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Plant species available for revegetation/restoration

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This document is intended to provide a quick reference to plant species for different soil types and environments and not to duplicate other recently published in-depth publications for reclamation and restoration. **In most cases, a mixture of species would be recommended to provide diversity and less chance of inadequate stands. Appropriate seeding techniques are very important to success.**

Additional references for minimum precipitation, height/growth type, seedling vigor/ease of establishment, seeding rates, soil texture adaptations, weed suppression ability, acid/alkalinity tolerance, seasons of use, varieties, mixture recommendations, values, management, and availability include:

Ferris, F. K., et al. 1996. *Handbook of western reclamation techniques*. Office of Technology Transfer, western region, Office of Surface Mining Reclamation and Enforcement, Denver, CO 80202-5733. (http://www.wrcc.osmre.gov)

Granite Seed Catalog. Granite Seed Company. 1697 West 2100 North, Lehi, Utah 84043.

Hijar, D. 2006. *Guide to Grasses*. Pawnee Buttes Seed Inc. P.O. Box 100, 605 25th St., Greeley, CO 80632.

Holzworth, L., J., Mosley, D. Cash, D. Koch, and K. Crane. 2003. *Dryland pastures in Montana and Wyoming*. Montana State University Extension Service. EB 19, revised.

Jensen, K., R., Reed, and R. Whitesides. *Intermountain planting guide*. USDA-ARS Forage and Range Research Lab, Logan, UT. AG 510.

Long, S. G. 1982. *Characteristics of plants used in western reclamation*. ERT. Fort Collins, CO.

Wind River Seed Catalog. Wind River Seed. 3075 Lane 51½ , Manderson, WY 82432.

Arranged as a dichotomous key, the categories that represent alternatives are preceded by the same number. This document is arranged initially in two major categories, dryland and irrigated (1). Within dryland, there are native and introduced species (2). Within these categories, species are arranged into groups that roughly fit ecological sites (3). Species with * have special needs or adaptation concerns. Within irrigated sites ** indicates salt-tolerant species.

1. Dryland, typically 5-9, 7-9, 10-14 inch precipitation zones (* species with 12-15 inch precipitation minimum; plants generally have lower requirements at higher elevations)

2. Native species

3. Sands ecological sites

4. Four-wing saltbush *(Atriplex canescens):* This shrub is typically adapted to soils with moderate salinity or alkalinity and is palatable to livestock and grazing wildlife. Presence of this species can enhance grass growth. Care needs to be taken in selenium-rich soils as this shrub can accumulate toxic concentrations. This is a very palatable species and provides excellent winter feed. The species concentrates nitrogen and other minerals and can be used to restore depleted soils. Rincon is a variety adapted to mesic portions of the salt-desert shrublands. Seed sources from warm areas should not be used in colder areas, but seeds from colder areas can be utilized in warmer areas.

4. *Sand bluestem *(Andropogon hallii)*: This is a rhizomatous grass, tall, and relatively palatable. It is slow to establish and has poor tolerance of saline conditions.

4. Prairie sandreed *(Calamovilfa longifolia)*: A tall rhizomatous grass that is relatively unpalatable especially as it matures.

4.* Little bluestem *(Schizachyrium scoparium)*: A medium-height bunchgrass with very upright stems that turn orange in the fall; it has decorative value. Stems are relatively unpalatable. This plant is slower to establish and is poor at suppressing weeds; however, it is fairly tolerant of acid and saline soils.

3. Sandy-Loamy ecological sites

5. Indian ricegrass *(Stipa hymenoides)*: This is a short, cool-season bunchgrass. It is a very palatable species for livestock. This plant is poor at weed suppression but fair at tolerating acidity and possesses a good salinity tolerance. It is best for use in the summer. The varieties Nezpar and Paloma are adapted to northern and southern areas, respectively. While Rimrock, a northern adapted variety, has similar qualities to these two varieties, it is less susceptible to seed shattering.

5. Needle and thread *(Stipa comata)*: This is a native bunchgrass with long, twisting awns. The forage value of this plant is good in the early part

of the growing season, but the long awns and sharp pointed seeds can pose problems particularly to sheep later in the season before the seeds fall.

5. Thickspike and streambank wheatgrass *(Elymus lanceolatus)*: This cool-season, rhizomatous grass is easy to establish and has excellent weed suppression capabilities. It tolerates acid and saline soils. Streambank variety is better adapted to heavier textured soils.

5. Bluebunch wheatgrass *(Elymus spicatus)*: This medium-height, cool-season bunchgrass is moderately easy to establish, is fair at weed suppression, and tolerates acid and saline soil conditions. It can be used in the spring or summer. This plant will withstand moderate grazing, and grazing systems should never remove more than 50 percent of the annual production.

5. Snake River wheatgrass (*Elymus wawawaiensis)*: This is a native, cool-season, bunchgrass similar to bluebunch wheatgrass. This species is known for seedling vigor. The variety Secar is known for establishing well under drought conditions.

5. Green needlegrass *(Stipa viridula)*: This tall, cool-season, bunchgrass is slower to establish and is poor at tolerating acid soil conditions. This species generally occurs on heavier textured soils in 10-14 -inch precipitation zones or areas receiving extra moisture. Varieties include Green Stipagrass, which has increased forage and seed yield, and Lodorm, which has low seed dormancy.

5 *Idaho fescue *(Festuca idahoensis)*: This is a cool-season native bunchgrass. This species can tolerate somewhat saline, alkaline, or acidic soils but prefers deep, fertile, silty, and clayey soils. The species grows between 800 and 12,000 feet elevation, does not tolerate flooding or high water tables, and is somewhat drought tolerant. This grass is utilized by livestock and wildlife, has grazing tolerance, and is also used in range plantings and mineland reclamation. It may be slow to establish. The varieties Nez Perce and Joseph were developed in Idaho, and Trident is a variety developed for use in Oregon.

5. *Canada wildrye *(Elymus canadensis)*: This is a native, cool-season perennial bunchgrass. Many ecotypes of this species are adapted to saline and sodic soils and can tolerate precipitation lower than 10 inches to more than 20 inches. This grass is tolerant of poorly drained soils, flooding, and high water tables. Canada wildrye has strong seedling vigor and is used for rapid cover and site stabilizer in mixtures on disturbed sites and mine lands. It is also often seeded on sub-irrigated and flooded sites as well as for upland game bird cover, fence row plantings, and stream filters.

5. Slender wheatgrass *(Elymus trachycaulus*: This native, cool-season, short-lived perennial bunchgrass is highly variable occurring from montane to semi-arid saline areas. This species does best if planted in a mixture due to its limited lifespan. This species is easily established and is known for excellent seedling vigor. This plant has good to fair forage value, and some varieties are tolerant of saline and alkaline soils. Copperhead, Pryor, and San Luis varieties were persistent in an upland soil trial in 7-9-inch precipitation zone.

5. Winterfat *(Ceratoides lanata)*: This sub-shrub, also known as whitesage, can take on forms that vary in height from 8 inches to 4 feet. It is adapted to elevations of 3,000 to 7,000 feet and precipitation of 7-12 inches. This species is relatively tolerant to grazing, but overgrazing has the potential to eliminate the species from a site. Winterfat makes nutritious winter forage for livestock and big game as well as rabbits. Many use it as an ornamental in arid landscapes. Its ability to tolerate neutral to alkaline soils in cold, arid regions gives it high potential for reclamation. Hatch is a variety adapted to salt-desert shrubland and pinyon-juniper areas with 9-14 inches of precipitation. It is a woody, rapid-growing variety that can be seeded or transplanted, but the variety does not tolerate spring frosts.

5. Lewis flax *(Linum lewisii)*: Maple grove variety is a short-lived, showy perennial native forb. The species is drought tolerant and reproduces from seed. Lewis flax is commonly used for range mixes and reclamation. Another common variety is Appar (*L. perrene*) selected for its vigor, beauty, and competitiveness.

5. Scarlet globemallow *(Sphaeralcea coccinea):* This native rhizomatous forb is tolerant to disturbances and has value for use as a forage. Varieties include Scarlet, which is recommended as a forb component on arid and semiarid sites, and Munroe (*S. munroeana*), which is an upright, bunch-type variety.

5. Fuzzy-tongue penstemon, Palmer's penstemon, Eaton's penstemon (*Penstemon spp*.): These species have shown promise in plantings in 7-9-inch precipitation areas.

5. Wyoming big sagebrush *(Artemisia tridentata var wyomingensis)*: This native shrub has a wide distribution but is difficult to establish from seed. This species is valuable as forage for domestic animals and wildlife as well as habitat for sage-grouse. Gordon Creek is a variety of Wyoming big sagebrush that adapted to 10-14 inches of precipitation. Sagebrushes establish best when winter snow cover provides protection for seedlings.

3. Clayey ecological sites

6. Western wheatgrass *(Pascopyrum smithii,* formerly *Agropyron smithii)*: This is a native cool season rhizomatous wheatgrass. This plant is tolerant to drought and alkali soil conditions and withstands close grazing. It is valuable for grazing and can make a high-protein hay. Varieties are geographically specific and include Barton, Rosana, Arriba, Rodan, Flintlock, and Walsh.

6. Green needlegrass *(Stipa viridula)*: This tall cool season bunchgrass is slower to establish and is poor at tolerating acidic soil conditions. This species generally occurs on heavier textured soils in 10-14 -inch precipitation zones or areas receiving extra moisture. Varieties include Green Stipagrass, which has increased forage and seed yield, and Lodorm, which has low seed dormancy.

6. Indian ricegrass *(Stipa hymenoides)*: This is a short, cool-season bunchgrass. It is a very palatable species for livestock. This plant is poor at weed suppression but fair at tolerating acidity and possesses a good salinity tolerance. It is best for use in the summer. The varieties Nezpar and Paloma are adapted to northern and southern areas, respectively. While Rimrock, a northern adapted variety, has similar qualities to these two varieties, it is less susceptible to seed shattering.

3. Saline upland ecological sites

7. Indian ricegrass *(Stipa hymenoides)*: This is a short, cool-season bunchgrass. It is a very palatable species for livestock. This plant is poor at weed suppression but fair at tolerating acidity and possesses a good salinity tolerance. It is best for use in the summer. The varieties Nezpar and Paloma are adapted to northern and southern areas, respectively. While Rimrock, a northern adapted variety, has similar qualities to these two varieties, it is less susceptible to seed shattering.

7. Bottlebrush squirriltail *(Elymus elymoides)*: This cool-season bunchgrass makes good winter and early spring forage; however, it is unpalatable because of the bristly nature of its seed head at maturity. This species makes a good early successional species for erosion control and use in range plantings. The only commercially available variety is Sand Hollow, and it is adapted to sandy soils and is used in restoration and reclamation of sites dominated by annual grasses.

7. Sand dropseed *(Sporobolus cryptandrus)*: This native warm-season bunchgrass is commonly used in revegetation programs because it is extremely drought tolerant. It is moderately palatable, but is not preferred by livestock.

7. Sandberg bluegrass *(Poa secunda)*: This is a short, cool-season bunchgrass. It is slower to establish and has poor weed suppression. This species has good tolerance to soil acidity and fair tolerance to salinity and is best for use in the spring.

7. Scarlet globemallow *(Sphaeralcea coccinea):* This native rhizomatous forb is tolerant to disturbance and has some forage value. Varieties include Scarlet, which is recommended as a forb component on arid and semiarid sites, and Munroe (*S. munroeana)*, which is an upright, bunch-type variety.

7. Shadscale (*Atriplex confertifolia)*: This species is also known as spiny saltbush as it is a spiny shrub found in dry and often saline and alkaline areas receiving 6-10 inches of precipitation. Its preferred ecological site is shallow sandy with saline horizons. The thick spines restrict its use by animals, and the species is difficult to establish because of its seed dormancy. Shad scale is utilized during the spring before the spines mature and is valuable forage due to its high production, frequent occurrence, and nutritional value (even if it is less palatable than many comparable shrubs). Fall planting is recommended, and the ability of this species to survive and thrive in poor soil conditions and harsh sites makes it a good restoration species.

7. Winterfat *(Ceratoides lanata)*: This sub-shrub, also known as whitesage, can take on forms that vary in height from 8 inches to 4 feet. It is adapted to areas with elevations of 3,000 to 8,000 feet and precipitation of 7-12 inches. This species is relatively tolerant to grazing, but overgrazing can eliminate the species from a site. Winterfat provides excellent, nutritious winter forage for livestock and big game as well as rabbits. Many use it as an ornamental in arid landscapes. Its ability to tolerate neutral-to-alkaline sites in cold, arid regions gives it high potential for reclamation. Hatch is a variety adapted to salt desert shrubland and pinyon-juniper areas with 9-14 inches of precipitation. It is a woody, rapidly growing variety that can be seeded or transplanted, but the variety does not tolerate spring frosts.

7. Gardner saltbush *(Atriplex gardneri)*: This is a common shrub on salt-desert shrublands and can persist in areas receiving 6-12 inches of precipitation. The species tolerates heavier-textured soils and drier sites than big sagebrush or four-wing saltbush. This species can tolerate alkaline, heavy-textured soils with poor percolation where very few species can survive. The species is not tolerant of heavy grazing but makes good forage throughout the year. This shrub should be planted in the fall at depths between 1/4 and 3/4 of an inch.

3. Subirrigated ecological sites

8. Basin wildrye *(Leymus cinereus)*: This is a tall, hardy, and robust perennial bunchgrass. It is adapted to overflow sites, draws, and low-lying locations that may receive extra moisture as well as upland sites in 15-19-inch precipitation zones. This grass becomes unpalatable at maturity but is used as forage and cover by livestock in spring and provides adequate winter forage. Some varieties have poor seedling vigor, but the species is one of the highest producing grasses after it is established.

Basin wildrye can be used in mixtures to reseed rangelands, mine spoils, road rights-of-way, and other disturbed areas. This grass can persist in areas with as little as 8 inches of annual precipitation, is moderately tolerant of alkaline and saline conditions, and is commonly associated with rabbit brush, sagebrush, and wheatgrasses. Its low seedling vigor, poor germination, and low seed fill may limit some varieties' usefulness. In areas with ergot, black sclerotia can be observed on this species; this fungus can cause abortions and should be considered poisonous to livestock. The Magnar variety has increased germination, seedling vigor, and uniformity. The Trailhead variety is more persistent under drought conditions. L-46, Washoe, Trailhead, and Continental varieties were persistent in a 7-9-inch precipitation zone upland site trial during drought.

8. Tufted hairgrass (*Deschampsia caespitosa)*: This bunchgrass can be found in wetter portions of moist meadows at elevations from 5,000 to 13,000 feet and has a high tolerance to flooding. The species can be found in upland areas at high elevations with more than 20 inches of precipitation. This grass is highly palatable to both livestock and wildlife. It is acid soil tolerant.

8. Slender wheatgrass *(Elymus trachycaulus)*: This native, cool-season, short-lived perennial bunchgrass is highly variable occurring from montane to semi-arid saline areas. This species does best if planted in a mixture due to its limited lifespan. This species is easily established and is known for excellent seedling vigor. This plant has good to fair forage value and some varieties are tolerant of saline and alkaline soils. Copperhead, Pryor, and San Luis varieties were persistent in an upland soil trial in 7-9 inch precipitation zone.

3. Saline subirrigated ecological sites

9. Basin wildrye *(Leymus cinereus)*: This is a tall, hardy, and robust cool-season perennial bunchgrass. It is adapted to overflow sites, draws, and low lying locations that may receive extra moisture as well as upland sites in 15-19-inch precipitation zones. This grass becomes unpalatable at maturity but is used as forage and cover by livestock in spring and provides adequate winter forage. Some varieties have poor seedling vigor, but the species is one of the highest producing grasses after establishment. Basin wildrye can be used in mixtures to reseed rangelands, mine spoils, road rights-of-way, and other disturbed areas. This grass can persist in areas with as little as 8 inches of annual precipitation, is moderately tolerant of alkaline and saline conditions, and is commonly associated with rabbit brush, sagebrush, and wheatgrasses. Its low seedling vigor, poor germination, and low seed fill may limit some varieties' usefulness. In areas with ergot, black sclerotia can be observed on this species; this fungus can cause abortions and should be considered poisonous to livestock. The Magnar variety has

increased germination, seedling vigor, and uniformity. The Trailhead variety is more persistent under drought conditions. L-46, Washoe, Trailhead, and Continental varieties were persistent in a 7-9-inch precipitation zone upland site trial during drought.

9. Alkali sacaton *(Sporobolus airoides)*: This native warm-season perennial bunchgrass is well adapted to alkali conditions and encroaching sand thus very good for erosion control especially on alkali flats. Forage value is moderate, but the species is used in pasture areas. The varieties Salado and Saltalk are both considered winter hardy.

9. Slender wheatgrass *(Elymus trachycaulus*) This native, cool-season, short-lived perennial bunchgrass is highly variable occurring from montane to semi-arid saline areas. This species does best if planted in a mixture due to its limited lifespan. This species is easily established and is known for excellent seedling vigor. This plant has good to fair forage value and some varieties are tolerant of saline and alkaline soils. Copperhead, Pryor, and San Luis varieties were persistent in an upland soil trial in 7-9 inch precipitation zone.

3. Foothill and Mountain ecosystems (15-19-inch and 20+ -inch precipitation zones)

10. Mountain brome *(Bromus carinatus)*: This native short-lived cool-season perennial bunchgrass is adapted to the mountain regions of the Western states, primarily on sites with deeper fertile soils. Mountain brome can take up to three years to reach full production and is less persistent then smooth brome. It can establish quickly on disturbed sites and is shade tolerant. This plant produces excellent yields and is a good forage, but it must be allowed to go to seed every couple of years to maintain the stand. The variety Bromar establishes quickly, matures late, and has early spring recovery. Garnet variety has superior disease resistance and is similar to Bromar.

10. Big bluegrass *(Poa ampla)*: This persistent, cool-season native bunchgrass is adapted to early spring grazing but becomes unpalatable without sufficient moisture. Big bluegrass has excellent cold tolerance but limited drought tolerance. If managed properly, this bluegrass will compete with cheatgrass. The Sherman variety is intended for range reseeding and revegetation.

10. Slender wheatgrass *(Elymus trachycaulus)*: This native, cool-season short-lived perennial bunchgrass is highly variable, occurring from montane to semi-arid saline areas. This species does best if planted in a mixture due to its limited lifespan. This species is easily established and is known for excellent seedling vigor. This plant has good to fair forage value and some varieties are tolerant of saline and alkaline soils. Copperhead, Pryor, and San Luis varieties were persistent in an upland soil trial in 7-9 -inch precipitation zone.

10. Blue wildrye *(Elymus glaucus)*: This plant is a self-fertilizing native, cool-season bunchgrass commonly found on burned forests and aspen woodland. It is shade tolerant, compatible with woody plants, and suppresses weeds.

10. Basin wildrye *(Leymus cinereus)*: This is a tall, hardy, and robust cool-season perennial bunchgrass. It is adapted to overflow sites, draws, and low-lying locations that may receive extra moisture as well as upland sites in 15-19-inch precipitation zones. This grass becomes unpalatable at maturity but is used as forage and cover by livestock in spring and provides adequate winter forage. Some varieties have poor seedling vigor, but the species is one of the highest producing grasses after it is established. Basin wildrye can be used in mixtures to reseed rangelands, mine spoils, road rights-of-way, and other disturbed areas. This grass can persist in areas with as little as 8 inches of annual precipitation, is moderately tolerant of alkaline and saline conditions, and is commonly associated with rabbit brush, sagebrush, and wheatgrasses. Its low seedling vigor, poor germination, and low seed fill may limit some varieties usefulness. In areas with ergot, black sclerotia can be observed on this species; this fungus can cause abortions and should be considered poisonous to livestock. The Magnar variety has increased germination, seedling vigor, and uniformity. The Trailhead variety is more persistent under drought conditions. L-46, Washoe, Trailhead, and Continental varieties were persistent in a 7-9-inch precipitation zone upland site trial during drought.

10. Idaho fescue *(Festuca idahoensis)*: This is a cool-season, native bunchgrass. This species can tolerate somewhat saline, alkaline, or acidic soils but prefers deep, fertile, silty, and clayey soils. The species grows between 800 and 12,000 feet elevation, does not tolerate flooding or high water tables, and is somewhat drought tolerant. This grass is utilized by livestock and wildlife, exhibits some tolerance to grazing, and is also used in range plantings and mined land reclamation. The varieties Nez Perce and Joseph were developed in Idaho, and Trident was developed in Oregon.

10. Columbia needlegrass (*Stipa nelsonii*): This cool-season bunchgrass species occurs on deeper fertile soils of montane and more mesic foothill areas.

10. Snake River wheatgrass (*Elymus wawawaiensis)*: This is a native bunchgrass similar to bluebunch wheatgrass. This species is known for its seedling vigor. The variety Secar establishes well under drought conditions.

10. Thickspike wheatgrass *(Elymus lanceolatus)*: This is a tall, cool-season rhizomatous grass. This species is easy to establish and has excellent weed suppression capabilities. Also, it has good tolerance to acidic and saline soils. It would be better adapted to foothill sites. Critana variety is commonly available.

10. Rocky Mountain *(Penstemon strictus)* and Wasatch penstemon (*P. cyauanthus*): These are native perennial forbs that have bright blue to purple flowers. These forbs are adapted to higher elevations up to 10,000 feet and have good cold tolerance. These species should be planted in mixtures and will not flower until the second season. Penstemon can be used for stabilization of disturbed, degraded, and eroded sites and has some value as forage for livestock and wildlife. Planting depth is 1/8 of an inch.

10. Blueleaf aster *(Aster glaucodes)*: This perennial rhizomatous forb is adapted to upland to subalpine sites that are disturbed, eroded, and exposed. Fall planting at a surface to ½ -inch depth is preferred, and the species is one of the first to green up in the spring.

10. Utah sweetvetch *(Hedysarum boreale)*: This cool-season, perennial native legume is recommended for use on rangelands and upland wildlife habitat. This plant does well on well-drained soils and should be planted at a soil depth of 1/8 to 3/4 of an inch. This species should not be grazed during establishment. Timp is the only variety of this forb commercially available. Innoculum for nitrogen fixation is recommended.

10. Showy goldeneye *(Viguiera multiflora)*: This perennial forb is adapted to heavy clay to gravel soils on rocky slopes, can tolerate high elevations, and competes well with other species. This species should not be planted deeper than ¼ inch.

10. Blue flax *(Linum lewisii)*: This native perennial forb grows best on well-drained soils. This plant can establish and persist on disturbed, droughty, and high-elevation sites. This species is easy to establish and does well on open sites. Another common variety is Appar (*L. perrene*), selected for its vigor, beauty, and competitiveness.

10. Arrowleaf balsamroot *(Balsamorhiza sagittata)*: This perennial forb is an indicator of good grazing management. This species is drought resistant but does better in areas with higher precipitation. It is intolerant of high water tables but is tolerant to heavy grazing by wildlife and livestock. Recommended planting depth is 1/3 of an inch.

10. Big sagebrush *(Artemisia tridentata)*: This aromatic shrub has a wide distribution with three subspecies (Wyoming, mountain, basin) although some authors subdivide vaseyana into two varieties. This shrub can grow as tall as 15 feet (basin,var. *tridentata*). The species is frequently found in a variety of soil conditions and topography across the arid plains (var. Wyomingensis) and mountains (var. vaseyana) and is usually found in association with other shrubs such as rabbitbrushes, bitterbrush, or snowberry. Seeds need to be dispersed on disturbed surfaces. The species becomes dominant with time and requires intensive grazing management to maintain grass species as an understory that can provide adequate forage and cover. Big

sagebrush is utilized by sage-grouse for feed and cover. Livestock and wildlife, especially deer and antelope, utilize available varieties for food, especially in winter. The Hobble Creek (var. vaseyana) variety is robust, palatable, and adapted to deep soils with more than 14 inches of precipitation. In many applications, local varieties are harvested for use on a site.

10. Red and blue elderberry *(Sambucus racemosa and Sambucus coerulea)*: Both of these species are sprouting deciduous shrubs palatable to livestock and wildlife. Blue elderberry can be found from sea level to 9,000 feet in elevation, can grow to 20 feet in height, and is associated with canyon bottoms and hillsides. Red elderberry is a shorter species that only reaches about 6 feet in height, is found from 7,000 to 10,000 feet elevation, and can be found on flats and slopes.

10. Snowberry *(Symphoricarpus oreophilus)*: This low and spreading shrub reaches about 3 feet in height. It occurs on hilly and well-drained areas up to 10,000 feet with adequate precipitation. This species can overcome heavy grazing, fire, and other disturbances. This species has high seed dormancy and is difficult to collect so seed cost for the species is high. This species is utilized by livestock and wildlife; cattle especially enjoy the berries.

10. Wood's rose *(Rosa woodsii)*: This flowering shrub grows from 2-6 feet in height and can be found up to 9,000 feet in elevation. This species prefers moist but well-drained sites and can often become hedge-like along streams. It can be an aggressive pioneer species and persists due to its rhizomatous nature on harsh sites, thus making it a good species for controlling erosion in many cases. Fall seeding is required, and it should not be planted any deeper than ¾ of an inch. This species is used as forage in the spring, and is used as cover and food for birds and small mammals. The fruits are edible for humans.

10. Chokecherry *(Prunus virginiana)*: This is a medium-to-large sprouting spreading shrub with edible fruits. This species will grow 5-25 feet tall and is adapted to silty or sandy soils that are deep, fertile, and well-drained. The species can be found at elevations between 2,000 and 9,000 feet and does not tolerate poor drainage. The twigs and leaves of this species can cause cyanogenic poisoning to all classes of livestock, especially after drought or freezing,

10. Antelope bitterbrush *(Purshia tridentata)*: This is a native shrub that can grow from 2 to 15 feet in height depending on the type. It is found at elevations ranging from 3,500 to 11,500 feet. This species is found on well-drained coarser soils. Seedlings are vigorous. The species competes well with other shrubs and is a fast-growing forage. The species does well with grazing but has poor tolerance to burning. The Lassen variety is a large variety that does well on neutral pH granite soils while most other varieties are region-specific.

10. Serviceberry *(Amelancher alnifolia)*: This native shrub can grow up to 15 feet tall. The species has good germination and persistence, is fairly easy to plant or establish, and produces good forage for wildlife even with low precipitation. This species can be established by lightly covering scarified seeds, transplants, and root cuttings. Serviceberry is used for erosion control, soil stabilization, wildlife forage, and range restoration.

10. Curlleaf mountain mahogany *(Cercocarpus ledifolius)*: This native shrub can grow in height to 23 feet. The species persists in dry, rocky areas as high as 10,000 feet in elevation. This species is difficult to establish and can be easily damaged by browsing animals and herbaceous competition because it has low seedling vigor and slow growth during establishment. After establishment, the species grows rapidly and produces excellent forage for many wildlife species and livestock throughout the year. Overgrazing can cause plant damage but lack of use causes decadence and production of lower-quality forage.

2. Introduced species. Drylands generally less than 14 inches precipitation on sandy, loamy, clayey soils

11. Siberian wheatgrass *(Agropyron fragile)*: This drought-tolerant, cool-season bunchgrass is adapted to sites that receive as little as 7 inches of precipitation. Forage production and palatability begins early in the growing season but declines rapidly beginning in July. This grass is superb at establishing on sandy soils and is one of the few grasses that competes well with weedy annuals in arid environments. This species has limited tolerance to salinity, flooding, and overgrazing; its production and vigor are reduced at high elevations. Varieties include P-27 and Vavilov. Vavilov is a newer variety selected for high seedling vigor.

11. Mammoth wildrye *(Leymus racemosus)*: This is a long-lived, drought-tolerant, cool-season rhizomatous grass. A tall-growing species, it is coarse-stemmed and unpalatable to livestock; however, it provides cover and nesting to wildlife. This species is used to control sand movement and provide permanent cover on sand dunes, deep sands, and mined spoil sites. It only requires 7 inches of rainfall to be successful. The species has also been used as an ornamental. The Volga variety has only recently been released commercially for use on sand dunes and soil stabilization.

11. NewHy wheatgrass *(Elymus hoffmannii)*: This cool-season species was developed from a hybrid between quackgrass and bluebunch wheatgrass. This hybrid has the vigor, persistence, salinity tolerance, and productivity of quackgrass along with the drought tolerance, growth habit, and seed and forage quality of bluebunch wheatgrass. This species is recommended for areas with minor salinity problems. This grass begins growing early but also remains palatable later into the fall than any other wheatgrass species. Under ideal growing conditions,

NewHy will be less productive than many species. However, under saline or droughty conditions, NewHy will remain productive while other species may exhibit reduced production or be short-lived. This species needs at least 25 days between grazing or cutting events and, in hotter, drier portions of the year, longer periods are suggested. NewHy will be more productive as a hay crop if planted with a legume.

11. Crested wheatgrass *(Agropyron cristatum* and *Agropyron desertorum)*: This long–lived, cool-season, drought-tolerant bunchgrass is better suited to use as grazing forage than hay. Crested wheatgrass is adapted to areas that receive as little as 10 inches of precipitation and has excellent seedling vigor. This species can be easily established under harsh environmental conditions. Crested wheatgrass matures early and thus makes a palatable spring forage and competes well with annual grasses such as cheatgrass. This species will tolerate limited (10 days or less) periods of flooding. Douglas is a recently released variety that requires at least 13 inches of precipitation. Hycrest, Nordan, Fairway, and CD-II are all adapted varieties of crested wheatgrass with CD-II having increased seeding vigor. Ephraim and Roadcrest are two rhizomatous varieties of crested wheatgrass. Roadcrest spreads, has a low canopy, and is commonly used for roadside stabilization.

11. Russian wildrye *(Psathyrostachys juncea)*: This cool-season bunchgrass is palatable through the spring and fall. This species is adapted to heavy grazing and succeeds in areas with at least 8 inches of precipitation. This species competes well with less desirable plants once established and is exceptionally tolerant of cold and drought succeeding in soils too alkaline for crested wheatgrass or too dry for tall wheatgrass. Slow seedling growth, seed shattering, and intolerance to flooding are the greatest limiting factors to stand establishment of this species. There are many varieties available for this species. Vinall is an earlier variety with poor seedling vigor. Swift is selected for seedling vigor. Cabree has seedling vigor and reduced seed shattering. Bozoisky-Select has increased seedling vigor and forage production. Mankota has increased seedling emergence, forage yield, and seed yield. Bozoisky-Select is the best adapted cultivar to the Intermountain Region.

11. *Sheep fescue *(Festuca ovina)* and hard fescue (*F. trachphylla)*: These cool-season perennial bunchgrasses are a long-lived, drought-tolerant hardy species mainly used to protect soils on highly erodible landscapes and as weed control. They often grow with other bunchgrasses and shrubs such as rabbitbrush and sagebrush. These fescues will not tolerate wet, saline, or alkaline soils. Most varieties of hard and sheep fescues were released as turf grass varieties however, Covar (sheep) and Durar (hard) varieties were released for soil erosion control and revegetation. Covar is winter hardy and drought tolerant. Durar is less drought tolerant but is adapted to well-drained soils.

11. Tall wheatgrass *(Thinopyrum ponticum)*: This cool-season bunchgrass is very late to mature among range grasses and is valued as a forage source during late summer to early winter. This grass has a high tolerance to alkaline and saline conditions. This species must receive at least 14 inches of precipitation and can be used on saline areas where greasewood and salt-grass grow. This species is very slow to establish compared to many introduced species. It appears to be effectively used in saline subirrigated soils. It is recommended this species be seeded alone due to its poor competitive ability and tendency to become coarse during the growing season. The variety Alkar is used specifically on alkaline soils. Jose and Largo are used on saline and alkaline soils for soil improvement and have better high-altitude tolerance. The newest variety, Platte, is not widely accepted yet but is noted for improved winter hardiness and improved production. This variety is best suited to low-elevation, alkaline sites such as along the Platte River drainage.

11. Pubescent wheatgrass *(Agropyron trichophorum)*: This perennial wheatgrass forms a loose sod. This species is drought tolerant and somewhat adapted to low fertility but does not tolerate wet conditions well. This species is a palatable source of nutritious forage for livestock and can produce a good hay yield alone; however, planting with legumes can obtain a higher quality and quantity of forage.

11. Yellow sweet clover *(Melilotus officinalis)*: This introduced, biennial, and nitrogen-fixing legume can grow up to 6 feet tall. This species can grow in all soil textures as well as in saline, alkaline, and weakly acidic soils. This species is an invader in areas such as road cuts and borrow pits, has good drought tolerance, and possesses some tolerance to fire and flooding. This legume is palatable to livestock and wildlife and is used by small mammals and birds. It is a source of pollen for bees and other pollinator insects. Yellow sweet clover contains cumerin, which can cause a bleeding disease in livestock. Rather heavy grazing is required once the species becomes established to keep it from getting stemmy and unpalatable. Improved varieties include Madrid from Spain, Goldtop from Wisconsin, and Yukon from Canada.

11. White sweetclover *(Melilotus alba)*: This short-lived perennial legume is easily established and cold hardy. This species is often used for reclamation of disturbed sites. It is tolerant to drought, salinity, and alkali conditions.

11. Alfalfa *(Medicago sativa falcata)*: The yellow-flowered ssp falcata appears to persist under grazing in dryland of around 14 inches precipitation once established. Alfalfa is a palatable, high-quality, and nitrogen-fixing forb. This forb improves soil fertility and competes with weeds. This species tolerates a wide variety of conditions including irrigated and dryland in higher precipitation zones, hot summers, and cold climates. The particular level of winter hardiness, grazing resistance, and disease

resistance depends on the variety. Overall, alfalfa has limited grazing resistance on native ranges unless a post-grazing recovery period is given. Alfalfa has fair tolerance to salinity and alkalinity but is very sensitive to acidity. Flood periods of more than two weeks and loss of root reserve carbohydrates will reduce productivity. Phosphorous additions help increase grazing tolerance and reduce winter damage. Bloat can be a problem when grazing some alfalfas, but planting with grass mixes can reduce the likelihood of bloat.

11. Sainfoin *(Onobrychis vicifolia)*: This early-growing forb has high forage quality and is commonly used in irrigated pasture and hay systems. This species competes poorly with aggressive grasses but is very winter hardy.

11. Small burnet *(Sanquisorba minor)*: This forb produces high-quality forage that does well with non-aggressive species in seeding mixtures. The species has many limitations. It is neither drought tolerant nor tolerant of flooding. It is slow to establish and can be grazed out. The only commercially available variety is Delar, which was selected for palatability, seed and forage production, and cold tolerance and is intended for forage as well as rangeland improvements. Planting depth should be ¼ to ½ of an inch.

11. Cicer milkvetch *(Astragalus cicer)*: This species is a rhizomatous forb that is very winter hardy, long-lived, and does well at moderately high elevations. It does well with 14 inches of precipitation but can be more productive under irrigation and can withstand high water tables. This species can be used for hay or pasture and usually takes two years to establish.

11. Forage kochia *(Kochia prostrata)*: This half-shrub will reach 1-3 feet in height at maturity. This species is often seeded in semiarid areas for forage, firebreak, and reclamation purposes. Forage kochia does not tolerate high water tables and survives highly saline conditions in areas that receive 6 inches of annual precipitation. This species can tolerate a wide variety of soil, temperature, and precipitation conditions; however, it does not do well in neutral or acidic soils. This species is non-invasive and can reduce invasion of halogeton and cheatgrass. Forage kochia can be seeded in strips (greenstripping) that is beneficial for fire reduction; it will resprout after burning. Broadcast seeding during the winter is recommended, and burning prior to planting will help the species establish among weedy annuals. This species may be one of the few that is suitable for saline upland ecological sites.

1. Irrigated pasture/hay and Mountain ecosystems (15-20+ inches of precipitation). Species are mostly introduced. (** species good in saline soils)

12. Perennial ryegrass *(Lolium perenne)*: This introduced, short-lived, cool-season perennial bunchgrass is not adapted to extended heat or drought. This species is used for pasture but can be associated with a fungal

endophyte that can cause a neurological disorder in livestock. Livestock have a grazing preference for this grass compared to other pasture grasses and, therefore, it should be planted with legumes rather than other grasses.

12.Orchardgrass *(Dactylis glomerata)*: This cool-season perennial bunchgrass requires regular grazing or clipping to prevent production of over-mature forage. This grass is winter hardy but not particularly drought resistant. Although it handles drought better than some grass species, lack of fall or winter moisture can result in severe stand reductions. The varieties Pizza, Command, Century, and Icon have varying maturity times and are all high-yield, disease-resistant varieties.

12.Intermediate wheatgrass *(Thinopyrum intermedium)*: This sod-forming wheatgrass is a vigorous easily established cool-season grass. This species produces high-quality forage in the spring and the fall, but growth stops during the hot, dry summer months. Intermediate wheatgrass makes a good hay crop either alone or in combination with alfalfa and/or bromegrass and orchardgrass. It will not withstand wet, saline, alkaline soils, or overgrazing.

12.** Altai wildrye *(Leymus angustus)*: This cool-season perennial rhizomatous grass has excellent winter hardiness and drought resistance. Coming from the mountains between Mongolia and Siberia, this species is found often in semi-desert and alkaline areas. This grass is almost as productive as tall wheatgrass on saline sites. The greatest limitations to this species are slow seedling growth and low seed yields. This species maintains nutrition after maturity better than most species. The Prairieland variety was developed for improved seed and production yield, high quality, and disease resistance. The newer varieties (Eejay and Pearl) are selected for the same qualities in addition to the ability to emerge from deep seeding.

12. Smooth brome *(Bromus inermis)*: This long-lived, cool-season rhizomatous grass is known for its vigorous seedlings and spreading character. The species overall is cold tolerant but is not well adapted to prolonged drought. Big-Ton variety has increased disease and drought resistance. Manchar is a high-elevation northern variety.

12. *Tall fescue*(Festuca arundinacea)*: This salt-tolerant, cool-season perennial bunchgrass is slow to establish but once established has very fast regrowth provided that seed heads are not allowed to be produced. Endophyte-infested varieties reduce intake and can affect animal production and conception. The Seine variety is especially palatable and has lower lignin levels as well as drought- and rust-resistance and increased yields. This variety is also endophyte free. Tuscany II is also endophyte-free and is well suited to spring growth. The Stargazer XL variety is endophyte-free, drought tolerant, extremely persistent, and makes an excellent hay or grazing variety.

12. Meadow bromegrass *(Bromus riparius)*: This cool-season perennial grass is weakly rhizomatous and can be used to extend the grazing season and increase forage production. Meadow brome has higher yields and quicker regrowth and recovery than smooth brome. This species can be used in dryland situations but will not spread much. This species will maintain a better composition in mixtures than many other brome grasses and can be used for hay or pasture forage. The variety Regar is characterized by early maturation with moderate spread and good regrowth. Fleet has improved seed production, a smaller awn, and reduced seed shattering than the variety Paddock while Paddock has good plant vigor and greater basal leaf production.

12. **Tall wheatgrass *(Thinopyrum ponticum)*: This cool-season perennial bunchgrass is very late to mature among range grasses and is valued as a forage source during the late summer to early winter. This grass has a high tolerance to alkaline and saline conditions. This species must receive at least 14 inches of precipitation and is used on saline areas where greasewood and salt-grass grow. This species is very slow to establish and has little drought tolerance. It is recommended that this species be seeded alone due to its poor competitive ability and tendency to become coarse during the growing season. The variety Alkar is used specifically on alkaline soils. Jose and Largo are used on saline and alkaline soils for soil improvement and have better high altitude tolerance. The newest variety, Platte, is not widely accepted yet but is noted for improved winter hardiness and improved production. This variety is best suited to low-elevation, alkali sites such as along the Platte River drainage.

12. **Beardless wildrye (*Leymus triticoides)*: This is a salt-tolerant cool-season rhizomatous grass. Native stands of this grass are cut for hay. It can be used on sites that are highly erodible. This species is difficult to establish (which has limited its use in seed mixtures), adapted to harsh alkaline sites, and has been successfully used for weed control in saline pastures. The Shoshone variety has aggressive rhizomes and is recommended for forage production, stabilization, or cover on wet or wet-saline or alkaline soils. The Rio variety has reduced seed dormancy and vigorous rhizomes and is used for similar purposes.

12. Creeping foxtail *(Alopecurus arundinaceus)*: This cool-season rhizomatous grass rapidly spreads and has good forage value for wildlife. This species is beneficial for reseeding along streambanks and waterways due to its tolerance to water but can become a weed problem along waterways. This species is not drought or heat tolerant but has excellent cold tolerance. This species plant is used commonly as hay and pasture forage. The variety Garrison has vigorous rhizomes, but seed shattering makes seed collection difficult. Dan is a Canadian variety selected for winter hardiness and resistance to smut. Mountain is a variety that was selected for spring and fall growth, seed yield, and disease resistance.

12. Reed canarygrass *(Phalaris arundinacea):* This tall, long-lived, cool-season rhizomatous grass produces high yields of nutritious forage. This species is adapted to poorly drained wet areas and is tolerant to waterlogged situations and should be considered first for these conditions. This species also produces good growth on upland sites. Reed canarygrass can grow up to 8 feet tall and makes good waterfowl cover. The variety Chiefton is cold tolerant and very persistent through the winter. Planting is best done during fall when weed competition is minimal.

12. Timothy *(Phleum pretense)*: This is a short-lived, perennial cool-season bunchgrass. This species is not drought tolerant and is adapted to cool, humid environments. It makes good hay and pasture forage alone or in combination with legumes. Talon is a variety that is selected for early maturity while Express is later maturing with higher yield. Timothy is persistent with heavy grazing in loamy overflow ecological sites in foothill and montane habitats.

12. Alfalfa *(Medicago sativa)*: Alfalfa is a palatable, high-quality, nitrogen-fixing forb. This forb improves soil fertility and competes with weeds. This species tolerates a wide variety of conditions including irrigated and dryland, hot summers, and cold climates. The particular level of winter hardiness, grazing resistance, and disease resistance depends on the variety. Overall, alfalfa has limited grazing resistance on native ranges unless a recovery period is given. Alfalfa has fair tolerance to salinity and alkalinity but is very sensitive to acidity. Flood periods of more than two weeks and loss of root reserve carbohydrates will reduce productivity. Phosphorous additions help increase grazing tolerance and reduce winter damage. Bloat can be a problem when grazing alfalfa, but planting with grass mixes can reduce the likelihood of bloat.

12. Cicer milkvetch *(Astragalus cicer)*: This species is a rhizomatous forb that is very winter hardy, long-lived, and does well at moderately high elevations. It does well with 14 inches of precipitation but can be more productive under irrigation and can withstand high water tables. This species can be used for hay or pasture and usually takes two years to establish.

12. **Alsike clover *(Trifolium hybridum)*: This is a perennial forb adapted to wet areas. This clover is not adapted to sand and produces best on fertile soils with other legumes or grasses. Alsike clover is more tolerant to alkalinity and cold than most clovers and can tolerate waterlogged soils for up to six weeks. This forb does not tolerate drought, shade, and high temperature conditions. This forb may also need extra drying time when cut as hay. This clover should not be planted more than ¼-inch deep.

12. **Strawberry clover *(Trifolium fragiferum)*: This perennial legume is very similar to white clover. This species is adapted to wet saline and alkaline soils and can be used where white clover does not persist. This clover requires supplemental irrigation and is more salt tolerant than other common clovers grown in the region. A common variety is Salina, and planting depth for this and other varieties should be ¼-inch.

12. ** Birdsfoot trefoil *(Lotus corniculatus)*: This legume is commonly used for pasture or hay. There are two distinct types of this plant, Empire and common. The Empire type is fine stemmed with later maturity as well as more winter hardy and thus more commonly used. This species can persist on a wide variety of soils from clays to sandy loams that experience droughty, infertile, acidic, and mildly saline or alkaline conditions. This legume is more resistant to waterlogged soils than alfalfa and does not suffer from root rot. This species is more productive when grown in well-drained soils. Birdsfoot trefoil can suffer from winter injury if not covered by snow. The species is also a poor competitor and must be inoculated for proper nitrogen fixation. This species has similar nutritional value to alfalfa but care must be taken for it to not be grazed out. Empire variety is low growing while Maitland is more upright.

12. White clover *(Trifolium repens)*: This perennial stoloniferous forb is a very nutritious, high-yielding, and palatable pasture and hay clover. It is also a good soil builder and is ideal for pasture rejuvenation. This plant is good at preventing weed encroachment; however, it does not tolerate a wide range of soil and moisture conditions nor does it tolerate saline or alkali soils. Varieties include Crescendo, which is early maturing and disease resistant, and Colt, which is grazing tolerant and is well-adapted to hot environments of the southeast U.S.

12. Red clover *(Trifolium pratense)*: This short-lived perennial forb is commonly grown for forage production and soil improvement. Red clover is well-adapted to areas with moderate summer heat and adequate moisture and is an aggressive establisher either alone or in mixes. The Cardinal variety has improved disease resistance and higher forage production. A higher-yielding variety across longer periods is 333 Brand. Other varieties include 880 Brand and Red Planet Brand blends.

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