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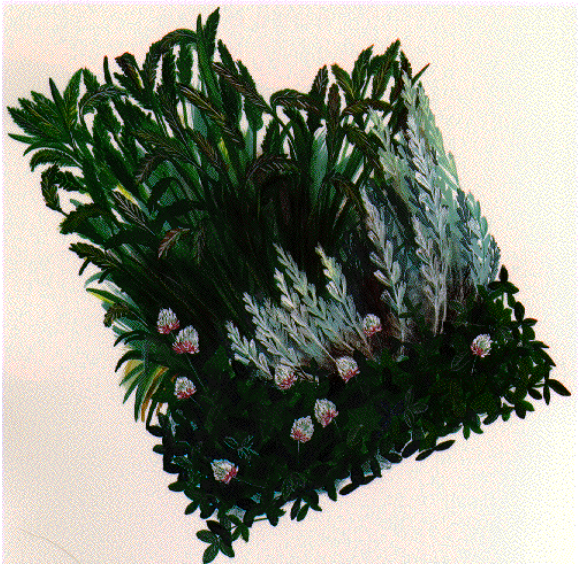

## INTERAGENCY FORAGE AND CONSERVATION

# PLANTING GUIDE FOR UTAH

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USDA Agricultural Research Service

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# Introduction

This planting guide provides a basis for developing seeding and plant recommendations in the State of Utah. The seeding mixtures shown are intended to serve as **A Guide**. Differences in climate, soil, and topography mean that no one set of recommendations applies to all conditions.

The publication was developed to help ranchers, farmers, wildlife managers, land managers, government agencies, and contractors, in seeding pastures, rangelands, wildlife habitat, mine lands, transportation and communication rights-of-way, watersheds, streambanks, construction sites, and other areas where permanent cover and erosion control is desired.

# How to Use This Guide

**STEP 1:** Read major considerations and criteria for seedings (pages 3-6). Then read about specific management considerations for type of seeding anticipated, **forage** or **erosion control** (pages 6-13).

**STEP 2:** Determine the effective precipitation zone of the site. See the Mean Annual Precipitation Map, page 15. You must be familiar with the proposed seeding site, e.g., elevation, plant community, slope, exposure, and soil depth.

**STEP 3**: After determining the approximate local rainfall, refer to the table sections concerning the particular type of seeding, **forage**, or **erosion control**. Alternative seeding mixtures are generally given for each use within a precipitation zone and a given plant community. Mixtures for forage plantings are designated A, B,...F. The entries designated by S may be used in a pure stand or with legumes, forbs or shrubs listed in the table. Always read the table from top to bottom; do not read across designations.

**STEP 4:** Check the descriptions of species in Appendix A, for **grasses**, **legumes** and **broadleaf forbs** and **woody plants**. Learn the unique characteristics and specific varieties and hybrids necessary to tailor a seeding to a particular site.

**STEP 5:** You may also substitute species from those listed below the tables. If this is done, consult Appendix B for suggested seeding rates.

# Major Considerations and Criteria for Seedings

It can be difficult to establish a forage stand on rangelands, wildlands, dryland pasture, irrigated pasture or other situations. It requires patience, time, and expense. Before a seeding operation is undertaken, consider the economic feasibility of the project. Correctly applying good management practices to the existing plant community may be more economical than seeding the site to new or improved forage species. Many watershed, range and wildlife sites are so degraded that regulating animal use may not be beneficial, and complete removal and extended rest may be required. Weeds frequently regulate plant recovery, and they have to be removed to facilitate artificial or natural recovery. Use of rotational and controlled grazing, water development, better salting methods, and drift fences to better distribute the stock are often essential improvements. Control of turn-on-time, season of grazing, chemical and mechanical control of undesirable species, the application of suitable fertilizers, and cultural treatments should be considered. Seeding can be an excellent tool for range and pasture improvement. Wildland improvement projects for wildlife generally result in highly productive livestock ranges. Diversification of plant species often increases benefits to each foraging class, and provides advantages not obtained in single species plantings.

Before beginning a seeding operation, you should answer the following two basic questions, and take the appropriate actions.

1. What is the main goal or purpose of the planting?
    a. Enhancement of forage production.
    b. Provide an earlier or a longer grazing season.
    c. Erosion control and soil stabilization.
    d. Reduce or control weeds.
    e. Enhancement and improvement of wildlife habitat.

2. Is seeding practical?

    a. Will the site support the desired species?
    b. Do undesirable plants dominate or have potential to dominate the site?
    c. Can the proposed treatments be conducted?

A successful seeding is based on certain fundamental principles, but the variability of soil and site conditions on range wildlands, and irrigated pastures mean that it is not possible to provide one set of guidelines. Remember that soil, elevation, site exposure, and climate are extremely variable and in many cases, make seedling establishment very difficult. Many sites cannot be treated with current techniques. However, seedling establishment is more likely to be successful if adapted species are properly seeded at the proper time.

An effort has been made to recommend species, regardless of origin, that are best adapted to the site and projected use. It is not in the best interest of range improvement to demand that species in a seeding mix be all native or all introduced. A mixture of native and introduced species may sometimes be the most suitable. However, remember that most introduced species evolved under heavy grazing pressure and are usually better adapted to grazing than natives. Native species add stability and diversity. These species also can persist in the plant community.

# Seed Quality

## Analysis Label

Accept only seed with a complete analysis label on the container and a reasonably current germination test conducted by an accredited laboratory. In Utah, seed cannot be legally sold without an analysis label. Analysis information and net weight may be written on either the bag, an attached tag, or both. The bag should show at least the lot number.

1. **Variety and kind**: Kind is the species or crop. The variety need not be stated, but if the seed is supposed to be a certain variety, it should list the variety on the label.

2. **Purity**: Purity + inert matter + weed seed + other crop seed percentages must add up to 100%. Most grass seed should contain no more than 10 to 15% inert matter or it will be difficult to plant. Even if the percentage of inert matter is low, seed should not contain pieces of stem or unthreshed clusters, which will block passage through a drill. The acceptable purity and inert matter of shrubs and forbs will vary by species; for additional information contact the State Seed Laboratory, 350 North Redwood Road, SLC, UT 84116. Phone: 801-538-7181.

3. **Weed seed**: The analysis should indicate that NO noxious weed seeds are present. The name and number of seeds per pound of any restricted weeds must be listed on the label (not to exceed 27 such seeds per pound). According to the Utah Seed Law, weed seed cannot total more than 0.5% by weight (except grass seed containing weedy ***Bromus*** species, which may not exceed 3.0%).

4. **Germination**: Total germination may include the sum of all seeds germinated plus hard seed and dormant seed. Dormant seed is viable but requires time or a physiological stimulus to induce germination. Hard seed is alive but has a thick seed coat that must be scarified, either mechanically, by frosting action, or by organisms in the soil, before it will germinate.

The higher the total germination, the better; germination of grass species should not be lower than 60%, while desirable germination percentages of shrubs and forbs vary widely according to species.

Total germination may be given as a percent followed by (TZ), which means that a staining technique using tetrazolium chloride was used to evaluate the viability of the seed; this technique is an acceptable substitute for the actual germination test.

Germination test date: Make sure the germination test is not out of date. Grasses and broadleaf forbs which include alfalfa must be updated every 18 months. All flowers, trees, and shrubs must be updated every 9 months. Certain species must be stored properly to retain viability, and must be tested more frequently to assure that there has been no reduction in seed quality.

5. **For alfalfa and red clover seed**, the state of origin must be listed on the tag. For tree and shrub seed, the origin (state) and elevation (when possible) of the collection site must be listed on the label.

6. **Pure live seed (PLS)**: Many species are sold on a PLS basis, with price adjusted accordingly. PLS = % purity X % total germination.

How to use PLS: If your plan calls for so many pounds of PLS per acre, how much bulk seed is needed? To calculate this amount, divide the PLS percentage into the number of pounds recommended. Example: You want to plant 5 PLS lbs of intermediate wheatgrass per acre. The analysis label indicated 85% pure seed and 79% total germination; 0.85 X 0.79 = 0.67 PLS. Divide 0.67 into 5 lbs/acre = 7.5 lbs of bulk seed/acre needed to plant 5 PLS lbs/acre. Note that you will plant a proportionally extra amount of any contaminants (such as weed seed) per acre to attain the desired PLS lbs/acre.

7. **Look at the seed before planting**. If the seed doesn't appear to match what is written on the label, send a representative sample to a seed laboratory. You may call a District Agricultural Inspector to help sample and evaluate the seed.

### Certification Tags

Seed is NOT certified unless there is a tag attached to the bag that clearly states CERTIFIED SEED (blue tag), REGISTERED SEED (purple tag) or FOUNDATION SEED (white tag). Don't be misled by someone who says that the seed "came from a certified field," "we don't have the tags yet," or "it's just as good as certified." Bags of certified 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) 797-2082.

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 labeled 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 labeled 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.

## 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 excess 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.

### 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.

### Seeding Depth

Proper seed placement is essential in successful seedings. Depth of seeding varies with seed size. Generally 1/4 to ½ 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

Seedings 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 seeding can have a major effect on economic feasibility.

### What Seed to Plant

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. Seedings 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, d) improved and increased cover, e) increased and improved edge or mosaic effect, and f) increased diversity of the animal communities.

Multi-species mixtures better insure the seeding is of adapted species capable of growing on diverse micro sites. Ground cover and soil stabilization is usually better when multi-species mixtures are established. Multi-species seedings can be more aesthetically pleasing, and can result in less plant disease and insect problems.

Seedings on deer and elk winter, fall, and spring ranges should include a number of species; early, intermediate, and later-greening grasses, succulent forbs including semi-evergreen species, and palatable fast growing shrubs. In shrub communities total or near total shrub eradication is not recommended. Allow for sufficient quality browse and for thermal, security, and travel cover.

There is considerable variation in the maximum size of openings in pinyon-juniper, and mountain-brush chainings and burns, depending on type of topography, aspect, plant communities, adjacent tree communities, shape of opening and location of roads and other disturbance sites. An opening can be larger if edges are irregularly shaped, thus maximizing the edge effect and ensuring that there is no more than 500 feet between edges at any one point in the opening. Patches or islands of cover within openings are sometimes desirable. Special attention should be given to the visual impact of creating open areas. A properly designed brush control project can enhance the visual quality of an area.

Big game depredation problems on agricultural lands can be reduced or eliminated by providing game animals cover and an alternate source of forage. If wildlands adjacent to farm

lands provide sufficient succulent and highly preferred plants along with security and thermal cover, big game can be diverted from agricultural fields. Including travel lanes and escape cover adjacent to agricultural fields improve big game access to fields, and should be eliminated.

Antelope require certain types of forage. Shrubs provide cover for young kids. However, high shrub density can be detrimental because they compete with much needed forbs and grasses. Shrubs over 2 feet high impede animal mobility and provide cover for predators. Kids and mature animals utilize forbs and improvement projects should consider the needs of both.

Monotypic shrublands and grasslands generally provide poor antelope habitat. Antelope make only slight use of pure grass stands, but make considerable use of grass stands that include alfalfa and other forbs.

Sagebrush control on sage grouse areas should incorporate sage grouse habitat requirements. Sagebrush, the dominant species on all sage grouse ranges, provides forage and cover. Sagebrush control or other range enhancement techniques require special planning on sage grouse wintering areas within 2 miles of a lek, on areas with limited nesting or brooding habitat, or during periods of nesting and brood rearing. Do not control sagebrush when live sagebrush canopy cover provides less than 20 percent ground cover on shallow soils or when sagebrush is less than 12 inches high. Avoid sagebrush control within 300 feet of meadows, herblands, and streams. A detailed plan should be developed to address the specific limiting factors of the habitat.

Anchor chaining is a preferred method of reducing sagebrush on sage grouse ranges. Chaining can be used to: a) thin sagebrush stands, b) create edge and mosaic openings, c) encourage forbs, grass, and meadow communities by removing competing shrubs, and d) prepare seedbeds and cover broadcast seed. Strip chaining or light disk chaining that follows terrain features can be beneficial. Treated strips should be no wider than 300 feet nor be larger than the non-treated areas. Use herbicides sparingly, and apply them carefully. Plowing of sagebrush is very destructive to sage grouse habitat and is not recommended.

Prescribed burns benefit sage grouse. Burn in a mosaic pattern early in the spring before forbs and grasses emerge or in the fall after grasses and forbs have dried. Diversity of habitat, (food and cover) should be the goal of any improvement project for sage grouse.

## Livestock Seedings

Seeding is a very important method of range improvement, which is done primarily to revegetate depleted areas or to improve the quality and increase the volume and variety of forage species.

The following approaches are used to improve animal performance:

**1. Increase total available forage.**

Seeding appropriate species can increase the general condition of the 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.
   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, runon 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.
3. 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.
   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.
8. 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.
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.
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) wildlife 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.
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 and wetland section.

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 reestablish by natural seeding. Seeding is most often required throughout the pinyon-juniper and big sagebrush sites that lack a suitable herbaceous understory.

Most aspen and conifer forests are able to recover following low or moderate intensity fires. Heavily grazed areas that lack a suitable understory or areas of serious runoff and erosion are often seeded. Seed highly erodible sites to rapidly developing herbs, including native species that naturally reappear after a disturbance. Steep slopes and rough areas that are not accessible to conventional ground equipment can be aerial seeded. Cover seed by chaining or harrowing. If it is not possible to cover seed, plant late in the fall and increase the seeding rate. Carefully seed firelines and other disturbances prone to erosion to ensure a protective cover.

Burned sites, including forest and desert ranges, are often broadcast seeded within a few days or weeks following a fire, in the mistaken belief that the ash will cover the seed. The little ash that usually remains after a wildfire is not uniformly distributed and does not cover seed well. Some inaccessible slopes are also seeded shortly after a burn so soil settling and compaction will help cover seed. This has been somewhat successful principally at high elevations. However, even if an ash residue or a loose seedbed is present, seed only during the appropriate seasons. Do not plant on a loose dry seedbed. Where it is possible use drills or other methods of seeding; plant in the late fall when seedbeds are firm.

Burned areas in the pinyon-juniper and big sagebrush vegetative types often create favorable conditions for seeding. If these sites are properly treated to adequately control weeds a favorable seedbed is usually created. Many wildfires occur on areas containing downy brome and other annual weeds. Fires usually occur from early to mid-summer after downy brome plants have matured. All seeds are not usually consumed, letting downy brome reestablish itself and spread. Downy brome plants can attain nearly complete dominance on burned sites within a year or two.

Downy brome must be controlled after a wildfire because remaining seeds may germinate in the fall or spring depending upon available moisture. Some seeds germinate after summer rains or fall storms and others overwinter and germinate in the early spring. Fall germinated seedlings are able to overwinter and begin growth immediately in the spring. These established plants are extremely competitive to perennial seedlings that germinate in the spring, and must be eliminated or controlled. Downy brome seeds that germinate in the spring are less likely to compete with planted seedlings, but can be detrimental.

Some herbs develop rapidly and are able to compete with established downy brome; but most perennials cannot. Downy brome can be removed with a disk, spring tooth harrow, spraying with a contact herbicide such as glyphosate, or by sculpting narrow strips with interseeders or deep furrow drills.

Establishment of drilled seedings is greatly enhanced by proper seed placement and a firm seedbed free of excessive competition. Drills should accurately place seeds and firm the soil after seed placement, e.g., packing wheels or rollers.

Seed downy brome-infested sites with desirable species the year of the burn. If this is not possible infested sites can be reburned with controlled fires. Burn when plants are dry but before seeds fall so they are more likely to be destroyed by the fire. Disking can control germinated seedlings, but be sure to turn the soil deep enough to bury ungerminated seeds and prevent their establishment. However, it is particularly risky to seriously disturb the soil on dry planting sites, unless the site remains fallow for a year to reestablish the subsurface soil moisture and firmness

critical for seedling establishment.

Burned-over downy brome areas with good soils and moderate topography have been successfully seeded with minimum-till drills in the late fall-early winter after slight tillage (i.e., spring tooth harrow, rolling mulcher). Seedings are more likely to be successful when intense summer fires destroy large amounts of existing downy brome. Heavy fall rains encourage the germination of remaining viable seed, and minor cultivation will expose roots of newly germinated downy brome to drought and frost desiccation. A late fall seeding will likely result the following spring with establishment of perennials in greatly reduced downy brome competition.

It is difficult to drill seed some large (thousands of acres) burns. Aerial seeding followed by pipe harrowing or anchor chaining are effective under these circumstances. Chaining and pipe harrowing will uproot and kill some fall-germinated downy brome seedlings, but are less effective control measures than disking or spring tooth harrowing.

A relatively new implement known as a “disk-chain” effectively disks and seeds in one operation. The unit is 30 feet wide and is drawn with a bulldozer. In one operation, this implement disks and removes weeds that establish following wildfires. It also firms up the seedbed and can plant a variety of seeds in one operation.

## Riparian and Wetland Seedings

Riparian areas are found along streams and rivers or around edges of lakes and ponds where extra ground water is available for plant growth. They are found throughout the state. Although they generally make up only 1 to 4 percent of an area, they often influence how the remaining area is managed.

Riparian areas attract people and many animal and bird species. They are natural congregation areas and often suffer much abuse from overgrazing and trampling. Many riparian zones need improved management and reestablishment of plant communities suitable for foraging, cover, and watershed protection.

### Areas with Fluctuating Water Tables

These areas include meadows or areas some distance from main water courses with seasonally high water tables and where surface soils dry out during the growing season.

Species best suited to these settings are very similar to those used at mid to upper elevation. Timothy and creeping foxtail, can normally withstand the temporary saturated soil and endure the somewhat droughty late summer season. Many desirable native carex and broadleaf herbs naturally occur in these sites and should be planted; there may be limited amount of seed available, however.

Because riparian areas serve several important functions, planted species should serve as forage and watershed protectors. Most plant species in the mix should be rhizomatous to protect the soil surface and to filter sediments from overland waters. They also create habitat for wild animals, birds, and fish. Seedings normally consist of mixed varieties and should be drilled, rather than broadcast, where possible. However broadcast seeding can often be very successful as crusts often form on these heavy soils when worked; broadcast seeding and light coverage reduce this possibility. If the area tends to be flooded during the spring, plant immediately after the high water recedes and the area can be worked. Carefully managed seedings can be a valuable forage resource for domestic animals.

### Permanently Wet Areas

These areas include lowland meadows or areas near water where soils in the plant root zone are always wet. Species for these settings must either require or tolerate supersaturated soils, and have strong, deep roots able to withstand buffeting by water. The ability to withstand these conditions is generally more important than forage value.

Wetter areas often recover adequately without artificial seeding, by implementing proper management practices. Native species that are scattered and not vigorous may be able to reseed themselves or spread through vegetative reproduction. If no native species are present, they should be reestablished, either by seeding or a planting of new starts (plugs).

The most common native species in these settings include: water, beaked, Nebraska, and wooly sedges; and baltic rush and bluejoint reedgrasses. Except for the exotic species, reed canarygrass (which often becomes dominant), few species have been developed for these areas. Until new varieties become available, managers will have to rely on seeds of native species collected from similar areas.

It is usually necessary to reestablish shrubs and trees. Rooted cuttings or transplants of willow, cottonwood, alder, birch, Woods rose, dogwood, and aspen have been successfully established in riparian disturbances. There is much to learn about this process, but experience has shown the following:

1. Rooted cuttings or nursery-grown stock is much more successful than planting cuttings. Plant transplants in moist areas, not rocky sites that dry quickly.
2. Do not place transplants or rooted cuttings into sodded areas unless competing plants are controlled. These plants do not compete well with other species.
3. Use transplants or rooted cuttings from species adapted to the local site or from developed species with wide ranges of adaptability.
4. Climatize transplants or rooted cuttings to sun and wind before planting.

## Forested Areas

Forested areas that receive at least 20 inches of precipitation annually and at elevations above 4,500 feet are found throughout much of the state. Moisture does not limit the establishment of forage seeded as much as other areas, and is less important than factors such as frost-free days or competition from tree species. Many species of grasses, forbs, and shrubs are adapted to these generally favorable environmental settings and may produce more than one-half ton of usable dry-weight forage per acre. The characteristics of these sites usually favor seeding with several species. However, most of these sites do not require seeding.

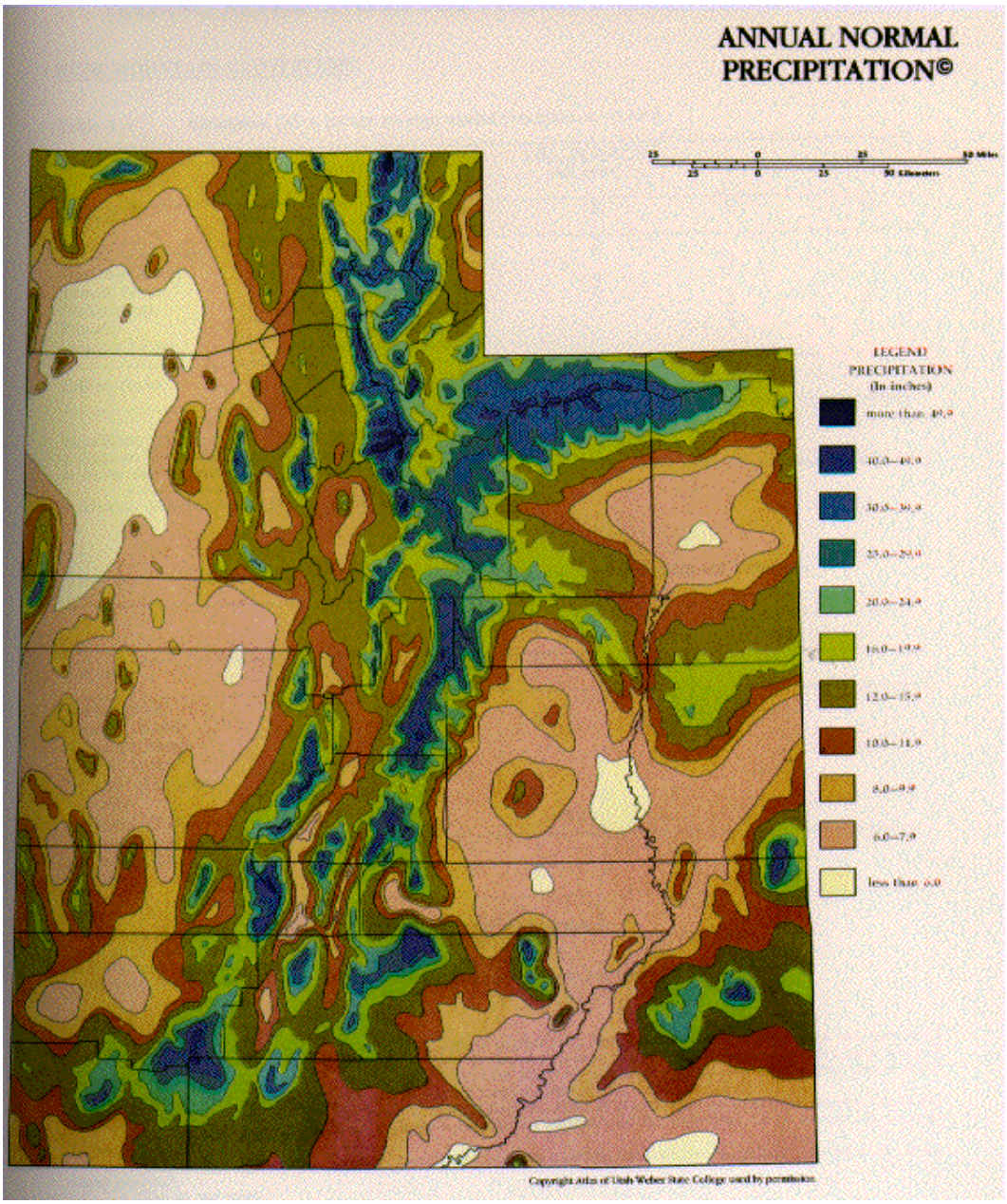
Areas where trees have been burned or harvested are generally suited to broadcast seeding, which is considerably less expensive than drilling. In some of the more productive timber sites, seedings prevent erosion until an overstory of trees is created, and forage production may be a secondary consideration. Grazing must be restricted when trees are young to reduce potential trampling and browsing damage.

On sites used for commercial timber production seed with grasses and forbs that are least competitive with tree growth. Tree seedlings must be planted before or during planting of the forage species, to reduce the chance that they will acquire competitive advantage over the trees.

In settings where the value of forage may equal or outweigh the value of commercial timber, it may be advantageous to plant more competitive species, such as smooth brome or other rhizomatous species. These species also are more tolerant of grazing and will probably provide a

longer period of grazing before trees dominate the site.

On areas where trees are widely dispersed, e.g., ponderosa pine, understory forage species may persist indefinitely with proper grazing management. Occasionally, appropriate forage species may be broadcast to increase production for wildlife or livestock. Remember that forested areas have many values, and the value of forage resources must be balanced with other values associated with an area.




## SEEDING ALTERNATIVES FOR FORAGE PRODUCTION IN UTAH

**Table 1. Subalpine** (35 + inches average annual precipitation (AAP)).

| | LBS. PLS/ACRE (All Soils) | | | | |
|---|---|---|---|---|---|
| Species | S[1] | A[2] | B | C | D |
| Slender wheatgrass | | 2 | 2 | | |
| Mountain brome | 8 | 4 | | 4 | |
| Smooth brome[3] | | | 3 | | |
| Orchardgrass | | 2 | 2 | 2 | 2 |
| Timothy | | | | 2 | |
| Meadow brome | 7 | | | | 4 |
| Ladino clover | 1 | 1 | 1 | 1 | 1 |

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

a. **Grasses:** Letterman needlegrass, Canada bluegrass, tall oatgrass, blue wildrye.
b. **Forbs and Legumes:** Alfalfa, mountain lupine, sweetanise, Wasatch and Rocky mountain penstemon, cow parsnip, porter ligusticum.
c. **Shrubs**: Mountain big sagebrush, mountain low brush, rubber rabbitbrush.

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[1]This 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.

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

[3]Smooth brome is a very dominant species, and must be carefully used where competition may adversely affect forest plantings.

[4] Use in wet areas.

**Table 2. Mixed Conifer** (30 + inches AAP). (Ponderosa Pine ecosystem not included.)

| | LBS.PLS/ACRE (All soils) | | | | | | |
|---|---|---|---|---|---|---|---|
| Species | S[1] | A[2] | B | C | D | E | F |
| Orchardgrass | | | | | | 2 | 2 |
| Meadow brome | 7 | | | 4 | | | 5 |
| Mountain brome | 8 | 4 | 4 | | | | |
| Smooth brome[3] | | | | | 5 | 4 | |
| Slender wheatgrass | | | 2 | | | | |
| Timothy | | 2 | | 2 | 2 | 2 | |
| Creeping foxtail[4] | 4 | | | | | | |
| Ladino clover | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Alfalfa | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

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

a. **Grasses**: Reed canarygrass, Canada bluegrass, blue wildrye.
b. **Forbs and Legumes:** Sweetanise, Rocky mountain penstemon.
c. **Shrubs:** Woods rose, red elderberry, snowberry, golden currant, shiny leaf ceanothus.

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[1]This 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.

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

[3]Smooth brome is a very dominant species, and must be carefully used where competition may adversely affect forest plantings.

[4] Use in wet areas.

**Table 3. Aspen Conifer and Maple** (25 to 30 inches AAP).

| | LBS. PLS/ACRE | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | | | Shallow, sandy and/or very gravelly soils | |
| Species | S[1] | A[2] | B | C | D | E | S[1] | A[2] |
| Meadow brome | 7 | | | | 4 | 3 | | |
| Orchardgrass | 4 | 2 | 2 | | 2 | 2 | | |
| Smooth brome[3] | | 4 | 3 | 4 | | | 6 | |
| Slender wheatgrass | | | | | | | | 2 |
| Creeping foxtail[4] | 4 | | | 2 | | | | |
| Timothy | | | 2 | | | 2 | | |
| Intermediate wheatgrass | | | | | | | 8 | 6 |
| Alfalfa | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cicer milkvetch | 1 | 1 | 1 | 1 | 1 | 1 | | |

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

a. **Grasses**: Tall oatgrass, Canada bluegrass, mountain bromegrass, Reed canarygrass, blue wildrye.
b. **Forbs and Legumes:** Sweetanise, showy goldeneye, crownvetch, Rocky Mountain penstemon.
c. **Shrubs:** Mountain big sagebrush, red elderberry, snowberry, maple, Woods rose.

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[1]This 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.

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

[3]Smooth brome is a very dominant species, and must be carefully used where competition may adversely affect forest plantings.

[4]Use in wet areas.

**Table 4. Mountain Big Sagebrush-Grass** (14 to 25 inches AAP).

| | LBS. PLS/ACRE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy, soils | | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | |
| Species | S[1] | A[2] | B | C | S[1] | A[2] | B | S[1] | A[2] |
| Orchardgrass | 4 | 2 | | 2 | 4 | 2 | 2 | | |
| Smooth brome[3] | 6 | 4 | 4 | | 6 | 4 | | | |
| Intermediate wheatgrass | | | | | | | | 8 | 6 |
| Slender wheatgrass | | | 3 | | | | | | 2 |
| Meadow brome | 7 | | | 4 | 7 | | 4 | | |
| Alfalfa | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Cicer milkvetch | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |

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

a. **Grasses:** Basin wildrye, bluebunch wheatgrass, western wheatgrass, mountain brome, sheep fescue, Idaho fescue, green needlegrass.
b. **Forbs and Legumes:** Rocky Mountain and Wasatch penstemon, blueleaf aster, yellow sweetclover, sainfoin, showy goldeneye, Lewis flax, small burnet, arrowleaf balsamroot.
c. **Shrubs:** Blue elderberry, chokecherry, bitterbrush, serviceberry, mountain big sagebrush, Woodsrose, rubber rabbitbrush.

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[1]This 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.

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

[3]Smooth brome is a very dominant species, and must be carefully used where competition may adversely affect forest plantings.

[4]Use in wet areas.

**Table 1. Mountain Brush** (Gambel Oak, Maple, etc.) (16 to 22 inches average annual precipitation (AAP)).

| | LBS. PLS/ACRE | | | | | |
|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soil | | | | Shallow, sandy and/or very gravelly soils | |
| Species | S[1] | A[2] | B | C | S[1] | A[2] |
| Meadow brome | 7 | | | 3 | | |
| Western wheatgrass | | | | | | 3 |
| Bluebunch wheatgrass | | | | | | 5 |
| Intermediate wheatgrass | 8 | 4 | | 5 | 8 | |
| Dryland orchardgrass | 4 | | 2 | | | |
| Smooth brome | 6 | 3 | 4 | | 6 | |
| Alfalfa[3] | 2 | 2 | 2 | 2 | | |
| Cicer milkvetch[3] | 1 | 1 | 1 | 1 | | |
| Sainfoin[3] | 2 | 2 | 2 | 2 | | |

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

a. **Grasses:** Basin wildrye, green needlegrass, tall wheatgrass, Idaho or sheep fescue, mountain brome, timothy, Russian wildrye, Altai wildrye, slender wheatgrass, fairway-type crested wheatgrass.
b. **Forbs and Legumes:** Yellow sweetclover, Wasatch and Rocky Mountain penstemon, arrowleaf balsamroot, sweetvetch, Lewis flax, sainfoin.
c. **Shrubs:** Mountain big sagebrush, serviceberry, bitterbrush, green ephedra, true mountain mahogany, cliffrose, curlleaf mountain mahogony, rubber rabbitbrush.

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[1]This 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.

[2]A,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 example footnote 1.) Always read the table from top to bottom; do not read across designations.

[3]Choose one or two.

**Table 2. Mountain and Big Sagebrush-Grass** (14 to 16 inches AAP).

| | LBS./PLS/ACRE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soil | | | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | |
| Species | S[1] | A[2] | B | C | D | S[1] | A[2] | B | S[1] | A[2] |
| Bluebunch wheatgrass | | 5 | | | 3 | | | | | 5 |
| Intermediate wheatgrass | 8 | | | 4 | | 8 | | 4 | 8 | |
| Dryland orchardgrass | 4 | | 2 | | | | 2 | | | |
| Smooth brome | 6 | | 4 | 3 | | 6 | 4 | 3 | | |
| Western wheatgrass | | 2 | | | | | | | | 3 |
| Russian wildrye | 7 | | | | 5 | 6 | | | | |
| Alfalfa[3] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Sainfoin[3] | 2 | 2 | 2 | 2 | 2 | | | | | |
| Cicer milkvetch[3] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |

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

a. **Grasses:** Basin wildrye, green needlegrass, tall wheatgrass, western wheatgrass, sheep fescue, Altai wildrye, Sherman big bluegrass, needle and thread grass.
b. **Forbs and Legumes:** Yellow sweetclover, small burnet, Rocky Mountain and Palmer penstemon, Lewis flax, sainfoin, sweetvetch.
c. **Shrubs:** Mountain big sagebrush, bitterbrush, cliffrose, green ephedra, fourwing saltbush, winterfat, forage kochia, black sagebrush, rubber rabbitbrush.

[1]This 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.

[2]A,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 example footnote 1.) Always read the table from top to bottom; do not read across designations.

[3]Choose one or two.

**Table 1. Pinyon-Juniper** (14 + inches average annual precipitation (AAP)).

| | LBS. PLS/ACRE | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy, soils | | | | | | Clayey soils | | | | Shallow, sandy and/or very gravelly soils | | | |
| Species | S[1] | A[2] | B | C | D | E | S[1] | A[2] | B | C | S[1] | A[2] | B | C |
| Smooth brome | 6 | 4 | | | 3 | | 6 | 3 | | | | | | |
| Dryland orchardgrass | 4 | 2 | 2 | | | | | | | 2 | | | | 2 |
| Intermediate wheatgrass | 8 | | 5 | | 5 | | 8 | 5 | | 5 | | | | |
| Crested wheatgrass | | | | | | | | | | | 6 | | 4 | |
| Russian wildrye | 7 | | | | | 5 | 7 | | | | | | | |
| Western wheatgrass | | | | 3 | | | | | 3 | | | 3 | | |
| Bluebunch wheatgrass | | | | 5 | | 3 | | | 5 | | | 5 | | |
| Pubescent wheatgrass | | | | | | | | | | | 8 | | 4 | 5 |
| Alfalfa[3] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | |
| Sainfoin[3] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | |
| Small Burnet[3] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| Cicer milkvetch[3] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| Lewis flax[3] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |

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

a. **Grasses:** Basin wildrye, green needlegrass, pubescent wheatgrass, slender wheatgrass, tall wheatgrass.
b. **Forbs and Legumes**: Yellow sweetclover, arrowleaf balsamroot, Palmer penstemon, Lewis flax, sweetvetch, Pacific aster.
c. **Shrubs:** Forage kochia, fourwing saltbush, winterfat, green ephedra, bitterbrush, mountain and Wyoming big sagebrush, mountain mahogany, cliffrose, black sagebrush, rubber rabbitbrush.

[1]This 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.

[2]A,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.

[3]Choose one or two.

**Table 2. Pinyon-Juniper** (12 to 14 inches AAP).

| | LBS. PLS/ACRE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy, soils | | | | Clayey soils | | Shallow, sandy and/or very gravelly soils | | | |
| Species | S[1] | A[2] | B | C | S[1] | A[2] | S[1] | A[2] | B | C |
| Crested wheatgrass | 6 | 4 | | | 6 | 4 | 6 | | 4 | 3 |
| Pubescent wheatgrass | 8 | 4 | | | 8 | 4 | 8 | | 4 | |
| Russian wildrye | 7 | | | 5 | 7 | | | | | |
| Bluebunch wheatgrass | | | 5 | 3 | | | | 5 | | |
| Thickspike wheatgrass | | | 3 | | | | | 3 | | 2 |
| Indian ricegrass | | | | | | | | | | 2 |
| Dryland orchardgrass | 4 | | | | | | | | | |
| Alfalfa[3] | 2 | 2 | 2 | 2 | 2 | 2 | | | | |
| Small burnet[3] | 2 | 2 | 2 | 2 | 2 | 2 | | | | |
| Lewis flax[3] | 1 | 1 | 1 | 1 | 1 | 1 | | | | |

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

a. **Grasses:** Indian ricegrass, dryland orchardgrass, galleta grass, needle and threadgrass, bottlebrush squirreltail.
b. **Forbs and Legumes**: Palmer penstemon, Lewis flax, yellow sweetclover, globemallow.
c. **Shrubs:** Forage kochia, winterfat, Wyoming big sagebrush, and black sagebrush, fourwing saltbush, bitterbrush, cliffrose, rubber rabbitbrush.

[1]This 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.

[2]A,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.

[3]Choose one or two.

**Table 3. Basin Big Sagebrush-Grass** (12 to 14 inches average AAP).

| | LBS. PLS/ACRE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy, soils | | | | | | Clayey soils | | | | Shallow, sandy and/or very gravelly soils | | |
| Species | S[1] | A[2] | B | C | D | E | S[1] | A[2] | B | C | S[1] | A[2] | B |
| Crested wheatgrass | 6 | | 4 | 3 | 4 | | 6 | 4 | 3 | 4 | 6 | | 4 |
| Pubescent wheatgrass | 8 | | 4 | | | | 8 | 4 | | | 8 | | 4 |
| Russian wildrye | 7 | | | | | 5 | 7 | | | | | | |
| Thickspike wheatgrass | | 3 | | 2 | | | | | 2 | | | 3 | |
| Bluebunch wheatgrass | | 5 | | | | 3 | | | | | | 5 | |
| Tall wheatgrass | | | | 3 | 4 | | | | 3 | 4 | | | |
| Alfalfa[3] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | |
| Small Burnet[3] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | |
| Lewis flax[3] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | |

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

a. **Grasses:** Basin wildrye, western wheatgrass, Letterman needlegrass, needle and threadgrass, Altai wildrye
b. **Forbs and Legumes**: Yellow sweetclover, Palmer penstemon, Lewis flax, sweetvetch, Pacific aster.
c. **Shrubs:** Forage kochia, mountain and Wyoming big sagebrush, fourwing saltbush, winterfat, bitterbrush, cliffrose, black sagebrush, Basin and Wyoming big sagebrush, rubber rabbitbrush.

[1]This 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.

[2]A,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.

[3]Choose one or two.

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

| | LBS. PLS/ACRE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | | | Clayey soils | | Shallow, sandy and/or very gravelly soils | |
| Species | S[1] | A[2] | 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, galletagrass.
b. **Forbs and Legumes:** Palmer penstemon, globemallow, Lewis flax, small burnet.
c. **Shrubs:** Forage kochia, winterfat, fourwing saltbush, black sagebrush, Wyoming big sagebrush, rubber rabbitbrush, shadscale, four wing saltbush.

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[1]This 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 till 9 lbs/ac). Generally, seedings of single grass species are not recommended.

[2]A,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.

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

| | LBS. PLS/ACRE | |
|---|---|---|
| | Wet soils<br>Shallow water table | Dry soils<br>Deep water table |
| Species[1] | A[2] | 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 |
| Fourwing saltbush | 2 | 2 |
| Gardner saltbush | 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.

[1]All species are adapted; economic considerations may require some choices between species.
[2]A 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.

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

| | LBS. PLS/ACRE (All soils) |
|---|---|
| Species[1] | 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 squirreltail, Russian wildrye, spike dropseed.
b. **Forbs:** Lewis flax, Nevada showy goldeneye, Palmer penstemon.
c. **Shrubs**: Antelope bitterbrush, desert bitterbrush, cliffrose, desert peach, Utah serviceberry.

[1]All species are adapted; economic considerations may require some choices between species.
[2]A 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.

**Table 3. Fourwing Saltbush/Big Sagebrush, Spiney Hopsage** (8 to 14 inches AAP).

| | 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.

---

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

[2]A 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.

[3]Utilize fairway crested wheatgrass in alkali soil conditions.

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

| | LBS. PLS/ACRE | |
|---|---|---|
| | Clayey soils | Sandy or well drained |
| Species[1] | 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.

[1]All species are adapted; economic considerations may require some choices between species.
[2]A 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.
[3]Utilize fairway crested wheatgrass in alkaline soil conditions.

# MOHAVE DESERT RANGE (Upper Level)

**Table 1. Basin and Range** (8 to 11 inches average annual precipitation (AAP)).

| | LBS. PLS/ACRE | | | | | | |
|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | Clayey soils | Shallow, sandy and/or very gravelly soils | | |
| Species | S[1] | A[2] | B | S[1] | S[1] | A[2] | B |
| Crested wheatgrass | 6 | 4 | | | 6 | 4 | |
| Western wheatgrass | 8 | 4 | 3 | 8 | 8 | 4 | 3 |
| Sideoats grama | 6 | | 3 | | | | 3 |
| Bluegrama | 2 | | 1 | | | | |
| Galleta | 6 | | 1 | | | | 1 |

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

a. **Grasses:** Indian ricegrass, galleta, pubescent wheatgrass.
b. **Forbs and Legumes:** Palmer penstemon, globemallow.
c. **Shrubs:** Desert bitterbrush, winterfat, fourwing saltbush, desert peach, forage kochia.

---

[1]This 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; if 1 lb/ac of a substitute species is selected, the total seeding rate is still 8 lbs/ac). Generally, seedings of single grass species are not recommended.

[2]A,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: Mohave Desert seedings can be very difficult, precipitation is usually less than 8 inches average annual precipitation and there is no reliable seeding technology.

**Table 1. Adequate Irrigation Water**.

| | LBS. PLS/ACRE | | | | | |
|---|---|---|---|---|---|---|
| | No major soil limitations | | | | | Clayey soils |
| Species | S[1] | A[2] | B | C | D | S[1] |
| Smooth brome | 6 | 5 | | 4 | | 6 |
| Orchardgrass | 4 | 2 | 2 | 2 | 2 | |
| Tall fescue | 6 | | | | | 6 |
| Meadow brome | 7 | | 5 | | 4 | |
| Timothy | | | | 2 | 2 | |
| Ladino clover[3] | 1 | 1 | 1 | 1 | 1 | 1 |
| Red clover[3] | 1 | 1 | 1 | 1 | 1 | 1 |
| Alfalfa[3] | 2 | 2 | 2 | 2 | 2 | 2 |

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

a. **Grasses:** Perennial ryegrass, Reed canarygrass.
b. **Forbs and Legumes:** Cicer milkvetch, sainfoin.

---

[1]This 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.

[2]A,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.

[3]Choose one.

**Table 2. Adequate Irrigation Water, Saline and Non-saline** (soils with water table 10 to 40 inches below the soil surface).

| | LBS. PLS/ACRE | |
|---|---|---|
| | Saline soils | Non-saline soils |
| Species | S[1] | S[1] |
| Timothy | | 4 |
| Tall fescue[2] | 6 | 6 |
| Creeping foxtail[3] | 4 | 4 |
| Tall wheatgrass [4] | 10 | |
| Reed canarygrass [5] | | 5 |
| Alsike clover[3] | 1 | 1 |
| Strawberry clover | 1 | |
| Birdsfoot trefoil | 1 | 1 |

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

a. **Grasses:** Basin wildrye[3], beardless wildrye[4], perennial ryegrass[6].

---

[1]This 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.

[2]Moderate to high salt tolerance.

[3]Moderate salt tolerance - high soil moisture tolerance.

[4]High salt tolerance.

[5]Tolerates standing water for long periods.

[6]High acid soils.

**Table 3. Inadequate Irrigation Water or Subject to Drought**

| | LBS. PLS/ACRE | | | | | |
|---|---|---|---|---|---|---|
| | No major soil limitations | | | Clayey soils | | Sandy soils |
| Species | S[1] | A[2] | B | S[1] | A[2] | S[1] |
| Pubescent wheatgrass | 8 | | | | | 8 |
| Intermediate wheatgrass | 8 | 4 | | 8 | 5 | |
| Tall wheatgrass | 10 | 4 | | 10 | | |
| Russian wildrye | 7 | | | 7 | | |
| Smooth brome[3] | 6 | 2 | 5 | 6 | 3 | |
| Dryland orchardgrass | 4 | | 2 | | | 4 |
| Alfalfa | 2 | 2 | 2 | 2 | 2 | |
| Sainfoin | 2 | 2 | 2 | 2 | 2 | |

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

a. **Grasses:** Crested wheatgrass.
b. **Forbs and Legumes**: Yellow sweetclover, small burnet.
c. **Shrubs:** Fourwing saltbush, winterfat, bitterbrush, Wyoming big sagebrush, forage kochia.

[1]This 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.

[2]A,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.

[3]Regar brome may be substituted for smooth brome.

# IRRIGATED PASTURE (MOHAVE DESERT)

**Table 1. Adequate Irrigation Water** (Mohave Desert).

| | LBS. PLS/ACRE | |
|---|---|---|
| | No major soil limitations | Clayey soils |
| Species | S[1] | S[1] |
| Pubescent wheatgrass | 8 | |
| Tall fescue | 6 | 4 |
| Bermudagrass | 3 | 3 |
| Blue panicum | 3 | |
| Orchardgrass | 4 | |
| Alfalfa | 2 | 2 |

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

a. **Forbs and Legumes:** Cicer milkvetch, small burnet, sainfoin.

**Table 2. Adequate Irrigation Water, Saline and Non-saline** (Mohave Desert saline and non-saline soils with water table 10 to 30 inches below the soil surface).

| | LBS. PLS/ACRE | |
|---|---|---|
| | Saline soils | Non-saline soils |
| Species | S[1] | S[1] |
| Tall wheatgrass | 10 | 10 |
| Tall fescue | 6 | 6 |
| Creeping foxtail | | 4 |
| Reed canarygrass | | 5 |
| Alsike clover[2] | 1 | 1 |
| Strawberry clover | 1 | |

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

a. **Grasses:** Basin wildrye, Altai wildrye, beardless wildrye.

---

[1]This 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.

[2]Moderate salt tolerance; high moisture tolerance.

**Table 3. Inadequate Irrigation Water or Subject to Drought** (Mohave Desert).

| | LBS.PLS/ACRE | | |
|---|---|---|---|
| | No major soil limitations | Clayey soils | Shallow, sandy and/or very gravelly soils |
| Species | S[1] | S[1] | S[1] |
| Bermudagrass | 3 | 3 | 3 |
| Blue panicum | 3 | | 3 |
| Sideoats grama | 6 | | |
| Pubescent wheatgrass | 8 | 8 | |
| Alfalfa | 2 | 2 | 2 |

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

a. **Grasses:** Dryland orchardgrass, intermediate wheatgrass, indian ricegrass, sand dropseed, crested wheatgrass, galleta, Altai wildrye.

[1]This 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.

**Table 1.**

| | LBS.PLS/ACRE | | |
|---|---|---|---|
| | Water table more than 20" below soil surface | | Water table less than 20" below soil surface |
| Species | S[1] | A[2] | S[1] |
| Tall fescue | 6 | | 6 |
| Tall wheatgrass | 10 | | 10 |
| Creeping foxtail | 4 | | 4 |
| Basin wildrye | 8 | 5 | |
| Reed canarygrass | | | 5 |
| Western wheatgrass | 8 | 3 | |
| Alsike clover | 1 | 1 | |
| Strawberry clover | 1 | 1 | 1 |
| Birdsfoot trefoil | 1 | 1 | 1 |

[1]This 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.

[2]A,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.

# STABILIZATION OF DISTURBED AREAS

## ROADSIDES, CONSTRUCTION SITES, MINE SITES, AND SPOILS:

**Table 1. Subalpine and Mixed Conifer** (35 + inches average annual precipitation (AAP)).

| | LBS.PLS/ACRE[1] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | Clayey soils | | | | Shallow, sandy and/or very gravelly soils | | |
| Species | S[2] | A[3] | B | C | S[2] | A[3] | B | C | S[2] | A[3] | B |
| Intermediate wheatgrass | 17 | 10 | | 6 | 17 | 10 | | | | | |
| Pubescent wheatgrass | | | | | | | | 10 | 18 | 10 | 10 |
| Smooth brome | 14 | | 10 | 6 | 14 | | 10 | | | | |
| Tufted hairgrass | | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 |
| Slender wheatgrass | | 3 | 3 | 2 | | 3 | 3 | 3 | | 3 | 4 |
| Mountain brome | | | | 2 | 14 | | | | | 2 | |
| Hard fescue | | 1 | 1 | 1 | | | | 1 | | 1 | 1 |
| Creeping red fescue | | | | | | 1 | 1 | | | | |
| Birdsfoot trefoil | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |
| Cicer milkvetch | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |

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

a. **Grasses:** Timothy, meadow brome Canada bluegrass, streambank wheatgrass, Letterman needlegrass.
   Wet soils: Creeping foxtail, Reed canarygrass, tall fescue.
   Quick temporary cover: Annual or perennial ryegrass.
b. **Forbs and Legumes:** Pacific aster, western yarrow, Canada goldenrod, mountain lupine, Rocky Mountain penstemon, Louisiana sage.
c. **Shrubs:** Golden currant, Woods rose.
d. **Trees:** Lodgepole pine, (transplants).

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[1]Rates for broadcast seeding, followed by dragging with 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 ½.

[2]This 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.

[3]A,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.

**Roadsides, Construction Sites, Mine Sites, and Spoils (Continued)**

**Table 2. Aspen** (25-30 inches AAP), **Mountain Big Sagebrush-Grass** (14-25 inches AAP).

| | LBS.PLS/ACRE[1] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | Clayey soils | | | | Shallow, sandy and/or very gravelly soils | | |
| Species | S[2] | A[3] | B | C | S[2] | A[3] | B | C | S[2] | A[3] | B |
| Crested wheatgrass | | | | | | | | | 12 | 6 | 3 |
| Intermediate wheatgrass | 17 | 12 | | 5 | 15 | 10 | | | | | |
| Pubescent wheatgrass | | | | | | | | 10 | 18 | 8 | |
| Smooth brome | 14 | | 10 | 5 | 13 | | 10 | | | | |
| Bluebunch wheatgrass[4] | 14 | | | | | | | | 14 | | 8 |
| Dryland orchardgrass | 6 | | | | | | | | | | |
| Western wheatgrass | | | | | 14 | | | | | | |
| Slender wheatgrass | | 3 | 3 | 2 | | 3 | 3 | 3 | | 3 | 3 |
| Hard fescue | | 2 | 2 | 2 | | | | | | 2 | 1 |
| Cicer milkvetch[5] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | |
| Sainfoin[5] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | |
| Alfalfa[5] | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | |
| Utah sweetvetch[5] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | |

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

a. **Grasses:** Timothy, meadow brome, mountain brome, beardless wheatgrass, western wheatgrass, thickspike wheatgrass, tall oatgrass, Altai and Russian wildryes, Canada bluegrass, Kentucky bluegrass, creeping red fescue, streambank wheatgrass.
   Wet soils: Creeping foxtail, Reed canarygrass, tall fescue.
   Quick temporary cover: Annual or perennial ryegrass.

b. **Forbs and Legumes:** Birdsfoot trefoil, sweetanise, showy goldeneye, small burnet, Lewis flax, Rocky Mountain penstemon, Louisiana sage, crownvetch.

c. Shrubs: Bitterbrush, cliffrose, shiny leaf ceanothus, Woods rose, rubber rabbitbrush, skunkbush sumac, golden willow, maple.

d. **Trees:** Aspen.

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

[4]Bluebunch wheatgrass generally has only fair seedling vigor. Generally it should not be seeded in a pure stand for erosion control.

[5]Choose one or two.

**Table 3. Mountain Brush** (16-22 AAP) (gambel oak, maple, etc.), **Mountain and Basin Sagebrush-Grass** (14-16 inches AAP), **Pinyon-Juniper** (12-18 inches AAP).

| | LBS.PLS/ACRE[1] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | Clayey soils | | | | Shallow, sandy and/or very gravelly soils | | | |
| Species | S[2] | A[3] | B | C | S[2] | A[3] | B | C | S[2] | A[3] | B | C |
| Crested wheatgrass | | | | | | | | | 12 | 8 | 6 | 8 |
| Intermediate wheatgrass | 17 | 14 | | 8 | 17 | 12 | | | | | | |
| Pubescent wheatgrass | 17 | | | | 17 | | | 1 | 17 | | | |
| Smooth brome | 14 | | 14 | 8 | 14 | | 12 | 2 | | | | |
| Russian wildrye | 12 | | | | 12 | | | | 12 | | 6 | |
| Dryland orchardgrass | 8 | | | | | | | | | | | |
| Western wheatgrass | | | | | | 3 | 3 | | | | 3 | 3 |
| Thickspike wheatgrass | | | | | | | | 3 | | 4 | | |
| Streambank wheatgrass | | | | | | | | | | | | 3 |
| Hard fescue | | 3 | 3 | 3 | | 2 | 2 | | | | | |
| Big bluegrass | | | | | | | | 2 | | 2 | | 2 |
| Cicer milkvetch | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| Lewis flax | | | | | | | | | 1 | 1 | 1 | 1 |
| Alfalfa | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | |

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

a. **Grasses:** Meadow brome, tall wheatgrass, beardless wheatgrass, slender wheatgrass. Basin and Altai wildryes.
   Wet soils: Creeping or meadow foxtail, Reed canarygrass, tall fescue, creeping red fescue.
   Sandy soils: Indian ricegrass.
   Quick temporary cover: Annual or perennial ryegrass.
b. **Forbs and Legumes**: Utah sweetvetch, Pacific aster, yellow sweetclover, small burnet, Rocky Mountain penstemon, Palmer penstemon.
c. **Shrubs:** Forage kochia, black sagebrush, Siberian peashrub, tartarian honeysuckle, maple.

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[1]Rates 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 ½.

[2]This 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.

[3]A,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.

**Table 4. Basin Big Sagebrush-Grass** (12-14 inches AAP).

| | LBS.PLS/ACRE[1] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | | | | |
| Species | S[2] | A[3] | B | S[2] | A[3] | B | S[2] | A[3] | B | C | D |
| Crested wheatgrass | 12 | | | | | 6 | 12 | 8 | 4 | 5 | 6 |
| Intermediate wheatgrass | 17 | 12 | | 17 | 12 | | | | | | |
| Pubescent wheatgrass | 18 | | 10 | 18 | | 8 | 18 | | | | 8 |
| Bluebunch wheatgrass[4] | 14 | | | | | | 14 | | 10 | | |
| Russian wildrye | 12 | | | 12 | | | | | | | |
| Dryland orchardgrass | 8 | | | | | | | | | | |
| Western wheatgrass | | 3 | | | 3 | 4 | | | | | |
| Thickspike wheatgrass | | | | | | | | | | 5 | |
| Streambank wheatgrass | | | 4 | | | | | 3 | 3 | | 3 |
| Sheep fescue | | 2 | 2 | | 2 | 2 | | 2 | 2 | | 2 |
| Indian ricegrass | | 5 | | | | | | | | | |
| Lewis flax[5] | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| Palmer penstemon[5] | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| Alfalfa[5] | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |

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

a. **Grasses:** Tall wheatgrass, Basin and Altai wildryes, green needlegrass.
Sandy soils: Indian ricegrass, mammoth wildrye or mammoth wildrye culms.
b. **Forbs and Legumes:** Alfalfa, yellow sweetclover, small burnet, sainfoin, cicer milkvetch.
c. **Shrubs:** Basin and Wyoming big sagebrush, rubber rabbitbrush, fourwing saltbush, forage kochia.

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

[4]Bluebunch wheatgrass has only fair seedling vigor. Generally it should not be seeded in a pure stand for erosion control.

[5]Choose one or two.

**Table 5. Pinyon-Juniper** (12 to 14 inches AAP).

| | LBS.PLS/ACRE[1] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | | | | |
| Species | S[2] | A[3] | B | S[2] | A[3] | B | S[2] | A[3] | B | C | D |
| Crested wheatgrass | 12 | 8 | | 12 | 8 | 6 | 12 | 8 | 5 | 8 | 10 |
| Pubescent wheatgrass | 18 | 8 | 12 | 18 | 8 | | 18 | | | 8 | |
| Bluebunch wheatgrass[4] | 14 | | | | | | 14 | 8 | | | |
| Russian wildrye | 12 | | | 12 | | 6 | | | | | |
| Western wheatgrass | | | | | 4 | | | | | | |
| Thickspike wheatgrass | | | | | | | | | 5 | | |
| Streambank wheatgrass | | | 4 | | | 3 | | 3 | | 3 | 4 |
| Sheep fescue | | 1 | 1 | | | 2 | | 2 | | 1 | 1 |
| Big bluegrass | | 1 | 1 | | | | | | | 2 | 1 |
| Indian ricegrass | | | | | | | | | 5 | | |
| Lewis flax | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| Palmer penstemon | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |
| Globe mallow | 1 | 1 | 1 | 1 | 1 | 1 | | | | | |

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

a. **Grasses**: Tall wheatgrass, beardless wheatgrass, needle and threadgrass, sand dropseed.
Sandy soils: Indian ricegrass, mammoth wildrye or mammoth wildrye culms.
b. **Forbs and Legumes:** Alfalfa, small burnet, Pacific aster.
c. **Shrubs:** Forage kochia, winterfat, rubber rabbitbrush, Wyoming big sagebrush, bitterbrush.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

[4]Bluebunch wheatgrass generally has only fair seedling vigor. Usually it should not be seeded in a pure stand for erosion control.

**Table 6. Wyoming Big Sagebrush-Grass** (8 to 12 inches AAP).

| | LBS.PLS/ACRE[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | | | |
| Species | 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.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

**Table 7. Salt Desert Shrub** (8-10 inches AAP).

| | LBS. PLS/ACRE[1] All soils | | |
|---|---|---|---|
| Species | A[2] | B | C |
| Crested wheatgrass | 6 | 8 | 8 |
| Russian wildrye | 6 | | |
| Thickspike wheatgrass | | 3 | 3 |
| Streambank wheatgrass | 3 | | |
| Indian wheatgrass | | 3 | |
| Lewis flax | 1 | 1 | 1 |
| Palmer penstemon | 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.

---

[1]Rates 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 ½.

[2]A,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** (8-11 inches AAP).

| | LBS. PLS/ACRE[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | | |
| Species | S[2] | A[3] | B | S[2] | A[2] | B | S[2] | A[2] | 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.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

**Table 1. Subalpine** (35 + inches AAP); **Mixed Conifer** (30 + inches AAP); **Aspen** (25-30 inches AAP).

| | LBS. PLS/ACRE | | | |
|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | Clayey soils | Shallow, sandy and/or very gravelly soils |
| Species | S[2] | A[3] | S[2] | S[2] |
| Wheat, winter or spring | 80 | | 80 | 80 |
| Rye, winter or spring | 80 | | | 80 |
| Barley, spring | 80 | | 80 | 80 |
| Oats, spring | 80 | 80 | | |
| Annual ryegrass | | 20 | 20 | 20 |
| OR PLANT | | | | |
| Short-life perennials | | | | |
| Perennial ryegrass | 20 | | 20 | 20 |
| Slender wheatgrass | 15 | | 15 | 15 |

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

a. **Short-life perennials**: Mountain brome, timothy, Louisiana sage, Pacific aster, western yarrow.
b. **Annuals or biennials**: Yellow sweetclover, hairy vetch.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

**Table 2. Mountain Big Sagebrush-Grass** (14-25 inches AAP); **Mountain Brush** (16-22 inches AAP); **Basin Big Sagebrush-Grass** (12-14 inches AAP); **Pinyon-Juniper** (14-18 inches AAP); **Wyoming Big Sagebrush-Grass** (8-12 inches AAP).

| | LBS. PLS/ACRE[1] | | |
|---|---|---|---|
| | Moderately deep to deep, loamy soils | Clayey soils | Shallow, sandy and/or very gravelly soils |
| Species | S[2] | S[2] | S[2] |
| Wheat, winter or spring | 80 | 80 | 80 |
| Rye, winter or spring | 80 | | 80 |
| Barley, spring[3] | 80 | 80 | 80 |
| Annual ryegrass[3] | 20 | 20 | 20 |

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

a. **Short life perennials**: Mountain brome, slender wheatgrass.
b. **Annuals or biennials**: Yellow sweetclover, hairy vetch, Austrian peas, Hungarian vetch.

[1]Rates 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 ½.

[2]This 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.

[3]Above 15 inches average annual precipitation only.

**Table 3. Pinyon-Juniper** (12-14 inches AAP); **Wyoming Big Sagebrush-Grass** (8-12 inches AAP); **Salt Desert Shrub** (8 to 10 inches AAP); **Basin and Range (Mohave Desert)** (8 to 10 inches AAP).

| | LBS. PLS/ACRE[1] | | |
|---|---|---|---|
| | Moderately deep to deep, loamy soils | Clayey soils | Shallow, sandy and/or very gravelly soils |
| Species | S[2] | S[2] | S[2] |
| Wheat, winter[3] | 80 | 80 | |
| Rye, winter | 80 | | 80 |

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

a. **Fast growing perennial**: Lewis flax.

---

[1]Rates 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 ½.

[2]This 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.

[3]Above 10 inches average annual precipitation only.

## COVER FOR TRAFFIC AREAS (OR OTHER MODERATE TO HIGH USE AREAS SUCH AS CAMPING AND PICNIC GROUNDS)

**Table 1.**

| | LBS. PLS/ACRE[1] | | | | | |
|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | | |
| Species | S[2] | A[3] | B | C | D | E |
| Crested wheatgrass[4] | 12 | 6 | | | 6 | 6 |
| Streambank wheatgrass[4] | | 6 | | | | |
| Sheep fescue[5] | 8 | | | | | |
| Hard fescue[6] | 8 | | | | | |
| Kentucky bluegrass[6] | 8 | | 6 | | | |
| Creeping red fescue[7] | 8 | | | 6 | | |
| Perennial ryegrass[7] | | | 2 | 2 | | |
| Tall fescue[7] | 8 | | | | | |
| Intermediate wheatgrass[6] | 12 | | | | 6 | |
| Pubescent wheatgrass[5] | 12 | | | | | 6 |

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

a. **Grasses:** Creeping bentgrass, colonial bentgrass, western wheatgrass, chewing fescue.
b. **Forbs and Legumes:** Blueleaf aster, rhizomatous alfalfa.

NOTE: As use increases, a mixture of Kentucky bluegrass and perennial ryegrass, under irrigation and intensive management, may be the only alternative. With severe use, gravel or paved pathways should be considered. Consider barrier plantings to keep people on pathways, i.e. dense shrubs and/or thorn bushes.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

[4] < 12 inches average annual precipitation AAP (all crested wheatgrass).

[5] > 12 inches AAP (Ephraim crested wheatgrass).

[6] > 15 inches AAP.

[7] > 18 inches AAP.

# STABILIZATION OF WATERWAYS

## GRASSED WATERWAYS

**Table 1. Subalpine** (35 + inches average annual precipitation (AAP); **Mixed Confer** (30 + inches AAP); **Aspen** (25-30 inches AAP); **Mountain Big Sagebrush-Grass** (14-25 inches AAP).

| | LBS. PLS/ACRE[1] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | Clayey soils | | | | Shallow, sandy and/or very gravelly soils | | |
| Species | S[2] | A[3] | B | C | S[2] | A[3] | B | C | S[2] | A[3] | B |
| Pubescent wheatgrass | 18 | | 8 | 8 | 18 | 8 | | | 18 | 8 | |
| Intermediate wheatgrass | 15 | 8 | | 8 | 15 | 8 | 8 | 8 | | 8 | 8 |
| Western wheatgrass | 15 | | 8 | | 15 | | 8 | | | | 8 |
| Smooth brome | 14 | 8 | | | 14 | | | 8 | | | |

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

a. **Grasses:** Wet soils: Hard fescue, creeping foxtail, Reed canarygrass, timothy, perennial ryegrass, tall fescue.
b. **Forbs:** Blueleaf aster.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

**Table 2. Mountain Brush** (16-22 inches AAP); **Mountain Basin Sagebrush-Grass** (14-16 inches AAP); **Pinyon-Juniper** (14-18 inches AAP).

| | LBS. PLS/ACRE[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | | |
| Species | S[2] | A[3] | B | D | S[2] | A[3] | B | S[2] | A[3] | B |
| Pubescent wheatgrass | 18 | | 8 | 8 | 18 | 8 | | 18 | 8 | |
| Intermediate wheatgrass | 15 | 8 | | | 15 | 8 | 8 | | | |
| Streambank wheatgrass | 15 | | | | 15 | | | 15 | | 8 |
| Thickspike wheatgrass | 15 | | | | | | | 15 | | |
| Western wheatgrass | 15 | | 8 | 8 | 15 | | 8 | | | |
| Crested wheatgrass[4] | | | | | | | | 12 | 6 | 6 |
| Smooth brome | 14 | 8 | | | 14 | | | | | |

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

a. **Grasses:** Hard fescue, big bluegrass.
Bottomland sites: Basin and Altai wildrye, tall wheatgrass, and meadow brome.
Wet soils: Creeping foxtail, Reed canarygrass, timothy.
Quick temporary cover: Annual or perennial ryegrass, slender wheatgrass.
b. **Forbs**: Blueleaf aster.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

[4]Use Ephraim crested wheatgrass.

**Table 3. Basin Big Sagebrush-Grass** (12-14 inches AAP); **Pinyon-Juniper** (12-14 inches AAP); **Wyoming Big Sagebrush-Grass** (8-12 inches AAP); **Salt Desert Shrub** (8-10 inches AAP); **Basin and Range** (8-11 inches AAP).

| | LBS. PLS/ACRE[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moderately deep to deep, loamy soils | | | | | Clayey soils | | | Shallow, sandy and/or very gravelly soils | |
| Species | S[2] | A[3] | B | C | D | S[2] | A[3] | B | S[2] | A[3] |
| Crested wheatgrass | 12 | 6 | | 6 | | | | | 12 | 6 |
| Pubescent wheatgrass[4] | 15 | 8 | | | 8 | 15 | 8 | | 15 | |
| Intermediate wheatgrass[4] | 15 | | 8 | | | 15 | 8 | | | |
| Streambank wheatgrass | 15 | | 8 | 8 | | 15 | | 8 | 15 | 8 |
| Thickspike wheatgrass | 15 | | | | | | | | 15 | |
| Western wheatgrass[4] | 15 | | | | 8 | 15 | | 8 | | |

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

a. **Grasses:** Sheep fescue, Basin wildrye (bottomland sites only), tall wheatgrass, Russian wildrye, needle and thread grass.

---

[1]Rates 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 ½.

[2]This 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.

[3]A,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.

[4]Above 12 inches average annual precipitation only.

# STABILIZATION OF RIPARIAN AREAS[1]

**Table 1. Fluctuating Watertable** (periodic drying in upper profiles) .

| 4000' to 5500' Elev | 5500' to 6500' Elev | 6500' + Elev (non alpine) |
|---|---|---|
| | **Grasses and Grasslikes:** | |
| Kentucky bluegrass<br>Timothy<br>Basin wildrye<br>Creeping foxtail<br>Winged sedge | Kentucky bluegrass<br>Timothy<br>Creeping foxtail<br>Basin wildrye<br>Blue wildrye<br>Baltic rush<br>Tufted hairgrass<br>Wooly sedge<br>Winged sedge | Kentucky blue<br>Tufted hairgrass<br>Baltic rush |
| | **Shrubs:** | |
| Willow<br>Currants<br>Rose | Willow<br>Mountain ash<br>Twinberry<br>Currents<br>Rose<br>Elderberry<br>Serviceberry<br>Shrubby cinquefoil | Willow<br>Twinberry<br>Elderberry<br>Shrubby cinquefoil |
| | **Trees:** | |
| Hybrid poplar<br>Cottonwoods<br>Lombardy<br>Russian olive<br>Golden and Crack willow | Aspen<br>Cottonwoods<br>Golden willow<br>Crack willow<br>Blue spruce<br>Water birch<br>Mountain alder | Aspen<br>Engelmann spruce<br>Subalpine fir<br>Lodgepole<br>Mountain alder |

Consider trees only in the flood plain, not the channel. Consider planting shrubs for diversity in copses (small thickets). Sow herbaceous or shrub seeds in the fall and conetainer, bare root, or rooted transplants in the spring. If you are attempting to plant shrubs into existing stands of herbaceous species, consider vegetation control methods to reduce competition to shrubs.

[1]Forb species not included since most will return naturally with proper care.

**Table 2. Permanently Wet** (upper soil profile).

| 4000' to 5500' Elev | 5500' to 6500' Elev | 6500' + Elev (non alpine) |
|---|---|---|
| | **Grasses and Grasslikes:** | |
| Nebraska sedge<br>Beaked sedge<br>Baltic rush<br>Reed canarygrass | Nebraska sedge<br>Water sedge<br>Beaked sedge<br>Baltic rush<br>Bluejoint reedgrass<br>Reed canarygrass | Water sedge<br>Beaked sedge<br>Wooly sedge<br>Baltic rush<br>Bluejoint reedgrass |
| | **Shrubs:** | |
| Willow<br>Dogwood | Willow<br>Dogwood<br>Twinberry | Willow<br>Bog birch<br>Dogwood<br>Twinberry |
| | **Trees:** | |
| Hybrid poplar<br>Cottonwoods<br>Lombardy<br>Golden willow<br>Crack willow<br>Whiplash willow | Aspen<br>Cottonwoods<br>Golden willow<br>Whiplash willow<br>Crack willow<br>Water birch | Aspen<br>Engelmann spruce<br>Water birch<br>Mountain alder |

Consider trees only in the flood plain, not the channel. Consider planting shrubs for diversity in copses (small thickets). Sow herbaceous or shrub seeds in the fall and conetainer, bare root, or rooted transplants in the spring. If you are attempting to plant shrubs into existing stands of herbaceous species, consider vegetation control methods to reduce competition to shrubs.

[1]Forb species not included since most will return naturally with proper care.

# APPENDIX A
# DESCRIPTION OF SPECIES

## CHARACTERISTICS OF GRASSES

(See Appendix D for scientific names.)

**Bermudagrass, green** (Introduced)

Bermudagrass is adapted to the hot irrigated desert valleys and performs well under many extremes of soil and moisture conditions. It will grow in both fine and coarse textured soils, soils of low fertility and those with a high salt content. Many improved varieties adapted to the southern area have poor seeding habits and are usually propagated from sprigs. “NK-37"and “Giant” can be propagated from seed; “Coastal” and “Midland” are best propagated from sprigs.

NOTE: Bermudagrass is a prohibited, noxious weed in all Utah counties except Washington County.

**Bluegrass, big** (Native)

A long-lived bunchgrass well adapted for early spring grazing; it can sometimes be grazed as much as 4 weeks before crested wheatgrass, but it becomes unpalatable earlier than most grasses. It has relatively low seedling vigor and requires as many as 4 to 8 years to reach full productivity. Because young plants are easily pulled up, grazing should be deferred until roots are well anchored. Recommended sites include favorable sagebrush sites, sunny places on mountain-brush and ponderosa pine ranges, and meadows at lower elevations. Adapted where effective environment is comparable to 9 to 15 inches precipitation. Planting depth 1/4 to ½ inch. Adapted variety is “Sherman.”

**Bluegrass, Canada** (Introduced)

A low growing bluegrass with short rhizomes and tolerance to shade, adapted to areas of low fertility and neutral or acid soils. Growth in the early spring provides good ground cover. An attractive low maintenance plant which provides excellent ground cover and erosion control on roadsides, ditch banks, borrow pits, dam sites, under trees and recreational areas. Effective moisture ranges from 20 to 40 inches precipitation. Planting depth, 1/4 to ½ inch. Adapted variety is “Ruebens.”

**Bluegrass, Nevada** (Native)

A perennial bunchgrass capable of withstanding reasonable grazing use. It requires 14 to 20 inches of moisture annually, and has good forage value to livestock and wildlife. It is well adapted to mountains, uplands and semi-desert on lighter textured and stony loam soils. It promotes moisture infiltration into the soil. Depth of seeding, 1/4 inch.

**Bluegrass, sandberg** (Native)

A perennial bunchgrass, and one of the first to green up in early spring. It is very palatable to all types of livestock and most wild animals. It has good nutritional qualities but yields are low. It is particularly adapted to medium to coarse textures, and on sandy and silty loam soils in the foothills and mountains at 4,000 to 9,000 feet where moisture ranges from 6 to 25 inches annually. Depth of seeding, 1/4 inch.

**Brome, meadow** (Introduced)

A perennial long-lived, mildly rhizomatous grass, which reaches full productivity in 2 to 3 years. Seedlings are strong and palatability to livestock and wildlife is excellent. It is used in pasture and hay seedings under irrigation or non-irrigated areas where precipitation exceeds 15 inches annually. It is moderately shade tolerant, winter hardy, and recovers quickly after grazing, and is well adapted to the mountain brush, aspen, conifer forest and subalpine. It is less summer dormant under high summer temperatures than smooth brome. Planting depth 1/4 to ½ inch. Only available variety is "Regar."

**Brome, mountain** (Native)

A short-lived vigorous bunchgrass that reaches full productivity in 1 to 3 years. It volunteers well in some situations, is moderately palatable, shade tolerant and valuable for quick cover. Will be replaced by long-lived species in mixtures, and is susceptible to smut. Recommended sites include weedy openings at medium to high altitudes and timber burns. Planting depth 1/4 to ½ inch. Adapted variety is "Bromar."

**Brome, smooth** (Introduced)

A long-lived sod-forming grass. It is very palatable, productive, and shade tolerant. Seedlings are often weak, but once established, plants spread vegetatively to provide full stands. It has notable ability to suppress reinvasion of undesirable vegetation. It recovers slowly when cut for hay, and tends to sod bind and requires root cultivation and high fertility. A very useful plant for erosion control. Southern strains (Lincoln) are best for mountain brush and favorable sites in the sagebrush and pinyon-juniper zone. Intermediate strains (Manchar) are best on higher elevation mountain rangelands. Planting depth 1/4 to ½ inch. "Manchar" is recommended for forage plantings on meadows, hay or pasture. "Lincoln" is recommended for erosion control and waterways; it produces less forage but is more aggressive in vegetative spread than "Manchar."

**Canarygrass, Reed** (Native)

A course, vigorous, productive, long-lived sodgrass, with wide adaptation. It is frost tolerant, suited to wet soils (but also somewhat drought tolerant). Initial stands are often poor because of tardy germination and weak seedlings. Once established it can withstand continuous water inundation for 70 days in cool weather. It invades wet areas along ditches, canals, and drains. Produces abundant spring foliage, with tremendous annual yields on moist fertile soils, high in nitrogen and organic matter. Infertile soils promote sod binding problems. Mature stands prove to be very unpalatable, requiring close grazing and mowing management for quality production. Planting depth 1/4 to ½ inch. Adaptable variety, "Rise." Alkaloid free varieties include "Palaton," "Venture," and "Ioreed."

**Dropseed, sand** (Native)

Sand dropseed is commonly found growing on sandy soils, but it grows well on other soils also. It is useful only in the southern part of the state in areas where there is a significant amount of summer precipitation. Young grass is readily eaten by all types of livestock, but it is relatively unpalatable when dry. Though its palatability is low, it provides fair winter forage. It is adapted to desert areas of low rainfall, 8 to 10 inches annual precipitation, and is extremely drought tolerant.

**Fescue, creeping red** (Introduced)

A long-lived, low-growing, competitive (but slow developing) weakly rhizomatous grass. It is moderately palatable, shade tolerant, and produces a good turf with fine leaves and fine tough roots. It is less drought tolerant than hard fescue. Performs best on acid soils, and productivity actually increases with acidity. Well adapted for roadside seedings, steep slopes, waterways, and burned over forests in areas where precipitation exceeds 15 inches and as a permanent cover crop in orchards. An important, persistent grass in erosion control seedings. Planting depth 1/4 to ½ inch. Adaptable varieties include "Pennlawn" and "Fortress."

**Fescue, hard** (Introduced)

A very fine leaved, low growing, bunchgrass with fair palatability to livestock. A dense voluminous root system often encourages increased rodent populations. It is widely used for highway plantings, airport strips, burned over timberland, where a low-growing, persistent, competitive ground cover is needed, in areas where precipitation exceeds 13 inches. Seedlings are slow to establish, but persist through the development of abundant fibrous roots. Planting depth 1/4 to ½ inch. "Durar" is the adapted variety.

**Fescue, sheep** (Introduced)

A perennial bunchgrass that is drought hardy, but difficult to establish. It requires 8 to 14 inches of precipitation for establishment at elevations that range from 5,000 to 8,000 feet. Once established it competes well with grass species noted for their endurance. It is quite unpalatable to cattle but readily used by sheep. The primary use is for seeding erodible mountain soils where grazing is less desirable, and good ground cover is desired. Established stands will protect soil from erosion on roadsides, ditchbanks, skid trails, campsites, dryland farmsteads, and recreation areas. It is adapted to high mountain, mountain and stony hill sites. Recommended variety is "Covar." Seeding depth 1/4 to ½ inch.

**Fescue, tall** (Introduced)

A long-lived, high producing, cool-season bunchgrass suited for use under a wide range of soil and climatic conditions. It tolerates acid to alkaline conditions, is less palatable than other pasture grasses, which may be grazed out of a mixed stand. Suited to irrigated, subirrigated, or moderately wet conditions, as well as dryland areas where the effective precipitation exceeds 18 inches. Best suited for moist alkali areas in the lowlands. Also a high producer in open aspen and subalpine ranges. Planting depth 1/4 to ½ inch. Adaptable varieties include "Alta" and "Fawn." "Forager," "Johnstone," "Mozark," and "Martin" are endophyte free cultivars.

"Kenhy" is a hybrid of fescue and perennial ryegrass. It is more palatable than regular strains of fescue, and retains its wide adaptation and resiliency.

NOTE: Fungal endophyte problems can occur when livestock graze tall fescue (especially pure stands); this problem can be greatly reduced, if not eliminated, by using endophyte-free seed at planting time.

**Foxtail, creeping** (Introduced)

A long-lived cool-season, dense sod-forming grass that is adapted to wetland meadow sites. It has low seedling vigor, but once established spreads readily by rhizomes. It grows early in the spring and leaves remain green until after hard frosts in the late fall. It is very cold tolerant and can persist in areas where the average frost-free period is less than 30 days. Meadow foxtail is adapted to wet and dry meadows, meadowland hay, most high elevation ranges in the subalpine zone and shoreline stabilization on ponds, lakes, streams, and waterways. It is only moderately salt tolerant but produces good quality forage on wet fertile sites where it is usually superior to other wetland grasses such as Reed canarygrass. The only cultivar of this species is "Garrison." Seed is very light and difficult to seed unless rice hulls are used. Planting depth is 1/4 to ½ inch.

**Galleta** (Native)

Galletagrass is a rhizomatous perennial grass. It is 6 to 14 inches tall with short curly leaves. Galletagrass is widely adapted and can grow on sandy to sandy clay loam soils. This grass is moderately palatable to all classes of livestock. It is a good cover species for watershed protection. It is adapted only to southern areas of the state of Utah. Recommended cultivar is "Viva."

**Grama, blue** (Native)

Blue grama is a warm-season, perennial grass. It is a short grass with narrow leaves that form a

curly mass of bunchy sod. Blue grama grows erect in definite bunches and reproduces only by seed. It will stand extreme drought and grows rapidly when conditions are favorable. It is very palatable, and is grazed by all types of livestock. Recommended releases are "Hachita" and "Lovington."

**Grama, sideoats** (Native)

Sideoats grama is a warm-season perennial. This mid-sized grass with short rhizomes is widely adapted from deep to shallow soils. It produces high quality, nutritious, green forage, readily eaten by all types of livestock. It cannot stand repeated close grazing of 2 to 3 inches during the growing season. This grass is a good seed producer and responds to nitrogen fertilizer. Recommended releases are "Vaughn" and "Niner."

**Needlegrass, green** (Native)

A cool-season, medium fine-leaved bunchgrass that is moderately palatable to livestock. Widely adapted from Alberta to New Mexico. Adapted to a wide range of soils, most often clayey soils. It is adapted to areas receiving 10 to 14 inches of annual precipitation. "Lodorm" is recommended. Planting depth is 1/4 to ½ inch.

**Needlegrass, Letterman** (Native)

A perennial bunchgrass adapted to mountain valleys and parklands in the 6,000 to 8,000 foot elevation. Preferred range sites include mountain loam, clay loam and semi-wet meadow sites that receive 16 to 18 inches annual precipitation. Its forage value to livestock is only fair to poor, but receives considerable use by wildlife. It responds as an invader under grazing pressure. It does well in watershed areas. Planting depth is 1/4 to ½ inch

**Orchardgrass** (Introduced)

A long-lived, high producing bunchgrass, adapted to well drained soils. It is very shade tolerant and is highly palatable to livestock and wildlife, especially in the early part of the season. It is a widely preferred species for hay, pasture, or silage. It is less winter hardy than smooth brome or timothy and is more vulnerable to diseases than many pasture grasses. Orchardgrass is compatible with alfalfa and clover. It can be grown under irrigation or on dryland where the effective precipitation is at least 16 inches and is used in erosion-control mixes for cut-over or burned timberland where it is valued, primarily as a forage. It is also adapted to favorable mountain-brush and mountain lands except those with dry south exposures. Planting depth is 1/4 to ½ inch. There are early-, mid-, and late-season varieties. Late maturing varieties are preferred in mixtures with alfalfa. The following varieties are adapted in Utah:

| | | |
|---|---|---|
| Early | "Hallmark," | "Potomac" |
| | Mid | "Akaroa" |
| | Late | "Latar" |

"Paiute" is a dryland orchard grass, which is more drought tolerant than other strains. Adapted to pinyon-juniper and mountain brush types.

**Panicum, blue** (Native)

Blue panicum is a warm-season, vigorous perennial bunchgrass. It has an extensive root system and forms tough crowns of short rhizomes. The early vigor of this grass makes it an excellent forage producer in warmer areas. The plant prefers heavy, rich loam soils. It produces well if properly fertilized and irrigated, but loses its vigor and becomes yellowish green with inadequate moisture and fertility. The adapted variety is "A-130."

**Redtop** (Introduced)

A perennial sod-forming grass. Its creeping rhizomes provide good soil protection for critical area

plantings, such as logging roads, ski slopes, roadbanks, and other disturbed areas at higher elevations where moisture is adequate. It can also be used for lawn or turf in these areas. It performs well on low fertility sites. It has good palatability for cattle and fair to good palatability for sheep. Deer graze it to a limited extent and it is a highly satisfactory forage for elk. It is primarily used for hay and pasture plantings in mountain meadows. It establishes easily from seed. Seeding depth is 1/4 inch.

**Ricegrass, indian** (Native)

A perennial bunchgrass adapted to sandy soils and dry desert ranges. Seed of most strains is very slow to germinate due to a thick seedcoat, which can be treated in sulfuric acid to improve germination.

Untreated seed must be planted deeper than most species so moisture will break down the seed coat and promote germination. It is palatable, and the high protein and fat content of its seeds increase its forage value. Grazing must be managed carefully if stands are to persist. Recommended sites are sunny exposures with sandy or gravelly soils. Grows on raw subsoils from the lowlands into high mountains. Planting depth can be up to 3 inches depending on pre-treatments and soil types. "Nezpar" is a variety with improved characteristics. "Paloma" is better adapted to south and southeastern Utah.

**Ryegrass, annual** (Introduced)

A vigorous, winter-active annual grass adapted to a wide variety of soil conditions. Can be grown under irrigation or on dryland where the effective precipitation is at least 15 inches. Makes a good winter cover crop or temporary seeding on disturbed areas. Establishes rapidly, is strongly competitive and retards establishment of perennial grasses and legumes if it is seeded too heavily in a mixture. Several varieties are available. Seeding depth, 1 to 2 inches.

**Ryegrass, perennial** (Introduced)

A relatively short-lived, rapid developing, vigorous, perennial bunchgrass adapted to a wide variety of soil conditions. Can be grown under irrigation or on dryland where the effective precipitation is at least 18 inches. It does best where winters are mild, but will perform adequately where winters are severe. Retards the growth of other perennials if it is seeded too heavily in a mixture. It recovers well after grazing in the spring but tends to become dormant in summer. Suited for most acidic areas in the lowlands, for hay or pasture. Planting depth 1/4 to ½ inch. Adapted varieties are "Linn," and "Manawa (H1)." Tetraploids are also available, and have shown promising results in tests at several locations in northern and central Utah. Most tetraploids were developed for short-rotation pastures or green chop. These varieties include "Bastian," "Grimalda," and "Reveille."

**Sacaton, alkali** (Native)

A perennial bunchgrass adapted and dependable on semi-desert alkali flats and meadows at elevations from 600 to 8,000 feet, receiving 12 to 18 inches of precipitation. It is commonly associated in plant communities supporting western wheatgrass, pinyon, and greasewood. Forage value is only fair to poor and becomes coarse, tough, and unpalatable when mature. Because of a strong root system it is valuable in erosion control.

**Squirreltail, bottlebrush** (Native)

A perennial bunchgrass, 10 to 22 inches tall, which provides energy for grazing animals in the winter and is a fair quality feed in the spring. It is commonly mistaken for foxtail barley but is a more desirable grass. It is a dependable soil cover plant and an important, persistent grass in erosion control seedings. It is well adapted to areas of sagebrush, shadscale, western wheatgrass, pinyon and juniper that receive 8 to 18 inches of annual precipitation. Overall forage value is good.

**Timothy** (Introduced)

A bunchgrass adapted to cool, humid areas. It performs well, with moderate to high yields on wet fertile meadowlands, forms cover quickly, volunteers readily on preferred sites, and is moderately palatable. Timothy hay is a premium feed for horses and is compatible with legumes. Severe damage can result from early grazing during moist conditions. It is adapted to high elevations where effective precipitation is 18 inches or more. Recommended sites include moist mountain sites, ponderosa pine zone, meadows, aspen, and open timber. Timothy is also used as a ground cover and to control erosion on cut-over or burned-over timberland. Planting depth 1/4 to ½ inch. Adapted varieties are "Climax," "Mohawk," and "Patomic."

**Wheatgrass, bluebunch** (Native)

Long-lived, drought-tolerant, wide-spread bunchgrass. It begins growth early in spring and again with the onset of fall rains. It is very palatable and recovers rapidly after grazing, but has low resistance to repeated grazing. Several years are required for stands to reach full productivity. Recommended sites include foothills with 10-14 inches precipitation, sagebrush, ponderosa pine, mountain-brush and juniper-pinyon ranges. Low plant vigor results in poor stands on sites above 6500 feet elevation. Recommended planting depth is 1/4 to ½ inch. Adapted varieties are "Whitmar" and "Goldar." "Secar," previously considered to be bluebunch wheatgrass but identified as a subspecies of thickspike wheatgrass is more vigorous and productive than bluebunch wheatgrass (see Snake River wheatgrass).

**Wheatgrass, crested - Fairway type** (Introduced)

A very long-lived, drought-tolerant, vigorous bunchgrass. Similar to standard crested wheatgrass, but shorter, earlier maturing, with finer stems and leaves, which facilitates uniform grazing. Establishes on similar sites as Standard and reportedly grows more effectively than Standard at higher elevations. Planting depth 1/4 to ½ inch. Adapted varieties are "Fairway" and "Ephraim."

"Ephraim" is a recently released tetraploid variety of *A. cristatum* that is rhizomatous. It appears to offer good possibilities for erosion control on adapted areas receiving increased moisture.

**Wheatgrass, crested - hybrid** (Hybrid)

A hybrid between standard and induced tetraploid fairway crested wheatgrass. Seedlings are very vigorous during germination and early establishment. Survives under greater competition and lower precipitation, yields 15-20% more forage than parents but is more stemmy than other crested wheatgrasses. It is an outstanding seed producer. Occupies same sites as standard and fairway crested. Especially useful in drier sagebrush, downy brome sites. Has established and survived in areas receiving 6 to 8 inches of precipitation. Planting depth 1/4 to ½ inch. The only cultivar is "Hycrest."

**Wheatgrass, crested - Siberian** (Introduced)

Similar to standard crested wheatgrass. It is awnless, has finer leaves and retains its greenness and palatability later into the summer than other crested wheatgrasses. However, it yields less, and has poorer seedling vigor than most crested cultivars. It occupies sites where standard crested wheatgrass will grow, and is especially useful on pinyon-juniper sites and sandier soils. Once established, it is reported to be well adapted to light, droughty soils. Planting depth 1/4 to ½ inch. Adapted variety is "P-27."

**Wheatgrass, crested - standard** (Introduced)

A very long-lived, drought tolerant bunchgrass adapted to a wide range of ecological sites and zones receiving as little as 8-10 inches of precipitation. Growth begins early in the spring and re-occurs with fall moisture. Palatability is excellent in the spring and late fall, but it is unpalatable during summer dormancy and after seed formation. It has very vigorous seedlings. Adapted to foothills receiving 10 to 15 inches of precipitation and sagebrush, ponderosa pine, mountainbrush,

and juniper-pinyon ranges. Expect low vigor and poor stands above 6,500 feet elevation, especially in Northern Utah. Planting depth 1/4 to ½ inch. Adapted variety is "Nordan."

**Wheatgrass, intermediate** (Introduced)

A mild sod-forming, late maturing, long lived grass suited for use as hay and pasture, alone or with alfalfa. Begins growth early in the spring, and remains green and palatable into the summer, producing large amounts of quality forage. It does not produce mature seed at high elevations, but spreads vegetatively. Recommended from intermediate sagebrush sites into the high mountains up to 9,000 feet, and on dry meadows, receiving 14 to 18 inches of precipitation. Useful on disturbed sites for soil stabilization. It is moderately shade tolerant. Planting depth 1/4 to ½ inch. Adapted varieties are: "Greenar" selected for forage production and compatibility with alfalfa; "Oahe," improved for seed production, forage yield, and rust resistance; and "Tegmar" which is a low-growing cultivar noted for erosion control, sod-formation and seedling vigor.

**Wheatgrass, pubescent** (Introduced)

A long-lived aggressive sod-former adapted to low-fertility sites and fine-textured soils. Similar to intermediate wheatgrass, but somewhat more drought-resistant, alkali tolerant, and less palatable. Is better adapted for pasture than for hay. Its ability to remain green during the summer when soil moisture is limited is a significant advantage.

Adapted to foothills receiving 12 to 16 inches of precipitation. It is suited to areas from intermediate sagebrush sites into the high mountains, but not to meadows and shady areas. Very useful for erosion control on a wide range of sites. Suggested varieties are "Luna," most commonly used in Utah, and most drought tolerant of pubescent varieties. Other varieties include "Mandan," "Topar," and "Greenleaf."

**Wheatgrass, slender** (Native)

This is a short-lived bunchgrass with good seedling vigor and moderate palatability. It is valuable in erosion-control seed mixes because of its rapid development, salt tolerance, and compatibility with other species. It tolerates a wide range of conditions and adapts well to high altitude ranges and more favorable sites on mountain-brush areas. Excellent in aspen and tall mountain brush. Recommended planting depth is ½ to 3/4 inch. "Revenue" is a Canadian variety, selected for salinity tolerance, seed set, and forage yield. "San Luis," a newly released variety is adapted to high elevations. "Pryor" has demonstrated good salinity and drought tolerance.

**Wheatgrass, Snake River** (Native)

A subspecies of thickspike wheatgrass that is similar to bluebunch wheatgrass. It is adaptable to most areas suitable for bluebunch; but is more vigorous and productive. (See bluebunch wheatgrass.) The only variety is "Secar."

**Wheatgrass, streambank** (Native)

A long-lived, drought-tolerant, creeping sod-former adapted to fine and medium textured soils. Has excellent seedling vigor and is particularly well adapted to erosion control where effective precipitation is 12 to 25 inches. It has little value as a forage crop and is primarily used to stabilize roadsides, ditch banks, and lakeshores. Planting depth 1/4 to ½ inch. The only variety is "Sodar."

**Wheatgrass, tall** (Introduced)

This is long-lived, tall, vigorous, very late-maturing bunchgrass. Established plants are very tolerant of salt, alkali and high water tables. It starts growing early in the spring and reaches maturity in late summer. Reported to be the latest maturing wheatgrass. Palatability is fair early in the season, but the mature plant becomes very unpalatable and must be managed so it is utilized at earlier stages of growth However, it does not tolerate continuous close grazing. Old coarse growth often prevents grazing of current growth. It is a good winter forage for livestock, especially for horses, when supplemental protein is provided. It is adapted to a very wide range of soils and

climates and is a useful erosion control species on critical areas. It does well in salty areas where greasewood and saltgrass grow, where the water table is a few inches to several feet below the surface. It is also suited to favorable intermediate sagebrush, mountain-brush, and pinyon-juniper sites because of its drought tolerance. Recommended planting depth is 1/4 to 3/4 inch. Adapted varieties are "Alkar"-north, "Jose"-south.

**Wheatgrass, thickspike** (Native)

A long-lived, sod-forming grass widely distributed in the northern part of the Intermountain Region. It is characterized by drought tolerance, early spring growth, and fair palatability but low forage production. More drought tolerant than western wheatgrass, it is well suited for wind erosion control on coarse-textured soils. It is best utilized as forage when crested wheatgrass is fully headed and has little nutritive value. Adapted to disturbed range sites and dry areas subject to erosion, roadsides, and waterways. Planting depth 1/4 to ½ inch. Improved varieties include "Critana" and "Elbee."

**Wheatgrass, western** (Native)

A long-lived, widely distributed, strongly rhizomatous grass that begins growth later in the spring than most wheatgrasses. It germinates poorly, has low seedling vigor. Plantings usually result in scattered stands that spread in 3 to 4 years to dominate the site. Once established it becomes very persistent and provides moderate quality forage and excellent soil binding and erosion control. It is particularly productive in clayey swales and waterways, and has moderate to high salt tolerance. It is adapted to lowlands receiving more than 12 inches of precipitation. Recommended planting depth is 1/4 to ½ inch. Adapted varieties are "Barton," "Rosana," "Arriba," and "Rodan."

**Wildrye, Altai** (Introduced)

Altai wildrye is a winter hardy, drought-tolerant, long-lived perennial grass. Seedlings are difficult to establish, but mature plants are very durable. Its good curing qualities and erect growth make it especially useful for late fall and winter grazing. Forage quality is similar to Russian wildrye. It is unique among the adapted cultivated grasses because the roots can penetrate 10 to 14 feet and can utilize moisture at that depth. It is almost as tolerant of salinity as is tall wheatgrass. It is adapted to semi-deserts and grows well on saline soils. Recommended cultivar is "Prairieland."

**Wildrye, basin** (Native)

A slightly spreading, robust, native grass throughout the western United States. It is tall, course, long-lived, highly palatable early, becoming very unpalatable with maturity, but useful for calving pasture and wildlife forage cover. Poor seedling vigor usually results in sparse stands but it is one of the highest producing grasses once established. Mature plants are unpalatable and need to be managed so they are utilized sooner. Avoid close grazing or clipping that may result in heavy plant loss in a single season. Providing protein supplements during winter grazing also makes more effective use of old growth. This plant is adapted to saline or alkaline lowlands, flood plains, and clayey loam soils that receive more than 14 inches of precipitation. It is particularly well suited for many big sagebrush, juniper areas, and performs well throughout the mountain brush zone. Recommended planting depth ½ to 3/4 inch. Adapted variety is "Magnar."

**Wildrye, beardless** (Native)

This cool season perennial rhizomatous grass provides early spring grazing for wildlife and livestock. Its ability to recover rapidly following inundation by spring flooding makes it an important erosion control plant. Salt tolerance makes it a good weed control plant in saline irrigated pastures. It is planted on dryland saline seep discharge areas and can be effectively established on moist alkaline soils at low and medium elevations, and along streams and moist, saline seepy areas. The rainfall where native stands are most abundant ranges from 5 to 9 inches annually. Fall plantings are required because seed must receive a cold treatment to germinate. Germination is poor and seedlings weak and compete poorly with weeds and other grasses in the

early developmental stages. However, once established it is very rhizomatous and maintains stands for many years. Recommended variety is "Shoshone."

**Wildrye, Mammoth** (Introduced)

This coarse stemmed, rhizomatous perennial is unpalatable to livestock. It is adapted to inland sand dunes, deep sands, and dredge spoils, where it will stop sand movement and provide permanent cover, and in wildlife plantings to provide cover and nesting sites for upland game birds. It requires at least 7 inches of rainfall annually. Cold, frost, and drought tolerant, it requires neutral to slightly alkaline soils with good drainage. Clones are used on moving dunes and nonstabilized areas. Two years are required to grow usable clones from seed. The recommended variety is "Volga."

**Wildrye, Russian** (Introduced)

This long-lived bunchgrass grows rapidly in the spring, and produces abundant basal leaves that remain green and palatable through summer and fall as long as soil moisture is available. It endures close grazing better than most grasses and established plants withstand drought as effectively as crested wheatgrass. However, most varieties have not consistently formed good stands, which is a result of poor seedling vigor. It is adapted to sagebrush, mountain-brush, and juniper-pinyon sites, and useful on soils too alkaline for crested wheatgrass and too dry for tall wheatgrass. Recommended planting depth 1/4 to ½ inch (very sensitive to deeper placement). "Vinall," an earlier variety, has rather poor seedling vigor, "Swift" was selected for seedling vigor and "Cabree" was selected both for seedling vigor and reduced seed shattering. "Bozoisky," the most recent selection, has increased seedling vigor and forage production.

## CHARACTERISTICS OF LEGUMES AND FORBS

(See Appendix D for scientific names.)

**Alfalfa** (Introduced)

A very productive, palatable perennial legume with numerous varieties whose characteristics are tailored to specific purposes. Suited for use as hay, pasture, or haylage under irrigation or on dryland where the effective precipitation is 12 inches or more. Does not persist with moderate to heavy grazing on rangelands unless rest periods occur. Taproots make it vulnerable to pocket gophers but some varieties are less susceptible to damage. Seedings can be made in the spring or late fall and seed may require inoculation with nitrogen-fixing bacteria before planting. Adapted to intermediate and favorable sagebrush, pinyon-juniper mountain-brush, and ponderosa pine sites. Does poorly at higher elevations. Alfalfa varieties are changed and improved continually to fit various situations and sites, and it is not feasible to make numerous recommendations in this guide. Contact local County Extension offices for information on alfalfa varieties adapted to local conditions. Recommended planting depth is 1/4 to ½ inch; 1 to 2 pounds per acre in mixture with grass; 10-15 pounds for hay. Plant in a very firm seedbed.

**Aster, blueleaf** (Native)

A perennial forb that commonly occurs in all vegetative types from the upper sagebrush-grass to the subalpine. This forb is generally found on exposed depleted and disturbed sites. It is one of the first forbs to green in the spring, making it highly desirable to livestock and big game. The strong rhizomatous root system make it a very useful species in stabilization of disturbed and erodible areas and in areas that must withstand considerable grazing and trampling. Fall seeding is preferred. Seed can be surface seeded on disturbed soil or drilled to a depth of ½ inch.

**Balsamroot, arrowleaf** (Native)

A broadleaf perennial with a deep woody taproot that grows on well-drained silt to loamy soils in

the sagebrush-grass, mountain brush, ponderosa pine, and on open sunny slopes in the aspen and coniferous forests. This forb is strongly drought-resistant, has good winter-hardiness, tolerates semi-shade, and is strongly tolerant of grazing and trampling. Livestock and big game make extensive use of this forb, especially on spring ranges. Fall seeding is recommended. Seed can be drilled or broadcast but should be covered to a depth of 1/3 inch.

**Burnet, small** (Introduced)

A perennial winter-active forb that grows 2 feet tall. It is semi-evergreen, moderate yielding and non-leguminous, but is deep rooted and has good palatability. Growth is most vigorous in fall and spring. It is best adapted to well-drained soils in the pinyon-juniper areas. It can be grown on low fertility, droughty soils as well as moderately wet and acidic soils. It is easy to establish. "Delar" is a much improved forage yielding variety. However, it may not be as drought tolerant as common localized sources. Planting depth is 1/4 inch.

**Clover alsike** (Introduced)

A short-lived perennial legume that produces abundant palatable foliage on fertile soils. It is suited for hay or pasture under irrigation or on dryland where the effective precipitation is 18 inches or more. It is adapted for use on poorly drained, acid soils, especially in cool areas. Makes good meadow hay and tolerates moderately alkaline conditions. Recommended planting depth is 1/4 inch. Adaptable variety is "Aurora."

**Clover, red** (Introduced)

This short-lived, perennial legume is suited primarily for hay and silage under irrigation, or on dryland where the effective precipitation is at least 25 inches. Requires well-drained soil. Produces best under medium acid to neutral soil conditions. It is compatible with white clover in pasture mixtures, and will reseed itself and spread under favorable conditions. Recommended planting depth is 1/4 inch. Adapted varieties are "Kenland," "Dollard," "Redman," and "Reddy."

**Clover, strawberry** (Introduced)

A spreading, pasture-type, perennial legume suited for use under irrigation or semi-wet soils, and tolerates very strong salty conditions. Less productive than white clover where the latter can be grown. "Salina" tolerates flooding, and is suitable for areas adjacent to overflowing waterways. Recommended planting depth is 1/4 inch.

**Clover, white** (Introduced)

A long-lived, stoloniferous perennial legume suited primarily for pasture but can be used for hay and silage. Can be grown under irrigation or on dryland where the effective precipitation is 18 inches or more. Requires medium to high fertility and adequate moisture for optimum production. It does not tolerate strongly acid or strongly alkaline conditions, but does tolerate poor drainage. May present a bloat hazard when it represents a high percentage of the pasture. It provides good erosion control on streambanks and roadsides, though usually lacking in persistence.

White clover thrives best in a cool, moist climate in soils with ample lime, phosphate, and potash. In general, white clover is best adapted to clay and silt soils in humid and irrigated areas. It grows successfully on sandy soils with a high water table or irrigated droughty soils that are adequately fertilized. White clover is shallow rooted and seldom roots deeper than 2 feet, which makes it adapted to shallow soils when moisture is adequate.

There are three general types of white clover:

**Ladino** is the only large-type variety. It is two to four times as large as common white clover. Winter kill is common under dry winter conditions. It requires a high soil phosphate level and good management for maximum production. "Pilgrim" and "Merit" have been developed for winter hardiness.

Intermediate—"Grassland Huia" is a representative of the intermediate type.

**Small type**—"New York" wild white clover is an example of the small type which is adapted to higher elevations and colder areas. It is the most drought resistant type, very persistent in pastures, withstands close grazing, and is the least productive of the white clovers. "Kent Wild" white clover is also a small type.

**Crownvetch** (Introduced)

A long-lived perennial legume with a strong rhizome and a deep taproot system does well in mountain big sagebrush, mountain brush, and aspen communities that receive more than 21 inches of precipitation. It prefers slightly acid to basic soils and does especially well in calcareous derived soils. It does not do well in poorly drained soils. This semi-evergreen forb forage is preferred by all classes of livestock and wildlife. The strong spreading rhizomes of this species make it an excellent soil stabilizer. Crownvetch does well in mixtures. It requires fall seeding 1/4 to ½ inch deep. Three improved varieties are available: "Emerald," "Penngift," and "Chemung." All do well in the mountain brush and aspen. "Emerald" is the smallest and produces less foliage but it is the most aggressive underground spreader.

**Flax, Lewis** (Native)

A perennial semi-evergreen forb that prefers well drained soils ranging from moderately basic to weakly acidic. It prefers growing in the open, but does have some shade tolerance. It is intolerant of poor drainage, flooding and high water tables. This species grows well in all three big sagebrush types, pinyon-juniper and mountain brush communities. It has been successfully seeded in the salt desert shrub type. Lewis flax does well in mixtures. It can be surface seeded on a disturbed seedbed and should not be seeded deeper than 1/8 inch. This semi-evergreen forb is eaten readily by livestock and big game, especially during spring and winter. Seedings do well on disturbed sites. "Appar" was released for its superior forage and seed production and palatability to livestock and wildlife.

**Globemallow, gooseberryleaf and Scarlet** (Native)

Gooseberryleaf globemallow is a drought tolerant perennial forb found throughout the pinyon-juniper, sagebrush-rabbitbrush, shadscale and blackbrush communities. It is most common in areas receiving 8 and 12 inches of precipitation. It has been successfully seeded in the blackbrush, shadscale, pinyon-juniper and sagebrush communities and on most disturbed sites with basic soils. Fall seeding is recommended. Seed should not be planted deeper than 1/4 inch. Livestock and big game make fair to good use of this species. It greens up early in the spring and following fall storms. It is one of few forbs that can be successfully seeded on disturbed, exposed, eroded sites in harsh environments.

Scarlet globemallow is a low-spreading perennial with creeping rhizomes. This species has considerable drought resistance and establishes especially well on disturbed sites. It is an excellent soil stabilization species on harsh sites.

**Goldeneye, showey** (Native)

A very attractive perennial occurring throughout the Intermountain West between 3,500 to 11,000 feet elevation. It is found in moderately moist habitats to dry, open rocky slopes in the sagebrush-grass, pinyon-juniper mountain brush, aspen, spruce-fir, and subalpine and often in riparian communities. It is somewhat shade tolerant, and adapted to a wide variety of soils ranging from heavy clays to gravel and from acidic to basic. It establishes quickly on disturbed sites, has rapid seedling development and competes well with annuals and perennials. It will invade disturbed sites and may quickly become the dominant species. The seed can be broadcast or drilled with equal success. Seed should not be planted deeper than 1/4 inch during late fall or early winter. It does well planted as a component of mixtures. Established stands should be allowed to set seed every 3 to 4 years.

It is a plant actively sought by big game and livestock, and becomes a good candidate for

summer home sites, campgrounds and other areas with a high aesthetic value.

**Ligusticum, Porter** (Native)

The most widespread ligusticum in the Intermountain West. A perennial which is found in the aspen, spruce-fir, and subalpine types in openings and as a component of the understory in aspen stands. Porter ligusticum prefers well-drained soils, has fairly good drought tolerance, good winter hardiness, and can stand considerable use. Livestock, particularly sheep, and big game make considerable use of this species.

Fall seeding onto a disturbed seedbed is preferred. Seeded areas should not be grazed for at least 2 years following seeding. Established stands should be allowed to produce seed periodically as reproduction is entirely by seed.

**Lupine, mountain** (Native)

Silky and silvery lupine have poisonous characteristics and can cause animal death if used improperly during some seasons of the year. Care should be taken with livestock where substantial quantities of lupine are available. Livestock that obtain forage from other species in addition to lupine are generally not aversely affected. When planting lupine, care should be taken to insure that it is seeded in mixtures with other species and solid stands of lupine are not established.

It has good potential for revegetation of ranges in the upper sagebrush-grass, mountain brush, ponderosa pine, and aspen types. This species provides early spring succulence and is taken by cattle, sheep, deer, rodents, and small mammals throughout the year. It can be seeded in mixtures with grasses and other broadleaf herbs. It is productive, provides soil protection, persists with grazing, and does well in riparian disturbances and dry meadows which are not flooded.

**Milkvetch, cicer** (Introduced)

A rhizomatous non-bloating legume that must be inoculated with rhizobium bacteria for successful planting. A heavy seed and forage producer with a forage quality similar to that of alfalfa. It is adapted to lowland areas that receive more than 14 inches of precipitation. Well adapted to sagebrush-grass, pinyon juniper and mountain brush, except in the shade of trees or high shrubs. Recommended planting depth is 1/4 to 3/4 inch. Recommended varieties include “Lutana,” and “Monarch.”

**Parsnip, cow** (Native)

Cow parsnip is found in Alaska across Canada, in the Western States, and Georgia. In the Intermountain West, cow parsnip occurs in the aspen, spruce-fir and subalpine areas, and meadows; mainly in rich, loamy soils. This species prefers semi shade and open woodlands. Seed can be broadcast or drill seeded, preferable in the fall before snow fall. Seed should not be covered more than ½ inch. It is highly palatable to livestock and big game. It has considerable potential as an ornamental around summer homes, offices, and recreational areas. Reproduction is by seed only, and if reproduction is to occur, seed crops must be allowed to mature occasionally. Ranges with cow parsnip as a preferred species require some type of deferred grazing.

**Penstemon, Palmer** (Native)

A relatively short-lived semi-evergreen forb that occurs in the blackbrush, sagebrush-grass and pinyon-juniper types in basic and slightly acidic soils on disturbed and exposed sites. It is a pioneering species and is especially suited for seeding exposed, depleted, and disturbed sites. It has considerable potential as an ornamental. This semi-evergreen species is readily sought out by big game and livestock during winter and spring months. It can be fall broadcast or drilled, but should not be seeded deeper than 1/8 inch.

The only released variety is “Cedar.” Selected for its wide area of adaptation, winter succulence, forage production and suitability to livestock and wildlife.

**Penstemon, Rocky Mountain** (Native)

This perennial semi-evergreen forb is found in the upper pinyon-juniper, mountain big sagebrush, mountain brush, and open areas in aspen and coniferous forest. This species does well in areas receiving more than 15 inches of precipitation and on rocky and sandy loam soils that range from weakly acidic to alkaline. It is readily consumed by livestock and wildlife. This species has considerable potential as an ornamental. It is widely used to stabilize depleted, disturbed, and eroded sites. Seed can be broadcast or drilled up to 1/8 inch deep. Fall seeding is recommended. The variety "Bandera" was released for its longevity and seed production.

**Penstemon, Wasatch** (Native)

A semi-evergreen forb found in the mountain brush, ponderosa pine, aspen-coniferous forest and subalpine that receive more than 18 inches annual precipitation. It can be found in rocky soil, but is more abundant in fertile deeper soil. Livestock and wildlife make considerable use of this forb. Wasatch penstemon does well in mixtures and on disturbed and erosive areas.

A number of penstemons are seeded primarily to stabilize depleted, disturbed and erosive areas, and as ornamentals. These include: Firecracker penstemon (*P. eatonii*), Low penstemon *(P. humilis*), Rydberg penstemon (*P. rydbergii*), and Thickleaf penstemon (*P. pachyphyllus*).

**Sage, Louisiana** (Native)

A perennial rhizomatous forb that occurs in all vegetative types from the sagebrush through the subalpine. This species does well on shallow as well as deep, slightly acid to basic soils. It is seeded on various types of disturbed areas and provides soil cover and stabilization. It can be broadcast or drilled, but should not be seeded more than 1/8 inch deep. The variety "Summit" was released for its vigorous rhizome activity, ground cover and wide area of adaptation.

**Sainfoin** (Introduced)

This cool-season legume is impervious to alfalfa weevil, is non-bloating, and early blooming but is not as productive as alfalfa. Adapted to deep soils of medium texture, high lime, dryland and irrigated, and alkaline soils. It does not tolerate wet soils, high water table, or frequent irrigation. Good seedling vigor. Can be grazed or used for hay. It requires at least 13 inches of annual precipitation. Recommended planting depth is ½ to 3/4 inch. Plant in spring and fall. Adapted varieties are "Eski," "Remont," "Onar," and "Renumex."

**Sweetanise** (Native)

This erect perennial grows to a height 4 feet and is found in cool, moist woods, moist hillsides, valleys and forest openings in stands of aspen, and spruce fir, and in subalpine areas. It has considerable shade tolerance but also does well in open areas. It grows in mixed communities and in pure stands. Seeding is best accomplished in the fall. Seed should not be covered more than 1/4 inch. It does well when seeded in mixtures, is fairly easy to establish and spreads fairly quickly from seed. Livestock and big game are fond of sweetanise. It remains green throughout the grazing season.

**Sweetvetch, Utah** (Native)

There is considerable variation in Utah sweetvetch, a perennial legume, that occurs from the shadscale saltbush to the subalpine areas receiving at least 10 inches of precipitation. It is found on acidic and basic soils ranging from sand to heavy clay. Its deep taproots extract deep soil moisture, which results in considerable drought resistance and winter hardiness. It does well in single seedings or in a mixture. Seed should be extracted from the pod and fall seeded at least 1/8 inch to 3/4 inch deep. Livestock and big game graze this species. It greens up early in the spring and basal leaves remain green throughout the winter.

**Sweetclover, yellow** (Introduced)

A tall, stemmy, deep rooted, biennial legume that produces abundant forage the first 2 years. It reseeds itself, and maintains good stands if it is not crowded out by perennials but produces poor quality forage during mid to later stages of growth. Adapted sites include the sagebrush-grass to the subalpine areas, also moist salty lowlands, road cuts and road sidings. Maintains stands in grass where ample moisture is available. Suited for green manure under irrigation or on dryland where the effective precipitation is at least 15 inches. Contains coumarin, a precursor dicoumarol, a blood anti-coagulant. Animals foraging on pure stands may be killed. Recommended planting depth is 1/4 to ½ inch. Adapted variety is "Madrid."

**Trefoil, birdsfoot** (Introduced)

A long-lived, deep-rooted legume suited for use as pasture or hay. Can be grown under irrigation or on dryland where the effective precipitation is 18 inches or more. Does not bloat grazing animals. It is very winter hardy, useful at high elevations and retains its quality better than alfalfa when mature. The decumbent and intermediate types tolerate close grazing better than erect types. It tolerates poor drainage, is quite vigorous, and is excellent for erosion control, big game food, and beautification. It is somewhat drought tolerant and does well in the upper half of mountain brush, openings in aspen and irrigated pasture. Recommended planting depth is 1/4 to ½ inch. Adapted varieties are "Empire" (decumbent growth), "Maitland" (erect growth), and "Tretana."

**Yarrow, western** (Native)

Western yarrow is a perennial member of the sunflower family found from the valley bottoms to subalpine areas. It is most common in mountain brush, aspen, and open timber areas. It has some shade, drought, and grazing tolerance and is found in sandy to loam soils ranging from weakly basic to weakly acid. Yarrow spreads by seed and rhizomes and is especially suited to disturbed and depleted areas. Fall seeding is recommended. Depth of seeding should not exceed 1/4 inch. The species can be seeded with other species and is easily transplanted. In some circumstances it is considered a weedy species.

## CHARACTERISTICS OF WOODY PLANTS

(See Appendix D for scientific names.)

**Bitterbrush, antelope** (Native)

Antelope bitterbrush is an intricately branched shrub which varies in form, from low prostrate to erect arborescent as tall as 15 feet. It normally occurs in well-drained, sandy, gravelly, or rocky soils throughout upper sagebrush, pinyon-juniper, mountain brush, ponderosa pine, and lodgepole pine zones. Seedlings are vigorous and compete well when seeded with herbs. It grows rapidly and furnishes considerable forage. Upright growth forms are heavily browsed during the winter. It is one of the principal species in game and range seedings. Antelope bitterbrush is an important browse plant for game animals, sheep, and cattle. This species maintains itself very well even under severe grazing conditions. It is very prone to fire damage. "Lassen" antelope bitterbrush is a large upright variety suited to neutral (especially granitic) soils.

**Bitterbrush, desert** (Native)

Desert bitterbrush is confined to warmer regions in the state than antelope bitterbrush. It is most prevalent throughout the pinyon-juniper, blackbrush, and big sagebrush communities of Southern Utah. It is shorter in stature than most antelope bitterbrush growth forms. This species differs from antelope bitterbrush in being evergreen instead of deciduous. It is genetically compatible with antelope bitterbrush and natural hybrids are commonly encountered. It is an important winter forage due to the presence of highly nutritious winter leaves. Seedlings of desert bitterbrush are usually less vigorous than those of antelope bitterbrush, yet plants establish well amid harsh

situations. Growth of young plants is also slower than antelope bitterbrush, but established plants persist well. It recovers after wildfires even under arid situations. It has been planted with good success in areas where antelope bitterbrush occurs, and is subjected to frequent burning. It becomes a critical species on winter ranges for big game. Seeding should be made in well prepared seedbeds.

**Ceanothus, Martin** (Native)

A native of the Intermountain West, this shrub occurs in pinyon-juniper, ponderosa pine, and aspen zones on well-drained, medium-textured soils, often rocky and shallow; it also tolerates weakly acid to weakly basic and mostly nonsaline soils. It has moderate shade tolerance, fair drought tolerance, and good grazing tolerance. Big game and livestock seek out this shrub. It can be seeded in the fall with other species on a firm seedbed to a depth of 1/3 inch.

Recommended for use in game range revegetation mixtures in sagebrush, mountain brush, and juniper-pinyon types. The spreading habit, fire tolerance, and flowers make this species potentially useful in seedings or plantings to stabilize disturbed soils and for roadside beautification.

**Chokecherry** (Native)

A shrub common in moist sites like drainages, ditches, and road shoulders and in cool and moist foothill, montane, and canyon habitats receiving 12 to more than 30 inches of precipitation. Adapted to a wide range of soil textures except dense clay; it does not tolerate poor drainage, prolonged spring flooding and high water tables. More common in silty or sandy soils with good depth, fertility, and drainage. It tolerates moderately acidic, moderately basic, and weakly saline soils. Its roots and suckers sprout aggressively after fire and it is moderately tolerant of grazing. Livestock and big game make extensive use of this shrub. Has good potential on disturbed sites as an ornamental and as a windbreak species. This species can be transplanted and broadcast or drill seeded. Place seed about ½ inch deep. Fall seeding is preferred.

**Cliffrose** (Native)

Cliffrose or Stansbury cliffrose is a broadleaf evergreen that often grows as high as 20 feet, even on severe sites. It grows as dominant stands intermixed with pinyon-juniper, and is widely distributed on favorable sites in the salt-desert shrub, big sagebrush, and black sagebrush types. It is normally found on south and west exposures throughout the mountain brush types. It is well adapted to shallow rocky soils. It provides important high-quality winter forage to game and livestock, although usually less palatable than antelope bitterbrush. Mature plants are killed by chaining, mechanical tillage, and burning, although younger multi-stemmed plants are better able to recover. Small seedlings can be suppressed by annual or perennial herbs. However, once seedlings become well established they are extremely persistent to drought and competition. This shrub hybridizes with antelope bitterbrush and some highly useful populations have developed that express very useful traits. It can be successfully seeded even on harsh sites, however, it should not be seeded directly with competitive herbs. It is one of the principal shrubs currently seeded in wildlife habitat improvement projects. Under natural conditions it does spread by new seedlings, however the invasion of cheatgrass into areas occupied by this shrub has significantly reduced shrub seedling survival.

**Current, golden** (Native)

Golden current is a fast growing shrub that under favorable conditions may reach a height of 10 feet. It grows in several forms and produces considerable foliage. It is best suited to areas receiving more than 12 inches of precipitation, especially in the pinyon-juniper and mountain brush zones. It is an excellent plant for erosion control because it spreads both vegetatively and by seed and is often used in conservation and windbreak plantings. This attractive shrub requires little maintenance and is frequently used in recreational plantings around campgrounds, roadways, etc. It provides food (berries) and cover for upland game and year-round browse for big game and

livestock. It can be readily established by direct seeding, transplanted seedlings, nursery stock, and wildlings.

**Ephedra, green** (Native)

This native evergreen species is common on shallow to medium depth sandy or rocky slopes and in valleys of the salt, southern, and higher creosotebush deserts; desert grasslands, Joshua tree, juniper-pinyon, and oak woodlands. It tolerates calcareous, weakly saline, and slightly saline-alkaline sites, and is sometimes in clay soils. It thrives in dry, well-drained sites, usually on sites receiving 8 to 12 inches of precipitation.

Green ephedra does well in a mixture. Fall seeding is recommended. Seed should be covered 1/4 to ½ inch deep on a well prepared, firm seedbed. Green ephedra is generally seeded in a mixture to revegetate depleted game ranges in the mountain shrub, juniper-pinyon types and sagebrush zones. It can stabilize soil erosion and is useful in highway and park beautification. Livestock and big game make extensive use of this species, which provides green browse year-round.

Nevada ephedra (*E. nevadensis*) is a desert species that is more tolerant of soil salinity and drought. It has potential as a forage and in stabilizing valleys and drier sites.

**Hopsage spiney** (Native)

Spiney hopsage is normally restricted to heavy textured basic soils. It frequently grows in conjunction with salt desert species, or intermixed with big sagebrush and pinyon-juniper communities. This shrub has not been widely seeded, but few substitute species have been found adapted to sites occupied by this shrub. It is particularly important as early spring forage to wildlife. It is a persistent long-lived shrub that occurs on sites that are important winter/spring ranges for big game. It should be fall planted, in a weed-free seedbed. Seedlings do not survive weedy competition, particularly downy brome grass.

**Kochia, forage** (Introduced)

Forage kochia is a semi-evergreen perennial subshrub introduced from Southern Eurasia. This valuable forage shrub is often associated with crested wheatgrass and is seeded on semiarid locations in the Western United States as a forage and reclamation plant.

This shrub develops a fibrous root system with a large deep tap root and has been successfully seeded in areas receiving 5 to 27 inches of precipitation.

It is adaptable to the pinyon-juniper, basin big sagebrush, Wyoming big sagebrush, and greasewood-shadscale zones. It can persist on disturbed harsh soils, has high salt and drought tolerance, tolerates extreme temperatures (-25° to 104°F), low oxalate levels (lower than winterfat and fourwing saltbush), spreads rapidly from seed, produces large number of seed, has moderate shade tolerance, is palatable to livestock and big game, provides food and cover for upland game birds, fair fire tolerance, is compatible with other perennials, competes with annuals, and can increase the forage quality of perennial grass stands during the fall and winter. The lower one-third of the plant remains green and succulent year-round. The upper stems and seed stalks turn brown to red and dry after seed shatter (November to December).

In annual communities such as halogeton or downy brome, forage kochia competes with annuals by reducing their dominance, density, forage, and seed production. In perennial communities, this shrub becomes established in unoccupied areas but does not reduce the density of established perennials.

Direct seeding on rangelands is best accomplished in the fall or winter by broadcasting on top of disturbed or undisturbed soil. If drill seeded, seed should not be seeded deeper than 1/16 inch. Seeding can be in combination with other perennial species. One variety, “Immigrant,” has been released and is described above. Viability of forage kochia seed may drop very rapidly.

**Mountain mahogany, curlleaf and true** (Native)

Two species of mountain mahogany are excellent wildland shrubs for several purposes. Curlleaf

mountain mahogany (*C. ledifolius*) is an evergreen shrub or small tree up to 23 feet tall. True mountain mahogany (*C. montanus*) is a deciduous shrub generally less than 12 feet tall. Both species commonly grow in rocky, mountainous habitats in shallow soils although they (true mountain mahogany in particular) will also grow in more moist fertile soils of canyon bottoms. Both are valuable browse plants for game animals and livestock. Curlleaf mountain mahogany is mainly browsed in the winter whereas true mountain mahogany is utilized year-round. Both are among the most palatable of shrubs to all classes of browsing animals. However, both species are difficult to establish because their seedlings are vulnerable to herbaceous competition and damage as browsing animals seek them out. "Montane" is a widely adapted variety of true mountain mahogany.

**Peachbush, desert** (Native)

Desert peachbush occurs throughout the more arid pinyon-juniper, big sagebrush, salt desert shrub, and blackbrush communities. It frequently occupies dry stream banks and gullies where infrequent runoff occurs. It is an upright deciduous shrub that provides important ground cover and wildlife habitat. This species is not highly palatable to big game or livestock, but is important to upland game birds and small mammals. Fruits form rather large stones or seeds. Germination is often erratic, but small seedlings grow quite rapidly and persist well amid arid conditions. Like many other desert shrubs, this species has not been widely planted, but it is an important species that has not been replaced with another plant.

**Rabbitbrush, rubber** (Native)

Rubber rabbitbrush is a shrub usually 12 to 80 inches high but various forms are available, from dwarf forms to those more than 10 feet tall. Rubber rabbitbrush is composed of numerous subspecies (>20) and shows considerable morphological variation in size, stem, leaf, and flower characteristics. A common plant on plains, valleys, and foothills, rubber rabbitbrush grows best in openings within the sagebrush, juniper-pinyon, and ponderosa pine zones in sandy, gravelly, or clay-alkaline soils. It vigorously invades disturbed sites such as roadcuts and overgrazed rangelands, but other plants will dominate as conditions improve. It is an excellent plant for controlling erosion because of its deep roots, heavy litter, and ability to become established on severe sites. It is used to seed mine disturbances, roadways, and big game ranges and does well when seeded with grasses and forbs. The value of rubber rabbitbrush as browse varies greatly between subspecies and populations. In general, the white to grayish subspecies are more palatable to livestock and big game than green subspecies. Some populations have excellent nutritive quality. Rubber rabbitbrush is browsed little in the summer, more in the fall, and heaviest during the winter. Some populations of this species may have potential as a source of industrial chemicals (rubber, resin, etc.). It is often difficult to control established, unwanted stands. Seed should be surface seeded on disturbed seedbeds and not deeper than 1/8 inch.

**Rose, Woods** (Native)

This species is common in well-drained loamy to sandy soils on plains, foothills, and mountain sites. It tolerates moderately acid to weakly basic but mostly non-saline soils and is most abundant in disturbed soils and open communities with reduced competition. It is an aggressive pioneer in abandoned fields, disturbed sites, gullies, and land cuts and fills, and is common in areas receiving 12 to over 20 inches of precipitation.

Woods rose has shallow roots that branch frequently and plants spread from rhizomes. The foliage is moderately palatable to livestock and big game. This shrub provides good cover and winter food for birds and small mammals.

Woods rose can be transplanted, drilled, or broadcast seeded ½ to 3/4 inch deep. Fall seeding is required.

This species is used by wildlife, especially in plantings for upland game birds, for erosion control and as an ornamental. Related species are used for roadside planting, and in site stabilization and beautification.

**Sagebrush, big** (Native)

Big sagebrush with its four subspecies (basin, Wyoming, mountain, spicate) is a widely occurring, landscape dominating shrub ranging in height from 2.5 to 15 feet. In the lower forms, several main stems generally arise from the base; the tall forms often have a single trunk. Big sagebrush grows in a variety of soils on arid plains, valleys, and foothills to mountain slopes. It is frequently associated with such shrubs as shadscale, saltbush, rubber rabbitbrush, low rabbitbrush, fourwing saltbush, spiny hopsage, spiny horsebrush, winterfat, broom snakeweed, antelope bitterbrush, snowberry, and serviceberry. Big sagebrush is one of the more nutritious shrubs on western winter livestock and game ranges. The palatability of the different populations of this shrub to mule deer, sheep, and other animals varies widely. It is one of the best shrubs for revegetating depleted winter game ranges in the Intermountain area. Because big sagebrush can establish rapidly from both transplants and direct seedings, it is useful for stabilizing washes, gullies, roadcuts, and other exposed sites. It is widely used in projects for large game improvement projects. Plants can spread by natural seeding and furnish considerable forage soon after seeding. "Hobble Creek" is a robust, palatable form of mountain big sagebrush adapted to areas receiving more than 14 inches of precipitation and deeper soils. Big sagebrush is aggressive and persistent and sometimes forms closed stands, which may require thinning and rejuvenation. Seed should be surface seeded on a disturbed seedbed and not deeper than 1/8 inch. Sagebrush seed rarely remain viable 2 years after harvest.

**Sagebrush, black** (Native)

Black sagebrush is a small spreading, aromatic shrub that usually reaches a height of 6 to 8 inches but occasionally may reach heights of 30 inches. It has a dull grayish-tomentose vesture that makes it appear to be darker than big sagebrush. It grows in dry, stony, shallow soils often over a caliche layer. These soils are usually calcareous. Individual populations of black sagebrush differ in their palatability to wildlife and livestock. In general, black sagebrush is considered excellent winter forage for sheep, antelope, and deer. It is an aggressive natural spreader from seed and can be easily established by broadcast seeding. Because it usually grows on dry rocky sites, it is usually not a candidate for plant control.

**Saltbush, fourwing** (Native)

Fourwing saltbush is an upright shrub from 1 to 6.7 feet tall depending on site conditions and genotype. The species grows in a wide variety of soil types from valley bottoms and plains to mountainous areas. It is well suited to deep, well-drained sandy soil, sand dunes, gravelly washes, mesas, ridges, and slopes, but vigorous plants are also found in heavy clays. It is frequently intermixed with numerous shrub and grass species. Fourwing saltbush is one of the most valuable forage shrubs in arid rangelands because of its abundance, accessibility, palatability, size, evergreen habit, nutritive value, rate of growth, and large volume of foliage. Its leaves, stems, and utricles provide browse in all seasons. It also withstands extremely heavy browsing, and growth often appears to be stimulated by use. This species is also one of the most important shrubs in the rehabilitation of depleted rangelands and in soil stabilization projects. It can be established by direct seeding and by bare root and container transplanting. The variety "Rincon" is a productive strain best adapted to the big sagebrush and pinyon-juniper zones but it also does well in the more mesic portions of salt desert shrub areas. Seed can be covered to 3/8 inch depth. Seed sources should not be moved and seeded in colder climates, but can be moved and seeded in warmer climates.

**Saltbush, gardner** (Native)

Gardner saltbush is a diverse taxa that is widespread throughout the salt desert shrublands. It is usually encountered on heavy textured soils, and drier sites than big sagebrush and fourwing saltbush. Seed germination is often erratic, but fall seedings normally establish satisfactorily. Plants establish and grow quite rapidly. The shrub produces excellent forage at all seasons. Both

big game and livestock graze the shrub. This species grows on heavy textured and basic soils, where few other species exist. It is also found on sites where poor peculation and infrequent flooding occur. Many sites once occupied by this shrub have been disrupted by heavy grazing, and are difficult to revegetate. Seeds should be fall seeded at a depth of 1/4 to 3/4 inch. It is best to seed this shrub in separate rows from fast growing herbs.

**Shadscale** (Native)

Shadscale saltbush occupies vast areas in Utah. It occupies low arid valley bottoms and benchlands. It frequently grows in nearly pure stands, existing in areas that receive between 8 to 14 inches annual precipitation. Most areas are difficult to revegetate because of low erratic precipitation patterns. Seeds are difficult to germinate, and erratic stands have resulted from large seedings. Few other shrubs can exist as substitute species for this important shrub. Seedlings usually grow slowly and can be suppressed by herbs. The plant provides excellent forage, particularly for winter browsing big game and livestock. As possible, seed should be collected from locations similar to the planting site, and fall plantings are recommended.

**Serviceberry, Saskatoon** (Native)

Saskatoon serviceberry is an erect deciduous shrub 3 to 15 feet tall. It is an important shrub in the pinyon-juniper zone, is less important in the big sagebrush zone, and is most productive and common in sloping moist habitats within or just below the ponderosa pine zone. Saskatoon serviceberry is a valuable browse plant due to its fair-to-high palatability and ready availability to livestock and big game. It is browsed by cattle after mid-summer when the more palatable grasses and forbs have been grazed or have dried up. Big game use it chiefly in the fall and winter. The fleshy fruits are sought by a wide variety of birds and mammals. Utah serviceberry (*A. utahensis*) prefers a drier habitat, is more pubescent and has smaller leaves, and produces less succulent fruits than Saskatoon serviceberry. Seedlings and young plants grow slowly and can be suppressed by grasses and broadleaf herbs. Once established both shrubs withstand heavy browsing.

**Snowberry, mountain** (native)

Mountain snowberry is a low spreading native shrub that occurs throughout the aspen-conifer forests, maple and other mountain brush communities. It may occur as an understory species or may be the dominant species at different locations. The plant persists from heavy grazing, burning and other major impacts. It is able to persist on harsh sites as well as more productive soils. Seeds are not easily collected, consequently costs are high. Seed germination is often erratic, and fall seeding is required to break dormancy. Direct seedings are only moderately successful, but transplanting of nursery grown bare root stock, wildlings and rooted transplants are quite successful. Once established the shrub persists exceptionally well. It grows well with herbaceous plants and provides useful summer and winter forage. If seeded in mixtures it should be planted in separate rows or spots away from more rapid growing herbs. It can be used to enhance soil stability and animal habitat. Its decumbent and spreading growth form is particularly important for conservation plantings. Once established it grows well with an assortment of understory herbs. Rangelands supporting this species should be managed or planted to retain the shrub.

**Sumac, skunkbush** (Native)

This shrub can be found on soils of most textures; it is common on hot, dry, shallow rocky foothills, and in well-drained soils. It is well adapted to areas receiving 10 to 20 inches of precipitation. It is thriftier in coarse-textured or disturbed soils and somewhat open communities. It has moderate drought tolerance and good fire and grazing tolerance. This species is useful in stabilizing disturbed sites and as a windbreak. Livestock and big game moderately utilize this shrub as forage. It is an excellent cover species for big game and upland game birds. Adapted variety is "Bighorn."

It can be transplanted or direct seeded in the fall at a depth of 1/4 to ½ inch.

**Winterfat** (Native)

Winterfat is an erect or spreading subshrub with wide variation in stature, from dwarf forms less than 8 inches in height to larger forms as tall as 4 feet. The dwarf forms are herbaceous above a woody base; taller forms tend to be woody throughout. Winterfat is most abundant on lower foothills, plains, and valleys with dry subalkaline soils. However, generally the upright forms are also intermixed with basin big sagebrush, pinyon-juniper, and ponderosa pine. Winterfat is a superior nutritious winter browse for livestock and big game. Sheep, cattle, antelope, elk, deer, and rabbits utilize it. Even though it is relatively tolerant to grazing, overgrazing has greatly reduced and even eliminated winterfat on some areas. Winterfat seed are viable for relatively short periods of time (6 months to 4 years) without special treatment. Seeds require an after-ripening period for maximum germination and germinate best at warm temperatures (77 to 80°F). Winterfat may be seeded or transplanted. However, young seedlings are generally vulnerable to spring frosts. The upright variety, “Hatch,” is widely adapted and grows rapidly.

# APPENDIX B
# RECOMMENDED SEEDING RATES FOR SUBSTITUTE SPECIES

| Common Names | Pounds/Acre in a Mixed Seeding |
|---|---|
| **Grasses:** | |
| Bentgrass, colonial | 1 |
| Bentgrass, creeping | 1 |
| Bluegrass, big | ½ - 1 ½ |
| Bluegrass, Canada | ½ - 1 ½ |
| Bluegrass, Kentucky | ½ - 1 ½ |
| Bluegrass, Nevada | ½ - 1 ½ |
| Bluegrass, sandberg | ½ - 1 ½ |
| Bluegrass, upland | ½ - 1 ½ |
| Dropseed, sand | 1 - 2 |
| Fescue, chewing | 1 ½ - 3 |
| Fescue, creeping red | 1 ½ - 3 |
| Fescue, hard | 1 ½ - 3 |
| Fescue, Idaho | 1 ½ - 3 |
| Fescue, sheep | 1 ½ - 3 |
| Grama, blue | 2 - 3 |
| Grama, sideoats | 2 - 3 |
| Needlegrass, green | 2 |
| Needlegrass, letterman | 2 |
| Oatgrass, tall | 1 - 2 |
| Panicum, blue | ½ - 1 |
| Redtop | 1 |
| Ricegrass, indian | 1 - 2 |
| Ryegrass, annual | 1 |
| Ryegrass, perennial | 1 - 2 |
| Sacaton, alkali | 1 |
| Squirreltail, bottlebrush | 1 |
| Wildrye, altai | 2 |
| Wildrye, basin | 2 |
| Wildrye, beardless | 2 |
| Wildrye, blue | 1 - 2 |
| Wildrye, mammoth | 1 |
| Wildrye, Russian | 2 |
| **Forbs and Legumes:** | |
| Aster, blueleaf | |
| Aster, Pacific | 1 - 2 |
| Balsamroot, arrowleaf | 1 - 2 |
| Burnet, small | 1 - 2 |
| Crownvetch, | 1 ½ - 3 |
| Flax, Lewis | 1 - 2 |
| Globemallow, gooseberryleaf | ½ - 1 |
| Globemallow, scarlet | ¼ - ½ |
| Goldeneye, showy | ¼ - ½ |
| Goldenrod, Canada | ½ - 1 |
| Ligusticum, Porter | ¼ - ½ |
| | ½ - 1 |

| Common Names | Pounds/Acre in a Mixed Seeding |
|---|---|
| **Forbs and Legumes - Cont.:** | |
| Lupine, mountain | 1 - 2 |
| Milkvetch, cicer | 1 - 2 |
| Parsnip, cow | 1 - 2 |
| Penstemon, Palmer | ½ - 1 |
| Penstemon, Rocky Mountain | ½ - 1 |
| Penstemon, Wasatch | ½ - 1 |
| Sage, Louisiana | ¼ - ½ |
| Sweetanise | 1 - 2 |
| Sweetclover, yellow | ¼ - 1 |
| Sweetvetch, Utah | ½ - 1 ½ |
| Vetch, hairy | ½ |
| Vetch, hungarian | ½ |
| Yarrow, western | ¼ - 1 |
| | |
| **Woody Plants:** | |
| Bitterbrush, antelope | ½ - 1 |
| Bitterbrush, desert | ½ - 1 |
| Ceanothus, Martin | ¼ |
| Chokecherry | ¼ - ½ |
| Cliffrose | ½ - 1 |
| Currant, golden | ¼ - ½ |
| Elderberry, blue | ¼ - ½ |
| Elderberry, red | ¼ - ½ |
| Ephedra, green | ½ - 1 |
| Honeysuckle, Tartarian | ¼ - ½ |
| Hopsage, spiny | ¼ - ½ |
| Kochia, forage | 1 - 2 |
| Mahogany, mountain (True) | ½ - 1 |
| Mohogany, mountain (Curlleaf) | ½ - 1 |
| Peachbush, desert | 1 - 2 |
| Peashrub, Siberian | 1 - 2 |
| Rabbitbrush, rubber | 1 - 2 |
| Rose, Woods | ½ - 1 |
| Sagebrush, Basin big | 1 - 2 |
| Sagebrush, big Wyoming | 1 - 2 |
| Sagebrush, big mountain | 1 - 2 |
| Sagebrush, black | 1 - 2 |
| Saltbrush, fourwing | 1 - 2 |
| Saltbrush, Gardner | 1 - 2 |
| Serviceberry, Saskatoon | 1 - 2 |
| Shadscale | 1 - 2 |
| Snowberry, common | ½ - 1 |
| Sumac, skunkbush | ½ - 1 |
| Winterfat | 1 - 2 |

# APPENDIX C
# SEED CHARACTERISTICS FOR CALIBRATING DRILLS

**Counting Method**

Drill calibration is necessary to deliver a specific quantity of seed per acre. The amount of seed going through a drill must be counted and the operator must know the number of seeds per pound. (See list of species below.)

Example: When seeding "Intermediate wheatgrass" at 8 lbs/acre:

Intermediate = 85,000 seeds/lb.

85,000 seeds/lb = Approx. 2 seeds/sq. foot at
43,560 sq. foot/acre 1 lb/acre rate

2 X 8 = 16 seeds/sq. foot required at the 8 lbs/acre rate

Therefore:

16 seeds/sq. foot required for broadcast seeding.
16 seeds/lineal foot with 12-inch row spacing.
8 seeds/lineal foot with 6-inch row spacing.

**SEEDS PER POUND**

| SPECIES | SEEDS/POUND | SPECIES | SEEDS/POUND |
|---|---|---|---|
| **GRASSES:** | | Orchardgrass, dryland | 600,000 |
| Burmudagrass | | Panicum, blue | 657,000 |
| Bluegrass, big | 917,000 | Ricegrass, Indian | 162,000 |
| Bluegrass, Canada | 2,500,000 | Ryegrass, annual | 190,000 |
| Bluegrass, Kentucky | 1,390,000 | Ryegrass, perennial (Tetraploid) | 126,000 |
| Bluegrass, Nevada | 1,047,000 | Sacaton, alkali | 1,750,000 |
| Bluegrass, sandberg | 1,100,000 | Squirreltail, bottlebrush | 192,000 |
| Bluegrass, upland | 2,500,000 | Timothy | 1,630,000 |
| Brome, meadow | 80,000 | Wheatgrass, bluebunch | 126,000 |
| Brome, mountain | 64,000 | Wheatgrass, crested (Fairway) | 311,000 |
| Brome, smooth | 145,000 | Wheatgrass, crested (hybrid) | 180,000 |
| Canarygrass, Reed | 538,000 | Wheatgrass, crested (siberian) | 206,000 |
| Dropseed, sand | 5,600,000 | Wheatgrass, crested (standard) | 194,000 |
| Fescue, creeping red | 590,000 | Wheatgrass, intermediate | 85,000 |
| Fescue, hard | 592,000 | Wheatgrass, pubescent | 85,000 |
| Fescue, sheep | 530,000 | Wheatgrass, slender | 133,000 |
| Fescue, tall | 206,000 | Wheatgrass, Snake River | 139,000 |
| Foxtail, creeping | 900,000 | Wheatgrass, streambank | 170,000 |
| Galleta | | Wheatgrass, tall | 75,000 |
| Grama, blue | 724,000 | Wheatgrass, thickspike | 156,000 |
| Grama, sideoats | 159,000 | Wheatgrass, western | 114,000 |
| Needlegrass, letterman | 150,000 | Wildrye, Altai | 175,000 |
| Oatgrass, tall | 150,000 | Wildrye, basin | 144,000 |
| Orchardgrass | 427,000 | Wildrye, beardless | 51,000 |

| SPECIES | SEEDS/POUND |
|---|---|
| Wildrye, mammoth | 55,000 |
| Wildrye, Russian | 162,000 |
| **FORBS AND LEGUMES:** | |
| Alfalfa | 225,000 |
| Aster, blueleaf | 540,000 |
| Balsamroot, arrowleaf | 55,000 |
| Burnet, small | 55,000 |
| Clover, alsike | 664,000 |
| Clover, red | 270,000 |
| Clover, strawberry | 288,000 |
| Clover, white | 710,000 |
| Crownvetch | 138,000 |
| Flax, Lewis | 286,000 |
| Globemallow, gooseberryleaf | 501,000 |
| Globemallow, scarlet | 500,000 |
| Goldeneye, showy | 1,055,000 |
| Ligusticum, Porter | 69,000 |
| Lupine, mountain | 12,000 |
| Milkvetch, cicer | 145,000 |
| Parsnip, cow | 45,000 |
| Penstemon, Palmer | 610,000 |
| Penstemon, Rocky Mountain | 286,000 |
| Penstemon, Wasatch | 290,000 |
| Sage, Louisiana | 2,495,000 |
| Sainfoin | 19,000 |
| Sweetanise | 30,000 |
| Sweetclover, yellow | 230,000 |
| Trefoil, birdsfoot | 470,000 |
| Yarrow, western | 4,124,000 |

| SPECIES | SEEDS/POUND |
|---|---|
| **WOODY PLANTS** | |
| Bitterbrush, antelope | 21,000 |
| Bitterbrush, desert | 15,800 |
| Ceanothus, Martin | 83,000 |
| Chokecherry | 4,000 |
| Cliffrose | 65,000 |
| Currant, golden | 356,000 |
| Elderberry, blue | 217,000 |
| Elderberry, red | 286,000 |
| Ephedra, green | 25,000 |
| Hopsage, spiny | 167,000 |
| Kochia, forage | 520,000 |
| Mahogany, mountain (true) | 59,000 |
| Mahogany, mountain (Curlleaf) | 52,000 |
| Peachbush, desert | 4,500 |
| Rabbitbrush, rubber | 756,000 |
| Rose, Woods | 45,000 |
| Sagebrush, big | 2,500,000 |
| Sagebrush, black | 970,000 |
| Saltbrush, fourwing | 55,000 |
| Saltbrush, Gardner | 111,000 |
| Serviceberry, Saskatoon | 45,000 |
| Shadscale | 65,000 |
| Snowberry, common | 54,000 |
| Sumac, skunkbush | 19,000 |
| Winterfat | 112,000 |

# APPENDIX D
# COMMON AND SCIENTIFIC NAMES OF SPECIES LISTED

| COMMON NAME | SCIENTIFIC NAME | SYNONYM |
|---|---|---|
| **Grasses and Grasslike**: | | |
| Barley | *Hordeum vulgare* | |
| Bentgrass, colonial | *Agrostis capillaris* | |
| Bermudagrass | *Cynodon dactylon* | |
| Bluegrass, big | *Poa ampla* | |
| Bluegrass, Canada | *Poa compressa* | |
| Bluegrass, Kentucky | *Poa pratensis* | |
| Bluegrass, Nevada | *Poa nevadensis* | |
| Bluegrass, sandberg | *Poa secunda* | |
| Bluegrass, upland | *Poa glaucantha* | |
| Brome, meadow | *Bromus biebersteinii* | |
| Brome, mountain | *Bromus carinatus* | |
| Brome, smooth | *Bromus inermis* | |
| Cannarygrass, Reed | *Phalaris arundinacea* | |
| Dropseed, sand | *Sporobulus cryptandrus* | |
| Fescue, chewing | *Festuca rubra* ssp. *commutata* | |
| Fescue, creeping red | *Festuca rubra* | |
| Fescue, hard | *Festuca ovina* var. *duriuscula* | |
| Fescue, Idaho | *Festuca Idahoensis* var. *ovina* | |
| Fescue, sheep | *Festuca ovina* | |
| Fescue, tall | *Festuca arundinacea* | |
| Foxtail, creeping | *Alopecurus arundinaceus* | |
| Foxtail, meadow | *Alopecurus pratensis* | |
| Galleta | *Hilaria jamesii* | |
| Galleta, big | *Hilaria rigida* | |
| Grama, blue | *Bouteloua gracilis* | |
| Grama, sideoats | *Bouteloua curtipendula* | |
| Hairgrass, tufted | *Deschampsia cespitosa* | |
| Needlegrass, green | *Stipa viridula* | |
| Needlegrass, letterman | *Stipa lettermanii* | |
| Oat | *Avena sativa* | |
| Oatgrass, tall | *Arrhenatherum elatius* | |
| Orchardgrass | *Dactylis glomerata* | |
| Panicum, blue | *Panicum antidotale* | |
| Redtop | *Agrostis alba* | |
| Ricegrass, Indian | *Oryzopsis hymenoides* | |
| Rush, Baltic | *Juncus balticus* | |
| Rye | *Secale cereale* | |
| Ryegrass, annual | *Lolium multiflorum* | |
| Ryegrass, perennial | *Lolium perenne* | |
| Sacaton, alkali | *Sporobulus airoides* | |
| Sedge, beaked | *Carex rostrata* | |
| Sedge, Nebraska | *Carex nebraskensis* | |
| Sedge, water | *Carex aquatilis* | |
| Sedge, wolly | *Carex lanuginosa* | |
| Squirreltail, bottlebrush | *Elymus elymoides* | *Sitanion hystrix* |

| COMMON NAME | SCIENTIFIC NAME | SYNONYM |
|---|---|---|
| **Grasses and Grasslike - Cont.:** | | |
| Timothy | *Phleum pratense* | |
| Wheat | *Triticum aestivum* | |
| Wheatgrass, bluebunch | *Pseudoroegneria spicata* | *Agropyron spicatum* |
| Wheatgrass, crested (Fairway) | *Agropyron cristatum* | |
| Wheatgrass, crested (Hybrid) | *A. cristatum X A. desertorum* | |
| Wheatgrass, crested (Siberian) | *Agropyron sibiricum* | |
| Wheatgrass, crested (standard) | *Agropyron desertorum* | |
| Wheatgrass, intermediate | *Thinopyrum intermedium* | *Agropyron intermedium* |
| Wheatgrass, pubescent | *Thinopyrum intermedium* | *Agropyron trichophorum* ssp. *barbulatu* |
| Wheatgrass, slender | *Elymus trachycaulus* | *Agropyron trachycaulum* |
| Wheatgrass, Snake River | *Elymus lanceolatus* ssp. *wawawai* | |
| Wheatgrass, streambank | *Elymus lanceolatus* ssp. *riparium* | *Agropyron dasystachyum* ssp |
| *riparium*Wheatgrass, tall | *Thinopyrum ponticum* | *Agropyron elongatum* |
| Wheatgrass, thickspike | *Elymus lanceolatus* | *Agropyron dasystachyum* |
| Wheatgrass, western | *Pascopyrum smithii* | *Agropyron smithii* |
| Wildrye, Altai | *Leymus angustus* | *Elymus angustus* |
| Wildrye, basin | *Leymus cinereus* | *Elymus cinereus* |
| Wildrye, beardless | *Leymus triticoides* | *Elymus triticoides* |
| Wildrye, blue | *Elymus glaucus* | |
| Wildrye, mammoth | *Leymus racemosus* | *Elymus giganteus* |
| Wildrye, Russian | *Psathyrostachys juncea* | *Elymus junceus* |
| **Forbs and Legumes:** | | |
| Alfalfa | *Medicago sativa* | |
| Aster, blueleaf | *Aster glaucodes* | |
| Aster, Pacific | *Aster adscendens* | |
| Balsamroot, arrowleaf | *Balsamorhiza saggitata* | |
| Burnet, small | *Sanguisorba minor* | |
| Clover, alsike | *Trifolium hybridum* | |
| Clover, red | *Trifolium pratense* | |
| Clover, strawberry | *Trifolium fragiferum* | |
| Clover, white | *Trifolium repens* | |
| Crownvetch | *Coronilla varia* | |
| Flax, Lewis | *Linum Perenne lewisii* | |
| Globemallow, gooseberryleaf | *Sphaeralcea grossulariifolia* | |
| Globemallow, scarlet | *Sphaeralcea coccinea* | |
| Goldeneye, showy | *Voguiera multiflora* | |
| Goldenrod, Canada | *Solidago canadensis* | |
| Ligusticum, Porter | *Ligusticum porteri* | |
| Lupine, mountain | *Lupinus alpestris* | |
| Milkvetch, cicer | *Astragalus cicer* | |
| Parsnip, cow | *Heracleum lanatum* | |
| Penstemon, Palmer | *Penstemon palmeri* | |
| Penstemon, Rocky Mountain | *Penstemon strictus* | |
| Penstemon, Wasatch | *Penstemon cyananthus* | |

| COMMON NAME | SCIENTIFIC NAME | SYNONYM |
|---|---|---|

**Forbs and Legumes - Cont.:**

| | |
|---|---|
| Sage, Louisiana | *Artemisia ludoviciana* ssp. *ana* |
| Sainfoin | *Onobrychis viciifolia* |
| Sweetanise | *Osmorhiza occidentalis* |
| Sweetclover, yellow | *Melilotus officinalis* |
| Sweetvetch, Utah | *Hedysarum boreale* ssp. *utahensis* |
| Trefoil, birdsfoot | *Lotus corniculatus* |
| Vetch, hairy | *Vicia villosa* |
| Vetch, Hungarian | *Vicia pannonica* |
| Yarrow, western | *Achillea millefolium* |

**Woody Plants:**

| | |
|---|---|
| Aspen, quaking | *Populus tremuloides* |
| Birch, bog | *Betula glandulosa* |
| Birch, water | *Betula occidentalis* |
| Bitterbrush, antelope | *Purshia tridentata* |
| Bitterbrush, desert | *Purshia glandulosa* |
| Cedar, red western | *Thuja plicata* |
| Ceanothus, Martin | *Ceanothus martinii* |
| Chokecherry | *Prunus virginiana* |
| Cliffrose | *Cowania stansburiana* |
| Cottonwood | *Populus deltoides* |
| Currant, golden | *Ribes aureum* |
| Dogwood | *Cornus stolonifera* |
| Elderberry, blue | *Sambucus cerulea* |
| Ephedra, green | *Ephedra viridis* |
| Ephedra, Nevada | *Ephedra Nevadensis* |
| Fir, subalpine | *Abies lasiocarpa* |
| Honeysuckle, tartarian | *Lonicera tartarica* |
| Hopsage, spiny | *Grayia spinosa* |
| Kochia, forage | *Kochia prostrata* |
| Mahogany, true mountain | *Cercocarpus montanus* |
| Mahogany, curlleaf mountain | *Cercocarpus ledifolius* |
| Olive, Russian | *Elaeagnus angustifolia* |
| Peach, desert | *Prunus fasciculata* |
| Pine, Lodgepole | *Pinus contorta* |
| Poplar, lombardy | *Populus nigra* |
| Rabbitbrush, rubber | *Chrysothamnus nauseosus* |
| Rose, Woods | *Rosa woodsii* |
| Sagebrush, Basin big | *Artemisia tridentata* ssp. *tridentata* |
| Sagebrush, mountain big | *Artemisia tridentata* ssp. *vaseyana* |
| Sagebrush, black | *Artemisia nova* |
| Sagebrush, Wyoming big | *Artemisia tridentata* ssp. *Wyomingensis* |
| Saltbrush, fourwing | *Atriplex canescens* |
| Saltbrush, Gardner | *Atriplex gardneri* |
| Serviceberry, Saskatoon | *Amelanchier alnifolia* |
| Shadscale | *Atriplex confertifolia* |

| COMMON NAME | SCIENTIFIC NAME | SYNONYM |
|---|---|---|
| **Woody Plants - Cont.:** | | |
| Snowberry, common | *Symphoricarpus albus* | |
| Spruce, Engelmann | *Picea engelmannii* | |
| Spruce, blue | *Picea pungens* | |
| Sumac, skunkbush | *Rhus trilobata* | |
| Willow, crack | *Salix fragilis* | |
| Willow, coyote | *Salix exigua* | |
| Willow, drummond | *Salix drummondiana* | |
| Willow, lemmons | *Salix lemmonii* | |
| Willow, scouler | *Salix scouleriana* | |
| Winterfat | *Ceratoides lanata* | |