FEDERAL SECURITY AGENCY
CIVILIAN CONSERVATION CORPS
FORESTRY PUBLICATION NO. 8

WASHINGTON, D. C. MAY 1940

REVEGETATING SEMIDESERT RANGE LANDS IN THE SOUTHWEST

By
JOHN T. CASSADY, *Associate Forest Ecologist*
and
GEORGE E. GLENDENING, *Assistant Forest Ecologist*
SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE, UNITED STATES
DEPARTMENT OF AGRICULTURE

United States
Government Printing Office
Washington : 1940

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - Price 10 cents

CONTENTS

	Page
Classification of sites	1
Arizona	1
New Mexico and southwestern Texas	2
Selection of species for seeding or planting	2
Reseeding methods	3
Transplanting methods	4
Mechanical aids to artificial planting and seeding	8
Protection from rodents and livestock	9
Cost of revegetation	14
Guides for revegetating southern Arizona range	15
Guides for revegetating southern New Mexico and southwestern Texas ranges	19
List of plant names	22

REVEGETATING SEMIDESERT RANGE LANDS IN THE SOUTHWEST

By JOHN T. CASSADY, *associate forest ecologist*, and GEORGE E. GLENDENING *assistant forest ecologist, Southwestern Forest and Range Experimental Station* [1]

In Arizona, New Mexico, and southwestern Texas are several million acres of deteriorated semidesert range that are in need of revegetation. Parts of this area may be revegetated naturally through better range management practices alone, such as conservative grazing and deferred-rotation grazing. Other lands, deteriorated to various degrees and requiring various methods of restoration, require artificial reseeding and planting. It is the purpose of this pamphlet to outline the best methods developed to date for artificially revegetating such ranges; but without any implication that artificial revegetation is to be considered a substitute for good range management. These methods are presented as aids in starting or hastening natural recovery processes on relatively small areas requiring special attention.

CLASSIFICATION OF SITES

The degree of success, the amount of cultural treatment necessary, and the time required to establish a satisfactory plant cover by artificial revegetation are dependent upon climatic conditions, the present plant cover, and the physical condition of the planting sites, particularly the condition of the soil. As treated in this pamphlet, the various types of deteriorated semidesert range in the southwestern region have been grouped into eight major problem areas, four of which occur mainly in Arizona and four are common to New Mexico and southwestern Texas.

ARIZONA

1. *Mixed shrub areas lying just above the true creosotebush belt and near the lower limits of the perennial grassland type.*—These areas are often characterized by rather heavy, impervious, slightly alkaline soils, and a rather sparse stand of some or all of the following shrubs: Velvet mesquite, southwestern jujube, wolfberry, fourwing saltbush or "chamiza," chollas, and burroweed.[2] In their present condition they are subject to excessive run-off and sheet erosion.

2. *Mixed shrub stands on fine-sand, silty, or loamy soils, often in a serious state of gully erosion.*—These areas are characterized by a fairly heavy stand of mesquite, catclaw, burroweed, and other shrubs, but usually support scattered clumps of such perennial grasses as sacaton, bristlegrass or "wild millet," bush muhly, and often a rather heavy stand of annual grasses during years of favorable summer rainfall. While brush may always be the principal cover on these

[1] Maintained at Tucson, Ariz., by the Forest Service, U. S. Department of Agriculture, in cooperation with the University of Arizona, for investigations in Arizona, New Mexico, and the western third of Texas.

[2] Scientific names for all plants mentioned in this pamphlet are listed on p. 22.

areas, they would have much higher grazing capacities if the full amount of grass which they are capable of supporting were restored.

3. *Barren or almost barren sheet-eroded gravelly ridges, characterized by fairly heavy clay soils.*—Often covered with small loose rock, and the topsoil usually very thin and often lacking. As a general rule, the plant cover is very sparse and composed mostly of shrubs such as mesquite, catclaw, and cholla. Fluffgrass occurs characteristically on these areas, and in favorable locations a few remnants of good perennial grasses such as Rothrock grama, black grama, slender grama, and others may be found.

4. *Deteriorated grassland areas receiving 14 or more inches of rainfall annually.*—Areas capable of supporting good stands of perennial grasses but upon which worthless half-shrubs, such as burroweed and snakeweed, have replaced the former grass cover and are now dominant. Soils range from fairly heavy clays to gravelly loams and are in various stages of deterioration, but as a rule are still fairly productive. Scattered clumps of good perennial forage grasses, such as black, slender, Rothrock, hairy, and blue grama, and others, are usually present under the protection of the unpalatable shrubs.

NEW MEXICO AND SOUTHWESTERN TEXAS

1. *Mesquite sand dune lands or similar brushy lands.*—Characterized by loose sandy or sandy loam soils; barren windswept areas interspersed with dunes; or sandy soil supporting honey mesquite bushes, soapweed, shinnery oak, and similar shrubs.

2. *Brushy areas on the mesas, slopes, and canyons of the lower foothills.*—Characterized by gravelly sand to clay soils, sparse herbaceous plant cover, and dominated by such shrubs as creosotebush, honey mesquite, tarbush or "blackbrush," catclaw, snakeweed, and various other thorny shrubs. Such areas, often important watershed lands, are now subject to excessive run-off and erosion.

3. *Barren or sparsely vegetated flats and bottomlands.*—Characterized by heavy clay or silt soils often with high salt content, deep gullies in places where there is pronounced drainage, and barren areas interspersed with well-vegetated areas supporting such plants as tobosa, burro grass, sacaton, tar-brush, fourwing saltbush, poisonous drymaria, and various other small annual plants.

4. *Grassland areas upon which half-shrubs and weeds have recently become dominant.*—Characterized by reasonably good soils, fair to good total plant density, but low grazing capacity because the former grass cover has been replaced by plants of low palatability. Common plants are snakeweed, rabbitbrush, and numerous annual and perennial weeds, and grasses. Usually there remains a sparse stand of good forage grasses, such as black and blue grama, dropseed grasses, and three-awn grasses.

SELECTION OF SPECIES FOR SEEDING OR PLANTING

In general the most successful species for reseeding or transplanting are those that are known to have grown on the area to be treated or are produced in the immediate vicinity. The essential qualities of species for revegetation are sufficient quantity and viability of seed, ease of collection, and sufficient adaptability to existing climatic conditions to become established and to spread. The majority of the exotics

recently introduced by the various Government agencies have not been sufficiently tested to warrant widespread use on semidesert ranges at this time. However, a few of these plants have shown sufficient promise to be worthy of consideration.

Unfortunately, seeds of most native plants are not sold commercially and must be obtained either by field collection by the Civilian Conservation Corps or other workers, or through agreement with some Government agency. As a general rule, some areas where seed can be collected will be found on most ranches.

RESEEDING METHODS

The term "seeding" is used to designate the planting of seed, as opposed to "transplanting," which designates the planting of grass clumps or shrub seedlings. Both methods are successful if properly applied, and it is believed that in any large-scale revegetation program there is a place for each. Seeding is generally the most practical method where large areas are to be treated. The amount of cultural treatment necessary to prepare a seedbed will not be excessive where a fairly good topsoil remains and the terrain allows easy working of the ground.

The chances for successful reseeding of semidesert range depend to a large degree on moisture conditions and the extent of range deterioration, as well as on the amount of control that can be exercised over livestock, rodents, and erosion.

Although some areas are much better adapted to reseeding than others, tests have shown that artificial reseeding will be successful even on the poorer types of soil, provided rainfall is sufficient and the proper cultural treatments are applied. Level or moderately sloping areas free from dense brush and with fairly loose soils are ideal. Revegetation work may also be successfully carried out on moderately steep slopes wherever light horse-drawn harrows or drags can be used and their manipulation is not too greatly hindered by scattered trees and shrubs. Tight impervious soils can be successfully seeded but require special treatment to insure good results. Possibly the greatest single obstacle to the germination of seed and establishment of seedlings on deteriorated semidesert range in the Southwest is the rapid drying-out of the surface layer of soil Consequently, the primary functions of cultural treatment on depleted areas that are to be seeded are to promote moisture retention, retard surface-soil moisture loss, and provide protection or shade for seedlings.

On sites where there is good soil, some plant litter, and a fair cover of weeds (such as snakeweed or burroweed), fair success may be had by merely broadcasting the seed and covering it. On the poorer sites, water-conserving practices through the use of contour furrows, flat-basin crescents, brush piles, or plant litter offer better chances for successful seeding.

In broadcast seeding, the seed should be lightly covered; that is, to a depth of one-half inch and never to more than 1 inch. The seed may be covered with light harrows, brush drags, or by driving sheep over the area. Hand rakes can sometimes be used to advantage where the seeded areas are small and scattered or inaccessible to other implements. The best time to seed is in the early summer (June) just prior to the rainy season.

The quantity of seed required to produce satisfactory revegetation results varies greatly with the purity and viability of the seeds. Under favorable conditions the following quantities of cleaned seed will give good results:

Species:	*Pounds per acre*
Blue, hairy, and Rothrock grama	5 to 8
Slender, sprucetop, and side-oats grama	6 to 8
Dropseed grasses	3 to 5
Three-awn grasses	4 to 5
Cane beardgrass and Arizona cottongrass	6 to 8
Tanglehead without awns	4 to 6
Fourwing saltbush	12 to 15
Weeping and mat lovegrass	3 to 5

In planting extremely small seeds, such as those of the dropseed and lovegrasses, it may be desirable to mix the seed thoroughly with some inert material, such as sawdust or sand, before broadcasting it. This practice makes for greater uniformity in spreading the seed and should reduce the amount required for a given area.

In the southwestern semidesert region, grass seedlings usually require some shade and protection during their early stages of growth, and it will be found that natural reproduction normally occurs under accumulations of dead plant material (litter). On completely barren areas the chances for successful establishment of seedlings may be greatly increased by scattering hay or straw over the bare spots after the seed has been lightly covered with earth. Annual grasses or weeds, if protected from grazing, will often furnish litter on areas that are otherwise bare. If native grass species can be cut at the time of seed maturity and scattered on denuded areas, this will serve to provide economically both seed and litter.

TRANSPLANTING METHODS

Transplanting of grass clumps and shrub seedlings is a more positive method of revegetation, and in some cases allows the use of a greater variety of plants. Transplanting is more costly than seeding, but under adverse soil conditions on critical areas where it is essential to establish a protective plant cover in the minimum time, and in cases where it is desirable to establish certain plants (black grama, for example) that ordinarily do not reproduce well from seed, transplanting offers distinct advantages and should be considered.

Under adverse conditions, vigorous transplants have a better chance to survive than young seedlings, but successful transplanting, like seeding, usually requires special cultural treatment on badly deteriorated sites. Since transplanting is more expensive than seeding, it is justifiable only on areas of watershed or other high value and where seeding is impractical.

There are two methods by which grass clumps can be obtained for transplanting. The first is by digging up the desired clumps from native grass stands and moving the clumps immediately to the desired location for planting. Such plants are termed "direct field transplants." The second method involves the growing of planting stock from seed under nursery practices.

Good results can be obtained with either kind of planting stock. Where soil conditions are favorable and the desired kinds of grasses are easily accessible, direct field transplants may be somewhat more economical than nursery-grown stock. Generally, however, plants grown in the nursery have the following advantages:

1. They cost less where large quantities are involved.
2. They are more portable and less perishable.
3. They have greater uniformity of size and stage of growth.
4. They offer greater selection of plants, including shrubs as well as grasses.
5. Production may be controlled so that planting stock is available at any desired time of the year.

"Potted nursery stock" is well adapted to spot planting over wide areas because of its portability. General instructions for handling this type of planting stock are as follows:

1. If shade-grown, the stock must be hardened off; i. e., grown with the minimum water required to prevent wilting and exposed to direct sunlight for 10 days to 2 weeks before planting.
2. Water thoroughly just before planting.
3. Clip grasses to 3 to 4 inches· remove one-half aerial part of shrubs.
4. Dig hole deep enough to allow root crown to set at ground level.
5. Fold back and tear off bottom of pot if present; leave sides.
6. Place pot in hole; pack dirt firmly around pot.
7. Water plant and loose dirt around pot. This is not absolutely necessary but is advisable where facilities permit

"Field transplant stock," if available nearby, is best for concentrated work, such as row planting. (See fig. 1.) It may be used in spot planting, but is not as portable as nursery stock and usually must be watered when set out. Open-rooted grass clumps may be successfully collected and transplanted where the soil is fairly heavy and sufficiently moist to allow a ball of soil to cling to the roots. The essential steps to be followed in direct field transplanting are listed below:

DIGGING

1. Soil must be moist to 6-inch depth; water if necessary. Cool part of day is preferable time.
2. Select vigorous appearing clumps not over 2 to 3 inches diameter. (Small rather than large clumps are most desirable.)
3. Make a vertical cut on four sides of clump so as to remove a sod 2 to 3 inches square and 3 inches deep.
4. Lift sod carefully; keep dirt in contact with roots.
5. Pack sods firmly into flats; 18 by 30 by 4 inches is a convenient size for flat.
6. Clip top part of grasses immediately to 3 to 4 inches.
7. Cover flat with wet burlap sacking. Water as soon as possible.

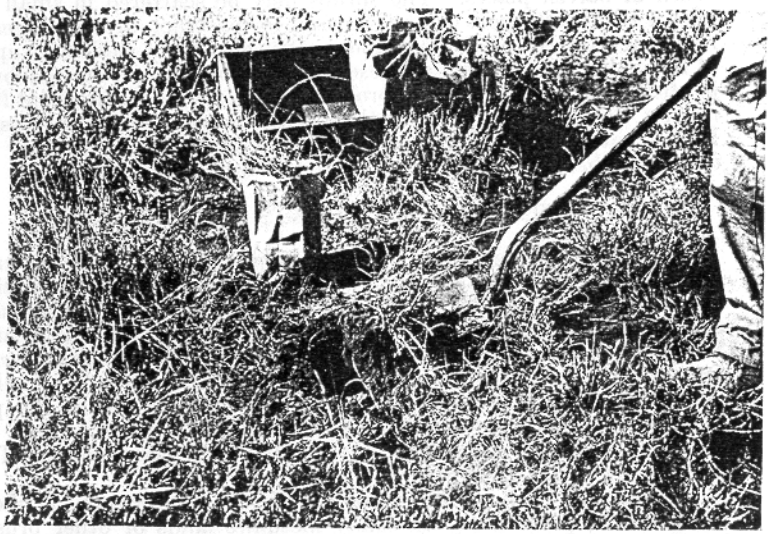
PLANTING

1. Dig holes or trench, if row planting, to at least a 4-inch depth.
2. Carefully remove clumps from flats and place in holes or trench; avoid shaking dirt loose from roots.
3. Pack dirt firmly around clumps.
4. Water plants unless soil is fairly moist.

212958°—40——2

F344278

FIGURE 1.—CCC enrollees transplanting grass clumps in rows on a small plot. Clumps are spaced at intervals of 3 to 4 inches. Where small areas are to be intensively planted, "field transplanting stock" is as practical as the potted nursery-grown plants. Watering the transplants, while helpful, is not necessary where soil moisture conditions are favorable.



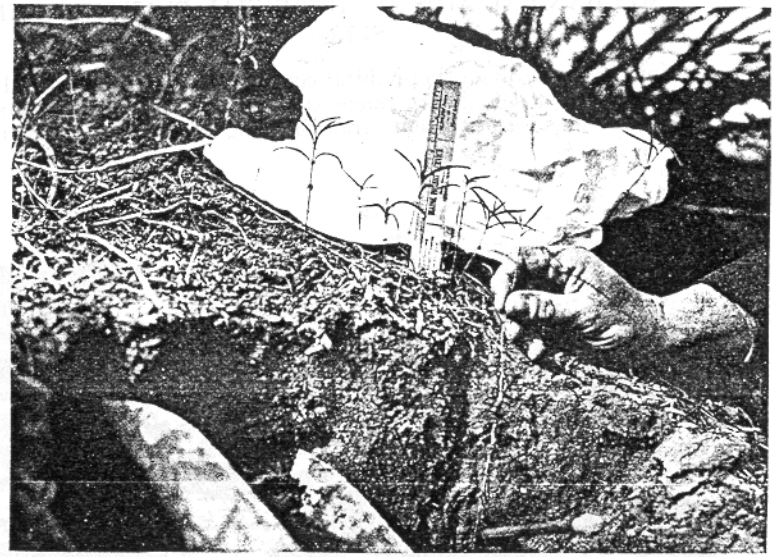
F315188

FIGURE 2.—Clumps of black grama that are to be transplanted to a depleted area are being collected from this well-sodded area and placed in paper bags. The sacks protect the roots from removal of the loose sandy soil and exposure to drying during subsequent transplanting operations.

On loose sandy soils where it is difficult to keep soil in contact with the roots of the grass clumps in making direct field transplants, the "paper sack" method works well. (See fig. 2.) The procedure for this method is as follows:

DIGGING

1. Select vigorous clumps in a well-vegetated area.
2. Make vertical cuts around the grass clump so as to remove a ball of earth and roots 5 inches in diameter.



F317439

FIGURE 3.—Often seedlings of desirable native plants can be found growing in or adjacent to the area to be planted. In this instance, advantage is being taken of the excess production of fourwing saltbush seedlings on a favorable site adjacent to a depleted mesquite sandhill.

3. Lift up clump and place in No. 6 kraft bag.
4. Water at earliest opportunity.

PLANTING

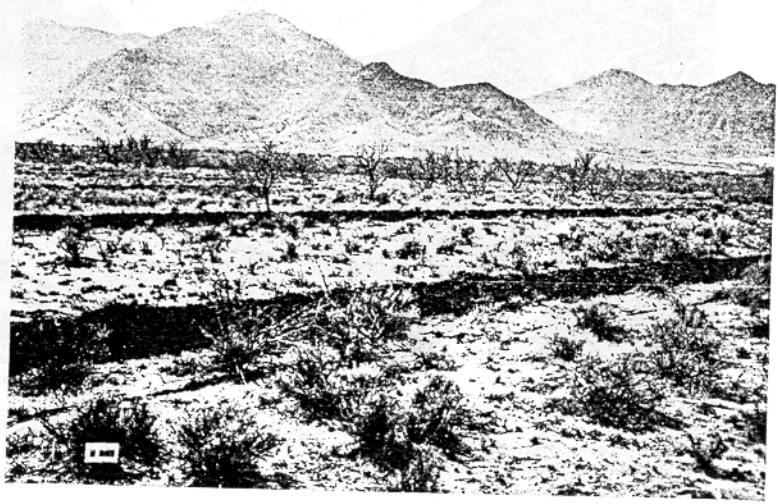
1. Make hole 6 inches deep.
2. Place sacked plant in hole.
3. Pack dirt firmly around outside of sack.
4. Water the sacked plant and dirt around plant if practical. If soil is moist, watering is unnecessary.

In some places, seedlings of valuable native shrubs, such as fourwing saltbush ("chamiza"), are available. (See fig. 3.) These may be safely transplanted during the rainy season. Dig the seedlings and immediately cover the roots with wet burlap sacks. Plant at intervals of 2 to 8 feet in holes punched in the moist soil with a dibble or pointed stick, and tamp the soil firmly around them. Old pick handles, when tapered and pointed, make good dibbles.

On extensive areas of level country, planting may be done in strips of 2 to 3 rows at widely spaced intervals without making erosion-control structures, but in either case the interval of planting should be sufficiently flexible to allow advantage to be taken of particularly favorable sites such as small natural depressions where moisture will be concentrated, the shade and protection of shrubs present, or small spots of good soil. Transplanting may be done during either the summer or winter rainy season and should be done as soon as the soil is moist enough to insure root growth.

MECHANICAL AIDS TO ARTIFICIAL PLANTING AND SEEDING

Moisture, soils, and other habitat conditions are generally so adverse on deteriorated semidesert range that special care is necessary to obtain success either from transplanting or seeding. In many



C-267

FIGURE 4.—Deteriorated semidesert grassland range where the original grass cover has been replaced mainly by burroweed and mesquite. Contour furrows were constructed by CCC enrollees using a crawler-type tractor and pull-blade. On moderately sloping land such as this, the furrows prevent excessive run-off, increase moisture penetration, and provide favorable sites for natural as well as artificial revegetation.

instances soils must be stabilized, excess rodent populations controlled, and grazing by domestic livestock prohibited prior to starting revegetation operations. Planting and seeding must be done at a time that will afford the young plants the most favorable growing conditions, particularly as regards soil mosture at the time the young plants are struggling to become established. Usually Civilian Conservation Corps enrollees will carry on the work under competent foremen or technicians.

It is common for deteriorated lands in this region to suffer seriously from water or wind erosion. Where this is the case, some form of mechanical treatment to retard run-off and stabilize the soil must be employed.

Various methods of checking water erosion have been successful. On the sloping ridges characteristic of much of the range lands in southern Arizona, small contour furrows at rather close intervals may be used to retard run-off and increase moisture penetration. (See fig. 4.) On relatively fast lands with tight impervious soils, such as adobe flats, mulching of the soil by disking-in straw, annual weeds, and grasses, or other plant material cuts down erosion and greatly increases moisture penetration. (See fig. 5.) Where gullies are actively cutting through an area, control in the form of check dams or gully plugs is often prerequisite to successful artificial revegetation. (See fig. 6.)

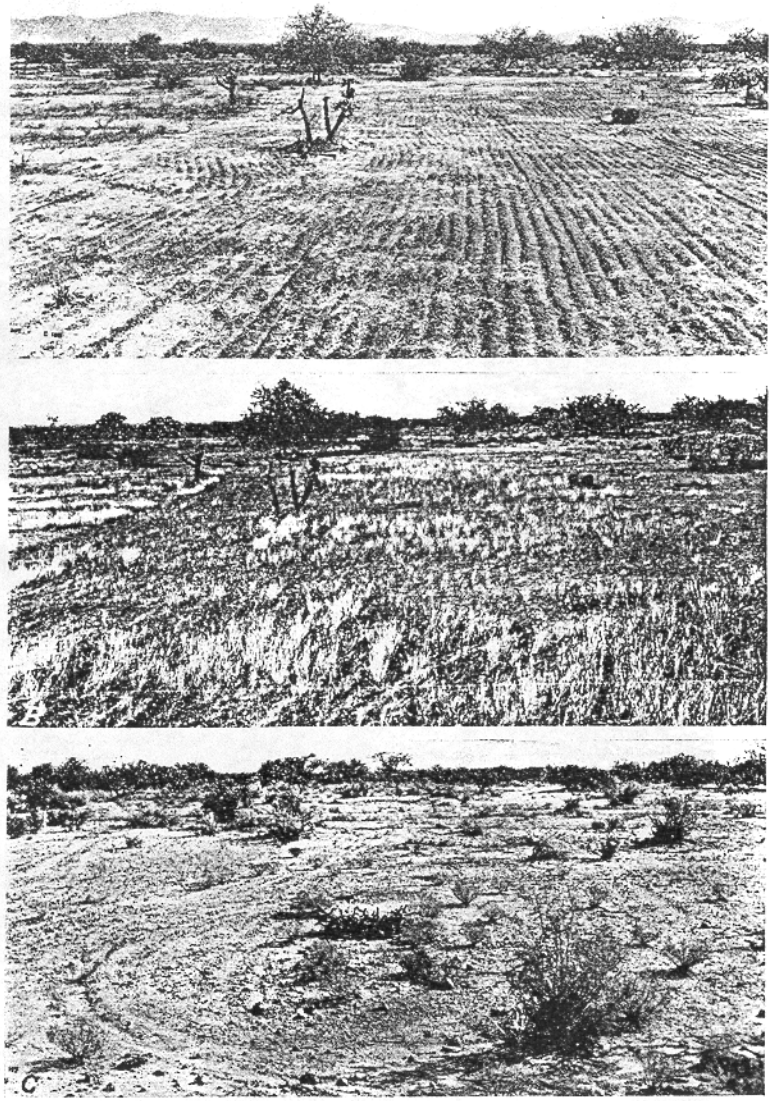
On sparsely vegetated hillsides in New Mexico a type of water-conserving basin called the "flat-basin crescent" has been used effectively. These basins are formed by raking a few inches of topsoil down slope from an area about 8 by 5 feet to form a small crescent-shaped dam 6 to 10 inches high and a shallow catchment basin, with the crest of the dam highest near the center so as to force excess water around the ends. (See fig. 7.) About 225 such crescents per acre should be sufficient to check erosion on moderate slopes. Rows of crescents should follow the general contour of the land, and the individual crescents of adjacent rows should be staggered so as to intercept overflow from the dams above.

It has been found that wind erosion in loose sandy lands can be partially controlled by cutting low-value shrubs and spreading the brush in barren places. The shrubs may be scattered in small flat piles 4 to 10 feet apart or may be used to construct brush hedges at right angles to the prevailing winds. (See fig. 8.) A sufficient supply of low-value shrubs, such as mesquite, blackbrush, and creosotebush, is often available within the problem area; otherwise, brush cut from nearby thickets may serve if their removal will not cause erosion. Where natural reseeding does not appear to be sufficient after the erosion is checked, seed may be sown directly in the brush piles.

PROTECTION FROM RODENTS AND LIVESTOCK

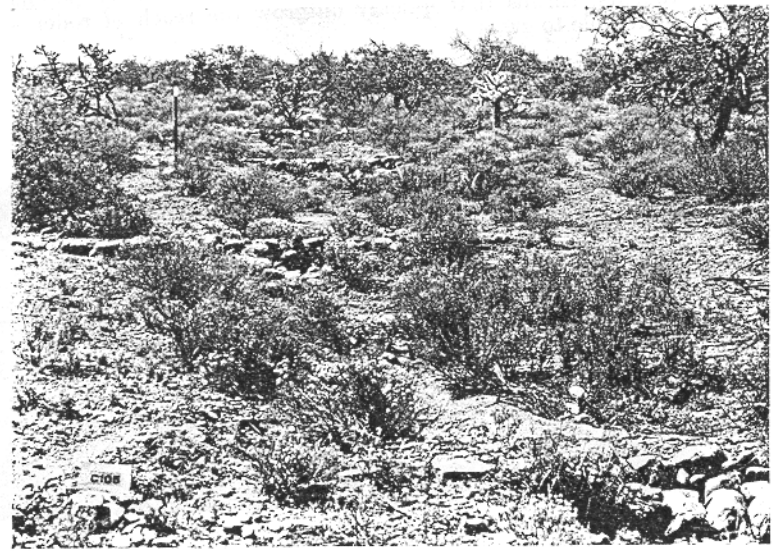
All artificial revegetation plantings require protection from grazing by domestic animals and forage-eating rodents. Domestic livestock should be excluded until the young plants are well established and have spread sufficiently to remedy the ills of the problem area. Where the problem is mainly one of reestablishing a stand of forage grasses on good soils that are not eroding, 2 to 5 years of complete protection should be ample. If erosion control is one of the primary objectives, however, livestock should be kept out until the accelerated erosion is checked by the resulting plant cover. This may require 5 or more years.

Rodents are often a definite limiting factor to successful artificial revegetation, particularly on sandy mesquite lands or other brushy lands that provide excellent escape cover and homesites for the rodents. (See fig. 9.) Intensive control campaigns will be necessary on such areas prior to the revegetation work, followed by addi-



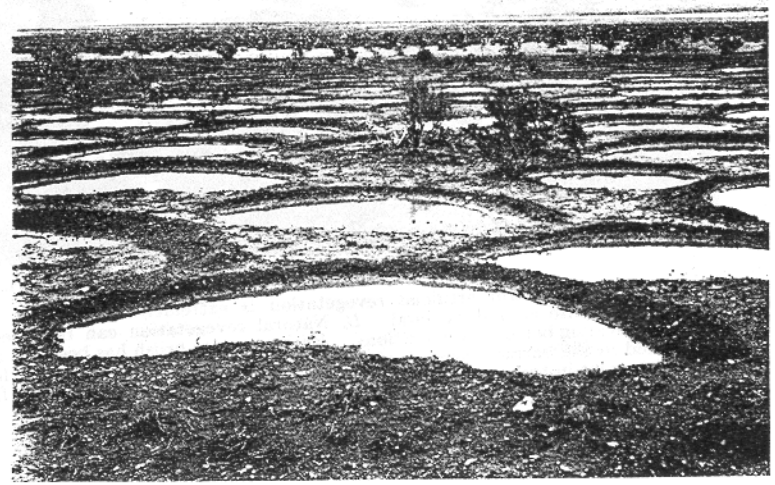
F357832–357844, C–117

FIGURE 5.—Barren sheet-eroded impervious soils, such as are found on the so-called "adobe flats," are difficult to reseed successfully with ordinary cultural treatments. Good results have been obtained from mulching with straw and disking. *A*, Properly prepared adobe flat. After seeding, during the summer rainy season, a light straw mulch was applied and the seed covered to a depth of ½ to 1 inch with a disk. *B*, The same area in the fall of the same year, showing the establishment of perennial grasses. *C*, Similar area, not mulched, seed covered with a harrow, and no grass. Contour furrowing on such areas would be a practical measure.



F357820

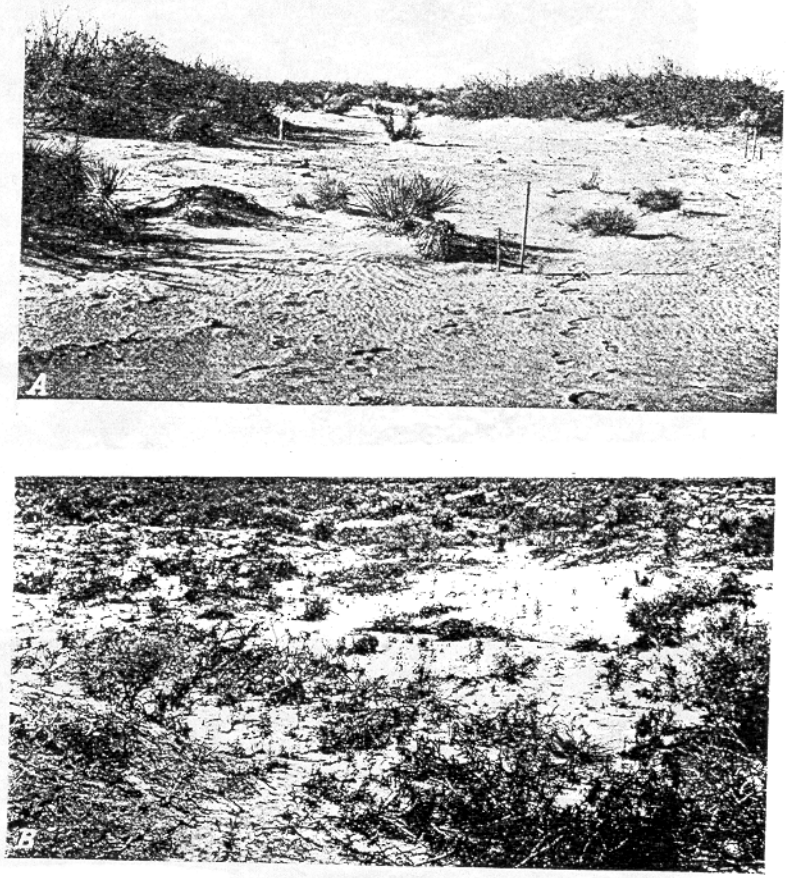
FIGURE 6.—Small check dams such as these can be constructed cheaply and are very effective in controlling gully erosion on depleted areas. The filled areas behind the dams provide excellent sites for seeding or transplanting.



J–1

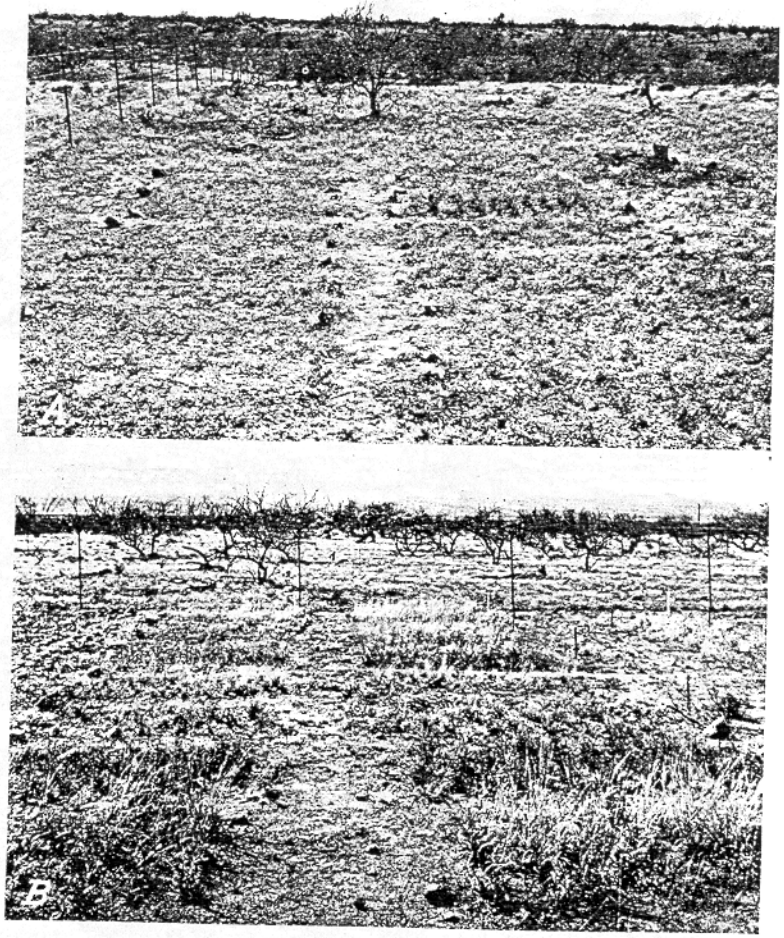
FIGURE 7.—These flat-basin crescents were built to stop the excessive run-off from a moderately sloping deteriorated area. They provide excellent sites for reseeding and are an effective method for revegetating critical areas quickly where a greater expenditure of money is justifiable.

tional control if the rodent population becomes large before the plant cover is well established. On areas densely populated with rodents, shrubs that quickly outgrow the reach of rodents may be preferable to grass.



F315265-333010

FIGURE 8.—*A*, Successful artificial revegetation is extremely difficult on this type of mesquite-sand dune land. *B*, Natural revegetation can be speeded up by providing better site conditions. Here mesquite brush has been cut and scattered in the barren areas. Seeds of the desirable fourwing saltbush, which is also present in the sand dunes, lodge in the brush, germinate, and under favorable conditions grow into mature bushes.



F329008

FIGURE 9.—Forage-eating rodents are often very destructive on small intensively planted plots where herbaceous plants are scarce. The two grass plots shown were established at the same time. After 2 years the grasses on *A* have been almost completely destroyed by rodent grazing while those on *B*, which is protected from rodent grazing, are making vigorous growth and are now a source of seed for the adjacent area. Both areas are closed to grazing by livestock.

COST OF REVEGETATION

Costs of the various revegetation treatments vary from about $2 to $15 per acre. In estimating the expenditure justifiable on a given area, all of the potential values that may result from the increased vegetation and the irreparable losses if the vegetation and soil are further deteriorated must be considered. A good plant cover may furnish forage for domestic livestock and game, watershed protection, flood control, dust control, fuel, and esthetic values.

Cost data for the large-scale construction of the "flat-basin crescents" are not available, but limited tests on the basis of Civilian Conservation Corps enrollee labor indicate a cost of about 3 man-days' labor or $4.50 per acre. Where large areas are worked, small contour furrows located at 20-foot intervals can be constructed for about 20 cents per acre.

The cost of cutting mesquite shrubs and making brush hedges is about 2½ man-days' labor or $3.75 per acre, but varies with the availability and size of the shrubs cut for brush. Seeding and transplanting costs are in addition to these and vary considerably depending upon the nature of the area worked, the cost of seed, the method used to cover the seed, the availability of transplanting stock, and the interval of planting. A few examples of seeding and transplanting costs are listed.

Cost per acre of broadcast seeding based on the work of Civilian Conservation Corps enrollees is as follows:

Labor:	
Sowing seed 1 hour at 19 cents	$0. 19
Raking in seed 2 hours at 19 cents	. 38
Seed—8 pounds at 20 cents [1] per pound	1. 60
Transportation, overhead, etc. (estimated)	. 23
Total cost per acre	2. 40

The cost of transplanting 9.1 acres of sandy mesquite land at intervals of 8 feet with black grama tufts by the paper-sack method was about $15 per acre. The considerable distance that the tufts had to be hauled and the close planting interval were partly responsible for the high cost.

The itemized cost per acre with Civilian Conservation Corps labor is as follows:

675 paper bags at $1. 64 per thousand	$1. 11
38 man-hours' labor at 19 cents per hour	7. 22
⅓ day's truck driver at $2	. 67
5 man-hours supervision at 60 cents	3. 00
31 miles transportation at 10 cents	3. 10
Cost per acre (average 675 transplants)	15. 10
Cost per transplant	. 022

Transplanting 10 acres with fourwing saltbush seedlings at intervals of 6 feet was a much quicker operation with correspondingly smaller cost per acre. In this case a little over two-thirds of the actual area was planted. On the basis of CCC labor, the costs per acre were as follows:

[1] The Soil Conservation Service were in 1939 obtaining *Bouteloua gracilis* seed on large-scale operations at cost of 20 cents per pound.

Labor:	
Digging seedlings, 4.6 man-hours at 19 cents	$0. 88
Transplanting 814 seedlings per acre, 7.4 man-hours at 19 cents	1. 41
Supervision—0.8 hours at 60 cents	. 48
Transportation, overhead, tools, etc	. 24
Total cost per acre	3. 01
Total cost per plant	. 004

The cost of transplanting a total of 17,484 grass clumps collected an average distance of 6 miles from the planting area and planted with varied spacing and on a variety of soils on the Santa Rita Experimental Range in southern Arizona was as follows, when computed on the basis of CCC labor:

Digging and planting clumps: 930 man-hours labor at 19 cents	$176. 70
Supervision—126 man-hours labor at 60 cents	75. 60
Travel—872 truck miles at 10 cents	87. 20
Total cost for 17,484 grass clumps	339. 50
Average cost per clump	. 019
Total cost per acre at 8-foot interval (675 clumps at 0.019)	12. 83

GUIDES FOR REVEGETATING SOUTHERN ARIZONA RANGE

(*Semidesert grassland and semidesert shrub types of the mesas and foothills; elevation 3,000 to 4,500 feet; annual precipitation 12 to 20 inches*)

Problem Area 1

Mixed shrub areas on impervious slightly alkaline soils, usually showing excessive sheet erosion.

SEEDING

Species to seed.—Sacaton, alkali sacaton, Rothrock grama, weeping lovegrass, mat lovegrass, and fourwing saltbush.

How to seed.—(1) On bare soils broadcast the seed, cover lightly with straw or other plant material, and disk at right angles to direction of the slope. If a cover of annual grasses or weeds is present, seed on untreated soil and disk the annuals into the soil. (2) Seed small spots under protection of existing shrubs; loosen soil and cover seeds by raking.

When to seed.—May or June (just prior to the summer rainy season).

SEEDING WITH HAY

Kind of hay to use.—Mixed dropseed grass hay, Rothrock grama hay

How to seed with hay.—Cut hay from well-grassed areas at time of maximum seed maturity. Scatter hay lightly over the area to be reseeded and disk on contour or at right angles to the direction of slope. If disking is impractical, allow stock to trample hay into soil.

When to use the hay.—(1) In fall at time the hay is cut; (2) June, or just prior to summer rains.

TRANSPLANTING

Species to transplant.—Sacaton, alkali sacaton, bush muhly, and Rothrock grama.

How to transplant.—(1) Spot planting (preferable). Plant at 5- to 10-foot intervals, under protection of shrubs where practical. (2) Close planting with plants in rows. On contour across shallow depressions and flooded areas.

When to transplant.—July and August or February and March, after the soil is moist. Summer planting is preferable.

Protection necessary.—Exclusion of livestock 2 to 4 years, light grazing indefinitely. Continued rodent control absolutely essential on this type until plants are well established.

Problem Area 2

Mixed shrub areas on sandy loam or silt soils, characterized by fairly dense stands of mesquite, catclaw, and other shrubs, and a few scattered clumps of sacaton, bush muhly, and wild millet. Often with active gully erosion.

SEEDING

Species to seed.—Alkali sacaton, sacaton, wild millet, Rothrock grama, tanglehead, cane beardgrass, and any other grasses growing naturally in the area.

How to seed.—Control active erosion by plugging gullies before seeding. Plant seed in spots under protection of shrubs and piles of dead brush. Cover seed by raking.

When to seed.—During May or June.

TRANSPLANTING

Species to transplant.—Bush muhly, sacaton, cane beardgrass, Rothrock grama, black grama, and poverty three-awn.

How to plant.—Control gully erosion by check dams, if needed. Spot transplant at 5- to 10-foot intervals, in the protection of shrubs, and on shoulders of check dams.

When to transplant.—During early part of summer or winter rainy season, i. e., July or February. Soil must be moist at planting time.

Protection necessary.—Exclude livestock for 2 to 4 years. Light grazing for indefinite period to allow spread of grasses. Continued control of rodents is usually necessary in this type.

Problem Area 3

Barren, or almost barren, eroded gravelly ridges; characterized by heavy clay soils, usually deteriorated and rocky, and with a sparse stand of shrubs and perennial grasses.

SEEDING

Species to seed.—Rockrock, slender, and side-oats gramas; tanglehead; cane beardgrass; and Arizona cottongrass.

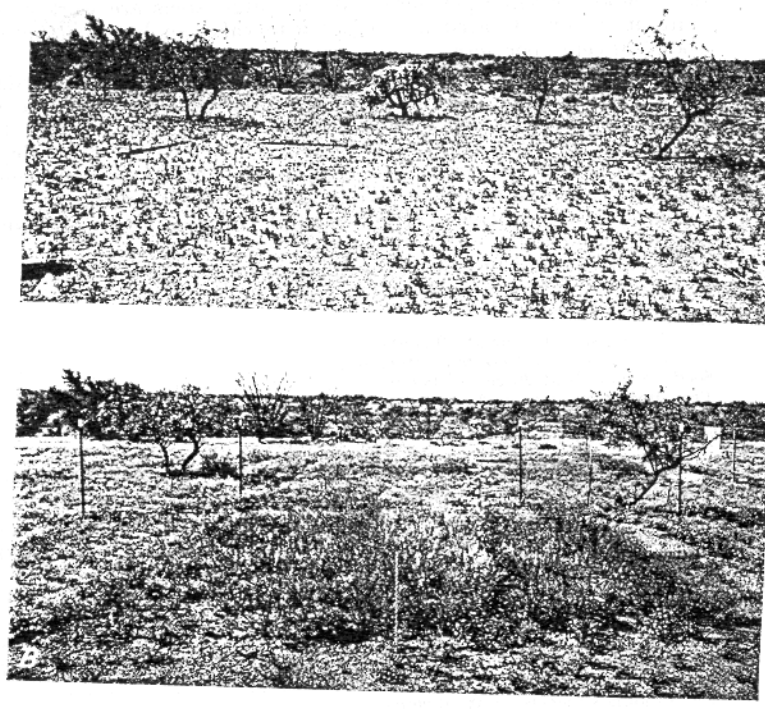
How to seed.—(1) On the steeper slopes seed on contour furrows. If litter cover is deficient or lacking, broadcast seed, rake or harrow to loosen soil, and cover lightly with straw or other available plant material. (2) If litter cover is present, broadcast seed and cover by harrowing or raking.

When to seed.—Construct furrows at any time prior to seeding. Plant seed during May or June.

TRANSPLANTING

Species to transplant.—Black, Rothrock, slender, and side-oats gramas; tanglehead; Arizona cottongrass; curly mesquite; cane beardgrass; and poverty three-awn.

How to transplant.—(1) If run-off is excessive, construct contour furrows. Plant in furrows at 4- to 6-foot intervals. (2) Concentrated row planting in small plots in "key" locations on tops of ridges. (See fig. 10.) Space plants at 4- to 6-inch intervals. Space rows at 6- to 12-inch intervals. (3) Spot planting with plants spaced at 5-foot intervals. Where possible plant in protection of shrubs and in patches of good soil.



F328587–328843

FIGURE 10.—*A*, A deteriorated gravelly ridge with a typical erosion pavement on the sheet-eroded heavy clay soil. Such conditions, especially where plant litter is lacking, are very unfavorable for revegetation. *B*, Vegetation can be established on depleted gravelly ridges by transplanting clumps of native forage grasses. If protected from grazing, these small "key plots" provide a source of seed which will aid in the natural reseeding of the surrounding area.

When to transplant.—July, August, or February and March. While soil is moist from summer rains is most desirable planting time.

Protection necessary.—Exclusion of livestock for 2 to 4 years or until the desired plant cover is present. Rodent control usually necessary on this type.

Problem Area 4

Deteriorated grassland areas with reasonably good loamy soils on sloping mesas, characterized by sparse to heavy stands of borroweed and snakeweed.

SEEDING

Species to seed.—Rothrock, slender, sprucetop, side-oats, hairy, and blue gramas; Arizona cottongrass; cane beardgrass; tanglehead; and poverty three-awn.

How to seed.—(1) If run-off is not excessive, broadcast the seed and cover by harrowing or dragging. If soil is loose and there is a good litter cover, it may not be necessary to cover seed. (2) If run-off is excessive, put in small contour furrows, broadcast seed, and cover as in (1). (3) Seed in contour furrows and cover by raking.

When to seed.—During May or June, prior to summer rainy season.

SEEDING WITH HAY

Kind of hay to use.—Mixed grama hay. Any species of native gramas except black grama.

How to seed with hay.—Cut the hay from well-grassed areas at the time of maximum seed maturity. Spread hay lightly between shrubs and in all barren spots. Drive livestock over the hay or let them graze the area until the hay is well trampled into the soil, or disk the area at right angles to the direction of slope.

When to use the hay.—(1) In the fall at time hay is cut; (2) June, or just prior to summer rains.

TRANSPLANTING

Species to transplant.—Black, Rothrock, slender, side-oats, blue, and sprucetop gramas; cane beardgrass; Arizona cottongrass; tanglehead; and poverty three-awn.

How to transplant.—Spot transplanting—intervals dependent upon amount of plant cover left—not over 10 feet.

[1] *When to transplant.*—July and August, or February and March, after soil is moist. Summer planting is preferable.

Protection necessary.—(1) Should not be grazed by livestock until the stand of forage grasses is reestablished. (2) Rodent control where damage is apparent.

GUIDES FOR REVEGETATING SOUTHERN NEW MEXICO AND SOUTHWESTERN TEXAS RANGES

(Semidesert grassland and shrub types of the lower plains and foothills; elevation 3,000 to 6,000 feet; annual precipitation 9 to 15 inches)

Problem Area 1

Mesquite sand dune lands or similar brushy areas.

SEEDING IN BRUSH PILES

Species to seed.—Fourwing saltbush and other drought-resistant plants in the vicinity.

How to seed.—(1) Preparation of site: Cut low-value shrubs from the dunes or from nearby thickets and make flat open brush piles or hedges in the barren areas. (2) Mechanics of seeding: If a sufficient number of seed plants are not present to provide for natural reseeding, broadcast seed in the brush piles. With shovels, throw enough dirt into the piles to cover the seed about one-half inch deep.

When to seed.—The brush piles can be made any time during the year, but should be in place prior to seeding. Sow seed in May, June or July.

TRANSPLANTING SEEDLINGS

Species to transplant.—Fourwing saltbush or any other valuable shrub seedlings conveniently available.

How to transplant.—Dig seedlings that are 4 to 10 inches high, securing 6 to 15 inches of roots. Do not pull up seedlings; dig the soil away from the roots, remove plant, and cover immediately with wet sacks. Punch holes in wet soil with sharpened pick handle (dibble) at intervals of 2 to 8 feet. Place seedlings in holes as far down as original root collar. Tamp soil around roots very thoroughly with dibble stick and fill resulting holes. Clip the longer stems to about 6 inches.

When to plant.—(1) During rainy periods from July to January 31. (2) At least 6 weeks before usual beginning of dry spring-summer season.

Protection necessary.—Exclude domestic livestock for 3 to 5 years or more until desired vegetation cover is produced. Control rodent population, if excessive.

Problem Area 2

Brushy areas on mesas or slopes and canyons of the lower foothills. High-value watershed areas with sparse herbaceous plant cover and accelerated erosion.

SEEDING IN WATER CONSERVATION BASINS

Species to seed.—Blue, hairy, or side-oats gramas, sand or mesa dropseed; alkali sacaton; tobosa grass; and fourwing saltbush, or any other locally important range plants of which a supply of seed is available.

How to seed.—(1) Preparation of site: Build erosion control and water conservation structures at fairly close intervals on the area. Flat-basin crescents or similar structures are advised. (2) Mechanics

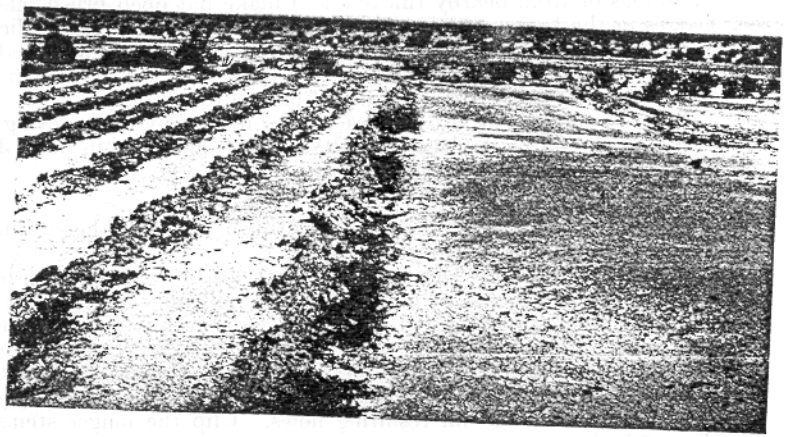
of reseeding: Sow seed in the basins of the control structures and rake over them lightly with hand rakes.

When to seed.—Structures may be made any time during the year. Sow seed in May, June, or July.

TRANSPLANTING GRASS CLUMPS

Species to transplant.—Black grama, other native perennial grama species, alkali sacaton, mesa dropseed, vine-mesquite grass, and any local species that spread rapidly by stolons or seed.

How to transplant.—Transplant grass clumps by the paper-sack method. The sacks may not be needed if heavy, wet turf is available nearby; however, the sack holds soil and roots together and conserves moisture. Plant behind terraces, in furrows, crescents, or at close



F333002

FIGURE 11.—On this impervious "adobe flat" furrows were plowed and filled with sand containing seeds of puncture vine, and a good weed stand has resulted. The weeds, while of low forage value, help stabilize the soil and provide humus which will result in more favorable site conditions for the later establishment of forage grasses. Under critical conditions it is often necessary to revegetate with such weeds as a first step in the reclamation of badly deteriorated range lands.

intervals in rows across the drainages. On level areas where erosion is not excessive, plant a series of several closely spaced rows with intervals between series of 25 to 30 feet, or merely plant at intervals of 2 to 8 feet. Be sure that transplants are thoroughly watered just before planting and that soil is packed around the lower parts of the sacks.

When to transplant.—During rainy periods, July 1 to September 10.

Protection necessary.—Exclude domestic livestock 3 to 5 years or more, until the plant cover has spread sufficiently to check erosion adequately. Control rodent population.

Problem Area 3

Barren or sparsely vegetated flats and bottom lands with heavy, impervious clay soils.

SEED-BEARING SOIL IN FURROWS

Species to seed.—Seeds that occur naturally in sandy loam soil nearby which supports a stand of mixed vegetation such as annual or perennial grasses and weeds, Russian-thistle, puncture vine, and fourwing saltbush.

How to seed.—(1) Preparation of site: Plug deep gullies with dams. Build check dams across shallow drainages and plow furrows as water spreading wings out from the dams. (2) Mechanics of seeding: Sow seed in deeper gullies and rake them in. Haul seed-bearing sand from most convenient area and spread 3 to 6 inches of the sand in the bottoms of furrows. (See fig. 11.)

When to seed.—Preferably in May and June, but at any time during year prior to the summer rainy season (July–September).

Protection of area after revegetation.—Exclude domestic livestock for 3, 5, or more years until plant cover has spread and adequately checks erosion. Control rodent population.

Problem Area 4

Grassland areas upon which half-shrubs and weeds have become dominant. Good loamy soils and fair plant cover, particularly snakeweed-grassland types.

BROADCAST SEEDING

Species to seed.—Sand, mesa, and giant dropseed; alkali sacaton; three-awn grasses; and other local perennial grasses of which there is an available seed supply.

How to seed.—Broadcast seed at the rate of about 8 to 10 pounds of cleaned seed per acre or 20 to 40 pounds of seed and chaff. Raking may not be necessary where there is a fair plant cover and soil is moderately loose. A very effective method for covering seed is to drive a band of sheep over the area. Do not destroy existing vegetation.

When to seed.—April, May, June, and July up to the beginning of the rainy season.

Protection of area after revegetation.—Very light grazing or no stocking until perennial grass cover is reestablished, probably 3 to 5 years. Control rodent population.

LIST OF PLANT NAMES

Grasses

Range Plant Handbook No.[1]	Scientific name	Accepted common name
G–14	*Andropogon barbinodis*	Cane beardgrass.
G–18	*Aristida divaricata*	Poverty three-awn.
	Bouteloua aristidoides	Needle grama.
	Bouteloua barbata	Sixweeks grama.
G–26	*Bouteloua chondrosioides*	Sprucetop grama.
G–27	*Bouteloua curtipendula*	Side-oats grama.
G–28	*Bouteloua eriopoda*	Black grama.
	Bouteloua filiformis	Slender grama.
G–29	*Bouteloua gracilis*	Blue grama.
G–30	*Bouteloua hirsuta*	Hairy grama.
G–31	*Bouteloua rothrockii*	Rothrock grama.
	Eragrostis curvula [2]	Weeping lovegrass.
	Eragrostis lehmaniana [2]	Mat lovegrass.
	Heteropogon contortus	Tanglehead.
G–69	*Hilaria belangeri*	Curly-mesquite.
G–71	*Hilaria mutica*	Tobosa.
G–82	*Muhlenbergia porteri*	Bush muhly.
	Panicum antidotale [2]	Giant panic.
G–91	*Panicum obtusum*	Vine-mesquite.
	Scleropogon brevifolius	Burro grass.
	Setaria macrostachya	Plains bristlegrass.
G–109	*Sporobolus airoides*	Alkali sacaton.
G–110	*Sporobolus cryptandrus*	Sand dropseed.
	Sporobolus flexuosus	Mesa dropseed.
G–113	*Sporobolus wrightii*	Sacaton.
G–122	*Trichachne californica*	Arizona cottongrass.
	Triodia pulchella	Fluffgrass.

[1] UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE. RANGE PLANT HANDBOOK. Illus. Washington, D. C. 1937.
[2] Introduced plants which have shown considerable promise of success in artificial revegetation trials.

Weeds

W–165	*Drymaria holosteoides*	Poisonous drymaria.
	Salsola pestifer	Russian-thistle.
	Tribulus terrestris	Puncturevine.

Shrubs

B–1	*Acacia* spp	Acacias.
	Aplopappus fruticosus	Burroweed.
B–27	*Atriplex canescens*	Fourwing saltbush.
B–54	*Chrysothamnus* spp	Rabbitbrushes.
B–67	*Covillea tridentata*	Creosotebush.
	Flourensia cernua	Tar-bush.
B–85	*Gutierrezia* spp	Snakeweeds.
	Lycium parviflorum	Wolfberry
	Opuntia spp	Chollas.
B–112	*Prosopis glandulosa*	Honey mesquite.
B–112	*Prosopis velutina*	Velvet mesquite.
	Quercus havardii	Havard oak.
B–157	*Yucca elata*	Soaptree yucca.
	Zizyphus lycioides	Southwestern jujube.