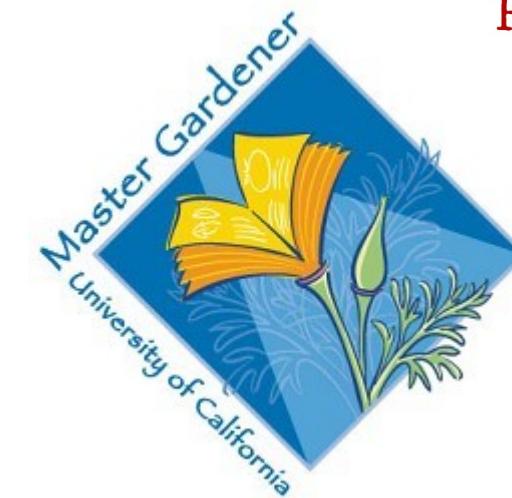


# FIRE-RESILIENCY: Hardening Your Home and Creating Defensible Space

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GEORGETOWN DIVIDE  
FIRE SAFE COUNCIL



# Wildland Urban Interface (WUI)

- WUI = zone of transition between wilderness and land more heavily developed for human activity
  - built environment meets / intermingles with the natural environment
- Are wildland urban interface disasters inevitable?
- Greater risk from wildfires from two sources
  - wildfire flames
  - embers

# Becoming Fire-resilient

- A home must be **ember-ignition resistant** to withstand the exposure to blown-in embers.
- The landscape around the home needs to protect from embers, not be a source of them.
- For maximum wildfire protection for your home, a combination of:
  - Utilizing appropriate building materials (**home hardening**), and
  - Near-home vegetation management, aka **defensible space**

# Becoming Fire- resilient

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Ember exposure during a wildfire means you cannot ignore building material and design considerations.

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If you ignore your defensible space, the wildfire will produce maximum ember, flame, and radiant heat exposure to your home.

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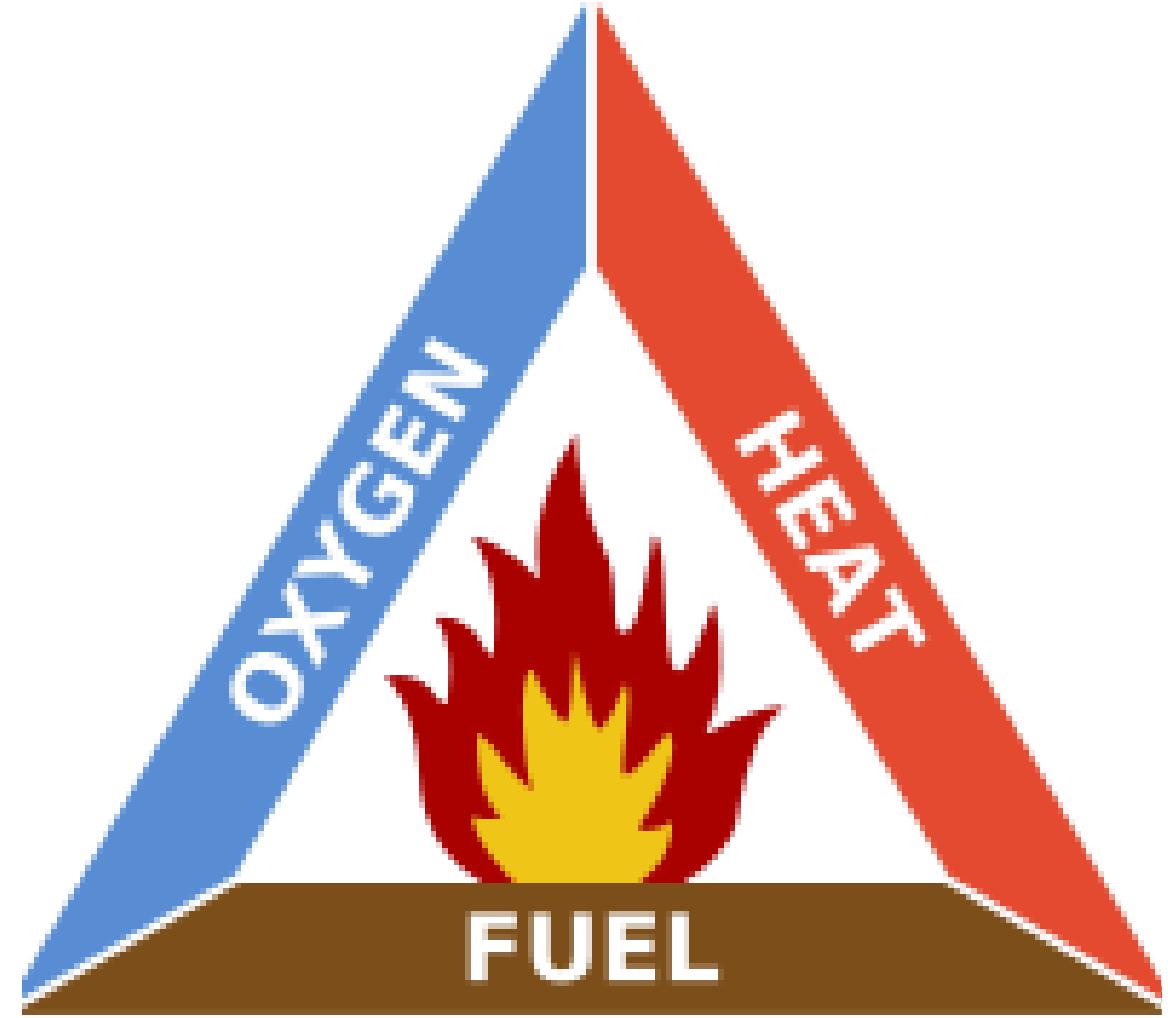
Even hardened buildings are unlikely survive such exposure, as a weak link will likely exist somewhere in the building enclosure.

# 3 Essential Ingredients

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Fire requires oxygen, fuel, and heat

- Oxygen is abundant from the atmosphere
- Plants are primary fuels -- their arrangement greatly influences the transfer of heat
- Three basic mechanisms of heat transfer are ***convection, radiation, and conduction.***



# Convection

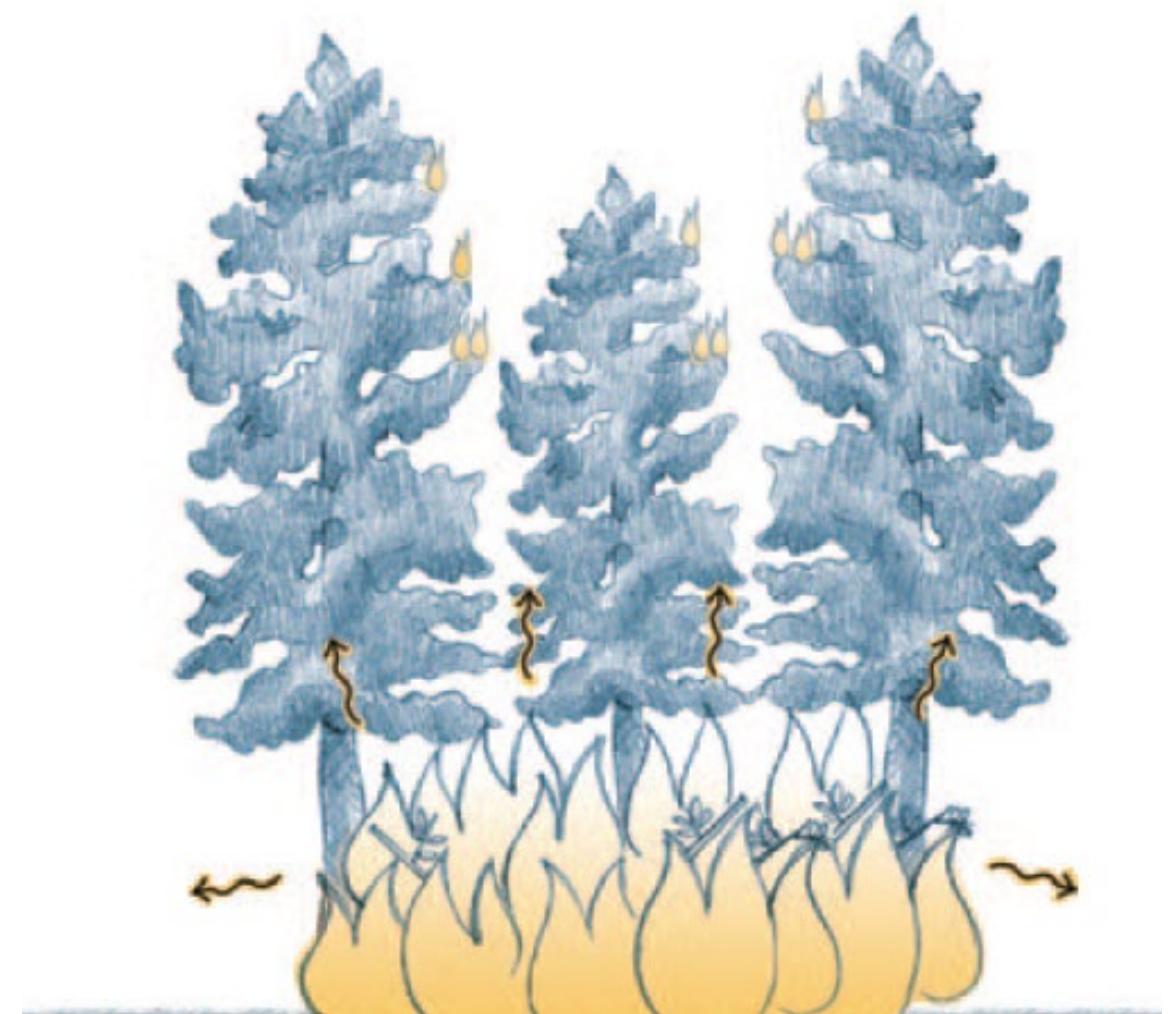
- The transfer of heat by the physical movement of hot masses of air upward.
- Burning vegetation creates convection currents that preheat the leaves and branches of shrubs and trees above the fire.
- Vertical air currents lift burning materials in the form of embers.

**CONVECTION:** *The transfer of heat by the movement of rising hot air or gasses*



# Radiation

- The heat you feel from burning objects is radiated heat.
  - Radiant heat is what you feel when you stand near burning campfire.
- Size and mass of the burning objects determines the amount of radiant heat released.
- In most cases, radiant heat from a wildfire will not ignite materials on homes 30 feet away.



# Conduction

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- Heat transfer from direct contact.
  - the heat that you feel when you touch a cup of hot water.
- Carries heat through fuels, such as logs or house walls, raising the temperature of fuels to the point that they ignite.

**CONDUCTION:** *The process by which heat is transferred through direct contact.*



# Cumulative Effects

The configuration of vegetation affects how these mechanisms come into play.

- Abundant and continuous flammable vegetation may cause a fire to rapidly advance.
  - Plants near the fire are dried, preheated, and even ignited through the effects of *convection* and *radiation*.
  - *Conduction* preheats and dries larger fuels that are touching each other intensifying the heat and the fire.



# Embers

- Burning pieces of airborne wood and/or vegetation
- Can be carried up to a mile by the wind
- ***Ember storms the greatest danger to homes in the WUI***

(Insurance Institute for Business & Home Safety)

# Embers

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- Blow onto buildings ahead of approaching flames and even after the flames have passed.
  - land on combustibles — such as dead vegetation, firewood or deck furniture — starting spot fires.
  - can enter buildings through vents and windows causing structures to burn from the inside out.



- Homes do not spontaneously ignite— they are lost as a result of the growth of initially small fires, either in or around the home or building



**Angora Fire – South Lake Tahoe**



# Embers



- **A common misconception is that the most loss occurs as the main body of the fire passes as a wall of flame**
- **The main flame front moves through an area in a very short time: anywhere from quickly -- 5 to 10 minutes**

# Factors Influencing Building Survival

- The most important are:
  - vegetation characteristics,
  - fire intensity,
  - building materials (especially roofing), and
  - maintenance



# Surviving Wildfire

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Not a matter of controlling the wildfire but changing conditions of your house and immediate surroundings to prevent ignition.

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It's about what **you** do to keep your home from burning down!

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*If your house doesn't ignite, it doesn't burn!*

# Doing an Ignition Assessment

- It's a matter of separating or house from the wildfire.
  - High intensity flames 30 away from home cannot ignite a home.
  - A handful of burning embers can ignite house directly or material around the house that then spreads the fire.
  - Must prevent surface fire from advancing across your property and connecting with your home.



# Home Construction

- Almost every aspect of how your home is built and the materials used will affect the potential for ignition



# Roof Coverings

- Most vulnerable due to its large, relatively horizontal surface.
- Fire ratings for roofs offer a measure of protection.
  - Class A provides greatest protection and class C the least.
  - Regardless of type, keep it in good condition and free of combustible debris.
  - Intersections of more complex roofs collect more debris.



# Skylights

- Potential entry point for embers.
- Flat skylights contain tempered glass
- Domed skylights have a plastic outer shell and interior screen.
  - close during a wildfire in order to avoid the entry of embers
- Look for accumulated debris that could combust at edges



# Roof Edges

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- Vulnerable to wildfire exposure in 3 ways when:
  - Debris in the rain gutter adjacent to the roof edge,
  - large gaps between the roof covering and roof sheathing (barrel clay tiles), and
  - and lack of a metal drip edge.
- Gaps at the roof edge allow for the entry of windblown debris and embers.
  - Bird stops available for barrel tiles must be properly installed.
  - Keep moss from lifting shingles.



# Rain Gutters

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- Burning debris in gutters provides exposure to the edge of the roof.
- Roof edging protects against ignition of exposed roof sheathing or exposed fascia board.



# Rain Gutters

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- **Keep gutters clear of debris!**
- Vulnerability of roof edge will depend on the materials used and how well flashing protects the edge.
  - Metal gutters will stay in place while debris burns.
  - Vinyl gutters melt quickly, detach, and fall to the ground causing siding to combust, especially if there are foundation plants present.
- Remove debris before fire season and continue through the summer and fall.



# Gutter Covers

- Gutter cover devices limit the build-up of debris in the gutter and allow for the free flow of water into and out.
  - These devices either cover the gutter with a solid material or screen



# Vents (Crawl Space, Attic and Eaves)

- Vents function to remove excess moisture from those spaces.
- Embers can enter vent screens!
- Building codes require non-combustible, 1/8" metal wire-mesh screen to prevent small rodents from and embers from entering.
  - Don't go smaller than 1/8" mesh-- may affect the air circulation in the spaces where they are used.
  - New vents designed specifically to resist intrusion of embers in flames or commercially available.



# Crawl Space Vents

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- In a pinch, install temporary covers prior to evacuation.
  - $\frac{1}{4}$ " plywood, sheet metal, metal tape, etc.
  - remove upon returning home

# Attic and Eave Vents

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- A system of vents are used to ventilate attic spaces:
  - inlet vents in the eaves and soffit areas, and
  - outlet vents placed at or near the ridge line of the roof.
- Embers entering attic vents can ignite fine debris and other combustible materials.
  - Ignition of structural support members can occur after exposure to the flames



# Gable-end Vents

- Vulnerable to ember entry.
- **Closure devices** for gable end and open-eave vents are commercially available.
  - Manually-operated (i.e., closed) by turning or pulling a wall- or ceiling-mounted handle.
  - Manually reopen after the wildfire threat has passed.



# Open-framing with Frieze-block Vents

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- Inlet vents used with open-eave framing.
  - Outlet vents are on top of the roof.
- Can be vulnerable even if vents are absent.
  - Improperly-installed or warped blocking can develop gaps where the blocking and rafter tails intersect.
  - Wind-blown embers can become lodged there and ignite debris, potentially spreading to structural support members.



# Open-framing with Frieze-block Vents

- If you can see exposed rafters in the eave, seal gaps with caulking for exterior applications, or
- Consider enclosing the underside of the roof eave/overhang
  - Highly recommended given the benefit from both an ember entry and flame contact exposure.

# Soffited Eaves

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- A 'strip vent,' which is commonly found in soffited eaves
- Vents in a soffited (boxed-in) eave are not as vulnerable to ember entry.





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## **Eye-brow (through-roof) Vents**

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- Dormer-type through-roof vents are vulnerable to ember entry.

# Ridge Vents

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- Found along the entire ridge of the roof.
  - Provide a negative pressure region that pulls air out of the attic.
  - Baffles at front edges keep rain and embers from entering.
  - Removal of debris from the inlet to any ridge vent is critical.



# Exterior Siding

- Provides weather protection, and contributes to the aesthetics of the building
- With proper selection and maintenance of nearby vegetation, most siding will be able to resist wildfire exposure.
- Non-combustible or ignition-resistant materials reduce potential fire exposure at windows and the eave area of a building.

# Exterior Siding

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- Common ***combustible*** siding products include:
  - Solid wood
  - composite wood products (plywood, oriented strand board, and other compressed wood fiber products), and
  - vinyl or other plastics.
- Common ***non-combustible*** materials include three-coat stucco, metal siding, and fiber-cement siding.
- ***Ignition-resistant*** wood products (treated with an exterior fire-retardant chemicals and pass a standard flame-spread test after undergoing a specified weathering procedure).

# Siding

- Combustible siding products can withstand flames and protect against penetration for the duration of a main flame front (5 to 10 minutes).
- Prolonged radiant or flame contact exposure from abundant close-by vegetation, or other building, may result in failure.



# Exterior Siding - Trim

- Combustible trim is vulnerable to embers and potential flame contact exposure, especially at internal corners.
  - Use non-combustible or ignition-resistant material.

# Windows

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- Open windows are most vulnerable to flames from embers.
- Closed windows will fail if the glass breaks or if the frame material ignites and burns through into the home.
- Larger windows are more vulnerable than small ones.



# Windows

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- The type of glass and framing materials affect vulnerability to flame.
  - Upgrade to dual- or triple-pane windows.
  - Tempered glass is four times stronger than normal annealed glass.
  - Reflective film on the exterior surface of exterior glass provides effective protection against radiant exposures.
    - These coatings also help reduce energy costs of a building and provide UV-protection for flooring and furniture.
  - Low-E coatings on the inner surfaces of dual pane windows also improve the performance of a window exposed to a wildfire.

# Window Screens

- Improve performance of glass exposed to radiant heat.
  - Bronze, fiberglass with a polyvinyl chloride coating, and aluminum screens improve glass performance by increasing the time needed for edge cracks to develop.
  - Bronze screens are most effective and aluminum screens the least effective.
  - Do not provide any added protection from flame-contact exposure, such as that from burning vegetation located under the window.

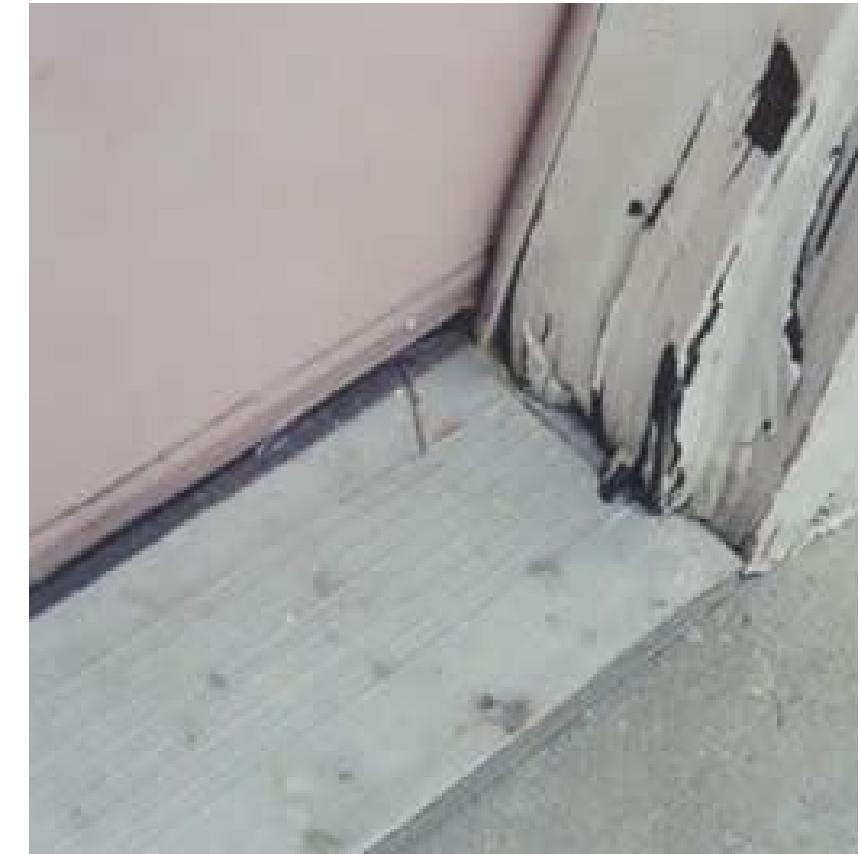
# Window Screens

- Windblown embers can pass through screens if glass in the window has failed.
  - Wind blowing against the screen will result in the ember being reduced in size until it can pass through.
  - Embers passing through fine mesh not likely to ignite internal furnishings.
- If glass and screening have both failed, embers entering will be able to ignite combustible materials in the home.

# Windowsills and Curtains

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- Windowsills and entry door sills are also vulnerable.
  - Embers can ignite debris or ignite decayed trim.
  - Decayed wood ignites at a lower temperature than sound wood.
- Ignition of window curtains from a radiant exposure prior to glass breakage is unlikely if annealed or tempered glass is used.



# Decks

- **Vulnerability of decks to wildfire will depend on:**
  - Deck-board material,
  - topography,
  - the amount, type, and condition of vegetation leading up to the deck, and
  - combustible material stored under the deck or kept on the deck.



# Decking

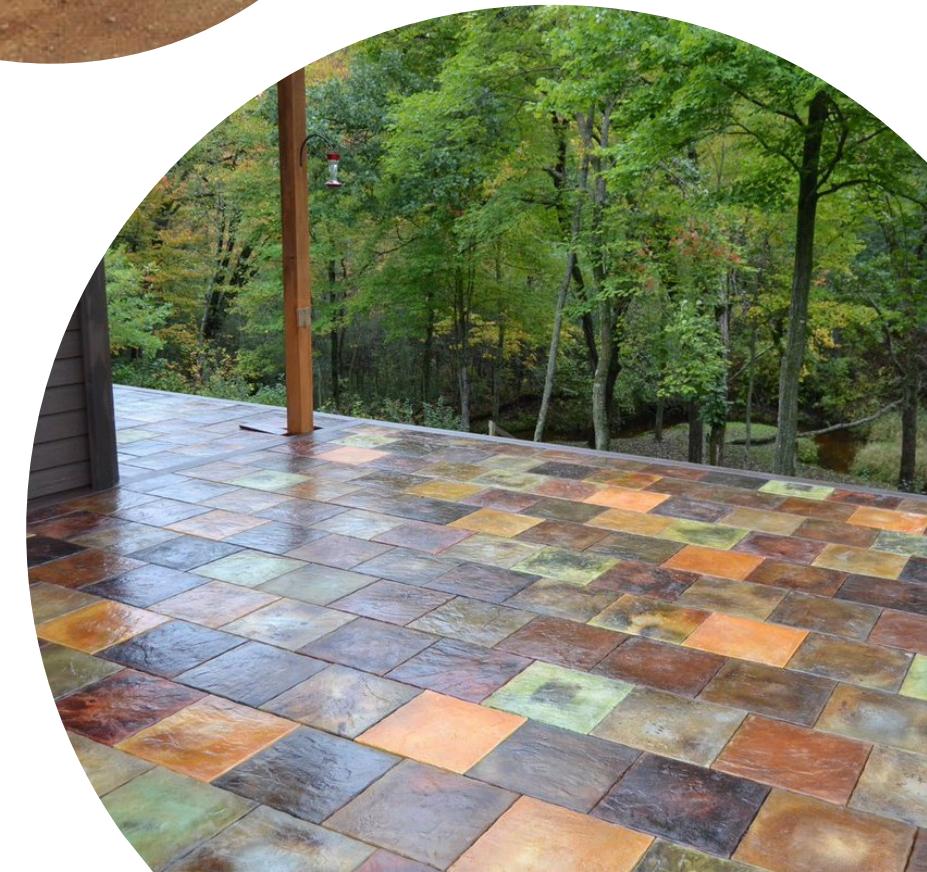
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- Lower-density wood (i.e., redwood), is more vulnerable to ignition by embers compared to a higher-density, wood-plastic composite decking.
- Higher-density wood, such as the tropical hardwood ipe, and exterior fire-retardant-treated deck boards, are also less vulnerable than a lower-density wood decking products.



# Decking

- Untreated and fire-retardant treated wood, and wood-plastic composite products are all combustible.
  - Untreated-wood decking is not highly combustible by itself.
  - Light-weight concrete is non-combustible.



# Decks

- Remove easily ignited materials that accumulate in gaps between deck boards and at interface between decking and siding of the home.
- Replace rotted decking or fascia boards.
- On wood decks, replace the first two or three boards with a fire-resistant, non-wood product more resistant to combustion.



# Decks

- Other fuel sources contribute to deck fires.
  - Combustible vegetation next to under the deck
  - Combustible materials on or under decks (e. g., brooms, umbrellas, patio furniture, door mats, wood piles, etc.)
    - Move as far from the building as possible
    - Space to avoid clustering items.





# Decks

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- Closing in the underside of the deck will reduce risk of ignition.
- The closer the deck is to the ground, the harder it is to use as a storage area, but it becomes more difficult to clean out debris that may accumulate.

# Deck Skirting

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- Apply non-combustible sheathing or siding around the perimeter (a vertical enclosure)
- $\frac{1}{2}$ " galvanized hardware cloth back with  $\frac{1}{8}$ " non-corrosive, metal mesh screen
- With existing wood lattice:
  - Apply fire-resistant coating
  - Install  $\frac{1}{8}$ " metal mesh screen on backside



# Fences and Shade Structures

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- Wood fences become freeways for fires.
  - Those lined with plants that get dense and twiggy catch embers and spread fire.
- Wood arbors, gazebos, and pergolas
- Flammable lath or shade cloth coverings
- Vines or other woody vegetation



# Fences and Shade Structures

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Replace with structures constructed of 1-hour fire-rated wood or metal and disconnect from the main house.

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Paint or stain existing wood structures with fire- or heat-resistant products.

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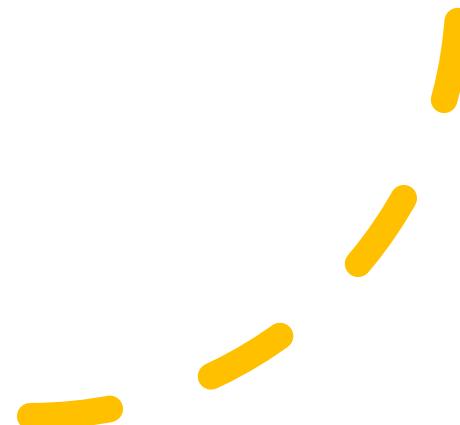
Replace shade cloth or lath with non-flammable materials such as tin, fire-rated plastic sheets, or aluminum louvered systems.

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Only fire-retardant plants should be used adjacent to structures.

# Fire-retardant Treated Wood

- **Exterior-rated, fire retardant-treated wood products are:**
  - Pressure-impregnated with chemicals that improve the fire performance characteristics, and resist flame-spread and smoke development caused by fire.
  - Weathering reduces the efficacy of retardants.
  - Periodic re-application required.



# Fire-retardant Treatments and Coatings

- ***Fire-resistant paints*** create a barrier against flames.
  - When met with flames, forms a char layer on the substrate increasing the time it takes for flames to penetrate.
  - Can be applied to steel, timber, and plasters to avoid burning and destruction.
  - Good for 30 minutes to hours before failing.
- ***Fire-retardant paints*** make combustible materials much more difficult to ignite slowing ignition.

# Fire-retardant Treatments and Coatings

- **Gel coatings** are a new fire protection alternative are available to homeowners.
  - Effective, if applied correctly to points of fire entry.
  - Can be applied by homeowners.
  - Coatings lose effectiveness within hours due to water evaporation.
- These paints and gels are **NO replacement for managing vegetation or improving building materials or design.**



# Defensible -space Zones

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Coupled with **home hardening**, defensible space is essential to improve your home's chance of surviving a wildfire.

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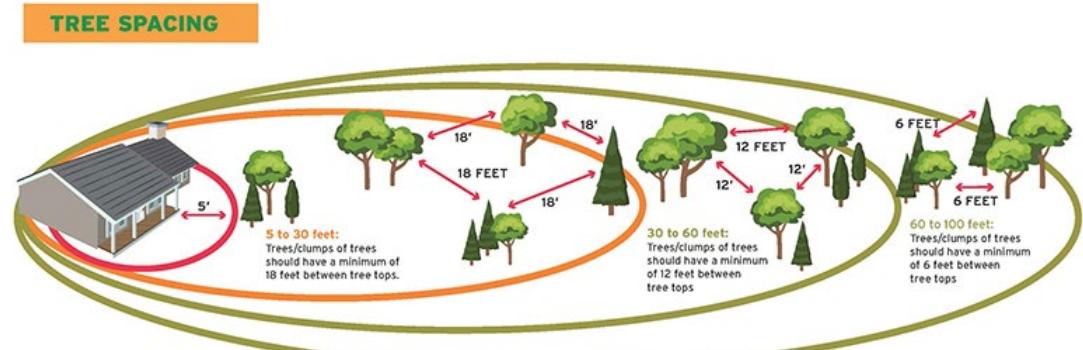
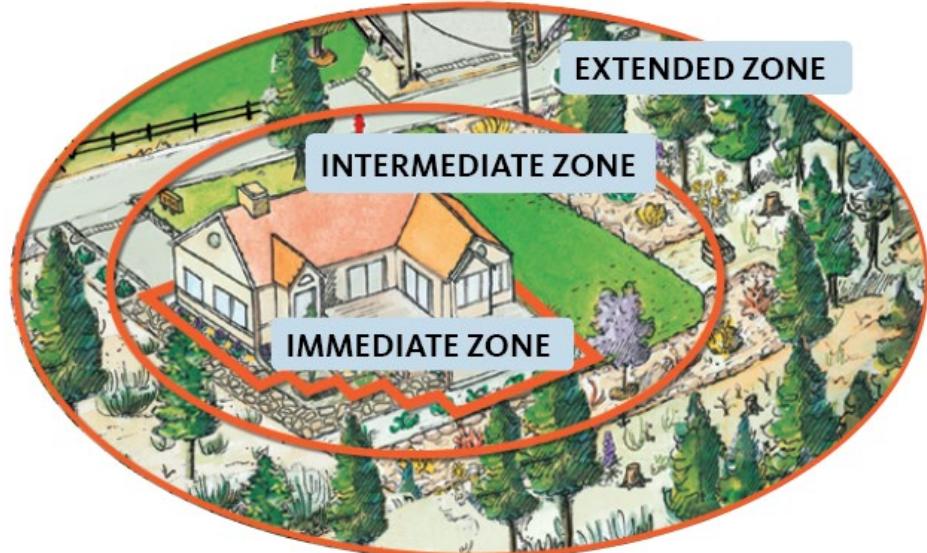
The buffer you create between a building on your property and the landscape vegetation, or wildland area that surrounds it.

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The space needed to slow or stop the spread of wildfire particularly from direct flame contact or radiant heat.

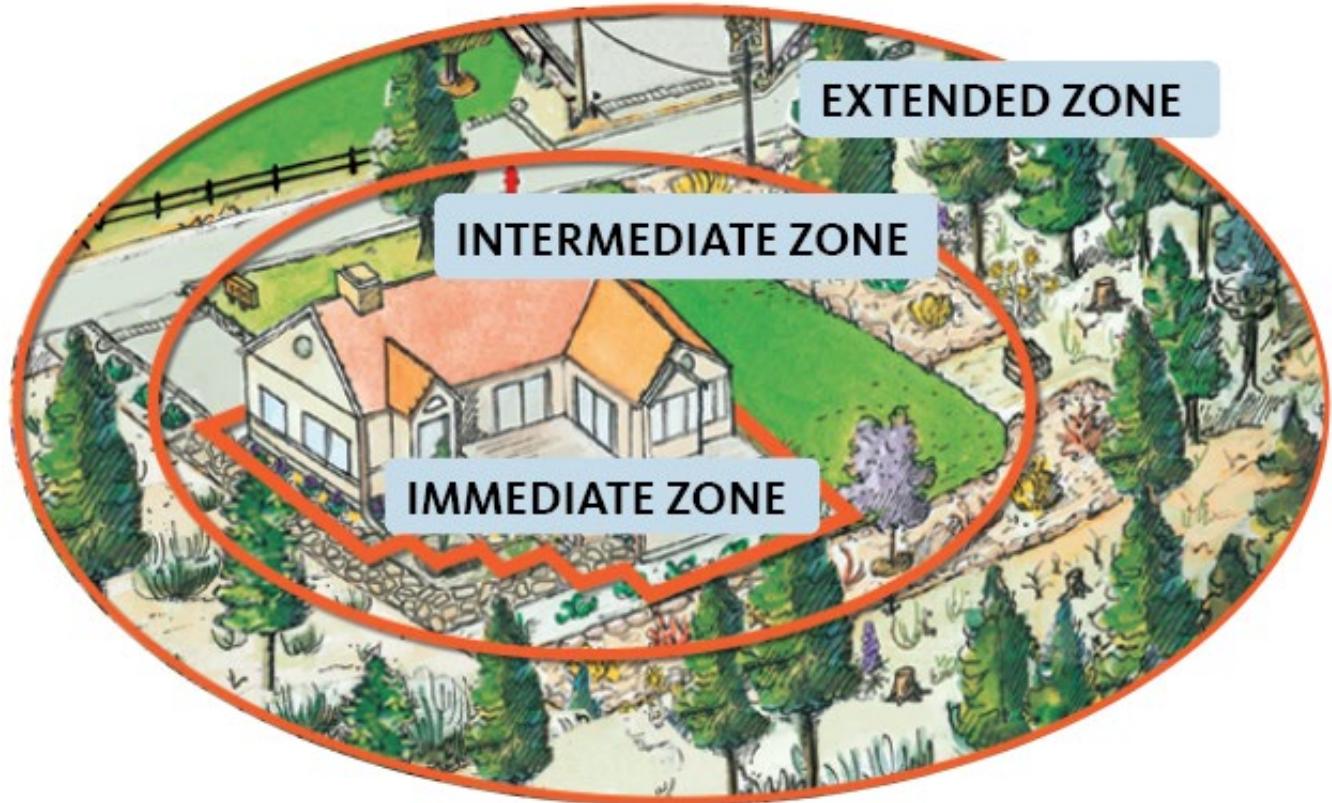
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Provides firefighters a safe area to work in to defend your home.



# Defensible Space Zones

## Old standard



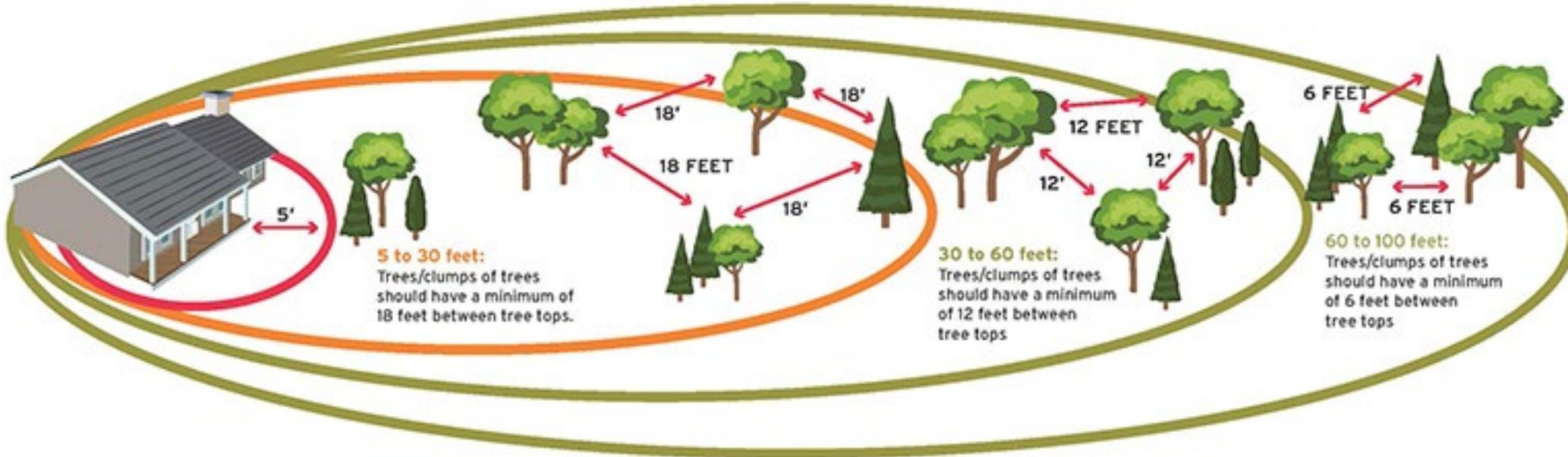
Defensible  
Space Zones  
Zones 1-3

# Defensible Space Zones

- Zones 0 - 3

## TREE SPACING

### New standard



Cut and remove  
branches that  
hang over roof.

**Zone 0**  
0' - 5'

**Zone 1**  
5' - 30'

**Zone 2 & 3**  
 $\geq 30'$

**Property  
Protection  
Zone**

$\geq 15'$   
(or 1/3 tree height)

# Zone 0 - Home Ignition Zone

- Zone 0, sometimes referred to as the ***immediate zone***.
- The areas closest to your house, 0 -5', including:
  - Surfaces of the structure itself (outside walls, roof)
  - Decks
  - This area is ***most vulnerable*** and should be more aggressively maintained for fire-resistance.
  - ***There should be zero combustibles in this zone!***

# Zone 0

- 
- Remove combustible outdoor furniture.
  - Remove or relocate all combustible materials, including garbage and recycling containers, firewood, and patio accessories, etc.
  - Replace jute or natural fiber doormats with heavy rubber or metal grates.

# Zone 0

- Do not store firewood, lumber, or combustibles here, or on or under decks or overhangs.
- Replace combustible fencing, gates, and arbors attached to the home with non-combustible alternatives.
- Remove tree limbs that extend into this zone.
- Remove all fallen leaves and needles.

# Zone 0

- **No vegetation** is recommended within 5 feet of any structure, including decks.
- Use only inorganic, non-combustible mulches such as stone or gravel.
- Hardscaping is strongly recommended around the base of the home.
- Avoid flames running across the ground and connecting with your home.



# Zone 1 - Lean, Clean & Green Zone

- The perimeter area surrounding your home to the distance of 30 feet.
  - Lean - minimization of flammable materials.
  - Clean – low-height and low-density of vegetation.
  - Green - the least flammable types of vegetation best suited to this zone.



# Zone 1

- Everyone should be able to move unimpeded through the zone.
- The zone in which firefighters will generally battle a blaze.
- Used for recreation and functional activities.
- Aesthetics and privacy play a role in making plant selections.
- Fences, hedges, sheds, compost areas, and any combustible items are fuel.

# Zone 1

- Remove all dead grasses, weeds, plants, stems and branches, cones and foliage.
- Remove fire-hazardous plants.
- Remove flammable mulches.
- Choose only ***fire-resistant plants*** and keep them healthy and irrigated.
- Use only compost or small bark mulch.
- Relocate boats, RVs, and other vehicles outside this zone.
- No firewood and lumber.

# Zone 1

- Space shrubs at least two times the width of the mature plant.
- Trim trees to remove limbs 8 to 10 feet from the ground.
- Separate the canopies of trees by at least 10'.
- Clear vegetation around fences, sheds, outdoor furniture, play structures, etc.
- Create 10' of clearance around outbuildings and LPG storage tanks.
- **Maintain regularly**, focusing on the areas closest to structures.



# Zone 2 - Extended Zone

- Area 31-100' from structures
- Cut or mow annual grass down to a maximum height of 4 inches.
- Create horizontal spacing (6-8') between shrubs and trees.
- **Separate the canopies of trees in this zone from Zone 1 by at least 10-15'.**
- Remove excess dead vegetation.
- Remove all piles of dead vegetation.

## **Zone 3 – Access Zone**

- 
- Clear routes are key to safe and unimpeded evacuation and allowing fire equipment and crews to fight wildfires.
  - Treat as a mini-shaded fuel break.

# Zone 3

- Clear vegetation 14' overhead and 10' from the sides of roads and driveways in the same manner as defensible space Zone 1 and 2
  - Create vertical spacing between shrubs, and lower tree limbs
  - Maintain 22 feet of unobstructed roadway for emergency responders.

# Private Roads & Driveways

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- **What the fire crew sees**
  - Narrow drive or road (<22'?)
  - Overhanging, dense vegetation
  - Is there a turnaround?
  - Is there a way out?
  - Will this become a death trap?



# Private Roads & Driveways

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- Same road after clearing



# Zone 3

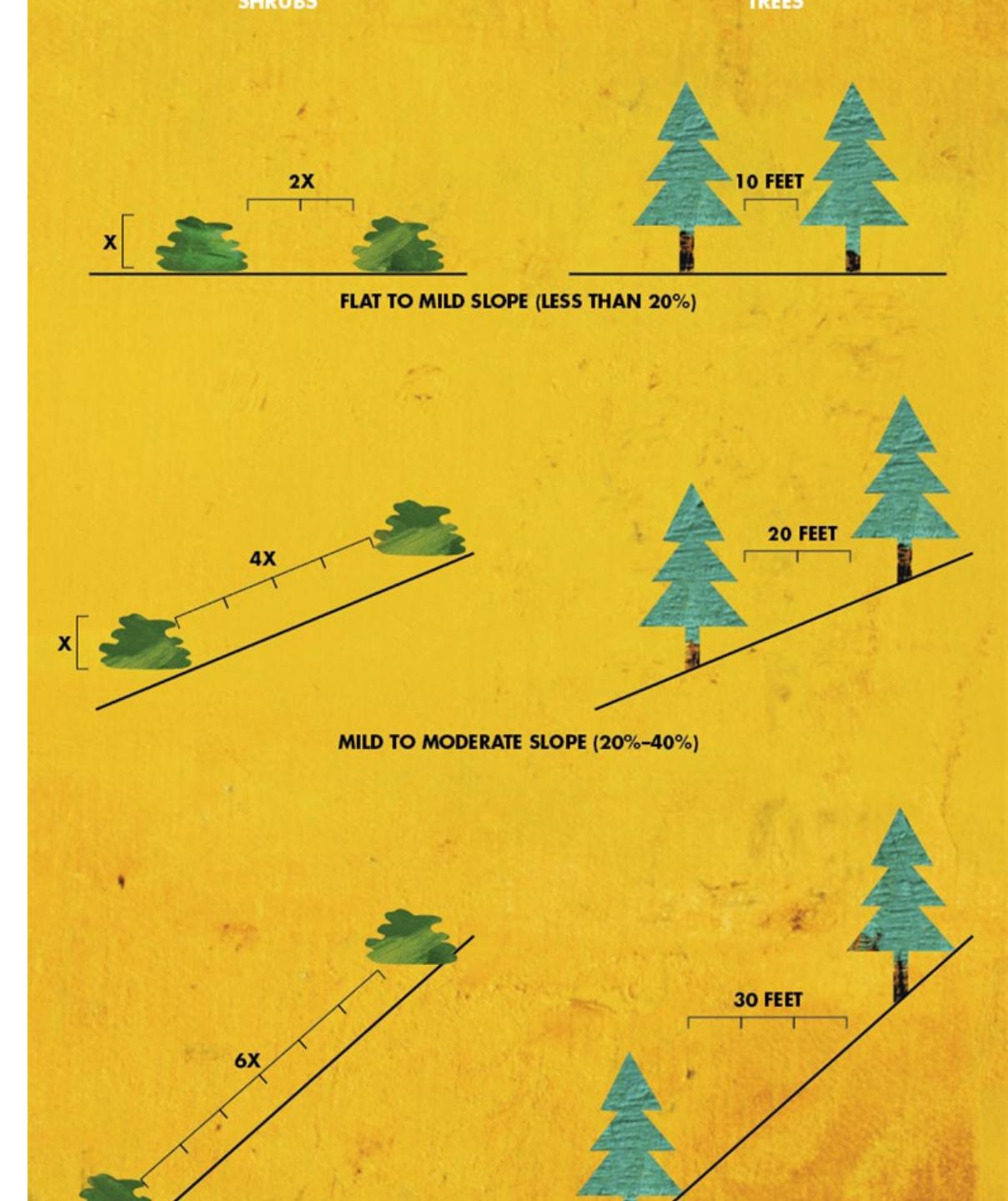
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- Address numbers must be clearly visible from the road
  - 4-inch reflective numbers on a contrasting background
  - Place numbers at driveway
  - Don't mount on flammable posts



# All Zones

- Thin and remove vegetation to reduce ladder fuels and prevent flames from moving closer to the home.





# Firescaping

- Well-thought-out landscapes can help defend the home against the threat of fire.
  - One of the biggest factors affecting fire-avoidance is the choice of plant materials in the Defensible-space Zones.

# Firescaping

- Not necessary to create a moonscape by removing vegetation or paving over the entire space.
  - Common misconception: no vegetation is safer than any vegetation.
  - Makes for a clear path for blowing embers.



# Zone and Island Approach

- This approach to fire-resiliency accommodates personal priorities + reduces wildfire vulnerability + respects water, soil, vegetation and habitat needs.
- **The Goal:** resist ignition from flying embers while accommodating most intensive uses in the transition from your house to the outdoor space.

# Zone and Island Approach

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Green vegetation can burn in a wildfire situation -- include small firebreaks to slow down a fire.

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Design walkways, dry stream beds, short walls, small patio area, and lawns function as small firebreaks.

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Islands of vegetation are aesthetically pleasing and reduce the potential vulnerability of your yard.

# Zone and Island Approach

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# Fuel Breaks

- Dry stream beds can break up larger areas
  - Slow, spread, sink water
- Paths can create islands and define hydrozones, saving water.



# Firescaping

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- **Thin rather than clear** to reduce plant fuels.
  - Excess and/or dead plants surrounding your home act as fuels when fire strikes.
  - Remove flammable varieties; replace with more with fire-resistant ones.
- Avoid plants that create lots of litter.
  - Select plants that shed minimal amounts of needles, leaves, and seed pods/cones.

# Firescaping

- Use native plants in your defensible space.
  - Easy to maintain
  - Have strong root systems that will reduce property damage from erosion after the fire has passed.
  - Commonly have roots that will regenerate the plant after a fire.



## Firescaping

- A well-maintained yard is not necessarily synonymous with a fire-resistant landscape.
  - Vegetation will either lead a fire to a structure, slow it or stop it.
  - Plants near a structure are one of the most important factors in its chance of it becoming involved.



# Everything Has A Life Span

- As a landscape ages, the risk of fire dramatically rises.
- A landscape that was planted 50 years ago may require the removal of some, if not most of the plants.



# Expected Life Span

Plant Group	Expected Life
Large Trees	40–120 years
Medium Trees	18–60 years
Large Shrubs	8–25 years
Small Shrubs	5–15 years
Vines	6–15
Perennials	2–6 years
Biennial	2 years
Annuals	Every Year

# Plant Selections

- Plant selection can be a challenge because at one point or another, **every plant may burst into flames.**
  - Some selections that are less likely to do that than others.
  - Consult online fire-wise plant guidelines, UCCE recommendations.
  - Don't be surprised! Plant lists conflict with one another.



# Plant Selections

- The ability of any plant to retard or resist fire depends on its condition.
  - Old, woody, water-starved, pest-infested, or disease-ridden plants are more flammable.

# Characteristics of Less Flammable Plants

- Determine likelihood that a plant will catch fire, feed a fire, or repel a fire.
- Knowing traits of less flammable plants is more important than remembering lists of plants.
- **Landscape maintenance, not plant selection, is the key for fire resilience!**



# Characteristics of Less Flammable Plants

- A less flammable plant will have:
  - Deciduous rather than evergreen leaves.
  - Large and broad rather than needle- and blade-like leaves.
  - Moist and easily bent leaves instead of stiff and leather-like.
  - Thick instead of fine or thin leaves.
  - A low amount of litter.
  - Watery sap as opposed to thick, gummy or resinous sap.
  - Leaves and stems without a heavy scent, as opposed to strong aromatic qualities.
  - Leaves that are silver or gray.
  - Leaves that are not hairy.

(Douglas Kent, Firescaping)

# Fire-retardant and Fire-resistant Plants

- Plants to be used in Zone 1 should be **fire-retardant**.
  - Sizzle and wilt when exposed to fire but reluctant to produce a flame.
  - Properly maintained, they can catch and extinguish fire brands.
  - The trade-off for this protection is irrigation.
    - Most need supplemental water to maintain adequate moisture.
    - Succulents are a notable exception.
- **Fire-resistant plants** repel fire.
  - Leaves and twiggy growth may produce a flame when exposed to fire, but the flame quickly dies.
  - Thick bark and dense wood protect the plant from fully igniting.
  - Many will resprout after a wildfire reducing risk of erosion following a fire.
  - Drought-tolerant, but most would benefit from an occasional deep watering.

# Plants for Zone 0

- Plants within the first 5 feet of all structures are totally discouraged.
- Should fall in the category of **fire-retardant** species,
  - High-moisture plants that will grow close to the ground and have a low sap or resin content.
  - Include:
    - succulents,
    - low, non-woody ground cover,
    - herbaceous perennials, and
    - lawn alternatives.



# Plants for Zone 1

- **Fire-retardant plants** should dominate the plant palette in this area.
- Food crops are very fire-retardant and fire-resistant (Edible gardens)
  - Usually have high moisture and large, supple leaves.
  - Annuals, perennials, subshrubs, shrubs, vines, or trees
  - Offer fire protection, personal health and even some environmental benefits.
    - Vegetable gardens, fruit trees and berry vines fall in this category.





# Plants for Zone 1

- **Lawns**
  - Fire resistant and exceptionally difficult to ignite.
  - A safe surface from which to fight a fire.
  - Consume large quantities of water with little return.
  - Future water restrictions may require letting them go brown.



# Plants for Zone 1

**Lawn alternatives**, primarily spreading perennials that root along their stems, use far less water, can tolerate limited foot traffic, and if properly cared for, will not be ignited by burning embers.

- Alum root/coral bells
- Birdsfoot trefoil
- Geranium/ Crane's bill
- Creeping red fescue
- Woodland strawberry
- Lippia
- Native clovers
- Coyote mint
- Fleabane

# Zone 1 Flowering Perennials

- A perennial is any non-woody plant that lives longer than two years.
- Most sport flowers for weeks at a time from spring through fall, supporting pollinators, including bees and butterflies.
- Be selective as many will become woody with age.
  - Alum root
  - Black eyed Susan
  - Columbine
  - Coreopsis
  - Flax
  - Hooker's evening primrose
  - Indian paintbrush
  - Lupine
  - Mallow
  - Helianthus
  - Milk weeds
  - Coneflowers
  - Poppies



# Zone 1 Hedges

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- The wrong type of hedge may lead a wildfire to a structure – a properly planned and maintained hedge will do just the opposite.
  - All hedges will have to be will be replaced at some point.
  - Avoid those species that have a dense, twiggy interior.
  - Hedges reluctant to ignite, have large leaves, are somewhat slow growing, and do not create excessive litter.
- 
- Coffeeberry
  - Spicebush
  - Currents and gooseberry
  - Cherry laurel
  - Mock orange





# Zone 1 Trees

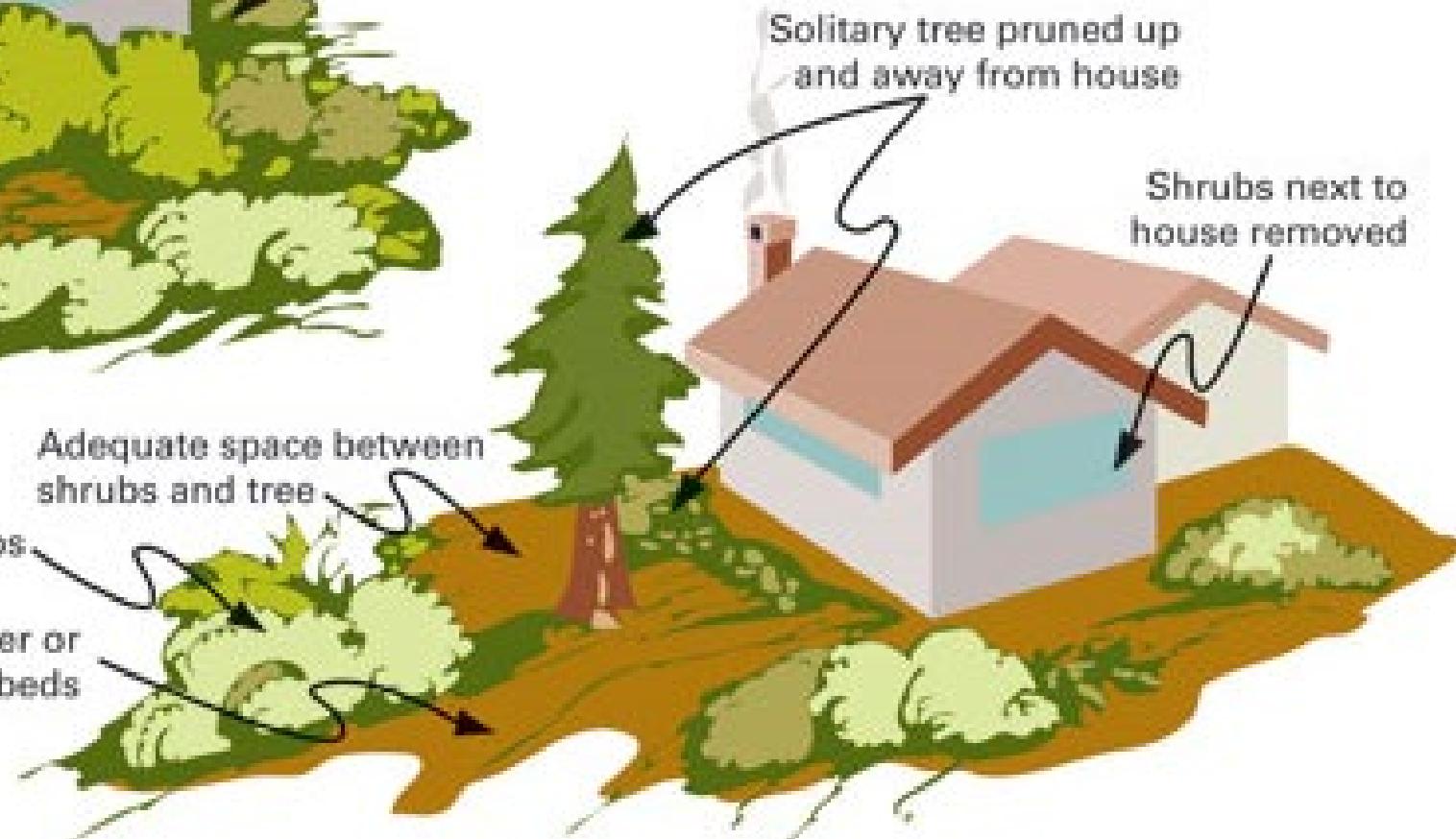
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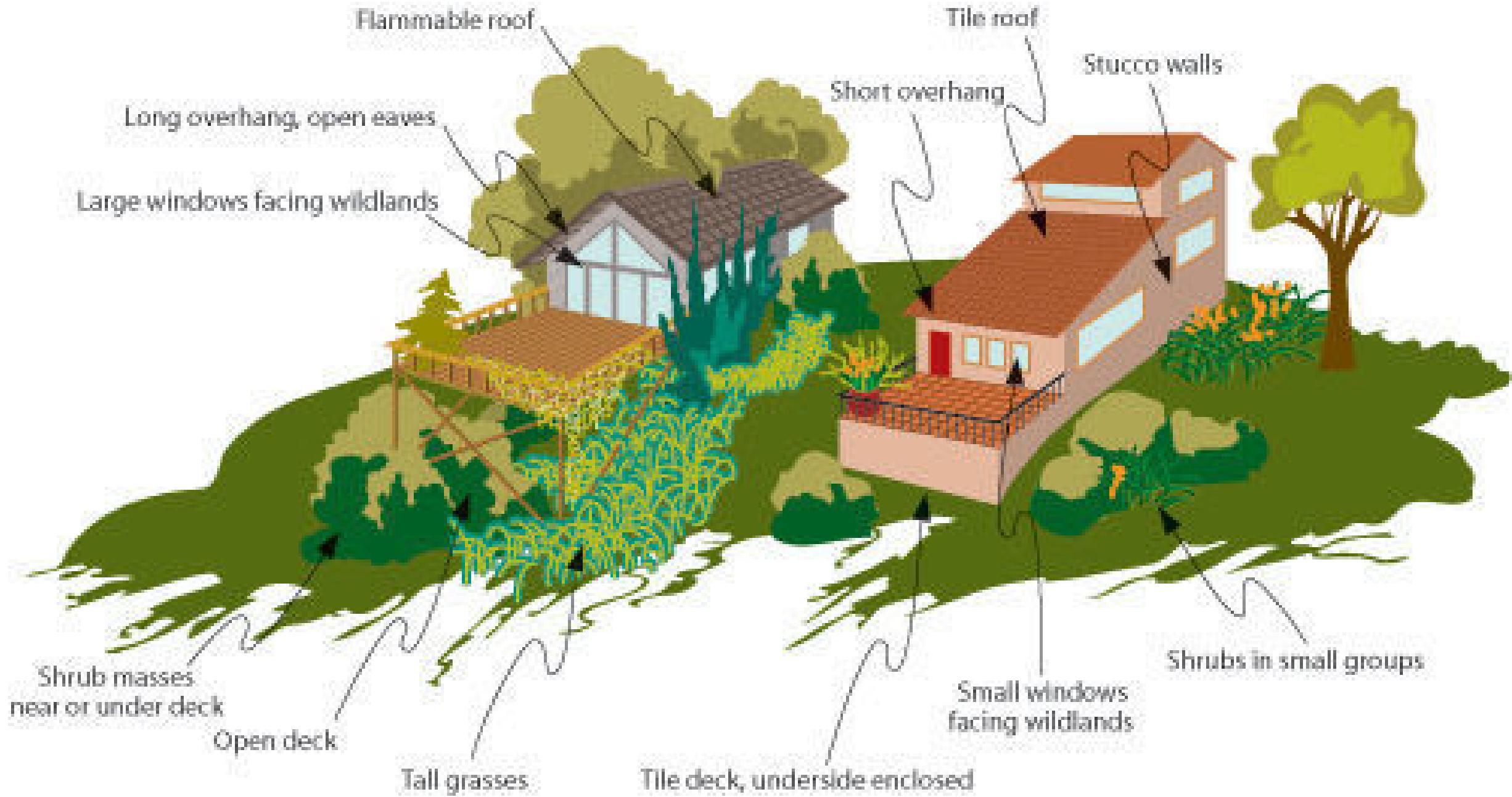
- The placement of trees needs to be carefully considered to avoid canopies that may eventually get big enough to be too close to structures.
  - Desert willow
  - Native dogwood
  - Buckeye
  - Deciduous oaks
  - Western redbud

## POORLY MAINTAINED LANDSCAPE



## WELL MAINTAINED LANDSCAPE





# Plants for Zone 2: Extended Zone

- **Objective** -- stop a groundfire utilizing plants with a level of fire-resistance despite drought and some neglect.
- The transition from domesticated landscape to a more natural one.
  - maintenance is more important than plant selection
- With irrigation, you will have far more selection of plants to use.
- Without irrigation, plants selections should be made carefully with respect to the structure and characteristics discussed previously and spaced further apart.

# Zone 2 Plants

- Properly landscaped and maintained, this area can dramatically slow an approaching fire.
- Native species encouraged, with adequate spacing between shrubs and trees.
- Eradicating invasive plants and controlling erosion should be primary management goals.



# Zone 2 Plants

- Break up continuity of growth and eliminate ladder fuels.
- Depending on the slope of your land, trees and plant clusters should be vertically and horizontally clear of one another.
  - groupings of short and tall plants create an opportunity for easy flame transfer.
- Make sure trees are trimmed clear 8 to 10 feet off the ground.



# Size, Placement and Spacing of Plants

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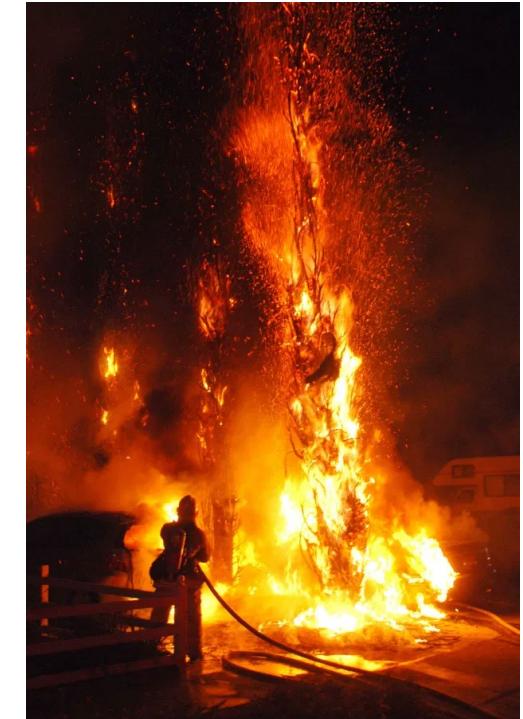
- Determine the slope of your property before planning your design or plan for thinning and removal.
- Spacing between plants on slopes must be greater than it would on level ground:
  - 0 to 20% slope requires at least 10 feet between tree crowns
  - 20 to 40% slope requires a 20' between the tree crowns
- Clear tree branches 20 to 40 feet from the ground on steeper slopes.
- Any Zone 1 trees should be clear of the home
  - No branches making no contact with roofing or siding.

# Zone 3 Plants

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- Same as Zone 1 & 2
    - Use more deer-resistant native species

# Highly-flammable Trees

- The plants listed below create highly ignitable and highly combustible conditions—some will ignite without flame contact.
  - These plants should be removed from Zones 1 and 2
    - Fir
    - Acacia
    - Incense cedar
    - Cedar
    - Leyland and Italian cypress
    - Eucalyptus
    - Sweet bay
    - Spruce
    - Pine
    - Coast redwood
    - Yew
    - Arborvitae
    - Hemlock
    - California bay



# Highly-flammable Shrubs/Perennials

- Chemise, greasewood
- Sage brush
- Coyote bush
- Field and black mustard
- Broom
- Hopseed bush
- Buckwheat
- Juniper
- Larch
- Creosote
- Tea tree
- Rosemary
- Blackberries
- White, Cleveland, purple, black sages

# Highly-flammable Grasses

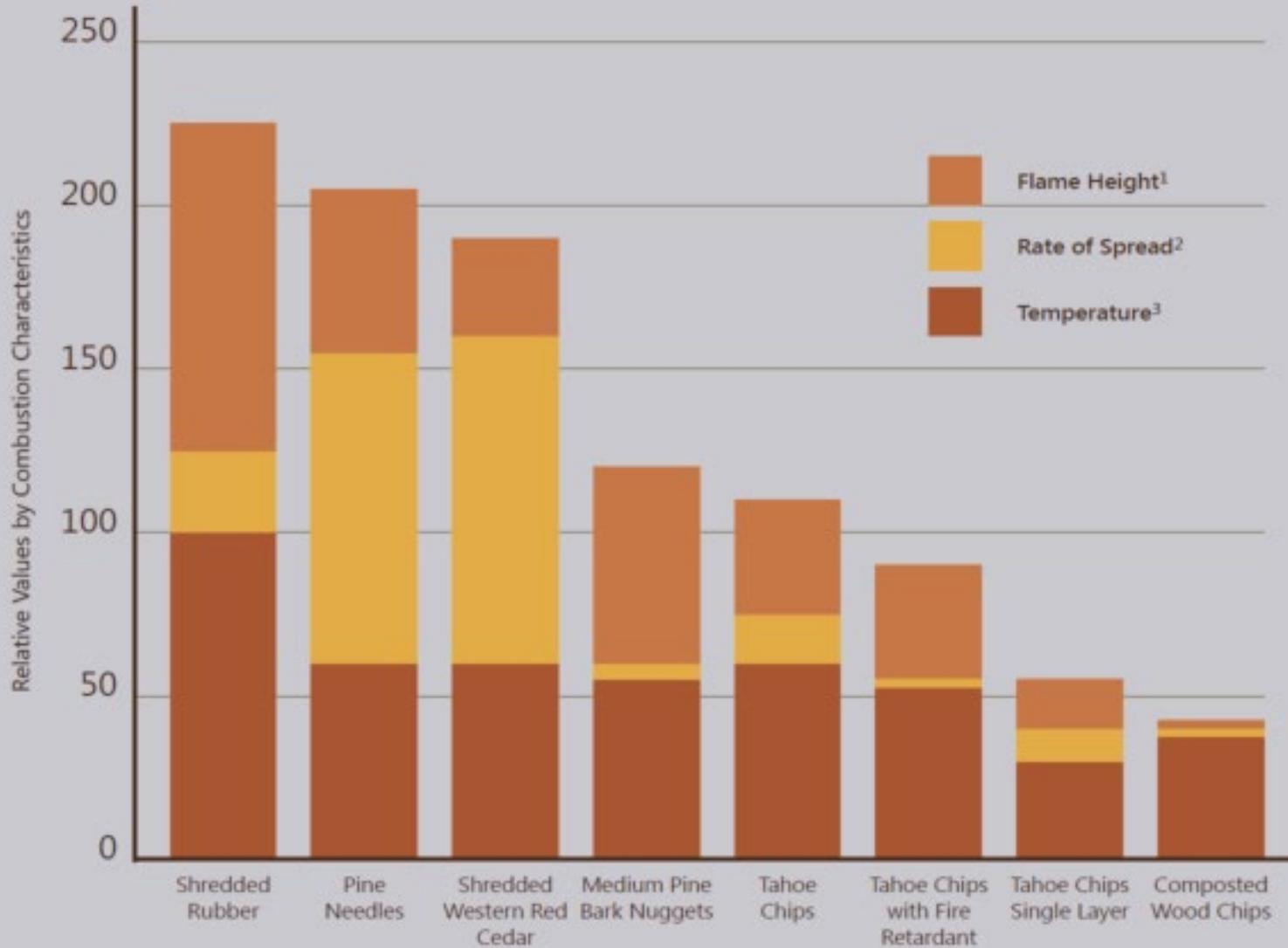
- Annual grasses: barley, oats, and rye
- Pampas grass
- Miscanthus
- Fountain grass
- Feather grass
- Quack grass

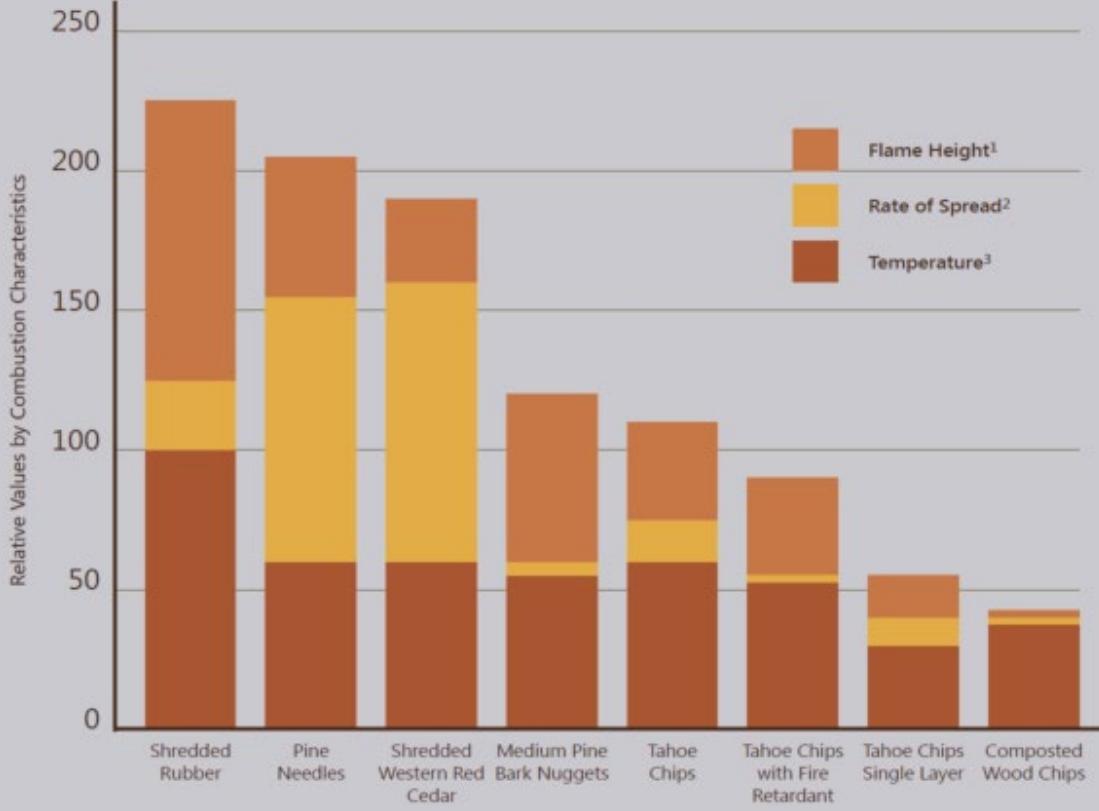


# Mulches

- Help retain soil moisture,
- Control weeds,
- Feeds the soil, and
- Moderate soil temperatures.

# Mulch Flammability Comparison





# Mulches

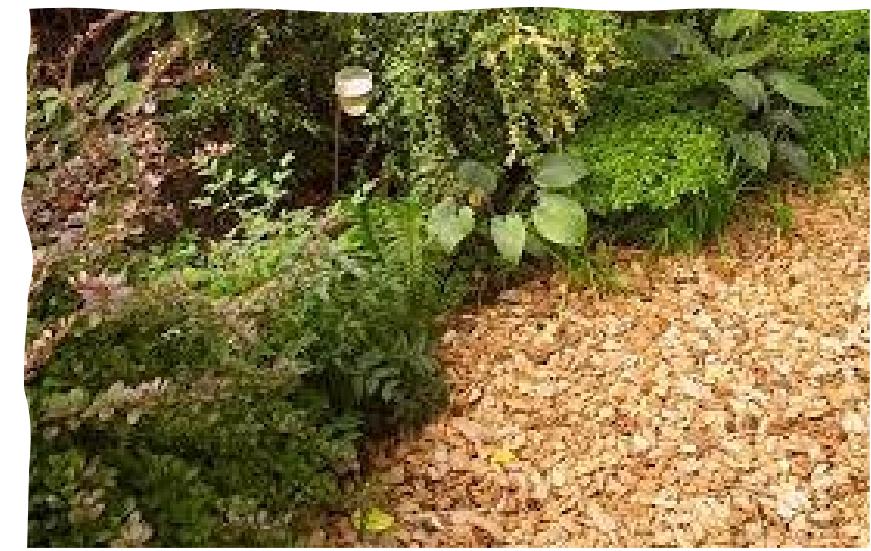
- Shredded rubber, pine needles and shredded cedar bark have the highest hazardous combustion characteristics
  - recommended for use only in areas more than 30 feet from the house

The Combustibility of Landscape Mulches, University of Nevada Cooperative Extension study

# Mulches

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- Use maximum of a 2” layer of mulch in planting beds
  - Compost and small particle-sized woody mulches don’t tend to ignite.
  - Only inorganic material should be used in Zone 0 adjacent to structures, including decks.



# Organic Mulches

- **Composted Wood Chips** under 1 inch in size.
  - Low burn-characteristics but may smolder.
- **Irrigating wood and bark mulches**, should not be relied upon to lessen fire hazard.
  - Irrigation reduces the ignitability of mulches, but water supply and pressure may be limited or unavailable during a wildfire.
  - Dry, hot, windy weather will dry out the mulch well in advance of the flaming front.

# Weed Fabric

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- Weed fabrics are made out of synthetic materials and will burn easily if exposed.
  - Really bad for the soil.
  - Best not to use at all.



# Emergency Watering Systems

- Can increase the ignition tolerance of a structure and landscape:
  - Help extinguish incoming embers and the small fires they create, and
  - Requires more time and heat to cause ignition.
- Must be able to operate during power outages and dramatic drops in water pressure.
- System needs to be easy to use.
- Use only the high-quality materials:
  - Galvanized steel pipe instead of PVC
  - Galvanized or brass fittings should be used instead of plastic.

# Emergency Watering Systems

- Create an environment that extinguishes embers by:
  - 1) **hydrating potential fuels**, thus making them less susceptible to ignition,
  - 2) **increasing humidity**, and
  - 3) **creating a cooler microclimate** around the home.





# Emergency Watering Systems

- Small amounts of water or wet surfaces can extinguish embers.
  - High-wind conditions cause the majority of wildland fire structure losses.
  - Most exterior sprinkler systems are NOT designed for high winds.
- 

# Emergency Watering Systems

- Water storage devices recommended to be at least 2500 gallons to make a difference.
- Cisterns, ponds, pools, and water tanks require a slightly different approaches to make water accessible.
- Bring to the attention of fire departments so that they are aware of them.



# Emergency Watering Systems

- An emergency water source should never be farther than 200 feet from the structure it is serving.
- A fire truck should be able to drive to within 10 feet of a water source.
- Provide a clear pathway between the water source and structures for fire fighters.

# Emergency Watering Systems

- Drainpipes of pools and water tanks need to be readily accessible and modified to make the fittings compatible with the fire fighter's hose.
- Firefighters need a 2-1/2" threaded male fitting.
  - A removable reducing bushing can be screwed onto this larger fitting to accommodate a garden hose.
  - Check with local officials for their recommendations.

# Emergency Watering Systems

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- With a loss of electricity and/or a big drop in water pressure, a good water pump can be critical in defending a structure.
  - Two types of pumps: gasoline- or electric- powered with a generator.
  - Should deliver a minimum of 100 gallons of water per minute at 50 pounds per square inch of pressure and has a standard 1-1/2" threaded outlet.
  - Any water pump should include an 8-foot suction hose, 100 feet of fire hose, and an adjustable fire nozzle.
    - A fire hose is distinguished from other hoses by its fire-resistant jacket.
    - Pumps drawing out of a pond should have a fine mesh screen over the water intake and a minimum 8'-long suction hose.



# Emergency Water Systems

- Rooftop Sprinkler Systems
  - While rooftop sprinkler systems may seem like a good idea, they are generally ineffective once domestic water systems lose pressure.
  - The steeper a roof, the less effective this irrigation system is.



# Wind-Enabled Ember Dousing (WEED) System

- Sprays into the wind
- Use the wind to blow spray onto the structure maximizing windward protection.
- Low flow rate
  - <30 gpm provides >3 hours protection with a 5000-gallon supply.
- ***Supplements*** defensible space
- 100' clearance to protect from radiant heat



# WEED System

- **CONCEPT**: Achieve wind-resilient ember protection by directing coarse water spray outward from the structure.
- The wind blows it back onto the structure.
- Spray accumulates where embers do (shown by computer simulation)
- Low spray densities needed to protect from embers (as opposed to radiant heat)

(Published in the International Fire Safety Journal,  
September 2006)

# Emergency Watering Systems

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- Test the system annually before the start of fire season and perform any maintenance needed on a regular basis.
- Oil and start generators: always run an engine dry before storing, which helps prevent gas from coming up inside the carburetor and cylinders.
- Replace old gasoline with fresh.
  - Aged gasoline has a tendency to turn dark and sour; please volatility; and gum up filters, lines, and carburetors.
- Test in oil water pumps. Turn all valves on and off several times to ensure proper function.

# Maintenance and Cleanup

- A garden designed for fire resilience is not static – it requires maintenance over its lifetime.
  - Get rid of dead and dying trees and plant debris promptly.
  - Water plants in the ember resistance zone regularly.
  - Mow, prune, and trim all zones regularly to maintain defensible spacing between trees and plant clusters.
  - Check and clean gutters regularly.
  - Place piles outside of Zone 2.
  - Beside your own property, trim vegetation on your property that impinges on a neighbor's Zone 1 and 2.

# Prepare for Evacuation

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- **Inside the House**

- Know your community's emergency response plan and have a plan on where to go when it is time to evacuate, and best routes for leaving your location.
- Shut all windows and doors; leave them unlocked.
- Remove flammable window shades, curtains and close metal shutters.
- Remove lightweight curtains.
- Move flammable furniture to the center of the room, away from windows and doors.
- Turn off pilot lights.
- Leave your lights on so firefighters can see your house under smoky conditions.
- Shut off the air conditioning.

# Prepare for Evacuation

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- **Outside**

- Gather up flammable items from the exterior of the house and bring them inside (patio furniture, children's toys, door mats, trash cans, etc.) or place them in your pool.
- Turn off propane tanks.
- Move propane BBQ appliances or tanks away from structures.
- Connect garden hoses to outside water valves or spigots for use by firefighters.
- Fill water buckets and place them around the house.
- Don't leave sprinklers on or water running, they can affect critical water pressure.

# Prepare for Evacuation

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- **Outside (cont.)**

- Leave exterior lights on so your home is visible to firefighters in the smoke or darkness of night.
- Have a ladder available and place it at the corner of the house for firefighters to quickly access your roof.
- Seal attic and ground vents with pre-cut plywood, metal tape, or commercial seals.
- Patrol your property and monitor the fire situation. Don't wait for an evacuation order if you feel threatened.
- Check on neighbors and make sure they are preparing to leave.

# No such thing as fire-proof!

- **You cannot have a fire-proof building!**
- These concepts are borrowed from other reliable sources.
- Not a substitute for professional assessments or hiring professionals to harden your home.
- Just listening to this won't do anything to reduce your risk.
- **Get out there and make some improvements!**

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- Fire in the Wildland-Urban Interface: Understanding Fire Behavior, Cotton Randall
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- Sierra Nevada Yard & Garden, Sierra Nevada Alliance (PDF)
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- <https://ucanr.edu/sites/fire/Prepare/Landscaping/Mulch/>

**Thank you for joining us!**

## **Q & A**

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