
RECOVERY
AFTER A
WILDFIRE
Firewise Wyoming

# Table of Contents



## Introduction

Wildfires are an integral part of nature. They can have many positive effects on plant ecology and wildlife but also can have devastating effects on life and property. The information in this booklet is offered to help landowners reduce or eliminate the harmful results caused by a wildfire, and minimize the impact of future wildfires.

# Hydrophobic Soils

Hydrophobic soils repel water. A thin layer of soil at or below the mineral soil surface can become hydrophobic after intense heating. The hydrophobic layer is the result of a waxy substance that is created from plant material burned during a hot fire. This waxy substance penetrates the soil as a gas and solidifies after cooling, forming a waxy coating around soil particles. The layer appears similar to non-hydrophobic layers but it is impervious to water.

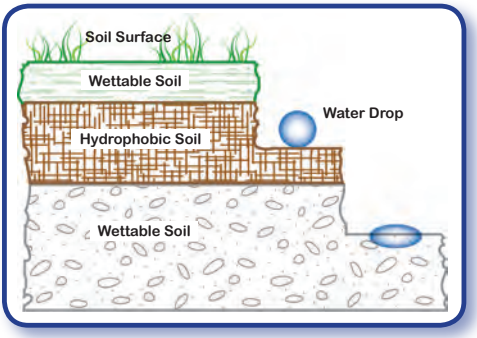
Hydrophobic soils do not form in every instance. Factors contributing to their formation are: a thick layer of litter before the fire; a severe slow-moving surface and crown fire; and coarse textured soils such as sand or decomposed granite. (Finely textured soils such as clay are less prone to hydrophobicity.)

Why is hydrophobicity important? Fire induced water repellency can affect the soil and the watershed in the following ways:

- Hydrophobic soils repel water, reducing the amount of water infiltrating the soil.
- Decreased soil infiltration results in increased water runoff, and stream flow.
- Erosion increases with greater amounts of runoff and fertile topsoil can be lost.
- Increased runoff carries large amounts of sediments that can clog stream channels and lower water quality.
- Depending on the intensity of the fire, hydrophobic layers can persist for years, especially if they are thick.
- Percolation of water into the soil profile is reduced, making it difficult for seeds to germinate and for the roots of surviving plants to obtain moisture.

Hydrophobic layers are generally ½ inch to 3 inches beneath the mineral soil surface and are commonly up to 1 inch thick, though some layers can be several inches thick. The thickness and continuity of the layer varies across the landscape. The more continuous the layer, the greater the reduction in infiltration. To detect these layers, scrape away the ash layer and expose the mineral soil surface.

1. Place a drop of water on the air-dry soil and wait one minute. If the water sits as a ball on the soil and does not penetrate for 10 to 40 seconds, the soil is moderately hydrophobic. If more than 40 seconds, it is strongly hydrophobic.




2. The upper few inches are generally not hydrophobic. In these cases, it is necessary to scrape away a layer of soil ½ to 1 inch thick and repeat the test until you find the upper boundary

of the water repellent layer. Once the layer is found, you can determine its thickness by continuing to scrape and use the water drop method until the water no longer forms a bead. Breaking this water repellent layer is essential for successful reestablishment of plants.

**To treat hydrophobic layers:**

- Place fallen logs or fall trees across slopes to slow runoff and intercept sediment.
- On level or gentle slopes, rake, hoe or till the upper few inches of soil to break up water repellent layers, allowing water to infiltrate the soil for seed germination and root growth.
- On gentle to steep slopes, scatter straw mulch to protect soils from erosion. If possible, anchor straw to hold it in place.
- Use seeding, straw bale check dams, silt fences, and other practices that control erosion and reduce runoff.
- On gentle slopes, land owners may hoe or till the soil a few inches deep to break-up the hydrophobic layer. This will allow rain or light irrigation waters to penetrate the soil surface for seed germination and root growth.

The use of mulch, or the incorporation of organic matter into soil, are ways to combat the effects of hydrophobic soils. In addition, freezing and thawing, and animal activity will help break up the hydrophobic layer over time.

On steeper slopes, lightly spray the soil surface with a soil wetting agent (surfactant), especially a "non-ionic" surfactant. This will break-up the hydrophobic substances coating soil particles the way dish-washing detergent breaks up grease. Surfactant chemistry is used in nearly every aspect of our lives. Detergents, soaps, shampoos, medicines, and even food products all use some type of surfactant chemistry to improve and manage product performance. They are also widely used with crop irrigation and golf course management.

Soil wetting products can be purchased at a lawn and garden store, but consult with your local Conservation District or NRCS before using these products to ensure you have the appropriate product for your situation.

# Erosion Control

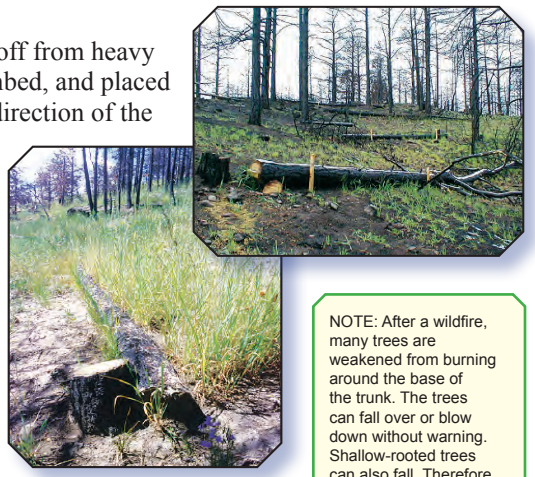
Wildfires are an integral part of nature. They can have many positive effects on plant ecology and wildlife but also can have devastating effects on life and property. The potential for severe soil erosion is a consequence of wildfire because as a fire burns it destroys plant material and the litter layer. Slopes left denuded by forest or range fires are susceptible to accelerated soil erosion, flash flooding, and debris flows.

Shrubs, forbs, grasses, trees, and the litter layer break up the intensity of severe rainstorms. Plant roots stabilize the soil, and stems and leaves slow the water to give it time to percolate into the soil profile. Fire can destroy this soil protection. There are several steps to take to reduce the amount of soil erosion. A landowner, using common household tools and materials, can accomplish most of these methods in the aftermath of a wildfire.

Following are illustrations of few of the structural practices: straw mulch, straw wattles, contour tree felling, straw bale check dams, water bars, and silt fences, all which stabilize slopes, reduce runoff, allow water to infiltrate soils and facilitate seed germination, root growth and re-vegetation.

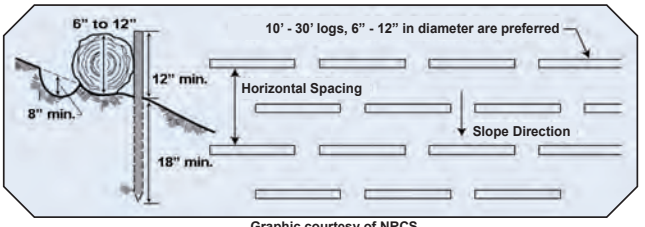
**Contour log terraces**

Log terraces provide a barrier to runoff from heavy rainstorms. Dead trees are felled, limbed, and placed on the contour perpendicular to the direction of the slope. Consider leaving some dead trees for wildlife habitat. Logs are placed in an alternating fashion so the runoff no longer has a straight downslope path to follow. The water is forced to meander back and forth between logs, reducing the velocity of the runoff, and giving water time to percolate into the soil.



NOTE: After a wildfire, many trees are weakened from burning around the base of the trunk. The trees can fall over or blow down without warning. Shallow-rooted trees can also fall. Therefore, be extremely alert when around burned trees.

Logs should be 6 to 8 inches in diameter (smaller logs can be used) and 10 to 30 feet long. The logs should be bedded into the soil for the entire log length and backfilled with soil so water cannot run underneath; backfill should be tamped down. Dig a trench 8 to 12 inches deep on the uphill side of each log to catch debris. Secure the logs from rolling downhill with stumps (left about 12 inches high after felling), along with stakes or stable standing trees, at each end of the downhill side. If you do not have the equipment or skills to do this work, contact your local Forester for advice, or you can hire experienced contractors.



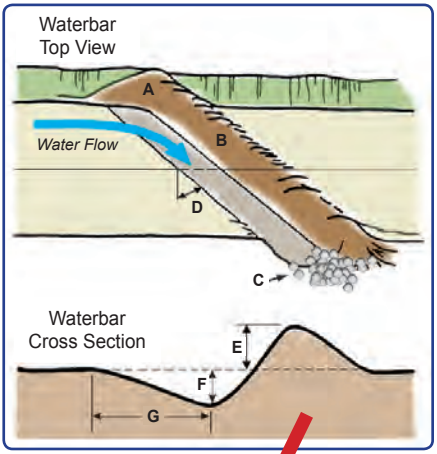

Graphic courtesy of NRCS

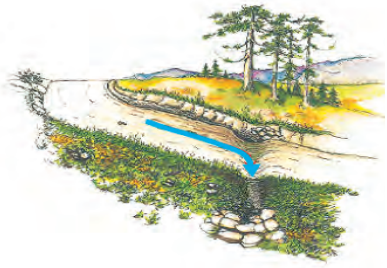
**Straw wattles**

Straw wattles are long tubes of plastic netting packed with excelsior, straw, or other material. Wattles are used in a similar fashion and method as log terraces. The wattle is flexible enough to bend to the contour of the slope. Wattles should be purchased from an erosion control material supplier.

**Water bars**

Bare ground and hydrophobic soils left after a fire increase water runoff. This requires intervention to channel water off of the burned area and release it to the streams below. Water bars are berms of soil or bedded logs that channel water off roads and trails to avoid the creation of gullies. Water bars are angled downslope to the outlet side. These bars can divert water to a vegetated slope below or redirect it to a channel that will take it to a culvert. On-site soils, type of road use, slope, season of use, amount of use and the road grade will dictate number of water bars used and their spacing.



Waterbar construction for forest or ranch roads with little or no traffic. Specifications are average and may be adjusted to conditions. See graphic above.

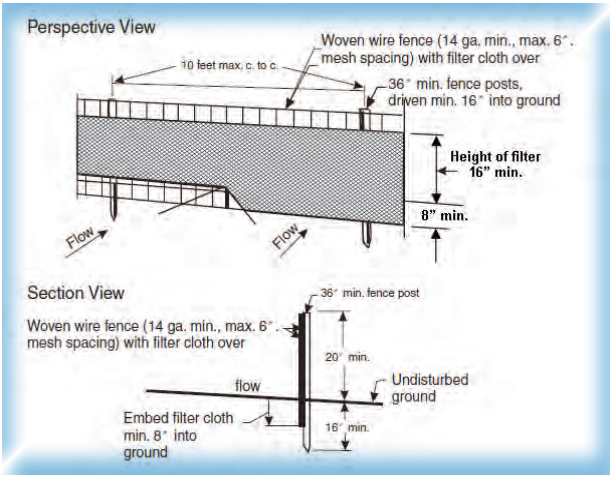
A. Bank tie-in point, cut 6 inches to 1-foot into the roadbed
B. Cross drain berm height 1 to 2 feet above the roadbed
C. Drain outlet cut 8" to 16" into the roadbed
D. Angle drain 30 to 45 degrees downgrade with road centerline
E. Up to 2 feet in height
F. Depth to 18 inches
G. 3 to 4 feet

**Silt fences**

A Silt Fence is a temporary barrier made of woven wire (14-gauge with openings no larger than six inches square) and fabric filter cloth (geotextile) that is used to catch sediment-laden runoff from small areas of disturbed soil to keep silt from getting in streams and homes. Posts should be at least 36 inches long. Wood posts should be of hardwood with a minimum cross-section area of three inches. Steel posts should be standard "T" section and should weigh no less than one pound per linear foot.

Silt fences are used for specific situations. Major considerations are slope, slope length, and the amount of drainage area from which the fence will catch runoff. Silt fences should be installed on the contour of a slope in areas where runoff is more dispersed over a broad flat area in the form of "sheet flow".

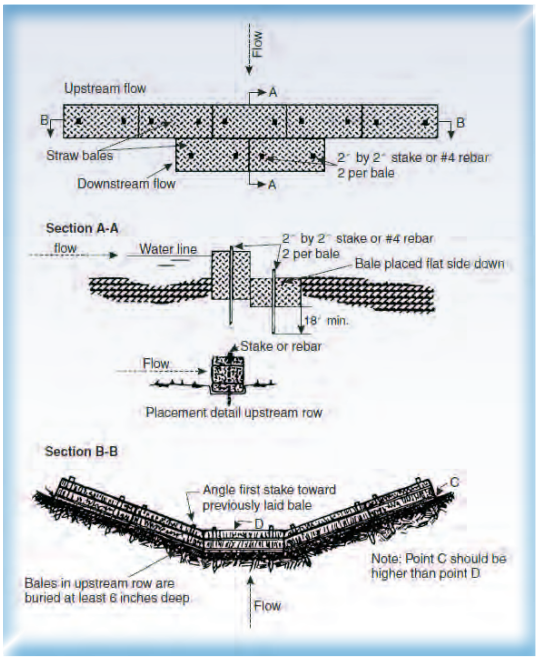
Silt fences should not be installed across drainage ways, swales, small rills, gullies, ditches or other areas of concentrated water flow. They should be installed near homes, roads, ponds, and streams to divert debris flows away from these sites. Silt fences are made from materials available at hardware stores, lumberyards, and nurseries.




(Graphic courtesy of NRCS)

**Straw Bale Check Dam**

These are temporary sediment barriers constructed of straw bales across very small drainages used to slow debris flow acting as a dam – collecting sediments from upslope and slowing the velocity of water traveling down slope. They are not intended to provide protection from large storm events or to control debris flows in water bodies such as creeks, streams and rivers.




Bales are carefully placed in rows with overlapping joints, much as one might build a brick wall. Some excavation is necessary to ensure bales butt up tightly against one another forming a good seal.

Two rows of bales are necessary and should be imbedded below the ground line at least six inches. For more detailed information visit Natural Resources Conservation Service (NRCS) web site.

(Graphic courtesy of NRCS)

# Re-Seeding

The first step after a wildfire is reseeding grass in the severely burned areas. Although burned vegetation may remain on your site, seeding can still be done. There's a good chance that native seeds on your property are still alive and will germinate. Old and new vegetation provides protection to the soil and conserves moisture. In general, severely and moderately burned sites should be reseeded to control erosion, shield the soil from the impact of rain, reduce the amount and velocity of runoff, and sediment movement down slopes, and to discourage weed invasion.

Grasses and forbs should be planted after the wildfire or ground disturbance when the soil surface is loose. Seeding in late fall or winter (even if there are a few inches of snow) improves success. The prime time to seed is immediately prior to the ground freezing to take advantage of reduced competition and to provide ground cover and forage as soon as possible. Trees or shrubs should be planted in the fall or early spring when plants are dormant.

Remember many plants can recover after fire depending on the severity of the burn. Lightly burned areas recover quite quickly from wildfire, in that case reseeding is usually not necessary. It is important to leave existing vegetation if the plants do not threaten personal safety or property.

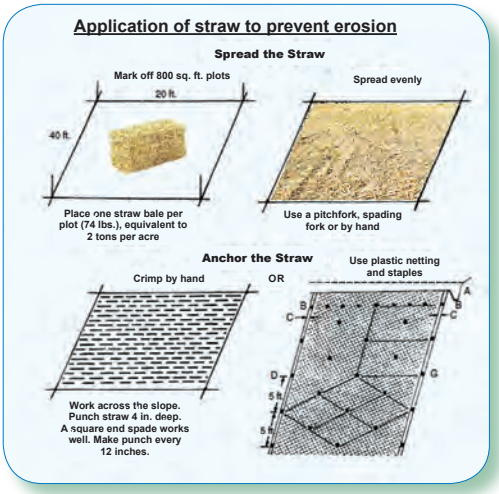
**Seeding tips for hand planting**

1. Roughen the soil surface to provide a better seedbed by breaking through the hydrophobic layer. A steel rake works well for this, or, depending on the slope, a small tractor drawn harrow could be used.
2. Broadcast the seed (a "Cyclone" type seeder works well). Seeding rate depends upon the variety of seed sown. A good estimate is 10 to 20 pounds per acre of grass seed with another 10 to 20 pounds per acre of the nurse crop
3. Rake or harrow 1/4" to 3/4" deep.
4. If the area is small enough, roll or tamp the seed down to ensure good soil/seed contact.

5. Control weeds as needed by cutting off the flower heads before they can produce seed.
6. Do not use herbicides for broadleaf weed control until after the grass has germinated and developed five leaves.
7. Spread certified, weed-free hay straw (mulch). If the area is small, crimp the hay in with a shovel. (This will help keep soil, seed, and mulch in place during wind and rain.)

## Mulching

Straw provides a protective cover over seeded areas to reduce erosion and create a suitable environment for re-vegetation and seed germination. If possible, the straw should be crimped into the soil, covered with plastic netting or sprayed with a tacking agent. The straw should cover the entire reseeded section and extend into the undamaged area to prevent wind and water damage. Use only certified weed-free hay straw to avoid spreading noxious weeds. Straw should be applied to a uniform depth of two to three inches. When applied at the proper density, 20 to 40 percent of the soil surface is visible. One typical square bale will cover about 800 square feet. For small areas a product call StrawNetTM (a pelletized, weed-free, straw fiber with binding agents) can be broadcast over the seeded area.




## What to Plant?

Species selection will vary from one site to another. Species selection is based on soils, elevation, aspect, and location in the state. You may plant a "nurse crop" with the grass mix to provide a quick cover (oats or a sterile hybrid such as RegreenTM or QuickGuardTM) until the native grasses germinate. Perennial grasses and forbs are slower to establish, but provide long-term cover for reseeded sites. Sites to re-vegetate with perennial grasses and forbs include severely burned sites and moderately burned sites that had populations of noxious weeds before the wildfire or that are less than 50 feet from a drainage channel. For example, slender wheat grass is a native grass that establishes quickly and is moderately long-lived. Over time, as the slender wheat grass begins to die out, other native species begin to fill in the site.

Annual rye grass and small grains are useful when quick establishment is key; however, they only provide one year of protection. Re-vegetate with annual species where perennial grasses will recover naturally, including moderately burned sites with slopes greater than 15 percent. For example, winter wheat is a good option if native seed varieties are unavailable.

If you have questions about whether you need to perform seeding and mulching activities on your land, contact the District Forester or USDA Natural Resources Conservation Service Field Office in your area. The professional conservationists that serve that office may provide an on-site evaluation and/or recommendations for seeding mixtures as well as guidance on proper seeding and mulching methods.

*Contact your local Weed & Pest District for a list of available Weed Free Hay*

# Vegetation Recovery

It's difficult to see the rebirth of a forest after a devastating fire. Nature has equipped many plants to recover quickly from fire. The speed and extent of recovery depends on the severity of the fire, when it occurred, and the plant community. Many shrubs, forbs and grasses readily sprout from underground root structures after a fire. The root systems of these plants run deep and are often protected from lethal temperatures. Once the above ground stem is removed, roots are stimulated to send up new shoots. The soil profile may contain many dormant seeds waiting for the right conditions to germinate and grow, sometimes years later. Given these adaptations to fire, recovery of many plants will occur, often rapidly.

Safety is a primary concern post wildfire. Burned trees may pose a significant hazard. The fire may have consumed a tree's root system leaving holes or hollow areas that can pose a stumbling hazard to people or livestock. Root systems, trunks or branches may be partially burned through leaving the tree unstable with the chance that all or portions of the tree may break way without warning. Fallen trees may be hung up in the branches on an adjacent tree Which again may give way without warning.

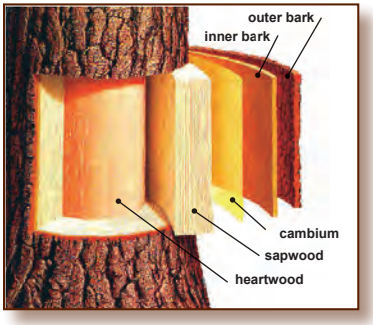
When first returning to a property following a wildfire, conduct a site assessment to identify potential hazards. Mark identified hazards with spray paint, flagging or survey flags and notify other family members, guests and contractors of their locations. Hazardous trees close to structures, utility lines, main access routes and any high use areas 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 species, 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.

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 fall with the potential for death, 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.

## TREES

The degree of damage to roots, stems, and the crown determines whether trees will survive a fire. Bark thickness plays an important role in the survival of these trees. For example, as a ponderosa pine matures, it develops a very thick bark that insulates the cambium from damaging heat. Cambium is a thin reproductive layer that forms new tissue to the inner bark and sapwood to increase a tree's girth. Cambium must survive a fire for the tree to survive. Even if the bark is considerably scorched, the cambium may remain undamaged. Cambium damage can be evaluated by chipping away a small section of bark with an axe. A healthy cambium is a light tan or cream color.




Some trees are so adapted to fire that they rely upon it to regenerate new stands. Hard seeds with thick seed coats are ruptured by fire allowing the seed to absorb moisture and germinate. Pinecones of some species will not open and release the seed until exposed to the heat of fire.

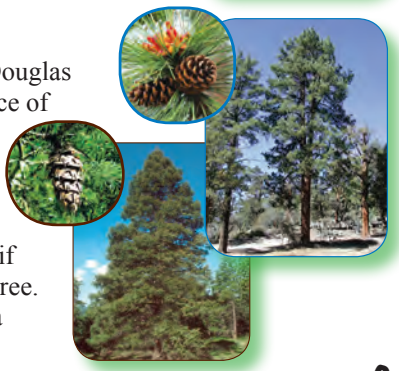
### Aspen

Although many of the aspen trees trunks and canopies will perish in a fire, the root systems often survive. A beneficial aspect of the timing of a fire is if it occurs before the aspens leaf out. Then, most of the aspens' stored food reserves will still be in their root systems. The dead standing aspen trees can be harvested for firewood.

### Lodgepole

The lodgepole pine will not rebound as quickly as other vegetation types. Foresters usually find an abundance of pine seed on the forest floor after a fire. This means that, if adequate moisture is 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.

### Ponderosa Pine and Douglas Fir



Natural reestablishment of Ponderosa Pine and Douglas Fir can occur from seed depending on the presence of cones on the tree. Most pine cones require two seasons to mature. Cones typically mature and release their seeds to the wind in late summer and early fall. Although most of the foliage may be severely scorched, the trees may survive if sufficient healthy foliage remains to support the tree. In some cases cones may continue to mature on a top-killed tree and release a viable seed crop.

**Re-vegetating with Wyoming Firewise Landscape Plants**

All vegetation is potential fuel for fire. There are no truly "fireproof" plant species. All will burn if the conditions are right. Although there are no "fire-proof" plants, there are plants, called *Firewise Landscape Plants*, to consider as the process of re-vegetating affected landscapes begins. These Firewise plants are native and/or adapted, meaning they will grow either on the mountain or on prairie-dominated slopes. *Firewise Landscape Plants* are more resistant to fire compared to others that are more susceptible. For example:

## FIRE- RESISTANT PLANTS

**Traits include:**

- Little or no seasonal accumulation of combustible dead leaves or needles
- Open, loose branches with a low volume of local vegetation
- Non-resinous wood
- High moisture content in their leaves
- Often short and grow close to the ground
- Grow slowly and need little maintenance or pruning
- Can re-sprout following a fire

**Examples:**

- Currant, mahogany, cottonwood, aspens, mountain ash and mountain maple
- Lilacs, chokecherry, littleleaf sumac, red-osier, dogwood Roses, wildflowers Succulents, herbaceous species and groundcovers, many deciduous species

## FIRE- PRONE PLANTS

**Traits include:**

- Needle-like or other fine leaves.
- Resinous, oily, or waxy foliage or wood.
- Loose or papery bark.

**Examples:**

- Most conifers, common juniper, Rocky Mountain juniper

**Common Causes of Seedling Mortality:**

It is common for a high percentage of newly planted seedlings to die in the first year, due in part to the dramatic change in growing conditions after transplant. However, you can improve the success rates for your seedlings if you are aware of the most common causes of mortality:

Improper storage before planting (i.e., roots exposed to hot, dry air)
Lack of available water/moisture
Seedlings planted too shallowly or too deeply
Insect damage
Roots tangled or not spread out
Seedlings accidentally mowed down
Deer/elk/livestock/rodents
Weed-killer spray
Competing weeds/vegetation
Sun scorch/desiccation of shade-tolerant species

***For a more complete list of native grasses, forbs, flowers, shrubs, trees and other vegetation that are recommended for re-seeding and re-vegetation, please visit:***

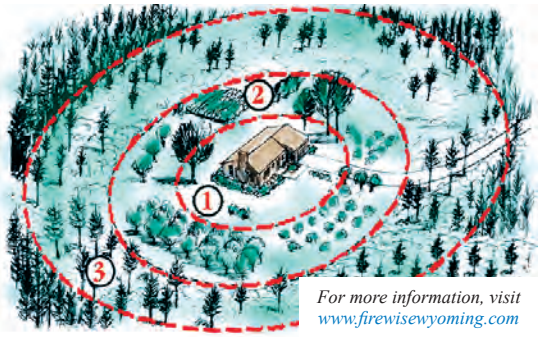
**Firewise Wyoming**
**http://www.firewisewyoming.com**

**Wyoming NRCS**
**http://www.wy.nrcs.usda.gov/**

The primary goal for Firewise Landscaping is fuel reduction — limiting the level of flammable vegetation and materials surrounding the home, and increasing the moisture content of remaining vegetation. When re-vegetating or re-landscaping, use the **"Defensible Space"** approach described below, to maximize property protection.

## Zone 1: "Defensible Space"

This well-irrigated area encircles the structure for at least 30 feet on all sides including decks and fences, and provides space for fire suppression equipment in the event of an emergency. Lawns should be well maintained and mowed. Plantings should be limited to carefully, widely spaced low flammability species, smaller than those farther away. Mulch (gravel and rock) to conserve moisture and reduce weed growth. Create pathways with gravel and decorative rock stepping stones within the landscaped area. This will help modify fire behavior and slow its spread across a property.



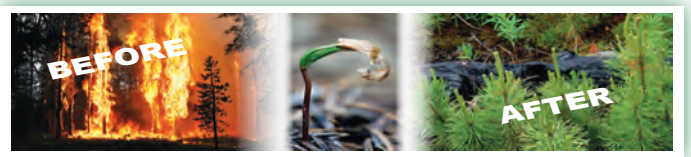
*For more information, visit www.firewisewyoming.com*

## Zone 2: The Mid Zone

This area encircles 30 – 70 feet from the home. This is an area for landscape trees, shrubs and gardens, but not for wild, dense woodland vegetation. Low flammability plant materials should be used here. Plants should be low-growing and the irrigation system should extend into this section. Shrubs and trees should be limbed up and spaced to prevent crowns of trees from touching.

## Zone 3: The Outermost Zone

This area encompasses 70 – 100 feet from the home. Place low-growing plants and well-spaced trees in this area, remember: keep the volume of vegetation (fuel) low. This is the wild forest area, but precautions are still in order.




Re-vegetation and structural practices often are needed to assist in the recovery from the aftermath of a wildfire. The best solution of all is to allow native vegetation to recover on the site, but often, supplemental seeding and seedling planting is necessary. Reestablishment of permanent vegetation provides long-term land protection and site stability, and this practice is the least expensive restoration method per acre. It is advantageous to quickly re-vegetate disturbed areas to prevent the invasion and germination of noxious weeds that will be present after a wildfire.

# Invasive Species


## Weed Control

Weeds are among the first plants to recolonize after a fire. In many instances they are not a problem. However, if the weeds are listed as noxious, they must be controlled. Noxious weeds displace native plants and decrease wildlife habitat, plant productivity, and diversity. They can spread downstream or into agricultural areas, resulting in high control costs. Control of noxious weeds is best accomplished through an integrated pest management system that includes chemical, biological, mechanical, and cultural controls.



Weeds can invade burned areas. Many seeds in the soil normally survive ground fires. The nearly bare, but nutrient enriched soil, is an excellent seed bed for weeds. Weeds like Canada thistle, leafy spurge, and downy brome (a.k.a. “cheatgrass”) often increase greatly after fire, from new seedlings or by sprouting from surviving underground parts.

## 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. Typical identification involves scanning an area for mature plants with identifiable flowers 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. This tactic is similar, except the area must be scanned for *new* plant growth, such as re-sprouting vegetation and seedling plants. With less vegetation, spotting and controlling younger plants before they mature will be easier. However, identification of younger growth stages of weed plants takes practice. So using a reference such as a weed identification book that shows pictures of weeds at early growth stages, or assistance from your local Weed & Pest office, or County Extension office, is recommended.

The following is a list of Wyoming State *designated*, *prohibited* and *declared* noxious and dangerous weeds and pests, with pictures of the adult plants and pests.

**WYOMING WEED & PEST CONTROL ACT DESIGNATED LIST**
**Designated, Prohibited and Declared Noxious Weeds**
**W.S. 11-5-102 (a)(xi) and W.S. 11-12-104**

(1) Field bindweed
(2) Canada thistle
(3) Leafy spurge
(4) Perennial sowthistle
(5) Quackgrass
(6) Hoary cress (whitetop)
(7) Perennial pepperweed
(8) Ox-eye daisy
(9) Skeletonleaf bursage
(10) Russian knapweed
(11) Yellow toadflax
(12) Dalmatian toadflax
(13) Scotch thistle
(14) Musk thistle
(15) Common burdock
(16) Plumeless thistle
(17) Dyers woad
(18) Houndstongue
(19) Spotted knapweed
(20) Diffuse knapweed
(21) Purple loosestrife
(22) Saltcedar
(23) Common St. Johnswort
(24) Common Tansy
(25) Russian olive

**Declared List (for Natrona County)**

(26) Black henbane
(27) Buffalobur
(28) Curlycup gumweed
(29) Foxtail barley
(30) Halogeton
(31) Puncturevine
(32) Showy milkweed
(33) Wild licorice
(34) Yellow starthistle
(35) Black medic
(36) Barberry
(37) Annual ragweed
(38) Cheatgrass / downy brome

**Designated Pests W.S. 11-5-102 (a)(xii)**

(39) Grasshoppers
(40) Mormon crickets
(41) Prairie dogs
(42) Ground squirrels
(43) Mountain pine beetle
(44) Beet Leafhopper
(45) Mosquito








**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 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.

**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 areas (such as near wetlands) where other control options may not be as desirable.

**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 appropriate competitive native or forage species that reduce the probability of weed invasion is another means of cultural control useful for highly productive sites.

**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, available at local University of Wyoming Extension offices, from your local Forester, local Conservation District office, local Weed & Pest office or Natural Resources Conservation Service (NRCS) office.

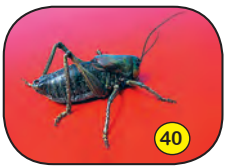
**Fire Hazards**

The early-season growth habits of cheatgrass provide a competitive advantage by allowing it to grow tall and abundant before native species emerge. During years of high precipitation, this grass can produce more than 10,000 plants per square yard.

Cheatgrass turns brown and dies by early summer leaving behind thick, continuous dry fuels and creating extreme wildfire hazards.

Though several components can affect flame length and fire spread, a typical cheatgrass fire on flat terrain with wind speeds of 20 miles per hour may generate flame lengths up to eight feet in height; the fire can travel more than four miles per hour. Grass fires are dangerous because they move quickly and grasses act as ladder fuels igniting larger and more volatile vegetation.










# Mountain Pine Beetle

Outbreaks of Mountain Pine Beetles (MPB) develop regardless of property lines, causing extensive damage to trees on mountains, in urban or urban-interface areas, in wilderness areas, mountain subdivisions and urban back yards. They have resulted in the loss of millions of trees annually. The dead trees left after epidemics are a source of fuel accumulation that will, in time, result in another wildfire unless removed.

MPB infestations are common following a wildfire as this native beetle targets stressed trees damaged in the fire. Landowners should take extra care in monitoring their property for MPB activity following a wildfire, particularly if they experienced significant tree mortality as a result of the fire. After a wildfire MPB will be most apparent on the edge of the fire area due to the trees weakened from the fire, and they will spread from there.

MPB develop in all mature pine species. The most common hosts for adult MPB's include large ponderosa, lodgepole and limber pines. During early stages of an outbreak, the trees most likely to be attacked are limited largely to trees not growing vigorously due to stress from injury, drought, poor site or growing conditions, fire or mechanical damage, overcrowding, root disease or old age. However, as beetle populations increase, attacks may involve most large trees in the area, healthy or not.

## Identification

Mountain pine beetles and related bark beetles in the genus Dendroctonus can be distinguished from other large bark beetles in pines by the shape of the hind wing cover. In side view, it is gradually curved. The wing cover of Ips or Pine Engraver beetle, another common group of bark beetles, is sharply spined.

Adult *Dendroctonus* (left) versus *Ips* (right). Note gradually curved wing of *Dendroctonus*. Actual size of *Dendroctonus* from 1/8 to 1/3 inch, *Ips* 1/3 to 1/4 inch.

## Life History and Habits


The MPB usually takes one year to complete its life cycle. Beginning in mid-July, adult MPB leave the dead trees in which they have developed to find new homes for the next generation. In general, females seek out larger diameter (over 5" diameter), live trees. However, under outbreak conditions, small diameter trees may also be infested. MPB develops through four stages: egg, larva, pupa, and adult. Except for a few days

during the summer when adults emerge and fly to new trees, all stages are spent under the bark of infested trees.

### Signs and Symptoms of MPB Attack

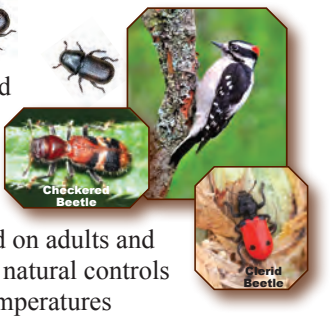
- Popcorn-shaped masses of resin, called "pitch tubes," on the tree trunk where the beetle began tunneling, ranging from cream to dark-red color masses mixed with boring dust, 1/4 to 1/2 inch diameter.
- Boring dust in bark crevices or on the ground immediately adjacent to the tree base.
- Evidence of woodpecker feeding on tree trunk. Patches of bark are removed and bark flakes lie on the ground at the base of the tree.
- Foliage turning yellowish to reddish throughout the entire tree crown. This usually occurs eight to 10 months after a successful MPB attack.
- Presence of live MPB (eggs, larvae, pupae and/or adults) as well as egg galleries under the bark.
- Blue stained sapwood. Check at more than one point around the tree's circumference.


Peeling back a portion of bark from the tree reveals the world of the MPB. The beetle will produce "J" shaped galleries that can extend up to 30 inches in the phloem of the tree. Depending on the time of year and stage of beetle development, it will be possible to find the eggs, larva or pupa living in the tree. If any of your pine trees show any signs of these symptoms, they should be removed to prevent beetles from spreading through the forest to other live pine trees. In firewood you may not see the pitch tubes. To check for beetles only in your firewood, peel back a piece of bark. Several logs should be sampled.

- Once MPB infests a tree, nothing practical can be done to save that tree. When looking at a standing tree that has been successfully attacked by beetles, it is dead regardless of the color of the canopy.

### Control & Prevention

Control options available for managing the MPB depend somewhat on the size of the outbreak, the age of the stand, the size of the trees, and conditions of the site.



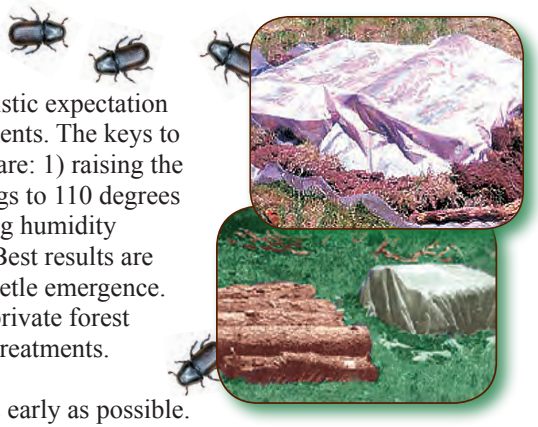

**Natural Controls** of the MPB include woodpeckers and insects such as checkered or clerid beetles, that feed on adults and larvae under the bark. However, during outbreaks these natural controls often fail to prevent additional attacks. Extreme cold temperatures also can reduce MPB populations. For winter mortality to be a significant factor, a severe freeze is needed (temperatures of at least 30 degrees below zero Fahrenheit, sustained for at least five days).

**Silviculture Control** measures are the most common prevention/suppression methods, and the most efficient. In general, MPB prefers forests that are over-mature and dense. Managing the forest by creating diversity in age and structure will result in a healthy forest that will be more resilient and thus, less vulnerable. Thinning lodgepole and ponderosa stands decreases tree competition, thereby increases vigor.

**Chemical Control** options are available for direct control of beetles in infested trees. Contact your local forester or weed and pest district for available registered pesticides and their proper application. The use of insecticides in such situations requires the combined efforts of all landowners within the management area. At best, insecticides provide a temporary control that slows infestations. Trees should be sprayed to the point of run-off depending on bark thickness and texture. Sprays are applied to living green trees from late spring through early summer.

## Treatment

Logs infested with MPB can be treated directly in various ways to kill developing beetles before they emerge as adults in summer. They include *solar treatment, partial peeling, chipping, burning or scorching in a pile, scoring, mill processing, debarking, burying under at least eight inches of soil, or removal - hauling infested trunks to a site at least a mile away*. Contact your local state forestry office or private forest consultant for assistance and information about these methods.



## Solar Treatment With Plastic

Beetle mortality of 80-90% is a realistic expectation of well-designed solar plastic treatments. The keys to successful, effective treatment with are: 1) raising the temperature under the bark of the logs to 110 degrees Fahrenheit or more, and 2) increasing humidity and mold growth beneath the bark. Best results are obtained from January until adult beetle emergence. Contact your local state forester or private forest consultant for assistance with solar treatments.

Infested trees should be identified as early as possible. Detection can be done with confidence after October 1st. MPB infests only the main stem of the tree, from the ground up to where the trunk narrows to about 5 inches. Cut this portion of the main stem into 4-foot long pieces. Stack logs, no more than two high, off the ground with space between each log. Place treated logs in areas with plenty of sunlight. Use clear plastic and material that is at least 6 mils thick and wide enough to eliminate the need for splicing. Seal the edges with surrounding soil, limbs, boards or rocks. Repair all tears and seal all seams in the plastic with duct tape. Logs should be under plastic for a period of at least two warm months.

# Resource Contact List

DISTRICT #1
Newcastle
District Forester
WY State Forestry Division
Office No. 307-746-4261
Fax No. 307-746-3411
Mailing Address
PO Box 639
431 Delaware Avenue
Newcastle, WY 82701

DISTRICT #2
Casper
District Forester
Office No. 307-234-6116
Fax No. 307-234-6966
Mailing Address
WY State Forestry Division
2020 Fairgrounds Road, Suite 101
Casper, WY 82604

DISTRICT #2
Assistant District Forester
Office No. 307-631-2352
Fax No. NA
Mailing Address
WY State Forestry Division
Laramie Plains Civic Center
710 E. Garfield ST, Suite 276
Laramie, WY 82070

DISTRICT #3
Riverton
District Forester
Office No. 307-856-8655
Fax No. 307-856-6563
Mailing Address
WY State Forestry Division
2500 Academy Court
Riverton, WY 82501

DISTRICT #4
Lyman
Assistant District Forester
Office No. 307-787-6148
Fax No. 307-787-6996
Mailing Address
WY State Forestry Division
PO Box 1497
100 Sage Street
Lyman, WY 82937

DISTRICT #4
Pinedale
District Forester
Office No. 307-367-2119
Fax No. 307-367-2129
Mailing Address
WY State Forestry Division
PO Box 1678
145 S. Fremont
Pinedale, WY 82941

DISTRICT #5
Buffalo
District Forester
Office No. 307-684-2752
Fax No. 307-684-7636
Mailing Address
WY State Forestry Division
600 Veterans' Lane
Buffalo, WY 82834

Wyoming State Forestry Division - Cheyenne 777-7586
https://lands.state.wy.us/index.php/forestry

Wyoming Wildfire Mitigation Coordinator - Natrona County 234-6116
Sam Weaver natronafirewise@gmail.com

# Resource List of Helpful Links

FIREWISE WYOMING
http://www.firewisewyoming.com
FIREWISE (has many other links)
http://www.firewise.org
Wyoming Association of Conservation Districts
http://www.conservewy.com/
Wyoming Bureau of Land Management
http://www.blm.gov/wy/st/en.html
Wyoming NRCS
http://www.wy.nrcs.usda.gov/
Wyoming Weed & Pest
http://www.wyoweed.org/
Wyoming State - listed Noxious Weeds
http://plants.usda.gov/java/noxious?rptType=State&statefips=56
Wyoming State Resources - Invasive Species
http://www.invasivespeciesinfo.gov/unitedstates/wy.shtml
Wyoming Department of Environmental Quality
http://deq.state.wy.us/
Wyoming Department of Game and Fish
http://wgfd.wyo.gov/web2011/home.aspx
Natural Resources Conservation Service
http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/
Wildfire Rehabilitation Fact Sheets
http://www.wy.nrcs.usda.gov/technical/ewpfactsheets/firebmp.html
Wildfires: Plant Species for Reseeding
http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/
Wildfire Mitigation & Education Publications
http://csfs.colostate.edu/pages/wf-publications.html#postfire
U.S. Department of Agriculture - Plants Database
http://plants.usda.gov/java/
U.S. Department of Agriculture - Forest Service
http://www.fs.fed.us/fire
UW - Wyoming Reclamation and Restoration Center
http://www.uwyo.edu/wrrc/index.html
UW - Barnyards and Backyards
http://www.uwyo.edu/barnbackyard/
Colorado State Forest Service
http://www.csfs.colostate.edu/
Soil Erosion Control after Wildfire
http://www.ext.colostate.edu/pubs/natres/06308.html
Vegetative Recovery after Wildfire
http://www.csfs.colostate.edu/
2003 & 2012 International Urban-Wildland Interface Code
http://publicecodes.cyberregs.com/icod/iwuic/2003/index.htm

# Resource Phone Numbers

| | |
|---|---|
| *State of Wyoming* http://wyoming.gov/ | 307-777-7011 |
| Wyoming Department of Transportation (WyDOT) | 307-777-4375 |
| Wyoming Department of Game & Fish | 307-777-4600 |
| State Fire Marshall | 307-777-7288 |
| Wyoming Bureau of Land Management | 307-775-6256 |
| NOAA - Weather Service - Forecast Office | 307-857-3898 - Riverton |
| Poison Control Center | 1-800-955-9119 |
| USDA Natural Resources Conservation Service | 307-233-6570 |
| Century Link - Buried Cable Locating | 1-877-348-9007 |
| AT&T - Residential | 1-800-222-0300 |
| AT&T - Business | 1-800-222-0400 |
| RT Communications - Buried Cable Locating | 1-800-849-2476 |
| Union Telephone Company | 1-888-926-2273 |
| High Plains Power, Inc. | 1-800-445-0613 |
| Pacific Power | |
| Emergencies | 1-877-548-3768 |
| Buried Line Locating | 1-800-348-1030 |
| Irrigation Hotline | 1-800-715-9238 |

## *Wyoming Wildfire Mitigation County Coordinators*

S. Albany County
307-760-9285

Big Horn County
307-333-1098

Carbon County
307-710-6165

Converse and N. Albany Counties
307-351-1388

Fremont County
307-857-3030

Johnson County Fire
307-684-9058

Laramie County
307-637-4912

Lincoln County
307-883-2480

Natrona County
307-234-6116

Sheridan County CAF Haz Fuels
307-752-9864

Sheridan County National Fire Plan
406-240-9646

Sublette County
406-370-2019

Teton County CAF Haz Fuels
307-733-4732

Weston County
307-629-1173

This has been prepared as a cooperative effort of the Firewise Wyoming Wildfire Mitigation Project, Casper Mountain Fire Department, Casper Mountain Forest Stewardship Association, Natrona County Fire Department, Casper Fire Department, U.S. Bureau of Land Management, a National Fire Plan Grant, Wyoming State Forestry Division, and USDA Forest Service.



FIREWISE WYOMING