30 feet (9144 mm).*
5. *Where shrubs are located below or within a tree's drip line, the lowest tree branch shall be a minimum of three times the h*

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1. *Shrubs shall not exceed 6 feet (1829 mm) in height.*
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3. *Shrub groupings shall be separated from other groupings a minimum of 15 feet (4572 mm).*
4. *Shrub groupings shall be separated from structures a minimum of 30 feet (9144 mm).*
5. *Where shrubs are located below or within a tree's drip line, the lowest tree branch shall be a minimum of three times the height of the understory shrubs or 10 feet (3048 mm), whichever is greater.*

4906.4.2 Trees.

Trees shall be managed as follows within the 30-foot (9144 mm) zone of a structure:

1. *New trees shall be planted and maintained so that the tree's drip line at maturity is a minimum of 10 feet (3048 mm) from any combustible structure.*
2. *The horizontal distance between crowns of new trees and crowns of adjacent trees shall not be less than 10 feet (3048 mm).*
3. *Existing trees shall be trimmed to provide a minimum separation of 10 feet (3048 mm) away from chimney and stovepipe outlets per Title 14, Section 1299.03.*

4906.4.2.1 Non-fire-resistant vegetation.

New trees not classified as fire-resistant vegetation, such as conifers, palms, pepper trees and eucalyptus species, shall be permitted provided the tree is planted and maintained so that the tree's drip line at maturity is a minimum 30 feet (9144 mm) from any combustible structure.

SECTION 4907

SECTION 4907
DEFENSIBLE SPACE INSIGHTS

> *INSIGHTS (1)*

4907.1 General.

Hazardous vegetation and fuels shall be managed to reduce the severity of potential exterior wildfire exposure to buildings and to reduce the risk of fire spreading to buildings as required by applicable laws and regulations.

Defensible space will be managed around all buildings and structures in State Responsibility Areas (SRA) as required in Public Resources Code 4291.

4907.2 Application.

Buildings and structures located in the following areas shall maintain the required hazardous vegetation and fuel management:

1. *All unincorporated lands designated by the State Board of Forestry and Fire Protection as a State Responsibility Area (SRA).*
2. *Land designated as a Very High Fire Hazard Severity Zone by the Director.*
3. *Land designated in ordinance by local agencies as a Very High Fire Hazard Severity Zone pursuant to Government Code Section 51179.*

4907.3 Requirements.

Hazardous vegetation and fuels around all buildings and structures shall be maintained in accordance with the following laws and regulations:

1. *Public Resources Code, Section 4291.*
2. *California Code of Regulations, Title 14, Division 1.5, Chapter 7, Subchapter 3, Article 3, Section 1299.03.*
3. *California Government Code, Section 51182*

Excerpts From the Government Code Chapter 6.8 regarding Fire Zones

51182

(a) A person who owns, leases, controls, operates, or maintains an occupied dwelling or occupied structure within a very high fire hazard severity zone designated by the local agency pursuant to Section 51179, shall at all times do all of the following:

(1)(A) Maintain defensible space of 100 feet from each side and from the front and rear of the structure, but not beyond the property line except as provided in subparagraph (B). The amount of fuel modification necessary shall consider the flammability of the structure as affected by building material, building standards, location, and type of vegetation.. . . Consistent with fuel management objectives, steps should be taken to minimize erosion, soil disturbance, and the spread of flammable nonnative grasses and weeds.

(B) A greater distance than that required under subparagraph (A) may be required by state law, local ordinance, rule, or regulation. Fuel modification beyond the property line may only be required by state law, local ordinance, rule, or regulation in order to maintain 100 feet of defensible space from a structure. Fuel modification on adjacent property shall only be conducted following written consent by the adjacent landowner. Any local ordinance related to fuel modification shall be in compliance with all applicable state laws, regulations, and policies. Any local ordinance may include provisions to allocate costs for any fuel modification beyond the property line.

(c) (1) The State Board of Forestry and Fire Protection, in consultation with the Office of the State Fire Marshal, shall develop, periodically update, and post on its internet website a guidance document on fuels management pursuant to this chapter. The guidance document shall include, but not be limited to, regionally appropriate vegetation management suggestions that preserve and restore native species that are fire resistant or drought tolerant, or both, minimize erosion, minimize the spread of flammable nonnative grasses and weeds, minimize water consumption, and permit trees and shrubs near homes for shade, aesthetics, and habitat; and suggestions to minimize or eliminate the risk of flammability of nonvegetative sources of combustion such as woodpiles, propane tanks, decks, and outdoor lawn furniture.

(2) On or before January 1, 2023, the State Board of Forestry and Fire Protection, in consultation with the Office of the State Fire Marshal, shall update the guidance

document to include suggestions for creating an ember-resistant zone within five feet of a structure based on regulations promulgated by the State Board of Forestry and Fire Protection, in consultation with the Office of the State Fire Marshal, to consider the elimination of materials in the ember-resistant zone that would likely be ignited by embers. Existing and new structures shall meet the same standard for the ember-resistant zone, but regulations shall allow the staging of work for existing structures to support implementation of the ember-resistant zone and address the costs of compliance.

51183.

(a) The local agency may exempt from the standards set forth in Section 51182 structures with exteriors constructed entirely of nonflammable materials, or conditioned upon the contents and composition of the structure, and may vary the requirements respecting the management of fuels surrounding the structures in those cases. This subdivision does not authorize a local agency to vary a requirement that is a building standard subject to Section 18930 of the Health and Safety Code, except as otherwise authorized by law.

(b) An exemption or variance under subdivision (a) shall not apply unless and until the occupant of the structure, or if there is no occupant, then the owner of the structure, files with the local agency a written consent to the inspection of the interior and contents of the structure to ascertain whether Section 51182 is complied with at all times.

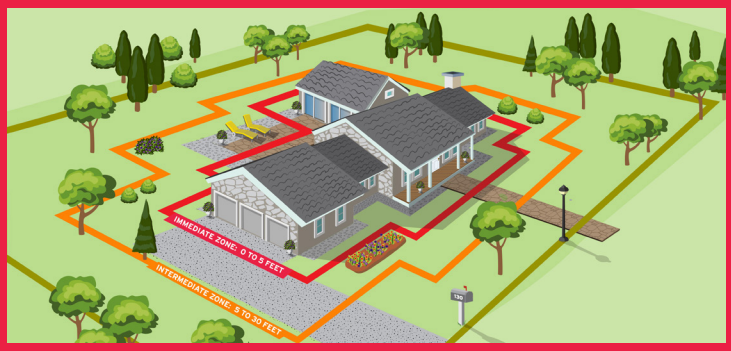
51185.

(a) A violation of Section 51182 is an infraction punishable by a fine of not less than one hundred dollars($100) nor more than five hundred dollars ($500).

(b) If a person is convicted of a second violation of Section 51182 within five years, that person shall be punished by a fine of not less than two hundred fifty dollars ($250) nor more than five hundred dollars ($500).

(c) If a person is convicted of a third violation of Section 51182 within five years, that person is guilty of a misdemeanor and shall be punished by a fine of not less than five hundred dollars ($500).

HOW TO PREPARE YOUR HOME FOR WILDFIRES



WILDFIRE RISK REDUCTION STEPS THAT CAN MAKE YOUR HOME SAFER DURING A WILDFIRE

VEGETATION MANAGEMENT

1. HOME IGNITION ZONES

To increase your home's chance of surviving a wildfire, choose fire-resistant building materials and limit the amount of flammable vegetation in the three home ignition zones. The zones include the **Immediate Zone:** (0 to 5 feet around the house), the I**ntermediate Zone** (5 to 30 feet), and the **Extended Zon**e (30 to 100 feet).

2. LANDSCAPING AND MAINTENANCE

To reduce ember ignitions and fire spread, trim branches that overhang the home, porch, and deck and prune branches of large trees up to 6 to 10 feet (depending on their height) from the ground. Remove plants containing resins, oils, and waxes. Use crushed stone or gravel instead of flammable mulches in the **Immediate Zone** (0 to 5 feet around the house). Keep your landscape in good condition.

FIRE RESISTIVE CONSTRUCTION

3. ROOFING AND VENTS

Class A fire-rated roofing products, such as composite shingles, metal, concrete, and clay tiles, offer the best protection. Inspect shingles or roof tiles and replace or repair those that are loose or missing to prevent ember penetration. Box in eaves, but provide ventilation to prevent condensation and mildew. Roof and attic vents should be screened to prevent ember entry.

4. DECKS AND PORCHES

Never store flammable materials underneath decks or porches. Remove dead vegetation and debris from under decks and porches and between deck board joints.

5. SIDING AND WINDOWS

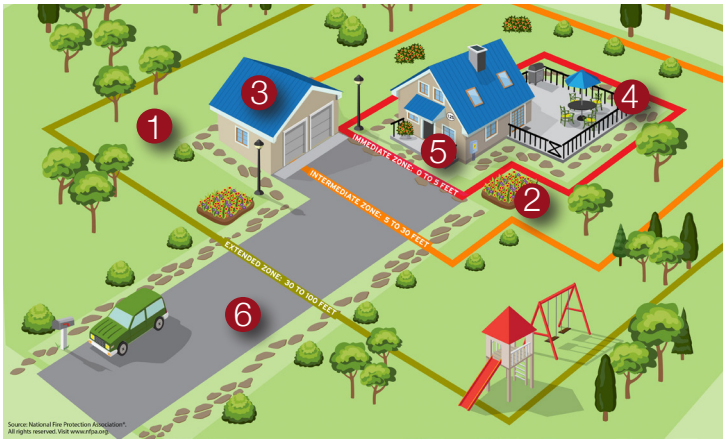
Embers can collect in small nooks and crannies and ignite combustible materials; radiant heat from flames can crack windows. Use fire-resistant siding such as brick, fiber-cement, plaster, or stucco, and use dual-pane tempered glass windows.

BE PREPARED

6. EMERGENCY RESPONDER ACCESS

Ensure your home and neighborhood have legible and clearly marked street names and numbers. Driveways should be at least 12 feet wide with a vertical clearance of 15 feet for emergency vehicle access.

- Develop, discuss, and practice an emergency action plan with everyone in your home. Include details for handling pets, large animals, and livestock.
- Know two ways out of your neighborhood and have a predesignated meeting place.
- Always evacuate if you feel it's unsafe to stay—don't wait to receive an emergency notification if you feel threatened from the fire.
- Conduct an annual insurance policy checkup to adjust for local building costs, codes, and new renovations.
- Create or update a home inventory to help settle claims faster.



TALK TO YOUR LOCAL FORESTRY AGENCY OR FIRE DEPARTMENT TO LEARN MORE ABOUT THE SPECIFIC WILDFIRE RISK WHERE YOU LIVE.

NFPA FIREWISE USA®
RESIDENTS REDUCING WILDFIRE RISKS

VISIT FIREWISE.ORG FOR MORE DETAILS

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Order a Reducing Wildfire Risks in the Home Ignition Zone checklist/poster at Firewise.org

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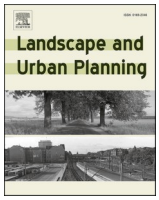

Exploring urban vegetation type and defensible space's role in building loss during wildfire-driven events in California

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HIGHLIGHTS

- Few studies on urban vegetation type's role on building loss/survival during fires.
- Mapped fire damaged buildings and parcel-scale vegetation types using eCognition.
- 2 models predicted building loss/survival across 3 buffer distances from buildings.
- Vegetation type-moisture, ground cover, building density; influential predictors.
- High tree moisture and bare ground cover near homes; predicted building survival.

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eCognition
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Normalized Difference Water Index

ABSTRACT

The role of building characteristics and survival during wildfires are well studied. Less so is the role of urban vegetation type, condition, and location on building loss in fire events. We mapped and statistically modeled parcel-scale urban vegetation characteristics across different Defensible Space Buffers (DSBs) and their role in predicting building loss in shrub and forest dominated urban ecosystems. Using 3.0 m resolution PlanetScope imagery, geospatial data, and eCognition we mapped parcel-scale vegetation types and building characteristics in fire affected neighborhoods in Ventura and Paradise, California US. Classification and Regression Trees predicted building loss according to three different DSBs in two different ecoregions. An urban-chaparral model predicted higher bare ground cover and higher moisture content trees were significant predictors of building survival in DSBs 0–2 m from buildings. While in DSBs 10–20 m from buildings, percent bare ground, distance to herbaceous, building density, and tree distance were predictors of building loss. The urban-forest model predicted percent bare ground, distance to bare ground and herbaceous cover were significant predictors of buildings loss, while percent overhanging tree cover was less influential in predicting in building loss in DSBs less than 2 m. In DSBs 2–10 m from buildings, low shrub and tree moisture, and building densities were the most important predictors of building loss; while distance to scattered trees and building density were significant predictors in DSBs 10–20 m from buildings. Results can be used to understand the tradeoffs between vegetation-related benefits and fire hazard and for developing home insurance and municipal ordinance requirements.

1. Introduction

Wildfire driven urban fires are increasingly affecting ecosystems and human settlements and are now an emerging extreme disturbance event spanning multiple scales with increasing fire severity, and costly economic, social, and environmental impacts (Bowman et al., 2017; Calkin et al., 2024; Moritz et al., 2014). In the United States (US) alone, communities in California are experiencing complex land use decisions, socio-political issues, and financial burdens that are being exacerbated by changing climates, and urbanization (Calkin et al., 2023; Modaresi, et al., 2023). Elsewhere, urban ecosystems in Australia (Cruz et al., 2012; Gibbons et al., 2018), Canada (Erni et al., 2021), Southern Europe (Elia et al., 2020; Mancini et al., 2018), Chile (Aguirre et al., 2024) and even Hawaii (US) are now experiencing these impacts as well increased

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loss of human lives.

Increased urban development in and near wildland areas or the Wildland-Urban Interface (WUI) has led to increased ignition sources and wildfire risk (Kramer et al., 2019; Syphard et al., 2017b). Similarly, WUI and adjacent urban ecosystems are also experiencing increased demographic change, population increases, conversion of habitats, and increasing fire impacts (Calkin et al. 2024; Yadav et al., 2023). As both land use and climate change extend wildfire seasons and exacerbates wildfire hazard, increased land management practices, regulatory urban planning policies, and building construction guidelines are being established (Elia et al., 2024; Goss et al., 2020; Halofsky et al., 2020). Indeed, building construction practices are a documented measure for reducing building loss probability (Knapp et al., 2021; Syphard et al., 2021) as are WUI land management practices for mitigating wildfire risk (Cohen and Stratton, 2003). However, less is known about the role of local-scale urban vegetation characteristics in building loss during urban fire events in highly urbanized and populated urban areas (Mancini et al., 2018; Thomas et al., 2022).

More specifically, studies on the role of wildfire in building loss and survival have mostly focused on building characteristics in the WUI and to a lesser degree on urban vegetation type and amount in the Home Ignition Zone or Defensible Space Buffers (hereafter) around homes (U. S. FEMA, 2023; Valachovic et al., 2021). Several studies have documented how building codes requiring construction practices and fire-resistant materials as well as the establishment of defensible space reduce building loss during fire events (Ackley, 2020; Mockrin et al., 2023; Syphard et al., 2021). Plant flammability and forest vegetation cover in these home ignition zones have also been reported to influence structure survival during wildfires (Cappelluti et al., 2024; Kramer et al. 2019). As such, percent tree cover, Normalized Difference Vegetation Index (NDVI), and distance to buildings using remotely sensed data (e. g., LANDSAT 30 m, aerial photography) are regularly used to correlate basic vegetation cover metrics and building loss during wildfires (Knapp et al., 2021; Syphard et al., 2014). These same vegetation cover and distance metrics have also been used to explore the role of Defensible Space in reducing building loss during fire events in the WUI (Gibbons et al., 2012; Troy et al., 2022).

However, the results from these studies have been mixed in terms of the effectiveness of these Defensible Space Buffer (DSB) practices (Penman et al., 2019; Syphard et al., 2014). Bar-Massada et al. (2011), Braziunas et al. (2021) and Cohen and Stratton (2003) studied overall vegetation cover and its role as fuel for wildfires and how certain building practices enhance the survivability of buildings (Hakes et al., 2017; Quarles et al., 2010). In fact, most of the above literature has been done in WUI or more rural contexts and has focused on building codes and construction practices in reducing building loss during fires (Gibbons et al., 2018; Suzuki et al., 2014). Conversely, there are very few studies focused on urban ecosystems or vegetation around urban homes, specifically: vegetation structure and composition, moisture levels, overall health and condition, building densities, and the distances of these different fuel types and their role in the loss of homes during catastrophic urban fire events (Aguirre et al., 2024; Chen & McAneney, 2004; Thomas et al., 2022).

In communities such as those in California USA, municipal codes and insurance companies are regularly requiring that these WUI and wildland focused DSB practices be implemented in more urbanized, highly populated, highly impervious residential and commercial areas (Knapp et al, 2021; Moritz et al., 2014; Syphard et al., 2021). Since urban fires are now increasingly affecting highly urbanized ecosystems throughout the globe, more information is needed to better understand the role of urban vegetation/fuels around buildings and the effectiveness of defensible space zones and their interactions with building damage during fire events (Aguirre et al., 2024; Calkin et al, 2024; Mockrin et al., 2023).

Much of the previous literature documents how building and construction-related variables are more influential than vegetation cover classes in building loss and survival during wildfire events. However, there are few studies examining the role of urban vegetation characteristics and DSBs on building loss using available high resolution spatial data and quantitative analyses. Therefore, we hypothesize that beyond vegetation land cover classes, finer-scale urban vegetation: types, moisture, and location relative to homes are also influencing factors behind building loss during fire events in more highly populated urban areas. Accordingly, the aim of this study is to better understand how parcel-scale urban vegetation characteristics across different DSBs influence building loss in shrub and forest dominated urban areas in California, USA. Specifically, our objectives are to first, characterize fine-scale urban vegetation types, densities, and moisture levels around buildings in two disparate fire-affected neighborhoods in different ecoregions. Second, we statistically analyze how vegetation type, densities, moisture, location, and building characteristics across DSBs, influenced building loss during urban fire events. Findings from objectives 1 and 2 will then be used to discuss the role of vegetation types, densities, location, and moisture in meeting defensible space and wildfire mitigation objectives in fire-prone urban ecosystems.

2. Methods

2.1. Study area

Our study areas are two different fire-affected urban ecosystems in two different ecoregions in California USA according to Bailey (1983): the Thomas Fire affected City of Ventura (December 4, 2017 – January 12, 2018) and the Camp Fire affected Town of Paradise (November 8–26, 2018). We define urban based on Yadav et al.'s (2023) urban census tract approach that identifies these communities as having more than 2500 inhabitants and where higher density residential, commercial, and transportation land cover types predominate. Ventura is representative of communities in southern California's coastal sage-chaparral ecoregions and approximately 345 urban hectares were fire-affected. Paradise is representative of inland, northern California communities in the Sierra Nevada ecoregion and about 4678 urban hectares were fire-affected. The Thomas Fire destroyed 1,643 structures and claimed two lives (Kolden and Henson, 2019) while the Camp Fire, resulted in 85 fatalities and the loss of over 18,000 structures (Maranghides et al., 2021).

The vegetation and landscapes found in the two fire affected communities are representative of two common fire-prone urban ecosystems in California with respect to urban land use-covers, vegetation types, and composition (Escobedo et al., 2024; Mockrin et al., 2023). Ventura is characterized by a Mediterranean climate with peri-urban vegetation dominated by native chaparral shrub species and afforested trees and landscaping vegetation in the urban land use covers. Among the most common types of urban vegetation are *Eucalyptus* spp., *Querus* spp., and *Cupressus spp*. trees, as well as ornamental shrubs (e.g., *Heteromeles arbutifolia*), forbs (e.g., *Eriogonum* spp.), and turf grasses. Accordingly, Ventura will be used to characterize highly populated afforested urban-chaparral ecosystems hereafter. Fire affected neighborhoods in Paradise were characterized by a Mediterranean climate and vegetation commonly found throughout the Sierra Nevada ecoregion and were predominantly *Pinus* spp., *Abies* spp., and *Calocedrus* spp. forests with deciduous trees in riparian areas and some *Quercus* spp. woodlands and shrublands. Such ecosystems are forested but were subsequently urbanized but have a forest structure like adjacent WUI areas. As such, Paradise will be used to characterize urban-forest ecosystems in our analysis. Both urban neighborhoods experienced easterly wind events and are located in broad, nearly level to hilly ridges, but are interspersed with steep to very steep canyons or hill sides.

2.2. Urban neighborhood delineation

Two fire affected neighborhoods in Ventura and Paradise were

delineated based on urban land use-cover classes derived from National Land Cover Data 2016 (https://www.mrlc.gov/data; Wickham, et al., 2021) and Google Earth Images during 2017–2018. The urban neighborhoods were delineated based on spatial datasets available from the Ventura and Paradise municipal websites (Fig. 1) and fire perimeter data described later in Section 2.2.1.

2.2.1. Remote sensing, Wildfire, and building Damage data

We developed a high spatial resolution (3.0 m), parcel-scale map of the different vegetation types near fire-affected buildings using PlanetScope satellite data (https://developers.planet.com/docs/data/planetscope/; Fig. 1-S). PlanetScope data are available in basic and ortho geometry types and visual and analytic radiometry products. Accordingly, for our urban vegetation types, we used ortho analytic 4 band surface reflectance scenes in a single-frame image capture with additional post processing, scene-based framing, and cartographic projection. The 4 bands used were: Blue (455—515 nm), Green (500—590 nm), Red (590—670 nm) and Near Infrared (780—860 nm) and data had a daily revisit time at nadir. The available scenes were atmospherically corrected and radiometrically interpreted 12-bit images. We used a cloud-free image from December 4, 2017 for Ventura and November 7, 2018 for Paradise.

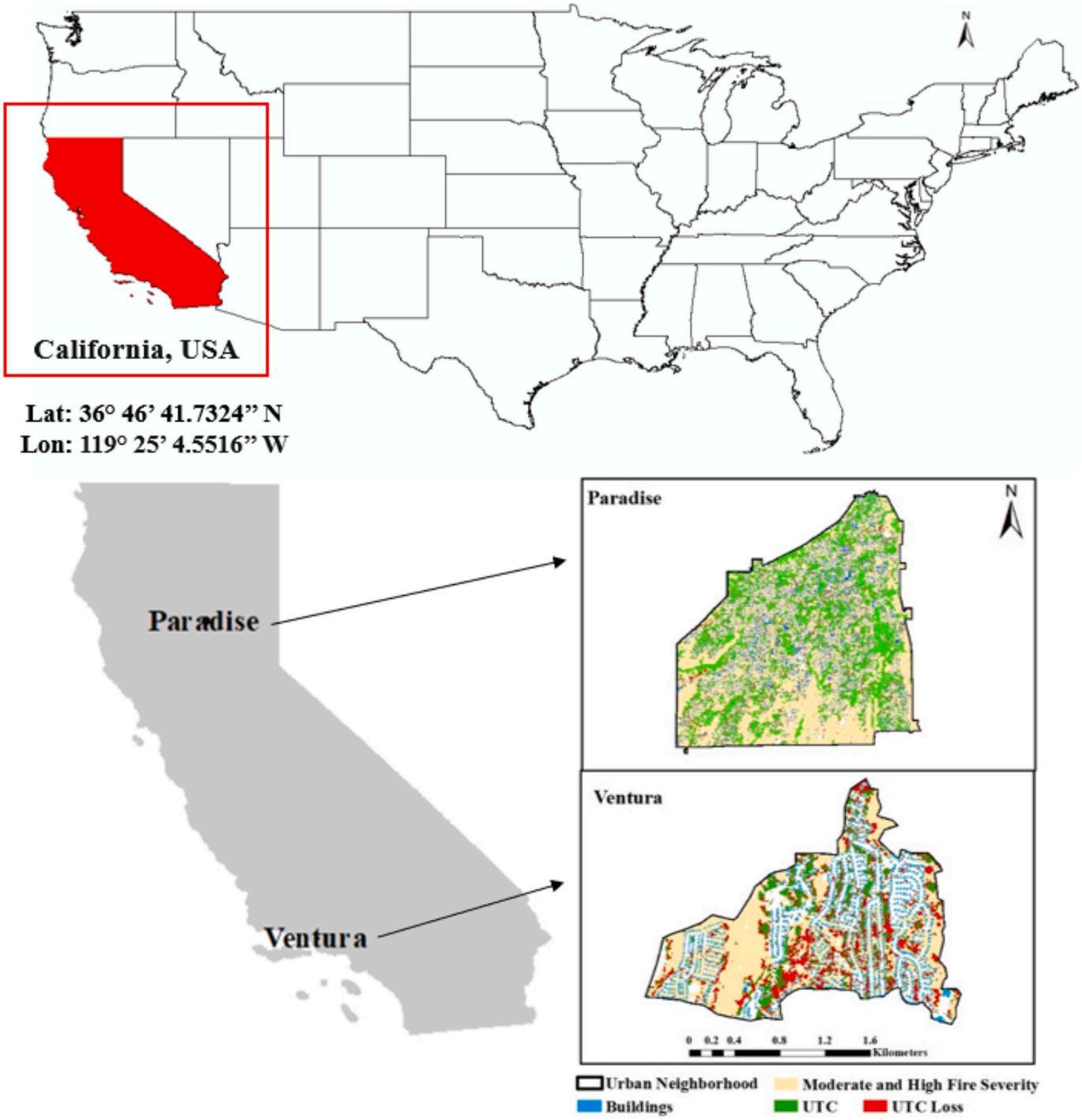

Fig. 1. Fire affected urban neighborhood study areas in Paradise and Ventura, California, USA. These two selected urban neighborhoods also exhibit fire severity, Urban Tree Cover (UTC), and UTC loss from pre- to post-fire.

Fire perimeters were mapped using Cal Fire's Fire and Resource Assessment Program (FRAP) data of historical fire perimeters for the Thomas (2017) and Camp (2018) fires (https://www.fire.ca.gov/what-we-do/fire-resource-assessment-program/fire-perimeters). The FRAP data is one of the most complete digital records of fire perimeters in California and is compiled from Cal Fire units as well as from cooperating land and fire management organizations in California.

Individual fire affected buildings in the study area were mapped using the Microsoft Building footprint data (https://github.com/Microsoft/USBuildingFootprints). The building layer was downloaded as a GeoJSON and converted to a shape file format using Python tools (Fig. 2). Damaged buildings were then identified using the 2020 wildfire building Damage Inspection Schema (DINS) data from the CAL FIRE Office of the State Fire Marshal that assesses and records structure damage during wildland fire incidents (https://gis.data.ca.gov/datasets/1b1c428af1f74a8c912f4b5c9e40d51e/about). The damage classes used in this analysis and their descriptions are presented in the Table 1 and are based on literature such as Knapp et al. (2021), Syphard et al. (2014), Gibbons et al. (2012) and Troy et al. (2022) that identifies building characteristics that are corelated to building loss during wildfires.

We accounted for both vegetation and building characteristics as dependent variables in our urban-forest model that analyzed building destruction and survival for Paradise only. Based on Knapp et al. (2021), we grouped the year a home was built into 3 classes: pre-1997, 1997–2007, and 2008–2018, the latter two time periods are related to periods before and after implementation of California's Building Code Chapter 7A, requiring fire resistant building construction measures. We also accounted for the exterior surface of roof construction materials per Knapp et al., (2021; e.g., metal, asphalt, tile, and concrete). Detailed building data (i.e., Year built and exterior surface material) were not available from the DINS data for Ventura, however we developed a more simplified urban-chaparral model for Ventura that only focused on urban vegetation characteristics and their influence on building destruction.

2.2.2. *Defensible space buffers surrounding fire-affected buildings*

Our review of the wildfire and building loss studies in Section 1, shows that building loss and survivability are highly correlated with building characteristics and surrounding vegetation cover within 200 feet from the building. Accordingly, this area referred to as DSBs is generally divided into three zones that are referred to as: immediate or Zone 1 (0–2 m), intermediate or Zone 2 (2–10 m), and extended or Zone 3 (10–30 m). These zones were delineated bases on criteria from the National Fire Protection Association (NFPA; https://www.nfpa.org/education-and-research/wildfire/preparing-homes-for-wildfire) to characterize parcel-scale building characteristics and adjacent vegetation types and their characteristics (Table 1). We delineated the three DSBs around building footprints using sequential rectangular polygons with the 'Buffer' spatial analyst tool in ArcGIS Pro version 3.2 (Fig. 2). This method allowed us to systematically map and define these buffers based on their proximity to each building edge in our two study areas. These buffers or zones are regularly used by fire and urban planning entities in North America, Australia, southern Europe and elsewhere as guidelines and ordinances for wildfire risk management (Penman et al., 2019; Syphard et al., 2021).

Table 1
Building characteristics and variables used in the parcel-based building-urban vegetation analysis.

Building Characteristics	Description
Damage classes	1–9 %, Affected Damage; 10–25 %, Minor Damage, 26–50 %: Major Damage, 51–100 %: Destroyed; No Damage
Exterior Surface: Roof Construction Material	Asphalt, Metal, Concrete, Tile
Year Built	Before 1900, 1900–2008, After 2008*

* California Building Code Chapter 7A went into effect in 2008, requiring fire resistance measures including: exterior construction materials used for roof coverings, vents, exterior walls, and decks.
Source: Cal Fire Damage Inspection data)

2.2.3. *Data processing and urban vegetation classification*

The orthorectified and radiometrically corrected surface reflectance 4-band PlanetScope pre-fire, mosaicked scenes (Fig. 4-A) were extracted and clipped to fire perimeters in both study areas. The pre-fire data were mosaicked using ERDAS Imagine software (Fig. 3, Step- A) to load study area data for use with eCognition. We used eCognition for our object-based classification as well as the spectral information, shape, compactness and other parameters to extract objects (Estoque et al., 2015; Wojtaszek et al., 2021). Specifically, our vegetation type maps for the two-fire affected urban neighborhoods were developed using pre-fire imagery (Fig. 2-S) and the eCognition software version 10.3 (Fig. 3-B). For specific methods related to the work flow that was used to map parcel-scale urban vegetation types (Fig. 3-C-D) and the classification scheme for the urban vegetation (i.e., Shrubs, Trees, Scattered trees, herbaceous) and non-vegetation types used in both our study sites (Fig. 2-S), refer to **Supplementary Methods** (**Sup. Mat. 1**). Non-

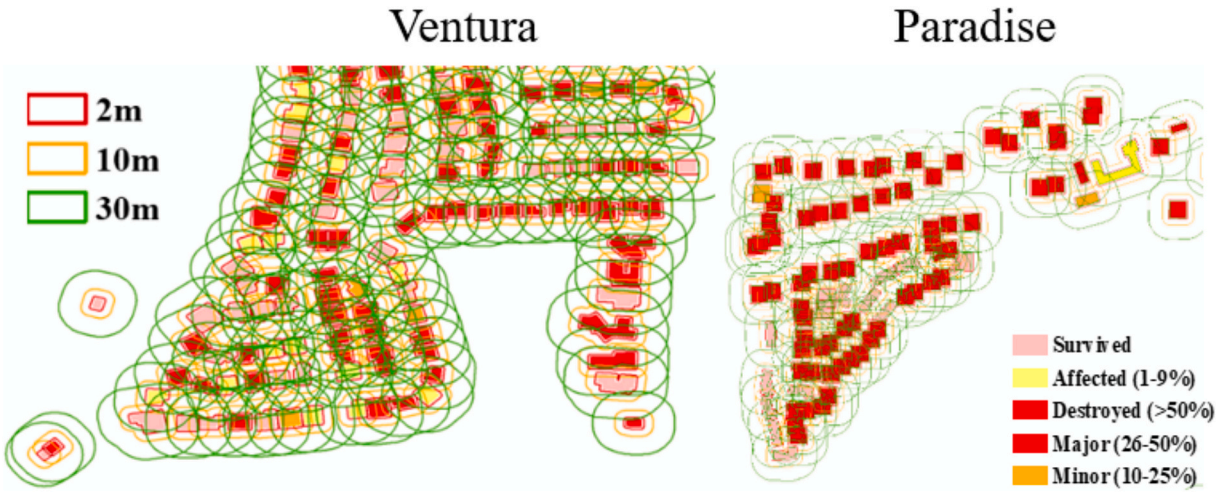

Fig. 2. Examples of the three defensible space buffers (0–2 m, 2–10 m, and 10–30 m) surrounding building footprints and CAL FIRE Damage Inspection Data classes in the Ventura and Paradise, California, USA study areas.

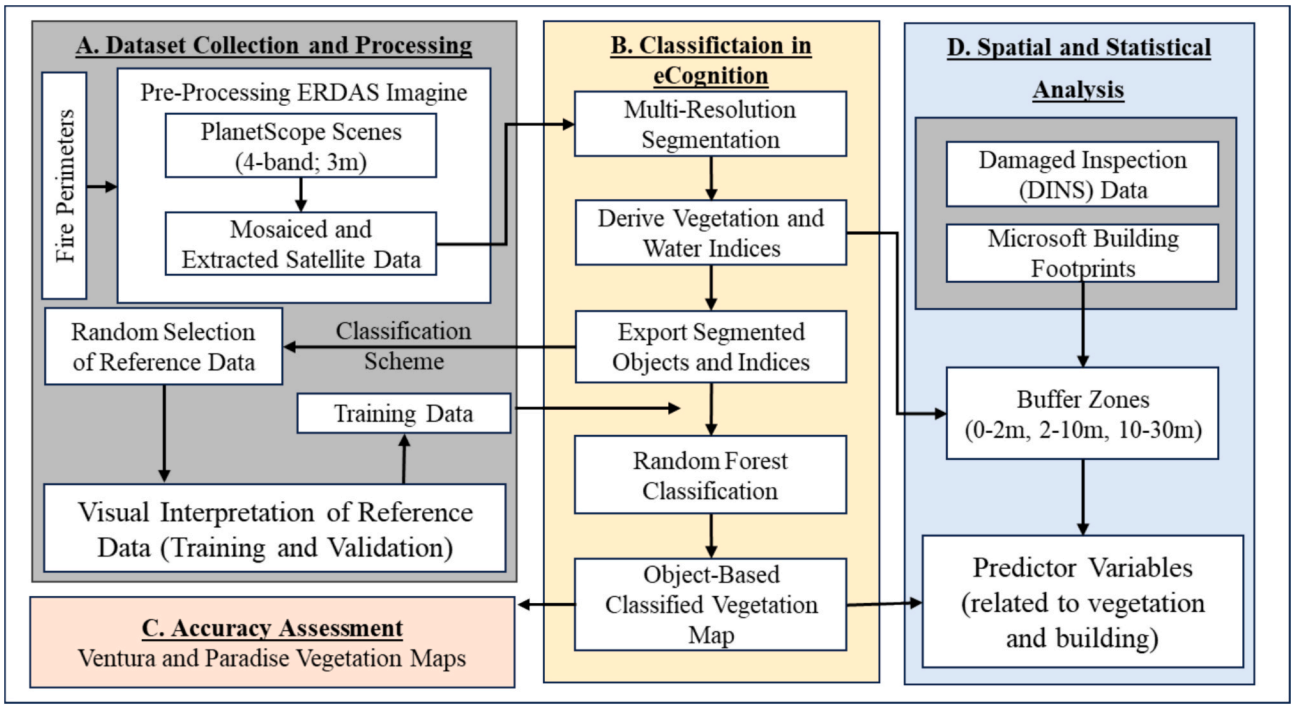

Fig. 3. Four-step (i.e., A-D) work flow used to map parcel-scale urban vegetation types and characteristics in fire-affected neighborhoods in Paradise and Ventura, California, US.

vegetation types included buildings and bare ground (i.e., bare soil, litter cover, wood chips, rocks, gravel, cement, asphalt, wood surfaces and debris).

2.3. Spatial analysis

Vegetation and building variables we analyzed (Table 2) account for: vegetation type, moisture, amount, composition, building characteristics, and density of buildings for the different DSB buffers in the two study areas (Fig. 3-D). Vegetation type characteristics were extracted from the vegetation map for the three DSBs in Ventura and Paradise. First, the polygons for each vegetation type class were extracted and clipped according to buffer boundaries and their characteristics. Second, the area of each vegetation type was estimated in ArcGIS Pro 3.2 using the "calculate area geometry" tool. Then, vegetation greenness and moisture content were derived using Normalized Difference Vegetation Index (NDVI) and the Normalized Difference Water Index (NDWI) based on equations 1 and 2 (Sup. Mat. 1). Specifically, NDVI and NDWI values (−1 to + 1) were extracted for each building's three DSB buffer zones using the zonal statistics tool in Arc GIS Pro 3.2. The NDWI has previously been applied by Maki et al. (2004) to relate vegetation leaf water status to forest fire risk using remotely sensed data.

The NDWI (Table 2) was first developed by McFeeters (2013 and 1996) to delineate and measure surface water bodies. Index values between −1 and 0 correspond to bright surfaces with no vegetation or water content (i.e., droughty), while higher values (+0) correspond to higher water content. Subsequently, NDWI was used by Jackson et al. (2004) to map water content in agricultural crops and by Gu et al. (2008) and Jackson (2004) to monitor vegetation drought conditions. Accordingly, NDWI values for water bodies are expected to be greater than 0.5, built-up features will have positive values between 0 and 0.2, while vegetation will have smaller values; thereby facilitating the differentiation of vegetation from water bodies (Table 3; https://eos.com/make-an-analysis/ndwi/). Based on this information, Table 3 lists the 4 NDWI classes used in subsequent vegetation moisture analyses.

The building density variable was estimated by counting the number of buildings (frequency of damaged and survived buildings) in the two most outer DSB (i.e., 2–10 m and 10–30 m) using the frequency tool in Arc Map 10.8.2. The direction and distance of vegetation types, relative to each building, in the 3 buffers were estimated using the 'Near' tool in ArGIS Pro. A near angle measures direction of the line connecting an input feature (i.e., building) to its nearest feature (i.e., vegetation type) at their closest locations. Using the Planar method as distance calculation parameter, the angle is within the range of −180° to 180°, with 0° being east, 90° being north, 180° (or −180°) being west, and −90° is south. The distance units were in meters and angular direction were analyzed as North, South, East, and West directions. The percent of overhanging tree cover occluding each building in Paradise (n = 1877) were estimated using the 'Intersect' tool in ArcGIS Pro. Overall, 15–17 variables related to vegetation and building characteristics (Table 2) were divided into the urban-chaparral and urban-forest models that were subsequently analyzed.

2.4. Statistical analysis

The vegetation and building variables (Table 2) were analyzed using Classification and Regression Trees (CART) and are represented in two statistical models: an urban-chaparral and a separate urban-forest model. The simplified urban-chaparral model for Ventura consisted of variables such as building density, and vegetation: types, moisture content, distance, and direction to buildings. While a more advanced urban-forest model for Paradise consisted of these previous vegetation type characteristics and building density plus building construction material, year of construction, and the proportion of tree cover occluding the buildings (Table 2). These two CARTs are also used to represent two disparate urban ecosystems and fuel-fire effects type models (Escobedo et al., 2024).

We then used CARTs and algorithms (Rutkowski e al., 2014) to produce decision trees that determine the predictive relationships between vegetation-building variables and whether homes were destroyed, or survived, during the fire event. A decision tree is therefore also a model or flowchart and associated rules (Kuhn et al., 2014) that lead to two possible *outcomes*; specifically, was the building destroyed or did it survive. Decision trees with fewer splits are less difficult to

Table 2
Variables used to characterize vegetation type, density, moisture, location, building density as well as building distance and direction to vegetation types that were used in both the urban-chaparral and urban-forest models.

Variable type	Variables	Unit	Method/Source
Vegetation	Trees (TreeP)	%	High Resolution
	Scattered trees (ScatP)	%	Vegetation Map
	Shrubs (ShrubP)	%	
	Herbaceous (HerbP)	%	
	Bare Ground (BareGP)	%	
	Vegetation type moisture (Mo_Tree, Mo ScatP, Mo_Herb, Mo_Shrub, Mo_Bare,)	No units	Water Index (NDWI)
	Vegetation greenness (Gr_Tree, Gr_Herb, Gr_Shrub, Gr_Bare)	No units	Vegetation Index (NDVI)
	Direction of Trees in buffer (Dir_Tree)	Azimuth	Near Tool in Arc Map 10.8.2
	Direction of Shrubs in buffer (Dir_Shrub)		
	Direction of bare ground in buffer (Dir_Bare)		
	Direction of Herbaceous in buffer (Dir_Herb)		
	Building Occluding Tree Cover (OverScatP)	%	Intersect and Summary Statistics Tool in Arc Map 10.8.2
	Distance to: Trees/Forest cover patches/Shrub/Bare ground/Herbaceous (Dis_Shrub, Dis_Herb, Dis_Tree, Dis_Bare)	m	Near Tool in ArcGIS Pro
Fire damaged buildings	Distance to Structures (Dis_Str)	m	
	Density of buildings in buffer (Bd_Dens)	No. of buildings per unit area	Frequency tool in Arc Map10.8.2
	Building construction (before 1997, 1997–2008, after 2008) (Built_Yr)	Year	Damage Inspection Schema data from CalFire
	Building/roof construction material (Roof)	Asphalt, metal, tile, concrete	

Table 3
Normalized difference water index (NDWI) classes and values from −1 to + 1.

NDWI	Description
0.2 – 1	Water surface
0.0 – 0.2	Flooded, humid areas, high vegetation moisture content
−0.3 – 0.0	Moderate drought, non-water surfaces
−1 – −0.3	Droughty, low vegetation moisture content, non-water surfaces

interpret than decision trees with many splits. This makes small decision trees (e.g., 2 or 3 splits) ideal for generating simple heuristics that can inform policy (Rutkowski et al., 2014), However, when interpretating splits to inform policy, care is needed when selecting variables for the decision tree model so that erroneous splits are less likely (Kuhn et al., 2014).

The CARTs (Breiman and Freedman, 1983) were implemented using a classification approach since the response variable *Outcome* is categorical. The primary objective of this approach was to identify the most influential vegetation and building factors associated with building destruction during the two fire events. The selection of hyperparameters, specifically the complexity parameter (CP), was conducted using 10-fold cross-validation to balance model complexity and applicability. This approach prevented overfitting while ensuring that decision trees can be interpreted. To do so, we adjusted the CP by iteratively pruning the decision tree at different thresholds and selecting the optimal value that minimized cross-validation error. Multiple rounds of cross-validation were performed to enhance the robustness of hyperparameter selection. The final CP value was chosen based on the average performance across iterations to ensure consistency in model selection.

We used the Adaptive Least Absolute Shrinkage and Selection Operator (Adaptive LASSO; Zou, 2006) for feature selection. This allowed us to retain the most relevant predictor variables while reducing redundancy and potential collinearity; thus refining the model and improving its predictive power while facilitating its interpretation. The response variable (i.e., *Outcome*) is a binary categorical variable and indicated whether a building was destroyed (1) or survived (0) during the fire event. The predictor variables used in the CART model were selected based on ecological, spatial, and structural factors listed in Table 2. These variables account for factors that have bene reported to influence wildfire impacts including: vegetation cover, moisture, spatial configuration, directional influence, and building characteristics (Alexandre et al., 2016a, 2016b; Syphard and Keeley, 2019; Van Der Kamp, 2017).

The final CARTs were applied to the two study areas to create the urban-chaparral model and a separate urban-forest model. For the urban-chaparral model in Ventura, we incorporated vegetation variables such as type, moisture, distance, and direction. The urban-forest model or Paradise combined building characteristics (e.g., roof material, year built, building density) with overstory vegetation structure. This integration allowed us to assess the combined influence of both natural and built environmental features on building survival. All statistical analyses were conducted using R version 4.1.2. The CARTs were developed using *rpart* version 4.1.16 package (Therneau et al., 2015) in R and the final decision tree model was visualized with the *rpart.plot* function (https://CRAN.R-project.org/package = rpart.plot), highlighting the most influential variables for determining building destruction risk. This graphical representation provides an intuitive understanding of how environmental and structural factors interact to influence wildfire outcomes. For specific methods on the LASSO model approaches as well as development and interpretation of the decision trees, please refer to the **Supplementary Methods** section.

3. Results

3.1. Vegetation type map and building loss

Urban vegetation type maps consisted of shrub, herbaceous, tree, bare ground, herbaceous as well as buildings (Fig. 4) and a scattered tree (ScatP) type and a percent building occluding tree cover (OverScatP; Table 2) for Paradise. We also developed vegetation moisture maps for the three DSB buffers surrounding each building in Ventura and Paradise using Equation 2 as shown in Fig. 5. The overall accuracy of vegetation maps for Ventura and Paradise were 90 % and 88 %, and Kappa indices were 0.73 and 0.72 respectively; metrics that are considered relatively high accuracies (Congalton and Green, 2019). In terms of individual classes, herbaceous and shrubs had slightly higher errors of commission (low user accuracy) than trees and bare ground (**Supplementary Results 2**). The accuracy of buildings class was not assessed because Microsoft building footprint and DINS damage inventory data were used to label all the building objects. However, in Ventura and Paradise, there were 1230 and 16,319 buildings, respectively, within the fire perimeters. Of these, 35 % and 88 % were destroyed in Ventura and Paradise, respectively.

3.2. Vegetation type and building characteristics, defensible space buffers, and building loss

The urban-chaparral model (Table 4, Fig. 6a) shows that in DSB 1, a bare ground cover (BareGP) of less than 19.86 % is the most important predictor of building loss. Specifically, 6 % of buildings immediately

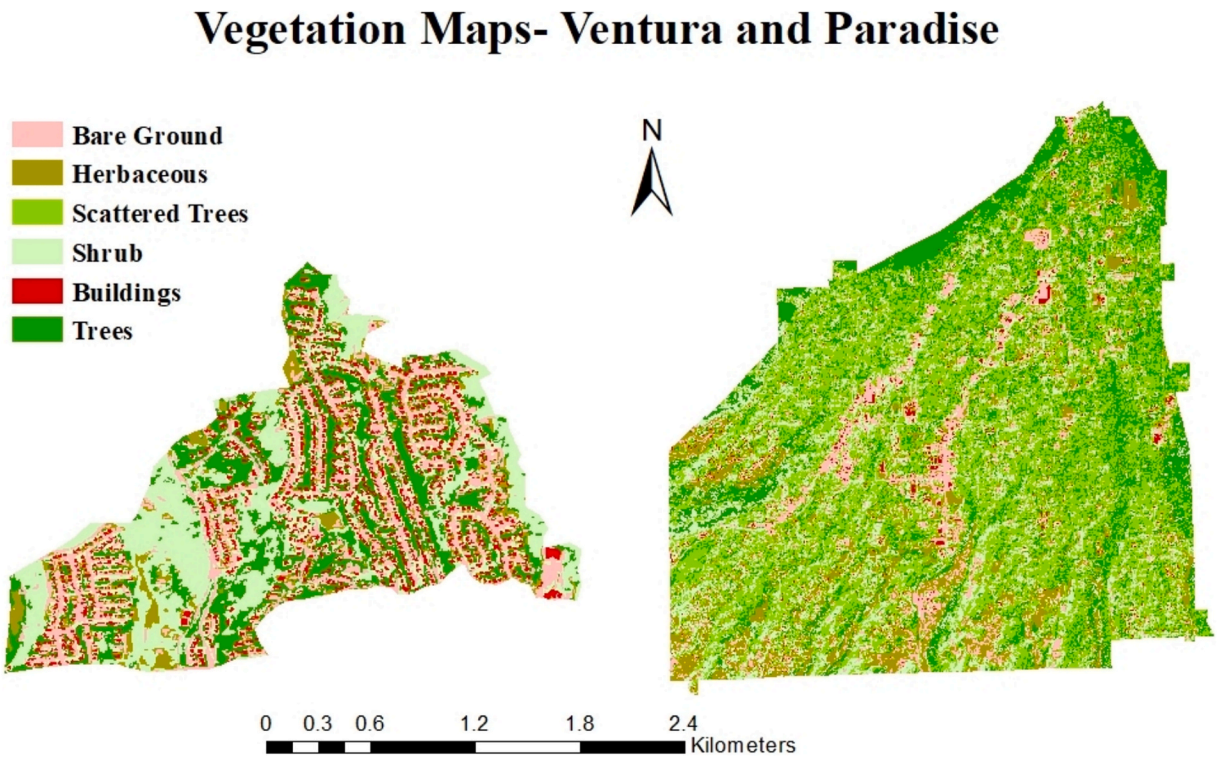

Fig. 4. Urban vegetation type map for Ventura (left) and Paradise (right) developed using Planetscope satellite data and object-based classification in eCognition software at 3 m spatial resolution for pre-fire 2017 and 2018.

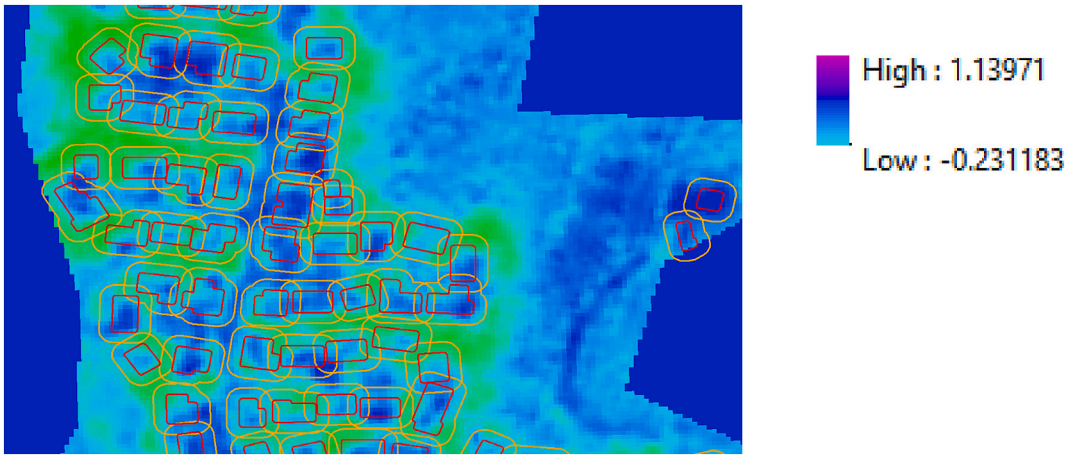

Fig. 5. Example of the Normalized Difference Water Index (NDWI) map used for the three different Defensible Space Buffers surrounding buildings in a fire affected neighborhood in Ventura, CA.

adjacent to bare ground cover less than 19.86 % and trees with moisture indices less than −0.43 moisture (i.e. droughty), were more likely to be destroyed. Conversely, 94 % of buildings in all other scenarios (e.g., bare ground covers greater than 19.86 %, NDWI tree moistures more than -0.43) for DSB1 were more likely to survive. Specifically, homes with more than 20 % bare ground cover and with trees with higher moisture content near them, were more likely to survive (Fig. 6a).

In DSB2, when herbaceous moisture indices were greater than −0.084 (i.e., less droughty; Fig. 6b; Table 4) and some criteria are met regarding distance to trees and direction of shrubs, the path predicted building survival for 37 % of buildings. Similarly, when herbaceous moisture was greater than −0.084, distance to trees was less than 8 m, the directional degrees of shrubs was less than 116, and the distance to bare ground was greater than 5.2 m, 6 % of buildings were more likely to be destroyed. When herbaceous moisture indices were less than −0.084 (i.e., more droughty) the decision tree presented more nuanced findings concerning building loss relationships in DSB2 because more terminal nodes predicted destroyed buildings than on the less droughty side. However, the first node predicting destroyed buildings only requires one additional split, that shrub moisture be less than −0.41 (Fig. 6b). This produces the parsimonious rule for DSB2 that buildings with herbaceous moisture less than −0.084 and shrub moisture less than −0.41 (i.e., droughty herbaceous and shrub vegetation types) in this buffer predict 4 % of buildings lost.

Finally, for DSB3 the most important split for predicting building loss was whether percent bare ground was greater or less than 41 % (Fig. 6c; Table 4). When bare ground is less than 41 % and distance to herbaceous vegetation (Dis_Herb) is greater than or equal to 25.97 m to the building,

Table 4
Estimated decision tree results for the Urban chaparral model, listed in order of inferred importance for building destruction or survival according to Ventura Defensible Space Buffer (DSB) 1 (0–2 m), 2 (2–10 m), and 3 (10–30 m).

Significant Variables	Buffer 1 estimates, predictors and paths; (Inferred importance ranking); [Model estimate per DSB]
% Bare Ground	< 19.86 % (2)
Tree Moisture	< −0.43 (4)
	Buffer 2 estimates
Herbaceous moisture	>= −0.084 (2)
Tree Distance*	< 10 m [8 m] (3)
Direction to Shrub	<116 (4)
Shrub moisture	< −0.41 (6)
Distance to bare ground*	>= 7.17 m [5.17 m] (16)
	Buffer 3 estimates
% Bare Ground	< 41 (2)
Distance to herbaceous*	>= 25.97 m [15.97 m] (4)
Building density	>= 8.5 (6)
Tree Distance*	>= 14.41 m [4.40 m] (10)
Tree Direction	Southwest [< −155.21] (14)
Distance to Structures*	< 15.35 m [5.34 m] (44)

*Actual distance to buildings.

the model predicted that 11 % of buildings were destroyed. Also, the model predicted 1 % of buildings were destroyed when bare ground is less than 41 %, distance to herbaceous is less than 15.97, and distance to trees was greater than or equal to 4.4 m. Conversely, 62 % of buildings were predicted to survive (Fig. 6c), where for these buildings bare ground is greater than 41 %, building density is less than 9, and the direction of trees is greater than 155 degrees (west-southwest).

In the urban-forest model, bare ground cover was a key variable in predicting building loss in DSB1 (Fig. 7a; Table 5). Overall, the most parsimonious path for predicting building loss, was when bare ground covers were less than 9.27 %, or when bare ground covers were greater than 9.27 % and distance to bare ground is less than 0.02 m (94 % of buildings). The most parsimonious path for predicted building survival (6 % of building) was when bare ground cover was greater than 9.27 % and distance to bare ground was greater than 0.02 m. Similarly, if Bare ground was greater than 9.27 %, Distance to bare ground was less than 0.02 m, Distance to herbaceous cover was greater than 1.1 and Overstory tree cover was less than 10 %, predicted that 2 % of buildings surviving.

In DSB 2, droughty shrub moisture content (Mo_Shrub, −0.5) was the most important predictor for building class, but nearly every model path led to building loss and paths that led to building survival contained fewer than 1 % of homes; therefore the model might not be as helpful in this specific DSB for predicting building loss or survival (Table 5; Fig. 7b). However, the path containing the greatest number of destroyed buildings, more than all other paths combined, is when together shrub moisture was greater than −0.5 and building density was less than 2. Similarly, droughty shrubs (Mo_Shrub < -0.5 and < -0.6) and droughty scattered trees (Mo_Scat_tree −0.06) also predicted 52 % buildings destroyed.

In DSB 3, we see that nearly every path leads to a prediction of building loss (Fig. 7c); particularly when distance to scattered trees was less than 10.01 m (86 % of buildings). For the remaining 14 % of buildings where distance of the scattered trees is greater than or equal to 10.01 m, there is only one path that leads to predicted survival. Specifically, when distance to scattered trees is greater than 10.01 m, building densities were less than or equal to 6, bare ground moisture was

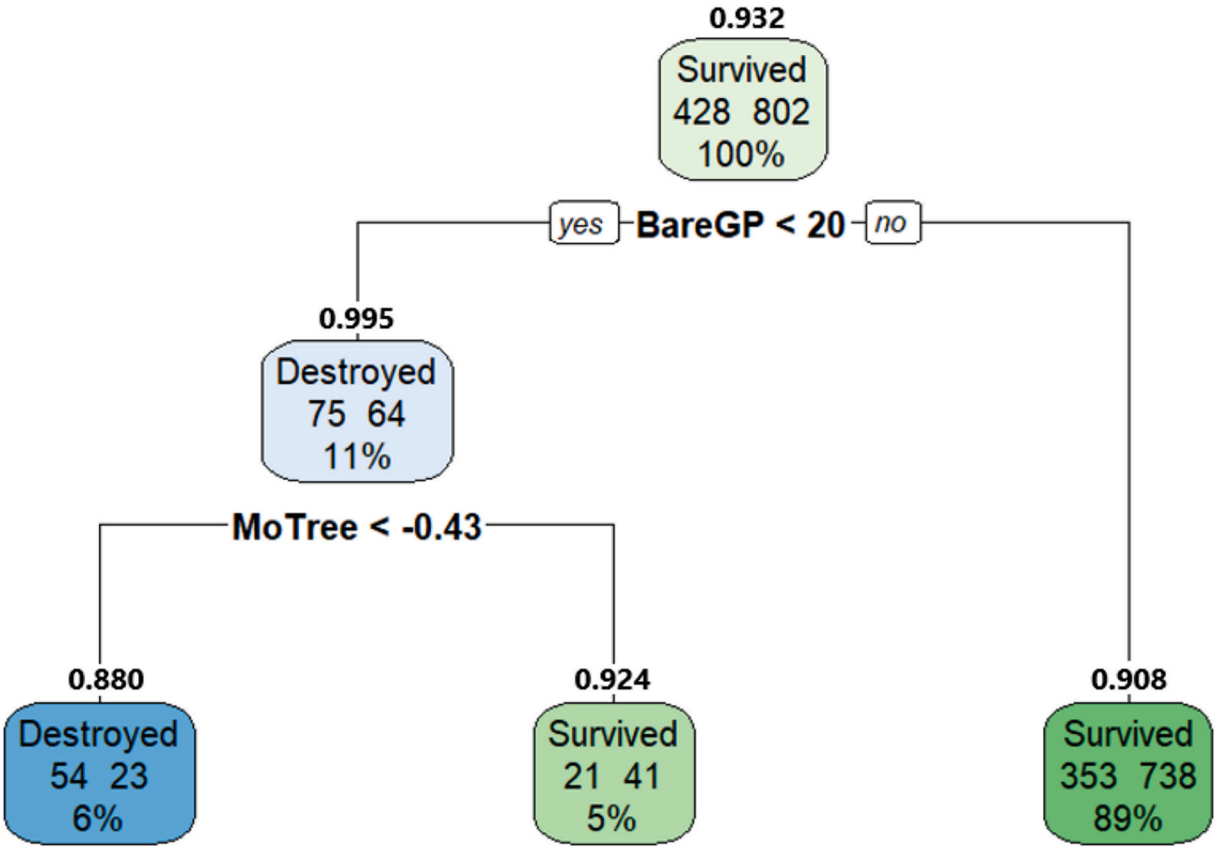

Fig. 6. Estimated decision trees for the urban chaparral model for Ventura, California's Defensible Space Buffers (DSB) 1 (Fig. 6a), 2 (Fig. 6b), and 3 (Fig. 6c). The values inside the nodes represent the predicted class (i.e., survived or destroyed), the predicted number of buildings in each class (destroyed and survived), and the percentage of buildings that were either destroyed or survived within the node. Entropy is indicated above each node.

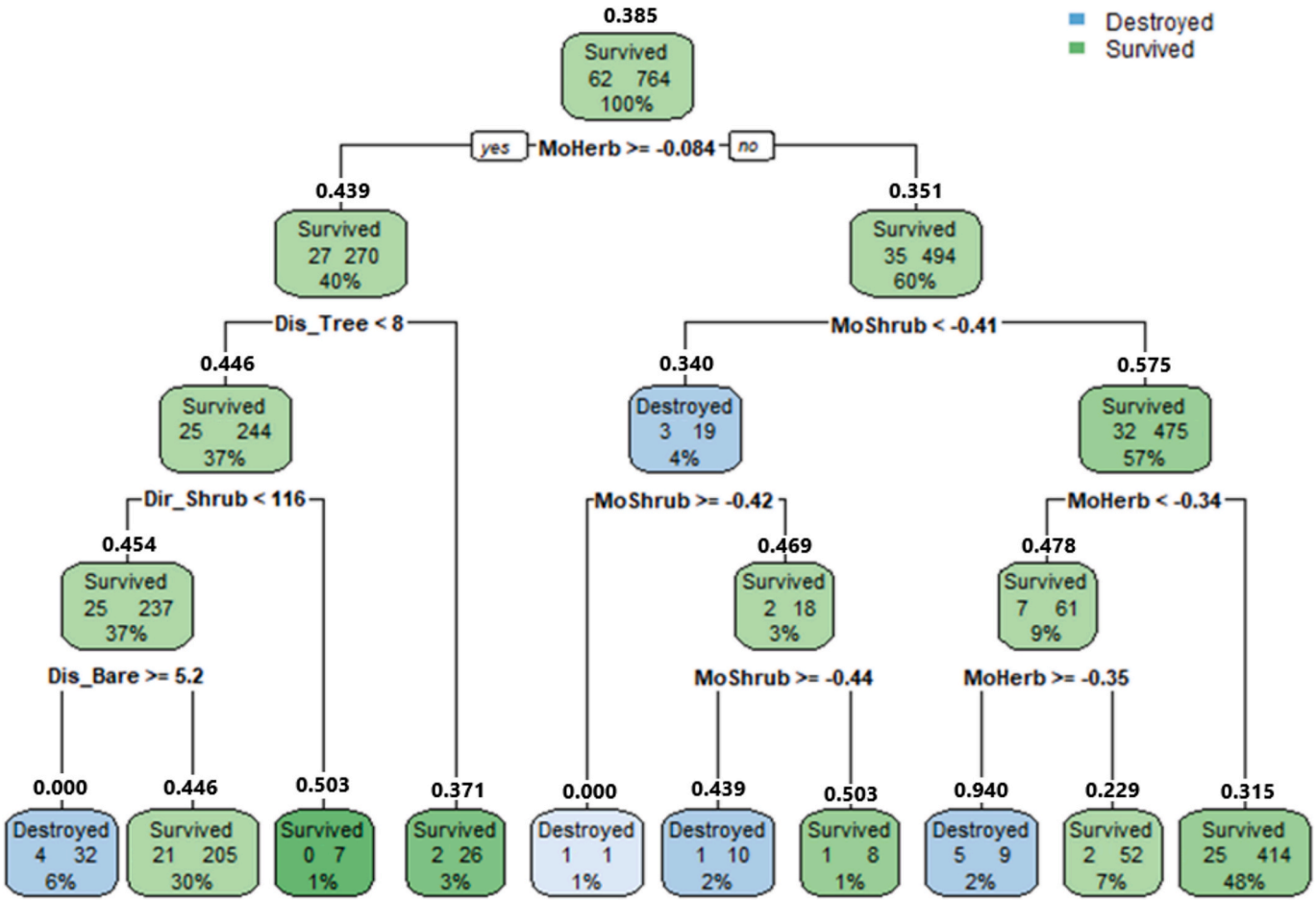

Fig. 6. (*continued*).

less than or equal to −0.28 (less droughty), and distances to herbaceous vegetation was greater than 10.05 m. Unlike DSB 2, the path that leads to building survival contains only 3 % of the buildings, so the model is more helpful at predicting building survival.

4. Discussion

Our methods and findings provide for a more nuanced understanding of the complex interactions between different vegetation types and building loss, or survival, during urban fire events in two fire-prone urban ecosystems in California US. Although studies such as those of Knapp et al. (2021), Syphard et al. (2014), Gibbons et al. (2012) and Troy et al. (2022) have documented the role, and importance, of building characteristics in building loss; our study presents novel findings regarding the role of different urban vegetation or fuel types in building loss across DSBs. In doing so, our study provides for a better understanding of the trade-offs associated with urban vegetation-related ecosystem services (e.g., temperature regulation, increased property values) and increased fire risk (i.e., ecosystem disservice; Cheng et al., 2024) in fire-prone urban ecosystems in places such as North and South America, Australia, and southern Europe, (Cruz et al., 2012; Escobedo et al., 2024).

The urban vegetation type maps for Ventura and Paradise display in a spatially explicit manner the heterogenous distribution of urban vegetation and fuels relative to residential buildings (Fig. 4). Previous studies have focused on mostly "structural" characteristics and a few tree cover variables often estimated using 30 m resolution satellite and aerial imagery (Knapp et al., 2021; Kramer et al., 2019; Syphard et al., 2014). Conversely, our study accounted for tree, shrub, and herbaceous types, moisture, and cover characteristics, as well as building occluding tree cover, scattered tree patches, tree and shrub distance and direction, as well non-vegetation factors such as bare ground and building characteristics (Table 2).

Studies such as those of Neyns and Canters (2022) have documented the advantage of using recent high resolution satellite data for mapping and monitoring the phenological and taxonomic characteristics of urban vegetation. Especially, with the use of supervised, non-parametric classification method and the launch of satellites with short revisit times and improved spectral and spatial resolutions (e.g., PlanetScope, RapidEye). Also, other urban vegetation mapping studies using random forest classification methods and object-based classification of high resolution maps have reported accuracies similar to our study of 80–84 % (Gibbes et al, 2010; Sicard et al., 2023). As such, our 3.0 m resolution maps produced using object-based classification, eCognition and our accuracy assessment metrics can provide for more accurate, yet less time-consuming classification approaches for mapping parcel-scale vegetation types, than other pixel-based algorithms (Bhaskaran et al., 2010, Knapp et al., 2021). Therefore, studies such as ours can provide for a better understanding of parcel-scale vegetation composition, structure and fire dynamics around urban and WUI homes (Figs. 4 and 5; Chen and McAneney, 2004).

Similarly by using NDWI, we also explore the role that vegetation moisture, and indirectly drought and irrigation practices, can play in determining building loss during fire events (Gibbons et al., 2018; Fig. 5). This is exemplified in our urban-chaparral model, where homes with low bare ground cover (~20 %) and with trees with high NDWI moisture content (−0.43) near them, were more likely to survive (Fig. 6a). This has implications for tree removals (i.e., fuel hazards) near

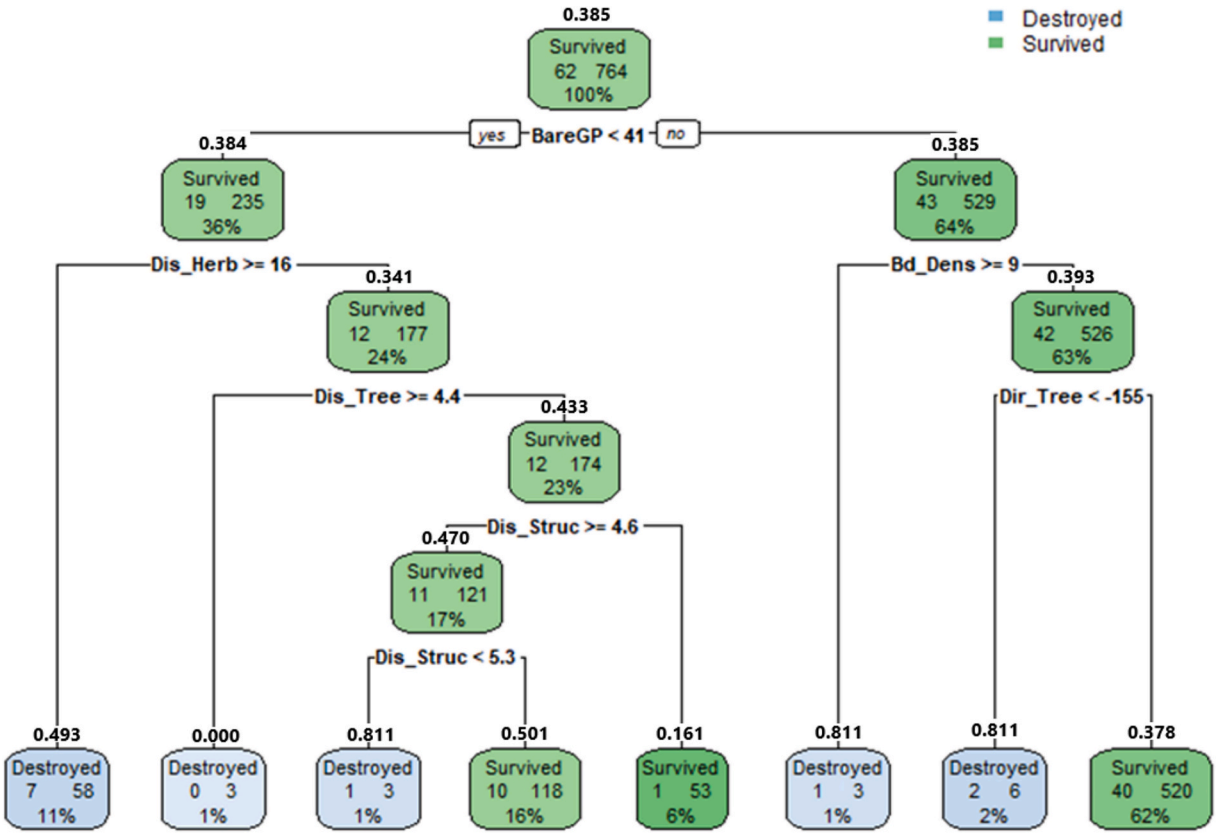

Fig. 6. (*continued*).

homes (Fig. 6a-6c) and for urban fire risk mitigation practices like "fire-smart" plant selection and design, proper irrigation, and pruning practices in fire-prone urban landscapes (Gibbons et al., 2012; Troy et al., 2022). Our vegetation type, moisture, density and cover analyses complement the other building-related factors that have been reported to predict home loss or survival in shrubland and forest-dominated urban ecosystem (See Section 1). For example, Syphard et al (2014) reported that in chaparral dominated San Diego County US, the most effective DSB for building survival was 5–20 m while distances > 30 m had little additional benefits. Although these authors report that percent vegetation cover in the first 2 DSB was most effective, we also found that low tree, shrub and herbaceous NDWI moisture levels were also significant predictors of building loss in the urban chaparral model (Table 4). Conversely, high NDWI moisture trees near homes were significant predictors of building survival in this same model (Fig. 6a). That said, Mockrin et al. (2023) reported that building materials and landscape-level characteristics in shrubland-dominated areas of Los Angeles County, USA were more influential in determining building outcomes than vegetation characteristics. Again, emphasizing that building characteristics are more important than vegetation types and characteristics in DSBs 1–3 in influencing building loss during fire events (Fig. 6).

In Paradise, our urban-forest model also estimates that amount and proximity of bare ground immediately next to the home as well as distance to herbaceous cover types were the most significant predictors of building loss, while percent occluding overstory tree over the home, was a much less influential predictor in DSB 1 (Table 5). The consistent significance of bare ground cover in predicting building loss across many DSBs in both our models was noteworthy and has not really been documented before (Figs. 6 and 7). However, it is important to note that our bare ground cover type also consisted of flammable fuels such as litter, mulch, vegetation debris or even flammable wooden decks or fences, which can increase the risk of fires or fire spread (Knapp et al., 2021). Similarly, bare soil or even concrete and pavement were also classified as bare ground. The less influential role of occluding or overstory tree cover is also informative (Table 5). Litter generation and possible flame contact from such trees has been reported as a factor in building loss and thus overstory tree cover is regulated in WUI-fire risk ordinances (Syphard et al., 2021; Troy et al., 2022). However, these tree crowns might be shielding homes from embers (Keeley and Syphard, 2019). Post-fire observations by the authors have also noted many instances where burning homes were the heat or flame source for nearby tree scorch and consumption.

Studies from Paradise CA have explored the influence of building characteristics, and broadly defined vegetation cover classes on building outcomes during the Camp Fire. Knapp et al., (2021) found that the "relative importance of nearby burning structures versus surrounding vegetation in explaining home survival" was variable. They found that greater distances between buildings, as well as overstory tree covers of less than 53 % in distances greater than 30 m, had a larger effect on home survival; than did tree cover within our DSBs (0–30 m). Troy et al.'s (2022) analysis found "less conclusive" and mixed results when analyzing the role of DSB vegetation cover and practices in building loss. They did however find that increased amount of dead grass near structures, and litter on roofs/gutters, were associated with increased building loss.

Other studies elsewhere in California have also explored the role of broadly defined vegetation and tree cover and amount, as well as defensible space, on building loss during fire events (Knapp et al., 2021; Syphard et al., 2014). For example, Syphard and Keeley (2019) study based on more than 40,000 structures in urban and WUI fire events concludes that building characteristics were more influential in reducing building loss than vegetation characteristics within the DSBs. Syphard et al, (2021) found no direct relationship between vegetation and building loss during fire events in the San Francisco area, interior north and southern California regions. Although vegetation less than 25–30 m from buildings was more influential in building loss than more distant

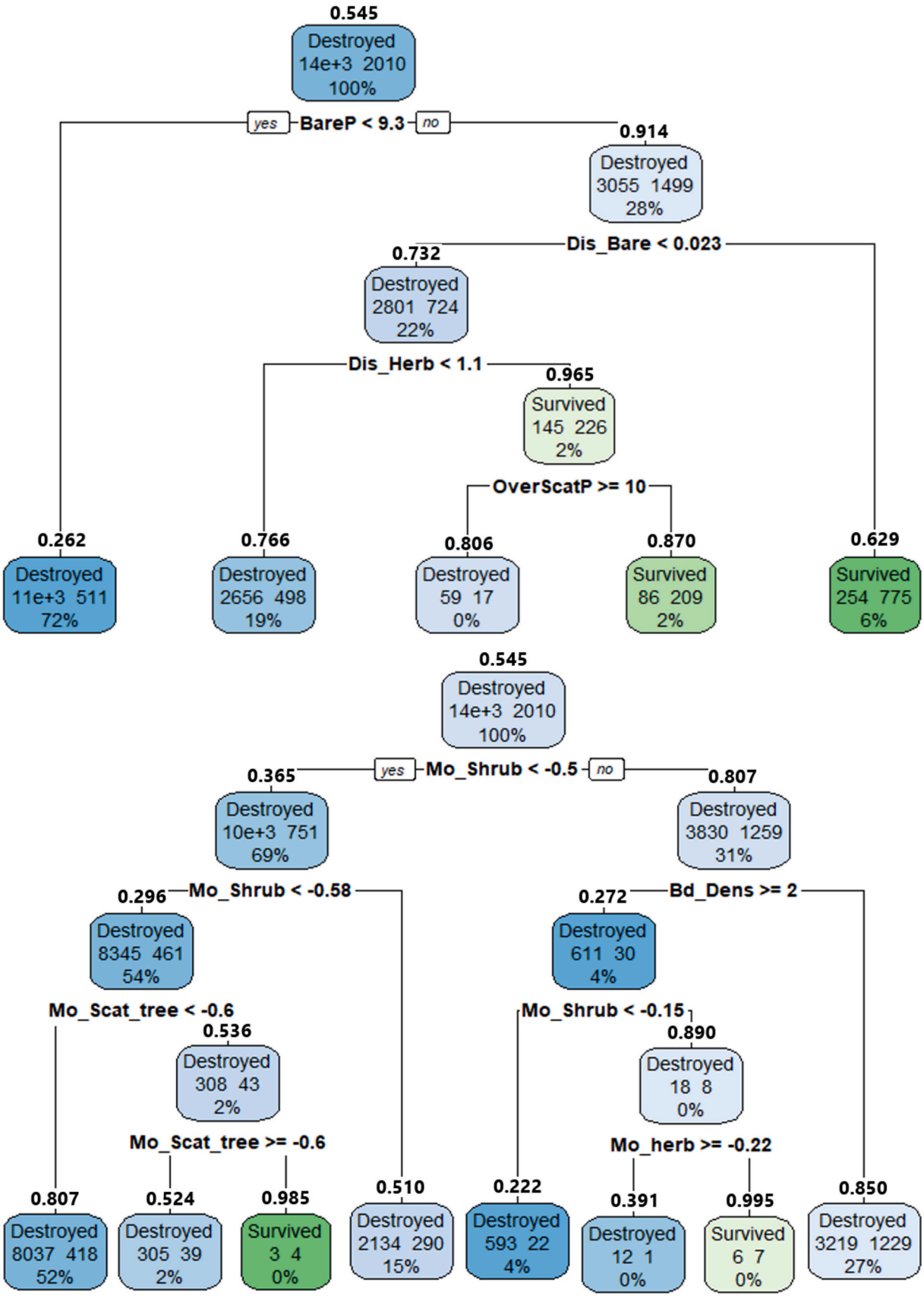

Fig. 7. Estimated decision tree results for the urban forest model for Paradise, California's Defensible Space Buffers (DSB) 1, 2 and 3. The values inside the nodes represent the predicted class (i.e., survived or destroyed), the predicted number of buildings in each class (destroyed and survived), and the percentage of buildings that were either destroyed or survived within the node. Entropy is indicated above each node.

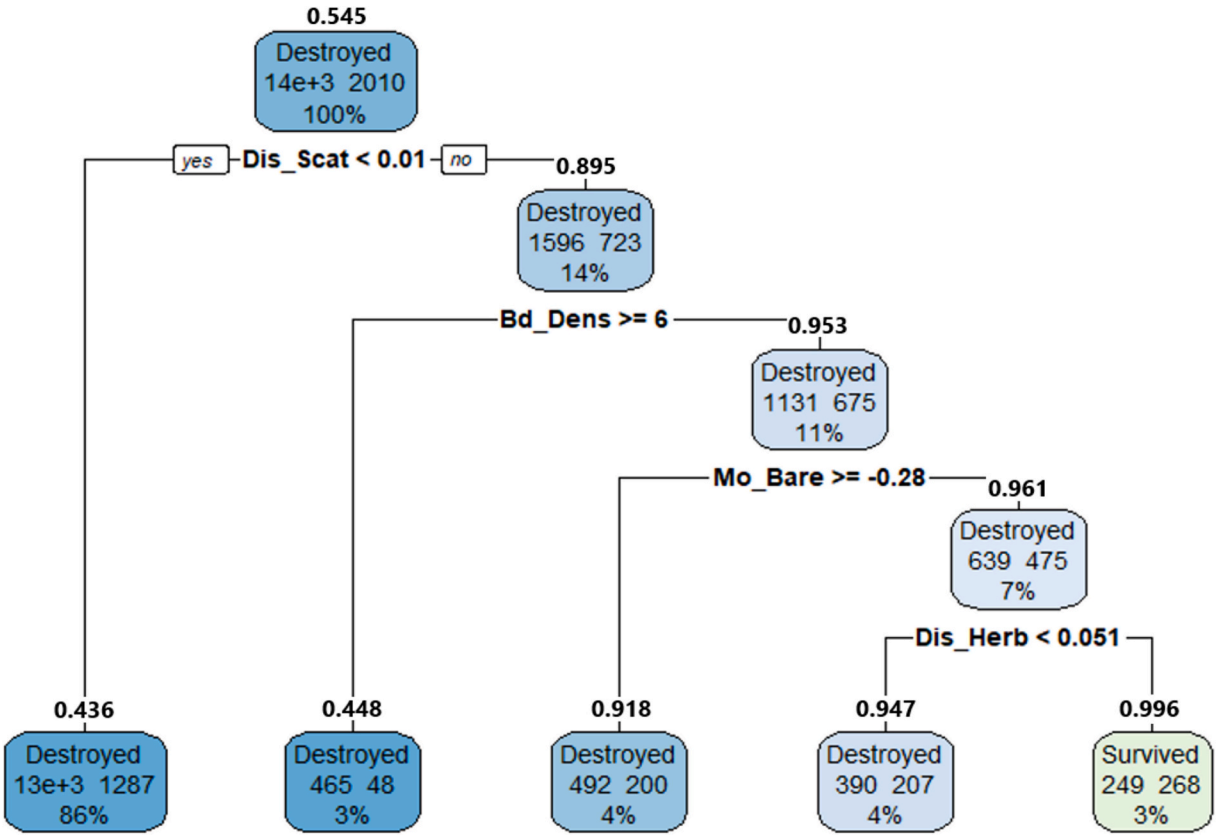

Fig. 7. (*continued*).

Table 5
Estimated decision tree results for the urban forest model for Paradise California's Defensible Space Buffers (DSB) 1 (0–2 m), 2 (2–10 m) and 3 (10–30 m).

Significant Variables	**DSB 1 estimates;** (Inferred importance ranking); [Model estimate per DSB]
% Bare Ground	< 9.27 % (2)
Distance to bare ground*	< 0.02 m [0.02 m] (6)
Distance to herbaceous*	<1.1 [1.13 m] (12)
% Overstory cover	>= 9.98 % (26)
	DSB 2 estimates
Shrub moisture	< −0.50 (2)
Building density	>= 1.5 (6)
Scattered tree moisture	< −0.59 (8)
	DSB 3 estimates
Distance to scattered trees*	< 10.01 m [0.01 m] (2)
Building density	>= 5.5 (6)
Bare ground moisture	>= −0.27 (14)
Distance to herbaceous*	< 10.05 m [0.05 m] (30)

*Actual distance to buildings.

vegetation, overall housing density and characterises (i.e. patterns) were more influential than local-scale vegetation in determining building loss outcomes (Schmidt 2022; Syphard et al., 2021). However, our parcel-level study complements other studies from California such as Kramer et al, (2019) and Syphard et al. (2021), by focusing on factors that have previously been little studied, specifically vegetation composition, type, moisture and location relative to burned buildings (Tables 2).

Overall, we found that tree, shrub and herbaceous moisture were better predictors of building loss than was overstory tree cover in DSBs 1–2 for both models (Tables 4 and 5). Studies from other WUI fires in Mediterranean climates such as Gibbons et al. (2012) found that home loss in southeastern Australia was associated with increased tree-shrub cover and composition (i.e., remnant or planted) within 40 m of the structure. Another study from Australia using vegetation cover classes within 20 m of a structure, found that vegetation cover "touching" or "overhanging" homes was related to increase loss, therefore risk was reduced by reducing vegetation cover, amount, and proximity to homes (Penman et al., 2019). Similarly, in central Chile, Aguirre et al., (2024) using high-resolution optical ortho mosaics from drones, found that homes located close to broadly defined NDVI vegetation classes, had "slightly higher" odds of damages at distances < 60 m from homes. However, contrary to these studies from Australia and Chile using broad tree cover class-based metrics (Knapp et al., 2021; Syphard et al., 2017a, 2014; Troy et al., 2022), our study is one of the first to specifically analyze the influence of parcel-level 3.0 m resolution: vegetation type, densities, and moisture as well as its distance and direction relative to DSB and building loss (Figs. 5, 6 and 7).

Although the role of building characteristics in their survival during WUI fire events has been well documented as outlined in our literature review, the role of parcel-scale urban vegetation characteristics has not. Alexandre et al. (2016a) for example did find that clusters of buildings were associated with a greater probability of loss, particularly in more densely populated WUI areas. Syphard et al. (2012) also used these broad vegetation cover classes (U.S. Geological Survey National Land Database; mrlc.gov) and found that housing arrangement and location were the most important contributors to property loss in the WUI fires. In terms of building characteristics and their role in survival, Knapp et al. (2021) found that homes constructed after 1997 demonstrated a 38 percent survival rate, whereas pre-1997 constructions exhibited only an 11.5 percent survival rate. Similarly, Baylis and Boomhower (2021) found that homes built in 2010 or later, three years following the implementation of updated building codes, were 15 percentage points less likely to be destroyed compared to those constructed in 1985 under

similar wildfire conditions.

Our study contributes to the fire-building loss literature by analysing the role of different urban vegetation types and their condition (i.e., moisture, location, and density; Table 2; Fig. 5) to home loss/survival in residential neighborhoods during urban fire events. Findings indicate that properly selected, irrigated, located, and maintained urban vegetation is not always complicit in building loss during fire events. Furthermore, we corroborate how dense urban or suburban developments (i.e. 2–9 structures within 30 m; Tables 4 and 5) are more susceptible to widespread building damage during wildfire events; regardless of parcel-level or landscape-level vegetation fuel characteristics. And as expected, burning buildings likely acted as sources of not only embers, but direct flame contact and radiant heat that can ignite nearby structures as shown by Suzuki et al. (2014).

Previous studies have called for stricter construction codes and building practices (e.g., non-combustible siding material, dual pane windows, fire-resistant roofing and construction materials; Knapp et al., 2021); these can however be very expensive. Also, other studies and policies recommend that urban development in high-fire risk areas be highly regulated by limiting new residential construction or integrating strategic open spaces to disrupt fuel continuity (Moritz et al., 2014; Syphard et al., 2017a). However, these land use options are likely difficult to implement in high real estate premium contexts. Accordingly, our study provides some basic low-cost options related to vegetation management in urban areas.

Like these other studies, our findings suggest that along with urban land use patterns, urban vegetation moisture and type, can play a role in influencing a building's vulnerability to fire (Fig. 5). For example, the moisture and amount of low growing vegetation types (i.e., shrubs and herbaceous) and bare ground covers (e.g., mulch, litter) in DSB1 are highly influential in building loss (Tables 4 and 5). Conversely taller vegetation (i.e. trees) in DBS 1 and 2 that is droughty and closer to buildings, did influence - but to a lesser degree - building loss in both Ventura and Paradise (Tables 4 and 5). Therefore these findings provide evidence for "*defensible* space" guidelines and municipal ordinances that emphasize that although these zones can alter fire behaviour around homes, their main purpose is to improve fire fighters access to better *defend* homes during fires (https://readyforwildfire.org/prepare-for-wildfire/defensible-space/). Our findings also suggest that WUI-based vegetation management practices and guidelines that are recommended for DSB3 in urban ordinances and planning instruments are less relevant and very difficult to implment. First because building density and distance to other buildings were more influential than vegetation characteristics. And second, urban parcels are usually smaller in area than WUI parcels, thus DSB3 is often not present or can overlap onto a neighbouring parcel's DSB2 (Escobedo et al., 2024).

We do note some limitations in our study. First, we note that CART algorithms are sensitive to collinearity between input variables, and this can lead to erroneous splits in the estimated decision tree. This has implications when interpreting our vegetation moisture findings as this variable is closely correlated with vegetation greenness and amounts. Second, we did not focus on building characteristics but rather on parcel-level vegetation composition, types, amounts and moisture. As shown in our urban-chaparral model, we were not able to account for these building variables due to lack of data availability (e.g., building materials) and both spatial and non-spatial inconsistencies in available datasets (e.g., year built). However, we did account for construction year and roof surface material type in our urban-forest model. Third, we admit that our bare ground cover non-vegetation type, is still too broad to sparse out how non-vegetation ground cover types (i.e., bare soil, concrete or wood surfaces) influence building loss during fires. And finally, we did not account for the role of tall, moist, vegetation "filtering" wind-borne embers or – conversely – producing flammable litter, nor individual home owner or fire fighter actions in defending homes and influencing home survivability.

5. Conclusion

Our findings and approach could be used to further study and better understand the tradeoffs society makes between urban ecosystem services versus disservices in warm, drought and fire prone urban biomes. Specifically the use of well-maintained urban vegetation types near homes for climate regulation, aesthetics, and human well-being versus the increased risk of wildfire and home ignition due to increased fuels adjacent to homes. For example, our study corroborated the importance of building construction codes, practices, and building density on damage to structures during fire events. But the significance of bare ground cover (i.e., litter, mulch, wood surfaces) as well as building densities in predicting building loss across many DSBs further adds to this understanding. We also document how tree, shrub, and herbaceous moisture in yards are better predictors of building loss – or survival – than just percent vegetation cover alone. Indeed according to our urban chaparral model, homes with nearby trees with higher NDWI moisture content were more likely to survive. This influential role of high moisture tree cover – relative to other factors- in home survival has rarely been documented. Such information can have implications for designing insurance regulations and vegetation ordinances, as well as urban plant selection, design, irrigation, and landscaping practices.

Our parcel-level study, while not focusing on buildings or the WUI, does however provide novel insights into home-property level processes around buildings, in terms of urban ecosystem structure, composition and vegetation density. By also examining different DSBs of interest around fire-affected buildings, our analysis also provides improved insights into the effectiveness of traditionally used fire risk mitigation practices. As fire increasingly affects urban ecosystems, this information sheds light on how relevant DSBs and WUI guidelines and fuel management practices are when applied to more densely urbanized, highly populated neighborhoods with diverse, heterogenous vegetation composition. The findings also provide insights into how homes in different ecosystems and fuel regimes interact with certain urban vegetation types and established defensible space guidelines. Our use of advanced object-based classification techniques to map urban vegetation composition, structure and distribution – as opposed to commonly used pixel-based land cover type-based approaches also provides an alternative approach for more rapid mapping of urban ecosystem characteristics and fuel types.

In conclusion, recently many home insurance providers and landscaping ordinances in California are requiring homeowners to remove all vegetation, particularly trees, near homes in high wildfire hazard areas or risk fines or cancellation of insurance policies. But most of the literature we reviewed, and our findings suggest that in urban fire events it is primarily building characteristics (i.e., building density), dry flammable structures (e.g., wood fences and decks) near homes, firefighting operations, and fire weather – and to a much lesser degree parcel-level urban vegetation composition and structure – that are most influential in building loss or survival. Thus, proper pruning, irrigation, and placement of ground covers and vegetation are key in determining the right balance between the ecosystem services benefits of urban vegetation, versus the ecosystem disservice costs of increased fire risk and hazard. Our study underscores the importance of urban planning as well as both landscape practices and building regulations in enhancing building resilience against wildfires. It also highlights the limits of applying guidelines that were developed in more rural, low housing density WUI contexts, to highly urbanized land use cover types that are now increasingly being affected by urban fires globally.

CRediT authorship contribution statement

Francisco J. Escobedo: Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Kamini Yadav:** Writing – original draft, Visualization, Software, Methodology, Formal

analysis, Data curation, Conceptualization. **Onofrio Cappelluti:** Writing – original draft, Visualization, Methodology, Investigation, Formal analysis. **Nels Johnson:** Writing – original draft, Supervision, Methodology, Investigation, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.landurbplan.2025.105421.

Data availability

Data will be made available on request.

References

Ackley, C.M., 2020. A case study on how insulated concrete forms can prevent structure loss during wildfires.

Aguirre, P., León, J., González-Mathiesen, C., Román, R., Penas, M., & Ogueda, A. (2024). Modelling the vulnerability of urban settings to wildland–urban interface fires in Chile. *Natural Hazards and Earth System Sciences, 24*(4), 1521–1537.

Alexandre, P. M., Stewart, S. I., Mockrin, M. H., Keuler, N. S., Syphard, A. D., Bar-Massada, A., Clayton, M. K., & Radeloff, V. C. (2016). The relative impacts of vegetation, topography and spatial arrangement on building loss to wildfires in case studies of California and Colorado. *Landsc. Ecol., 31*, 415–430. https://doi.org/10.1007/s10980-015-0257-6

Alexandre, P. M., Stewart, S. I., Keuler, N. S., Clayton, M. K., Mockrin, M. H., Bar-Massada, A., Syphard, A. D., & Radeloff, V. C. (2016). Factors related to building loss due to wildfires in the conterminous United States. *Ecological applications, 26*(7), 2323–2338.

Bailey, R. G. (1983). Delineation of ecosystem regions. *Environmental Management, 7*, 365–373.

Baylis, P., & Boomhower, J. (2021). *Building codes and community resilience to natural disasters. Working Paper*. Vancouver, BC, Canada: University of British Columbia.

Bhaskaran, S., Paramananda, S., & Ramnarayan, M. (2010). Per-pixel and object-oriented classification methods for mapping urban features using Ikonos satellite data. *Applied geography, 30*(4), 650–665.

Bowman, D. M. J. S., Williamson, G. J., Abatzoglou, J. T., Kolden, C. A., Cochrane, M. A., & Smith, A. M. S. (2017). Human exposure and sensitivity to globally extreme wildfire events. *Nat. Ecol. Evol., 1*, 0058. https://doi.org/10.1038/s41559-016-0058

Braziunas, K. H., Seidl, R., Rammer, W., & Turner, M. G. (2021). Can we manage a future with more fire? Effectiveness of defensible space treatment depends on housing amount and configuration. *Landscape Ecology, 36*, 309–330.

Breiman, L., & Freedman, D. (1983). How Many Variables Should Be Entered in a Regression Equation? *J. Am. Stat. Assoc., 78*, 131–136. https://doi.org/10.1080/01621459.1983.10477941

Calkin, D. E., Barrett, K., Cohen, J. D., Finney, M. A., Pyne, S. J., & Quarles, S. L. (2023). Wildland-urban fire disasters aren't actually a wildfire problem. *Proceedings of the National Academy of Sciences, 120*(51), Article e2315797120.

Cappelluti, O., Elia, M., & Sanesi, G. (2024). Could different structural features affect flammability traits in Mediterranean forest ecosystems? *Trees*. https://doi.org/10.1007/s00468-024-02513-w

Chen, K., & McAneney, J. (2004). Quantifying bushfire penetration into urban areas in Australia. *Geophysical Research Letters, 31*(12).

Cheng, H., Escobedo, F. J., Thomas, A. S., De Los Reyes, J. F., & Soto, J. R. (2024). Comparing individual and collective valuation of ecosystem service tradeoffs: A case study from montane forests in southern California, USA. *Ecosystem Services, 69*, Article 101648.

Cohen, J. and Stratton, R., 2003. Home destruction within the Hayman Fire perimeter. *In:* Graham, Russell T., Technical Editor. Hayman Fire Case Study. Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 263-292, 114.

R.G. Congalton K. Green Assessing the Accuracy of Remotely Sensed Data: Principles and Practices, Third Edition 3rd ed. 2019 CRC Press 10.1201/9780429052729.

Cruz, M. G., Sullivan, A. L., Gould, J. S., Sims, N. C., Bannister, A. J., Hollis, J. J., & Hurley, R. J. (2012). Anatomy of a catastrophic wildfire: The Black Saturday Kilmore East fire in Victoria, Australia. *Forest Ecology and Management, 284*, 69–285.

Elia, M., Giannico, V., Spano, G., Lafortezza, R., & Sanesi, G. (2020). Likelihood and frequency of recurrent fire ignitions in highly urbanised Mediterranean landscapes. *Int. J. Wildland Fire, 29*, 120. https://doi.org/10.1071/WF19070

Elia, M., Lafortezza, R., Cappelluti, O., Costa-Saura Josè, M., Bacciu, V., Giannico, V., Changliang, S., & Sanesi, G. (2024). Coupling heat wave and wildfire occurrence across multiple ecoregions within a Eurasia longitudinal gradient. *Sci. Total Environ., 912*, Article 169269. https://doi.org/10.1016/j.scitotenv.2023.169269

Erni, S., Johnston, L., Boulanger, Y., Manka, F., Bernier, P., Eddy, B., Christianson, A., Swystun, T., & Gauthier, S. (2021). Exposure of the Canadian wildland–human interface and population to wildland fire, under current and future climate conditions. *Canadian Journal of Forest Research, 51*(9), 1357–1367.

Escobedo, F. J., Yadav, K., Ossola, A., Klein, R., & Drury, S. (2024). Urban forest cover and ecosystem service response to fire varies across California communities. *Urban For. Urban Green., 101*, Article 128547. https://doi.org/10.1016/j.ufug.2024.128547

Estoque, R. C., Murayama, Y., & Akiyama, C. M. (2015). Pixel-based and object-based classifications using high- and medium-spatial-resolution imageries in the urban and suburban landscapes. *Geocarto Int., 30*, 1113–1129. https://doi.org/10.1080/10106049.2015.1027291

Gibbes, C., Adhikari, S., Rostant, L., Southworth, J., & Qiu, Y. (2010). Application of Object Based Classification and High Resolution Satellite Imagery for Savanna Ecosystem Analysis. *Remote Sens., 2*, 2748–2772. https://doi.org/10.3390/rs2122748

Gibbons, P., Gill, A. M., Shore, N., Moritz, M. A., Dovers, S., & Cary, G. J. (2018). Options for reducing house-losses during wildfires without clearing trees and shrubs. *Landsc. Urban Plan., 174*, 10–17. https://doi.org/10.1016/j.landurbplan.2018.02.010

Gibbons, P., Van Bommel, L., Gill, A. M., Cary, G. J., Driscoll, D. A., Bradstock, R. A., Knight, E., Moritz, M. A., Stephens, S. L., & Lindenmayer, D. B. (2012). Land Management Practices Associated with House Loss in Wildfires. *PLoS ONE, 7*, Article e29212. https://doi.org/10.1371/journal.pone.0029212

Goss, M., Swain, D. L., Abatzoglou, J. T., Sarhadi, A., Kolden, C. A., Williams, A. P., & Diffenbaugh, N. S. (2020). Climate change is increasing the likelihood of extreme autumn wildfire conditions across California. *Environ. Res. Lett., 15*, Article 094016. https://doi.org/10.1088/1748-9326/ab83a7

Gu, Y., Hunt, E., Wardlow, B., Basara, J. B., Brown, J. F., & Verdin, J. P. (2008). Evaluation of MODIS NDVI and NDWI for vegetation drought monitoring using Oklahoma Mesonet soil moisture data. *Geophys. Res. Lett., 35*, Article 2008GL035772. https://doi.org/10.1029/2008GL035772

Hakes, R. S. P., Caton, S. E., Gorham, D. J., & Gollner, M. J. (2017). A Review of Pathways for Building Fire Spread in the Wildland Urban Interface Part II: Response of Components and Systems and Mitigation Strategies in the United States. *Fire Technol., 53*, 475–515. https://doi.org/10.1007/s10694-016-0601-7

Halofsky, J. E., Peterson, D. L., & Harvey, B. J. (2020). Changing wildfire, changing forests: The effects of climate change on fire regimes and vegetation in the Pacific Northwest, USA. *Fire Ecol., 16*, 4. https://doi.org/10.1186/s42408-019-0062-8

Jackson, T. (2004). Vegetation water content mapping using Landsat data derived normalized difference water index for corn and soybeans. *Remote Sensing Of the Environment, 92*, 475–482. https://doi.org/10.1016/j.rse.2003.10.021

Keeley, J.E. and Syphard, A.D., 2019. Twenty-first century California, USA, wildfires: fuel-dominated vs. wind-dominated fires. Fire Ecology, 15(1),.1-15.

Knapp, E. E., Valachovic, Y. S., Quarles, S. L., & Johnson, N. G. (2021). Housing arrangement and vegetation factors associated with single-family home survival in the 2018 Camp Fire, California. *Fire Ecology, 17*, 1–19.

Kolden, C. A., & Henson, C. (2019). A Socio-Ecological Approach to Mitigating Wildfire Vulnerability in the Wildland Urban Interface: A Case Study from the 2017 Thomas Fire. *Fire, 2*, 9. https://doi.org/10.3390/fire2010009

Kramer, H. A., Mockrin, M. H., Alexandre, P. M., & Radeloff, V. C. (2019). High wildfire damage in interface communities in California. *Int. J. Wildland Fire, 28*, 641. https://doi.org/10.1071/WF18108

Kuhn, L., Page, K., Ward, J., & Worrall-Carter, L. (2014). The process and utility of classification and regression tree methodology in nursing research. *Journal of Advanced Nursing, 70*(6), 1276–1286.

Maki, M., Ishiahra, M., & Tamura, M. (2004). Estimation of leaf water status to monitor the risk of forest fires by using remotely sensed data. *Remote Sensing of Environment, 90*(4), 441–450.

Mancini, L., Elia, M., Barbati, A., Salvati, L., Corona, P., Lafortezza, R., & Sanesi, G. (2018). Are Wildfires Knocking on the Built-Up Areas Door? *Forests, 9*, 234. https://doi.org/10.3390/f9050234

Maranghides, A., Link, E., Mell, W. "Ruddy," Hawks, S., Wilson, M., Brewer, W., Brown, C., Vihnaneck, B., Walton, W.D., 2021. A Case Study of the Camp Fire – Fire Progression Timeline (No. NIST TN 2135). National Institute of Standards and Technology, Gaithersburg, MD. https://doi.org/10.6028/NIST.TN.2135.

Massada, A. B., Radeloff, V. C., & Stewart, S. I. (2011). Allocating fuel breaks to optimally protect structures in the wildland–urban interface. *International Journal of Wildland Fire, 20*(1), 59–68.

McFeeters, S. (2013). Using the Normalized Difference Water Index (NDWI) within a Geographic Information System to Detect Swimming Pools for Mosquito Abatement: A Practical Approach. *Remote Sens., 5*, 3544–3561. https://doi.org/10.3390/rs5073544

McFeeters, S. K. (1996). The use of the Normalized Difference Water Index (NDWI) in the delineation of open water features. *Int. J. Remote Sens., 17*, 1425–1432. https://doi.org/10.1080/01431169608948714

Mockrin, M. H., Locke, D. H., Syphard, A. D., & O'Neil-Dunne, J. (2023). Using high-resolution land cover data to assess structure loss in the 2018 Woolsey Fire in Southern California. *Journal of Environmental Management, 347*, Article 118960.

Modaresi Rad, A., Abatzoglou, J. T., Kreitler, J., Alizadeh, M. R., Agha Kouchak, A., Hudyma, N., Nauslar, N. J., & Sadegh, M. (2023). Human and infrastructure exposure to large wildfires in the United States. *Nature Sustainability, 6*(11), 1343–1351.

Moritz, M. A., Batllori, E., Bradstock, R. A., Gill, A. M., Handmer, J., Hessburg, P. F., Leonard, J., McCaffrey, S., Odion, D. C., Schoennagel, T., & Syphard, A. D. (2014). Learning to coexist with wildfire. *Nature, 515*, 58–66. https://doi.org/10.1038/nature13946

Neyns, R., & Canters, F. (2022). Mapping of urban vegetation with high-resolution remote sensing: A review. *Remote sensing, 14*(4), 1031.

Penman, S. H., Price, O. F., Penman, T. D., & Bradstock, R. A. (2019). The role of defensible space on the likelihood of house impact from wildfires in forested landscapes of south eastern Australia. *Int. J. Wildland Fire, 28*, 4. https://doi.org/10.1071/WF18046

Quarles, S. L., Valachovic, Y., Nakamura, G. M., Nader, G. A., & De Lasaux, M. J. (2010). Home Survival in Wildfire-Prone Areas: Building Materials and Design Considerations. *University of California, Agriculture and Natural Resources.*. https://doi.org/10.3733/ucanr.8393

Rutkowski, L., Jaworski, M., Pietruczuk, L., & Duda, P. (2014). The CART decision tree for mining data streams. *Information Sciences, 266*, 1–15.

Schmidt, J. (2022). The Effects of Vegetation, Structure Density, and Wind on Structure Loss Rates in Recent Northern California Wildfires. *MPRA Paper No., 112191*. https://mpra.ub.uni-muenchen.de/112191/.

Sicard, P., Coulibaly, F., Lameiro, M., Araminiene, V., De Marco, A., Sorrentino, B., Anav, A., Manzini, J., Hoshika, Y., Moura, B. B., & Paoletti, E. (2023). Object-based classification of urban plant species from very high-resolution satellite imagery. *Urban For. Urban Green., 81*, Article 127866. https://doi.org/10.1016/j.ufug.2023.127866

Suzuki, S., Brown, A., Manzello, S. L., Suzuki, J., & Hayashi, Y. (2014). Firebrands generated from a full-scale structure burning under well-controlled laboratory conditions. *Fire Safety Journal, 63*, 43–51.

Syphard, A. D., Keeley, J. E., Massada, A. B., Brennan, T. J., & Radeloff, V. C. (2012). Housing Arrangement and Location Determine the Likelihood of Housing Loss Due to Wildfire. *PLoS ONE, 7*, Article e33954. https://doi.org/10.1371/journal.pone.0033954

Syphard, A. D., Brennan, T. J., & Keeley, J. E. (2014). The role of defensible space for residential structure protection during wildfires. *Int. J. Wildland Fire, 23*, 1165. https://doi.org/10.1071/WF13158

Syphard, A. D., Brennan, T. J., & Keeley, J. E. (2017). The importance of building construction materials relative to other factors affecting structure survival during wildfire. *Int. J. Disaster Risk Reduct., 21*, 140–147. https://doi.org/10.1016/j.ijdrr.2016.11.011

Syphard, A. D., Keeley, J. E., Pfaff, A. H., & Ferschweiler, K. (2017). Human presence diminishes the importance of climate in driving fire activity across the United States. *Proc. Natl. Acad. Sci., 114*, 13750–13755. https://doi.org/10.1073/pnas.1713885114

Syphard, A., & Keeley, J. (2019). Factors Associated with Structure Loss in the 2013–2018 California Wildfires. *Fire, 2*, 49. https://doi.org/10.3390/fire2030049

Syphard, A. D., Rustigian-Romsos, H., & Keeley, J. E. (2021). Multiple-Scale Relationships between Vegetation, the Wildland–Urban Interface, and Structure Loss to Wildfire in California. *Fire, 4*, 12. https://doi.org/10.3390/fire4010012

Therneau, T., Atkinson, B., Ripley, B., Ripley, M.B., 2015. Package 'rpart.' Available Online Cran Ma Ic Ac Ukwebpackagesrpartrpart Pdf Accessed 20 April 2016.

Thomas, A. S., Escobedo, F. J., Sloggy, M. R., & Sanchez, J. J. (2022). A burning issue: Reviewing the socio-demographic and environmental justice aspects of the wildfire literature. *PLoS One, 17*(7), Article e0271019.

Troy, A., Moghaddas, J., Schmidt, D., Romsos, J. S., Sapsis, D. B., Brewer, W., & Moody, T. (2022). An analysis of factors influencing structure loss resulting from the 2018 Camp Fire. *International journal of wildland fire, 31*(6), 586–598.

U.S. Fema M.f.m., Team: Homeowner's Guide to Reducing Wildfire Risk Through Defensible Space 2023.

Valachovic, Y., Quarles, S. L., & Swain, S. V. (2021). Reducing the Vulnerability of Buildings to Wildfire: Vegetation and Landscaping Guidance. *University of California, Agriculture and Natural Resources.*. https://doi.org/10.3733/ucanr.8695

D.W. Van Der Kamp Spatial patterns of humidity, fuel moisture, and fire danger across a forested landscape 2017 https://doi.org/10.14288/1.0355217.

Wickham, J., Stehman, S. V., Sorenson, D. G., Gass, L., & Dewitz, J. A. (2021). Thematic accuracy assessment of the NLCD 2016 land cover for the conterminous United States. *Remote Sensing of Environment, 257*, Article 112357.

Wojtaszek, M. V., Ronczyk, L., Mamatkulov, Z., & Reimov, M. (2021). Object-based approach for urban land cover mapping using high spatial resolution data. EDP Sciences. *In E3S Web of Conferences, 227*, 01001.

Yadav, K., Escobedo, F. J., Thomas, A. S., & Johnson, N. G. (2023). Increasing wildfires and changing sociodemographics in communities across California, USA. *International Journal of Disaster Risk Reduction, 98*, Article 104065.

Zou, H. (2006). The Adaptive Lasso and Its Oracle Properties. *J. Am. Stat. Assoc., 101*, 1418–1429. https://doi.org/10.1198/016214506000000735

What are the primary threats to homes during a wildfire?

Research around home destruction vs. home survival in wildfires point to embers and small flames as the main way that the majority of homes ignite in wildfires. Embers are burning pieces of airborne wood and/or vegetation that can be carried more than a mile through the wind can cause spot fires and ignite homes, debris and other objects.

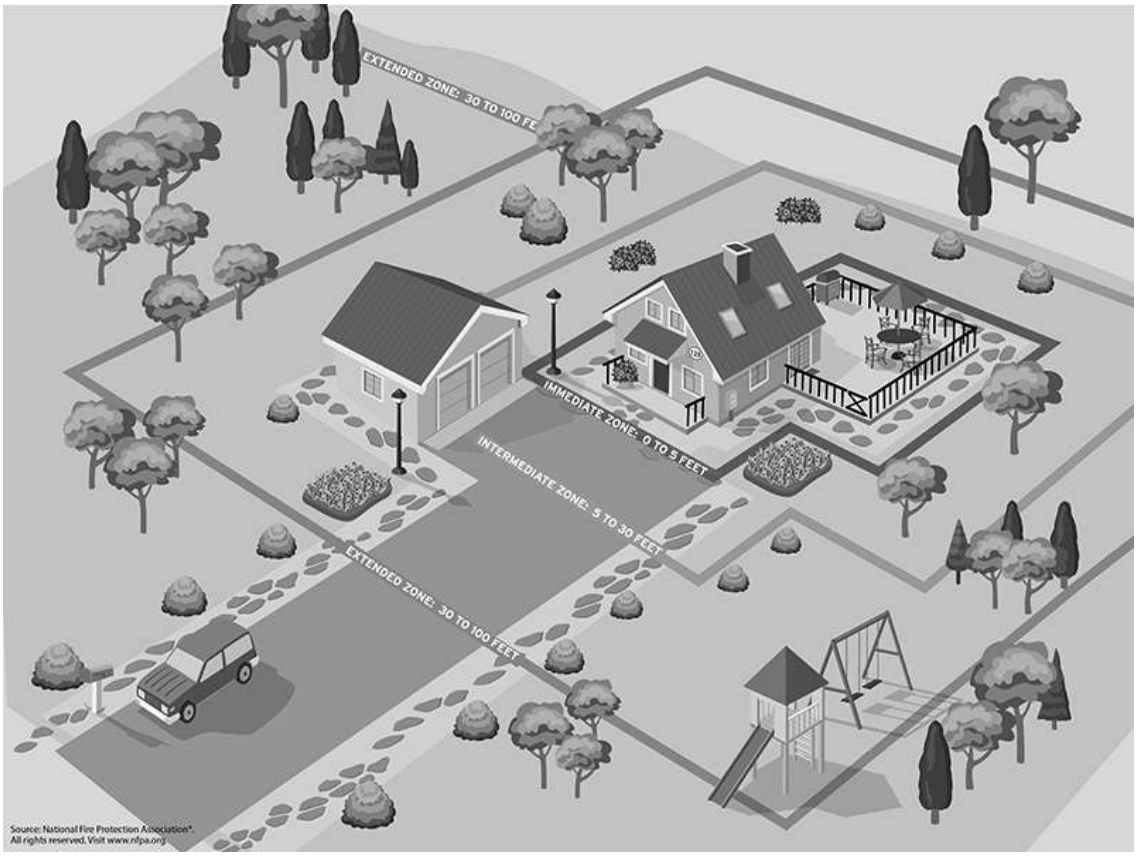
There are methods for homeowners to prepare their homes to withstand ember attacks and minimize the likelihood of flames or surface fire touching the home or any attachments. Experiments, models and post-fire studies have shown homes ignite due to the condition of the home and everything around it, up to 200' from the foundation. This is called the Home Ignition Zone (HIZ).

Learn more about how wildfires spread and ignite home in our online course Understanding the Wildfire Threat to Homes. An overview of fire history, fire basics, and how homes burn.

Download the How to Prepare Your Home From Wildfire Fact Sheet in English or Spanish.

What is the Home Ignition Zone?

The concept of the home ignition zone was developed by retired USDA Forest Service fire scientist Jack Cohen in the late 1990s, following some breakthrough experimental research into how homes ignite due to the effects of radiant heat. The HIZ is divided into three zones.



Immediate zone

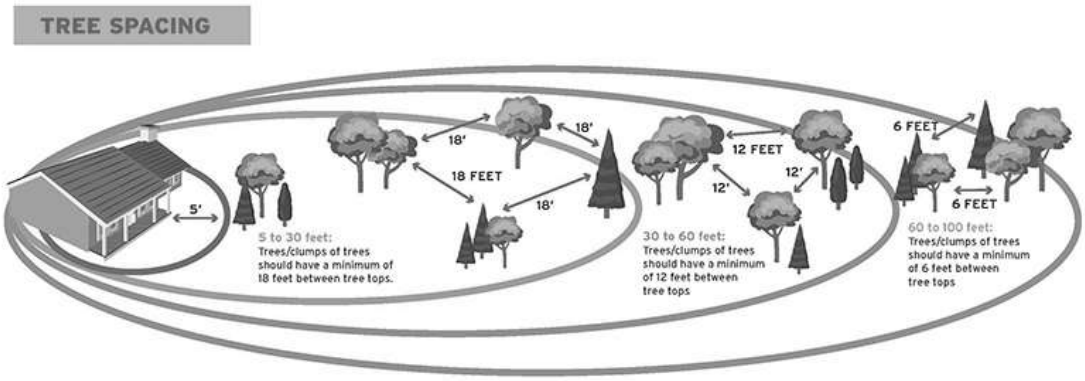
The home and the area 0-5' from the furthest attached exterior point of the home; defined as a non-combustible area. Science tells us this is the most important zone to take immediate action on as it is the most vulnerable to embers. START WITH THE HOUSE ITSELF then move into the landscaping section of the Immediate Zone.

- Clean roofs and gutters of dead leaves, debris and pine needles that could catch embers.
- Replace or repair any loose or missing shingles or roof tiles to prevent ember penetration.
- Reduce embers that could pass through vents in the eaves by installing 1/8 inch metal mesh screening.
- Clean debris from exterior attic vents and install 1/8 inch metal mesh screening to reduce embers.
- Repair or replace damaged or loose window screens and any broken windows Screen or box-in areas below patios and decks with wire mesh to prevent debris and combustible materials from accumulating.
- Move any flammable material away from wall exteriors – mulch, flammable plants, leaves and needles, firewood piles – anything that can burn. Remove anything stored underneath decks or porches.

Intermediate zone

5-30' from the furthest exterior point of the home. Landscaping/hardscaping- employing careful landscaping or creating breaks that can help influence and decrease fire behavior

- Clear vegetation from under large stationary propane tanks.
- Create fuel breaks with driveways, walkways/paths, patios, and decks.
- Keep lawns and native grasses mowed to a height of four inches.
- Remove ladder fuels (vegetation under trees) so a surface fire cannot reach the crowns. Prune trees up to six to ten feet from the ground; for shorter trees do not exceed 1/3 of the overall tree height.
- Space trees to have a minimum of eighteen feet between crowns with the distance increasing with the percentage of slope.
- Tree placement should be planned to ensure the mature canopy is no closer than ten feet to the edge of the structure.
- Tree and shrubs in this zone should be limited to small clusters of a few each to break up the continuity of the vegetation across the landscape.



Extended zone

30-100 feet, out to 200 feet. Landscaping – the goal here is not to eliminate fire but to interrupt fire's path and keep flames smaller and on the ground.

- Dispose of heavy accumulations of ground litter/debris.
- Remove dead plant and tree material.
- Remove small conifers growing between mature trees.
- Remove vegetation adjacent to storage sheds or other outbuildings within this area.
- Trees 30 to 60 feet from the home should have at least 12 feet between canopy tops.*
- Trees 60 to 100 feet from the home should have at least 6 feet between the canopy tops.*

**The distances listed for crown spacing are suggested based on NFPA 1144. However, the crown spacing needed to reduce/prevent crown fire potential could be significantly greater due to slope, the species of trees involved and other site specific conditions. Check with your local forestry professional to get advice on what is appropriate for your property.*

HOME IGNITION ZONE CHECKLIST

SIMPLE STEPS FROM ROOF TO FOUNDATION TO MAKE A HOME SAFER FROM EMBERS AND RADIANT HEAT

- [ ] Clean roofs and gutters of dead leaves, debris and pine needles that could catch embers
- [ ] Replace or repair any loose or missing shingles or roof tiles to prevent ember penetration
- [ ] Reduce embers that could pass through vents in the eaves by installing 1/8 inch metal mesh screening
- [ ] Clean debris from exterior attic vents and install 1/8 inch metal mesh screening to reduce embers
- [ ] Repair or replace damaged or loose window screens and any broken windows
- [ ] Screen or box-in areas below patios and decks with wire mesh to prevent debris and combustible materials from accumulating
- [ ] Move any flammable material away from wall exteriors – mulch, flammable plants, leaves and needles, firewood piles – anything that can burn
- [ ] Remove anything stored underneath decks or porches

VISIT FIREWISE.ORG FOR MORE DETAILS

Image by NFPA, with funding from USDA Forest Service

Questions? Contact the Firewise team.

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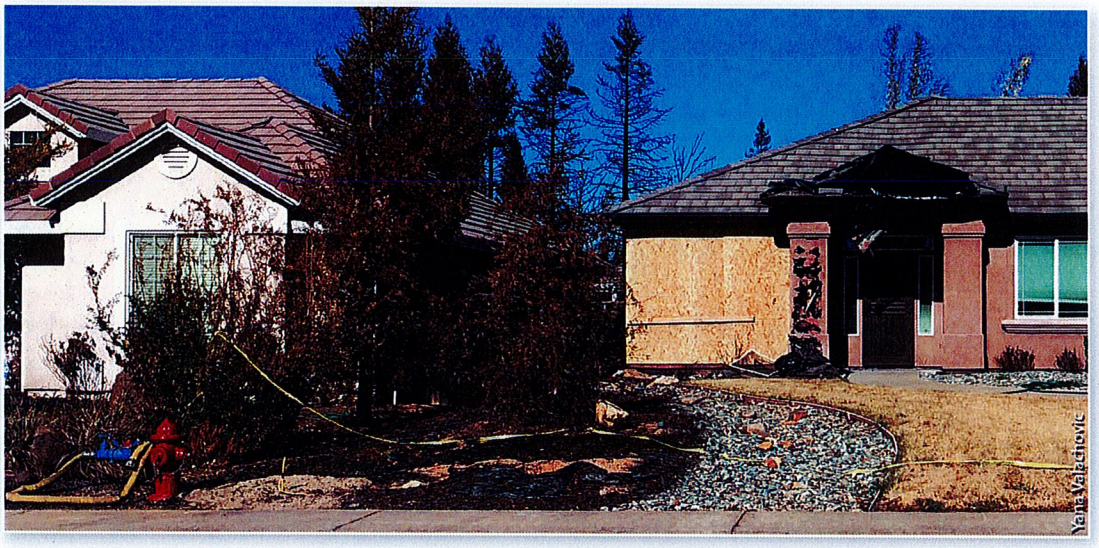

Reducing the Vulnerability of Buildings to Wildfire: Vegetation and Landscaping Guidance

Introduction

What can Californians do to improve the chances that their homes will survive a wildfire? The good news is that research demonstrates that a home's odds of surviving a wildfire can be substantially improved through careful attention to three principles: (1) thoughtful landscape design aimed at reducing and separating combustibles (vegetation, lawn furniture, and other landscape assets) within the defensible space on a property, (2) retrofitting homes to resist wildfire, and (3) implementing ongoing maintenance of the home and landscaping to reduce combustible materials (for example, leaves and needles) and to address the wear and tear that homes incur over time.

This publication acknowledges the importance of a coupled approach to improving the odds of home survival—an approach that encompasses the home as well as the vegetation and other combustible materials on the property. However, this publication focuses primarily on landscaping issues on a property; more detail about home hardening can be found in publications listed in the reference section (IBHS 2019; Quarles et al. 2010).

Preparing for wildfire does not have to be costly. The first step is to understand the three types of exposures that can threaten a home during a wildfire so that actions specific to the context of an individual's home and landscape can be prioritized.

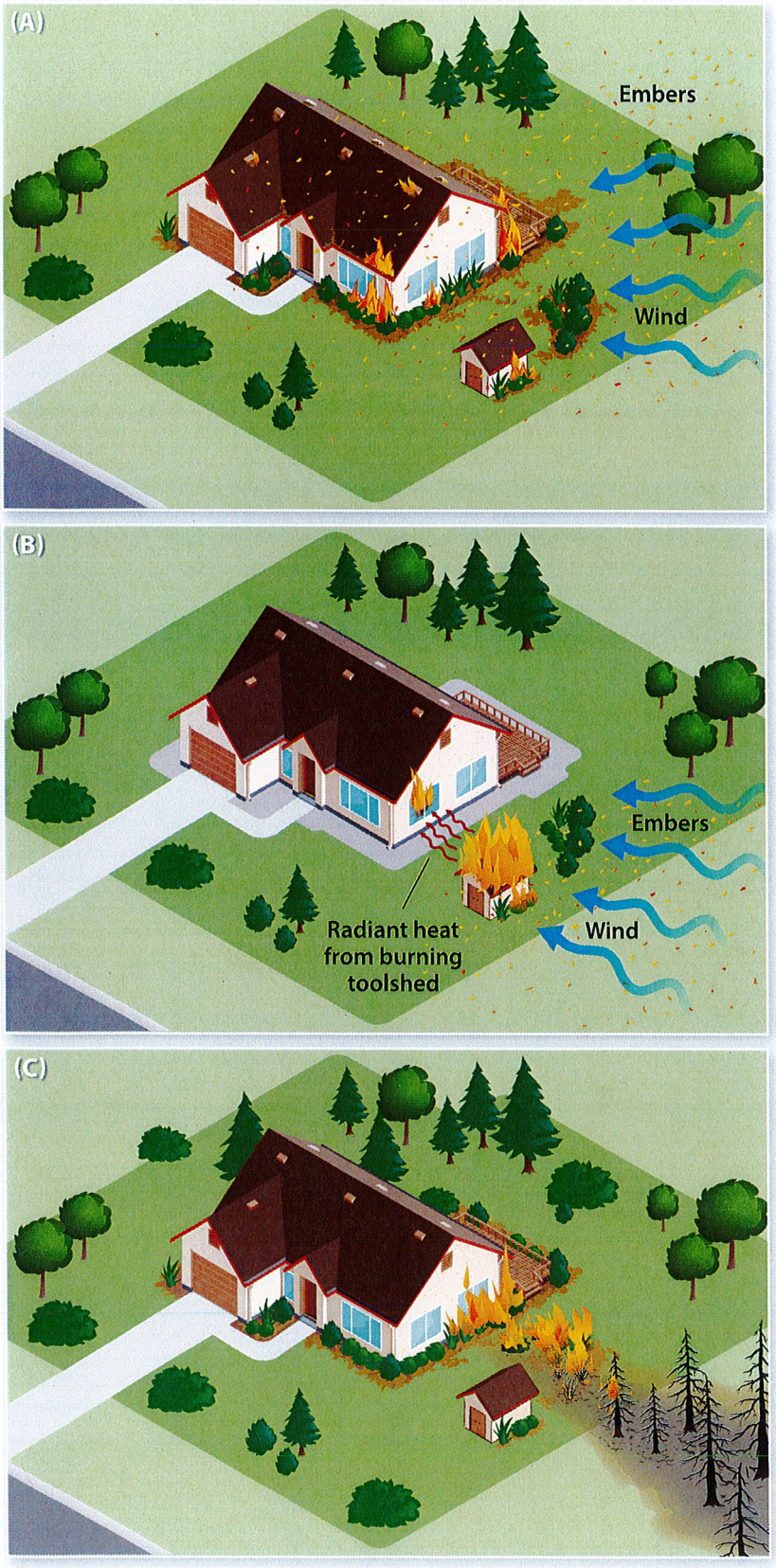

Figure 1. Incorporating fire safe concepts requires preparing for three different types of fire exposures—embers (A), radiant heat (B), and direct flame contact (C).

How buildings burn during a wildfire

Home loss during wildfire occurs when some part of the building ignites due to one or more of the three types of wildfire exposure: embers, radiant heat, and direct flame contact (fig. 1).

Embers

Wildland fires spread through a combination of a moving flame front and wind distribution of burning embers (also called firebrands). Embers are small pieces of vegetation or trees, or parts of buildings and other structures, that are light enough to be blown through the air. Embers rapidly spread wildfire when, blown ahead of the main body of the fire, they start new fires, known as spot fires. Embers have been reported to travel over a mile from the main fire front.

Embers can cause home and building ignitions by directly igniting materials on, in, or attached to the building. Additionally, embers can ignite vegetation or combustible materials near the building—which can result in flames touching the building or in a radiant heat exposure that can break window glass or directly ignite some portion of the building. Building ignitions caused by these types of extended exposures are referred to as indirect ember ignitions. It is important to understand that indirect ember ignitions ultimately cause the home or building to be exposed to radiant heat or direct flame contact.

Embers often often pile up on the roof of or around the corners of a house. Once embers land, they can ignite combustible mulch, plants, and other combustible materials (for example, vegetative debris, a woodpile, outdoor furniture, cushions, or storage sheds). Once combustible materials have ignited, fire can travel to or penetrate into the house. Mulch in a garden bed, for example, can easily ignite, with the fire burning to the home. Embers that accumulate on the roof or deck may also ignite these parts of the house and find a path to enter the home. Embers can also directly enter the home or attic through a vent or an unscreened, open window. When embers enter the home or attic, they can ignite combustible contents, causing the home to burn from the inside out. When this occurs, there is often

little damage to the surrounding vegetation, making it difficult to understand how the home ignited.

Radiant heat

When heat produced by burning materials is transferred through the air to heat a nearby surface, it is known as radiant heat. If the radiant exposure is hot enough or lasts long enough, exposed materials can ignite even without direct flame contact. A home can be exposed to radiant heat due to the burning of nearby buildings such as sheds, garages, or a neighbor's home, as well as vehicles, firewood piles, uncovered recycling bins, and surrounding vegetation. A good rule of thumb is to locate these larger combustible items as far as possible from a home (or other building of concern) to reduce the threat of radiant heat exposure. Another approach would be to modify, or harden, the home and other buildings of concern, but the most certain approach would be to address the near-home combustible items.

Direct flame contact

When fire burns directly to the house, what determines whether the house will ignite is the duration of direct flame contact and the combustibility of the building component that is exposed. Combustible siding, the underside of an attached deck, wood steps, and nontempered (annealed) glass are particularly vulnerable to direct flame contact exposures.

It is important to take actions that minimize the chances of flame touching the home. Once flames reach the home, combustible siding can ignite, as can decks and combustible materials in the under-eave area, and window glass can break, increasing the likelihood that the home will be destroyed or will experience major damage. For homes with decks and siding made of wood or wood-based products, or other combustible products, it is critical to create and maintain an effective defensible space that minimizes the chance that combustibles close to the home will ignite.

What you can do

The odds of home survival increase when a coupled approach, which encompasses the home as well as the maintenance of the vegetation and other combustible materials on the property, is implemented. Such an approach combines

- careful selection, placement, and maintenance of landscaping vegetation and application of a three-zone defensible space strategy
- awareness and management of other combustible materials on the property (for example, leaf litter or outside furniture and furniture cushions)
- incorporation of fire- and ember-resistant construction materials, with particular attention given to installation details and maintenance

Defensible space zones: What to implement

Defensible space is a term used to describe actions to take in zones around a home that involve the careful selection, location, and maintenance of vegetation and other combustible materials on a property. The goal of defensible space is to

- eliminate pathways for a wildfire to burn directly to the home
- reduce radiant heat exposures
- reduce the potential for embers to ignite vegetation and other combustible materials adjacent to the home
- provide a safe place for fire personnel to defend the home and allow safe routes for evacuation

Implementing an effective defensible space strategy requires awareness that overgrown, dense, or unmaintained vegetation creates significant vulnerabilities (fig. 2)—and that it can enable fire to burn to the home through several fire-spread scenarios, including ember ignition of vegetative debris on the ground and ember ignition of vegetative debris on roofs. Ignition of outbuildings can also occur due to ember ignition of nearby combustibles. These fire-spread scenarios can also result in radiant heat

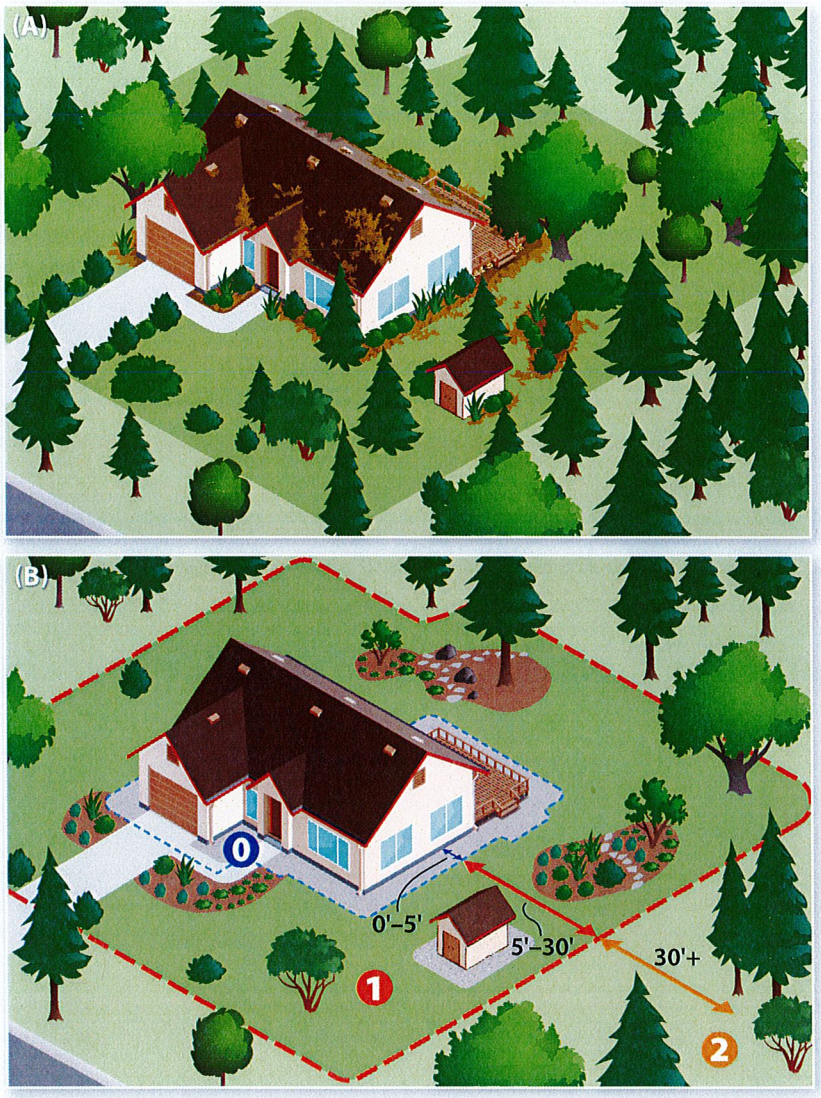

Figure 2. Before (A) and after (B) implementation of the three-zone defensible space strategy. While this figure shows a forested setting, the same concepts apply to other vegetation types or more residential settings.

or flame contact exposures to the home. Additional fuel reduction strategies, such as reducing vegetation along access routes or limbing trees to allow for easier passage of fire equipment, should be implemented to create safe routes for evacuation.

Zone Zero: Ember-resistant zone (0–5 ft from home)

Zone Zero (see fig. 2) is the area within 5 feet of the house and any outbuildings, as well as the area under the footprint of all attached decks and stair landings. For some, removing combustibles in Zone Zero may be a radical change, but both postfire assessments and research (Hedayati et al. 2018) have demonstrated the importance of this area in reducing the threat from wildfire-caused exposures. The most critical part of an effective defensible space strategy includes Zone Zero because eliminating combustible materials and vegetation in this region reduces the potential for direct flame contact and elevated radiant heat exposures that would result from near-building ember ignitions. Because embers can accumulate at the base of an exterior wall, it is essential that Zone Zero features be coupled with a 6-inch noncombustible zone between the ground and the start of the building's exterior siding.

What can be kept

In this zone, removing combustible plants, planter boxes, combustible mulches, wood piles, and wooden fences is highly recommended. In some cases, this may mean placing walkways closer to the home and placing garden beds 5 feet or more from the home. Zone Zero is an excellent location for walkways or hardscaping with pavers, rock mulch, or pea gravel. In some cases, it may not be possible to remove all vegetation. In such situations, develop and maintain

- a well-maintained and irrigated lawn (for example, mowed dry grass less than 1 inch in height would be an acceptable alternative)
- sparsely planted, widely separated, low-growing, nonwoody, herbaceous plants without surrounding combustible mulch

In addition, some low-growing ground cover (such as Fragaria, Ajuga, Alyssum, succulents, moss, and so on) may be acceptable alternatives. Keep in mind that a decision to keep vegetation in this zone creates several challenges because the plants shed dead foliage and may develop a dead thatch layer. In addition, their presence may serve as a net that accumulates dead leaves and debris blown in the wind, which can collect at the base of the building's exterior walls and can be difficult to remove. As a rule of thumb, the more vegetation present in Zone Zero, the more likely the horizontal and vertical protection functions of the zone will be compromised, resulting in ignition of this vegetation and flames that can impinge on the building's siding.

Actions to take in Zone Zero

Creating Zone Zero requires removing combustibles near the home and under attached decks, as well as developing a maintenance program to rake, sweep, or dispose of leaves and other debris that accumulate throughout the year. Suggested actions include

- removal of accumulated leaves or needles
- removal of combustible mulches
- removal of woody vegetation of any type, including foundation plantings and climbing plants
- relocation of planters made from combustible materials or that contain woody plants
- relocation of all stored firewood, lumber, storage containers, and propane tanks
- removal of tree limbs overhanging the building (these limbs will lead to greater accumulation of vegetative debris on and near the home)
- replacement of wooden gates and arbors that attach to the house (replace with metal or other noncombustible alternatives)
- replacement of natural fiber doormats, or locating them inside when a wildfire threatens
- relocation of plastic garbage and recycling containers when fire threatens; alternatively, storing them in a noncombustible enclosure—for example, a metal structure or one clad with a fiber cement product

Firewood, lumber, storage containers, and propane tanks should be placed more than 30 feet from the home. If a neighboring property lies closer than 30 feet away, move these items as far away as possible. Firewood can be stored in a noncombustible enclosure. Larger propane tanks can also be enclosed, or undergrounded.

When wildfire threatens, and if there is sufficient time, take a series of steps in Zone Zero before evacuating. These actions include moving combustible cushions and natural-fiber doormats inside and relocating wicker furniture away from the house. Also, propane tanks for gas grills located on patios or decks should be moved as far from the home as possible. Propane tanks' valves should be turned off and the tanks should be left standing up so that, if they vent, they vent upward. If no suitable outside location for a tank exists, it should be moved indoors. In addition, close all windows, pet doors, and operable skylights.

Zone One: The lean, clean, and green zone (5–30 ft from home)

Zone One adds a defensible zone that extends outward from Zone Zero to 30 feet from the house. In this area, the goal is to reduce the connectivity between garden beds, shrubs, and trees so that if a wildfire enters this zone, the vegetation will not burn to the house or into the crowns of trees. If fire personnel are available, Zone One can also provide a safe place where they can work to defend the home.

What can be kept

Short-statured trees, irrigated lawns, and garden beds, along with other landscaping elements—which provide shade and beauty for a home—are appropriate in Zone One. From a fire-prevention perspective, the goal in this zone is to reduce the connectivity between islands of vegetation by increasing spacing between trees, by removing lower branches of trees and shrubs to reduce ladder fuels, and by creating areas of irrigated and mowed grass or hardscape between lush vegetation islands. Key strategies include

- maintaining the moisture content in the vegetation located in this zone by selecting plants that retain moisture and use water efficiently
- pruning and thinning plants to reduce fuel densities
- creating separation between plantings, trees, and the home to achieve fuel and vegetation discontinuity

Actions to take in Zone One

Working outward from the house, continue to manage accumulations of leaves and other vegetative debris, limb and prune trees, and mow or trim grass to reduce pathways along which fire can reach the house. Key concepts include

- removing all dead and dying grasses, weeds, shrubs, plants, and trees
- disposing of all fallen leaves, needles, twigs, bark, cones, and small branches surrounding the vegetation

- incorporating organic soil amendments to increase water holding capacity before planting and using noncombustible rock mulches and avoiding shredded bark mulch (gorilla hair)
- allowing space between shrubs measuring at least two times the height of mature plants, increasing spacing on steeper slopes (fig. 3)
- trimming tall trees to remove limbs from 6 feet to 10 feet off the ground (see fig. 2); for younger and smaller trees, limbing lower branches over time but maintaining at least two-thirds of the total height in foliage (that is, only removing branches in the lower one-third of the tree)
- removing branches that overhang the roof of the home or come within 10 feet of chimneys; overhanging tree limbs lead to greater accumulation of vegetative debris on and near the home

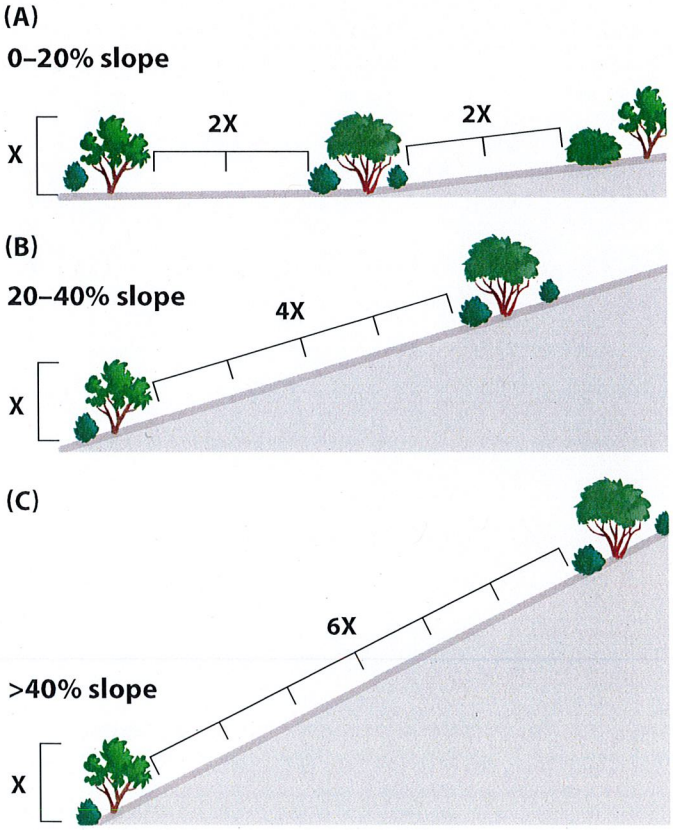

Figure 3. Distance between islands of vegetation increases as slope increases—in the figure, from 0 to 20% (A), 20 to 40% (B), and greater than 40% (C). The distance between islands will also vary with the height of the tallest plant in each island grouping. Spacing distance, shown as "X," is a function of the slope and the height of the vegetation.

- moving firewood and lumber out of Zone One—or storing in a noncombustible enclosure
- removing combustibles from around and under detached decks and overhead structures (pergolas, gazebos, and arbors, for example); avoiding incorporation of climbing vegetation on these structures
- reducing ignition sources for wooden structures by removing vegetation and other combustibles around and at the bases of wooden fences, outdoor furniture, and sheds and other outbuildings
- if Zone One extends into a neighbor's yard, coordinating actions with the neighbor to enhance the value of your collective efforts

Zone Two: The extended, or reduced-fuel, zone (30–100 ft from home)

Zone Two extends from 30 feet to at least 100 feet from the home (or more, if manageable). This zone may need to be extended when the home is located on a steep slope. In this zone, the goal is to reduce the flame heights of an approaching wildfire or spot fire. Due to modifications of tree or shrub spacing and reductions in the connectivity between tree limbs and shrubs, a fire burning under moderate conditions may drop out of the tree or shrub canopy to the ground. Also, if fire personnel are available, they may find a safe place to defend the home. These actions will increase the effectiveness of Zone One efforts.

What can be kept

In this zone, the goal is to moderate potential fire behavior by reducing the density of trees, shrubs, and herbaceous plants or grasses to slow fire spread and reduce flame height. Vegetation does not need to be eliminated, but should be managed.

Actions to take in Zone Two

In this zone, focus on managing the space between tree and shrub canopies to create islands of vegetation. Prune lower branches or remove understory shrubs to eliminate the risk of fuel ladders. Key strategies include

- thinning trees so the branches that extend between trees, or groupings of trees, are separated by at least 10 feet; removing dead

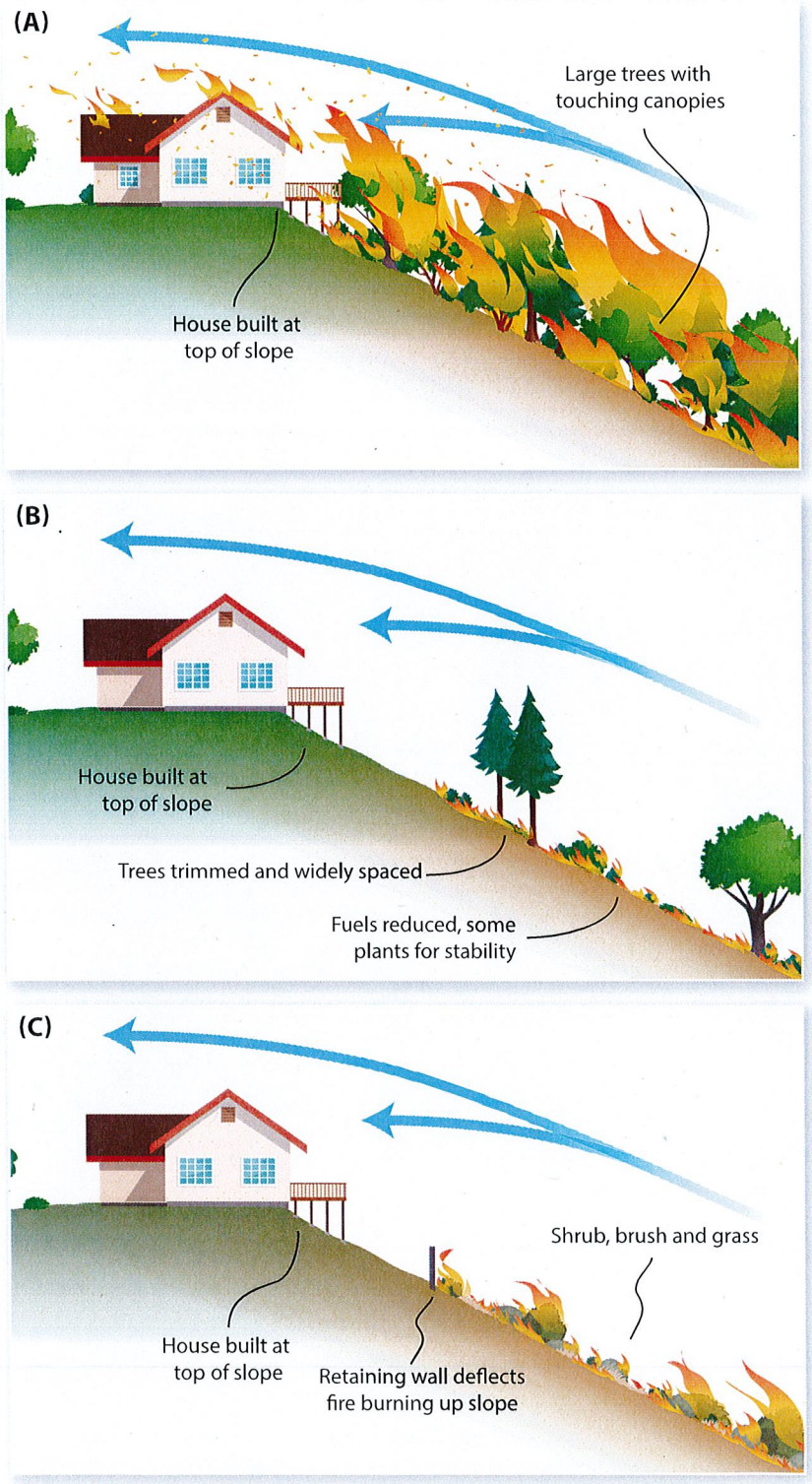

Figure 4. When an attached deck overhangs a slope, take additional precautions to reduce the chance that flames from burning vegetation can impinge on the underside of the deck (A). When downslope vegetation is composed of trees (B), thinning, limbing, and removing ladder fuels are recommended because flame heights from trees can easily exceed the height of a noncombustible wall. When downslope vegetation is low-growing (that is, shrubs, brush, and grass), clearance can be supplemented with the addition of a noncombustible wall (C).

or dying trees and branches; planning for the growth of retained trees

- for taller trees, limbing the lower branches up to a height of at least 10 feet to reduce connectivity between fuels on the ground and the tree canopies
- mowing grasses to a maximum height of 4 inches
- disposing of fallen leaves, needles, twigs, bark, cones, and small branches
- removing all piles of dead vegetation
- storing exposed woodpiles on bare mineral soil or other noncombustible surfaces, such as rock or concrete, and providing as much separation as possible from other combustibles (for example, 5–10 feet); covering woodpiles with a tarp treated with fire retardant or enclosing them in a noncombustible structure (to avoid accumulation of vegetative debris inside woodpiles, which is easily ignited by embers)
- if Zone Two extends into a neighbor's yard, working with neighboring property owners so that the actions of each owner provide mutual benefits

Steep slopes

If a home is located on a steeper slope (see fig. 3), in a drainage, in a windy area, or in an area surrounded by unusually dense, tall vegetation, the need for thinning increases. Additionally, if the home's surroundings include a vegetation type that is especially prone to ignition, or if the area has an active fire history, greater clearance and separation between plants and plant groupings will be needed. How much space is needed between trees, shrubs, or groupings is a function of slope (see fig. 3). If a home is at the top of a slope, keep in mind that fire and heat rise, allowing for preheating of upslope fuels, which results in the potential for more intense fire behavior (fig. 4). In these cases, greater effort should be directed toward the area downhill or upwind from the home. When an attached deck overhangs the slope, higher levels of fuel treatment should be used to minimize the chance that flames will contact the underside of the deck (see fig. 4). For shrub, brush, and grass vegetation types, installing a noncombustible retaining wall downslope

from the deck could reduce the threat of a fire burning upslope (see fig. 4).

Space limitations

If your property doesn't extend 100 feet or more around your house, prioritize the actions recommended for Zones Zero and One (fig. 5). After completing these actions, work with neighbors so that each side supports the other's efforts. Additional resources may be available from CAL FIRE or your local fire department, Fire Safe Council, or Firewise Community.

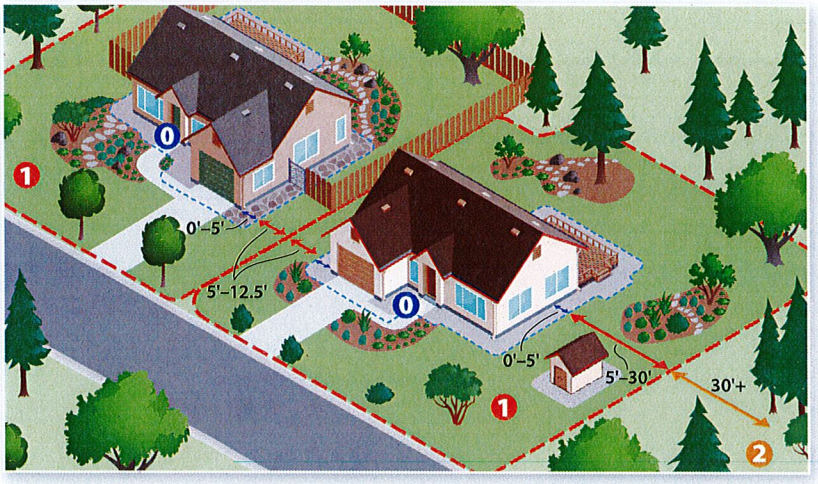

Figure 5. When spacing between homes is less than 30 feet, home-to-home fire spread is likely. By working together, neighbors can minimize the chance of individual home ignitions and can increase the impact and reach of each other's defensible space efforts. A critical step is neighborhood development and maintenance of effective defensible space, including Zones Zero and One. Incorporation of a metal gate, as shown outside the house on the left, is part of an effective Zone Zero.

Figure 6. Before (A) and after (B) a fuel reduction treatment in which smaller trees are thinned and lower limbs are pruned from larger trees.

Defense of larger properties

As property size increases, so do the opportunities for strategic fuel treatments (fig. 6). Along any road system it is good practice to thin and prune trees, mow grass, and cut back shrubs to allow for safe emergency access and evacuation from the property. Strategic fuel breaks may be an option, especially along ridgelines or other critical control points that the local fire department can help identify. Ladder fuel reduction on a broad scale will be beneficial for tree survival during wildfires. Water storage and installation of easily accessible pipe fittings for fire personnel are also recommended.

"Fire safe" plants and landscaping

Is there such as thing as a "fire safe" plant? While some plants are marketed and described as "fire safe" or "fire resistant," all plants will burn under the right conditions, regardless of their classification. A plant's environment and maintenance generally have more influence on the combustibility of the plant than does its characterization as fire safe or not fire safe. For example, a plant with a good water supply could have a greater growth form (that is, grow taller and wider) and hold leaves longer, whereas a plant in a stressed or drought condition may have stunted growth and accumulate dead materials. Therefore, a certain species may be relatively fire resistant in one environment and less so in another. Some plants, such as lavender, may initially have lush supple growth—but several years later, the growth may be woody and choked with dead materials. Other plants, under a green surface, may develop a highly combustible dead thatch layer.

Plant lists

Be cautious about "fire safe" plant lists and labels. In general, there is little evidence to support fire safe claims. In a recent review of 20 years of plant flammability studies, Bethke et al. (2016) determined that fire safe labels often relied on inconsistent types of testing or no testing at all—in part because, according to

the researchers, "no consistent, standardized plant flammability testing or criteria for rating" exists to assess flammability. Furthermore, across regions and climate areas, the researchers found that labels confused common and species names, relied on problematic definitions, and gave inconsistent recommendations for plant care.

Plant characteristics and basic properties

Given these difficulties in ratings and labels, what can be done? When selecting plants, apply an ignition-resistant framework to the decision-making process by asking a few key questions.

Are the plant's leaves high in moisture, and therefore less likely to ignite? The leaves of plants that grow in vegetable gardens, for example, are high in moisture.

Does the plant contain a lot of waxes, oils, and resins? The leaves of waxy and oily plants have a protective shine or film that will likely be more flammable and release more energy when they burn. Resinous plants include many conifers.

Does the plant have an open-growth structure (fig. 7)? A more densely structured plant, like a juniper or cypress, can capture embers and may be more likely to ignite, especially if the densely structured areas of the plant consist of dead and fine fuels. A densely structured plant is also more likely to readily ignite from a surface fire.

Does the plant accumulate dead branches, needles, or leaves? A plant with a big leaf or needle drop creates a greater need for cleanup around the property, on the roof, and in rain gutters.

Does the plant shed bark? A plant that sheds bark or branches is likely to need more regular cleanup to reduce fuel accumulations on the ground.

How fast does the plant grow? How tall will the plant grow? A plant that grows quickly may exceed growth expectations and require greater maintenance.

Native plants and pollinator-friendly or drought-tolerant plants can be good choices for people who value these plant characteristics, but such features don't directly translate to fire resistance.

Plant placement and maintenance

Where plants are placed and how they are maintained are more important than the type of plant selected. When vegetation touches the siding located in front of windows, under eaves and vents, or under or near a deck, the likelihood increases that a home will be ignited and destroyed during a wildfire. Incorporating

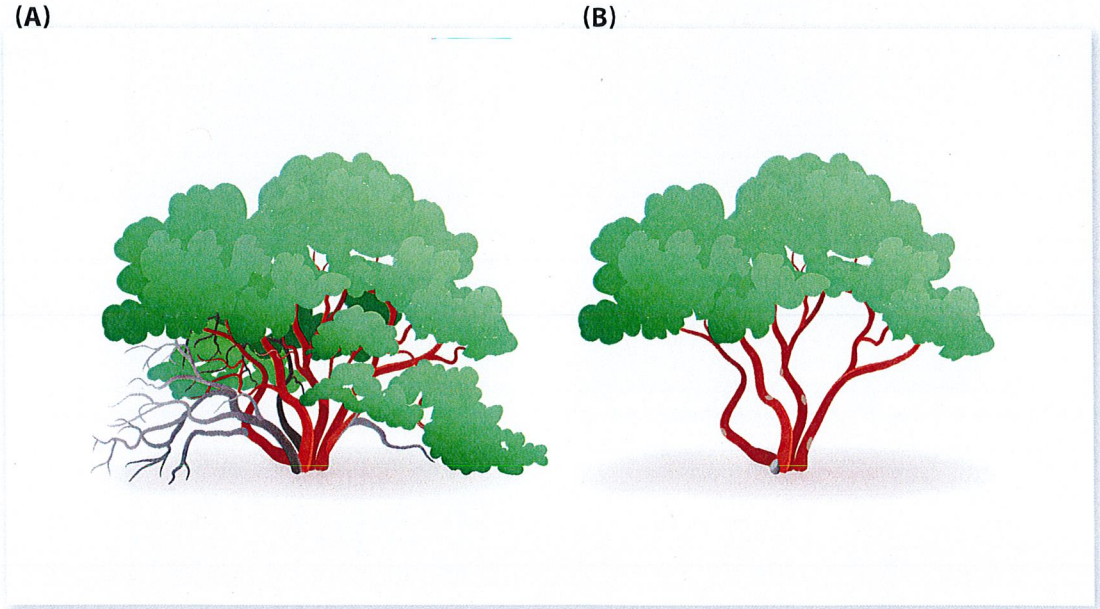

Figure 7. Over time, a dense manzanita bush can become a plant with lots of dead branches (A). With regular pruning, it is possible to create a more open-growth structure that eliminates ladder fuels, resulting in a plant that is less susceptible to wildfire (B).

Zone Zero practices, whereby combustible vegetation and other combustible materials are minimized or eliminated in the area immediately adjacent to the home, reduces the potential that near-home ember ignitions will result in flame contact exposures to the house. Following Zone One recommendations—which include separation of landscaping into islands of vegetation, resulting in fuel discontinuity—can minimize the chances of direct flame and radiant heat exposures to the home and increase the odds of home survival.

From a fire-resilience perspective, essential vegetation management involves good water management practices, appropriate fertilization, and regular plant pruning and cleanup (fig. 8). With regular watering, plant health increases, and plants that are green and lush (or nonwoody) are more resistant to ignition. Drip irrigation and mulching can be beneficial for water conservation (Downer and Faber 2019). Unfortunately, combustible mulches near the home create an additional fire risk (Quarles and Smith 2008). In Zone Zero, eliminate combustible mulches; in Zone One, recognize that combustible mulch can burn or smolder. Rock mulches are noncombustible and are a better choice for Zone Zero. As such, it may be a better alternative when working near the perimeter of Zone Zero.

As plants age, overhead branches receive the majority of the light and older branches are shed. To decrease the potential that fire will climb from the ground into the upper portion of the plant, remove lower branches and prune to create a more open structure. Clean up dead leaves, branches, and flower heads on the ground. Monitor plant height and prune to reduce continuity to taller vegetation.

Other considerations

Additional elements are important to evaluate in a landscaped yard. Do the trees on the property provide protection from the sun, or do they contribute to increased fire risk? What about other wooden structures that support climbing vines or provide shade?

Shade trees

Trees have many beneficial qualities, including their ability to absorb solar radiation and provide shade. Unfortunately, a tree that overhangs a home can cause physical damage to the house when branches rub on the roof or walls. More importantly, from a fire perspective, leaf and needle drop result in the accumulation of debris on the roof and decks, in gutters, and on the surrounding landscape. For this reason, remove trees or branches that overhang any roof or deck. A healthy and lush green tree canopy itself is not necessarily receptive to

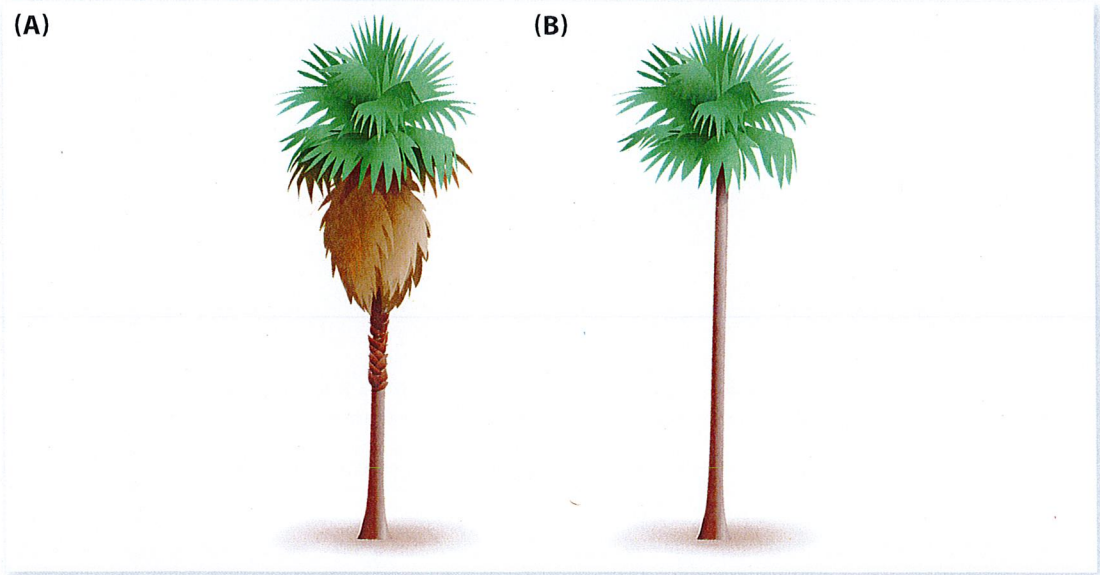

Figure 8. Vegetation maintenance is critical to reducing ember receptivity and continuity of fuels from the ground to the crown. When working with a poorly maintained palm (A), prune dead fronds until the branches grow in a horizontal position (B). Be careful not to overprune and stress the plant.

embers or immediately flammable. To maintain the benefits of a shade tree while simultaneously increasing fire safety, remove trees in Zone Zero and favor the retention of trees in Zone One—as long as the lower limbs are pruned and vegetation, vines, and other dead fuels that could allow fire to move from the ground to the upper portion of the tree (that is, the tree crown) are eliminated. If a tree in a Zone One location is diseased or showing signs of decline, consider removal and replacement. If trees in Zone Zero cannot be removed, it is important to understand the ongoing maintenance needed to remove leaves and debris from gutters, decks, skylights, and other vulnerable locations. Even with regular maintenance, the wind associated with an approaching wildfire will bring more debris down upon the house at the same time as distributing embers.

Trellises and arbors

Generally, decorative structures that support climbing vegetation are made of wood products and are therefore ignitable. If a home has an attached trellis, it is recommended that the structure and the vegetation be removed to implement the standards of Zone Zero. If the structure is farther from the home, work to reduce fuel continuity by removing combustible grasses, mulch, and leaf material that may accumulate at the base of the structure and provide continuity to other combustible vegetation. Keep in mind that the structure is likely to ignite during a wildfire, so the goal is to make sure that, if structure ignition does occur, it does not connect directly to other vegetation or the home.

Conclusions

Wildfire will always be a part of the California landscape. The challenge is to design and maintain homes and adjacent property in ways that reduce their vulnerability to wildfire. A key component of such protection is the proper placement and maintenance of plants on the property and around the home. Many people seek plants whose labels assure some level of fire resistance, but it is important to recognize that any plant will burn under the right conditions and regular plant maintenance is therefore critical. To reduce a home's exposure—whether from embers, radiant heat, or direct flame contact—develop and implement a three-zone strategy whereby the highest priorities and most restrictive measures are incorporated in the area closest to the home or other building of interest. Incorporating these strategies requires adjusting the ways of the past, but with a change in approach it is possible to have both a beautiful landscape and a home that is more resilient to wildfire.

Acknowledgements

This publication is a revision of the 2007 version of UC ANR 8228 publication titled "Home Landscaping for Fire." We thank three reviewers who helped us substantially improve the manuscript.

Figure 6 appears courtesy of Humboldt County Fire Safe Council.

References

Bethke, J. A., C. E. Bell, J. G. Gonzales, L. L. Lima, A. J. Long, and C. J. MacDonald. 2016. Research literature review of plant flammability testing, fire-resistant plant lists and relevance of a plant flammability key for ornamental landscape plants in the Western states. San Diego: UC Cooperative Extension. https://ucanr.edu/sites/SaratogaHort/files/235710.pdf

Downer, J., and B. Faber. 2019. Mulches for landscapes. Davis: UC Agriculture and Natural Resources Publication 8672. https://anrcatalog.ucanr.edu/pdf/8672.pdf

Hedayati, F., C. Stansell, D. Gorham, and S. L. Quarles. 2018. Wildfire research: Near-building noncombustible zone. Richburg, South Carolina: Insurance Institute for Business & Home Safety. https://ibhs.org/wildfire/near-building-noncombustible-zone/

(IBHS) Insurance Institute for Business & Home Safety. 2019. Protect your property from wildfire: California edition. https://disastersafety.org/wp-content/uploads/2019/03/Wildfire-Retrofit-Guide-California_IBHS.pdf

Quarles, S., and Smith E. 2008. The combustibility of landscape mulches. Reno: University of Nevada Cooperative Extension. https://naes.agnt.unr.edu/PMS/Pubs/1510_2011_95.pdf?utm_source=publications&utm_medium=pub-download&utm_campaign=pub-link-clicks&utm_content=2982

Quarles, S. L., Y. Valachovic, G. M. Nakamura, G. A. Nader, and M. J. De Lasaux. 2010. Home survival in wildfire-prone areas: Building materials and design considerations. University of California Agriculture and Natural Resources Publication 8393. https://anrcatalog.ucanr.edu/pdf/8393.pdf

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Zone 0 Update

Note: Click “View” at top left and select slideshow to view these slides properly

Travis Longcore | June 13, 2025

So what does the science say about zone zero?

- I compiled all published post-fire studies for southern California
- Focused on investigations of 0–5 feet where these regulations will apply

2014

International Journal of Wildland Fire **2014**, *23*, 1165–1175
http://dx.doi.org/10.1071/WF13158

The role of defensible space for residential structure protection during wildfires

Alexandra D. Syphard[A,D], *Teresa J. Brennan*[B] *and Jon E. Keeley*[B,C]

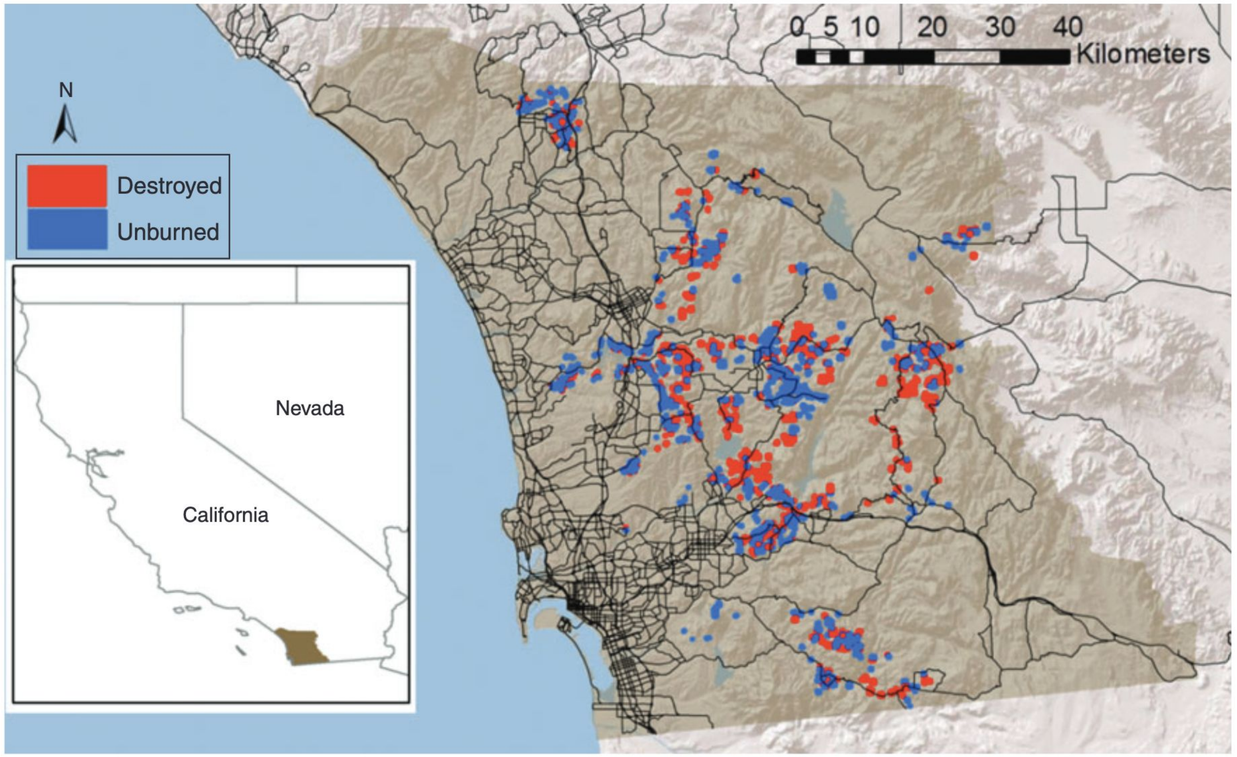

Fig. 1. Location of destroyed and unburned structures within the South Coast ecoregion of San Diego County, California, USA.

Table 5. Results of multiple regression models of destroyed homes using all possible variable combinations and corrected Akaike's Information Criterion (AICc)

Includes variables measured beyond property boundary. Top-ranked models include all those ($n = 6$) with AICc within 2 of the model with the lowest AICc. Relative variable importance is the sum of 'Akaike weights' over all models including the explanatory variable

Variable in order of importance	Relative variable importance	Model-averaged coefficient	Number inclusions in top-ranked models
Housing density	1	−0.003	6
Distance to major road	1	−0.0005	6
Total distance defensible sp			
Percentage clearance			
Vegetation overhang roof			
Slope			
Fuel type			
South-westness			
Distance to minor road			
Neighbours' vegetation			
Vegetation touch structure			
D^2 of top-ranked model			

However, as with defensible space, percentage clearance did not need to be draconian to be effective. Even on steep slopes, the effective percentage clearance needed on the property was <40%, with no significant advantage beyond that. Although these steep-slope structures benefited more from clearance, they tended to have less clearance than the effective amount, which may

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among trees and shrubs. Although we could not identify the vertical profile of fuels through Google Earth imagery, the fact that at least 60% of the horizontal woody vegetative cover can remain on the property with significant protective effects demonstrates the importance of distinguishing defensible space from complete vegetation removal. Thus, we suggest the term 'clearance' be replaced with 'fuel treatment' as a better way of communicating fire hazard reduction needs to home owners.

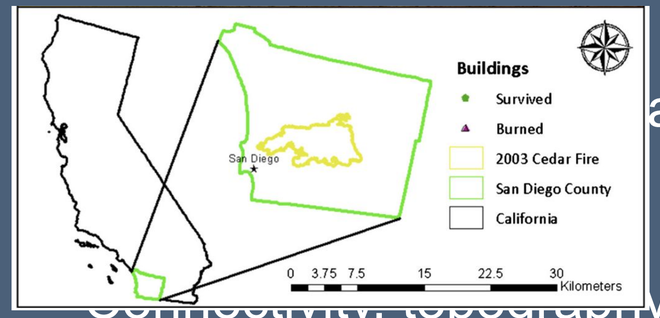
2016

Landscape Ecol (2016) 31:415–430
DOI 10.1007/s10980-015-0257-6

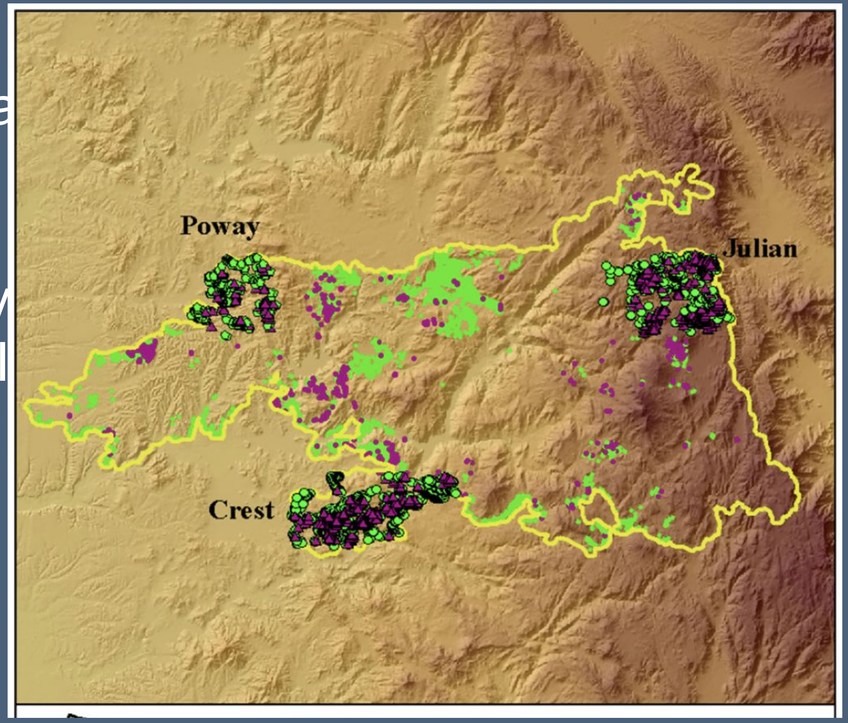
RESEARCH ARTICLE

The relative impacts of vegetation, topography and spatial arrangement on building loss to wildfires in case studies of California and Colorado

Patricia M. Alexandre · Susan I. Stewart · Miranda H. Mockrin · Nicholas S. Keuler · Alexandra D. Syphard · Avi Bar-Massada · Murray K. Clayton · Volker C. Radeloff



connectivity, topography
far more important than l
structure loss



2017

International Journal of Disaster Risk Reduction 21 (2017) 140–147

Contents lists available at ScienceDirect

International Journal of Disaster Risk Reduction

journal homepage: www.elsevier.com/locate/ijdrr

The importance of building construction materials relative to other factors affecting structure survival during wildfire

Alexandra D. Syphard[a,*], Teresa J. Brennan[b], Jon E. Keeley[b,c]

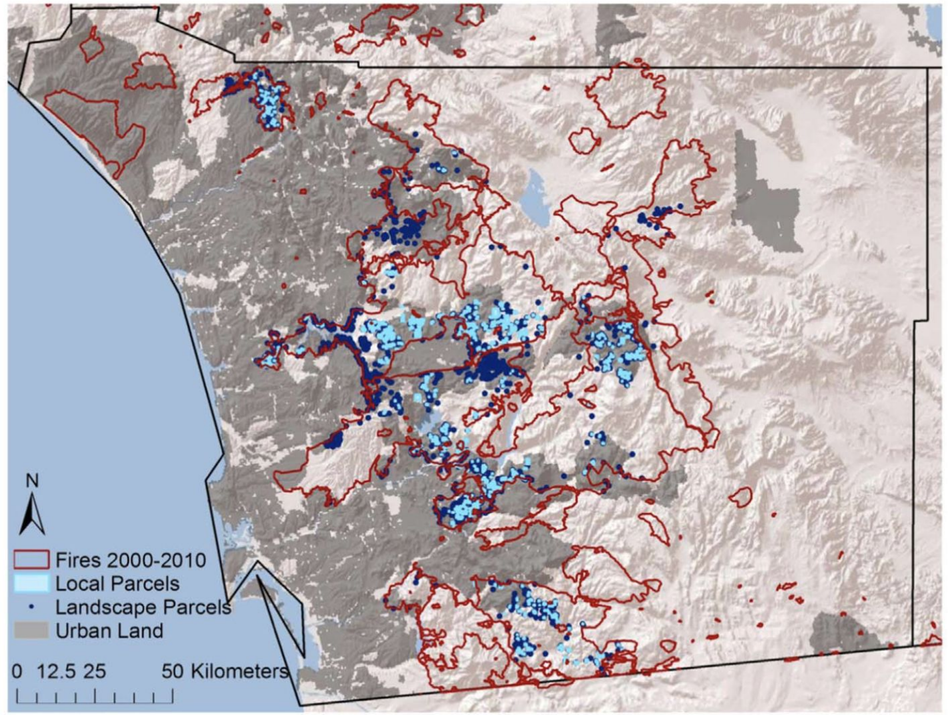


Fig. 1. Study area showing fire perimeters between 2000–2010 and the location of parcels analyzed at the local and landscape scales.

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2021

Factors leading to structure loss on the Thomas Fire

Uribe, Rodolfo

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Figure 16 Buffer zones of increasing size (0 - 1.5 m, 1.5 m – 9 m and 9- 30 m) around houses included in the analysis.

2023

Journal of Environmental Management 347 (2023) 118960

Contents lists available at ScienceDirect

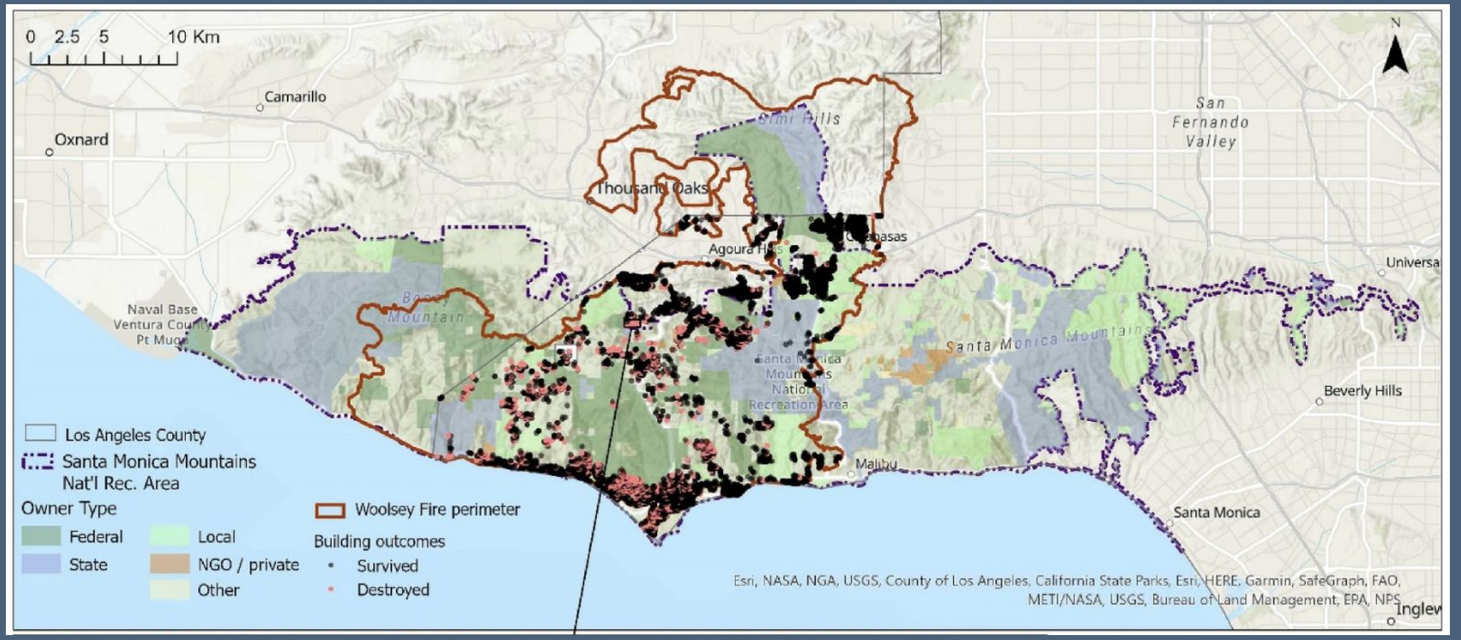
Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

Using high-resolution land cover data to assess structure loss in the 2018 Woolsey Fire in Southern California

Miranda H. Mockrin [a,*], Dexter H. Locke [a], Alexandra D. Syphard [b], Jarlath O'Neil-Dunne [c]



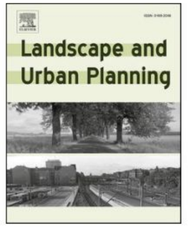
2025

Landscape and Urban Planning 262 (2025) 105421

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan



Exploring urban vegetation type and defensible space's role in building loss during wildfire-driven events in California

Francisco J. Escobedo [a,*], Kamini Yadav [a], Onofrio Cappelluti [b], Nels Johnson [c]

[a] USDA Forest Service, Pacific Southwest Research Station, Riverside, CA USA
[b] Department of Soil, Plant and Food Sciences, University of Bari Aldo Moro, Italy
[c] USDA Forest Service, Pacific Southwest Research Station, Vallejo, CA USA

densities in predicting building loss across many DSBs further adds to this understanding. We also document how tree, shrub, and herbaceous moisture in yards are better predictors of building loss – or survival – than just percent vegetation cover alone. Indeed according to our urban chaparral model, homes with nearby trees with higher NDWI moisture content were more likely to survive. This influential role of high moisture tree cover – relative to other factors- in home survival has rarely been documented. Such information can have implications for designing insurance regulations and vegetation ordinances, as well as urban plant selection, design, irrigation, and landscaping practices.

2021

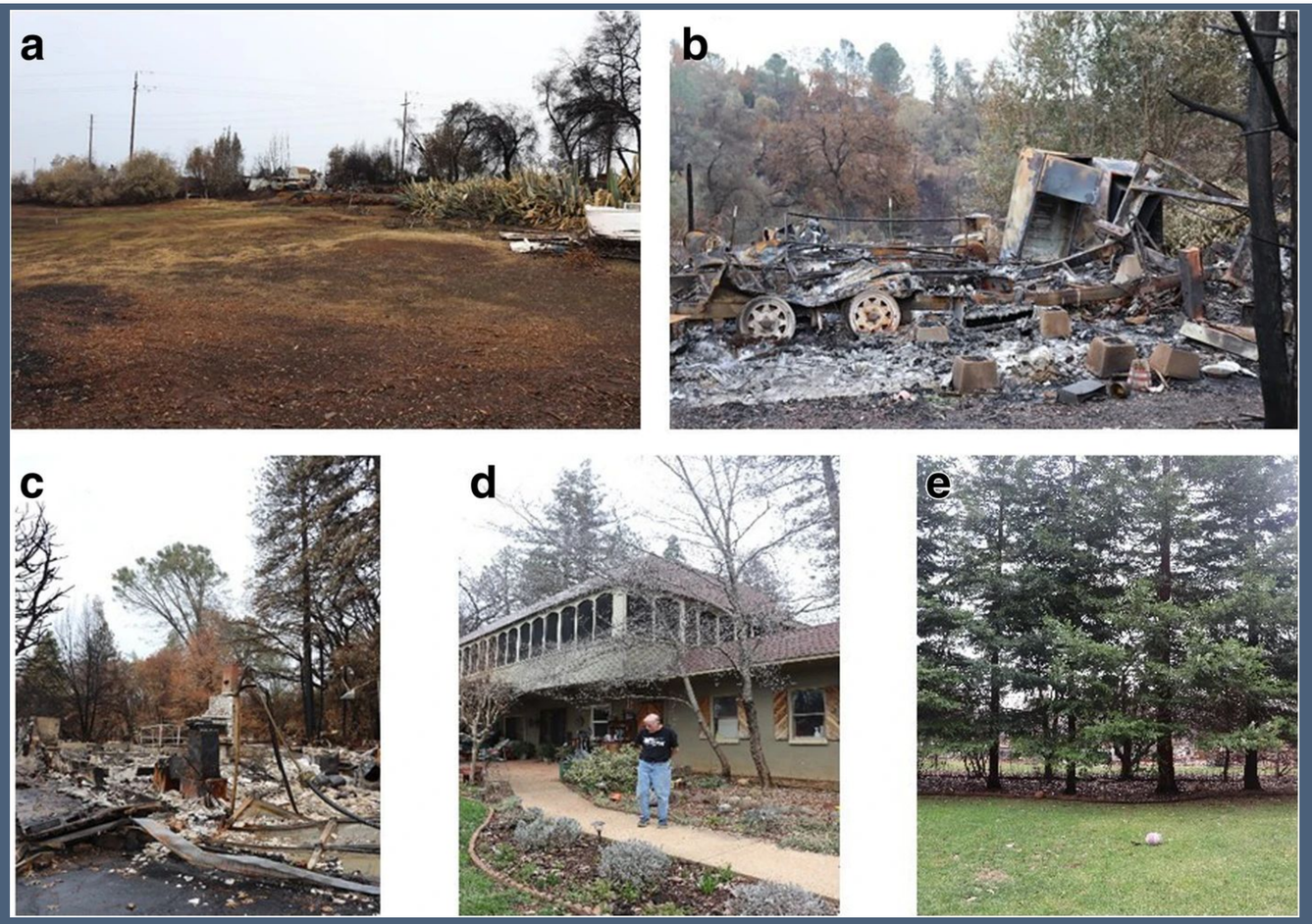
- Promoted as AI study by insurance industry
- Used AI to classify images
- Study includes many vegetation types and presumably both wind-driven and fuel-driven fires
- Does not use modeling to sort out the influence of different vegetation or landscape factors
- Does not address correlations between variables and so cannot attribute risk to one factor or another

2021

- Currently unavailable online
- Appears to only look at one variable at at time without considering any other factors and so results cannot assess their individual contributions

Trees may be a benefit in wind-driven fires

(**a**) Home incinerated with very little vegetation surrounding the home, illustrating the role of embers, not radiant heat of the fire front (actually, lack of vegetation may have contributed to more rapid laminar flow of the ember load to the house. (**b**, **c**) Homes incinerated while adjacent green trees survived. (**d**) Home unburned while homes within 30 m were destroyed. (**e**) Home that survived had a border of green trees between it and adjacent destroyed homes, perhaps acting as a barrier to embers hitting the house. Photo credit: Jon Keeley, USGS, Nov 2018, in the town of Paradise



Deodar Cedar, oaks, and even healthy pines seem to block embers

- Healthy, well-maintained vegetation may serve as buffers against flying embers (Gill 2005, Moritz et al. 2014, Keeley and Syphard 2019; Escobedo et al. 2025)
- This hypothesis has been suggested in studies in Australia, California, and Alaska (Wilson and Ferguson 1986, Gibbons et al. 2018, Schmidt et al. 2024) and demonstrated in California (Escobedo et al. 2025)
- Authors of studies showing danger of trees overhanging structure attribute risk to leaf litter accumulation (Keeley et al. 2013)

My suggestions

- Go ahead and ban connected wood fences, this is well supported by the science, as are the maintenance requirements
- Exempt healthy vegetation and focus on dangerous plant species and their characteristics
- Exempt locally protected native tree species (e.g., oaks, sycamores, walnuts)
- Exempt municipal street trees, because they are now at risk of removal
- Reject the increased offset required for tree limbs from the “ridgeline” — this is covered by the maintenance requirements
- Give flexibility to local fire departments — California is too diverse for a single rule to make sense from Chinatown to Chico.

BRENTWOOD HOMEOWNERS ASSOCIATION

PO Box 49427 ■ Los Angeles, California 90049 ■ (424) BHA-8765 ■ info@brentwoodhomeowners.org

April 28, 2025

Zone Zero Regulatory Advisory Committee
California Board of Forestry and Fire Protection
Natural Resources Building
715 P Street
Sacramento, CA 95814
Via email: PublicComments@bof.ca.gov

Re: Comments on Proposed Zone 0 Regulations

Dear Committee Members:

The Brentwood Homeowners Association (BHA) represents approximately 4,500 single family homes and condominiums north of San Vicente Blvd to the Santa Monica Mountains, west of the 405, and east of Canyon View Drive in the Los Angeles zip code of 90049. A majority of our members reside in a Very High Fire Hazard Severity Zone near the Santa Monica Mountains. Given our location in a wildland-urban interface and experience[1] with fires, BHA established the first California Fire Safe Council in Brentwood last year to educate our community on fire prevention and mitigation. BHA is committed to fire safety.

Based on our experience and research into fire ecology, we object to the residential vegetation clearance mandates being developed under AB3074 regarding defensible space for Zones 0, 1 and a transition zone. After attending the April 7 workshop and reviewing the Advisory Committee's Draft Rules, BHA opposes these proposed regulations governing defensible space for the following reasons:

- The very broad, one size fits all approach is not appropriate for the Southern California urban environment in which we live. According to the California Wildfire and Forest Resilience Task Force, S**outhern California is unique and requires carefully tailored management approaches for wildfire resilience.**
- Fire ecology shows that proper vegetation can help prevent fire risk, especially in wind-driven wildfires. According to Dr. Jon Keeley, once the embers reach the urban environment, the vegetation growing around the homes doesn't play a critical role. **Certain trees may help protect homes by catching embers, contrary to some conventional wisdom.[2]**
- The complete removal of vegetation around homes in a densely populated urban environment such as Los Angeles will increase rather than reduce the risk to our homes. **In a wind driven fire like the recent Palisades Fire where homes burned due to flying embers, totally clearing the area will carry embers right into the house.**

[1] In October 2019, the Getty wildfire burned 745 acres in Brentwood. 10 homes in BHA territory were destroyed and 15 damaged. In December 2017 our members were evacuated due to the Skirball Fire and again this year during the Palisades Fire.

[2] Presentation by Dr. Jon Keeley, a senior scientist with the U.S. Geological Survey, professor at the UCLA Institute of the Environment and Sustainability, and author on 400+ peer reviewed journal articles on fire ecology, at a February 18, 2025 virtual meeting of the Brentwood Homeowners Association.

- Implementation of the proposed regulations would cause irreparable harm to the environment as a whole and is not grounded in science.

Fire Experts Agree—Southern California is Nothing Like the Rest of the State
According to Dr. Jon Keeley, Southern California is nothing like Northern California when it comes to fire risk management. In fact, he went so far as to say that what is appropriate for the northern part of the state does not apply to the southern part. Applying defensible space standards that are effective in places like Paradise that experienced a wildfire fueled by vegetation does not make sense in our urban setting where houses are built close to one another on smaller lots. In addition, fires fueled by our unique Santa Ana winds have been known to cast embers miles into the environment. Homes not protected by vent coverings, dual paned glass windows and fire-resistant roofs are most at risk.

Science Does Not Support the Proposed Guidelines
The mandates that will be imposed on our homes in West Los Angeles do not take into account the fact that fires like we experienced locally in the Palisades were from flying embers. In discussing the recent Palisades Fire, Dr. Keeley concluded that it was an urban conflagration where the homes were the fuel, not the surrounding vegetation.

According to Dr. Keeley's research, once embers reach the urban environment, the vegetation growing around the homes does not play a critical role. In the case of the Eaton fire, homes were destroyed, not by fuels that carried the fire from one house to another, or wild land fuels, **but by the homes themselves.** "Once a home is ignited, it produces extremely intense fires, and those spread from house to house. Once the fire gets started in these areas, it's an urban fire. It's not a wildland fire, and it's spread by the fuels of the homes themselves in large part, because homes represent very dry fuels. Homes are made from dried material, and they are in equilibrium with the ambient conditions. When you have a Santa Ana Wind environment, 5% relative humidity, homes are extremely dry, and they ignite readily."[3]

Proposed Guidelines Could Actually Increase the Risk to Our Homes in an Urban Environment
In an area with small lots, if each neighbor is forced to clear Zone 0 and most of Zone 1 we will be left with very little greenery—anywhere. Consider the fact that the Los Angeles Municipal Code requires a five-foot setback for side yards. This would mean that there would be no vegetation at all between homes. And if it is all hardscape around homes, you run the risk of laminar flow, which Dr. Keeley described to us in February, "**There's actually a downside to totally clearing an area. And that is that when the winds are blowing embers blow in a laminar flow, and if there's nothing obstructing that laminar flow, embers can be carried right into the house. There is a downside to total clearance, and it has to be recognized that trees themselves can play a really critically important role."**

According to a University of California Agriculture and Natural Resources (UCANR) guidance document, fire-safe landscaping does not mean removing all vegetation but rather ensuring that plants are well-maintained, hydrated, and properly pruned. Similarly, the U.S. Geological Survey has found that lightly irrigated native shrubs can actually reduce fire hazard around homes. (We have examples from the Palisades fire where hedges and trees captured embers protecting the homes.) When properly maintained, trees play a crucial role in fire mitigation:

[3] Presentation by Dr. Jon Keeley at February 18, 2025, virtual meeting of the Brentwood Homeowners Association.

1. Moisture retention – Large trees increase humidity and reduce overall dryness, making landscapes less flammable.
2. Soil stability – Trees have deep roots that prevent erosion and mudslides, which are major post-fire hazards.
3. Wind and ember control – Tree canopies can catch and slow flying embers, preventing them from reaching homes.

No Consideration of the Impact on the Environment of Removing 40% of the Urban Forest in our Area
The loss of this expanse of urban forest would have significant adverse impacts on biological resources, greenhouse gas emissions, air quality, and hydrology/water quality. In addition, the proposed rules will deprive us of vegetation that is critically important, not only for our quality of life and well-being but for our safety. It is our understanding that there has not been any environmental review done under CEQA on this legislation. Please pause, do an environmental impact report and then listen to the science and the most impacted residents in fire zones to formulate more appropriate rules that make us truly safer.

Conclusion
Analysis of the Palisades and Eaton Fires has shown that the primary fuel was structures. Homes burned because embers ignited buildings, fences, and other flammable materials—not because of trees. A review of the Eaton Fire shows that the first night and into the morning of the Eaton fire, the fire had spread several miles in many directions from the ignition point, primarily from wind-driven embers and in some areas closely spaced, flammable homes, igniting each other through radiant heat and flame contact. It is evident that urban trees and plants did not cause the spread of this fire. The homes themselves, along with cars, were the most combustible part of the landscape.[4]

The most devastating Southern California fires have been Santa Ana fueled wind driven fires. Experts have concluded: **Removing all vegetation does not prevent embers from landing on the home. Data from past fires show while vegetation may be scorched during fires, the fire did not burn through to get to the home, rather embers blown onto the top of the home ignited the home, even though the adjacent landscape was relatively untouched.[5]**

If we really want to protect our homes and property, it starts with hardening our homes not with creating barren landscapes.

Sincerely,

Thelma Waxman

Thelma Waxman
President

[4] "With a Landscape Approach, We Can Reduce the Risk of Wildfire." By Ronnie Siegel, ASLA. THE DIRT. Uniting the Built and Natural Environments.
[5] Presentation by Dr. Jon Keeley at February 18, 2025, virtual meeting of the Brentwood Homeowners Association.

PSA

Zone 0 Won't Save Your Home from Wildfire
It Will Strip Your Yard, Your Privacy, and Your Rights

In response to the Eaton and Palisades fires, the State of California is quietly pushing a strict mandate at the end of this year that will force us to rip out the gardens around our homes in the high fire severity zones. Remove almost every tree and plant within 5 feet of our homes or any structure in the yard or our neighbor's yard. They call it **Zone 0** — the latest wildfire "solution." But will it actually protect our homes?

The truth? Zone 0 is based on junk science and false assumptions from the insurance industry. Real research — like the in-depth study of the Thomas Fire and Camp Fire — found:

- **Defensible space 5 feet around buildings had little impact** on whether homes burned.
- Combustible fences, deck materials, and building design mattered far more.
- **Well-watered plants didn't fuel fires** — homes did. In fact, some plants helped block flying embers from reaching homes, especially when those plants were hydrated or oak trees.

Zone 0 ignores this science. It distracts the public, greenwashes political inaction, and makes it easy for insurance providers to deny claims — all while creating ecological damage and giving people a false sense of security.

We Say Hands Off Our Yards - There's a Better Way to Protect Your Home.

The smartest fire strategy isn't ripping out your trees and garden. It's creating a shaded, moist, resilient yard with the right plants—and combining that with structural home hardening.

- **Moisture Retention**: Healthy, green vegetation doesn't burn easily. Tree canopies reduce heat and wind exposure, creating cooler, more humid microclimates that resist ignition.
- **Microclimate Control**: Tree Canopies decrease solar radiation and block winds—two key factors that drive fire intensity.
- **Backed by Science**: Research warns that aggressive vegetation clearance can worsen fire outcomes by drying out the soil, and promoting flammable weed

Don't let Sacramento impose State Controlled landscape rules on your property. Don't let politicians use wildfire fear to promote insurance industry friendly policies. Don't be silent. Learn more at dianaznicole.com and take action.

WUI VEGETATION CODE WORKGROUP

REGULAR MEETING

SEPTEMBER 24, 2025

3:00 PM

Redwood Room – 2180 Milvia St. 6th Floor North

Fire Chief's Representative – Asst. Chief Colin Arnold

Assistant Chief David Winnacker
Richard Illgen
George Perez-Velez
Eric Weaver
Margit Roos-Collins

DRAFT MINUTES

Preliminary Matters

Call to Order: 3:00 PM

Present:

- Assistant Fire Chief, Colin Arnold
- Eric Weaver
- Richard Illgen
- Margit Roos-Collins
- George Perez-Velez

Not Present:

- Assistant Fire Chief, David Winnacker

Approval of the September 17 Minutes
Motion by Eric Weaver, seconded by Richard Illgen, and approved by consensus.

Public Comment on Non-Agenda Matters
Public Members: 2 comments

AGENDA MATTERS *All Regular agenda matters are for discussion and possible action.*

1. **Action:** **Discussion of existing local code amendments to ensure clarity, and discussion and possible action to establish procedures for the introduction of evidence.**

Written Materials: Vegetation Ordinance, Annotated
Clean Copy of Vegetation Ordinance
Gov. Code 51175-51189
Summary of Proposed State Changes
General Guidance for Creating Defensible Space
Review of Nearby City and District Zone 0 Policies
Summary of Zone 0 Requirements and Guidance from Nearby Cities and Districts
Draft language on approved materials.

Discussion: The group continued review of the annotated vegetation ordinance and suggested additional revisions. A member requested the opportunity to review the final draft before submission to the Fire Chief. The group requested a copy of the Very High Fire Severity Zone map and suggested providing a map with an indented outline of Grizzly Peak and the Panoramic Area. A member asked for clarification that mitigation requirements apply only to those areas. Wrap-up discussions on the ordinance included enforcement and exceptions, such as eucalyptus and other hazardous trees. A special meeting was proposed for September 30th from 2:30 to 4:00 p.m. to conduct a final review of the draft ordinance before submitting to the Fire Chief for review. A member requested to place on record at the next meeting the review of an email regarding the internal citation process. At the next regular meeting, the group will also review additional recommendations, enforcement and mediation timelines, and guidelines related to the workgroup charge.

2. **Action:** **Identify and Clarify AMMR Process, clarify modification process (including local conditions and evidence to support the same practical effect**

Written Materials: COB Workgroup AMMR PPT
State Appendix A1-A5
BMC 1.28

Discussion: Agenda item #2 was not addressed and will be carried forward to the next regular meeting for discussion.

3. **Action:** **Discussion on the definition of combustible materials.**

Discussion: Agenda item #3 was not addressed and will be carried forward to the next regular meeting for discussion.

4. **Action:** **Discussion and possible action on suggestions for the Resident Guide.**

Discussion: Agenda item #4 was not addressed and will be carried forward to the next regular meeting for discussion.

5. **Action:** **Discussion regarding citations, penalties, and appeals process.**

Written Materials: EMBER Enforcement, Page 3 (modified).
Email regarding internal Administrative Citation Progress.

Discussion: Agenda item #5 was not addressed and will be carried forward to the next regular meeting for discussion.

6. **Action:** **Agenda topics submitted by a member for consideration and discussion:**
State Fire Regulations
Excerpts from the Government Code on Fire Zones
Soils and Geology
Fire-resistant Vegetation
Eucalyptus and Other Dangerous Trees
Building Composition and Compliance
Compliance Costs

Written Materials: State Fire Regulations
Excerpts from the Government Code on Fire Zones

Discussion: Agenda item #6 was not addressed and will be carried forward to the next regular meeting for discussion.

WORK GROUP REPORTS

Adjournment

The meeting was adjourned at 5:00 PM on a motion by George Perez-Velez, seconded by Eric Weaver, and approved by consensus.

A special meeting is scheduled for Tuesday, September 30, 2025, at 2:30 PM.

The next regular meeting is scheduled for Wednesday, October 1, 2025, at 9:00 AM.

This meeting will be conducted in accordance with the Brown Act, Government Code Section 54953. Any member of the public may attend this meeting. Questions regarding this matter may be addressed to the Wildland Urban Interface Division of the Berkeley Fire Department, wildfire@berkeleyca.gov 510-981-5620. Communications to Berkeley boards, commissions or committees are public record and will become part of the City's electronic records, which are accessible through the City's website. Please note: E-mail addresses, names, addresses, and other contact information are not required but, if included in any communication to a City board, commission, or committee, will become part of the public record. If you do not want your e-mail address or any other contact information to be made public, you may deliver communications via U.S. Postal Service or in person to the secretary of the relevant board, commission, or committee. If you do not want your contact information included in the public record, please do not include that information in your communication. Please contact the secretary to the relevant board, commission, or committee for further information.
Any writings or documents provided to a majority of the commission regarding any item on this agenda will be made available for public inspection at Berkeley Fire Department located at 2100 Martin Luther King Jr. Way Berkeley, CA.

COMMUNICATION ACCESS INFORMATION:
This meeting is being held in a wheelchair-accessible location. To request a disability-related accommodation(s) to participate in the meeting, including auxiliary aids or services, please contact the Disability Services specialist at 981-6418 (V) or 981-6347 (TDD) at least three business days before the meeting date. Please refrain from wearing scented products to this meeting.
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I hereby certify that the agenda for this regular/special meeting of the Berkeley City's Disaster and Fire Safety Commission was posted at the front of the Division of Training, 997 Cedar Street, as well as on the City's website, three days prior to the scheduled Commission meeting.

SECRETARY SIGNATURE
Colin Arnold
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