Living with WILDFIRE in WYOMING

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WE HOPE WE HELP YOU ANSWER
'HOW DO I PREPARE?' AND 'WHAT'S NEXT'?

Wildfires have shaped Wyoming for thousands of years. Whether you live on a forest, grass, or sagebrush-dominated property, it's a matter of "when" not "if" a wildfire occurs.

We created this resource to help you prepare property for wildfire and to determine what, if anything, needs to be done after a wildfire.

If you have not yet experienced a fire on your property, now is the time to create a defensible space around your cabin, home, or outbuildings. Now is also the time to ensure you are as prepared as possible to evacuate quickly with your most essential items. A little time spent planning and preparing now can save months to years of trouble after a wildfire.

If you have had wildfire on your property recently, there are many issues to think about and decisions to be made. This guide can help you evaluate the effects of the fire and how to best target your efforts. Many of the suggested practices will have immediate impact on the land. Others will take many years before they return a property to pre-fire conditions.

How long will the land take to recover from a fire? The rate of recovery varies based upon the vegetation, climate, wildfire intensity, soil type, and water present. A low-intensity wildfire that kills only a portion of the vegetation will recover faster than a high-intensity fire that kills all plants and leads to significant erosion. The different plant species on the property before a fire will also greatly affect the timing of recovery. For example, burned pastures have the ability to be mechanically treated and seeded the following spring and quickly return to pre-wildfire conditions. On the other hand, a mature stand of lodgepole pine trees or a tall sagebrush and bitterbrush shrub community will not quickly recover. A stand of lodgepole pine or tall shrubs may take 50 years or longer to return to pre-fire height and size. Suggestions for helping a property recover faster are presented in this guide.

Wildfires are often thought about with negative connotations, yet wildfires may alter property in good ways. For example, a stand of trees that was very dense can be managed after the fire to thin seedlings and young trees for a less-dense stand. The new community of trees will be more resistant to a return fire, and young trees will grow faster with less competition during recovery. A wildfire may also allow easier access to areas for reseeding more desirable grass, forb, and shrub species.

While not always true, recovery of a burned area can be manipulated for a faster and more desired outcome compared to a natural recovery. At other times with less-severe fires, little may need to be done other than monitoring the land for problems such as weed invasion and erosion.

Every wildfire is unique. This variation affects the recovery speed of a burned landscape and may cause some areas of your property to recover faster or slower compared to your neighbor's. We hope this practical guide helps you answer, "How do I prepare?" or "What's next?"

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UNIVERSITY of WYOMING EXTENSION | SUSTAINABLE MANAGEMENT OF RANGELAND RESOURCES

For more information on wildfire subjects, visit Barnyardsandbackyards.com

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DEFENSIBLE Landscaping

Create Defensible Space for Fire Safety

Wildfires burn hundreds of thousands of acres in the United States every year, force evacuations, burn structures, and claim lives.

Firefighting agencies do all they can, but their resources can be quickly overwhelmed by a large blaze. Only the homeowner can help guarantee his or her safety, the safety of family members, firefighters, and pets, and increase the chances your home, outbuildings, and landscaping survive a wildfire. For Wyoming homeowners, there are many things that can be done during a weekend to increase your wildfire preparedness.

The 3 R's of Defensible Space

Neighborhoods and subdivisions should work together to create defensible space when possible. Begin by inventorying the vegetation around you and your neighbors' houses.

Remove

- Remove dead vegetation, and clear weeds.
- Remove low tree branches.
- Remove ladder fuels (these are explained below).
- Remove firewood piles from near the house.

Reduce

- Breakup dense shrub fields and thick tree cover.
- Prune dead wood from shrubs.
- Reduce the amount of highly flammable native vegetation.

Replace

- Replace highly flammable plant material with less flammable, low-growing species within 30 feet to 100 feet of your house; check with your fire agency for local regulations.
- Consider replacing flammable roofing, siding, and other combustible building materials with

SPACE
steps to reduce the wildfire threat

fire-rated non-combustible materials, such as class A asphalt roof shingles, fiber cement siding.

- Replace attic vents and soffits that are plastic or can easily allow embers to pass into the attic or other parts of the house. Vents should be metal and less than ¼-inch mesh.

Following local regulations when creating defensible space is important. For example, the Casper Mountain Zoning District of Natrona County has regulations pertaining to fuel reduction requirements (see page 10 for Casper Mountain requirements). These requirements for homeowners on Casper Mountain are the only of their kind in Wyoming. If you live in an area without any requirements, these regulations may work as a guide.

Most people realize houses in or adjacent to wildland vegetation are at-risk for damage from wildfire. However, few people recognize that houses within urbanized areas are also threatened. During intense wildfires, burning pinecones, branches, and other material can be carried a half-mile or more beyond the fire front. Showers of embers are produced. If these embers land in spots where there are easily ignited fuels, such as wood shingle roofs, trash piles, or dried grass, new fires can start.

What is Defensible Space?

Defensible space describes an area of reduced wildfire threat around a home. You can modify a landscape to create defensible space by altering vegetation to decrease overall fuel volume and altering the arrangement and height of plant material. It is also important to ensure adequate space for firefighters to operate safely. These practices can make the difference between a structure surviving a wildfire or being destroyed. Factors affecting how easy it will be to create your own defensible space are:

- **The size of your property**
- **Types of vegetation**
- **Accessibility**
- **Slopes and steepness**

In some instances, a homeowner may already have an effective defensible space in place and need to perform only minimal additional work to contribute substantially to protecting a home from wildfire.

From Natrona County Firewise www.firewisewyoming.com

How To Create Effective Defensible Space

Make areas closest to the house lean, clean, and green – reduce the amounts of fuel, remove dead or high-risk vegetation, and keep the areas closest to the house well-maintained, green, and healthy. Many people find defensible space fits other landscape objectives as well. The area closest to the house is where you entertain guests, eat outside in good weather, and enjoy a lawn or flower garden. Many houses are adjacent to forests or prairie or on steep vegetated slopes, which are areas of high wildfire hazard. They need both the lean, clean, and green zone (first 100 feet) and an additional area outside of that.

Step One: Determine your defensible space

The amount and type of highly flammable wildland vegetation (grass, shrubs, or trees) growing on or adjacent to your property and how steep the slope of the area around and leading up to the house determines how much defensible space is needed. The minimum for most homes in Wyoming is 100 feet from a house, but a heavier amount of vegetation or steep slopes could mean at least 200 feet.

If the recommended distance goes beyond the property boundaries, contact the adjacent property owner and work cooperatively to create defensible space. The effectiveness of defensible space increases when property owners work together. Do not implement defensible space practices on neighboring properties without first securing permission. The county assessor's office can provide assistance if the owners of adjacent parcels are unknown.

Once the recommended distance is determined, temporarily mark the outer boundary with survey flagging or paint on trees or shrubs. The land within this boundary is the defensible space you need.

Step Two: Make a list of what you need to do and do it

Clean Up

Look around – is there dead vegetation in your defensible space zone?

Dead vegetation includes dead trees and shrubs, dead branches lying on the ground or still attached to plants, dried grass and flowers, dropped leaves and needles, and firewood. Dead vegetation should be removed from the defensible space area. Two important exceptions are pine needles covering bare soil and downed trees embedded in the ground. Pine needles are good cover for bare soil but should be kept to a thickness of between 1 and 2 inches – more is a hazard and less promotes erosion. Be careful not to remove the duff area – the dark brown zone beneath the needles where the needles have begun to decompose. Remove all pine needles under decks and within 2 feet of any structure. Move firewood piles away from the structure during fire season.

This mountain cabin owner thinned and pruned up the trees and removed a significant amount of under-brush. Limbs and whole trees have been chipped.

This cabin owner followed up a year after the treatment with a native wildflower mix on the bare soil. Photo: Nick Williams

Breakup the canopy

Within the defensible space, is there a dense, continuous cover of shrubs or tree canopies? Sometimes, wildland plants grow as an uninterrupted layer of vegetation as opposed to patchy or widely spaced plants. The more continuous and dense the vegetation, the greater the threat of wildfire. If the branches of neighboring trees or shrubs touch, break them up. There are two types of

dense, continuous vegetation that homeowners are likely to encounter in mountain areas – brush fields and crowded stands of coniferous trees.

Prairie and other brush fields

Create separation between shrubs based on shrub height and steepness of slope. The separation between individual or small groups of shrubs on flat to gently sloping terrain should be twice the height of remaining shrubs. For example, if the shrub height is 4 feet, then the recommended separation should be 8 feet (2 x 4-foot shrub height = 8-foot separation). Separation is measured from the edge of the canopy of one shrub to another and not from trunk to trunk. The separation between shrub canopies should increase as the steepness of the slope increases.

Crowded and dense stands of trees

In many mountainous areas, coniferous trees occur in dense, overcrowded stands where their branches are touching or interwoven. These conditions contribute to the risk of an uncontrollable and possibly catastrophic crown fire (wildfire burning through the tree canopies, independent of the understory vegetation). Create a separation between trees within the defensible space area. This is typically accomplished through tree removal or thinning of the stands. Note the photos on page 6; homeowners do not have to completely remove all the trees around their houses to have adequate defensible space.

Make sure there are no ladder fuels within your defensible space

Sometimes, plants serve like rungs of a ladder; they carry flames from fuels burning at ground level, such as dead grass and weeds, to taller fuels, such as shrubs, which ignite still taller fuels, such as tree branches. The ladder fuel problem can be remedied by removing the lower tree branches or reduce the height of the shrub or both. Exceptions to this practice are:

- Removal of lower tree branches should not exceed one-third to half of the tree's total height.
- Lower tree branches should be removed to at least 7 feet in height when no understory vegetation is present.
- Lower branches on shrubs taller than 3 feet should be removed to provide at least 12 inches of separation from the ground.

Remember, if you create slash piles of dead material such as tree branches during your creation or maintenance of defensible space, these piles should be eliminated annually. Landowners should consult their local law enforcement and fire protection district on slash pile burning and disposal of slash. Some communities have publically designated slash piles that are burned by the local fire department or forestry agency on an annual basis. Take advantage of these opportunities if they are available in your community.

No junipers

Junipers are often planted around the foundations of homes. They are very flammable – not good choices for a firewise landscape.

Ladder fuels are created when vegetation of different heights is close enough to allow a surface fire to become a crown fire.

From "A Landscape Guide for Mountain Homes," by University of Nevada Cooperative Extension

Step Three: Plant choice critical for defensible space areas

You should keep your defensible space in mind when planning a landscape or planting. Poor plant choice and spacing can jeopardize your defensible space. In addition to choosing plants to meet needs, such as providing shade, producing wind protection, adding color, and controlling erosion, select plants that have a low fire hazard. There are no fireproof plants. Any plant can burn during extreme fire conditions. There are, however, important differences in flammability. Some plants are more difficult to ignite, burn more slowly, produce less heat, and have shorter flame length. See "Some native plants for use in Wyoming landscapes" for a list of native plants and other tips that can get you started on a landscaping endeavor.

As you conduct landscaping activities, preserve or create your concentric "rings" of protection around your home or cabin.

In the first ring – an area around the home at least 3 feet and preferably 5 feet – do not use any wood mulch or flammable plants. Choose short (less than 18 inches high), fire-resistant plants and keep them away from contact with the structure. Have no plants in this area if the structure is built of logs or flammable material.

In the next ring, a space 30 feet out from the structures, herbaceous, fire-resistant plants should dominate. For example, a lawn planted in this area can be a cool and relaxing place for family members to gather. For defensible space purposes, this lawn should be kept green, if possible, and short. Any shrubs should be deciduous and less than 2 feet high. Any fire-resistant trees, shrubs, or other plants in this ring or the final ring from 30 to100 or 200 feet should meet the spacing requirements and other safety considerations listed above.

In addition to the right plants, hardscaping can help protect a home. Rock mulch is a very useful addition to landscapes where wildfire is a concern. Using pea-sized gravel mulches and/or larger rocks up to boulder-sized can be an attractive form of hardscaping that will not burn or carry flames to the home. Other forms of hardscaping to create firebreaks around a house include paved patio areas, walkways and driveways of gravel, concrete or pavers, and raised beds made of rock or brick.

This cabin appears at first glance to not have any problems but look closely at how thick and dense the forest is, how tall the brown grass is, and the firewood pile under and near the deck. See the photo to the right after the wildfire arrived.

Firefighters were unable to reach this home before embers entered the firewood pile and the cabin, which caused the cabin to become fully involved with fire. Wildland firefighters are often not equipped to handle structure fires once a house is fully involved with fire.

WELL-PLANNED HOME LANDSCAPE CAN REDUCE WILDFIRE DANGER

Many Wyoming families have homes or cabins in forested areas, which provide a get-away from the heat and cares of lower-elevation towns.

The defensible tips given here can help protect a cabin or home and the many memories these family gathering places hold; however, few want to go away for the weekend to a place with nothing around the building to beautify the site and make the structure seem part of the natural landscape.

A well-planned home landscape can reduce fire danger, protect your investment, and help the cabin fit in with the natural vegetation.

As mentioned, landscape plants, if not selected and placed well, can actually increase the fire hazard to a house. Evergreen trees are the most common plants around cabins and mountain homes. Unfortunately, these are some of the most flammable plants. Even their needles are highly flammable after they fall from the trees at the end of the growing season.

What makes one plant less flammable than another?

Some characteristics of less flammable plants include: high moisture content, low growing, and lack of very flammable chemicals. Herbaceous plants (grasses, bulbs, annual and perennial flowers, and some ground covers) tend to contain the most moisture. Of the shrubs and trees, deciduous varieties (ones that lose leaves in fall) tend to contain the most moisture and lack many of the flammable chemicals found in evergreens. Many of the native plant species found in mountainous areas, such as sagebrush or ground juniper, are very flammable. Water plants well during the fire season to maximize their fire resistance. Inspect regularly for any dry or dead material and remove.

Step Four: Maintain for fire safety

Remember these three words – lean, clean, and green – when there is any potential of wildfire in your area. Keep your landscape lean by reducing, removing, or replacing the most flammable vegetation within your defensible zone. Keep it clean – make sure there is no accumulation of dead vegetation or other flammable debris. Keep it green – make sure plants are healthy and green during the fire season. Creating a defensible space should not be viewed as a one-shot effort. Maintaining an effective defensible space is an ongoing process.

Working with your community, neighborhood, or homeowners association will improve the chances that structures will survive a wildfire. Ask a forester or local fire department about how your community could become a nationally recognized Firewise Community. For more information about Firewise communities, including additional tips on preparing your home for wildfire season, go to www.firewise.org/.

Some native plants for use in Wyoming landscapes

Scientific Name	Common Name	Water Needs	Sun/Shade	Height
Flowers and Groundcovers				
Antennaria parvifolia	Small leaf pussytoes	Low – Moderate	Sun	3″– 8″
Antennaria rosea	Rosy pussytoes	Low – Moderate	Sun	3″– 8″
Aquilegia spp.	Columbine	Low – Moderate	Part Shade/Shade	18″– 24″
Arabis spp.	Rockcress	Low	Sun/Part Sun	6″
Campanula rotundifolia	Common harebell	Low – Moderate	Part Sun/Part Shade	4″– 5″
Claytonia lanceolata	Spring beauty	Moderate	Part Sun/Part Shade	6″
Echinacea purpurea	Purple coneflower	Moderate	Sun	2′– 3′
Erigonum umbellatum	Sulphur flower	Low – Moderate	Sun/Part Shade	6″–12″
Gaillardia aristata	Blanket flower	Low – Moderate	Sun/Part Shade	12″– 20″
Geum triflorum	Prairie smoke	Moderate	Sun/Part Shade	8″– 18″
Ipomopsis aggregata	Scarlet gilia	Low – Moderate	Sun/Part Sun	18″– 24″
Liatris punctata	Dotted gayfeather	Low – Moderate	Sun/Part Sun	6″–18″
Penstemon spp.	Penstemon	Low – Moderate	Sun/Part Shade	6″– 36″
Sedum spp.	Stonecrop	Very Low – Low	Sun	1″– 6″
Shrubs				
Mahonia repens	Creeping grape holly	Low – Moderate	Sun/Part Shade	4″– 6″
Philadelphus microphyllus	Little-leaf mockorange	Low – Moderate	Sun/Part Shade	18″– 40″
Rosa woodsii	Wood's rose	Moderate	Sun/Shade	2′– 3′
Trees				
Amelanchier alnifolia	Saskatoon alder-leaf serviceberry	Moderate	Sun/Part Shade	6′– 8′
Crataegus spp.	Hawthorn	Moderate	Sun	6′– 8′
Acer grandidentatum	Bigtooth maple	Low	Moderate Sun/Part Shade	10′– 20′
Populus tremuloides	Quaking aspen	Moderate	Sun	8′– 25′

Other or more extensive plant lists are available from local extension, USDA Forest Service, or Wyoming State Forestry Division offices. Plant lists are also available on the Internet but be sure plants are cold hardy enough for your location.

Remember, fire-resistant landscaping requires annual maintenance to be effective! Pine needles should be raked away from the house in the closest zone, gutters cleaned, plants pruned or thinned, dead material removed, and slash piles disposed of by legal means.

By taking these steps, time spent at mountain cabins or rural homes can be much safer. Nothing can guarantee a cabin or house will survive a wildfire, but steps to modify the natural vegetation and create an attractive, less-flammable landscape near your forest sanctuary will help.

Obtaining More Information

Wyoming State Forestry Division and most counties have Firewise and fuels reduction programs to assist landowners who live in the wildland–urban interface. Some counties even have federal assistance grants for landowners to help offset some of the costs of creating defensible space. For more information, please contact Nick Williams, fire resource forester, with the Wyoming State Forestry Division, at nick.williams@wyo.gov or 307-777-7586. Or, go to www.firewisewyoming.com.

This document was modified from the University of Nevada's Cooperative Extension document "A Landscape Guide for Mountain Homes."

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Photo: Micahel Rieger/FEMA

Vegetative Management and Defensible Space

Public agencies and some local homeowners associations have fuel-reduction requirements. Below are those for the Casper Mountain Zoning Area of Natrona County (2011).

Casper Mountain Zoning Fuel Reduction Requirements for Building Permits

(a) A mitigation plan for vegetative management and defensible space/fire safety shall be submitted with site plans for principle building construction. Zoning certificates shall be issued after approval by the reviewing officials (fire inspector or other designated official, and building official).

(i) Vegetative Management Recommendations:

(A) Fuel breaks: This can be implemented along access roads, driveways, and subdivision boundaries. The fuel break should be a minimum of 10 feet wide, and all material should be removed as well as all live brush and trees under 20 feet tall. A few larger trees (20 feet tall and larger) can be left, although all branches should be pruned to a height of 10 feet.

(ii.) Defensible Space Zones:

(A) Zone 1 – This area is the first 30 feet from the structure.

(I) Remove all dead material from this area and firewood piles and other combustible materials.

(II) Maintain an area of non-combustible material 3 to 5 feet away from structure.

(III) Remove all shrubs and trees except for a few individuals. (Minimum spacing between crowns of trees is 10 feet.)

(IV) Prune branches off of remaining trees to a minimum height of 10 feet. If a tree is less than 20 feet tall, prune it to half of total height.

(V) Plant species in this zone should be of a fire-resistant variety, which is mostly leafy species. These plants need to be watered well to maintain adequate moisture content.

(VI) Keep all vegetation mowed to a height not exceeding 2 inches.

(VII) Prune away any branches within 10 feet of structure and 15 feet away from any chimney outlets.

(VIII) Clear pine needles, leaves, limbs, and other debris from roofs and gutters.

(B) Zone 2 – This zone extends 70 feet beyond the outer edge of Zone 1.

(I.) Thin all trees to a spacing of 8 feet between tree crowns.

(II.) Prune all remaining trees to a minimum height of 10 feet

(III.) Remove dead trees and downed combustible materials. Firewood and other combustible material can be stored here, but keep it at least 15 feet away from trees.

(IV.) Control ground vegetation.

(C) Recommendations for remaining lot area:

(I.) Mark all fire protection equipment and water sources so they are clearly identified.

(II.) Inspect power lines on the property and ask the utility company to remove any trees within 15 feet of the lines.

(III.) Place propane tanks at least 50 feet from structures and maintain a clear 10-foot area around the tank. Also, locate tanks at same or lower level as structure.

SURVIVE THE UNTHINKABLE if wildfire threatens your home

Families in some areas of Wyoming can be safe and secure one day and have their lives turned upside down by wildfires the next.

To increase your safety and preparedness, we offer the following.

Ready **– Preparing for the fire threat.** Be ready, be firewise, and create defensible space. Prepare before the threat of a wildfire so you, other family members, and your house are ready. Assemble emergency supplies and belongings in a safe spot. Make sure everyone living within the home is familiar with the escape plan; set escape routes. Ask your local fire department if your county has a reverse 911 service and how to join. This service will try to contact your phone number in the event of a major incident in your area.

Set **– Situational awareness when a fire starts.**

If a wildfire breaks out near your area, pack emergency items in your vehicle. Listen to the latest news from the media and local fire department either by AM/FM radio, local TV, or by talking with authorities on-scene. Prepare domestic animals and livestock for possible evacuation. Livestock trailers should be pre-positioned to capture and transport large animals before the fire arrives. Do not rely on phones or TV as the only means of obtaining information. Power and phone lines can go down, and cell phone towers can quickly become overloaded in large incidents such as wildfires. Knowing when and how to go is your responsibility.

Go **– Leave early!** With a plan in place, you are prepared to leave at a moment's notice. Firefighters can take appropriate action without endangering you or your family. Evacuations take a lot of time and effort for authorities to accomplish. You can help by leaving as soon as possible in the event of an evacuation. Do not return home unless given permission by authorities.

STAY INFORMED! LEAVE EARLY!

Before a Wildfire

If you see a wildfire, call 911. Don't assume someone else already has. Have a disaster kit (see page 14) and emergency plan ready.

Well Before the Fire Approaches Your House

- Evacuate pets, the young, and anyone with medical or physical limitations.
- Wear protective clothing made of cotton that covers exposed skin. Do not wear nylon or similar fabrics.
- Clear flammable items from around the house, including woodpiles, lawn furniture, barbecue grills, tarp coverings, etc. Move them at least 30 feet from the area around your home.
- Close and protect openings. Close all doors inside the house to prevent drafts. Open the damper on a fireplace but close the fireplace screen. Close outside attic, eave and basement vents, windows, doors, pet doors, etc. Remove flammable drapes and curtains. Close all shutters, blinds, or heavy non-combustible window coverings to reduce radiant heat.
- Shut off any natural gas, propane, or fuel oil supplies at the source.
- Connect garden hoses and fill any pools, hot tubs, garbage cans, tubs, or other large containers with water. Firefighters may take advantage of these resources if near your home.
- Back your car into the driveway and roll up the windows.
- Disconnect any automatic garage door openers so doors can still be opened by hand if the power fails. Close all garage doors.
- Place valuable papers, mementos, and anything "you can't live without" inside the car, ready for quick departure. Any remaining pets should also be put in the car.

Preparing to Leave

- Turn on outside lights and leave a light on in every room to make the house more visible in heavy smoke.
- Leave doors and windows closed but unlocked. Firefighters may need quick entry into a home to fight fire. The entire area typically will be isolated and patrolled by sheriff's deputies or police after the fire moves on.

During a Wildfire

Survival in a Vehicle

This is dangerous and should only be done in an emergency, but surviving a firestorm is possible if you stay in a car. It is much less dangerous than trying to run from a fire on foot.

- Roll up windows and close air vents. Drive slowly with headlights on. Watch for other vehicles and pedestrians. Do not drive through heavy smoke.

FIREFIGHTING DEPENDENT ON ACCESS AND WATER


Photo: NPS, Kelly Martin

During a wildfire, firefighting resources are generally limited, and those fighting the fire have to decide how to best position those resources. Firefighters unable to safely enter and leave properties may not defend structures. Make sure firefighters have the room and water needed to best defend your home if able.

Some items to consider:

- Underground cisterns, aboveground water tanks, or draftable water sources that are accessible by emergency vehicles can help provide firefighters with water. Remember, your well may not pump water fast enough for firefighters to use, and the electricity that powers your water pump may go out. Make sure signs or other markings indicate any water sources firefighters can use.
- Reflectorized fire numbers and street name signs can help firefighters find your property, especially in smoky situations.
- Firefighters need a clearance of 12 feet wide and 14 feet high along any roads to and through the property.
- Firefighters need a 45-foot turnaround area and pullouts large enough for emergency vehicle use to safely enter and leave a property.
- Fire trucks can be very heavy. They may not be able to climb slopes steeper than 10 percent grade when fully loaded.
- Bridge weight limits should be posted. Bridges should be wide enough and strong enough to support a fire truck weighing 18 tons or more (check with your local fire department for their requirements) and built of non-combustible material.
- All roads more than 150 feet in length should have turnouts to allow two vehicles to pass.

DON'T GET INTO THESE SITUATIONS!

- If you have to stop, park away from the heaviest trees and brush. Turn headlights on and ignition off. Roll up windows and close air vents.
- Get on the floor and cover up with a blanket or coat.
- Stay in the vehicle until the main fire passes. Do not run. The engine may stall and not restart. Air currents may rock the car, and some smoke and sparks may enter the vehicle. Temperature inside will increase, but metal gas tanks and containers rarely explode.

If Caught in the Open

- The best temporary shelter is in a sparse fuel area. Some examples would be a plowed field, large paved or gravel car parking area, or an irrigated lawn or field.
- If a road is nearby, lay face down along the road cut or in the ditch on the uphill side. Cover yourself with anything for protection from the fire's heat.
- If hiking in the back country, seek a depression with sparse fuel. Clear fuel away from the area while the fire is approaching and then lay face down in the depression and cover yourself. Stay down until the fire passes.

After a Wildfire

- When allowed to return, immediately check the roofs of all buildings. If any heat or fire still exists, contact 911 and emergency services first. If safe and possible, extinguish any roof fires, sparks, or embers. Check the attic for hidden burning embers. Keep checking for several days after the fire. See page 16 of this guide for tips on how to keep safe during the aftermath of a wildfire.
- The water in the pool or hot tub and other containers can come in handy now if you need to apply water to embers or heat on or around the house.
- After the fire, maintain a fire watch. Re-check for smoke and sparks throughout the house.

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To Learn More:

- http://www.ready.gov/
- Information from the International Association of Fire Chiefs program; "Ready, Set, GO!; Your personal Wildland Fire Action Guide." See http://www.wildlandfirersg.org/
- Firewise Wyoming at www.firewisewyoming.com/index.html

Creating an *emergency plan*

- Find out what disasters could occur in your community. Do you live in a flood zone or a wildfire-prone area? Learn what to do in different disasters.
- Your local government and local Red Cross chapter should have details on evacuation routes. Learn the emergency signals and discuss them with your family.
- Determine the best ways to leave your home and the best ways to escape disaster in your neighborhood or town.
- If you cannot meet loved ones at your home, determine a meeting place in the neighborhood. You may also consider looking at evacuation plans outside of the neighborhood or community in case meeting in the vicinity of your home isn't possible.
- Check disaster plans at schools, daycares, work, and places where you and your family tend to spend time in the community. Try to coordinate the evacuation procedures at each place to ensure everyone will be able to reach each other or end up on the same side of town.
- It's not a bad idea to have a Plan A, a Plan B, and a Plan C. Whatever the plans, make sure everyone in the family knows about them and what to do in different scenarios.
- Calling long distance during disasters may be easier since cell phone lines and local telephone networks may be down or overwhelmed. Be sure to have an out-of-town emergency contact.
- After a disaster, services or aid might not arrive for days. You might even have to flee your home or you might not be able to get to your house. In such cases, it will help to have a few things handy. Make a disaster kit for your home and car, along with a portable one.
- Don't forget to think about how to care for pets during an emergency. Many shelters may not allow them inside because of health laws. Make sure to prepare pets for the worst.
- This is a lot to remember. Write down your family's plans and emergency contact numbers and give everyone a copy.

PREPARE EMERGENCY NECESSITIES

If forced to evacuate, you will want to be ready. Have a plan and list of things needed ready well before fire season. Here is a list of commonly considered emergency necessities in wildfire season. Put these items in easy-to-carry containers such as backpacks, duffel bags, or plastic crates for easy transport.

Water

Store a minimum of 1 gallon per person per day for drinking and sanitation purposes. You should store a three-day supply. Store water in plastic containers.

Food

Store at least a three-day supply of ready-to-eat, canned food. Select foods that require no refrigeration, preparation, or cooking, and little or no water. If food must be heated, pack a can of Sterno. Don't forget to store food and water for your pet if you have one!

Other Items

Sleeping bag or blankets for everyone	Computers	Flashlight
Extra car keys, cash, and checks	Portable radio	Extra batteries
Cell phones and chargers	Sanitation supplies	Keys to safety deposit boxes

First Aid Kits

You should have two: one for your home and one for the car. Both should include:

sterile adhesive bandages in assorted sizes	scissors
assorted sizes of safety pins	tweezers
soap	needles
latex gloves	moist towelettes
sterile gauze pads of various sizes	antiseptic
various sizes of bandages	thermometer

Special Items

- **For babies:** Formula, diapers, bottles, medications
- **For adults:** Medications, denture needs, contact lenses and supplies, extra eyeglasses
- **Entertainment:** Games and books
- **Important family documents:** Keep these in a waterproof, portable container:
  - Wills, insurance policies, contracts, deeds, stocks and bonds, titles
  - Passports, social security cards, immunization records, copy of driver's license, copies of health insurance cards
  - Bank account numbers, loan and investment info, first two pages of last year's tax records, computer usernames and passwords
  - Credit card account numbers and companies
  - Inventory (written, photo, video) of household goods, important telephone numbers
  - Family records (birth, marriage, death certificates)

A Few Things To Remember

- Keep items in airtight plastic bags.
- Change your stored water supply every six months so it stays fresh.
- Replace your stored food every six months.
- Rethink your kit and family needs at least once a year.
- Ask your physician or pharmacist about storing prescription medications.
- It is a good idea to have a safety deposit box in which copies of all valuable items are kept.

Many only think of lightning strikes or un-doused campfires as sources of wildfires; however, vehicles can also start fires. Here are tips to help avoid starting a fire.

Make sure the vehicle is tuned and functioning properly. This will maintain or improve the vehicle's performance, ensure fuel economy, and reduce potential fire mishaps.

Inspect regularly to ensure there is nothing being dragged, such as chains or incorrectly loaded equipment on a trailer. Sparks from dragging metal can light multiple wildfires along roadways. Regularly check tire pressure and tire wear. Change a flat tire as soon as safety permits. Tire rims hitting the road or rocks can produce sparks.

Catalytic converters (CC) on vehicles can start fires. CC reduce emissions by accelerating combustion of pollutants. The exhaust is then sent through a vehicle's exhaust system. The outside metal temperatures of the CC, which is a flat, plate-like surface under a vehicle, can reach 1,000 degrees F under certain conditions, such as running the air conditioner, towing a trailer, or navigating a mountain pass. Fires can then start when flammable materials, such as dry grass and seeds, collect on the exhaust/CC system or if the vehicle is parked where dried vegetation touches this system. To prevent these types of fire:

- After driving through dry vegetation, check the exhaust/CC system for debris buildup that could pose a fire danger. Remember, the exhaust/CC system will be HOT so allow time to cool prior to removing any accumulated dry vegetation.
- Periodically check the vehicle's exhaust prior to driving first thing in the morning, since it will be cool and thereby allowing removal of debris.
- Avoid driving and parking in dry vegetation.
- And, carry a fire extinguisher in the vehicle.

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BE DILIGENT LOOKING FOR HIDDEN

Many homeowners may wonder when they can safely re-enter a property after a wildfire and how to resolve issues that could harm themselves or family members.

There are a number of safety precautions to consider before re-entering a property burned by wildfire.

Landscape Safety

- Visually inspect for stability any standing trees that remain. Trees weakened by fire are serious hazards and could fall at any moment in any direction. Walking through such sites poses serious risks, especially in windy areas. Keep in mind that wind patterns on a property may have changed due to the loss of adjacent tree cover. Check for burnt roots by probing the base of trees with a rod. If roots have been burned, trees should be considered very unstable and may fall over at any time.
- Watch for ash pits when walking around property scorched by fire. An ash pit is a hole of hot ashes left behind by tree stumps and root systems that have burned underground. Ash pits can stay hot for many days after a wildfire and cause serious burns. Mark their locations.
- Remember, hot spots in a burned landscape could flare up without warning and start new fires.

Livestock and Pet Safety

- Inspect areas where animals roam since there may be hidden embers, hot spots, and ash pits that might burn hooves and paws or break limbs.
- Do not tie animals to burned trees or structures.
- Be vigilant about checking any animals that may have been exposed to smoke inhalation during a fire. Smoke-related pneumonia is the most common cause of fire-related death in animals.
- Consult a veterinarian for treatment of any burns suffered by animals.

Building Safety

- Only enter buildings that have been inspected by local fire authorities and have passed inspection.

Ash pits, 'widow-makers,' chemicals — be careful

DANGERS ON PROPERTY FOLLOWING FIRE

- Be on the lookout for structural damage. Roofs and floors damaged by fire can collapse without warning.
- Frequently check the entire structure for embers and smoke, particularly the roof, attic, and crawl space of a house for several days after re-entry.
- Once you have ensured there are no gas leaks or damage to electrical lines, contact local utilities (water, natural gas, propane, electricity) to restore service. Local suppliers will often come to a property to inspect their systems before reconnections occur.
- Remember to contact your insurance company before beginning any cleanup procedures. A complete inventory of damaged goods needs to be taken before insurance claims can be made.

Personal Safety During Cleanup

- Wet down debris before the cleanup to reduce the risk of inhaling ash and dust particles.
- Wear a protective mask of at least an N-95 or P-100 rating. Debris from burned buildings may contain toxic substances such as asbestos, arsenic, and lead, which can be easily inhaled along with small dust and ash particles.
- Avoid activity that stirs up ash, such as the use of leaf blowers. Instead, gently sweep surfaces or use a wet cloth or mop.
- Wear a hardhat, goggles, leather or rubber gloves, heavy-soled boots, long sleeves, and pants.

- Get a tetanus shot booster if you have not had one in the past 10 years. There is a risk of obtaining puncture wounds, cuts, and burns from the cleanup of broken glass, exposed wires, nails, wood, metal, plastic, and other potentially hazardous debris.

Food and Water Safety

- Throw away food that may have thawed, spoiled, or come in contact with harmful materials, such as fire retardant or ash, or has been exposed to heat and smoke.
- Do not use water that may be contaminated to wash dishes, brush teeth, prepare food, wash hands, or make ice. Until water can be confirmed as safe to drink, use bottled water or boil water to ensure it has been properly disinfected.
- If a home was damaged in a fire, water wells may have become contaminated with bacteria due to a loss of water pressure. Water from wells should be sent to a laboratory for testing before it is consumed. (See "Drinking water and septic systems" on page 18 for more information on testing and decontaminating wells.)
- If a municipal water source is used, request that a routine three-month bacteria water sample be collected and tested before consumption.

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DRINKING WATER AND WHAT

Homeowners returning to their sites affected by fires may have questions about their drinking water and septic systems.

Individuals with private wells need to be concerned about how safe the water is to drink. Have the water tested at a certified environmental testing laboratory to ensure the water is safe. Laboratory listings are in the Yellow Pages of the telephone book. Each lab will have directions how to submit the sample, the charge, and other information. You will want the laboratory to test for total coliform bacteria.

Laboratories will provide a bottle for collection and usually will have results in a few days. Instructions with the sample container must be followed carefully so results are accurate.

Contaminated System?

The laboratory should test for bacterial contamination – total coliform bacteria. If there are specific concerns about chemicals in the water, talk with laboratory personnel about additional tests they could recommend.

The water should only be used for showering and flushing toilets while waiting for test results. Use bottled water for drinking, brushing teeth, or cooking. If bottled water is not available, disinfect small quantities of water by boiling it for two to five minutes. If impractical, mix 1 gallon of clear water with 6 to 8 drops of 5 percent regular household bleach (do not use scented or perfumed bleach). Regular household bleach is 5 percent to 5.25 percent. Do not use ultra bleach, which has a higher concentration. Let the mixture stand 30 minutes before drinking. If the water is cloudy and contains particulates, allow the particles to settle, drain the clear solution from the top into another clean container, and add double the amount of drops listed above.

If Contaminated

If the water sample comes back positive for bacteria, the well needs disinfected. To disinfect a well, mix 2 quarts of 5.25 percent bleach (regular household bleach) with 10 gallons of water. Use only regular, unscented bleach. Pour the solution into the well, start the pump, and open all the faucets in the home. When a chlorine odor is noticeable at the faucets, close them and stop the pump. Allow the well to stand for 24 hours without pumping.

SEPTIC SYSTEMS —
YOU NEED TO KNOW AFTER THE FIRE

After 24 hours, open taps and flush all lines until the chlorine odor is no longer detected. A laboratory testing the water will provide more information about how to disinfect a well if results are positive for bacterial contamination.

Thoroughly flush water lines if the water tastes or smells smoky after a fire by running water through all faucets inside and outside of the home.

If there was a loss of pressure, some backflow of water and other contamination could have occurred

Perform a visual inspection of the well. Check the following to ensure there is no damage:

1. Electrical components that supply power to the pump
2. Additional disinfecting equipment, if applicable (UV lamps, reverse osmosis filter)
3. Pressure tanks, storage tanks, and vents
4. Wellhouse, aboveground cap, and casing
5. Any pipes aboveground that bring water into the home

If damage is found, contact a professional knowledgeable with well maintenance. Listings should be in the Yellow Pages of the telephone book. If the well top was not capped or otherwise protected, call a laboratory to determine if there are additional tests to consider.

Septic System

Homeowners need to determine if the septic system was damaged. The fire should not have affected the underground system; however, there is the possibility of damage if heavy equipment was parked on top.

Look for damage from the cleanout outside the house to the end of the drainfield. Often, firefighters dig firebreaks or dozer lines to protect a structure from a fire.

- Septic systems designed for infiltrator chambers may have damage if heavy equipment drove over the system.
- Heat may have damaged aboveground plastic PVC cleanouts on the septic tank and the distribution box.
- Piping in raised bed systems that are not buried underground may have damage from the extreme heat produced by the fire.
- Once the system is used again, there may be surfacing sewage or toilets and plumbing fixtures that may not drain properly. These are indications something is wrong.

Contact the local agency that permitted the septic system to help determine the problem. Most systems are installed in a flat area. In mountainous areas, systems are sometimes installed on slopes. Since vegetation in the area is likely gone, there is a concern the topsoil could start eroding away from the septic system.

Articles on erosion and how to deal with it are included in this guide. Be advised to only use shallow-rooted plants, such as some grasses, to revegetate around septic systems. Plants that grow long roots, such as trees, should not be planted on top of septic systems. Their roots can grow into the system and cause damage as these plants seek water and nutrients.

Contact a local health department for information about any of the above topics. You can also visit barnyardsandbackyards.com for information about wells and septic systems.

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HAZARDS, DEAD TREES
ARE ONLY A FEW ISSUES TO CONSIDER FOLLOWING WILDFIRE

A landowner may face a bleak landscape and be unsure how to respond following a wildfire.

Safety is the most immediate concern. As suppression efforts wind down, crews will work to clear out some hazards, such as trees, that pose a danger of falling. This type of work is usually concentrated in higher-use areas, such as along roads, trails, fire lines, and public areas.

Remote or interior areas will likely have not been assessed or treated for hazards. Don't assume hazardous conditions have been addressed by fire crews prior to a landowner's return.

Burned Trees Post Multiple Hazards

Burned trees may pose a hazard in three ways. Fire does not just burn above ground; stumps and root systems are also consumed leaving holes and hollow areas below the ground. A person can easily stumble into these holes or have the earth give way above a burned-out root system. Immediately following a fire, these pockets may still be hot and pose a burn risk.

The fire may have consumed a significant portion of a tree's root system or lower trunk, although the tree is frequently left standing. These trees may fall at any time, even without wind. Fallen trees may get hung up in the branches of other trees and break away at a later time. Upper portions of the trunk and branches may have been partially consumed in the fire, yet still retain a fragile connection to the tree. Again, these may break away from the main tree without warning. Wind will exacerbate the problem.

Identify Potential Hazards

When first returning to a property following a wildfire, conduct a site assessment to identify potential hazards. Mark identified hazards with spray paint, flagging, or survey flags and notify other family members, guests, and contractors of their locations.

Hazardous trees close to structures, utility lines, main access routes, and any high-use area, should be addressed as soon as possible. In many cases, this work should be done by a professional because the tree's instability will make handling difficult and dangerous. Hazard abatement should continue outward from priority areas.

Most trees within the burn area will not pose an immediate hazard, although landowners should carefully consider future forest management needs and options. Tree survival and death is largely dependent on fire severity, which is influenced by factors such as live tree density, dead and down woody debris, terrain, and weather conditions. Trees may survive in a range of conditions from untouched to severely damaged.

Even in cases of severe fire behavior and high tree mortality, most trees are not completely consumed, and the main trunk will remain standing although the leaves/needles and branches may be gone.

Plan to Remove All Dead Trees

Dead trees, particularly in large numbers, will eventually pose a hazard and a nuisance. Landowners should consider having them removed within five years of the burn. All dead trees can be expected to eventually fall with the potential for death and injury, damage to buildings, property, and other infrastructure, and obstruction of roads and trails.

These dead trees will also contribute to fuel loading on the property and will significantly increase the future threat of wildfire. Cleanup of dead trees can represent a considerable cost to a landowner, although this should be weighed against such factors as injury, damage to structures and utilities, and continual maintenance needed to keep roads and trails open.

At a minimum, consider removing all dead trees in areas that receive regular human use and within a tree's length of structures, utilities, and access routes. This is especially important for smaller properties where uses are more concentrated.

Firefighter Brian Pickard watches for falling tree limbs while fighting a forest fire with his crew, Sunday July 8, 2012, near Big Piney. (Photo: Dave Weaver / Shutterstock.com)

Dead trees that were not severely burned may still have a use for timber, posts and poles, and firewood. Markets are currently weak and the glut of dead trees will depress values further, but salvaging the dead wood for products could possibly offset some of the cost of cleanup.

Following a wildfire, there is approximately a three- to five-year window in which the wood can be expected to be useable. What was usable for timber in year one may only be fit for firewood by year five. Some commercial operators dislike handling recently burned wood as it is hard on saws, and firewood customers don't like to purchase dirty firewood. If not salvaged quickly, wood borers may destroy a tree's timber value.

How to Know Which Trees to Keep?

Knowing which trees to remove and which to keep can be problematic. Damage assessment is not always straightforward. Color can be a good indicator of condition. If a tree retains a bright green color in most of its branches, that is a good indicator damage was slight and survival probable. A predominant yellow-green color indicates significant damage and, depending on the extent, the tree might survive in a weakened state or die later. Many trees "cook" rather than burn, exhibiting a rusty brown color, which usually indicates severe damage. If extensive, the tree is likely dead or will die soon. Judging tree survival is usually easier the next growing season after a fire, and a landowner may chose to wait a year to determine which trees to keep.

Mountain Pine Beetles Like Recent Wildfire Areas

Mountain pine beetle infestations are common following a wildfire. Trees weakened in a fire are particularly susceptible to MPB; this native beetle targets stressed trees. A key indicator of an MPB infestation is globs of pitch on the trunk. Given their stressed condition, these may be absent on infested trees. Another indicator of infestation is sawdust-like material (frass) that collects in bark crevices and at the base of the tree. Trees may be infested from late spring through the summer depending on the elevation. A new generation overwinters in the tree and emerges in late spring to early summer. An infested tree will fade and turn brown the summer following the year of infestation. The emerging beetles will normally infest trees near the original infestation.

Once infested, there is nothing a landowner can do for the infested tree. Infested trees are typically removed before the beetles can emerge and infest other trees. If MPB are active on or near a property, a landowner might consider preventively spraying trees with a chemical such as Carbaryl (trade name Sevin) or permethrins (trade names Astro, Dragnet). The chemical must be applied before infestation occurs. Spraying is an expensive option and should not be applied indiscriminately. Focus spray treatments selectively on high-value trees.

For more information, contact Wyoming State Forestry Division at lands.state.wy.us.

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WILDFIRE BURN SEVERITY CLASSIFICATION

Knowing how intensely the wildfire burned will help you make decisions about your property. The following indicators can help determine the intensity of the wildfire.

(To determine hydrophobicity (soil repels water), scrape ash away and drip water on the soil surface. Hydrophobic soils will cause water to bead at the surface for several minutes. Repeat test in several areas. Determine root damage by digging down and carefully examining the extent of root burning.)

Low Fire Severity (Type III)

General statements

- primarily occur on rangeland
- no sediment delivery
- natural recovery likely

Indicators

- duff and debris are partly burned
- soil is a normal color
- hydrophobicity is low to absent
- standing trees may have some brown needles

Interpretations

- root crowns and surface roots will resprout quickly
- infiltration and erosion potential are not significantly changed

Adapted from: USDA Natural Resources Conservation Service

Medium Fire Severity (Type II)

General statements

- primarily occur on steep, lightly timbered slopes with grass
- some sediment delivery

Indicators

- duff is consumed
- burned needles are still evident
- ash is generally dark colored
- hydrophobicity is low to medium on surface soil up to 1 inch deep
- soil is brown to reddish-brown and up to 2 inches of soil is darkened from burning (below ash)
- roots are alive below 1 inch
- shrub stumps and small fuels are charred but present
- standing trees are blackened but not charcoal

Interpretations

- root crowns will usually resprout
- roots and rhizomes below 1 inch will resprout
- most perennial grasses will resprout
- vegetative recovery (non-tree), depending on conditions, could be one to five years
- soil erosion potential will increase due to the lack of ground cover and moderate hydrophobicity

High Fire Severity (Type I)

General statements

- primarily occurs in unprotected drainages on steep, timbered, north or east slopes with dense forest canopy
- sediment delivery likely
- natural recovery limited

Indicators

- duff consumed
- uniformly gray or white ash (in severe cases ash is thin and white or light)
- no shrub stumps or small fuels remain
- hydrophobicity medium to high – up to 2 inches deep
- 2 to 4 inches of soil is darkened (soil color often reddish orange)
- roots burned 2 to 4 inches
- soil physically affected (crusting, crystallization, agglomeration)
- standing trees charcoal up to 1 inch deep

Interpretations

- soil productivity is significantly reduced
- some roots and rhizomes will resprout but only those deep in soil
- vegetative recovery (non-tree), depending on conditions, could be five to 10 years
- soil erosion potential can be significantly increased

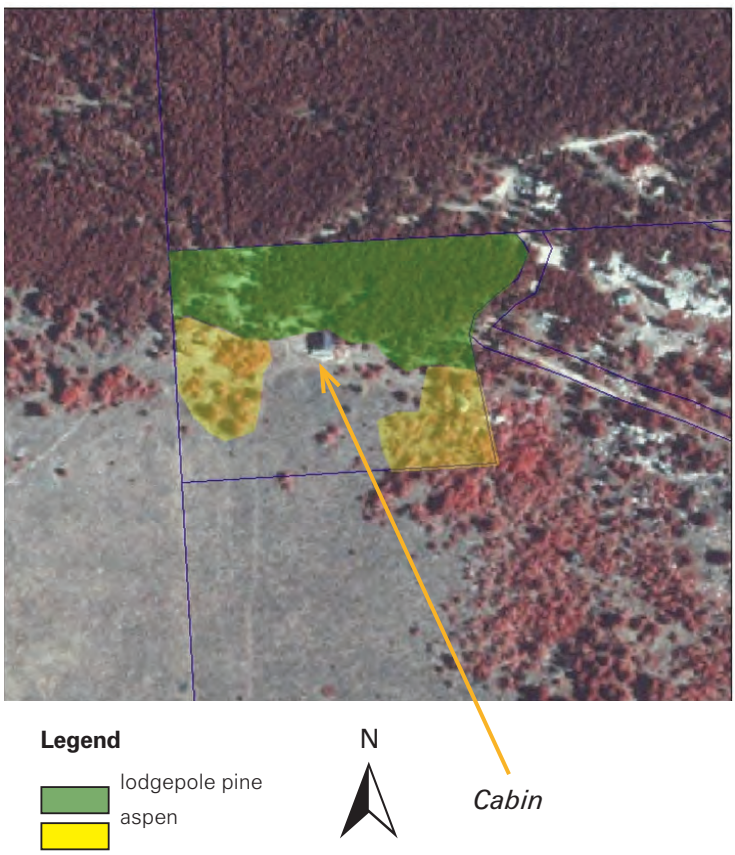
Example property shows

Preexisting vegetation, wildfire severity, erosion potential – all tie into choices you may make after a wildfire. This example wildfire property description shows how these factors interact.

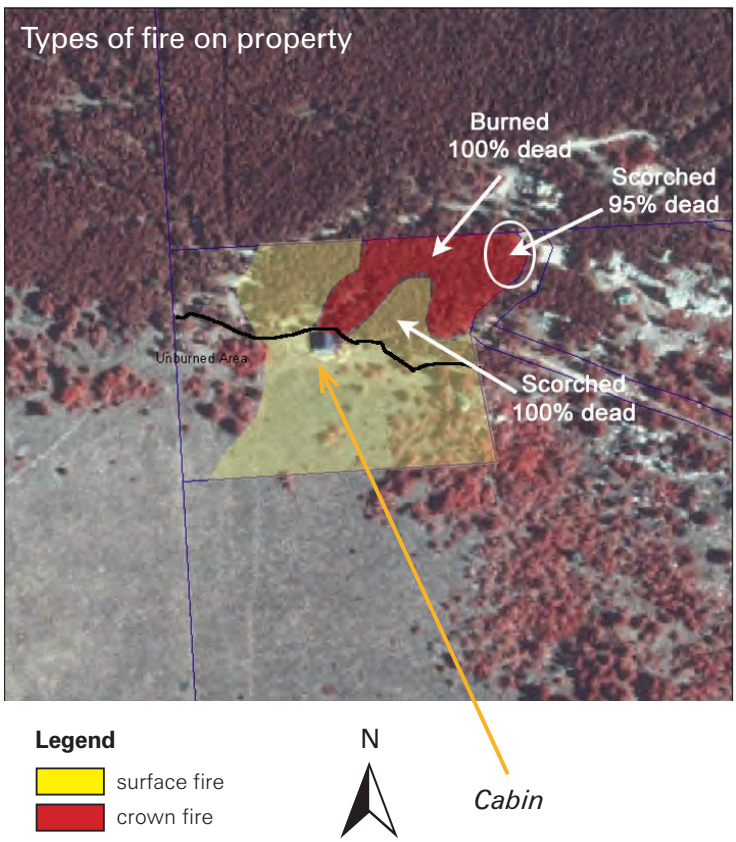
Lodgepole pine forest before the fire

Before the wildfire:

The landowner's cabin was in the middle of the site. The mid- and southwest section of the property consisted of mixed sagebrush and grassland. Mature, dense, lodgepole pine, limber pine, and Douglas fir dominated the rest of the property. Sagebrush and conifers were encroaching into the two aspen stands. Canada thistle, an aggressive weed, was found in small, isolated patches. The soils and topography gave portions of the site a moderate to severe erosion hazard.



CONSIDERATIONS FOLLOWING WILDFIRE



The Fire:

A fire occurred at the site in early April. All plants were dormant except for coniferous trees (lodgepole, limber pine, and Douglas fir). The southeastern aspen stand was consumed as were all of the grassland and sagebrush areas. Only a few trees were burned in the western aspen stand. A deep fire line was cut by firefighters in the southwestern corner of the property in the grassland area. The lodgepole pine forest was exposed to crown fire (fire that reaches the canopy of trees), which kills and consumes trees outright, and to surface fire (fire which does not burn the canopy but can scorch canopies and tree trunks). A heavy snowfall occurred after the fires. Since then, little precipitation has fallen. The landowner's cabin was destroyed.

After the Fire:

From the landowners' perspective, the wildfire was devastating – it consumed most of their trees and their cabin. From a natural resource perspective (depending on the goals for the property), the fire may be beneficial in the long-run due to the preexisting conditions. Each vegetation type (coniferous forest, aspen forest, and grassland) within the landscape appeared to be declining due to old age and/or encroachment from competing vegetation.

The forested (conifer and aspen) portion of the area was regenerated about 130 years ago as the result of a stand-replacing fire. The grassland portion of the area had not been regenerated for many years. Consequently, sagebrush had come to dominate the meadows.

Grassland

After the fire in that area, the grassland area quickly rebounded due to the nature of the fire, which did not destroy the roots of the grasses and forbs. The snowfall that followed the fire provided water that helped them resprout and grow quickly after temperatures warmed. The sagebrush plants were killed. This will free up resources (sunlight, nutrients, water) for the grasses and forbs. After consulting with the landowners on the goals for the property and viewing the regrowth two months after the fire, natural resource experts recommended that, for now, the landowners just monitor most of this area of the property. Unless the landowners start to see existing plant populations decline and significant erosion, no further action would be needed.

In the southwestern corner of the property, firefighters cut a deep fire line, which dug up all roots, and plant life was destroyed. A berm and other debris from creation of the fire line were also present after the fire. Based on the slope and nearby Canada thistle populations, erosion and weed invasion were concerns. The landowners were advised to scatter the dirt and other debris from the berm back into the fireline. This will help minimize the scar and reduce erosion. Because the slope was significant and the fireline was running almost parallel with it, the landowners were also advised to install waterbars to move runoff away from the fireline. These could be created with trees on the property that were killed in the fire and which the owner planned to remove. The trunks could be laid perpendicular to the slope and would function as waterbars/sediment traps.

Resource experts suggested reseeding before fall to stabilize the area and to help keep weeds out. They suggested using a hand-operated broadcast seeder for reseeding because the area is too rocky for a drill seeder. This area is not used for livestock grazing so forage production was not an issue. Therefore, a native seed mix was suggested at a rate of 10 to 20 pounds (lbs) of pure live seed (PLS) per acre. To calculate pounds of PLS, the percentage of PLS listed on the seed packet label was used. For example, for a 15-pound bag with a PLS percentage of 90, .9 times 15 equals 13.5 lbs of PLS in the bag.

This picture taken in May shows how quickly grass and forbs are returning to many parts of the burned area.

Below is a native species seed mix that could be used.

Common name	Cultivar	Lbs PLS/acre
Mountain brome grass	Bromar	8.0
Idaho fescue	Winchester	2.0
Green needlegrass	Lodorm	4.0
Slender wheatgrass	Pryor	3.0
Rocky Mountain penstemon	Penstemon strictus	2.0
	Total pounds per acre	19.0

The landowners were advised to rake the soil where possible after seeding to ensure good soil-to-seed contact and to exercise patience while waiting for germination. Many landowners become concerned and frustrated if the seed does not grow after the first growing season; however, three years may be needed to see results and for the seeding to become established.

The landowners were advised to treat the Canada thistle population on both sides of the fire line (burned and unburned areas). Canada thistle has an extensive root system and has a purple flower that readily releases wind- blown seeds. After consulting with local experts, several tactics were decided upon to prevent spread. The plants were to be treated before they reached maturity this year to decrease seed production and root growth. Chemical herbicides and physical damage are the most effective strategies for this. They were advised they could mow or cut plants but to avoid injury to the root system and crown, which would further spread new plants from

These aspen trees were killed as a result of trunk scorch; however, the root system was not killed

Aspen suckers (small glossy shoots) are emerging and prevalent in and around the burned aspen trees.

sprouting roots. They were also told biological controls (insects that harm Canada thistle) could be released. The biological controls would not completely eliminate the plants but would help control the spread in not easily accessible areas.

A combination of control tactics over several years would provide best results. They were also advised to watch for new populations of thistle developing in the fireline area from root sections or seed present in the scattered soil from the berm.

Aspens

Although many of the aspen trees trunks and canopies perished in the fire, the root systems survived. A beneficial aspect of the timing of the fire was that it occurred before the aspens leafed out. Therefore, most of the aspens' stored food reserves were still in their root systems. These reserves were being mobilized, and aspen suckers had already begun to emerge by the time the property was examined two months later. The dead standing conifer and aspen trees could be harvested for firewood (if adequate safety precautions were complied with); however, the location of the stands made access by vehicle difficult. Based on these factors, foresters recommended the landowners just monitor the site.

Aspen suckers are often eaten by livestock and wildlife. The landowners were advised that, if they saw evidence of heavy browsing that would keep the suckers from growing, fencing or other alternatives, such as felling dead aspen and leaving them on site (the trunks and branches act as a barrier and deter browsing), could provide protection until the stand was older.

Lodgepole Forest

The lodgepole pine will not rebound as quickly as other vegetation types, although the prognosis was good for regeneration. Foresters found an abundance of pine seed on the forest floor. This meant that, if adequate moisture was received during the summer, seedlings could emerge as early as late summer; however, regeneration could be delayed up to three years if moisture is not received. If adequate regeneration did not take place within three years, foresters recommended that potted seedlings (lodgepole pine and Douglas fir) be planted.

The foresters recommended that all dead trees within the lodgepole pine stand be felled that summer or as soon as possible to improve conditions for natural regeneration. By removing the skeleton stand, more sunlight would reach the forest floor and aid in pine tree regeneration and development. Trees should be felled and marketable stems (for post and poles, and firewood) 4 inches in diameter and larger should be removed from the property. Trees smaller than 4 inches in diameter and treetops should be chipped back into the stand. The wood chips help stabilize the soil and improve soil moisture levels. Trees with 25-percent live crown or greater should be left standing and monitored for the next few years. They also recommended that scorched trees with red needles should be closely observed to see if green needles had started growing at the tips of the branches. If tips are green, they recommend those trees remain standing and be monitored over the next few years

The tops of these trees were consumed by a crown fire.

These trees have been scorched; however, the wood is still suitable for posts and poles or firewood.

Many small pine seed wings are visible laying on the thin layer of duff

These lodgepole pines suffered different degrees of scorch. Some may survive, but many more will perish.

The suggested work plan above would mean an increased amount of vehicle traffic in the area, and existing roads would have to be improved. The costs of these improvements and the timber harvesting activities would be significantly higher than any funds received from the wood products.

Erosion Control

Upon examination, a 100-foot by 500-foot area of shallow topsoil was beginning to erode in the northeastern portion of the property despite the site receiving minimal precipitation. The sediment was being carried into a small creek. Based on the site's moderate-to-severe erosion potential, the landowners were advised to fell some dead trees and lay them along the contour of the slope and scatter the branches and limbs to reduce erosion and sedimentation.

Cabin

The landowners were planning to rebuild. They were advised to make their cabin and its surroundings as fire-resistant as possible. They were also advised to build-in adequate water resources for future firefighting and to construct/alter roads to provide easy access and mobility for firefighters.

Summary

The effects of wildfire and the suggested strategies in recovering from wildfire vary according to the characteristics of the land, its vegetation, the climate, and landowner goals. If you have experienced wildfire on your land and would like assistance, the following can help depending upon the issues: the University of Wyoming Extension; conservation districts, weed and pest control districts; Wyoming State Forestry Division; and the USDA Natural Resources Conservation Service.

ELIMINATE REFRIGERATOR OR FREEZER ODORS

Did your refrigerator or freezer quit? Was electricity interrupted? How do I clean it? How do I get rid of the odor in my freezer?

A clean refrigerator and freezer are important to keeping food safe.

Disconnect the unit from the electrical outlet and remove all food. Thoroughly clean the freezer or refrigerator with soap and water, including the tray beneath, condenser coils, front grill, and the inside of the unit. Use a mild soap – no solvent cleaning agents, abrasives, or cleansers that might impart taste to food or ice cubes or cause damage to the appliance interior. Follow the manufacturer's instructions.

Then, try some combination of these suggestions from the U. S. Department of Agriculture Food Safety and Inspection Service:

- Wipe out the inside of the appliance with a solution of equal parts vinegar and water. The vinegar is an acid, which destroys mildew.
- Wash the inside of the unit with a solution of baking soda and water. Scrub the gaskets, shelves, sides, and door. Allow the refrigerator to air out for several days in a secured place where children won't be endangered.
- Sprinkle fresh coffee grounds or baking soda loosely in the bottom of the freezer or in an open container inside the appliance for 24 to 48 hours.
- Place a cotton swab soaked with vanilla inside the clean freezer or refrigerator. Close the door for 24 hours then check the unit for odors.
- Stuff the refrigerator or freezer with rolled newspapers. Close the door and leave the newspapers for several days. Remove the paper and clean the unit with a vinegar-water solution.

Smell better? If not, one or more of these techniques may need to be repeated. Refrigerator odors can be very difficult to remove.

Once the refrigerator or freezer is clean and running, add new, safe foods to them.

Keep the refrigerator smelling fresh by making a habit of cleaning spills and throwing out old and spoiled food. A small, open box of baking soda kept on the shelf will absorb odors.

Christine Pasley *is a University of Wyoming Extension nutrition and food safety educator for Platte, Goshen, and Laramie counties. She can be reached at 307-322-3667 or chrisp@uwyo.edu.*

YOUR HOMEOWNER OR BUSINESS INSURANCE COVERAGE MAY NEED A CHECKUP

Have insurance documents prepared and ready for evacuation if a wildfire is in your area. Take them with you when you leave.

Contact your insurance company representatives to let them know you have been displaced if evacuated or if there is damage.

Home Insurance

- Ask if you have additional living expense coverage on your policy. This coverage typically reimburses additional necessary and reasonable food and lodging expenses during mandatory evacuations or the repair of your home. Most companies pay up to 20 percent of your house's dwelling coverage limit. Keep receipts for any expenses incurred.
- Make a list of your damaged property. Take photos of damaged areas. Do not throw away damaged items until a claims adjuster has seen them.
- Make necessary repairs to protect your house and property from further damage. Don't make permanent repairs until your insurance company inspects the damages. Keep a record of repair expenses and save all receipts.
- Try to be present when the adjuster inspects the damage. You may also have your contractor present at the inspection or have the contractor review the adjuster's report.

Auto

- Damage to your automobile from smoke, soot, heat, and fire are typically under a vehicle's comprehensive coverage, when elected. This is not a mandatory coverage; review your policy or contact your agent to determine if you are covered.

Business Owner

- Business interruption coverage is a standard but not often well-known part of property and casualty insurance policies sold under a business owner's policy. It helps a small business by covering income lost due to a covered loss.
- Business interruption coverage may cover the following in the event of covered loss: lost profits, increased operating expenses, cost of operating out of a temporary location, and reasonable expenses to allow the business to continue operating while repairs are made to the property.
- Business owners whose locations suffer smoke or fire damage should contact their insurance companies and/or insurance agents for more information.

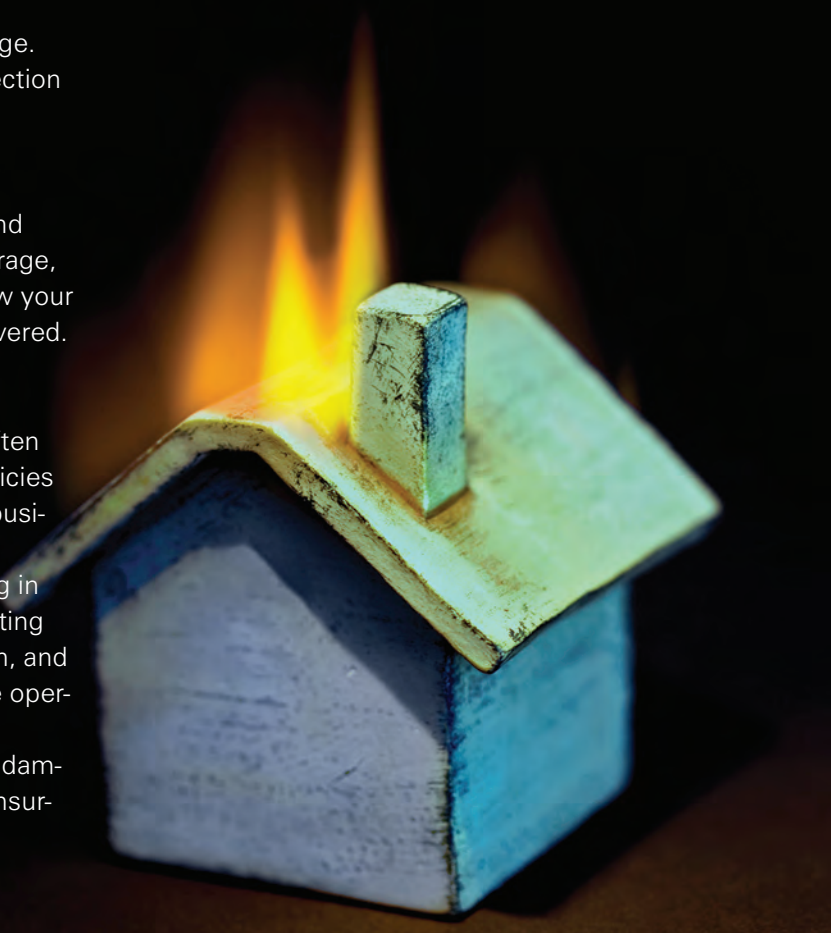
Resource

Visit the Rocky Mountain Insurance Information Association for more information about protecting your home and reducing damages from wildfires at

http://www.rmiia.org/Catastrophes_and_Statistics/Wildfire.asp.

The National Association of Insurance Commissioners also offers insurance tips for consumers under threat of a natural disaster at http://www.insureuonline.org/disaster_preparedness.htm.

For more information about insurance issues, please contact the Wyoming Department of Insurance at 106 East 6th Avenue, Cheyenne, WY 82002, 307-777-7401 or toll-free in Wyoming at 800-438-5768, and on-line at http://insurance.state.wy.us.



In 2012, there were at least 1,300 wildfires in Wyoming that affected more than 600,000 acres of land.

THE SCIENCE BEHIND WILDFIRE EFFECTS ON WATER QUALITY, EROSION

Wildfires are common in western watersheds and are a natural form of disturbance in forests and rangelands. Fire can provide long-term benefits to forest and watershed health; however, high intensity or large wildfires can result in significant increases in runoff and erosion, which can negatively impact water quality in the streams, rivers, and lakes within a watershed.

Large increases in runoff and erosion following wildfires can affect drinking water supplies, water treatment plant operations, irrigation systems, fisheries, and other aquatic life.

Increased runoff and erosion are highest in the areas immediately adjacent to the fire; however, effects can often be seen within a 100-mile radius. Annual runoff volume can increase as much as 30 percent the first year following a fire. In steep terrain, peak runoff may be 10 to 100 times average peak flow rates.

Why Do Runoff and Erosion Increase?

The amount of rainwater or snowmelt absorbed by unburned forest soils is often high (high infiltration rate) compared to the amount that runs off the soil surface. The forest canopy and litter layer protect the soil from the erosive power of high-intensity rainfall and also serve to increase infiltration into the soil by slowing the movement of water from the area and giving it more time to be absorbed.

Photo: U.S. Geological Survey, John A. Moody

- Wildfire can reduce infiltration and increase surface runoff by removing surface litter and vegetation. This decreases the amount of time water is held on the area and exposes the mineral soil surface to raindrop impact and splash that can detach soil particles. Detached clay particles can form a seal (light crust) and keep water from moving into the soil.

The primary factors that affect erosion risk potential are the fire severity, the degree to which the vegetation and soil surface have been disturbed by the fire, and the timing and magnitude of precipitation following the fire.

- Wildfires also reduce the amount of water taken up by plants, further increasing the amount of surface runoff and the subsurface lateral flow (the flow of water below the soil's surface) that occurs in the years following a wildfire.
- Increased runoff may also be caused by a water-repellent (hydrophobic) soil layer that can form following moderate and severe, slow-moving fires. They vary in thickness and duration. To test if the soil is hydrophobic, place a drop of water directly on the soil surface (avoiding burned vegetation.) If the water forms a bead and holds its shape, it is hydrophobic. This drop test should be repeated several times.

High-intensity Fires

Researchers have learned that high-intensity wildfires can cause erosion rates at much higher rates than lower-intensity, prescribed burns due to destruction of the litter layer. The percentage of surface cover from the litter layer and canopy cover are important determinants of erosion risk; less cover, greater the chance of accelerated erosion. The presence of ash can reduce surface runoff, and larger reductions are observed for the thicker ash layers; however, by the second or third rainfall event, the protective effects of the ash are often gone.

A heavy rainstorm following a wildfire could cause excessive runoff and erosion, depending on the local soils and topography, whereas light rains could have minimal impact and increase plant growth.

Soils, topography, and the underlying watershed geology can help determine the types of erosion to expect after a fire. Steep watersheds with shallow soils are more susceptible to large increases in runoff and erosion than gentle slopes with deep soils. Local NRCS, UW Extension educators and conservation district personnel can help landowners identify potential erosion risks.

Impacts of Runoff and Erosion on Water Quality

The streams, rivers, or lakes within a watershed can experience increased sediment loading following a wildfire. Runoff from erosive upland areas can transport sediment to surface waters. Eroding stream banks can also contribute sediment if increased runoff volumes have altered the physical characteristics of a stream channel, such as width, depth, and cross-sectional area, to the point the stream channel becomes unstable.

The loss of vegetation that, prior to the fire, helped hold stream banks together can also lead to bank instability and erosion. Increased sediment loads in surface waters can affect aquatic habitat, food webs, fish spawning grounds, and, in severe cases, can directly cause fish kills.

Wildfire is a natural ecosystem process

While the effects of a severe fire can be devastating, the effects of low- to moderate-intensity fires can be rejuvenating to watershed health. Low- to moderate-intensity wildfires can encourage vegetative succession and promote diverse habitats. Post-fire high flows and floods may be important sources of spawning gravel, and inputs of sediment and nutrients may cause short-term increases in productivity. Short-term impacts to water quality from moderate fires may not always result in long-term degradation of water resources. Prescribed fire can be used as a tool not only for forest health but also for long-term water quality management.

KEY FINDINGS IN RECENT RESEARCH

In the coarse soils studied in the Rocky Mountains, post-fire erosion rates declined to near-normal in five to eight years after fire on most slopes.

The key to reducing post-fire erosion is to maintain or rebuild ground cover. Straw mulch followed by seeding is often more effective than other potential treatments.

Most post-fire erosion occurs during the summer convective thunderstorm season, and little erosion is caused by snowmelt runoff.

There are several post-wildfire runoff and erosion predictive models such as the Revised Universal Soil Loss Equation (RUSLE) and Disturbed Water Erosion Prediction Project (WEPP) that are useful for estimating runoff and "average" sediment yields after wildfires. These tools can be "run" by Burned-Area Emergency Rehabilitation (BAER) teams, land management agencies such as NRCS and USFS, and some universities.

Studies suggest that, for larger watersheds, significant changes in water yield, peak flows, and flow duration following wildfires or other disturbances are not generally detectable until 15 percent or more of the vegetation in the watershed is removed.

A great deal of information is available concerning impacts from the 1988 Yellowstone fires, which burned more than one million acres in the Greater Yellowstone Ecosystem. These fires provided researchers an opportunity to understand the impacts of fire and compare severely burned watersheds to watersheds with minimal burned area. Overall, researchers have concluded that the 1988 fires did not cause long-term degeneration of aquatic ecosystems. Most water quality impacts were seen in low-order streams (i.e., smaller tributaries) with steep gradients.

Downstream, higher sediment loads can fill reservoirs used for drinking water and can increase processing requirements for water treatment plants.

The sediment that ends up in streams often carries other pollutants, most notably phosphorus, which readily binds to sediment. Phosphorous is an important nutrient; however, elevated levels in waterbodies can overstimulate growth of aquatic vegetation leading to depletion of oxygen levels in water that can kill fish.

The deposition of ash into waterbodies can also affect fish by limiting visibility or clogging gills.

Nitrogen released from plant tissues during and after a fire can leach as nitrate from burned areas and be carried to nearby lakes, rivers, and streams. High nitrate levels in waterbodies used for drinking water can be a concern for human health.

Fire retardants are usually ammonia, nitrogen, and phosphorus-based and therefore can be an additional source of nutrient pollution into aquatic systems if the retardant is released into or near surface waters. Retardants that are released or flushed into waterbodies can cause short-term increases in nutrient levels and eutrophication.

Through direct heating, wildfires can increase the temperature of surface waters for a short time during the fire, and long-term increases in water temperature can occur due to removal of riparian plants that previously shaded the streams or due to streams becoming wider and shallower if channel morphology is altered.

Temperature increases can be a factor in reduced or depleted oxygen levels, which are detrimental to fish populations.


Photo: USFS Baer

THESE PRACTICES CAN HELP SLOW RUNOFF AFTER WILDFIRES

Once you have established how intense the wildfire was and how susceptible the property is to erosion, you can determine if you will need to take action to reduce erosion.

Some Runoff and Soil Erosion Control Measures

The most critical period for recovery is the first two years following a fire; however, the sooner steps are taken to reduce runoff and the potential for erosion, the better. A number of measures can lower the soil erosion hazard and protect the land's productivity and water quality. A combination of measures is often recommended when appropriate or feasible. BAER (Burned-Area Emergency Rehabilitation) treatments that provide immediate ground cover are the most effective in reducing post-fire runoff and erosion rates.

1. **Reseeding** *(For more information, see article page 36)*
   Many plants can recover after even a severe fire; it is recommended to leave existing vegetation when possible. For areas without plant cover, the soil can be covered with a mulch and/or planted or seeded vegetation, which is usually a grass that sprouts quickly and has a dense, fibrous root system to bind the soil.
2. **Mulch** can be effective ground cover immediately after wildfire; it is a common choice for post-fire hillslope stabilization. It protects the soil surface and is often used with seeding to provide ground cover in critical areas. The improved moisture retention it provides may increase the success of a seeding. Due to the cost and logistics of mulching, it is usually applied where there are items downstream at high risk for damage such as above municipal water intakes, heavily used roads, and stream reaches that are critical habitat for protected species.
3. **Channel treatments**, such as straw bales and check dams, can decrease streamflow rates in channels and streams and store sediment. They should be viewed as secondary treatments, and their use should be evaluated carefully, especially in areas where the adjacent hill slopes are

unstable. When not used correctly, check dams can cause more harm than good and may cause channel bank instability and increased erosion.

4. **Contour log** terraces can provide a barrier to runoff from heavy rain. Properly placed, they can force the water to meander back and forth across the slope between the logs, slowing the water and allowing it more time to soak in. Trees (with limbs removed) or logs 6 to 8 inches in diameter are placed on the contour perpendicular to the direction of water flow or slope. Logs should be placed in an alternating pattern so water cannot flow directly down the slope. Embed logs into the soil their entire length and backfill with soil to prevent water from running underneath. Stabilize the logs by driving in stakes on the downhill side of the logs.
5. **Straw wattles** can be used in a similar fashion. Straw wattles are flexible enough to follow the contour of the slope. Wattles are tubes of plastic netting packed with straw or similar packing material. The wattle tubes can be purchased from an erosion control material supplier (such as www.strawwattles.com). As with contour logs, the wattles should be fully embedded in the soil and secured with stakes.
6. **Silt fences** can be used where runoff is more dispersed, such as broad, flat areas. Silt fences can trap and remove sediment from runoff water. Silt fences are constructed out of woven wire fence with a fabric filter cloth. Soil is filtered out as the water and sediments pass through the cloth. Silt fences may need to be periodically maintained to remain effective.

Additional Information

Firewise: The national Firewise Communities Program is a multi-agency effort designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire – before a fire starts. Information can be found on line at www.firewise.org/.

More specific information on how to install soil erosion control practices and other methods to lessen the effects of wildfire can be found by accessing links in these U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) and WY NRCS Wildfire Recovery websites:

http://www.wy.nrcs.usda.gov/technical/ewpfactsheets/firebmp.html

http://plant-materials.nrcs.usda.gov/technical/publications/wildfirepubs.html

As mentioned previously, determining the severity of the fire and your land's erosion potential as soon as possible after a fire will help determine if any of the above measures are needed or appropriate. On federal lands, BAER teams will often develop a "post-wildfire" risk assessment. However, on private lands there are several resources that can help a landowner 1) assess the potential runoff and erosion risks that exist and 2) identify the potential practices to address those risks.

These resources include local NRCS, Wyoming State Forestry Division, conservation districts, and local extension offices.

Wattles (Photo: US Forest Service)

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CANNED FOOD PRECAUTIONS
CAN KEEP YOU SAFE AFTER FIRE

Concerned about canned foods in a home or storage area affected by fire? Are they safe?

Cleanup after a disaster is never easy. Confusion regarding safety makes the process even harder.

Discard any food in cans or jars that have been near a fire. The heat can activate food spoilage bacteria. Extreme heat can split or rupture the can or jar, rendering the food unsafe. If the jars or cans have been exposed to fire-fighting chemicals without heat, they can be decontaminated the same as cookware (described later). Wash and sanitize them, discard the old label, and put on a new label with the name of the product and expiration date (if applicable).

Discard any food in permeable packaging, like cardboard, plastic wrap, screw-topped jars, and bottles that have been stored outside a refrigerator. They may have been exposed to fire retardant and/or toxic fumes released from burning materials. Foods stored in refrigerators and freezers may also be contaminated by fumes. The seals are not airtight.

What about cookware? Thoroughly wash pots and pans exposed to fire-fighting chemicals in soapy, hot water and rinse in clean, hot water. Submerge cookware for 15 minutes in a sanitizing solution of 1 tablespoon of chlorine bleach per gallon of water.

Discard food if near a fire. If food develops an off-odor or flavor, throw it out. This is a sign of spoilage.

For additional information on food safety, contact a county University of Wyoming Extension office, consumer health specialist, environmental health office, or the U.S. Department of Agriculture Meat and Poultry Hotline at (888) 674-6854.

If in doubt as to whether food is safe, throw it out!

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InciWeb
Incident Information System

Interested in information about a wildfire in the state?

InciWeb is an interagency site that provides information to the public.

Information about wildfire incidents, including updates on control measures, is listed. The material is for informational purposes only and, if there is high traffic, the website could become overwhelmed or update slowly. If in an area affected by wildfire, rely on information from local officials rather than websites and evacuate when directed to do so or earlier. See http://www.inciweb.org/

Burn severity, erosion potential only a few factors to consider

RESEEDING AFTER FIRE:
IF, WHEN, AND HOW

Once a wildfire is out, questions arise about whether or not a site needs revegetation.

There are many considerations, and each site represents different concerns depending upon burn severity, erosion potential, and the presence of a soil seed bank (seeds dormant in the soil) or nearby vegetation.

Burn Severity

In a severe burn, 75 percent or more of the shrub or forest overstory is lost and little or no ground cover remains. Soils are exposed, and the site experiences stand replacement over time. The loss of organic matter and cover due to the fire raises the risk of erosion and limits plant regeneration because seedlings require an adequate seed bed and soil moisture for survival. These factors slow site recovery and may significantly affect wildlife habitat and livestock forage capacity.

Severe cases often require post-fire site stabilization and reseeding. In contrast, light or moderate burns are less likely to kill woody plants, such as shrubs and trees, and fire-adapted grasses and forbs may regenerate quickly. These sites have a good chance for natural recovery and may need little human intervention.

Erosion Potential

Soil erosion potential not only increases with burn severity but also at sites with steep terrain. Even moderate slopes (5 percent) can lose significant amounts of sediment due to runoff. Wildfire sites in Wyoming are particularly susceptible to erosion when the wildfire occurs prior to summer precipitation. In these situations, using plants for site stabilization can be important for post-fire recovery.

Seedbank and Nearby Vegetation Sources

Plants recolonize wildfire sites by resprouting or germinating from seed either from soil seed banks or as seeds that disperse from nearby locations where vegetation is undamaged. Seed dispersal from outside areas will depend on the distance to healthy vegetation, wind direction, and the species present at those sites.

Weedy species are often the first to colonize a site after a fire. Many weeds are native and not noxious; these species present no threat to the site's recovery and long-term health. Their numbers decline over time with successional change. However, if seed sources include noxious or invasive, introduced weeds, these plants may threaten forage quality and wildlife habitat. Some invasive weeds such as cheatgrass *(Bromus tectorum)* can dominate a landscape and increase the fuel load each summer. This raises the risk of future wildfires.

When Can We Rely on Natural Recovery?

Unassisted recovery of vegetation is the most cost-effective method for post-fire management where sites have limited erosion potential and a low probability of invasive weed infestation. Much of Wyoming's native vegetation is fire adapted, which results in resprouting or rapid germination. For example, at forested sites, aspen is a well-known post-fire resprouter – the trunks of existing trees may be severely damaged, but the roots survive and will send up new shoots. A similar response is common in shrubs such as ceanothus, antelope bitterbrush, and mountain mahogany.

So, a relatively non-weedy site may recover naturally from wildfire without landowner assistance. If the sloping terrain at these sites requires erosion control, mulching or other methods, such as placement of straw wattles, silt fences, and rock berms (see page 33), may be needed to reduce soil loss. Early monitoring will determine if natural recovery is occurring and erosion is minimal. Signs of recovery include new sprouts from fire-damaged trees and shrubs and germination of herbaceous species. Signs of erosion would include gullies and exposed (unburnt) rock surfaces.

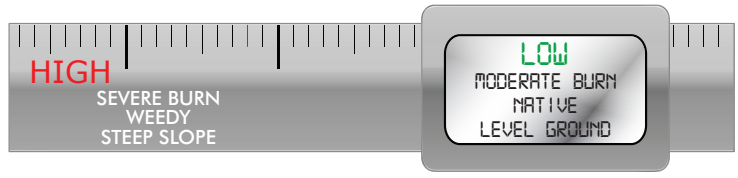
But what if a burn site covers a large area susceptible to erosion and invasive plant species? These circumstances are often unavoidable in the semi-arid west.

When is Post-fire Rehabilitation Needed?

Introducing desirable plants to the burn site may be crucial to prevent widespread weed invasion, particularly where burns are severe. In these cases, site stabilization and reseeding are options, but each measure will have associated costs.

Reseeding costs include the price of a seed mix, equipment, and/or time for application, and the funds required to implement any erosion control and other site management measures. Benefits may outweigh costs if reseeding minimizes the presence of species such as cheatgrass and prevents the buildup of fuels caused by weed dieback that can increase future fire hazards. The reseeding of native grasses and forbs at degraded sites will also improve wildlife habitat and livestock forage.

When determining whether or not to actively restore vegetation after wildfire, consider a sliding scale of conditions that will point to either natural or assisted site recovery.



Reseeding Tools and Methods

Seed mix

Many native plants are available commercially, and local seed distributors will have recommendations for your area. Statewide offices of the Bureau of Land Management often have lists of desirable species for land rehabilitation (look for reclamation resources).

Other sources for help in selecting a seed mix include University of Wyoming Extension, Natural Resources Conservation Service, and conservation district offices. Most seed mixes consist of grass species, but other species such as shrubs and forbs can also be purchased.

At sites where native plant diversity is still relatively high, many species will recolonize a site on their own, and a simple grass mix may be sufficient to stabilize the area and allow natural revegetation. For example, a planting might include some combination of slender, western, or thickspike wheatgrass, and bottlebrush squirreltail, Indian ricegrass, and blue grama.

Sterile varieties of fast-growing wheat species are also available (for example, Triticale and Regreen). Sterile plants are short-lived and provide rapid ground cover, minimize openings for invasive weeds, and allow time for desirable species to germinate and grow. Due to their sterility, they will not reseed and spread in subsequent years. Sterile hybrids can be planted mid-summer to late fall as they are winter annuals that will germinate when there is adequate soil moisture and continue to grow until late spring or early summer.

If native plant diversity is low, increasing the number of site-appropriate species in a mix can improve habitat and may extend seasonal forage due to variable growing times among species. Native plants are adapted to regional climates and are more likely to tolerate drought conditions and increase the chances for planting success. A more extensive species list is available through the Wyoming Reclamation and Restoration Center (http://www.uwyo.edu/wrrc/bulletins.html).

Seeding

Replanting is usually recommended in fall when seeds are naturally dispersed. Planting should occur when ground temperatures are below 50 F to ensure germination will not occur until spring. Winter temperatures break seed dormancy and lead to a flush of germination during spring thaw. Seed germination may not occur for six months or more after fall planting, and weed control measures may be required during that time to reduce competition from weeds when the planted seeds germinate.

Depending on the size and terrain of the burn site, replanting may be successfully accomplished by broadcast seeding. The simplest form is hand casting of seeds on the soil surface. For larger areas and rougher terrain, manual or mechanical broadcast equipment is available. Broadcast seeding is the least expensive technique, but seeds remain exposed on the soil surface and may be lost to rodents, birds, or blown off site by wind.

Hydromulching generally mixes seeds with water and mulch prior to application to the soil surface. In arid environments, apply seeds first to ensure seed-to-soil contact before mulch application. This method requires specialized equipment that raise costs but provides the advantage that seeds are less likely to be dispersed off site.

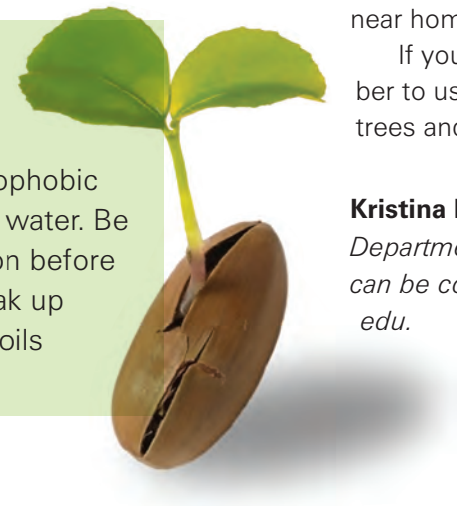
Drill seeding puts seeds below the soil surface and provides a more uniform application of the seed mix. Similar to hydromulching, drill seeding is more expensive and requires special equipment. This method works best on slopes less than 60 percent, and rangeland drills are available for rugged terrain. Many native species have small seeds or seeds with large appendages that make seed drill calibration and application difficult. The pros and cons of each method must be carefully considered to improve planting success. More information about planting depths and seeding rates is available online from the Wyoming Reclamation and Restoration Center and WRRC bulletins.

Forest Recovery

Lastly, you may be interested in regrowth of trees at your site. If the site is only moderately burned, many trees will survive and recover. To determine survival rates, burned trees can be monitored the following spring to see if new growth is visible. Alternatively, where mortality is high, pines often have cones that open during fire and naturally reseed without assistance. If assistance is needed, reforestation is generally accomplished by planting seedlings and saplings. Firewise plantings are recommended near homes and other structures.

If you choose to actively revegetate a site, remember to use proper safety equipment and watch for falling trees and tree limbs in forested areas.

A unique characteristic of wildfire sites, particularly when burns are severe, is the potential for the development of hydrophobic soils, which are impermeable to water. Be sure to check for water infiltration before planting and be prepared to break up the soil surface if hydrophobic soils are present.



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WEEDS ARE REALLY NOT WAITING FOR A WILDFIRE TO POUNCE ON YOUR PROPERTY – but sure can seem so

Peas and carrots.
Milk and honey.
Wildfire and weeds.
They go together.

Weeds are superb opportunists. Wildfire often provides avenues for weeds to move into new areas or to greatly increase their numbers in already-established locations. Early monitoring of weed populations and early intervention can prevent development of new, long-lasting weed issues on a property.

Post-wildfire weed management is most effective for rangeland, pasture, or forested areas if you had a pre-wildfire weed management plan in place. If you didn't, consider creating one for all areas of your property at-risk of fire. Effective control of weedy plants prior to a fire decreases the chance of large infestations establishing after the fire.

Creating a weed management plan is not difficult and often pays significant dividends if implemented. Check out the article 'Weeds, Ways to Whip 'Em' in the *Barnyards & Backyards Rural Living in Wyoming* guide (www.barnyardsandbackyards.com) for great ideas on developing a pre-wildfire weed management plan.

What Happens During Wildfires

There are different speeds and intensities at which wildfires burn. The intensity and duration depend on weather, topography, and available fuels. Wildfires with small, flashy fuel types (they burn quickly) will usually have little effect on roots of perennial plants (perennial plants have larger, deeper root systems than annual plants) because the fire is not hot enough for an extended period of time to harm roots.

Grasses are a good example of small, flashy fuels. They often fuel fires that kill aboveground vegetation and leave roots unburned.

Hot, slow-burning wildfires, fueled by thick shrubs, dead logs on the ground, or a thick stand of trees, may kill perennial plants, destroying their roots and their aboveground vegetation.

What exactly happens after a hot, long-duration fire compared to a low-intensity wildfire? Once the long-duration fire is out, fewer plants remain to compete for resources (such as soil and sunlight), and a flush of nutrients (nitrogen for example) is released from burned plant material.

Cheatgrass – a Superb Opportunist

These factors create a great growing environment for many plants. Weedy species adapted to fast growth in high-nutrient sites can rapidly grow and reproduce under such high-nutrient availability/low-competition situations. Cheatgrass, or downy brome, is probably the most well-known of such invasive weeds. It responds quickly to freely available nutrients in the soil and may produce thousands of seeds per square yard. As an annual, no energy is wasted putting down long, well-developed root systems, but instead it grows quickly, produces seed, then dries out – sometimes leaving highly flammable fine fuels that can lead to further, more frequent, fires.

Sagebrush has difficulty reestablishing in areas with frequent wildfires. This can change a once-productive sagebrush grassland into annual grassland dominated by cheatgrass and populated largely by species that can withstand frequent fires.

After a low-intensity wildfire, many native plants resprout from their roots or singed crowns. Given enough moisture, they can quickly rebound and will compete against many weed species.

Detect, ID Weeds

Early detection and identification of weedy plant species is the first step in avoiding the ecosystem changes such as the cheatgrass example described above. This identification is a bit different than the typical weed identification in undisturbed rangelands or forested areas. Typical identification involves scanning an area for mature plants with identifiable flowers and using a reference such as a weed identification book, weed and pest employee, or extension office personnel to see if the plant is a weed that needs to be controlled. This tactic changes once a wildfire has burned and the smoke has cleared.

Fireweed is a common native wildflower in recently burned areas. Despite its name, it is not an invasive weed and doesn't need to be controlled. *(Photo: NPS, Jim Peaco)*

The next tactic is a similar approach, except you must scan the area for new plant growth, such as resprouting vegetation and seedling plants. With less vegetation, spotting and controlling younger plants before they mature will be easier. However, identification of young plants takes practice. You'll need to learn what younger growth stages of weeds look like. The same references can be used for proper identification. Purchasing an identification book that shows pictures of weeds at early growth stages can be very helpful.

Four Weed Control Methods

Control and management can begin once weeds are identified. There are many weed control methods. The most often-used control methods are physical, biological, cultural, and chemical control.

Physical control methods cause physical damage to structural parts of the weed. Physical methods include mowing, digging, hand-pulling, burning, and cutting. Physical methods such as hand-pulling or cutting allows land managers to selectively remove individual weeds from among other plants. Often, wildfires make control of weeds by physical means, such as mowing, easier since it is less likely you'll have to worry about harming desired plants. Physical control methods are very effective on small infestations of annual weeds. Annuals live for only one growing season and, if uprooted before seeds are set, will not be able to reproduce.

Biological control methods often use insect herbivores from weed species' native ranges to inflict damage to target weeds. Insects used for biological control (agents) undergo rigorous testing and evaluation before being approved for use in the United States to ensure they will not become problematic themselves. Biological control may be preferred in sensitive

Cheatgrass (Photo: Bruce Bosley, Colorado State University, Bugwood.org)

areas (such as near wetlands) where other control options may not be as desirable. Effects of biological control are relatively subtle and slow to develop, but self-sustaining populations of biological control agents are at work even while weed managers are elsewhere. Biological control agents often reduce the ability of weeds to reproduce and spread but don't often eradicate them. You may need to wait for weeds to grow large enough to support the insects before releasing them.

Cultural control includes prevention of weed populations through management of competitive desirable species to exclude, or reduce the negative impacts of, weed species in an area. Perhaps the most effective control method is to prevent weed populations from becoming established in the first place, so continued monitoring increases a landowner's probability of managing new populations early. Planting competitive forage species that reduce the probability of weed invasion is another means of cultural control useful for highly productive sites (please see the revegetation article page 36 in this publication).

Chemical control, or the use of herbicides, is the most widely used control method in pastures and rangelands. Herbicides are organic, synthetic chemicals toxic to plants. Aside from its effectiveness, chemical control has many advantages for weed management in natural systems including no soil disturbance, relatively low amount of effort expended, and great flexibility in the choice of the management system implemented. Chemical control can be highly selective. For example, certain herbicides will damage only broadleaf plants without harming grasses and vice versa. Some potential problems associated with chemical control include injury of non-target plants, chemical residues in soil or water, and public concerns for human safety. Such problems can be minimized by receiving adequate training in the selection, handling, and application of herbicides. Information regarding such training is available at local University of Wyoming Extension offices or at uwyoextension.org/psep.

Special effort should be expended in targeting new and isolated weed patches before plants reach maturity. Implement control with the methods described above and continue monitoring problem areas. Ensure weeds are confined only to currently infested sites and not spreading into new areas. Weeds kept in small, isolated patches are much easier to control than an entire property covered with weeds.

Practices described in this article should help reduce, remove, or prevent problem weeds on your property following a wildfire.

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SCORCHED HABITAT FORCES ANIMAL BEHAVIOR CHANGES

Wildfires have significant short- and long-term effects on the availability and quality of wildlife habitats.

Immediately after a fire, reduced cover and lack of food will force most wildlife out of an area. Within a few weeks – depending upon the time of the fire, soil moisture, and precipitation – many species of herbaceous plants and sprouting shrubs resume growth and provide forage for grazing wildlife. If the fire occurs late in the year, limited resprouting will take place that year.

Seek Food and Habitat

Larger animals, primarily deer, will move into populated areas seeking food and habitat. Landowners could see increased damage to landscape plants in autumn and winter, notably trees and shrubs, and should take precautions to prevent browsing and rubbing. A simple and effective way to prevent damage is to put three to four steel posts in the ground around the trees and shrubs in question at equal spacing about 4 feet away from the tree. Wrap with landscape fabric or poly plastic snow fence to form an enclosure. Take the enclosure down in April or May.

Predators Could Move In

Mountain lions, bobcats, and coyotes often follow deer and could also be a concern. Although rare, mountain lions have been known to stalk humans, but the real concern is pet predation. Coyotes, too, can prey upon pets. The Wyoming Game and Fish Department has direct authority regulating mountain lions and other wildlife. If mountain lions are seen in human-populated areas, call your local Wyoming Game and Fish Department office.

While not abundant initially, vegetation regrowth can attract deer and elk. Eventually, these plant species will often become more abundant than before the fire, thus improving the habitat quality for all grazing wildlife species. Use of burned habitat by these animals should increase compared to before a fire.

Wildfires generally remove fuels like grasses, forbs, shrubs, and small limbs on trees. The remaining tree trunks provide only a little cover but may be sufficient for elk, deer, and large predators such as mountain lions, bears, and coyotes.

Wildlife Needing Mature Habitat May Leave

Some wildlife find improved habitat after wildfire; however, wildlife needing mature forest and shrub lands will leave. Birds and small mammals with stricter habitat requirements may not return because of the loss of nesting sites and food resources. Cavity-nesting birds (flickers, kestrels, and chickadees), those that prefer open areas

TO GRAZE OR NOT TO GRAZE…

Determining when to graze livestock after a fire can be a controversial and sometimes difficult decision. Much of the post-fire consideration depends upon site characteristics (percent slope, soil type), plants that grew in the area burned, and intensity of the fire.

As recovery starts and vegetation begins growing, emerging plants will be very attractive to grazing animals. Monitor such areas to prevent overuse of vulnerable plants when they are trying to recover from wildfire. Newly germinated plants, or existing ones putting out new foliage, need to collect and store enough energy to develop healthy root systems.

Land managers may decide to delay or limit grazing in burned areas due to these factors; however, in some instances, allowing animals to graze the year after the fire may not be detrimental. One way to limit the effects of grazing is to graze burned areas during the dormant season (late summer or fall). The plants have set seed and are no longer actively growing so the impact of grazing on the plants will be minimal.

Limiting grazing to light or moderate levels after the fire will ensure there is adequate plant material (stubble) for continued sustainability of that plant community.

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(western bluebirds, mountain bluebirds, and robins), and those that eat insects that infest dead timber (such as woodpeckers) may increase following fires. Those preferring more densely vegetated areas (such as goshawks and hermit thrushes) may decrease.

Unburned habitat areas provide a refuge for species requiring more mature plant communities. These areas can increase the diversity of habitat and wildlife.

Sage Grouse and Sagebrush

The sage grouse is a common bird in sagebrush habitats in the state. In the short-term, sage grouse will be unable to use the burned area except for the edges of the burn due to their need for the overhead cover sagebrush provides. Only after sagebrush returns to the site in sufficient height and cover will it be satisfactory sage grouse habitat. In some areas, the return of sufficient sagebrush could take decades.

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What do I do AFTER THE FIRE?

Use economic analyses to understand aesthetic and financial uncertainties following wildfire

While many landowners would like to do everything they can after a wildfire to help their land, it is often neither practical nor affordable.

Finding Economic Help

Assistance in economic analysis can be found by contacting:

- **University of Wyoming Department of Agricultural and Applied Economics**
- **Natural Resources Conservation Service in your area**
- **University of Wyoming Extension office in your county**

How does a landowner decide what to invest in?

There are many factors to consider.

- *What values are you trying to restore?*
- *Are they short-term or long-term issues?*
- *And, how much can you afford to spend?*

What Values Do You Want to Restore?

Create a plan that lists goals and objectives for the land to define what you want to restore to your property after the wildfire. Is it grazing capacity, timber production, scenic views, wildlife habitat, clean water, or something else? Once done, put economic values on the goals and objectives. Some are easier than others to value. Grazeable forage and trees for timber generally have a market value. Scenic views and wildlife habitat are generally called nonmarket values and have to be inferred from other sources. Clean water can be valued different ways depending upon whether or not things like municipal water sources (a market value or cost-reducing value) or fish habitat (a nonmarket value) are helped.

Short-term versus Long-term

Next, to complete an economic analysis that will help evaluate different scenarios, think about the assumptions you made about short-term and long-term inputs and consequences of possible actions.

In the short-term, if revegetating a site burned by a wildfire, one assumption may be that the seeds you plant will grow next year. If your plan is to use those plants for grazing, you may have to assume they will be ready to graze in the second year and produce some known amount of forage that will persist for a known number of years. Consider the risk involved in those assumptions. How likely will the seeding succeed? How much variation in forage production is expected year to year?

Some decisions will have long-term consequences. Deciding to revegetate to reduce erosion after the wildfire brings a new set of issues. In cases like this, economists may choose to do a with-and-without treatment analysis. Account for all the direct and indirect impacts of erosion in the short- and long-term. In the short-term, once the fire is out, there may not be much ground cover to protect the soil from raindrops or wind. Any weather event can cause soil to move into waterways or into the atmosphere and create water and air quality problems. In the long-term, this soil loss may reduce the overall productivity of the land – an effect that may be irreversible other than in geologic time.

Long-term Analyses Pose Problems

Herein lies the economic problem.

We can do some analyses on the short-term issues, but long-term analyses are more problematic. Both timeframes require that soil scientists and ecologists quantify those impacts (e.g., if you lose 0.25 inches of topsoil, that means water quality decreases by X amount, air quality by Y amount, and long-term forage productivity by Z amount). For economic purposes, focus on costs and returns over the next 30-50 years (see the reforestation example page 46).

Consider this: time has value. A discount rate to account for the time value of money is used during an economic analysis of investments. All that means is a dollar received sometime in the future is worth less than a dollar in hand today. It is the opposite of compound interest (the bank pays interest for money in a savings account). Choosing the discount rate for analysis is tricky. In theory, the discount rate represents the long-term, risk-free return on investments. In reality, economists and others often use a range of discount rates in the analysis to see if it makes a difference in the outcome. If it does, then more investigation may be necessary to determine if you really want to make the investment. If it doesn't, and you are comfortable with all the assumptions that go into an investment, then the analysis would indicate you may want to pursue those profitable options.

How Much Can You Afford to Spend?

As with all investment decisions, there are multiple aspects to consider. "How much can you afford to spend?" depends on how much cash you have or how much a bank is willing to loan. The question is, do you want to spend that much and is it a good investment of a scarce resource (capital and labor)?

That is what economic analysis is all about.

There are many options for how you use your cash. You can choose to use it for restoration that will return value to you or your operation or you may choose to use that cash to go on a vacation that will return a different set of values to you. If a rancher, restoring the forage base for your livestock gives one set of values while restoring it for wildlife habitat may give a different value depending on whether you like or dislike wildlife and whether you can capitalize on that wildlife as an enterprise within your ranch.

The Bottom Line

From an economic standpoint, there are many things to consider as you decide what to do following the wildfire. The basic decision depends a lot on what the land is capable of doing.

Knowing things like the land's potential, how it will respond to the fire, what the likely biological, ecological, and physical impacts of the fire are going to be, what the likely time frames are for the responses, and what the chances are for each response will all be critical factors in making an economic decision.

Once biologists, ecologists, and physical scientists define those responses, you can make an investment decision.

The questions you are seeking answers to include:

1. Should I spend my money and time on this project,
2. Will I get the type of outputs I am hoping for,
3. Will those outputs provide me with the values I want, and
4. How much should I invest?

From strictly an economic perspective, the important decisions are should I invest – can you expect a positive net return – and where and how much should I invest, and should I treat everywhere or just in areas with the best response likelihood to get the biggest bang for my buck?

The bottom line is choices have to be made on what you want to see happen on the landscape based on your values. If the benefits outweigh the costs, it will be a good investment. If you run an enterprise on your land and can't cover the cash costs with the market benefits you receive, think long and hard whether you can afford to invest in something that only returns "good feelings" or provides benefits to society at large rather than to your business.

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An example economic analysis of a forest restoration project

Tom has 40 acres of forested land burned to varying degrees by fire. His cabin damage is being handled by insurance, but he would like to take a proactive approach to reforestation of his property.

First, he should determine his objectives for the restoration. Questions such as what he wants the land to look like, time frames, and how the land will be used during and after restoration are important considerations.

Second, he should determine which trees are likely to survive and how that fits in with his objectives. He may have to wait until spring when the conifers put on new growth to determine which are alive. His aspen stands will likely survive and send up suckers in the spring.

He decides he wants to remove all dead trees and prevent heavy fuel loading as the trees come down. He also wants to plant several large aspen trees in high priority areas such as at the cabin site and plant seedling conifers where aspen trees are not present. He is advised to wait several years to see where natural conifer regeneration of the conifers occurs so he can better target planting efforts.

Here are some of his considerations from a financial perspective:

- Purchasing balled-and-burlapped aspen and hiring a contractor to plant trees: $350-$400/tree clump
- Hiring a contractor to cut trees down, remove from property, and chip tops and branches: $2,000-$4,000/acre (cost could be slightly offset by value of post and poles and firewood: $75-$125/acre)
- Purchasing conifer tree seedlings: $40/30 trees, need 436 trees/acre = $581.33/acre
- Hiring a contractor to plant conifer tree seedlings at 10-foot x 10-foot spacing: $200-$400/acre on 10 acres of best ground

Item	description	quantity	cost	total
Aspen clumps	Trees and labor	3 clumps	$ 400	$1,200
Tree removal	contractor to cut trees	10 acres	$ 3,000	$ 30,000
Seedling trees	planted 10 ft x 10 ft on 10 acres	4,360 trees	$ 1.34	$ 5,842
Contractor seedling trees	Labor	10 acres	$ 300	$ 3,000
replant 20%	replant for mortality after year 1	872 trees	$ 1.34	$ 1,168.48
Watering for first five years of establishment			$ 1,000	$ 5,000
Incidentals			$ 1,000	$ 1,000
Total nominal cost				$ 47,210.88

Since not all of the investment occurs in the first year, subsequent year costs must be discounted to the present (when you make your decision).

After working through his expected costs, Tom discovers it will cost about $46,429 after seven years in today's dollars if his discount rate is 3 percent.

This presumes there was no regeneration on his property the first two years and he opted to plant seedlings. After seven years, he will have some trees started on the property, and he expects them to be about waist high at that point.

Tom takes this plan to visit with a forestry expert, who tells him that, after 20 years, he should expect a 50-percent survival rate on the trees he plants. Those that survive will likely be 10 feet tall and provide nice aesthetic value; however, he also learns if he does nothing, after 30 years trees will likely begin to populate the property on their own, and 50 years later there will have been little difference between the site if Tom would have done nothing or taking the proposed action.

If Tom puts the money he would have spent into investments instead, making 3 percent interest, he would have $53,823 after five years and $203,538 at the end of the 50 years.

To round out the picture, Tom can expect other benefits to accrue from his investment. If the trees are planted, he expects to harvest $125 of firewood per acre starting in year 20. He expects the value of his property to increase by $1,000/year starting in year 20 and increasing by $100/year thereafter. He has no interest in selling the trees, so this is the only value he will derive from them directly. Forage for livestock would start in year four and produce $25/acre, increase by $1/year through year 20 and then decline by $1/year thereafter as the trees begin to close in. Wildlife habitat values would start at $20/acre, increase by $1/year through year 20 and then remain at $39/acre thereafter. Additionally, he has found a group to cost-share the restoration at 50 percent of his costs that occur in year three. The cost-share is to pay for societal benefits such as aesthetics, water quality and quantity, and reduced soil erosion.

The following table summarizes the total investment choices he has at different discount rates. In this example, if the landowner believes his opportunity cost or cost of borrowing is 3 percent, the investment would be profitable. If his rates are much higher than that, the investment should not be made from an economic standpoint.

Example of expected net present value for a 50-year forest restoration investment

Discount rate	Investment in present value	Benefits in present value	Net present value
3	$46,429	$50,421	$3,992
5	$45,979	$35,321	($10,658)
8	$45,578	$24,820	($20,758)

What Should Tom Do?

As the article states, all depends upon his goals, values, and his opportunity costs. It also depends on the value restoration would add to his property. This scenario is designed to convey the concepts. The specifics of costs, benefits, and timing need to be determined on an individual basis and will bring in many complex issues.

If you:

*Reseed at $60/acre

*Expect forage to be produced starting in the second year that is worth $5/year

*Expect that to last 20 years before trees reduce production or accessibility, and

*You use a 3% and 5% discount rate,

Your expected profit is $9.53 at 3 percent and -$2.45 at 5 percent.

You have to decide your opportunity cost for the initial investment. Would your funds be better invested in something where you could earn at least 3 percent? 5 percent?

If you think 3 percent is appropriate, then the reseeding should return a positive net present value. If you expect you could earn 5 percent elsewhere, then the reseeding probably should not be done from an economic standpoint.

Of course, there are other values to consider besides just forage value, such as any loss of topsoil due to erosion caused by lack of vegetation cover, and those would need to be included in a real analysis.

Photo: Michael Rieger/FEMA

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