



## Lesson 5: Fire Resistant Structures

### Preparing with Defensible Space and Home Hardening

**Guiding Question:** What can be done to improve a structure’s chance of surviving a wildfire?

**Goals:**

- To give students an introduction to wildfire preparedness.
- To give students knowledge about achievable actions they can communicate to their families about defensible space and home hardening.

**Objectives**

Students will be able to:

- 1) Explain defensible space through describing features of the three Home Ignition Zones.
- 2) Make recommendations to improve a structure’s likelihood of surviving a wildfire by using the Firewise principles.

**Materials and Preparation:**

- Pre-print the Firewise student handout, *How to Prepare Your Home For Wildfires*. <https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Preparing-homes-for-wildfire>
- Prepare PowerPoint slideshow for *Lesson 5: Fire Resistant Structures*.
- Students will need their wildfire journals in class.

**Subjects:** Science, Writing, Speaking and Listening

**Duration:** 60 minutes

**Setting:** Classroom

**Vocabulary:**  
 Defensible Space, The North Winds, Embers, Ladder Fuel, Crown Fire, Home Hardening, Firewise, Home Ignition Zones

<b>Standards:</b>		
<b>NGSS</b>	Crosscutting Concepts	Scale, Proportion, and Quantity Structure and Function
	Science and Engineering Practices	Developing and Using Models Engaging in argument from evidence
	Disciplinary Core Ideas	ESS3.B Natural Hazards
<b>Environmental Principles and Concepts</b>		Principle 3: Natural systems change in ways that people can benefit from and can influence.

## Lesson Overview:

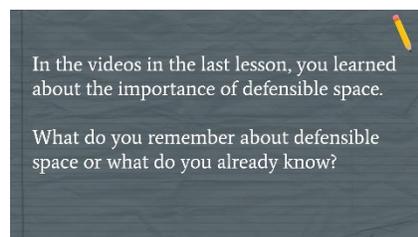
If you did not read the story, *Once Upon a Wildfire*, this lesson is the beginning of the series on personal and family fire preparedness. These topics may be more difficult for students to discuss, especially students who have experienced a personal loss to a wildfire. It is recommended to refer to houses as “structures” whenever possible and acknowledge that these structures come in many shapes and sizes, including apartments or mobile homes.

The purpose of this lesson is to give students knowledge about achievable actions they can communicate to their families about defensible space and home hardening. Lesson resources and information is primarily from the National Fire Protection Association’s (NFPA) Firewise program. Students may not have the ability to make changes at home, but as future adult community members and potential land or homeowners, they are important concepts to be familiar with. Try to focus the lesson and checklist activity on actions that do not require expensive remodels or major landscaping, which could feel unachievable and overwhelming. The many students whose families live in rentals are also limited about what actions can be taken to change structures and property. Students can still use their knowledge after this lesson to start discussions at home and help with smaller projects such as removing surface fuels and ladder fuels. They can also be valuable observers, pointing out potential hazards and offering suggestions. The printable Firewise handout is a way to support students in bringing this lesson’s topics home to their families.

The recommended FireWorks lesson expands on the Firewise checklist activity to conduct a school assessment. This single or multiple-day lesson gives students the power to contribute to your school’s wildfire preparedness.

## Procedure:

1. Review your class community rules poster.
2. Go through the presentation slides for *Lesson 5: Fire Resistant Structures*.



Factors that can put structures at risk from a wildfire:

- Windy conditions
- Flying embers
- Dense vegetation and fuels
- Flammable building materials

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This lesson will look at these factors and what can be done to lessen the risk from wildfire by preparing the space around a structure, and the structure itself.

### Wind-driven Fire



- “The North Wind” is a local, seasonal wind that occurs during the late summer and fall months.
- These strong winds travel downslope from the mountains toward the valley.
- Dry wind dries out fuel and increases the air temperature from friction.
- Wind-driven fires produce large amounts of embers.

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Dry, downslope winds can speed through mountain passes at nearly 100 mph. The North Winds blow from the North and travel down the Sierra Nevada Mountains. If you remember from Lesson 3, wind is the most critical factor affecting fire behavior.

### Embers

Small pieces of burning material that are light enough to be blown through the air. This results in the rapid spread of wildfire as embers can be blown over a mile ahead of the main fire and start new fires. This is called spotting.

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Embers cause the majority of wildfire home ignitions by igniting surrounding vegetation or materials on or near the home. Hardening efforts must prepare the structure and surrounding land from the threat of wind-blown ember storm.

### Fuel-driven Fire

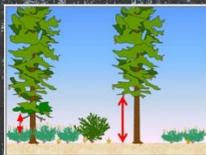
- Supported by dense vegetation.
- Temperatures can reach up to 1,200 degrees F.
- Fires can burn as surface fires (surface litter and duff), canopy fuels (through the trees), or crown fires (across the tops of trees).

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Wildfires are much harder to control if they turn into crown fires. Firefighting efforts are focused on keeping fire on the ground where it is easier to defend against and extinguish.

### Ladder Fuel

Which tree stands a better chance against a surface fire? Why?



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Ladder fuel is fuel that can carry a fire burning in low-growing vegetation up to the taller vegetation. This can move fire up into the canopy and crown where it can spread quickly to surrounding trees. The tree is unlikely to survive this type of fire, whereas it could often survive a surface fire. The tree on the right does not have ladder fuels around the base. Pruning trees up six to ten feet high is an important part of fire-preventative landscaping.

What can be done to prepare a structure for wind-driven and fuel-driven fires?

Defensible Space + Structure Hardening

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“Defensible space is essential to improve your home’s chance of surviving a wildfire. It’s the buffer you create between a building on your property and the grass, trees, shrubs, or any wildland area that surround it. This space is needed to slow or stop the spread of wildfire and it helps protect your home from catching fire—either from direct flame contact or radiant heat. Defensible space is also important for the protection of the firefighters defending your home.”

Image and quote from CAL FIRE: [Prepare for Wildfire - Defensible Space](#)



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Why might it be beneficial to have smaller groups of people working together? Have you and your neighbors ever worked on a project or had to make a decision as a group?

Are you already part of a Firewise community?



As of 2021, there are eight Firewise USA® communities 'In Good Standing' in Butte County. Smaller communities and individual neighborhoods can still form within existing larger Firewise community boundaries.



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Homeowners can play an important role in fire-safe communities by making choices that protect their home and property from wildfire risks. This 4-minute video shows some of those choices.  
Video: [Your Home and Wildfire. Choices that can make a](#)



Pass out the Firewise *Prepare Your Home* handout. Printed handouts are available as a pdf in English and Spanish here: [Preparing homes for wildfire](#)

In the video you heard about the “home ignition zone”. The National Fire Protection Association has created a list of guidelines that people can use to create an ideal defensible space around their homes, called the Firewise guidelines. They divide the area around a building into areas referred to as the home ignition zones. These zones are broken into:

- Immediate Zone (0 to 5 feet around the house)
- Intermediate Zone (5 to 30 feet)
- Extended Zone (30 to 100 feet or property line)



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“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.” -NFPA

**Immediate Zone: 0-5 feet around home and deck**

- Use crushed stone or gravel instead of flammable mulches.
- Remove pine needles and leaves from roof.
- Clear rain gutters.
- Trim branches that overhang the home, porch, or deck.
- Trim, rake, and remove all dead plant matter.
- Move firewood stacks and lumber piles at least 30 feet from buildings.
- Remove any flammable materials from under decks.

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Full checklist for each section can be found at:

[Prepare for Wildfire - Defensible Space](#)

**Intermediate Zone (5 to 30 feet around home)**

Let's zoom out to the intermediate zone. What is a priority to maintain this area?



**Intermediate Zone (5 to 30 feet)**

Keep it "Lean, Clean, and Green"

- Remove plants containing resins, oils, and waxes often found in highly flammable plants.
- Create fuel breaks with driveways, walkways/paths, patios, and decks.
- Keep lawns and native grasses irrigated and mowed to a height of four inches.
- Remove ladder fuels so a surface fire cannot reach the tree canopy.

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Invasive plants can include Scotch and Spanish Broom, Large Periwinkle, Ivy, Eucalyptus, Mustard, and Non-native seasonal grasses.

For further investigation, this 5-page pdf from the University of California Agriculture and Natural Resources features some of these invasive and flammable plants that can have a negative impact on your landscape and the habitat around you.

[Invasive plants and wildland health](#)

**Extended Zone (30 to 100 feet or property line)**

What do you notice in the extended zone?



**Extended Zone (30 to 100 feet or property line)**

Break up both vertical and horizontal fuels. ↑ →

- Reduce ladder fuels by pruning branches of large trees up to 6 to 10 feet (depending on their height) from the ground.
- Space out remaining trees and plants.
- Remove ground litter/debris and dead plant and tree material.
- The extended zone can go out to 200 feet if the property is on a slope with lots of vegetation.

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According to the California Fire Safe Council, "Fire hardened means your home is prepared for wildfire and an ember storm. It does not mean fireproof. Home hardening addresses the most vulnerable components of your house with building materials and techniques that increase resistance to heat, flames, and embers that accompany most wildfires."



How can each area be "hardened" to reduce the risk from embers or flame contact?

Roof	Deck/Porch	House Siding
S Skylights	Patio Furniture	Woodpiles
Chimney	Eaves	Garage Door
Windows	Flowerbeds	Garbage Cans
Vents	Vehicles	Fencing
Rain Gutters		

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Group brainstorm. Quickly go through each point and have students share an idea to harden that area from embers or how to close up that area if there is an approaching wildfire. Refer to the Ember Awareness Checklist at the end of the lesson for ideas/answers.

Work with a partner to make a simple "Firewise Checklist". Write five or more questions that can be used to evaluate a structure's protection from wildland fire.

Make a list in your journal and be ready to share your questions with the class.

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Students can use the *How to Prepare your Home For Wildfires* handout for guidance.

Example questions:

- Is the roof clean?
- Is there a strip of un-burnable material separating vegetation from the house?
- Are there any trees overhanging the roof?

Our Class Firewise Checklist

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Have each pair share one of their Firewise questions with the class. Make a combined class list on the whiteboard with 7-10 questions. If other groups put the same question on their lists, they can raise their hands when the question is read aloud.

Once the list is complete, click through the next three photos.

**Assessment:**

Part 1

Students will use their personal and class Firewise checklists to make observations about the defensible space or hardening in three photos of foothill homes that survived a recent wildfire. What from the checklists can be seen in the photos?



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## Part 2

Students write a paragraph about their thoughts on the importance of creating defensible space and hardening structures to prepare for a wildfire. Students can respond to the following questions in their paragraph:

- What are three Firewise principles you think are particularly important?
- Is there anything you learned today that you think your family should know about?
- What are some home or property fire-preparedness actions you think kids could help with?

### Evaluation:

	<b>Good</b>	<b>Fair</b>	<b>Poor</b>
Part 1 Firewise Checklist	Worked collaboratively with a partner to make a list of five Firewise questions.	Worked semi-collaboratively with a partner to make a list of four or five Firewise questions.	Did not work with a partner to make a Firewise list, or the list had less than four items.
Part 2 Paragraph Response	Students show a strong understanding of the Firewise principles in their paragraph reflections.	Students show an understanding of the Firewise principles in their paragraph reflections.	Students do not show an understanding of the Firewise principles in their paragraph reflections.

### Lesson Extension Recommendation:

FireWorks: Northern California Oak Woodlands

M.3.4.A Assessing Your School

<https://www.frames.gov/fireworks/curriculum/norcal-oak-woodlands>

## Ember Awareness Checklist

### **Wood Roof**

Replace wood shake and shingle roofs with fire-resistant types such as composition, metal, and tile.

### **Roof Openings**

Plug openings in roof coverings, such as the open ends of barrel tiles with non-combustible materials.

### **Roof Debris**

Routinely remove plant debris such as pine needles, leaves, branches, and bark from the roof.

### **Skylights**

Replace plastic skylights with types constructed of double-pane glass. One of the panes should be tempered glass. Close skylights if wildfire threatens.

### **Spark Arrester**

Install an approved spark arrester on chimneys.

### **Windows**

Replace single-pane, non-tempered glass windows with multiple-pane, tempered-glass types. Close all windows if a wildfire is threatening.

### **Vents**

Cover attic, eave, and foundation vents with 1/8 inch wire mesh or install new vent types designed to prevent ember entry. If a wildfire is threatening, consider covering vent openings with precut plywood or aluminum foil folded several layers thick and stapled.

### **Rain Gutters**

Keep rain gutters free of plant debris during fire season. Consider using rain gutter covers to reduce maintenance.

### **Siding**

Fill gaps in siding and trim materials with a good quality caulk and replace poor condition building materials.

### **Woodpiles**

Move firewood stacks and scrap lumber piles at least 30 feet from the house or other buildings.

### **Patio Furniture**

Place combustible patio furniture, such as lounges, tables, and hammocks, inside the house or garage if a wildfire is threatening.

### **Deck Boards**

Replace deck boards that are less than one inch thick or that are in poor condition with thicker, good condition boards. Use metal flashing between the deck and the house.

### **Deck Debris**

Remove plant debris from the gaps between deck boards, the gap between the deck and house, and lying on top of the deck.

- Porch and Deck Accessories**

If a wildfire is threatening, remove combustible materials from the porch and deck including newspapers, wicker baskets, doormats, dried flower arrangements, and place BBQ propane tanks indoors.

- Under the Deck**

Remove plant debris, woodpiles, and other easily ignited materials from under decks. Consider enclosing the open sides of the deck with siding materials that are properly vented or 1/8 inch wire mesh to reduce maintenance and deter ember entry. Do not use wooden lattice to enclose decks.

- Flowerboxes**

Remove wooden flower boxes from beneath windows if a wildfire is threatening.

- Eaves**

Cover open eaves with sheathing, such as plywood or fiber-cement board. Use tongue and groove joints or other intricate joint types and don't use butt joints.

- Flowerbeds**

Replace wood mulches with noncombustible types and remove plant debris, including dried grass and flowers, dead leaves, and dead branches from flowerbeds next to the house, other buildings, and next to wooden fences. Replace ornamental junipers with low-growing deciduous shrubs or flowers under irrigation.

- Vehicles**

Close vehicle windows. Back into the garage and close the garage door or park away from the house.

- Garage Door**

Adjust garage doors to achieve as tight a fit as possible with the door frame. Consider using trim around the garage door opening to reduce the size of gap openings. Close the garage door if a wildfire is threatening.

- Garbage Cans and Recycling Bins**

Use garbage cans covered with tight-fitting lids near the house or other buildings. Move newspaper recycling bins indoors.

- Wooden Fences**

Maintain wooden fences in good condition and create a noncombustible fence section or gate next to the house for at least five feet.

From:

[https://www.nps.gov/samo/learn/management/upload/EmberAwarenessChecklist\\_4\\_2013\\_Final.pdf](https://www.nps.gov/samo/learn/management/upload/EmberAwarenessChecklist_4_2013_Final.pdf)

# 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 **Intermediate Zone** (5 to 30 feet), and the **Extended Zone** (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

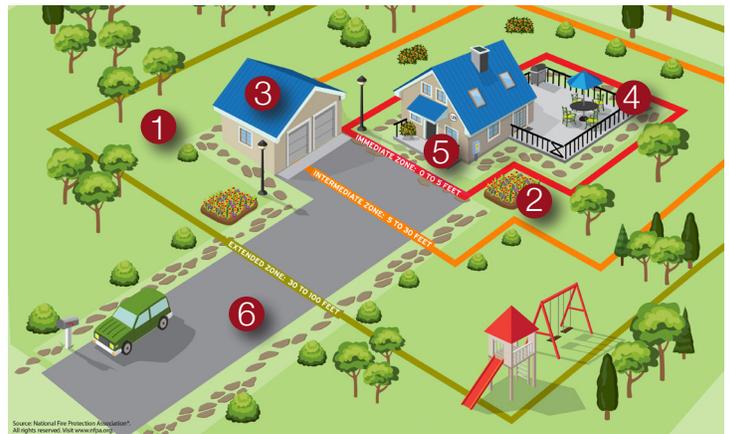
Embers can collect in small nooks and crannies and ignite combustible materials; radiant heat from flames can crack windows. Use fire-resistant siding such as brick, fiber-cement, plaster, or stucco, and use dual-pane tempered glass windows.

## ■ 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.**



**FIREWISE USA®**  
RESIDENTS REDUCING WILDFIRE RISKS

VISIT [FIREWISE.ORG](https://www.firewise.org) FOR MORE DETAILS

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