



## Spanish Peaks Bighorn Sheep Winter Range Habitat Improvement Project

**Objective:** Improve bighorn sheep winter range habitat

**County:** Gallatin County near Big Sky

**Project partners:**

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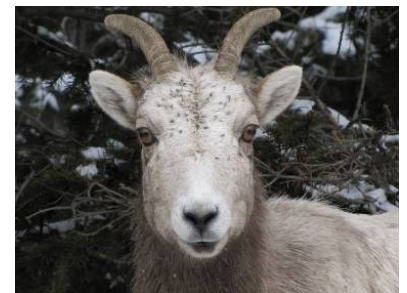
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**Spanish Peaks Bighorn Sheep Herd:** The population is considered a potential source for bighorn sheep augmentation in other areas. Herd numbers: still about 140-150 bighorn. The herd is capable of producing trophy quality rams – not as big as Missouri River Breaks rams, but still a good 170-180 Boone and Crockett score. Lamb:ewe ratios is a way to express productivity. Lamb:ewe ratios reflect herd health and indirectly habitat health. In a bad snow year when there is poor forage, there is very low recruitment (<20 lambs:100 ewes). In good years, there is as many as 59 lambs per 100 ewes. Keeping good habitat, especially on winter range, is key to keeping these sheep healthy and on the mountain. Sheep have surprisingly flexible diets! A comparison of 4 studies in the northern Rockies revealed they are predominantly grazers, but can also rely heavily on browse. Forbs generally are a small component in the diet. These studies reported bighorn use, to differing degrees, of the following species or genera: sedges (*Caryx* sp.), grasses (*Koeleria* sp., *Festuca* sp., *Pseudoroegneria spicata*), yarrow (*Achillea* sp.), mountain maple (*Acer glabrum*), serviceberry (*Amelanchier alnifolia*), Douglas fir (*Pseudotsuga menziesii*), juniper (*Juniperus scopulorum*), Ceanothus sp., bitterbrush (*Purshia tridentata*), and mountain mahogany (*Cercocarpus ledifolius*). The above information on the bighorn population was provided by Julie Cunningham (MFWP).



**Project History:** In 2010, the Gallatin Invasive Species Alliance (GISA) identified wildlife habitat areas within the project area with high densities of noxious weeds. The area northwest of Lone Mountain Trail and Highway 191 was selected as it was heavily infested with multiple noxious weed species (houndstounge, musk thistle, hoary alyssum, spotted knapweed, and others), and has been identified by Montana Fish, Wildlife and Parks as critical winter range for the Spanish Peaks bighorn sheep herd. With the assistance of partners (Gallatin National Forest Service, Montana Fish, Wildlife, and Parks, Montana Department of Transportation, and Gallatin County Weed District), GISA initiated annual treatment of noxious weeds in 2010.



In 2014, with the help of rangeland experts, partners concluded that current range conditions indicate a downward trend, unfavorable to the needs of bighorn sheep during winter months. The increase in noxious weeds results in fewer resources and space for critical native grass and forb production. Utilization of existing desirable grass species is high, as almost no litter from previous year's growth is present. Production was estimated at only 1/6th of potential and noted that there were only 25-30% of the kinds and amounts of potential native plants on the site. Seed bank of desirable grasses is likely non-existent due to repeated grazing (no or few seeds produced) and seeds only survive for 2-3 years. It is reasonable to expect the seed bank of desirable species is not adequate to maintain a sustainable native vegetation population. Downy brome was present in high densities in areas that should be occupied by desirable grass species, further indicating a downward trend. The low utilization of this species means seed production will be high, furthering the species shift from desirable native grasses to low value invasive grass species.

With tree encroachment, bighorn sheep become concentrated in openings where they exert more pressure on plant communities; further exacerbating the potential for invasive plant establishment. Lisa Stoeffler, GNF, acknowledged tree encroachment into openings is a recognized natural resource issue on the Gallatin National Forest.

This use was determined to be unsustainable. With that assessment came action. In partnership with Natural Resources Conservation Service, Gallatin National Forest, Gallatin County Weed District, and Montana Fish, Wildlife and Parks, the Gallatin-Big Sky Weed Committee initiated revegetation test plots to determine what native plants could compete and thrive on the steep slopes.

**Average Annual Precipitation:** 20 inches

**Elevation:** 6100 ft

**Site History:** Douglas fir forest opening, bighorn sheep winter range, heavily overgrazed and conifer encroachment

**Test Sites:** There were three test areas with eight plots: individual species, a non-seeded control, and a mix of all species. Grazing enclosure cages (32 x 48 inches) were placed in each plot at Sites 1 and 2.

#### **Methods and Procedures:**

Site Preparation: Downy brome dead thatch residue was hand raked to expose mineral soil and weeds. Glyphosate was applied October 21, 2015. Makaze (Glyphosate) was mixed at 5 ounces per 1 gallon of water. The surfactant Liberate was added at the rate of 1 ounce per 1 gallon of water. The total amount used at the Lone Mountain Trail site was 6 gallons and 4 gallons at the Deer Creek site.



Seeding: All three sites were hand broadcast seeded 12 November 2015. Site 1 & 3 are 64 feet by 40 feet and site 2 is 40 feet by 15 feet, 0.1 acre total. The seeded plots were planted in randomized complete blocks (RCB) with 8 treatments each (table 1). The RCB treatments on the representative three sites will serve as three replications for distribution of variability and the statistical analysis of collected data.



Table 1. Seeded species and their seeding rate.

Scientific Name	Common Name	Cultivar	Ibs PLS/acre
<i>Poa secunda</i>	Nevada bluegrass	Opportunity	8.4
<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass	Goldar	30.0
<i>Elymus lanceolatus</i>	Thickspike wheatgrass	Critana	30.0
<i>Linum lewisii</i>	Lewis flax	Maple Grove	14.8
<i>Dalea candida</i>	Slender white prairie clover	Antelope	17.0
<i>Ratibida columnifera</i>	Prairie coneflower	Stillwater	8.4

Installation of exclosure cages: On October 26, 2016, exclosure cages (32 inch by 48 inch steel cages) were installed at one (1) random established segment on each of the 8 treatments at two (2) of the 3 sites to protect from grazing.



**Sites:**

Site 1: Lone Mountain Trail (sheep 1, Rep 1), Size: 64' x 24', elevation 6197 ft., coordinates (NW corner) latitude: N 45 degrees 16.054', W 111 degrees 15.676'

'Stillwater' upright prairie coneflower	'Maple Grove' Lewis flax	'Opportunity' Nevada bluegrass	'Goldar' bluebunch wheatgrass	'Antelope' slender white prairie clover	Mix	'Critana' thickspike wheatgrass	No seed control
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Site 2: Lone Mountain Trail (sheep 2), Size 40' x 14', elevation 6139 ft., coordinates (NW corner) latitude: N 45 degrees 16.040', W 111 degrees 15.669'

'Antelope' slender white prairie clover	No seed control	Mix	'Goldar' bluebunch wheatgrass	'Critana' thickspike wheatgrass	'Opportunity' Nevada bluegrass	'Maple Grove' Lewis flax	'Stillwater' upright prairie coneflower
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Site 3: Deer Creek (sheep 3), size 64' X 24', elevation 6044 ft, coordinates N45 18.152'; W111 12.438', 45% slope with a bearing of 210 degrees.

Mix	'Opportunity' Nevada bluegrass	'Goldar' bluebunch wheatgrass	'Critana' Thickspike wheatgrass	'Antelope' slender white prairie clover	'Maple Grove' Lewis flax	No-seed control	'Stillwater' upright prairie coneflower
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**Evaluation:** Evaluation of the test plots began in the summer of 2016 and will continue to be monitored for five (5) years. The plots will be evaluated for stand density (plants/ft<sup>2</sup>) to determine what species established best (# plants/ft<sup>2</sup>), and were there more seeded plants within the grazing exclosures than outside of them.



**Results:**

The seeded species had low establishment in 2016 and 2017. All species increased over time except for slender white prairie clover. In 2018, all seeded species were observed except Nevada bluegrass (Table 2). Where seeded species established, the density was higher within the grazing exclosure cage than outside the cage indicating that protecting seedlings from grazing was beneficial in their establishment (T-test:  $p=0.04$ ). Lewis flax and prairie coneflower had the highest density for forbs, and they established well throughout the plots. Thickspike wheatgrass had the highest density of the seeded grasses. Lewis flax averaged 23 inches tall, prairie coneflower averaged 15 inch tall, and thickspike wheatgrass was 10 inches tall. Cheatgrass, common mullein, musk thistle, and other weeds species re-established on the sites at approximately 70% canopy cover. Even with the weed pressure, prairie cornflower, Lewis flax and thickspike wheatgrass successfully established. Prairie coneflower was the only seeded species being grazed by wildlife.

Table 2. Seeded species density (plants/ft<sup>2</sup>) outside of grazing exclusion cages and within cages, July 2018.

Location	Seeded Species Density (plants/ft <sup>2</sup> )									
	Bluebunch Wheatgrass		Thickspike Wheatgrass		Lewis Flax		Slender White Prairie Clover		Prairie Coneflower	
	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage
Site 1	0.07	0.64	0.21	0.96	0.11	1.07	0.0	0.11	0.18	0.86
Site 2	0.02	0.21	0.12	0.86	0.07	0.43	0.0	0.0	0.23	2.14
Site 3	0.01	n/a	0.00	n/a	0.03	n/a	0.0	n/a	0.01	n/a
Ave <sup>1</sup>	0.03	0.43	0.11	0.91	0.07	0.75	0.0	0.05	0.14	1.5

Outside the cage is average of three sites, inside the cage is average of two sites.  
n/a: cages were not installed at site 3.



Lewis flax (left) and prairie coneflower (right) established well despite cheatgrass cover. Photos courtesy of Monica Pokorny, NRCS Plant Materials Specialist



**Summary:**

- Prairie coneflower, Lewis flax, and thickspike wheatgrass were the seeded species with the highest densities. They established well on the weedy, southern aspect.
- Protecting seeded species from grazing improved the density of all species.
- Additional weed management for cheatgrass prior to seeding, or using a herbicide with residual to control cheatgrass and other weeds for a longer period of time, may improve seeded species establishment.