BRUSH CONTROL AND SEEDING RANGELAND

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Natural Hazards to Range Plants

Droughts Occur Often

For many people, the romance of the Southwest is the favorable climate-winters are warm and dry, and summers are relatively dry so the heat is rarely oppressive. For the range manager, the key word in these descriptions is "dry."

Over the arid Southwest, the average annual precipitation is 8 to 12 inches. Averages, however, mean very little. Precipitation varies widely from one time to another and from one place to another, only a few miles away. Rainfall from April through September governs the growing season for range forage. West of the Sacramento Mountains, about 55 percent of the average annual precipitation falls from July through September; springs are usually dry and windy. East of the Sacramento Mountains, growing-season precipitation is more evenly distributed between spring and summer. The average annual evaporation from Weather Bureau pans is about 90 inches-about 10 times as much as the precipitation. The range plants, therefore, grow in brief bursts, when soil moisture is available immediately after rainfall.

Droughts are frequent and expected. Infrequent wet spells may bring a false sense of security, but chances are that drought-hopefully short, but possibly of several years' duration-will follow.

Stands of perennial grasses are often severely reduced by drought. On the Jornada Experimental Range, near Las Cruces, the basal cover of black grama was reduced to 42 percent of its predrought cover during the 1916-18 drought, 11 percent during the 1921-26 drought, and 23 percent in 1934. During the Great Drought from 1951 to 1956, black grama cover was reduced to 1 to 50 percent of its predrought average, depending on soil type. The drought loss was much more severe on deep sandy sites than on sites with shallower sands. Where 99 percent of the black grama was lost, there has been no recovery.

Droughts are a fact of life in this region and must be anticipated in the management of any southwestern range. There is no evidence that the climate is getting drier.

Brush Invasion Reduces Grass Stands

Stands of brush increase the cost of handling livestock, reduce livestock production, increase parasite damage, and make necessary the use of more breeding males. Brush-infested areas also support less wildlife than comparable rangeland in good condition. As undesirable shrubs increase, protective forage grasses decrease, and wind and water erosion increases. In this region, part of the dust during the inevitable spring windstorms and part of the sedimentation in streams and reservoirs come from brush-infested ranges.

On the Jornada Experimental Range, honey mesquite dominated only 4.8 percent of the area in 1858, but this had increased to 50.3 percent by 1963. As mesquite begins to dominate a sandy site, low dunes form, and grass cover is greatly reduced. The first infestations of mesquite on the Jornada are generally attributed to earlier Indian activities. The rapid increase in recent years is due to dispersal of mesquite seed by livestock.

Creosotebush dominated 0.4 percent of the area in 1858 and 14.2 percent of the area in 1963. This shrub was mainly confined to the dry, rocky ridges in the 1850s. Tarbush dominated 0.4 percent of the area in 1858 and 86. percent of the area in 1963. It originally grew on the slopes next to mountains, but it has moved down the slopes and is now most prevalent on heavier soils, where it competes with tobosa and burrograss.

As mesquite and tarbush began to dominate the slopes next to mountains, the original grass stands were thinned. Eventually creosotebush moved onto those sites and gained dominance over the mesquite, tarbush, and the residual grass stand. Four to six inches of topsoil have been lost from slopes now dominated by creosotebush, leaving the larger pebbles and stones to form an erosion pavement. Creosotebush generally invades sites where the original grass stand has been depleted.

Rodents and Rabbits Can Prevent Improvement

The impact of damage by rodents and rabbits is often underestimated. On deteriorated mesquite-sand dune sites in southern New Mexico, 462 pounds of rodent biomass were found per section. This plus rabbit populations, which may be as high as one or two per acre, exert as much pressure on desirable vegetation as one to three cows per section. It may keep the range in a deteriorated condition. Rodents and rabbits consume vegetation, destroy roots and above-ground plant parts, and collect seed that would otherwise aid in natural revegetation. Even in good grassland areas, the bannertailed kangaroo rats kept 10 percent of the area out of vegetative production by denuding the ground in the vicinity of their mounds. Rodent and rabbit populations are usually greater on poor than on good-condition ranges.

How to Control Brush

Undesirable plants can be controlled and ranges can be revegetated with forage species, but it takes judicious use of control methods and sound grazing practices. Woody plants such as mesquite, creosotebush, tarbush, and shinnery oak cannot be eliminated by good grazing practices alone. The brush has to be controlled before the range can benefit from other practices such as a grazing management plan, seeding, or water-spreading.

The most effective method for control of woody plants depends upon the site, the specific vegetation, and the degree of infestation. Any control job requires considerable attention to detail for maximum benefit per dollar spent. Here are some general guidelines for selecting control methods:

. Brush control generally costs less when invasion is just beginning and the plants are small and scattered. In this situation, the best method is one that will not destroy the residual forage plants.

. On sandy soils heavily infested with brush, a broadcast chemical method will control the undesirable plants and result in an increase of forage plants. Mechanical control methods are generally avoided on sandy soils, because of the wind-erosion hazard if a good plant cover is not maintained. Fortunately, natural revegetation is often quite rapid on sandy soils after chemical control of the brush.

. On soils with a medium to heavy texture, a heavy infestation of brush, and a poor stand of desirable plants, a mechanical method accompanied by seeding may be required. Natural revegetation after brush control is often very slow on medium- to heavy-textured soils.

. Controlling stands of mixed brush species with a single spray application is often difficult, because species vary in degree and time of susceptibility to herbicides.

Mesquite

The best way to control mesquite depends on degree of infestation, site condition, and available equipment. The following methods have been proven successful:

Hand-grubbing. Eradicate sparse stands (less than 75 plants per acre) of relatively small mesquites (less than three feet in canopy diameter) with a grubbing hoe or mattock. The plants must be completely severed from their roots, below the budding zone. On small plants, the budding zone is generally three to six inches below the surface of the ground.

If a crew is used, provide good supervision to keep the laborers well spaced (about 30 feet apart) and in line across the treatment swath so that they do not miss plants.

Where labor is available and not too expensive, hand-grubbing is an effective and economical method for cleaning up a potentially serious infestation while the mesquites are small and before the grass stand has been reduced. On one field-scale job, it took 0.6 man-hour per acre to hand-grub an average of 51 mesquites per acre.

Mechanical grubbing. Mechanical grubbing is used to control mesquite where the grass stand is good, mesquite plants are mostly large, and the stand is no denser than about 200 plants per acre. The method is particularly suited to areas with medium- to heavy-textured soils and good residual stands of desirable grasses. Areas that are duned and subject to wind erosion should not be grubbed.

Large acreages infested with light to moderate stands of mesquite are being cleared by mechanical grubbing in eastern New Mexico. The equipment often used consists of a large, wheel-type, front-end loader equipped with a hydraulically-operated stinger blade in place of the bucket. A farm-type wheel tractor with a drawbar-mounted stinger blade will handle small plants more economically than the larger equipment and can be used to advantage as a companion to the heavier equipment. A track-type tractor with a stinger blade extending below the dozer blade is needed on loose sandy sites.

Grubbing may be done any time except when the soil is wet. In some instances, the pits left after grubbing can be seeded. The mesquite plants must be grubbed below the budding zone. Costs average about three to five cents per plant.

Basal treatment with dry herbicides. Herbicidal pellets, granules, or powders, placed around the base of each plant, control relatively small mesquites (up to about six feet in canopy diameter) in sparse stands (up to about 100 plants per acre). The pellets and granules can be applied from horseback. Each horseman can cover a swath about 100 feet wide.

Such treatments should be applied immediately before, or in the early part of, an expected rainy season. The materials lose their effectiveness if they lie on the surface of the ground for more than about 60 days.

Ground spraying. Mesquite plants of any size can be sprayed from the ground, but the stands should be no denser than 200 plants per acre. The mesquites must be growing vigorously when they are sprayed. Generally, the January to May 15 precipitation before spraying must be at least two inches. The best time of the year to spray is after the leaves are fully developed and dark green, and the plants are in full flower or are forming seed pods. This is generally June 1 to 15 in southern New Mexico. Cover all parts of the plant with the spray.

Aerial spraying. Aerial spraying is particularly useful for controlling heavy infestations of mesquite on sandy soils. For satisfactory results, attend to every detail. The mesquite must be growing vigorously, which means that it should have received at least two inches

of precipitation from January to mid-May. The leaves must be fully developed and dark green, and the plants should be in the stage between full flower and seed pods that are elongated but not filled. The percentage of kill will be reduced if the plants have been damaged by insects, late frost, hail, or wind, or if they are suffering from drought stress.

Here are some details that are important in applying aerial sprays properly:

- Have good mixing equipment and keep the mixture properly agitated in the aircraft.

- Do not spray when the wind velocity averages more than five mph or the air temperature exceeds 90°F. Do not spray near susceptible crops or with volatile formulations.

- Check the calibration of the aircraft sprayer before each job.

Aerial spraying was tested for 11 years on the Jornada Experimental Range, with extremely variable results, as the table shows. Control ranged from 8 to 57 percent. The best control was obtained in years when the soil moisture was plentiful before and at the time of spraying, and the plants were fully leafed and growing vigorously.

Mesquite control from aerial sprays of 2,4,5-T (½ lb in 5 gal. of spray mixture per acre), Jornada Experimental Range, 1958 to 1969

Year of Application	Percent Control	Soil Moisture Status	Foliage Condition
1958	18	good	Vigorous
1959	34	good	Fully leaved, vigorous
1960	9	very dry	Good
1961	14	fair	Vigorous
1962	8	good	Fair, topgrowth of many plants killed back by cold
1963	57	good	Well-leaved, vigorous
1965	32	fair	Fair
1966	22	fair	Fair
1967	9	very dry	Poor
1968	43	very good	Good, vigorous
1969	22	fair	Fair

Poor control was obtained in extremely dry years, and when the foliage was scant because of dieback caused by extremely cold weather in January. Since 1959, more years have been favorable for spraying mesquite in southeastern New Mexico than in southwestern New Mexico.

Many herbicides, herbicide mixtures, and various kinds and quantities of spray material have been tested for mesquite control.

Research indicates that the best rates of 2,4,5-T for mesquite control are 0.75 pound per acre in southeastern New Mexico and 0.50 pound per acre in southwestern New Mexico.

For four years, mesquite control averaged 30 percent with the combination of 0.25 pound each of dicamba and 2,4,5-T, but only 23 percent with 0.5 pound of 2,4,5-T alone. In the one year it was tested, doubling the rate of herbicides in the combination treatment increased the mesquite kill by 50 percent.

Spraying with 0.25 pound or more of 2,4,5-T per acre usually defoliates mesquite at least for one season. This practice increases forage production on ranges where the stand of desirable grasses is fair or better, because it reduces competition from mesquite. But on severely depleted ranges, three or more years may be needed for a stand of grass to develop enough to increase production. With light control of mesquite, the mesquite may recover before the grass density increases much. The length of time that the increased production persists depends on the degree of mesquite control obtained; the better the control, the greater the level of forage production and the longer it persists.

A single aerial spray treatment generally gives 80 to 95 percent defoliation and from a trace to 50 percent kill, depending on the season. When soil moisture is good and mesquite plants are in good physiological condition and at the proper stage of growth, properly applied herbicides should kill at least 20 percent of the plants. The degree of control from repeated treatments is about additive, and there appears to be some advantage in respraying within two or three years.

Defer grazing during the growing season for one to three years after spraying mesquite to give desirable forage species an opportunity to increase. Grass production has increased significantly after mesquite spraying, particularly on sandy sites with a source of viable grass seeds. On the Jornada Experimental Range, an area sprayed twice for mesquite control from 1958 to 1961 has produced an annual average yield of 232 pounds of herbage per acre during the past eight years. An adjacent unsprayed area averaged 32 pounds per acre for the same period. The major perennial grass species on that area was mesa dropseed. The mesquite canopy has remained virtually unchanged during that period, indicating that the area may not need respraying for another 10 to 15 years. About 55 percent of the mesquites were killed by the two aerial applications. The sand dunes on that spray area have leveled appreciably, and there has been a marked reduction in wind erosion.

On the Brininstool Ranch, southeast of Carlsbad, an aerial spray in 1965 killed half of the mesquite plants. By 1967, perennial grass production on the sprayed area was 463 pounds per acre, while the production on an adjacent unsprayed area was 84 pounds per acre. The major grasses on the range were dropseeds, black grama, plains bristlegrass, and threeawns.

When only part of a mesquite-infested pasture is sprayed, livestock and wildlife tend to graze mostly on the sprayed area. Overgrazing and further deterioration of the site can occur unless livestock are removed after proper forage utilization in the treated area. Treatment of all infested areas within a pasture as soon as possible will help alleviate this problem.

Seeding Presents Problems

Where vegetation has been severely depleted by past grazing abuses, droughts, and encroachment of brush, natural recovery may take years, or it may never occur. On such sites, seeding is the only hope of revegetation. But establishing seeded species is difficult in arid areas. Since summer is the only season with reliable rainfall, the seedlings must be established in hot weather. Many species are small-seeded, requiring shallow planting. Precipitation is limited, evaporation is rapid, and soil surfaces often crust over.

How to Seed Range Plants

The procedures that are best for germinating and establishing seedlings on semidesert ranges depend upon the site.

Before seeding, some sites may be shallow-disked to reduce competition from weeds, increase infiltration of moisture, and leave a trash-covered surface. More intensive tillage is usually avoided, where possible, not only to prevent disturbing the soil surface excessively (bringing up heavier subsoils or burying the friable top soil and litter) but also because of the cost. Furthermore, wind erosion is a serious problem on loose, unprotected seedbeds.

Broadcasting is the poorest method of seeding, particularly on unprepared seedbeds.

Only limited success has been obtained on seedbeds prepared with a pitting disk or a ripper. Ripping lines often seal over within a year or so. Narrow pits can fill with soil rather rapidly on some sites. Seeding success is improved if the pitting disk has opener blades following the disk and a packer wheel.

Broad, shallow pits made with a basin-forming machine or a bulldozer blade make a good seedbed for a drill. Such pits are successful on medium- to heavy-textured soils on flat or gently sloping sites.

Contour furrows form good seedbeds on medium- to heavy-textured soils. Interrupted furrows prevent a large water loss if a furrow wall breaks, and they preclude the necessity of furrowing exactly on the contour.

Concentrating water with various land-forming procedures does not always insure seedling establishment. The surface soil still dries rapidly. This often leads to the formation of a heavy crust on medium- to heavy-textured soils. If such soil surfaces can be protected to reduce evaporation, seedling emergence and establishment are improved.

A cover of brush or litter over seeded areas substantially reduces soil temperatures and evaporation of the limited moisture. A method has been developed to seed brush-infested areas in a once-over operation. The brush and other competing vegetation is killed by a rootplow. The rootplowed seedbed is loose and fluffy, so a seeder is used that firms the soil into a V-shaped groove and places the seed in it. Drag chains cover the seed with loose soil to a depth up to 0.5 inch. A brush conveyor designed and developed by George Abernathy, agricultural engineer at New Mexico State University, picks up the brush behind the rootplow and deposits it behind the seeder. The brush is concentrated on a seeded strip about 40 percent as wide as the rootplowed swath. In addition, there is a hydraulically operated bulldozer blade in front of the seeder which forms basin pits. Thus, in one once-over operation, the competing vegetation is killed; a seedbed is prepared; the seed is placed in a firm seedbed; the dead brush is used for partial shade on the seeded area, there by substantially reducing maximum soils temperatures during the summer; and water is concentrated on the seeded area.

Species to Seed

Species used in range seedings vary according to climatic and site conditions, and ranch management. Many range managers plant native species, harvested from ranges. If you do this, choose native varieties or strains of local origin, generally within 200 miles north and 300 miles south of your area.

Light- to medium-textured soils. Species adapted for seeding on sandy sites are black grama, sideoats grama, blue grama, Lehmann lovegrass, Boer lovegrass, blue panic, and fourwing saltbush. A typical seeding might include a mixture of some or all of these species. Generally, Lehmann lovegrass comes up to a reasonably good stand within a year of seeding, while there may only be scattered plants of the other species. Within two or three years, there may be more plants of the longer-lived gramas and saltbush. After the seeding is established, grazing it when the lovegrass is green and succulent may favor the longer-lived species.

Medium- to heavy-textured soils. Species adapted for seeding on loamy sites are sideoats grama, blue grama, alkali sacaton, sacaton, vine mesquite, yellow bluestem, Sorghum almum, blue panic, Boer lovegrass, and fourwing saltbush. Typically, a mixture of some or all of these would be planted in pits or other conformations that would concentrate water. The species easiest to establish are sideoats grama, Sorghum almum, blue panic, and yellow bluestem.

Seed characteristics of some of the species adapted for seeding on semidesert rangelands

Species	Seed per Pound	Seeds per sq. ft. at 1 lb/A	Avg. Purity	Avg. Germination
			percent	percent
Yellow bluestem	1,409,000	32	60	70
Sideoats grama	143,000	3	60	50
Blue grama	712,000	16	40	60
Black grama	1,335,000	31	40	60
Lehmann lovegrass	4,245,000	99	90	60
Boer lovegrass	2,922,000	67	90	70
Blue panic	679,000	16	70	60
Vine mesquite	143,000	3	50	30
Alkali sacaton	1,750,000	40	98	80
Fourwing saltbush	30,000	1	80	50

Seeding Rates and Dates

Use enough seed to get a good stand, but not more than necessary. Too much seed may produce a stand of seedlings so dense that there will be excessive competition among plants. Use the number of pure live seed (PLS) per pound to determine your seeding rate. For the percentage of PLS in a seed lot, multiply the germination times the purity. A 100-pound bag of seed with a germination of 80 percent and a purity of 90 percent would have a PLS of 72 percent (80% X 90% = 72%). If you seed by drilling, use a seeding rate of 20 to 25 PLS per square foot. Double the rates for broadcast seeding.

A typical mixture to be drilled on a sandy loam site would be calculated as follows:

	Desired PLS/sq.ft.[1]	Number of PLS/lb.[2]	Mixture lb./A.[3]
Black grama	11	320,400	1½
Fourwing saltbush	1	12,000	3½
Sideoats grama	5	42,900	5
Lehmann lovegrass	7	2,292,300	1/8

[1]Desired mixture.

[2]Calculated by multiplying germination x purity x number of seed per pound. See above.

[3]Calculated by multiplying the desired PLS/sq. ft. by 43,560 (sq. ft/A) and dividing the product by PLS/lb.

The best time of the year to seed is just before the most reliable seasonal rainfall. Since the most reliable rainfall in most of the semidesert region occurs in summer, the best time to seed is in June or early July.

How to Manage New Seedings

Protect new range seedings from grazing through the second growing season, or until the seeded species are well established. Manage seeded areas separately from other rangelands.

Sometimes, a dense crop of weeds may compete with the new seedlings. Spraying to control the weeds may prevent the loss of the seeding.

Rodent and rabbit activity can also cause the failure of any seeding. Where forage-destroying animals such as jackrabbits, cottontail rabbits, kangaroo rats, and field mice are a problem, they should be controlled before seeding or shortly after.