

SEED MIX GUIDELINE - NON SAGE GROUSE HABITAT

The following seed mixes are recommended for Opencut mine site reclamation on Montana's plains, foothills, intermountain valleys, and wetland areas. The use of one of the site-specific seed mixes listed below may be appropriate depending on site conditions, the postmining land use, compatibility with surrounding vegetation, or landowner preference. The drill rates given are based on 12 pounds of pure live grass seed per acre, with an additional 1 to 2 pounds of forbs. The use of the forbs is highly recommended as they will fill the niche usually occupied by noxious weeds and other weedy species. The use of highly competitive introduced grasses, particularly crested wheatgrass and smooth brome, is not recommended unless the area to be seeded is in, or next to, an area where such species are already established. A nurse crop is recommended on highly erodible sites and, if used, should be seeded at 10 lbs/acre. The use of wheat, oat, or barley (in order of preference) is recommended for cover crop and nurse crop seeding.

- The Operator must purchase certified seed on a pure live seed (PLS) basis.
- Contact your local county extension agent or the Natural Resource Conservation Service (NRCS) for assistance with formulating alternative seed mixes.
- The seeding rate must be doubled for broadcast seeding.

NATIVE GRAZING/PASTURE MIX - For general use throughout the state

<u>Species</u>	<u>Lbs PLS/Acre</u>
Slender wheatgrass	2
Western wheatgrass	3
Thickspike wheatgrass	2.5
Bluebunch wheatgrass	2.5
Green needlegrass	2
Western Yarrow*	0.5

NON-NATIVE GRAZING/PASTURE MIX - For general use throughout the state

<u>Species</u>	<u>Lbs PLS/Acre</u>
Intermediate wheatgrass	3
Orchardgrass	3
Timothy	2
Tall Fescue	2
Alfalfa	2

NATIVE RANGELAND MIX - For moist/riparian areas

<u>Species</u>	<u>Lbs PLS/Acre</u>
Mountain brome	2
Bluejoint reedgrass	1
Tufted hairgrass	1
Canada wild rye	2
Western wheatgrass	3
Bluebunch wheatgrass	2
Western yarrow*	1

NATIVE RANGELAND MIX - For arid regions

<u>Species</u>	<u>Lbs PLS/Acre</u>
Slender wheatgrass	1
Thickspike wheatgrass	5
Western wheatgrass	3
Sandbergs bluegrass	2
Prairie junegrass	1
Yellow prairie coneflower*	1

WETLAND SEED MIX - For pond edges throughout the state

<u>Species</u>	<u>Lbs PLS/Acre</u>
Slough grass	2
Basin Wildrye	2
Baltic rush	1
Nebraska sedge	2
Creeping spike rush	2
Beaked sedge	2
Bluejoint reedgrass	1

* - Listed forbs may be substituted for other forb species depending on availability/pricing. Alternative forbs include but are not limited to Purple Coneflower, Yellow Prairie Coneflower, Western Yarrow, Lewis Flax, Rocky Mountain Bee Plant, Scarlet Globemallow, Alfalfa and Prairie Sagewort.



SEED MIX GUIDELINE - SAGE GROUSE HABITAT



The following seed mixes are **REQUIRED** for Opencut mine site reclamation within Sage Grouse General, Interconnectivity and Core Habitat areas; unless a baseline vegetative study is completed by a vegetation specialist using accepted sampling criteria. The Operator must choose the seed mix that is designed for the region that the Opencut mine will be located in. Refer to page 4 of this document for the Sagebrush Seeding Method that must be used with the below seed mixes.

Sagebrush **cannot** be drill seeded and must be broadcast seeded at the rates described below. It may be necessary to broadcast seed sagebrush separately from the other seeds, especially if the other seeds are drill seeded.

- The Operator must purchase certified seed on a pure live seed (PLS) basis.
- The seeding rate must be doubled for broadcast seeding.

NORTHERN REGION SAGEBRUSH SEED MIX

Grasses

Agropyron smithii – Western Wheatgrass
Agropyron dasystachyum – Thickspike wheatgrass
Koeleria cristata – Prairie junegrass
Poa sandbergii – Sandberg bluegrass
Stipa comata – Needle and thread

Lbs PLS/Acre

1.5 for drill seed rate & 3.0 for broadcast
 .75 for drill seed rate and 1.5 for broadcast
 0.05 for drill seed rate and 0.1 for broadcast
 0.25 for drill seed rate and .5 for broadcast
 1.25 for drill seed rate and 2.5 for broadcast

Forbs

Achillea millefolium – Yarrow
Artemisia frigida – Fringed sagewort

0.025 for drill seed rate and 0.05 for broadcast
 0.025 for drill seed rate and 0.05 for broadcast

Shrubs

Artemisia cana – Silver sagebrush
Artemisia tridentata ssp. Wyomingensis – Wyoming Big Sagebrush
Chrysothamnus nauseosus – Rubber rabbitbrush

5.0 for broadcast rate No Drill Seeding allowed
 2.0 for broadcast rate No Drill Seeding allowed
 1.0 for drill seed rate and 2.0 for broadcast

Info:

1. The northern region includes the following counties: Blaine, Chouteau, Hill, Liberty Phillips, Roosevelt, and Valley.
2. In general, shrub seed should originate from areas within 300 miles of the project to insure compatibility with local conditions.
3. Seeding grass at a heavier rate than shown is likely to reduce sagebrush establishment.
4. The species described in the seed mix must be used at the rates required.

CENTRAL & SOUTHEASTERN REGIONS SAGEBRUSH SEED MIX

Grasses

Agropyron smithii – Western wheatgrass
Agropyron spicatum – Bluebunch wheatgrass
Agropyron trachycaulum – Slender wheatgrass
Calamovilfa longifolia – Prairie sandreed
Poa sandbergii – Sandberg bluegrass
Schizachyrium scoparium – Little bluestem
Stipa comata – Needle and thread

Lbs PLS/Acre

.75 for drill seed rate & 1.5 for broadcast
.5 for drill seed rate & 1.0 for broadcast
.5 for drill seed rate & 1.0 for broadcast
0.38 for drill seed rate & .75 for broadcast
0.25 for drill seed rate & .5 for broadcast
0.25 for drill seed rate & .5 for broadcast
1.25 for drill seed rate & 2.5 for broadcast

Forbs

Achillea millefolium – Yarrow
Artemisia frigida – Fringed sagewort

0.025 for drill seed rate & 0.05 for broadcast
0.025 for drill seed rate & 0.05 for broadcast

Shrubs

Artemisia cana – Silver sagebrush
Artemisia tridentata ssp. Wyomingensis – Wyoming Big Sagebrush
Chrysothamnus nauseosus – Rubber rabbitbrush

2.0 for broadcast rate No Drill Seeding allowed
3.0 for broadcast rate No Drill Seeding allowed
1.0 for drill seed rate & 2.0 for broadcast

Info:

1. The central and southeastern region includes the following counties: Big Horn, Carbon, Carter, Custer, Dawson, Fallon, Fergus, Garfield, Golden, Judith Basin, McCone, Musselshell, Petroleum, Powder River, Prairie, Rosebud, Stillwater, Treasure, Wibaux, Wheatland, and Yellowstone.
2. In general, shrub seed should originate from areas within 300 miles of the project to insure compatibility with local conditions.
3. Seeding grass at a heavier rate than shown is likely to reduce sagebrush establishment.
4. The species described in the seed mix must be used at the rates required.

SOUTHWESTERN AND SOUTH CENTRAL REGIONS SAGEBRUSH SEED MIX

Grasses

Agropyron smithii – Western wheatgrass
Agropyron spicatum – Bluebunch wheatgrass
Agropyron trachycaulum – Slender wheatgrass
Festuca idahoensis – Idaho fescue
Poa sandbergii – Sandberg bluegrass
Stipa comata – Needle and thread

Lbs PLS/Acre

.5 for drill seed rate & 1.0 for broadcast
1.0 for drill seed rate & 2.0 for broadcast
.5 for drill seed rate & 1.0 for broadcast
0.13 for drill seed rate & 0.25 for broadcast
0.13 for drill seed rate & 0.25 for broadcast
1.0 for drill seed rate & 2.0 for broadcast

Forbs

Achillea millefolium – Yarrow
Dalea purpureum – Purple prairie clover

0.025 for drill seed rate & 0.05 for broadcast
.5 for drill seed rate & 1.0 for broadcast

Shrubs

Artemisia tridentata ssp. Tridentate – Basin big sagebrush
Artemisia tridentata ssp. Vaseyana – Mountain big sagebrush
Chrysothamnus nauseosus – Rubber rabbitbrush

2.0 for broadcast rate No Drill Seeding allowed
2.0 for broadcast rate No Drill Seeding allowed
1.0 for drill seed rate & 2.0 for broadcast

Info:

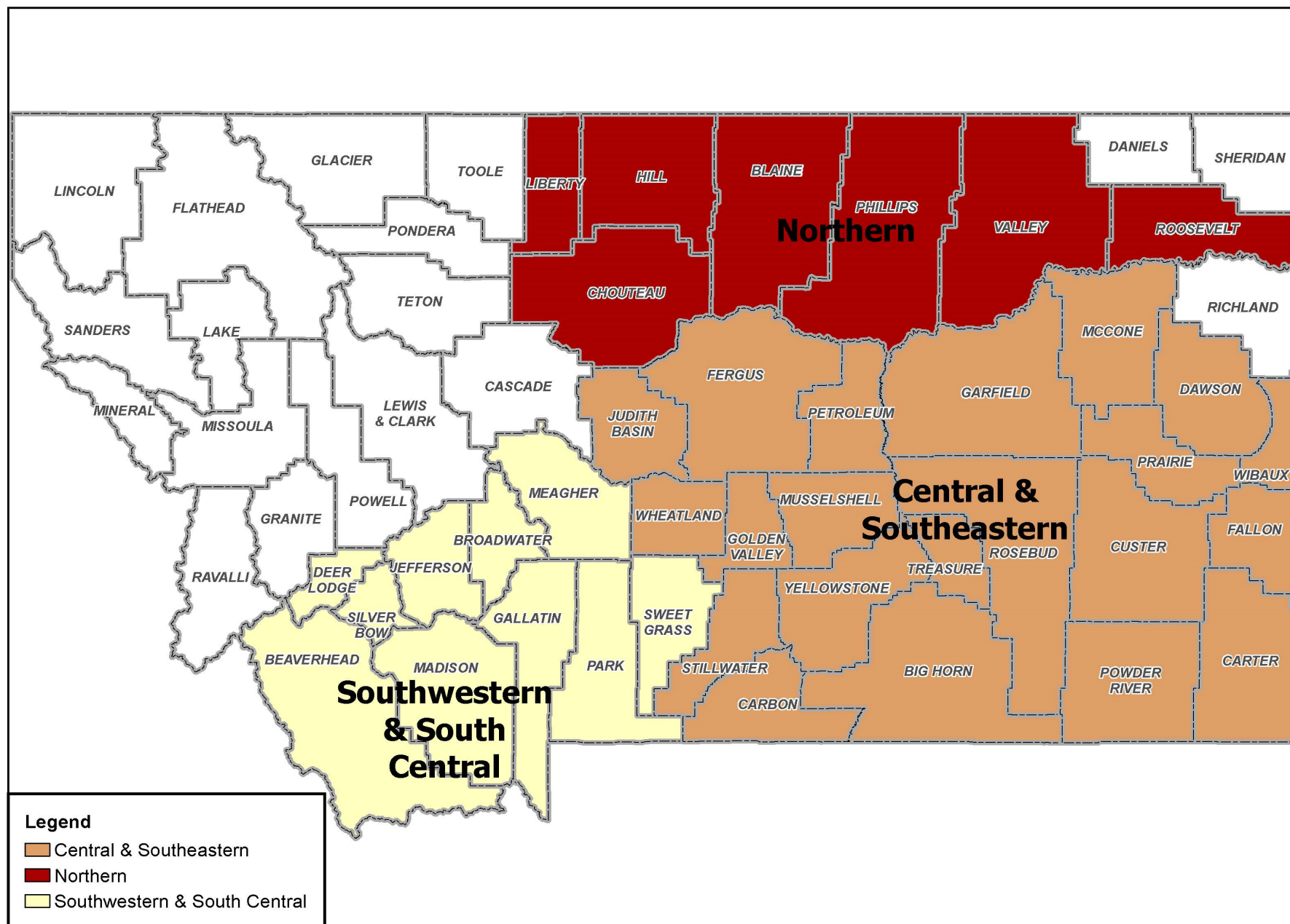
1. The southwestern and south central region includes the following counties: Beaverhead, Broadwater, Deer Lodge, Gallatin, Jefferson, Madison, Meagher, Park, Silverbow, and Sweetgrass.
2. In general, shrub seed should originate from areas within 300 miles of the project to insure compatibility with local conditions.
3. Seeding grass at a heavier rate than shown is likely to reduce sagebrush establishment.
4. The species described in the seed mix must be used at the rates required.



SAGEBRUSH SEEDING METHOD & TIPS



- Broadcast seeding is the best method to seed sagebrush.
- Ensure a relatively firm seedbed; a boot should register in the soil but not sink. If the soil is too hard, sagebrush seed will not establish.
- Sagebrush is to be seeded between October 15 and March 1 in Montana.
- Seeding on snow is an effective means of establishing sagebrush.
- Seeding immediately prior to snow or rain is often effective.
- Do not seed sagebrush seed more than 1/8 inch below the surface.
- Mix sagebrush seed and forb seed with grass seed in a broadcast seeder to prevent clogging. Seeding sagebrush by itself without a carrier, like native wheatgrass seed, is often difficult.
- Broadcast the seed manually or mechanically using cyclone-type bucket spreaders. Mix seed frequently to prevent clogging. Do not use a grain drill.
- Following broadcast seeding, good seed/soil contact must be established. Drag a flexible meadow harrow or a chain over the seeded area.
- Hydraulic seeding equipment (hydro-seeder) can be effective if the seed is applied without any hydro mulch. Sagebrush and other forbs often stick in hydromulch, do not contact the soil, and often do not grow. Apply hydromulch in a second application after seeding.



Sage Grouse Region Map for Seed Mixes

J.J. Conner
3/17/2016
Aerial Photo 2013

0 420,000 Feet
N 1 inch = 420,000 feet
DEQ
Madison Department of Environmental Quality
Industrial and Energy Minerals Bureau
Openpit Mining Program