

NRCS-UTAH

NATURAL RESOURCES CONSERVATION SERVICE

Date 7-8-03

Transmittal Sheet and 12 Pages

To Jerciann OGM

Telephone No. 801-538-5214

FAX Telephone No. 801-359-3940

From Jim Brown

Natural Resources Conservation Service
Roosevelt Field Office
Nile Chapman Building
240 West Highway 40, (333-4)
Fax: (435)722-9065

RECEIVED
AUG 07 2003
DIV. OF OIL, GAS & MINING

Problems with transmission, please call sender (435) 722-4621 x 130

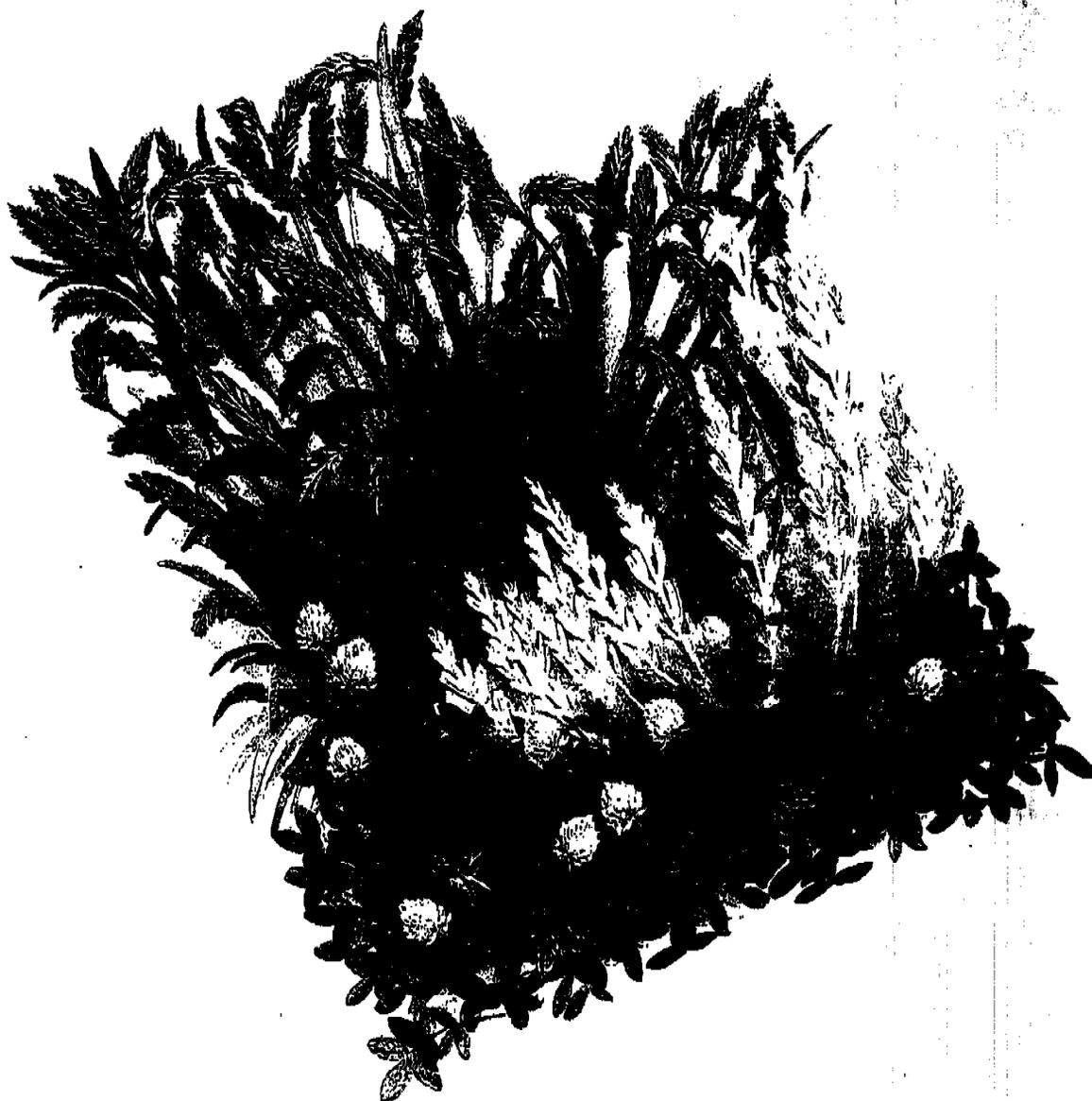
Comments This is general information only. More site specific information to be used for the final recommendation. This is a harsh site and receives less ppt than the charts show. JB

Shared Values - The Natural Resources Conservation Service in Utah honors each employee as an essential member of the conservation team. We pledge to provide the best possible service to our clients while at the same time seeking to achieve the greatest technical excellence.

Commitment from the Ground Up

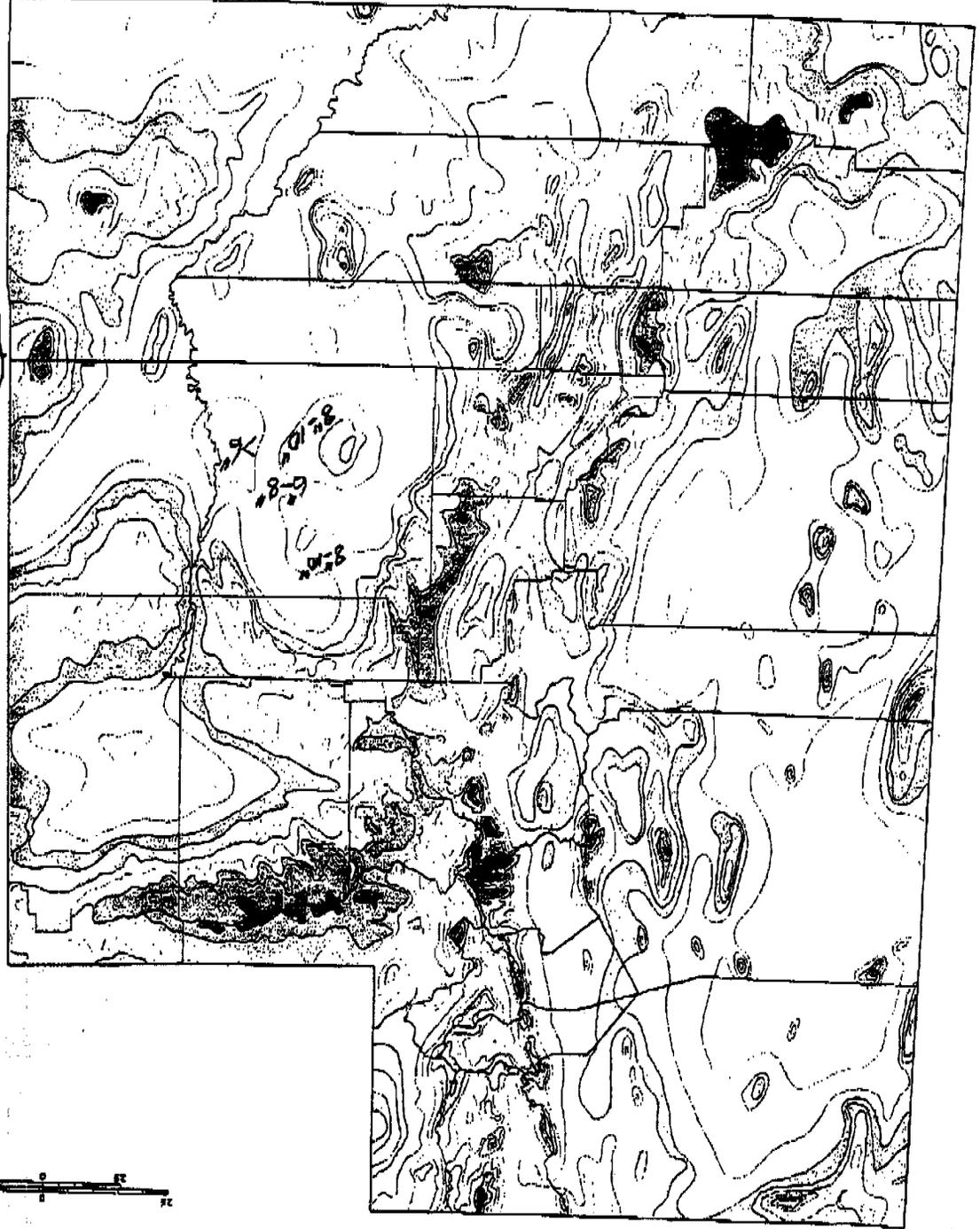
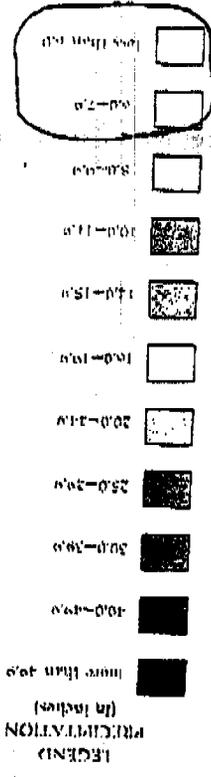
INTERAGENCY FORAGE AND CONSERVATION

PLANTING GUIDE FOR UTAH



Cooperative Extension Service
Utah State University

Copyright © 1998 by the United States Government. All rights reserved. This map is a work of the United States Government and is in the public domain in the United States of America.



**ANNUAL NORMAL
PRECIPITATION**

seed must have tags. Additional information about seed certification is available from the Utah Crop Improvement Association, Utah State University, Logan, UT 84322-4855. Phone: (801) 750-2082.

1. With certified seed you can be assured that the seed in the bag is the variety claimed. This is very important as new varieties are developed. For instance, there is no easy way to confirm that someone is selling Hycrest or Ephraim crested wheatgrass seed unless it is certified.
2. Certification for variety and genetic purity means that the seed meets high quality standards for mechanical purity, germination, and contains strictly limited amounts of other crop seed, weed seed, inert matter, and diseased seed. (NOTE: Some seed of varieties in short supply may be labelled SUBSTANDARD if quality factors other than varietal identity and genetic purity do not meet normal certification standards; the substandard factor will be listed on the certification tag.)
3. Native collected seed in some states labelled as Source Identified, provides the location (at least to county) and elevation (nearest 100 ft) at which the seed was collected. Utah will soon have a similar program with bags reading Origin Verified. Those selling native seed may require some time to adopt such a program. If buyers ask for and are willing to pay a fair premium for this seed, the seed industry will make it available. This is the only way to be sure the seed will be adapted to the area you want to plant.

① ESTABLISHING AND MANAGING A SEEDING

TIME OF SEEDING

On rangelands, seed only when there will be enough moisture to assure seedling establishment. This will generally be in the early spring or late fall. Seed early enough in the spring to take advantage of moisture and cool temperatures. Spring seedings are often unsuccessful because seeding is delayed by ex-

cess soil moisture which often means that by the time equipment can be used on the sites, it is too late for optimum germination and establishment. Fall seedings should be made late enough so germination will not occur until the following spring. Early fall seedings are very risky since adequate establishment prior to heavy frost and winter conditions is questionable. During winter, exposed seedlings can experience high mortality, especially in areas of limited snow cover. Much more flexibility is possible with pasture seedings where irrigation water is available. However, careful management is required to establish seedings during midsummer heat.

② SEEDBED PREPARATION

The best seedbed is firm, fine, moist, and free from competition. It is extremely important to have a firm seedbed to reduce air space and ensure that germinating seed contacts moist soil. Also, careful seedbed preparation enhances proper seed placement. Seedings on unprepared hard seedbeds where there is competition from existing plants will generally fail.

③ SEEDING DEPTH

Proper seed placement is essential in successful seedings. Depth of seeding varies with seed size. Generally 1/4 to 1/2 inch is recommended for most grasses, but very small-seeded grass species and legumes should be planted 1/8 to 1/4 inch deep. However, a few forbs and shrubs do best seeded on a disturbed surface. On light textured soils seed should be planted deeper than on heavy textured soils. Drilling is usually the best method. Minimum-till drilling has been highly successful in suitable areas if proper precautions are taken to eliminate competitive species. This technique generally reduces costs, retains soil moisture and dramatically reduces soil erosion. Where it is not possible to drill seeds, broadcasting by hand, ground rigs, or aerial seeding is recommended. Broadcast seed should be covered by dragging with a harrow, chain or similar type equipment.

*NOTE: Never expect that increasing seeding rates will compensate for lack of seedbed preparation or haphazard seeding methods.

GRAZING

Seedlings should be protected from grazing and trampling until the plants are established (i.e., root systems are developed enough so plants will not be pulled up by grazing animals). This most often requires two growing seasons on arid lands. Many irrigated pastures are grazed safely and successfully after having been protected for one growing season. The time required to protect a seedling can have a major effect on economic feasibility.

WHAT SEED TO PLANT

4 The species to seed depends on the expected precipitation, availability of irrigation water, site exposure, elevation, temperatures, soil type and properties, the purpose of the seeding, and availability of seed.

Seeded varieties and species must be adapted to the site. Since no one species meets all of the varied conditions of the site, seeding mixtures provides better insurance against total failure. Mixtures provide a variety of micro-environments and forage quality for various species of wildlife and livestock. Mixtures extend the grazing period and generally increase production and soil protection.

It may be necessary to inoculate legumes with the proper rhizobium bacteria for successful establishment and optimum production. Legumes fix atmospheric nitrogen and make it available to companion grasses, thus increasing the protein content of the forage.

Several improved varieties of introduced and native legume, forb, shrub, and grass species have been developed during recent years. Information on many of these relatively new plant releases is included in this guide.

MANAGEMENT CONSIDERATIONS

WILDLIFE SEEDINGS

The number of wildlife species, densities, and distribution are directly related to the quality and quantity of habitat. Productive wildlife ranges (particularly those for big game) are generally productive livestock ranges. With proper planning and management, productive livestock ranges can be productive wildlife

ranges. The lack of proper planning diminishes wildlife values. Productivity of a range improvement project for livestock is generally not jeopardized but enhanced when wildlife considerations are incorporated into the project.

Productive wildlife habitat offers diverse spaces, cover, food, and water. As diversity of a plant community increases, so does the diversity and health of the animal community.

No two wildlife species are affected by habitat changes in the same way or to the same degree. It is not possible to enhance habitat for all species. Within a given area identify key wildlife species and design and implement projects to meet the needs of these key species. Projects must be based on information about the habitat required by each wildlife species. Avoid factors that limit wildlife habitat, food, cover, movement, space or water.

Grasses, legumes, forbs, and shrubs are important in most improvement projects. Sites should be managed or seeded to provide an adapted composition of plants that provide for wildlife and livestock needs. Number of species in a seeding or planting mixture will vary with site potential. Sites should not be seeded with only one or two species or one plant type (grass, forb, or shrub). For maximum wildlife value a single species should not make up more than 35 percent (seeds per pound, number of transplants) of the mixture. Seedlings that consist of limited species or one plant type generally provide less productive wildlife and livestock ranges than mixtures. Wildlife and livestock values are compromised when improvement projects consist of few plant species and only one plant type.

Multi-species improvement projects benefit wildlife by providing: a) vertical and horizontal plant diversity, b) increased forage production, c) improved nutritional variety and quality, e) improved and increased cover, f) increased and improved edge or mosaic effect, and g) increased diversity of the animal communities.

Multi-species mixtures better insure the seeding is of adapted species capable of growing on diverse microsites. Ground cover and soil stabilization is usually better when multi-species mixtures are established. Multi-species

area or species can be planted that produce more herbage per acre. For example, both Kentucky bluegrass and intermediate wheatgrass grow well at mid elevations in the state. However, intermediate wheatgrass may produce several times as much forage as bluegrass because of different genetic potentials within the two species. Many new varieties have high production potentials, if they are matched to the proper sites.

2. Alter the season when forage is available.

Not all seeded species begin growth and mature at the same time. Crested wheatgrass begins new growth in late fall, depending on precipitation and temperature patterns, and again in early spring. It then matures quickly and cures by early summer. Intermediate wheatgrass starts to grow later in the spring and remains green through mid to late summer. Planting pastures with appropriate species can extend the time that feed is available.

3. Establish more grazing-tolerant species.

Native grass species in the Intermountain Region have not evolved with intense herbivore use. Consequently, many native grass species in Utah have only a low to moderate tolerance to grazing. Other species such as crested wheatgrass, Russian wildrye and certain other exotic species have built-in tolerances for utilization exceeding most native grasses.

4. Change the forage to fit specific types of animals.

Various improvement practices can remove unsuitable species; species better suited to that operation can then be seeded. For example, various low palatability shrubs are often eradicated and replaced with good forage grasses. Some pasture grasses preferred by cattle are not suited to sheep. The land manager must match the species planted to the animals using the area, which requires seeding a variety of species.

5. Alter animal distribution patterns.

Seeding in strategically placed areas can help improve animal distribution. Animals move throughout the seeding, and graze their way to and from the seeding, thus more fully utilizing an area.

6. Improve nutritional aspects of the forage.

Seeding species that maintain high nutritional value may help balance the nutritional needs of the animals. Grass/legume/shrub mixtures, for example, often provide a more balanced animal diet than either grass, shrubs or alfalfa alone. A mixed seeding often produces more forage per acre. Species tolerant of grazing will often predominate in mixed seedings due to selective grazing or competition among species. Range for livestock and wildlife grazing should include species that tolerate grazing.

SOIL STABILIZATION SEEDINGS

Exposed soil can erode and increase water runoff, which reduces the quality of surface water and aesthetic values. Exposed soil is usually a result of human disturbance, i.e., activities, grazing, construction, mining, and agriculture. Seeding is often considered when the costs associated with exposed soil outweigh costs of the revegetation.

Soil disturbance activities often result in subsoil exposure and/or mixes of topsoil and subsoils. Conditions on disturbed sites often create very harsh environments for plants to succeed, including low fertility, low moisture retention and extreme temperatures. Mining, road construction and related activities result in significant changes in surface water drainage, water infiltration, percolation, internal drainage, and soil productivity.

Considerations

1. Identify the cause of disturbance and confine it to as small an area as possible.

— a. Preserve as much topsoil as possible.

bottom road
— b. Treat disturbances by ripping topsoil or other treatments to facilitate water infiltration and storage.

2. — Carefully assess the effective moisture available for plants. Slope exposure, soil texture, depth, runoff and runoff water, elevation, and organic matter are a few factors that can greatly influence effective moisture. Climatic factors such as annual rainfall, its seasonal distribution, storm intensities, annual variation by years, depth and duration of snow, length of growing season should also be considered.

~~X~~ — Regrade and install structures needed to reduce erosion.

4. — Determine the appropriate site preparation and seeding methods.

5. — Prepare a good seedbed.

— a. Leave exposed topsoil in a roughened condition.

— b. Rescarify old seedbeds.

~~c. Subsoil or deep chisel if necessary to break up hard subsoil layers. Compaction is often a problem.~~

~~d. Stockpile topsoil so it can be redistributed over the site later.~~

— e. Prepare seedbed at the appropriate season.

— f. A very firm seedbed should be prepared well in advance.

6. — Check soil fertility, pH, and if the area has been mined, determine whether toxic materials such as heavy metals are present.

Not indicated?
a. Incorporate necessary and economically feasible soil amendments, including fertilizer. A balanced fertilizer containing nitrogen and phosphorus is usually the minimum application.

b. Consider a follow-up fertilizer program to maintain or promote plant

vigor. Fertilize at appropriate dates to attain initial establishment and subsequent growth.

7. — Prevent invasion of weedy species.

~~X~~ — Transplant shrubs and trees onto erodible sites to reduce initial runoff and stabilize the site.

9. — It is often not possible to drill seed on disturbed sites. Seed can be effectively incorporated with a drag or rail chain. Do not seed on a loose or fresh seedbed. Seed on a firm seedbed at the appropriate season.

10. — Select species carefully. A mix is usually better suited to grow given the variability in soil moisture and quality associated with most sites. Consider fast-developing plants in the mix to provide quick ground cover.

11. — Use range site descriptions where possible or similar references to determine which native species are best adapted to the site. However, consider the changes in soil and related site conditions if serious disturbances have been created.

P
12. — Mulching is often necessary to conserve moisture, minimize erosion during establishment, and reduce temperature extremes. Clean straw crimped into the soil with a disk-mulcher is often the most cost-effective method of mulching. Avoid straw containing weed seeds or unwanted crop seed. Straw or netting can be used on steep slopes to maintain soil stability.

P
13. — Revegetation treatments should be designed to control erosion that occurs the first year.

Specific Situations

1. Road construction:
a. Water runoff from road surfaces can cause extensive damage. Consequently roads must be properly designed, constructed, and drained.

b. Plant selection can influence: 1) place and size of snow drifts, 2) wild-

life populations, 3) physical hazards, e.g. large trees, 4) aesthetics, 5) visibility of litter, and 6) lack of visibility or road hazards and visibility at intersections.

2. Other construction sites:

a. Construction sites are often unused for extended periods of time and can benefit from temporary and permanent seedings. Housing developments should consider permanent seedings of low cover to control weeds. An attractive site will improve sales.

6
? 3. Mining sites and spoils:

a. Soil analysis is essential because each situation is unique. Variations in textures, pH, heavy metals, or other toxic materials affect treatment.

b. Soil amendments such as mulches may be necessary.

NOTE: Consult other publications for more information on the relationship between mine sites and revegetation. These considerations are beyond the scope of this publication.

4. Grass waterways:

~~a. Consider construction in spring after the runoff period. After completion, check soil moisture to determine if seeding can be completed in spring. If so, plants have a complete growing season for establishment prior to the next runoff period.~~

b. In limited situations only, consider planting a spring grain with grass in the fall. The rapidly growing grain plants can reduce erosion the first runoff period. Because annual grains are very competitive with new grass seedlings, plant grain at only light to moderate rates.

5. Streambank stabilization and riparian development:

NOTE: These complex situations can only be dealt with in a general way in this guide. Sites should be inventoried initially and restoration measures

planned from the onset. Consult experts and specific current research and publications. Also see riparian seedings (page 12) and wetland section (pages 43 and 44).

a. Inventory the area carefully and completely. Often the desirable plants are already present and can be improved by proper management.

b. Determine a satisfactory time frame for stabilization.

(1) Implement the necessary management practices. (This may require fences, water development, and other practices).

(2) Employ management practices to improve the area for 50-70% of the time scheduled for improvement, e.g., if improvements are to take 10 years, employ management practices for the first 6 years.

(3) Reinventory the area. Determine which regions can benefit from using plant materials. Implement this plan and continue to improve management.

(4) If possible, implement structural practices in the last 10-20% of time scheduled for improvement and use them on the critical spots that remain. Sites that need structural improvement are the most critical sites and cannot be allowed to persist. These sites are easily identified and should be treated early.

WILDFIRE SEEDINGS

Not all sites burned by wildfires require artificial seeding. Many sites, particularly forested communities, recover satisfactorily. Fires actually benefit many forest and shrublands and burning can improve forage or habitat conditions. Generally sites that support a desirable composition of species can recover from a fire. Most forested and mountain communities support sprouting shrubs that regrow after a fire. Seeding is most often required to improve areas that lack a desirable combination of plants. These sites may be invaded by weedy species or support non-sprouting species that are extremely slow to

SEMI-DESERT ECOSYSTEMS

8L

Table 1. Wyoming Big Sagebrush-Grass (8 to 12 inches average annual precipitation (AAP)).

Species	LBS. PLS/ACRE									
	Moderately deep to deep, loamy, soils						Clayey soils		Shallow, sandy and/or very gravelly soils	
	S ¹	A ¹	B	C	D	E	S ¹	A ²	S ¹	A ²
Crested wheatgrass	6	4		2	4		6	4	6	4
Russian wildrye	7			2		5	7			
Thickspike wheatgrass		3						3		3
Bluebunch wheatgrass				2	2	2				
Indian Ricegrass			3	2						
Needle and threadgrass			5							
Lewis Flax	1	1	1	1	1	1	1	1		

Substitute species (see Appendix B for recommended seeding rates):

- a. Grasses: Green needlegrass, indian ricegrass, bottlebrush squirreltail, galleta grass.
- b. Forbs and Legumes: Palmer penstemon, globe amaranth, Lewis flax, small burnet.
- c. Shrubs: ~~Forage kochia~~, ~~wingrubs~~, ~~fourwing saltbush~~, black sagebrush, Wyoming big sagebrush, rubber rabbitbrush, ~~shadscale~~, four wing saltbush.

¹This is the seeding rate for a single grass species planted with legumes and forbs. Plant the same total amount if the grass is planted with legumes, forbs, or shrubs from the list of substitute species (e.g. if the recommended table rate is 8 lbs/acre of a grass, plus 1 lb/acre of a legume; if 1 lb/ac of a substitute species is selected, the total seeding rate is still 9 lbs/ac). Generally, seedings of single grass species are not recommended.

²A,B,C,...etc. Seeding rates for blends of grasses, legumes, forbs or shrubs. Use the same total seeding rate in the table if substitute species are used. (See the example footnote 1.) Always read the table from top to bottom; do not read across designations.

SEMI-DESERT ECOSYSTEM - SALT DESERT SHRUBLANDS

Table 1. Black greasewood (8 to 14 inches average annual precipitation (AAP)).

Species ¹	LBS. PLS/ACRE	
	Wet soils Shallow water table A ²	Dry soils Deep Water Table A ²
Tall wheatgrass	2	1
Crested wheatgrass	1	2
Intermediate wheatgrass	1	1
Red fescue	2	2
Russian wildrye	2	3
Strawberry clover	1	
Yellow sweetclover	3	2 ²
Fourwing saltbush	2	2
Gardner saltbush	2	2
Rubber rabbitbrush	1	
Forage kochia	2	2
Winterfat		2

Substitute species (see Appendix B for recommended seeding rates):

- a. Grasses: Alkali sacaton, Western wheatgrass, creeping wildrye, Basin wildrye, Reed canarygrass.
 c. Shrubs: Big sagebrush

Table 2. Blackbrush (8 to 14 inches AAP).

Species ¹	LBS. PLS/ACRE
	All Soils A ²
Pubescent wheatgrass	2
Intermediate wheatgrass	2
Crested wheatgrass	1
Sand dropseed	1
Alfalfa	2
Small burnet	2
Gooseberryleaf globemallow	1
Fourwing saltbush	3
Winterfat	3

Substitute species (See Appendix B for recommended seeding rates):

- a. Grasses: Alkali sacaton, Western wheatgrass, bottlebrush squireltail, Russian wildrye, spike dropseed.
 b. Forbs: Lewis flax, Nevada showy goldeneye, Palmer penstemon.
 c. Shrubs: Antelope bitterbrush, desert bitterbrush, cliffrose, desert peach, Utah serviceberry.

¹All species are adapted; economic considerations may require some choices between species.

²A is the seeding rates for blends of grasses, legumes, forbs or shrubs. Always read the table from top to bottom; do not read across designations.

SEMI-DESERT ECOSYSTEM - SALT DESERT SHRUBLANDS (Continued)

Table 3. Fourwing Saltbush/Big Sagebrush, Spiney Hopsage (8 to 12 inches average annual precipitation (AAP)).

(6-8) more selective

LBS. PLS/ACRE	
All Soils	
Species ¹	A ²
Crested wheatgrass ³	2
Russian wildrye	3
Indian ricegrass	2
Bottlebrush squirreltail	3
Gooseberryleaf globemallow	2
Lewis flax	2
Fourwing saltbush	3
Winterfat	2

Substitute species (see Appendix B for recommended seeding rates):

- a. Grasses: Sand dropseed, green needlegrass, galleta, pubescent wheatgrass, Western wheatgrass, needle and threadgrass, Salina wildrye, tall wheatgrass.
- b. Forbs and Legumes: Alfalfa, yellow sweetclover, small burnet.
- c. Shrubs: Big sagebrush, black sagebrush, low rabbitbrush, rubber rabbitbrush, forage kochia, shadscale, Gardner saltbush.

Table 4. Shadscale Saltbush/Winterfat (8 to 12 inches AAP).

(6-8)

Species ¹	LBS. PLS/ACRE	
	Clayey soils	Sandy or well drained
	A ²	A ²
Crested wheatgrass ³	2	2
Russian wildrye	2	
Basin wildrye	2	
Indian ricegrass	2	3
Sand dropseed		2
Lewis flax	2	2
Gooseberryleaf globemallow	1	1
Alfalfa	2	
Forage kochia	2	2
Winterfat	2	3
Shadscale	3	2

Substitute species (see Appendix B for recommended seeding rates):

- a. Grasses: Alkali sacaton, green needlegrass, Salina wildrye, Western wheatgrass.
- b. Forbs and Legumes: Small burnet, yellow sweetclover.
- c. Shrubs: Big sagebrush, black sagebrush, rubber rabbitbrush, fourwing saltbush, low rabbitbrush, Gardner saltbush.

¹All species are adapted; economic considerations may require some choices between species.
²A is the seeding rates for blends of grasses, legumes, forbs or shrubs. Always read the table from top to bottom; do not read across designations.
³Utilize fairway crested wheatgrass in alkali soil conditions.

ROADSIDES, CONSTRUCTION SITES, MINE SITES, AND SPOILS (Continued):

11

6-8 Shadscale

Table 6. Wyoming Big Sagebrush-Grass (8 to 12 inches average annual precipitation (AAP)).

Species	Moderately deep to deep, loamy soils			LBS. PLS/ACRE ¹ Clayey soils			Shallow, sandy and/or very gravelly soils			
	S ²	A ³	B	S ²	A ³	B	S ²	A ³	B	C
Crested wheatgrass	12	8	5	12	5	5	12	8	8	8
Russian wildrye	12		5	12	5	5				
Thickspike wheatgrass									5	5
Streambank wheatgrass		5	5		5	5		5		
Indian ricegrass									5	
Bottlebrush squirreltail		5	5		5	5		5	5	5
Lewis flax	1	1	1	1	1	1				
Palmer penstemon	1	1	1	1	1	1				

Substitute species (see Appendix B for recommended seeding rates):

- a. Grasses: Bluebunch wheatgrass. (Use on bottomland or fill disturbances only); Basin wildrye, tall wheatgrass. Sandy soils: Indian ricegrass.
- b. Shrubs: Forage kochia, winterfat, fourwing saltbush, Wyoming big sagebrush, rubber rabbitbrush.

¹Rates for broadcast seeding, followed by dragging with a light harrow or other equipment to cover seed. Target rate is about 50-100 seeds/sq. ft. with mixes. Drilling is preferred. If drilled, cut rates by 1/4 to 1/2.

²This is the seeding rate for a single grass species planted with legumes and forbs. Plant the same total amount if the grass is planted with legumes, forbs, or shrubs from the list of substitute species (e.g. if the recommended table rate is 8 lbs/acre of a grass, plus 1 lb/acre of a legume; if 1 lb/ac of a substitute species is selected, the total seeding rate is still 9 lbs/ac). Generally, seedings of single grass species are not recommended.

³A,B,C,...etc. Seeding rates for blends of grasses, legumes, forbs or shrubs. Use the same total seeding rate in the table if substitute species are used. (See the example footnote 1.) Always read the table from top to bottom; do not read across designations.



NOTE: Seeding in this ecosystem can be very difficult, precipitation is low and unpredictable.

ROADSIDES, CONSTRUCTION SITES, MINE SITES, AND SPOILS (Continued):

(12)

Table 7. Salt Desert Shrub (8 to 10 inches average annual precipitation (AAP)).

Species	LBS. PLS/ACRE ¹		
	All soils		
	A ²	B	C
Crested wheatgrass	6	8	8
Russian wildrye	8		
Thickspike wheatgrass		3	3
Streambank wheatgrass	3		
Indian ricegrass		3	
Lewis flax	1	1	1
Palmer penstemon <i>maybe</i>	1	1	1
Fourwing saltbush	2	2	2
Forage kochia	3	3	3

Substitute species (see Appendix B for recommended seeding rates):

- a. Grasses: (On bottomland or fill disturbances only: Basin wildrye, tall wheatgrass), bottlebrush squirreltail, sand dropseed, alkali sacaton, Sandberg bluegrass, galleta. Sandy soils: Indian ricegrass.
- b. Shrubs: Forage kochia, winterfat, fourwing saltbush, shadscale, rubber rabbitbrush.

hand *

¹Rates for broadcast seeding, followed by dragging with a light harrow or other equipment to cover seed. Target rate is about 50-100 seeds/sq. ft. with mixes. Drilling is preferred. If drilled, cut rates by 1/4 to 1/2.

²A,B,C,...etc. Seeding rates for blends of grasses, legumes, forbs or shrubs. Use the same total seeding rate in the table if substitute species are used. Always read the table from top to bottom; do not read across designations.

Table 8. Mohave Desert Range and Basin Range (8 to 11 inches average annual precipitation).

Species	LBS. PLS/ACRE ¹								
	Moderately deep to deep, loamy soils			Clayey soils			Shallow, sandy and/or very gravelly soils		
	S ²	A ³	B	S ²	A ³	B	S ²	A ³	B
Crested wheatgrass	12	10	10	12	8	8	12	8	5
Western wheatgrass		4			4	4		4	
Sideoats Grama		1	2		1	1		2	1
Bluegrama		1	3		2	1		1	2
Galleta		1	2		1	2		1	2
Palmer penstemon		1	1		1	1		1	1

Substitute species (see Appendix B for recommended seeding rates):

- a. Grasses: Sandy soils: Indian ricegrass
- b. Shrubs: Desert bitterbrush, winterfat, fourwing saltbush, desert peach.

¹Rates for broadcast seeding, followed by dragging with a light harrow or other equipment to cover seed. Target rate is about 50-100 seeds/sq. ft. with mixes. Drilling is preferred. If drilled, cut rates by 1/4 to 1/2.

²This is the seeding rate for a single grass species planted with legumes and forbs. Plant the same total amount if the grass is planted with legumes, forbs, or shrubs from the list of substitute species (e.g. if the recommended table rate is 8 lbs/acre of a grass, plus 1 lb/acre of a legume; if 1 lb/ac of a substitute species is selected, the total seeding rate is still 9 lbs/ac). Generally, seedings of single grass species are not recommended.

³A,B,C,...etc. Seeding rates for blends of grasses, legumes, forbs or shrubs. Use the same total seeding rate in the table if substitute species are used. (See the example footnote 1.) Always read the table from top to bottom; do not read across designations.

NOTE: Seeding in this ecosystem can be very difficult, precipitation is low and unpredictable.