Fire Preparation Toolkit

WHAT TO DO BEFORE, DURING, AND AFTER A FIRE

FROM THE PERMACULTURE DESIGN AND RESILIENCE PERSPECTIVE

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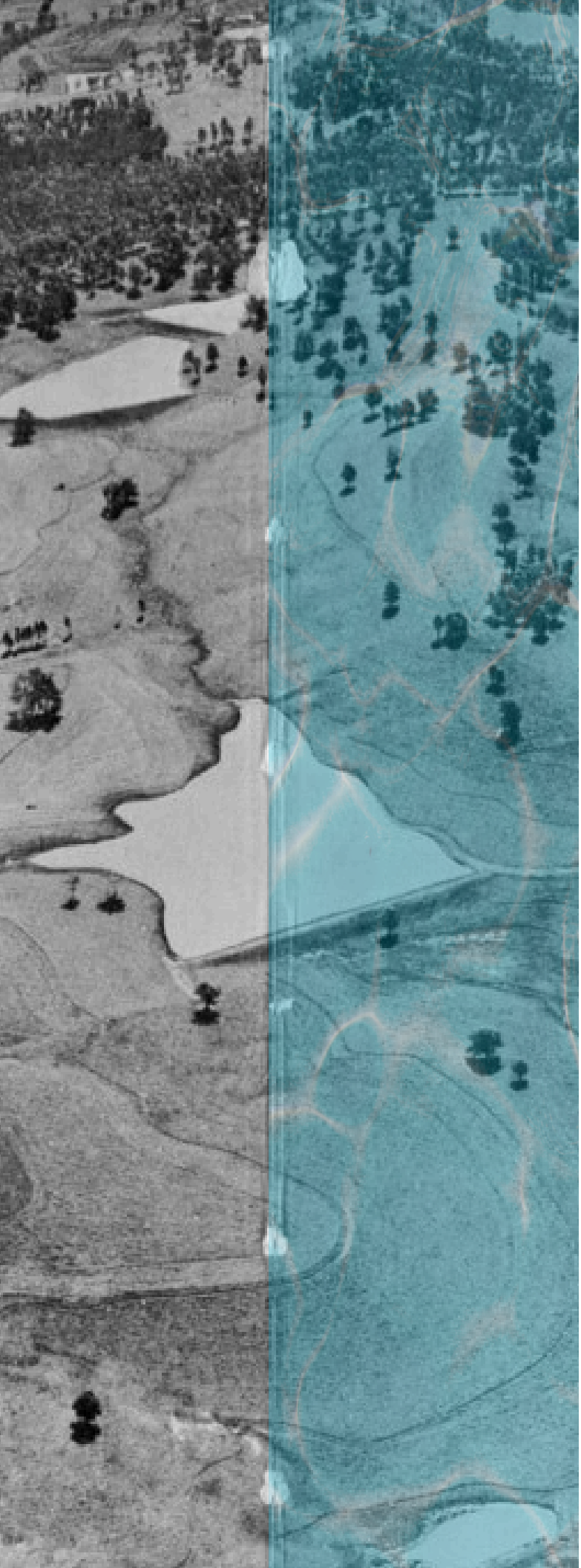

FIRE

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IMAGE: P.A. YEOMAN'S FIRE PROOF FARM

About

This Fire Preparation Toolkit is one of a series of **free guides** designed to help you prepare for disasters. It provides regenerative solutions to create more resilient landscapes, ease recovery, build long-term resilience, and restore local ecosystems.

These guides were created in response to the widespread damage caused by Hurricane Helene, southern California wildfires, and other recent devastating disasters. The Permaculture Institute of North America (PINA), Association for Regenerative Culture (ARC), and WeRegenerate have come together as the **Disaster Resilience Initiative** to produce this series of educational resources on disaster management viewed through an integrated, multi-solution, permaculture lens.

Our guides outline **step-by-step** actions to lessen impacts and protect yourself from imminent disasters, prepare quickly, and develop longer-term resilience strategies. In addition to these resources, we offer monthly town halls, an online forum, and are developing a comprehensive online library of regenerative solutions, online summits, a resource directory, and other educational and networking opportunities.

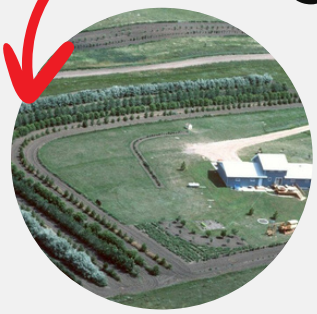
These collated, targeted resources support community leaders, groups, and individuals in preparing for and responding to fire, flood, hurricane, tornado, landslide, other extreme weather, and economic or social crises—helping to **rebuild homes, communities, and environments in a more resilient and regenerative way**.

We've gathered best practices from a wide range of sources, including wildfire specialists from California, Australia, and Canada, as well as permaculturists working in fire-prone regions. We are grateful to the many experts who contributed to this document through their generous advice and free materials.

This is a **community based project** and a living document. We are actively seeking input from others to improve this information. Please contact us if you have resources to share or if you'd like to contribute to this project in other ways.

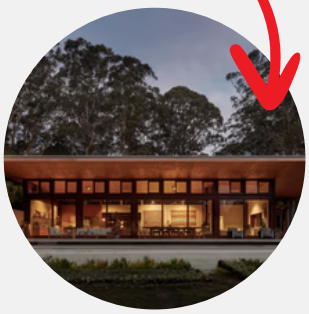
If you print, printing in black and white will save ink. A print copy of checklists is **here (link)**, to place in your bug-out bag. We will continue to update this manual. For the most up to date versions and access to all other guides see: **PcX.earth/disaster**

Regenerative Solutions



Wind breaks and fire breaks are designed to keep fire away

Drought proof and fire proof farm by design



Homes made of hempcrete are fire resistant

What Is Bioregionalism?

Bioregionalism is the idea that our communities, economies, and identities should be rooted in the natural characteristics of the place we inhabit—**its watersheds, soils, native plants, animals, climates, and landforms**—instead of political borders or abstract markets. Rather than forcing a one-size-fits-all model onto every landscape, bioregionalism calls on us to **live within the ecological limits of our home region,** drawing our food, energy, materials, and culture from what can be produced sustainably within it. By aligning our lifestyles, governance, and trade with the unique patterns of each bioregion, we reduce ecological footprints, strengthen local resilience, and foster a deep sense of belonging to the land itself.

The United States of America's watershed map. These maps by Szűcs Róbert show the nested nature of watersheds and the bioregions that emerge from them. *What if the whole world used bioregional ecologies to drive its global economy?*

Fire Preparation Guide

Fire season is an expanding reality in many parts of the U.S. While preparation varies by circumstance, the first priority is surviving a fire.

INSIDE

Part One: Surviving a Fire

A fire is headed your way. When do you evacuate? What do you take? What if you're caught or cut off? This section can help people who have yet to prepare, but this checklist is equally valuable for anybody, in the heat of the moment.

Two Major Actions to Take Beforehand:

STEP 1

Fire-harden your home. There are many cases of homes surviving devastating fires because they were hardened against wildfires. This technology is known and can be used to retrofit your home. There are emergency steps (see 'Basic Preparation' below) that you can take as well as longer term, more in-depth steps.

STEP 2

Have a good evacuation route, and as many alternate routes worked out and don't wait to evacuate until the last minute. Even if your home is hardened, you can be at risk from fumes and heat.

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Stay Informed

STEP 1

Sign up for a free fire alert service like Watch Duty (FEMA App also provides warnings and alerts for All-Hazards) or another trusted fire alert app on your phone. If your phone is accurately linked to your address, you will get evacuation warnings and orders via your phone.

STEP 2

Emergency service personnel might be available to come through neighborhoods to warn people to evacuate as well. If they say evacuate, do so. If the fire is moving fast enough or is large enough, they may not get to your neighborhood so do not wait!

Understand Your Risk

Evacuation warning:

Get ready to leave now. The fire is not immediately life-threatening but is highly likely to become so. Pack your "go bag", put everything in the car you need and irreplaceable items you want to take with you. Have your pets contained and supplies for their immediate needs packed. Know where your family members are. Communicate your evacuation plans with loved ones. You will not have time to do any of this once an evacuation order is given.

Evacuation order:

Leave immediately. This means the fire is close enough to take your life and destroy your property. If you wait to leave, you could die or at minimum, interfere with firefighters' access or be trapped by flames crossing the exit routes. Especially if there are heavy winds, sparks could ignite your home,a neighbor's, or your exit route at any time.

Trust Your Instincts

Leave without getting a warning or order if you feel there is a risk. If you see the fire and it is moving toward your location, especially if it is windy, consider a calm, orderly evacuation even if there has been no warning or order. Fast-moving fires can cause chaos and orders may come too late. People have lost their lives even when the risk is obvious because they were waiting for a notice to leave. Trust your instincts and keep you, your family and your pets safe!

Part Two: Rapid Response

You have received an evacuation warning or a fire is headed your way. Get prepared early!

First Actions

Back your car into the driveway and pack (have it facing toward the route out), load it up with things you can't readily replace (if you have a "go bag," get it in your car plus anything else you are taking), be sure to leave enough room for pets, or a neighbor without transportation.

Check on elderly or handicapped neighbors. If you know of elderly neighbors, or someone who may have difficulty evacuating, check on them to see if they need a ride.

Alert other neighbors of the risk. Check on or call neighbors to alert them to prepare at the first sign of fire.

About This Guide

This **Fire Preparation Guide** was created in response to the widespread damage caused by Hurricane Helene to landscapes, communities, and individuals. The Permaculture Institute of North America (PINA), Association for Regenerative Culture (ARC), and WeRegenerate collaborated as the **Disaster Resilience Initiative** to produce a series of educational resources focused on disaster planning, preparedness, and recovery, viewed through a permaculture lens. The goal of these guides is to freely distribute them to community leaders, groups, and individuals before or immediately following a disaster. These resources address fire, flood, hurricane, tornado, landslide, extreme weather events, and economic or social crises, with the aim of rebuilding homes, communities, and environments in a regenerative manner.

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Prepare your home (do this only if you have time):

Inside Home Actions Checklist

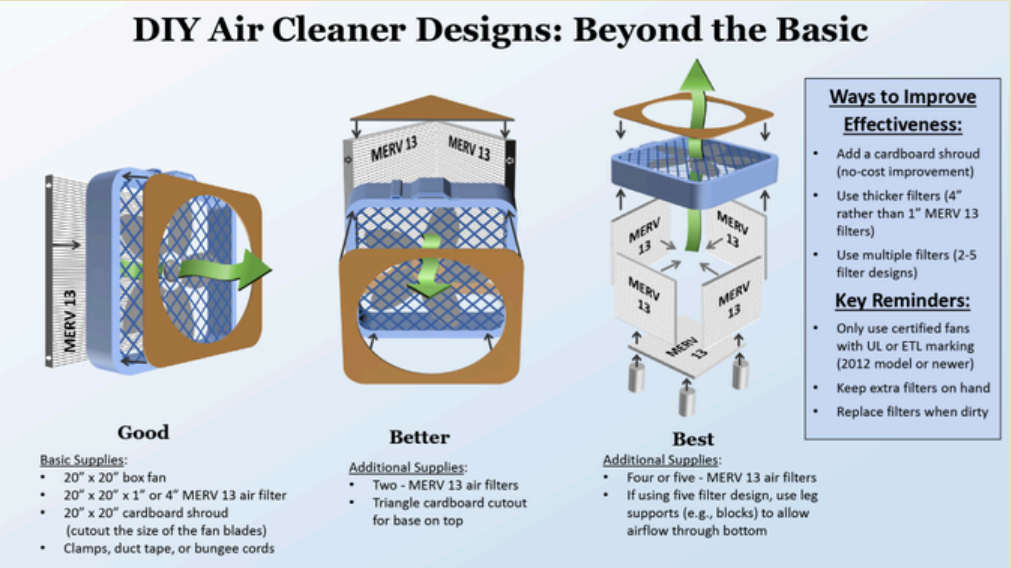
- [ ] If not already done: Walk through the house quickly with video camera on and video each room of the house. Open all the closets, drawers and cabinets and video the contents.
- [ ] If you still have power, TURN ON LIGHTS so firefighters can see your house- (this saved many homes in some areas as did solar lights), both indoor and outdoor. This can help firefighters see your home through smoke.
- [ ] Shut all windows and doors and leave them unlocked.
- [ ] Shut off A/C, heat, and pilot lights on gas stoves.
- [ ] Move furniture to the center of the room, away from windows.
- [ ] Remove combustible window shades and curtains; close metal shutters if you have them.
- [ ] Leave a note with your contact info and out-of-area contact taped to fridge or inside a front window.

DIY Air Filter

Even if the fire is not close to you, the smoke can be toxic and damage lungs. Don't underestimate the risk from breathing smoke, especially over time. Damage can be cumulative. Air filters in your home are good options, but you can also make your own for much lower cost with a box fan.

Materials:

- **Box Fan:** A 20x20 inch box fan (newer models with safety features are recommended).
- MERV 13 or Higher Furnace **Filter:** A 20x20 inch filter (or a size that fits your box fan).
- **Duct Tape**: For sealing and securing the filter.
- **Cardboard** (Optional): For a shroud to improve airflow.



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Prepare your home (do this only if you have time):

Outside Home Actions Checklist

- [ ] Leave gates unlocked and prop them open so firefighters have fast, easy access.
- [ ] Attach hoses to spigots and connect squeeze grip nozzles. Turn on sprinklers and wet down your roof. Leave the hose out where it's easy to spot when you turn the water off.
- [ ] If you are on a public water system, turn off the water before you leave to ensure water pressure where it will be needed most. Even if you are on a private well, turn the sprinklers off when you leave so your well pump does not burn out if the well empties since you might be gone for several days.
- [ ] Move all flammable items away from structures, including trash cans.
- [ ] Remove vegetation and other combustible debris from around large unmovable propane tanks.
- [ ] Shut all windows and doors and leave them unlocked.
- [ ] If you have a swimming pool, large pond, or creek accessible by firetruck hoses, write "WATER" on cardboard with an arrow pointing in the direction of the source for firefighters
- [ ] Place combustible outdoor items (patio furniture, toys, doormats, trash cans, etc.) in the garage or 30' from structures (optional: place in a pool).
- [ ] Shut off gas at the meter or propane tank.
- [ ] Move propane BBQ and any tanks at least 15' away from combustibles.
- [ ] Fill water buckets and place them around outside of the house, especially near decks and fences for animals & firefighters.
- [ ] Place ladder(s) where firefighters can find them. Also leave garden implements like rakes etc at the front of the house for firefighters.
- [ ] DISCONNECT automatic garage doors so they can open by hand (close door). If you have them, activate wildlife cameras so that you can stay updated from afar- this helped fire-survivors greatly in some areas.
- [ ] Clean debris from roof and gutters.
- [ ] Do not leave sprinklers on because it can decrease water pressure for firefighters to use.
- [ ] If vents are not protected, seal attic and ground vents with precut plywood or 1/8" metal wire mesh covers (even duct tape will protect from ember entry).
- [ ] Fill and ready any gas or solar-powered water pumps.

3000 Fire Survivors Agree!

The Top 5 Things People WISH They Had Taken With Them That Haunt Them

🐱 **#1 - Pets**

💖 **#2 - Family Photos/Videos/Heirlooms**

💵 **#3 - Cash Safes & Valuables -** cash will burn inside, some valuables may melt

🪪 **#4 - Vital Records -** (Deeds, social security cards, passports) these are replaceable but I've watched people suffer greatly over replacing these documents after losing their homes and it delays and can even block you from receiving disaster assistance. **GRAB THEM IF YOU CAN QUICKLY. BUT NOT WORTH RISKING YOUR LIFE OVER.**

💊 **#5 - Vital Medications**

The Emotional Toll

The emotional toll of a fire is as profound as the fire damage itself. Individuals have lost lives, homes, and a sense of security. Communities have lost even more. Survivors guilt and PTSD are common after effects for those that survive the fire.

"*We have people today, almost five years later, still in every stage of recovery*," Sarah says. "*You have to live in your experience and just take it day by day.*"

"*I had to humble myself and learn trust, learn vulnerability, learn acceptance of what it means for others to provide for my welfare because I had nothing*"

"*Stand up. Start each day anew and go receive what help is out there*," Richard says. "*Our advice is, stay strong, seek help, receive it, and life will get back on track.*"

We provide more practical mental and emotional health tips and strategies later in this document.

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Evacuation

What to Bring: A regular bug out bag (see our Overall Preparation Guide coming soon)

If there is risk of nearness or exposure to fire while evacuating:

- [ ] **Protective clothing** (boots, pure wool or other fire resistant clothing if you have it, wool hat)
- [ ] **Pure wool blankets** can save you from burning if you're exposed to flames.
- [ ] **Goggles** to protect your eyes from embers and smoke
- [ ] **N95 or better face mask** - bandana or T-shirt for your face if that's all you have. Note: N95s will not offer full protection during a fire if you're exposed to a lot of smoke. If you're in fire country, a full face respirator that protects eyes and filters to .1 micron is a smart purchase. Cover your N95 mask with another cloth if you don't have a respirator and when smoke/ash is very thick.
- [ ] **Multiple jugs of water** (1 gallon per person per day; 3 days worth or more for evacuation is ideal)
- [ ] **Fire extinguisher**
- [ ] **Flashlights**, preferably headlamps. At least one for each person. (Check the charge or battery level beforehand.)

Pets and Livestock: If you have to evacuate and you will not or cannot take your pets or livestock, please, do not leave them trapped in your house, in a corral, coop, or barn, or tied up outside. Give them a chance to flee. (Check ahead of time on Facebook or other social media for other livestock owners offering emergency evacuation and holding services for your livestock. Put the names/numbers in a prominent place.)

Actions

- [ ] In case of separation from other household members, work out a meeting place and place to leave messages beforehand - cell service may not work.
- [ ] Let your out-of-area contact know you're leaving. Update them as you can.
- [ ] Look up the best evacuation routes in relation to the fire and traffic. This can be a changing situation - some routes may be blocked. Leaving early can prevent being trapped in a traffic jam or fire. Watch Duty or similar service may have these routes marked.
- [ ] Download a map in case you lose service. Bring a paper map for redundancy. Mark it with at least two evacuation routes (this is best done well before a fire).

Actions Continuted

- [ ] Have evacuation location set up and have backup just in case (this is best done beforehand, but get out first if you don't already have this determined ; there will be shelters and places to go).
- [ ] If you have to abandon your car for any reason, pull the car off the road and don't block traffic. Leave keys in the car if you're stuck and everyone's abandoning cars. This could save lives and homes - maybe your own!
- [ ] Avoid down power lines! Go around them if there are fallen power lines on the road. Don't assume they aren't live.

Sheltering-In-Place

Use extreme caution if you decide to shelter-in-place. To do so safely is beyond the scope of this manual.

Some people stay during a fire to protect their home. Refusing to evacuate or waiting too long to evacuate is the main reason people die in wildfires. Most thought they were fine until they weren't. You are risking your life by staying to fight the fire, especially if there are high winds (when the fire can send sparks ahead and surround you), and especially if evacuation routes may be cut off. You are potentially risking the lives of emergency personnel who might try to save you.

People who survive if the fire reaches them have usually had training in emergency fire response and had appropriate equipment to help them survive such as respirators and appropriate shelter. Most people who survive do so because the main fire never reached them. They were able to put out spot fires, often in cooperation with professional firefighters.

Part Three: Basic Preparation

Do these steps when a fire is not headed straight toward you, but you're in a fire-vulnerable area and you have limited time and resources to prepare.

Three Major Actions to Take

STEP 1

Do a basic fire audit - a quick checklist to determine your risk. This will give you an idea of what to focus on addressing as a priority.
https://firesmartcanada.ca/

STEP 2

Work through a plan to complete the above steps to prepare for evacuation, including making plans for pets and livestock.

STEP 3

Drill this procedure - this includes driving primary and alternate escape routes so you and your family feel comfortable doing it. This step makes a huge difference in being able to salvage as much as you can as quickly as you can.

11 steps to fire harden your home:

STEP 1 **Remove vegetation** within 5 feet of your home. “Fire ladders” are a key entrance point for fire to enter your home. This is tough for most of us who love plants.

STEP 2 **Fit vents with fire resistant screens.** Vents are another key entrance point for burning embers.

STEP 3 **Remove attached combustible fences or gates**. Replace with non-flammable or fire resistant barrier (or nothing).

STEP 4 **Remove combustible materials** like mulch, wood stack, wooden furniture, etc, from around your house. Check under steps and decks for accumulated leaves and debris. Use rock or other non-flammable material within five feet of home.

STEP 5 **Remove combustible materials** like mulch, wood stack, wooden furniture, etc, from around your house including roof and gutters. Use rock or other non-flammable material within five feet of home. Replace wooden shake or wooden shingle roofs with metal or tile if possible.

STEP 6 **Use fire resistant plants** near the home. Opuntia cactus (including spineless edible varieties) has been a plant that has stopped fires from progressing. Iceplant is another. Check local lists.

STEP 7 **Understand your site**. Ascertain the direction of the most immediate threat including direction of the prevailing winds. This might be a forest, a thicket of shrubs, a wooden boundary fence, fire-hazards on a neighboring property.

STEP 8 **Keep highly flammable plants out** of your immediate landscaping completely (30 feet from home). This includes plants like eucalyptus, ornamental grasses, conifers, cedar.

STEP 9 **Document your efforts.** Before and after photos are powerful tools in convincing insurance companies to keep insuring you. Tell your local fire district of your work, this will help in an emergency as they will know your property can serve as a ‘safety zone’.

STEP 10 **Talk to your neighbors**. An isolated island - your property - in a sea of neighborhood hazards, remains at high risk despite your best efforts. Try to help your neighbors understand risks, take action, and potentially participate in creating a FireWise community association.

Resource: https://readyforwildfire.org/prepare-for-wildfire/firewise-communities/

STEP 11 **Investigate and take advantage of assistance** programs and services. Agencies and organizations in your area might offer free FireWise training or inspections, grants, or other services. Participate in training programs and certification options to further underscore your efforts.

Part Four: Post Fire Recovery

The fire is over and you want to return. See our overall recovery section here.

Here are a few things to keep in mind about fires specifically:

1. Don't return until authorities give the go ahead. They may still be putting out spot fires or there still may be risk of new fires starting.

2. Your home or neighboring buildings could be structurally unsound, in risk of collapse. Be sure of a building's integrity before you enter. If in doubt, stay out.

3. Stirring up ash can uncover hot spots or sparks and start new fires. It can also release toxins that can affect others in the area. Keep that in mind as you begin your recovery efforts.

Toxins Beware!

When authorities say the debris is toxic, they're serious. Ash may contain, among other toxins, asbestos, heavy metals, microplastics, or other unknown chemicals. These can cause immediate or long-term injury through inhalation, or contact with eyes or skin. People end up in the emergency room or worse when they don't wear masks, goggles, and protective clothing.

On a fire that burns multiple buildings, or many, the following step-wise procedure is used:

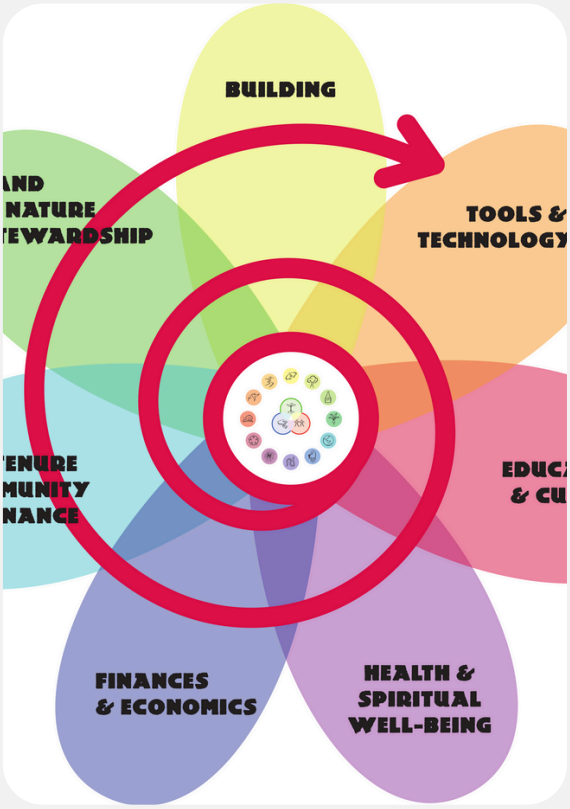
1. **Search and rescue** - search for people and pets that are trapped, or who didn't survive
2. **Hazardous waste clean up** - the EPA will search for hazards like asbestos, heavy metals, etc, and clean those up
3. **Restoration of basic needs** - Utility companies work to restore power, water, and sanitation.
4. **Hazard identification and mitigation** - FEMA contracts with professionals trained in disaster clean-up to ensure toxic ash is not sent floating through the neighborhood and waste is properly disposed of. The topsoil may be removed along with any ruined materials. Topsoil often has been contaminated by toxic ash, microplastics, etc. Other hazards could include water contamination (ground and surface), and engineering review of structure integrity.
5. **Individual responsibilities** - Residents can file a "right to entry" form that allows the government to come in and clean up their property. If it is a federal disaster, that would be FEMA. Otherwise, the state. Cleaning up your property beyond the basic hazards is your responsibility. Check your insurance to determine how they can help you and the process for filing a claim.

Part Five: Deeper Dive

Fire Hardened Property

If you have time and resources to do more, there are additional steps you can take.

Fire is only a risk if it can ignite your home. This most often occurs via burning embers, usually penetrating the roof.. There are numerous ways to harden your home and prevent it from catching on fire in the first place.



This section covers how you can create a much more fire resistant property, both your landscape and your home, using regenerative techniques that can help the ecosystem, reduce costs and enhance long term survival for you and all living things in your area. We also share recommendations for neighborhoods and towns to work together to create more fire safety.

There are some very good, well researched resources out there on this topic which we share with you here, tried-and- true approaches that can reduce your risk.Note that a lot of the viral memes of homes that survived with little or no damage are not necessarily properties that are truly fire resilient, they just got lucky.

In the case of high winds and drought, any property no matter how fire hardened, can be damaged. But yet you can do a lot more than most people realize to fire-harden your property in advance.

INSIDE

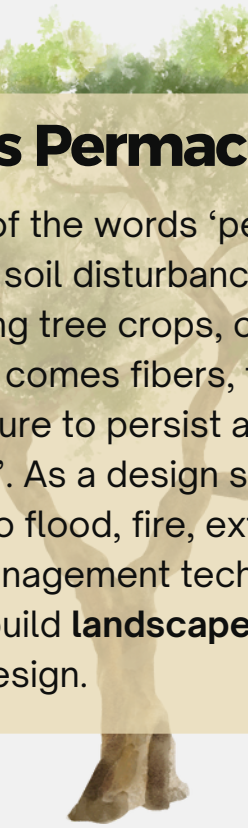
Do a fire risk assessment:

Conduct an analysis to understand where your wildfire risk exposure is near your property and surrounding areas. This will help with designing evacuation routes and property design (fire-resistant plant locations, water reservoirs, fire breaks/buffers, etc.) https://wildfirerisk.org/explore

This checklist by Insurance Institute for Business and Home Safety can be helpful training (certificate offered). The national FireWise program likewise offers extensive resources and training (certificate offered).

Study the various options you have to improve your fire resistance. There is copious literature beyond this manual on how to reduce fire risk and fire harden your home, yard and even neighborhood. We've included some in our "Resources" section.

Finally, design your property and stage your resilience plan. We strongly recommend you design to make your home resistant to multiple potential disasters as most areas are vulnerable to more than one type of disaster. See our other disaster guides for assistance with this.

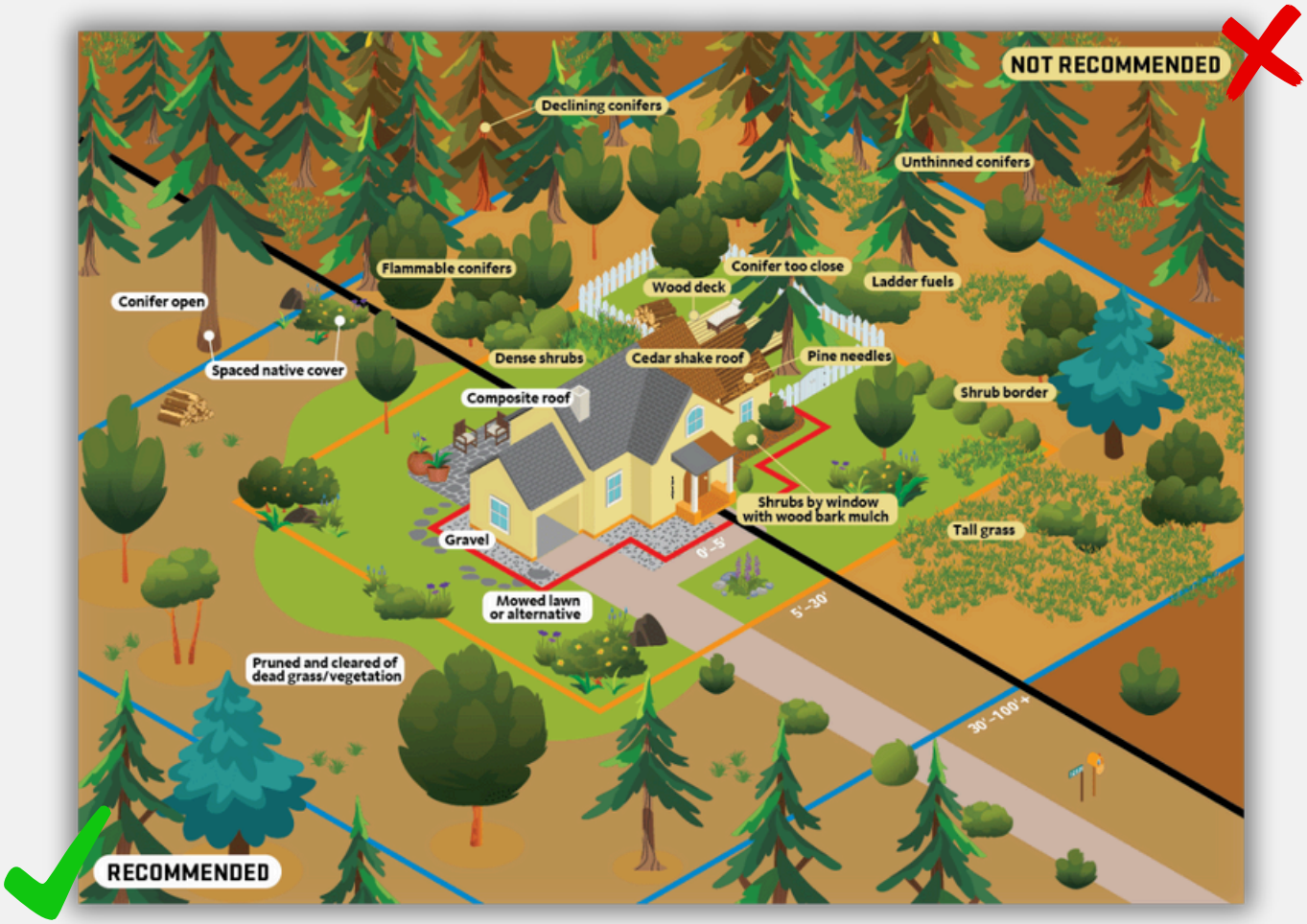


What Is Permaculture?

Permaculture is a contraction of the words 'permanent' and 'agriculture' which reconcieves annual tillage and soil disturbance-based agriculture into a **perennial-plant based agriculture** favoring tree crops, cover crops, and minimal soil disturbances. From agriculture comes fibers, fuels, medicines, foods, and other essential requirements for culture to persist and thrive. Permaculture has come to now mean '**permanent culture**'. As a design science, permaculture studies and catalogues **natural solutions** to flood, fire, extreme heat, droughts, climate adaptation, and ecosystem management techniques both old and new. Using permaculture design, we can build **landscapes, buildings, and communities** that resist disasters by their very design.

Create Defensible Space

Modify your structures, vegetation, and landscapes to create a more fire-resilient environment.



This graphic illustrates a fire hardened property vs one that is at much greater risk of burning.

If building, siting your home can give you significant advantages:

1. **Avoid ridge tops** and steep slopes - fire runs uphill.
2. **Increase defensible space** if on a slope
3. **Use natural barriers** like rock outcroppings, streams and low lying areas as natural firebreaks
4. **Build at a distance** from neighboring fire-vulnerable properties

5 feet (1.5M) from home

- [ ] Remove all flammable material such as grass, bushes, vines, mulch.
- [ ] Replace with gravel, brick or other non-flammable, non-toxic material, preferably sustainably harvested and produced.
- [ ] Ensure to keep this area clear of flammable material (weeds, flammable outdoor furniture, leaves, pine needles, etc) during fire season.
- [ ] Place patio, driveway and other firebreaks between likely source of wildfire and home.

5 ft to 30 ft (10M)

- [ ] Plant low growing shrubs and fire resistant plants for landscaping.
- [ ] Fire resistant ground cover and plants are preferable to open ground to prevent heat gain, erosion, growth of fire-happy annual weeds hard to maintain, and other undesirable features.
- [ ] Cut grass to max 4” (or shorter) and keep all plants near your home watered, if possible. Of note, longer grass will retain more moisture in the soil for longer than short-cut grass.
- [ ] Clear area of tree debris (e.g. leaves, pine needles, fallen branches).
- [ ] Trim any conifer tree branches below 6’ (2M) above the ground or less than 10’ (3M) between canopies, but leave at least 50% of the crown intact.
- [ ] Smooth barked trees are recommended. They don’t release flying bark streamers.
- [ ] Open the canopy of trees in your yard by pruning density and dead branches.
- [ ] Dense canopies can become a torch.
- [ ] Request utility company to trim trees near power lines. DO NOT attempt this yourself. They often do this periodically.
- [ ] Relocate shrubs that are under or near trees. If plants are fire resistant and the home is well hardened, there may be exceptions.
- [ ] Work with neighbors to address any fire-hazard risks from trees overhanging property lines.
- [ ] Space low-growing bushes and shrubs or place in small groupings of no more than three at a time.
- [ ] Recycle the removed vegetation, prunings, tree branches and leaves for compost, woodchips, biochar, or livestock feed, as applicable.
- [ ] Use radiation shields of rock, earth berm, low flammable hedges to reduce heat gain, sparks into property.

30 ft to 90 ft

- [ ] All firewood, mulch piles or other combustibles should be located in this area Smooth barked trees are preferred.
- [ ] Thick, dead underbrush should be removed if possible.
- [ ] Trim conifer tree branches up to six feet and within 10 feet of one another.
- [ ] Vegetation removal and thinning can be conducted by prescribed grazing and browsing by livestock, as applicable, to improve nutrient and water cycling and overall soil health.

Plant fire-resistant plants:

When looking for fire-resistant plants, check for the following characteristics:

- Plants should be native, **perennial**, or appropriate for USDA hardiness zone/climate
- Leaves are **wide, flat, moist, supple** or have high water-content, succulent.
- **Watery sap** with little odor, no resin or volatile oils
- Within your maintenance, time, and capability prior to fire season (pruning out dead wood, clearing fallen leaves, etc.)
- Thick and/or **smooth bark** that does not peel away from the trunk
- Branching patterns are **open and loose**
- Long lived, easy to maintain

Right to left: Ice Plant, Agave, Long Leaf Pine

Fire-resistant plants:

Plant fire-resistant foliage along the perimeter (**each bioregion will have its own list**, check with your local IFAS or Firewise resource):

GROUNDCOVERS

Succulents like Sedum, yellow iceplant, Kinnickkinnick, fortnight lily, lamb's ear, yucca, aloe. Other fire resistant groundcovers include blue fescue, barberry, daylily.

SHRUBS

Opuntia cactus, Lilac, currant, Oregon boxwood, willow, serviceberry, agave. Note that bushes can acquire dense, dead wood and become more flammable unless maintained.

TREES

(If no ladder fuel) Willow (*Salix*), Hackberry (*Celtis*), Crabapple, Red oak (*Quercus*), Longleaf Pine (*Pinus palustris*), Ponderosa Pine (*Pinus ponderosa*), Maple (*Acer*), Catalpa, White Pine (*Pinus monticola*). Smooth barked, deciduous trees tend to be less flammable.

Plant fire-resistant foliage along the perimeter.

Iceplant
Opuntia cactus
Long leaf pine (if fire doesn't get into the canopy)
Agave

Tips to maintain fire-resistant plants:

You can ensure your plants will be more resistant to wildfire by regularly watering, fertilizing them with compost, and clearing away dry debris.

Using water conserving earthworks, ponds and/or drip irrigation can help both conserve water and deliver enough water to your plants. In dry regions where watering landscape is not sustainable, using desert or drylands succulents is the best solution.

Pruning or thinning shrubs and trees to have a more open structure will help ensure they do not to accumulate dead branches or leaves within themselves.

Fire travels horizontally and vertically. In locating plantings, ensure frequent

breaks in the horizontal continuity of plants (10’/3m). Break up vertical continuity by maintaining 8-10’ feet between the lowest tree branches and plants on the ground, thus removing opportunities for ground fires to rise into the canopy (ladder fuel).

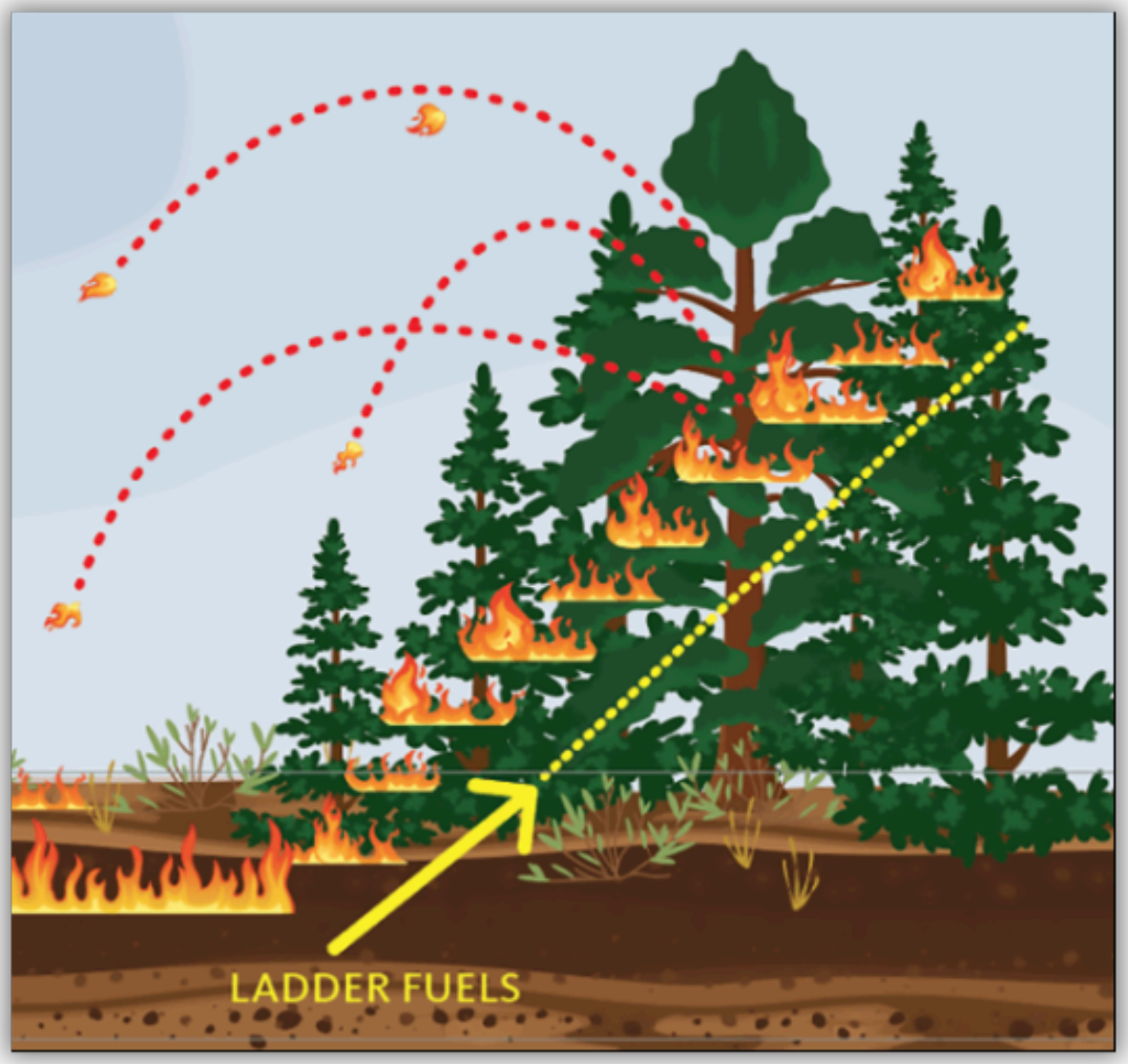


Image Source

Highly flammable vegetation:

- Leaves, twigs and stems that contain **volatile waxes, terpenes or oils**
- Leaves are **aromatic** (strong odor when crushed)
- Sap is **gummy, resinous**, or has a strong odor
- Bark that is l**oose, stringy or papery** (burning streamers can be blown miles)
- Plants that contain/produce a lot of **fine, dry or dead material**, such as twigs, needles and leaves
- **Annual weeds**, when dry, create fast moving, hot fires

Flammable plant list:

In general, conifers have flammable resin in them. Eucalyptus and other fragrant trees can be explosively flammable - sparks can travel miles.

HIGHLY FLAMMABLE PLANT LIST

DOWNLOAD

FIRE RESISTANT PLANTS FOR HOME LANDSCAPES

DOWNLOAD

LIST OF THE MOST FIRE RESISTANT PLANTS

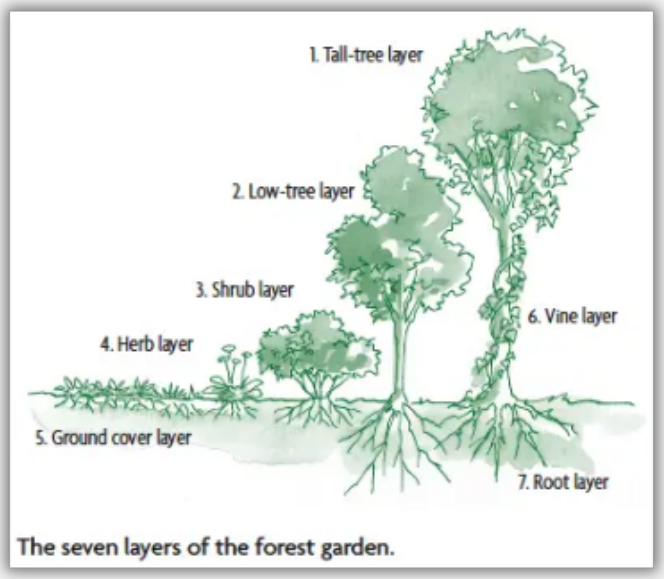
DOWNLOAD

Image Source

What about food forests and gardens?

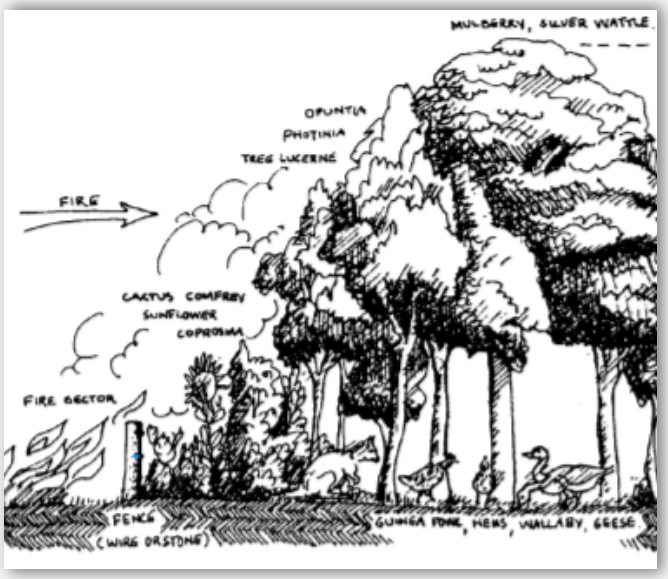
These recommendations seem counter to what many permaculturists and regenerative farmers are trying to achieve with intensive, dense food systems like polycrops, guilds, or seven layer food forests. Permaculturists in suburban areas who have only a small lot to grow food, ideally want to fill the space with edible plants. The use of wood mulch and “chop and drop” organic material to feed our soil and keep it moist is desirable and common.

There is a balance between producing local food sustainably and preventing fires. Especially in dry regions.



Seven layers from Edible Forest Gardens


Ponds near structures can slow fire



Fire mitigation food forests designed by Bill Mollison


Ceanothus - can be considered a ‘heat shield’ type plant

Some techniques that can be used to reduce fire risk in food forests are:

- [ ] Include generous water catchment features such as swales, ponds, cisterns, or large rainwater tanks in your design that can be used to keep your soil moisture high, fight fires, or flood irrigate before a fire
- [ ] Use water retention earthworks to maintain a moist system even in drought
- [ ] Choose fire resistant edible plants versus highly flammable varieties (See Resources for your region listed above.)
- [ ] Fruit trees tend to be more fire resistant than other types and can act as a heat barrier to your home
- [ ] Work with neighbors to create fire breaks surrounding the larger area
- [ ] Focus on fire-hardening your home and structures
- [ ] Leave a fire break 5 feet around your home
- [ ] Cover flammable organic mulch with non-flammable material such as soil or succulent ground cover
- [ ] Compost organic matter at a distance from the home and other flammables; use compost in your food system rather than “chop and drop” or dry mulch
- [ ] Hedge your property with highly fire resistant plants such as prickly pear cactus (Opuntia) (wonderful food)
- [ ] Be prepared to coppice “fire ladder” plants such as berry bushes placed under fruit trees before an approaching fire; choose plants that can handle coppicing Alternatively, space trees and bushes and use fire resistance ground cover like yucca or succulents between plants
- [ ] Ensure dead branches are trimmed and plants are pruned to open canopies before and during fire season
- [ ] Focus on smooth-barked trees
- [ ] Remove conifers from food forest
- [ ] Stagger trees and bushes to avoid wind tunnels for sparks

These are not foolproof techniques but will reduce the risk. More study is needed on this topic!

Case Study #1: Edge of the Chaparral

A homeowner in Southern California at the edge of the chaparral created a **fire resistant food forest** and garden in the following way:

A hillside leading up to the home was covered in iceplant, a very fire resistant plant that also helped prevent erosion. The side of the property adjoining the chaparral was planted with iceplant and other fire resistant species or native wildflowers, which were mowed before fire season. This created a firebreak of 30 or more feet to the house.

The food forest was planted at the bottom of the hill, protected from the chaparral by the hill and by the firebreak of 30 feet. **Earthworks** and aggressive soil building were used to maintain moisture in the food forest even in dry season.

A pond was placed upslope from the food forest/garden that could gravity feed flood irrigation if needed. **Fire resistant species** were used in the food forest. A wall of opuntia cactus was planted between the forest and the chaparral

The house was fire hardened.

There was a fire in the chaparral, and because of this preparation and retired firefighters who stayed to put out spot fires, **both house and garden were spared**.

In severe drought, record heat and heavy wind, which we've seen more of and could get worse, the outcome may not have been as pleasant. In a true conflagration, it may be difficult to protect any single home or food supply. **Preparing the entire community** makes this more realistic (see section on Preventing Wildfires). Nonetheless, homes and gardens have been saved using the methods in this manual.

Fire resistant building material

Building materials' fire resistant are defined by classes. Class A is a designation for the most fire resistant materials. Use Class A materials whenever possible if you live in wildfire-prone country. An example of a Class A material would be metal roofing because sparks cannot ignite it.

Many homes burn from the inside out because sparks reach wall insulation, the attic, curtains or other material inside the home. Fire breaches the exterior by melting vinyl siding or traveling through windows and vents, burning through soffits, or sparks igniting roofs. Fire resistant insulation, non-flammable shutters, curtains and other exposed material, and indoor sprinklers can save the home.

If the fire is hot enough (exacerbated by heavy surrounding fuel, very dry air and high winds), it can melt a metal roof or crack walls and windows. A fire-ready landscape and, if close to other homes, encouraging your neighbors to also harden their homes and property can make a difference.Here are some building materials and strategies that can make a difference.

Roofs

Roof coverings that are flammable, such as wood shingles, pose a significant risk in fires regardless of other protections. Sparks can catch in the uneven textures of a wood roof and start a massive blaze relatively quickly.

1. Install Class A-rated fire resistant roofs

Some environmentally-friendly roof materials that won't burn include:

- **Clay** - clay tiles can have holes that give sparks entry to the wood underneath. Ensure clay tile installations have no holes or gaps.
- **Cob** - As long as no wood is exposed, a mix of earth, sand and straw will not catch fire.
- **Green roofs** - These can catch fire if dried out or poorly maintained. To maintain fire resistance ensure:
  - The roof follows American National Standards Institute criteria for green roofs
  - Greenery is only sedums and succulents, no grasses or other flammable plants
  - Support material is flame resistant
  - Roof is well maintained in fire season - no dead plants, watered as needed

Less environmentally friendly materials include metal, slate, and fiberglass asphalt. Of these, metal roofs last for decades, can be coated with reflective paint to reduce heat gain, can be painted with **intumescent** (fireproof) paint, and have other advantages.
2. Ensure **eaves, soffits and fascia are fire resistant** and enclosed so that sparks cannot enter the attic or get underneath the roof.
3. **If the roof is not fire resistant**, installing sprinklers on it can save your home as long as they have power. A solar/battery 12V pump from a water supply such as tanks or pool will ensure sprinklers work even if grid electricity fails.
3. Ensure the roof is installed onto a **fire resistant underlayment**.
4. **Steeper roofs** allow sparks to roll off of them, creating less risk.
5. **Avoid vinyl gutters** as they easily melt and give access to building material behind them. Use metal.
6. **Metal gutter guards** can prevent gutters from collecting fuel material (leaves, etc)
7. If you're in a remote area, **lights on your roof** can help firefighters find your home.

Walls

1. Ensure gaps and **holes in walls are filled** with fire resistant material
2. **Fire resistant insulation** include fiberglass, mineral wool (such as Thermafiber), stone wool, reflective insulation, straw bale, or non-toxic Icynene, a mix of carbon dioxide and water, and Airkrete, a fireproof environmentally friendly, high-R value insulation created by extracting magnesium oxide from seawater) is actually fireproof. Fire resistant and fireproof insulation can slow fires, giving more time to fire fighters.
3. **Deck or porch** should be made of fire-rated or non-combustible materials.
4. **Underside of deck or porch** should be enclosed with fine screen or other fire resistant material, and all combustibles underneath removed and placed at 30 feet/10 meters or more from home
5. Any **exposed wood trim**, soffits, etc can burn and along with it, everything inside the walls. Cover with fire resistant material or intumescent (fire resistant) paint.
6. Metal core or fiber-cement **doors** are much more fire resistant than wood or glass doors, giving up to 90 minutes of protection. Fire-treated wood doors offer 20 minutes.
7. **Garage doors** are vulnerable. Ensure they are caulked and sealed so there is no space for sparks to enter the building. Metal is best here too, but must be tightly fitted to prevent sparks from entering.

8. Ensure the **chimney** has a fire rated screen on it and flashing is fireproof. Close the fireplace during fire season if possible.
9. Ideally **fences** are metal, stone or other non-flammable material. Minimally, remove wooden fences near the house.
10. Mesh covers can be purchased for **air conditioners,** etc.
11. If your home is wood, **fire resistant paint** can help. Although expensive, it's a worthwhile investment to protect it.
12. **Vinyl siding** can melt in a fire and expose wood and insulation underneath. If you have it, ensure there are no holes anywhere.

Environmentally friendly fire resistant construction material

These have the advantage of non-toxicity, and in many cases, very good insulation and ability to store carbon. Some building materials such as hempcrete are also resistant to flood, earthquake and other disasters.

Adobe/cob - Earth buildings are not flammable and have survived fires when their roof and other appurtenances are fire-hardened. Can be insulating. When appropriately plastered can have water resistant qualities as well. There are examples of this type of building that are thousands of years old.
Straw bale - A number of straw bale homes have survived fires where other buildings have been lost. Straw bales have been tested for one hour (with earth plaster) and two hour (with stucco) resistance to fire. Strawbales will smolder but not ignite due to lack of oxygen within the bales. Strawbales can be load bearing, sequester carbon, insulate well and have earthquake resistance.
Earth Bermed home - earth is a major protection from fires. Ensure exposed portions of house are fire hardened. Earth bermed homes have excellent insulative qualities.
Earthships - A form of earth bermed homes. These homes repurpose garbage to build a self-sufficient place using indigenous subsoil, tires, cans, bottles, building scraps and other recycled/reused materials. Earth berming and non-flammable materials used on exposed areas protect homes from fires.
Hempcrete - Hempcrete chars rather than burning. One study showed resistance at 1700F, hempcrete blocks have survived fires in Australia. Hempcrete does not release toxic fumes in a burn, it's a sustainable building material and it sequesters carbon. Modular design means quick rebuilds, and its insulative qualities means lower energy costs.
Rammed earth - an earthen mixture poured into forms and tamped to make walls and is non-flammable.

Earthbag/superadobe - when plastered with fire resistant plaster, this is fire resistant.
Brick - is fired, so is resistant to both fire and water. Depending on how it is made, it can be environmentally friendly or not.
Mycelium - Mycoworks creates insulation made from fungi that is fire resistant and sustainably produced.
Wool - Wool insulation is fire resistant
Airkrete and Icynene - Insulations mentioned above are fireproof and environmentally friendly.
Lime plaster (over strawbale, earthbag, etc) - has shown a great resistance to fire, protecting strawbales from charring for 1 hour

See resource section for more information on the fire resistance of these materials.

Other fire resistant materials

Stucco
Stone
Fibre cement
Insulated concrete forms
Concrete
Metal
Aerated concrete

Mycleial walls

Earthship home

Windows

Ideal windows are tempered glass and double paned. Single paned or untempered glass can buckle or break when exposed to high heat.

Ensure window sash is well maintained, fire hardened material, and there are no gaps or holes anywhere around the window.

When framing your windows, experts suggest that steel framing is the most flame-resistant option, followed by aluminum, with vinyl as the least resistant. If possible, opt out of an acrylic skylight, which could be susceptible to melting, leaving a hole in the roof.

In high fire risk areas, consider metal shutters for windows. These also protect against hurricanes and high winds. Metal screens can help keep sparks from window frames.

Window treatments: Vertical, roller and cellular blinds can all be made with fire-retardant materials. Roller blinds are often made with woven polyester, which has good fire resistant quality, while vertical blinds made from aluminum is a good choice too.

Wood Home

If you live in a wood home, there are steps you can take to fire harden it.

If your home is built of hardwood or timber frame it is less vulnerable than a stick frame home built of softwood pine (Class C, burns easily). Hardwoods include white oak, cedar, hemlock, spruce. These are Class B rated, unless further fire hardened.

Large, solid pieces of wood are more fire resistant than strips of wood.

Wood can be heat treated and fire retardant applied

Paint your home with fire resistant paint like intumescent (swells when heated) paints or add coatings such as stucco to walls and structural components.

Add fire resistant siding to your home such as brick or stone veneers or fiber cement.

Case Study #2: Straw Bale

A straw bale home **did not burn and suffered no permanent damage** in Redwood Valley, Calif. The owner "*left in his truck to make an escape to the valley floor, along with a neighbor they met on long driveway, but at that moment his well pump house burst into flames, blocking the drive, so they retreated to the house which held them safe until dawn.*

***All of the surrounding landscape, trees, outbuildings and infrastructure were burnt**, along with two neighboring homes. Visible in the photos here, we posit that the metal roof, strawbale walls, wrap around porch supported by fire-salvaged redwood posts, and ample defensible space all contributed in saving the house, and possibly lives.*"

The owner is making his plans, including engineering, **available for free** to fire victims, via the architect firm Arkin Tilt.

The firm offers several other examples of straw bale buildings surviving and one that didn't, that wasn't as defensible. https://www.arkintilt.com/strawbale-and-earth-projects-survive-north-bay-wildfires

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Case Study #3: Earthen Plaster

A straw bale home with a **metal roof** and earthen plaster survived a wildfire in Sonoma, California. The fire burnt around the house up to the walls, turned the plaster pink from chemical change, and charred a wooden door but the home did not catch on fire or create any permanent damage to the walls. The home did not have defensible space in the landscape. https://limes.us/strawbale-walls-survive-california-fires/

fig.1. Norrbon Road Strawbale Home - fires burned to the foundation on but not up the walls.

fig. 2. Norrbon Road - Mineral oxides in Natural Hydraulic Lime turn pink when heated.

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Cob benches

Earthen plaster walls

Preventing wildfires

Over time, human habitation has sprawled into wild areas, including fire ecologies that regularly burn. This has greatly increased the risk of lives and properties being impacted by fire. This wildland-urban interface creates great challenges to firefighters who must focus on saving lives.

It thus becomes important for communities that exist in these interfaces to reduce their fire risk by increasing awareness, preventing careless fires and making homes, properties and communities more resilient in the face of wildfires. Doing this on a neighborhood or village scale can significantly increase the likelihood of survival.

VILLAGE SCALE DEFENSE

Use **grazing animals** in woods, meadows, and along roadways to reduce fuel load near towns during fire season (see public lands case study)

Alternatively, **clear low brush and grasses and thin trees** in wooded areas surrounding towns in drought and when there is a large fuel load

Chip and compost or convert to biochar bulky wood or green waste to reduce fuel load in public spaces

Composting per the **Jean Pain method** (see case study) can create energy and cooking fuel for schools or other public buildings though this should be done in a fire safe manner

Make fallen or harvested trees available to residents for firewood or other uses. Gradiently **replace flammable trees** with native fire resistant species near and in town where possible

If **controlled burns** are done, use indigenous methods that leave canopy and healthy soil intact. Focus on areas where fire is most likely to impact the community as a priority

Create reservoirs and other water retention facilities like keypoint dams on public lands, and if possible, fund this creation on nearby farms/ranches or other private land

Repair **riparian areas** and plant trees that will offer shade to waterways where possible

VILLAGE SCALE DEFENSE

Where appropriate, **capture street and other runoff in swales** or other earthworks with biofilters to keep landscapes more hydrated. Design, where appropriate, to filter and release water efficiently during times of heavy rain.

Control development (especially sprawl) to minimize impact on infrastructure, housing and ecological systems. Create walkable neighborhoods, with mixed density housing, and creative spaces where people will want to congregate and use. Good city planning incentivizes residents to protect their town and invest in it.

Teaching wildfire safety in schools, offices and other venues can greatly aid in protecting towns from fire.

Take full advantage of **existing programs** and incentives to educate and address fire resilience at neighborhood and village scales.

Develop **public-private partnerships** to increase the pace and scale of treatments to address larger areas more effectively.

Thank you to **David Holmgren** for his work, from which much of this section is drawn. https://holmgren.com.au/wp-content/uploads/2013/02/Hepburn-BushfirePlan5.2.pdf

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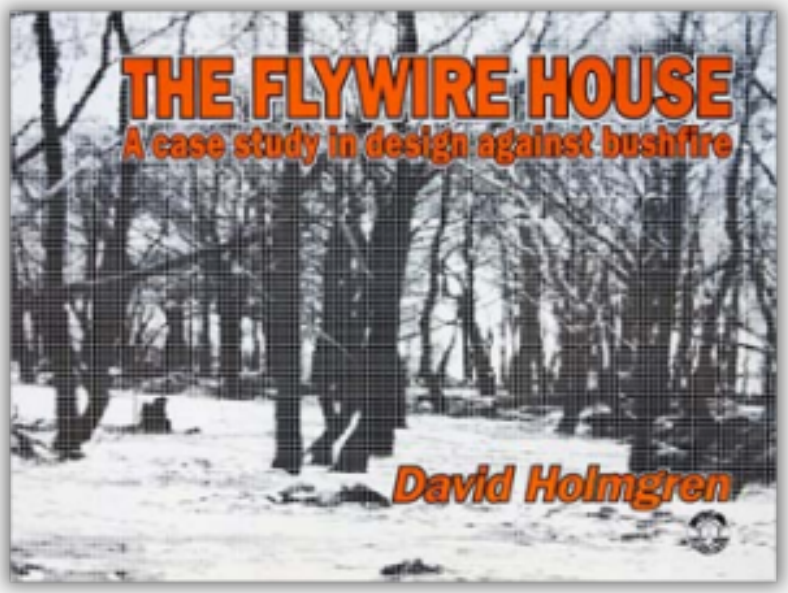

Case Study #4: Fire Ecology Restoration

The **Permaculture Institute of North America** trained 3 crews in Wildlands Biochar Production in Oregon in conjunction with conventional forest thinning for wildfire reduction. By replacing burn-piles with simple to operate, portable kilns the crews created many cubic yards of **biochar** that was applied to the forest floor, increasing soil health and sequestering carbon while reducing dangerous fuel loads. Once forests are restored in this way, the traditional indigenous practice of cultural burning and prescribed burning are better able to resume with less risk of catastrophic wildfire. This combination of techniques has the potential to create an emerging new wildlands biochar industry to add a financial stimulus to perform more **Fire Ecology Restoration** across the many acres of forest that need it across the West.

Case Study #5: Fire as a Tool on the Land

The **Karuk tribe** in the Klamath region of Northern California work with wildfire agencies and other groups to practice ancient techniques of controlled burns to **reduce fire load** and open up ecosystems for more diversity of food, shelter, and wildlife. California recently passed a bill to enter into written agreements with federally recognized California tribes that would exempt them from state permitting and regulatory requirements for cultural burning. Their approach is careful, and informed by hundreds of years of experience but challenged by the new and more explosive conditions created by climate change and past mismanagement. By allowing Native Americans to resume **ancient practices managing landscapes** through the use of fire, the risk of major wildfire conflagrations can be reduced in some areas. Similarly, public land management agencies are accelerating the use of prescribed fire to create greater fire resilience by reintroducing fire into fire-dependent ecosystems.

Wildfires, with the locally important use of cultural fires, maintained ecosystems in dynamic equilibrium for millenia. Because of a lack of understanding of the role of fire in maintaining this equilibrium, a directive to extinguish all wildfires on public lands was implemented over 100 years ago.

Over time, this caused increased forest density, greater competition, changes in stand composition favoring less fire tolerant species, denser understories, higher mortality, and greater fuel loading. These changes were challenging enough but since climate change has caused more drought and heat, nature did what it is designed to do: **re-establish balance**. Wildfire is its tool of choice, thus the major conflagrations we see today. Although over 90% of wildfire starts on public lands are extinguished quickly, those fires that escape can become highly destructive, consuming millions of acres and threatening lives and infrastructure.

Cultural Burning

"Cultural burning" refers to the Indigenous practice of "the intentional lighting of smaller, controlled fires to provide a desired cultural service, such as promoting the health of vegetation and animals that provide food, clothing, ceremonial items and more" (Roos, 2021). According to Frank Kanawha Lake, a research ecologist with the USDA Forest Service, and a wildland firefighter of Karuk descent, "[Cultural burning] links back to the tribal philosophy of fire as medicine. When you prescribe it, you're getting the right dose to maintain the abundance of productivity of all ecosystem services to support the ecology in your culture" (Roos, 2021).

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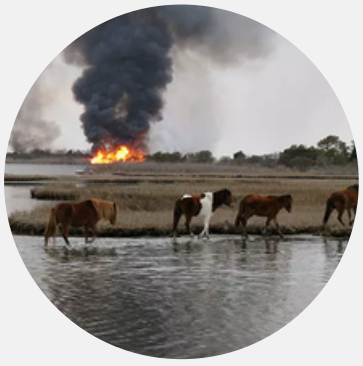

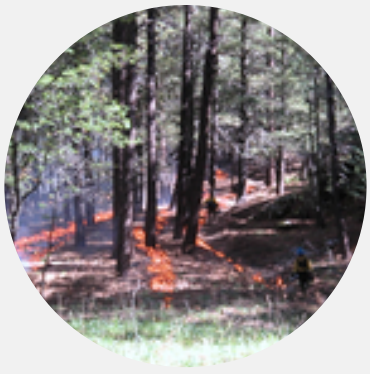

Cultural burning and prescribed burning continue to be important tools, keeping alive **Traditional Ecological Knowledge**, refining practices to help landscapes be more resilient while enhancing ecosystem health and wildlife habitat and in reducing the intensity and destructiveness of wildfires in both forests and prairies where it is used.

Grazing Animals

Goats and other grazing animals have been successfully used to reduce brush and grass fuel near buildings and villages that can drive fires into canopies and make them much hotter and more destructive. Grazing animals fertilize the land with manure, trample organic matter into the ground, accelerating the composting process, while creating soil indentations that catch seeds and moisture

Case Study #6: Grazing Goats

Mills College near Oakland, California has been using goat grazing to reduce fuel load for 25 years, grazing goats on 100 of their 135 acre campus. Grazing keeps down "**fuel ladder**" plants that exacerbate fire risk, while adding fertility to the soil with their manure and encouraging more biodiversity. They can climb steep hillsides that are otherwise difficult to access and are vulnerable to fire. Goat, cattle, buffalo and other grazing animals are being used in other parts of California and the west to reduce fire risk around neighborhoods and towns. These ruminants often eat invasive species, but because of their unique digestive systems, seeds are dissolved and will not germinate. **Goats are particularly useful** as they prefer shrubs and woody materials over grasses and more succulent plants. Some goat ranchers hire their goats out to graze overgrown rural roadsides or steep hillsides in suburban areas. They are more ecologically friendly than heavy machinery often used to clear land.

Jean Pain compost method

In an ecology that is not dependent upon burning, and especially after a wind event where many trees are damaged or killed, there is an alternative approach to handling the dead woody fuel that can create multiple benefits.

Case Study #7: The Jean Pain Method

Jean Pain is a French inventor who, when given the task to protect 1000 acres of wildland from fire, cleared underbrush yearly but rather than burning, turned it into rich and valuable compost. He didn't stop there however. Using principles of capturing and storing energy, he used the natural heat generated by compost piles. He developed the **compost heater**, a large compost pile with embedded hoses that produced enough heat to **heat his home and water supply** for the winter. He then devised a simple system to catch enough methane to run an electric generator, cooking elements, and power his truck for up to 18 months. He created energy independence for his home and transport with a large compost pile, built yearly.

This system is so simple, it can be created anywhere with basic tools, such as a front end loader, wood chipper, heat resistant hoses, and storage containers for the methane. This system has been successfully replicated on smaller scales to heat greenhouses, water for outdoor showers, and more. Basic instructions:

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If you are aware of a case study or other information that should be included in this manual, please contact us at:

For all resources and further study go here:
https://permaculture.omeka.net/items/browse?collection=3

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WORK IN PROGRESS

PROJECT OVERVIEW

Project Information	Details
Project Name	Disaster Resilience Initiative
Project Managers	Jesse Tack, Lee Barnes, Suzanne Bonefas, Elizabeth Lynch, Koreen Brennan
Project Start Date	September, 2024
Project End Date	Continuous

1. Project Summary

Objective	To create a complete set of free resources for all disaster types in North America and Hawaii from the permaculture perspective
Scope	Across many media types, we will produce: checklists, printouts, guides, research libraries, town halls, summits, interviews, etc.

2. Project Milestones

click here

Milestone	Date	Result	Status
Overall Preparation Guide	Sep, 2024	Guide	In Progress
1st Town Hall	Nov 15, 2024	Video	Complete
Open Disaster Resiliency Working Group	Nov, 2024	Open Working Group	In Progress
2nd Town Hall	Dec 13th, 2024	Video	Complete
3rd Town Hall	Jan 17th, 2025	Video	Complete
4th Town Hall	Feb 21st, 2025	Video	Complete
5th Town Hall	Mar 21st, 2025	Video	Complete
Fire Preparation Toolkit	Mar, 2025	Guide	In Progress
Winter Prep Toolkit	Coming soon	N/A	In Progress