

Seed Mixes, BMPs and Guidelines for Seeding and Mulching in the Cameron Peak Burn Area

SEED MIXES FOR UPLAND (DRY) SITES

The seed mixes in Appendix B intended for upland post-fire restoration sites. The species in these mixes have been designed to balance the goals of erosion control, habitat restoration, weed control, and general biological diversity. In addition, mixes have been designed for four different elevation bands (foothills, lower montane, mid montane, and upper montane). There are many more species that are desirable for restoration within the Cameron Peak Burn area but are not in the seed mixes below due to lack of consistent commercial availability, price limitations, or other factors. The seed mixes below are not intended for wetlands or creek-side areas, but rather the drier upland sites typical of most of the burn area. As not all the species on this list will be available from a single vendor at the time of ordering, the following ordering methods are recommended to ensure the restoration goals of these seed mixes are met:

- Find the seed mix that best fits your property (mixes are listed by elevation above sea level). For each elevation, there is a recommended mix, and an “acceptable alternatives” list. You want to send both lists to the seed vendor when ordering.
- Refer to the vendor list below for Colorado vendors who are likely to have the species in these mixes. Availability does change regularly, and you will likely need to use a few species on the alternates list.
- Work with several vendors to fulfill as best as possible the prescribed seed mix for your area, rather than simply accepting what one vendor has available. If you receive seeds from 2 or more vendors, mix the resulting seed yourself to obtain the prescribed seed mixes for your area.
- There can be a lot of chaff (e.g., stems, bracts, inert material), unviable seeds, and other “non target” material in seed mixes. Because of this reality, be sure to accept only quotes from vendors on a Pure Live Seed (PLS) basis. If a vendor is not able or willing to quote a seed mix on a PLS basis, seek a different vendor.
- When a given species in the mix is unavailable, or the weed content is unacceptable in a given lot of seed (e.g., the western wheatgrass seeds the vendor has available also includes some undesirable weed seeds), request that the vendor supplement that species with species in the “acceptable alternates”. The correct substitutes should have the same life history trait (e.g., native perennial grass, native perennial forb, etc.) as the species that is being replaced. What constitutes an unacceptable weed can depend on the site in question, the post-restoration land use, land-owner desires, and also CO State law. Refer to the weed management section below for some basic information and references.

GENERAL SEEDING PROTOCOLS AND GUIDELINES

The following are general guidelines applicable to a wide variety of post-fire seeding projects. Site specific details may require additional methods and approaches, which may be applied at the discretion of the landowner:

- A. The following **order of operations** is recommended. See later section for specific details:
 - 1) Decomcompact soils if necessary;
 - 2) Perform seedbed preparation to create crevices for seed to fall into;
 - 3) Do not add soil amendments unless absolutely necessary;
 - 4) Broadcast seed, and then cover seed with an appropriate depth of soil using a drag harrow, rakes, or other methods (see below);
 - 5) Tamp soil lightly over seeded area using a roller packer or similar methods; and
 - 6) Apply soil surface protection treatments such as mulch, straw, wood chips, erosion control blanket, or other appropriate materials based on site needs.
- B. **Hydroseeding** is not recommended. Seed SHOULD NOT be applied in hydromulch.
- C. **Timing:** The best timing to seed most sites is fall, after September 15 for sites above 8,000 feet elevation, and later into the fall for lower elevation sites. Early spring is another good time for seeding, and should be done as early as possible when the ground is workable: before May 1 for sites below 8,000 feet elevation, and before May 15 for sites above 8,000 feet elevation. Because snow levels can be an impediment to spring seeding at higher elevations, higher elevations should be seeded in the fall whenever possible.

NOTE: For various reasons, landowners may need to seed their property after April 21. While a later sowing of seeds might still work, landowners should know that later sowing will reduce the likelihood of success. If at all possible, we recommend a fall sowing of seeds if the late April window has closed.
- D. **Methods of Seeding (Broadcast vs drill):** Due to the nature of post-fire sites (e.g., steep hillsides, uneven terrain, rocky soils, downed branches, and other obstacles, etc.), drill seeding is typically not feasible. Broadcast seeding then becomes the preferred method and can be successful even on large sites (i.e., over 100 acres). Broadcast seeded sites have the added benefit of having a more natural appearance (i.e., the finished product is not in regular crop-like rows) and is an easy way to incorporate a greater variety of seeds into the soil (i.e., more diversity) compared to some methods of drill seeding.

*** All seeding rates provided are based on broadcast seeding. If drill seeding is being used, seeding rates should be cut in half.**
- E. **Seed Depth:** Proper seed depth varies from 1/8 inch deep to 1/2 inch deep, depending on the seed and site conditions. In sandier soils, deeper burial of seed (up to 1/2" deep) is preferred for most grass seed. In general, the smaller the seed (such as many small wildflower/forb seeds, and very small sedge or rush seeds) the shallower it should be buried.
- F. **Weather.** Seeding or mulching should not occur during windy weather or when ground is frozen or otherwise not tillable

SEEDBED PREPARATION

Many disturbed sites have compacted soil, resulting in difficult conditions for seedling establishment. However, most burn areas do not have compacted soils. If the burn area has hydrophobic soils (i.e., repellant to water due to post-burn conditions), decompaction may be

necessary. Other sites that may require decompaction include access roads, material and equipment staging areas, skid roads, etc. Typically, these areas should be decompacted (i.e., ripped) to about 8-12” deep. Depending on the severity of the compaction and the soil type, recommended decompaction depths may be shallower or slightly deeper. Decompaction can be accomplished with a dozer pulling ripper blades (for heavily compacted soils), the bucket of an excavator (for moderate to heavily compacted soils), or by disc (in lightly compacted soils). If decompacted soil produces a high degree of large clods (e.g., 4 inch diameter or larger clumps of soil), the soil may need to be disced or harrowed after decompaction in order to create the appropriate degree and depth of furrows for seeding. Following discing or ripping, the proper seedbed should have a variety of ridges/furrows (0.5-1.5” high), which allows for seeds to fall into crevices before raking or drag harrowing the site.

SEED VENDORS FOR COLORADO

Seed Company	Contact Name	Phone	Email	Website	City
Applewood Seed Co	Diane Wilson	303-431-7333	dwilson@applewoodseed.com	www.applewoodseed.com	Arvada, CO 80002
Arkansas Valley Seed, INC	David Weigand	303-320-7500	dweigand@avseeds.com	www.avseeds.com	Denver, CO 80216
Buffalo Brand Seed Co	Dustin Terrell	970-356-4710	dterrell@buffalobrandseed.com	www.buffalobrandseed.com	Greeley, CO 80631
Granite Seed	Daniel Bradley	720-496-0600	Daniel@graniteseed.com	www.graniteseed.com	Denver, CO 80229
Pawnee Buttes Seed Co	Elizabeth Pfannebecker	970-356-7002	Elizabeth@pawneebutteseed.com	www.pawneebutteseed.com	Greeley, CO 80631
Western Native Seed	Alex Tonnesen	719-942-3935	info@westernnativeseed.com	www.westernnativeseed.com	Coaldale, CO 81222-0188

SOIL AMENDMENTS

Most restoration sites in Colorado do not require soil amendments (e.g., Nitrogen) to be establish a successful stand of native plants. In addition, many burn areas already experience a spike in nitrogen in the early years following the fire. Actually, too much nitrogen in Colorado soils can often lead to a proliferation of non-native weeds. If in doubt, do not add any nitrogen amendments to a soil. A soil test can verify if any nitrogen or other soil amendments are needed. If you believe there is a reason to apply a nutrient fertilizer, consider a slow-release low nitrogen fertilizer such as Biosol or Richlawn (two widely accepted fertilizers) at a rate 300 to 500 lbs/acre. Except under very rare conditions, do not apply these fertilizers at a rate greater than 500 lbs/acre. These are granular fertilizers that can be broadcast on the soil at the same time as seeding or incorporated into the top 1-3” of the soil surface during discing.

For soil sampling and testing information visit Colorado State University Soil Testing Lab <http://www.soiltestinglab.colostate.edu/>

SOIL SURFACE PROTECTION GUIDELINES

Covering a seeded area with mulch or erosion control blanket (ECB, also known as erosion matting) accomplishes several important objectives in a seeded area: 1) protects the soil surface from wind or water erosion, 2) helps retain soil moisture in the soil, 3) reduces risk of herbivory by birds and other animals, and 4) reduces soil surface temperatures. Like seed, any mulch or other erosion control products brought into a

restoration site should be free of undesirable weed seeds, as well as free of plastic. Below are some basic erosion control guidelines for some common products.

- A. Seeded areas should be covered by mulch as soon as possible after seeding.
- B. **Agricultural Hay (even if it is certified weed free) is strongly discouraged** due to presence of troublesome exotic plants that may not currently be prohibited by state law, but which can be a problem in restoration sites.
- C. **Agricultural straw** (typically from wheat, barley, or oats) shall be Colorado certified weed free with bail bindings consisting of blue and orange twine, a specially produced galvanized shiny wire, and/or a certified program tag indicating the weed free certification number. Agricultural straw should be applied uniformly at a rate of two tons (4,000 lbs) per acre. This equates to 100 40-pound bales per acre, or 25 bales per quarter acre. In high wind areas, straw should be crimped into the ground to prevent removal by wind. Tackifier may be added to the crimped straw in these windy areas for added protection.
- D. On **very steep slopes** (e.g., greater than 30% slopes), or in areas exposed to high winds, flowing water, or highly erodible soils exist, erosion control blankets will provide more protection than mulch or straw. All erosion control blankets should be 100% biodegradable. Photodegradable mesh and other plastic or other synthetic products are not recommended due to their potential to injure or kill wildlife.

ADDITIONAL RESTORATION GUIDELINES AND RESOURCES

This document provides basic information for post-fire seeding and mulching. To learn more about restoration and revegetation in Colorado, please see the link below:

Larimer County Land Stewardship Program

<https://www.larimer.org/naturalresources/weeds/resources>

Coalition for the Poudre River Watershed

<https://www.poudrewatershed.org/>

Big Thompson Watershed Coalition

<https://bigthompson.co/>

Natural Resources Conservation Service (NRCS) post-fire restoration resources

<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/planners/?cid=nrcseprd337723>

Coalitions and Collaboratives Post-fire Recovery Resources

<https://co-co.org/programs/post-fire/>

Colorado Revegetation Guide (Via Rivers Edge West)

<https://riversedgewest.org/resource-center/documents/native-plant-revegetation-guide-colorado>

WEED MANAGEMENT BASICS

A number of non-native weed species have been identified in the burn area. The Colorado Noxious Weed Act (C.R.S. 35-5.5-101-119) defines weeds as “alien plants or part of alien plants that have been designated by rule as being noxious or has been declared a noxious weed by a local advisory board, and meets one or more criteria: aggressively invades or is detrimental to economic crops or native plant communities; is poisonous to livestock; is a carrier of detrimental insects, diseases, or parasites; the direct or indirect presence of this plant is detrimental to the environmentally sound management of natural or agricultural ecosystems.” Non-native weeds can be ecologically and economically detrimental and could undermine the success of many restoration projects. In some instances, noxious weeds also secrete phytotoxins which actively inhibit the germination or growth of native vegetation.

The Colorado Noxious Weed Act creates a legally binding obligation for the removal/control of noxious weed species. Through the Colorado Department of Agriculture, a treatment priority list of A, B, and C species is managed and periodically updated in order to prioritize the control of weeds.

State of Colorado Noxious Weed Act List Definitions:

List A - Species that have not become well established in the state or may have not been reported yet in the state, but are anticipated to be a serious concern. The most effective way to treat these species is to eradicate them wherever they are found, and to prevent their introduction into the state if they are not yet present.

List B - Species for which the Colorado Department of Agriculture Commissioner, in consultation with the state noxious weed advisory committee, local governments, and other interested parties, develops and implements state noxious weed management plans designed to stop the continued spread of these species. Refer to the Larimer County Weed Management Plan for more about species-specific management requirements.

List C - These are species that are recommended for management, but management is not required.

Watch List (WL) - Species that have been determined to pose a potential threat to the agricultural productivity and environmental values of the lands of the state. The Watch List is intended to serve advisory and educational purposes only. Its purpose is to encourage the identification and reporting of these species to the Commissioner in order to facilitate the collection of information to assist the Commissioner in determining which species should be designated as noxious weeds.

Weed Free Forage

The State of CO Department of Agriculture also works to minimize weed content in forage grown and used in Colorado. For information on weed restrictions in agricultural straw and in seed mixes, please visit:

Colorado Department of Agriculture weed free forage program:

<https://ag.colorado.gov/conservation/weed-free-forage>

Weed Management Resources

To assist with weed management, a great variety of weed management resources are provided by these entities, including how to create a weed management plan, best management practices for weed management, and more:

Larimer County Weed Management Plan

https://www.larimer.org/sites/default/files/uploads/2018/larimer_county_noxious_weed_plan_2018.pdf

Colorado Department of Agriculture website:

<https://www.colorado.gov/pacific/agconservation/noxious-weed-publications>

Colorado State University Extension, Weed Resources:

<https://sam.extension.colostate.edu/topics/weeds/>

Colorado Weed Management Association

<https://cwma.org/>

APPENDIX A: SEED MIXES

Life History Codes used in Seed Mixes

NPF = native perennial forb (e.g., insect pollinated wildflower). NBF = native biennial forb. NAF = native annual forb. NPG-L = native perennial grass or grass-like plant. N

Acres: 1
PLS Seeds Per Sq. Ft. (Broadcast): 110

Foothills Mix: 6,000 - 7,500 feet a.s.l.

Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History	% Mix	Pounds PLS Needed
<i>Bouteloua gracilis</i>	blue grama	Fremont CO ecotype	NPG-L	5	0.32
<i>Cleome serrulata</i>	Rocky Mountain beeplant	CO Ecotype (or VNS)	NAF	2	0.84
<i>Bouteloua curtipendula</i>	sideoats grama	Niner	NPG-L	10	2.52
<i>Coreopsis tinctoria</i>	plains coreopsis	CO Ecotype (or VNS)	NBF	3	0.10
<i>Elymus elymoides</i>	squirreltail	Pueblo or Wapiti	NPG-L	10	2.50
<i>Elymus trachycaulus</i>	slender wheatgrass	Pryor or First Strike or San Luis	NPG-L	14	4.63
<i>Festuca arizonica</i>	Arizona fescue	Redondo	NPG-L	8	0.80
<i>Gaillardia aristata</i>	blanketflower	CO Ecotype (or VNS)	NPF	2	0.51
<i>Helianthus annuus</i>	common sunflower	CO Ecotype (or VNS)	NAF	2	0.83
<i>Monarda fistulosa</i>	wild bergamot	CO Ecotype (or VNS)	NPF	3	0.10
<i>Pascopyrum smithii</i>	western wheatgrass	Arriba	NPG-L	12	5.05
<i>Poa secunda</i>	Sandberg bluegrass	Sims Mesa or High Plains	NPG-L	8	0.37
<i>Pseudoroegneria spicata</i>	bluebunch wheatgrass	Anatone	NPG-L	7	2.87
Quickguard	Quickguard	Quickguard	cover crop	1	3.42
<i>Ratibida columnifera</i>	upright prairie coneflower	CO Ecotype (or VNS)	NPF	3	0.18
<i>Rudbeckia hirta</i>	blackeyed Susan	CO Ecotype (or VNS)	NBF	3	0.09
<i>Schizachyrium scoparium var. scoparium</i>	little bluestem	Camper	NPG-L	7	2.58

100 27.72

Acceptable Alternatives (Foothills Mix)

Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History
<i>Achillea lanulosa var. occidentalis</i>	Western yarrow	Eagle or Yakima	NPF
<i>Achnatherum hymenoides</i>	Indian ricegrass	Paloma	NPG-L
<i>Adenolinum lewisii</i>	Lewis flax	CO ecotype or Maple Grove	NPF
<i>Artemisia frigida</i>	prairie sagewort	CO Ecotype preferred	NPF
<i>Bouteloua curtipendula</i>	sideoats grama	Niner	NPG-L
<i>Dalea candida</i>	white prairie clover	CO Ecotype preferred	NPF
<i>Dalea purpurea</i>	purple prairie clover	Kaneb or Stephanie	NPF
<i>Festuca idahoensis</i>	Idaho fescue	Trident	NPG-L
<i>Helianthus petiolaris</i>	prairie sunflower	CO Ecotype (or VNS)	NAF
<i>Nassella viridula</i>	green needlegrass	Cucharas	NPG-L
<i>Poa fendleriana</i>	muttongrass	Ruin Cyn	NPG-L
Regreen	Regreen	Regreen	cover crop
<i>Symphotrichum laeve</i>	smooth blue aster	CO Ecotype (or VNS)	NPF

Acres: 1
 PLS Seeds Per Sq. Ft. (Broadcast): 110

Lower Montane Mix: 7,501 - 8,500 feet a.s.l.

Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History	% Mix	Pounds PLS Needed
<i>Adenolinum lewisii</i>	Lewis flax	CO ecotype or Maple Grove	NPF	2	0.32
<i>Bouteloua gracilis</i>	blue grama	Fremont CO ecotype	NPG-L	8	0.52
<i>Cleome serrulata</i>	Rocky Mountain beeplant	CO Ecotype (or VNS)	NAF	2	0.84
<i>Elymus elymoides</i>	squirreltail	Pueblo or Wapiti	NPG-L	10	2.50
<i>Elymus trachycaulus</i>	slender wheatgrass	Pryor or First Strike or San Luis	NPG-L	14	4.63
<i>Festuca arizonica</i>	Arizona fescue	Redondo	NPG-L	10	1.00
<i>Gaillardia aristata</i>	blanketflower	CO Ecotype (or VNS)	NPF	3	0.77
<i>Pascopyrum smithii</i>	western wheatgrass	Arriba	NPG-L	14	5.89
<i>Poa secunda</i>	Sandberg bluegrass	Sims Mesa or High Plains	NPG-L	12	0.55
<i>Pseudoroegneria spicata</i>	bluebunch wheatgrass	Anatone	NPG-L	8	3.28
Quickguard	Quickguard	Quickguard	Cover crop	1	3.42
<i>Rudbeckia hirta</i>	blackeyed Susan	CO Ecotype (or VNS)	NBF	3	0.09
<i>Bromus marginatus</i>	mountain brome	Cold Springs Ecotype	NPG-L	12	6.85
<i>Penstemon strictus</i>	Rocky Mountain penstemon	Bandera	NPF	1	0.11
Totals:				100	30.76

Acceptable Alternatives (Lower Montane Mix)

Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History
<i>Elymus lanceolatus ssp. lanceolatus</i>	thickspike wheatgrass	Critana	NPG-L
<i>Achillea lanulosa var. occidentalis</i>	Western yarrow	Eagle or Yakima	NPF
<i>Achnatherum hymenoides</i>	Indian ricegrass	Paloma	NPG-L
<i>Achnatherum robustum</i>	sleepygrass	0	NPG-L
<i>Artemisia frigida</i>	prairie sagewort	CO Ecotype preferred	NPF
<i>Erigeron speciosus</i>	aspen fleabane	CO Ecotype (or VNS)	NPF
<i>Festuca idahoensis</i>	Idaho fescue	Trident	NPG-L
<i>Helianthus petiolaris</i>	prairie sunflower	CO Ecotype (or VNS)	NAF
<i>Heliomeris multiflora</i>	showy goldeneye	CO Ecotype (or VNS)	NPF
<i>Hesperostipa comata</i>	needle-n-thread	CO Ecotype (or VNS)	NPG-L
<i>Koeleria macrantha</i>	prairie Junegrass	Sims Mesa	NPG-L
<i>Penstemon virgatus</i>	Front Range beardtongue	CO Ecotype or Bluebuckle	NPF
<i>Poa fendleriana</i>	muttongrass	Ruin Cyn	NPG-L
Regreen	Regreen	Regreen	Cover crop
<i>Symphotrichum laeve</i>	smooth blue aster	CO Ecotype (or VNS)	NPF
<i>Chamerion angustifolium</i>	fireweed	CO Ecotype (or VNS)	NPF



Acres: 1
 PLS Seeds Per Sq. Ft. (Broadcast): 120

Mid Montane Mix: 8,501 - 9,500 feet a.s.l.					
Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History	% Mix	Pounds PLS Needed
<i>Adenolinum lewisii</i>	Lewis flax	CO ecotype or Maple Grove	NPF	2	0.35
<i>Elymus elymoides</i>	squirreltail	Pueblo or Wapiti	NPG-L	7	1.91
<i>Elymus trachycaulus</i>	slender wheatgrass	Pryor or First Strike or San Luis	NPG-L	14	5.05
<i>Festuca arizonica</i>	Arizona fescue	Redondo	NPG-L	10	1.09
<i>Poa secunda</i>	Sandberg bluegrass	Sims Mesa or High Plains	NPG-L	12	0.60
Quickguard	Quickguard	Quickguard	Cover crop	1	3.73
<i>Bromus marginatus</i>	mountain brome	Cold Springs Ecotype	NPG-L	14	8.71
<i>Penstemon strictus</i>	Rocky Mountain penstemon	Bandera	NPF	2	0.23
<i>Deschampsia cespitosa</i>	tufted hairgrass	Peru Creek	NPG-L	8	0.21
<i>Elymus glaucus</i>	blue wildrye	Elkton	NPG-L	8	3.11
<i>Festuca saximontana</i>	Rocky Mountain fescue	CO Ecotype preferred	NPG-L	10	0.43
<i>Trisetum spicatum</i>	spike trisetum	CO Ecotype preferred	NPG-L	12	0.25
Totals:				100	25.68

Acceptable Alternatives (Mid Montane Mix)

Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History
<i>Elymus lanceolatus ssp. lanceolatus</i>	thickspike wheatgrass	Critana	NPG-L
<i>Artemisia frigida</i>	prairie sagewort	CO Ecotype preferred	NPF
<i>Erigeron speciosus</i>	aspen fleabane	CO Ecotype (or VNS)	NPF
<i>Festuca idahoensis</i>	Idaho fescue	Trident	NPG-L
<i>Heliomeris multiflora</i>	showy goldeneye	CO Ecotype (or VNS)	NPF
<i>Koeleria macrantha</i>	prairie Junegrass	Sims Mesa	NPG-L
<i>Poa fendleriana</i>	muttongrass	Ruin Cyn	NPG-L
Regreen	Regreen	Regreen	Cover crop
<i>Symphotrichum laeve</i>	smooth blue aster	CO Ecotype (or VNS)	NPF



Acres: 1
 PLS Seeds Per Sq. Ft. (Broadcast): 120

Upper Montane Mix: 9,501 - 10,500 feet a.s.l.

Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History	% Mix	Pounds PLS Needed
<i>Elymus trachycaulus</i>	slender wheatgrass	Pryor or First Strike or San Luis	NPG-L	16	5.77
<i>Poa secunda</i>	Sandberg bluegrass	Sims Mesa or High Plains	NPG-L	14	0.70
Quickguard	Quickguard	Quickguard	cover crop	1	3.73
<i>Bromus marginatus</i>	mountain brome	Cold Springs Ecotype	NPG-L	16	9.96
<i>Deschampsia cespitosa</i>	tufted hairgrass	Peru Creek	NPG-L	14	0.37
<i>Elymus glaucus</i>	blue wildrye	Elkton	NPG-L	10	3.89
<i>Festuca saximontana</i>	Rocky Mountain fescue	CO Ecotype preferred	NPG-L	12	0.52
<i>Trisetum spicatum</i>	spike trisetum	CO Ecotype preferred	NPG-L	12	0.25
<i>Festuca idahoensis</i>	Idaho fescue	Trident	NPG-L	5	0.58
Totals:				100	25.76

Acceptable Alternatives (Upper Montane Mix)

Scientific Name (USDA)	Common Name (USDA)	Cultivar or Ecotype	Life History
<i>Erigeron speciosus</i>	aspen fleabane	CO Ecotype (or VNS)	NPF
<i>Heliomeris multiflora</i>	showy goldeneye	CO Ecotype (or VNS)	NPF
<i>Koeleria macrantha</i>	prairie Junegrass	Sims Mesa	NPG-L
<i>Poa fendleriana</i>	muttongrass	Ruin Cyn	NPG-L
Regreen	Regreen	Regreen	cover crop

