



August 2005

WILDFIRE RECOVERY TIPS

SOUTHEAST WASHINGTON

Slopes left denuded by range or forest fires are especially prone to accelerated soil erosion, flash flooding, and debris flows because of the absence of desirable vegetation and roots to bind the soil. These same slopes can be rapidly invaded by noxious weeds when a healthy stand of desirable vegetation is lacking.

This booklet contains some techniques that homeowners and land managers can use to avoid or reduce these hazards.

The Natural Resources Conservation Service, WSU Extension Service, and your local Conservation Districts are available to answer your questions and provide assistance as you recover from the aftermath of a wildfire.

The content of this document were largely borrowed from the Idaho NRCS. Their help in preparing this document are greatly appreciated.

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Revegetation

Vegetation is one of the most important factors influencing soil erosion. It helps control erosion by shielding the soil from the impact of raindrops, maintaining a soil surface capable of absorbing water, and slowing the amount and velocity of runoff.

Some plant species are quite resilient to fire and will resprout in the spring. Some plants might grow from seed that survived the fire. The decision to seed or not seed a burned area needs to be made soon after a fire.

Your first step is to inspect the burned area and map out areas that have burned intensely and thus have very little live plants and/or live seed under the ash.

White ash shows where the fire was very hot, and plants & seeds most likely were destroyed. Areas burned that were in thick brush without a grass understory will not have enough seed. Areas around burned farm buildings tend to burn very hot for long periods of time, and will need revegetation. Soils in these areas might be temporarily altered by the fire and resist water infiltration (hydrophobic soil condition).

Areas that had mainly crown fires or rapid running fires probably did little permanent damage to grasses. Seeding these areas should be of low importance.

The second step is to inspect the access routes into the burned area. Roads, jeep trails, and firebreaks are “weed arteries”. If the routes are weedy outside the burned area, the routes inside the burned area probably have weed seed contaminating the soil. Seeding these areas should be considered because the desirable plants will compete with weeds that will eventually sprout. Areas that have exposed soil such as fire equipment staging sites should also be planted.

Desirable plants are generally grasses and forbs. The MINIMUM amount of seed is an aggregate of 50 viable seeds per square foot drilled and 100 viable seeds per square foot broadcast. *Aggregate totals exceeding 300 seeds per square foot do not buy much more plant cover.* Rather than spending more money on additional seed, focus on doing a better job of seedbed preparation and seeding.

Recommended Grasses

These plants are recommended for use on burned areas in southeastern Washington. They are adapted to the soils on the region, climatic conditions, availability of seed, and the amount of cover produced.

Wheat has commonly been added to seeding mixes. Observations show that winter wheat is very competitive with seedling grasses and should not be used. If rapid cover is needed, 15 pounds per acre of spring wheat or spring triticale is recommended to be added to your mix. Spring grains grow rapidly in the fall, winterkill, and do not compete with grass and legumes the following spring.

Rhizomatous grasses such as intermediate wheatgrass and pubescent wheatgrass should not be planted in areas planned for reforestation. These grasses have proven too competitive and tree survival will suffer.

Hard and Sheep fescue are fine-leaved fescues that do not produce much above-ground growth. They are less of a fire hazard than most grasses. Heavy seeding rates (15-25 pounds/acre) will produce dense, weed-resistant cover. Neither species is palatable and will reduce wildlife use around buildings.

Species Recommendation for a Durable, Forage-type Cover: 15-25" rainfall

<u>Species</u>	<u>Seeding Rate LB/ACRE</u>
Alpowa Spring wheat	15
Intermediate wheatgrass or Pubescent wheatgrass	6
Secar Snake River Wheatgrass	6
Idaho Fescue	2
Sandberg Bluegrass	2
Sherman Big Bluegrass	4
Paiute Orchardgrass	2

All rates in PLS and Certified seed.

Species Recommendation for Fire Control around Buildings

<u>Species</u>	<u>Seeding Rate LB/ACRE</u>
Durar Hard Fescue or Covar Sheep Fescue	15

All rates in PLS and Certified seed.

Species Descriptions

Bluegrass, Big

Poa secunda or *P. ampla*

A medium-lived native bunchgrass, which re-establishes from seed for long-lived, stands. Adapted for early spring grazing, sometimes as much as four weeks ahead of crested wheatgrass, but becomes unpalatable earlier in summer than most grasses. It has poor seedling vigor and requires as much as 4 to 8 years to reach full productivity. Because young plants are easily pulled up, grazing should be deferred until roots are well anchored. Recommended sites include sagebrush - grass sites at 2,000 to 6,000 feet elevation, sunny places on mountain brush and ponderosa pine ranges. It provides excellent nesting cover for upland birds. Adapted to 9 to 20 inch precipitation. It will not tolerate early spring flooding, high water tables, or poor drainage. It tolerates weakly acidic to weakly saline conditions. It can also be used for ground cover and erosion control on cut or burned-over timberland. Use only in native seed mixtures due to its slow establishment. Planting depth 0-1/4 inch. Adapted variety, 'Sherman'. Average seeds/ft² at 1 lb. rate 21. Recommend pure stand rate 2 lb./ac.

Bluegrass, Sandberg

Poa secunda or *P. sandbergii*

Sandberg bluegrass is a small, low producing, very drought tolerant, native, perennial bunchgrass that grows in small tufts usually no larger than 6-8 inches in diameter. It is widely distributed throughout western range plant communities where it is considered an important grass for soil stabilization and forage for wildlife. It is best adapted to medium to heavy textured soils. It is found from 1,000 feet in Washington to 12,000 feet in northern New Mexico. It is adapted to 8-20 inches of moisture annually. It is tolerant of heavy trampling. Forage yields are very low, seed viability is generally poor, and forage quality declines rapidly in mid to late spring as it matures. It is one of the first grasses to green-up in the spring. Due to its low stature, Sandberg bluegrass can withstand heavy grazing pressure. On large areas of western semi-desert rangelands, overgrazing has depleted most of the desirable bunchgrasses except Sandberg bluegrass. It provides little to no forage in summer and fall unless fall rains occur. High Plains Selected Class Germplasm is a recent release from Bridger PMC. The Forest Service is nearing release of another accession. Plant at 1/4 inch or less depth. Average seeds/ft² at one pound rate 21. Recommended pure stand seeding rate 2 lb./ac. It is best utilized in low rainfall area native mixes.

Fescue, Hard

Festuca trachyphylla or *F. ovina duriuscula*

A very fine leaved, low growing introduced bunch grass with poor palatability to livestock. It is widely used for turf, highway plantings, airport landing strips, burned over timberland and reclamation areas where a long-lived, persistent, competitive ground cover is needed. It is adapted to areas having an excess of 14 inches precipitation. Seedlings are slow to establish but persist through the development of abundant fibrous roots. The dense root system may encourage increased rodent populations. Early spring seedings are recommended. Only pure stands or mixtures with sheep fescue are recommended. Planting depth 0-1/4 inch. 'Durar' is the adapted variety. Average seeds per ft² at 1 lb. rate 13. Recommended pure stand rate 4 lb./ac.

Fescue, Idaho

Festuca idahoensis

A long-lived, native, perennial bunchgrass. It has fine leaves and stems, which grow primarily from the base. It is a palatable grass in spring, cures well on the stem and makes good fall forage. It commonly greens up in fall with rain. Idaho fescue occurs abundantly on north exposures in areas with 14 inches and above rainfall and is best adapted to areas above 16 inches precipitation. It prefers medium textured soils but is also found on coarser textured soils with steep north slopes. Planting depth 1/4 to 1/2 inch. 'Joseph'

and 'Nezpurs' are adapted varieties, but are very difficult to establish due to poor seedling vigor. Winchester Source Identified Germplasm is a selection originating from the Winchester grade between Lewiston and Grangeville, Idaho. Average seeds/ft² at 1 lb. rate 10. Recommended pure stand seeding rate 4 lb./ac.

Fescue, Sheep

Festuca ovina

A long-lived short stature introduced bunchgrass with short leaf blades. It is more drought tolerant than other fescues. Production is low, but groundcover and root production is excellent. It is used for turf, highway plantings, airport landing strips, burned over timberland and reclamation areas where a long-lived, persistent, competitive ground cover is needed. Not recommended for pasture or hay. Sheep fescue is best adapted to 10+ inch precipitation zones. A very good erosion control and understory species that competes well with weeds. Early spring seedings are recommended. Only pure stands or mixtures with hard fescue are recommended. Planting depth 0-1/4 inch. Adapted varieties are 'Covar' and 'Bighorn'. Average seed per ft² is 16 at a 1 lb. rate. Recommended pure stand rate is 4 lb./ac.

Orchardgrass

Dactylis glomerata

A long-lived, high producing, introduced bunchgrass, adapted to well drained soils. It produces long folded leaves arising mostly from the plant base. A shade tolerant plant that is highly palatable to livestock and wildlife, especially in the early part of the growing season. It is a widely preferred species for hay, pasture, or silage. For highest forage quality and regrowth, harvest while still in the boot stage. It is less winter hardy than meadow or smooth brome or timothy and is more vulnerable to diseases than many pasture grasses. Orchardgrass is compatible in alfalfa, sainfoin and clover mixes. It can be grown under irrigation or on dryland where the effective precipitation is 18 inches or more. It requires a good fertility program for high production. It is also used in erosion-control mixes primarily for its forage value. This species does best on soils with few limitations and good drainage. Avoid shallow and sandy soils. Varieties are early-, mid-, and late-season in maturity. Late-season varieties are preferred in mixture with alfalfa. Early - 'Hallmark', 'Potomac'; Mid - 'Akaroa', 'Ambassador'; Late - 'Latar' (recommended with alfalfa). 'Paiute' orchardgrass is more drought tolerant (adapted to 16 inches of precipitation) than the other varieties. Planting depth is 1/4 to 1/2 inch. Average seeds per ft² at 1 lb. rate 12. Recommend pure stand rate 4 lb./ac.

Wheatgrass, Intermediate *Thinopyrum intermedium* or *Elytrigia intermedia* or *Agropyron intermedium*

A mildly rhizomatous sod-forming, late maturing, long-lived, introduced grass, suited for use as hay and pasture, alone or with alfalfa or other legumes on medium to fine textured soils. It begins growth early in the spring and remains green and palatable into the summer, producing large amounts of quality forage. It does not mature seed at high elevations, but spreads vegetatively. Recommended for the sagebrush to high mountain zones (up to 9000 feet) and deep, upland soils with 13-18 inches of rainfall. This species is excellent for situations where only one to two irrigations are possible, because it readily responds to irrigation with increased forage production, but can also withstand extended drought periods when irrigation water is not available. Useful on disturbed sites for soil stabilization and erosion control. It is not shade tolerant, but is moderately tolerant of saline soil conditions. Planting depth 1/4 to 1/2 inch. Adapted varieties are 'Rush,' selected for excellent seedling vigor, drought tolerance, and forage yield; 'Reliant,' selected for disease resistance and production; 'Oahe' with improved seed production, forage yield, and rust resistance; 'Amur' selected for slightly more drought tolerance performs well at higher elevations, and 'Tegmar', a low growing cultivar noted for erosion control, sod-formation and seedling vigor. Average seeds per ft² at 1 lb. rate 2. Recommend pure stand rate 8 lb./ac.

Wheatgrass, Pubescent *Thinopyrum intermedium* or *Elytrigia intermedia* or *Agropyron trichophorum*

A long-lived, late maturing, introduced, sod-forming grass adapted to low-fertility sites and coarse to medium textured soils. Very similar to intermediate wheatgrass (pubescence on leaves and seed heads) but slightly more drought-resistant, alkali tolerant, and somewhat less palatable. It is better adapted for pasture than for hay. Its ability to remain green during the summer, when soil moisture is limited, is a significant characteristic. Adapted to foothills with 11-18 inches precipitation, this species is excellent for situations where only one to two irrigations are possible, because it readily responds to irrigation with increased forage production, but can also withstand extended drought periods when irrigation water is not available. Useful on disturbed sites for soil stabilization and erosion control. It is not shade tolerant, but is moderately tolerant of saline soil conditions. It is very useful for erosion control on a wide range of sites. Suggested varieties are 'Luna' (most commonly used) as well as 'Manska' and 'Greenleaf'. Average seeds per ft² at 1 lb. rate 2. Recommend pure stand rate 8 lb./ac.

Wheatgrass, Snake River *Elymus wawawaiensis* or *Pseudoroegneria spicata*

Snake River wheatgrass is a native of the lower canyons of the Snake River and its tributaries in Washington, eastern Oregon, and western to northern Idaho. It is similar in appearance to bluebunch wheatgrass, but differs morphologically in having narrower, acuminate (pointed) to aciculate (needle-like) glumes, a more imbricate (overlapping) spike, and glabrate (without hairs) basal leaf sheaths. It is adaptable to most bluebunch wheatgrass areas but is best suited for the lower precipitation areas (8 to 12 inches). (See bluebunch wheatgrass). The only variety is 'Secar'. It is an early maturing bunchgrass with good seedling vigor and establishes well in native seed mixes. Secar is considered more drought tolerant than previously released bluebunch wheatgrasses. Average seeds per ft² at 1 lb. rate 3. Recommend pure stand rate 7 lb./ac.

Methods of Seeding

Seeds can be broadcast, hydroseeded, drilled or distributed by aircraft. Most homeowners and small landowners will find broadcasting to be the most economical method. Hydroseeding requires roads for equipment access and a nearby water supply. Aerial seeding is most applicable for large areas and areas that very difficult to access such as excessively steep slopes. Drill seeding is the preferred method but it is largely restricted to cropland.

High-traffic bare areas such as fire equipment staging areas and jeep trails are usually highly compacted and especially prone to weed invasion. Breaking the surface crust is frequently required in order for desirable vegetation to establish. Disks or shanks set to cut 2-4 inches are effective tools for obliterating compacted traffic areas prior to seeding.

When to Seed

The best time to seed after a fire is between September 15 and October 15. Late fall seeding is not preferred because the plants will not grow large enough to protect the soil and many seedlings will winterkill. Seeding prior to September 15 generally offers little extra benefit unless rain is expected. However, it is better to seed early than late. This is especially true if the amount of ground to be seeded is large and manpower is limited.

Spring seeding dates vary. Aerial and broadcast seeding can begin much sooner than other seeding methods. Broadcasting seed on the snow is discouraged. Hydroseeding must be postponed until the ground will support the weight of the equipment and not tear up the existing vegetation. Drill seeding must be postponed until the soil is dry enough to farm properly.

Seed Specifications

Total amount of seed purchased should equal the acres burned multiplied by the recommended seeding rate per acre. Include any roads, jeep trails, firebreaks, and other bare areas in the burned acreage.

The total amount of seed is based upon PURE LIVE SEED. Your seed dealer will sell you seed based upon PURE LIVE SEED. Check seed tags for species and the percent germination and purity. If purity and/or germination for a species are less than 90%, discuss this with the seed dealer. Low quality seed should never be used.

The best means to ensure that you are purchasing quality seed is to insist on Certified Grade seed. Certified seed has been inspected by the Washington State Department of Agriculture and meets several important quality criteria.

If you are unfamiliar with seed purchasing, contact your USDA Natural Resources Conservation Service or County Extension Service office. They can assist you with determining your seed needs.

Equipment and Materials Needed for Hand Operated Cyclone Spreaders

Equipment and materials should be ready before you start. This list of items will minimize disruptions and let you finish a small seeding in one day:

- 1 hand operated cyclone seeder for each person doing the seeding
- Weighing scale, at least 20 pound capacity
- At least 2 plastic buckets
- Seed targets. At least 2 pieces of 2'x2' soft cloth or cardboard with corrugations exposed

Seeding Specifications

Adjust cyclone seed spreader to the manufacturer's instructions. Add approximately 1 quart of seed to the spreader. Set out 2 seed targets 10 feet apart and offset 10 feet. Walk past the targets while broadcasting seed. Stop and check the seed counts on each target. Adjust the opening on the spreader until you acquire a minimum of 50 seeds per square foot (200 seeds/target).

Broadcast the seed such that it is uniformly distributed. This might take some trial and error depending on terrain, wind and how fast you crank the handle on the spreader. Areas that are prone to concentrated flow such as gullies need special attention. Seeding gullies should be done with 2 passes to ensure thorough seed distribution.

Wild oats, mustards, and tarweed are very problematic in moist draws. A dense stand of grass is one of the most cost effective means of controlling these weeds. Many producers will double-seed draws to obtain a dense stand of grass.

Hydroseeding and Hydromulching.

The terms are often times used interchangeably.

- Hydroseeding is applying a slurry of water, wood fiber mulch, and seed to prevent soil erosion and provide an environment conducive for plant growth.
- Hydromulching is applying a slurry of water, wood fiber mulch, and a tackifier to a slope to prevent soil erosion.

When to Use

General recommendation: On steep, highly erosive slopes that have been partially or completely denuded of vegetation due to fire, apply the seed to the site first and then hydromulch over the seed.

This is fairly expensive and it is often reserved for areas close to bridges, roads, homes, and other structures. Use is sometimes restricted due to lack of access roads and adequate water supplies. Slope lengths of 125-225 feet can be treated.

Reforestation

Key points in reforesting areas that have been burnt are: matching proper tree species to the site (soils, aspect, elevation, climate), removing standing dead trees to provide planting sites and reduce future human safety and potential fire hazard, using quality seedling stock from correct seed zone, proper care and handling of seedlings before planting, proper planting techniques, and protection of seedlings from big game and rodents.

Matching Tree Species to Site (See WA Tree Seed Transfer Zones)

Ponderosa pine is the most drought tolerant tree species in this area. Southern and western aspects are more suitable to ponderosa pine. These aspects should be planted back to ponderosa pine at 12-14 foot spacing. On North and NE aspects a mix of species could be planted including ponderosa pine, Douglas-fir, and western larch. Plant spacing should range 10-12 feet. Cold air drainages and frost pockets should be planted to Douglas-fir. Ponderosa pine is not suitable on these sites. Elevation will also be factor on tree selection. Elevations over 4000' should be inventoried to determine is sites are cool and moist enough for Douglas-fir.

While planting, look for good micro-sites to protect seedlings from hot temperatures, such as north or east sides of stumps or logs.

WA Tree Seed Transfer Zones

Matches correct seed zone for reforestation of tree species growing in specific geographical areas of Washington.

For selected species in Southeast WA; Douglas fir – Grande Ronde TZ 16; Ponderosa pine – Grande Ronde TZ 11; Western Larch – Grande Ronde TZ 6.

Grass Seeding in Reforestation Areas

In areas that are prioritized for tree planting, grass seed mixes should not include rhizomatous grasses such as smooth brome, intermediate or pubescent wheatgrass. Native bunch grass species are preferable with fast growing annual species such as wheat.

Dead Tree Removal

Standing dead timber should be removed as much as possible to prevent potential for future lightning strikes. Merchantability of standing dead timber goes down each year due to wood borers and fungi. Cutting down some of the unmerchantable trees to provide better planting sites should be considered on southern and western aspects.

Quality Nursery Stock

Seedling stock comes in a variety of types; bareroot 2-0 or 2-1 stock, and 1-0, 1-1 container plug stock. It is important to obtain stock from the correct seed zone noted above. For Southern and western aspects 10-cubic inch container stock is recommended.

Nurseries to order seedlings include, but are not limited to;

USFS Coeur d'Alene Nursery
WA DNR Webster Forest Nursery

Lawyer Nursery
U of I Pitkin Forest nursery

Seedling Care and Handling

Once the seedlings arrive on site they should be planted within 48 hours. Keep seedlings not being planted in a cool moist area. Avoid exposure to hot temperatures and drying winds. If bareroot seedlings not planted within 72 hours, store in appropriate cooler that can keep environment between 34-38 degrees F and 90-95% humidity.

The best time to plant is during cloudy moist conditions less than 60 degrees. Usually planting period is March through early May depending on snowmelt and frost leaving soil.

Planting Technique

Shovels and different type of tree dibbles can be used to plant the seedlings. It is extremely important that they are planted at the correct depth and the roots have good soil contact. The correct depth for bareroot and container seedlings is ½ inch above the root collar. Avoid jamming the roots into the planting hole. This causes “J” rooting and poor seedling survival.

Seedling Protection

Once the seedlings are planted they may need protection from big game and rodents. Vexar mesh tree shelters can be installed over the seedlings to prevent the terminal buds from being browsed. Another alternative is to spray animal repellants. Their effectiveness is variable depending on rainfall events. The best defense against rodents is to keep the area around the seedling free of weeds and grass. Post and pre-emergent herbicides can be used. It is important to read the herbicide label to check if herbicide is labeled to use for tree species planted.

Fall Weed Control

Weed frequently proliferate after fires. The dark soil stays warm late into the fall and the absence of desirable vegetation that was killed by the fire make for ideal growing conditions for weeds. Fire control equipment accidentally moves weed seed from weedy areas to weed free areas. Biocontrol agents that kept weed populations in check may be significantly impacted by fire.

Most seedlings of perennial grasses are very poor competitors with weeds. While some annual weeds may be beneficial to the establishment of perennial grasses from seed, most are serious problems. Therefore, it is critical to design a long term weed management plan which includes aspects of preventive, cultural, chemical, and mechanical control to effectively reestablish stands of desired grasses and forbs following fires. If an effective weed management program is not put in place desired vegetation may never be established or remedial weed control will be much less effective and much more expensive.

Managing the reestablishing vegetation in the most competitive manner and avoiding weed infestations are the best tools for managing weeds during the reestablishment phase. Normally, preplant planning means using nonselective systemic herbicides for control of perennial weeds. However, because bare soils must be covered with vegetation quickly to prevent soil erosion and other negative impacts, it is best to limit perennial weed management to scouting and mapping for the time being. It will be more effective to apply perennial weed control measures to localized areas at later dates so that the control measure can be more effective.

Winter Annual Weeds

Yellow starthistle

Yellow Starthistle is fairly common in southeast Washington. Fires that burn through starthistle patches rarely do any appreciable damage to the seed soil bank. The Lewiston Grade burns almost every summer and starthistle has yet to be reduced! Starthistle invades burned slopes very rapidly, and it is not uncommon to find over 100 starthistle seedlings per square foot on burned areas in the fall. Once starthistle has successfully colonized an area, establishing desirable cover is exceedingly difficult. Starthistle rosettes will appear in October but they are not overly competitive in the fall. They are easy to control in the spring with most broadleaf herbicides. Some broadleaf herbicides are injurious to seedling grasses so it is important to select an appropriate herbicide.

Starthistle biocontrol agents such as seed weevils may be reduced for a few years so it is important to rely less on them. Augmenting biocontrol populations may be prudent. Check with your county extension service or county weed superintendent.

Cheatgrass

Cheatgrass will provide a modicum level of soil protection in the fall and can be important temporary fall forage. However, it is very competitive and a tremendous fire fuel. Fire rarely does a thorough job of reducing seed in the soil because cheatgrass fires advance very fast and do not heat up the soil. Areas that were heavily infested with cheatgrass prior to the fire will be heavily infested this fall.

Cheatgrass control should begin in the fall. Fall tillage after a flush can greatly reduce populations and the seed bank. Tillage coupled with reseeding can be a very effective control system. There are several herbicides that are effective in the fall. Be sure to select compounds that will not interfere with any revegetation efforts that might be needed.

Mustards, Hairy vetch, and Filaree

These broadleaf weeds are common in waste areas and moist draws. One factor that should be considered is rodents because their populations can be very high in stands of these weeds. Tilling the ground in the fall can greatly reduce weed populations as well as reducing the rodent population. A dense stand of grass is very effective for controlling these weeds but seeding should be delayed until the spring. Seeding this fall will probably result in a failure.

Perennial Weeds

Canada Thistle

Canada Thistle has rhizomes that will sprout in the spring but the patches do not spread rapidly. Seed will be produced the following summer and allow long distance dispersal. Concentrate on revegetating the majority of the land that needs vegetation regardless if Canada thistle was present prior to the fire. Canada thistle patches will show the following spring and these can be surgically addressed. Low residue compounds such as glyphosate can be applied in the spring and summer, and revegetation of the patches can be initiated afterwards.

Common Tansy

Common Tansy grows very well on disturbed soil. It is most troublesome on road cuts, jeep trails and other highly disturbed areas. The seed is frequently moved by vehicles, ATVs, and animals. Like Canada thistle, it tends to grow in patches so its control and revegetation practices are similar.

St. Johnswort

St. Johnswort is fairly fire resistant. A beetle was released many years ago for suppression of this weed. Population levels of the beetle might be reduced from the fire and takes a few years to rebuild. Augmenting weevil populations may be prudent. Check with your county extension service or weed supervisor.

Engineered Erosion Control Practices

Jute Netting

Netting made of jute can be laid and anchored over straw or other mulch to protect it from wind and water damage. Netting will help reduce soil erosion and provides a good environment for vegetative growth. Jute is biodegradable and will eventually decompose.

When to Use

Jute netting can be used on areas that may erode near structures such as homes or on small, steep, disturbed areas.

Netting can be used alone (without mulch) as an alternative to straw or wood mulches on flat sites for dust control and seed germination enhancement.

It should not be used alone where runoff quantities are expected to be high.

The use of jute netting is not appropriate for all situations. Examples of when it is not appropriate:

- Steep slopes with sandy soils
- Steep slopes with many rocks on the surface
- Steep slopes with a significant amount of fire burned vegetation remaining.

Specifications

The soil surface should be reasonably smooth. Remove rocks and other obstructions which rise above the level of the soil surface. Jute netting should be cloth of a uniform plain weave of undyed and unbleached single jute yarn. The material should weigh about 1.2 pounds per linear yard and have approximately 78 warp ends per width of cloth and 41 weft ends per linear yard.

Most nurseries and landscape contractors can find netting that meets these recommended specifications.

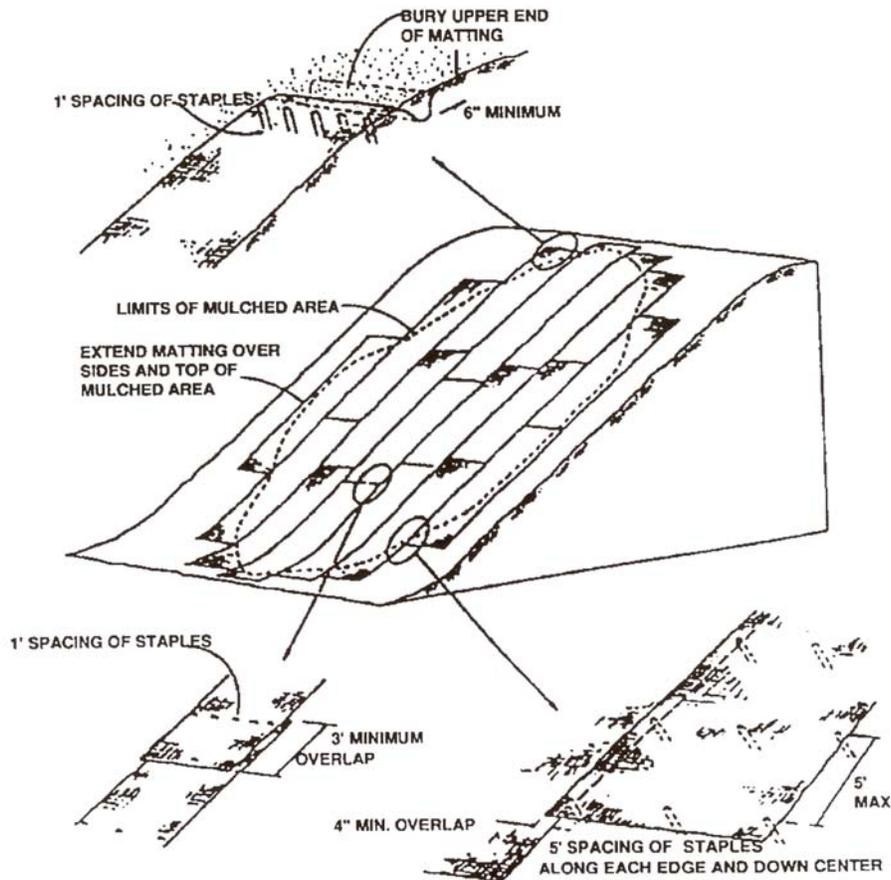
Individual rolls of netting should be applied up and down slope—never along the contour.

Bury the upper end of the netting at the top of the slope in a trench at least 6-8 inches deep.

Lay out rolls so edges overlap each other by 4 inches. Extremely important: When more than one roll is required going down the slope, the ends going down the slope should overlap by at least 3 feet. Anchor the netting to the soil surface with pins or staples. Pins and anchors should be 10 inches long and made of heavy, rigid, galvanized wire.

Staples and pins need to be driven into the soil and spaced about 5 feet apart. Spacing between staples at the end overlaps should be at 1 foot.

Jute Netting



Sandbag protection

An inexpensive temporary barrier or wall, 1-2 feet high, can be constructed by stacking sand-filled or earth-filled bags. They can be placed to divert mud and other debris flows away from buildings. They will not, however, provide protection from high debris flows.

When to Use

- To protect building sites vulnerable to low mud debris flows from steep, erodible slopes that are partially or completely void of vegetation due to wildfire.
- As an inexpensive, temporary protection method for homes before predicted rainfall.

Methods and Materials

Sandbag barriers are easy to construct. Burlap or poly bags are readily available at feed stores. Fire stations and other emergency centers might have bags on hand.

Place filled bags to direct debris flow away from buildings and other structures. Do not try to dam or stop debris flows.

Sandbag Protection



Sliding glass door sealing

Directing flows between buildings

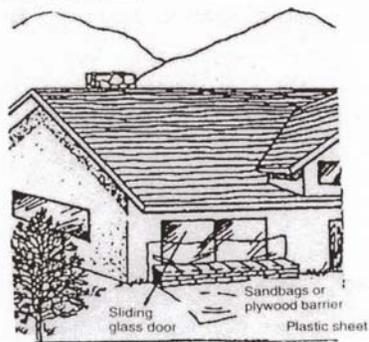


PLACE BAG WITH FLAP UNDER BAG

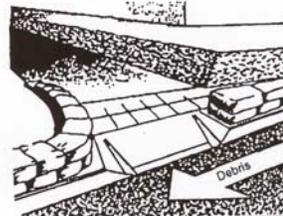
Directing debris away from buildings



Building protection



Sliding glass door sealing



Controlling debris/storm flows in streets

Silt Fences

A silt fence made of woven wire and fabric filter cloth is a temporary barrier that can be used to catch sediment-laden runoff from small areas.

Silt fences are easy to construct. Materials are available from most farm & ranch supply stores and lumber stores.

When to Use

Major considerations for use of silt fence are slope, slope length, and the amount of drainage area which the fence will catch runoff.

Here are some design considerations:

Slope Steepness	Maximum Slope Length
2:1 = 50%	50 feet
3:1 = 33%	75 feet
4:1 = 25%	125 feet
5:1 = 20%	175 feet
<5:1 = <20%	200 feet

For longer slopes, additional silt fences are needed.

Drainage Area

The area that contributes runoff should not be greater than ½ acre for 100 feet of fence.

Type of Runoff

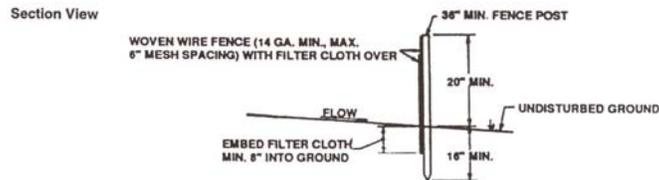
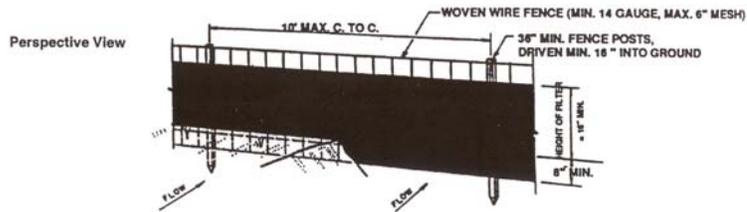
Silt fences are designed to catch runoff that is in the form of “sheet flow” not “concentrated flow.”

Silt Fence

Fabric Properties:

Filter fabric properties should be as follows (hardware store personnel can help you with these):

Fabric Property	Minimum Acceptable Value	Test Method
Grab tensile strength (LBS)	90	ASTM D1682
Elongation at Failure (%)	50	ASTM D1682
Mullen Burst Strength (PSI)	190	ASTM D3786
Puncture Strength (lbs)	40	ASTM D751 (mod)
Slurry flow Rate (gal./min/sf)	0.3	
Equivalent Opening Size	40-80	US Std Sieve
Ultraviolet Rad. Stability	90	ASTM-G-26



Construction Notes

1. Woven wire fence to be fastened securely to fence posts with wire ties or staples.
2. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24" at top and midsection.
3. When 2 sections of filter cloth adjoin each other, they shall be overlapped by 6" and folded.
4. Maintenance shall be performed as needed and material removed when "bulges" develop in the silt fence.

Straw Bale Check Dams

Straw bale check dams are temporary barriers constructed of straw bales located across small drainages. They are temporary structures used to slow debris flows in small channels. They are not intended to provide protection from large storm events nor to control debris flows in water bodies such as creeks, rivers, and ponds.

Planning Criteria

0-15% slope

Maximum drain area: 1 acre

Maximum slope length between check dams: 200 feet

15-20% slope

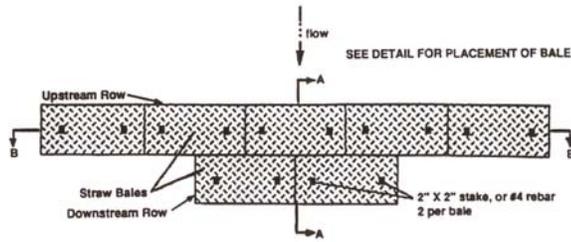
Maximum drain area: ½ acre

Maximum slope length between check dams: 100 feet

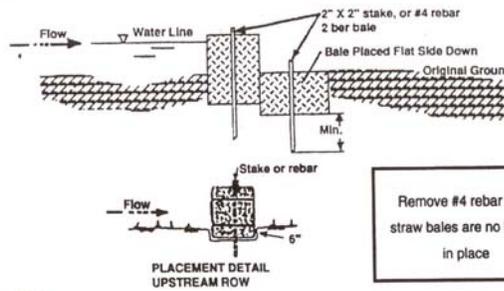
Greater than 20% slope

NOT Recommended

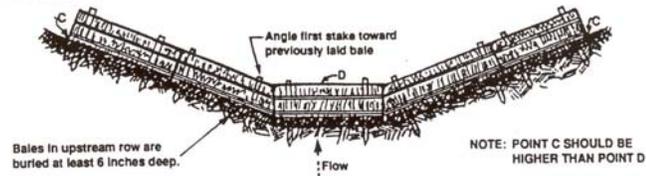
Straw Bale Check Dams



Section A-A



Section B-B



Straw Bale Dikes

Straw bale dikes are a temporary sediment barrier constructed of straw bales located down-slope of a disturbed area or around a storm drainage outlet to redirect debris flows or trap debris materials.

They are usually installed in areas requiring protection from sedimentation expected from predicted rainfall events that will cause erosion.

They are intended to provide protection for a limited time period, usually less than 3 months.

Installation Tips

0-15% slope

Maximum drainage area: 1 acre

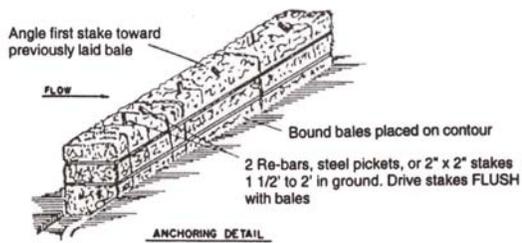
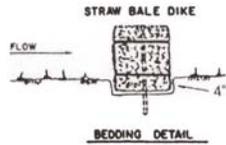
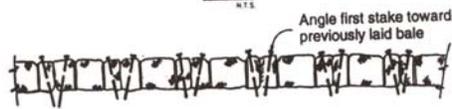
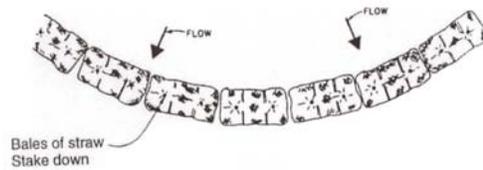
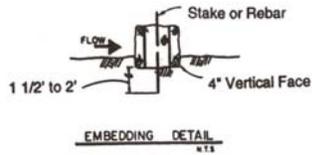
Maximum slope length: 200 feet

More than 15% slope:

Maximum drainage area: ½ acre

Maximum slope length: 100 feet

Straw Bale Dikes

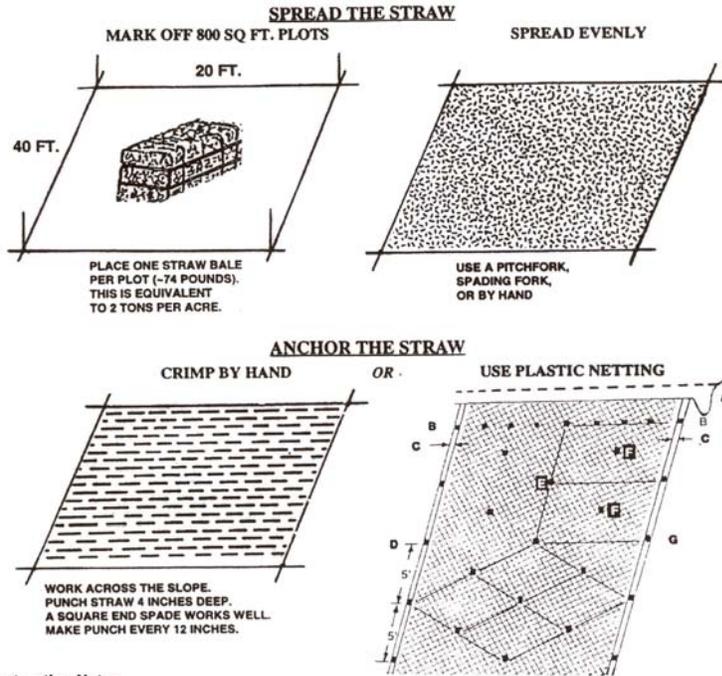


Straw Mulching

Straw mulching should be used on slopes that have been seeded and have a high potential for erosion. It will provide a protective cover to reduce erosion and improve water infiltration.

Mulching requires some type of anchoring by matting, crimping, or other method to prevent blowing or “washing away.” Jute netting or spraying with a tackified are also effective for anchoring straw mulch.

Straw Mulching



Construction Notes

1. Lay matting in strips down the slope over the straw. Bury upper end in 6-8 inch deep and wide trench. Most netting comes in 14-17 feet wide rolls.
2. Secure the upper end with stakes every 2 feet.
3. Overlap seams on each side 4-5 inches.
4. Secure seams with stakes every 5 feet.
5. Stake down the center every 5 feet.
6. Stake middles to create diamond pattern that provides stakes spaced 4-5 feet apart.
7. Use pointed 1x2 inch stakes 8-9 inches long. Leave 1-2 inch top above netting or use "U" shaped metal pins at least 9 inches long.
8. When joining 2 strips, overlap upper strip 3 feet over lower strip and secure with stakes every 2 feet like in "B" above.

Fire Related Hydrophobic Soils

Definition

Wildfires burn vegetation that accumulates on the soil surface. This burning produces volatile hydrophobic substances which can penetrate the soil up to a depth of 6 inches. When these substances penetrate the cool soil, they condense and coat the soil particles, making the soil hydrophobic or water repellent.

Soils that are water repellent exhibit a decreased water infiltration rate and an increased water runoff rate, creating extreme soil erosion potential.

Initially, rain or irrigation water will run off hydrophobic soils instead of infiltrating and promoting germination of seed and growth of roots. This makes it difficult to establish new vegetation. Water repellency will be worst where fuel and burn temperatures were extreme, especially under trees, shrubs, and around building that burned to the ground.

Field Check

Field check for water repellent soil conditions by digging a shallow trench with a vertical wall and applying water droplets.

- If water sits as a ball on the soil for 10-40 seconds, it is moderately hydrophobic.
- If water sits as a ball for more than 40 seconds, it is strongly hydrophobic.

Treatment

On gentle slopes, work the soil a few inches deep to break up the layer. This will allow the water to penetrate the soil surface.

On steeper slopes, lightly spray the soil surface with a soil wetting product (surfactant). This will break up the hydrophobic substances and allow the water to infiltrate.

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