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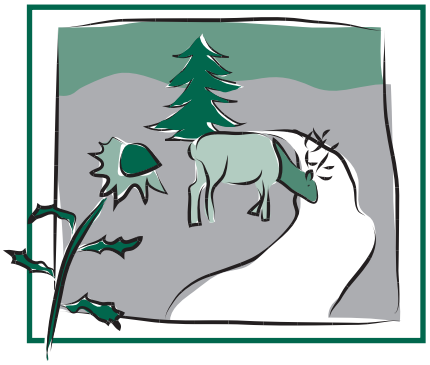

Soil Erosion Control after Wildfire

Fact Sheet No. **6.308** Natural Resources Series | **Forestry**

by R. Moench and J. Fusaro*

After a severe fire, soil erosion can cause adverse effects on many ecosystems.

The potential for severe soil erosion is a consequence of wildfire because as a fire burns it destroys plant material and the litter layer. 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.

Hydrophobic Soils

In severe, slow-moving fires, the combustion of vegetative materials creates a gas that penetrates the soil profile. As the soil cools, this gas condenses and forms a waxy coating. This causes the soil to repel water – a phenomena called hydrophobicity. This hydrophobic condition increases the rate of water runoff. 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 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.)

The hydrophobic layer can vary in thickness. There is a simple test to determine if this water repellant layer is present:

1. Place a drop of water on the exposed soil surface and wait a few moments. If the water beads up and does not penetrate the soil than it's hydrophobic.

2. Repeat this test several times, but each time remove a one-inch thick layer of the soil profile. Breaking this water repellant layer is essential for successful reestablishment of plants.

In addition, freezing and thawing, and animal activity will help break up the hydrophobic layer.

Erosion Control Techniques

The first step after a wildfire is reseeding grass in the severely burned areas. Remember many plants can recover after fire depending on the severity of the burn. It is important to leave existing vegetation if the plants do not threaten personal safety or property (hazardous trees in danger of falling should be identified first).

A simple test can determine whether a water repellent layer is present.

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Quick Facts

- The most immediate consequence of fire is the potential for soil erosion.
- Intense heat from fire can make the soil repel water, a condition called hydrophobicity.
- Landowners should take quick action to minimize erosion once it's safe to return to the property:

  fell damaged trees to slow water runoff after rainfall;

  create check dams in drainages using straw bales;

  spread straw to protect the soil and reseeding efforts;

  use water bars to reduce soil erosion on roads.

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A positive initial step after a wildfire is to reseed grass in the affected area.

A "cyclone" seeder works well to broadcast grass seed.

Seed can be purchased throughout Colorado. It's a good idea to obtain certified (blue tag) seed – this guarantees the variety, that it was tested under field conditions, and that it is recommended for the state.

Varieties recommended (this is not an all inclusive list) include mountain bromegrass, slender wheat-grass, bluebunch wheatgrass, western wheatgrass, Arizona fescue, streambank wheatgrass, Idaho fescue (western slope), thickspike wheatgrass, steambank wheatgrass, and blue gramma. 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 Regreen™ or QuickGuard™) until the native grasses germinate.

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" 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 15 pounds per acre of the nurse crop.

3. Rake or harrow in 1/4 inch to 3/4 inch deep.

4. If the area is small enough, roll or tamp the seed down to ensure good soil/seed contact.

5. Spread certified, weed-free hay straw. 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.)

6. Control weeds as needed by cutting off the flower heads before they can produce seed.

7. Do not use herbicides for broadleaf weed control until after the grass has germinated and developed five leaves.

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. (See fact sheet 3.106, *Weed management for small rural acreage owners*.)

Mulching

Straw provides a protective cover over seeded areas to reduce erosion and create a suitable environment for revegetation and seed germination. If possible, the straw should be crimped into the soil, covered with plastic netting or sprayed with a tacking agent. If you can only broadcast the straw, do so; it's better to have some coverage than none at all. 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. (Contact the State Department of Agriculture for a listing of Certified Weed Free Hay growers.)

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. (Figure 1.) For small areas a product call StrawNet™ (a pelletized, weed-free, straw fiber with binding agents) can be broadcast over the seeded area.

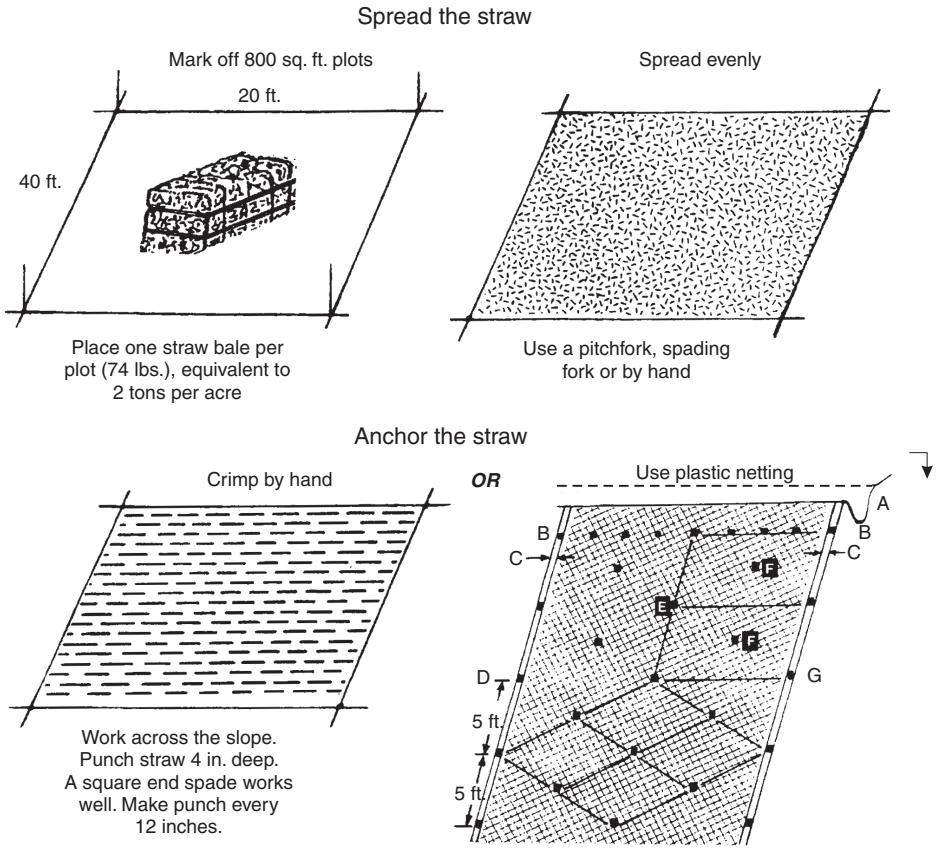

Figure 1: Application of straw to prevent erosion control (graphic courtesy of Natural Resources Conservation Service.)

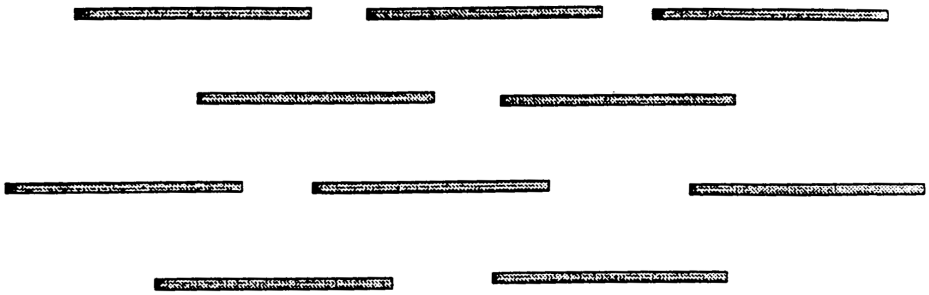

Figure 2: Contour Log Terrace. These barriers are an effective, first-year treatment for hydrophobic soils, low ground cover density, and severely burned areas (graphic courtesy of Natural Resources Conservation Service).

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. Logs are placed in an alternating fashion (Figure 2.) 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.

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. Secure the logs from rolling by driving stakes on the downhill side. It is best to begin work at the top of the slope and work down. (It is easier to see how the water might flow by looking down on an area to better visualize the alternating spacing of the logs.)

Straw wattles

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

Silt fences

Silt fences are made of woven wire and a fabric filter cloth. The cloth traps sediment from runoff. These should be used in areas where runoff is more dispersed over a broad flat area. Silt fences are not suitable for concentrated flows occurring in small rills or gullies. Silt fences are made from materials available at hardware stores, lumberyards, and nurseries. (Figure 3.)

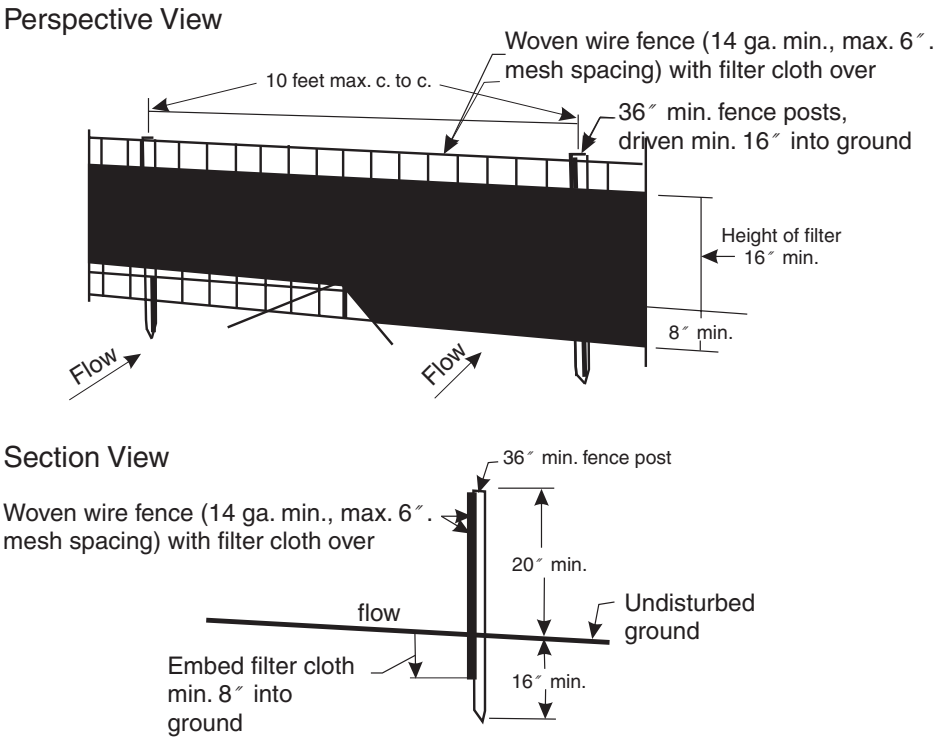

Figure 3: Silt fences are suitable for areas where runoff is in the form of "sheet flow" (graphic courtesy of Natural Resources Conservation Service).

Straw bale check dam

Straw bales placed in small drainages act as a dam – collecting sediments from upslope and slowing the velocity of water traveling down slope. Bales are carefully placed in rows with overlapping joints, much as one might build a brick wall. Some

Spread straw over seeded areas to prevent erosion.

Contour log terraces (above and below).

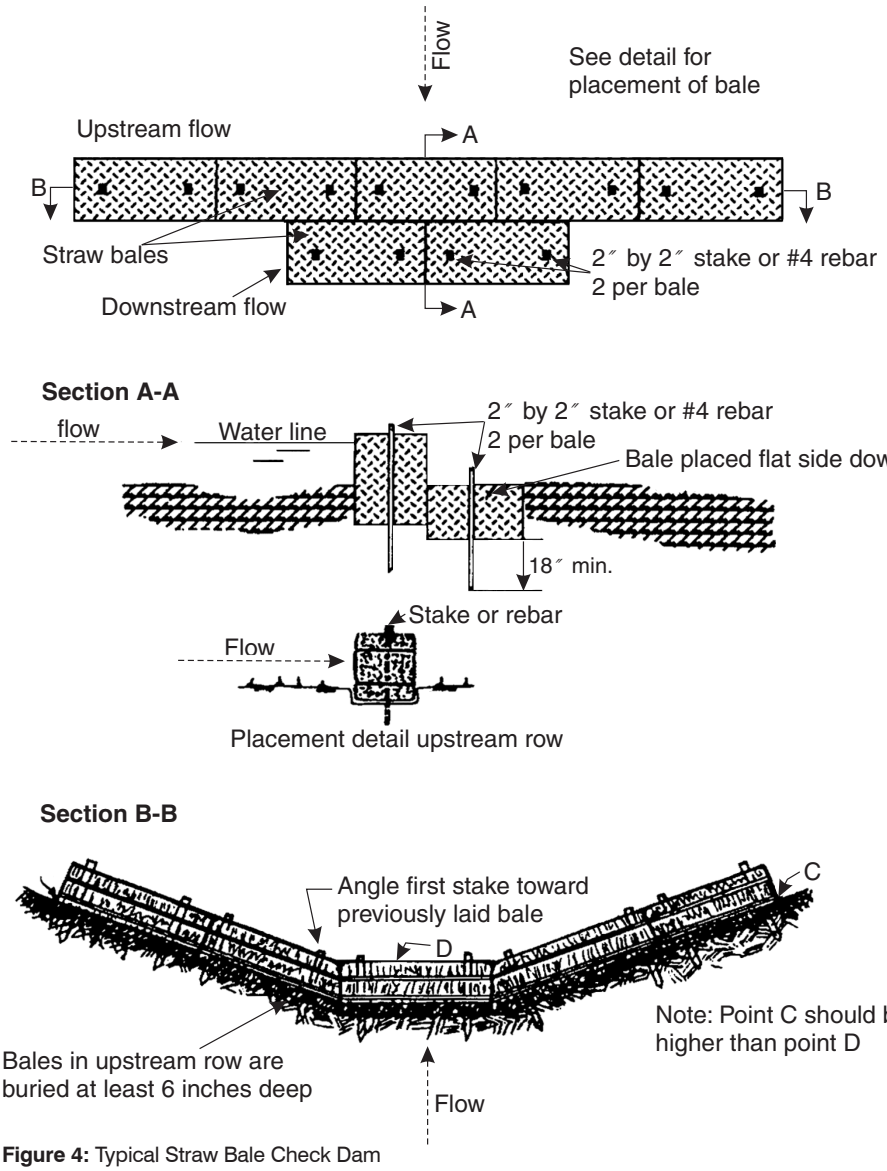

Figure 4: Typical Straw Bale Check Dam

excavation is necessary to ensure bales butt up tightly against one another forming a good seal. Two rows (or walls) of bales are necessary and should be imbedded below the ground line at least six inches. (Figure 4.)

Water bars and culverts

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. The two most common structures to do this are culverts and water bars. Determining the type of drainage practice to use depends on the soil, type of road use, slope, speed of vehicles, season of use, and amount of use.

Culverts

A professional engineer is able to determine the size of the drainage area and the amount of runoff for rainfall events of varying intensity that needs carried by culverts. Once sized, the culverts must be installed properly at the correct locations. Installing more culverts than previously existed before the fire may be required. The inlet sides must be regularly maintained to prevent sediment and trash from plugging the pipe. It is common practice to armor the ground at the outlet end with rock rip rap in order to dissipate the energy of the discharged water and to spread it over the slope below. The inlet side can have a drop inlet so as to allow sediment to settle out before water enters the pipe. Armoring the inlet side with rock will also prevent water from scouring under and around the pipe and flowing under the road.

Straw wattles are used in a similar fashion to log terraces.

To be effective, culverts must be installed properly and at proper locations.

Water bars

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 and the road grade will dictate spacing. (Figure 5.)

References

USDA Natural Resources Conservation Service, New Mexico State Office, 6200 Jefferson NE, Albuquerque, NM 87109; (800) 410-2067; www.nm.nrcs.usda.gov

USDA NRCS Fact Sheet, Vegetation Establishment for Soil Protection

USDA NRCS Fact Sheet, Temporary Erosion Control Around the Home Following a Fire

USDA NRCS Fact Sheet, *Straw Mulching*

USDA NRCS Fact Sheet, *Contour Log Terraces*

USDA NRCS Fact Sheet, *Straw Bale Check Dam*

USDA NRCS Fact Sheet, *Silt Fence*

USDA NRCS Fact Sheet, *Drainage Tips*

From Colorado State Forest Service, Colorado State University-Foothills, 5060 Campus Delivery, Fort Collins, CO 80523-5060; (970) 491-6303; Fax (970) 491-7736; www.colostate.edu/Depts/CSFS:

6.302, *Creating Wildfire-Defensible Zones*

6.303, *Fire-Resistant Landscaping*

6.304, *Forest Home Fire Safety*

6.305, *FireWise Plant Materials*

6.307, Vegetative Recovery after Wildfire.

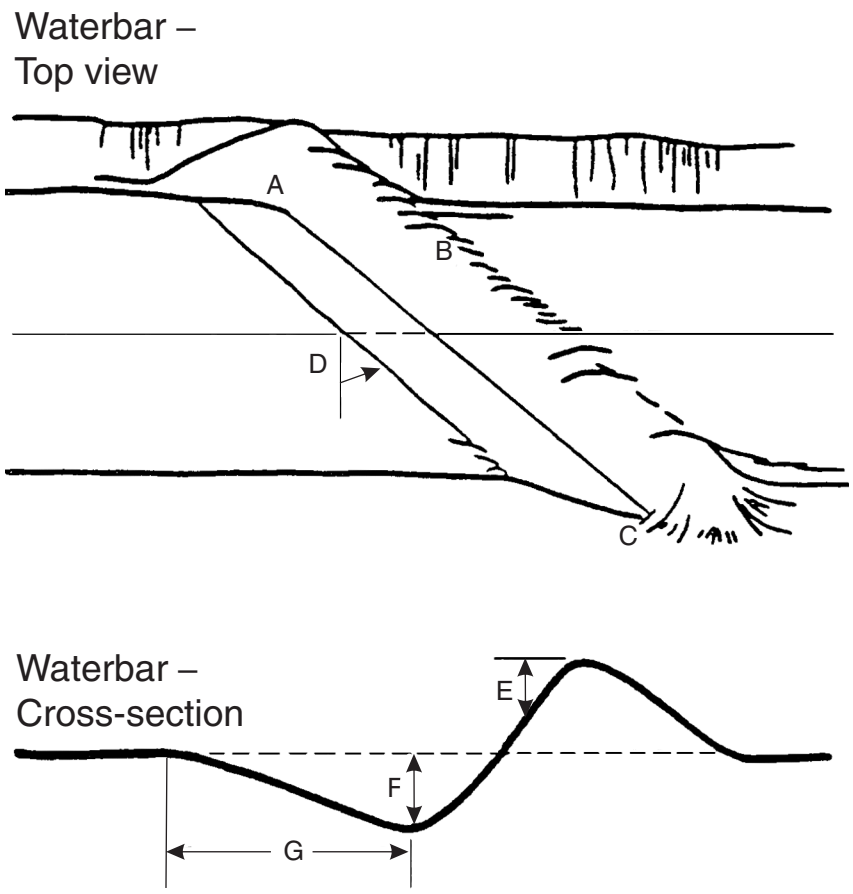

Figure 5: Waterbar construction for forest or ranch roads with little or no traffic. Specifications are average and may be adjusted to conditions.
A. Bank tie-in point; cut 6 inches to 1 foot into the roadbed.
B. Cross drain berm height 1 to 2 feet above the roadbed.
C. Drain outlet cut 8 inches to 16 inches 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.

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FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.

Colorado State FOREST SERVICE

This fact sheet was produced in cooperation with the Colorado State Forest Service.