Summit County Sage-Grouse Thistles ISM Monitoring 2018-2020 Year 3

Introduction

The Summit County Sage-grouse project has the overall goal of improving habitat for sage-grouse and is funded by the Forest Service. One of the ways this project is improving habitat is by controlling noxious weeds on the property. The Summit County Weed Department has been working closely with both the Forest Service and private land owners to control noxious weeds, and they asked us, the Utah Department of Agriculture and Food, to assist in monitoring the changes in the noxious weeds at three sites.

Fig. 1. Map of the general project area with the project center and transects displayed.

Location

This project is located in Summit County and is very large, encompassing about 305,193 acres (Fig. 1). We only monitored a much smaller portion of that by installing 3, 100 ft. transects. The transects were located on 2 different private properties, east of Coalville and off of Chalk Creek Road (Fig. 1). Both properties utilize the land for grazing and provide great habitat for wildlife.

Invasiveness of Noxious Weeds on Site

The main noxious weeds found on site are thistles, primarily musk thistle (*Carduus nutans*) but also Canada thistle (*Cirsium arvense*) and Scotch cottonthistle (*Onopordum acanthium*). In 2020, we also discovered trace amounts of houndstongue (*Cynoglossum officinale*) encroaching.

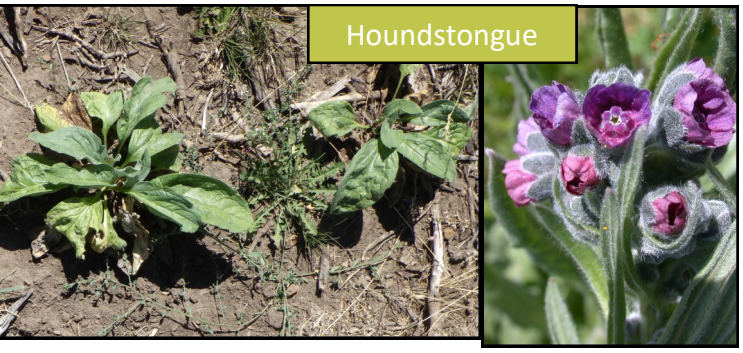
Flower photo courtesy of Tooele County Weed Department

Musk and Scotch thistles are biennials that spread with easily dispersed seeds.[1,2] These thistles are incredibly difficult to eradicate because the seeds can remain viable for long periods of time. Musk can last up to 15 years in the soil.[3,4] Scotch thistle seeds can last up to 39 years.[2] They can grow in thick stands that outcompete other more desirable plants.[4] In fact, research has found these species have allelopathic qualities.[2,5] Also, the spines on the plant inhibit grazing, human recreation, and likely movement of wildlife.[2,6]

Photos courtesy of Jerry Caldwell

Unlike musk and Scotch thistle, Canada thistle is a perennial plant that spreads quickly through both seeds and rhizomes (creeping roots).[7,8] As a result, it is very difficult to control.[9] Canada thistle outcompetes other desirable plants and will form monocultures.[7]

Canada thistle rosette photo courtesy of Tooele County Weed Department; Flower photo courtesy of Jerry Caldwell



Flower photo courtesy of Jerry Caldwell

Houndstongue was first detected in the 2020 monitoring session on transect 1 and near transect 3. It is not a big problem yet, but it could be if not kept in check. It is a biennial, and it spreads through seeds with barbs that make the seed very sticky.[10] As a result, these seeds can be transported long distances, reduce wool quality, and can cause skin and eye irritation in animals.[10] Additionally, houndstongue it toxic to horse and cattle and can even result in death.[10]

Because of the negative impacts of these noxious weeds, controlling these weeds is high priority for not only the private land owners, the county, and the state, but also for preserving sage-grouse habitat. The Western Association of Fish and Wildlife Agencies listed Canada thistle as #10 for relative invasiveness in sage-grouse habitats, Scotch thistle as # 17, and musk thistle as # 19.[11] Therefore, this project is a great example of multiagency cooperation to meet multiple goals. Annual grasses are another big concern for sage-grouse habitat including cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*).[11]

Photo from "Invasive Plant Management and greater Sage-Grouse Conservation: report from the Western Association of Fish and Wildlife Agencies

Treatment and Timing

This project began both herbicide treatment and monitoring in 2018. Grazing has continued throughout the timeline of the project. For thistles and houndstongue, research has recommended spraying rosettes early in the growing season or in late fall when the plants are actively growing.[2,8,10,12] Research has also found that mixing grazing with spraying is one of the most effective ways to quickly control musk thistle.[12] The herbicide and time of spraying for this project are on target and recommended by research for all noxious weed species found on the properties (Table 1).[2,8,10,12]

For monitoring timing, we monitor over a 5 year time frame, but take a break in year 4. This report is occurring after our third year of monitoring. We monitored in early June for the past 3 years and were able to pretreatment measurements in 2018.

Photo courtesy of Summit County Weed Department

Year	Treatment Type	Treatment Date	Monitoring Date
2018	Milestone (5 oz./acre), Escort (0.5 oz./acre)- aerial spray	June 24th	June 6th
2019	Milestone (5 oz./acre), Escort (0.5 oz./acre)- aerial spray; Transect 1 was not sprayed this year	June 24th	June 7th
2020	Milestone (5 oz./acre), Escort (0.75 oz./acre), 2-4 D (38 oz./ acre)	June 15th	June 4th

Table 1. Treatment details and monitoring dates.

Monitoring Methods

We went out to these sites to measure changes over time with treatment. To do this, we recorded several observations and took measurements along transects. We used SamplePoint to analyze the photos, and we used excel to calculate the means and confidence intervals to determine changes over time.

Monitoring methods include the following:

-Creating a species list
-Taking Landscape photos
-Taking ground cover photos
- Measuring noxious weed cover using the line intercept method
-Counting plant density (1 m. x 100 ft. belt)

Goals

Although not predetermined, we set goals on what we would consider success for the treatment of noxious weeds in the project. This project met its goals for musk thistle in 2019, but an increase in transect 1 increased the musk thistle cover enough to be slightly over the goal by 2020. The data presented here is from our line intercept data

Goal:
<10% Musk thistle cover
<2% Canada thistle cover

Current Average Cover:
11% Musk thistle cover
0% Canada thistle cover

Results

After the first year of treatment, the percent cover of musk thistle dropped to less than 2% on all transects. Musk thistle is a biennial with long lived seed source and allelopathic chemicals that suppress the growth of other plants.[4,12,13] Therefore, for the first 2-3 years, it is very important to treat all rosettes, even if the cover and density is small. Transect 1 was not treated in year 2. Although, at that time, it only had a 0.3% cover of musk thistle with a small number of plants (1 per m^2), the untreated plants expanded to a cover of 33% of the ground by 2020 (Fig. 2 and 3). We would recommend aggressively treating here for at least 2 more years consecutively. Transect 2 also had about 3 plants/m^2 in 2019, but after treatment, the percent cover dropped from 1.3% in 2019 to 0.4% in 2020 with no plants found rooted in the transect itself (Fig. 2 and 3). Because there were still trace amounts of musk thistle near transect 2, we would recommend at least 1 more year of spot treating here. Transect 3 had the smallest coverage of musk thistle to begin with, and the plant has not been detected at the site after the first round of treatment. On average, the cover of musk thistle had decreased from 29% to 11%, which is great progress.

Other noxious weeds were found in trace amounts. Scotch thistle was found near transect 1 in 2018, and by 2020, it had spread onto the transect. Houndstongue was also found near transect 1 and 3. At Transect 1, we did not only see a rebound of musk thistle, but also a slight increase of 2 other noxious weeds. Canada thistle was initially a problem on transect 2, but careful management has left only trace amounts of Canada thistle near this transect. Although not listed as noxious by the state, we found cheatgrass (*Bromus tectorum*) at all transects. This annual grass is a particular concern for sage-grouse habitat and is listed as the second most problematic weed for sage-grouse.[11] Fortunately, Milestone also suppresses cheatgrass, and it has decreased on all transects except transect 3 (Fig. 4).[14] Again, we recommend aggressive treatment of noxious weeds at transect 1 for the next 2 years, and spot spraying and careful monitoring at transects 2 and 3.

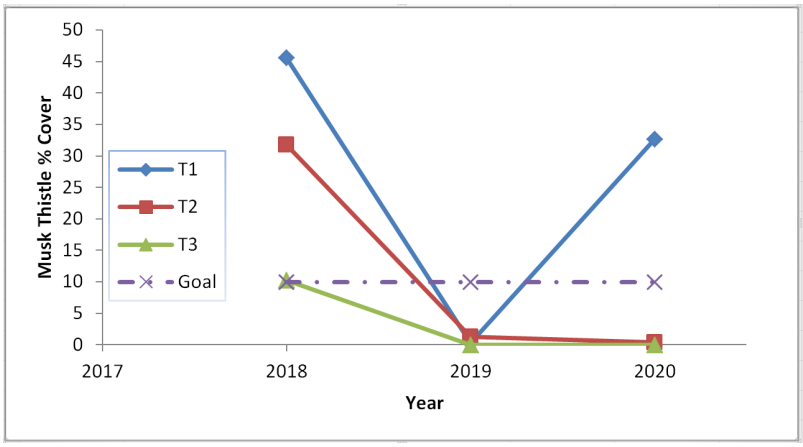


Fig. 2. This graph displays the mean percent cover of musk thistle by transect and year from the line intercept data. The dashed line represents the goal percent cover.

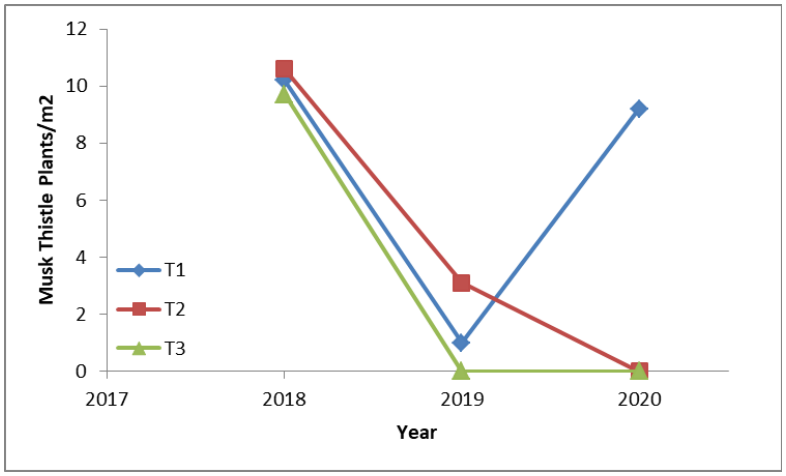


Fig. 3. This graph displays the density of musk thistle plants per meter squared by transect and year from the line intercept data.

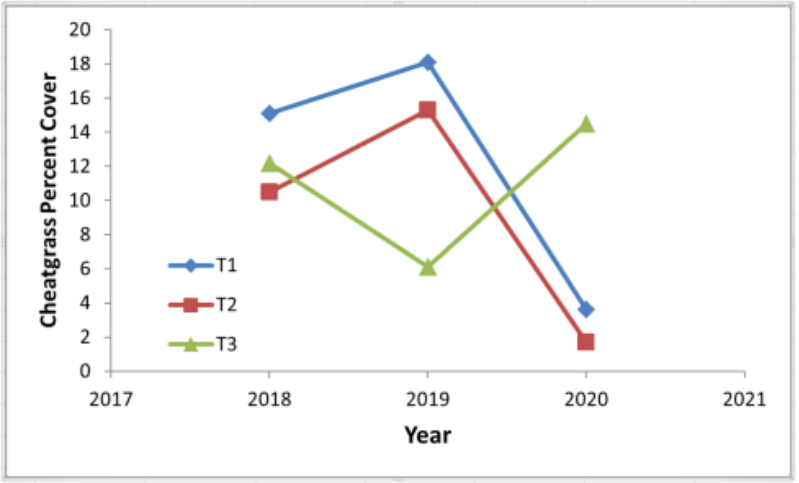


Fig. 4. This graph displays the average percent cover of cheatgrass by transect and year from the ground cover photo analysis.


Cheatgrass at transect 3 in 2020

This project has successfully maintained species richness (the number of different species occurring on the site) and slightly increased biodiversity and non-noxious plant cover (Fig. 5 and 6). Native plant cover has increased from 4.5% on average in 2018 to 14% on average in 2020 (Fig. 6). On average, forbs have decreased slightly, and grasses have increased slightly (Table 6). Maintaining and even slightly increasing plant cover is incredibly difficult while using herbicide as a control method. This could be due to the early timing of the spray, which protects later sprouting plants. Also, the health and seedbank of the sites before the infestation likely play a large role in the rapid recovery time.

Plants and litter that cover the ground (ground cover) play an important role in ecosystems because they decreases soil erosion, while an increase of bare ground can lead to loss of top soil through wind and water erosion.[15] Ground cover is very important in areas with steep slopes, which this project has.[15] For this project, bare ground is increasing (Fig. 6, Table 7). This is likely due to the decrease in litter and noxious weeds. However, plant cover, not including noxious weeds, is increasing (Fig. 6, Table7). As long as overall plant cover is increasing, soil erosion will likely not become a problem. However, if bare ground continues to increase and overall vegetation decrease, revegetating the site with beneficial plant is recommended. For now, we recommend continued monitoring of the site

Precipitation can also be a big driver for plant cover. 2019 was a very big water year compared to previous years (Fig. 6). This increase in precipitation is likely also driving the increase in biodiversity and plant cover. 2020 has been much drier than 2019 and may slow some of the reestablishment of beneficial plants.[16]

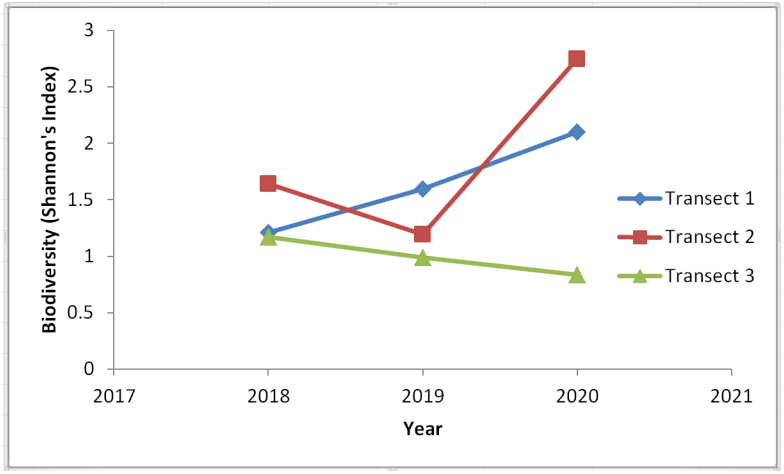


Fig 5. This graph displays the biodiversity of each transect over time. The higher the points indicates a higher biodiversity.

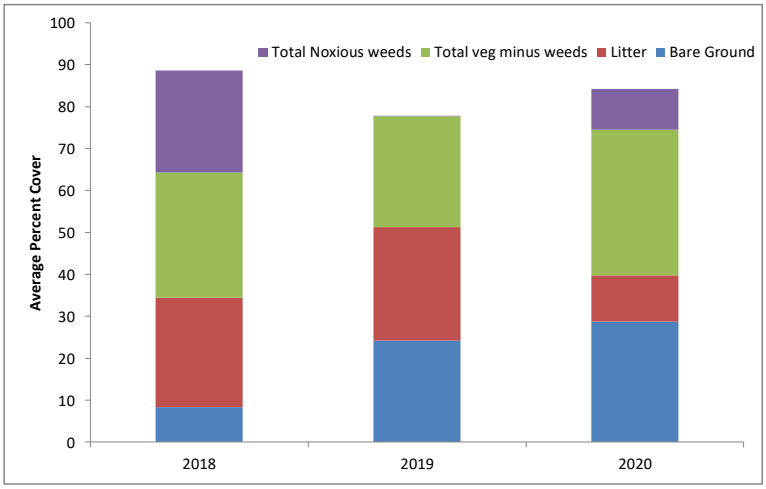


Fig 6. This graph displays the average percent cover over time from the ground cover photo analysis. It is grouped by total noxious weeds, all other vegetation minus noxious weeds, litter, and bare ground. The size of the bar indicates the percent cover for that group.

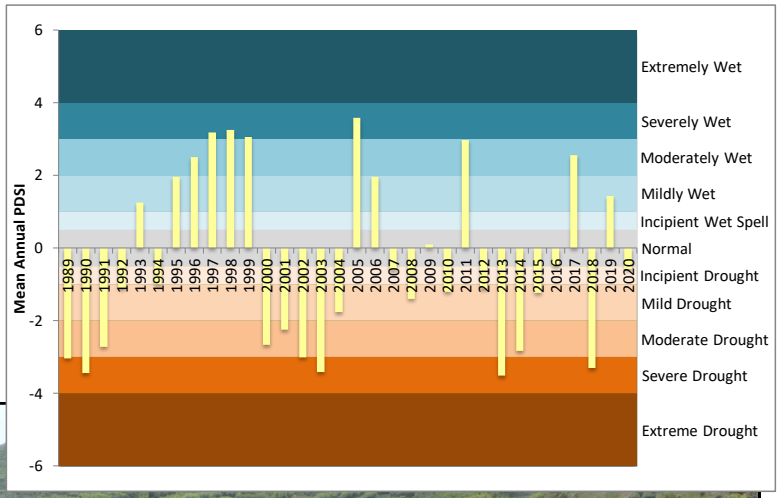
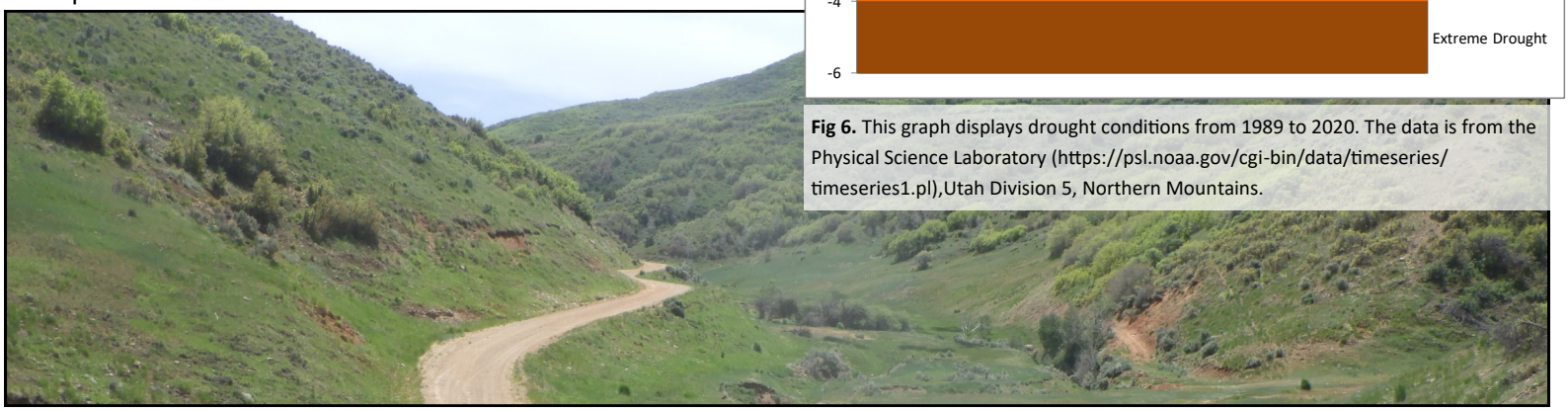


Fig 6. This graph displays drought conditions from 1989 to 2020. The data is from the Physical Science Laboratory (https://psl.noaa.gov/cgi-bin/data/timeseries/timeseries1.pl),Utah Division 5, Northern Mountains.



Conclusion

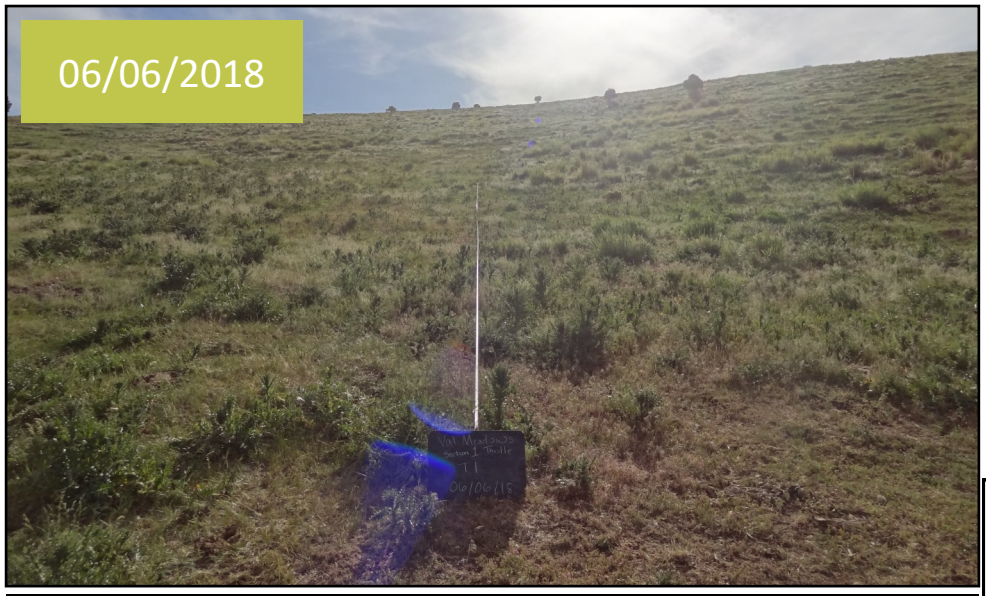
By spraying in early summer and using appropriate herbicides, this project has decreased the noxious weed plant cover by 60% while increasing the cover of other plants 16%. The goal of this project was <10% cover of musk thistle and <2% of Canada thistle. They successfully reached their goal for Canada thistle. For musk thistle, the goal would have easily been met if treatments had gone as planned, and if treatments resume, they should easily met their goal by year 5 of monitoring. The increase of non-noxious plants and biodiversity is impressive, and if the sites continue on this trajectory, no other additional restoration activities should be needed (i.e. seeding). We recommend herbicide treatment at transect 1 should begin again with 2 years of consistent sprays. We recommend considering spot spraying transects 2 and 3 at least 1 more time to be sure all thistles and any other encroaching weeds are eradicated. We also recommend checking the sites in the future to ensure noxious weeds are not rebounding, that beneficial plants are increasing, and that erosion is not becoming a problem.

Summary

- Canada thistle goal was met!
- Musk thistle goal is close but not yet met.
- A decreased noxious weeds by 60% and increased non-noxious plant cover by 16% indicates an effective project.
- If bare ground cover continues to increase, additional restoration activities may be needed (i.e. seeding) to prevent erosion or reintroduction of noxious weeds. However, with the increase in non-noxious plant cover and biodiversity, further restoration is likely not needed.

Transect 1

Landscape Photos



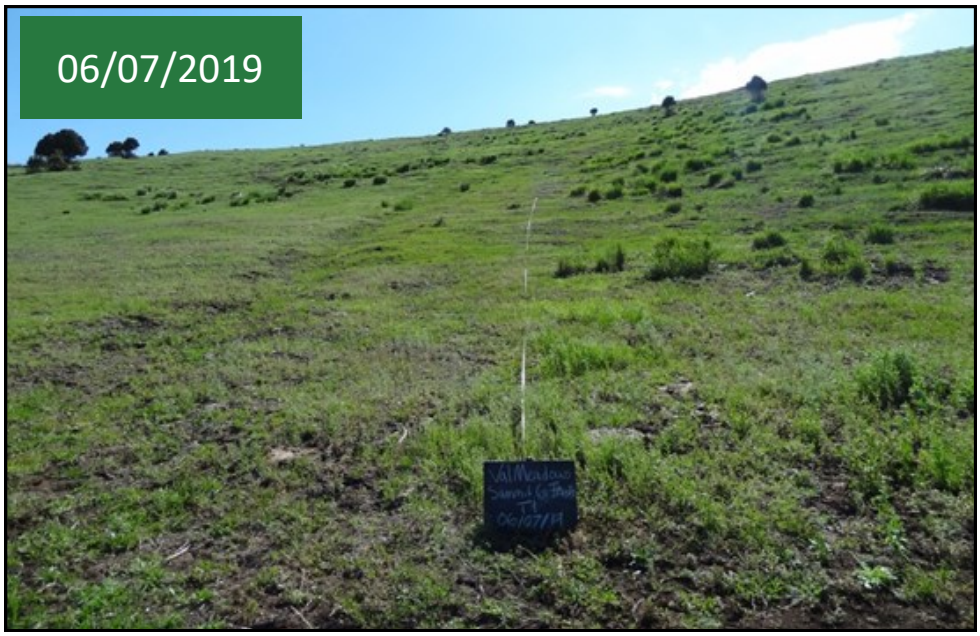


Fig. 7. Zoomed in view of Transect 1

Transect 2

Landscape Photos

Fig. 8. Zoomed in view of Transect 2 and 3

Transect 3

Landscape Photos

Fig. 9. Zoomed in view of Transect 2 and 3

Tables and Graphs

Native Plants

Type:	Annual (A)/ Biennial (B)/ Perennial (P)	USDA Code	*Scientific Name*	Common Name
Forb	A	COPA3	*Collinsia parviflora*	maiden blue eyed Mary
Forb	A/B/P	DEPI	*Descurainia pinnata*	western tansymustard
Forb	P	GABO2	*Galium boreale*	northern bedstraw
Forb		HACKE	*Hackelia sp.*	stickseed
Forb	P	HEMUM	*Heliomeris multiflora var. multiflora*	showy goldeneye
Forb	P	HYCA4	*Hydrophyllum capitatum*	ballhead waterleaf
Forb	A/B	LAOC3	*Lappula occidentalis*	flatspine stickseed
Forb	P	LIRU4	*Lithospermum ruderale*	western stoneseed
Forb	A	MIGR	*Microsteris gracilis*	slender phlox
Forb	P	PHLO2	*Phlox longifolia*	longleaf phlox
Forb	P	PSJA2	*Pseudostellaria jamesiana*	tuber starwort
Forb	P	THFE	*Thalictrum fendleri*	Fendler's meadow-rue
Grass	P	ACHY	*Achnatherum hymenoides*	Indian ricegrass
Grass	A/P	ARPU9	*Aristida purpurea*	purple threeawn
Grass	P	CAPE7	*Carex petasata*	Liddon sedge
Grass	P	ELEL5	*Elymus elymoides*	squirreltail
Grass	P	HECO26	*Hesperostipa comata*	needle and thread
Grass	P	JUHA	*Juncus hallii*	Hall's rush
Grass	P	KOMA	*Koeleria macrantha*	prairie Junegrass
Grass	P	LECI4	*Leymus cinereus*	basin wildrye
Grass	P	PASM	*Pascopyrum smithii*	western wheatgrass
Grass	P	POSE	*Poa secunda*	Sandberg bluegrass
Grass	P	PSSP6	*Pseudoroegneria spicata*	bluebunch wheatgrass
Shrub	P	ARTR2	*Artemisia tridentata*	big sagebrush
Shrub	P	CHVI8	*Chrysothamnus viscidiflorus*	yellow rabbitbrush
Shrub	P	EROV	*Eriogonum ovalifolium*	cushion buckwheat
Shrub	P	QUGA	*Quercus gambelii*	Gambel oak
Shrub	P	SYOR2	*Symphoricarpos oreophilus*	mountain snowberry

Table 2. This table contains a list of all the native plants that were found on site by plant type, life span, USDA plant code, scientific name, and common name.


Showy goldeneye


Hall's rush


Basin wildrye


Indian ricegrass

Other Plants

Type:	Introduce (I)/ Native (N)/ Noxious (Nx)	Annual (A)/ Biennial (B)/ Perennial (P)	USDA Code	*Scientific Name*	Common Name
Forb	I/N	P	ACMI2	*Achillea millefolium*	common yarrow
Forb	I	A/B	ALAL3	*Alyssum alyssoides*	pale madwort
Forb	Nx	B/P	CANU4	*Carduus nutans*	nodding plumeless thistle
Forb	I	A	CETE5	*Ceratocephala testiculata*	curveseed butterwort
Forb	Nx	P	CIAR4	*Cirsium arvense*	Canada thistle
Forb	Nx	B	CYOF	*Cynoglossum officinale*	gypsyflower (houndstongue)
Forb	I	A/B	DESO2	*Descurainia sophia*	Herb sophia
Forb	I	A	DRVE2	*Drava verna*	Spring draba
Forb	I	A/B	ERCI6	*Erodium cicutarium*	redstem stork's bill
Forb	I	A	ERRE4	*Erysimum repandum*	Spreading wallflower
Forb	I	A/B	LASE	*Lactuca serriola*	prickly lettuce
Forb	I/N		LUPIN	*Lupinus sp.*	Lupine
Forb	I	A	MYST2	*Myosotis stricta*	strict forget-me-not
Forb	Nx	B	ONAC	*Onopordum acanthium*	Scotch cottonthistle
Forb	I	A/B	SIAL2	*Sisymbrium altissimum*	tall tumblemustard
Forb	I/N	P	TAOF	*Taraxacum officinale*	common dandelion
Forb	I	B	VETH	*Verbascum thapsus*	common mullein
Forb	I/N		VIOLA	*Viola sp.*	violet
Grass	I	A	BRAR5	*Bromus arvensis*	field brome
Grass	I/N	P	BRIN2	*Bromus inermis*	smooth brome
Grass	I	A	BRTE	*Bromus tectorum*	cheatgrass
Grass	I/N		JUNCU	*Juncus sp.*	rush
Grass	I	P	POBU	*Poa bulbosa*	bulbous bluegrass
Grass	I/N	P	POPR	*Poa pratensis*	Kentucky bluegrass

Table 3. This table contains a list all of plants that were found on site that could be introduced, native, and/or state listed noxious. The plants are organized by plant type, origin, life span, USDA plant code, scientific name, and common name.


Herb Sophia/ flixweed


Common mullein


Cheatgrass

Species Percent Cover				
Scientific name	**Common name**	**2018**	**2019**	**2020**
Alyssum alyssoides	pale madwort	0	0.7	0
Carduus nutans	nodding plumeless thistle	24.3	0	9.7
Ceratocephala testiculata	curveseed butterwort	0	0.9	0.4
Cirsium arvense	Canada thistle	0	0.1	0
Collinsia parviflora	maiden blue eyed Mary	0	2.2	0
Descurainia sophia	Herb Sophia	0	0	0.2
Erodium cicutarium	redstem stork's bill	0.8	0.5	0.1
Galium boreale	northern bedstraw	0.7	0	0
Lappula occidentalis	flatspine stickseed	0	0	0.6
Sisymbrium altissimum	tall tumblemustard	0	0.1	0
Taraxacum officinale	common dandelion	0	0.1	0
Thalictrum fendleri	Fendler's meadow-rue	0.2	0.2	0
Verbascum thapsus	common mullein	0.6	0	0.4
Bromus arvensis	field brome	0	0	0.9
Bromus tectorum	cheatgrass	12.7	13	6.6
Carex petasata	Liddon sedge	0.2	0	0
Leymus cinereus	basin wildrye	0	0	0.5
Pascopyrum smithii	western wheatgrass	1.6	0	11
Poa bulbosa	bulbous bluegrass	0.6	1.8	4.9
Poa pratensis	Kentucky bluegrass	10.7	4.1	7.2
Poa secunda	Sandberg bluegrass	0	0.7	1.8
Pseudoroegneria spicata	bluebunch wheatgrass	1.1	2.1	0.2
Chrysothamnus viscidiflorus	yellow rabbitbrush	0.1	0	0
Quercus gambelii	Gambel oak	0.5	0	0

Table 4. This table contains a the average percent cover of plants from the SamplePoint analysis of ground cover photos.

% Cover by Plant Origin	**2018**	**2019**	**2020**
Total Introduced	25.4	21.1	20.7
Total Native	4.5	5.3	14
Total Noxious	24.3	0.1	9.7

% Cover by Plant Type	**2018**	**2019**	**2020**
Total Forbs	2.5	4.8	1.6
Total Grasses	26.9	21.7	33.1
Total Shrubs	0.6	0	0

% Ground Cover	**2018**	**2019**	**2020**
Bare Ground	8.4	24.3	28.8
Litter	26	27	11
Manure	0.3	0	0
Rock	9.7	18	14.4
Standing Dead	0.4	0	0
Woody Debri	0	1.7	0.7
Total Vegetation	54.3	26.5	44.4

Tables 5, 6, and 7. These tables show the average percent cover from the SamplePoint analysis grouped in different ways. The first is by plant origin, the second is by plant type, and the third is by overall ground cover.

Musk Thistle % Cover	2018	2019	2020
T1	45.6	0.3	32.7
T2	31.8	1.3	0.4
T3	10.3	0	0
average	29.2	0.5	11

Canada Thistle % cover	2018	2019	2020
T1	0	0.1	0
T2	3.3	0	0
T3	0	0	0
average	1.1	0	0

Tables 8 and 9. These tables show the average percent cover from the line intercept measurements by transect and year. The average of the transects for each year is shown I the last row.

Density								
Plants per meter squared	2018	2019	2020		Estimated plants per 0.1 acres	2018	2019	2020
Musk thistle	10.2	1.4	3.5		Musk thistle	4111	558	1239
Canada thistle	10	0	0.2		Canada thistle	385	9	75.3
Scotch thistle	0	0	Trace		Scotch thistle	0	0	4.33
Houndstongue	0	0	Trace		Houndstongue	0	0	4.33

Tables 10 and 11. These tables show the number of plants in a 1 meter squared area and an upscaling estimate

References

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