# *From the House Outward*

## Protecting your home from wildfire

**From the California Chaparral Institute**
With links - http://www.californiachaparral.com/images/From_the_House_Outward.pdf

The traditional approach to wildfire protection is backward. It focuses on vegetation rather than what we want to protect – our families and homes.

Homes burn because they are flammable. Most structures ignite during wildfires **because of flying embers** that can travel a mile or more from the fire front in high winds. Contrary to what many think, flames and a burning fire front are not the main problem. This is why so many families have lost their homes even though they have complied with defensible space regulations. This is why communities far from wildland areas have been destroyed during wildfire. This is why fuel breaks, twelve-lane freeways, and even large bodies of water fail to protect our homes during wind-driven fires.

**However, there is hope.** While wildfire is inevitable, the destruction of our communities is not.

What is the way forward? We need to reverse the traditional approach to wildfire protection.
First, we must focus on reducing the flammability of structures themselves.
Next, nearby flammable materials need to be removed such as wooden fences connected to the home, trash cans under eaves, patio furniture, and wood piles.
Then, if there is available space, vegetation within 100 feet of the structure should be properly thinned (not cleared).

Embers are the primary cause of home ignition. During wind-driven fires, embers can travel a mile or more from the fire front, making traditional defensible space ineffective.

Ironically, large, cleared areas can increase the flammability of a home by creating an open pathway for embers to reach the structure.

As renowned US Forest Service fire scientist Jack Cohen has said repeatedly, **the wildland fire problem is a home ignition problem, not a wildfire control problem.** Cohen has been trying to help fire agencies understand this since 1999. Unfortunately, there remains major resistance to this idea from some wildland fire agencies because it's in conflict with their traditional approach to wildland firefighting – focusing on extinguishing burning vegetation rather than on what we want to protect, our lives and homes.

## 1. Structural retrofits to existing homes

The easiest way embers can ignite homes is by entering the attic through vent openings. Therefore, the two most important structural retrofits that can be added to a home to help prevent ember ignition are **ember-resistant attic vents** and non-flammable roofing (not Spanish-style tile roofing, which can trap embers in the spaces beneath the rounded tiles). Although re-roofing is expensive, installing ember-resistant vents is a relatively easy, inexpensive thing to do.

The good news is that local Fire Safe Councils can apply for FEMA grants to retrofit entire communities.

Southern California mountain communities of Big Bear and Idyllwild have used millions of dollars from FEMA pre-disaster mitigation grants to pay up to 70% of the cost of re-roofing homes with fire-safe materials and installing ember-resistant attic vents.

Ember-resistant attic vents are key to preventing embers from entering the home, a main cause of home loss during wildfires.

## 2. Exterior sprinklers

*Exterior* fire sprinklers systems work, are affordable, and can be easily installed.

Exterior sprinklers work by creating an environment that extinguishes embers (spotting firebrands) that are the primary cause of building ignition. The sprinklers do this by 1) **hydrating potential fuels**, thus making them less susceptible to ignition, 2) **increasing humidity**, and 3) **creating a cooler microclimate** around the home.

The effectiveness of exterior fire sprinklers was proven during the 2007 wind-driven Ham Lake Fire in Cook County, Minnesota. In 2001, exterior sprinklers had been installed on 188 properties, including homes and a number of resorts. **All 188 properties survived.** More than 100 neighboring properties were destroyed.

The cost of the Cook County program was covered by a FEMA hazard mitigation grant. The program was finished on time and on budget by Wildfire Protection Systems (WPS), costing $764,255. Minnesota U.S. Senator Amy Klobuchar credited the program with saving over $42 million in property value. The grant paid 75% of the cost of the sprinklers. Individual property owners covered the balance.

The sprinklers were so successful that a $3 million FEMA pre-disaster mitigation grant was awarded in 2008 to install additional wildfire sprinkler systems throughout Cook County. In 2013, another grant was awarded to install the systems in two additional counties, including properties with low-water resources.

Canadians have successfully utilized exterior sprinklers too, with the implementation of portable sprinkler kits placed in the path of wildfires. The kits can tap into nearby water sources, pools, or local water tanks. These kits have protected over $2 billion in property value over the past 20 years in Canada, according to Morris Douglas, a retired advisor to various Ministries of Natural Resources.

Exterior fire sprinklers in action in Australia. From Platypus Fire Pty Ltd.

Unfortunately, when exterior fire sprinklers are mentioned as an innovative way to protect homes from wildfires in California, it is often met with skepticism. The common reasons given for dismissing the idea include:

– Water pressure disappears during catastrophic fire events, disabling sprinklers.
– Too expensive (guesses as high as $60,000 have been mentioned).
– Wind will blow the water away from the house.
– The power goes off during catastrophic events, disabling water pumps.
– People won't have time to turn the sprinklers on.

All of these doubts are either incorrect or can be easily addressed.

**Independent Systems.** During a catastrophic fire event, critical public infrastructure often collapses. Electrical power goes out and water pressure drops. This is why an exterior fire sprinkler system **needs to be independent, or off the grid**. A propane, gas, or diesel water pump (about $1,000) must be connected to a dependable water source (e.g. pool, 10,000-gallon water tank, or body of water as is the case in Cook County). A 10,000-gal water tank costs about $6,000, so that adds to the system's total price, but considering the cost of losing a home it's a smart investment. A neighborhood could invest in a larger water tank or a series of tanks that could serve a number of homes.

**Affordable.** As mentioned above, grants can be obtained that can reduce the cost of a professionally installed system for an individual homeowner with a ready source of water to around $3,000. Without a grant, homeowners can install the systems themselves for considerably less than the professional price of around $10,000 - $15,000.

**Wind.** Strong winds will deflect the water spray. However, despite 20-25 mph wind gusts during the Ham Lake Fire, the installed sprinkler systems worked well. Inspections during the fire found that although the rooftop sprinklers were the least effective when impacted by wind, other placements (e.g. under eaves) performed as expected. Some innovative solutions, such as WEEDS (see below) actually use wind to distribute the water.

The key point to remember is that sprinkler systems need time to work. During strong wind events, like those experienced during the 2018 Woolsey and Camp Fires in California, one can not expect sprinklers to be effective if turned on as embers begin impacting the structure. However, if you are alert during fire weather, you will often have plenty of time to prepare. For example, the 2018 Woolsey Fire started nearly 24 hours prior reaching Malibu where many homes ended up burning.

**Time.** When people are awakened in the middle of the night and see smoke everywhere, panic can set in. It's difficult enough to evacuate, much less run outside and turn on the sprinklers. Unless the system is automated or can be activated by a switch on the way out (this adds to the cost), time is definitely an issue. However, this is not an excuse to dismiss the possibility of installing an exterior sprinkler system.

Extra time can be found if communities can get their emergency alert systems up to speed and trained CERT volunteers serve as support personnel (they do not evacuate). These fire volunteers can activate the systems, extinguish ember-caused spot fires, and help those who are stranded. During wind-driven, catastrophic wildfires there will never be enough professional emergency personnel available to do the job. Communities should consider picking up the slack.

Many other residents have taken it upon themselves to retrofit their own homes with exterior sprinkler systems. Under-eave misters on the Conniry/Beasley home played a critical role in allowing the structure to survive the 2003 Cedar Fire in San Diego County. The home was located in a canyon where many homes and lives were lost to the flames. You can read their story here.

There are a number of other options available as well. M-Bar Technologies offers an objective analysis of one approach that uses the wind to help distribute the water spray, the Wind-Enabled Ember Dousing System (WEEDS). The system is credited with saving another home threatened by the 2003 Cedar Fire.

Wildfire Protection Systems (the company that saved the homes in Minnesota) has begun installing exterior sprinkler systems in Payson, Arizona and Mill Valley, California.

Another option is the Giant Soaker. It's basically a huge soaker hose that you can drape over or lay around a house or structure. It is less expensive than sprinklers, outputs more water, and is easier to install and use. You can contact the company/inventor, Dean Landers, at 608-346-5229. Address: Giant Soaker Co., 1010 N Wuthering Hills Drive, Janesville, WI 53546. You will need a pump, so please see our suggestions in the last section of this document.

## 3. Defensible space

**How much defensible space?**

In a study of over a half million homes it was found that:

1. The most effective vegetation management strategy to reduce structure loss is to reduce the percentage of woody cover up to 40% to 50% immediately adjacent to the structure and ensure vegetation (trees) does not overhang or touch the structure.

2. There is **no additional structure protection provided by clearing beyond 100 feet**, even on steep slopes, and the most important treatment zone is from 16-58 feet.

3. The amount of cover reduced is as important as the fuel modification distance; however complete removal of cover is not necessary. **The term "clearance" should be replaced** with

"fuel modification" to emphasize this fact.

Here is a concise USGS summary of the study.

The notion that if 100 feet of defensible space is good, then 200-300 feet must be better is false. Creating large areas of clearance with little or no vegetation creates a **"bowling alley" for embers**. Without the interference of thinned, lightly irrigated vegetation, the house becomes the perfect ember catcher.

To make matters worse, when a fire front hits a bare fuel break or clearance area, a more destructive shower of embers is often released.

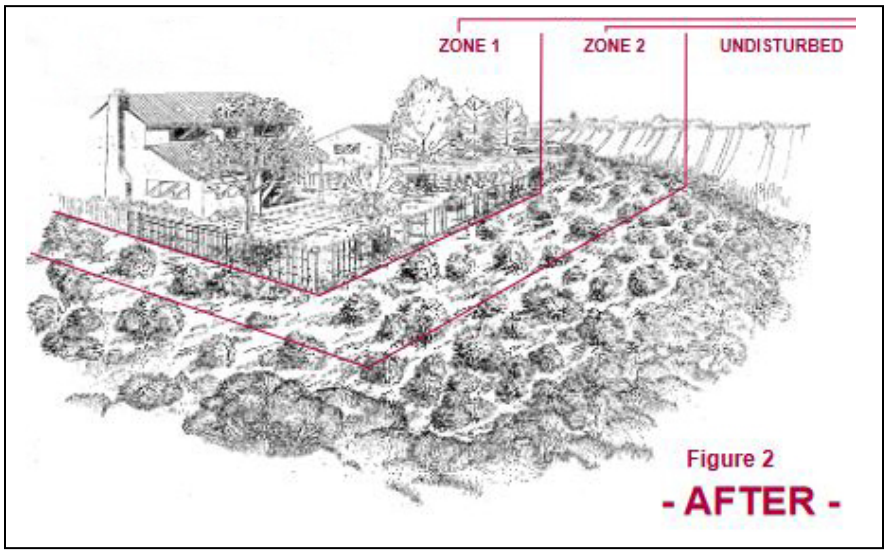
**How to create proper "Defensible Space" Around Your Home: The Difference Between Rational Action and Overreaction**

Dense and flammable vegetation needs to be removed from the area immediately around a home in order to reduce the risk of structural ignition during a wildfire. The question is how to properly do so without causing additional problems (e.g. encouraging the growth of flammable, non-native weeds). The basic rule is to eliminate flammable materials (fire-prone vegetation, wood stacks, wood decking, patio furniture, umbrellas, etc.) from within 30 feet of the home. Then, for structures near wildland open space, an additional 70 feet should be modified in such a way as to remove dead wood from shrubbery, thin and trim trees and shrubs (lower limbs removed), and prevent the growth of weedy grasses. Maintaining a modified canopy of vegetation to shade the ground is important to reduce weed growth.

The basic rule of thumb is **to reduce the level of vegetation within 70 foot zone so that 50% of the ground remains covered by a vegetative canopy.**

Unfortunately the term "clearance" is typically used when referring to the 100 foot defensible space zone, leading people to think all vegetation must be removed down to bare soil. This is why the city of San Diego Fire and Rescue Department has replaced the word "clearance" with "thinning" when referring to vegetation management around homes. Bare soil clearance not only unnecessarily compromises large amounts of native wildlands and increases erosion, but will lead to the growth of flammable weeds in the now disturbed soil. These weeds are considered "flashy fuels" which actually increase fire risk because they ignite so easily.

A document from the San Diego City Fire Department provides one reasonable plan to reduce fire risk around your home WITHOUT unnecessary, excessive clearing.




**What plants to plant**

When considering what type of plants should be planted within 100 feet of a home, one is often confronted with a confusing array of plant lists. Be forewarned - very few of these lists are based on scientific research.

Rather than following a specific plant list, here is what you should consider. All plants within the 100-foot zone should:
1. Not produce a lot of litter (avoid pine trees, eucalyptus), dead wood (avoid acacia shrubs), or material that can easily ignite (fronds from palm trees).
2. Be easily maintained.
3. Require a minimal amount of water to remain hydrated (many native plants fit this category). Healthy, hydrated plants are difficult to burn.

Nearly all plant material is flammable. The idea is to create a landscape that can be a barrier to embers, will not carry a fire (because the plants are hydrated and properly spaced), and requires maintenance only once every few years. Ironically, **it is usually the burning house that ignites the surrounding vegetation, not the other way around**.

**Key Point: Wildfire will exploit the weakest link.** Many homes with adequate (or excessive) defensible space will still burn to the ground because embers have entered through attic vents, ignited flammable materials around the home (litter in the gutter, wood stacks, wood fencing), or found their way under roofing materials.

**Solution: Reduce the flammability of the home as much as possible.** Install ember resistant vents, Class A roofing, exterior sprinklers operated by an independent system, remove flammable materials from around the structure, and **thin** vegetation 100 feet around the home.

Extreme, wind-driven wildfires are inevitable. Does that mean wildfire caused disasters to communities are inevitable as well? **No.** Please watch the excellent video created by Dr. Jack Cohen and the National Fire Protection Association. It does an outstanding job explaining the home flammability issue what how to best address it.

## Additional Information

For additional recommendations on how to improve the fire safety of your home and community, please see our webpage at www.californiachaparral.org on Protecting Your Home. Also please see our full set of recommendations to policy makers on how to reduce wildfire losses in California.

**This document with active links to cited references is available here:**
http://www.californiachaparral.com/images/From_the_House_Outward.pdf

## 4. Personal fire suppression systems

The safest thing to do when threatened by a wildfire is to follow timely evacuation orders. Many people think they can face a wildfire and defend their home, only to panic when confronted with the terrifying noise, heat, and hot ember rain created by the flames. They try to leave, only to be killed while running or driving away.

However, if it becomes impossible to leave or if you have proper training, we offer the following tips on a personal home firefighting system that involves an independent water source, an independent water pump, and firefighting hoses/equipment.

Homeowner demonstrating use of a fire hose on the balcony of his home. From Fire, Chaparral, and Survival in Southern California. Photo by Geoffrey D. Smith.

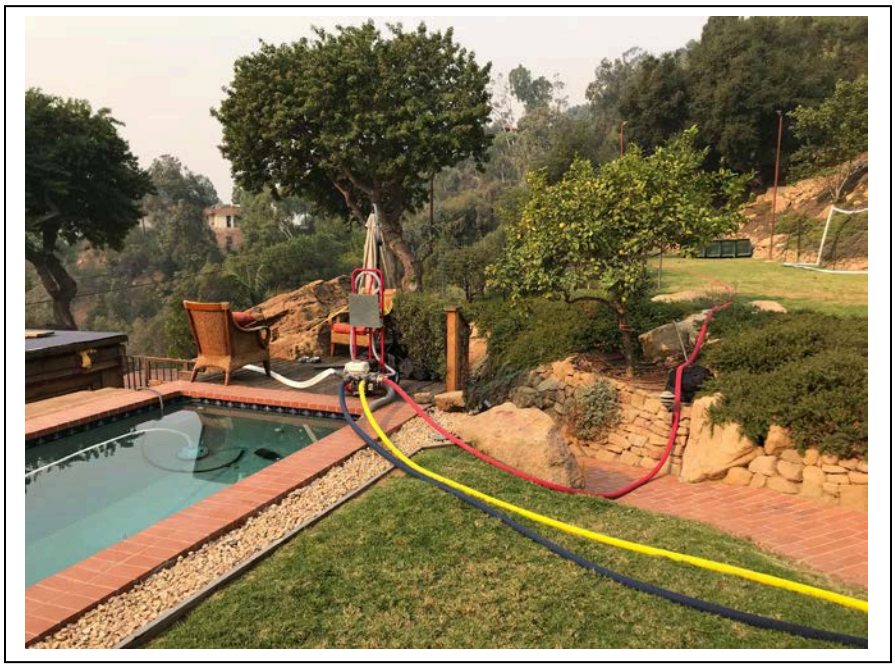
Again, we stress, **if ordered to evacuate by emergency personnel, do so**. Do not wait. Before the fire, you should become familiar with your local emergency evacuation plan. Honestly evaluate it assuming the worst-case scenario (most plans to NOT meet this test). If it doesn't seem realistic, demand that your local representatives correct it.

## Residential Fire Suppression Equipment

Contributed by Fred DeVault

**Water Pump**:

There are a number of portable fire-fighting pumps available on the market. We had a floating "Fyr Flote" pool pump back in the 1990s. But I like the cart-based ones for the ease of moving from storage to pool-side, and for the adaptability. The Keene pump is well thought-through and well-made, and often available locally (e.g. Chatsworth, California). That said, I customized the outlet of mine, converting to wildland-standard NST/NH thread, and abandoned their 100 ft hose in favor of 50 ft NST/NH hoses I bought elsewhere.



Keene unit custom-rigged w/ four independent 150 ft hose lines, protecting a 1-acre property.

Keene Fire-Fighter pump, with a Honda engine

160 lb head; 250 gallons per minute (gpm) max flow; 6.5 horsepower (hp); Keene P180 pump; Honda GX200 engine ~ 1:45 run time per tank (3.3 quarts), full throttle.

Any pump with an engine power around 6.5 hp will be able to drive two 30 gpm nozzles simultaneously, and as such can be shared with one neighbor. Anyone who wants to cooperate with up to three or four neighbors, or has need for more than two nozzles at once, will need something more powerful than the Keene. The biggest name in portable fire-pumps is Davey,

and they offer a number of models through their distributors. The 14 hp cart-based system from Primo Supply could be shared amongst three to four neighbors and has the power to drive two 50 gpm or three 30 gpm nozzles simultaneously:

Davey High Pressure Twin-Stage Firefighter Pump-Engines

Supplier of Davey Firefighter and Pump Cart Systems

**Fuel/Storage:**
The Honda engine on the Keene Firefighter takes regular gas. I made the decision to get fancy stabilized fuel for mine. It is not recommended to leave un-stabilized gas in small engines for longer than a few months, or you face the need to either clean out the engine yourself or pay for an expensive overhaul at the small engine shop. Stabilized gas can sit in an engine tank for two or more years, and can be stored for five or more years. I buy "TruFuel" from Home Depot. If you're dutiful with your small engine maintenance and reliably fill and drain the tank as needed you can certainly avoid this added expense.

You also don't want to create a new fire hazard while trying to solve the one you already face. I went to the bother of buying dedicated, steel fuel cans and a little steel double-walled fuel storage cabinet, just to reduce the risk of my fuel supply becoming involved in a fire and taking down the house:

Compact Flammable Storage Cabinet 12 gallon capacity

Type II Safety Can – 1 ½ gallon

**Hoses**:
1 ½ inch Single Jacket Fire Hose (500 lb test)
1-1/2" "single jacket"/ "wildland"/ "forestry", 50 ft lengths, aluminum couplings, NST/NH thread
250 lb / 500 lb / 750 lb Service / Proof / Burst

City fire fighters and structural fire-fighting in general use the heavier and more expensive "double jacket" hoses, both because of the extra strength, and especially the extra durability. Either can handle the demands of home fire-fighting and the pressure and flow of any pool pump rig. Single-jacket hoses are more than ample for occasional homeowner firefighting. I also standardized on 50 ft hoses, simply coupling them together as needed to create the 150 ft lengths required on my property. 50 ft hoses are MUCH easier to roll-up, un-roll, carry around, etc. Whatever hoses you buy and wherever you buy them, get American made hoses. Ditto for nozzles.

Go with “NST” (aka, “NH”) threads. The other thread standards are older, special-purpose, and increasingly non-standard. NST/NH threads are designed for quick, tool-less, coupling/un-coupling while having the necessary strength and sealing capabilities.

**Adding Foam:**
Foaming agents are technically “surfactants”, which in simple terms makes the water “wetter” (it absorbs more readily and resists evaporation far longer). The result is that your structure/shrubbery stays wetter about 5 times longer than with just straight water. If all you have time to do before evacuation is to foam your house and go, you will have done a lot to increase the survival prospects of your home (provided you were able to time the treatment within 8 hours or so of the fire event). There are a number of solutions on the market. I’m familiar with and like the Scotty 4010 series Foam-Fast. The 4010 Foam Fast is a bazooka-looking thing that takes 12“ foam “sticks” which get mixed in to the flowing water stream.

Scotty’s 30 gpm model is my go-to unit because it provides plenty of foaming while conserving my small (3,000-gallon pool) water supply. Those with regular-sized pools and/or more agility may prefer their 50 gpm model.

The device can be ordered with choice of thread. If you convert your Keene to NST/NH and use NST/NH hoses, get NST/NH threads on your Scotty Foam-Fast (Note: The Foam-Fast units Keene sells have NPT/NPSH threads).

Operating pressure range for the 1-1/2” Scotty 4010 foam-fast unit is 50 psi – 125 psi, max of 150 psi. The 30 gpm and/or 50 gpm models (4010-30 and 4010-50) pair very well with the Keene Firefighter and, presumably, any fire-pump with a 6 hp – 8 hp engine. When using with more powerful pumps, such as a 14 hp Davey, you’ll want to either throttle-down or add a pressure-relief by-pass, to keep static pressure below 150 psi.

Running at 85 psi, a 12-inch foam stick lasts about 25 minutes @ 50 gpm, 35 minutes @ 30 gpm, 45 min @ 15 gpm. The Phos-Chek foam agent is the same stuff the planes drop, w/out the colorant. It goes on invisibly, leaves no residue, and is plant-safe.

**Nozzles:**
Super High-End, Pistol, Adjustable flow, Bale On-Off.
High-End, Straight, Adjustable flow.

Don’t go cheap. The value of higher-end nozzles is in the ease and convenience of easy on-off (which makes episodic ember-dousing easy and efficient over the course of a prolonged fire event), and the ability to conserve your water source by metering the flow rate.

**Fittings:**
If you want more than one hose line (different sides of your property, sharing w/ neighbor, etc.), you'll need to add one or more wyes at your outlet. To convert my Keene, I added an adapter to go from NPT to NST/NH thread, then a plain wye, then two shut-off wyes coming out of the plain wye, altogether providing me with four independently controllable 1-1/2" NST/NH outlets on my rig:

1-1/2" Plain Wye (NST/NH)

1-1/2" F Swivel X 2 1-1/2" M outlets (all NST/NH)

**Tools**:
If you end up with longer hose runs (100 ft or more) you'll eventually face the problem of wanting to switch nozzles (e.g. foam to water) while the hose is charged. Running back and forth to the pump to close and then re-open the outlet valve gets old in a hurry, and could cost you your house in an emergency. The solution is to buy a "strangler" (aka, "hose shut-off clamp") and keep it handy out at the end of hose. Note that these only work on hose up to 1-1/2" and single-jacket.

NST/NH threads are designed for tool-less operation, but that assumes strong fireman hands and you'll want some spanners, for when the hose couplings need tightening or loosening more than your hands can handle.

**In an Emergency - PPE ("Personal Protection Equipment"):**
If you live in fire country, having personal protection equipment (i.e. fire-resistant clothing, etc.) is a good idea in case of an emergency. But please understand that no amount of clothing or gear can save you from a bad plan in worst-case conditions. In the event you cannot safely evacuate and become trapped by fire, the cornerstone of personal safety in a fire event is taking the necessary precautions to avoid over-exposure to extreme heat. That means having certain access to a well-chosen safety zone away from any and all foreseeable extreme heat.

A safety zone is at least 100 ft from any structure or natural fuel source of size, is not in an exposed area likely to be swept by intense heat or flame, and affords some opportunity to stay low on fuel-free ground with breathable air. Some examples of what are NOT reliable safety zones: pools near houses (the heat can last longer than you can stay underwater); cars; wide slopes; large unbroken fields; canyon mouths; heads of ravines. A house or building can be a safety zone from an approaching or passing wildfire, but you need to have a plan for retreat if the structure becomes involved.

Look for cleared, fuel-free areas well-away from structures, away from fire-paths, and as naturally free of winds as possible. In a large open area, look for depressions, berms or boulders, or any sort of non-flammable protection from the sweep of heat or flame. If on a

mountainside, the inside of a road-cut can afford some protection from the exposed slopes and surrounding vegetation, as can angular, sparsely-vegetated gullies and ravines, especially ones with boulders to hide behind. (But avoid wind-swept ravines that can become fire funnels, especially any ravine oriented in the direction of fire.) Any minor topography which seems to get you out of prevailing winds can be your friend. You'll want to stay as low as possible in your safety zone, with your mouth near the ground, breathing the coolest, cleanest air available. You'll want to be wearing your Personal Protection Equipment (PPE).

A critical point to remember: Do NOT be fooled by thinking an area with dried grass provides a safety zone. **One of the common denominators of wildland firefighter fatalities is the presence of grassy fuels**. Grass is a "flashy fuel," meaning once it ignites, it burns extremely hot and fast. Grass fires are considered more dangerous than shrub of forest fires because people do not expect them to move so fast.

For clothing (coat and pants, or coveralls) I think the "Tecasafe" material makes a good homeowner choice – it is more breathable and costs less than the Nomex, while providing equivalent heat protection. Trade-off is less durability, but that shouldn't matter for occasional home firefighting.

Whatever clothing you choose, you'll want to add a helmet, cartridge respirator, goggles, gloves, boots, and, optionally, additional head/neck protection.

A fire shelter is also wise, provided you have a good safety zone to use it in, and have been trained how to us it. Having to deploy a fire shelter, however, means you've made a tragic mistake an are at high risk of losing your life.