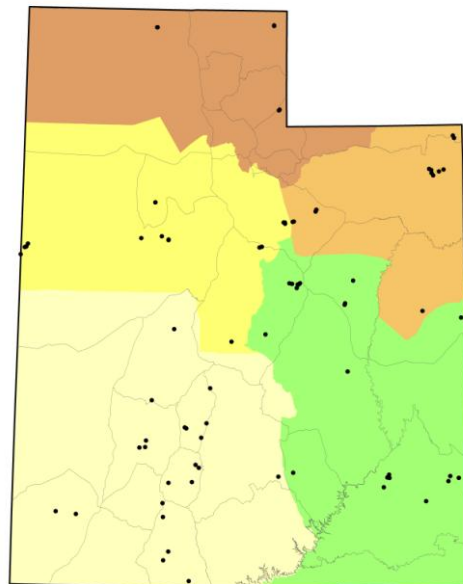


Watershed Restoration Initiative Vegetation Monitoring Report 2012



**PUBLICATION NUMBER 13-07
REPORT FOR FEDERAL AID PROJECT W-82-R-57**

**STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES**

2012 Watershed Restoration Initiative Vegetation Monitoring Report

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Performance Report for Federal Aid Project W-82-R-57

Publication No. 13-07

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Reports for all regions, with accompanying photographs, are available online at <http://wri.utah.gov/WRI/>.

PROGRAM NARRATIVE

State: UTAH

Project Number: W-82-R-57

Grant Title: Wildlife Habitat and Monitoring

Project Title: Wildlife Habitat Monitoring/Watershed Restoration Initiative

Need: Utah's Watershed Restoration Initiative (WRI) is a partnership-driven effort to conserve, restore and manage ecosystems in priority areas across the state. The WRI focuses on enhancing Utah's water quality and yield as well as its biological diversity. To achieve these results, WRI partners fund and perform physical and mechanical habitat manipulation, negotiate administrative changes in land management, and strengthen communication and team-building among the public and stakeholders. As part of the habitat manipulation projects, range trend data is collected on selected treatment areas. Pre-treatment and post-treatment data is collected. The WRI range trend studies are used to evaluate the success and failure of land treatment projects. The health and vigor of big game populations are closely correlated to the quality and quantity of forage in key areas. Range trend data are used by Utah Division of Wildlife Resources (DWR) biologists, public land managers and private land owners for habitat improvement planning purposes.

Objective: Monitor, evaluate, and report results of habitat treatment projects conducted under the WRI throughout the state, and inform DWR biologists, public land managers and private landowners of significant changes in plant community composition in these areas.

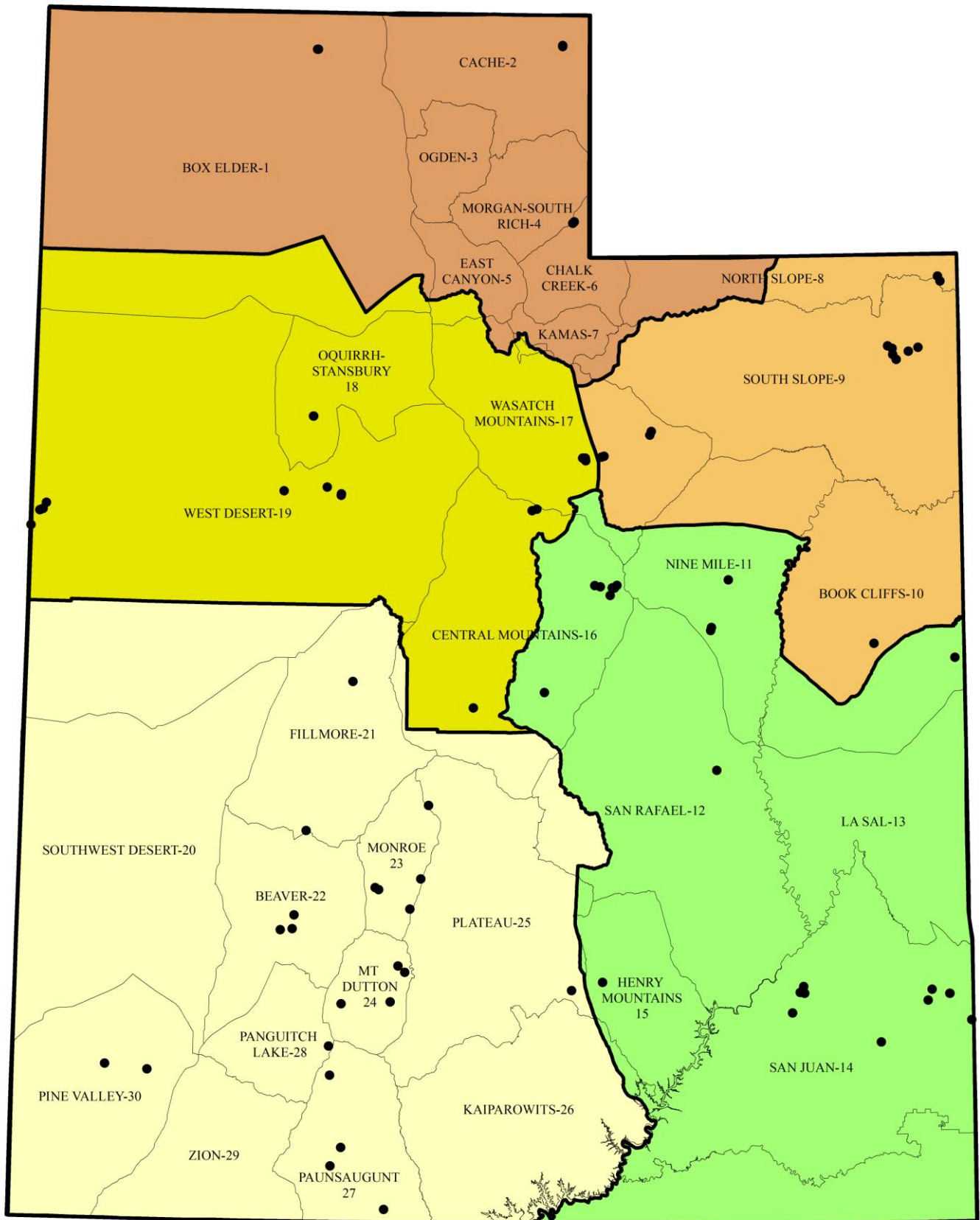
Expected Results and Benefits: WRI range trend studies in each region will be reread, and vegetation condition and trend assessments will be made for project areas. DWR biologists, land management personnel from the United States Forest Service (USFS) and Bureau of Land Management (BLM), and private landowners will use the WRI database to evaluate the impact of land management programs on big game habitat. Annual reports will be readily available on the DWR website, on CDs, and in hard copies located in DWR regional offices, BLM and USFS offices, and public libraries.

REMARKS

The work completed during the 2012 field season and reported in this publication involves the reading of projects initiated as part of the Watershed Restoration Initiative throughout the state of Utah.

The BLM and USFS offices provided information and/or assistance in completion of the trend studies which add to the value of this interagency report. Private landowners were cooperative in allowing access to study sites located on their land.

WRI Studies Surveyed in 2012



RANGE TREND STUDY METHODS

Studies monitoring range trend depend greatly on site selection, especially when dealing with large geographic areas such as wildlife management units. Since it is impossible to intensively monitor all vegetation or habitat types within a unit, it is necessary to concentrate on specific sites and/or “key” areas within distinct plant communities on big game ranges. These “key” areas should be places where big game has demonstrated a definite pattern of use during normal climatic conditions over a long period of time. Trend studies are located within these areas of high use and/or crucial habitat as agreed upon by DWR, BLM, and USFS personnel. Often, range trend studies are established in conjunction with permanently marked pellet group transects. Once a “key” area has been selected, specific placement for sampling is determined. The sampling grid is carefully placed in order to adequately represent the surrounding area. All sampling baselines are permanently marked by half-high steel fence posts. The first, or “0 foot baseline stake”, is marked with a metal tag for proper identification of the transect.

Vegetation Composition

Determining vegetation characteristics for each “key” area is determined by setting up five consecutive 100 foot baseline transects in the area of interest. This 500 foot line is the baseline and one, 100 foot belt is placed perpendicular to each 100 foot section of the baseline at random foot marks and centered on the 50 foot mark. The beginning of each belt is marked by a rebar stake to ensure a more precise alignment of the originally sampled belt. A 1/4 m² quadrat is centered every 5 feet along the same side of the belt, starting at the 5 foot mark. Cover and nested frequency values are determined for vegetation, litter, rock, pavement, cryptogams, and bare ground. Cover and nested frequency values are also estimated for all plant species occurring within a quadrat, including annual species. However, prior to 1992 no data was collected for annual species.

Percent Cover: Cover is determined using an ocular cover estimation procedure using 7 cover classes (Bailey and Poulton 1968, Daubenmire 1959). The seven cover classes are: 1) .01-1%, 2) 1.1-5%, 3) 5.1-25%, 4) 25.1-50%, 5) 50.1-75%, 6) 75.1-95%, and 7) 95.1-100% (Figure 1). For example, to estimate vegetation cover with this method, an observer would visualize which cover class all the vegetation would fit into if the plants were moved together until they were touching. To quantify percent cover for bare ground, litter, rock, pavement, and cryptogams, the observer would visually estimate which cover class could accommodate all of the specified cover type within the quadrat. These numbers are then recorded. To determine percent cover for each belt, the midpoint for each cover class value observed is summed and divided by the number of sampling quadrats (20). The mean for the five belts is the average for a given site.

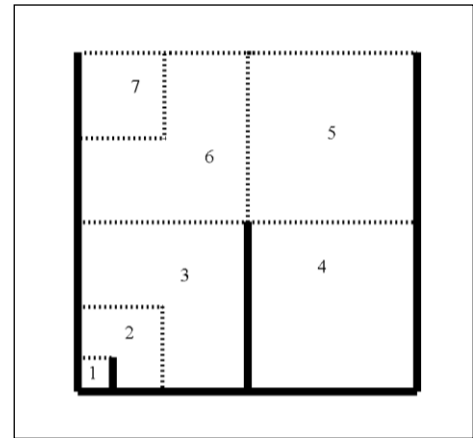


Figure 1. Cover classes of the 1/4 m² sampling quadrat.

Total canopy cover of shrubs or trees is also estimated using the line-intercept method (¹U.S. Department of Interior Bureau of Land Management 1999). The distance along each belt covered by a particular species of tree or shrub is divided by the total length of the line to give percent canopy cover. Prior to 2002, only canopy cover above eye level was estimated. After 2002 all canopy cover both above and below eye level was estimated.

Nested Frequency: Nested frequency values for the quadrat range from 1-5 according to which area or sub-quadrat the plant species or cover type is rooted in. The notation for each sub-quadrat is as follows: 5 = 1% of the area, 4 = 5% of the area, 3 = 25% of the area, 2 = 50% of the area, and 1 = the remainder of the quadrat. Each time a particular plant species or cover type occurs within the quadrat, it is scored relative to which of the smallest nested quadrats it is rooted in (in the case of vegetation) or where it first occurs (for all other cover

types). The highest possible score is 5 for each quadrat occurrence and 100 per belt, for a possible score of 500 for each species or cover type at a given site (Figure 2).

Higher nested frequency scores represent a higher abundance for that plant species or cover type. These summed values are used to help determine changes in trend and composition through time. Nested frequency has been found to be a more sensitive measurement for changes taking place within plant communities than quadrat frequency (Smith et al. 1987, Smith et al. 1986, Mosley et al. 1986). Plant cover and density values are not reliable indicators of trend for herbaceous species and can fluctuate greatly with precipitation and time of season sampled. Therefore, plant cover and density values can be misleading if used independently and do not necessarily indicate changes in composition and/or distribution of key plant species.

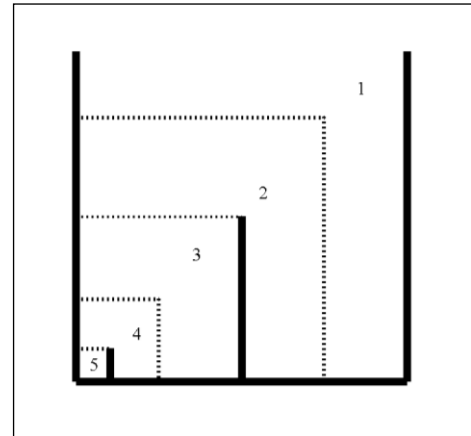


Figure 2. Nested frequency sub-quadrats of the 1/4 m² sampling quadrat.

Nested frequency and average percent cover data for individual grass and forb species are summarized in the “Herbaceous Trends” table of each study discussion. Nested frequency and average cover of vegetation, rock, pavement, litter, cryptogams, and bare ground are summarized in the “Basic Cover” table of each study discussion.

Shrub Density & Characterization: Shrub densities are estimated using five, 1/100th acre strips centered over the length of each 100 foot belt. All shrubs rooted within each strip are counted and categorized using a modified Cole Browse Method (²U.S. Department of Interior Bureau of Land Management 1999):

Seedling: Plants up to three years old which have become firmly established, usually less than 1/8-inch diameter.

Young: Larger with more complex branching. Does not show signs of maturity. Usually between 1/8 and 1/4-inch diameter.

Mature: Complex branching, rounded growth form, larger size, seed is produced on healthy plants. Generally larger than 1/4-inch diameter.

Decadent: Plant, regardless of age, that is in a state of decline, usually evidenced by 25% or more dead branches.

Dead: A plant which is no longer living.

Shrubs are also rated according to their availability and the amount of use they display, and placed in one of nine form classes:

1. All available, lightly hedged.
2. All available, moderately hedged.
3. All available, heavily hedged.
4. Largely available, lightly hedged.
5. Largely available, moderately hedged.
6. Largely available, heavily hedged.
7. Mostly unavailable.
8. Unavailable due to height.
9. Unavailable due to hedging.

Lightly hedged: 0 to 40 percent of twigs browsed.

Moderately hedged: 41 to 60 percent of twigs browsed.

Heavily hedged: Over 60 percent of twigs browsed. Degree of hedging is based on leader use over the past three years: current annual growth is not included.

Largely available: One-third to two-thirds of plant available to animal.

Mostly unavailable: Less than one-third of plant available to animal.

Unavailable: In classifying browse to a form class, unavailability may be the result of height, location, or density.

Shrubs are also rated on their health and placed into one of four vigor classes:

1. Normal and vigorous.
2. Insect infested or diseased.
3. Poor vigor - chlorotic or discolored leaves, smaller than normal stems or leaves, flowering restricted, partially trampled, pulled up, or otherwise damaged. Stunted growth, partial crown death.
4. Dying - substantial portion of crown dead (more than 50%), more extreme than 3 above. Probably an irreversible condition.

In addition, each mature shrub species closest to every 10 foot mark along a sampling belt is measured to determine average height and crown. This allows a maximum sample of 50 plants per species to be measured at a given site depending on their respective densities. Annual leader growth is estimated for key browse species at each study site. This is done by measuring five leaders on the closest mature shrub in each quarter (similar to point-center quarter method) from 3 stakes along the study site baseline (0', 200' and 400' stakes). These numbers are then averaged. Tree density is determined using the point-center quarter method (Mitchell 2007, Dahdouh-Guebas and Koedam 2006, Pollard 1971, Cottam and Curtis 1956) at 100 foot intervals along the baseline measuring to a maximum of 15 meters. If trees are rare due to a treatment or wildfire, the sampling area is extended to 200 foot intervals measuring to a maximum of 30 meters, and 300 feet is added to the end of the transect so that five, 200 foot point-quarter centers can be read. This allows sampling trees on a much larger scale. The strip method that is used to estimate shrub density can, in most cases, effectively inventory seedling and young tree densities. However, the strip method is less effective at estimating densities of mature trees that are often widely disbursed.

Prior to 1992, shrub frequency was determined using the nested frequency method that was previously described. It was found that nested frequency of shrubs did not usually reflect accurate trends in shrub populations which had particularly low or high densities. Therefore, beginning in mid-1992, each 1/100th acre shrub strip is divided into 20, five foot segments. To give a more accurate measure of shrub frequency, presence or absence of shrub species is determined within these strip segments, and this measurement is termed strip frequency. For example, if a species was rooted in 25 of the 100 shrub strips, strip frequency for this species would be 25%. This data along with shrub cover is recorded in the "Browse Trends" table.

Trend Determination

The methods described above rely on relative and absolute measurements of plant composition as determined from the frequency, cover, and density data. In addition, estimates of plant vigor, average height and crown diameter, form class, and age class are utilized to characterize shrub populations.

Browse: Particular attention is given to woody plants and their important role as indicators on crucial big game winter ranges. A variety of parameters are used to help determine trend for key browse species through time. These include:

- 1) changes in density or number of plants/acre
- 2) proportion of cover contributed by key species
- 3) recruitment or proportion of young plants in population
- 4) proportion of decadent plants
- 5) proportion of plants in poor vigor
- 6) changes in height and crown diameter measurements for mature age class
- 7) changes in browse species composition
- 8) strip frequency values

Herbaceous Understory: Trends in herbaceous plants as a group or as a single “key” species are determined by comparing the sum of nested frequency values between readings. Attention is also given to changes in species composition of grasses and forbs through time. A non-parametric statistical test, the Friedman test (analogous to analysis of variance) (Conover 1980), is conducted on nested frequencies of each species to determine significant changes at $\alpha = 0.10$.

Soil: Ground cover parameters are analyzed and compared in the discussions of the reread studies, but no actual trend is determined. Beginning in 2002, an erosion condition class assessment adapted from the Bureau of Land Management was also completed on each study site to provide additional qualitative information on soil condition (Clark 1980).

Data Interpretation

The following tables and partial tables are taken from study number 13A-1 to help illustrate how to read the data and some basic comparisons that can be made with the data.

Herbaceous Understory: The “Herbaceous Trends” table summarizes the average cover and nested frequency data for individual grass and forb species. The table contains all the grass and forb species that have been sampled on study 13A-1. Readings prior to mid-1992 include only nested frequency data for **perennial** species. Beginning in mid-1992, all trend studies have data for **perennial** and **annual** species, as well as cover estimates for individual species. In the following example, trend is determined using the change in the sum of nested frequency and cover of perennial grasses, and the change in composition of grasses determined by each species nested frequency and cover.

As shown in the “Herbaceous Trends” table, the undesirable species bulbous bluegrass (*Poa bulbosa*) was the most common species in nested frequency on the site in all sample years. The subscript letters indicate that the nested frequency value for *P. bulbosa* declined significantly between 1999 and 2004. Cover of *P. bulbosa* was estimated at a high of 8.01% in 1999 to a low of 2.43% in 2004. Trend for this grass species is down over the life of the study due to a significant decline in sum of nested frequency and a decrease in cover, though the decrease in this species is desirable for the grass trend of the site. The more desirable species crested wheatgrass (*A. cristatum*) has also decreased in nested frequency over the life of the study, but the decrease was only significant between the 1987 and 2009 sample years. Grasses had a combined total cover value of 11.52% in 1994, 13.89% in 1999, 11.35% in 2004 and 7.32% in 2009. These changes would indicate a slightly downward perennial grass trend over the life of the study. The forb trend can be determined in a similar manner.

HERBACEOUS TRENDS--
Management unit 13A, Study no: 1

Type	Species	Nested Frequency					Average Cover %			
		'87	'94	'99	'04	'09	'94	'99	'04	'09
G	<i>Agropyron cristatum</i>	b135	ab106	ab100	ab112	a81	2.46	2.50	4.81	2.00
G	<i>Agropyron intermedium</i>	-	-	3	2	3	-	.03	.00	.03
G	<i>Bouteloua gracilis</i>	15	19	17	13	17	1.07	.14	.53	.30
G	<i>Bromus inermis</i>	75	67	63	68	92	.63	2.40	1.00	1.35
G	<i>Bromus tectorum</i> (a)	-	-	3	-	-	-	.00	-	-
G	<i>Hilaria jamesii</i>	-	-	-	2	-	-	-	.03	-
G	<i>Koeleria cristata</i>	b61	a3	a19	a3	a-	.03	.18	.01	-
G	<i>Oryzopsis hymenoides</i>	-	3	3	3	8	.00	.00	.03	.07
G	<i>Poa bulbosa</i>	b220	b256	b250	a129	a136	7.14	8.01	2.43	2.86
G	<i>Poa fendleriana</i>	a-	b16	d53	cd55	bc24	.06	.38	1.24	.33
G	<i>Sitanion hystrix</i>	6	1	-	-	-	.00	-	-	-
G	<i>Stipa comata</i>	b48	a14	bc24	bc30	a21	.11	.23	1.24	.36
Total for Annual Grasses		0	0	3	0	0	0	0.00	0	0
Total for Perennial Grasses		560	485	532	417	382	11.52	13.89	11.35	7.32
Total for Grasses		560	485	535	417	382	11.52	13.90	11.35	7.32
F	<i>Astragalus convallarius</i>	b40	bc17	ab25	b37	a9	.10	.42	.99	.10
F	<i>Calochortus nuttallii</i>	8	-	-	1	-	-	-	.00	-
F	<i>Castilleja chromosa</i>	b38	a4	a-	a-	a-	.01	-	-	-
F	<i>Castilleja linariaefolia</i>	-	2	1	-	-	.01	.03	-	-
F	<i>Comandra pallida</i>	-	-	-	3	-	-	-	.01	-
F	<i>Cordylanthus sp. (a)</i>	-	-	-	5	5	-	-	.16	.01
F	<i>Crepis acuminata</i>	b14	a6	a-	a-	a-	.03	-	-	-
F	<i>Erigeron flagellaris</i>	-	-	3	-	1	-	.15	-	.00
F	<i>Erigeron pumilus</i>	b111	a21	a43	a20	a12	.07	.51	.53	.08
F	<i>Eriogonum racemosum</i>	b63	a30	a34	a25	a28	.14	.30	.35	.21
F	<i>Hymenoxys acaulis</i>	3	-	3	1	-	-	.00	.03	-
F	<i>Lomatium triternatum</i>	b31	a-	a-	a-	a-	-	-	-	-
F	<i>Lupinus argenteus</i>	d162	c57	b20	a-	a-	3.64	.14	-	-
F	<i>Machaeranthera canescens</i>	1	-	2	-	-	-	.01	-	-
F	<i>Penstemon caespitosus</i>	85	2	6	6	5	.01	.03	.07	.02
F	<i>Petroradia pumila</i>	-	-	5	-	-	-	.06	-	-
F	<i>Phlox longifolia</i>	c67	bc53	ab31	a7	a17	.14	.06	.05	.10
F	<i>Polygonum douglasii</i> (a)	-	-	-	-	6	-	-	-	.01
F	<i>Senecio multilobatus</i>	-	1	1	-	-	.00	.00	-	-
F	<i>Sphaeralcea coccinea</i>	58	55	52	49	48	1.24	.38	.60	.59
F	<i>Tragopogon dubius</i>	6	-	-	-	-	-	-	-	-
F	<i>Trifolium gymnocarpon</i>	-	3	3	2	-	.00	.00	.00	-
F	<i>Zigadenus paniculatus</i>	-	-	3	-	1	-	.00	.00	.03
Total for Annual Forbs		0	0	0	5	11	0	0	0.15	0.01
Total for Perennial Forbs		693	251	232	151	121	5.43	2.15	2.66	1.15
Total for Forbs		693	251	232	156	132	5.43	2.15	2.82	1.17

Values with different subscript letters are significantly different at alpha = 0.10

Browse: The following “Browse Trends” table summarizes strip frequency and cover for all shrub species occurring on this site. All of the shrubs encountered at study number 13A-1 are listed. For example, mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) had a strip frequency of 86 out of a possible 100 in 1994, 82 in 1999 and 85 in 2004 and 2009. Average cover is determined using cover classes in conjunction with the 1/4m² quadrat and estimating the percent of the quadrat covered. In this case, mountain big sagebrush cover was estimated to be 16.28% in 1994, 9.40% in 1999, 10.65% in 2004 and 9.94% in 2009.

BROWSE TRENDS--

Management unit 13A, Study no: 1

Type	Species	Strip Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
B	<i>Amelanchier utahensis</i>	18	18	16	20	2.25	3.74	6.50	5.30
B	<i>Artemisia tridentata vaseyana</i>	86	82	85	85	16.28	9.40	10.65	9.94
B	<i>Chrysothamnus depressus</i>	12	26	23	23	.66	.72	1.46	.87
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	86	81	72	72	3.62	4.96	5.00	6.14
B	<i>Coryphantha vivipara arizonica</i>	0	2	5	5	-	.00	.00	.00
B	<i>Eriogonum microthecum</i>	10	16	10	9	.01	.53	.12	.12
B	<i>Gutierrezia sarothrae</i>	0	4	8	4	.01	.04	.15	.03
B	<i>Juniperus osteosperma</i>	0	0	0	0	-	-	-	.15
B	<i>Opuntia</i> sp.	36	35	41	45	.32	.56	1.12	1.33
B	<i>Pinus edulis</i>	0	16	14	10	2.92	3.53	7.21	8.53
B	<i>Purshia tridentata</i>	0	1	1	1	-	.00	.00	.00
B	<i>Quercus gambelii</i>	0	3	3	2	.76	.63	1.48	.76
B	<i>Symphoricarpos oreophilus</i>	3	2	4	2	.00	.00	.00	.00
Total for Browse		251	286	282	278	26.86	24.13	33.72	33.20

To more accurately estimate canopy cover of trees and shrubs, the line-intercept method is used along each 100 foot belt. This data is reported in the “Canopy Cover, Line Intercept” table. For example, mountain big sagebrush had a cover of 13.21% in 2004 and 13.93% in 2009. Compare this to the cover determined using the 1/4m² quadrat cover class method. Prior to 2002, only trees species were sampled in the line-intercept transect above eye level. Beginning in 2002, all woody species were included in the line-intercept transect and a total canopy cover (above and below eye level) value for each was determined.

CANOPY COVER, LINE INTERCEPT--

Management unit 13A, Study no: 1

Species	Percent Cover		
	'99	'04	'09
<i>Amelanchier utahensis</i>	.80	7.25	9.48
<i>Artemisia tridentata vaseyana</i>	-	13.21	13.93
<i>Chrysothamnus depressus</i>	-	1.04	.58
<i>Chrysothamnus viscidiflorus viscidiflorus</i>	-	4.73	7.25
<i>Eriogonum microthecum</i>	-	.11	.06
<i>Opuntia</i> sp.	-	.65	.71
<i>Pinus edulis</i>	3.59	11.86	13.43
<i>Quercus gambelii</i>	-	1.23	1.43
<i>Symphoricarpos oreophilus</i>	-	-	.08

Beginning in 2002, annual leader growth of the key browse species was measured to get an idea of shrub production and vigor. This data is displayed in the “Key Browse Annual Leader Growth” table. For example, annual leaders on serviceberry (*Amelanchier utahensis*) averaged 1.8 inches and 1.7 inches in length in 2004 and 2009, respectively, while mountain big sagebrush leaders averaged 1.3 inches in both sample years.

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 13A, Study no: 1

Species	Average leader growth (in)	
	'04	'09
<i>Amelanchier utahensis</i>	1.8	1.7
<i>Artemisia tridentata vaseyana</i>	1.3	1.3

The following “Point-Quarter Tree Data” table displays tree density estimates using the point-center quarter method which better estimates density of widely disbursed trees than the shrub density strips. Average basal diameter is also listed in inches. Point-quarter tree data for pinyon estimated 201 trees/acre in 1999, 175 tree/acre in 2004 and 213 trees/acre in 2009, with average basal diameters of 2.1 inches, 2.8 inches and 3.2 inches, respectively.

POINT-QUARTER TREE DATA--

Management unit 13A, Study no: 1

Species	Trees per Acre			Average diameter (in)		
	'99	'04	'09	'99	'04	'09
<i>Pinus edulis</i>	201	175	213	2.1	2.8	3.2

The “Browse Characteristics” table summarizes characteristics of the shrub community. Only mountain big sagebrush is included in this example. The sagebrush population is characterized by age class, vigor, utilization, and average height and crown for mature plants. Total density in plants/acre for mountain big sagebrush, excluding seedlings, was 3,198 plants/acre in 1987, 4,800 plants/acre in 1994, 4,080 plants/acre in 1999, 3,800 plants/acre in 2004 and 3,820 plants/acre in 2009. Seedlings are excluded from the population estimate because with summer drought, many will die by late fall causing great fluctuations in population estimates between sampling dates. Since mid-1992, a larger shrub sample area (more than three times larger) was used to better characterize the shrub populations. Therefore, changes in density (before and after 1992) may not necessarily indicate changes in trend, especially shrub populations that characteristically are clumped and/or have discontinuous distributions. The earlier smaller sample could easily either overestimate or underestimate shrub populations. Other characteristics like percent decadence, percent of the population displaying poor vigor, percent heavy hedging, young recruitment, etc., are given more weight in determining shrub trend when comparing survey years where sample sizes are different.

BROWSE CHARACTERISTICS--

Management unit 13A, Study no: 1

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>									
87	3198	8	79	12	-	42	8	2	13/17
94	4800	4	54	42	940	13	2	10	18/32
99	4080	13	63	24	360	41	3	3	21/31
04	3800	5	73	22	-	33	10	9	15/24
09	3820	6	68	26	60	34	17	22	17/25

The data for mountain big sagebrush from study 13A-1 shows the proportion of decadent shrubs in the population was highest in 1994 at 42%, but has been more moderate at an average of 24% since 1999. More seedlings were also encountered in 1994, but recruitment of young plants has been low (< 10%) in all sample years except for 1999. The percentage of plants displaying poor vigor was low in most sample years, but increased to 22% in 2009. Considering all these factors, trend for sagebrush over the life of the study is stable.

Soil: The “Basic Cover” table summarizes average cover of vegetation, rock, pavement, litter, cryptogams, and bare ground. Average cover prior to mid-1992 adds up to only 100%, while cover with the current method (post mid-1992) estimates several layers of plant and ground cover and will usually exceed 100%. For vegetation cover, the previous method only determined basal vegetation cover (15.25% in 1987), while the new method estimates the vertical projection of the crown, or aerial cover (33.38% in 1994, 39.61% in 1999, 42.08% in 2004 and 42.20% in 2009). Therefore, comparisons can be made for all cover measurements except for general vegetation cover.

BASIC COVER--

Management unit 13A, Study no: 1

Cover Type	Average Cover %				
	'87	'94	'99	'04	'09
Vegetation	15.25	33.38	39.61	42.08	42.20
Rock	0	.02	.00	.00	.00
Pavement	0	.03	.04	.05	.03
Litter	61.00	46.05	40.37	45.25	50.69
Cryptogams	3.50	1.50	8.07	2.74	2.00
Bare Ground	20.25	32.20	29.56	34.09	22.93

A summary of the soil data is found in the “Soil Analysis Data” table. Effective rooting depth is an average of 25 soil penetrometer readings, 5 of the deepest probes possible near each of the 5 baseline starting stakes. The effective rooting depth is a relative index that can be used for site comparisons with regard to individual species differences, site preferences, and abundance. Chemical and textural characteristics are also listed and were determined by laboratory analysis of a composite soil sample taken near each of the 5 baseline starting stakes (Allison and Moode 1965, Day 1965, Kenney and Nelson 1982, Normandin et. al. 1998, Olsen et. al. 1954, Rhodes 1982, Schoenau and Karamonos 1993, Sims and Jackson 1934, Walkley and Black 1971).

SOIL ANALYSIS DATA --

Management unit 13A, Study no: 1, Study Name: Two Mile Chaining

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11	6.5	48.2	30.6	21.3	2	8	105.6	0.4

The descriptive terms used for ranges in pH are as follows:

- Ultra acidic < 3.5
- Extremely Acidic 3.5-4.4
- Very Strong Acidic 4.5-5.0
- Strongly Acidic 5.1-5.5
- Moderately Acidic 5.6-6.0
- Slightly Acidic 6.1-6.5
- Neutral 6.6-7.3
- Slightly Alkaline 7.4-7.8
- Moderately Alkaline 7.9-8.4
- Strongly Alkaline 8.5-9.0
- Very Strongly Alkaline > 9.1

Percent organic matter (% OM) refers to the amount of organic matter in the top 12 inches of the soil profile. Parts per million (ppm) of phosphorus (P) and potassium (K) are also included. Values for phosphorus and potassium less than 6 ppm and 60 ppm, respectively, are considered to have low availability for plant growth and development (Tiedemann and Lopez 2004).

The electrical conductivity of the soil is reported in decisiemens per meter (dS/m). Electrical conductivity is related to the amount of salts more soluble than gypsum in the soil. The following classes can be used as a reference.

Non saline	0-2
Very slightly saline	2-4
Slightly saline	4-8
Moderately saline	8-16
Strongly saline	>16

Utilization: The “Pellet Group Data” table summarizes the frequency of animal pellets sampled within the 100 quadrats placed along the sampling belts as well as data from a pellet group transect read parallel to the study site baseline. Quadrat frequency of wildlife and livestock droppings is included in reports done prior to mid-1992. For example in 1994, rabbit pellets were found in 44% of the quadrats placed on study 13A-1, decreasing to just 6% in 1999 and 2004, then increasing again to 34% in 2009. Quadrat frequency of rabbit or big game pellets indicates a relative amount of use by that particular animal. This data can help characterize changes in wildlife use patterns on the site.

It was determined that additional information on pellet groups was necessary. Therefore, a pellet group transect is now sampled in conjunction with the vegetation transects. The pellet group transect utilizes 50, 100ft² circular plots which are placed through the study area. These are usually two parallel transects of 25 plots on each side of the vegetation transect which runs 400 feet to 500 feet in length. The number of recent pellet groups for wildlife (usually deer and elk) and pats for cattle are recorded. That number is then converted to days use per acre (hectare) (Neff 1968). Rabbit pellet groups are not included in this sample. In the example, elk days use/acre was estimated at 70 in 1999 and decreased steadily to 4 elk days use/acre in 2009.

PELLET GROUP DATA--

Management unit 13A, Study no: 1

Type	Quadrat Frequency				Days use per acre (ha)		
	'94	'99	'04	'09	'99	'04	'09
Rabbit	44	6	6	34	-	-	-
Elk	28	26	11	3	70 (173)	27 (68)	4 (10)
Deer	14	28	15	9	32 (79)	16 (40)	25 (63)
Cattle	-	2	-	1	6 (14)	4 (11)	4 (9)

Other Information: Management background information, photographs, and knowledgeable plant identification add to the database for each site. Management and background information for each site is obtained from the administering agency. Permanently located photographs are taken including a general view down and back up the baseline. A close-up of each half-high baseline post further characterizes individual sites. Correct plant identification is critical for a complete and accurate site analysis. Species identification mostly follows "A Utah Flora" (Welsh et al. 2003). In some cases, most notably *Agropyron spp.* and *Purshia spp.*, the species names used by the Range Trend Study Plant Species List (Giunta 1983), Intermountain Flora (Cronquist et al. 1977) and the Intermountain Range Plant Names and Symbols (Plummer et al. 1977) are retained to maintain continuity and alleviate confusion with earlier published reports.

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REPORT FORMAT

The name and directions for locating the site are given on the location page. Also included on this page are the vegetation type, range type, NRCS ecological site description, land ownership, elevation, aspect, slope, arrangement and diagrammatic sketch of the baseline, and the location on a topographical map. The 7.5 minute topographical map name and public land survey description are located below the map. In addition, UTM coordinates follow the public land survey location. Compass bearings are in degrees relative to magnetic north, unless specified as true north (T).

A discussion of the study site includes descriptions of the site's historic characteristics, soil, ground cover, vegetation community, and species composition. A comparison of the pre-treatment data to post-treatment data occurs prior to the trend assessment section. The trend assessment is based upon the comparison of the recent year and the previous year's data. Additional assessment is made by comparing photographs from year to year.

Tables with the compiled data follow the study discussions. A computer-generated data summary presents the pooled data for nested frequency, quadrat frequency, basic ground cover, soil characterization, shrub density, and shrub characterization. A nonparametric statistical analysis, the Friedman test, is performed on the nested frequency values between years. This analysis indicates significance levels between species over time at $\alpha = 0.10$. Significant changes are indicated in the herbaceous trends table with subscript letters.

SUMMARY OF STUDY TREATMENT TYPES

Northern Region

	<u>Treatment Type</u>	<u>WRI ID#</u>
1R-02 Rattlesnake Fire Seeded	*Fire Rehab Seeding	PDB
1R-03 Rattlesnake Fire Unseeded	Fire Rehab Reference	PDB
2R-09 Rabbit Creek Burn	Fire Rehab Reference	PDB
2R-10 Rabbit Creek Burn Seeded	*Fire Rehab Seeding	PDB
6R-01 Cache Cave 1	**Aerator	PDB
6R-02 Cache Cave 2	**Aerator	PDB

Northeastern Region

8R-01 Brown's Park Double Drum	**Aerator/Herbicide (Tordon)	Project #26
8R-04 Bake Oven	***Herbicide	Project #2268
9R-04 Diamond Mountain Bullhog	*Bullhog	PDB
9R-05 Little Donkey	***Herbicide (generic Round-up)	PDB
9R-06 North Little Donkey	***Seeding	PDB
9R-07 Red Fleet Lop and Scatter	Lop and Scatter	PDB
9R-15 Brush Creek Dixie	**One-Way Harrow /Plateau, ***Seeding	Project #1659
9R-25 Davis Draw Sagebrush	Two-Way Chain Harrow	Project #2266
10-06 Little Jim Canyon	Bullhog	Project #2219
17R-11 Santaquin Greasewood	*One-Way Smooth Chaining	PDB
17R-12 Santaquin Chaining	*/Two-Way Ely Chaining	PDB

Southeastern Region

10R-54 Bitter Creek Herbicide	***Prescribe Fire/Plateau	Project #2161
11R-12 Burnt Cabin Spring	Prescribe Fire	Project #1198
11R-13 Horse Canyon	*Lop and Scatter	Project #2238
11R-14 Horse Canyon 2	*Bullhog	Project #2238
12R-01 San Rafael Tamarisk Removal	*Tamarisk Removal	Project #867
14-23 South Plain	***/**Prescribe Fire/Plateau	Project #2177
14R-07 Adams CE Harrow	**Two-Way Harrow	PDB
14R-08 Adams CE Control	Control	PDB
14R-15 SITLA Dixie 2	**One-Way Harrow	Project #334
14R-17 South Stateline	**One-Way Harrow	Project #334
14R-27 Seep Creek	***Disking/Herbicide	Project #2325
14R-28 Johnson Creek 2	Bullhog	Project #2265
14R-29 South Plain 2	***/**Prescribe Fire/Plateau	Project #2177
14R-30 North Plain	***/**Prescribe Fire/Plateau	Project #2177
14R-31 Dark Canyon	*Bullhog	Project #2177
15R-02 Tarantula Mesa Lop and Scatter	Lop and Scatter	Project #1336
16B-23 Consumer Bench	**/*Aerator	Project #228
16R-11 Lower Cedar Bench	**Dozer Push	PDB
16R-12 Upper Cedar Bench	**Dozer Push	PDB
16R-13 Upper Porphyry Bench	*/***Aerator	Project #229
16R-14 Consumer Bench North	*/**Aerator	Project #228
16R-15 Consumer Bench 2	*/**Aerator	Project #228
16R-25 Black Dragon Bullhog	Bullhog	Project #1133

Central Region

16R-46 Dairy Fork 1	*Bullhog	Project #2214
16R-47 Dairy Fork 2	*/Two-Way Ely Chaining	Project #2214
16R-48 North Hollow	*/Two-Way Ely Chaining	Project #2276
17R-17 Strawberry Sage-Grouse 1	NA	NA

Central Region

17R-18 Wildcat Sage-Grouse
 17R-19 Road Hollow
 17R-20 Road Hollow Ridge
 17R-34 Wildcat
 18R-02 Clover Bullhog Drill
 18R-03 Clover Bullhog Aerial
 19R-01 West Lee's Creek
 19R-02 Deep Creek Aerator
 19R-03 Deep Creek Drill
 19R-05 Goshute Chaining
 19R-06 Sage Valley Dixie
 19R-14 Ibapah Harrow
 19R-16 Benmore Harrow
 19R-20 East Pasture Harrow
 19R-22 East Vernon Bullhog

Treatment Type

NA
 NA
 NA
 Two-Way Chain Harrow
 ***/*Bullhog
 *Bullhog
 *Bullhog
 ***Aerator
 ***Seeding
 */[†]Two-Way Ely Chaining
 **Two-Way Harrow
 **Two-Way Harrow
 **Two-Way Harrow
 **Two-Way Harrow
 Bullhog

WRI ID#

NA
 NA
 NA
[Project #2309](#)
[Project #30](#)
[Project #30](#)
 PDB
[Project #24](#)
[Project #24](#)
[Project #354](#)
[Project #291](#)
[Project #1104](#)
[Project #1361](#)
[Project #662](#)
[Project #2292](#)

Southern Region

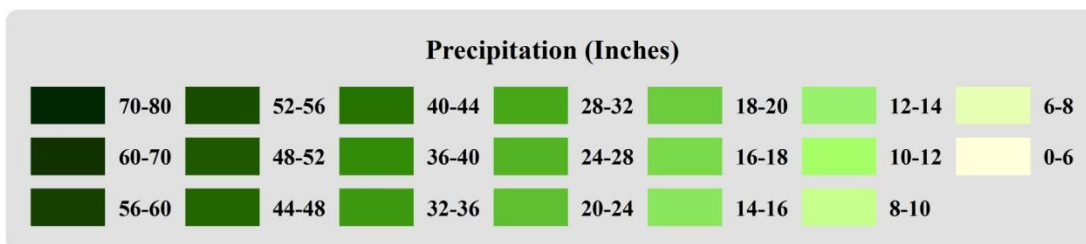
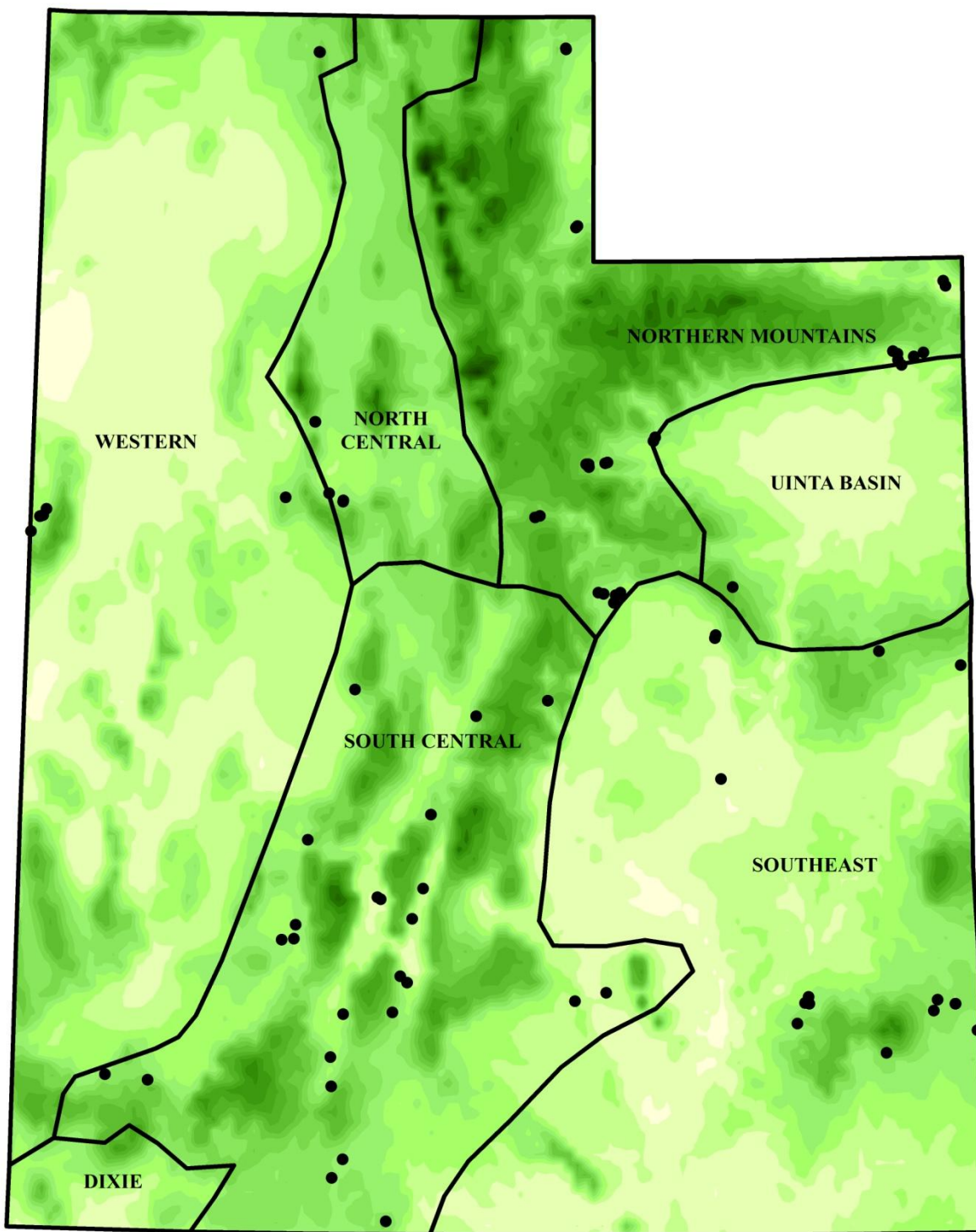
21R-12 Water Canyon
 21R-15 Duggins Creek
 22R-05 Black Mountain
 22R-06 Greenville Bullhog
 22R-23 South Beaver Year 7
 23R-05 Elbow Ranch 1
 23R-06 Elbow Ranch 2
 23R-07 South Narrows
 23R-08 Browns Canyon Drill
 24R-06 Panguitch East Bench Harrow
 24R-09 Johns Valley 2
 24R-10 Antimony Lop and Scatter
 24R-11 Antimony PJ Reduction
 25R-05 Lamp Stand
 25R-09 Sand Ledges
 27R-16 Alton/Mill Creek LS
 27R-20 Hatch Bench
 27R-21 Buckskin Lop and Scatter
 27R-22 Pine Point Handthin
 28R-09 South Canyon 2
 30R-01 Newcastle Bullhog
 30R-05 Duncan Creek/HWY 56

Brushsaw/Bullhog
 Lop and Scatter
 *Seeding, L&S, **/*Two-Way Harrow
 ***/*Bullhog
 *Bullhog
 /*One-Way Harrow, ***Seeding
 NA
 **Two-Way Harrow, **Two-Way Harrow
 ***Disking, ***Seeding
 */**One-Way Harrow
 Bullhog
 *Lop and Scatter/One-Way Chaining
 *Bullhog
 ***Seeding
 Lop and Scatter
 ***Dozer Push
 */[†]Two-Way Ely Chaining
 Lop and Scatter
 *Lop and Scatter
 *Bullhog
 Bullhog
 *Bullhog

[Project #1493](#)
[Project #2197](#)
[Project #1294](#)
 PDB
[Project #2227](#)
[Project #800](#)
 NA
 PDB
 PDB
 PDB
[Project #2400](#)
[Project #2597](#)
[Project #2239](#)
 PDB
[Project #2334](#)
 NA
[Project #2069](#)
[Project #2383](#)
[Project #2359](#)
[Project #2311](#)
 PDB
[Project #2303](#)

*Aerial Seeding
 **Broadcast Seeding
 ***Drill Seeding
[†]Dribbler

NOAA Precipitation Divisions



PRECIPITATION SUMMARY

Vegetation trends and treatment success are dependent upon annual and seasonal precipitation patterns. Precipitation and Palmer Drought Severity Index (PDSI) data for the study sites were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of Western Utah (Division 1), North Central (Division 3), South Central (Division 4), Northern Mountains (Division 5), Uintah Basin (Division 6), and South East (Division 7).

Western Division

There are eight study sites located in the Western Division, which include Rattlesnake Fire Seeded (1R-2), Rattlesnake Fire Unseeded (1R-3), West Lee's Creek (19R-1), Deep Creek Aerator (19R-2), Deep Creek Drill (19R-3), Goshute Chaining (19R-5), Iapah Harrow (19R-14), and East Pasture Harrow (19R-20). The Western Division had a historic annual mean precipitation of 8.66 inches from 1895 to 2012. The mean annual PDSI of Western Utah displayed predominance to drought in the division from 1982 to 2012. Wetter than normal years in Western Utah included 1983-1984, and 2005; and drought years included 1989-1992, 1996, 1999-2004, 2007-2009, and 2012 (Figure 1 and Figure 2) (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 12-14 in. on the Deep Creek Aerator, Deep Creek Drill, Goshute Chaining, Iapah Harrow, and East Pasture Harrow studies; 14-16 in. on the West Lee's Creek study; 16-18 in. on the Rattlesnake Fire Seeded and Rattlesnake Fire Unseeded studies (PRISM Climate Group 2011).

North Central Division

There are five study sites located in the North Central Division, which include Clover Creek Bullhog Drill (18R-2), Clover Creek Bullhog Aerial (18R-3), Sage Valley Dixie (19R-6), Benmore Harrow (19R-16), and East Vernon Bullhog (19R-22). The North Central Division had a historic annual mean precipitation of 16.51 inches from 1895 to 2012. The mean annual PDSI of North Central displayed cycles of wetter than normal years proceeded by dryer than normal years from 1982 to 2012. Wetter than normal years in North Central included 1982-1986, 1993, 1995, 1997-1998, 2005, and 2011; and drought years included 1987-1990, 2000-2003, 2007-2008, and 2012 (Figure 3 and Figure 4) (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 12-14 in. on the Benmore Harrow study; 14-16 in. on the Clover Creek Bullhog Drill, Clover Creek Bullhog Aerial, Sage Valley Dixie, and East Vernon Bullhog studies (PRISM Climate Group 2011).

South Central Division

There are 25 study sites located in the South Central Division, which include Tarantula Mesa Lop and Scatter (15R-2), Black Dragon Bullhog (16R-25), North Hollow (16R-48), Water Canyon (21R-12), Duggins Creek (21R-15), Black Mountain (22R-5), Greenville Bullhog (22R-06), South Beaver Year 7 (22R-23), Elbow Ranch 1 (23R-5), Elbow Ranch 2 (23R-6), South Narrows (23R-7), Browns Canyon Drill (23R-8), Panguitch East Bench Harrow (24R-6), Johns Valley 2 (24R-9), Antimony Lop and Scatter (24R-10), Antimony PJ Reduction (24R-11), Lamp Stand (25R-5), Sand Ledges (25R-9), Alton/Mill Creek LS (27R-16), Hatch Bench (27R-20), Buckskin Lop and Scatter (27R-21), Pine Point Handthin (27R-21), South Canyon 2 (28R-9), Newcastle Bullhog (30R-1), and Duncan Creek/HWY 56 (30R-5). The South Central Division had a historic annual mean precipitation of 12.52 inches from 1895 to 2012. The mean annual PDSI of South Central displayed cycles of wetter than normal years proceeded by dryer than normal years from 1982 to 2012. Wetter than normal years in South Central included 1983-1985, 1993, 1995, 1997-1999, 2005, and 2011; and drought years included 1989-1991, 2002, and 2012 (Figure 5 and Figure 6) (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 8-10 in. on the Tarantula Mesa Lop and Scatter, Elbow Ranch 1, Elbow Ranch 2, South Narrows, and Browns Canyon Drill studies; 10-12 in. on the Black Mountain, South Beaver Year 7, Panguitch East Bench Harrow, Antimony Lop and Scatter, and Lamp Stand, studies; 12-14 in. on the Greenville Bullhog Antimony PJ Reduction, Alton/Mill Creek LS, and South Canyon 2 studies; 14-16

in. on the North Hollow, Water Canyon, Duggins Creek, Johns Valley 2, Sand Ledges, Buckskin Lop and Scatter, Pine Point Handthin, and Newcastle Bullhog studies; 16-18 in. on the Duncan Creek/HWY 56 study; and 18-20 in. on the Black Dragon Bullhog study (PRISM Climate Group 2011).

Northern Mountains Division

There are 24 study sites located in the Northern Mountains Division, which include Rabbit Creek Burn (1R-9), Rabbit Creek Burn Seeded (2R-10), Cache Cave 1 (6R-1), Cache Cave 2 (6R-2), Brown's Park Double Drum (8R-1), Bake Oven (8R-4), Diamond Mountain Bullhog (9R-4), Little Donkey (9R-5), North Little Donkey (9R-6), Red Fleet Lop and Scatter (9R-7), Davis Draw Sagebrush (9R-25), Consumer Bench (16B-23), Lower Cedar Bench (16R-11), Upper Cedar Bench (16R-12), Upper Porphyry Bench (16R-13), Consumer Bench North (16R-14), Consumer Bench 2 (16R-15), Dairy Fork 1 (16R-46), Dairy Fork 2 (16R-47), Santaquin Chaining (17R-12), Strawberry Sage-Grouse 1 (17R-17), Wildcat Sage-Grouse (17R-18), Road Hollow (17R-19), Road Hollow Ridge (17R-19), Wildcat (17R-34). The Northern Mountains Division had a historic annual mean precipitation of 19.13 inches from 1895 to 2012. The mean annual PDSI of the Northern Mountains displays a cycle of several wet years followed by several drought years from 1982 to 2012. Wetter than normal years in the Northern Mountains included 1982-1986, 1993, 1995-1999, 2005, and 2011. Drought years included 1987-1992, 2000-2003 and 2007 (Figure 7 and Figure 8) (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 8-10 in. on the Brown's Park Double Drum, Bake Oven, and Little Donkey studies; 10-12 in. on the Cache Cave 1, Cache Cave 2, North Little Donkey, Red Fleet Lop and Scatter, Consumer Bench, Consumer Bench North, and Consumer Bench 2 studies; 12-14 in. on the Diamond Mountain Bullhog, Santaquin Chaining, Lower Cedar Bench, Upper Cedar Bench, and Upper Porphyry Bench studies; 14-16 in. Rabbit Creek Burn, Rabbit Creek Burn Seeded, and Davis Draw Sagebrush studies; 16-18 in. on the Dairy Fork 2, Strawberry Sage-Grouse 1, Wildcat Sage-Grouse, Road Hollow, Road Hollow Ridge, and Wildcat studies; 18-20 in. on the Dairy Fork 1 study (PRISM Climate Group 2011).

Uintah Basin Division

There are three study sites located in the Uintah Basin Division, which include Brush Creek Dixie (9R-15), Burnt Cabin Spring (11R-12), and Santaquin Greasewood (17R-11). The Uintah Basin Division had a historic annual mean precipitation of 7.98 inches from 1895 to 2012. The mean annual PDSI of Uintah Basin displayed a cycle of several wet years followed by several drought years from 1982 to 2012. Wetter than normal years in Uintah Basin included 1982-1984, 1993, 1997, 2005, and 2011; and drought years included 1989-1991 and 2000-2003 (Figure 9 and Figure 10) (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 8-10 in. on the Brush Creek Dixie study; 12-14 in. on the Santaquin Greasewood study; 18-20 in. on the Burnt Cabin Spring study (PRISM Climate Group 2011).

South East Division

There are 14 study sites located in the South East Division, which include Bitter Creek Herbicide (10R-54), Horse Canyon (11R-13), Horse Canyon 2 (11R-14), San Rafael Tamarisk Removal (12R-01), South Plain (14-23), Adams CE Harrow (14R-07), Adams CE Control (14R-8), SITLA Dixie 2 (14R-15), South Stateline (14R-17), Seep Creek (14R-27), Johnson Creek 2 (14R-28), South Plain 2 (14R-29), North Plain (14R-30), and Dark Canyon (14R-31). The South East Division had a historic annual mean precipitation of 9.04 inches from 1895 to 2012. The mean annual PDSI of the South East displays a cycle of several wet years followed by several drought years from 1982 to 2012. Wetter than normal years in the South East included 1983-1985, 1993, 2005, and 2010. Drought years included 1989-1990, 2000, and 2002-2003 (Figure 11 and Figure 12) (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 6-8 in. on the San Rafael Tamarisk Removal study; 10-12 in. on the Horse Canyon, Horse Canyon 2, Bitter Creek Herbicide, and North Plain studies; 12-14 in. on the South Plain, South Stateline, and South Plain 2 studies; 14-16 in. on the Adams CE Harrow, Adams CE Control, SITLA Dixie 2, Seep Creek, and Dark Canyon studies; 18-20 in. on the Johnson Creek 2 study; (PRISM Climate Group 2011).

Western Utah Division

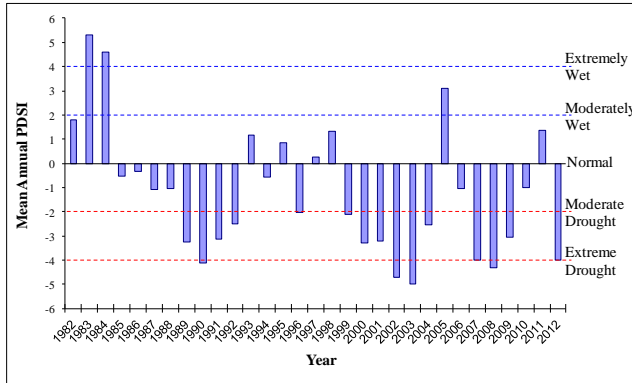


Figure 1. The 31 year mean annual Palmer Drought Severity Index (PDSI) for Western Utah (Division 1). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

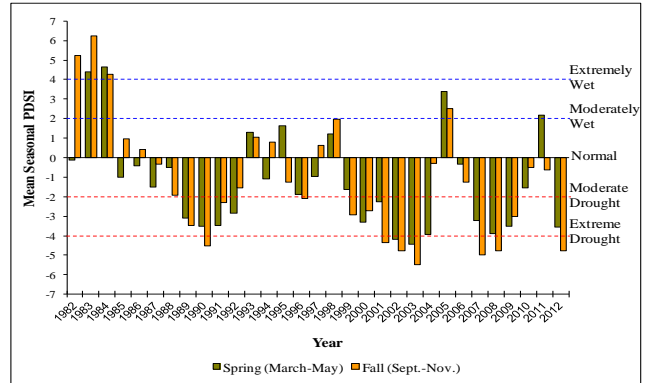


Figure 2. The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for Western Utah (Division 1). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

North Central Division

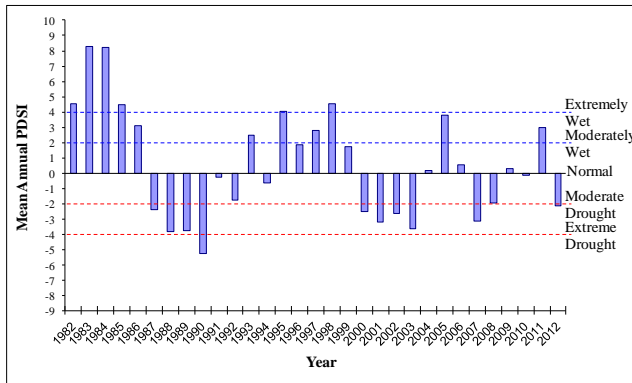


Figure 3. The 31 year mean annual Palmer Drought Severity Index (PDSI) for North Central (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

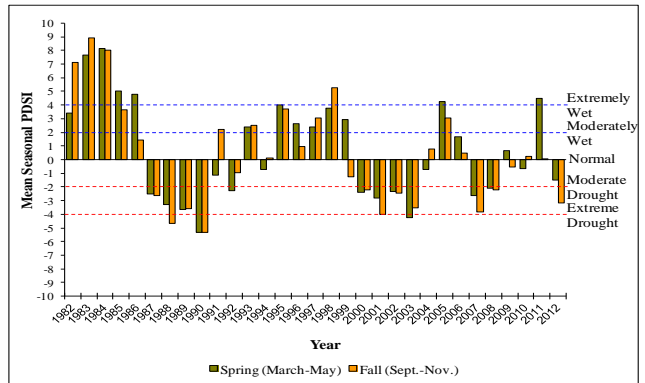


Figure 4. The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for North Central (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

South Central Division

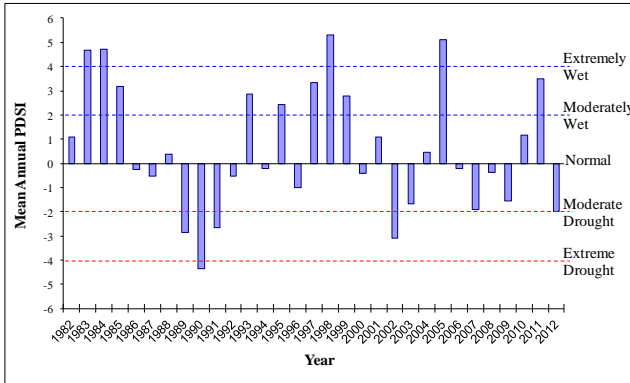


Figure 5. The 31 year mean annual Palmer Drought Severity Index (PDSI) for South Central (Division 4). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

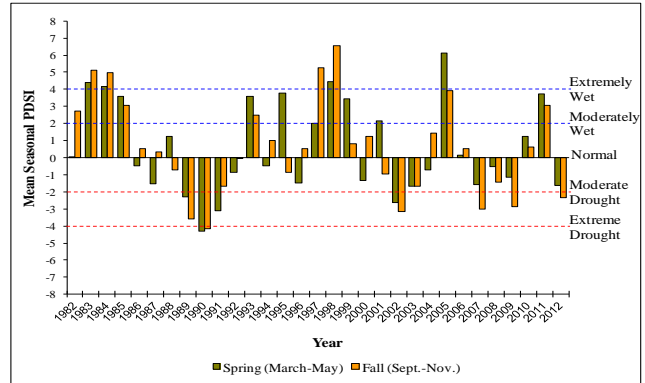


Figure 6. The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for South Central (Division 4). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

Northern Mountains Division

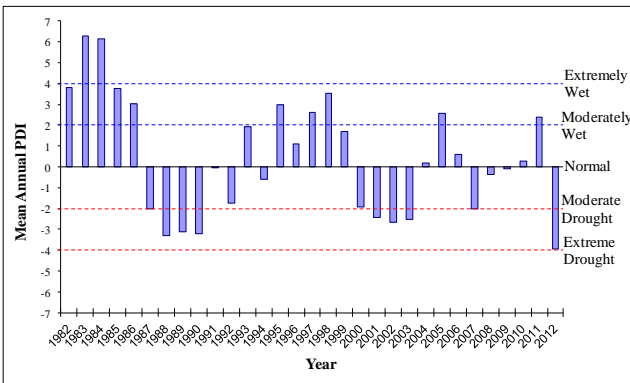


Figure 7. The 31 year mean annual Palmer Drought Severity Index (PDSI) for the Northern Mountains (Division 5). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

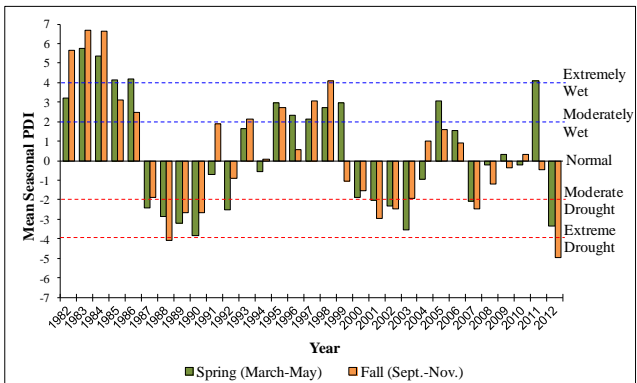


Figure 8. The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for the Northern Mountains (Division 5). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

Uintah Basin

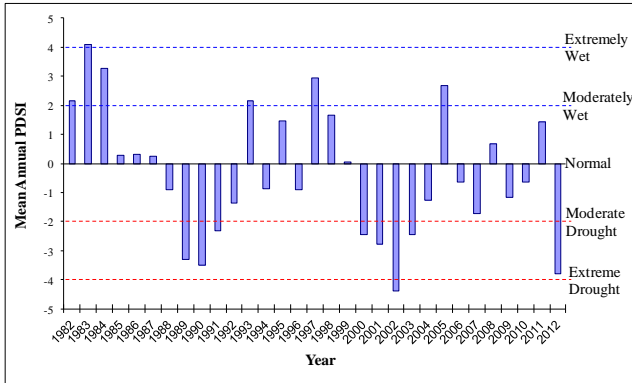


Figure 9. The 31 year mean annual Palmer Drought Severity Index (PDSI) for Uintah Basin (Division 6). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

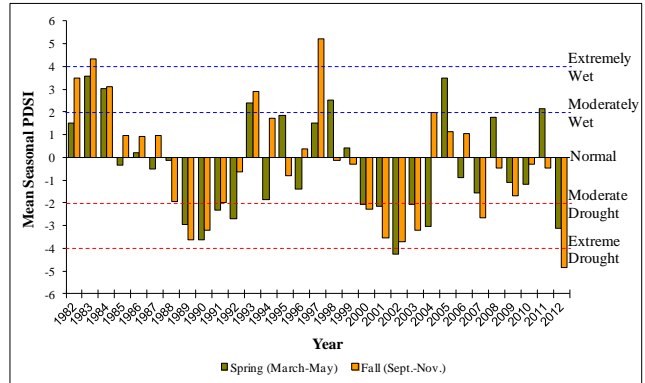


Figure 10. The 31 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for Uintah Basin (Division 6). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

South East Division

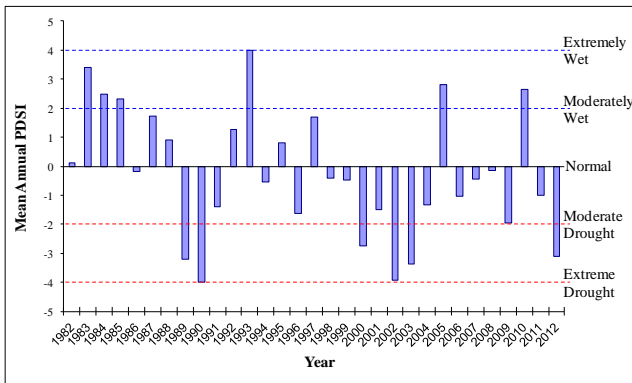


Figure 11. The 31 year mean annual Palmer Drought Severity Index (PDSI) for South East (Division 7). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

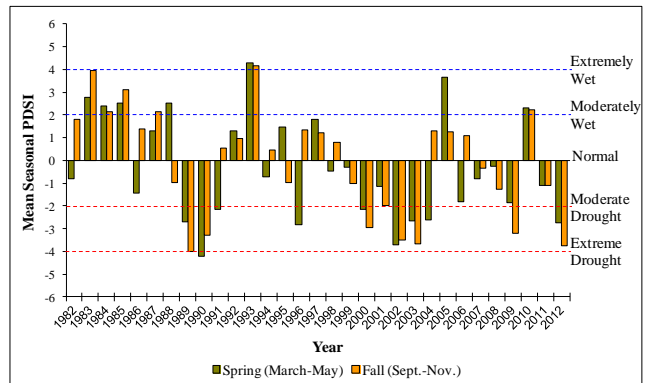
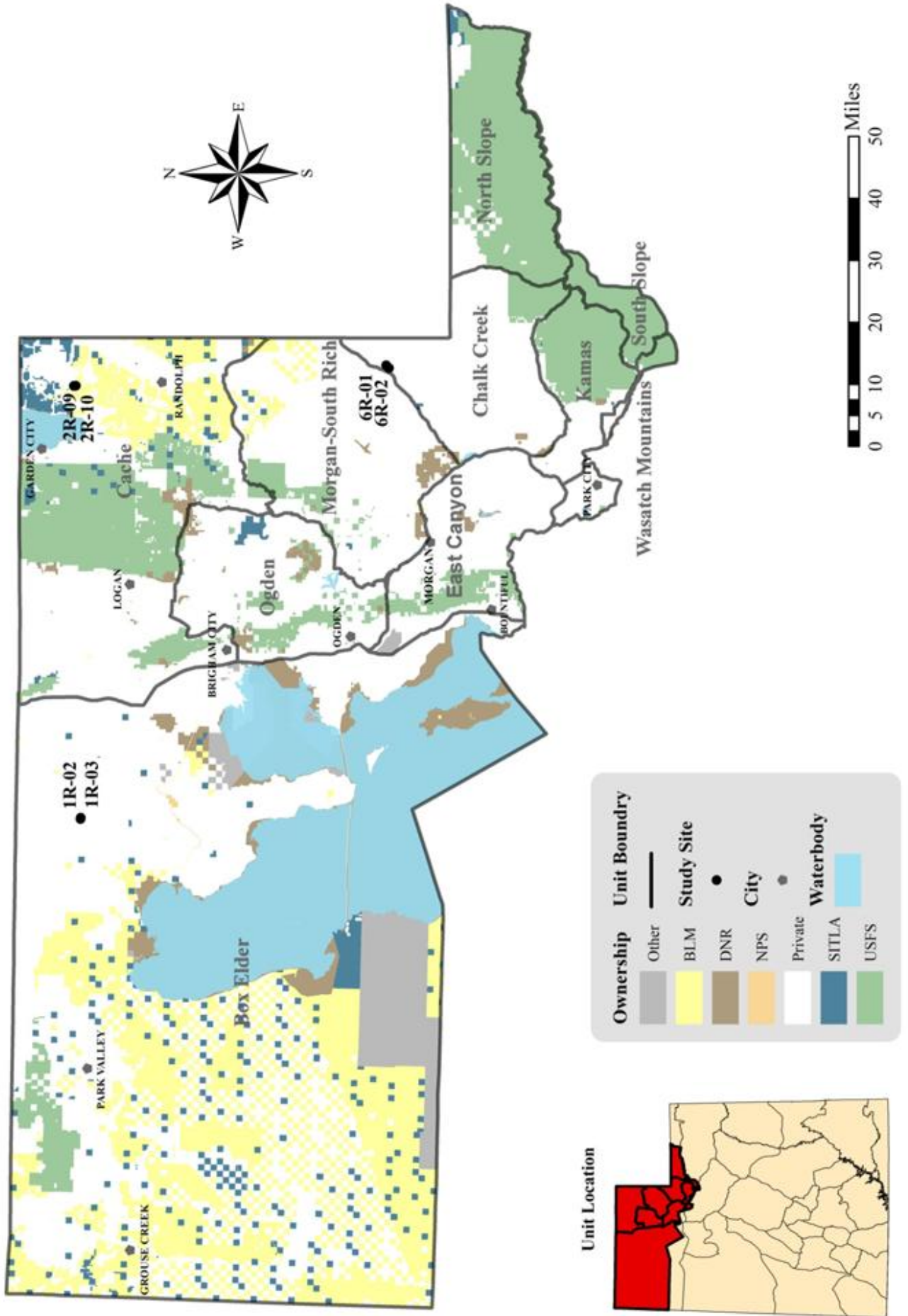


Figure 12. The 31 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for South East (Division 7). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥ 4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤ -4.0 = Extreme Drought (Time Series Data 2013).

Northern Region WRI Studies 2012



RATTLESNAKE FIRE SEEDED - TREND STUDY NO. 1R-2-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Summer

NRCS Ecological Site Description: [Upland Loam \(Mountain Big Sagebrush\), R028AY310UT](#)

Land Ownership: Private

Elevation: 6,000 ft (1,830 m)

Aspect: Northwest

Slope: 20%-30%

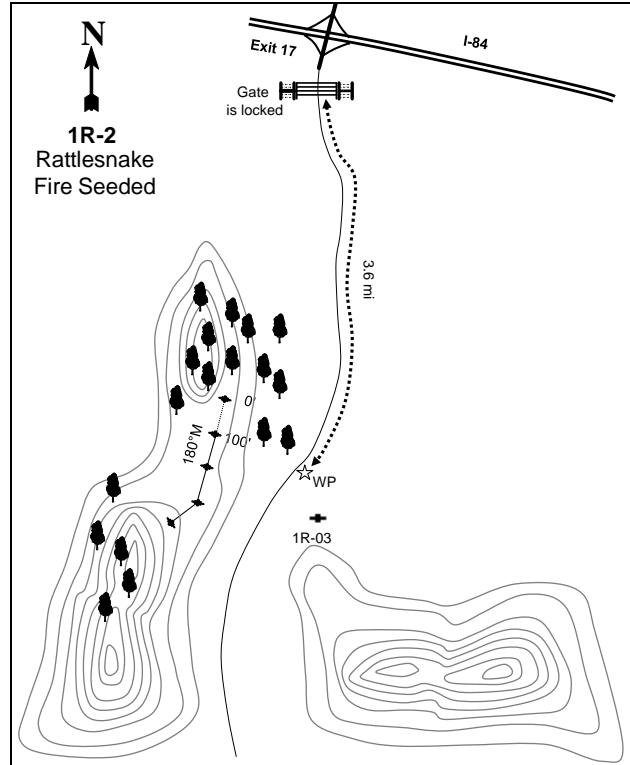
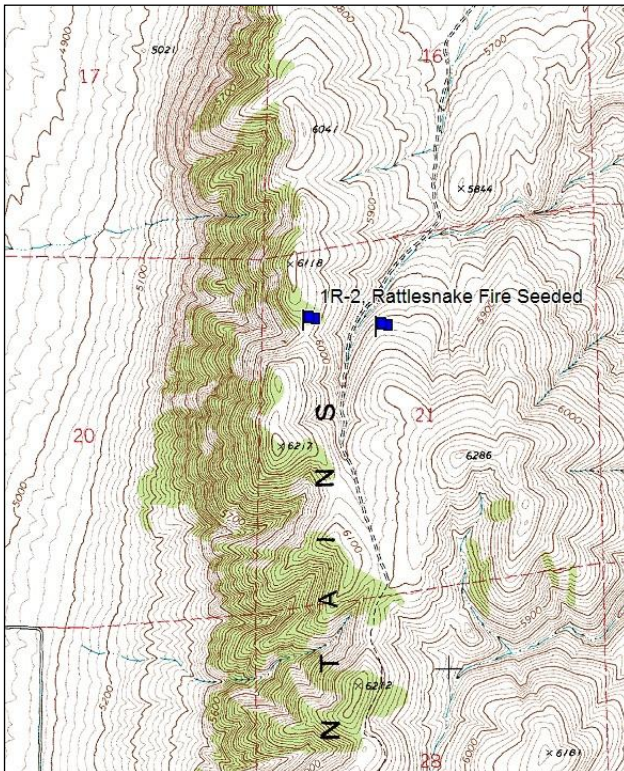
Transect bearing: 180° magnetic

Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: Take exit 17 off of I-84 and turn south passing through a gate. Travel south for 3.6 miles to a witness post on the right hand side of the road. The baseline is to the right (west) of the witness post and is on top of the saddle right outside of a clump of juniper trees. The 0-foot post is marked with browse tag #30.

Map Name: Bulls Pass

Diagrammatic Sketch:



Township: 13N Range: 6W Section: 21

GPS: NAD 83, UTM 12S 371286 E 4633943 N

RATTLESNAKE FIRE SEEDED - TREND STUDY NO. 1R-2

Site Information

Site Description: The study is located three and a half miles south of Rattlesnake Pass on Interstate 84. The study is on private land on the north end of the Promontory Mountain Range. This study was established in 2004 to monitor the effectiveness of a seeding within a mixed mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), pinyon pine (*Pinus edulis*), and Utah juniper (*Juniperus osteosperma*) burn that occurred in 2003 on the north end of the Promontory Mountains. This study site was established on a portion of the burn that was seeded, likely aerially, in the fall of 2003 (Table - Seed Mix). The comparison study site, Rattlesnake Fire Unseeded (1R-3), was established on an untreated ridge 1,000 feet to the east. Deer pellet groups were sampled in low abundance throughout the sample years (Table - Pellet Group Data).

Browse: The dominant browse species is stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), which has provided the majority of the browse cover on the study site over the sample years. Previous to the fire, mountain big sagebrush was the dominant browse species. The key preferred browse species on the site is mountain big sagebrush. The mountain big sagebrush is a small population with low decadence and good vigor within the population throughout the sample years. Other browse species sampled on the site are Saskatoon serviceberry (*Amelanchier alnifolia*), black sagebrush (*Artemisia nova*), rubber rabbitbrush (*Chrysothamnus nauseosus*), Wyeth eriogonum (*Eriogonum heracleoides*), broom snakeweed (*Gutierrezia sarothrae*), mountain snowberry (*Symphoricarpos oreophilus*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species are bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in relatively low abundance on the site, though in 2007, it was sampled in higher abundance. Seeded grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass, and orchardgrass (*Dactylis glomerata*). Other grass species sampled on the site include mutton bluegrass (*Poa fendleriana*). Forbs are moderately abundant and fairly diverse on the site. No single forbs species dominates the site. Seeded forb species sampled on the site include western yarrow (*Achillea millefolium*) and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Sandall-Promo association, which is found on mountain slopes. The parent material consists of colluviums and/or residuum derived from limestone, sandstone, and quartzite. The soils within this classification are characterized as moderately deep, well drained, and with a highly permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.0). Bare ground cover is low on the site, though there is a high amount of vegetation and litter providing protective ground cover. Bare ground cover was fairly high in 2004 and has since decreased (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Trend Assessments

Browse:

- **2004 to 2007 - stable (0):** The density of mountain big sagebrush increased from 80 plants/acre to 240 plants/acre. The sagebrush population remained a small, young population.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush remained similar at 240 plant/acre.

Grass:

- **2004 to 2007 - up (+2):** The sum of nested frequency of perennial grasses increased 19%, and cover increased from 13% to 32%. Bluebunch wheatgrass remained similar in nested frequency, but cover

increased from 9% to 21%. Sandberg bluegrass increased significantly in nested frequency, and cover increased from 4% to 10%. Cheatgrass also increased significantly in nested frequency, and cover increased from 1% to 4%.

- **2007 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 16%, and cover increased to 34%. Sandberg bluegrass increased significantly in nested frequency, and cover increased to 13%. Cheatgrass decreased significantly in nested frequency, and cover decreased to 1%.

Forb:

- **2004 to 2007 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 17%, though cover remained similar at 5%.
- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased 56%, and cover decreased to 3%.

SEED MIX--

Management unit 01R, Study no: 2

Project Name: Rattlesnake Fire Seed Mix			
WRI Database #:PDB			
Application: Aerial		Acres: 900	
Seed type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Goldar'	1750	1.94
G	Crested Wheatgrass 'Douglas'	450	0.50
G	Crested Wheatgrass 'Hycrest'	1550	1.72
G	Orchardgrass 'Paiute'	2000	2.22
G	Russian Wildrye 'Bozoisky'	350	0.39
G	Sheep Fescue	526	0.58
G	Snake River Wheatgrass 'Secar'	255	0.28
G	Western Wheatgrass 'Arriba'	2000	2.22
F	Alfalfa 'Ladak+'	2000	2.22
F	Sainfoin	2000	2.22
F	Small Burnet 'Delar'	2500	2.78
F	Western Yarrow	300	0.33
Total Pounds:		15681	17.42
PLS Pounds:			16.03

Trend Summary

HERBACEOUS TRENDS--

Management unit 01R, Study no: 2

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	-	1	4	-	.01	.18
G	Agropyron spicatum	_a 254	_{ab} 270	_b 290	8.46	21.40	20.18
G	Bromus tectorum (a)	_a 86	_b 169	_a 93	.82	4.26	.45
G	Dactylis glomerata	5	-	-	.03	-	-
G	Poa fendleriana	_b 21	_a 2	_a -	.40	.01	-
G	Poa secunda	_a 188	_b 283	_c 348	3.96	10.25	13.27
Total for Annual Grasses		86	169	93	0.82	4.26	0.45
Total for Perennial Grasses		468	556	642	12.85	31.67	33.63

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
	Total for Grasses	554	725	735	13.68	35.94	34.09
F	<i>Achillea millefolium</i>	ab5	b9	a1	.06	.21	.03
F	<i>Agoseris glauca</i>	b83	b111	a16	.45	.72	.02
F	<i>Allium</i> sp.	b115	a-	a4	.52	-	.01
F	<i>Alyssum alyssoides</i> (a)	a13	b204	c293	.04	.84	1.72
F	<i>Arabis</i> sp.	-	5	-	-	.01	-
F	<i>Astragalus convallarius</i>	11	16	8	.11	.24	.04
F	<i>Astragalus</i> sp.	b16	ab1	a-	.10	.03	-
F	<i>Astragalus utahensis</i>	3	-	-	.00	-	-
F	<i>Balsamorhiza sagittata</i>	-	-	1	.03	-	.03
F	<i>Borago</i> sp.	b6	a-	a-	.21	-	-
F	<i>Calochortus nuttallii</i>	b26	a-	a-	.09	-	-
F	<i>Camelina microcarpa</i> (a)	-	2	3	-	.01	.00
F	<i>Cirsium</i> sp.	8	7	9	.22	.21	.04
F	<i>Collinsia parviflora</i> (a)	a3	c234	b125	.00	1.02	.24
F	<i>Collomia linearis</i> (a)	b39	c70	a5	.14	.26	.03
F	<i>Comandra pallida</i>	a-	b11	a1	-	.07	.03
F	<i>Crepis acuminata</i>	-	2	5	-	.03	.03
F	<i>Cymopterus</i> sp.	b44	b34	a11	.60	.06	.02
F	<i>Descurainia pinnata</i> (a)	b9	c128	a-	.05	.83	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	7	-	-	.02
F	<i>Haplopappus acaulis</i>	-	3	-	-	.18	-
F	<i>Hedysarum boreale</i>	3	-	-	.04	-	-
F	<i>Helianthus annuus</i> (a)	-	-	-	.15	-	-
F	<i>Lactuca serriola</i> (a)	8	5	-	.08	.07	-
F	<i>Lappula occidentalis</i> (a)	a11	b35	a-	.16	.10	-
F	<i>Lithophragma tenella</i>	-	-	4	-	-	.01
F	<i>Lomatium</i> sp.	-	-	-	.01	-	-
F	<i>Lupinus argenteus</i>	28	38	25	.70	1.54	.63
F	<i>Lupinus</i> sp.	10	18	-	.54	.06	-
F	<i>Machaeranthera canescens</i>	-	-	3	-	-	.00
F	<i>Mentzelia</i> sp.	2	-	-	.01	-	-
F	<i>Microsteris gracilis</i> (a)	a8	c178	b69	.02	.67	.17
F	<i>Phlox austromontana</i>	24	28	36	.61	.94	1.51
F	<i>Phlox longifolia</i>	a19	b48	ab25	.07	.39	.38
F	<i>Polygonum douglasii</i> (a)	2	16	13	.01	.03	.03
F	<i>Ranunculus testiculatus</i> (a)	a-	b33	a1	-	.06	.00
F	<i>Sanguisorba minor</i>	3	-	-	.01	-	-
F	<i>Sisymbrium altissimum</i> (a)	26	38	11	3.22	.46	.07
F	<i>Townsendia</i> sp.	-	2	-	-	.03	-
F	<i>Tragopogon dubius</i> (a)	-	6	5	-	.06	.01
F	<i>Veronica biloba</i> (a)	c277	b214	a91	3.81	1.08	.46
F	<i>Vicia americana</i>	-	5	-	-	.03	-
	Total for Annual Forbs	396	1163	623	7.70	5.52	2.79
	Total for Perennial Forbs	406	338	149	4.42	4.79	2.80

Type	Species	Nestled Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
Total for Forbs		802	1501	772	12.12	10.31	5.59

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 01R, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia nova	0	1	1	-	-	-
B	Artemisia tridentata vaseyana	3	9	11	.01	.30	1.30
B	Chrysothamnus nauseosus	0	1	1	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	59	53	57	2.15	2.24	3.30
B	Gutierrezia sarothrae	0	17	12	-	.99	.43
B	Symphoricarpos oreophilus	0	1	0	-	.00	-
Total for Browse		62	82	82	2.16	3.54	5.03

CANOPY COVER, LINE INTERCEPT--

Management unit 01R, Study no: 2

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata vaseyana	-	.21	1.36
Chrysothamnus nauseosus	-	.23	-
Chrysothamnus viscidiflorus viscidiflorus	2.38	4.40	6.30
Gutierrezia sarothrae	-	.23	.53
Symphoricarpos oreophilus	-	.21	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 01R, Study no: 2

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	1.6

BASIC COVER--

Management unit 01R, Study no: 2

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	29.43	43.40	45.90
Rock	6.19	6.56	6.90
Pavement	18.62	10.66	8.21
Litter	10.44	25.48	53.08
Cryptogams	.13	.07	.66
Bare Ground	43.53	22.68	12.19

SOIL ANALYSIS DATA --

Management unit 1R, Study no: 2, Study Name: Rattlesnake Fire Seeded

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.4	7.0	47.2	38.6	14.2	4.1	13.5	291.2	0.6

PELLET GROUP DATA--

Management unit 01R, Study no: 2

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	1	8	16	-	-	-
Deer	5	1	-	15 (38)	1 (2)	1 (3)

BROWSE CHARACTERISTICS--

Management unit 01R, Study no: 2

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Amelanchier alnifolia									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	14/23
Artemisia nova									
04	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	13/31
12	20	0	100	-	-	0	100	0	15/33
Artemisia tridentata vaseyana									
04	80	75	0	25	360	0	25	0	9/19
07	240	75	25	0	-	17	0	0	16/22
12	240	0	100	0	80	17	0	33	19/25
Chrysothamnus nauseosus									
04	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	17/17
12	20	100	0	-	-	100	0	0	23/36
Chrysothamnus viscidiflorus viscidiflorus									
04	3540	5	95	1	300	0	0	0	11/11
07	2700	4	78	19	-	.74	1	15	11/17
12	2840	1	75	25	-	8	.70	61	13/17
Eriogonum heracleoides									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	5/26
Gutierrezia sarothrae									
04	0	0	0	0	-	0	0	0	-/-
07	1120	14	55	30	-	0	0	30	6/9
12	780	23	64	13	20	0	0	13	8/11

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Symphoricarpos oreophilus</i>										
04	0	0	0	-	-	0	0	0	10/21	
07	20	0	100	-	-	100	0	0	20/39	
12	0	0	0	-	-	0	0	0	14/27	
<i>Tetradymia canescens</i>										
04	0	0	0	-	-	0	0	0	8/10	
07	0	0	0	-	-	0	0	0	11/20	
12	0	0	0	-	-	0	0	0	9/16	

RATTLESNAKE FIRE UNSEEDED - TREND STUDY NO. 1R-3-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Summer

NRCS Ecological Site Description: [Upland Loam \(Mountain Big Sagebrush\), R028AY310UT](#)

Land Ownership: Private

Elevation: 5,900 ft (1,800 m)

Aspect: Northwest

Slope: 20%-30%

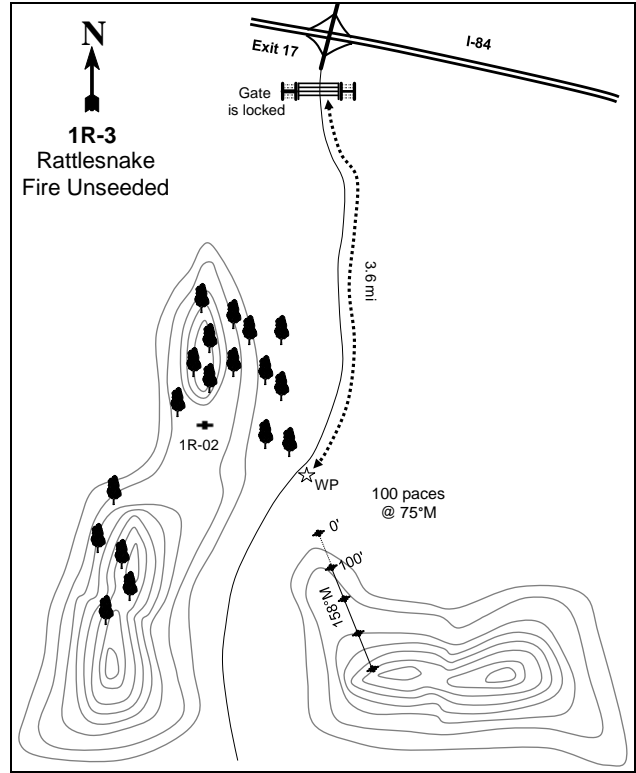
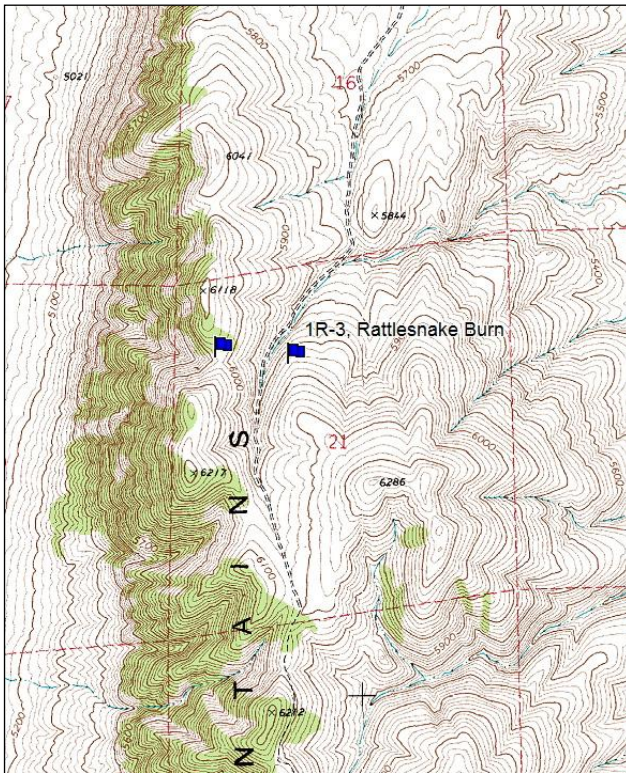
Transect bearing: 158° magnetic

Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: Take exit 17 off of I-84 and turn south passing through a gate. Travel south for 3.6 miles to a witness post on the right hand side of the road. The beginning of the baseline is to the left (east) of the witness post about 100 paces at 75°M. The 0-foot stake is marked with browse tag #31.

Map Name: Bulls Pass

Diagrammatic Sketch:



Township: 13N Range: 6W Section: 21

GPS: NAD 83, UTM 12S 371611 E 4633907 N

RATTLESNAKE FIRE UNSEEDED - TREND STUDY NO. 1R-3

Site Information

Site Description: The study is located three and a half miles south of Rattlesnake Pass on Interstate 84. The study is on private land on the north end of the Promontory Mountain Range. This study was established in 2004 to monitor the effectiveness of a seeding on a mixed mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), pinyon pine (*Pinus edulis*), and Utah juniper (*Juniperus osteosperma*) burn that occurred in 2003 on the north end of the Promontory Mountains. This study site was established on a portion of the burn that was unseeded. The comparison study site, Rattlesnake Fire Seeded (1R-2), was established in a seeded portion 1,000 feet to the west. Deer pellet groups were sampled in low abundance throughout the sample years (Table - Pellet Group Data).

Browse: The dominant browse species is stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), which has provided the majority of the browse cover on the study site over the sample years. Previous to the fire, mountain big sagebrush was the dominant browse species. The key preferred browse species on the site is mountain big sagebrush. The mountain big sagebrush is a small population with low decadence and good vigor within the population throughout the sample years. Other browse species sampled on the site are rubber rabbitbrush (*Chrysothamnus nauseosus*), slenderbush eriogonum (*Eriogonum microthecum*), broom snakeweed (*Gutierrezia sarothrae*), antelope bitterbrush (*Purshia tridentata*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species are bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in relatively low abundance on the site. Other grass species sampled on the site include mutton bluegrass (*Poa fendleriana*). Forbs are moderately abundant and fairly diverse on the site. No single forbs species dominates the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Middle-Broad association, which is found on mountain slopes. The parent material consists of alluvium and residuum derived from limestone, sandstone, and quartzite. The soils within this classification are characterized as moderately deep, well drained, and with a highly permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a shallow stony loam with a neutral soil reaction (pH 7.0). Bare ground cover is low on the site, though there is a high amount of vegetation and litter providing protective ground cover. Bare ground cover was fairly high in 2004 and has since decreased (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2007, but was classified as slight in 2012 due to pedestalling, surface litter movement, and soil movement.

Trend Assessments

Browse:

- **2001 to 2006 - stable (0):** Mountain big sagebrush remained rare on the site.
- **2006 to 2011 - stable (0):** Mountain big sagebrush remained rare on the site.

Grass:

- **2001 to 2006 - up (+2):** The sum of nested frequency of perennial grasses increased 28%, and cover increased from 13% to 31%. Bluebunch wheatgrass and Sandberg bluegrass increased significantly in nested frequency, and cover increased from 9% to 20% and 4% to 11%, respectively. Cheatgrass decreased significantly in nested frequency, and cover decreased to less than 1%.
- **2006 to 2011 - stable (0):** The sum of nested frequency of perennial grasses remained similar, though cover increased from 31% to 35%.

Forb:

- **2001 to 2006 - down (-2):** The sum of nested frequency of perennial forbs decreased 24%, though cover remained similar at 5%.
- **2006 to 2011 - down (-2):** The sum of nested frequency of perennial forbs decreased 39%, and cover decreased to 3%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 01R, Study no: 3

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron spicatum	a292	b340	b351	9.10	19.91	24.35
G	Bromus tectorum (a)	b189	a85	a69	1.08	.43	.86
G	Poa fendleriana	2	-	-	.03	-	-
G	Poa secunda	a233	b336	b342	3.81	11.00	10.42
Total for Annual Grasses		189	85	69	1.08	0.43	0.86
Total for Perennial Grasses		527	676	693	12.94	30.92	34.78
Total for Grasses		716	761	762	14.03	31.35	35.64
F	Achillea millefolium	7	11	14	.19	.18	.19
F	Agoseris glauca	38	17	14	.10	.08	.03
F	Allium sp.	b89	a4	a5	.35	.01	.01
F	Alyssum alyssoides (a)	a95	c363	b328	.38	2.90	2.00
F	Arabis sp.	-	1	-	-	.03	-
F	Astragalus convallarius	b47	a23	a23	.59	.19	.33
F	Calochortus nuttallii	b20	a4	a-	.08	.01	-
F	Camelina microcarpa (a)	1	-	-	.00	-	-
F	Chenopodium sp. (a)	6	-	-	.01	-	-
F	Collinsia parviflora (a)	a-	c90	b50	-	.28	.08
F	Collomia linearis (a)	-	2	-	-	.00	-
F	Cordylanthus sp. (a)	-	2	-	-	.03	-
F	Crepis acuminata	-	-	-	-	.00	-
F	Cymopterus sp.	c58	b31	a9	.39	.16	.04
F	Descurainia pinnata (a)	b19	ab12	a4	.19	.01	.06
F	Lactuca serriola (a)	b8	a1	a-	.05	.00	-
F	Lappula occidentalis (a)	-	1	-	-	.00	-
F	Lupinus argenteus	31	43	27	1.52	2.06	.73
F	Lupinus sp.	20	25	-	.66	.22	-
F	Machaeranthera canescens	-	-	1	-	-	.00
F	Microsteris gracilis (a)	a-	c66	b15	-	.15	.08
F	Phlox austromontana	28	41	31	.24	.78	1.15
F	Phlox longifolia	a89	b123	a74	.33	.85	.33
F	Polygonum douglasii (a)	1	3	-	.00	.00	-
F	Ranunculus testiculatus (a)	a2	b69	a-	.00	.19	-
F	Sisymbrium altissimum (a)	2	10	1	.00	.36	.00
F	Tragopogon dubius (a)	3	5	4	.15	.03	.01
F	Veronica biloba (a)	c304	b141	a18	2.85	.45	.11

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
	Total for Annual Forbs	441	765	420	3.66	4.44	2.36
	Total for Perennial Forbs	427	323	198	4.48	4.58	2.84
	Total for Forbs	868	1088	618	8.14	9.02	5.21

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 01R, Study no: 3

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	2	1	1	-	.03	.03
B	<i>Chrysothamnus nauseosus</i>	1	1	12	.00	-	.71
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	71	64	71	2.75	3.25	4.71
B	<i>Eriogonum microthecum</i>	4	18	16	.03	.45	.55
B	<i>Gutierrezia sarothrae</i>	1	54	48	.00	3.04	2.06
B	<i>Tetradymia canescens</i>	26	28	16	.92	1.17	1.28
	Total for Browse	105	166	164	3.71	7.96	9.34

CANOPY COVER, LINE INTERCEPT--

Management unit 01R, Study no: 3

Species	Percent Cover		
	'04	'07	'12
<i>Chrysothamnus nauseosus</i>	.13	-	.86
<i>Chrysothamnus viscidiflorus viscidiflorus</i>	3.70	5.68	4.43
<i>Eriogonum microthecum</i>	-	1.06	.75
<i>Gutierrezia sarothrae</i>	-	2.73	2.20
<i>Tetradymia canescens</i>	1.03	2.53	2.21

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 01R, Study no: 3

Species	Average leader growth (in) '12
<i>Artemisia tridentata vaseyana</i>	0.5

BASIC COVER--

Management unit 01R, Study no: 3

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	29.13	45.83	53.47
Rock	4.49	4.82	4.69
Pavement	12.78	9.35	4.97
Litter	18.79	32.77	60.29
Cryptogams	0	.18	.26
Bare Ground	42.96	15.58	7.38

SOIL ANALYSIS DATA --

Management unit 1R, Study no: 3, Study Name: Rattlesnake Fire Unseeded

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.9	7.0	47.2	38.6	14.2	5.1	13.5	291.2	0.6

PELLET GROUP DATA--

Management unit 01R, Study no: 3

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	1	1	-	-	-	-
Grouse	-	2	-	-	-	-
Deer	-	1	-	5 (13)	3 (7)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 01R, Study no: 3

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
04	60	67	33	-	60	0	0	0	35/42
07	20	100	0	-	20	0	0	0	21/13
12	20	0	100	-	-	0	0	0	27/33
Chrysothamnus nauseosus									
04	20	0	100	0	-	0	0	0	17/18
07	20	0	100	0	-	0	100	0	24/30
12	340	0	71	29	-	0	0	100	20/25
Chrysothamnus viscidiflorus viscidiflorus									
04	4220	4	95	1	4160	0	0	0	11/13
07	3700	5	44	51	-	0	0	45	12/18
12	3300	1	90	9	-	5	0	50	14/19
Eriogonum microthecum									
04	140	0	100	0	-	0	0	0	8/10
07	680	0	94	6	-	15	0	0	10/14
12	580	0	97	3	-	0	0	55	9/16

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
04	20	0	100	0	-	0	0	0	7/5	
07	7400	16	74	11	-	0	0	36	6/7	
12	2820	2	94	4	20	.70	0	4	9/10	
<i>Purshia tridentata</i>										
04	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	8/21	
12	0	0	0	-	-	0	0	0	-/-	
<i>Tetradymia canescens</i>										
04	1380	19	81	0	-	0	0	0	11/16	
07	1060	2	40	58	-	0	2	28	13/24	
12	580	0	86	14	-	14	0	31	14/26	

RABBIT CREEK BURN - TREND STUDY NO. 2R-9-12

Vegetation Type: Stickyleaf Low Rabbitbrush

Range Type: Crucial Deer Summer, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Loam \(Wyoming Big Sagebrush\), R025XY314UT](#)

Land Ownership: BLM

Elevation: 7,000 ft (2,134 m)

Aspect: East

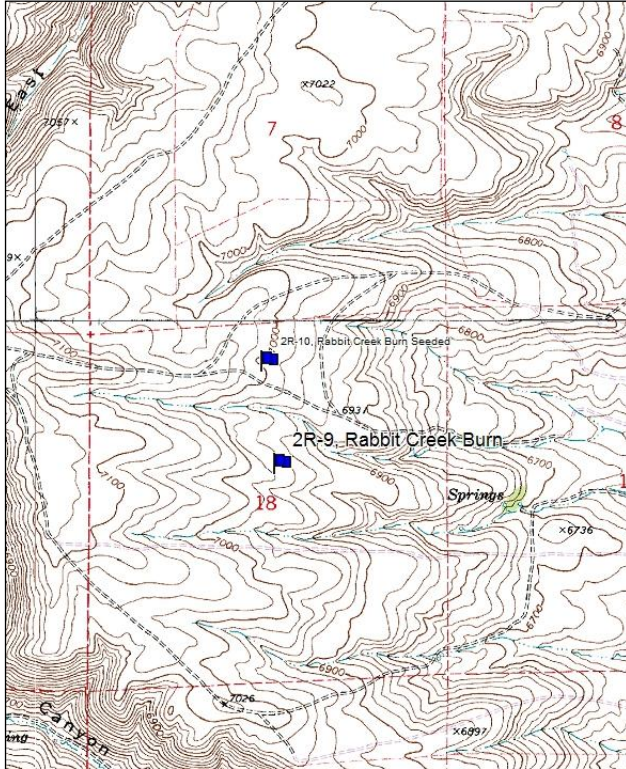
Slope: 8%

Transect bearing: 76° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

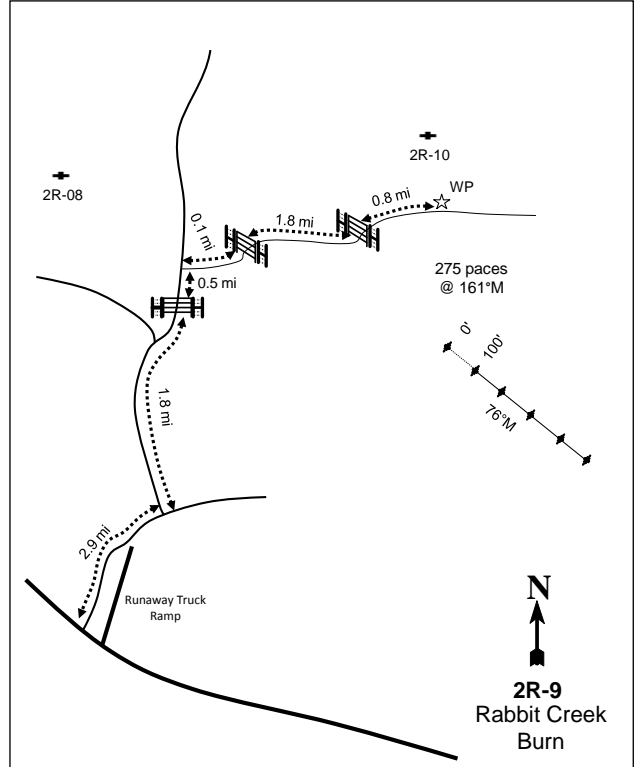
Directions: Traveling on Highway 30, toward Bear Lake from Sage Creek Junction, turn right on a road that turns off the highway along with a runaway truck ramp. The road turns to the west of the ramp. Follow this road for 2.9 miles to a road that comes in on the left. Turn left on this road and drive 1.8 miles to a gate. Pass through the gate and continue 0.5 miles to a two-track road on the right. Turn onto this and follow it for 0.1 miles to a gate, continue 1.8 miles to another gate. Pass through the gate and travel 0.8 miles to the witness post on the left (north) side of the road. The 0-foot post is 275 paces at 161°M from the witness post and is marked with browse tag #33.

Map Name: Sage Creek



Township: 13N Range: 7E Section: 18

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 483726 E 4635213 N

RABBIT CREEK BURN - TREND STUDY NO. 2R-9

Site Information

Site Description: The study is located approximately five miles east of Bear Lake, within burned Wyoming big sagebrush flat. This study was established on land administered by the Bureau of Land Management (BLM) in 2004 to monitor the vegetation response to a naturally caused fire (East Bear fire) which burned about 887 acres east of Bear Lake in the fall of 2003. The study site is located within the BLM Rabbit Creek allotment. One-third of a mile to the north, the Rabbit Creek Burn Seeded study (2R-10) was established on an area that was drill seeded after the fire. Prior to the fire, the area was dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). The area is important habitat for antelope, wintering deer, and sage-grouse. About a dozen sage-grouse were seen west of the study in some unburned sagebrush in 2007 and fresh sage-grouse pellet groups were found near the site in 2012. Antelope/deer pellet groups were sampled in low abundance in 2012. Cattle pellet groups were sampled in low abundance in 2004 and moderate abundance in 2007 and 2012. Sage-grouse pellet groups were sampled at 9 groups/acre in 2007 and 17 groups/acre in 2012 (Table - Pellet Group Data).

Browse: The dominant browse species is stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), which has provided the majority of the browse cover on the study site over the sample years. Previous to the fire, Wyoming big sagebrush was the dominant browse species. The key preferred browse species on the site is Wyoming big sagebrush. Other browse species sampled on the site are Utah serviceberry (*Amelanchier utahensis*), slenderbush eriogonum (*Eriogonum microthecum*), antelope bitterbrush (*Purshia tridentata*), mountain snowberry (*Symphoricarpos oreophilus*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species is thickspike wheatgrass (*Agropyron dasystachyum*), which has provided the majority of the grass cover since the outset of the study. The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in relatively low abundance on the site. Other abundant grass species sampled on the site include big bluegrass (*Poa ampla*) and Sandberg bluegrass (*Poa secunda*). Forbs are moderately abundant and fairly diverse on the site. Forbs have fluctuated in abundance and diversity over the course of the study. False dandelion (*Agoseris glauca*), an astragalus (*Astragalus* sp.), thistle (*Cirsium* sp.), tansymustard (*Descurainia pinnata*), purpledaisy fleabane (*Erigeron corymbosus*), longleaf phlox (*Phlox longifolia*), Hoods phlox (*Phlox hoodii*), and clover (*Trifolium* sp.) have been more common on the site, though in 2012 forbs were rare (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Kearsley component, which is found on hillslopes. The parent material consists of colluvium and/or alluvium weathered from sandstone. The soils within this classification are characterized as moderately deep, well drained, and with a highly permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a silt loam with a neutral soil reaction (pH 6.8). Bare ground cover is moderate on the site, though there is a moderate amount of vegetation and high amount of litter providing protective ground cover. Bare ground cover was fairly high in 2004 and has since decreased (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Trend Assessments

Browse:

- **2001 to 2006 - stable (0):** Wyoming big sagebrush remained rare on the site.
- **2006 to 2011 - stable (0):** Wyoming big sagebrush remained rare on the site.

Grass:

- **2001 to 2006 - up (+2):** The sum of nested frequency of perennial grasses increased 42%, and cover increased from 6% to 17%.
- **2006 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased 21%, though cover remained similar at 18%.

Forb:

- **2001 to 2006 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 13%, and cover increased from 8% to 13%.
- **2006 to 2011 - down (-2):** The sum of nested frequency of perennial forbs decreased substantially and cover decreased to 3%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 02R, Study no: 9

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron dasystachyum	_a 271	_{ab} 318	_c 406	4.30	10.31	10.17
G	Agropyron spicatum	_a 1	_b 36	_a 2	.03	1.16	.00
G	Bromus tectorum (a)	_a 1	_{ab} 16	_b 32	.00	.03	.33
G	Dactylis glomerata	-	2	1	-	.03	.00
G	Koeleria cristata	-	33	8	-	.71	.19
G	Poa ampla	_a 64	_{ab} 87	_b 108	1.07	3.34	4.07
G	Poa bulbosa	-	3	-	-	.03	-
G	Poa secunda	_a 60	_a 88	_b 172	.40	1.63	2.85
G	Sitanion hystrix	6	2	-	.04	.03	-
G	Stipa lettermani	7	13	6	.01	.10	.19
Total for Annual Grasses		1	16	32	0.00	0.03	0.33
Total for Perennial Grasses		409	582	703	5.86	17.35	17.48
Total for Grasses		410	598	735	5.87	17.38	17.81
F	Agoseris glauca	_b 174	_b 194	_a 9	1.14	1.82	.04
F	Allium sp.	8	-	-	.01	-	-
F	Alyssum alyssoides (a)	3	-	-	.00	-	-
F	Antennaria rosea	3	-	5	.00	-	.03
F	Astragalus cibarius	_a 2	_b 12	_a 1	.03	.09	.03
F	Astragalus convallarius	_b 24	_b 26	_a 3	.15	.26	.01
F	Astragalus sp.	_b 123	_b 132	_a 18	1.94	1.78	.13
F	Calochortus nuttallii	5	-	-	.01	-	-
F	Chenopodium album (a)	6	-	-	.02	-	-
F	Cirsium sp.	_b 52	_{ab} 28	_a 12	1.65	.93	.07
F	Collinsia parviflora (a)	_a 8	_b 64	_a -	.01	.22	-
F	Collomia linearis (a)	_b 13	_c 68	_a -	.03	.33	-
F	Cordylanthus sp. (a)	6	-	-	.01	-	-
F	Crepis acuminata	_b 10	_{ab} 3	_a -	.16	.30	-
F	Cryptantha sp.	-	4	7	-	.09	.06
F	Delphinium nuttallianum	-	6	-	-	.04	-
F	Descurainia pinnata (a)	_b 26	_c 209	_a -	.48	1.27	-

T y p e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	<i>Erigeron corymbosus</i>	_b 37	_c 60	_a 9	.66	1.57	.01
F	<i>Gayophytum ramosissimum</i> (a)	3	12	-	.04	.10	-
F	<i>Lactuca serriola</i> (a)	-	3	-	-	.00	-
F	<i>Lomatium</i> sp.	_b 13	_b 19	_a -	.25	.35	-
F	<i>Lupinus argenteus</i>	4	5	1	.03	.04	.00
F	<i>Machaeranthera canescens</i>	-	1	-	-	.00	-
F	<i>Microsteris gracilis</i> (a)	_a 2	_b 25	_a -	.00	.10	-
F	<i>Penstemon radicosus</i>	_b 24	_{ab} 15	_a 2	.10	.50	.03
F	<i>Phlox hoodii</i>	_a 48	_b 84	_b 91	.31	1.39	2.44
F	<i>Phlox longifolia</i>	_b 72	_c 171	_a 30	.28	2.29	.12
F	<i>Polygonum douglasii</i> (a)	2	4	-	.01	.01	-
F	<i>Schoenocrambe linifolia</i>	_b 36	_b 50	_a 7	.30	.24	.05
F	<i>Senecio integerrimus</i>	_b 15	_a 1	_a -	.11	.03	-
F	<i>Tragopogon dubius</i> (a)	9	3	-	.10	.00	-
F	<i>Trifolium</i> sp.	_c 146	_b 97	_a -	1.10	1.27	-
F	<i>Veronica biloba</i> (a)	_a 2	_b 13	_a -	.01	.03	-
F	<i>Viola</i> sp.	5	-	-	.01	-	-
F	<i>Zigadenus paniculatus</i>	3	-	-	.00	-	-
Total for Annual Forbs		80	401	0	0.73	2.09	0
Total for Perennial Forbs		804	908	195	8.30	13.04	3.05
Total for Forbs		884	1309	195	9.03	15.13	3.05

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 02R, Study no: 9

T y p e	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	<i>Artemisia tridentata wyomingensis</i>	0	0	5	-	.00	-
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	88	89	86	3.92	6.07	6.98
B	<i>Eriogonum microthecum</i>	1	6	4	-	.12	.18
B	<i>Symphoricarpos oreophilus</i>	5	6	7	.15	.53	.21
B	<i>Tetradymia canescens</i>	43	39	41	.66	1.44	1.87
Total for Browse		137	140	143	4.73	8.17	9.25

CANOPY COVER, LINE INTERCEPT--

Management unit 02R, Study no: 9

Species	Percent Cover		
	'04	'07	'12
Chrysothamnus viscidiflorus viscidiflorus	4.50	9.26	7.78
Eriogonum microthecum	-	-	.03
Symphoricarpos oreophilus	.48	.91	.96
Tetradymia canescens	.55	2.01	2.28

BASIC COVER--

Management unit 02R, Study no: 9

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	22.79	43.17	31.14
Rock	.59	.85	.36
Pavement	28.48	5.43	2.97
Litter	1.61	28.73	44.02
Cryptogams	0	.00	0
Bare Ground	53.31	34.23	36.44

SOIL ANALYSIS DATA --

Management unit 2R, Study no: 9, Study Name: Rabbit Creek Burn

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
14.0	6.8	34.6	47.9	17.5	3.2	7.2	336.0	0.8

PELLET GROUP DATA--

Management unit 02R, Study no: 9

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	1	13	17	-	-	-
Grouse	1	-	9	-	9 groups/acre	17 groups/acre
Antelope/Deer	-	1	15	-	-	17 (43)
Cattle	-	4	4	1 (2)	20 (48)	23 (57)

BROWSE CHARACTERISTICS--

Management unit 02R, Study no: 9

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	22/25
12	0	0	0	-	-	0	0	0	27/31

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
04	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	60	0	0	0	-/-
12	100	0	80	20	-	0	20	40	14/16
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
04	8340	62	38	0	200	0	0	0	8/10
07	8620	3	88	9	20	.23	0	6	10/15
12	7580	1	91	8	120	29	7	53	9/14
<i>Eriogonum microthecum</i>									
04	20	100	0	-	-	0	0	0	5/7
07	120	0	100	-	20	33	0	0	6/6
12	140	0	100	-	20	0	0	29	7/9
<i>Purshia tridentata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	16/62
<i>Symphoricarpos oreophilus</i>									
04	180	89	11	-	-	0	0	0	14/19
07	180	11	89	-	-	0	0	0	16/29
12	280	7	93	-	-	14	0	36	17/38
<i>Tetradymia canescens</i>									
04	1160	79	21	0	380	0	0	0	7/9
07	1220	11	82	7	-	10	0	7	10/18
12	1240	10	61	29	-	13	5	24	11/22

RABBIT CREEK BURN SEEDED - TREND STUDY NO. 2R-10-12

Vegetation Type: Stickyleaf Low Rabbitbrush

Range Type: Crucial Deer Summer, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Loam \(Wyoming Big Sagebrush\), R025XY314UT](#)

Land Ownership: Private

Elevation: 7,000 ft (2,134 m)

Aspect: East

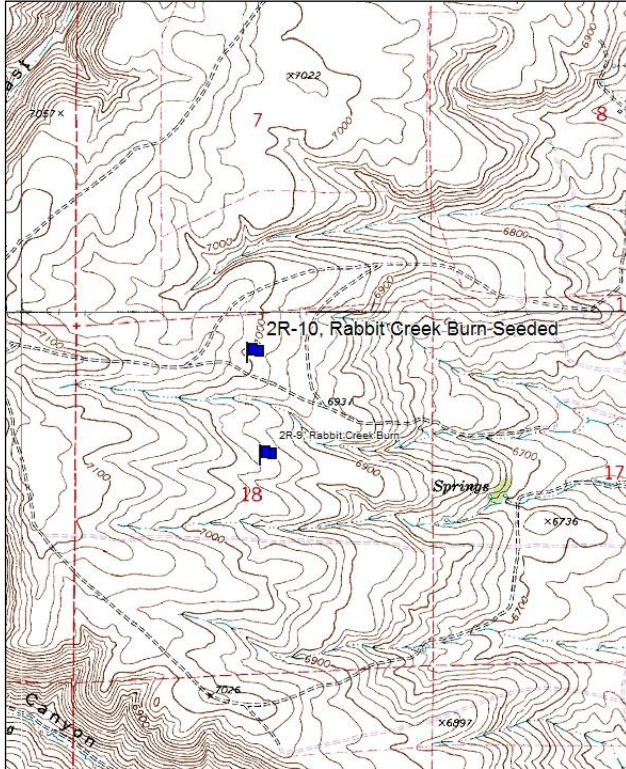
Slope: 5%

Transect bearing: 90° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

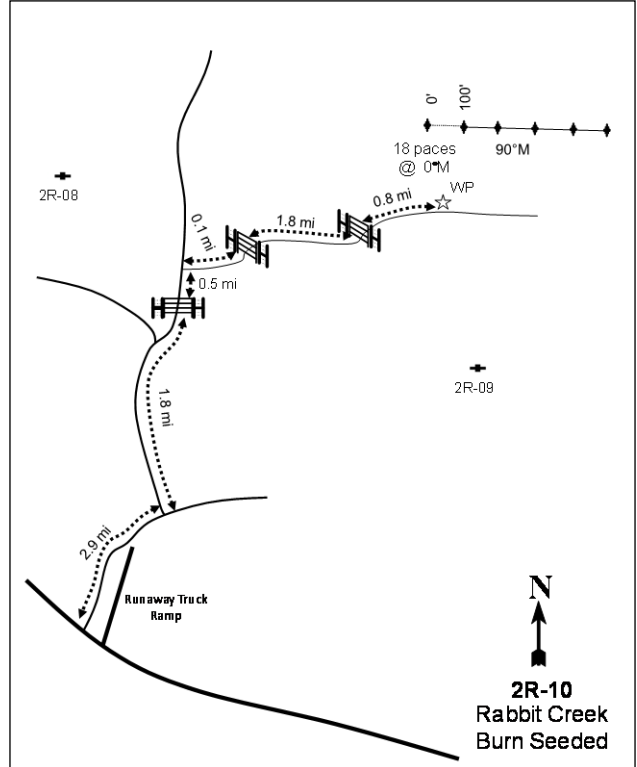
Directions: Traveling on highway 30, toward Bear Lake from Sage Creek Junction, turn right on a road that turns off the highway along with a runaway truck ramp. The road turns to the west of the ramp. Follow this road for 2.9 miles to a road that comes in on the left. Turn here and drive 1.8 miles to a gate. Pass through the gate and continue 0.5 miles to a two-track road on the right. Turn onto this and follow it for 0.1 miles to a gate, continue 1.8 miles to another gate. Pass through the gate and travel 0.8 miles to the witness post on the left (north) side of the road. The 0-foot post is 18 paces at 0°M from the witness post and is marked with browse tag #34.

Map Name: Sage Creek



Township: 13N Range: 7E Section: 18

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 483669 E 4635675 N

RABBIT CREEK BURN SEEDED - TREND STUDY NO. 2R-10

Site Information

Site Description: The study is located approximately five miles east of Bear Lake, within burned Wyoming big sagebrush flat. This study was established on private land in 2004 to monitor the vegetation response to a naturally caused fire (East Bear fire) which burned about 887 acres east of Bear Lake in the fall of 2003. The study site is located within the Bureau of Land Management (BLM) Rabbit Creek allotment. Approximately 500 acres of private land and 300 acres of BLM land were burned in the fire. The private land was drill seeded in 2003. The pasture was rested for two growing seasons following the seeding. The study was established on an area that was drill seeded after the fire (Table - Seed Mix). One-third of a mile to the south, the Rabbit Creek Burn study (2R-9) was established in an unseeded portion of the burn. Prior to the fire, the area was dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). The area is important habitat for antelope, wintering deer, and sage-grouse. About a dozen sage-grouse were seen east of the study in some unburned sagebrush in 2007 and fresh sage-grouse pellet groups were found near the site in 2012. Antelope/deer pellet groups were sampled in low abundance in 2007 and 2012. Cattle pellet groups were sampled in low abundance in 2004 and high abundance in 2007 and 2012. Sage-grouse pellet groups were sampled at 9 groups/acre in 2007 and 78 groups/acre in 2012 (Table - Pellet Group Data).

Browse: The dominant browse species is stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), which has provided the majority of the browse cover on the study site over the sample years. Previous to the fire, Wyoming big sagebrush was the dominant browse species. The key preferred browse species on the site is Wyoming big sagebrush. Other browse species sampled on the site are Utah serviceberry (*Amelanchier utahensis*), slenderbush eriogonum (*Eriogonum microthecum*), mountain snowberry (*Symphoricarpos oreophilus*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species is thickspike wheatgrass (*Agropyron dasystachyum*), which has provided the majority of the grass cover since the outset of the study. The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in relatively low abundance on the site. Other abundant grass species sampled on the site include Russian wildrye (*Elymus junceus*), big bluegrass (*Poa ampla*), and Sandberg bluegrass (*Poa secunda*). Seeded grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Agropyron intermedium*), orchardgrass (*Dactylis glomerata*), Great Basin wildrye (*Elymus cinereus*), and Russian wildrye. Forbs are moderately abundant and fairly diverse on the site, though in 2012 forbs were not very abundant. Forbs have fluctuated in abundance and diversity over the course of the study. False dandelion (*Agoseris glauca*), milkvetch (*Astragalus* sp.), tansymustard (*Descurainia pinnata*), purpledaisy fleabane (*Erigeron corymbosus*), longleaf phlox (*Phlox longifolia*), and clover (*Trifolium* sp.) have been more common on the site, though in 2012 forbs were rare (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Thatcher component, which is found on hillslopes and plateaus. The parent material consists of colluvium and/or slope alluvium derived from sandstone, quartzite, limestone, and conglomerate. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.6). Bare ground cover is moderate on the site, though there is a moderate amount of vegetation and high amount of litter providing protective ground cover. Bare ground cover was fairly high in 2004 and has since decreased (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Trend Assessments

Browse:

- **2001 to 2006 - slightly up (+1):** The density of Wyoming big sagebrush increased from 20 plants/acre to 360 plants/acre, though cover remained minimal.

- **2006 to 2011 - slightly up (+1):** The density of Wyoming big sagebrush increased to 560 plants/acre, and cover increased to 1%.

Grass:

- **2001 to 2006 - up (+2):** The sum of nested frequency of perennial grasses increased 30%, and cover increased from 10% to 17%. Thickspike wheatgrass increased significantly in nested frequency, and cover increased from 4% to 10%.
- **2006 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased 21%, though cover decreased to 16%. Thickspike wheatgrass increased significantly in nested frequency though cover decreased to 8%.

Forb:

- **2001 to 2006 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 13%, though cover remained similar at 12%.
- **2006 to 2011 - down (-2):** The sum of nested frequency of perennial forbs decreased 80%, and cover decreased to 2%.

SEED MIX--

Management unit 02R, Study no: 10

Project Name: Rabbit Creek			
WRI Database #:PDB			
Application: Drill		Acres: 500	
Seed type		lbs in mix	lbs/acre
G	Great Basin Wildrye	500	1.00
G	Intermediate Wheatgrass	500	1.00
G	Russian Wildrye	1000	2.00
G	Orchardgrass 'Paiute'	500	1.00
F	Alfalfa 'Ranger'	500	1.00
F	Small Burnet	1184	2.37
B	Bitterbrush	120	0.24
B	Fourwing Saltbush	250	0.50
Total Pounds:		4554	9.11

Trend Summary

HERBACEOUS TRENDS--

Management unit 02R, Study no: 10

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	5	2	2	.18	.15	.15
G	Agropyron dasystachyum	a228	b337	c381	4.40	10.18	7.81
G	Agropyron intermedium	b30	a8	a-	.63	.04	-
G	Agropyron spicatum	a-	a8	b33	-	.33	.85
G	Bromus japonicus (a)	-	9	-	-	.01	-
G	Bromus tectorum (a)	a14	ab39	b68	.24	.13	.22
G	Dactylis glomerata	b116	a29	a8	2.22	1.27	.06
G	Elymus cinereus	-	5	5	-	.03	.03
G	Elymus junceus	a-	c84	b46	-	2.28	1.45
G	Koeleria cristata	-	4	14	-	.15	.08

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Melica bulbosa	-	-	-	.00	-	-
G	Oryzopsis hymenoides	3	1	-	.00	.00	.00
G	Poa ampla	23	15	52	.66	.54	1.15
G	Poa bulbosa	-	-	-	-	.00	-
G	Poa secunda	a41	b116	c196	.98	1.95	4.24
G	Sitanion hystrix	1	1	-	.00	.03	-
G	Stipa columbiana	b15	a-	a-	.39	-	-
G	Stipa comata	4	-	6	.03	-	.02
G	Stipa lettermani	16	16	13	.12	.25	.22
Total for Annual Grasses		14	48	68	0.24	0.14	0.22
Total for Perennial Grasses		482	626	756	9.65	17.25	16.09
Total for Grasses		496	674	824	9.89	17.40	16.32
F	Achillea millefolium	2	-	10	.15	-	.07
F	Agoseris glauca	b124	b127	a1	1.01	1.33	.00
F	Allium sp.	-	-	-	.00	-	-
F	Alyssum alyssoides (a)	-	2	-	-	.00	-
F	Astragalus cibarius	b15	a-	a-	.97	-	-
F	Astragalus convallarius	6	6	3	.02	.04	.01
F	Astragalus sp.	c104	b69	a2	1.06	.84	.00
F	Astragalus utahensis	-	3	-	-	.01	-
F	Calochortus nuttallii	3	-	-	.01	-	-
F	Chenopodium album (a)	b18	a-	a-	.10	-	-
F	Chenopodium fremontii (a)	2	-	-	.03	-	-
F	Chenopodium leptophyllum(a)	1	-	-	.00	-	-
F	Cirsium sp.	12	8	2	.15	.20	.01
F	Collinsia parviflora (a)	b52	b64	a1	.39	.16	.00
F	Collomia linearis (a)	a-	b23	a-	-	.04	-
F	Cordylanthus sp. (a)	3	-	-	.00	-	-
F	Crepis acuminata	14	-	-	.04	-	-
F	Cryptantha sp.	5	-	-	.01	-	-
F	Cymopterus sp.	-	4	-	-	.00	-
F	Descurainia pinnata (a)	b129	c277	a-	3.69	2.46	-
F	Draba sp. (a)	1	-	-	.03	-	-
F	Erigeron corymbosus	b82	b75	a22	2.33	2.27	.12
F	Erigeron filifolius	8	-	6	.15	-	.01
F	Eriogonum umbellatum	1	-	5	.03	-	.01
F	Gayophytum ramosissimum(a)	4	-	-	.03	-	-
F	Lactuca serriola (a)	-	-	-	.00	-	-
F	Linum lewisii	b1	b9	a-	.00	.05	-
F	Lupinus argenteus	-	-	-	-	.00	-
F	Medicago sativa	c50	b18	a-	.38	.10	-
F	Microsteris gracilis (a)	b2	b14	a-	.01	.05	-
F	Penstemon radicosus	1	2	-	.00	.00	-
F	Phlox hoodii	a24	a20	b47	.14	.40	.78
F	Phlox longifolia	a73	b207	a56	.26	2.82	.52

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	<i>Polygonum douglasii</i> (a)	_b 25	_a 5	_{ab} 14	.18	.00	.03
F	<i>Ranunculus testiculatus</i> (a)	_a 7	_b 36	_a 8	.03	.16	.04
F	<i>Sanguisorba minor</i>	_c 110	_b 12	_a -	1.56	.13	-
F	<i>Schoenocrambe linifolia</i>	_b 14	_b 21	_a -	.55	.19	-
F	<i>Senecio integerrimus</i>	_b 20	_a 2	_a -	.81	.01	-
F	<i>Sphaeralcea grossulariifolia</i>	3	1	-	.03	.03	-
F	<i>Taraxacum officinale</i>	3	-	-	.06	-	-
F	<i>Tragopogon dubius</i> (a)	-	-	-	.00	-	-
F	<i>Trifolium</i> sp.	_b 198	_b 198	_a -	1.79	3.36	-
F	<i>Veronica biloba</i> (a)	_a -	_b 23	_a -	-	.08	-
F	<i>Viola</i> sp.	26	-	-	.20	-	-
F	<i>Zigadenus paniculatus</i>	-	1	-	-	.03	-
Total for Annual Forbs		244	444	23	4.53	2.98	0.08
Total for Perennial Forbs		899	783	154	11.77	11.86	1.54
Total for Forbs		1143	1227	177	16.30	14.85	1.62

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 02R, Study no: 10

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	<i>Artemisia tridentata wyomingensis</i>	1	16	21	.01	.10	.94
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	80	87	87	2.17	5.24	5.34
B	<i>Eriogonum microthecum</i>	2	6	10	.03	.63	.24
B	<i>Symphoricarpos oreophilus</i>	1	1	1	-	.03	-
B	<i>Tetradymia canescens</i>	26	36	36	.27	1.17	2.96
Total for Browse		110	146	155	2.50	7.17	9.50

CANOPY COVER, LINE INTERCEPT--

Management unit 02R, Study no: 10

Species	Percent Cover		
	'04	'07	'12
<i>Artemisia tridentata wyomingensis</i>	-	.10	1.03
<i>Chrysothamnus viscidiflorus viscidiflorus</i>	2.46	5.18	7.11
<i>Eriogonum microthecum</i>	.11	.21	.60
<i>Symphoricarpos oreophilus</i>	.31	.63	.58
<i>Tetradymia canescens</i>	.25	1.61	2.18

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 02R, Study no: 10

Species	Average leader growth (in) '12
Artemisia tridentata wyomingensis	1.4

BASIC COVER--
Management unit 02R, Study no: 10

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	32.12	43.76	27.36
Rock	.53	.26	.87
Pavement	9.01	3.31	3.06
Litter	1.81	31.26	45.37
Bare Ground	65.31	35.21	37.35

SOIL ANALYSIS DATA --

Management unit 2R, Study no: 10, Study Name: Rabbit Creek Burn Seeded

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
13.1	6.6	32.6	40.1	27.3	3.9	19.1	195.2	0.9

PELLET GROUP DATA--
Management unit 02R, Study no: 10

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	-	15	10	-	-	-
Grouse	1	2	16	-	9 groups/acre	78 groups/acre
Deer	-	-	4	-	1 (2)	3 (7)
Cattle	-	5	12	1 (4)	49 (120)	67 (165)

BROWSE CHARACTERISTICS--
Management unit 02R, Study no: 10

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Amelanchier utahensis									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	17/25
Artemisia tridentata wyomingensis									
04	20	100	0	-	120	0	0	0	-/-
07	360	61	39	-	180	17	6	0	9/11
12	560	21	79	-	140	11	14	11	15/20

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
04	5780	49	51	0	720	0	0	0	8/9	
07	6000	2	83	15	-	0	3	9	10/15	
12	6360	3	93	4	-	18	2	36	9/18	
<i>Eriogonum microthecum</i>										
04	60	100	0	-	-	0	0	0	6/6	
07	200	0	100	-	-	0	0	0	9/11	
12	340	0	100	-	-	53	0	0	8/14	
<i>Symphoricarpos oreophilus</i>										
04	40	100	0	-	-	0	0	0	24/41	
07	40	0	100	-	-	0	0	0	23/45	
12	20	0	100	-	-	0	0	0	20/42	
<i>Tetradymia canescens</i>										
04	900	76	24	0	60	0	0	0	8/10	
07	1000	12	88	0	-	6	0	0	11/21	
12	1020	6	90	4	80	18	12	24	13/27	

CACHE CAVE 1 - TREND STUDY NO. 6R-1-12

Vegetation Type: Basin Big Sagebrush

Range Type: Crucial Deer Summer, Crucial Elk Summer

NRCS Ecological Site Description: [Upland Loam \(Basin Big Sagebrush\), R047XA308UT](#)

Land Ownership: Private

Elevation: 6,560 ft (2,000 m)

Aspect: North

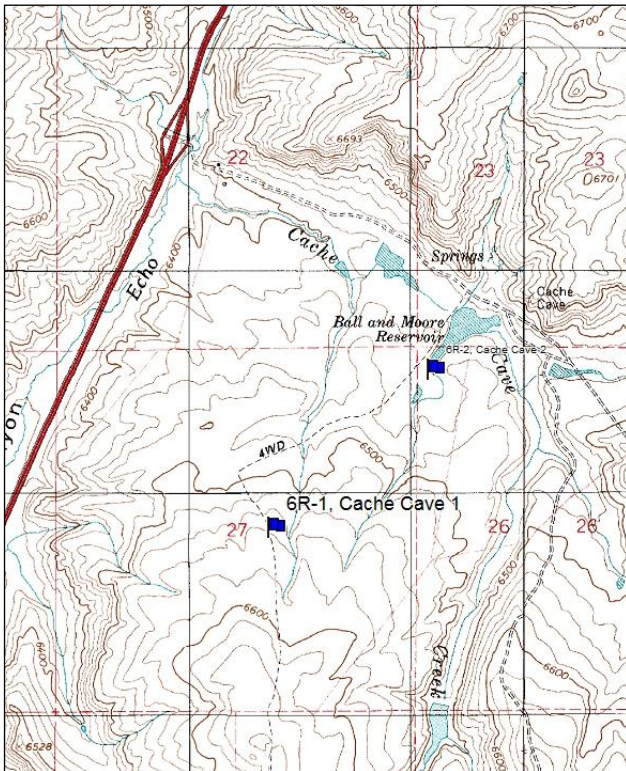
Slope: 5%

Transect bearing: 343° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

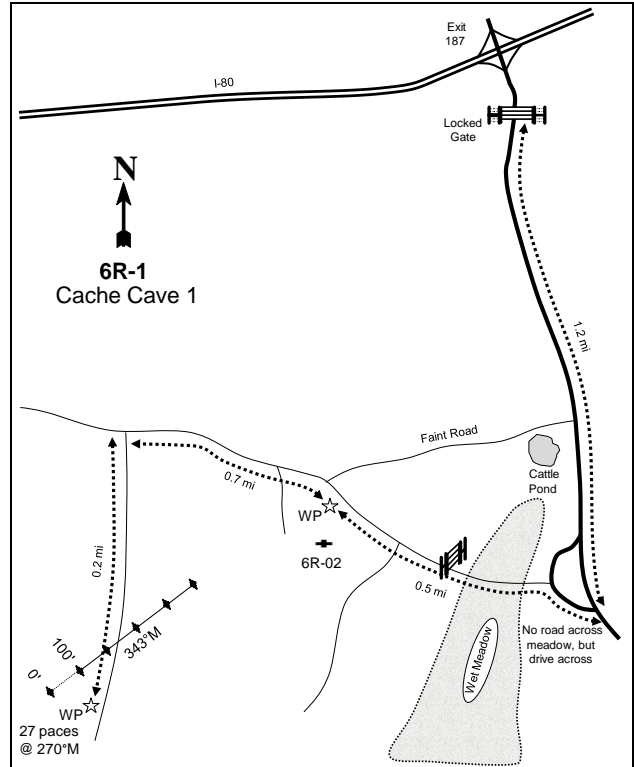
Directions: From I-80 take exit 187 and turn southeast onto the access road. Travel 1.2 miles southeast to a road that comes in from the right. Turn here and travel 0.5 miles northwest through a meadow to a road. There is a witness post for study 6R-2 on the left (southeast) side of the road. Continue 0.7 miles to a road on the left (south). Take this road and travel 0.2 miles to a witness post on the right (west) side of the road. The 0-foot stake is 27 paces from the witness post at 270°M and is marked with browse tag #32.

Map Name: Shearing Corral



Township: 5N Range: 7E Section: 27

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 488295 E 4553998 N

CACHE CAVE 1 - TREND STUDY NO. 6R-1

Site Information

Site Description: The study is located approximately one mile east of Interstate 80 and quarter mile south of Cache Cave. Prior to treatment, the study was established on private land in 2004 to monitor the effects of a 500-acre double-drum aerator and seeding treatment in the fall of 2004 to reduce sagebrush and to enhance the herbaceous understory. Another study, Cache Cave 2 (6R-2) was established two thirds mile to the northeast to monitor the same treatment in two locations, but not as comparisons of one another. Sheep ranching is the primary use of the land. Deer and elk also use the area. Sheep pellet groups were sampled in moderate abundance throughout the sample years. Deer and elk pellet groups were sampled in low abundance over the sample years. Cattle pellet groups were sampled in low abundance in 2004. Sage-grouse pellet groups were sampled at 9 groups/acre in 2012 (Table - Pellet Group Data).

Browse: The dominant preferred browse species on the site is basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) has been sampled in moderately abundant on the site since the outset of the study. The basin big sagebrush population is a dense, young population with low decadence and poor vigor within the population, though decadence was high in 2004 and 2007. The sagebrush population displays mostly moderate use, though use was light in 2004 and 2007. The recruitment of young sagebrush plants to the population has been good following the treatment. Other browse species sampled on the site include black sagebrush (*Artemisia nova*), broom snakeweed (*Gutierrezia sarothrae*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species on the site is western wheatgrass (*Agropyron smithii*), which has provided the majority of the grass cover on the site over the sampled years. The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in low abundance on the site over the sample years, though in 2007 abundance was higher. Seeded species sampled on the site include bluebunch wheatgrass (*Agropyron spicatum*) and orchardgrass (*Dactylis glomerata*). Forbs are not abundant, but are somewhat diverse on the site, though forbs were very rare in 2012. Seeded forb species sampled on the site include alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*), though each species has been rare on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Richsum-Heiners complex and is likely part of the Richsum component, which is found on mountain slopes. The parent material consists of slope alluvium derived from sandstone, conglomerate, and shale. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a slightly acidic soil reaction (pH 6.5). Bare ground cover is low on the site, though there is a moderate amount of vegetation and high amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of basin big sagebrush decreased from 4,600 plants/acre to 4,360 plants/acre, and canopy cover decreased from 23% to 6%. The health of the sagebrush population improved slightly with decadence decreasing from 38% to 26% and plants displaying poor vigor remained similar at 16%. The recruitment of young sagebrush plants to the population increased after the treatment from 3% to 56%. The density of stickyleaf low rabbitbrush increased 60% from 5,420 plants/acre to 8,660 plants/acre, and canopy cover remained similar at 7%.

Grasses: The sum of nested frequency of perennial grasses increased 56%, and cover increased from 5% to 20%. Western wheatgrass remained similar in nested frequency, and cover increased from 3% to 10%. Cheatgrass increase in cover from less than 1% to 3% cover. The seeded grass species orchardgrass provided 1% cover following the treatment.

Forbs: The sum of nested frequency of perennial forbs increased 26%, and cover increased from 1% to 3%. Pale alyssum (*Alyssum alyssoides*) increased significantly in nested frequency and cover increased from 1% to 7%.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of basin big sagebrush increased 75% to 7,620 plants/acre, and canopy cover increased to 13%. The health of the sagebrush population improved with decadence decreasing to 5% of the population, though plants displaying poor vigor increased to 21%. The recruitment of young sagebrush plants to the population remained good at 27%. The density of stickyleaf low rabbitbrush decreased by 32% to 5,860 plants/acre, and canopy cover decreased to 2%.

Grass:

- **2007 to 2012 - Slightly down (-1):** The sum of nested frequency of perennial grasses decreased 17%, and cover decreased to 12%. Western wheatgrass cover decreased to 7%. Cheatgrass cover decreased to 1%.

Forb:

- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased 74%, and cover decreased to less than 1%.

SEED MIX--

Management unit 06R, Study no: 1

Project Name: Cache Cave			
WRI Database #: PDB			
Application: Aerator		Acres: 500	
Seed type		lbs in mix	lbs/acre
G	Great Basin Wildrye 'Trailhead'	500	1.00
G	Orchardgrass 'Paiute'	500	1.00
G	Bluebunch Wheatgrass 'Goldar'	750	1.50
G	Russian Wildrye 'Bozoisky'	500	1.00
F	Alfalfa 'Ladak+'	650	1.30
F	Cicer Milkvetch 'Lutana'	650	1.30
F	Sainfoin	1000	2.00
F	Small Burnet 'Delar'	1000	2.00
B	Fourwing Saltbush	250	0.50
Total Pounds:		5800	11.60
PLS Pounds:			10.25

Trend Summary

HERBACEOUS TRENDS--

Management unit 06R, Study no: 1

T y p e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron smithii	_a 248	_{ab} 304	_b 306	2.60	10.39	6.87
G	Agropyron spicatum	_a -	_a -	_b 27	-	.00	.84

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Bromus tectorum (a)	58	89	62	.35	3.01	1.18
G	Carex sp.	a34	a16	b62	.26	.26	.95
G	Dactylis glomerata	a-	b77	a-	-	1.21	-
G	Juncus balticus	5	-	-	.03	-	-
G	Poa fendleriana	b69	ab33	a28	.61	.70	.85
G	Poa pratensis	-	8	-	-	.18	-
G	Poa secunda	a8	c184	b135	.06	4.35	1.44
G	Sitanion hystrix	b29	b32	a4	.73	.49	.01
G	Stipa comata	12	25	12	.27	.93	.48
G	Stipa lettermani	a52	ab33	a20	.31	1.18	.64
Total for Annual Grasses		58	89	62	0.35	3.01	1.18
Total for Perennial Grasses		457	712	594	4.88	19.73	12.11
Total for Grasses		515	801	656	5.24	22.74	13.29
F	Achillea millefolium	-	1	-	-	.00	-
F	Agoseris glauca	3	2	3	.01	.00	.00
F	Allium sp.	3	1	-	.01	.00	-
F	Alyssum alyssoides (a)	b229	c408	a141	.88	7.01	.31
F	Antennaria rosea	b43	b30	a7	.20	.41	.19
F	Arabis sp.	-	7	-	-	.01	-
F	Astragalus beckwithii	2	-	-	.01	-	-
F	Astragalus convallarius	-	-	4	-	-	.00
F	Calochortus nuttallii	4	-	-	.01	-	-
F	Carduus nutans (a)	-	1	-	-	.03	-
F	Chenopodium leptophyllum(a)	11	1	-	.02	.00	-
F	Cirsium sp.	-	1	-	-	.03	-
F	Collinsia parviflora (a)	b22	b26	a2	.05	.06	.01
F	Cordylanthus sp. (a)	b157	a29	a26	2.50	.21	.10
F	Descurainia pinnata (a)	4	11	2	.01	.02	.00
F	Erigeron pumilus	a1	b13	a-	.00	.04	-
F	Lappula occidentalis (a)	4	-	-	.01	.00	-
F	Medicago sativa	a-	b20	a-	-	.09	-
F	Microsteris gracilis (a)	c104	b35	a-	.23	.13	-
F	Navarretia intertexta (a)	3	-	1	.00	-	.03
F	Onobrychis viciaefolia	a-	b21	a-	-	.25	-
F	Phlox austromontana	17	25	9	.22	.57	.05
F	Phlox longifolia	b86	ab65	a34	.24	.37	.10
F	Polygonum douglasii (a)	b19	c51	a-	.05	.12	-
F	Ranunculus testiculatus (a)	a40	b91	a28	.10	.36	.07
F	Sanguisorba minor	a-	b27	a2	-	.46	.01
F	Schoenrambe linifolia	-	3	-	-	.00	-
F	Sphaeralcea munroana	-	3	1	-	.01	.00
F	Taraxacum officinale	b14	ab10	a-	.19	.09	-
F	Tragopogon dubius (a)	4	-	-	.00	-	-
F	Trifolium sp.	5	-	-	.01	-	-
F	Verbascum thapsus	-	4	-	-	.15	-

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	Viola sp.	b ⁷	a ⁻	a ⁻	.02	-	-
Total for Annual Forbs		597	653	200	3.87	7.98	0.52
Total for Perennial Forbs		185	233	60	0.96	2.54	0.38
Total for Forbs		782	886	260	4.83	10.52	0.91

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 06R, Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata tridentata	90	82	87	21.10	7.01	12.32
B	Chrysothamnus viscidiflorus viscidiflorus	77	80	75	6.36	6.33	2.52
B	Gutierrezia sarothrae	0	2	2	.00	.06	.15
B	Tetradymia canescens	1	0	1	.00	-	-
Total for Browse		168	164	165	27.47	13.41	14.99

CANOPY COVER, LINE INTERCEPT--

Management unit 06R, Study no: 1

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata tridentata	23.25	6.40	12.54
Chrysothamnus viscidiflorus viscidiflorus	7.18	7.25	2.08
Gutierrezia sarothrae	-	.06	.21

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 06R, Study no: 1

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata tridentata	1.4	1.4	1.7

BASIC COVER--

Management unit 06R, Study no: 1

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	42.39	43.73	29.27
Rock	.39	.40	.45
Pavement	.45	1.64	.54
Litter	38.98	43.14	65.87
Cryptogams	15.86	4.85	.88
Bare Ground	22.38	17.75	18.79

SOIL ANALYSIS DATA --

Management unit 6R, Study no: 1, Study Name: Cache Cave 1

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.8	6.5	47.3	29.4	23.3	2.8	27.0	166.4	0.7

PELLET GROUP DATA--

Management unit 06R, Study no: 1

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Sheep	5	37	29	26 (64)	39 (96)	32 (79)
Rabbit	20	41	9	-	-	-
Grouse	-	-	1	-	-	9 groups/acre
Elk	1	-	-	3 (7)	1 (2)	2 (5)
Deer	2	1	2	7 (18)	3 (7)	3 (8)
Cattle	-	-	1	1 (2)	-	-

BROWSE CHARACTERISTICS--

Management unit 06R, Study no: 1

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia nova</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	9/22
<i>Artemisia tridentata tridentata</i>									
04	4600	3	59	38	840	0	.43	17	44/37
07	4360	56	18	26	2900	13	1	16	29/28
12	7620	27	68	5	2980	51	8	21	26/25
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
04	5420	3	97	1	380	0	0	.36	9/12
07	8660	2	88	10	180	30	13	2	6/12
12	5860	4	49	47	460	27	53	70	5/9
<i>Gutierrezia sarothrae</i>									
04	0	0	0	-	-	0	0	0	-/-
07	120	0	100	-	-	0	0	0	4/5
12	540	0	100	-	-	0	0	0	3/7
<i>Tetradymia canescens</i>									
04	20	100	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	-/-
12	40	0	0	100	-	0	0	100	2/4

CACHE CAVE 2 - TREND STUDY NO. 6R-2-12

Vegetation Type: Stickyleaf Low Rabbitbrush

Range Type: Crucial Deer Summer, Crucial Elk Summer

NRCS Ecological Site Description: [Upland Loam \(Basin Big Sagebrush\), R047XA308UT](#)

Land Ownership: Private

Elevation: 6,450 ft (1,966 m)

Aspect: North

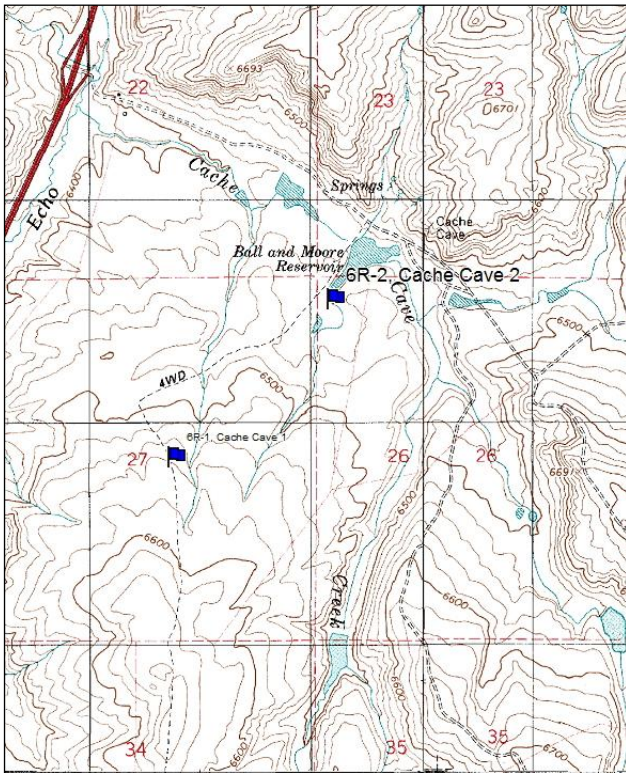
Slope: 3%

Transect bearing: 180° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

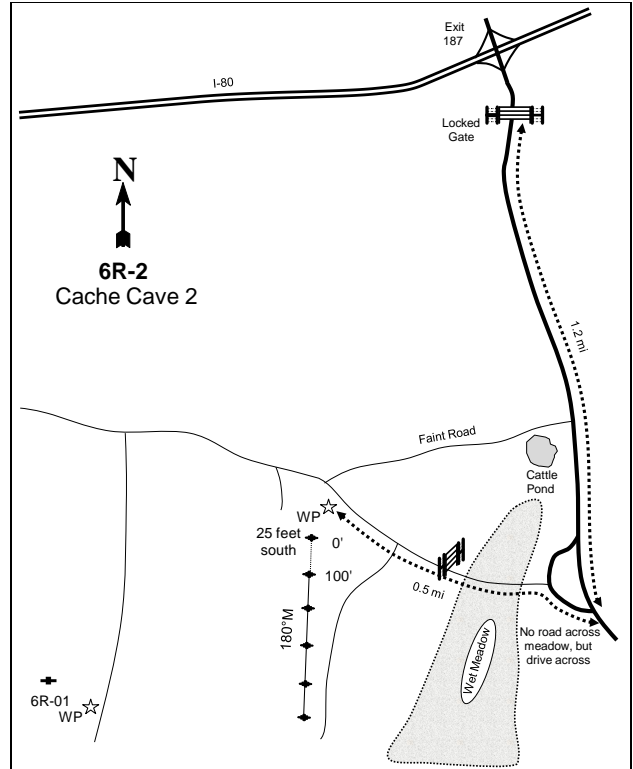
Directions: Directions: From I-80 take exit 187 and turn southeast onto the access road. Travel 1.2 miles southeast to a road that comes in from the right. Turn here and travel 0.5 miles northwest through a meadow to a road. There is a witness post on the left (southeast) side of the road. The 0-foot stake is 25 feet southeast of the witness post.

Map Name: Shearing Corral



Township: 5N Range: 7E Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 489017 E 4554708 N

CACHE CAVE 2 - TREND STUDY NO. 6R-2

Site Information

Site Description: The study is located approximately one mile east of Interstate 80 and a quarter mile south of Cache Cave. Prior to treatment, the study was established on private land in 2004 to monitor the effects of a 500-acre double-drum aerator and seeding treatment in the fall of 2004 to reduce sagebrush and to enhance the herbaceous understory. This study is located in a bottom area, which is more mesic than the upland Cache Cave 1 (6R-1) study located two-thirds mile to the southwest. Sheep ranching is the primary use of the land. Deer and elk also use the area. Sheep pellet groups were sampled in high abundance in 2007 and moderate abundance in 2004 and 2012. Deer and elk pellet groups were sampled in low abundance over the sample years. Cattle pellet groups were sampled in low abundance in 2004 and 2007 (Table - Pellet Group Data).

Browse: The dominant browse species is stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), which has provided the majority of the browse cover on the study site over the sample years. The preferred browse species on the site is basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and black sagebrush (*Artemisia nova*). The basin big sagebrush population is a moderately dense, young population with low decadence and good vigor within the population, though decadence was high in 2004 and 2007 and vigor was poor in 2007. The big sagebrush population displays mostly moderate use, though use was light in 2004 and 2007. The recruitment of young big sagebrush plants to the population has been good following the treatment. The black sagebrush is a dense, heavily used population with low decadence and poor vigor within the population. Recruitment of young black sagebrush plants to the population has been poor over the sampled years (Table - Browse Characteristics).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The dominant grass species on the site is western wheatgrass (*Agropyron smithii*), which has provided the majority of the grass cover on the site over the sampled years. Other common grass species sampled on the site include orchardgrass (*Dactylis glomerata*), mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*P. secunda*), and Letterman bluegrass (*Stipa lettermani*). The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in low abundance on the site in 2012. Seeded species sampled on the site include bluebunch wheatgrass (*Agropyron spicatum*), Russian wildrye (*Elymus junceus*), and orchardgrass (*Dactylis glomerata*). Forbs are not abundant, but are somewhat diverse on the site, though forbs were very rare in 2012. Seeded forb species sampled on the site include sainfoin (*Onobrychis viciaefolia*) and small burnet (*Sanguisorba minor*), though each species has been rare on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Richsum-Heiners complex and is likely part of the Richsum component, which is found on mountain slopes. The parent material consists of slope alluvium derived from sandstone, conglomerate, and shale. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.3). Bare ground cover is low on the site, though there is a moderate amount of vegetation and high amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of basin big sagebrush decreased 37% from 3,800 plants/acre to 2,400 plants/acre, and canopy cover decreased from 15% to 1%. The health of the sagebrush population improved slightly with decadence decreasing from 32% to 28% though plants displaying poor vigor increased from 19% to 26%. The recruitment of young sagebrush plants to the population increased after the treatment from 9% to 57%. The density of black sagebrush decreased from 2,960 plants/acre to 2,800 plants/acre, and canopy cover decreased from 10% to 3%. The density of stickyleaf low rabbitbrush increased from 7,400 plants/acre to 18,420 plants/acre, and canopy cover increased from 16% to 7%.

Grasses: The sum of nested frequency of perennial grasses increased 74%, and cover increased from 4% to 22%. Western wheatgrass increased significantly in nested frequency, and cover increased 2% to 9%. The seeded grass species orchardgrass provided 1% cover following the treatment.

Forbs: The sum of nested frequency of perennial forbs increased 41%, and cover remained similar at 2%.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of basin big sagebrush increased by 33% to 3,180 plants/acre, and canopy cover increased to 4%. The health of the sagebrush population improved with decadence decreasing to 3% of the population, and plants displaying poor vigor decreased to 16%. The recruitment of young sagebrush plants to the population remained good at 20%. The density of black sagebrush increased 34% to 3,740 plants/acre, and canopy cover increased to 6%. The density of stickyleaf low rabbitbrush decreased to 17,120 plants/acre, and canopy cover increased to 18%.

Grass:

- **2007 to 2012 - Slightly down (-1):** The sum of nested frequency of perennial grasses decreased 17%, and cover decreased to 6%. Western wheatgrass significantly decreased in nested frequency, and cover decreased to 7%.

Forb:

- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased 56%, and cover decreased to 1%.

SEED MIX--

Management unit 06R, Study no: 2

Project Name: Cache Cave			
WRI Database #: PDB			
Application: Aerator		Acres: 500	
Seed type		lbs in mix	lbs/acre
G	Great Basin Wildrye 'Trailhead'	500	1.00
G	Orchardgrass 'Paiute'	500	1.00
G	Bluebunch Wheatgrass 'Goldar'	750	1.50
G	Russian Wildrye 'Bozoisky'	500	1.00
F	Alfalfa 'Ladak+'	650	1.30
F	Cicer Milkvetch 'Lutana'	650	1.30
F	Sainfoin	1000	2.00
F	Small Burnet 'Delar'	1000	2.00
B	Fourwing Saltbush	250	0.50
Total Pounds:		5800	11.60
PLS Pounds:			10.25

Trend Summary

HERBACEOUS TRENDS--

Management unit 06R, Study no: 2

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron smithii	_a 200	_c 294	_b 251	1.64	9.05	2.98
G	Agropyron spicatum	_a -	_a 3	_b 32	-	.03	.23
G	Bromus tectorum (a)	-	-	5	-	-	.00
G	Carex obtusata	_a 30	_a 54	_b 113	.13	.39	.58
G	Dactylis glomerata	_a -	_b 105	_a -	-	1.18	-
G	Elymus junceus	-	11	-	-	.09	-
G	Juncus balticus	_a -	_a 6	_b 27	-	.06	.09
G	Poa fendleriana	_b 83	_{ab} 67	_a 38	.69	2.79	.22
G	Poa pratensis	-	9	-	-	.36	-
G	Poa secunda	_a -	_b 88	_c 162	-	2.46	1.14
G	Sitanion hystrix	_a 8	_b 27	_a 5	.02	.32	.01
G	Stipa comata	-	-	8	-	-	.09
G	Stipa lettermani	_b 153	_b 159	_a 45	1.51	5.44	.59
G	Unknown grass - annual (a)	31	-	-	.08	-	-
Total for Annual Grasses		31	0	5	0.08	0	0.00
Total for Perennial Grasses		474	823	681	4.00	22.20	5.97
Total for Grasses		505	823	686	4.08	22.20	5.98
F	Achillea millefolium	34	33	32	.14	.28	.12
F	Agoseris glauca	2	2	-	.01	.00	-
F	Allium sp.	-	2	-	-	.00	-
F	Alyssum alyssoides (a)	_b 55	_c 134	_a 8	.09	.62	.01
F	Antennaria rosea	59	48	32	1.18	.93	.46
F	Arabis sp.	3	6	-	.01	.01	-
F	Chenopodium leptophyllum(a)	4	4	2	.01	.03	.00
F	Collinsia parviflora (a)	_b 55	_b 30	_a -	.11	.12	-
F	Cordylanthus sp. (a)	_c 92	_b 12	_a -	.87	.08	-
F	Cryptantha sp.	1	-	-	.00	-	-
F	Descurainia pinnata (a)	_a 5	_b 77	_a -	.01	.27	-
F	Draba sp. (a)	-	5	-	-	.01	-
F	Gayophytum ramosissimum(a)	4	-	-	.02	-	-
F	Lappula occidentalis (a)	_{ab} 2	_b 8	_a -	.01	.02	-
F	Microsteris gracilis (a)	_b 57	_b 29	_a -	.10	.10	-
F	Navarretia intertexta (a)	-	-	1	-	-	.00
F	Onobrychis viciaefolia	-	5	8	-	.01	.01
F	Orthocarpus luteus (a)	-	3	-	-	.00	-
F	Phlox austromontana	5	6	3	.06	.09	.03
F	Phlox longifolia	_b 45	_b 47	_a 1	.12	.16	.00
F	Polygonum douglasii (a)	_b 70	_c 147	_a 26	.16	.66	.06
F	Ranunculus testiculatus (a)	_a 33	_b 161	_a 12	.09	.99	.02
F	Sanguisorba minor	_a -	_b 21	_a -	-	.41	-
F	Sphaeralcea munroana	-	2	-	-	.03	-
F	Taraxacum officinale	4	3	-	.00	.00	-

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	Tragopogon dubius (a)	-	1	-	-	.03	-
F	Trifolium sp.	_b 11	_{ab} -	_b 1	.03	-	.00
F	Unknown forb-annual (a)	-	3	-	-	.03	-
F	Viola sp.	_b 17	_a -	_a -	.05	-	-
Total for Annual Forbs		377	614	49	1.48	3.00	0.11
Total for Perennial Forbs		181	175	77	1.62	1.95	0.64
Total for Forbs		558	789	126	3.10	4.96	0.76

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 06R, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia nova	45	42	49	8.83	3.54	2.86
B	Artemisia tridentata tridentata	77	55	63	11.21	1.28	2.56
B	Chrysothamnus viscidiflorus viscidiflorus	97	95	95	11.41	13.62	13.00
Total for Browse		219	192	207	31.46	18.45	18.42

CANOPY COVER, LINE INTERCEPT--

Management unit 06R, Study no: 2

Species	Percent Cover		
	'04	'07	'12
Artemisia nova	9.66	2.73	5.56
Artemisia tridentata tridentata	14.85	1.26	3.75
Chrysothamnus viscidiflorus viscidiflorus	16.20	15.76	18.03

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 06R, Study no: 2

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata tridentata	1.9	1.1	1.5

BASIC COVER--

Management unit 06R, Study no: 2

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	40.46	42.90	25.72
Rock	.04	.05	.03
Pavement	.13	.42	.11
Litter	35.42	39.23	61.74
Cryptogams	5.06	.65	.01
Bare Ground	34.38	29.57	24.25

SOIL ANALYSIS DATA --

Management unit 6R, Study no: 2, Study Name: Cache Cave 2

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.6	7.3	33.3	36.1	30.6	2.3	34.9	268.8	0.8

PELLET GROUP DATA--

Management unit 06R, Study no: 2

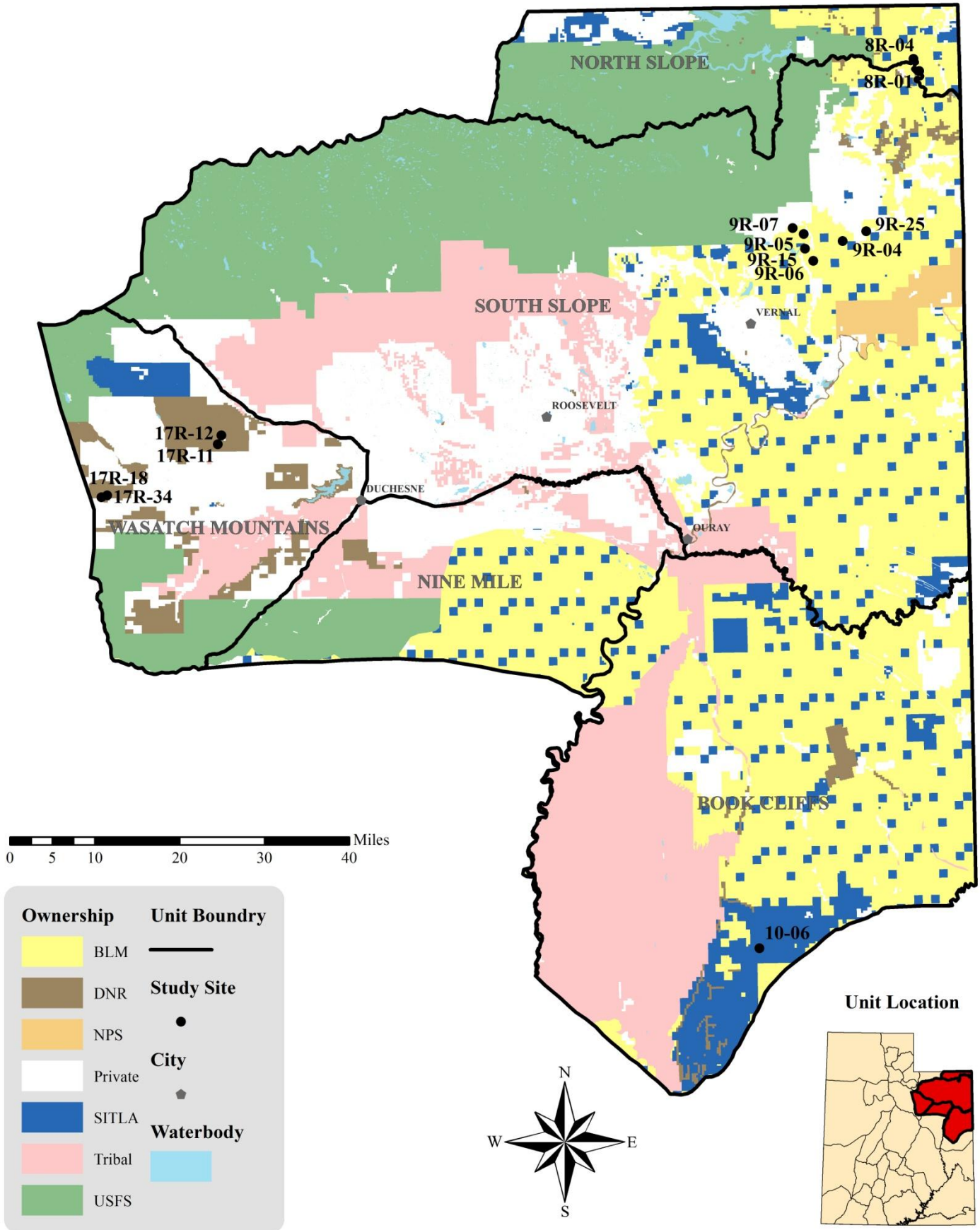
Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Sheep	5	42	30	25 (61)	70 (172)	32 (78)
Rabbit	22	31	7	-	-	-
Horse	-	1	-	-	1(1)	-
Grouse	-	-	3	-	-	-
Elk	5	1	-	6 (15)	1 (3)	1 (2)
Deer	4	4	6	3 (8)	1 (3)	-
Cattle	1	-	-	1 (4)	4 (9)	-

BROWSE CHARACTERISTICS--

Management unit 06R, Study no: 2

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia nova									
04	2960	1	78	20	40	7	5	5	8/15
07	2800	0	79	21	360	8	0	25	6/15
12	3740	0	91	9	20	20	78	22	6/15
Artemisia tridentata tridentata									
04	3800	9	59	32	860	2	.52	19	37/36
07	2400	57	16	28	1000	6	.83	26	20/17
12	3180	20	77	3	60	59	16	16	15/16
Chrysothamnus viscidiflorus viscidiflorus									
04	7400	5	95	1	260	0	0	0	8/12
07	18420	13	79	8	480	19	5	3	8/15
12	17120	7	91	2	920	24	1	26	7/12

Northeastern Region WRI Studies 2011



BROWN'S PARK DOUBLE DRUM - TREND STUDY NO. 8R-1-12

Vegetation Type: Black Greasewood

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Alkali Flat (Black Greasewood), R034XY006U

Land Ownership: UDWR

Elevation: 5,445 ft (1,660 m)

Aspect: Southwest

Slope: 2%

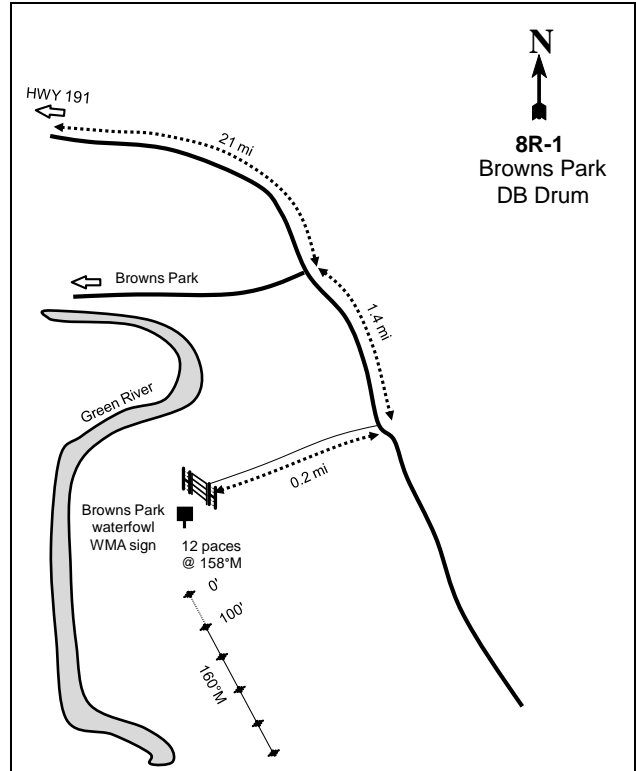
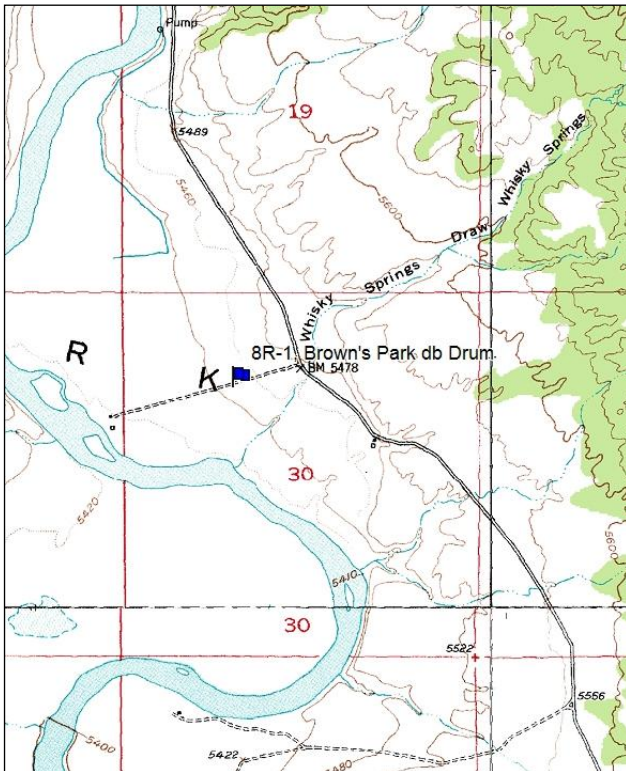
Transect bearing: 160° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: From Dutch John, proceed north toward Antelope Flat on Highway US 191 for approximately 8 miles. Turn east onto the Antelope Flat Road, before reaching the Wyoming border, toward Goslin Mountain. Drive for 21 miles to a fork. Continue south on the main road for 1.4 miles to another fork. Turn right (west) and drive 0.2 miles to a UDWR gate. From the southern-most post of the gate walk 12 paces at 158°M to the 0-foot stake. The 0-foot stake is marked with browse tag #84.

Map Name: Clay Basin

Diagrammatic Sketch:



Township: 2N Range: 25E Section: 30

GPS: NAD 83, UTM 12S 656751 E 4527531 N

Site Information

Site Description: The study is located in the Utah Division of Wildlife Resources Brown's Park Waterfowl Management Area. The Brown's Park area is a crucial mule deer winter range. The area was dominated by black greasewood (*Sarcobatus vermiculatus*). To prevent greasewood from competing with desired seeded species, 141 acres of greasewood were sprayed with a mixture of 2,4-D (2,4-Dichlorophenoxyacetic acid) and Tordon (picloram) in June of 2005, prior to the establishment of the study. Following the establishment of the study in 2005, the project area was treated with a double-drum Lawson aerator and seeded in September of 2005. Following aerator treatment, forage kochia (*Kochia prostrata*) was then broadcast seeded over the treatment (Table - Seed Mix). The objective of the project is to provide additional mule deer winter forage to help reduce winter range mortality (WRI Database 2013). Deer pellet groups were sampled in low abundance in 2005 and 2008, and were sampled in high abundance in 2012. Elk pellet groups were sampled in moderate abundance in 2005 and low abundance in 2008 (Table - Pellet Group Data).

Browse: Black greasewood is the dominant browse species on the site, though decreasing notably in abundance following the treatment. Preferred browse species are rare on the site, but include basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), fourwing saltbush (*Atriplex canescens*), shadscale (*A. confertifolia*), and forage kochia. In 2005, most of the browse species had a high amount of decadence and poor vigor within the population, likely due to the herbicide treatment one month prior to the establishment of the study. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics)

Herbaceous Understory: Grasses are very rare on the site. Following the treatment, the diversity of grass species increased due to the sampling of seeded species on the site. Seeded grass species sampled after the treatment include crested wheatgrass (*Agropyron cristatum*), thickspike wheatgrass (*A. dasystachyum*), Russian wildrye (*Elymus junceus*), and Great Basin wildrye (*E. Cinereus*). Forbs are not diverse, but are moderately abundant with the majority of the forb component consisting of annual forb species. Perennial forbs are extremely rare and no perennial forb was sampled in 2008 or 2012. The dominant annual forb species is annual kochia (*Kochia scoparia*), which increased substantially in abundance on the site following the treatment in 2008, but decreased in 2012 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Yarts-Bunkwater complex and is likely part of the Bunkwater component. The parent material consists of eolian deposits derived from sandstone and/or eolian deposits derived from quartzite. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a moderately alkaline soil reaction (pH 7.9) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Three Years Post Treatment, 2005 vs. 2008

Browse: The density of black greasewood decreased 76% from 2,700 plants/acre to 660 plants/acre, and canopy cover decreased from 40% to 9%. Shadscale decreased in density from 220 plants/acre to 20 plants/acre and canopy cover remained minute. Preferred browse species remained rare on the site.

Grasses: Grasses remain rare on the site, but the seeded species crested wheatgrass, Russian wildrye, and Great Basin wildrye were sampled at low cover and frequency.

Forbs: Perennial forbs are rare on the site with no perennial forb species being sampled in 2008. Annual forbs are abundant. The sum of nested frequency of annual forbs increased 61% and cover increased from 5% to 26%. The significant increase in annual forbs can be solely attributed to annual kochia which increased in nested frequency fivefold, and cover increased from 2% to 26%.

Trend Assessments

Browse:

- **2008 to 2012 - stable (0):** The density of black greasewood decreased by 15% to 560 plants/acre, though canopy cover increased to 16%. Preferred browse species remained rare on the site.

Grass:

- **2008 to 2012 - stable (0):** Grasses remain rare on the site.

Forb:

- **2008 to 2012 - stable (0):** Perennial forbs are rare on the site with no perennial forb species being sampled in 2012. Annual forbs are abundant. The sum of nested frequency of annual forbs decreased 48%, and cover increased to 5%.

SEED MIX--

Management unit 08R, Study no: 1

Project Name: Brown's Park Greasewood WRI Database #: 26				Project Name: Crouse Bench Shrubs WRI Database #: 26			
Application: Double Drum Aerator		Acres: 150		Application: Broadcast seeder		Acres: 225	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Douglas'	300	2.00	B	Sagebrush, Wyoming	225	1.00
G	Great Basin Wildrye 'Trailhead'	300	2.00	B	Forage Kochia	225	1.00
G	Russian Wildrye	300	2.00	Total Pounds:		450	2.00
G	Thickspike Wheatgrass 'Critana'	300	2.00	PLS Pounds:			0.92
F	Alfalfa 'Ladak+'	150	1.00				
F	Small Burnet 'Delar'	300	2.00				
B	Forage Kochia	225	1.50				
B	Fourwing Saltbush	300	2.00				
Total Pounds:		2175	14.50				
PLS Pounds:			11.32				

Trend Summary

HERBACEOUS TRENDS--

Management unit 08R, Study no: 1

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	Agropyron cristatum	-	1	-	-	.01	-
G	Agropyron dasystachyum	-	-	2	-	-	.03
G	Bromus tectorum (a)	-	-	3	-	-	.00
G	Elymus cinereus	-	1	6	-	.15	.18
G	Elymus junceus	a-	b11	a1	-	.17	.03
G	Sitanion hystrix	3	7	4	.01	.17	.03

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	<i>Vulpia octoflora</i> (a)	5	7	-	.01	.04	-
Total for Annual Grasses		5	7	3	0.01	0.04	0.00
Total for Perennial Grasses		3	20	13	0.01	0.50	0.27
Total for Grasses		8	27	16	0.02	0.54	0.28
F	<i>Alyssum alyssoides</i> (a)	_c 63	_b 19	_a -	1.03	.12	-
F	<i>Chenopodium album</i> (a)	_b 66	_a 2	_a 3	1.55	.00	.00
F	<i>Chenopodium leptophyllum</i> (a)	6	-	1	.04	-	.03
F	<i>Descurainia pinnata</i> (a)	_b 17	_a -	_a 4	.24	-	.01
F	<i>Eriogonum cernuum</i> (a)	6	-	-	.06	-	-
F	<i>Kochia scoparia</i> (a)	_a 65	_c 335	_b 175	2.42	25.56	5.15
F	<i>Lepidium latifolium</i>	14	-	-	.64	-	-
F	<i>Salsola iberica</i> (a)	2	6	5	.00	.16	.01
F	<i>Sisymbrium altissimum</i> (a)	-	2	-	-	.00	-
Total for Annual Forbs		225	364	188	5.36	25.85	5.21
Total for Perennial Forbs		14	0	0	0.63	0	0
Total for Forbs		239	364	188	6.00	25.85	5.21

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 08R, Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
B	<i>Atriplex canescens</i>	0	1	0	-	.00	-
B	<i>Atriplex confertifolia</i>	9	1	2	.66	-	-
B	<i>Chrysothamnus nauseosus</i>	0	0	0	.15	-	-
B	<i>Chrysothamnus viscidiflorus</i> <i>viscidiflorus</i>	5	0	1	.03	-	.15
B	<i>Gutierrezia sarothrae</i>	5	6	0	.01	.04	-
B	<i>Opuntia</i> sp.	0	0	0	.15	-	.15
B	<i>Sarcobatus vermiculatus</i>	2	1	1	28.56	7.95	12.45
Total for Browse		21	9	4	29.58	8.00	12.75

CANOPY COVER, LINE INTERCEPT--

Management unit 08R, Study no: 1

Species	Percent Cover		
	'05	'08	'12
<i>Atriplex confertifolia</i>	.43	.18	-
<i>Chrysothamnus viscidiflorus</i> <i>viscidiflorus</i>	.50	-	-
<i>Gutierrezia sarothrae</i>	.21	-	-
<i>Opuntia</i> sp.	.08	-	.48
<i>Sarcobatus vermiculatus</i>	38.98	9.39	16.03

BASIC COVER--

Management unit 08R, Study no: 1

Cover Type	Average Cover %		
	'05	'08	'12
Vegetation	33.61	33.49	17.17
Rock	.16	.18	.16
Pavement	.06	.23	.10
Litter	66.20	49.99	70.86
Cryptogams	3.63	.57	.42
Bare Ground	20.72	29.80	22.43

SOIL ANALYSIS DATA --

Management unit 8R, Study no: 1, Study Name: Browns Park db Drum

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.9	7.9	60.2	24.0	15.8	0.4	11.5	761.6	1.3

PELLET GROUP DATA--

Management unit 08R, Study no: 1

Type	Quadrat Frequency			Days use per acre (ha)		
	'05	'08	'12	'05	'08	'12
Rabbit	40	56	16	-	-	-
Elk	3	1	10	44 (107)	15 (38)	-
Deer	10	6	25	5 (13)	1 (2)	97 (240)

BROWSE CHARACTERISTICS--

Management unit 08R, Study no: 1

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia tridentata tridentata									
05	0	0	0	-	-	0	0	0	26/22
08	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	22/35
Atriplex canescens									
05	0	0	0	-	-	0	0	0	-/-
08	20	100	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	18/18
Atriplex confertifolia									
05	220	0	73	27	20	0	0	55	14/20
08	20	0	100	0	-	0	0	0	13/8
12	40	0	100	0	-	0	0	0	11/13
Chrysothamnus nauseosus									
05	0	0	0	-	-	0	0	0	26/35
08	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
05	120	0	67	33	-	17	0	33	16/21
08	0	0	0	0	-	0	0	0	18/20
12	20	0	0	100	-	0	100	100	19/23
<i>Gutierrezia sarothrae</i>									
05	400	65	30	5	-	0	0	5	10/11
08	260	0	100	0	-	0	0	0	12/13
12	0	0	0	0	-	0	0	0	7/11
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	7/5
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
05	120	0	100	0	-	0	0	0	4/16
08	60	0	67	33	-	0	0	33	3/6
12	60	0	100	0	-	0	0	0	6/15
<i>Sarcobatus vermiculatus</i>									
05	2700	2	36	61	-	1	0	100	48/61
08	660	12	85	3	-	0	0	12	35/51
12	560	4	93	4	20	4	7	4	46/73

BAKE OVEN - TREND STUDY NO. 8R-4-12

Vegetation Type: Black Greasewood

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Alkali Flat (Black Greasewood), R034XY006U

Land Ownership: BLM

Elevation: 5,460 ft (1,664 m)

Aspect: South

Slope: 5%

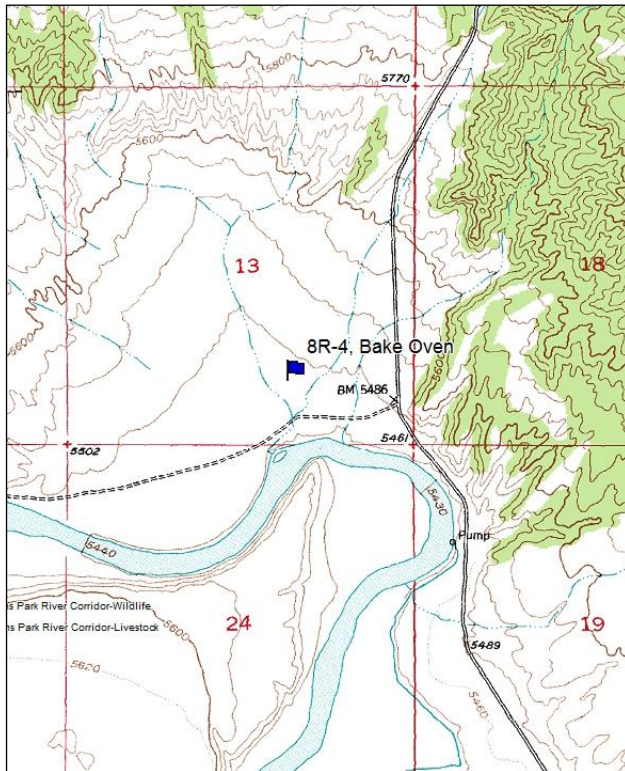
Transect bearing: 288° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Note: No Rebar

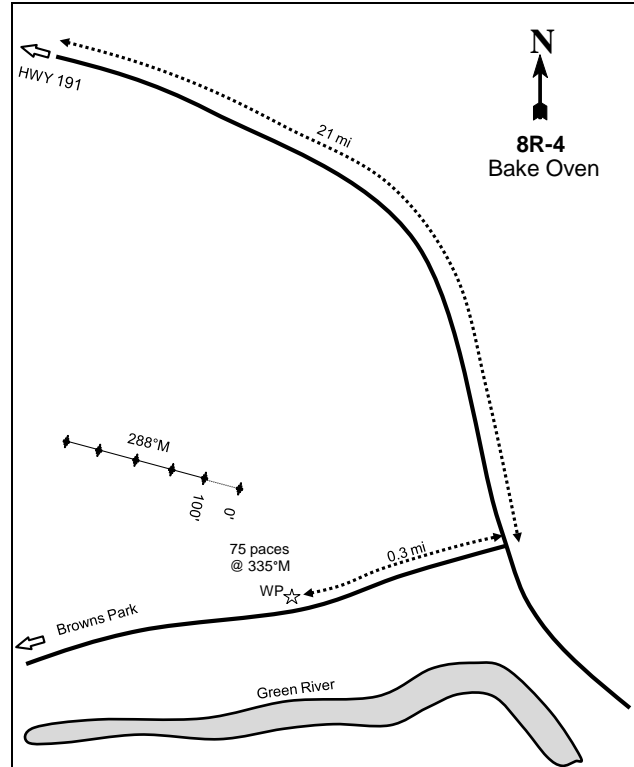
Directions: From highway 191, drive 21 miles on the Browns Park Road to the junction of highway 318. From the junction, turn right (west) onto the Browns Park Road for 0.3 miles to a witness post on the right (north). From the witness post walk 75 paces at 335°M to the 0-foot stake.

Map Name: Clay Basin



Township: 2N Range: 24E Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 655632 E 4529839 N

BAKE OVEN - TREND STUDY NO. 8R-4
[Project #2268](#)

Site Information

Site Description: The study is located approximately 13 miles east of Dutch John within a black greasewood (*Sarcobatus vermiculatus*) flat. Prior to treatment, the study was established in 2012 on land administrate by the Bureau of Land Management (BLM) in 2012 to monitor an herbicide treatment of black greasewood and seeding project. The study occurs on the border of two BLM allotments, Red Creek Flat and Bridgeport. The project is planned to be treated in the spring/summer of 2013. The area will be treated with herbicide aerially over 150 acres and seed will be drill seeded using a rangeland drill. The objectives of the project are to improve 150 acres of deer winter by reducing greasewood cover and seeding desirable forbs, grasses, and browse species (WRI Database 2013). Deer pellet groups were sampled in low abundance on the site (Table - Pellet Group Data).

Browse: The dominant browse species on the site is black greasewood, which provides the majority of canopy cover on the site. The preferred browse species on the sites are fringed sagebrush (*Artemisia frigida*) and shadscale (*Atriplex confertifolia*), though each species was rare on the site (Table - Browse Characteristics).

Herbaceous Understory: Grasses are rare on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) and the annual grass species sixweeks fescue (*Vulpia octoflora*) were the only grass species sampled on the site. Forbs are rare on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Yarts-Bunkwater complex and is likely part of the Bunkwater component. The parent material consists of eolian deposits derived from sandstone and/or eolian deposits derived from quartzite. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer. The soil surface texture is a fine sandy loam (Soil Survey Staff 2011). Bare ground cover is high on the site, and a moderate amount of vegetation and litter provide protective ground cover (Table - Basic Cover). The soil erosion condition was classified as critical due to surface litter movement, pedestalling, flow patterns, presence of rill and gullies, and soil movement.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 08R, Study no: 4

Type	Species	Nested Frequency '12	Average Cover % '12
G	<i>Bromus tectorum</i> (a)	3	.03
G	<i>Vulpia octoflora</i> (a)	1	.00
Total for Annual Grasses		4	0.04
Total for Perennial Grasses		0	0
Total for Grasses		4	0.04
F	<i>Cryptantha gracilis</i> (a)	24	.24
F	<i>Halogeton glomeratus</i> (a)	96	.69
F	<i>Lepidium latifolium</i>	11	.03
F	<i>Salsola iberica</i> (a)	6	.01
Total for Annual Forbs		126	0.95
Total for Perennial Forbs		11	0.02
Total for Forbs		137	0.98

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 08R, Study no: 4

Type	Species	Strip Frequency '12	Average Cover % '12
B	Artemisia frigida	12	.06
B	Atriplex confertifolia	6	-
B	Opuntia sp.	32	5.69
B	Sarcobatus vermiculatus	59	13.59
Total for Browse		109	19.34

CANOPY COVER, LINE INTERCEPT--

Management unit 08R, Study no: 4

Species	Percent Cover '12
Artemisia frigida	.08
Atriplex confertifolia	.10
Opuntia sp.	5.81
Sarcobatus vermiculatus	21.70

BASIC COVER--

Management unit 08R, Study no: 4

Cover Type	Average Cover % '12
Vegetation	20.87
Rock	.38
Pavement	5.94
Litter	21.27
Cryptogams	1.53
Bare Ground	63.29

PELLET GROUP DATA--

Management unit 08R, Study no: 4

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	22	-
Deer	3	10 (25)

BROWSE CHARACTERISTICS--
 Management unit 08R, Study no: 4

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia frigida</i>										
12	340	0	82	18	-	0	100	100	3/6	
<i>Atriplex confertifolia</i>										
12	160	13	88	-	-	38	0	25	10/13	
<i>Opuntia sp.</i>										
12	1220	0	87	13	-	0	0	13	6/32	
<i>Sarcobatus vermiculatus</i>										
12	1920	3	79	18	-	0	2	15	26/39	

DIAMOND MOUNTAIN BULLHOG - TREND STUDY NO. 9R-4-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Upland Stony Loam (Utah Juniper-Pinyon), R034XY330UT

Land Ownership: BLM

Elevation: 7,000 ft (2,134 m)

Aspect: South

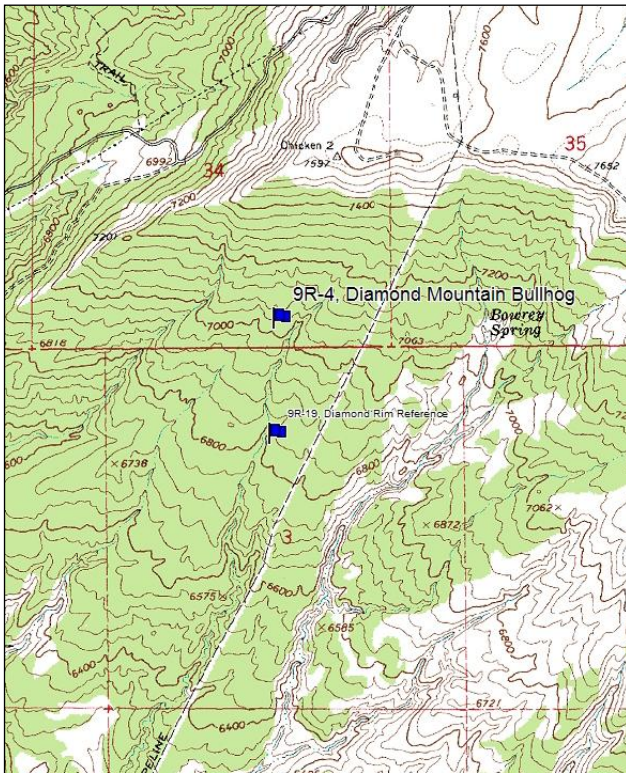
Slope: 12-14%

Transect bearing: 209° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

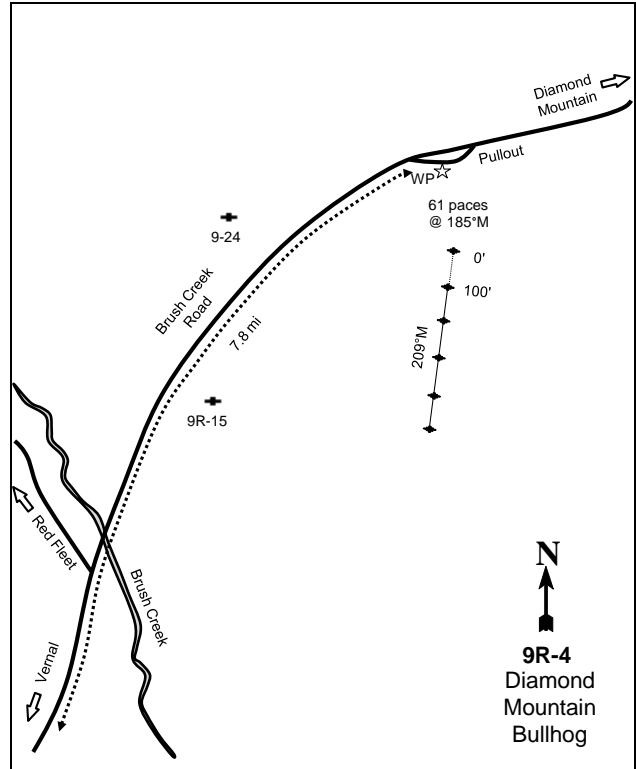
Directions: From Vernal travel northeast on Brush Creek Road heading toward Diamond Mountain for 7.8 miles to a pull off on the right (south) and park in the pull off. The witness post is on the south side of the pull off. The 0-foot stake is 185 feet from the witness post at 185°M and is marked with browse tag #133.

Map Name: Jensen Ridge



Township: 23E Range: 2S Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 642204 E 4495283 N

DIAMOND MOUNTAIN BULLHOG - TREND STUDY NO. 9R-4

Site Information

Site Description: The study is located approximately five and half miles east of Red Fleet Reservoir within a treated pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established on land administrated by the Bureau of Land Management (BLM) in June of 2004 prior to treatment later that September. The study site is within the BLM S. J. Hatch allotment. In the fall of 2004, a total of 320 acres of mature pinyon and juniper woodland were bullhogged in a fuels reduction project near the Diamond Mountain rim northeast of Vernal. A seed mix of grasses, forbs and fourwing saltbush (*Atriplex canescens*) was flown on prior to the bullhog treatment. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) seed was applied following treatment (late November). Deer and cattle pellet groups were sampled in low abundance in all sample years. Elk pellet groups were sampled in low abundance in 2004, 2010, and 2012; and was sampled in moderate abundance in 2007 and 2009 (Table - Pellet Group Data).

Browse: Wyoming big sagebrush and black sagebrush (*Artemisia nova*) are the dominant preferred browse species. Prior to the bullhog treatment, Utah juniper dominated the site providing the majority of the cover and other browse species were rare. Wyoming big sagebrush and fourwing saltbush were established on the site with the seed mix applied in 2004. The Wyoming big sagebrush population has responded well to the treatment and provided the majority of the canopy cover in 2012 (Table - Canopy Cover). Utilization of browse species has been light since the outset of the study, though use of antelope bitterbrush (*Purshia tridentata*) has been heavy in all sample years and use of Wyoming big sagebrush was more moderate in 2012. Poor vigor and decadence of sagebrush have been mainly good over the sample years, and recruitment of young plants to the population has been excellent throughout the sample years. However, recruitment of black sagebrush was low in 2007 (Table - Browse Characteristics). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Prior to treatment in 2004, the herbaceous understory was sparse. Cheatgrass (*Bromus tectorum*) was the most common grass species and provided most of the cover. In 2007, following the treatment, cheatgrass cover increased significantly, but has since decreased to near pretreatment levels. Perennial grasses increased in cover and frequency following the treatment. Bottlebrush squirreltail (*Sitanion hystrix*) is the dominant perennial species increasing substantially in frequency and cover following the treatment. The seeded species western wheatgrass (*Agropyron smithii*), orchardgrass (*Dactylis glomerata*), and Sandberg bluegrass (*Poa secunda*) were sampled following the treatment, but are not abundant on the site. Forb cover has increased overall since 2004, although seeded forbs have provided little cover in each sample year (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Clapper component, which is found on fan remnants. The parent material consists of slope alluvium derived from sandstone, limestone, shale, and quartzite. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 6.6) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a moderate amount of vegetation and high amount litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004, 2007, 2009, and 2010. The soil erosion condition was classified as slight in 2012 due to surface litter and soil movement.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: Following treatment, the preferred browse component improved with the introduction and establishment of Wyoming big sagebrush and the removal of Utah juniper. Utah juniper dominated the site in 2004, prior to treatment, with canopy cover at 39%. Juniper density was also very high at 444 trees/acre. Juniper cover was reduced to 0% after the treatment and density decreased to less than 18 trees/acre.

Wyoming big sagebrush provided 2% canopy cover, and black sagebrush canopy cover increased from 2% to 3%.

Grass: The sum of nested frequency of perennial grasses increased 89%, while cover increased to 9% from less than 1%. Western wheatgrass and orchardgrass were seeded species that were sampled following the seeding at low frequency and cover. Crested wheatgrass (*Agropyron cristatum*) was not sampled prior to the treatment and was not seeded with the treatment, but was sampled at low frequency and cover following the treatment. Bottlebrush squirreltail increased significantly in nested frequency and increased from less than 1% cover prior to treatment to 7% cover afterwards. Cheatgrass followed a similar pattern with a significant increase in nested frequency and increased from 1% cover to 14%.

Forb: The sum of nested frequency of perennial forbs increased 64% and cover increased from 1% to 6%. Seeded species sampled included Lewis flax (*Linum lewisii*), alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*) and small burnet (*Sanguisorba minor*). Only Lewis flax provided close to 1% cover.

Trend Assessments

Browse

- **2007 to 2009 - up (+2)**: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Preferred browse species, black sagebrush and Wyoming big sagebrush, continued to increase in canopy cover from 3% to 6% and from 2% to 4%, respectively.
- **2009 to 2010 - stable (0)**: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Black sagebrush canopy cover decreased from 6% to 4% while Wyoming big sagebrush cover increased slightly to 5%. The recruitment of young black sagebrush increased from 6% in 2007 to 49% in 2010 and Wyoming big sagebrush recruitment increased from 36% in 2007 to 57% of the population in 2010. Decadent plants comprise 1% or less of each population.
- **2010 to 2012 - slightly up (+1)**: The density of Wyoming big sagebrush decreased 28% from 2,900 plants/acre to 2,080 plants/acre, though canopy cover increased to slightly to 6%. Most of the decrease of Wyoming big sagebrush density can be attributed to a decrease in young sagebrush plants. The density of black sagebrush decreased 17% from 4,340 plants/acre to 3,620 plants/acre, though canopy cover increased to 6%. The health of the both sagebrush population is good with decadence and plants displaying poor vigor very low. The recruitment of young sagebrush plants to the population remained good, though Wyoming big sagebrush decreased to 38% and black sagebrush decreased to 47 %.

Grass

- **2007 to 2009 - up (+2)**: The sum of nested frequency of perennial grasses increased 29%, though cover decreased slightly from 9% to 7%. Cheatgrass declined significantly in nested frequency, and decreased from 14% to 5% cover. Western wheatgrass and crested wheatgrass increased significantly in nested frequency. None of the seeded species provide more than 1% cover, and bottlebrush squirreltail decreased from 7% to 4% cover.
- **2009 to 2010 - slightly up (+1)**: The sum of nested frequency of perennial grasses increased 14% while cover remained similar at 8%. No single perennial grass species had a significant increase in nested frequency, and only bottlebrush squirreltail provided notable cover at 5%. Cheatgrass had a significant decrease in nested frequency, and cover decreased from 5% to 2%.
- **2010 to 2012 - stable (0)**: The sum of nested frequency of perennial grasses remained similar, and cover remained similar at 8%. No single perennial grass species had a significant increase in nested frequency, and only bottlebrush squirreltail provided notable cover at 5%. Cheatgrass remained similar in nested frequency, and cover decreased to 1%.

Forb

- **2007 to 2009 - down (-2):** The sum of nested frequency of perennial forbs decreased 26%, and cover decreased to 4%. Lewis flax continued to be the most predominant seeded species with 1% cover.
- **2009 to 2010 - up (+2):** The sum of nested frequency of perennial forbs increased 67%, and cover increased from 4% to 7%. Timber poisonvetch (*Astragalus convallarius*) was the most common forb and provides nearly 3% cover. No seeded species provided more than 1% cover.
- **2010 to 2012 - stable (0):** The sum of nested frequency of perennial forbs increased 16%, though cover decreased from to 5%. No seeded species provided more than 1% cover.

SEED MIX--

Management unit 09R, Study no: 4

Project Name: Diamond Rim Bullhog					
WRI Database #: PDB					
Application: Aerial Seed		Acres: 320		Application: Aerial Seed	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Orchardgrass 'Paiute'	650	2.03	B	Sagebrush, Wyoming
G	Western Wheatgrass 'Arriba'	650	2.03	Total Pounds:	
G	Sandberg Bluegrass	150	0.47	PLS Pounds:	
F	Yellow Sweetclover	300	0.94		
F	Alfalfa 'Ladak+'	650	2.03		
F	Sainfoin	350	1.09		
F	Blue Flax 'Appar'	300	0.94		
F	Small Burnet 'Delar'	650	2.03		
B	Fourwing Saltbush	150	0.47		
Total Pounds:		3850	12.03		
PLS Pounds:			10.74		

Trend Summary

HERBACEOUS TRENDS--

Management unit 09R, Study no: 4

Type	Species	Nested Frequency					Average Cover %				
		'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
G	Agropyron cristatum	a-	a ³	ab ²³	ab ¹⁷	b ³⁵	-	.22	.42	.37	.73
G	Agropyron smithii	a-	a ¹⁰	b ³⁷	ab ²⁶	b ⁴²	-	.18	.95	.62	1.02
G	Agropyron spicatum	-	-	3	2	2	-	-	.03	.03	.03
G	Bromus tectorum (a)	a ¹³²	b ³⁴⁴	b ³⁰²	a ¹⁶⁴	a ¹⁴⁵	.81	14.07	5.41	1.49	.69
G	Carex sp.	-	4	-	2	6	-	.06	-	.00	.09
G	Dactylis glomerata	a-	b ¹⁷	b ²³	b ¹⁹	b ²¹	-	.45	.73	.56	.32
G	Oryzopsis hymenoides	b ⁵⁰	a ⁹	a ¹⁷	a ¹⁰	a ³	.22	.52	.58	.13	.18
G	Poa fendleriana	-	-	-	-	1	-	-	-	-	.03
G	Poa secunda	ab ²⁷	ab ³⁵	ab ²⁷	b ⁴⁴	a ²¹	.14	.44	.28	.35	.30
G	Sitanion hystrix	a ²²	b ¹³³	b ¹⁴⁴	c ¹⁸⁴	bc ¹⁶⁵	.16	6.75	4.25	5.28	5.11
G	Stipa lettermani	b ¹⁴	ab ²	a-	ab ⁷	ab ⁴	.10	.03	.03	.21	.00
Total for Annual Grasses		132	344	302	164	145	0.81	14.07	5.41	1.49	0.69
Total for Perennial Grasses		113	213	274	311	300	0.63	8.66	7.28	7.56	7.83
Total for Grasses		245	557	576	475	445	1.45	22.74	12.69	9.05	8.52

Type	Species	Nested Frequency					Average Cover %				
		'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
F	Agoseris glauca	-	-	-	-	4	-	-	-	-	.00
F	Alyssum alyssoides (a)	-	-	1	-	-	-	-	.00	-	-
F	Arabis sp.	b27	a2	a-	a-	a-	.06	.00	-	-	-
F	Arenaria fendleri	-	6	7	13	11	-	.03	.04	.08	.02
F	Astragalus convallarius	a5	b45	ab18	c85	c75	.01	2.06	.67	2.74	1.56
F	Astragalus utahensis	-	-	-	-	2	-	-	-	-	.03
F	Chaenactis douglasii	-	-	-	1	-	-	-	-	.00	-
F	Chenopodium fremontii (a)	-	-	-	4	-	-	-	-	.00	-
F	Cirsium sp.	-	-	-	1	-	-	-	-	.15	-
F	Cryptantha sp.	b9	ab2	a-	a-	a-	.02	.00	-	-	-
F	Cymopterus sp.	a1	b35	a2	b21	b22	.00	.19	.00	.13	.05
F	Descurainia pinnata (a)	-	3	-	-	3	-	.07	-	-	.01
F	Draba sp. (a)	-	-	-	1	-	-	-	-	.00	-
F	Gilia sp. (a)	a-	b16	a-	a3	a-	-	.03	-	.00	-
F	Grindelia squarrosa	-	-	-	-	2	-	-	-	-	.15
F	Ipomopsis aggregata	-	1	-	1	-	-	.15	-	.00	-
F	Lactuca serriola (a)	a-	a-	b38	c83	b19	-	-	.43	1.02	.06
F	Lappula occidentalis (a)	-	-	-	2	-	-	-	-	.00	-
F	Lesquerella sp.	-	-	-	3	-	-	-	-	.00	-
F	Linum perenne	a-	b20	b23	b12	b27	-	.95	1.18	.43	.16
F	Lithospermum incisum	-	-	-	-	1	-	-	-	-	.15
F	Medicago sativa	a-	b14	b16	b17	b20	-	.43	.27	.89	1.04
F	Melilotus officinalis	-	-	-	1	-	-	-	-	.15	-
F	Oenothera sp.	-	-	-	-	3	-	-	-	-	.03
F	Onobrychis viciaefolia	-	1	-	1	2	-	.03	.03	.03	.03
F	Penstemon humilis	3	4	-	4	2	.00	.04	-	.06	.00
F	Petradoria pumila	b56	a33	ab42	ab47	ab52	1.01	1.66	1.49	1.42	1.23
F	Phlox austromontana	1	6	10	2	6	.00	.01	.19	.00	.04
F	Phlox longifolia	ab2	a-	b10	b3	b9	.01	-	.05	.00	.02
F	Polygonum douglasii (a)	-	-	-	1	-	-	-	-	.00	-
F	Salsola iberica (a)	a3	ab11	b27	b20	a-	.00	.08	.91	.48	-
F	Sanguisorba minor	-	6	1	-	6	-	.18	.03	.01	.06
F	Sphaeralcea coccinea	-	-	-	3	-	-	-	-	.00	-
F	Townsendia sp.	-	5	-	1	4	-	.03	-	.00	.00
F	Tragopogon dubius (a)	-	-	2	4	7	-	-	.03	.21	.04
F	Trifolium longipes	ab6	a-	a5	ab8	b12	.02	-	.00	.01	.03
F	Unknown forb-annual (a)	-	-	-	-	-	-	-	.03	-	-
Total for Annual Forbs		3	30	68	118	29	0.00	0.18	1.42	1.74	0.11
Total for Perennial Forbs		110	180	134	224	260	1.15	5.80	3.97	6.17	4.65
Total for Forbs		113	210	202	342	289	1.16	5.97	5.39	7.91	4.77

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 09R, Study no: 4

Type	Species	Strip Frequency				Average Cover %				
		'04	'07	'10	'12	'04	'07	'09	'10	'12
B	Artemisia nova	42	34	40	39	2.98	1.83	3.58	3.27	2.92
B	Artemisia tridentata wyomingensis	0	27	29	34	-	1.45	2.37	3.84	4.02
B	Atriplex canescens	0	1	1	1	-	.00	.03	.15	.63
B	Chrysothamnus nauseosus	0	1	0	1	-	-	-	-	.63
B	Chrysothamnus nauseosus albicaulis	0	1	3	1	-	.06	.38	1.01	1.13
B	Eriogonum microthecum	2	1	0	0	.00	-	-	-	-
B	Gutierrezia sarothrae	1	0	0	0	-	-	.00	-	-
B	Juniperus osteosperma	23	0	0	0	16.80	-	-	-	-
B	Opuntia sp.	2	0	0	0	.00	-	-	-	-
B	Purshia tridentata	2	2	1	2	-	-	.00	.03	.03
Total for Browse		72	67	74	78	19.79	3.35	6.37	8.30	9.37

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 4

Species	Percent Cover				
	'04	'07	'09	'10	'12
Artemisia nova	2.30	2.60	6.28	4.43	5.46
Artemisia tridentata wyomingensis	-	1.61	4.26	4.63	6.33
Atriplex canescens	-	.36	.61	.81	.91
Chrysothamnus nauseosus	-	-	-	.91	.16
Chrysothamnus nauseosus albicaulis	-	-	.53	.13	1.28
Juniperus osteosperma	39.00	-	-	-	-
Purshia tridentata	.03	-	.15	.10	.21

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 09R, Study no: 4

Species	Average leader growth (in)	
	'10	'12
Artemisia nova	-	1.0
Artemisia tridentata wyomingensis	1.8	1.2
Purshia tridentata	2.0	0.9

POINT-QUARTER TREE DATA--

Management unit 09R, Study no: 4

Species	Trees per Acre				
	'04	'07	'09	'10	'12
Juniperus osteosperma	444	23	<18	<18	22

Average diameter (in)				
'04	'07	'09	'10	'12
13.3	5.1	2.2	-	6.6

BASIC COVER--

Management unit 09R, Study no: 4

Cover Type	Average Cover %				
	'04	'07	'09	'10	'12
Vegetation	21.13	32.41	26.40	27.36	25.82
Rock	23.10	8.66	11.42	10.17	8.23
Pavement	9.55	2.20	2.64	2.78	1.15
Litter	46.48	62.60	65.35	65.90	72.44
Cryptogams	2.37	.00	.03	.04	.03
Bare Ground	15.22	3.81	2.54	3.27	2.67

SOIL ANALYSIS DATA --

Management unit 9R, Study no: 4, Study Name: Diamond Mountain Bullhog

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
8.0	6.6	61.4	19.1	19.5	2.0	7.0	153.6	0.6

PELLET GROUP DATA--

Management unit 09R, Study no: 4

Type	Quadrat Frequency					Days use per acre (ha)				
	'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
Rabbit	65	23	3	-	1	-	-	-	-	-
Elk	7	19	10	3	6	9 (21)	25 (63)	20 (50)	13 (31)	8 (20)
Deer	1	1	12	9	2	5 (13)	7 (18)	6 (15)	6 (15)	1 (2)
Cattle	-	-	6	2	3	-	2 (5)	11 (27)	6 (14)	3 (7)

BROWSE CHARACTERISTICS--

Management unit 09R, Study no: 4

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia nova									
04	2560	26	53	21	180	21	44	7	9/16
07	1700	6	91	4	860	6	0	1	10/18
09	No Density Collected								11/19
10	4340	49	51	0	2520	11	12	0	10/21
12	3620	47	52	1	200	50	1	0	10/21
Artemisia tridentata wyomingensis									
04	0	0	0	0	-	0	0	0	-/-
07	2020	36	64	0	1460	.99	0	0	18/21
09	No Density Collected								20/25
10	2900	57	43	1	4980	12	11	4	20/28
12	2080	38	62	0	5300	73	12	4	25/32

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Atriplex canescens</i>									
04	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	30/49
09	No Density Collected								21/26
10	20	0	100	-	-	0	0	0	24/33
12	20	0	100	-	-	100	0	0	36/58
<i>Chrysothamnus nauseosus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	24/43
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	35/58
12	20	0	100	-	-	0	0	0	27/41
<i>Chrysothamnus nauseosus albicaulis</i>									
04	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	17/17
09	No Density Collected								24/33
10	60	0	100	-	-	0	0	0	26/40
12	20	0	100	-	-	0	0	0	37/51
<i>Chrysothamnus viscidiflorus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	13/22
12	0	0	0	-	-	0	0	0	-/-
<i>Eriogonum microthecum</i>									
04	60	33	33	33	-	0	100	0	1/1
07	20	0	100	0	-	0	0	0	7/6
09	No Density Collected								-/-
10	0	0	0	0	-	0	0	0	-/-
12	0	0	0	0	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
04	20	100	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	11/15
09	No Density Collected								10/15
10	0	0	0	-	-	0	0	0	9/12
12	0	0	0	-	-	0	0	0	7/8
<i>Juniperus osteosperma</i>									
04	500	12	76	12	20	4	0	0	-/-
07	0	0	0	0	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	0	20	0	0	0	-/-
12	0	0	0	0	20	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Opuntia</i> sp.										
04	40	0	100	-	-	0	0	0	3/16	
07	0	0	0	-	-	0	0	0	-/-	
09	No Density Collected								4/11	
10	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	5/14	
<i>Purshia tridentata</i>										
04	60	0	67	33	-	0	100	33	7/46	
07	40	0	100	0	-	0	100	0	8/55	
09	No Density Collected								11/45	
10	40	0	100	0	-	0	100	0	9/38	
12	40	0	100	0	-	0	100	0	10/53	

LITTLE DONKEY - TREND STUDY NO. 9R-5-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT

Land Ownership: BLM

Elevation: 5,800 ft (1,768 m)

Aspect: Southwest

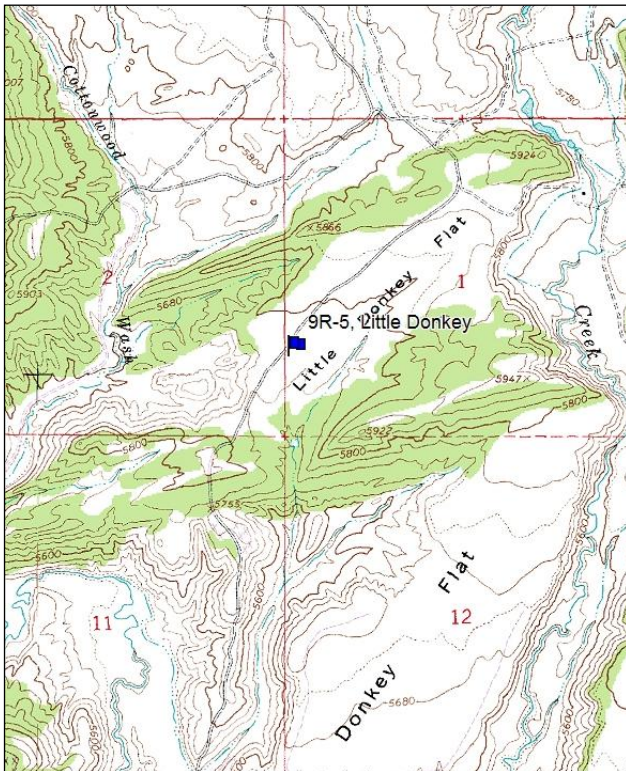
Slope: 3%

Transect bearing: 170° magnetic

Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

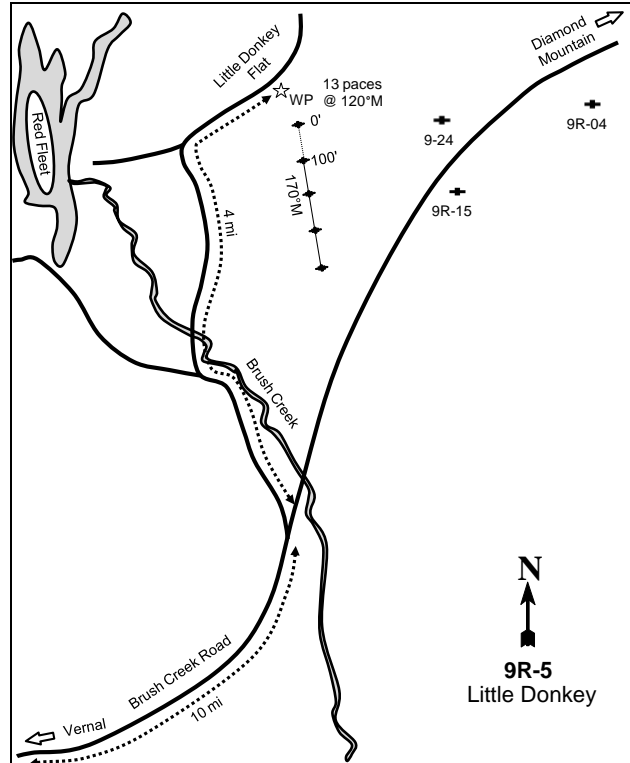
Directions: From Vernal travel northeast on Brush Creek Road heading toward Diamond Mountain. Turn left (north) at the Red Fleet turnoff, just before crossing Brush Creek. Follow the road as it turns north toward Little Donkey Flat. There is a witness post on the right (southeast) side of the road. The 0-foot stake is 13 paces from the witness post at 120°M.

Map Name: Donkey Flat



Township: 3S Range: 22E Section: 1

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 635070 E 4493818 N

LITTLE DONKEY - TREND STUDY NO. 9R-5

Site Information

Site Description: The study is located approximately a mile northeast of the Red Fleet Reservoir Dam. The study was established in 2004 on land administrated by the Bureau of Land Management (BLM) to monitor an herbicide and drill seeding treatment. The study site is located within the BLM Donkey Flat allotment. This treatment is part of the Red Fleet habitat projects. In October of 2004 parts of the flat were sprayed with 8 ounces of GLY-4 Plus (generic Round-up) to kill the crested wheatgrass. In November those areas were then drill seeded with a mixture of grasses, forbs, and shrubs with a no till drill (Table - Seed Mix). Deer and elk pellet groups were sampled in low abundance in 2004 and 2007. Deer pellet groups were sampled in high abundance in 2012. Cattle pellet groups were sampled in low abundance in all sample years (Table - Pellet Group Data).

Browse: The dominant browse species on the site is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), though prior to treatment broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia* sp.) provided the majority of the browse cover on the site. The key browse species on the site are Wyoming big sagebrush and forage kochia (*Kochia prostrata*). The Wyoming big sagebrush is a heavily used population with low decadence and high amount of plants displaying poor vigor within the population. The recruitment young sagebrush plants to the population has been good within the population following the treatment, though prior to treatment recruitment was poor. The forage kochia is a heavily used population with low decadence and good vigor within the population. The recruitment of young forage kochia plants to the population has been good since the treatment (Table - Browse Characteristics). The surrounding area is dominated by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are not overly abundant, but are somewhat diverse on the site. The dominant grass species is crested wheatgrass (*Agropyron cristatum*), which has provided the majority of the perennial grass cover on the site. The invasive annual grass specie cheatgrass has been sampled in low abundance on the site following the treatment. In 2007 the annual grass species sixweeks fescue (*Vulpia octoflora*) was sampled in high cover and frequency. Seeded grass species sampled on the site include western wheatgrass (*Agropyron cristatum*) and Russian wildrye (*Elymus junceus*), though occurring in low abundance. Forbs are not abundant and are moderately diverse on the site. Alfalfa has been the only seeded forb species to be sampled on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Solirec component, which is found on fan remnants. The parent material consists of eolian deposits over slope alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). Bare ground cover is high on the site, though there is a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2007. The soil erosion condition was classified as slight in 2012 due to an active gully to the south of the study location.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush increased substantially following the treatment from 80 plants/acre to 6,440 plants/acre, and canopy cover increased from less than 1% to 2%. The health of the sagebrush population improved with decadence decreasing from 25% to 0% and plants displaying poor vigor remained very low within the population. The recruitment of young sagebrush plants increased from 0% to 68% of the population. Forage kochia was sampled at 2,880 plants/acre following the treatment.

Grass: The sum of nested frequency of perennial grasses decreased 62%, and cover decreased from 17% to

2%. Crested wheatgrass significantly decreased in nested frequency, and cover decreased from 16% to 2%. Cheatgrass was sampled for the first time following the treatment at 1% cover following the treatment. The annual grass species sixweeks fescue increased significantly, and cover increased from 5% to 21%.

Forb: The sum of nested frequency of perennial forbs decreased 41%, and cover decreased from 3% to 1%. The annual forb species woolly plantain (*Plantago patagonica*) increased significantly in nested frequency, and cover increased from 2% to 16%.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of Wyoming big sagebrush increased 59% to 10,240 plants/acre, and canopy cover increased to 10%. The health of the sagebrush population decreased with plants displaying poor vigor increasing 74% of the population, though decadence remained similar at 0%. Forage kochia increased to 36,720 plants/acre and cover increased to 2%.

Grass:

- **2007 to 2012 - up (+2):** The sum of nested frequency of perennial grasses increased 44%, and cover decreased to 3%. Cheatgrass increased significantly in nested frequency, and cover increased to 2%.

Forb:

- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased 22%, and cover decreased to less than 1% cover.

SEED MIX--

Management unit 09R, Study no: 5

Project Name: Red Fleet			
WRI Database #: PDB			
Application: Drill		Acres: 470	
Seed type		lbs in mix	lbs/acre
G	Russian Wildrye 'Bozoisky'	470	1.00
G	Western Wheatgrass 'Arriba'	470	1.00
F	Alfalfa 'Ladak+'	700	1.49
F	Blue Flax 'Appar'	50	0.11
F	Cicer Milkvetch 'lutana'	470	1.00
F	Sainfoin 'Eski'	700	1.49
F	Small burnet 'Delar'	1175	2.50
F	Western Yarrow	50	0.11
B	Forage Kochia 'Immigrant'	500	1.06
B	Fourwing Saltbush	470	1.00
B	Sagebrush, Wyoming	450	0.96
Total Pounds:		5505	11.71
PLS Pounds:			9.28

Trend Summary

HERBACEOUS TRENDS--

Management unit 09R, Study no: 5

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	_b 241	_a 101	_a 103	16.35	1.57	2.17
G	Agropyron smithii	_a -	_a -	_b 17	-	-	.06
G	Bromus tectorum (a)	_a -	_b 145	_c 187	-	.97	1.75
G	Elymus junceus	_a -	_{ab} 6	_b 8	-	.06	.12
G	Hilaria jamesii	6	-	5	.19	-	.30
G	Oryzopsis hymenoides	3	-	9	.03	-	.19
G	Poa secunda	_b 42	_a 4	_{ab} 18	.70	.04	.09
G	Vulpia octoflora (a)	_b 301	_c 490	_a 132	5.31	19.67	.34
Total for Annual Grasses		301	635	319	5.31	20.64	2.08
Total for Perennial Grasses		292	111	160	17.27	1.67	2.94
Total for Grasses		593	746	479	22.58	22.32	5.03
F	Alyssum alyssoides (a)	_a -	_a 2	_b 26	-	.00	.05
F	Calochortus nuttallii	6	-	-	.01	-	-
F	Chenopodium leptophyllum(a)	48	-	-	.11	-	-
F	Chorisporea tenella (a)	-	-	3	-	-	.03
F	Collinsia parviflora (a)	-	-	3	-	-	.00
F	Descurainia pinnata (a)	-	7	-	-	.05	-
F	Lappula occidentalis (a)	_a 31	_b 85	_a 37	.81	.93	.07
F	Machaeranthera canescens	1	1	11	.03	.00	.03
F	Medicago sativa	-	7	2	-	.04	.00
F	Plantago patagonica (a)	_a 207	_b 442	_a 249	2.05	15.51	.59
F	Sisymbrium altissimum (a)	_a -	_b 59	_a 7	-	.46	.33
F	Sphaeralcea coccinea	_b 170	_a 99	_a 70	2.61	.51	.29
F	Unknown forb-perennial	3	-	-	.03	-	-
Total for Annual Forbs		286	595	325	2.98	16.97	1.08
Total for Perennial Forbs		180	107	83	2.68	0.55	0.32
Total for Forbs		466	702	408	5.66	17.53	1.41

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 09R, Study no: 5

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia nova	1	0	0	-	-	-
B	Artemisia tridentata wyomingensis	2	73	82	.38	2.35	8.24
B	Chrysothamnus nauseosus	1	5	2	-	.01	-
B	Chrysothamnus viscidiflorus	1	7	0	-	.00	-
B	Grayia spinosa	-	-	-	-	.00	-
B	Gutierrezia sarothrae	58	40	37	1.16	.86	.75
B	Kochia prostrata	0	54	87	-	.48	5.45
B	Opuntia sp.	44	35	33	1.54	.13	.69
Total for Browse		102	129	157	3.08	3.85	15.14

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 5

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	.16	1.71	10.21
Chrysothamnus nauseosus	-	.03	-
Gutierrezia sarothrae	1.18	1.63	.56
Kochia prostrata	-	.18	1.50
Opuntia sp.	1.56	.23	.63

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 09R, Study no: 5

Species	Average leader growth (in)	
	'07	'12
Artemisia tridentata wyomingensis	2.0	0.3

BASIC COVER--

Management unit 09R, Study no: 5

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	38.32	47.73	23.21
Rock	0	.03	.00
Pavement	.05	.01	.01
Litter	17.45	29.25	19.05
Cryptogams	1.04	.36	.03
Bare Ground	54.10	36.47	63.44

SOIL ANALYSIS DATA --

Management unit 9R, Study no: 5, Study Name: Little Donkey

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
12.7	6.7	60.4	22.1	17.5	1.0	14.7	316.8	0.6

PELLET GROUP DATA--

Management unit 09R, Study no: 5

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	77	96	21	-	-	-
Horse	-	-	1	-	-	-
Grouse	1	-	-	-	-	-
Elk	11	1	-	7 (18)	6 (15)	-
Deer	35	10	41	11 (26)	11 (28)	41 (101)
Cattle	16	5	5	6 (16)	7 (18)	7 (18)

BROWSE CHARACTERISTICS--

Management unit 09R, Study no: 5

		Age class distribution				Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Artemisia nova										
04	20	0	0	100	-	0	100	100	10/15	
07	0	0	0	0	-	0	0	0	-/-	
12	0	0	0	0	-	0	0	0	-/-	
Artemisia tridentata wyomingensis										
04	80	0	75	25	-	0	100	0	14/24	
07	6440	68	32	0	5380	22	3	0	9/10	
12	10240	22	77	0	60	8	88	74	12/16	
Atriplex canescens										
04	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	14/19	
Chrysothamnus nauseosus										
04	20	0	100	-	-	0	0	0	8/13	
07	100	60	40	-	20	20	0	0	9/10	
12	40	0	100	-	-	100	0	0	16/17	
Chrysothamnus viscidiflorus										
04	40	0	100	-	-	0	0	0	4/7	
07	200	20	80	-	20	0	0	0	6/7	
12	0	0	0	-	-	0	0	0	7/11	
Gutierrezia sarothrae										
04	4520	26	73	1	-	0	0	.44	5/6	
07	1800	8	68	24	320	4	0	22	6/8	
12	1860	23	77	0	-	4	8	11	4/6	
Kochia prostrata										
04	0	0	0	0	-	0	0	0	-/-	
07	2880	24	76	0	540	24	25	0	5/7	
12	36720	87	13	0	54020	12	40	2	6/8	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Opuntia sp.										
04	1260	5	90	5	-	0	0	0	4/18	
07	1000	2	54	44	-	0	0	32	3/13	
12	1220	8	90	2	-	0	0	2	4/12	
Purshia tridentata										
04	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	5/4	

NORTH LITTLE DONKEY - TREND STUDY NO. 9R-6-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT

Land Ownership: BLM

Elevation: 6,000 ft (1,829 m)

Aspect: Southwest

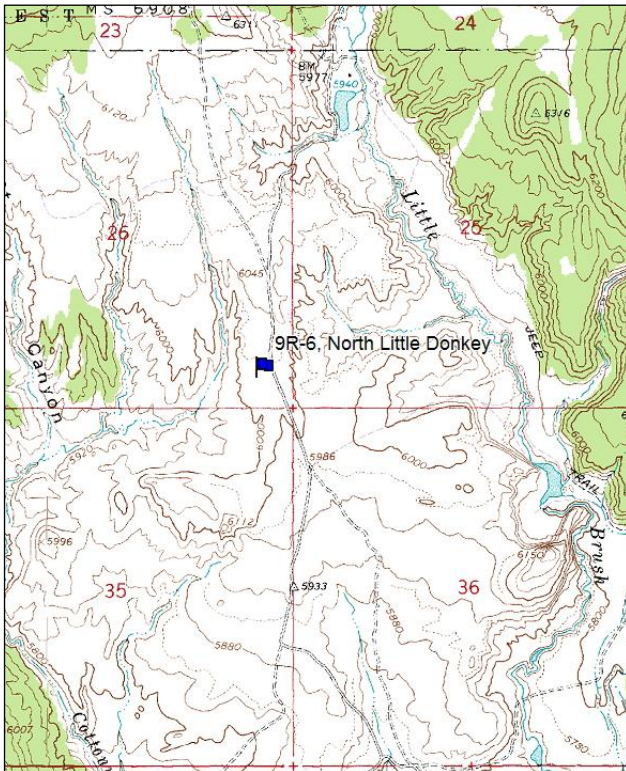
Slope: 1-2%

Transect bearing: 340° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

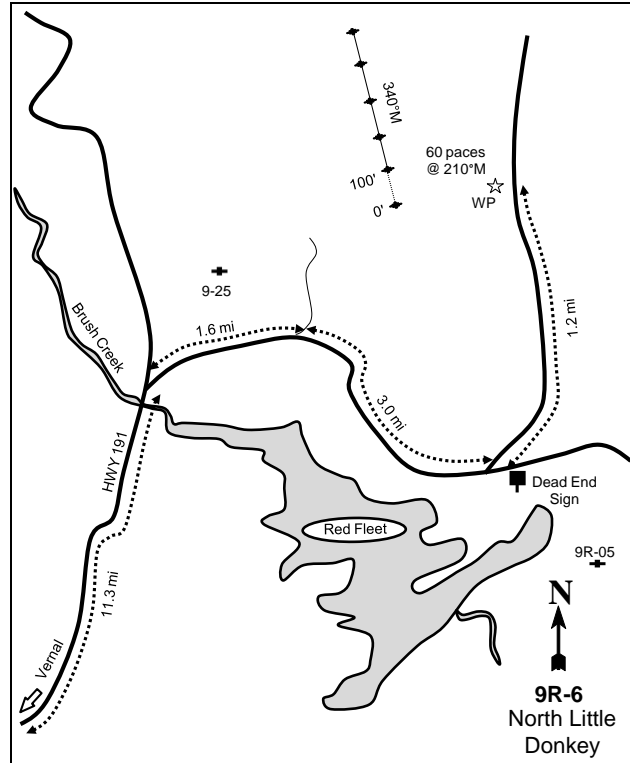
Directions: From Vernal travel north on highway 191 for about 11.3 miles to a road that comes in from the right (east). Turn here and travel 1.6 miles to a fork, stay to the right. Continue 3.0 miles, passing Red Fleet Reservoir, to another fork with a dead end sign and continue left (north). Drive 1.2 miles to a witness post on the left (west) side of the road. The 0-foot stake is 60 paces from the witness post at 210°M marked with browse tag #36.

Map Name: Donkey Flat



Township: 2S Range: 22E Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 634830 E 4496614 N

NORTH LITTLE DONKEY - TREND STUDY NO. 9R-6

Site Information

Site Description: The study is located approximately 2 miles north of little Donkey Flat within a Wyoming big sagebrush (*Artemisia tridentata* spp. *Wyomingensis*) flat. The study was established in 2004 on land administrated by the Bureau of Land Management (BLM) to monitor reseeding project. The study site is located within the BLM Donkey Flat allotment. This treatment is part of the Red Fleet habitat projects. In the fall of 2004 the area was drill seeded to enhance grasses, forbs, and shrubs (Table - Seed Mix). Deer pellet groups were sampled in moderate abundance in 2004 and low abundance in 2007 and 2012. Elk pellet groups were sampled in low abundance over the sample years. Cattle pellet groups were sampled in moderate abundance in 2004 and 2007 (Table - Pellet Group Data).

Browse: The dominant preferred browse species on the site is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and forage kochia (*Kochia prostrata*). The Wyoming big sagebrush population is a moderate to heavily used population with low decadence and a high amount of plants displaying poor vigor within the population, though decadence was high in 2004 and 2007. The recruitment of young sagebrush plants has been good following the treatment. The forage kochia population is a moderate to heavily used population with low decadence and good vigor. The recruitment of young kochia plants to the population has been good since the treatment. All three of the seeded browse species have been sampled on the study site which include Wyoming big sagebrush, fourwing saltbush (*Atriplex canescens*), and forage kochia (Table - Browse characteristics). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and fairly diverse on the site. The dominant grass species is crested wheatgrass, which has provided the majority of the grass cover on the site over the study years. Seeded grass species sampled on the site include western wheatgrass (*Agropyron cristatum*) and Russian wildrye (*Elymus junceus*), though occurring in low abundance and Russian wildrye was sampled prior to treatment. Forbs are not abundant or very diverse on the site. The weedy annual species annual stickseed (*Lappula occidentalis*) has been the most abundant forb species on the site, though it was rare in 2012 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Solirec component, which is found on fan remnants. The parent material consists of eolian deposits over slope alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.2). Phosphorus was low at only 5 ppm and may be limiting to plant growth and development (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high on the site, though there is a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush increased 42% following the treatment from 1,720 plants/acre to 2,440 plants/acre, and canopy cover remained similar at 1%. The health of the sagebrush population improved with decadence decreasing from 73% to 20% and plants displaying poor vigor decreasing from 57% to 18% of the population. The recruitment of young sagebrush plants increased from 1% to 35% of the population. Forage kochia was sampled at 2,220 plants/acre following the treatment.

Grass: The sum of nested frequency of perennial grasses increased two fold, and cover increased from 5% to 12%. Crested wheatgrass significantly increased in nested frequency, and cover increased from 5% to 10%. Cheatgrass was sampled for the first time following the treatment, though occurring in low abundance.

Forb: The sum of nested frequency of perennial forbs decreased 20%, and cover decreased from 2% to 1%. The weedy annual forb species annual stickseed decreased significantly in nested frequency, and cover decreased from 19% to 3%.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of Wyoming big sagebrush increased 54% following the treatment to 3,760 plants/acre, and canopy cover increased to 2%. Decadence of sagebrush decreased to 5% and plants displaying poor vigor increased to 48% of the population. The recruitment of young sagebrush plants remained good at 28% of the population. Forage kochia increased to 8,620 plants/acre, and cover increased to 2%.

Grass:

- **2007 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses decreased 17%, though cover increased to 21%. Crested wheatgrass significantly increased in nested frequency, and cover increased to 19%. Cheatgrass remained rare on the site.

Forb:

- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial forbs, and cover remained similar. The weedy annual forb species annual stickseed decreased significantly in nested frequency, and cover decreased from to less than 1%.

SEED MIX--

Management unit 09R, Study no: 6

Project Name: Red Fleet			
WRI Database #: PDB			
Application: Drill		Acres: 470	
Seed type		lbs in mix	lbs/acre
G	Russian Wildrye 'Bozoisky'	470	1.00
G	Western Wheatgrass 'Arriba'	470	1.00
F	Alfalfa 'Ladak+'	700	1.49
F	Blue Flax 'Appar'	50	0.11
F	Cicer Milkvetch 'lutana'	470	1.00
F	Sainfoin 'Eski'	700	1.49
F	Small burnet 'Delar'	1175	2.50
F	Western Yarrow	50	0.11
B	Forage Kochia 'Immigrant'	500	1.06
B	Fourwing Saltbush	470	1.00
B	Sagebrush, Wyoming	450	0.96
Total Pounds:		5505	11.71
PLS Pounds:			9.28

Trend Summary

HERBACEOUS TRENDS--

Management unit 09R, Study no: 6

T y p e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	_a 199	_b 302	_c 369	4.57	10.05	18.70
G	Agropyron smithii	_a -	_b 47	_a -	-	.18	-
G	Bromus tectorum (a)	_a -	_{ab} 6	_b 9	-	.01	.02
G	Elymus junceus	8	5	19	.33	.18	.78
G	Oryzopsis hymenoides	1	-	3	.03	-	.00
G	Poa secunda	_a 24	_c 194	_b 61	.21	1.27	1.18
G	Stipa comata	-	-	2	-	-	.03
Total for Annual Grasses		0	6	9	0	0.01	0.02
Total for Perennial Grasses		232	548	454	5.15	11.69	20.70
Total for Grasses		232	554	463	5.15	11.70	20.73
F	Chenopodium leptophyllum(a)	4	-	-	.02	-	-
F	Collinsia parviflora (a)	-	1	8	-	.00	.01
F	Comandra pallida	-	1	-	-	.00	-
F	Descurainia pinnata (a)	_a 2	_b 63	_a -	.01	.21	-
F	Halogeton glomeratus (a)	2	9	5	.00	.05	.01
F	Lappula occidentalis (a)	_c 430	_b 322	_a 15	18.69	3.34	.04
F	Machaeranthera canescens	-	-	5	-	-	.00
F	Phlox longifolia	10	9	3	.02	.01	.01
F	Ranunculus testiculatus (a)	_a -	_b 27	_a 3	-	.04	.00
F	Salsola iberica (a)	_b 20	_a -	_a 2	.47	-	.00
F	Sphaeralcea coccinea	_b 149	_{ab} 119	_a 114	2.15	.52	.52
F	Townsendia sp.	3	-	2	.00	-	.01
Total for Annual Forbs		458	422	33	19.20	3.65	0.07
Total for Perennial Forbs		162	129	124	2.18	0.54	0.55
Total for Forbs		620	551	157	21.39	4.20	0.62

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 09R, Study no: 6

T y p e	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	50	54	61	.98	.85	1.83
B	Gutierrezia sarothrae	4	5	6	.01	.03	.00
B	Kochia prostrata	0	29	60	-	.29	2.37
B	Opuntia sp.	2	1	0	-	-	-
Total for Browse		56	89	127	0.99	1.16	4.20

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 6

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	1.08	1.01	2.33
Gutierrezia sarothrae	-	.08	-
Kochia prostrata	-	.25	2.13

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 09R, Study no: 6

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata wyomingensis	2.5	1.5	0.7

BASIC COVER--

Management unit 09R, Study no: 6

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	28.80	18.98	28.41
Rock	.00	0	0
Pavement	.50	.09	.27
Litter	17.93	31.29	18.96
Cryptogams	.90	1.17	.87
Bare Ground	62.21	60.14	61.75

SOIL ANALYSIS DATA --

Management unit 9R, Study no: 6, Study Name: North Little Donkey

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
12.6	7.2	33.0	39.5	27.5	1.3	5.0	300.8	0.6

PELLET GROUP DATA--

Management unit 09R, Study no: 6

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	69	91	28	-	-	-
Horse	-	-	1	-	-	-
Elk	17	3	1	18 (45)	7 (18)	-
Deer	30	7	16	21 (53)	11 (28)	11 (26)
Cattle	9	4	4	25 (61)	20 (50)	-

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 6

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
04	1720	1	26	73	160	3	97	57	11/17	
07	2440	35	45	20	4040	48	36	18	8/11	
12	3760	28	67	5	80	57	41	48	8/12	
<i>Atriplex canescens</i>										
04	0	0	0	-	-	0	0	0	24/27	
07	0	0	0	-	-	0	0	0	25/32	
12	0	0	0	-	-	0	0	0	22/29	
<i>Chrysothamnus nauseosus</i>										
04	0	0	0	-	-	0	0	0	11/14	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Gutierrezia sarothrae</i>										
04	140	14	86	0	-	0	14	0	5/8	
07	220	0	45	55	60	18	0	45	6/9	
12	140	0	100	0	-	0	0	0	5/5	
<i>Kochia prostrata</i>										
04	0	0	0	0	-	0	0	0	-/-	
07	2220	41	59	0	2200	3	3	0	4/5	
12	8620	8	92	0	12360	60	34	.46	5/7	
<i>Leptodactylon pungens</i>										
04	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	7/12	
<i>Opuntia sp.</i>										
04	60	0	33	67	-	0	0	0	4/12	
07	20	100	0	0	-	0	0	0	3/6	
12	0	0	0	0	-	0	0	0	4/10	

RED FLEET LOP AND SCATTER - TREND STUDY NO. 9R-7-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Semidesert Gravelly Loam (Wyoming Big Sagebrush), R034XY205UT

Land Ownership: BLM

Elevation: 6,300 ft (1,920 m)

Aspect: Southeast

Slope: 4%

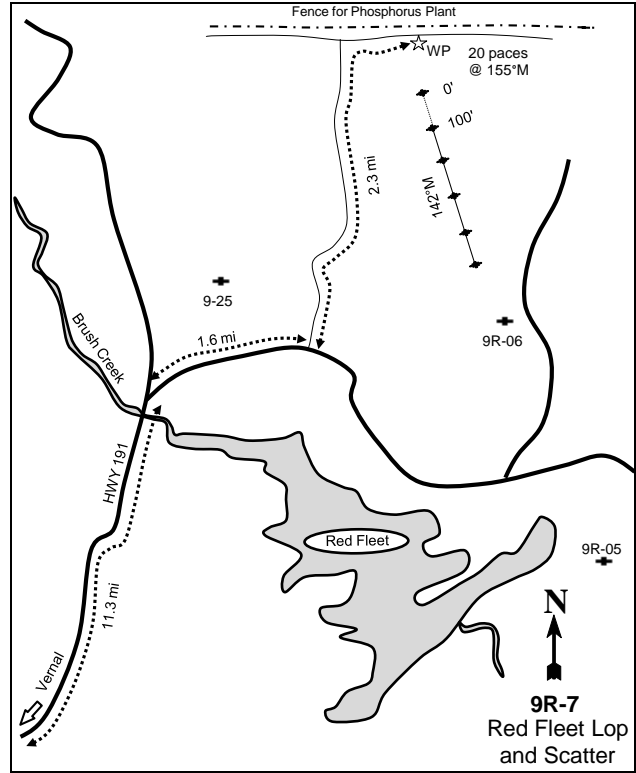
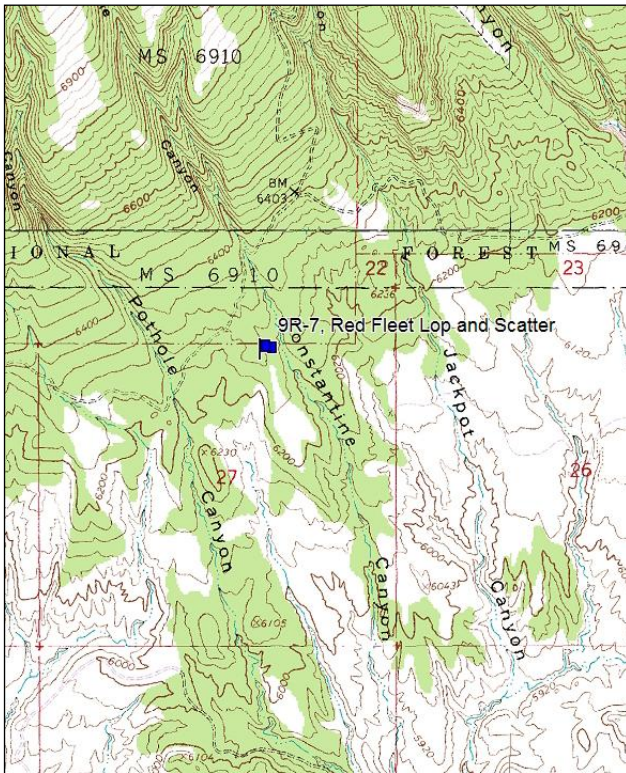
Transect bearing: 142° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: From Vernal travel north on highway 191 for about 11.3 miles to a road that comes in from the right (east). Turn here and travel 1.6 miles to a fork. Turn left (north) and travel 2.3 miles to T-intersection just before a fence for the phosphorus plant. Turn right (east) and drive for a short distance to the witness post on the right (south) side. From the witness post, walk down a very faint road at 155°M for about 200 feet to the 0-foot stake marked with browse tag #37.

Map Name: Donkey Flat

Diagrammatic Sketch:



Township: 2S Range: 22E Section: 27

GPS: NAD 83, UTM 12S 632742 E 4497729 N

RED FLEET LOP AND SCATTER - TREND STUDY NO. 9R-7

Site Information

Site Description: The study is located approximately three miles north of Red Fleet reservoir. The study monitors an old Utah juniper (*Juniper osteosperma*) chaining that was treated in the 1960s or 1970s. Due to the reinvasion or release of junipers within the chaining this area was targeted to be retreated before junipers dominated the site once again. The study was established on land administrated by the Bureau of Land Management (BLM) in June of 2004 and was later treated by lopping and scattering juniper trees later that fall. The study site is located within the BLM Donkey Flat allotment. No seeding was done to this area. Elk and deer appear to use the area in winter and spring. Deer pellet groups were sampled in moderate abundance in 2004 and low abundance in 2007 and 2012. Elk pellet groups were sampled in high abundance in 2004, moderate abundance in 2007, and low abundance in 2012. Cattle pellet groups were sampled in moderate abundance in 2004 and 2007 (Table - Pellet Group Data).

Browse: The dominant browse species on the site is Utah juniper, which has provided the majority of the browse cover on the site since the outset of the study. The dominant preferred browse species is black sagebrush (*Artemisia nova*). The black sagebrush is heavily used population with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population has been good since the treatment. Other browse species sampled on the site include Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics). The stage of woodland succession was in Phase I transistion to Phase II prior to the treatment, and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant but not diverse. The dominant grass species is crested wheatgrass (*Agropyron cristatum*), which has provided the majority of the grass cover on the site over the sample years. The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site following the treatment, though occurring in low abundance. Other grass species sampled on the site include Sandberg bluegrass (*Poa secunda*) and needle-and-thread (*Stipa comata*). Forbs are not abundant or diverse on the site. Scarlet globemallow (*Sphaeralcea coccinea*) has been the dominant forb species on the site in all sample years (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Abracon component, which is found on fan remnants. The parent material consists of slope alluvium derived from sandstone, limestone, shale, and quartzite. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is a high amount of litter and a moderate amount of vegetation and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of black sagebrush increased 20% following the treatment from 1,880 plants/acre to 2,260 plants/acre, and canopy cover remained similar at 1%. The health of the sagebrush population improved with decadence decreasing from 18% to 5% and plants displaying poor vigor decreasing from 12% to 5% of the population. The recruitment of young sagebrush plants increased from 12% to 25% of the population.

Grass: The sum of nested frequency of perennial grasses increased 66%, and cover increased from 13% to 20%. Crested wheatgrass significantly increased in nested frequency, and cover increased from 13% to 20%. Cheatgrass was sampled for the first time following the treatment, though occurring in low abundance.

Forb: The sum of nested frequency of perennial forbs decreased 20%, and cover decreased from 3% to 1%. Scarlet globemallow increased significantly in nested frequency, though cover decreased from 2% to 1% cover.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of black sagebrush increased 68% to 3,800 plants/acre, and canopy cover increased to 2%. Decadence and plants displaying poor vigor remained low within the population. The recruitment of young sagebrush plants increased to 37% of the population.

Grass:

- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial grasses remained similar, though cover increased to 23%. Crested wheatgrass significantly decreased in nested frequency, though cover increased to 21%. Cheatgrass remained rare on the site.

Forb:

- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial forbs increased 22%, though cover remained similar at 1%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 09R, Study no: 7

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	a257	c416	b380	13.26	20.30	21.13
G	Bromus tectorum (a)	a-	b28	a6	-	.12	.01
G	Poa secunda	a3	a19	b69	.03	.11	1.91
G	Stipa comata	4	3	-	.01	.00	-
Total for Annual Grasses		0	28	6	0	0.12	0.01
Total for Perennial Grasses		264	438	449	13.30	20.42	23.04
Total for Grasses		264	466	455	13.30	20.55	23.05
F	Astragalus convallarius	b35	a7	ab19	1.04	.07	.07
F	Chenopodium leptophyllum(a)	b19	a1	a-	.10	.00	-
F	Cryptantha sp.	3	2	12	.00	.03	.02
F	Descurainia pinnata (a)	a-	b41	a3	.00	.08	.00
F	Draba sp. (a)	-	3	-	-	.00	-
F	Erigeron sp.	-	1	-	-	.00	-
F	Gilia sp. (a)	1	-	-	.00	-	-
F	Ipomopsis congesta	10	-	-	.09	-	-
F	Lappula occidentalis (a)	a-	b70	a18	.00	.32	.04
F	Sphaeralcea coccinea	a61	b80	ab78	2.21	1.28	1.15
F	Townsendia sp.	3	-	1	.00	-	.00
Total for Annual Forbs		20	115	21	0.12	0.41	0.04
Total for Perennial Forbs		112	90	110	3.37	1.39	1.25
Total for Forbs		132	205	131	3.49	1.80	1.29

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 09R, Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia nova	22	24	30	2.26	1.76	2.22
B	Artemisia tridentata wyomingensis	0	0	1	-	-	-
B	Chrysothamnus nauseosus	1	0	0	.15	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	1	0	-	.03	-
B	Gutierrezia sarothrae	9	15	56	.06	.05	1.72
B	Juniperus osteosperma	7	5	6	7.62	.68	.71
B	Kochia prostrata	0	0	0	-	-	.38
B	Opuntia sp.	11	10	7	.48	.21	.01
Total for Browse		11	21	17	10.58	2.75	5.05

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 7

Species	Percent Cover		
	'04	'07	'12
Artemisia nova	.91	.71	1.83
Artemisia tridentata wyomingensis	-	-	.11
Chrysothamnus viscidiflorus viscidiflorus	-	.15	-
Gutierrezia sarothrae	-	-	.80
Juniperus osteosperma	9.21	2.48	2.08
Opuntia sp.	.71	.21	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 09R, Study no: 7

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia nova	2.0	1.1	0.4
Artemisia tridentata wyomingensis	-	2.1	1.2

POINT-QUARTER TREE DATA--

Management unit 09R, Study no: 7

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'12	'04	'07	'12
Juniperus osteosperma	66	41	37	4.2	3.4	3.2

BASIC COVER--

Management unit 09R, Study no: 7

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	26.77	25.87	30.13
Rock	2.29	1.36	1.86
Pavement	26.86	16.01	14.27
Litter	27.71	41.33	39.66
Cryptogams	3.43	.90	.20
Bare Ground	25.02	24.80	25.13

SOIL ANALYSIS DATA --

Management unit 9R, Study no: 7, Study Name: Red Fleet Lop and Scatter

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.2	7.2	40.6	35.9	23.5	4.2	13.3	217.6	1.3

PELLET GROUP DATA--

Management unit 09R, Study no: 7

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	26	67	15	-	-	-
Elk	47	12	3	46 (114)	29 (71)	2 (5)
Deer	25	9	11	36 (89)	18 (45)	14 (35)
Cattle	2	6	7	21 (52)	20 (48)	-
Horse	-	-	-	-	-	1 (1)

BROWSE CHARACTERISTICS--

Management unit 09R, Study no: 7

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia nova									
04	1880	12	70	18	-	40	1	12	5/12
07	2260	25	70	5	240	11	79	5	7/13
12	3800	37	63	1	2580	0	67	.52	6/12
Artemisia tridentata wyomingensis									
04	0	0	0	-	-	0	0	0	10/19
07	0	0	0	-	-	0	0	0	16/24
12	20	0	100	-	-	100	0	0	20/25
Chrysothamnus nauseosus									
04	20	0	100	-	-	0	0	0	9/13
07	0	0	0	-	-	0	0	0	16/12
12	0	0	0	-	-	0	0	0	21/25

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
04	20	0	100	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	7/11
12	0	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
04	200	20	80	0	20	0	0	0	7/11
07	500	8	56	36	1720	4	32	44	8/11
12	5660	1	99	0	20	0	0	31	5/6
<i>Juniperus osteosperma</i>									
04	160	0	100	0	-	13	0	0	-/-
07	100	0	80	20	-	0	0	80	-/-
12	160	75	25	0	-	0	0	25	-/-
<i>Opuntia sp.</i>									
04	300	0	93	7	-	0	0	7	4/17
07	220	0	73	27	20	0	9	18	3/11
12	180	0	89	11	-	0	0	33	3/9
<i>Purshia tridentata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	15/75
12	0	0	0	-	-	0	0	0	-/-

BRUSH CREEK DIXIE - TREND STUDY NO. 9R-15-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT

Land Ownership: BLM

Elevation: 5,750 ft (1,753 m)

Aspect: Southwest

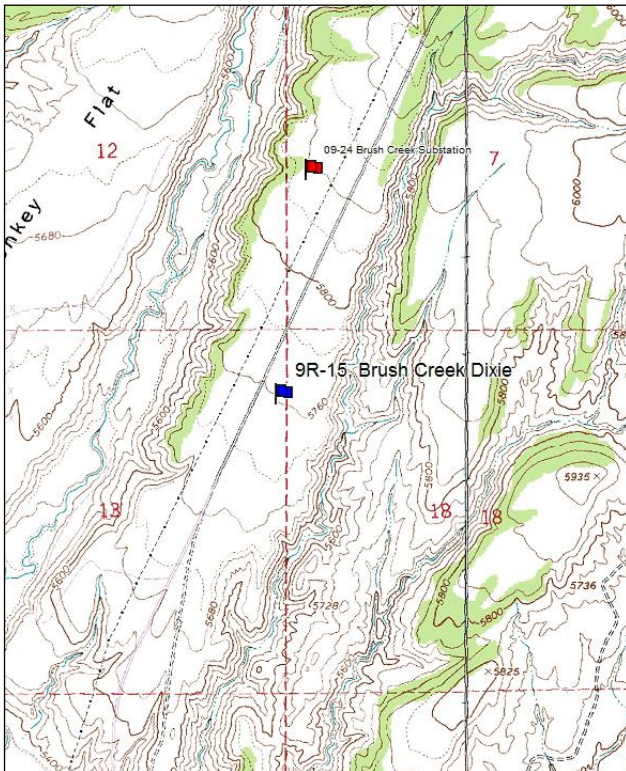
Slope: 2%

Transect bearing: 22° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

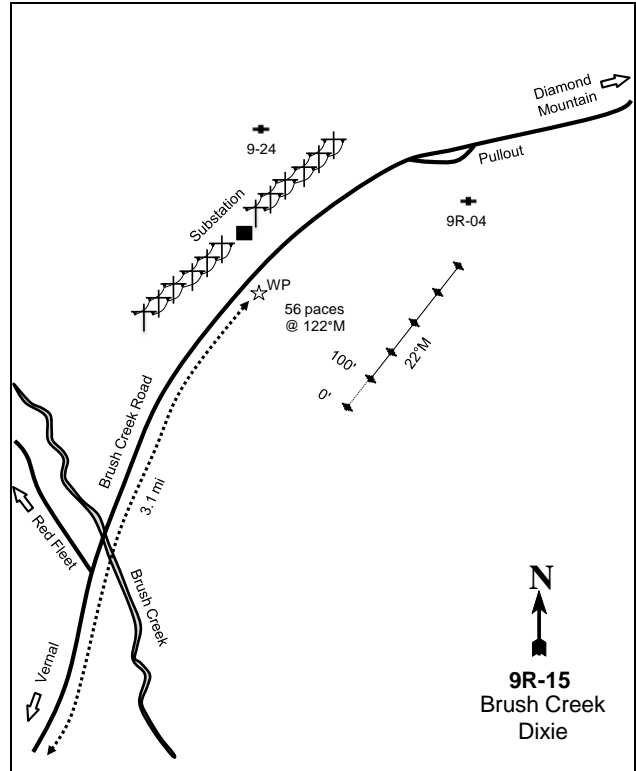
Directions: From 500 North in Vernal, travel north on Brush Creek Road 3.1 miles to the witness post on the right (east) side of the road. From the witness post, the 0-foot stake is 56 paces at 122°M and is marked with browse tag #134.

Map Name: Donkey Flat



Township: 3S Range: 22E Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 636649 E 4491523 N

BRUSH CREEK DIXIE - TREND STUDY NO. 9R-15
[Project #315](#) and [Project #1659](#)

Site Description

Site Information: The study is located approximately two miles to the east of Red Fleet Reservoir on Brush Creek Bench. The study was established on land administrated by the Bureau of Land Management (BLM) in 2007 to monitor a Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*) restoration project north of Vernal. The study site is within the BLM S. J. Hatch allotment. The treatment sprayed 300 acres with Plateau (Imazapic) herbicide to control cheatgrass in the fall of 2008, and then was one-way Dixie harrowed while being seeded using a broadcast seeder. Wyoming big sagebrush seed was then aerially applied in March of 2009. In the fall of 2010 the treatment area was reseeded with a rangeland drill due to the lack of response from the first seeding attempt. The objectives of this treatment were to improve crucial deer, elk, and sage-grouse winter range by establishing new sagebrush and forage kochia (*Kochia prostrata*) in an area with heavy sagebrush die-off (WRI Database 2013). Deer pellet groups were sampled in high abundance in all sample years. Elk pellet groups were sampled in low abundance in 2007, 2010, and 2012; and moderate abundance in 2009. Cattle pellet groups were sampled in low abundance in 2007, 2009, and 2010 (Table - Pellet Group Data).

Browse: Wyoming big sagebrush is the dominant preferred browse, providing the majority of browse cover in all sample years and has increased in cover since being seeded on the site. Forage kochia (*Kochia prostrata*) was seeded in the spring of 2009, but has not established well (Table - Canopy Cover). The Wyoming big sagebrush population was mostly decadent at the outset of the study, but decadence has since declined substantially as cheatgrass (*Bromus tectorum*) dominance also decreased. Sagebrush plants displaying poor vigor were extremely high in 2007, but have since been low. The recruitment of young sagebrush plants to the population has mostly been poor throughout the sample years, though in 2012 recruitment was good (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are diverse, but are not abundant and are in poor condition. The annual grass cheatgrass is the dominant species. Prior to treatment, cheatgrass cover was extremely high and accounted for the majority of grass cover. Following the Plateau application, cheatgrass cover was substantially lowered, but still provided the majority of grass cover and increased in 2012. Sixweeks fescue (*Vulpia octoflora*) was common in 2007, but has become rare after the treatment. Perennial forbs are not abundant with scarlet globemallow (*Sphaeralcea coccinea*) being the dominant species and providing the majority of the perennial forb cover. In 2010, annual kochia (*Kochia scoparia*) was sampled for the first time in moderate frequency and cover, but has since decreased. Perennial forb cover and nested frequency decreased initially following treatment, and has since increased slightly (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Solirec component, which is found on fan remnants. The parent material consists of eolian deposits over slope alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). Bare ground cover is moderate, though there is a moderate amount of vegetation and a high amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Two Years Post Treatment, 2007 vs. 2009

Browse: One year after treatment, the canopy cover of Wyoming big sagebrush declined slightly from 7% to 6%. Forage kochia, broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia* sp.) were rare. Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover.

Grass: The sum of nested frequency of perennial grasses remained similar to pretreatment. Perennial grasses are rare and provided 1% cover. Sandberg bluegrass (*Poa secunda*) was the only seeded species sampled in 2009, but was present prior to treatment. Cheatgrass decreased substantially in nested frequency, and cover decreased from 32% to 9%.

Forb: The sum of nested frequency of perennial forbs declined 81% and cover declined from 2% to less than 1%. There was a significant decrease in the nested frequency of scarlet globemallow, and cover decreased from 2% to less than 1%. No seeded species were established within the sample.

Trend Assessments

Browse

- **2009 to 2010 - up (+2)**: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Wyoming big sagebrush canopy cover increased from 6% to 13%. A visual comparison of photos from 2009 to 2010 shows sagebrush to be much more vigorous with a high amount of growth in 2010.
- **2010 to 2012 - slightly down (-1)**: The density of Wyoming big sagebrush decreased 15% from 5,100 plants/acre to 4,340 plants/acre, though canopy cover increased to 14%.

Grasses

- **2009 to 2010 - slightly up (+1)**: Perennial grasses are very rare on this site, barely providing 1% cover in 2009 and less than 1% in 2010. The sum of nested frequency for perennial grasses has increased each year since treatment, but due to their scarcity provide no true difference. Cheatgrass cover decreased from 9% to 6% while there was a significant decrease in nested frequency. The spraying treatment has reduced cheatgrass abundance, but it was still sampled in nearly every quadrat.
- **2010 to 2012 - stable (0)**: Perennial grasses remained rare on this site, and cover remained similar at 1%. Cheatgrass increased significantly in nested frequency, and cover increased from to 12%.

Forbs

- **2009 to 2010 - slightly up (+1)**: The sum of nested frequency of perennial forbs increased nearly fourfold, and cover returned to pretreatment levels at 2%. Scarlet globemallow provided the majority of the perennial forb cover at 1%. Annual kochia appeared on the site in 2010 and provided 5% cover. Annual forb cover increased from almost no cover to 6% cover.
- **2010 to 2012 - slightly up (+1)**: The sum of nested frequency of perennial forbs decreased 22%, and cover decreased to 1%. Scarlet globemallow provided the majority of the perennial forb cover at 1%. Annual kochia decreased significantly in nested frequency, and cover decreased to less than 1%.

SEED MIX--

Management unit 09R, Study no: 15

Project Name: Brush Creek Bench Sage Restoration (2008) WRI Database #: 315				Project Name: Brush Creek Bench Seeding (2010) WRI Database #: 1659			
Application: Broadcast Seeder		Acres: 300		Application: Rangeland Drill		Acres: 410	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Douglas'	450	1.50	G	Crested Wheatgrass 'Ephraim'	400	0.98
G	Crested Wheatgrass 'Hycrest'	300	1.00	G	Crested Wheatgrass 'Nordan'	400	0.98
G	Russian Wildrye 'Bozoisky'	300	1.00	G	Russian Wildrye 'Bozoisky'	400	0.98
G	Sandberg Bluegrass	150	0.50	G	Sandberg Bluegrass	200	0.49
G	Snake River Wheatgrass 'Secar'	300	1.00	G	Siberian Wheatgrass 'Vavilov'	200	0.49
G	Thickspike Wheatgrass 'Critana'	300	1.00	G	Snake River Wheatgrass 'Secar'	450	1.10
F	Alfalfa 'Ladak'	600	2.00	G	Western Wheatgrass 'Arriba'	450	1.10
Total Pounds:		2400	8.00	F	Alfalfa 'Ladak Plus'	200	0.49
PLS Pounds:			6.86	F	Alfalfa 'Ranger'	200	0.49
Application: Aerial Seed		Acres: 300		F	Alfalfa 'Spreador 4'	200	0.49
Seed type		lbs in mix	lbs/acre	F	Blue Flax 'Appar'	400	0.98
B	Forage Kochia	300	1.00	F	Small Burnet 'Delar'	400	0.98
B	Sagebrush, Wyoming	300	1.00	B	Fourwing Saltbush	417	1.02
Total Pounds:		600	2.00	Total Pounds:		4317	10.53
PLS Pounds:			0.85	PLS Pounds:			8.70

Trend Summary

HERBACEOUS TRENDS--

Management unit 09R, Study no: 15

T y p e	Species	Nested Frequency				Average Cover %			
		'07	'09	'10	'12	'07	'09	'10	'12
G	Agropyron cristatum	a-	a-	a ⁴	b ²²	-	-	.01	.29
G	Agropyron smithii	10	6	3	13	.09	.41	.00	.05
G	Agropyron spicatum	-	-	-	1	-	-	-	.03
G	Bromus tectorum (a)	d ⁴⁸⁰	b ³⁶⁰	a ²⁹⁹	c ³⁹⁸	30.54	9.37	6.29	12.26
G	Oryzopsis hymenoides	5	-	-	3	.04	-	-	.00
G	Poa bulbosa	-	-	1	-	-	.03	.00	-
G	Poa secunda	a ⁴	ab ⁸	ab ⁸	b ²²	.04	.06	.05	.29
G	Sitanion hystrix	13	18	16	4	.25	.16	.05	.01
G	Stipa comata	a ¹⁹	ab ²⁶	ab ³⁷	b ³⁶	.43	.64	.53	.35
G	Vulpia octoflora (a)	c ¹⁰⁸	a-	ab ³	b ¹⁴	1.24	-	.00	.04
Total for Annual Grasses		588	360	302	412	31.78	9.37	6.30	12.31
Total for Perennial Grasses		51	58	69	101	0.86	1.31	0.65	1.04
Total for Grasses		639	418	371	513	32.64	10.69	6.95	13.35
F	Allium sp.	b ⁷	a-	ab ⁴	a-	.02	-	.00	-
F	Astragalus convallarius	ab ¹	a-	b ⁸	a-	.03	.03	.07	-
F	Chenopodium leptophyllum(a)	a-	a-	b ¹⁰	a-	-	-	.06	-
F	Descurainia pinnata (a)	b ⁴⁴	a-	a ¹	a ⁹	.09	-	.00	.02
F	Grindelia squarrosa	-	2	-	3	-	.03	-	.01

T y P e	Species	Nested Frequency				Average Cover %			
		'07	'09	'10	'12	'07	'09	'10	'12
F	Kochia scoparia (a)	a-	a-	c173	b21	-	-	4.87	.05
F	Lappula occidentalis (a)	c36	a2	ab11	bc23	.12	.03	.02	.05
F	Lygodesmia sp.	-	-	7	-	-	-	.03	-
F	Machaeranthera canescens	a1	ab1	c25	bc19	.00	.00	.20	.09
F	Penstemon sp.	9	-	-	-	.01	-	-	-
F	Phlox longifolia	a1	a-	ab13	b17	.00	-	.02	.06
F	Plantago patagonica (a)	c178	a3	b42	a43	1.03	.00	.59	.10
F	Salsola iberica (a)	a4	a-	b22	a5	.00	-	.65	.01
F	Sphaeralcea coccinea	c159	a31	b74	b65	2.26	.59	1.29	.97
F	Townsendia sp.	2	-	4	4	.00	-	.15	.06
Total for Annual Forbs		262	5	259	101	1.25	0.03	6.20	0.23
Total for Perennial Forbs		180	34	135	108	2.34	0.65	1.78	1.20
Total for Forbs		442	39	394	209	3.60	0.69	7.99	1.44

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 09R, Study no: 15

T y P e	Species	Strip Frequency			Average Cover %			
		'07	'10	'12	'07	'09	'10	'12
B	Artemisia tridentata wyomingensis	95	90	89	5.97	7.72	7.44	10.46
B	Ceratoides lanata	1	0	0	-	-	-	-
B	Gutierrezia sarothrae	4	3	4	.15	.06	.03	-
B	Kochia prostrata	0	1	1	-	-	.01	.01
B	Opuntia sp.	7	10	15	.15	.15	.15	.05
Total for Browse		107	104	109	6.27	7.93	7.63	10.53

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 15

Species	Percent Cover			
	'07	'09	'10	'12
Artemisia tridentata wyomingensis	6.70	6.10	12.50	13.65
Gutierrezia sarothrae	.11	.03	.21	-
Opuntia sp.	.21	.21	.15	.23

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 09R, Study no: 15

Species	Average leader growth (in)	
	'10	'12
Artemisia tridentata wyomingensis	1.2	0.4

BASIC COVER--

Management unit 09R, Study no: 15

Cover Type	Average Cover %			
	'07	'09	'10	'12
Vegetation	41.44	22.67	23.38	28.86
Rock	.03	.02	0	.03
Pavement	.15	.10	.11	.21
Litter	46.24	48.16	46.02	47.51
Cryptogams	1.03	.24	.15	.15
Bare Ground	23.17	28.59	40.22	30.12

SOIL ANALYSIS DATA --

Management unit 9R, Study no: 15, Study Name: Brush Creek Dixie

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	6.7	52.2	26.4	21.4	1.1	19.6	176.0	0.5

PELLET GROUP DATA--

Management unit 09R, Study no: 15

Type	Quadrat Frequency				Days use per acre (ha)			
	'07	'09	'10	'12	'07	'09	'10	'12
Rabbit	49	5	10	6	-	-	-	-
Grouse	1	-	-	-	-	-	-	-
Elk	4	5	4	5	2 (5)	24 (60)	1 (2)	3 (7)
Deer	48	44	52	34	64 (159)	116 (288)	62 (154)	66 (164)
Cattle	1	1	1	3	6 (14)	17 (43)	5 (13)	-

BROWSE CHARACTERISTICS--

Management unit 09R, Study no: 15

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia tridentata wyomingensis</i>									
07	4420	0	10	90	2640	64	28	62	13/19
09	No Density Collected								14/20
10	5100	8	71	21	100	8	41	11	15/21
12	4340	23	60	17	8760	50	35	21	15/22
<i>Atriplex canescens</i>									
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	25/64
<i>Ceratoides lanata</i>									
07	20	0	100	-	-	0	100	0	9/10
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
07	220	9	91	-	-	0	0	0	8/10	
09	No Density Collected								9/13	
10	160	0	100	-	-	0	0	0	11/16	
12	100	40	60	-	-	0	20	0	5/8	
<i>Kochia prostrata</i>										
07	0	0	0	-	-	0	0	0	-/-	
09	No Density Collected								-/-	
10	20	100	0	-	100	0	0	0	-/-	
12	20	100	0	-	20	0	100	0	2/3	
<i>Opuntia sp.</i>										
07	140	0	57	43	-	0	0	43	4/12	
09	No Density Collected								4/13	
10	240	0	92	8	-	17	0	8	4/14	
12	340	18	82	0	-	0	0	0	3/9	

DAVIS DRAW SAGEBRUSH - TREND STUDY NO. 9R-25-12

Vegetation Type: Mountain Big Sagebrush and Antelope Bitterbrush

Range Type: Crucial Deer Summer, Crucial Elk Summer

NRCS Ecological Site Description: [Upland Loam \(Mountain Big Sagebrush\), R047XC310UT](#)

Land Ownership: BLM

Elevation: 7,610 ft (2,320 m)

Aspect: Northwest

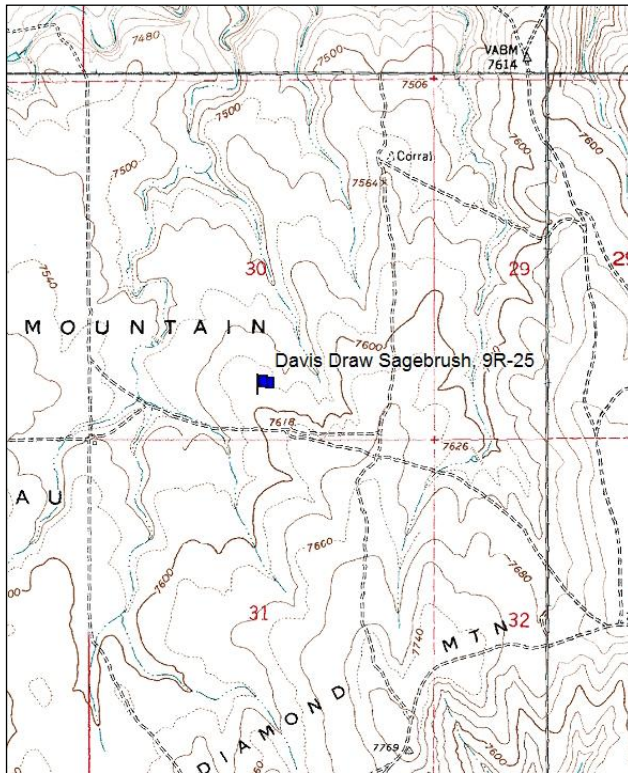
Slope: 5%

Transect bearing: 335° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

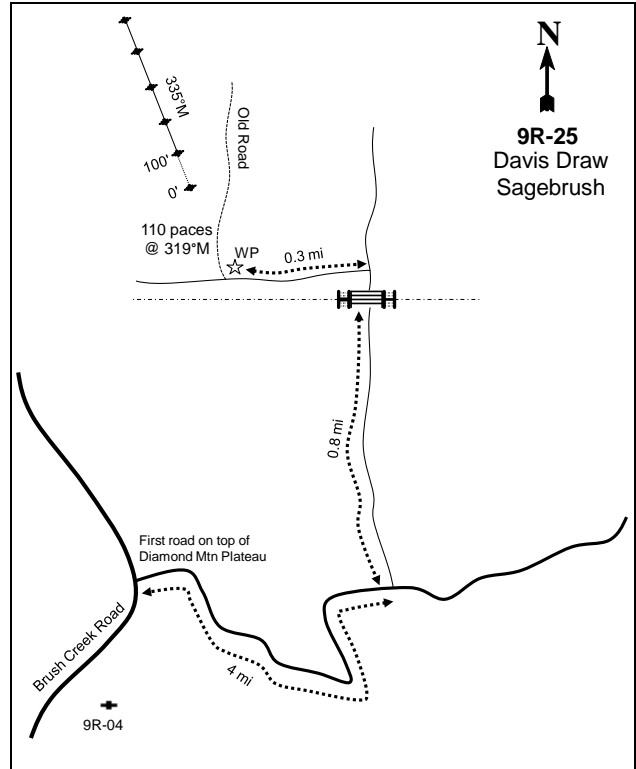
Directions: From Vernal, take the Brush Creek Road to the top of the Diamond Mountain Plateau. At the top of the plateau take the first road to the right (Rim Road). Travel 4 miles along the Rim Road then turn left (north) on a two track road. Travel 0.8 miles to a gate. Turn left (west) after going through the gate and travel 0.3 mile to the witness post on the right (north). Walk 110 paces at 319°M to the 0-foot stake.

Map Name: Jensen Ridge



Township: 2S Range: 24E Section: 30

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 646683 E 4497123 N

DAVIS DRAW SAGEBRUSH - TREND STUDY NO. 9R-25

[Project #2266](#)

Site Information

Site Description: The study is located eight and half miles east of Red Fleet Reservoir within a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*) ridge. The site was established on land administrated by the Bureau of Land Management (BLM) to monitor a two-way chain harrow project. The study site is within the BLM Davis Draw allotment. Approximately 425 acres were two-way chain harrowed in the fall of 2012. The project was not seeded (WRI Database 2013). Deer pellet groups were sampled in high abundance. Cattle pellet groups were sampled in low abundance (Table - Pellet Group Data).

Browse: Mountain big sagebrush and antelope bitterbrush are the dominant preferred browse species on the site. The mountain big sagebrush is a moderately used population with low decadence and good vigor within the population. The recruitment of young sagebrush to the population was good. The antelope bitterbrush is a moderately used population with low decadence and good vigor within the population. The recruitment of young to the population was poor. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), prickly phlox (*Leptodactylon pungens*), and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species are thickspike wheatgrass (*Agropyron dasystachyum*), mutton bluegrass (*Poa fendleriana*), and needle-and-thread (*Stipa comata*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site in low abundance. Other common grass species sampled on the site include Sandberg bluegrass (*Poa secunda*), June grass (*Koeleria cristata*), and Letterman needlegrass (*Stipa lettermani*). Forbs are not overly abundant but are fairly diverse on the site. The dominant forb species sampled on the site is rose pussytoes (*Antennaria rosea*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Ironco-Emlin complex and is likely part of the Emlin component, which occurs on plateaus. The parent material consists of eolian deposits over slope alluvium derived from sandstone, limestone, shale, and quartzite. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer. The soil surface texture is an extremely cobbly sandy loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified stable.

Trend Summary

HERBACEOUS TRENDS--

Management unit 09R, Study no: 25

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Agropyron dasystachyum</i>	184	3.83
G	<i>Bromus tectorum</i> (a)	6	.01
G	<i>Carex obtusata</i>	13	.13
G	<i>Koeleria cristata</i>	47	1.13
G	<i>Poa fendleriana</i>	174	8.04
G	<i>Poa pratensis</i>	11	.06
G	<i>Poa secunda</i>	98	1.44

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	Sitanion hystrix	39	.35
G	Stipa columbiana	10	.33
G	Stipa comata	165	8.21
G	Stipa lettermani	52	.98
Total for Annual Grasses		6	0.01
Total for Perennial Grasses		793	24.53
Total for Grasses		799	24.54
F	Agoseris glauca	10	.08
F	Antennaria rosea	131	4.96
F	Arabis holboellii	36	.10
F	Arenaria congesta	55	.42
F	Astragalus convallarius	12	.06
F	Collinsia parviflora (a)	21	.04
F	Cymopterus sp.	25	.07
F	Erigeron eatonii	6	.04
F	Erigeron pumilus	34	.14
F	Eriogonum racemosum	3	.01
F	Eriogonum umbellatum	16	.57
F	Lactuca serriola (a)	6	.01
F	Lappula occidentalis (a)	5	.00
F	Penstemon humilis	4	.03
F	Phlox longifolia	132	.80
F	Polygonum douglasii (a)	55	.08
F	Sphaeralcea coccinea	2	.00
F	Taraxacum officinale	3	.01
F	Trifolium gymnocarpon	37	.12
Total for Annual Forbs		87	0.14
Total for Perennial Forbs		506	7.45
Total for Forbs		593	7.59

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 09R, Study no: 25

T y p e	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata vaseyana	91	21.62
B	Chrysothamnus viscidiflorus viscidiflorus	7	.06
B	Opuntia sp.	2	.00
B	Purshia tridentata	72	12.17
Total for Browse		172	33.86

CANOPY COVER, LINE INTERCEPT--
 Management unit 09R, Study no: 25

Species	Percent Cover '12
Artemisia tridentata vaseyana	23.41
Chrysothamnus viscidiflorus viscidiflorus	.16
Purshia tridentata	17.78

KEY BROWSE ANNUAL LEADER GROWTH--
 Management unit 09R, Study no: 25

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	1.2
Purshia tridentata	1.3

BASIC COVER--
 Management unit 09R, Study no: 25

Cover Type	Average Cover % '12
Vegetation	68.25
Rock	.06
Pavement	.07
Litter	44.81
Cryptogams	.45
Bare Ground	9.11

PELLET GROUP DATA--
 Management unit 09R, Study no: 25

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	2	-
Deer	24	74 (182)
Cattle	2	9 (23)

BROWSE CHARACTERISTICS--
 Management unit 09R, Study no: 25

		Age class distribution					Utilization		
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>									
12	5920	42	46	12	1820	28	22	9	27/36
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
12	220	0	100	-	-	0	0	9	13/22
<i>Leptodactylon pungens</i>									
12	40	50	50	-	-	0	0	0	9/15
<i>Opuntia sp.</i>									
12	40	50	50	-	-	0	0	0	3/11
<i>Purshia tridentata</i>									
12	2500	8	90	2	60	38	47	.80	20/40

LITTLE JIM CANYON - TREND STUDY NO. 10-6-12

Vegetation Type: Mixed Mountain Brush

Range Type: Substantial Deer Summer, Crucial Elk Summer

NRCS Ecological Site Description: Upland Shallow Loam (Pinyon-Utah Juniper), R034XY322UT

Land Ownership: SITLA

Elevation: 7,720 ft (2,353 m)

Aspect: Southwest

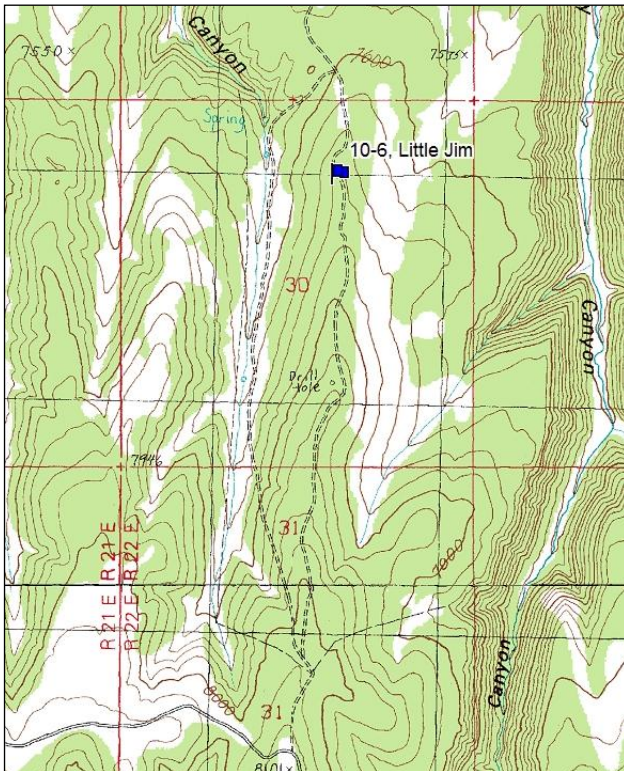
Slope: 15%

Transect bearing: 204° magnetic

Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

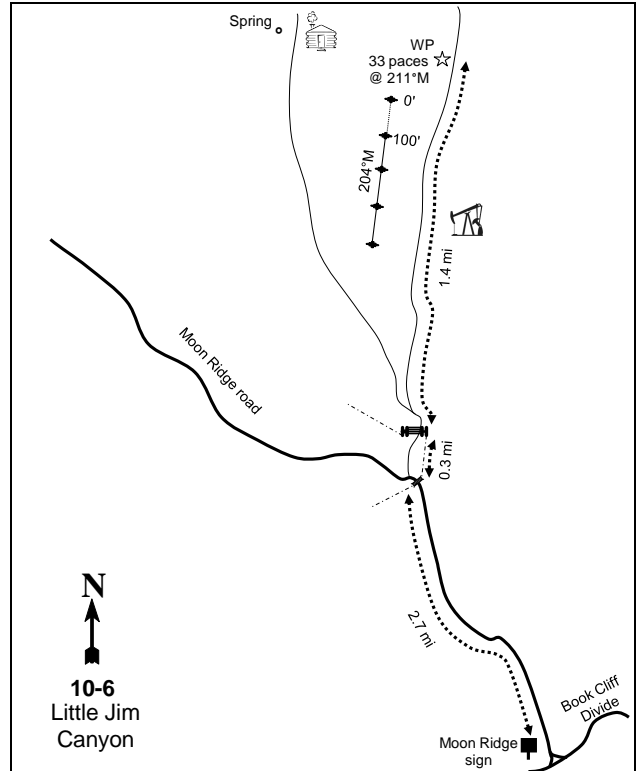
Directions: From Three Pines, proceed southwest along the divide road for about 10.5 miles to a major junction at Moon Ridge. Turn right here, and go 2.7 miles to a cattle guard. Just past the cattle guard and fence, turn right and drive down along the fence 0.3 miles to a gate. Stay to the right and continue down the ridges 1.4 miles to the witness post on the left. From the witness post, the 0-foot baseline stake is 100 feet bearing 211°M into the chaining. The 0-foot stake is marked by browse tag number 9099.

Map Name: Tenmile Canyon North



Township: 16S Range: 22E Section: 30

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 626445 E 4361161 N

LITTLE JIM CANYON - TREND STUDY NO. 10-6
[Project #2219](#)

Site Information

Site Description: The study is located on the east side of Little Jim Canyon in the Book Cliffs. The study was established on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) in 1988. This study will monitor a bullhog project to remove pinyon pine (*Pinus edulis*) and juniper (*Juniperus sp.*). The study occurs on the McClelland allotment and is managed for wildlife. The project area was chained and seed prior to the establishment of the study in the 1970s. The project area is planned to be bullhogged to remove the pinyon and juniper trees within the project boundaries in the spring/summer of 2013. The area will not be seeded and grazing will not be rested following the treatment. The objective of the project is to reduce the pinyon and juniper canopy cover to improve summer habitat for mule deer, elk, and bison (WRI Database 2013). Deer pellet groups were sampled in low abundance in 2000 and moderate abundance in 2012. Elk pellet groups were sampled in low abundance since 2000 (Table - Pellet Group Data).

Browse: The dominant preferred browse species on the site are basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), mountain mahogany (*Cercocarpus montanus*), and Gambel oak (*Quercus gambelii*). Pinyon and juniper has steadily increased in cover on the site over the course of the study (Table - Browse Trends). The stage of woodland succession is considered to be within Phase II (Tausch et al. 2009). The basin big sagebrush is a small, lightly used population with low decadence and moderate amount of plants displaying poor vigor within the population, though vigor has been good in prior sample years. The mountain mahogany is a moderately used, small population with high decadence and high amount of plants displaying poor vigor within the population, though in prior sample years, decadence and plant displaying poor vigor was low within the population. The gamble oak is a lightly used population with low decadence and good vigor within the population over the sample years (Table - browse characteristics).

Herbaceous Understory: Grasses are not over abundant but are somewhat diverse on the site. The dominant grass species on the site is Indian ricegrass (*Oryzopsis hymenoides*), which has provided the majority of the perennial grass cover on the site over the course of the study. The invasive grass species cheatgrass has been sampled on the site in relatively low abundance. Forbs are rare on the site. Forbs have decreased in abundance and diversity on the site since the outset of the study (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Moonset-Whetrock association and is likely part of the Moonset component, which occurs on hills. The parent material consists of slope alluvium and colluviums derived from sandstone and shale. The soils within this classification are characterized as shallow, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is low, though there is a moderate amount of vegetation and a high amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012 due to surface litter, surface rock movement, flow patterns, and soil movement.

Trend Assessments

Browse:

- **1988 to 1995 - stable (0):** Differences in density may be related to the larger sample area used in 1995; therefore, trend was determined using other parameters. Decadence and plants displaying poor vigor for basin big sagebrush, mountain mahogany, and Gambel oak remained low within the population.
- **1995 to 2000 - slightly up (+1):** The density of basin big sagebrush increased 24% from 420 plants/acre to 520 plants/acre and browse cover increased from 4% to 7%. The density of mountain mahogany remained similar at 460 plants/acre and browse cover increase from 3% to 4%.

- **2000 to 2012 - slightly down (-1):** The density of basin big sagebrush increased 19% to 620 plants/acre, though browse cover decreased to 5%. The density of mountain mahogany decreased 35%, and browse cover decreased to 2%. The density of pinyon and juniper increased from 231 trees/acre with an average diameter of 2.2 inches to 241 trees/acre with an average diameter of 2.4 inches, and 58 trees/acre with an average diameter of 6.1 to 70 trees/acre with an average diameter of 10.2 inches, respectively.

Grass:

- **1988 to 1995 - down (-2):** The sum of nested frequency of perennial grasses decreased 56%.
- **1995 to 2000 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 14%, though cover remained similar at 3%.
- **2000 to 2012 - stable (0):** The sum of nested frequency of perennial grasses remained similar, and cover remained similar at 3%.

Forb:

- **1988 to 1995 - down (-2):** The sum of nested frequency of perennial forbs decreased 53%.
- **1995 to 2000 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 34%, and cover remained similar at 1%.
- **2000 to 2012 - slightly down (-1):** Forbs were rare on the site. Cover of perennial forbs decreased to less than 1% cover

Trend Summary

HERBACEOUS TRENDS--

Management unit 10, Study no: 6

Type	Species	Nested Frequency				Average Cover %		
		'88	'95	'00	'12	'95	'00	'12
G	Agropyron dasystachyum	-	-	2	-	-	.01	-
G	Bromus tectorum (a)	a-	d70	c34	b6	1.61	.14	.04
G	Carex sp.	b34	ab19	a8	a14	.41	.39	.16
G	Elymus junceus	1	5	-	3	.53	-	.01
G	Koeleria cristata	-	-	-	5	-	-	.04
G	Oryzopsis hymenoides	b85	a37	b66	b79	1.33	1.63	2.16
G	Oryzopsis micrantha	c73	b26	a3	a-	.20	.03	-
G	Poa fendleriana	-	3	2	-	.03	.01	-
G	Poa pratensis	a-	ab4	b14	a-	.03	.12	-
G	Sitanion hystrix	b139	a53	a32	a21	.67	.41	.32
Total for Annual Grasses		0	70	34	6	1.61	0.14	0.04
Total for Perennial Grasses		332	147	127	122	3.21	2.61	2.70
Total for Grasses		332	217	161	128	4.83	2.76	2.74
F	Androsace septentrionalis (a)	-	-	-	4	-	-	.03
F	Antennaria rosea	-	-	3	-	-	.00	-
F	Arabis sp.	22	15	9	-	.02	.02	-
F	Aster chilensis	1	-	-	-	-	-	-
F	Chaenactis douglasii	6	1	-	-	.00	-	-
F	Cryptantha sp.	8	3	-	-	.01	-	-
F	Delphinium nuttallianum	-	1	-	-	.00	-	-
F	Descurainia sp. (a)	a-	b66	a-	a-	1.54	-	-

Type	Species	Nested Frequency				Average Cover %		
		'88	'95	'00	'12	'95	'00	'12
F	Draba sp. (a)	a ⁻	b ²⁰	a ⁻	a ⁻	.09	-	-
F	Erigeron pumilus	4	1	-	-	.00	-	-
F	Gilia latifolia (a)	a ⁻	b ¹¹	a ⁻	a ⁻	.16	-	-
F	Lappula occidentalis (a)	-	26	3	-	.06	.01	-
F	Lesquerella sp.	-	-	6	-	-	.06	-
F	Lupinus argenteus	a ⁻	b ¹⁹	a ⁻	a ⁻	.09	-	-
F	Machaeranthera canescens	6	-	-	-	-	-	-
F	Machaeranthera grindelioides	b ⁴⁵	a ¹⁵	a ²¹	a ⁵	.61	.23	.01
F	Melilotus alba	-	7	-	-	.04	-	-
F	Penstemon sp.	c ¹¹¹	a ⁻	b ²⁶	b ¹⁵	-	.77	.23
F	Phlox longifolia	2	-	-	-	-	-	-
F	Physaria newberryi	b ³⁰	ab ²⁹	a ⁹	ab ²³	.06	.10	.08
F	Polygonum douglasii (a)	-	5	-	-	.01	-	-
F	Senecio multilobatus	a ⁻	b ²²	a ¹	a ⁻	.05	.00	-
F	Unknown forb-perennial	3	-	-	-	-	-	-
Total for Annual Forbs		0	128	3	4	1.88	0.01	0.03
Total for Perennial Forbs		238	113	75	43	0.90	1.20	0.33
Total for Forbs		238	241	78	47	2.78	1.21	0.37

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 10, Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'95	'00	'12	'95	'00	'12
B	Artemisia frigida	1	6	16	-	.04	.75
B	Artemisia tridentata tridentata	13	15	16	3.57	6.79	4.64
B	Cercocarpus montanus	17	23	15	3.30	4.22	1.85
B	Chrysothamnus nauseosus	0	6	1	-	.03	.38
B	Chrysothamnus nauseosus hololeucus	14	10	11	2.01	1.12	.63
B	Chrysothamnus viscidiflorus	3	0	0	-	-	-
B	Gutierrezia sarothrae	0	2	6	.00	-	.18
B	Juniperus osteosperma	0	3	4	2.32	1.79	1.82
B	Juniperus scopulorum	0	2	0	-	.15	.03
B	Mahonia repens	5	4	5	1.41	.33	.24
B	Opuntia sp.	4	7	3	.56	.18	.66
B	Pinus edulis	1	10	11	1.73	1.78	7.03
B	Pseudotsuga menziesii	0	1	0	-	.15	-
B	Purshia tridentata	1	1	0	.15	-	-
B	Quercus gambelii	1	9	8	1.22	2.83	2.72
B	Ribes cereum cereum	4	5	4	1.66	1.30	1.26
B	Symphoricarpos oreophilus	45	50	54	6.42	8.07	4.61
Total for Browse		109	154	154	24.39	28.78	26.81

CANOPY COVER, LINE INTERCEPT--
Management unit 10, Study no: 6

Species	Percent Cover '12
Artemisia frigida	.65
Artemisia tridentata tridentata	4.28
Cercocarpus montanus	3.25
Chrysothamnus nauseosus	.05
Chrysothamnus nauseosus hololeucus	1.11
Gutierrezia sarothrae	.15
Juniperus osteosperma	3.26
Juniperus scopulorum	.86
Mahonia repens	.13
Opuntia sp.	.20
Pinus edulis	7.80
Quercus gambelii	4.18
Ribes cereum cereum	.70
Symphoricarpos oreophilus	11.08

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10, Study no: 6

Species	Average leader growth (in) '12
Artemisia tridentata tridentata	0.9
Cercocarpus montanus	0.9

POINT-QUARTER TREE DATA--
Management unit 10, Study no: 6

Species	Trees per Acre		Average diameter (in)	
	'00	'12	'00	'12
Juniperus osteosperma	58	70	6.1	10.2
Juniperus scopulorum	-	<18	-	-
Pinus edulis	231	241	2.2	2.4

BASIC COVER--
Management unit 10, Study no: 6

Cover Type	Average Cover %			
	'88	'95	'00	'12
Vegetation	3.75	33.42	31.84	29.82
Rock	2.50	3.23	3.13	1.46
Pavement	34.50	19.30	25.40	30.47
Litter	53.25	49.20	54.47	50.90
Cryptogams	0	.64	1.03	0
Bare Ground	6.00	3.25	7.91	3.65

SOIL ANALYSIS DATA --

Management unit 10, Study no: 6, Study Name: Little Jim Canyon

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.5	7.3	38.0	37.4	24.6	6.7	8.3	96.0	0.8

PELLET GROUP DATA--

Management unit 10, Study no: 6

Type	Quadrat Frequency				Days use per acre (ha)	
	'88	'95	'00	'12	'00	'12
Rabbit	-	9	33	5	-	-
Horse	-	-	-	2	-	2 (6)
Elk	-	4	11	9	6 (15)	19 (48)
Deer	-	3	3	12	7 (17)	25 (61)

BROWSE CHARACTERISTICS--

Management unit 10, Study no: 6

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia frigida</i>									
88	0	0	0	-	-	0	0	0	-/-
95	20	0	100	-	-	0	0	0	11/10
00	320	25	75	-	80	0	0	0	5/8
12	1440	0	100	-	-	10	0	0	5/11
<i>Artemisia tridentata tridentata</i>									
88	333	100	0	0	-	0	0	0	-/-
95	420	10	86	5	-	0	0	0	22/27
00	520	12	88	0	-	4	0	0	32/36
12	620	6	81	13	-	26	29	23	23/34
<i>Cercocarpus montanus</i>									
88	866	31	69	0	466	8	54	8	58/39
95	440	9	86	5	-	14	0	0	47/44
00	460	26	74	0	-	30	9	0	45/42
12	300	20	47	33	-	33	33	27	44/45
<i>Chrysothamnus nauseosus</i>									
88	0	0	0	-	-	0	0	0	-/-
95	0	0	0	-	-	0	0	0	-/-
00	140	14	86	-	-	0	0	0	29/32
12	20	0	100	-	20	0	0	100	28/38
<i>Chrysothamnus nauseosus hololeucus</i>									
88	332	60	20	20	-	20	0	0	31/10
95	340	18	71	12	-	0	0	6	25/33
00	200	10	80	10	-	0	10	10	34/33
12	220	0	73	27	-	18	9	73	29/35

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Chrysothamnus viscidiflorus										
88	0	0	0	-	-	0	0	0	-/-	
95	60	67	33	-	-	67	0	0	22/23	
00	0	0	0	-	-	0	0	0	24/15	
12	0	0	0	-	-	0	0	0	12/10	
Gutierrezia sarothrae										
88	0	0	0	-	-	0	0	0	-/-	
95	0	0	0	-	-	0	0	0	-/-	
00	40	0	100	-	-	0	0	0	7/9	
12	300	7	93	-	-	0	0	0	6/10	
Juniperus osteosperma										
88	133	0	100	-	-	0	0	0	69/295	
95	0	0	0	-	-	0	0	0	-/-	
00	60	67	33	-	-	0	0	0	-/-	
12	80	0	100	-	20	0	0	0	-/-	
Juniperus scopulorum										
88	0	0	0	-	-	0	0	0	-/-	
95	0	0	0	-	-	0	0	0	-/-	
00	40	0	100	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
Mahonia repens										
88	0	0	0	-	-	0	0	0	-/-	
95	1840	24	76	-	-	0	0	0	3/7	
00	720	0	100	-	-	0	0	0	2/4	
12	1600	29	71	-	-	0	0	0	3/4	
Opuntia sp.										
88	0	0	0	0	-	0	0	0	-/-	
95	120	0	67	33	-	0	0	33	6/15	
00	240	0	100	0	-	0	0	0	3/11	
12	80	0	100	0	-	0	0	100	5/20	
Pinus edulis										
88	200	100	0	-	66	0	0	0	-/-	
95	40	100	0	-	-	0	0	0	-/-	
00	320	56	44	-	-	0	0	0	-/-	
12	300	13	87	-	-	0	0	0	-/-	
Pseudotsuga menziesii										
88	0	0	0	-	-	0	0	0	-/-	
95	0	0	0	-	-	0	0	0	-/-	
00	20	100	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Purshia tridentata									
88	0	0	0	-	-	0	0	0	-/-
95	20	0	100	-	-	0	0	0	27/44
00	20	0	100	-	-	0	100	0	38/47
12	0	0	0	-	-	0	0	0	21/37
Quercus gambelii									
88	0	0	0	-	-	0	0	0	-/-
95	60	0	100	-	-	0	0	0	15/31
00	1400	16	84	-	-	0	0	0	64/28
12	820	24	76	-	-	0	0	0	30/19
Ribes cereum cereum									
88	0	0	0	0	-	0	0	0	-/-
95	80	0	100	0	60	0	0	0	36/48
00	100	0	100	0	-	20	0	0	34/41
12	100	40	40	20	-	40	0	20	33/40
Sambucus sp.									
88	0	0	0	-	-	0	0	0	-/-
95	0	0	0	-	-	0	0	0	-/-
00	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	67/51
Symphoricarpos oreophilus									
88	3132	47	47	6	200	6	0	21	35/38
95	1340	21	79	0	-	3	0	0	22/42
00	2080	30	68	2	40	14	2	.96	22/38
12	1620	20	72	9	-	26	5	17	21/43

SANTAQUIN GREASEWOOD - TREND STUDY NO. 17R-11-12

Vegetation Type: Black Greasewood

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Loam \(Basin Big Sagebrush\), R047XA308UT](#)

Land Ownership: UDWR

Elevation: 6,810 ft. (2,076 m)

Aspect: South

Slope: 2%

Transect bearing: 180° magnetic

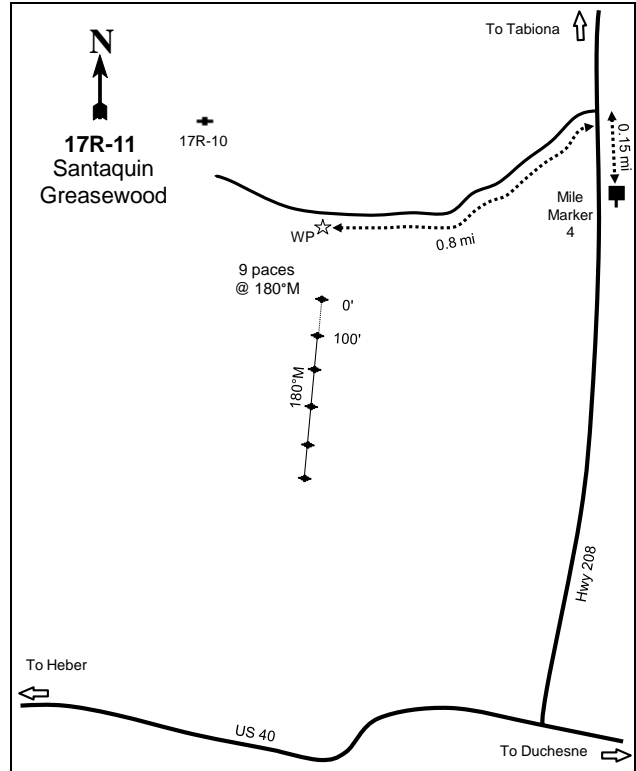
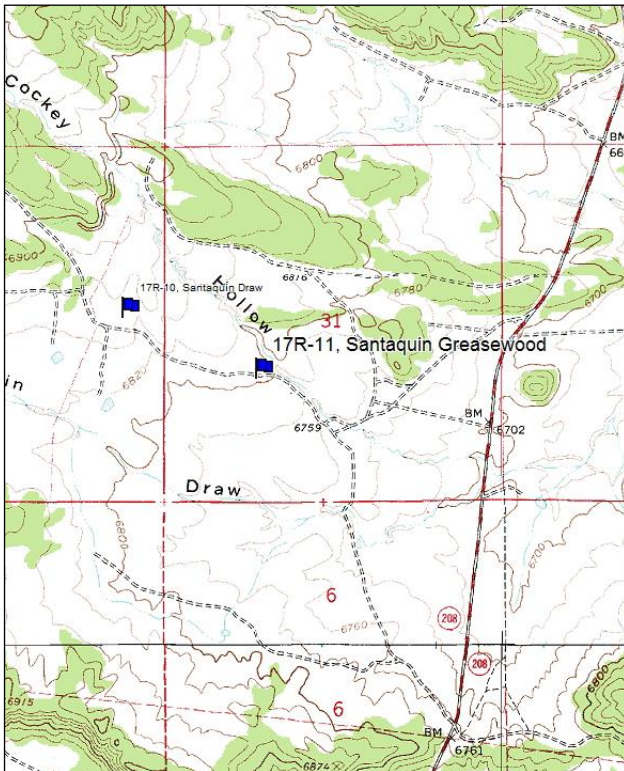
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions:

From US 40 turn north on highway 208. Travel 0.15 miles north of mile marker 4 to a road that comes in from the left (west). Turn here and drive 0.8 miles to a witness post on the left side of the road. The 0-foot stake is 9 paces from the witness post at 180°M, and is marked with browse tag #40.

Map Name: Tabiona

Diagrammatic Sketch:



Township: 2S Range: 7W Section: 31

GPS: NAD 83, UTM 12S 523637 E 4456729 N

SANTAQUIN GREASEWOOD - TREND STUDY NO. 17R-11

Site Description

Site Information: The study is located eighteen miles to the northwest of Duchesne within a greasewood (*Sarcobatus vermiculatus*) and big sagebrush (*Artemisia tridentata*) flat. The study was established prior to treatment in 2004 on Tabby Mountain Wildlife Management Area (WMA) to monitor a chaining treatment. Areas within the WMA dominated by sagebrush, greasewood, pinyon pine (*Pinus edulis*), and Utah juniper (*Juniperus osteosperma*) were chained with a smooth chain in 2004. Sagebrush stands within Santaquin Draw experienced a vegetation die off in 2002 and 2003 attributed to drought conditions. The study site was established in July of 2004 and was chained later that fall. The treatment area was first seeded, chained, then another seed mix including Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and forage kochia (*Kochia prostrata*) was flown onto the treatment. The objectives of the chaining treatment are to remove greasewood and to establish grass, forb, and preferred browse species for wildlife winter range. Deer pellet groups were sampled in high abundance in 2004, moderate abundance in 2007 and 2010, and low abundance in 2009 and 2012. Elk pellet groups were sampled in moderate abundance in 2004, 2007, 2010, and 2012; and high abundance in 2009. Cattle pellet groups have been sampled in low abundance in all sample years (Table - Pellet Group Data).

Browse: Black greasewood is the dominant shrub on the site. Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and Wyoming big sagebrush are the dominant preferred browse species. Decadence and poor vigor of basin big sagebrush has steadily decreased over the study years, though plants displaying poor vigor increased in 2012. The recruitment of young basin big sagebrush has been excellent after 2004. Wyoming big sagebrush has gradually increased in abundance since being seeded to the site after the treatment. The Wyoming big sagebrush is a relatively young population with low decadence and good vigor. Utilization of sagebrush has been light since the outset of the study. Seeded species sampled on the site include Wyoming big sagebrush, winterfat (*Ceratoides lanata*), and forage kochia, though winterfat was only sampled in 2007. Forage kochia was abundant on the site in 2010. Other species found on site include shadscale (*Atriplex confertifolia*) and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse. The dominant species on the site are Siberian wheatgrass (*Agropyron fragile*), Indian ricegrass (*Oryzopsis hymenoides*), and Sandberg bluegrass (*Poa secunda*). Cheatgrass (*Bromus tectorum*) has been sampled over the sample years, but is rare on the site. Western wheatgrass (*Agropyron smithii*) was the dominant grass species at the outset of the study. Seeded species sampled on the site include thickspike wheatgrass (*Agropyron dasystachyum*), Siberian wheatgrass (*A. fragile*), Great Basin wildrye (*Elymus cinereus*), and Russian wildrye (*E. junceus*). Forbs are not diverse or abundant, but are rare on the site. Annual forbs were moderately abundant at the outset of the study, but have become rare on the site. Fleabane (*Erigeron* sp.) is the dominant forb species and accounts for the majority of the cover on the site. At the outset of the study pinnate tansymustard (*Descurainia pinnata*) and slimleaf goosefoot (*Chenopodium leptophyllum*) were the dominant species, but have become rare on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is moderately high, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2004 due to pedestalling. The soil erosion condition has been classified as stable in 2007, 2009, 2010, and 2012.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: Basin big sagebrush density increased 42% from 2,640 plants/acre to 3,760 plants/acre and cover increased from 4% to 6%. Decadence of sagebrush decreased from 85% to 29% and plants displaying poor vigor decreased from 64% to 27%. The recruitment of young sagebrush plants increased from 4% to 60% of

the population. Greasewood seem to be unaffected by the treatment. The density of greasewood remained similar at 1,280 plants/acre and cover increased from 14% to 19%. The average size of greasewood remained similar with an average height of 34 inches and crown of 50 inches.

Grass: The sum of nested frequency of perennial grasses increased nearly threefold and perennial grass cover increased from 2% to 6%. Siberian wheatgrass and Russian wildrye were seeded species sampled following the treatment. Siberian wheatgrass was sampled in low frequency and cover and Russian wildrye was the dominant grass species with 2% cover. Sandberg bluegrass and western wheatgrass provided 1% cover and increased in frequency.

Forb: The sum of nested frequency for perennial forbs increased substantially and cover increased from nearly 0% to 2%. Fleabane was the dominant perennial forb and provided 2% cover. Weedy annual forb species had dominated the site prior to treatment but decreased 13% in sum of nested frequency and cover decreased from 3% to 2%.

Trend Assessments

Browse

- **2007 to 2009 - stable (0)**: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Basin big sagebrush canopy cover increased 6% to 7% and greasewood canopy cover remained similar at 19%. Forage kochia and Wyoming big sagebrush were sampled in low cover.
- **2009 to 2010 - up (+2)**: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Basin big sagebrush canopy cover increased to 11% while Wyoming big sagebrush canopy cover increased from 1% to 5%. Young plants accounted for 44% of the basin big sagebrush population and decadence was low at 4% while the Wyoming big sagebrush population consisted of 72% young and 27% mature. All populations exhibited good vigor. Greasewood canopy cover decreased slightly to 18%.
- **2010 to 2012 - slightly down (-1)**: The density of basin big sagebrush decreased 50% from 7,000 plants/acre to 3,520 plants/acre, and canopy cover decreased to 3%. The density of Wyoming big sagebrush increased 47% from 5,480 plants/acre to 8,040 plants/acre, and canopy cover increased to 7%. Some of the differences maybe a result of misidentification of the two sagebrush species. Although, the combined densities of sagebrush decreased 920 plants/acre.

Grass

- **2007 to 2009 - stable (0)**: The sum of nested frequency of perennial grasses remained similar and cover changed little at 6%. There was a slight change in composition as there was a significant decrease in the nested frequency of Russian wildrye and a significant increase in Siberian wheatgrass. Siberian wheatgrass may have been misidentified as bluebunch wheatgrass. No cheatgrass was sampled this year.
- **2009 to 2010 - up (+2)**: The sum of nested frequency of perennial grasses increased 30% while cover remained similar at 6%. Siberian wheatgrass cover decreased form 3% to 2% while Sandberg bluegrass cover decreased from 2% to 1% and neither has significantly changed in nested frequency. Indian ricegrass significantly increased in nested frequency and provided 1% cover.
- **2010 to 2012 - up (+2)**: The sum of nested frequency of perennial grasses increased 23%, and cover increased to 7%. Siberian wheatgrass increased significantly in nested frequency and cover increased to 3%.

Forb

- **2007 to 2009 - up (+2)**: The sum of nested frequency of perennial forbs increased 26%, but cover decreased from 2% to 1%. The sum of nested frequency of annual forbs decreased 85% and became rare on the site.

- **2009 to 2010 - slightly down (-1):** The nested frequency of perennial forbs decreased 29%, though cover increased slightly to 2%. Forbs remained rare on the site.
- **2010 to 2012 - slightly down (-1):** Forbs remained rare on the site. Fleabane decreased in cover from 2% to less than 1% .

SEED MIX--

Management unit 17R, Study no: 11

Project Name: Santaquin Greasewood WRI Database #: None				Project Name: Santaquin Sagebrush Browse (Post Treatment) WRI Database #: None			
Application: Aerial Seed		Acres: 380		Application: Aerial Seed		Acres: 1755	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Great Basin Wildrye 'Trailhead'	750	1.97	F	Alfalfa 'Ladak+'	1000	0.57
G	Russian Wildrye 'Bozoisky'	750	1.97	F	Sainfoin 'Eski'	1000	0.57
G	Siberian Wheatgrass 'Vavilov'	400	1.05	B	Forage Kochia 'Immigrant'	800	0.46
G	Thickspike Wheatgrass 'Critana'	750	1.97	B	Sagebrush, Wyoming	1465	0.83
F	Alfalfa 'Ladak+'	200	0.53	B	Winterfat	300	0.17
F	Sainfoin	400	1.05	Total Pounds:		4565	2.60
B	Fourwing Saltbush	300	0.79	PLS Pounds:			1.65
Total Pounds:		3550	9.34				
PLS Pounds:			8.39				
Application: Dribbler		Acres: 40					
Seed type		lbs in mix	lbs/acre				
F	Sainfoin	40	1.00				
F	Alfalfa 'Ladak+'	20	0.50				
B	Sagebrush, Wyoming	40	1.00				
Total Pounds:		100	2.50				
PLS Pounds:			1.71				

Trend Summary

HERBACEOUS TRENDS--

Management unit 17R, Study no: 11

T y p e	Species	Nested Frequency					Average Cover %				
		'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
G	Agropyron fragile	a-	a7	bc49	b39	c69	-	.30	2.74	1.85	2.87
G	Agropyron smithii	31	36	19	32	35	1.13	1.28	.28	.82	.54
G	Agropyron spicatum	a-	a-	b20	b14	b24	-	-	.40	.24	.77
G	Bromus tectorum (a)	2	7	-	8	1	.00	.01	-	.01	.00
G	Elymus cinereus	-	-	1	-	-	-	-	.03	-	-
G	Elymus junceus	a-	b35	a10	a11	ab31	-	1.57	.47	.22	.63
G	Oryzopsis hymenoides	a-	a12	a7	b38	a17	-	.71	.10	1.27	.10
G	Poa secunda	a35	bc78	ab65	89	109	.46	1.41	2.03	1.20	1.69
G	Sitanion hystrix	a1	b16	ab13	a5	ab6	.03	.34	.20	.00	.21
G	Stipa comata	-	5	-	12	3	-	.01	-	.06	.00
Total for Annual Grasses		2	7	0	8	1	0.00	0.01	0	0.01	0.00
Total for Perennial Grasses		67	189	184	240	294	1.63	5.62	6.26	5.68	6.84

Type	Species	Nested Frequency					Average Cover %				
		'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
	Total for Grasses	69	196	184	248	295	1.64	5.64	6.26	5.70	6.85
F	Alyssum alyssoides (a)	-	1	1	20	5	-	.01	.03	.02	.01
F	Arabis sp.	a ⁻	b ¹⁰	a ⁻	a ⁻	ab ¹	-	.03	-	-	.00
F	Chenopodium album (a)	b ²⁷	a ⁻	a ⁴	a ³	a ⁻	.17	-	.01	.03	-
F	Chenopodium leptophyllum(a)	b ¹¹¹	a ¹⁸	a ³⁹	a ²⁶	a ¹⁶	1.00	.04	.18	.38	.04
F	Collinsia parviflora (a)	5	-	-	-	3	.03	-	-	-	.00
F	Descurainia pinnata (a)	b ¹⁹⁹	b ²⁴²	a ⁻	a ⁷	a ⁶	1.87	1.23	-	.03	.01
F	Erigeron sp.	a ⁸	bc ⁷⁸	c ¹⁰²	bc ⁷⁴	b ⁵⁵	.04	2.01	.98	1.85	.20
F	Gilia sp. (a)	3	-	-	-	-	.01	-	-	-	-
F	Lappula occidentalis (a)	ab ¹³	c ⁴⁸	a ⁻	a ⁹	a ⁻	.08	.22	-	.01	-
F	Linum lewisii	-	3	4	2	-	-	.16	.09	.03	-
F	Phlox longifolia	1	6	2	4	1	.00	.01	.03	.00	.00
F	Schoenrambe linifolia	-	11	27	19	3	-	.07	.11	.16	.01
F	Sphaeralcea coccinea	-	2	4	-	-	-	.00	.01	-	-
	Total for Annual Forbs	358	309	44	65	30	3.18	1.51	0.22	0.49	0.06
	Total for Perennial Forbs	9	110	139	99	60	0.05	2.29	1.22	2.05	0.22
	Total for Forbs	367	419	183	164	90	3.23	3.80	1.45	2.54	0.29

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 17R, Study no: 11

Type	Species	Strip Frequency				Average Cover %				
		'04	'07	'10	'12	'04	'07	'09	'10	'12
B	Artemisia tridentata tridentata	56	57	56	20	6.69	4.87	5.85	5.63	5.07
B	Artemisia tridentata wyomingensis	0	0	61	63	.33	-	1.53	5.88	6.16
B	Atriplex confertifolia	7	17	13	17	.51	.25	.40	.10	.36
B	Ceratoides lanata	0	1	0	0	-	.00	-	-	-
B	Kochia prostrata	0	3	38	24	-	.03	.76	3.02	.76
B	Opuntia sp.	34	29	21	24	.46	.52	.19	.06	.10
B	Sarcobatus vermiculatus	41	40	43	50	11.46	10.67	12.33	8.79	10.87
	Total for Browse	138	147	232	198	19.47	16.35	21.07	23.49	23.34

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 11

Species	Percent Cover				
	'04	'07	'09	'10	'12
Artemisia tridentata tridentata	4.41	5.66	6.50	10.90	3.33
Artemisia tridentata wyomingensis	-	-	.50	5.23	7.23
Atriplex confertifolia	.30	.30	.23	1.13	.30
Kochia prostrata	-	-	.06	1.75	.88
Opuntia sp.	.38	.65	1.18	.30	.41
Sarcobatus vermiculatus	13.98	18.65	18.61	17.88	12.15

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 11

Species	Average leader growth (in)				
	'04	'07	'09	'10	'12
Artemisia tridentata tridentata	2.2	1.3	-	1.7	1.2
Artemisia tridentata wyomingensis	-	-	-	-	0.9

BASIC COVER--
Management unit 17R, Study no: 11

Cover Type	Average Cover %				
	'04	'07	'09	'10	'12
Vegetation	25.38	25.39	32.08	31.85	30.18
Rock	.38	.00	.00	.06	.21
Pavement	.16	.08	.00	0	.01
Litter	44.01	50.01	55.73	49.94	52.92
Cryptogams	10.02	3.75	.98	1.30	1.12
Bare Ground	35.42	34.75	27.12	31.70	33.72

SOIL ANALYSIS DATA --
Management unit 17R, Study no: 11, Study Name: Santaquin Greasewood

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
12.1	7.2	49.6	32.9	17.5	1.1	4.5	137.6	1.0

PELLET GROUP DATA--
Management unit 17R, Study no: 11

Type	Quadrat Frequency					Days use per acre (ha)				
	'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
Rabbit	13	42	35	14	42	-	-	-	-	-
Grouse	-	2	-	-	1	-	-	-	-	-
Elk	7	17	12	11	27	27 (68)	29 (71)	48 (117)	28 (69)	35 (86)
Deer	49	33	27	10	13	236 (584)	27 (68)	11 (26)	23 (58)	3 (7)
Cattle	-	-	2	2	5	1 (2)	1 (2)	7 (16)	12 (30)	9 (22)

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 11

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia tridentata tridentata									
04	2640	4	11	85	2260	25	7	66	27/29
07	3760	60	12	29	9860	5	.53	27	17/22
09	No Density Collected								15/16
10	7000	44	53	4	640	15	.28	1	19/21
12	3520	44	53	3	-	11	0	34	25/25

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
04	0	0	0	0	-	0	0	0	18/37
07	0	0	0	0	-	0	0	0	-/-
09	No Density Collected								11/13
10	5480	72	27	1	2840	0	0	.72	14/17
12	8040	45	51	4	100	18	28	37	13/15
<i>Atriplex confertifolia</i>									
04	160	13	75	13	200	0	13	0	13/19
07	1040	75	25	0	440	0	0	0	10/16
09	No Density Collected								11/17
10	780	44	56	0	260	0	0	0	11/16
12	1080	6	93	2	-	6	6	2	8/13
<i>Ceratoides lanata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	20	100	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Echinocactus sp.</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								1/3
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Kochia prostrata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	60	33	67	-	140	0	0	0	5/6
09	No Density Collected								4/6
10	8880	50	50	-	200	.22	0	0	6/7
12	4660	5	95	-	60	.85	94	0	3/7
<i>Opuntia sp.</i>									
04	1120	7	59	34	-	0	0	16	5/12
07	920	0	74	26	-	2	0	13	4/10
09	No Density Collected								5/9
10	560	0	93	7	-	7	0	7	4/10
12	1380	0	93	7	-	0	0	7	3/8
<i>Sarcobatus vermiculatus</i>									
04	1340	16	79	4	2140	3	0	1	32/50
07	1280	16	75	9	3060	0	0	16	34/50
09	No Density Collected								33/45
10	1380	23	77	0	20	4	0	0	33/45
12	2260	42	58	0	40	4	5	.88	29/41

SANTAQUIN CHAINING - TREND STUDY NO. 17R-12-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Black Sagebrush\), R047XA332UT](#)

Land Ownership: UDWR

Elevation: 6,870 ft. (2,094 m)

Aspect: East

Slope: 2-3%

Transect bearing: 294° magnetic

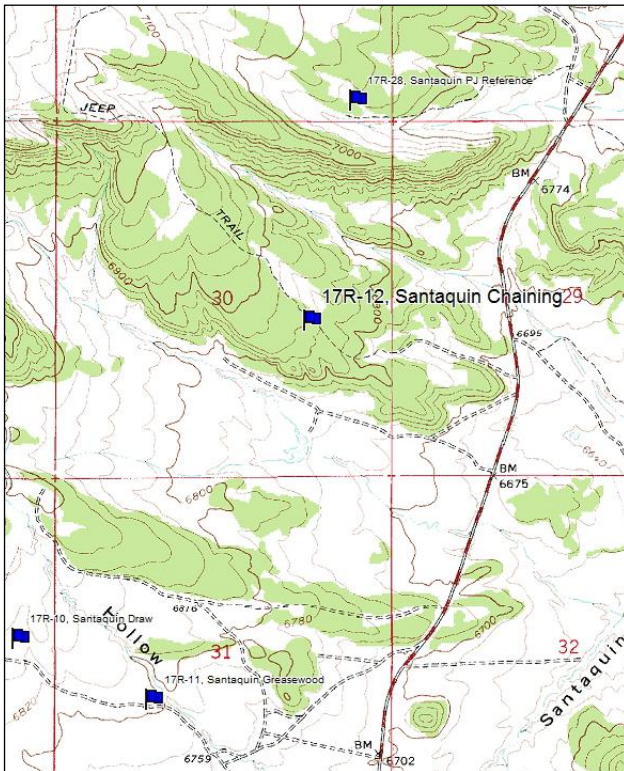
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions:

From US 40 turn north on Highway 208. Travel 4.7 miles north to a road that comes in from the left (west).

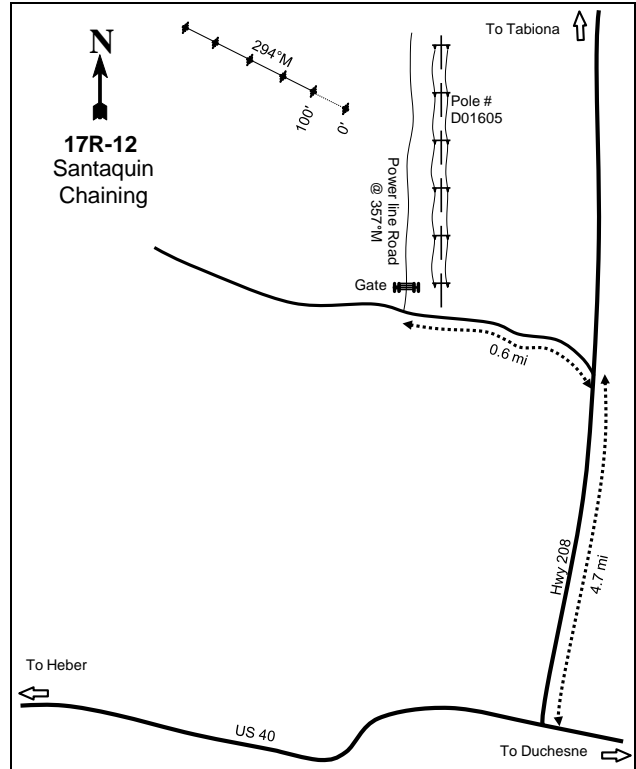
Turn here and drive 0.6 miles to the power line road that comes in from the right. Turn here, pass through the gate and travel on this road at 357°M to pole #D01605. The 0-foot stake is 40 paces from this pole at 330°M, and is marked with browse tag #136.

Map Name: Tabiona



Township: 2S Range: 7W Section: 30

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 524346 E 445837 N

SANTAQUIN CHAINING - TREND STUDY NO. 17R-12

Site Description

Site Information: The study is located approximately eighteen miles to the northwest of Duchesne within a chained pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established prior to treatment in 2004 on the Tabby Mountain Wildlife Management Area (WMA) to monitor the effects of a pinyon and juniper chaining. Prior to treatment this area was dominated by pinyon and juniper with limited herbaceous understory. The chaining treated about 300 acres of a pinyon and juniper covered ridge. The treatment area was first seeded with grass species, then two-way chained with an Ely chain. Following the chaining another seed mix including Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and forage kochia (*Kochia prostrata*) was flown onto the treatment. Deer pellet groups were sampled in moderate abundance in 2004, 2007, and 2009; high abundance in 2010; and low abundance in 2012. Elk Pellet groups were sampled in moderate abundance in 2004, 2007, and 2012; and high abundance in 2009 and 2010 (Table - Pellet Group Data). The soil erosion condition was classified as stable in all sample years.

Browse: Pinyon pine and Utah juniper canopy cover was effectively reduced from the chaining treatment and canopy cover has been minimal over the sample years following the treatment (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be in Phase I (Tausch et al. 2009). Wyoming big sagebrush and black sagebrush (*Artemisia nova*) are the preferred browse species on the site. Black sagebrush has been present in all sample years. The black sagebrush is a heavily used mature population with good vigor and low decadence over the sample years; though use was mostly light prior to 2012 sample year. Decadence and poor vigor of black sagebrush plants were high before the treatment. Wyoming big sagebrush, which was seeded on the site, has increased in each sample year. Decadence and poor vigor of Wyoming big sagebrush has been low since being seeded on the site. The recruitment of young plants for both sagebrush populations has been good following the treatment (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses have responded well to this treatment and have steadily increased in frequency since 2004. The most prevalent species that have been sampled on the site are crested wheatgrass (*Agropyron cristatum*), Indian ricegrass (*Oryzopsis hymenoides*) and western wheatgrass/thickspike wheatgrass (*A. smithii*, *A. dasystachyum*). Western wheatgrass and thickspike wheatgrass was combined in 2012 due to the difficulty in distinguishing between species. Cheatgrass (*Bromus tectorum*) and rattail fescue (*Festuca myuros*) were the only annual grass species sampled, though occurring in low abundance. Seeded species sampled after the treatment include crested wheatgrass, thickspike wheatgrass, orchard grass (*Dactylis glomerata*), and Russian wildrye (*Elymus junceus*). Other common grass species include needle-and-tread (*Stipa comata*) and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are fairly diverse and moderately abundant. Perennial forbs initially responded well to this treatment but have fluctuated in frequency and cover in each sample year. The seeded species blue flax (*Linum perenne*) has been sampled in moderate abundance following the treatment, but has steadily decreased in abundance since 2009 (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is moderate though there is a high amount of litter and moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: Black sagebrush had similar cover to the pretreatment condition at 2%, though density of black sagebrush decreased 63% from 3,440 plants/acre to 1,260 plants/acre. Decadence of black sagebrush decreased from 48% to 0% and poor vigor decreased from 25% to 5%. The seeded species, Wyoming big sagebrush, increased substantially in density and cover increased to 1% with most of the sampled plants being

young plants. Canopy cover decreased from 19% for Utah juniper and 27% for pinyon pine to less than 1% for each species. Utah juniper density decreased from 235 trees/acre to 37 trees/ acre and pinyon pine density decreased from 208 trees/acre to 57 trees/acre.

Grass: The sum of nested frequency of perennial grasses increased 88% and cover increased from 2% to 10%. Following the treatment the dominant species were crested wheatgrass, bluebunch wheatgrass, Indian ricegrass, and bottlebrush which significantly increased in frequency and each provided 2% cover. Seeded species sampled following to treatment include crested wheatgrass, orchardgrass, and Russian wildrye.

Forb: The sum of nested frequency of perennial forbs increased 33% while cover increased from 2% to 6%. Annual forbs continued to be a minor part of the system. Two seeded species, Lewis flax and small burnet (*Sanguisorba minor*), were established in moderate frequency and cover. Sainfoin (*Onobrychis viciaefolia*) was also sampled, but at low frequency and cover.

Trend Assessments

Browse

- **2007 to 2009 - stable (0):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Black sagebrush canopy cover slightly increased from 2% to 3% and Wyoming big sagebrush remained similar at 1%
- **2009 to 2010 - stable (0):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Black sagebrush canopy cover increased slightly to 4% and Wyoming big sagebrush remained similar. Young plants represented 44% of the Wyoming big sagebrush population with no decadent plants. The density of pinyon pine and Utah juniper increased from 20 trees/acre to 32 trees/acre and 16 trees/acre to 35 trees/acre, respectively.
- **2010 to 2012 - up (+2):** The density of black sagebrush increased 26% from 2,720 plants/acre to 3,420 plants/acre, and canopy cover increased to 5%. The density of Wyoming big sagebrush increased 29% from 820 plants/acre to 1060 plants/acre and canopy cover increased to 2%. Decadence remained low within both sagebrush species and plants displaying poor vigor remained low for black sagebrush and increased to 40% of the population for Wyoming big sagebrush. The density of pinyon pine increased to 62 trees/acre and the density of Utah juniper remained similar at 37 trees/acre.

Grass

- **2007 to 2009 - up (+2):** The sum of nested frequency of perennial grasses increased 24% and cover increased from 10% to 20%. Crested wheatgrass increased substantially in cover from 2% to 6% and Indian ricegrass increased from 2% to 4%. The seeded species, thickspike wheatgrass, was sampled for the first time in 2009.
- **2009 to 2010 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 14% while cover decreased slightly to 19%. Crested wheatgrass, western wheatgrass, and Indian ricegrass combined to provide 72% of grass cover.
- **2010 to 2012 - up (+2):** The sum of nested frequency of perennial grasses increased 21% while cover decreased slightly to 18%. Crested wheatgrass increased in nested frequency and cover increased from 5% to 7%.

Forb

- **2007 to 2009 - down (-2):** The sum of nested frequency of perennial forbs decreased 45%, though cover increased slightly from 5% to 6%. Much of the increase in cover came from a significant increase in the nested frequency of blue flax and a large increase in cover from 2% to 4%. Annual forbs are still a minor part of the system.
- **2009 to 2010 - stable (0):** The sum of nested frequency of perennial forbs increased 16% but cover decreased from 6% to 3%. The decrease of cover can be attributed to blue flax which decreased in cover to 1%

- **2010 to 2012 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 45%, though cover remained similar at 3%. No species provided 1% or more cover.

SEED MIX--

Management unit 17R, Study no: 12

Project name: Santaquin Sagebrush Browse (Post Treatment)				Project name: Santaquin Pinyon/Juniper			
WRI Database #: None							
Application: Aerial		Acres: 1755		Application:		Acres: 305	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
F	Alfalfa 'Ladak+'	1000	0.57	G	Crested Wheatgrass 'Ephraim'	300	0.98
F	Sainfoin 'Eski'	1000	0.57	G	Orchardgrass 'Paiute'	300	0.98
B	Forage Kochia 'Immigrant'	800	0.46	G	Russian Wildrye 'Bozoisky'	300	0.98
B	Sagebrush, Wyoming	1465	0.83	G	Thickspike Wheatgrass 'Critana'	350	1.15
B	Winterfat	300	0.17	F	Alfalfa 'Ladak+'	250	0.82
Total Pounds:		4565	2.60	F	Alfalfa 'Nomad'	100	0.33
PLS Pounds:			1.65	F	Blue Flax 'Appar'	150	0.49
Project name: Santaquin Sagebrush Shrub							
Application:		Acres: 40		F <th colspan="2">Sainfoin </th>		Sainfoin	
Seed type		lbs in mix	lbs/acre	F <th colspan="2">Small Burnet 'Delar' </th>		Small Burnet 'Delar'	
F	Alfalfa 'Ladak+'	20	0.50	B		Fourwing Saltbush	
F	Sainfoin	40	1.00	Total Pounds:		2950 9.67	
B	Sagebrush, Wyoming	40	1.00	PLS Pounds:		8.58	
B	Winterfat	20	0.50				
Total Pounds:		120	3.00				
PLS Pounds:			1.94				

Trend Summary

HERBACEOUS TRENDS--

Management unit 17R, Study no: 12

T y p e	Species	Nested Frequency					Average Cover %				
		'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
G	Agropyron cristatum	a ⁻	b ⁹³	b ¹¹⁰	b ¹³⁰	c ¹⁸¹	-	2.36	6.22	4.61	7.28
G	Agropyron dasystachyum	a ⁻	a ⁻	b ⁴⁸	b ³⁰	c ¹³²	-	-	1.77	.33	3.93
G	Agropyron smithii	bc ⁴⁵	b ²⁴	bc ⁴⁰	c ⁶¹	a ⁻	.21	.48	2.15	4.31	-
G	Agropyron spicatum	a ⁻	b ⁵⁶	a ¹³	a ⁻	a ³	-	1.99	.65	-	.03
G	Bouteloua gracilis	7	6	6	11	8	.03	.03	.18	.23	.06
G	Bromus tectorum (a)	a ¹	b ⁶²	b ⁴⁰	b ⁴⁷	b ⁷⁰	.00	.53	.93	1.15	.81
G	Carex geyeri	a ⁻	a ⁻	a ⁻	a ⁻	b ¹⁰	-	-	-	-	.13
G	Carex obtusata	a ⁻	a ⁻	a ⁻	a ⁻	b ³⁹	-	-	-	-	.33
G	Carex sp.	b ⁹	b ¹⁹	b ¹¹	b ¹⁶	a ⁻	.08	.22	.39	.27	-
G	Dactylis glomerata	-	6	10	-	10	-	.28	.25	-	.12
G	Elymus cinereus	-	-	-	1	-	-	-	-	.03	-
G	Elymus junceus	a ⁻	a ³	ab ⁹	b ²⁷	ab ⁸	-	.15	.59	1.37	.09
G	Festuca myuros (a)	-	1	-	-	-	-	.00	-	-	-
G	Oryzopsis hymenoides	a ⁵²	a ⁴³	ab ⁶⁰	b ⁹³	ab ⁸¹	.66	2.15	4.15	5.33	4.31
G	Poa secunda	19	17	24	18	27	.39	.14	.55	.13	.51

Type	Species	Nested Frequency					Average Cover %				
		'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
G	<i>Sitanion hystrix</i>	a33	ab55	b66	ab58	ab52	.24	1.79	2.97	1.20	.64
G	<i>Stipa comata</i>	9	5	8	17	5	.48	.22	.18	.83	.06
G	<i>Stipa lettermani</i>	-	-	-	-	5	-	-	-	.00	.03
Total for Annual Grasses		1	63	40	47	70	0.00	0.54	0.93	1.15	0.81
Total for Perennial Grasses		174	327	405	462	561	2.11	9.84	20.07	18.69	17.56
Total for Grasses		175	390	445	509	631	2.12	10.38	21.00	19.84	18.37
F	<i>Arabis</i> sp.	b21	a6	a-	a-	a3	.06	.01	-	-	.00
F	<i>Astragalus convallarius</i>	10	-	-	-	12	.04	-	-	-	.04
F	<i>Astragalus</i> sp.	-	-	2	-	-	-	-	.03	-	-
F	<i>Astragalus utahensis</i>	a-	a5	b19	b27	b20	-	.06	.75	.96	.69
F	<i>Chaenactis douglasii</i>	-	3	6	16	10	-	.00	.03	.03	.02
F	<i>Chenopodium album</i> (a)	a-	a2	b20	a10	a3	-	.00	.65	.02	.00
F	<i>Chenopodium leptophyllum</i> (a)	-	-	2	-	-	-	-	.00	-	-
F	<i>Chenopodium</i> sp. (a)	2	1	-	-	-	.00	.03	-	-	-
F	<i>Cryptantha</i> sp.	1	12	-	-	4	.00	.07	-	-	.00
F	<i>Cymopterus</i> sp.	a11	a7	a1	a-	b23	.02	.04	.00	-	.05
F	<i>Descurainia pinnata</i> (a)	a4	b17	ab6	a-	ab4	.00	.03	.06	-	.01
F	<i>Erigeron eatonii</i>	1	-	-	2	-	.00	-	-	.03	-
F	<i>Gayophytum ramosissimum</i> (a)	-	-	-	4	5	-	-	-	.01	.04
F	<i>Ipomopsis aggregata</i>	4	4	-	-	12	.01	.00	-	-	.04
F	<i>Ipomopsis congesta</i>	-	11	-	10	-	-	.19	-	.06	-
F	<i>Lactuca serriola</i> (a)	a-	b10	a-	a-	a-	-	.08	-	-	-
F	<i>Lappula occidentalis</i> (a)	a-	b29	a5	a7	a1	-	.61	.18	.03	.00
F	<i>Linum perenne</i>	a-	bc37	c59	bc45	b29	-	1.64	3.99	.86	.19
F	<i>Machaeranthera canescens</i>	3	-	3	9	4	.00	-	.00	.21	.01
F	<i>Onobrychis viciaefolia</i>	-	2	-	-	2	-	.03	-	-	.00
F	<i>Opuntia fragilis</i>	-	-	-	-	6	-	-	-	-	.01
F	<i>Penstemon humilis</i>	b20	a5	a-	a4	a-	.48	.45	-	.18	-
F	<i>Penstemon</i> sp.	-	-	5	1	-	-	-	.33	.00	-
F	<i>Phlox hoodii</i>	ab19	a17	a11	a19	b32	.57	.31	.25	.45	1.05
F	<i>Polygonum douglasii</i> (a)	5	-	-	-	-	.01	-	-	-	-
F	<i>Sanguisorba minor</i>	a-	b22	b14	b8	b20	-	.50	.40	.16	.11
F	<i>Schoenocrambe linifolia</i>	a4	b17	ab13	ab12	a3	.00	.06	.20	.45	.00
F	<i>Senecio multilobatus</i>	c87	c89	a3	a4	b56	.53	1.75	.01	.01	.32
F	<i>Streptanthus cordatus</i>	-	5	-	5	-	-	.03	-	.01	-
F	<i>Tragopogon dubius</i> (a)	-	-	1	-	-	-	-	.00	-	-
F	<i>Trifolium</i> sp.	11	3	4	2	-	.04	.01	.00	.00	-
F	<i>Zigadenus paniculatus</i>	-	-	-	-	1	-	-	-	-	.00
Total for Annual Forbs		11	59	34	21	13	0.02	0.77	0.91	0.06	0.06
Total for Perennial Forbs		192	245	140	164	237	1.79	5.18	6.02	3.44	2.60
Total for Forbs		203	304	174	185	250	1.81	5.95	6.93	3.50	2.66

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 17R, Study no: 12

Type	Species	Strip Frequency				Average Cover %				
		'04	'07	'10	'12	'04	'07	'09	'10	'12
B	Artemisia nova	66	34	46	52	1.90	1.72	2.85	2.91	2.99
B	Artemisia tridentata wyomingensis	1	16	18	19	-	.51	.72	1.49	1.07
B	Chrysothamnus nauseosus	0	0	1	0	-	-	-	-	-
B	Chrysothamnus viscidiflorus stenophyllus	0	0	0	0	-	-	.00	-	-
B	Gutierrezia sarothrae	6	4	2	3	.03	.00	.00	-	.00
B	Juniperus osteosperma	12	3	3	5	1.06	.38	.53	.63	.18
B	Kochia prostrata	0	3	0	9	-	.03	.15	-	.22
B	Leptodactylon pungens	12	9	9	9	.25	.25	.36	.22	.30
B	Opuntia fragilis	12	11	11	6	.06	.06	.06	.04	.03
B	Pediocactus simpsonii	1	0	0	0	-	-	-	-	-
B	Pinus edulis	16	1	1	7	6.82	.53	.53	.03	.18
B	Tetradymia canescens	0	0	0	1	-	-	-	-	-
Total for Browse		126	81	91	111	10.12	3.50	5.23	5.32	4.99

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 12

Species	Percent Cover				
	'04	'07	'09	'10	'12
Artemisia nova	2.98	2.71	3.33	3.46	4.46
Artemisia tridentata wyomingensis	-	.80	1.06	1.30	1.70
Gutierrezia sarothrae	-	.15	.10	-	.03
Juniperus osteosperma	18.50	.01	.13	.05	.16
Kochia prostrata	-	.01	-	-	.06
Leptodactylon pungens	.23	-	.28	.11	.45
Opuntia fragilis	.13	.23	-	.06	.01
Pinus edulis	27.33	.50	.40	.30	.30
Tetradymia canescens	-	-	-	-	.05

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17R, Study no: 12

Species	Average leader growth (in)		
	'07	'10	'12
Artemisia nova	1.1	1.0	0.4
Artemisia tridentata wyomingensis	2.2	1.9	1.2

POINT-QUARTER TREE DATA--
Management unit 17R, Study no: 12

Species	Trees per Acre					Average diameter (in)				
	'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
Juniperus osteosperma	235	37	16	35	37	9.6	3.7	2.4	3.9	2.5
Pinus edulis	208	57	20	32	62	4.7	1.3	1.5	1.1	1.4

BASIC COVER--
Management unit 17R, Study no: 12

Cover Type	Average Cover %				
	'04	'07	'09	'10	'12
Vegetation	13.21	22.37	33.32	32.21	30.52
Rock	2.91	4.47	4.05	3.48	5.44
Pavement	6.34	2.60	2.28	1.85	3.64
Litter	61.74	55.81	55.33	50.53	51.62
Cryptogams	7.78	.43	.15	.00	.24
Bare Ground	17.40	24.82	19.75	19.27	20.10

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 12, Study Name: Santaquin PJ Chaining

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
6.9	7.0	65.4	15.1	19.5	3.5	16.3	128.0	0.9

PELLET GROUP DATA--
Management unit 17R, Study no: 12

Type	Quadrat Frequency					Days use per acre (ha)				
	'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
Rabbit	19	26	18	8	23	-	-	-	-	-
Elk	11	19	31	29	28	17 (41)	36 (89)	108 (266)	77 (190)	27 (68)
Deer	33	25	31	19	11	26 (64)	40 (98)	47 (116)	29 (71)	6 (15)
Cattle	-	1	-	-	-	-	-	-	-	-

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 12

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia nova									
04	3440	20	33	48	80	4	0	25	8/15
07	1260	10	90	0	380	30	2	5	8/15
09	No Density Collected								10/14
10	2720	24	75	1	780	.73	17	0	8/15
12	3420	47	48	5	480	10	43	7	7/15

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
04	20	0	100	0	-	0	0	0	-/-
07	740	62	35	3	360	8	5	3	14/14
09	No Density Collected								13/12
10	820	44	56	0	200	5	5	0	17/18
12	1060	32	62	6	120	21	30	40	14/15
<i>Atriplex canescens</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	21/16
09	No Density Collected								17/16
10	0	0	0	-	-	0	0	0	25/22
12	0	0	0	-	-	0	0	0	29/28
<i>Atriplex confertifolia</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								15/13
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Ceratoides lanata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	8/9
09	No Density Collected								6/8
10	0	0	0	-	-	0	0	0	8/7
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus depressus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	3/6
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus nauseosus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	20	0	100	-	-	100	0	0	14/15
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	13/22
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Echinocactus sp.									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	1/3
12	0	0	0	-	-	0	0	0	-/-
Gutierrezia sarothrae									
04	200	0	100	0	-	0	0	30	7/7
07	160	0	100	0	-	0	0	0	6/8
09	No Density Collected								7/10
10	60	33	67	0	-	0	0	0	8/8
12	100	0	80	20	-	0	0	60	5/6
Juniperus osteosperma									
04	260	31	54	15	-	8	0	23	-/-
07	60	67	33	0	-	0	0	0	-/-
09	No Density Collected								-/-
10	60	100	0	0	-	0	0	0	-/-
12	100	100	0	0	-	0	0	0	-/-
Kochia prostrata									
04	0	0	0	-	-	0	0	0	-/-
07	60	0	100	-	-	0	0	0	7/8
09	No Density Collected								8/8
10	0	0	0	-	-	0	0	0	9/10
12	300	0	100	-	-	47	47	0	4/5
Leptodactylon pungens									
04	440	0	68	32	-	0	0	14	5/7
07	360	0	100	0	-	11	0	0	4/7
09	No Density Collected								4/8
10	240	0	100	0	100	0	0	0	5/10
12	340	0	100	0	-	0	0	65	4/8
Opuntia fragilis									
04	640	9	63	28	-	0	0	9	3/12
07	360	11	89	0	-	0	0	0	3/10
09	No Density Collected								3/8
10	300	47	53	0	40	7	0	0	2/5
12	120	0	83	17	20	0	0	17	2/5
Pediocactus simpsonii									
04	20	0	100	-	-	0	0	0	1/3
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	2/8

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Pinus edulis</i>									
04	400	65	35	-	80	0	0	0	-/-
07	20	100	0	-	60	0	0	0	-/-
09	No Density Collected								-/-
10	20	100	0	-	60	0	0	0	-/-
12	160	88	13	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	26/69
<i>Tetradymia canescens</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	0	0	0	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	10/6

WILDCAT SAGE-GROUSE - TREND STUDY NO. 17R-18-12

Vegetation Type: Silver Sagebrush

Range Type: Crucial Deer Summer, Crucial Elk Summer

NRCS Ecological Site Description: [High Mountain Loam \(Mountain Big Sagebrush\), R047XA516UT](#) and [High Mountain Loam \(Silver Sagebrush\), R047XA517UT](#)

Land Ownership: UDWR

Elevation: 7,980 ft (2,432 m)

Aspect: Southwest

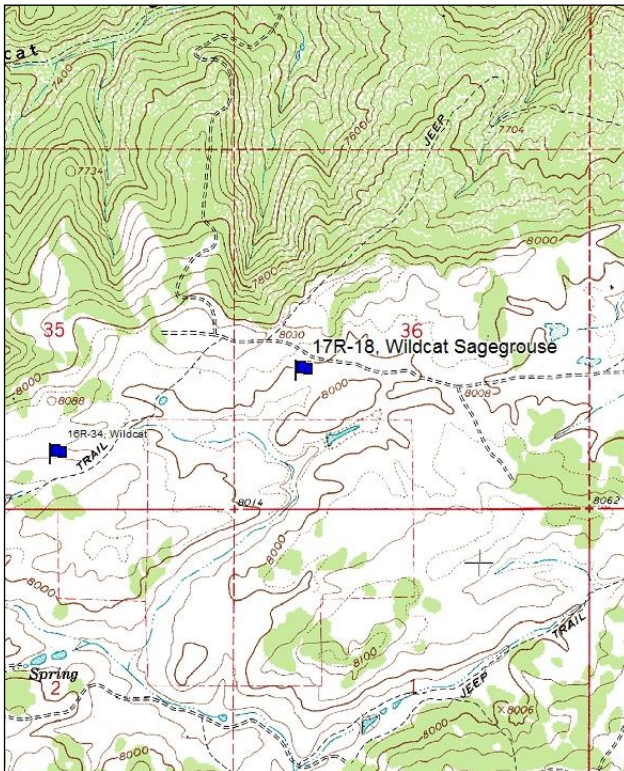
Slope: 1%

Transect bearing: 230° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

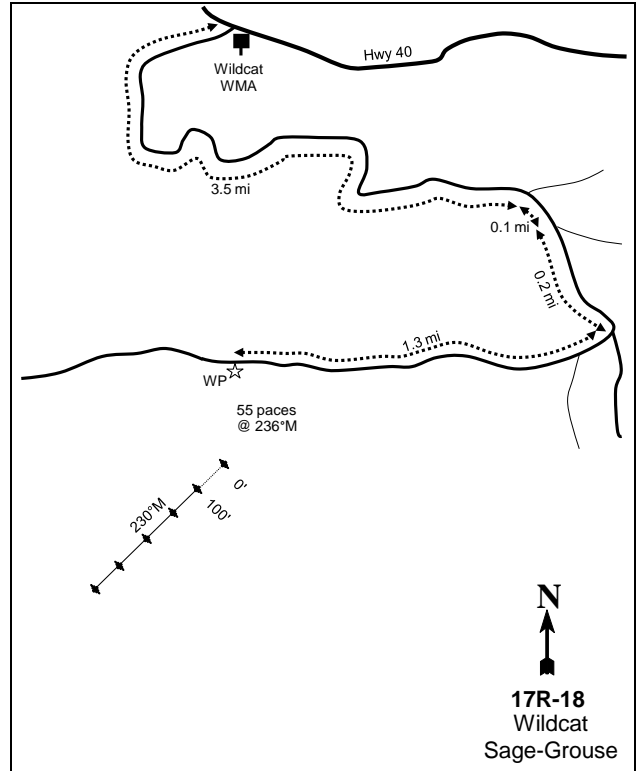
Directions: On US 40, drive east past Strawberry Reservoir to the road that goes to the Wildcat WMA. Turn right (south) and drive 3.5 miles to a fork. Turn right and drive 0.1 miles to a fork and stay right. Drive 0.2 miles to another fork and stay right again. Drive 1.3 miles to the witness post on the left (south) side of the road just before a hill. From the witness post, walk 55 paces at 236°M to the 0-foot stake. The 0-foot stake is marked with browse tag #95.

Map Name: Deep Creek Canyon



Township: 3S Range: 10W Section: 36

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 502660 E 4447065 N

WILDCAT SAGE-GROUSE - TREND STUDY NO. 17R-18

Site Information

Site Description: The study is located approximately seven miles west of Fruitland on the east side of Strawberry Reservoir. The study was established in 2005 on Current Creek Wildlife Management Area (WMA) to monitor habitat for sage-grouse. The Wildcat Sage-Grouse study is one of four established in 2005 to monitor habitat for sage-grouse in the Strawberry Valley and surrounding brood area. In conjunction with Brigham Young University, the data from the four studies will be used to better manage sage-grouse populations in the Strawberry Valley. This study is located within an area that is strictly sage-grouse brooding habitat. The Strawberry Sage-Grouse 1 (17R-17), Road Hollow (17R-19) study, and the Road Hollow Ridge (17R-20) study are all located within sage-grouse winter and brooding habitat approximately five mile to the west. Sage-grouse pellet groups were sampled at 96 groups/acre in 2005 and 26 groups/acre in 2012. Deer pellet groups were sampled in low abundance in 2005 and 2012. Elk pellet groups were sampled in moderate abundance in 2005. Moose pellet groups were sampled in low abundance in 2005 (Table - Pellet Group Data).

Browse: The dominant browse species on the site is silver sagebrush (*Artemisia cana*), which provided the majority of the canopy cover on the site over the sample years (Table - Canopy Cover). The preferred browse species sampled on the site are mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), Antelope bitterbrush (*Purshia tridentata*), and current (*Ribes sp.*). Decadence and poor vigor of silver sagebrush was high in 2012. Mountain big sagebrush is a moderately used population with low decadence and good vigor within the population. The recruitment of young plants has been poor for silver sagebrush and has been good for the mountain big sagebrush over the sample periods (Table - Browse Trends).

Herbaceous Understory: Grasses are abundant and diverse on the site. Sheep fescue (*Festuca ovina*) is the dominant grass species and has provided the majority of the cover on the site. Other common grass species sampled on the site are sedge (*Carex sp.*), June grass (*Koeleria cristata*), and Letterman needlegrass (*Stipa lettermani*). Forbs are abundant and fairly diverse on the site. Western yarrow (*Achillea millefolium*) and aster (*Aster sp.*) are the dominant forbs species on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a clay loam with a slightly acidic soil reaction (pH 6.5) (Table - Soil Analysis Data). Bare ground cover is low though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to pedestalling around shrubs, surface litter movement, flow patterns, and soil movement. The soil erosion condition was classified as stable in 2012.

Trend Assessments

Browse:

- **2005 to 2012 - slightly down (-1):** The density of mountain big sagebrush increased 47% from 1,560 plants/acre to 2,300 plants/acre, though canopy cover decreased from 5% to 4%. The density of silver sagebrush decreased 13% from 6,000 plants/acre to 5,220 plants/acre and canopy cover decreased from 17% to 10%. Poor vigor of silver sagebrush increased within the population from 2% to 30%, and decadence increased from 10% to 30%. Mountain big sagebrush decadence and plants displaying poor vigor remained low within the population. Recruitment of young sagebrush plants remained poor in the silver sagebrush population and remained good in the mountain big sagebrush population.

Grass:

- **2005 to 2012 - up (2):** The sum of nested frequency of perennial grasses increased 44%, and cover increased from 30% to 49%. Several grass species increased significantly in nested frequency and cover. The dominant grass species sheep fescue increased significant in nested frequency, and cover increased from 19% to 34%.

Forb:

- **2005 to 2012 - down (-2):** The sum of nested frequency of perennial forbs remained similar, though cover decreased from 20% to 7%. Several forb species decreased in cover on the site. Western yarrow, aster, and Rainier pleated gentian (*Gentiana calycosa*) had the largest decrease in cover from 5%, 4%, and 4% to 1%, 2%, and 1%, respectively.

Trend Summary

HERBACEOUS TRENDS--

Management unit 17R, Study no: 18

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
G	Agropyron dasystachyum	a5	b83	.01	.38
G	Bromus anomalus	a3	b15	.00	.24
G	Carex sp.	a164	b242	4.39	5.72
G	Deschampsia caespitosa	b15	a-	.45	-
G	Festuca ovina	a319	b399	18.76	34.01
G	Juncus balticus	a62	b113	.50	.35
G	Koeleria cristata	a41	b120	.48	2.68
G	Muhlenbergia richardsonis	a-	b22	-	.22
G	Poa fendleriana	58	43	1.79	.13
G	Poa pratensis	49	50	.37	.91
G	Sitanion hystrix	b24	a1	.34	.00
G	Stipa columbiana	45	34	1.11	1.04
G	Stipa comata	13	9	.39	.02
G	Stipa lettermani	a39	b74	1.18	2.95
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		837	1205	29.81	48.69
Total for Grasses		837	1205	29.81	48.69
F	Achillea millefolium	164	163	4.58	1.07
F	Agoseris glauca	1	5	.15	.00
F	Androsace septentrionalis (a)	a-	b123	-	.33
F	Antennaria rosea	31	35	.40	1.31
F	Aster sp.	151	171	4.29	1.54
F	Astragalus tenellus	9	-	.07	-
F	Cerastium beeringianum	-	4	-	.01
F	Cirsium scariosum	11	13	.91	.18
F	Draba cuneifolia (a)	-	7	-	.01
F	Gayophytum ramosissimum(a)	-	2	-	.00
F	Gentiana calycosa	b112	a62	3.95	.56
F	Geranium richardsonii	4	4	.15	.15
F	Iris missouriensis	-	2	-	.00
F	Lactuca serriola (a)	-	2	-	.00
F	Lupinus caespitosus utahensis	a40	b95	.68	.76
F	Microsteris gracilis (a)	2	-	.00	-
F	Orthocarpus tolmiei (a)	135	10	1.17	.01
F	Pedicularis groenlandica	-	5	.00	.01

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
F	Penstemon watsonii	80	105	1.98	.78
F	Phlox longifolia	_b 20	_a 7	.21	.01
F	Polygonum douglasii (a)	_b 29	_a 2	.09	.00
F	Potentilla gracilis	48	47	1.52	.46
F	Potentilla hippiana	-	8	-	.19
F	Potentilla pennsylvanica	-	6	-	.06
F	Potentilla sp.	_b 29	_a -	.81	-
F	Schoenrambe linifolia	-	2	-	.00
F	Taraxacum officinale	18	12	.11	.02
F	Trifolium sp.	_a -	_b 32	-	.06
Total for Annual Forbs		166	146	1.28	0.37
Total for Perennial Forbs		718	778	19.85	7.23
Total for Forbs		884	924	21.13	7.60

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 17R, Study no: 18

Type	Species	Strip Frequency		Average Cover %	
		'05	'12	'05	'12
B	Artemisia cana	71	71	11.95	8.07
B	Artemisia tridentata vaseyana	28	28	2.95	4.92
B	Chrysothamnus parryi	-	-	.03	-
B	Chrysothamnus viscidiflorus viscidiflorus	15	13	.18	.54
B	Purshia tridentata	1	3	.76	1.48
Total for Browse		16	16	15.87	15.02

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 18

Species	Percent Cover	
	'05	'12
Artemisia cana	16.81	9.86
Artemisia tridentata vaseyana	4.96	3.86
Chrysothamnus viscidiflorus viscidiflorus	.53	.43
Purshia tridentata	.75	1.04

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17R, Study no: 18

Species	Average leader growth (in)	
	'05	'12
Artemisia tridentata vaseyana	2.0	1.4
Purshia tridentata	2.5	0.8

BASIC COVER--

Management unit 17R, Study no: 18

Cover Type	Average Cover %	
	'05	'12
Vegetation	62.35	64.65
Rock	.00	.85
Pavement	.01	0
Litter	27.44	64.22
Cryptogams	.55	.89
Bare Ground	22.08	8.56

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 18, Study Name: Wildcat Sage-Grouse

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.1	6.5	32.4	39.8	27.8	4.5	18.1	275.2	0.5

PELLET GROUP DATA--

Management unit 17R, Study no: 18

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'12	'05	'12
Rabbit	14	-	-	-
Moose	1	-	1 (2)	-
Grouse	6	2	96 groups/acre	26 groups/acre
Elk	13	1	30 (74)	-
Deer	4	4	3 (8)	3 (7)

BROWSE CHARACTERISTICS--

Management unit 17R, Study no: 18

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia cana									
05	6000	9	82	10	20	0	0	2	15/23
12	5220	7	63	30	220	.38	0	30	12/21
Artemisia tridentata vaseyana									
05	1560	13	71	17	-	45	1	4	19/25
12	2300	23	63	14	20	24	2	11	16/24
Chrysothamnus viscidiflorus viscidiflorus									
05	660	9	88	3	-	0	0	0	10/14
12	840	2	98	0	-	0	0	0	5/5
Potentilla fruticosa									
05	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	9/17

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Purshia tridentata										
05	20	0	100	-	-	0	0	0	24/78	
12	240	0	100	-	-	100	0	0	19/37	
Ribes sp.										
05	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	34/64	

WILDCAT - TREND STUDY NO. 17R-34-12

Vegetation Type: Mountain Big Sagebrush/Antelope Bitterbrush

Range Type: Crucial Deer Summer, Crucial Elk Summer

NRCS Ecological Site Description: [High Mountain Loam \(Mountain Big Sagebrush\), R047XA516UT](#)

Land Ownership: UDWR

Elevation: 8,031 ft (2,448 m)

Aspect: Southeast

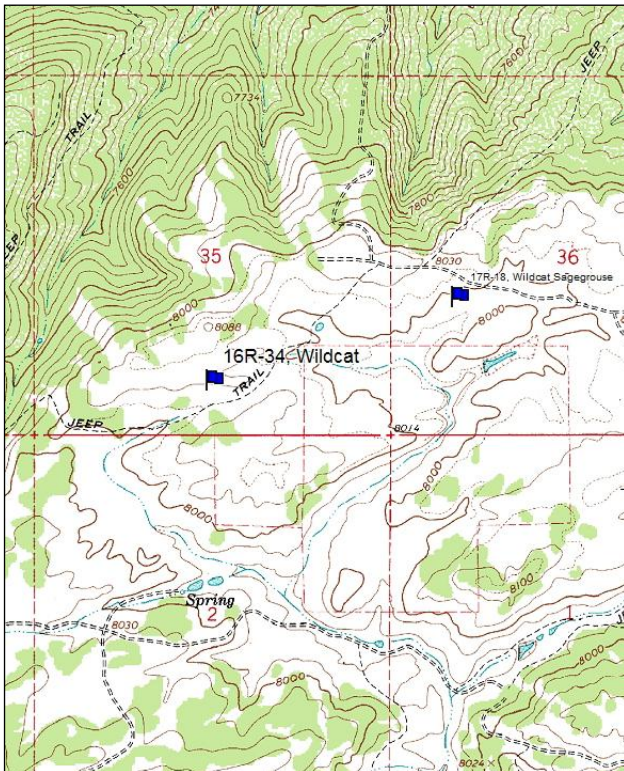
Slope: 1%

Transect bearing: 58° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

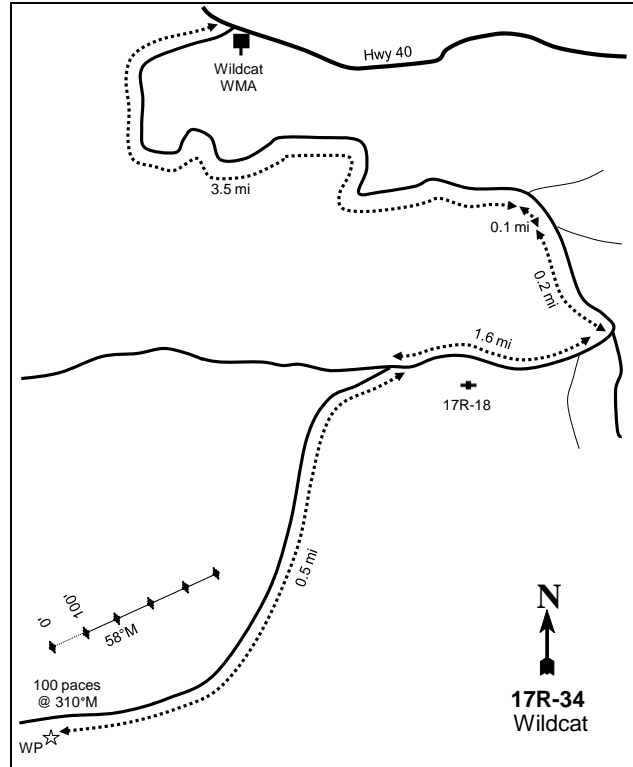
Directions: On US 40, drive east past Strawberry Reservoir to the road that goes to the Wildcat WMA. Turn right (south) and drive 3.5 miles to a fork. Turn right and drive 0.1 miles to a fork and stay right. Drive 0.2 miles to another fork and stay right again. Drive 1.6 miles to a road on the right. Turn right and travel for another 0.5 miles to a witness post on the left. From the witness post, walk 33 paces at 310°M to the 0-foot stake. The 0-foot stake is marked with browse tag #9169.

Map Name: Deep Creek Canyon



Township: 3S Range: 10W Section: 35

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 501550 E 4446688 N

WILDCAT - TREND STUDY NO. 17R-34

[Project #2309](#)

Site Information

Site Description: The study is located approximately seven and half miles west of Fruitland on the east side of Strawberry Reservoir. The study was established prior to treatment in 2012 on Current Creek Wildlife Management Area (WMA) to monitor a sagebrush (*Artemisia sp.*) treatment project. In the fall of 2012, approximately 250 acres were two-way chained harrow. Seeding was not needed due to the elevation, moisture, and presence of desirable grass and forb species. The objective of the project is to reduce sagebrush cover in order to maintain and increase grass and forbs in the nesting and brood rearing habitat (WRI Database 2013). Sage-grouse pellet groups were sampled 157 groups/acre in 2012. Deer pellet groups were sampled in moderate abundance in 2012. Elk and moose pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: The dominant browse species on the site are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*), which provides the majority of the canopy cover on the site (Table - Canopy Cover). The preferred browse species sampled on the site are mountain big sagebrush, Antelope bitterbrush, and Utah serviceberry (*Amelanchier utahensis*). Decadence and poor vigor of sagebrush was high in 2012. Mountain big sagebrush is a moderately used population with poor recruitment of young plants to the population. The bitterbrush is a moderately used population with high decadence and poor vigor (Table - Browse Trends).

Herbaceous Understory: Grasses are abundant and diverse on the site. Sheep fescue (*Festuca ovina*) is the dominant grass species and has provides the majority of the cover on the site. Other common grass species sampled on the site are thickspike wheatgrass (*Agropyron dasystachyum*), nodding brome (*Bromus anomalus*), sedge (*Carex sp.*), June grass (*Koeleria cristata*), mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and Letterman needlegrass (*Stipa lettermani*). Forbs are moderately abundant and fairly diverse on the site. Rose pussytoes (*Antennaria rosea*) and sandwort (*Arenaria sp.*) are the dominant forbs species on the site and provide the majority of the forb cover on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is low though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 17R, Study no: 34

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	Agropyron dasystachyum	117	.99
G	Bromus anomalus	53	1.16
G	Carex sp.	120	1.42
G	Festuca ovina	158	7.45
G	Koeleria cristata	96	3.55
G	Poa fendleriana	68	2.28
G	Poa pratensis	17	.93
G	Poa secunda	76	1.49

Type	Species	Nested	Average
		Frequency	Cover %
		'12	'12
G	Sitanion hystrix	52	.88
G	Stipa columbiana	4	.03
G	Stipa comata	8	.15
G	Stipa lettermani	69	1.33
Total for Annual Grasses		0	0
Total for Perennial Grasses		838	21.70
Total for Grasses		838	21.70
F	Androsace septentrionalis (a)	19	.05
F	Antennaria rosea	64	2.31
F	Arabis sp.	2	.00
F	Arenaria sp.	184	5.15
F	Aster sp.	17	.07
F	Astragalus convallarius	11	.02
F	Chaenactis douglasii	3	.01
F	Draba cuneifolia (a)	17	.03
F	Eriogonum umbellatum	12	.19
F	Gayophytum ramosissimum(a)	9	.02
F	Linum lewisii	5	.06
F	Lychnis drummondii	5	.01
F	Orthocarpus tolmiei (a)	17	.07
F	Penstemon sp.	3	.03
F	Penstemon watsonii	61	.62
F	Phlox longifolia	2	.00
F	Potentilla gracilis	6	.01
F	Potentilla hippiana	3	.03
F	Taraxacum officinale	5	.02
F	Trifolium sp.	28	.05
Total for Annual Forbs		62	0.18
Total for Perennial Forbs		411	8.62
Total for Forbs		473	8.80

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 17R, Study no: 34

Type	Species	Strip Frequency '12	Average Cover % '12
B	Artemisia tridentata vaseyana	93	13.16
B	Chrysothamnus viscidiflorus viscidiflorus	83	4.28
B	Mahonia repens	6	.12
B	Purshia tridentata	64	14.89
B	Ribes sp.	1	-
B	Symphoricarpos oreophilus	3	.06
B	Tetradymia canescens	7	.06
Total for Browse		257	32.58

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 34

Species	Percent Cover '12
Artemisia tridentata vaseyana	20.98
Chrysothamnus viscidiflorus viscidiflorus	6.05
Mahonia repens	.38
Purshia tridentata	19.06
Symphoricarpos oreophilus	.26
Tetradymia canescens	.06

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17R, Study no: 34

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	1.1
Purshia tridentata	1.3

BASIC COVER--

Management unit 17R, Study no: 34

Cover Type	Average Cover % '12
Vegetation	64.11
Rock	.03
Litter	62.92
Cryptogams	1.90
Bare Ground	11.39

PELLET GROUP DATA--

Management unit 17R, Study no: 34

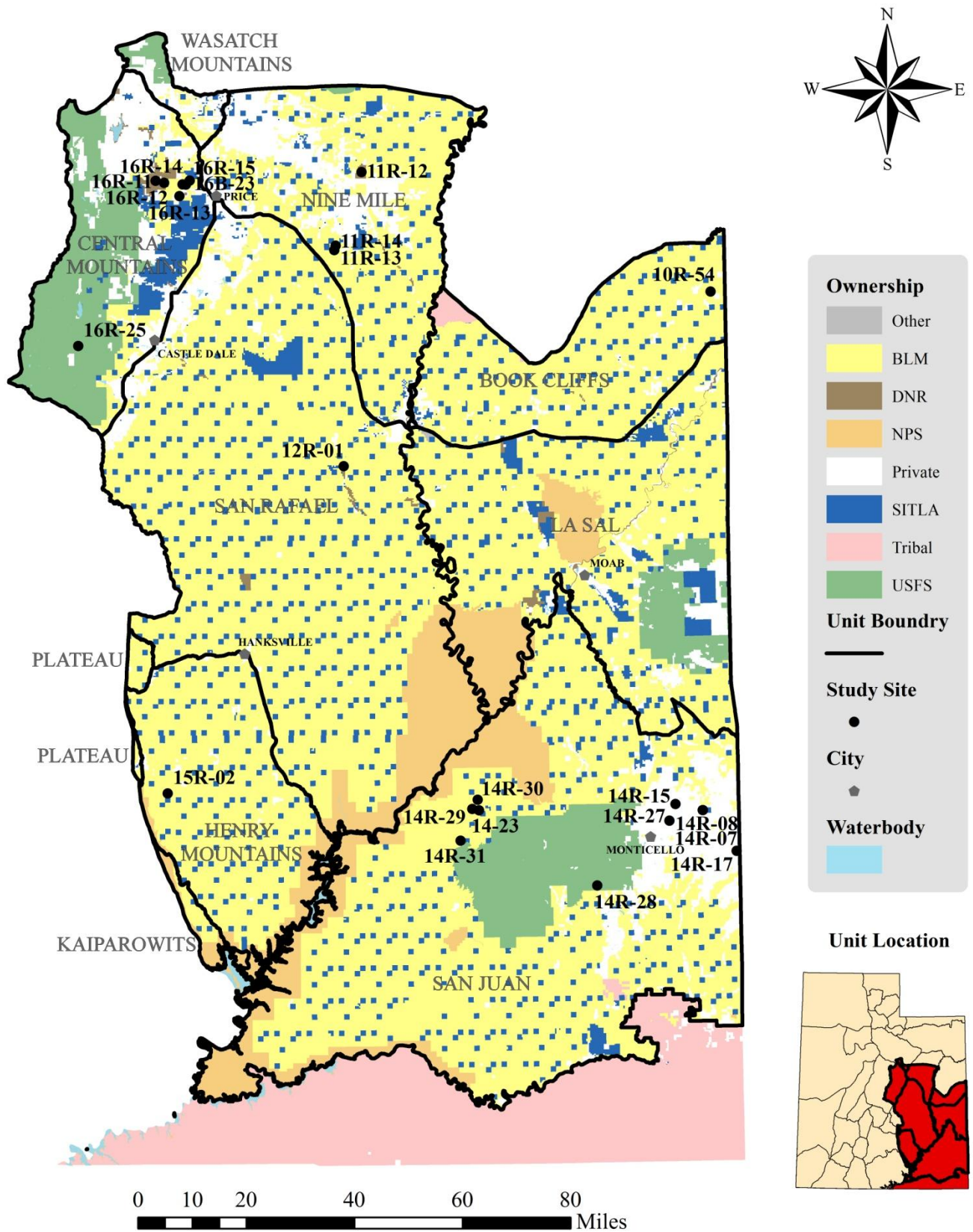
Type	Quadrat Frequency '12	Days use per acre (ha) '12
Elk	-	3 (7)
Grouse	-	157 groups/acre
Moose	3	4 (10)
Deer	8	36 (88)

BROWSE CHARACTERISTICS--

Management unit 17R, Study no: 34

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Amelanchier utahensis										
12	0	0	0	-	-	0	0	0	42/39	
Artemisia tridentata vaseyana										
12	5440	3	72	25	-	25	1	32	22/30	
Chrysothamnus viscidiflorus viscidiflorus										
12	6960	1	96	3	60	0	.28	6	8/10	
Mahonia repens										
12	3840	0	100	-	-	0	0	0	3/3	
Purshia tridentata										
12	2300	1	61	38	20	57	16	24	22/43	
Ribes sp.										
12	20	0	100	-	-	0	0	0	26/43	
Symphoricarpos oreophilus										
12	60	0	100	-	-	0	0	0	19/20	
Tetradymia canescens										
12	240	0	92	8	-	0	0	0	8/7	

Southeastern Region WRI Studies 2012



BITTER CREEK HERBICIDE - TREND STUDY NO. 10R-54-12

Vegetation Type: Annual Grass

Range Type: Crucial Elk Winter

NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT

Land Ownership: BLM

Elevation: 5,197 ft (1,584 m)

Aspect: Flat

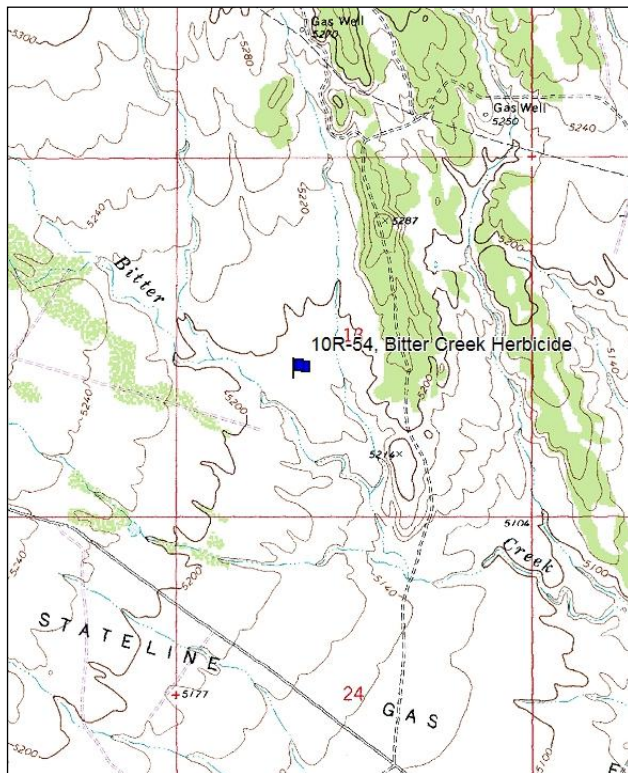
Slope: 3%

Transect bearing: 0° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

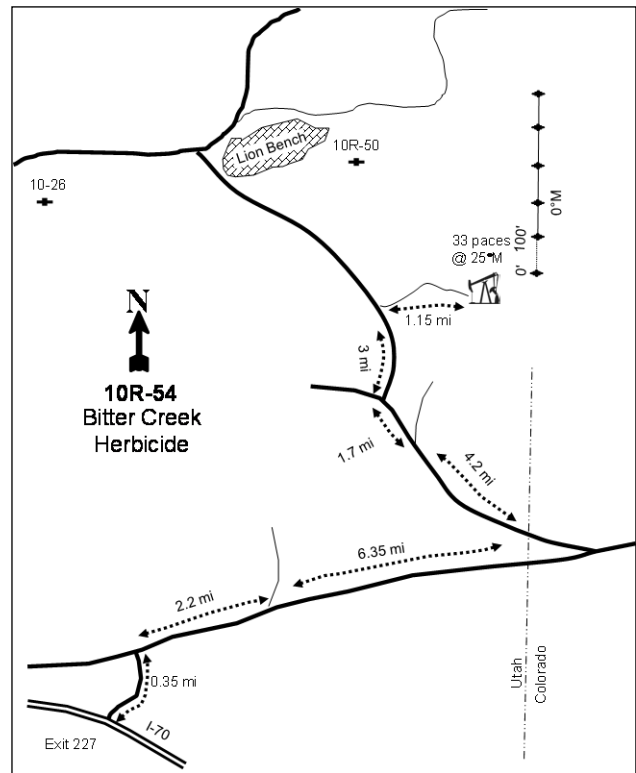
Directions: From I-70 take exit 227. Travel west for 0.35 miles to US 6 BUS. Turn right and travel 8.55 miles crossing the Utah/Colorado border to 1 8/10 road/ Book Cliff Ridge road and turn left. Travel along the Book Cliff Ridge road for 8.9 miles and turn right. Travel 1.15 miles to an oil/gas pad. The 0-foot stake is 33 paces at 25°M.

Map Name: Bryson Canyon



Township: 17S Range: 25E Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 663623 E 4354758 N

BITTER CREEK HERBICIDE - TREND STUDY NO. 10R-54
[Project #2161](#)

Site Information

Site Description: The study is located approximately nine and half miles north of Interstate 70. The study was established on land administrated by the Bureau of Land Management (BLM) to monitor cheatgrass (*Bromus tectorum*) reduction project. The study occurs on the BLM San Arroyo allotment. The entire project area lies within the large 17, 156 acres. In the fall of 2012, approximately 2,250 acres were aerially sprayed with Plateau (Imazapic) herbicide and 925 acres were seeded with a rangeland drill (WRI Database 2013). Deer and cattle pellet groups were sampled in low abundance in 2012. Elk pellet groups were sampled in moderate abundance on the site in 2012 (Table - Pellet Group Data).

SEED MIX--

Management unit 10R, Study no: 54

Project Name: Bitter Creek 2					
WRI Database #: 2161					
Application: Drill		Acres: 950		Application: Aerial	
				Acres: 950	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Blue Grama 'Alma'	300	0.32	B	Forage Kochia
G	Bluebunch WG 'P-7'	1433	1.51	B	Sagebrush, Wyoming
G	Crested Wheatgrass 'Douglas'	1077	1.13	Total Pounds:	
G	Crested Wheatgrass 'Ephraim'	289	0.30	PLS Pounds:	
G	Crested Wheatgrass 'Hycrest II'	900	0.95		
G	Crested Wheatgrass 'Nordan'	131	0.14		
G	Galleta	720	0.76		
G	Indian Ricegrass	1450	1.53		
G	Pubescent Wheatgrass 'Luna'	1900	2.00		
G	Russian Wildrye	950	1.00		
G	Sand Dropseed	95	0.10		
G	Western Wheatgrass 'Arriba'	1417	1.49		
F	Blue Flax 'Appar'	475	0.50		
F	Palmer Penstemon	225	0.24		
F	Small Burnet 'Delar'	1750	1.84		
B	Fourwing Saltbush	1425	1.50		
B	Winterfat	58	0.06		
Total Pounds:		14595	15.36		
PLS Pounds:			12.04		

Browse: Browse is rare on the site. The only browse species sampled on the site are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and broom snakeweed (*Gutierrezia sarothrae*).

Herbaceous Understory: Grasses are dominated by the invasive annual grass species cheatgrass. Perennial grasses are rare on the site. Crested wheatgrass (*Agropyron cristatum*) was the only perennial grass species on the site. Perennial forbs are rare on the site. The weedy annual forb species tumbled mustard (*Sisymbrium altissimum*) is the dominant forb species on the site and provided the majority of the forb cover on the site (Table - Herbaceous Understory).

Soil: The soil is classified as part of the Barx component, which occurs on alluvial fans and fan terraces. The parent material consists of alluvium derived from sandstone. The soils within this classification are

characterized as deep, well drained, and with a moderately high permeable restrictively layer. The soil surface texture is a fine sandy loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a high amount of litter and moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 10R, Study no: 54

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	Agropyron cristatum	6	.33
G	Bromus tectorum (a)	426	23.63
Total for Annual Grasses		426	23.63
Total for Perennial Grasses		6	0.32
Total for Grasses		432	23.96
F	Cryptantha sp.	5	.01
F	Draba sp. (a)	3	.00
F	Erodium cicutarium (a)	60	.55
F	Sisymbrium altissimum (a)	213	5.44
F	Sphaeralcea coccinea	29	.26
F	Sphaeralcea sp.	77	.32
F	Townsendia sp.	5	.38
Total for Annual Forbs		276	6.00
Total for Perennial Forbs		116	0.97
Total for Forbs		392	6.97

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 10R, Study no: 54

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata wyomingensis	3	-
Total for Browse		3	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 10R, Study no: 54

Species	Average leader growth (in)
	'12
Artemisia tridentata wyomingensis	0.6

BASIC COVER--

Management unit 10R, Study no: 54

Cover Type	Average Cover % '12
Vegetation	31.63
Rock	.38
Litter	53.08
Cryptogams	.01
Bare Ground	32.66

PELLET GROUP DATA--

Management unit 10R, Study no: 54

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	5	-
Elk	25	32 (78)
Deer	5	3 (8)
Cattle	2	1 (2)

BROWSE CHARACTERISTICS--

Management unit 10R, Study no: 54

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia tridentata wyomingensis									
12	60	0	100	-	-	0	100	0	14/22
Gutierrezia sarothrae									
12	0	0	0	-	-	0	0	0	-/-

BURNT CABIN SPRING - TREND STUDY NO. 11R-12-12

Vegetation Type: Aspen Conifer Encroached

Range Type: Crucial Deer Summer, Crucial Elk Summer

NRCS Ecological Site Description: High Mountain Loam (Douglas Fir), R048AY509UT

Land Ownership: UDWR

Elevation: 8,777 ft (2,675 m)

Aspect: Northwest

Slope: 25%

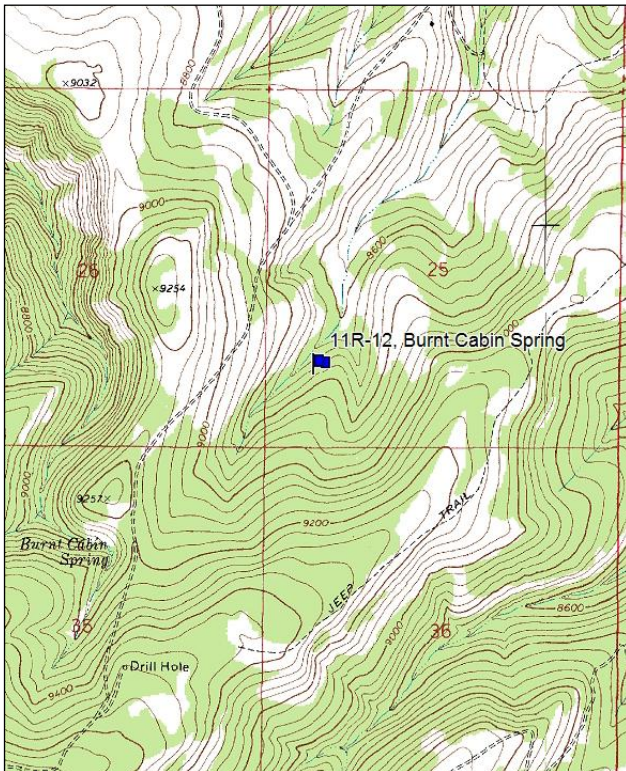
Transect bearing: 215° magnetic (line 5 doglegs at 265° magnetic)

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Notes: No rebar

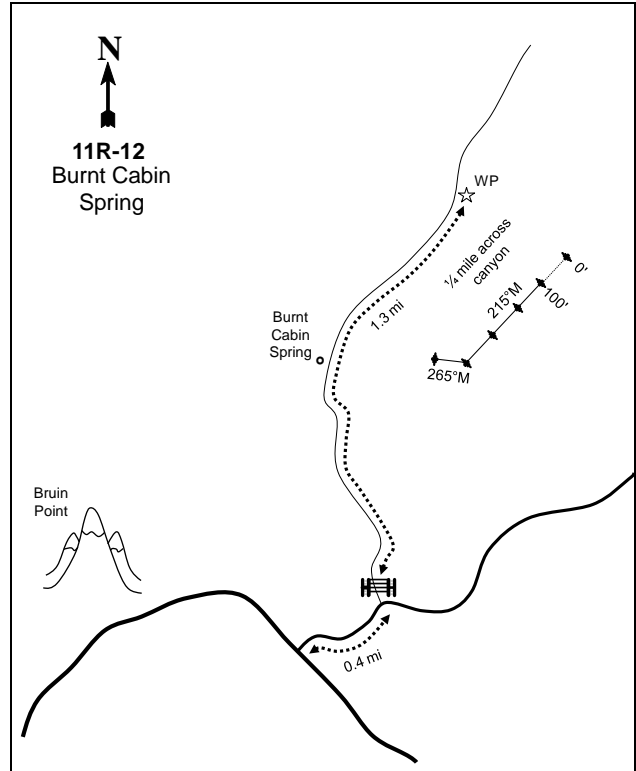
Directions: From Bruin Point travel east to the entrance to the WMA and turn left. Drive 0.4 miles to a locked gate on the left. Proceed through gate 1.3 miles to witness post. The study site is across the canyon to the southeast on the lower portion of the hill slope.

Map Name: Bruin Point



Township: 13S Range: 14E Section: 25

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 559659 E 4390313 N

BURNT CABIN SPRING - TREND STUDY NO. 11R-12

[Project #1198](#)

Site Information

Site Description: The study is located two and half miles northeast of Bruin Point within the Range Creek Wildlife Management Area. The study was established in 2012 on land administrated by the Utah Division of Wildlife (UDWR) to monitor the Cold Springs Aspen Enhancement project to improve aspen (*Populus tremuloides*) and reduce conifer encroachment. The study occurs on the Bureau of Land Management (BLM) Green River allotment. The project area will be burned using the helitorch when prescribed fire conditions permit ignition. The study area will not be seeded (WRI Database 2013). Elk and deer pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: The site is dominated by the conifer species white fir (*Abies concolor*) and Douglas-fir (*Pseudotsuga menziesii*) and the broadleaf tree aspen, which provided the majority of the canopy cover on the site. Preferred browse species were rare on the site. Other common browse species sampled on the site include myrtle Pachistima (*Pachistima myrsinites*), woods rose (*Rosa woodsii*), and mountain snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are rare on the site. Nodding brome (*Bromus anomalus*), Ross sedge (*Carex rossii*), and Kentucky bluegrass (*Poa pratensis*) were the only grass species sampled on the site. Forbs are not very abundant or diverse on the site. The dominant forb species are starry Solomon-plume (*Smilacina stellata*), Fendler meadowrue (*Thalictrum fendleri*), and violet (*Viola sp.*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Senchert-Toze complex, which occurs on mountain slopes. The parent material consists of colluviums and/or slope alluvium over residuum weathered from sandstone and shale or colluviums derived from sandstone, shale, and siltstone. The soils within this classification are characterized as moderate to deep, well drained, and with a low to high permeable restrictively layer. The soil surface texture is a loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012 due to surface litter and soil movement.

Trend Summary

HERBACEOUS TRENDS--

Management unit 11R, Study no: 12

Type	Species	Nested Frequency '12	Average Cover % '12
G	Bromus anomalus	20	.23
G	Carex rossii	24	.24
G	Poa pratensis	11	.16
Total for Annual Grasses		0	0
Total for Perennial Grasses		55	0.64
Total for Grasses		55	0.64
F	Achillea millefolium	8	.06
F	Aster sp.	12	.07
F	Astragalus miser	10	.19
F	Descurainia californica (a)	1	.00
F	Fragaria virginiana	13	.27

Type	Species	Nested Frequency	Average Cover %
		'12	'12
F	<i>Osmorhiza chilensis</i>	47	.43
F	<i>Smilacina racemosa amplexicaulis</i>	9	.56
F	<i>Smilacina stellata</i>	39	1.74
F	<i>Thalictrum fendleri</i>	38	1.20
F	<i>Viola</i> sp.	80	1.16
Total for Annual Forbs		1	0.00
Total for Perennial Forbs		256	5.71
Total for Forbs		257	5.71

Values with different subscript letters are significantly different at $\alpha = 0.10$

BROWSE TRENDS--

Management unit 11R, Study no: 12

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	<i>Abies concolor</i>	61	49.56
B	<i>Acer negundo negundo</i>	-	.03
B	<i>Mahonia repens</i>	10	.66
B	<i>Pachistima myrsinites</i>	65	1.99
B	<i>Populus tremuloides</i>	20	2.66
B	<i>Pseudotsuga menziesii</i>	5	10.94
B	<i>Ribes cereum cereum</i>	2	.00
B	<i>Rosa woodsii</i>	47	.85
B	<i>Symphoricarpos oreophilus</i>	55	1.92
Total for Browse		204	68.62

CANOPY COVER, LINE INTERCEPT--

Management unit 11R, Study no: 12

Species	Percent Cover '12
<i>Abies concolor</i>	73.78
<i>Mahonia repens</i>	.28
<i>Pachistima myrsinites</i>	2.96
<i>Populus tremuloides</i>	21.40
<i>Pseudotsuga menziesii</i>	6.06
<i>Ribes</i> sp.	.06
<i>Rosa woodsii</i>	1.11
<i>Symphoricarpos oreophilus</i>	3.40

POINT-QUARTER TREE DATA--
 Management unit 11R, Study no: 12

Species	Trees per Acre	Average diameter (in)
	'12	'12
Abies concolor/Pseudotsuga menziesii	2571	1
Populus tremuloides	200	3.4

BASIC COVER--
 Management unit 11R, Study no: 12

Cover Type	Average Cover %
	'12
Vegetation	66.26
Litter	85.71
Cryptogams	1.08
Bare Ground	.57

PELLET GROUP DATA--
 Management unit 11R, Study no: 12

Type	Quadrat Frequency	Days use per acre (ha)
	'12	'12
Elk	-	5 (13)
Deer	1	9 (22)

BROWSE CHARACTERISTICS--
Management unit 11R, Study no: 12

		Age class distribution					Utilization			
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Abies concolor										
12	3500	78	15	6	920	0	0	9	-/-	
Mahonia repens										
12	1540	0	100	-	-	0	0	0	5/6	
Pachistima myrsinites										
12	6860	11	88	1	-	0	0	0	5/6	
Populus tremuloides										
12	520	19	81	-	440	0	0	0	-/-	
Pseudotsuga menziesii										
12	180	22	56	22	-	0	44	11	-/-	
Ribes cereum cereum										
12	60	67	33	-	-	0	0	0	25/20	
Rosa woodsii										
12	2780	9	91	-	-	0	0	0	10/9	
Symphoricarpos oreophilus										
12	3560	4	96	-	-	0	0	.56	19/14	

HORSE CANYON - TREND STUDY NO. 11R-13-12

Vegetation Type: Utah Juniper

Range Type: Substantial Deer Winter

NRCS Ecological Site Description: Semidesert Stony Loam (Utah Juniper-Pinyon), R034XY247UT

Land Ownership: BLM

Elevation: 5,852 ft (1,784 m)

Aspect: Southwest

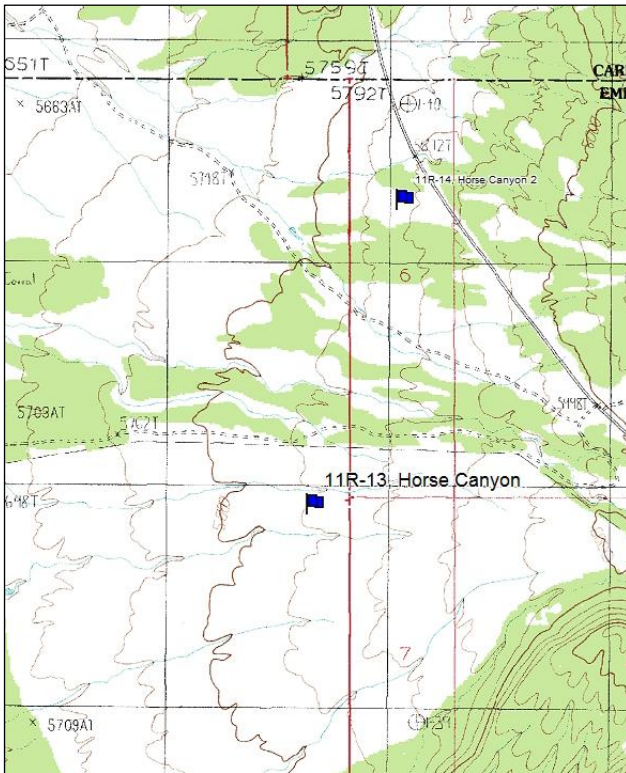
Slope: 5%

Transect bearing: 80° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

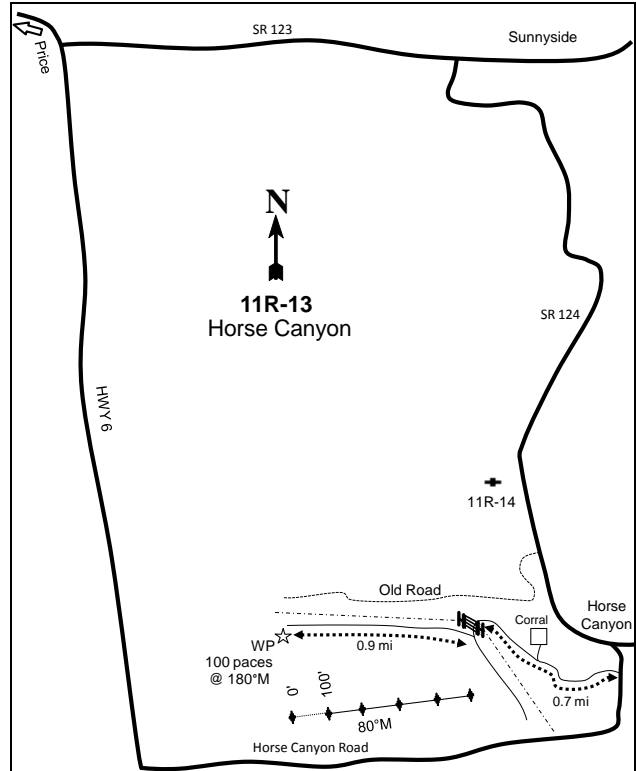
Directions: From Hwy 6 and the junction of Horse Canyon Road travel 4.5 miles east on Horse Canyon Road. Turn left on a dirt road just before SR 124. Travel for 0.7 miles to a gate. Proceed through the gate and travel along the fence for 0.9 miles. The 0-foot state is on the south at 180°M for 100 paces. There is no browse tag.

Map Name: Cedar



Township: 16S Range: 13E Section: 12

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 551577 E 4367069 N

HORSE CANYON - TREND STUDY NO. 11R-13

[Project #2238](#)

Site Information

Site Description: The study is located six and half miles to the south of East Carbon City within pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established in 2012 on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon and juniper reduction project. The study occurs on the BLM Icelander allotment. The project area was previously chained in the past. Approximately, 700 acres of pinyon and juniper were lop and scattered in the winter of 2012-2013, and a seed mix of grass forb and browse species were aerially seeded following the treatment. The project area will be rested from livestock grazing for two years following the treatment (WRI Database 2013). No pellet groups were sampled within the pellet group transect in 2012, though old cattle pellet groups were noted (Table - Pellet Group Data).

SEED MIX--

Management unit 11R, Study no: 13

Project Name: Horse Canyon Fuel Reduction		
WRI Database #: 2238		
Application: Aerial seed	Acres:	1752
Seed type	lbs in mix	lbs/acre
G *Bottlebrush Squirriltail 'Toe Jam Creek'	2100	1.20
G *Galleta 'Viva'	400	0.23
G *Indian Ricegrass 'Nezpar'	1850	1.06
G Bottlebrush Squirreltail	400	0.23
G Galleta	2778	1.59
G Indian Ricegrass	1400	0.80
G Intermediate Wheatgrass	2503	1.43
G Needle and Threadgrass	3514	2.01
G Sand Dropseed	100	0.06
G Sandberg Bluegrass	700	0.40
G Intermediate Wheatgrass 'Clarke'	2750	1.57
F Blue Flax 'Appar'	900	0.51
F Rocky Mountain Penstemon	315	0.18
B Fourwing Saltbush	4440	2.53
Total Pounds:	24150	13.78
PLS Pounds:		9.92

*Seed provided by the BLM

Browse: The dominant browse species sampled on the site are broom snakeweed (*Gutierrezia sarothrae*), green ephedra (*Ephedra viridis*), and Utah juniper, which provided the majority of the canopy cover on the site. Green ephedra is the dominant preferred browse species on the site, though occurring in low abundance on the site. Velvet ash (*Fraxinus velutina*) is scattered across the site, though not being sampled in the strip density plots. Pinyon and juniper tree were moderately large, but were not densely populated across the site (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are rare on the site. Crested wheatgrass (*Agropyron cristatum*), purple three-awn (*Aristida purpurea*), Russian wildrye (*Elymus junceus*), and Indian ricegrass (*Oryzopsis hymenoides*) were the only grass species sampled on the site. Forbs are not overly abundant and are moderately diverse on

the site. The dominant forb species on the site are cryptantha (*Cryptantha sp.*) and whitemargin frasera (*Frasera albomarginata*), though occurring in low abundance (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Strych component, which occurs on fan remnants. The parent material consists of alluvium and/or slope colluviums derived from sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer. The soil surface texture is a very stony fine sandy loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a moderate amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified slight in 2012 due to surface litter and soil movement.

Trend Summary

HERBACEOUS TRENDS--

Management unit 11R, Study no: 13

Type	Species	Nested	Average
		Frequency	Cover %
		'12	'12
G	Agropyron cristatum	3	.03
G	Aristida purpurea	20	.16
G	Elymus junceus	5	.15
G	Oryzopsis hymenoides	6	.21
Total for Annual Grasses		0	0
Total for Perennial Grasses		34	0.55
Total for Grasses		34	0.55
F	Caulanthus crassicaulis	1	.03
F	Cryptantha sp.	70	1.59
F	Descurainia pinnata (a)	25	.18
F	Eriogonum cernuum (a)	14	.06
F	Eriogonum ovalifolium	16	.19
F	Eriogonum sp.	40	.45
F	Euphorbia albomarginata	12	.12
F	Frasera albomarginata	112	1.18
F	Lesquerella sp.	8	.04
F	Machaeranthera grindelioides	13	.20
F	Penstemon sp.	7	.05
F	Salsola iberica (a)	4	.02
F	Senecio multilobatus	3	.00
Total for Annual Forbs		43	0.26
Total for Perennial Forbs		282	3.88
Total for Forbs		325	4.14

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 11R, Study no: 13

Type	Species	Strip Frequency '12	Average Cover % '12
B	Cercocarpus montanus	2	.03
B	Ephedra viridis	2	1.48
B	Eriogonum microthecum	5	.03
B	Gutierrezia sarothrae	64	3.92
B	Juniperus osteosperma	2	1.03
B	Leptodactylon pungens	2	.03
B	Opuntia sp.	1	-
Total for Browse		78	6.53

CANOPY COVER, LINE INTERCEPT--

Management unit 11R, Study no: 13

Species	Percent Cover '12
Ephedra viridis	1.78
Gutierrezia sarothrae	2.60
Juniperus osteosperma	2.53

POINT-QUARTER TREE DATA--

Management unit 11R, Study no: 13

Species	Trees per Acre '12	Average diameter (in) '12
Fraxinus velutina	32	3.9
Juniperus osteosperma	46	5.0
Pinus edulis	20	3.4

BASIC COVER--

Management unit 11R, Study no: 13

Cover Type	Average Cover % '12
Vegetation	10.73
Rock	5.42
Pavement	11.75
Litter	26.93
Cryptogams	1.48
Bare Ground	48.52

PELLET GROUP DATA--

Management unit 11R, Study no: 13

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	17	-
Deer	1	-
Cattle	1	-

BROWSE CHARACTERISTICS--

Management unit 11R, Study no: 13

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Cercocarpus montanus</i>									
12	40	50	50	-	-	100	0	0	33/29
<i>Cowania mexicana stansburiana</i>									
12	0	0	0	-	-	0	0	0	67/80
<i>Ephedra viridis</i>									
12	40	0	100	-	-	0	0	0	43/85
<i>Eriogonum microthecum</i>									
12	120	17	83	-	-	17	0	0	3/5
<i>Gutierrezia sarothrae</i>									
12	4900	20	76	4	320	0	0	27	6/10
<i>Juniperus osteosperma</i>									
12	40	0	100	-	-	0	0	0	-/-
<i>Leptodactylon pungens</i>									
12	40	50	50	-	-	0	0	0	2/6
<i>Opuntia sp.</i>									
12	20	0	100	-	-	0	0	0	4/11

HORSE CANYON 2 - TREND STUDY NO. 11R-14-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Substantial Deer Winter

NRCS Ecological Site Description: Semidesert Shallow Loam (Wyoming Big Sagebrush), R034XY225UT

Land Ownership: BLM

Elevation: 5,879 ft (1,792 m)

Aspect: West

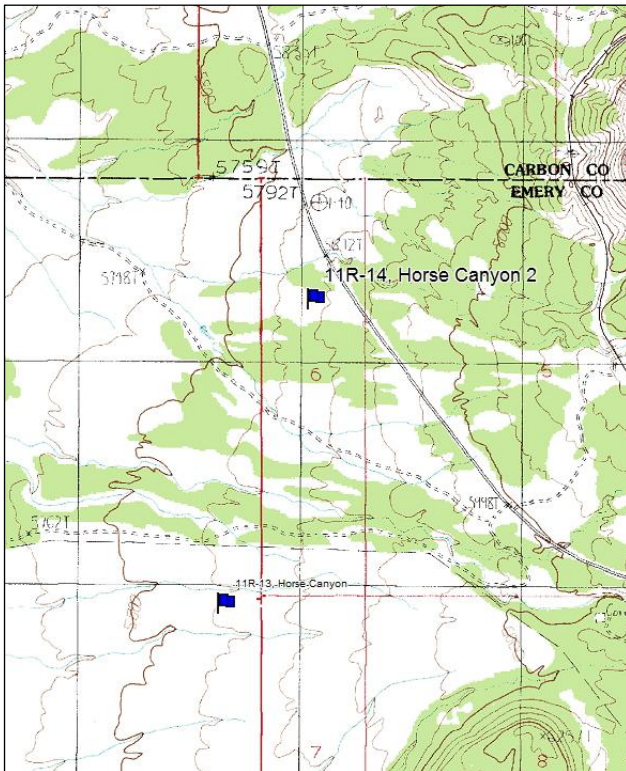
Slope: 5%

Transect bearing: 295° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

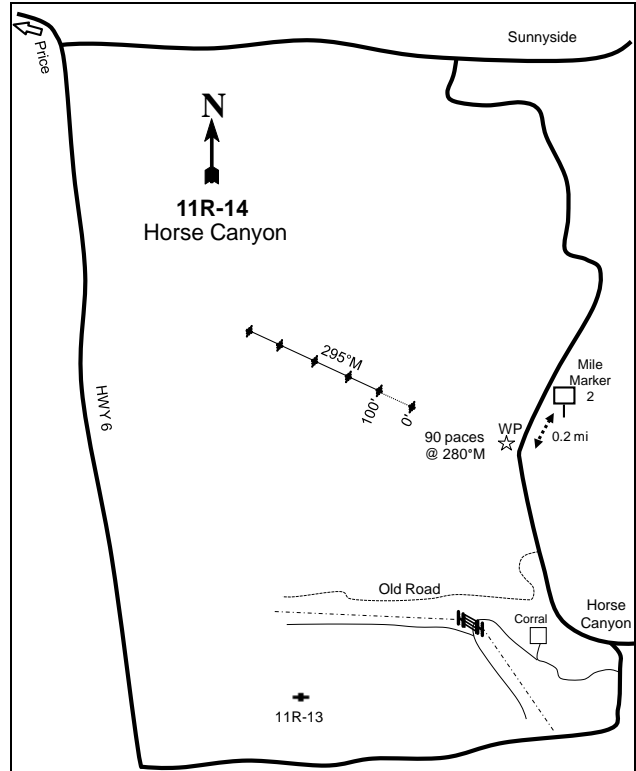
Directions: From SR 124 mile marker 2 travel 0.2 miles to the south. The study site is 280°M at 90 paces. There is no browse tag.

Map Name: Cedar



Township: 16S Range: 14E Section: 6

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 551974 E 4368440 N

HORSE CANYON 2 - TREND STUDY NO. 11R-14

[Project #2238](#)

Site Description: The study is located five and half miles to the south of East Carbon City within Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established in 2012 on land administrated by the Bureau of Land Management to monitor a pinyon and juniper reduction project. The study occurs on the BLM Icelandier allotment. Approximately, 578 acres of pinyon and juniper were bullhogged in the winter of 2012-2013, and a seed mix of grass forb and browse species were aerially seeded following the treatment. The project area will be rested from livestock grazing for two years following the treatment (WRI Database 2013). Deer pellet groups were sampled in moderate abundance on the site (Table - Pellet Group Data).

SEED MIX--

Management unit 11R, Study no: 13

Project Name: Horse Canyon Fuel Reduction		
WRI Database #: 2238		
Application: Aerial seed		Acres: 1752
Seed type		lbs in mix lbs/acre
G	*Bottlebrush Squirriltail 'Toe Jam Creek'	2100 1.20
G	*Galleta 'Viva'	400 0.23
G	*Indian Ricegrass 'Nezpar'	1850 1.06
G	Bottlebrush Squirreltail	400 0.23
G	Galleta	2778 1.59
G	Indian Ricegrass	1400 0.80
G	Intermediate Wheatgrass	2503 1.43
G	Needle and Threadgrass	3514 2.01
G	Sand Dropseed	100 0.06
G	Sandberg Bluegrass	700 0.40
G	Intermediate Wheatgrass 'Clarke'	2750 1.57
F	Blue Flax 'Appar'	900 0.51
F	Rocky Mountain Penstemon	315 0.18
B	Fourwing Saltbush	4440 2.53
Total Pounds:		24150 13.78
PLS Pounds:		9.92

*Seed provided by the BLM

Browse: The dominant browse species sampled on the site are broom snakeweed (*Gutierrezia sarothrae*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and Utah juniper, which provided the majority of the canopy cover on the site. Wyoming big sagebrush is the dominant preferred browse species on the site. The Wyoming big sagebrush is a lightly used population with low decadence and a high amount of plants displaying poor vigor within the population. Juniper trees were moderately abundant on the site. (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are not overly abundant on the site, but are fairly diverse. Purple three-awn (*Aristida purpurea*), blue grama (*Bouteloua gracilis*), and Indian ricegrass (*Oryzopsis hymenoides*) are the dominant grass species on the site. Forbs are rare on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Strych component, which occurs on fan remnants. The parent material consists of alluvium and/or slope colluviums derived from sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer.

The soil surface texture is a very bouldery fine sandy loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 11R, Study no: 14

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Aristida purpurea</i>	48	1.15
G	<i>Bouteloua gracilis</i>	77	1.28
G	<i>Festuca ovina</i>	2	.00
G	<i>Oryzopsis hymenoides</i>	6	.07
G	<i>Sitanion hystrix</i>	40	1.17
G	<i>Stipa comata</i>	7	.12
G	<i>Vulpia octoflora</i> (a)	4	.01
Total for Annual Grasses		4	0.01
Total for Perennial Grasses		180	3.81
Total for Grasses		184	3.82
F	<i>Astragalus</i> sp.	3	.15
F	<i>Cryptantha</i> sp.	2	.00
F	<i>Descurainia pinnata</i> (a)	6	.04
F	<i>Phlox longifolia</i>	12	.02
F	<i>Schoenrambe linifolia</i>	1	.03
F	<i>Sphaeralcea coccinea</i>	1	.00
Total for Annual Forbs		6	0.04
Total for Perennial Forbs		19	0.21
Total for Forbs		25	0.25

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 11R, Study no: 14

T y p e	Species	Strip Frequency	Average Cover %
		'12	'12
B	<i>Artemisia tridentata wyomingensis</i>	70	9.18
B	<i>Ephedra viridis</i>	3	.45
B	<i>Gutierrezia sarothrae</i>	76	3.83
B	<i>Juniperus osteosperma</i>	8	6.77
B	<i>Opuntia</i> sp.	3	-
B	<i>Sclerocactus</i> sp.	1	-
Total for Browse		161	20.24

CANOPY COVER, LINE INTERCEPT--
Management unit 11R, Study no: 14

Species	Percent Cover '12
Artemisia tridentata wyomingensis	7.30
Ephedra viridis	.98
Gutierrezia sarothrae	3.95
Juniperus osteosperma	9.04
Opuntia sp.	.03

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 11R, Study no: 14

Species	Average leader growth (in) '12
Artemisia tridentata wyomingensis	0.6

POINT-QUARTER TREE DATA--
Management unit 11R, Study no: 14

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	147	3.2

BASIC COVER--
Management unit 11R, Study no: 14

Cover Type	Average Cover % '12
Vegetation	21.53
Rock	3.85
Pavement	.69
Litter	33.01
Cryptogams	5.41
Bare Ground	50.07

PELLET GROUP DATA--
Management unit 11R, Study no: 14

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	29	-
Horse	1	-
Deer	15	24 (68)

BROWSE CHARACTERISTICS--
 Management unit 11R, Study no: 14

		Age class distribution					Utilization			
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
12	4020	52	33	14	40	20	19	38	22/31	
<i>Ephedra viridis</i>										
12	120	83	17	-	-	0	0	0	12/15	
<i>Gutierrezia sarothrae</i>										
12	11480	17	82	1	220	1	0	25	6/9	
<i>Juniperus osteosperma</i>										
12	160	88	13	-	-	0	0	25	-/-	
<i>Opuntia sp.</i>										
12	60	0	100	-	-	0	0	33	3/15	
<i>Pinus edulis</i>										
12	0	0	0	-	-	0	0	0	-/-	
<i>Sclerocactus sp.</i>										
12	20	0	100	-	-	0	0	0	4/8	

SAN RAFAEL TAMARISK REMOVAL - TREND STUDY NO. 12R-1-12

Vegetation Type: Black Greasewood

Range Type: Substantial Deer Year-Long

NRCS Ecological Site Description: Alkali Flat (Black Greasewood), R034XY006UT

Land Ownership: UDWR

Elevation: 4,137 ft (1,261 m)

Aspect: Southeast

Slope: 1-3%

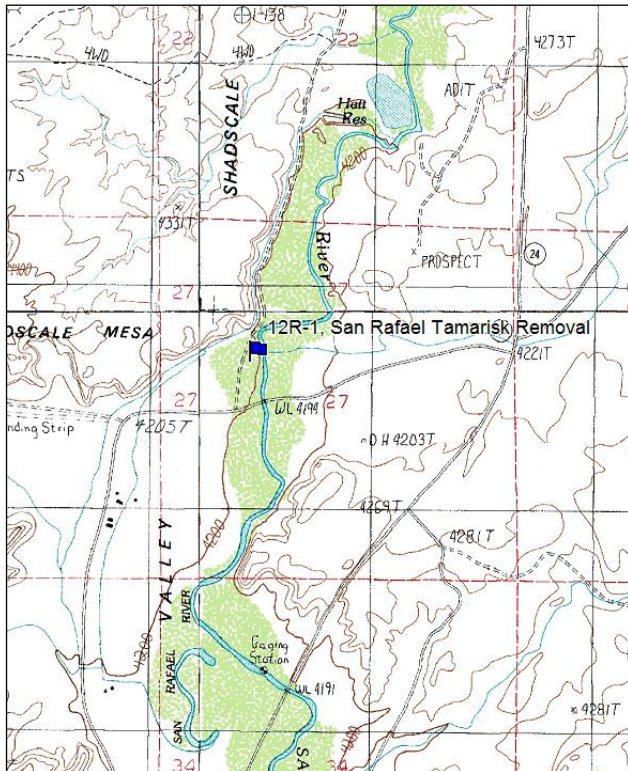
Transect bearing: 190° magnetic

Belt placement: line 1 (11ft & 95 ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Note: No Rebar

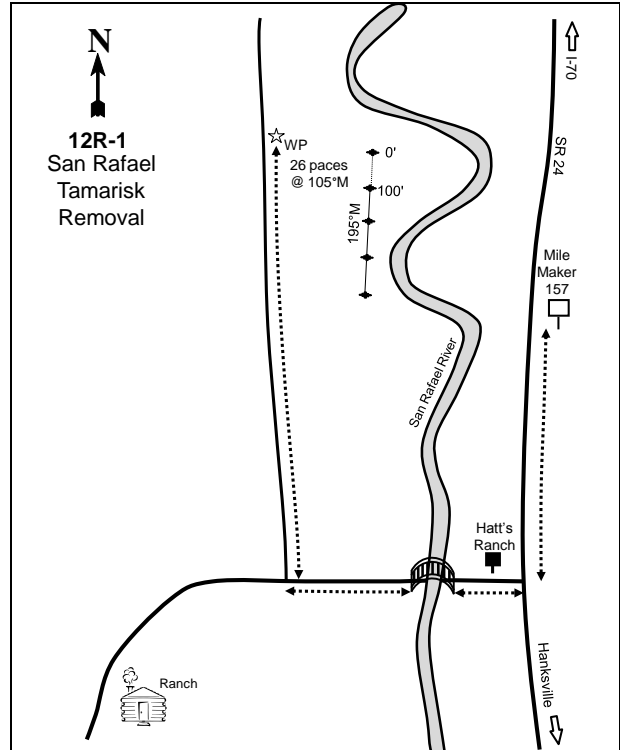
Directions: From I-70, take SR 24 south towards Hanksville. Go 0.4 miles passed mile marker 157 and then turn right, near the Hatt's Ranch sign. Continue 0.6 miles passed a gate to a bridge and then go 0.1 miles to a right turn. Drive 0.1 miles to the witness post on the right the 0-foot stake is 26 paces from the witness post at 105°M. The 0-foot stake is marked with browse tag #246.

Map Name: Horse Bench West



Township: 22S Range: 14E Section: 27

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 554387 E 4302858 N

SAN RAFAEL TAMARISK REMOVAL - TREND STUDY NO. 12R-1
[Project #867](#)

Site Description

Site Information: The study is located approximately fourteen miles southwest of Green River, within a five-stamen tamarisk (*Tamarix chinensis*) dominated San Rafael River bottom, on the north end of the San Rafael Valley. The study was established in 2008, prior to treatment, to monitor the effects of a mechanical removal of tamarisk, re-seeding, bank reshaping, and removal of fish passage barriers in the Lower San Rafael Wildlife Management Area (WMA). The study occurs on the Bureau of Land Management (BLM) Iron Wash allotment. Historically, the roundtail chub, bluehead sucker, flannelmouth sucker, and the Colorado pikeminnow used the San Rafael River. However, over time the fish have been extirpated from the river due to water quantity issues and lack of habitat. Beginning in the fall of 2008, a total of 740 acres of tamarisk were mechanically removed using a track hoe equipped with a grapple. The slash piles resulting from the removal projects were burned in the spring of 2010. The project area was reseeded in the fall of 2010 (Table - Seed Mix). Bank reshaping and barrier removal were not performed after it was determined that removing the tamarisk along the river bank allowed the banks and the floodplain to begin to reestablish naturally. The objectives of the project are to restore the connectivity of the San Rafael River through the Hatt Ranch property by creating a fish passage in the new diversion, and institute a water saving sprinkler irrigation system on 300 acres of property adjacent to the river, thus allowing more water to be in the river for healthier fish habitat (WRI Database 2013). Pellet groups were sampled in moderate abundance for deer/antelope, and light abundance for cattle in 2008. Deer pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: The browse component was dominated by tamarisk and black greasewood (*Sarcobatus vermiculatus*) prior to treatment, but following treatment tamarisk was substantially decreased on the site following the treatment. Fourwing saltbush (*Atriplex canescens*) was seeded on the site and was sampled in moderate abundance following the treatment (Table - Browse Characteristics).

Herbaceous Understory: Grasses were rare on the site prior to the treatment, but following the treatment grasses increased slightly in abundance. The dominant grass species sampled on the site is alkali sacaton (*Sporobolus airoides*), which has provided the majority of the grass cover on the site over the sample years. Other grass species sampled on the site include common reed (*Phragmites communis*) and saltgrass (*Distichlis spicata*). Forbs are moderately abundant, but are not particularly diverse and are dominated by weedy annual species. The annual forb species annual kochia (*Kochia scoparia*) is the dominant forb species and provides the majority of the forb cover. Other forb species sampled on the site include halogeton (*Halogeton glomeratus*) and Russian thistle (*Salsola iberica*) (Table - Herbaceous Trends).

Soil: The soil is likely classified (study site was barely outside of mapped unit) as part of the Green River-Garley-Huntsman complex and is likely part of the Garley component, which occurs on stream terraces. The parent material consists of alluvium derived from sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a slightly alkaline soil reaction (pH 7.5). Phosphorus may have limited availability for plant growth and development at 5.3 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderately high, though there is also a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

Pre vs. Four Years Post Treatment, 2008 vs. 2012

Browse: The density of tamarisk decreased substantially from 3,400 plants/acre to 60 plants/acre, and canopy cover decreased from 38% to 0%. Fourwing saltbush was seeded on the site and was sampled at 80 plants/acre and cover of 2%.

Grass: The sum of nested frequency of perennial grassed increased two fold, and cover increased from 1% to 3%. Alkali sacaton remained similar in nested frequency, though cover increased from 1% to 3%.

Forb: Perennial forbs are rare on the site. The sum of nested frequency of annual forbs decreased 67%, though cover increased from 10% to 17%. Annual kochia decreased significantly in nested frequency, though cover increased from 9% to 14%.

SEED MIX--

Management unit 12R, Study no: 1

Project Name: San Rafael Tamarisk Removal - Hatt Ranch			
WRI Database #: 867			
Application: Aerial Seed		Acres: 172	
Seed type		lbs in mix	lbs/acre
G	Alkali sacaton	40	0.23
G	Blue Flax 'Appar'	175	1.02
G	Galleta	175	1.02
G	Great Basin Wildrye 'Trailhead'	175	1.02
G	Indian Ricegrass	350	2.03
G	Needle and Threadgrass	85	0.49
G	Sand Dropseed	25	0.15
G	Western Wheatgrass 'Arriba'	250	1.45
F	Scarlet Globemallow	42	0.24
B	Fourwing Saltbush	175	1.02
Total Pounds:		1492	8.67
PLS Pounds:			6.86

Trend Summary

HERBACEOUS TRENDS--

Management unit 12R, Study no: 1

T y p e	Species	Nested Frequency		Average Cover %	
		'08	'12	'08	'12
G	Distichlis spicata	14	31	.16	.75
G	Phragmites communis	6	5	.16	.15
G	Sporobolus airoides	3	13	.71	2.08
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		23	49	1.03	2.98
Total for Grasses		23	49	1.03	2.98
F	Chenopodium fremontii (a)	_b 55	_a -	.98	-
F	Halogeton glomeratus (a)	2	13	.03	2.76
F	Iva axillaris	_a -	_b 18	-	.72
F	Kochia scoparia (a)	_b 251	_a 85	9.05	13.78
F	Salsola iberica (a)	9	6	.30	.80
Total for Annual Forbs		317	104	10.36	17.34
Total for Perennial Forbs		0	18	0	0.72
Total for Forbs		317	122	10.36	18.07

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 12R, Study no: 1

Type	Species	Strip Frequency		Average Cover %	
		'08	'12	'08	'12
B	Atriplex canescens	0	3	-	2.26
B	Chrysothamnus nauseosus	6	15	.07	1.08
B	Sarcobatus vermiculatus	27	31	10.53	7.63
B	Tamarix chinensis	54	3	24.71	.15
Total for Browse		87	52	35.30	11.12

CANOPY COVER, LINE INTERCEPT--

Management unit 12R, Study no: 1

Species	Percent Cover	
	'08	'12
Atriplex canescens	-	2.28
Chrysothamnus nauseosus	1.08	4.81
Sarcobatus vermiculatus	12.73	11.55
Tamarix chinensis	38.26	-

BASIC COVER--

Management unit 12R, Study no: 1

Cover Type	Average Cover %	
	'08	'12
Vegetation	47.96	33.21
Pavement	.52	.04
Litter	55.37	28.22
Bare Ground	31.47	57.49

SOIL ANALYSIS DATA --

Management unit 12R, Study no: 1, Study Name: San Rafael Tamarisk Removal

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.5	46.0	33.4	20.6	0.1	5.3	259.2	6.0

PELLET GROUP DATA--

Management unit 12R, Study no: 1

Type	Quadrat Frequency		Days use per acre (ha)	
	'08	'12	'08	'12
Rabbit	30	10	-	-
Deer	3	3	21 (51)	4 (10)
Cattle	-	1	2 (4)	-

BROWSE CHARACTERISTICS--

Management unit 12R, Study no: 1

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Atriplex canescens</i>										
08	0	0	0	-	-	0	0	0	-/-	
12	80	0	100	-	-	0	0	0	42/58	
<i>Chrysothamnus nauseosus</i>										
08	320	0	100	-	-	0	0	0	49/63	
12	520	23	77	-	-	0	0	0	30/45	
<i>Sarcobatus vermiculatus</i>										
08	1520	37	62	1	-	0	0	3	42/55	
12	1360	22	78	0	-	0	0	1	40/54	
<i>Tamarix chinensis</i>										
08	3400	9	91	-	-	10	0	0	82/64	
12	60	100	0	-	-	0	0	0	33/36	

ADAMS CE HARROW - TREND STUDY NO. 14R-7-12

Vegetation Type: Black Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Shallow Loam \(Black Sagebrush\), R035XY312UT](#)

Land Ownership: Private

Elevation: 6,772 ft (2,064 m)

Aspect: Northwest

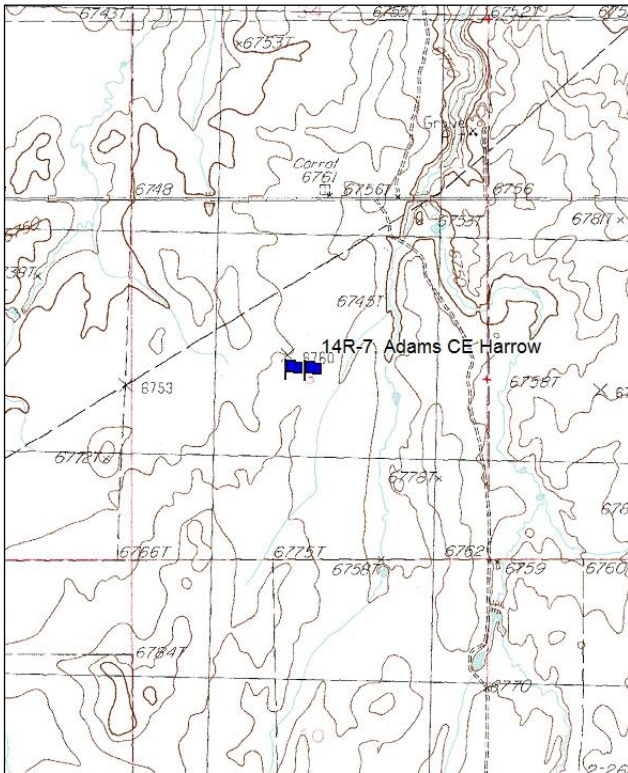
Slope: 2-5%

Transect bearing: 80° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

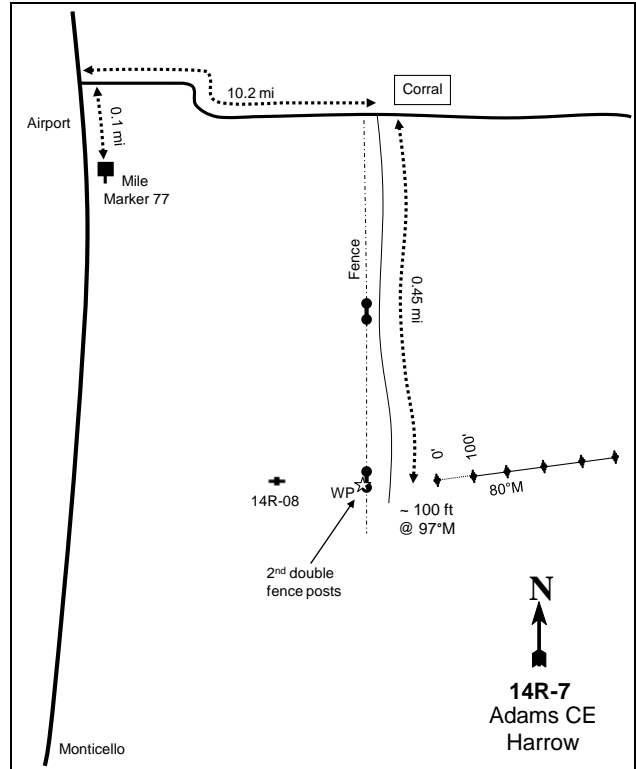
Directions: On US 191 travel north of Monticello for about 5.5 miles to mile marker 77. Continue 0.1 miles to a road that comes in from the right. Turn here and follow this road 10.2 miles to another road that comes in from the right. Turn here and travel south 0.45 miles to the second pair of wood fence posts on the right side of the road. The 0-foot stake is about 100 feet from these fence posts at 97°M.

Map Name: Eastland NW



Township: 33S Range: 25E Section: 3

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 661341 E 4200538 N

ADAMS CE HARROW - TREND STUDY NO. 14R-7

Site Information

Site Description: The study is located approximately ten and half miles northeast of Monticello within a black sagebrush (*Artemisia nova*) flat. The study was established in 2004 on private land to monitor a Dixie pipe harrow project. Approximately 320 acres of black sagebrush (*Artemisia nova*) dominated land was harrowed in alternating strips in fall 2001. A two-direction treatment, a one-direction treatment, and untreated sagebrush were alternated in strips running east to west. Seed was applied with a broadcast seeder attached to the tractor pulling the harrow. The monitoring study was established within the harrow treatment, and appeared to be the within the two-direction harrow treatment, in summer 2004. A control study, Adams CE Control (14R-08), was established about 250 feet west of this study, outside of the treatment area. Cattle pellet groups have been sampled in low abundance since the outset of the study. Sage-grouse pellet groups were sampled at 26 pellet groups/acre in 2004, 104 pellet groups/acre in 2007, and no pellet groups were sampled on the site in 2012 (Table - Pellet Group Data).

Browse: The key browse species is black sagebrush and is the dominant browse species on the site, which has provided the majority of the browse cover on the site over the sample years. Other common preferred browse species sampled on the site include winterfat (*Ceratoides lanata*) and dwarf rabbitbrush (*Chrysothamnus depressus*). The black sagebrush is a moderate to heavily use population with low decadence and good vigor within the population, though decadence and plants displaying poor vigor were high at the outset of the study. The recruitment of young black sagebrush plants to the population has been poor over the sampled years. The winterfat and dwarf rabbitbrush are fairly abundant population with light to moderate use, and low decadence and good vigor within the population (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the study site. The dominant grass species on the site is crested wheatgrass (*Agropyron cristatum*), which has provided the majority of grass cover on the site. Seeded grass species sampled on the site crested wheatgrass, pubescent wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), and bluebunch wheatgrass (*A. spicatum*) (Table - Seed Mix). The invasive annual grass species cheatgrass was sampled in 2007 in low abundance. Forbs are not overly abundant or diverse on the site. The dominant forb species on the site is desert phlox (*Phlox austromontana*) which has provided the majority of the forb cover on the site (Table - Herbaceous Trends). Seeded forb species sampled on the site include blue flax (*Linum perenne*) and small burnet (*Sanguisorba minor*) (Table - Seed Mix)

Soil: The soil is classified as part of the Montvale component, which occurs on plateaus and uplands. The parent material consists of eolian deposits derived from sandstone over colluviums and/or residuum weathered from sandstone. The soils within this classification are characterized as shallow, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay with a neutral soil reaction (pH 7.1). Phosphorus may have limited availability for plant growth and development at 2.6 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high, though there is also a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2007, and was classified as slight in 2012 due to pedestalling of plants, surface litter, flow pattern, and soil movement.

Trend Assessments

Browse:

- **2004 to 2007 - stable (0):** The density of black sagebrush remained similar at 4,980 plants/acre and canopy cover increased slightly from 6% to 7%. The health of the black sagebrush population improved with decadence decreasing from 59% to 41% and plants displaying poor vigor decreasing from 39% to 11%. Recruitment of young sagebrush plants remained poor at 8% of the population. The density of winterfat increased substantially from 3,420 plants/acre to 9,980 plants/acre, though cover remained similar at 4%. Dwarf rabbitbrush decreased slightly in density from 4,260 plants/acre

to 3,820 plants/acre, and cover remained similar at 3%.

- **2007 to 2012 - down (-2):** The density of black sagebrush decreased 15% to 4,240 plants/acre and canopy cover decreased slightly to 6%. Recruitment of young sagebrush plants remained poor at 5% of the population. The density of winterfat decreased 31% to 6,900 plants/acre, and cover decreased slightly to 3%. Dwarf rabbitbrush decreased 32% in density to 2,580 plants/acre, and cover decreased to 1%.

Grass:

- **2004 to 2007 - up (+2):** The sum of nested frequency of perennial grasses increased two fold and cover increased from 7% to 21%. Crested wheatgrass and bottlebrush squirreltail (*Sitanion hystrix*) increased significantly in nested frequency and cover increased from 4% to 11% and from 1% to 4%, respectively.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 11%, and cover decreased 21% to 19%. Crested wheatgrass increased significantly in nested frequency and cover increased to 16%. Bottlebrush squirreltail decreased significantly in nested frequency and cover decreased to 1%.

Forb:

- **2004 to 2007 - up (+2):** The sum of nested frequency of perennial forbs increased 26%, and cover increased from 2% to 5%. Desert phlox remained similar in nested frequency and cover increased from 1% to 3%.
- **2007 to 2012 - down (-2):** The sum of nested frequency decreased 29%, and cover decreased to 2%. Diversity of forbs decreased on the site.

SEED MIX--

Management unit 14R, Study no: 7

Project Name: Adams CE Harrow	
WRI Database #: PDB	
Application: Broadcast	
Seed type	lbs/acre
G Bluebunch Wheatgrass	2.00
G Crested Wheatgrass	1.00
G Pubescent Wheatgrass	1.00
G Slender Wheatgrass	1.00
G Thickspike Wheatgrass	2.00
G Western Wheatgrass	1.00
F Alfalfa	2.00
F Blue Flax	0.30
F Small Burnet	2.00
Total Pounds:	12.30

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 7

T y p e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	_a 76	_b 195	_c 246	3.99	11.25	15.46
G	Agropyron intermedium	_a 4	_b 30	_a 11	.03	.31	.16

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron smithii	_e 102	_b 111	_a 64	1.53	2.32	1.15
G	Agropyron spicatum	-	-	5	-	-	.18
G	Bouteloua gracilis	_a 1	_a 1	_b 20	.03	.03	.29
G	Bromus inermis	-	10	10	-	.46	.04
G	Bromus tectorum (a)	_a -	_b 13	_a -	-	.02	-
G	Elymus junceus	_a 4	_b 14	_{ab} 7	.09	.70	.07
G	Hilaria jamesii	10	14	12	.22	.48	.24
G	Koeleria cristata	-	4	4	-	.38	.00
G	Oryzopsis hymenoides	_a 15	_{ab} 24	_b 31	.25	1.06	.41
G	Poa secunda	-	-	9	-	-	.33
G	Sitanion hystrix	_a 50	_b 112	_a 41	1.01	4.15	.85
Total for Annual Grasses		0	13	0	0	0.02	0
Total for Perennial Grasses		262	515	460	7.16	21.16	19.22
Total for Grasses		262	528	460	7.16	21.18	19.22
F	Antennaria rosea	-	1	-	-	.00	-
F	Chenopodium leptophyllum(a)	_b 60	_a -	_a -	.15	-	-
F	Cordylanthus sp. (a)	6	-	-	.04	-	-
F	Cryptantha sp.	6	3	12	.04	.04	.03
F	Descurainia pinnata (a)	_a 4	_b 109	_a 2	.02	.85	.01
F	Draba sp. (a)	-	4	-	-	.01	-
F	Erigeron pumilus	2	4	2	.03	.15	.00
F	Lappula occidentalis (a)	_b 5	_c 45	_a -	.02	.58	-
F	Lesquerella sp.	_a 8	_b 26	_a 9	.16	.30	.04
F	Linum perenne	-	1	-	-	.03	-
F	Medicago sativa	12	5	-	.03	.02	-
F	Phlox austromontana	132	137	123	1.10	2.67	1.87
F	Ranunculus testiculatus (a)	-	3	-	-	.00	-
F	Salsola iberica (a)	_b 11	_c 30	_a -	.05	.07	-
F	Sanguisorba minor	8	-	-	.01	-	-
F	Sphaeralcea grossulariifolia	_a 71	_b 123	_a 68	.93	1.73	.16
Total for Annual Forbs		86	191	2	0.28	1.52	0.01
Total for Perennial Forbs		239	300	214	2.31	4.96	2.12
Total for Forbs		325	491	216	2.59	6.49	2.13

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia frigida	0	0	1	-	-	-
B	Artemisia nova	73	81	73	6.92	7.53	6.16
B	Ceratoides lanata	45	65	64	2.46	3.39	3.35
B	Chrysothamnus depressus	55	58	53	1.32	2.12	1.34
B	Eriogonum microthecum	15	19	16	.02	.05	.10
B	Gutierrezia sarothrae	9	8	7	.18	.03	.00
B	Tetradymia canescens	1	1	4	-	-	-
Total for Browse		198	232	218	10.92	13.14	10.97

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 7

Species	Percent Cover		
	'04	'07	'12
Artemisia nova	5.98	6.81	6.00
Ceratoides lanata	3.13	3.46	2.45
Chrysothamnus depressus	3.76	3.18	1.03
Eriogonum microthecum	.05	.03	.18
Gutierrezia sarothrae	.08	.13	.10
Tetradymia canescens	.18	.28	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 7

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia nova	1.1	0.9	0.2
Ceratoides lanata	3.9	2.3	0.2

BASIC COVER--

Management unit 14R, Study no: 7

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	20.27	35.60	35.40
Rock	.39	.14	.17
Pavement	1.95	3.16	4.23
Litter	19.76	22.18	23.93
Cryptogams	.04	.16	0
Bare Ground	67.80	50.92	48.92

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 7, Study Name: Adams CE Harrow

Effective rooting depth (in)	pH	clay			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
14.3	7.1	31.3	28.2	40.5	1.8	2.6	182.4	0.5

PELLET GROUP DATA--

Management unit 14R, Study no: 7

Type	Quadrat Frequency		
	'04	'07	'12
Rabbit	2	35	-
Grouse	-	1	-
Cattle	-	-	2

Days use per acre (ha)		
'04	'07	'12
-	-	-
26 groups/acre	104 groups/acre	-
4 (11)	15 (36)	12 (30)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 7

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia frigida</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	4/8
12	20	0	100	-	-	0	100	0	-/-
<i>Artemisia nova</i>									
04	5000	0	41	59	140	15	18	39	9/14
07	4980	8	51	41	500	35	0	11	9/16
12	4240	5	85	10	-	10	33	12	9/16
<i>Ceratoides lanata</i>									
04	3420	4	96	0	2900	13	2	0	8/11
07	9980	39	57	5	2500	6	8	1	7/10
12	6900	7	90	3	80	27	14	1	5/8
<i>Chrysothamnus depressus</i>									
04	4260	0	87	13	120	13	0	7	8/14
07	3820	9	79	12	200	14	1	5	5/9
12	2580	5	91	5	40	12	.77	4	4/12
<i>Chrysothamnus nauseosus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	17/25
<i>Eriogonum microthecum</i>									
04	480	0	100	0	20	4	0	0	3/5
07	600	13	70	17	80	3	23	10	3/4
12	660	0	97	3	20	0	0	3	4/7
<i>Gutierrezia sarothrae</i>									
04	220	9	91	-	40	0	0	0	6/9
07	160	25	75	-	-	0	0	0	5/7
12	160	13	88	-	-	0	0	0	5/7
<i>Tetradymia canescens</i>									
04	20	0	100	-	-	0	0	0	-/-
07	60	0	100	-	-	100	0	0	9/15
12	100	0	100	-	-	20	0	0	5/10

ADAMS CE CONTROL - TREND STUDY NO. 14R-8-12

Vegetation Type: Black Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Shallow Loam \(Black Sagebrush\), R035XY312UT](#)

Land Ownership: Private

Elevation: 6,772 ft (2,064 m)

Aspect: Northwest

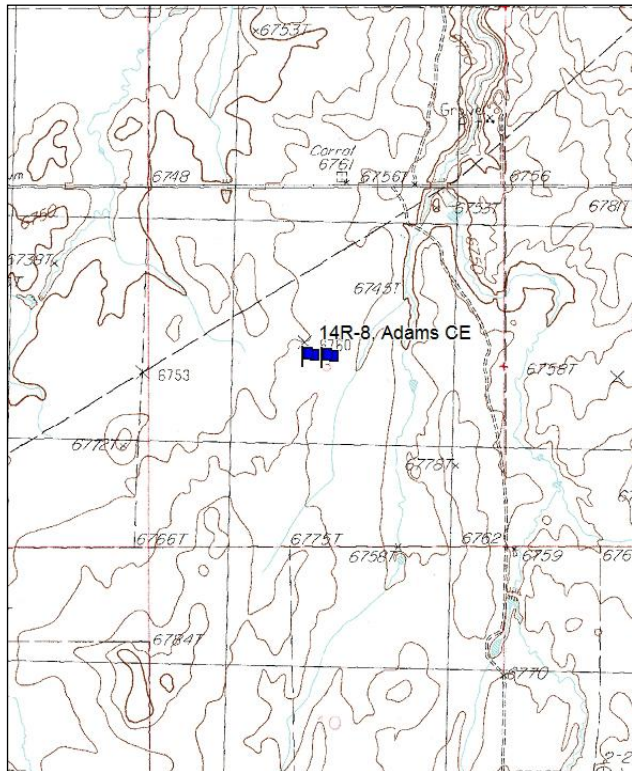
Slope: 2-5%

Transect bearing: 255° magnetic

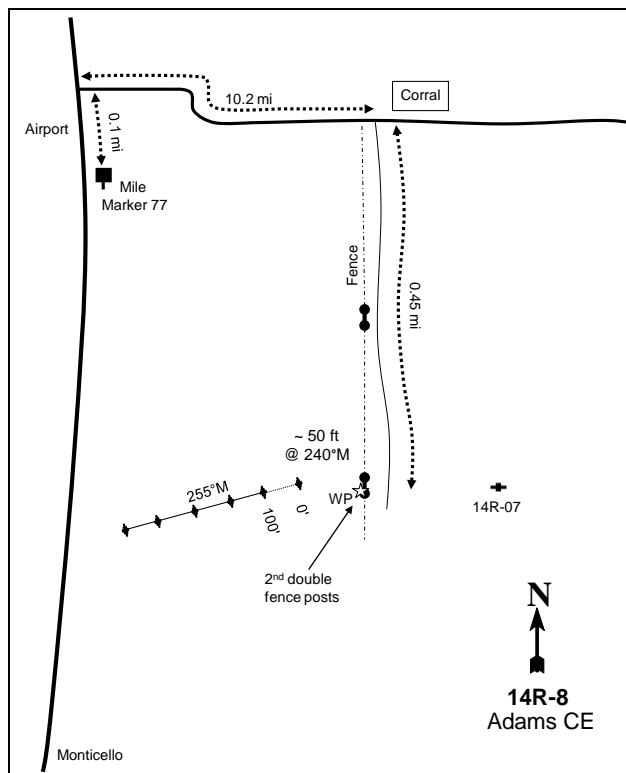
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: On US 191 travel north of Monticello for about 5.5 miles to mile marker 77. Continue 0.1 miles to a road that comes in from the right. Turn here and follow this road 10.2 miles to another road that comes in from the right. Turn here and travel south 0.45 miles to the second pair of wood fence posts on the right side of the road. The 0-foot stake is 50 feet from the fence posts at 240°M.

Map Name: Eastland NW



Diagrammatic Sketch:



Township: 33S Range: 25E Section: 3

GPS: NAD 83, UTM 12S 661258 E 4200540 N

ADAMS CE CONTROL- TREND STUDY NO. 14R-8

Site Information

Site Description: The study is located approximately ten and half miles northeast of Monticello within a black sagebrush (*Artemisia nova*) flat. The study was established in 2004 on private land as a control study for a Dixie pipe harrow project. Approximately 320 acres of black sagebrush (*Artemisia nova*) dominated land was harrowed in alternating strips in fall 2001. A two-direction treatment, a one-direction treatment, and untreated sagebrush were alternated in strips running east to west. Seed was applied with a broadcast seeder attached to the tractor pulling the harrow. The monitoring study was established west of the treatment area in untreated sagebrush flat in 2004. Adams CE Harrow (14R-07), was established about 250 feet east of this study, within the harrow treatment, and appeared to be the within the two-direction harrow treatment. Cattle pellet groups have been sampled in low abundance since the outset of the study. Sage-grouse pellet groups were sampled at 9 pellet groups/acre in 2004, 470 pellet groups/acre in 2007 and 38 pellet groups/acre in 2012 (Table - Pellet Group Data).

Browse: The key browse species is black sagebrush and is the dominant browse species on the site, which has provided the majority of the browse cover on the site over the sample years. The black sagebrush is a moderate to heavily use population with low decadence and good vigor within the population, though decadence and plants displaying poor vigor were high in 2007. The recruitment of young black sagebrush plants to the population has been poor over the sampled years (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the study site. The dominant grass species on the site is crested wheatgrass (*Agropyron cristatum*), which has provided the majority of grass cover on the site. Seeded grass species sampled on the site crested wheatgrass, pubescent wheatgrass (*A. intermedium*), and western wheatgrass (*A. smithii*) (Table - Seed Mix). The invasive annual grass species cheatgrass was sampled in 2007 in low abundance. Forbs are not overly abundant or diverse on the site. The dominant forb species on the site is desert phlox (*Phlox austromontana*) which has provided the majority of the forb cover on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Montvale component, which occurs on plateaus and uplands. The parent material consists of eolian deposits derived from sandstone over colluviums and/or residuum weathered from sandstone. The soils within this classification are characterized as shallow, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is high, though there is also a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2007, and was classified as moderate in 2012 due to pedestalling of plants, surface litter, and soil movement.

Trend Assessments

Browse:

- **2004 to 2007 - stable (0):** The density of black sagebrush remained similar at 6,980 plants/acre and canopy cover decreased from 23% to 20%. Recruitment of young sagebrush plants remained poor at 4% of the population.
- **2007 to 2012 - stable (0):** The density of black sagebrush decreased 14% to 6,020 plants/acre and canopy cover increased slightly to 21%. Recruitment of young sagebrush plants remained poor at 5% of the population.

Grass:

- **2004 to 2007 - up (+2):** The sum of nested frequency of perennial grasses increased 38% and cover increased from 8% to 15%. Crested wheatgrass increased significantly in nested frequency and cover increased from 5% to 10%.

- **2007 to 2012 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 15%, and cover decreased to 14%. Crested wheatgrass remained similar in nested frequency and cover increased to 11%.

Forb:

- **2004 to 2007 - stable (0):** The sum of nested frequency of perennial forbs remained similar, and cover remained similar at 1%.
- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial forbs remained similar, and cover remained similar at 2%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 8

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	_a 160	_b 235	_b 244	5.00	9.79	11.20
G	Agropyron intermedium	-	7	-	-	.66	-
G	Agropyron smithii	_b 127	_b 118	_a 53	2.17	2.46	1.45
G	Bouteloua gracilis	-	4	10	-	.18	.21
G	Bromus tectorum (a)	-	3	-	-	.00	-
G	Elymus junceus	-	-	10	-	-	.09
G	Hilaria jamesii	1	-	9	.03	-	.09
G	Koeleria cristata	_a 2	_b 26	_{ab} 7	.03	.70	.02
G	Oryzopsis hymenoides	_a 2	_b 9	_b 11	.06	.21	.53
G	Sitanion hystrix	9	16	8	.26	.46	.01
Total for Annual Grasses		0	3	0	0	0.00	0
Total for Perennial Grasses		301	415	352	7.56	14.48	13.63
Total for Grasses		301	418	352	7.56	14.48	13.63
F	Calochortus nuttallii	3	-	-	.00	-	-
F	Chenopodium leptophyllum(a)	10	-	-	.02	-	-
F	Descurainia pinnata (a)	_a 4	_b 31	_a -	.01	.22	-
F	Draba sp. (a)	_a -	_b 15	_a -	-	.03	-
F	Erigeron eatonii	3	-	-	.01	-	-
F	Erigeron pumilus	2	10	3	.00	.19	.03
F	Erigeron sp.	3	-	-	.03	-	-
F	Holosteum umbellatum (a)	-	11	-	-	.07	-
F	Lappula occidentalis (a)	_a 7	_b 19	_a -	.01	.18	-
F	Lupinus sp.	3	-	-	.00	-	-
F	Penstemon sp.	-	-	3	-	.00	.03
F	Phlox austromontana	61	57	64	.56	.95	1.52
F	Ranunculus testiculatus (a)	-	5	-	-	.01	-
F	Sphaeralcea grossulariifolia	29	31	25	.16	.13	.22
F	Tragopogon dubius (a)	1	-	-	.00	-	-
F	Trifolium sp.	20	23	17	.07	.08	.07
F	Unknown forb-perennial	3	-	-	.03	-	-
Total for Annual Forbs		22	81	0	0.05	0.52	0
Total for Perennial Forbs		127	121	112	0.89	1.38	1.88

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
	Total for Forbs	149	202	112	0.94	1.90	1.88

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 8

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia nova	97	95	96	17.06	16.34	15.43
B	Ceratoides lanata	8	6	6	.09	.06	.15
B	Chrysothamnus depressus	5	4	6	.00	-	.00
B	Chrysothamnus viscidiflorus viscidiflorus	4	7	6	-	.15	.15
B	Eriogonum microthecum	7	6	6	.09	.15	.01
B	Gutierrezia sarothrae	8	0	0	.04	-	-
	Total for Browse	129	118	120	17.29	16.71	15.75

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 8

Species	Percent Cover		
	'04	'07	'12
Artemisia nova	22.84	19.60	21.41
Ceratoides lanata	.28	.06	.38
Chrysothamnus depressus	.18	-	-
Chrysothamnus viscidiflorus viscidiflorus	-	.16	.38
Eriogonum microthecum	.11	-	-
Gutierrezia sarothrae	.18	-	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 8

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia nova	1.0	0.8	0.2
Ceratoides lanata	2.5	2.5	1.2

BASIC COVER--

Management unit 14R, Study no: 8

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	24.42	29.58	32.32
Rock	.07	.01	.03
Pavement	.90	.32	.61
Litter	17.09	20.28	24.87
Cryptogams	.62	.68	.34
Bare Ground	66.58	60.93	55.03

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 8, Study Name: Adams CE Control

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
14.0	7.2	33.3	31.4	35.3	1.5	12.4	160.0	0.6

PELLET GROUP DATA--

Management unit 14R, Study no: 8

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	1	17	-	-	-	-
Grouse	1	7	-	9 pellets/acre	470 pellets/acre	38 pellets/acre
Cattle	5	6	3	8 (20)	15 (36)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 8

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Artemisia nova										
04	7700	3	72	25	80	4	0	10	12/21	
07	6980	4	56	40	80	13	0	17	13/22	
12	6020	4	83	13	180	11	16	12	12/23	
Ceratoides lanata										
04	220	0	82	18	-	9	0	9	7/10	
07	160	0	100	0	800	0	0	0	7/9	
12	160	0	100	0	20	13	0	25	9/12	
Chrysothamnus depressus										
04	140	0	86	14	-	0	0	14	4/7	
07	80	0	75	25	-	0	0	25	5/15	
12	120	0	100	0	-	0	0	0	6/12	
Chrysothamnus viscidiflorus viscidiflorus										
04	80	0	100	0	-	0	0	0	10/16	
07	160	0	88	13	20	0	0	25	7/12	
12	140	0	100	0	-	29	0	0	8/14	
Eriogonum microthecum										
04	220	0	100	0	-	36	0	0	4/5	
07	220	0	82	18	-	0	0	0	6/10	
12	120	0	83	17	-	0	0	17	5/4	
Gutierrezia sarothrae										
04	220	0	100	-	-	0	0	0	5/11	
07	0	0	0	-	-	0	0	0	4/3	
12	0	0	0	-	-	0	0	0	-/-	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Tetradymia canescens										
04	0	0	0	-	-	0	0	0	11/22	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	

SITLA DIXIE 2 - TREND STUDY NO. 14R-15-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Loam \(Big Sagebrush\), R036XY306UT](#)

Land Ownership: SITLA

Elevation: 6,800 ft (2,073 m)

Aspect: Southwest

Slope: 4%

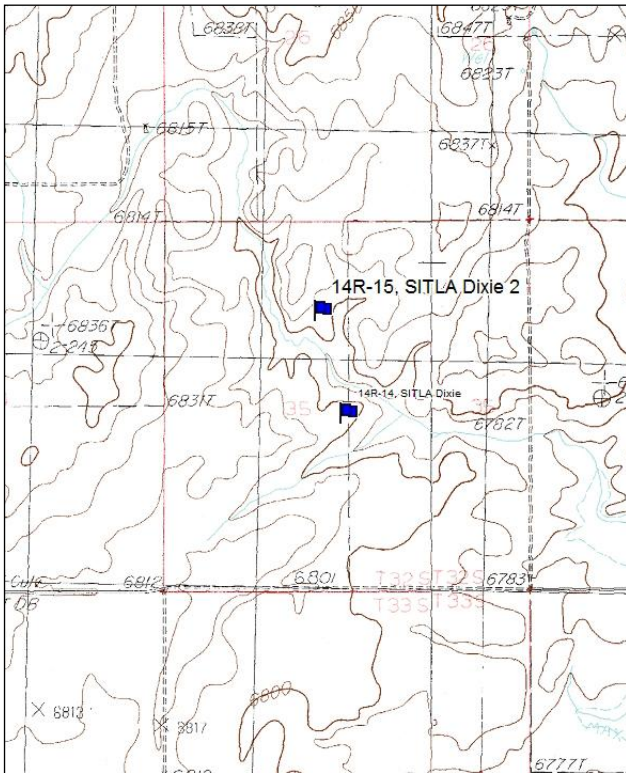
Transect bearing: 271° magnetic, (line 4 doglegs at 358° magnetic)

Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Note: No rebar

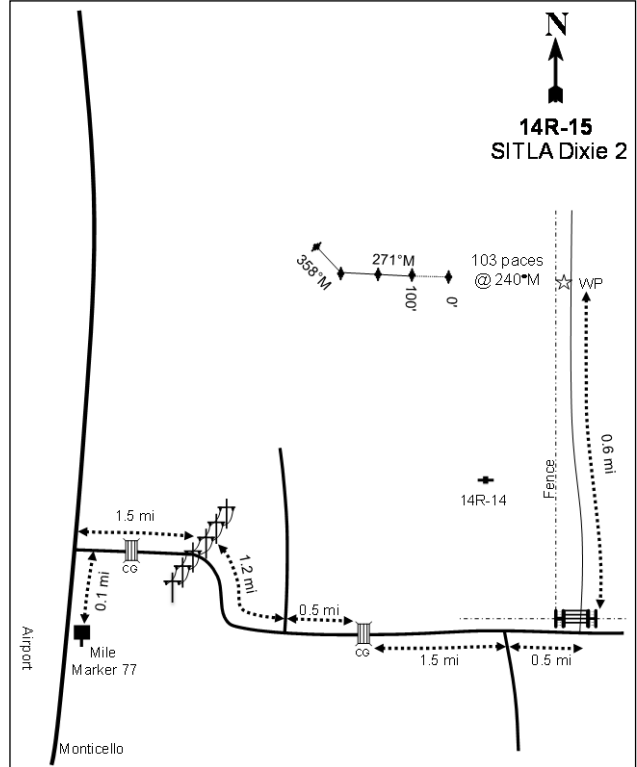
Directions: From mile marker 77 on highway 191 north of Monticello, drive 0.2 miles north and turn right onto a road heading east (Hickman Flat Road). From there drive for 1.5 miles to some power lines and a southward bend in the road. Go 1.2 miles to a junction and stay straight for another 0.5 miles to a cattle guard. From the cattle guard drive 1.5 miles to another junction and continue straight for 0.5 miles. Turn left onto a two-track road and a gate. Drive 0.6 miles to a witness post on the left. Walk 103 paces from witness post at 257 degrees magnetic to the 0-foot stake marked with browse tag #163.

Map Name: Monticello North



Township: 32S Range: 24E Section: 35

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 653183 E 4202361 N

SITLA DIXIE 2 - TREND STUDY NO. 14R-15
[Project #334](#)

Site Information

Site Information: This study is located within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community approximately seven miles northeast of Monticello. The study was established prior to treatment in 2006 on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) to monitor the effects of a one-way Dixie harrow treatment to rejuvenate sagebrush stands currently occupied by sage-grouse. A seed mix of grass, forb, and browse species was broadcast seeded during the harrow treatment (Table - Seed Mix). The project was completed in the fall of 2006. The objectives of the project were to improve brood and rearing habitat for the Gunnison sage-grouse by establishing young sagebrush and a diverse herbaceous understory (WRI Database 2013). Part of the transect was not treated so the transect was modified to fit within the treatment area. Cattle pellet groups were sampled in low abundance in 2006 and 2012. Deer pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: Wyoming big sagebrush is the primary preferred browse species, and has accounted for most of the browse cover in all sample years (Table - Canopy Cover). The Wyoming big sagebrush is a lightly used mature population with low decadence and good vigor following the treatment. The recruitment of young sagebrush plants was poor since the outset of the study. Other browse species sampled on the site include fringe sagebrush (*Artemisia frigida*), pricklypear cactus (*Opuntia* sp.), rubber rabbitbrush (*Chrysothamnus nauseosus* spp. *hololeucus*) and broom snakeweed (*Gutierrezia sarothrae*) though occurring in low abundance (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory improved following the treatment, but is still not very abundant. Cheatgrass (*Bromus tectorum*) was the dominant grass species on the site prior to the treatment but has since been rare on the site. Seeded perennial grass species sampled following the treatment, included Indian ricegrass (*Oryzopsis hymenoides*) and bluebunch wheatgrass (*Agropyron spicatum*). Forbs are not overly abundant or diverse on the site. The dominant perennial forb species is scarlet globemallow (*Sphaeralcea coccinea*), which has provided the majority of the forb cover on the site since the outset of the study (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Montvale component, which occurs on plateaus and uplands. The parent material consists of eolian deposits derived from sandstone over colluviums and/or residuum weathered from sandstone. The soils within this classification are characterized as shallow, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is high with moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as moderate in 2006 due to surface rock movement, rills, soil movement, pedestalling, flow patterns and surface litter movement. In 2012, the soil erosion condition was classified as slight due to surface litter movement, pedestalling, and flow patterns.

Pre vs. Six Years Post Treatment, 2006 vs. 2012

Browse: The density of Wyoming big sagebrush decreased 10% from 5,900 plants/acre to 5,300 plants/acre, but canopy decreased from 28% to 20%. The health of the sagebrush population improved with decadence decreasing from 44% to 7% and plants displaying poor vigor decreasing from 23% to 9%. The recruitment of young sagebrush plants to the population remained poor.

Grass: Perennial grass species remained rare on the study site. The sum of nested frequency of perennial grasses increased substantially and cover increased to 2%. Cheatgrass decreased significantly in nested frequency and cover remained minimal on the site.

Forb: The sum of nested frequency increased 31% and cover remained similar at 2%. Scarlet globemallow increased significantly in nested frequency, though cover remained similar at 1%.

SEED MIX--

Management unit 14R, Study no: 15

Project Name: Gunnison Sage Grouse Sagebrush Treatments			
WRI Database #: 334			
Application: Broadcast		Acres: 150	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	300	2.00
G	Indian Ricegrass 'Rimrock'	300	2.00
G	Sand Dropseed	10	0.07
G	Thickspike Wheatgrass 'Bannock'	300	2.00
G	Pubescent Wheatgrass	150	1.00
G	Western Wheatgrass 'Arriba'	150	1.00
F	Alfalfa 'Ladak'	150	1.00
F	Cicer Milkvetch 'Lutana'	150	1.00
F	Sainfoin 'Eski'	450	3.00
F	Small Burnet 'Delar'	300	2.00
B	Sagebrush, Wyoming	150	1.00
Total Pounds:		2410	16.07
PLS Pounds:			14.04

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 15

Type	Species	Nested Frequency		Average Cover %	
		'06	'12	'06	'12
G	Agropyron cristatum	13	31	.06	.47
G	Agropyron spicatum	a-	b16	-	.39
G	Bouteloua gracilis	1	-	.00	-
G	Bromus tectorum (a)	b28	a15	.48	.03
G	Oryzopsis hymenoides	-	1	-	.03
G	Sitanion hystrix	a-	b13	-	.57
G	Stipa comata	-	4	-	.00
Total for Annual Grasses		28	15	0.48	0.03
Total for Perennial Grasses		14	65	0.07	1.47
Total for Grasses		42	80	0.55	1.51
F	Astragalus convallarius	1	-	.00	-
F	Astragalus sp.	2	2	.03	.15
F	Cryptantha sp.	7	4	.04	.01
F	Erodium cicutarium (a)	1	-	.00	-
F	Lappula occidentalis (a)	7	3	.02	.00
F	Phlox austromontana	7	-	.02	-
F	Phlox longifolia	6	7	.01	.02
F	Senecio multilobatus	b20	a4	.07	.01

Type	Species	Nested Frequency		Average Cover %	
		'06	'12	'06	'12
F	<i>Sphaeralcea coccinea</i>	_a 122	_b 187	1.23	1.24
F	<i>Trifolium</i> sp.	_a 1	_b 14	.00	.04
Total for Annual Forbs		8	3	0.02	0.00
Total for Perennial Forbs		166	218	1.42	1.47
Total for Forbs		174	221	1.45	1.48

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 15

Type	Species	Strip Frequency		Average Cover %	
		'06	'12	'06	'12
B	<i>Artemisia frigida</i>	8	17	.44	.53
B	<i>Artemisia tridentata wyomingensis</i>	87	88	21.46	19.56
B	<i>Chrysothamnus nauseosus hololeucus</i>	8	8	.53	.03
B	<i>Gutierrezia sarothrae</i>	40	22	1.11	.36
B	<i>Opuntia</i> sp.	13	1	1.01	-
Total for Browse		156	136	24.57	20.49

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 15

Species	Percent Cover	
	'06	'12
<i>Artemisia frigida</i>	.15	.66
<i>Artemisia tridentata wyomingensis</i>	28.18	19.90
<i>Chrysothamnus nauseosus hololeucus</i>	.38	.53
<i>Gutierrezia sarothrae</i>	1.31	.30
<i>Opuntia</i> sp.	.18	.05

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 15

Species	Average leader growth (in)	
	'06	'12
<i>Artemisia tridentata wyomingensis</i>	0.8	0.7

BASIC COVER--

Management unit 14R, Study no: 15

Cover Type	Average Cover %	
	'06	'12
Vegetation	24.97	23.45
Rock	6.36	4.26
Pavement	3.61	3.08
Litter	33.52	22.45
Cryptogams	.87	.18
Bare Ground	47.93	57.41

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 15, Study Name: SITLA Roller Chopper

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
9.6	7.2	45.2	24.0	30.8	1.3	14.9	134.4	0.5

PELLET GROUP DATA--

Management unit 14R, Study no: 15

Type	Quadrat Frequency		Days use per acre (ha)	
	'06	'12	'06	'12
Rabbit	75	28	-	-
Deer	-	-	4 (10)	-
Cattle	-	-	1 (2)	2 (4)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 15

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia frigida</i>									
06	540	48	52	-	380	0	11	0	8/12
12	780	18	82	-	-	0	0	0	3/8
<i>Artemisia tridentata wyomingensis</i>									
06	5900	3	53	44	14000	0	0	23	24/32
12	5300	8	85	7	-	32	.75	9	19/28
<i>Chrysothamnus nauseosus hololeucus</i>									
06	180	0	33	67	-	22	11	44	16/18
12	160	0	88	13	-	13	0	13	15/19
<i>Gutierrezia sarothrae</i>									
06	2820	20	80	-	2800	0	0	0	6/9
12	640	6	94	-	-	0	0	0	5/6
<i>Opuntia sp.</i>									
06	480	25	75	-	-	0	0	0	6/16
12	20	0	100	-	-	0	0	0	5/13

STATELINE SOUTH - TREND STUDY NO. 14R-17-12

Vegetation Type: Basin Big Sagebrush

Range Type: Crucial Deer Winter, Substantial Elk Year-Long

NRCS Ecological Site Description: [Upland Shallow Loam \(Black Sagebrush\), R035XY312UT](#) and [Upland Loam \(Basin Big Sagebrush\), R035XY306UT](#)

Land Ownership: BLM

Elevation: 6,667 ft (6,096 m)

Aspect: East

Slope: 3%

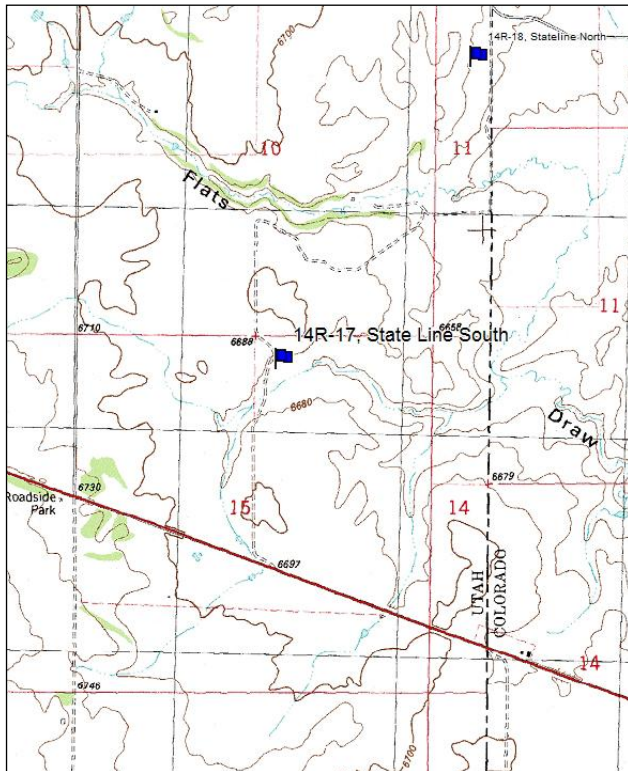
Transect bearing: Line 1-3 at 80° magnetic, Line 3-5 at 37° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Note: No Rebar

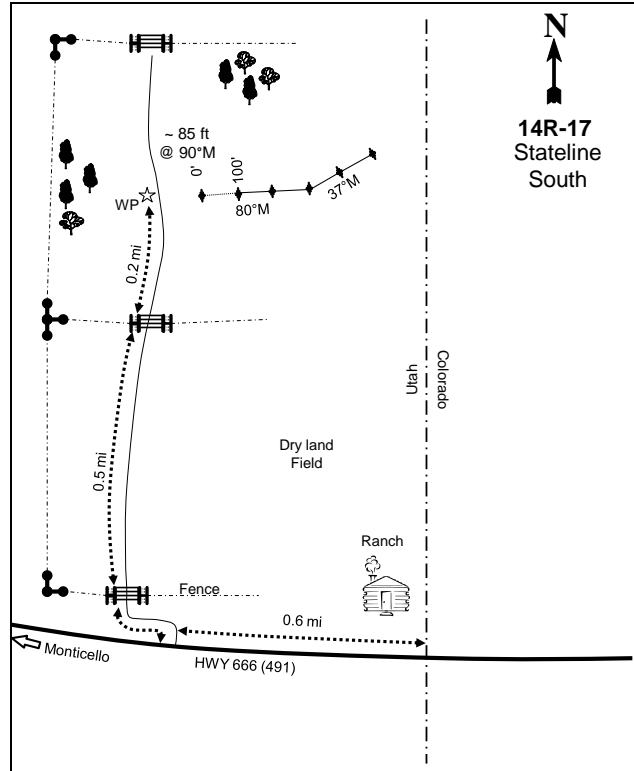
Directions: On highway 666 (491) drive 0.6 miles west from the Utah/Colorado border to a turnoff on the right (north). Travel north on this road for 0.7 miles to a witness post on the right. Walk 85 feet at 90°M to the 0-foot stake marked with browse tag #198.

Map Name: Northdale



Township: 34S Range: 26E Section: 15

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 671360 E 4188477 N

STATELINE SOUTH - TREND STUDY NO. 14R-17

[Project #334](#)

Site Information

Site Information: The study is located sixteen miles east of Monticello north of Highway 666 (491) near the Colorado state line. The study is located within a black sagebrush (*Artemisia nova*) and basin big sagebrush (*A. tridentata* ssp. *tridentata*) browse community. The study was established prior to treatment in 2006 on land administrated by the Bureau of Land Management (BLM) to monitor the effects of a one-way Dixie harrow treatment to rejuvenate sagebrush stands currently occupied by sage-grouse. The study occurs on the BLM Stateline allotment. A seed mix of grass, forb, and browse species was broadcast seeded during the harrow treatment (Table - Seed Mix). The project was completed in the fall of 2006. The project was completed in the fall of 2006. The objectives of the project were to improve brood and rearing habitat for the Gunnison sage-grouse by establishing young sagebrush and a diverse herbaceous understory (WRI Database 2013). Deer shed antlers were found on the site in 2006 and 2012. Deer and cattle pellet groups were sampled in low abundance on the site over the sample years (Table - Pellet Group Data).

Browse: The dominant preferred browse species sampled on the site include black sagebrush and basin big sagebrush, which have provided the majority of the browse cover on the site over the sampled years. The black sagebrush population is moderately used population with low decadence and good vigor within the population, though prior to the treatment decadence and plants displaying poor vigor was high within the population. The recruitment of young sagebrush plants to the population has been good following the treatment. Other common browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*) and stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*) (Table - Browse characteristics). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The dominant perennial grass species on the site are blue grama (*Bouteloua gracilis*) and mutton bluegrass (*Poa fendleriana*). The invasive annual grass species cheatgrass has been sampled in moderate abundance on the site over the sample years. Forbs are not overly abundant, but are fairly diverse on the site. No single forb species was dominant in either sample year (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Montvale component, which occurs on plateaus and uplands. The parent material consists of eolian deposits derived from sandstone over colluviums and/or residuum weathered from sandstone. The soils within this classification are characterized as shallow, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is high with moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as critical in 2006 due to surface rock movement, rills, soil movement, pedestalling, flow patterns, active gully formation, and surface litter movement. In 2012, the soil erosion condition was classified as slight due to flow patterns, pedestalling, and active gully formation.

Pre vs. Six Years Post Treatment, 2006 vs. 2012

Browse: The density of black sagebrush decreased 50% from 5,540 plants/acre to 2,760 plants/acre, and canopy decreased from 17% to 11%. The health of the black sagebrush population improved with decadence decreasing from 30% to 7% and plants displaying poor vigor decreasing from 17% to 2%. The recruitment of young black sagebrush plants to the population was good at 11%. The density of basin big decreased from 1,200 plants/acre to 820 plants/acre, and canopy cover decreased from 6% to 3%.

Grass: The sum of nested frequency of perennial grasses increased 17% and cover increased from 3% to 6%. Cheatgrass increased significantly in nested frequency, though cover remained similar at 2%.

Forb: The sum of nested frequency increased three fold and cover increased from less than 1% to 2%. No single forb species provided more than 1% cover in either sample years.

SEED MIX--

Management unit 14R, Study no: 17

Project Name: Gunnison Sage Grouse Sagebrush Treatments			
WRI Database #: 334			
Application: Broadcast		Acres: 150	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	300	2.00
G	Indian Ricegrass 'Rimrock'	300	2.00
G	Sand Dropseed	10	0.07
G	Thickspike Wheatgrass 'Bannock'	300	2.00
G	Pubescent Wheatgrass	150	1.00
G	Western Wheatgrass 'Arriba'	150	1.00
F	Alfalfa 'Ladak'	150	1.00
F	Cicer Milkvetch 'Lutana'	150	1.00
F	Sainfoin 'Eski'	450	3.00
F	Small Burnet 'Delar'	300	2.00
B	Sagebrush, Wyoming	150	1.00
Total Pounds:		2410	16.07
PLS Pounds:			14.04

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 17

T y P e	Species	Nested Frequency		Average Cover %	
		'06	'12	'06	'12
G	Agropyron intermedium	a-	b36	-	1.10
G	Agropyron spicatum	a-	b13	-	.15
G	Bouteloua gracilis	39	38	1.53	2.01
G	Bromus tectorum (a)	a182	b258	1.45	2.27
G	Carex sp.	-	4	-	.00
G	Koeleria cristata	7	15	.07	.33
G	Oryzopsis hymenoides	1	1	.00	.00
G	Poa fendleriana	34	37	.55	1.11
G	Poa secunda	3	6	.03	.36
G	Poa sp.	b65	a-	.68	-
G	Sitanion hystrix	a12	b31	.08	.51
G	Stipa comata	a-	b8	-	.08
Total for Annual Grasses		182	258	1.45	2.27
Total for Perennial Grasses		161	189	2.97	5.66
Total for Grasses		343	447	4.42	7.93
F	Alyssum alyssoides (a)	-	8	-	.04
F	Antennaria rosea	-	4	-	.00
F	Astragalus tenellus	1	6	.00	.18
F	Astragalus zionis	7	22	.04	.07

Type	Species	Nested Frequency		Average Cover %	
		'06	'12	'06	'12
F	Chaenactis douglasii	a ⁻	b ¹⁰	-	.12
F	Cirsium sp.	1	-	.00	-
F	Collinsia parviflora (a)	-	3	-	.00
F	Crepis acuminata	-	5	-	.01
F	Cryptantha sp.	2	1	.01	.03
F	Cymopterus sp.	-	1	-	.00
F	Erigeron eatonii	12	11	.02	.07
F	Erigeron pumilus	-	8	-	.19
F	Eriogonum racemosum	3	11	.00	.02
F	Eriogonum umbellatum	9	11	.18	.07
F	Erodium cicutarium (a)	-	1	-	.00
F	Heterotheca villosa	a ⁻	b ¹²	-	.22
F	Lappula occidentalis (a)	a ⁻	b ³⁸	-	.08
F	Medicago sativa	-	3	-	.00
F	Oenothera sp.	2	6	.01	.01
F	Orobanche fasciculata	-	3	-	.03
F	Penstemon caespitosus	a ³	b ¹¹	.03	.07
F	Penstemon sp.	b ¹⁰	a ⁻	.02	-
F	Phlox hoodii	22	24	.15	.18
F	Phlox longifolia	a ³	b ³⁵	.00	.29
F	Polygonum douglasii (a)	-	2	-	.00
F	Ranunculus testiculatus (a)	-	8	-	.02
F	Sanguisorba minor	-	-	-	.03
F	Sphaeralcea coccinea	a ²²	b ³⁹	.07	.47
F	Tragopogon dubius (a)	-	1	-	.00
F	Trifolium gymnocarpon	-	62	-	.15
Total for Annual Forbs		0	61	0	0.15
Total for Perennial Forbs		97	285	0.57	2.27
Total for Forbs		97	346	0.57	2.43

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 17

Type	Species	Strip Frequency		Average Cover %	
		'06	'12	'06	'12
B	Artemisia frigida	9	9	.04	.16
B	Artemisia nova	86	67	13.14	4.90
B	Artemisia tridentata tridentata	29	22	6.67	6.45
B	Chrysothamnus depressus	0	9	-	.33
B	Chrysothamnus nauseosus	12	12	2.37	2.66
B	Chrysothamnus viscidiflorus viscidiflorus	26	25	1.12	2.21
B	Coryphantha sp.	2	0	.00	-
B	Gutierrezia sarothrae	18	12	.36	.22
B	Opuntia sp.	3	1	.03	.00
B	Pediocactus simpsonii	1	0	-	-
B	Pinus edulis	0	0	.03	-
Total for Browse		186	157	23.78	16.95

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 17

Species	Percent Cover	
	'06	'12
Artemisia frigida	.11	.11
Artemisia nova	16.59	11.41
Artemisia tridentata tridentata	5.85	3.15
Chrysothamnus depressus	-	.16
Chrysothamnus nauseosus	3.23	1.70
Chrysothamnus viscidiflorus viscidiflorus	1.46	2.86
Gutierrezia sarothrae	.06	.31
Opuntia sp.	.08	.03

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 17

Species	Average leader growth (in)	
	'06	'12
Artemisia tridentata tridentata	0.6	1.4

BASIC COVER--

Management unit 14R, Study no: 17

Cover Type	Average Cover %	
	'06	'12
Vegetation	28.25	28.18
Rock	3.02	2.71
Pavement	2.19	1.80
Litter	26.42	31.98
Cryptogams	3.57	.27
Bare Ground	52.07	44.68

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 17, Study Name: State Line South

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
8.6	7.3	39.2	33.0	27.8	2.1	15.0	156.8	0.5

PELLET GROUP DATA--

Management unit 14R, Study no: 17

Type	Quadrat Frequency		Days use per acre (ha)	
	'06	'12	'06	'12
Rabbit	70	2	-	-
Deer	5	3	2 (5)	4 (10)
Cattle	-	-	6 (14)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 17

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia frigida</i>									
06	320	0	100	-	-	31	6	0	6/9
12	280	0	100	-	-	93	0	0	7/16
<i>Artemisia nova</i>									
06	5540	2	69	30	140	2	0	17	11/22
12	2760	11	82	7	860	45	25	2	10/22
<i>Artemisia tridentata tridentata</i>									
06	1200	10	55	35	40	0	0	12	30/44
12	820	12	88	0	40	5	2	2	19/33
<i>Chrysothamnus depressus</i>									
06	0	0	0	-	-	0	0	0	-/-
12	220	0	100	-	-	18	0	0	6/10
<i>Chrysothamnus nauseosus</i>									
06	380	0	79	21	-	0	0	0	23/30
12	340	35	59	6	-	0	0	24	22/35
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
06	1300	5	71	25	-	38	58	17	5/11
12	1060	21	72	8	-	0	0	2	8/14
<i>Coryphantha sp.</i>									
06	40	50	50	-	-	0	0	0	5/12
12	0	0	0	-	-	0	0	0	-/-
<i>Echinocereus triglochidatus</i>									
06	0	0	0	-	-	0	0	0	5/12
12	0	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
06	580	10	90	-	60	0	0	0	7/11	
12	520	27	73	-	-	4	0	0	8/11	
<i>Opuntia sp.</i>										
06	80	50	50	-	-	0	0	0	4/10	
12	20	0	100	-	-	0	0	0	4/8	
<i>Pediocactus simpsonii</i>										
06	40	0	100	-	-	0	0	0	2/3	
12	0	0	0	-	-	0	0	0	3/3	
<i>Pinus edulis</i>										
06	0	0	0	-	20	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Quercus gambelii</i>										
06	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	24/18	
<i>Tetradymia canescens</i>										
06	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	11/18	

SEEP CREEK - TREND STUDY NO. 14R-27-12

Vegetation Type: Annual Grass and Forb

Range Type: Crucial Deer Spring/Fall

NRCS Ecological Site Description: [Upland Loam \(Big Sagebrush\), R036XY306UT](#)

Land Ownership: Private

Elevation: 6,824 ft (2,080 m)

Aspect: South

Slope: 3%

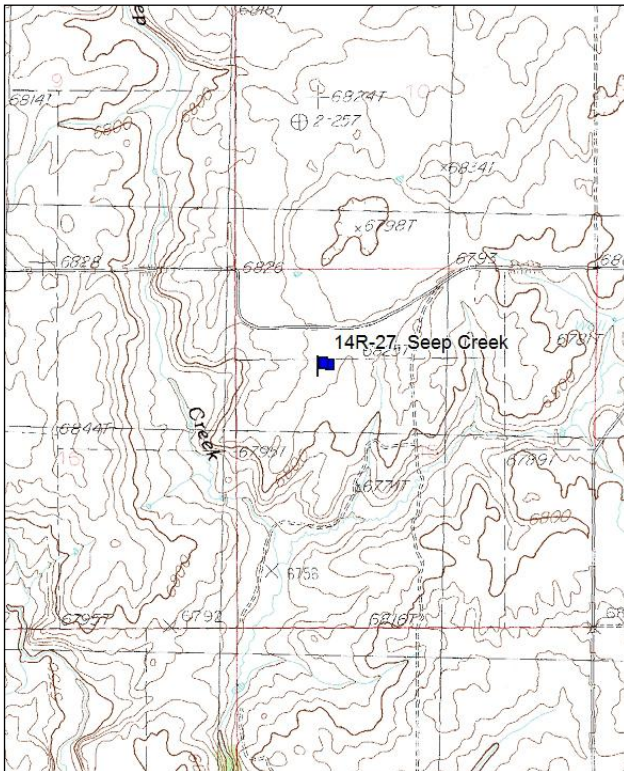
Transect bearing: 215° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Note: No Stakes or Rebar

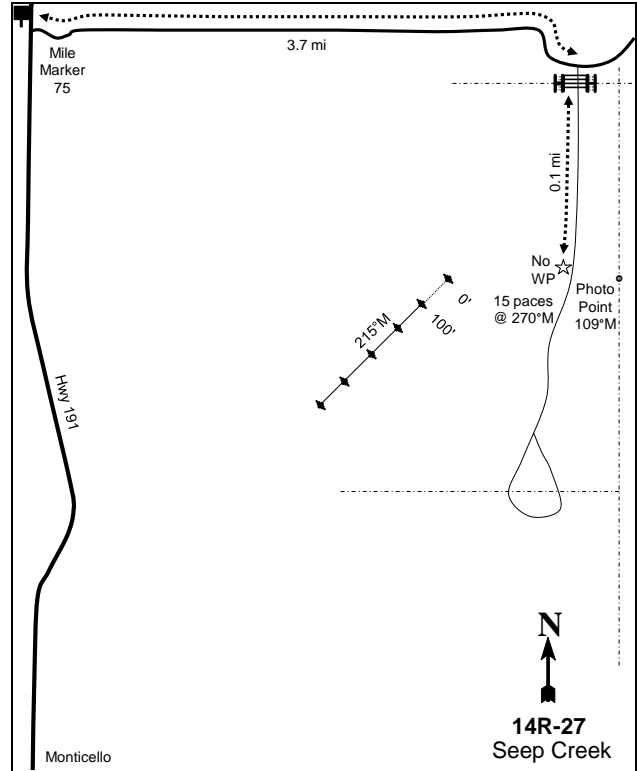
Directions: From mile marker 75 on hwy 191, head east on a gravel road for 3.7 miles. Turn right and pass through a gate and drive 0.1 miles. There is no witness post. There is a photo point marked with browse tag #9,163 on one of the t-post on the fence line.

Map Name: Monticello North



Township: 33S Range: 24E Section: 15

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 651361 E 4197447 N

SEEP CREEK - TREND STUDY NO. 14R-27
[Project #2325](#)

Site Information

Site Description: The study is located approximately four and half miles northeast of Monticello within an abandoned dry farm agricultural field. The study was established on private land to monitor a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) restoration project. The Nature Conservancy (TNC) purchased 1,080 acres of farmland located within the core area of occupied habitat for Gunnison sage-grouse. In fall of 2012, approximately 130 acres were sprayed with Plateau (Imazapic) herbicide, disked, drill seeded with grass and forb species, and aerial seeded with alfalfa (*Medicago sativa*) and Wyoming big sagebrush (Table - Seed Mix). In the spring of 2013 approximately 24,500 bareroot/plugs of sagebrush stock were planted. In addition, TNC and Utah Division of Wildlife Resources (UDWR) propose to work with the Colorado Division of Parks and Wildlife (CDPW) to augment Gunnison sage-grouse populations in Utah by translocation of 20-30 birds from Colorado. The intended long-term outcome is to increase population numbers of Gunnison sage-grouse by 30% and establish a third lek site in Utah (WRI Database 2013). No sage-grouse pellets were sampled on the site in 2012. Deer pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: Browse species are rare on the site. There is fairly dense patch of Wyoming sagebrush to the east of the study site.

Herbaceous Understory: Perennial grasses are rare on the site and are dominated by the weedy annual grass species cheatgrass (*Bromus tectorum*) and annual agricultural crop species winter rye (*Secale cereale*) and wheat (*Triticum aestivum*). Crested wheatgrass (*Agropyron cristatum*) was the only perennial grass species sampled on the site. Forbs are abundant but are dominated by weedy annual forb species tumbled mustard (*Sisymbrium altissimum*), tansymustard (*Descurainia sophia*, *D. pinnata*), and storksbill (*Erodium cicutarium*). Perennial forbs are dominated by field bindweed (*Convolvulus arvensis*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Northdale component, which occurs on plateaus and uplands. The parent material consists of eolian deposits derived from sandstone over colluviums and/or residuum weathered from sandstone. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictively layer. The soil surface texture is a loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a high amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

SEED MIX--

Management unit 14R, Study no: 27

Project Name: Seep Creek Sagebrush and Wet Meadow Enhancement					
WRI Database #: 2325					
Application: Drill		Acres: 130		Application: Aerial	
Acres: 130				Acres: 130	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Bluebunch WG 'P-7'	50	0.38	F	Alfalfa 'Nomad'
G	Bluebunch Wheatgrass 'Anatone	50	0.38	B	Sagebrush, Wyoming
G	Bottlebrush Squirreltail	90	0.69	Total Pounds:	
G	Galleta	50	0.38	185	
G	Great Basin Wildrye 'Trailhead'	100	0.77	PLS Pounds:	
G	Indian Ricegrass	175	1.35	0.64	
G	Needle and Threadgrass	25	0.19		
G	Western Wheatgrass 'Arriba'	150	1.15		
F	Blue Flax 'Appar'	50	0.38		
F	Sainfoin 'Eski'	65	0.50		
F	Scarlet Globemallow	25	0.19		
F	Small Burnet 'Delar'	150	1.15		
F	Strawberry Clover	65	0.50		
F	Western Yarrow 'Eagle'	10	0.08		
F	Western Yarrow 'Eagle Mountain'	1	0.01		
Total Pounds:		1056	8.12		
PLS Pounds:			6.68		

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 27

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	Agropyron cristatum	2	.00
G	Bromus tectorum (a)	344	15.13
G	Secale cereale (a)	111	7.92
G	Triticum aestivum (a)	65	.62
Total for Annual Grasses		520	23.68
Total for Perennial Grasses		2	0.00
Total for Grasses		522	23.68
F	Camelina microcarpa (a)	24	.61
F	Chenopodium fremontii (a)	2	.00
F	Convolvulus arvensis	87	1.98
F	Descurainia pinnata (a)	33	.78
F	Descurainia sophia (a)	31	1.07
F	Erodium cicutarium (a)	36	2.02
F	Helianthus annuus (a)	1	.03
F	Lactuca serriola (a)	26	.17
F	Microsteris gracilis (a)	2	.06

Type	Species	Nested Frequency	Average Cover %
		'12	'12
F	Oenothera pallida	29	.17
F	Polygonum aviculare (a)	6	.01
F	Ranunculus testiculatus (a)	26	.18
F	Salsola iberica (a)	61	.89
F	Sisymbrium altissimum (a)	167	9.38
F	Sphaeralcea coccinea	4	.01
Total for Annual Forbs		415	15.22
Total for Perennial Forbs		120	2.17
Total for Forbs		535	17.39

Values with different subscript letters are significantly different at alpha = 0.10

BASIC COVER--

Management unit 14R, Study no: 27

Cover Type	Average Cover % '12
Vegetation	46.17
Rock	2.73
Litter	14.15
Bare Ground	48.07

PELLET GROUP DATA--

Management unit 14R, Study no: 27

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	2	-
Deer	-	1 (2)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 27

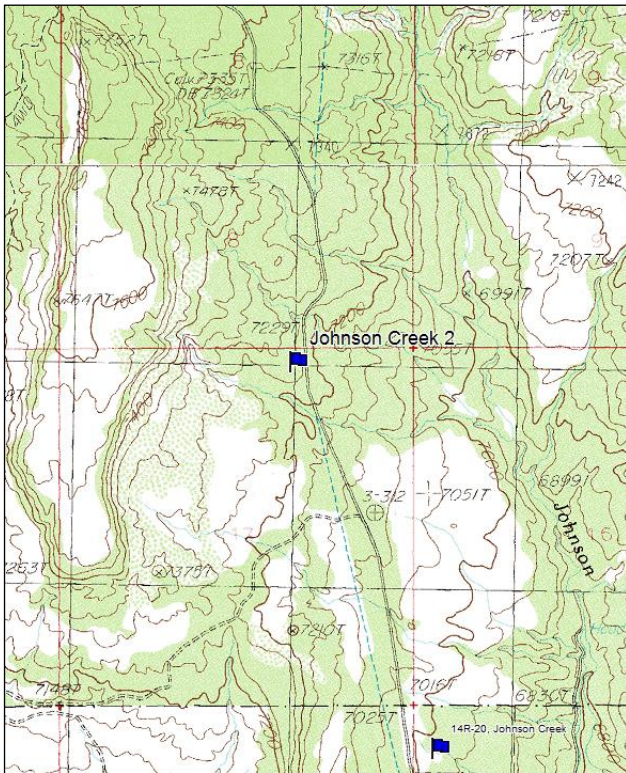
Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia tridentata wyomingensis									
12	0	0	0	-	-	0	0	0	35/68
Chrysothamnus viscidiflorus viscidiflorus									
12	0	0	0	-	-	0	0	0	13/24

JOHNSON CREEK 2 - TREND STUDY NO. 14R-28-12

Vegetation Type: Pinyon Pine and Utah Juniper
Range Type: Crucial Deer Summer, Crucial Elk Winter
NRCS Ecological Site Description: [Mountain Loam \(Oak\), R048AY415UT](#)
Land Ownership: USFS
Elevation: 7,243 ft (2,208 m)
Aspect: South
Slope: 10%
Transect bearing: Line 1-2 at 280° magnetic, Line 2-5 at 354° magnetic.
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)
Note: No Rebar

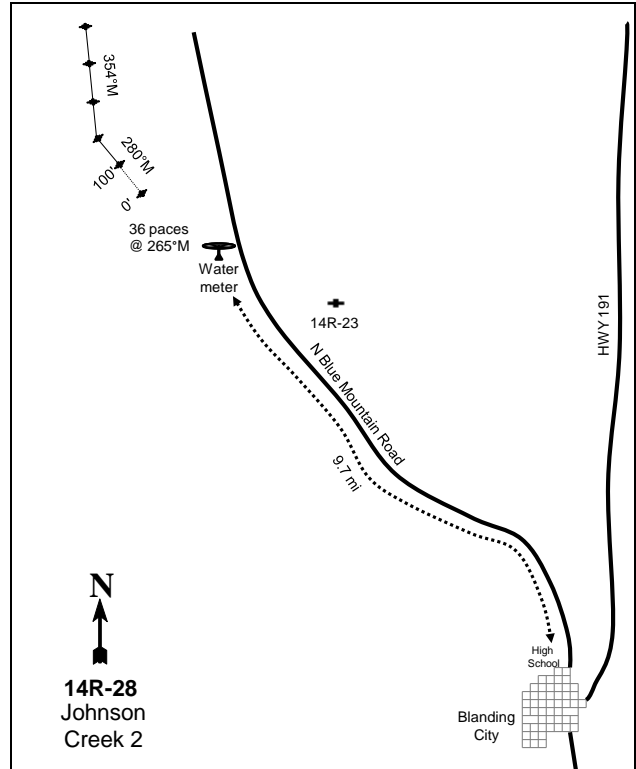
Directions: From Blanding high school travel north on N Blue Mountain Road for 9.7 miles. On the left side of the road is a water meter. From the water meter walk 36 paces at 265°M. There is no browse tag.

Map Name: Mancos Jim Butte



Township: 35S Range: 22E Section: 17

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 629919 E 4178162 N

JOHNSON CREEK 2 - TREND STUDY NO. 14R-28

[Project #2265](#)

Site Information

Site Description: The study is located approximately eight and half miles north of Blanding within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniper osteosperma*) woodland. The study was established prior to treatment in 2012 on land administrated by the U.S. Forest Service (USFS) to monitor a bullhog project. The study occurs on the USFS Camp Jackson allotment. Approximately 1,800 acres of pinyon pine (*Pinus edulis*), juniper (*Juniperus sp.*), and ponderosa (*Pinus Ponderosa*) will be thinned through mechanical thinning and prescribed burn treatments. Thinning will be accomplished utilizing logging, bullhog, and chainsaws; followed by prescribed burning of ponderosa pine, pinyon-juniper, Gambel oak and associated surface and ladder fuels. Thinning of these stands will reduce large woody fuels and will create or maintain open, park-like forest structures with reduced susceptibility to the occurrence of stand-replacing fire and bark beetle infestation (WRI Database 2013). Deer and elk pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon pine and Utah juniper (*Juniperus osteosperma*) dominated the overstory canopy cover on the site, though Gambel oak (*Quercus gambelii*) and Utah serviceberry (*Amelanchier utahensis*) provided good canopy cover on the site (Table - Canopy Cover). There were several preferred browse species sampled which include Utah serviceberry, Gambel oak, mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), true mountain mahogany (*Cercocarpus montanus*), and antelope bitterbrush (*Purshia tridentata*). Utah serviceberry and Gambel oak were the dominant preferred browse species on the site. The other preferred browse species were not very abundant on the site. Utah serviceberry and Gambel oak were lightly used population with low decadence and good vigor within the population. The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: The herbaceous understory is sparse. Grasses are not abundant or diverse on the site. Only two grass species were sampled on the site in 2012, which include Ross sedge (*Carex rossii*) and mutton bluegrass (*Poa fendleriana*). Forbs are not abundant or diverse on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is high on the site, though there is a high amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 28

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	Carex rossii	40	.52
G	Poa fendleriana	3	.03
Total for Annual Grasses		0	0
Total for Perennial Grasses		43	0.55
Total for Grasses		43	0.55
F	Arabis holboellii	22	.04
F	Aster sp.	21	.48
F	Astragalus sp.	2	.03
F	Cryptantha sp.	9	.04

Type	Species	Nested Frequency	Average Cover %
		'12	'12
F	Descurainia pinnata (a)	-	.00
F	Eriogonum alatum	5	.06
F	Ipomopsis aggregata	4	.01
F	Lesquerella sp.	1	.00
F	Phlox hoodii	7	.06
Total for Annual Forbs		0	0.00
Total for Perennial Forbs		71	0.74
Total for Forbs		71	0.74

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 28

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Amelanchier utahensis	5	3.78
B	Artemisia tridentata vaseyana	6	1.51
B	Cercocarpus montanus	1	.38
B	Gutierrezia sarothrae	7	.16
B	Juniperus osteosperma	9	3.23
B	Opuntia fragilis	9	.22
B	Pediocactus simpsonii	1	-
B	Pinus edulis	16	8.64
B	Quercus gambelii	47	18.23
Total for Browse		101	36.17

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 28

Species	Percent Cover '12
Amelanchier utahensis	5.55
Artemisia tridentata vaseyana	.51
Cercocarpus montanus	.20
Gutierrezia sarothrae	.31
Juniperus osteosperma	13.83
Opuntia fragilis	.08
Pinus edulis	29.95
Quercus gambelii	26.35

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14R, Study no: 28

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	0.7
Amelanchier utahensis	0.8

POINT-QUARTER TREE DATA--
Management unit 14R, Study no: 28

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	173	16
Pinus edulis	143	7.5

BASIC COVER--
Management unit 14R, Study no: 28

Cover Type	Average Cover % '12
Vegetation	36.34
Rock	6.19
Pavement	1.89
Litter	73.78
Cryptogams	1.45
Bare Ground	12.34

PELLET GROUP DATA--
Management unit 14R, Study no: 28

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	3	-
Elk	1	3 (7)
Deer	-	1 (3)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 28

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier utahensis</i>									
12	440	32	68	-	60	0	0	0	95/109
<i>Artemisia tridentata vaseyana</i>									
12	120	33	67	-	-	33	0	17	17/27
<i>Cercocarpus montanus</i>									
12	20	0	100	-	-	0	0	0	56/52
<i>Gutierrezia sarothrae</i>									
12	660	6	94	-	400	0	0	0	6/6
<i>Juniperus osteosperma</i>									
12	200	10	50	40	-	0	0	40	-/-
<i>Opuntia fragilis</i>									
12	240	17	83	-	-	0	0	17	3/11
<i>Pediocactus simpsonii</i>									
12	20	0	100	-	-	0	0	0	2/4
<i>Pinus edulis</i>									
12	360	28	72	-	40	0	0	0	-/-
<i>Purshia tridentata</i>									
12	0	0	0	-	-	0	0	0	7/24
<i>Quercus gambelii</i>									
12	7460	60	40	-	-	3	0	0	41/48
<i>Yucca sp.</i>									
12	0	0	0	-	-	0	0	0	15/29

SOUTH PLAIN - TREND STUDY NO. 14-23-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Year-Long

NRCS Ecological Site Description: [Semidesert Sandy Loam \(Wyoming Big Sagebrush\), R035XY216UT](#)

Land Ownership: BLM

Elevation: 6,300 ft (1,920 m)

Aspect: North

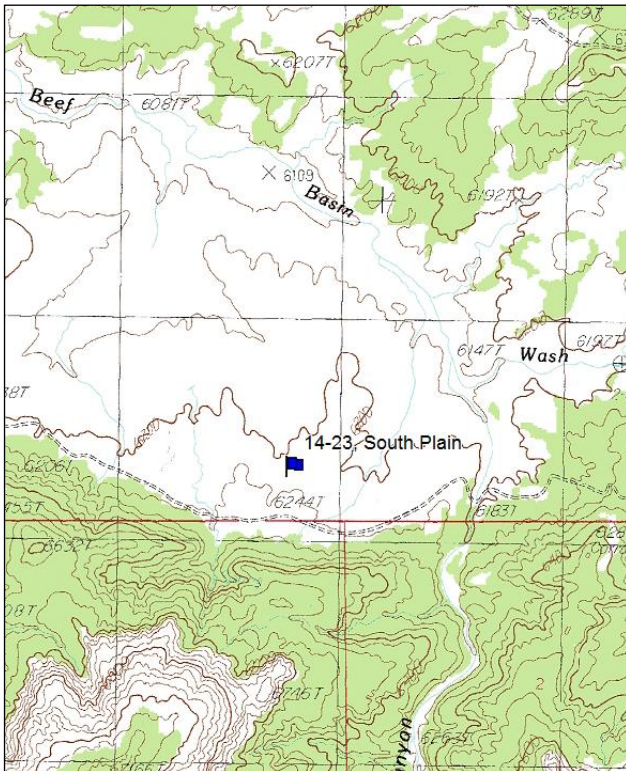
Slope: 5%

Transect bearing: 165° magnetic

Belt placement: line 1 (11ft & 71), line 2 (34ft), line 3 (59ft), line 4 (95ft)

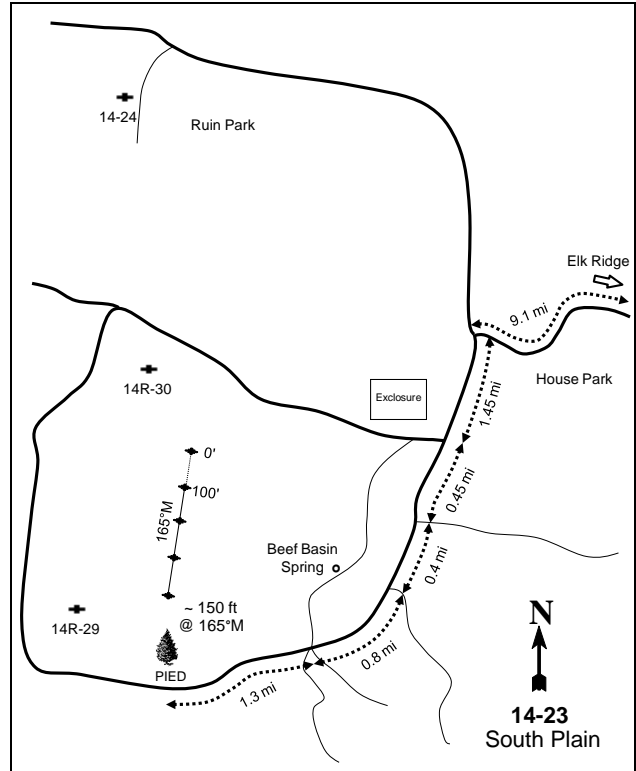
Directions: At the junction of the Elk Ridge-Salt Creek Mesa-Beef Basin Roads, go north down into the Beef Basin area. Follow the main road for 9.1 miles, passing the FS/BLM boundary down to an intersection where there is a BLM register box. Stay left on County Road #104 and proceed 1.45 miles to the turnoff to an enclosure. Stay left for 0.45 miles to a fork. Stay right again and go 0.4 miles to a fork. Go right at the intersection with the Beef Basin Canyon Road and go 0.8 miles to a 5-way intersection. Take west fork straight through the intersection (left fork goes to Indian ruins) and continue 1.3 miles to a large pinyon pine on the right. Stop here. The 400-stake of the transect starts 150 feet north of the pinyon.

Map Name: Warren Canyon



Township: 32S Range: 18E Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 594698 E 4200481 N

SOUTH PLAIN - TREND STUDY NO. 14-23

[Project #2177](#)

Site Information

Site Description: The study is located in the southern part of Beef Basin, in an area known as South Plain. The whole flat is surrounded by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) covered hills and slickrock. The study is on land administrated by the Bureau of Land Management (BLM) and is part of the Indian Creek allotment. There is very little vegetation cover over two feet in height out in the flat. Besides heavy winter-spring use by deer, Beef Basin also receives heavy grazing pressure from cattle. There are plans for additional water developments to help distribute livestock use to the north part of the basin. Deer pellet groups were numerous in 1986 with no elk sign observed. In 2013, 1,000-2,200 acres would be treated with a broadcast burn, drill seeded with a native seed mix, aerial seeded with sagebrush and aerial sprayed with Plateau (Imazapic) herbicide in the late fall or early winter. In areas not suitable for a drill seeder, seed will aerially be applied. The objectives of the project are to re-establish a diverse community of grasses, forbs and shrubs; reduce or eliminate cheatgrass; reduce the potential for increased fire frequency in the project area as well as adjacent areas; reduce wind and water erosion potential; and improve crucial big game winter range (WRI Database 2013). A Utah Division of Wildlife (UDWR) pellet group transect in the area shows years of continuous high abundance of deer (Jense et al. 1987, Jense et al. 1992, Hodson 2000). Pellet group data taken along the study site baseline estimated high abundance for deer in 1999, but decreased to more moderate abundance since 2004, and low abundance in 2012. Estimated cattle pellet group abundance was low in 1999, 2004, and 2012; but abundance was high in 2009. Elk pellet groups were sampled for the first time in 2009 and were sampled in low abundance in 2009 and 2012 (Table - Pellet Group Data).

Browse: A moderately dense stand of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) dominated the area at the outset of the study in 1986. However, the stand was overly mature, heavily hedged and in poor vigor, and has decreased in cover (Table - Browse Trends) and density since 1992. Decadence and poor vigor have remained high in the population in all sample years. Recruitment of young sagebrush plants decreased markedly between 1992 and 1999, and has remained low. Utilization of sagebrush has been very heavy in all sample years (Table - Browse Characteristics). The livestock enclosure in Beef Basin is a dramatic example of overuse and subsequent decline of sagebrush compared to a protected stand in the total enclosure. The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Other preferred browse species on the study site are winterfat (*Ceratoides lanata*) and fourwing saltbush (*Atriplex canescens*). Winterfat is selected by both cattle and deer, and both winterfat and fourwing saltbush show signs of heavy hedging but still maintain good vigor and low decadence, though hedging was light for fourwing saltbush in 2012 (Table - Browse Characteristics). Narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*) is also common. There are also a few scattered pinyon pine and juniper throughout the site and into the flat.

Herbaceous Understory: Grasses are an important part of the community, providing more than twice as much ground cover as the shrubs. The most abundant perennial include blue gramma (*Bouteloua gracilis*), needle-and-thread (*Stipa comata*), and sand dropseed (*Sporobolus cryptandrus*). The annual species cheatgrass (*Bromus tectorum*) is abundant on the site, though nested frequency and cover of cheatgrass have fluctuated with precipitation patterns. Cheatgrass provided 88% of the grass cover in 1999, but both cover and nested frequency have decreased steadily since then. Perennial forbs are relatively scarce and provide little forage on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Ignacio-Leanto association, which occurs on cuestas and structural benches. The parent material consists of eolian deposits derived from sandstone. The soils within this classification are characterized as moderate to shallow, well drained, and with a high permeable restrictively layer (Soil Survey Staff 2011). The soil is a light red sandy loam with a slightly alkaline soil reaction (pH 7.6) and deep effective rooting depth. Phosphorus has limited availability for plant growth and development at 5.3

(Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Litter and soil are building under plants, however, the average bare ground cover increased in 2004 and is fairly high (Table - Basic Cover). The soil erosion condition was classified as moderate in 2009 and slight in 2012 due to pedestalling of plants, gullies, flow patterns, and surface litter and soil movement.

Trend Assessments

Browse:

- **1986 to 1992 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1992; therefore, trend was determined using other parameters. Decadence of sagebrush increased from 47% to 81% and poor vigor increased from 36% to 61%.
- **1992 to 1999 - down (-2):** The density of the primary browse species, Wyoming big sagebrush, decreased by 67% from 3,520 plants/acre to 1,160 plants/acre, and cover decreased from 5% to 2%. Decadence and poor vigor remained very high, and recruitment of young sagebrush decreased.
- **1999 to 2004 - down (-2):** The density of sagebrush decreased 48% to 600 plants/acre and cover decreased to 1%. Decadence of sagebrush decreased slightly, but decadence and poor vigor remained high. There was no new recruitment of young sagebrush plants.
- **2004 to 2009 - stable (0):** There was a slight decrease in the density of sagebrush to 540 plants/acre, though cover remained similar at 1%. Decadence of sagebrush decreased from 77% to 67%, but poor vigor increased from 60% to 67%. There was no recruitment of young sagebrush plants.
- **2009 to 2012 - slightly down (-1):** There was a slight decrease in the density of sagebrush to 440 plants/acre, though cover remained similar at 1%. Decadence of sagebrush decreased to 55%, and plants displaying poor vigor decreased to 45%. There was very little recruitment of young sagebrush plants to the population.

Grass:

- **1986 to 1992 - up (+2):** The sum of nested frequency of perennial grasses increased 28% with a significant increase in the nested frequency of blue grama and bottlebrush squirreltail (*Sitanion hystrix*).
- **1992 to 1999 - down (-2):** There was a 54% decrease in the sum of nested frequency of perennial grasses and cover decreased from 26% to 4%. There was a significant increase in the nested frequency of cheatgrass and cover increased from 2% to 26%. Bottlebrush squirreltail, sand dropseed, and blue grama all had a significant decrease in nested frequency.
- **1999 to 2004 - up (+2):** The sum of nested frequency of perennial grasses increased 44% and cover increased to 11%. Cheatgrass decreased significantly in nested frequency and cover decreased to 10%. There was a significant increase in the nested frequency of blue grama.
- **2004 to 2009 - up (+2):** There was a 29% increase in the sum of nested frequency of perennial grasses and cover increased to 19%. Cheatgrass decreased significantly in nested frequency and cover continued to decrease to 1%. There was a significant increase in the nested frequency of needle-and-thread.
- **2009 to 2012 - stable (0):** There sum of nested frequency of perennial grasses remained similar, though cover increased to 24%. Cheatgrass remained similar in nested frequency and cover. There was a significant increase in the nested frequency of sand dropseed.

Forb:

- **1986 to 1992 - slightly down (-1):** There was a slight decrease in the sum of nested frequency of perennial forbs due to a significant decrease in the nested frequency of low fleabane (*Erigeron pumilus*). Forbs are extremely rare on the site.
- **1992 to 1999 - stable (0):** There was little change in the sum of nested frequency or cover of perennial forbs.
- **1999 to 2004 - stable (0):** There was little change in the sum of nested frequency or cover of perennial forbs. There was a significant decrease in the nested frequency of woolly milkvetch (*Astragalus*

mollissimus)

- **2004 to 2009 - stable (0):** There was little change in the sum of nested frequency or cover of perennial forbs. There was a significant increase in the nested frequency of woolly milkvetch.
- **2009 to 2012 - stable (0):** Forbs remained rare on the site. There was little change in the sum of nested frequency or cover of perennial forbs.

Trend Summary

HERBACEOUS TRENDS--

Management unit 14, Study no: 23

Type	Species	Nested Frequency						Average Cover %				
		'86	'92	'99	'04	'09	'12	'92	'99	'04	'09	'12
G	<i>Bouteloua gracilis</i>	b141	c192	a58	b100	b132	b130	18.76	1.20	5.47	7.97	9.44
G	<i>Bromus tectorum</i> (a)	a-	b27	e336	d268	c146	c144	1.95	26.46	9.62	1.24	1.24
G	<i>Oryzopsis hymenoides</i>	-	7	2	12	11	8	.21	.03	.16	.34	.22
G	<i>Sitanion hystrix</i>	c42	d96	c48	bc36	ab11	a3	1.10	.46	.41	.16	.06
G	<i>Sporobolus cryptandrus</i>	c95	c92	a20	ab42	bc66	d173	4.33	.32	2.07	2.98	11.38
G	<i>Stipa comata</i>	ab67	a54	ab74	b100	c153	b89	1.51	1.58	2.70	7.08	3.31
G	<i>Vulpia octoflora</i> (a)	a-	b21	a5	a1	a-	a5	.10	.01	.00	-	.01
Total for Annual Grasses		0	48	341	269	146	149	2.06	26.48	9.63	1.24	1.25
Total for Perennial Grasses		345	441	202	290	373	403	25.91	3.60	10.82	18.54	24.43
Total for Grasses		345	489	543	559	519	552	27.97	30.08	20.45	19.78	25.68
F	<i>Antennaria rosea</i>	-	-	-	1	-	-	-	-	.00	-	-
F	<i>Astragalus mollissimus</i>	b9	b18	b12	a-	b10	a-	.06	.06	-	.03	-
F	<i>Calochortus nuttallii</i>	-	1	-	-	-	-	.00	-	-	-	-
F	<i>Chenopodium leptophyllum</i> (a)	a-	b11	a-	ab1	ab1	a-	.03	-	.00	.00	-
F	<i>Collinsia parviflora</i> (a)	-	-	-	10	-	-	-	-	.02	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	1	5	-	1	-	.00	.02	-	.00
F	<i>Erigeron pumilus</i>	b35	a7	a2	a2	a3	a1	.06	.06	.03	.00	.00
F	<i>Eriogonum cernuum</i> (a)	-	4	-	-	-	-	.01	-	-	-	-
F	<i>Euphorbia</i> sp.	-	-	-	-	-	1	-	-	-	-	.00
F	<i>Gayophytum ramosissimum</i> (a)	-	-	5	-	-	-	-	.01	-	-	-
F	<i>Lappula occidentalis</i> (a)	-	-	-	4	-	2	-	-	.04	-	.00
F	<i>Machaeranthera canescens</i>	b12	ab8	ab7	ab1	a-	a-	.07	.09	.00	-	-
F	<i>Phlox austromontana</i>	-	3	-	3	6	7	.03	-	.15	.30	.30
F	<i>Phlox longifolia</i>	-	-	2	5	-	-	-	.00	.01	-	-
F	<i>Plantago patagonica</i> (a)	a-	ab18	bc28	b35	a1	a3	.03	.16	.45	.00	.01
F	<i>Portulaca oleracea</i> (a)	a-	a-	a-	a-	a-	b17	-	-	-	-	.04
F	<i>Sphaeralcea coccinea</i>	2	-	-	-	-	-	-	-	-	-	-
Total for Annual Forbs		0	33	34	55	2	23	0.07	0.18	0.53	0.01	0.06
Total for Perennial Forbs		58	37	23	12	19	9	0.24	0.21	0.20	0.34	0.31
Total for Forbs		58	70	57	67	21	32	0.31	0.40	0.74	0.35	0.37

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14, Study no: 23

Type	Species	Strip Frequency					Average Cover %				
		'92	'99	'04	'09	'12	'92	'99	'04	'09	'12
B	Artemisia tridentata wyomingensis	60	38	22	21	21	4.69	2.01	.99	.91	.77
B	Atriplex canescens	3	2	3	4	7	.00	.15	.15	.33	.73
B	Ceratoides lanata	10	7	5	5	3	.30	.53	.33	.33	.15
B	Chrysothamnus viscidiflorus stenophyllus	47	51	42	45	42	3.83	4.67	4.76	6.00	6.65
B	Gutierrezia sarothrae	0	1	0	0	2	-	-	-	-	.15
B	Juniperus osteosperma	0	1	0	0	0	-	.03	-	-	-
B	Opuntia sp.	6	4	6	6	6	.15	.15	.06	.04	.04
B	Pinus edulis	0	2	1	1	1	.85	.63	.85	.38	1.64
B	Sclerocactus whipplei	5	8	6	5	4	.04	.12	.12	.06	.21
Total for Browse		131	114	85	87	86	9.87	8.31	7.28	8.07	10.36

CANOPY COVER, LINE INTERCEPT--

Management unit 14, Study no: 23

Species	Percent Cover		
	'04	'09	'12
Artemisia tridentata wyomingensis	.68	.50	.90
Atriplex canescens	.90	.88	1.68
Ceratoides lanata	.66	.40	.50
Chrysothamnus viscidiflorus stenophyllus	5.31	7.53	8.38
Gutierrezia sarothrae	-	-	.08
Opuntia sp.	.06	-	-
Pinus edulis	1.04	1.93	2.68
Sclerocactus whipplei	.05	.13	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14, Study no: 23

Species	Average leader growth (in)		
	'04	'09	'12
Artemisia tridentata wyomingensis	1.4	1.3	1.0
Atriplex canescens	2.2	1.9	3.1
Ceratoides lanata	3.4	1.6	2.6

POINT-QUARTER TREE DATA--

Management unit 14, Study no: 23

Species	Trees per Acre			
	'99	'04	'09	'12
Juniperus osteosperma	10	<18	23	31
Pinus edulis	11	<18	29	25

Average diameter (in)			
'99	'04	'09	'12
6.8	-	2.0	3.3
7.7	-	4.7	2.2

BASIC COVER--

Management unit 14, Study no: 23

Cover Type	Average Cover %					
	'86	'92	'99	'04	'09	'12
Vegetation	9.50	39.09	37.93	32.02	29.15	35.64
Rock	0	1.76	.06	.00	0	.00
Pavement	0	0	.65	.33	.75	.82
Litter	52.75	30.99	34.20	24.16	41.15	37.83
Cryptogams	0	.68	.33	.38	.11	.93
Bare Ground	37.75	33.59	33.42	52.01	51.56	42.62

SOIL ANALYSIS DATA --

Management unit 14, Study no: 23, Study Name: South Plain

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
19.8	7.6	60	23.4	16.6	0.8	5.3	67.2	0.4

PELLET GROUP DATA--

Management unit 14, Study no: 23

Type	Quadrat Frequency					Days use per acre (ha)			
	'92	'99	'04	'09	'12	'99	'04	'09	'12
Rabbit	25	28	9	21	5	-	-	-	-
Elk	-	-	2	-	2	-	1 (2)	3 (8)	7 (18)
Deer	47	47	32	17	15	76 (188)	40 (99)	32 (79)	16 (40)
Cattle	1	6	17	11	10	13 (32)	17 (43)	52 (129)	4 (11)

BROWSE CHARACTERISTICS--

Management unit 14, Study no: 23

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia tridentata wyomingensis									
86	3000	0	53	47	-	0	96	36	19/23
92	3520	18	2	81	20	19	77	61	-/-
99	1160	2	7	91	140	22	66	52	18/23
04	600	7	17	77	-	0	93	60	17/24
09	540	0	33	67	-	15	52	67	12/19
12	440	5	41	55	-	5	86	45	13/19
Atriplex canescens									
86	0	0	0	0	-	0	0	0	-/-
92	60	0	100	0	-	67	0	0	-/-
99	40	0	100	0	-	0	0	0	39/58
04	60	0	100	0	20	67	33	0	41/59
09	100	0	80	20	-	20	40	0	34/46
12	220	73	27	0	40	0	0	9	35/54

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Ceratoides lanata</i>									
86	933	0	36	64	-	36	64	0	11/8
92	640	66	6	28	20	25	53	13	-/-
99	400	0	95	5	-	0	100	5	16/12
04	440	18	82	0	20	18	64	0	11/11
09	540	19	74	7	20	11	22	7	9/14
12	160	13	88	0	-	0	25	0	12/14
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
86	2333	23	17	60	200	17	6	23	12/14
92	2320	31	52	17	-	9	0	22	-/-
99	1920	4	77	19	-	13	2	3	18/28
04	1500	0	80	20	-	0	0	16	16/27
09	1600	1	78	21	-	0	0	15	15/28
12	1460	1	79	19	80	7	1	79	17/31
<i>Gutierrezia sarothrae</i>									
86	0	0	0	-	-	0	0	0	-/-
92	0	0	0	-	-	0	0	0	-/-
99	20	0	100	-	-	100	0	0	9/10
04	0	0	0	-	-	0	0	0	7/7
09	0	0	0	-	-	0	0	0	7/9
12	80	25	75	-	-	0	0	0	7/10
<i>Juniperus osteosperma</i>									
86	0	0	0	-	-	0	0	0	-/-
92	0	0	0	-	-	0	0	0	-/-
99	20	100	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
09	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
86	0	0	0	0	-	0	0	0	-/-
92	200	100	0	0	60	0	0	30	-/-
99	80	25	75	0	20	0	0	0	6/13
04	220	0	91	9	-	0	0	9	4/12
09	260	23	69	8	-	0	0	8	4/13
12	220	82	18	0	20	0	0	0	4/15
<i>Pediocactus simpsonii</i>									
86	0	0	0	-	-	0	0	0	-/-
92	0	0	0	-	-	0	0	0	-/-
99	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
09	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	3/7

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Pinus edulis</i>										
86	0	0	0	-	66	0	0	0	-/-	
92	0	0	0	-	-	0	0	0	-/-	
99	40	0	100	-	-	0	0	0	-/-	
04	20	0	100	-	-	0	0	0	-/-	
09	20	0	100	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	-/-	
<i>Sclerocactus whipplei</i>										
86	0	0	0	0	-	0	0	0	-/-	
92	100	60	40	0	20	0	0	0	-/-	
99	160	0	100	0	-	0	0	0	4/6	
04	120	0	100	0	-	0	0	0	5/6	
09	100	0	100	0	-	0	0	0	5/6	
12	80	0	50	50	-	0	0	50	5/5	

SOUTH PLAIN 2 - TREND STUDY NO. 14R-29-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Year-Long

NRCS Ecological Site Description: [Semidesert Sandy Loam \(Wyoming Big Sagebrush\), R035XY216UT](#)

Land Ownership: BLM

Elevation: 6,198 ft (1,889 m)

Aspect: North

Slope: 3%

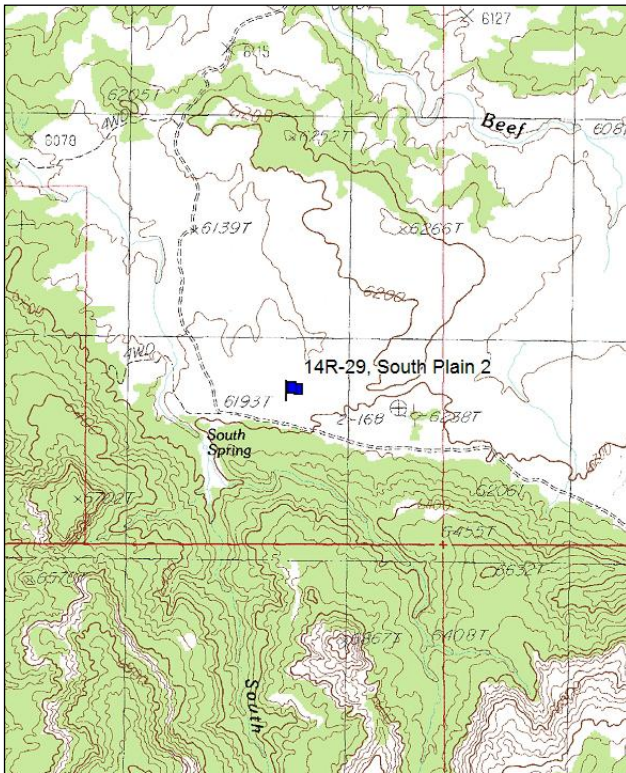
Transect bearing: 337° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Note: No rebar or stakes

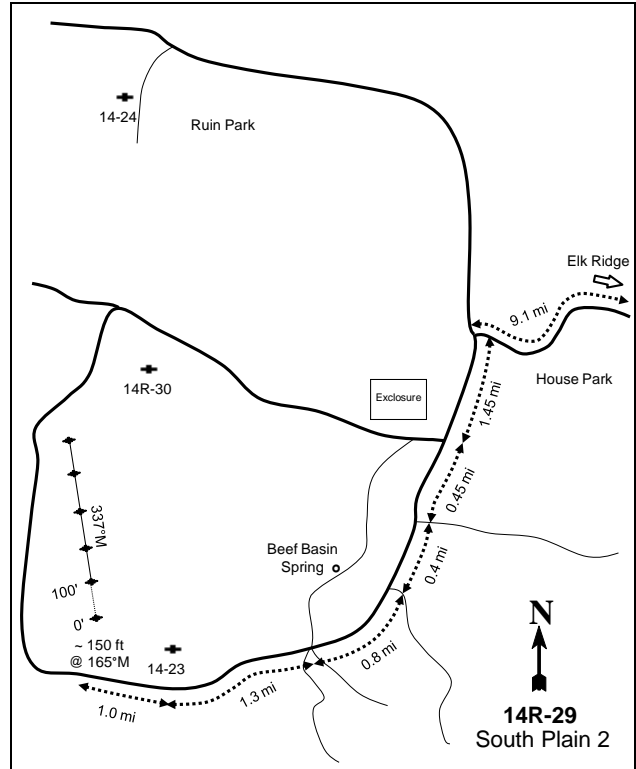
Directions: At the junction of the Elk Ridge-Salt Creek Mesa-Beef Basin Roads, go north down into the Beef Basin area. Follow the main road for 9.1 miles, passing the FS/BLM boundary down to an intersection where there is a BLM register box. Stay left on County Road #104 and proceed 1.45 miles to the turnoff to an enclosure. Stay left for 0.45 miles to a fork. Stay right again and go 0.4 miles to a fork. Go right at the intersection with the Beef Basin Canyon Road and go 0.8 miles to a 5-way intersection. Take west fork straight through the intersection (left fork goes to Indian ruins) and continue 1.3 miles to a large pinyon pine on the right. Travel 1.0 mile and stop. The study site is approximately 150 ft to the north at 165°M. There is no stake on the site.

Map Name: Fable Valley



Township: 32S Range: 18E Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 592659 E 4200914 N

SOUTH PLAIN 2 - TREND STUDY NO. 14R-29
[Project #2177](#)

Site Information

Site Description: The study is located in the southern part of Beef Basin, in an area known as South Plain. The whole flat is surrounded by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) covered hills and slickrock. The study is on land administrated by the Bureau of Land Management (BLM) and is part of the Indian Creek allotment. The study was established prior to treatment in 2012. There is very little vegetation cover over two feet in height out in the flat. Besides heavy winter-spring use by deer, Beef Basin also receives heavy grazing pressure from cattle. There are plans for additional water developments to help distribute livestock use to the north part of the basin. In 2013, 1,000-2,200 acres would be treated with a broadcast burn, drill seeded with a native seed mix, aerial seeded with sagebrush and aerial sprayed with Plateau (Imazapic) herbicide in the late fall or early winter. In areas not suitable for a drill seeder, seed will aerially be applied. The objectives of the project are to re-establish a diverse community of grasses, forbs and shrubs; reduce or eliminate cheatgrass; reduce the potential for increased fire frequency in the project area as well as adjacent areas; reduce wind and water erosion potential; and improve crucial big game winter range (WRI Database 2013). A Utah Division of Wildlife (UDWR) pellet group transect in the area shows years of continuous high abundance of deer prior to the establishment of this study (Jense et al. 1987, Jense et al. 1992, Hodson 2000). Elk, deer, and cattle pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: Browse species are not abundant on the site. The dominant preferred browse species sampled on the site are Wyoming big Sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and winterfat (*Ceratoides lanata*), though occurring in low abundance on the site. Wyoming big sagebrush is a heavily used population with high decadences and a high amount of plants displaying poor vigor within the population. Recruitment of young sagebrush plants was poor in 2012. Winterfat is a heavily used population with low decadence and good vigor within the population. Recruitment of young winterfat plants to the population was good in 2012. A dense stand of pinyon and juniper trees are located to the south of the site (Table - Browse Trends). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species is blue grama (*Bouteloua gracilis*), which provided the majority of the grass cover on the site. Other common grass species sampled on the site include sand dropseed (*Sporobolus cryptandrus*) and needle-and-thread (*Stipa comata*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site in low abundance. Forbs are not abundant or very diverse on the site. No single forb species was dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Bengay component, which occurs on cuestas and structural benches. The parent material consists of eolian deposits derived from sandstone. The soils within this classification are characterized as deep, well drained, and with a high permeable restrictively layer. The soil surface texture is a fine sandy loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 29

Type	Species	Nested	Average
		Frequency	Cover %
		'12	'12
G	<i>Bouteloua gracilis</i>	320	19.49
G	<i>Bromus tectorum</i> (a)	64	.25
G	<i>Oryzopsis hymenoides</i>	4	.04
G	<i>Sitanion hystrix</i>	9	.10
G	<i>Sporobolus cryptandrus</i>	56	2.40
G	<i>Stipa comata</i>	172	7.25
Total for Annual Grasses		64	0.25
Total for Perennial Grasses		561	29.29
Total for Grasses		625	29.54
F	<i>Astragalus</i> sp.	1	.00
F	<i>Chenopodium leptophyllum</i> (a)	23	.35
F	<i>Cordylanthus</i> sp. (a)	4	.00
F	<i>Cryptantha</i> sp.(a)	7	.04
F	<i>Descurainia pinnata</i> (a)	1	.00
F	<i>Erigeron pumilus</i>	2	.00
F	<i>Machaeranthera canescens</i>	12	.25
F	<i>Portulaca oleracea</i> (a)	58	.09
F	<i>Salsola iberica</i> (a)	9	.16
Total for Annual Forbs		102	0.65
Total for Perennial Forbs		15	0.26
Total for Forbs		117	0.91

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 29

Type	Species	Strip	Average
		Frequency	Cover %
		'12	'12
B	<i>Artemisia tridentata</i> <i>wyomingensis</i>	11	.45
B	<i>Ceratoides lanata</i>	21	1.21
B	<i>Opuntia</i> sp.	12	.48
B	<i>Pediocactus simpsonii</i>	2	-
B	<i>Sclerocactus whipplei</i>	1	.00
Total for Browse		47	2.15

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 29

Species	Percent Cover '12
Artemisia tridentata wyomingensis	.56
Ceratoides lanata	.86
Opuntia sp.	.23

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 29

Species	Average leader growth (in) '12
Artemisia tridentata wyomingensis	0.6

BASIC COVER--

Management unit 14R, Study no: 29

Cover Type	Average Cover % '12
Vegetation	33.09
Pavement	.18
Litter	39.08
Cryptogams	1.21
Bare Ground	41.99

PELLET GROUP DATA--

Management unit 14R, Study no: 29

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	8	-
Elk	1	1 (2)
Deer	8	8 (20)
Cattle	9	11 (27)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 29

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
12	260	0	38	62	-	0	100	62	11/23	
<i>Atriplex canescens</i>										
12	0	0	0	-	-	0	0	0	43/77	
<i>Ceratoides lanata</i>										
12	1280	33	67	-	160	17	45	2	12/15	
<i>Chrysothamnus viscidiflorus stenophyllus</i>										
12	0	0	0	-	-	0	0	0	11/28	
<i>Opuntia sp.</i>										
12	280	29	57	14	-	0	0	21	5/20	
<i>Pediocactus simpsonii</i>										
12	40	0	100	-	-	0	0	0	2/5	
<i>Sclerocactus whipplei</i>										
12	20	0	100	-	20	0	0	0	4/5	

NORTH PLAIN - TREND STUDY NO. 14R-30-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Year-Long

NRCS Ecological Site Description: [Semidesert Sandy Loam \(Wyoming Big Sagebrush\), R035XY216UT](#)

Land Ownership: BLM

Elevation: 6,167 ft (1,880 m)

Aspect: South

Slope: 3%

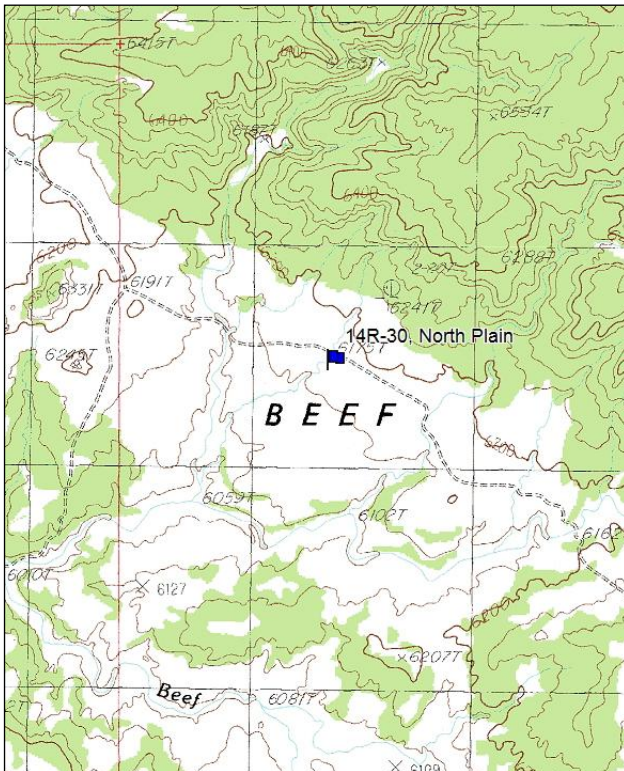
Transect bearing: 169° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Note: No rebar and stakes

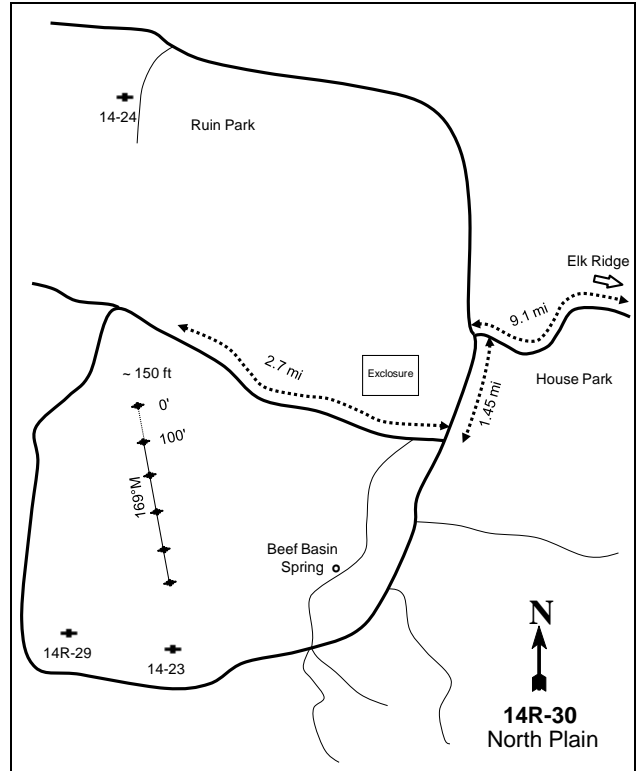
Directions: At the junction of the Elk Ridge-Salt Creek Mesa-Beef Basin Roads, go north down into the Beef Basin area. Follow the main road for 9.1 miles, passing the FS/BLM boundary down to an intersection where there is a BLM register box. Stay left on County Road #104 and proceed 1.45 miles to the turnoff to an enclosure. Turn right and drive past enclosure for 2.7 miles. The site is approximately 150 feet to the south of the road. There is no stakes.

Map Name: Fable Valley



Township: 32S Range: 18E Section: 22

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 594277 E 4203631 N

NORTH PLAIN - TREND STUDY NO. 14R-30
[Project #2177](#)

Site Information

Site Description: The study is located in the southern part of Beef Basin, in an area known as North Plain. The whole flat is surrounded by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) covered hills and slickrock. The study is on land administrated by the Bureau of Land Management (BLM) and is part of the Indian Creek allotment. The study was established prior to treatment in 2012. There is very little vegetation cover over two feet in height out in the flat. Besides heavy winter-spring use by deer, Beef Basin also receives heavy grazing pressure from cattle. There are plans for additional water developments to help distribute livestock use to the north part of the basin. In 2013, 1,000-2,200 acres would be treated with a broadcast burn, drill seeded with a native seed mix, aerial seeded with sagebrush and aerial sprayed with Plateau (Imazapic) herbicide in the late fall or early winter. In areas not suitable for a drill seeder, seed will aerially be applied. The objectives of the project are to re-establish a diverse community of grasses, forbs and shrubs; reduce or eliminate cheatgrass; reduce the potential for increased fire frequency in the project area as well as adjacent areas; reduce wind and water erosion potential; and improve crucial big game winter range (WRI Database 2013). A Utah Division of Wildlife (UDWR) pellet group transect in the area shows years of continuous high abundance of deer prior to the establishment of this study (Jense et al. 1987, Jense et al. 1992, Hodson 2000). Elk, deer, and cattle pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: Browse species are not abundant on the site. The dominant preferred browse species sampled on the site are Wyoming big Sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) fourwing saltbush (*Atriplex canescens*), and winterfat (*Ceratoides lanata*), though occurring in low abundance on the site. Wyoming big sagebrush is a heavily used population with high decadences and a high amount of plants displaying poor vigor within the population. Recruitment of young sagebrush plants was poor in 2012. Fourwing saltbush is a lightly used population with high decadence and poor vigor within the population. Winterfat is a heavily used population with low decadence and good vigor within the population. Recruitment of young winterfat plants to the population was good in 2012. (Table - Browse Trends). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant but not overly diverse on the site. The dominant grass species is blue grama (*Bouteloua gracilis*), which provided the majority of the grass cover on the site. Other common grass species sampled on the site include sand dropseed (*Sporobolus cryptandrus*) and needle-and-thread (*Stipa comata*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site in low abundance. Forbs are not abundant or very diverse on the site. No single forb species was dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Bengay component, which occurs on cuestas and structural benches. The parent material consists of eolian deposits derived from sandstone. The soils within this classification are characterized as deep, well drained, and with a high permeable restrictively layer. The soil surface texture is a fine sandy loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 14R, Study no: 30

Type	Species	Nested	Average
		Frequency	Cover %
		'12	'12
G	<i>Bouteloua gracilis</i>	183	12.29
G	<i>Bromus tectorum</i> (a)	21	.07
G	<i>Sporobolus cryptandrus</i>	132	6.99
G	<i>Stipa comata</i>	150	6.68
Total for Annual Grasses		21	0.07
Total for Perennial Grasses		465	25.98
Total for Grasses		486	26.05
F	<i>Chenopodium leptophyllum</i> (a)	2	.00
F	<i>Descurainia pinnata</i> (a)	3	.00
F	<i>Euphorbia</i> sp.	4	.00
F	<i>Phlox longifolia</i>	2	.00
F	<i>Portulaca oleracea</i> (a)	41	.07
F	<i>Sphaeralcea coccinea</i>	3	.03
Total for Annual Forbs		46	0.08
Total for Perennial Forbs		9	0.04
Total for Forbs		55	0.13

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 30

Type	Species	Strip	Average
		Frequency	Cover %
		'12	'12
B	<i>Artemisia tridentata</i> <i>wyomingensis</i>	12	.48
B	<i>Atriplex canescens</i>	3	.03
B	<i>Ceratoides lanata</i>	24	.92
B	<i>Gutierrezia sarothrae</i>	7	.18
B	<i>Opuntia</i> sp.	29	1.25
B	<i>Pediocactus simpsonii</i>	1	-
B	<i>Sclerocactus whipplei</i>	2	.00
Total for Browse		78	2.88

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 30

Species	Percent Cover '12
Artemisia tridentata wyomingensis	.66
Atriplex canescens	.25
Ceratoides lanata	.58
Opuntia sp.	1.71

BASIC COVER--
Management unit 14R, Study no: 30

Cover Type	Average Cover % '12
Vegetation	30.96
Pavement	.27
Litter	32.12
Cryptogams	.65
Bare Ground	49.59

PELLET GROUP DATA--
Management unit 14R, Study no: 30

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	19	-
Elk	2	1 (3)
Deer	9	14 (35)
Cattle	7	5 (13)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 30

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia tridentata wyomingensis									
12	320	6	38	56	-	0	88	31	14/23
Atriplex canescens									
12	100	20	20	60	-	0	0	60	31/45
Ceratoides lanata									
12	1680	2	93	5	-	36	44	10	8/12
Chrysothamnus viscidiflorus stenophyllus									
12	0	0	0	-	-	0	0	0	5/7
Ephedra viridis									
12	0	0	0	-	-	0	0	0	10/21

		Age class distribution						Utilization	
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae									
12	140	0	29	71	-	0	0	86	6/9
Opuntia sp.									
12	720	11	31	58	40	0	0	47	6/24
Pediocactus simpsonii									
12	20	100	0	-	-	0	0	0	2/4
Sclerocactus whipplei									
12	40	0	100	-	-	0	0	0	2/4

DARK CANYON - TREND STUDY NO. 14R-31-12

Vegetation Type: Pinyon pine

Range Type: Crucial Deer Year-Long, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Sand \(Utah Juniper/Pinyon\), R035XY324UT](#)

Land Ownership: BLM

Elevation: 7,506 ft (2,288 m)

Aspect: North

Slope: 5%

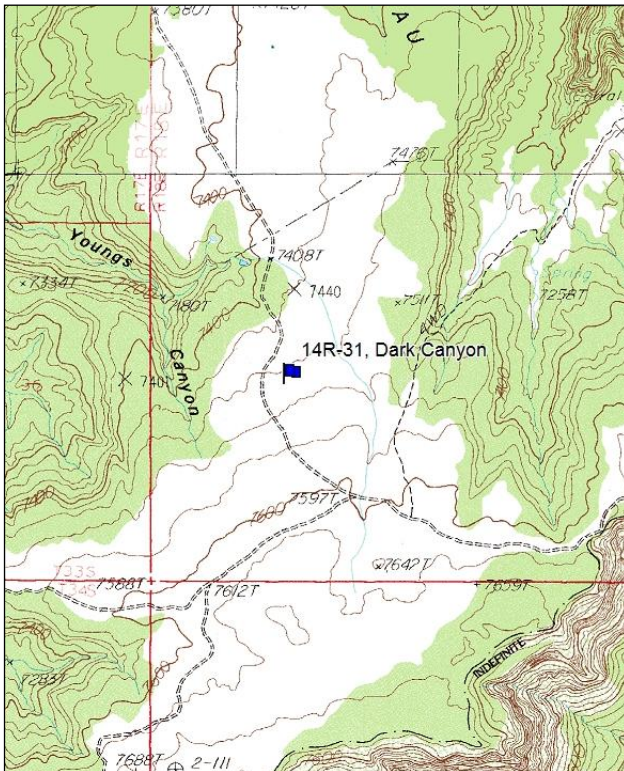
Transect bearing: 20° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Note: No rebar and stakes

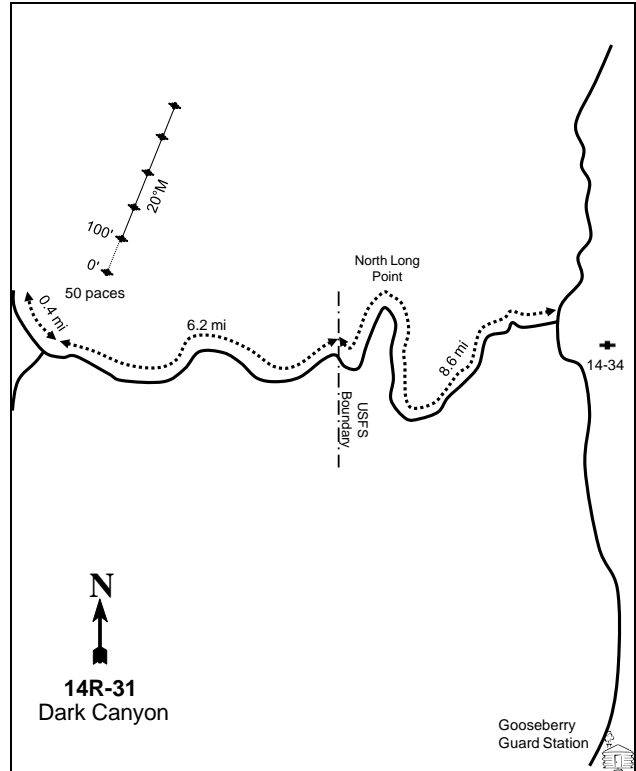
Directions: From the junction of Sweet Alice Road and the Beef Basin Road, travel west on the Sweet Alice Road for 8.6 miles to the USFS boundary. Continue for another 6.2 miles to the junction of Sweet Alice Road and Left Leg Road. Take the road that fork to the north for 0.4 miles. No rebar or stakes were place on the site.

Map Name: Warren Canyon



Township: 33S Range: 18E Section: 31

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 589169 E 4191477 N

DARK CANYON - TREND STUDY NO. 14R-31
[Project #2177](#)

Site Information

Site Description: The study is located approximately 12 miles west of the Gooseberry guard station on Dark Canyon Plateau. The study was established prior to treatment in 2012 on land administrated by the Bureau of Land Management (BLM) to monitor pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus Osteosperma*) reduction project. The study occurs on the BLM Indian Creek allotment within an old chaining. The project is planned to be bullhogged in the spring of 2013 to remove pinyon and juniper trees. The objectives of the project are to re-establish a diverse community of grasses, forbs and shrubs; reduce or eliminate cheatgrass; reduce the potential for increased fire frequency in the project area as well as adjacent areas; reduce wind and water erosion potential; and improve crucial big game winter range (WRI Database 2013). Elk and deer pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: The overstory canopy cover is dominated by pinyon pine, which provided the majority of the browse cover on the site. The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* spp. *Vaseyana*), Utah serviceberry (*Amelanchier utahensis*), and Gambel oak (*Quercus gambelii*). The key browse species is mountain big sagebrush, which is a moderately abundant population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor (Table - Browse Trends). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse. The dominant grass species is crested wheatgrass (*Agropyron cristatum*), which provided the majority of the grass cover on the site. The invasive grass species cheatgrass was sampled on the site in low abundance. Forbs are not abundant or very diverse on the site. No single forb species was dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Barx component, which occurs on cuestas and structural benches. The parent material consists of eolian deposits derived from sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer. The soil surface texture is a loam (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as critical in 2012 due to surface soil movement, pedestalling around plants, flow patterns, rills, active gully erosion, and soil movement.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 14R, Study no: 31

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	Agropyron cristatum	151	7.08
G	Bouteloua gracilis	7	.18
G	Bromus tectorum (a)	22	.11
G	Dactylis glomerata	11	.44
G	Poa fendleriana	35	1.12
G	Poa pratensis	5	.03
G	Sitanion hystrix	1	.00
G	Sporobolus cryptandrus	11	.25

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Stipa comata</i>	17	.34
Total for Annual Grasses		22	0.11
Total for Perennial Grasses		238	9.46
Total for Grasses		260	9.57
F	<i>Arabis</i> sp.	10	.02
F	<i>Astragalus</i> sp.	1	.00
F	<i>Calochortus nuttallii</i>	3	.03
F	<i>Castilleja linariaefolia</i>	1	.03
F	<i>Cryptantha</i> sp.	1	.03
F	<i>Eriogonum racemosum</i>	4	.16
F	<i>Phlox longifolia</i>	34	.19
F	<i>Senecio multilobatus</i>	11	.34
Total for Annual Forbs		0	0
Total for Perennial Forbs		65	0.81
Total for Forbs		65	0.81

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 14R, Study no: 31

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	<i>Amelanchier utahensis</i>	1	.03
B	<i>Artemisia tridentata vaseyana</i>	54	5.46
B	<i>Chrysothamnus depressus</i>	49	2.59
B	<i>Gutierrezia sarothrae</i>	4	.19
B	<i>Opuntia</i> sp.	3	.53
B	<i>Pinus edulis</i>	19	20.35
B	<i>Purshia tridentata</i>	6	.71
B	<i>Quercus gambelii</i>	1	.03
Total for Browse		137	29.90

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 31

Species	Percent Cover '12
Amelanchier utahensis	.30
Artemisia tridentata vaseyana	8.08
Chrysothamnus depressus	1.56
Gutierrezia sarothrae	.03
Opuntia sp.	.36
Pinus edulis	27.48
Purshia tridentata	.51
Quercus gambelii	.78

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14R, Study no: 31

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	0.4

POINT-QUARTER TREE DATA--
Management unit 14R, Study no: 31

Species	Trees per Acre '12	Average diameter (in) '12
Pinus edulis	543	6.7

BASIC COVER--
Management unit 14R, Study no: 31

Cover Type	Average Cover % '12
Vegetation	36.30
Rock	.60
Pavement	.03
Litter	59.25
Cryptogams	3.48
Bare Ground	27.30

PELLET GROUP DATA--

Management unit 14R, Study no: 31

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	14	-
Horse	1	-
Elk	1	1 (2)
Deer	8	13 (33)
Cattle	2	-

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 31

		Age class distribution			Utilization				
Y	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Amelanchier utahensis</i>									
12	20	0	100	-	-	100	0	0	70/72
<i>Artemisia tridentata vaseyana</i>									
12	1520	3	43	54	-	41	16	38	21/33
<i>Chrysothamnus depressus</i>									
12	3440	5	89	6	-	80	6	5	5/11
<i>Gutierrezia sarothrae</i>									
12	100	20	80	-	20	0	0	0	6/9
<i>Opuntia sp.</i>									
12	80	0	100	-	-	0	0	0	4/10
<i>Pinus edulis</i>									
12	500	8	92	-	160	0	0	0	-/-
<i>Purshia tridentata</i>									
12	140	0	57	43	-	43	57	29	22/38
<i>Quercus gambelii</i>									
12	120	100	0	-	-	0	0	0	22/20

TARANCULA MESA LOP AND SCATTER - TREND STUDY NO. 15R-2-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Deer Winter

NRCS Ecological Site Description: [Semidesert Sandy Loam \(Wyoming Big Sagebrush\), R035XY216UT](#)

Land Ownership: BLM

Elevation: 6,400 ft (1,951 m)

Aspect: Northwest

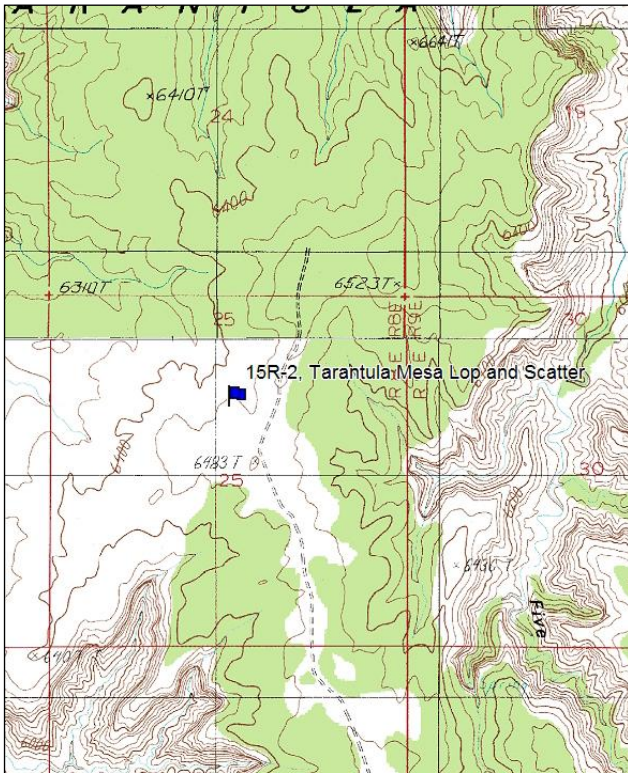
Slope: 3%

Transect bearing: 190° magnetic

Belt placement: line 1 (11ft & 95), line 2 (34ft), line 3 (59ft), line 4 (71ft)

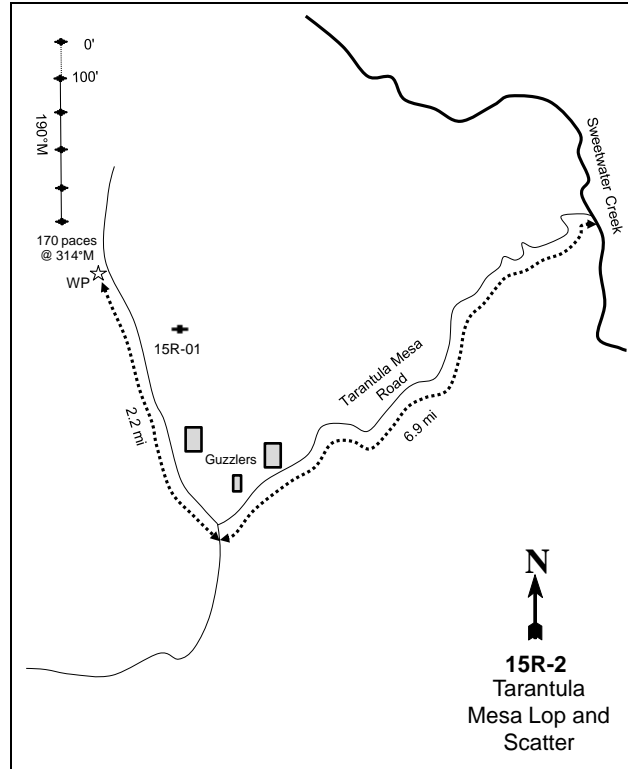
Directions: Turn onto G14240 (Tarantula Mesa Road), from the road in the bottom of Sweetwater Creek. Drive 4.3 miles to a guzzler with catch basin, then 2.7 miles to a turn, go right (north) 2.2 miles (total of 9.35 miles). Witness post is on the left. Proceed 450 yards at 314°M. 0-foot stake has browse tag #2____.

Map Name: Cave Flat



Township: 32S Range: 8E Section: 25

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 501995 E 4205504 N

TARANTULA MESA LOP AND SCATTER - TREND STUDY NO. 15R-2
[Project #1336](#)

Site Information

Site Description: The study is located approximately nine miles to the southwest of the Henry Mountains cabin on Tarantula Mesa. The study was established in 2009, prior to treatment, on land administrated by the Bureau of Land Management (BLM) to monitor the effects of a lop and scatter treatment. The study occurs on the BLM Steele Butte allotment. Tarantula Mesa was chained between 1962 and 1965 to remove pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) trees. In the fall of 2009, approximately 1,784 acres of encroaching pinyon and juniper trees were lop and scattered. The project area was not seeded. The objectives of the project are to reduce pinyon and juniper and increase the abundance of grass, forb and browse species on the site (WRI Database 2013). Deer pellet groups were sampled in moderate abundance in 2009 and low abundance in 2012. Cattle pellet groups were sampled in low abundance over the sample years (Table - Pellet Group Data).

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant preferred browse on the site, providing the majority of the canopy cover over the sample years (Table - Canopy Cover). Wyoming big sagebrush is a moderately used population with low decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was good follow in the treatment in 2012. Green ephedra (*Ephedra viridis*) has been common on the site over the sample years (Table - Browse Trends). Utah juniper decreased in canopy cover following the treatment (Table - Canopy Cover). The stage of woodland succession was in phase I transitioning to phase II prior to treatment, and following the treatment is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant but are not overly diverse on the site. Crested wheatgrass (*Agropyron cristatum*), blue grama (*Bouteloua gracilis*), and galleta (*Hilaria jamesii*) have been the dominant grass species sampled on the site, though galleta was rare in 2012. Forbs are rare on the site. No forbs were sampled in 2009 and only milkvetch (*Astragalus sp.*) was sampled in 2012 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Palma component, which occurs on mesas. The parent material consists of alluvium derived from sandstone and/or residuum weathered from sandstone. The soils within this classification are characterized as deep, well drained, and with a high permeable restrictively layer. The soil surface texture is a very fine sandy loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as critical in 2009 and 2012 due to surface soil movement, pedestalling around plants, flow patterns, rills, active gully erosion, and soil movement.

Pre vs. Three Years Post Treatment, 2009 vs. 2012

Browse: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. The canopy cover of Wyoming big sagebrush increased from 16 to 17%. The density of pinyon and juniper remained similar, though the average height decreased. Canopy cover of juniper decreased from 4% to 2%.

Grass: The sum of nested frequency of perennial grasses increased 14%, though cover decreased from 8% to 7%. There was a significant increase in the nested frequency of crested wheatgrass and blue grama, and cover increased from 3% to 4% and 2% to 3%, respectively.

Forb: Forbs remained rare on the site. No forbs were sampled prior to treatment and only milkvetch was sampled in low abundance following treatment.

Trend Summary

HERBACEOUS TRENDS--

Management unit 15R, Study no: 2

Type	Species	Nested Frequency		Average Cover %	
		'09	'12	'09	'12
G	Agropyron cristatum	_a 100	_b 152	3.19	4.13
G	Bouteloua gracilis	_a 84	_b 125	2.38	2.96
G	Hilaria jamesii	_b 62	_a 1	2.40	.00
G	Sitanion hystrix	-	7	-	.01
G	Stipa comata	5	-	.19	-
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		251	285	8.18	7.11
Total for Grasses		251	285	8.18	7.11
F	Astragalus sp.	-	3	-	.01
Total for Annual Forbs		0	0	0	0
Total for Perennial Forbs		0	3	0	0.01
Total for Forbs		0	3	0	0.01

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 15R, Study no: 2

Type	Species	Strip Frequency	Average Cover %	
			'09	'12
B	Artemisia tridentata wyomingensis	59	11.99	12.73
B	Ephedra viridis	22	1.31	1.01
B	Gutierrezia sarothrae	40	1.58	.61
B	Juniperus osteosperma	1	2.55	.78
B	Opuntia sp.	15	.34	.57
B	Sclerocactus sp.	1	-	-
Total for Browse		138	17.78	15.70

CANOPY COVER, LINE INTERCEPT--

Management unit 15R, Study no: 2

Species	Percent Cover	
	'09	'12
Artemisia tridentata wyomingensis	15.68	17.08
Ephedra viridis	2.41	2.91
Gutierrezia sarothrae	1.33	.18
Juniperus osteosperma	3.53	1.53
Opuntia sp.	.51	.45

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 15R, Study no: 2

Species	Average leader growth (in)
	'12
Artemisia tridentata wyomingensis	0.9

POINT-QUARTER TREE DATA--
Management unit 15R, Study no: 2

Species	Trees per Acre		Average diameter (in)	
	'09	'12	'09	'12
Juniperus osteosperma	44	34	4.2	3.8
Pinus edulis	<18	<18	5	4

BASIC COVER--
Management unit 15R, Study no: 2

Cover Type	Average Cover %	
	'09	'12
Vegetation	25.51	23.19
Rock	.60	.29
Pavement	.15	.11
Litter	26.59	22.27
Cryptogams	2.63	1.78
Bare Ground	55.60	65.78

PELLET GROUP DATA--
Management unit 15R, Study no: 2

Type	Quadrat Frequency		Days use per acre (ha)	
	'09	'12	'09	'12
Rabbit	50	2	-	-
Deer	11	1	32 (79)	11 (28)
Cattle	2	1	3 (7)	4 (9)

BROWSE CHARACTERISTICS--
Management unit 15R, Study no: 2

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)	
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor		
Artemisia tridentata wyomingensis										
09		No Density Collected							21/36	
12	2580	21	68	11	20	33	33	51	21/35	
Atriplex canescens										
09		No Density Collected							42/47	
12	0	0	0	-	-	0	0	0	39/42	

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Ephedra viridis</i>									
09		No Density Collected							19/25
12	1080	11	80	9	-	37	0	56	20/26
<i>Gutierrezia sarothrae</i>									
09		No Density Collected							5/6
12	2060	36	60	4	500	3	0	7	5/5
<i>Juniperus osteosperma</i>									
09		No Density Collected							-/-
12	60	67	33	-	-	0	0	0	-/-
<i>Leptodactylon pungens</i>									
09		No Density Collected							2/5
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
09		No Density Collected							4/13
12	620	35	65	-	-	0	0	6	3/12
<i>Sclerocactus sp.</i>									
09		No Density Collected							3/3
12	20	0	100	-	-	0	0	0	5/5

CONSUMER BENCH - TREND STUDY NO. 16B-23-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT

Land Ownership: BLM

Elevation: 6,100 ft (1,859 m)

Aspect: South

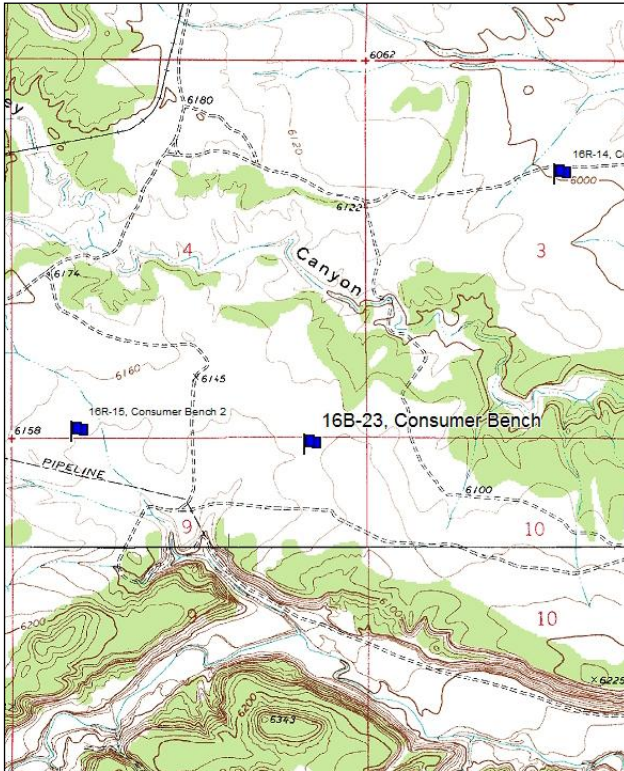
Slope: 5%

Transect bearing: 328° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

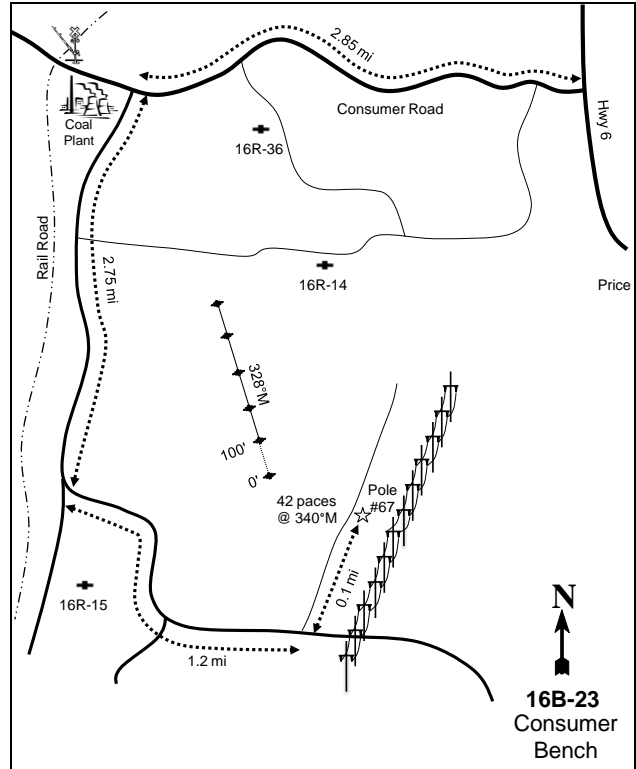
Directions: On US 6 south of Helper, turn right (west) on Consumer Road and travel 2.85 miles. Turn left on a dirt road, and go 2.75 miles passing a coal plant. Turn left and travel 0.7 miles to a fork. Stay left for an additional 0.5 miles to another fork. Turn left and go 0.1 miles to a telephone pole (#67). The 0-foot stake is 42 paces away at 340°M from the telephone pole.

Map Name: Standardville



Township: 14S Range: 9E Section: 4

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 507432 E 4386548 N

CONSUMER BENCH - TREND STUDY NO. 16B-23

[Project #228](#)

Site Information

Site Description: The study is located approximately six mile northwest of Price on Consumer Bench. The study was established on land administrated by the Bureau of Land Management (BLM) monitors a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and grass community with a few scattered Utah junipers (*Juniperus osteosperma*). The site occurs within the BLM Consumers Wash allotment, which is allotted for winter and spring sheep grazing. The area has many other land uses than just grazing and wildlife as evidenced by an oil pad about 400 feet to the south, a pressure station about one mile to the west, a coal loading station two miles to the north, and numerous power lines that crisscross the area. The study area was treated with a double drum aerator in the fall of 2004 and spring of 2005. Remediation treatments focused on the worst sagebrush die-off areas near Price. The basic approach was to establish drought-hardy mule deer winter forage plants on contoured belts covering about one-quarter to one-third of each delineated block. Belts were about 12'-14' wide, the exact width determined by the equipment used. The project area was seeded from a seedbox mounted in front of the aerator. Forage Kochia (*Kochia prostrata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) were seeded aerielly during the spring (Table - Seed Mix). Because of difficulties in differentiating between species, deer and sheep use was combined. Three dead lambs were found on the study site in 2012. Pellet group data indicated high abundance of sheep/deer since 1999. Estimated elk abundance has declined from moderately high in 1999 to moderately low abundance in 2009 and low abundance in 2012 (Table - Pellet Group Data).

Browse: The key browse species on the site is Wyoming big sagebrush. There was a large die-off of sagebrush between the 1999 and 2004 sample years attributed to a severe drought in the years prior to the 2004 sampling. The cover of sagebrush decreased from an average of 10% in 1994 and 1999 to around 2% after 2004 (Table - Browse Trends). Sagebrush density also decreased substantially from 1999 to 2004 with 94% of the population being classified as decadent in 2004. Sagebrush plants displaying poor vigor also increased to 90% in 2004 and recruitment of young sagebrush plants was very poor. The density of sagebrush remained low in 2009, but had increased with improved recruitment of young sagebrush. Decadence and poor vigor in sagebrush decreased in 2009 and 2012, as well. Utilization of sagebrush was mostly heavy in 1999, 2004, and 2012, but was mostly light in 2009 (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is relatively abundant for a Wyoming big sagebrush site. Perennial native grasses dominate the site. There was a sharp decline in the cover and sum of nested frequency of perennial grasses in 2004, but both returned to near or above 1999 levels in 2009. There was a significant increase in the nested frequency of needle-and-thread (*Stipa comata*) in 2009, but it decreased substantial in 2012 on the site. Blue grama (*Bouteloua gracilis*) was the dominant grass at the outset of the study in 1994, but decreased significantly in nested frequency in 2004 and has remained stable since then. Other common grasses on the site include Indian ricegrass (*Oryzopsis hymenoides*) and western wheatgrass (*Agropyron smithii*). Salina wildrye (*Elymus salina*) was prevalent on the site at the outset of the study, but decreased significantly in 2004 and is now rare on the site. Forbs have been fairly diverse and abundant in past sample years, but decreased substantially in 2009 and in 2012, and are now rare on the site. Scarlet globemallow (*Sphaeralcea coccinea*) is the dominant forb on the site providing nearly all of the forb cover over the sample years, though Russian thistle (*Salsola iberica*) was nearly as abundant in 2012 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Hernandez component, which occurs on fan remnants. The parent material consists of alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a slightly soil reaction (pH 7.8). Phosphorus and potassium have limited availability for plant growth and development at 3.3 ppm and 41.6 ppm, respectively (Tiedemann

and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high with moderate amount of litter providing protective ground cover (Table - Basic Cover). A couple of active gullies were noted on the site in 2004 and the soil erosion condition was classified as slight in 2004. The soil erosion condition was classified as stable in 2009 and in 2012.

Trend Assessments

Browse:

- **1994 to 1999 - slightly up (+1):** Density of the primary browse species, Wyoming big sagebrush, increased by 17% from 3,820 plants/acre to 4,480 plants/acre, and cover increased slightly. Decadence and vigor of sagebrush remained good in the population. Recruitment of young sagebrush plants also remained good at 17% of the population.
- **1999 to 2004 - down (-2):** Density of sagebrush decreased by 77% to 1,040 plants/acre and cover decreased from 10% to 2%. Decadence of sagebrush was high at 94% and 90% of the population displayed poor vigor. There was minimal recruitment of young sagebrush plants in the population.

Grass:

- **1994 to 1999 - stable (0):** There was a slightly increase in the sum of nested frequency and cover of perennial grasses, but no significant increases.
- **1999 to 2004 - down (-2):** The sum of nested frequency of perennial grasses decreased by 44% and cover decreased from 16% to 5%. There was a significant decrease in the nested frequency many of the grass species.

Forb:

- **1994 to 1999 - up (+2):** The sum of nested frequency of perennial forbs increased by 65%, though there was little change in cover.
- **1999 to 2004 - stable (0):** There was a 13% decrease in the sum of nested frequency of perennial forbs, but cover increased from 2% to 11%.

Pre vs. Five Years Post Treatment, 2004 vs. 2009

Browse: The density of sagebrush increased to 1,940 plants/acre, though there was little change in cover. Decadence and poor vigor of sagebrush both decreased to more moderate levels of 24% and 18%, respectively. Recruitment of young sagebrush plants increased to 35% of the population.

Grasses: The sum of nested frequency of perennial grasses increased to near 1999 levels and cover increased to 24%. There was a significant increase in the nested frequency of many grasses including needle-and-thread, which also increased in cover from 3% to 14%.

Forb: The sum of nested frequency of perennial forbs decreased by 21% and cover decreased to 5%.

Post Treatment Trend Assessments

Browse:

- **2009 to 2012 - down (-2):** The density of sagebrush decreased 26% to 1440 plants/acre, and cover decreased to 1%. Decadence and poor vigor of sagebrush both increased to high levels at 35% and 76%, respectively. Recruitment of young sagebrush plants remained good at 44% of the population.

Grass:

- **2009 to 2012 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 16% and cover decreased to 14%. There was a significant increase in the nested frequency of Indian ricegrass (*Oryzopsis hymenoides*) and cover increased from 5% to 7%, while needle-and-thread

decreased significantly in nested frequency and cover decreased to 2%.

Forb:

- **2009 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased by 42% and cover decreased to 1%.

SEED MIX--

Management unit 16B, Study no: 23

Project Name: Price West Benches Year 2- Consumers-Airport							
WRI Database #: 228							
Application: Double Aerator Drum		Acres: 1,851		Application: Aerial Seed		Acres: 2,750	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Douglas'	1150	0.62	B	Sagebrush, Wyoming	1320	0.48
G	Crested Wheatgrass 'Hycrest'	1000	0.54	B	Forage Kochia	350	0.13
G	Indian Ricegrass 'Nezpar'	849	0.46	Total Pounds:		1670	0.61
G	Indian Ricegrass 'Rimrock'	1000	0.54	PLS Pounds:			0.20
G	Russian Wildrye 'Bozoisky'	4115	2.22				
G	Western Wheatgrass	1850	1.00				
F	Alfalfa 'Ladak+'	750	0.41				
F	Alfalfa 'Nomad'	750	0.41				
F	Alfalfa 'Ranger'	750	0.41				
F	Sainfoin 'Eski'	2500	1.35				
F	Small Burnet 'Delar'	1500	0.81				
F	Yellow Sweetclover	416	0.22				
B	Fourwing Saltbush	2000	1.08				
Total Pounds:		18630	10.06				
PLS Pounds:			8.44				

Trend Summary

HERBACEOUS TRENDS--

Management unit 16B, Study no: 23

T y p e	Species	Nested Frequency					Average Cover %				
		'94	'99	'04	'09	'12	'94	'99	'04	'09	'12
G	Agropyron smithii	a-	a-	b18	b34	b20	-	-	.12	1.41	.37
G	Bouteloua gracilis	b195	b193	a109	a109	a120	6.22	4.79	2.02	2.91	3.42
G	Bromus tectorum (a)	-	-	-	1	-	-	-	-	.00	-
G	Elymus salina	b86	b105	a1	a3	a33	.95	2.60	.00	.15	.82
G	Oryzopsis hymenoides	ab114	bc159	a68	b145	c198	2.07	3.81	.22	5.14	6.68
G	Sitanion hystrix	ab24	b22	a1	b19	ab10	.39	.56	.03	.46	.16
G	Sporobolus cryptandrus	1	-	1	1	2	.00	-	.00	.03	.01
G	Stipa comata	b181	ab142	ab147	c271	a109	4.69	4.33	3.03	13.77	2.41
G	Vulpia octoflora (a)	a-	a6	b44	c70	a4	-	.01	.10	.23	.01
Total for Annual Grasses		0	6	44	71	4	0	0.01	0.10	0.24	0.01
Total for Perennial Grasses		601	621	345	582	492	14.33	16.10	5.44	23.89	13.88
Total for Grasses		601	627	389	653	496	14.33	16.11	5.54	24.13	13.89
F	Astragalus convallarius	b6	c39	c30	b10	a-	.01	.19	1.57	.04	-

Type	Species	Nested Frequency					Average Cover %				
		'94	'99	'04	'09	'12	'94	'99	'04	'09	'12
F	Astragalus sp.	7	-	-	-	-	.04	-	-	-	-
F	Calochortus nuttallii	a ⁻	b ¹¹	b ¹⁶	a ⁻	a ⁻	-	.04	.05	-	-
F	Castilleja linariaefolia	a ⁻	b ¹⁷	a ³	a ³	a ⁻	-	.04	.00	.03	-
F	Chenopodium fremontii (a)	-	-	3	-	2	-	-	.04	-	.00
F	Chenopodium leptophyllum(a)	-	-	162	33	14	-	-	1.55	.17	.03
F	Collinsia parviflora (a)	17	15	16	-	-	.06	.25	.11	-	-
F	Comandra pallida	-	10	11	8	1	-	.02	.25	.07	.00
F	Cordylanthus sp. (a)	-	-	1	-	-	-	-	.00	-	-
F	Cryptantha sp.	-	-	11	-	-	-	-	.27	-	-
F	Cymopterus sp.	-	3	1	-	-	-	.00	.00	-	-
F	Descurainia pinnata (a)	a ³	a ¹	b ¹⁶	a ⁻	a ¹	.00	.01	.08	-	.00
F	Eriogonum cernuum (a)	a ⁴	a ⁻	b ²²	a ¹	ab ¹²	.01	-	.12	.00	.03
F	Eriogonum ovalifolium	5	16	1	3	-	.04	.34	.03	.01	-
F	Gayophytum ramosissimum(a)	a ⁻	a ⁻	b ⁶⁵	a ⁻	a ⁻	-	-	.73	-	-
F	Gilia sp. (a)	a ⁻	a ⁻	b ¹¹⁴	a ⁻	a ³	-	-	.95	-	.00
F	Lappula occidentalis (a)	-	-	20	-	-	-	-	.06	-	-
F	Lepidium montanum	12	3	3	7	1	.21	.01	.07	.04	.00
F	Lygodesmia sp.	-	-	3	-	-	-	-	.06	-	-
F	Machaeranthera canescens	1	3	2	-	3	.00	.03	.03	-	.00
F	Penstemon linarioides	3	-	-	-	-	.00	-	-	-	-
F	Penstemon sp.	11	3	4	-	-	.02	.03	.03	-	-
F	Phlox longifolia	ab ²⁶	b ⁵⁰	b ³⁰	a ⁸	a ⁻	.05	.15	.18	.01	-
F	Plantago patagonica (a)	a ³	a ²	b ¹⁰³	a ⁴	a ⁻	.00	.01	1.01	.01	-
F	Salsola iberica (a)	a ⁻	a ⁻	b ³⁸	a ¹¹	a ¹⁰⁶	-	-	.57	.07	.49
F	Schoenrambe linifolia	a ⁷	ab ¹⁷	a ⁵	b ²²	a ⁶	.01	.07	.06	.11	.01
F	Sisymbrium altissimum (a)	-	-	-	2	-	-	-	-	.00	-
F	Sphaeralcea coccinea	ab ¹²⁸	ab ¹⁶⁶	b ¹⁷³	b ¹⁶⁹	a ¹²³	.93	1.04	8.54	4.19	.79
F	Taraxacum officinale	-	-	1	-	-	-	-	.00	-	-
F	Tragopogon dubius (a)	-	2	1	4	-	-	.00	.00	.03	-
Total for Annual Forbs		27	20	561	55	138	0.08	0.27	5.26	0.29	0.56
Total for Perennial Forbs		206	338	294	230	134	1.33	2.00	11.17	4.52	0.82
Total for Forbs		233	358	855	285	272	1.41	2.27	16.43	4.82	1.38

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16B, Study no: 23

Type	Species	Strip Frequency					Average Cover %				
		'94	'99	'04	'09	'12	'94	'99	'04	'09	'12
B	Artemisia tridentata wyomingensis	77	74	35	34	35	9.19	10.32	1.80	1.92	1.10
B	Ceratoides lanata	2	1	2	5	10	-	.00	.01	.07	.01
B	Chrysothamnus viscidiflorus	1	2	2	5	16	-	.15	.01	.01	.01
B	Gutierrezia sarothrae	28	62	11	11	31	.78	.97	.25	.22	.31
B	Kochia prostrata	0	0	0	0	10	-	-	-	.15	.30
B	Opuntia polyacantha	29	21	20	20	24	.51	.66	.64	1.10	1.50
B	Pinus edulis	0	1	1	0	0	-	-	.03	-	-
B	Sclerocactus sp.	0	0	0	0	0	-	-	-	.03	-
Total for Browse		137	161	71	75	126	10.49	12.11	2.74	3.51	3.25

CANOPY COVER, LINE INTERCEPT--

Management unit 16B, Study no: 23

Species	Percent Cover		
	'04	'09	'12
Artemisia tridentata wyomingensis	1.23	1.00	.78
Ceratoides lanata	.01	.11	.15
Chrysothamnus viscidiflorus	.01	.08	.03
Gutierrezia sarothrae	.20	-	.10
Kochia prostrata	-	-	.26
Opuntia polyacantha	.35	.46	.36

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16B, Study no: 23

Species	Average leader growth (in)		
	'04	'09	'12
Artemisia tridentata wyomingensis	4.3	1.9	0.2
Ceratoides lanata	9.4	4.4	-

BASIC COVER--

Management unit 16B, Study no: 23

Cover Type	Average Cover %				
	'94	'99	'04	'09	'12
Vegetation	24.63	32.35	26.24	31.95	19.56
Rock	.05	.01	.00	.01	.03
Pavement	.44	.26	.60	.26	.08
Litter	17.95	24.32	30.77	32.55	33.55
Cryptogams	1.43	11.09	2.56	.19	.19
Bare Ground	45.89	36.49	51.98	45.53	61.68

SOIL ANALYSIS DATA --

Management unit 16B, Study no: 23, Study Name: Consumer Bench

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
16.4	7.8	54.7	27.4	17.8	1.7	3.3	41.6	0.6

PELLET GROUP DATA--

Management unit 16B, Study no: 23

Type	Quadrat Frequency					Days use per acre (ha)			
	'94	'99	'04	'09	'12	'99	'04	'09	'12
Rabbit	6	66	36	38	10	-	-	-	-
Horse	-	-	-	-	1	-	-	-	-
Elk	20	17	16	10	3	64 (159)	25 (63)	17 (43)	1 (2)
Deer/Sheep	55	58	62	53	44	90 (223)	106 (263)	137 (339)	86 (213)
Cattle	-	-	-	4	1	-	1 (2)	2 (4)	-

BROWSE CHARACTERISTICS--

Management unit 16B, Study no: 23

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia tridentata wyomingensis									
94	3820	17	54	28	260	15	0	10	16/26
99	4480	17	55	27	300	26	47	11	17/30
04	1040	2	4	94	-	38	54	90	16/19
09	1940	35	41	24	60	13	6	18	10/14
12	1440	44	21	35	-	1	96	76	11/12
Atriplex canescens									
94	0	0	0	-	-	0	0	0	-/-
99	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
09	0	0	0	-	-	0	0	0	34/26
12	0	0	0	-	-	0	0	0	48/43
Ceratoides lanata									
94	60	0	100	-	-	0	0	0	9/8
99	20	100	0	-	-	0	0	0	3/4
04	40	0	100	-	20	0	100	0	11/13
09	220	36	64	-	20	0	0	0	9/12
12	280	21	79	-	-	36	36	0	7/9
Cercocarpus ledifolius									
94	0	0	0	-	-	0	0	0	-/-
99	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
09	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	11/13

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Chrysothamnus viscidiflorus										
94	60	0	100	0	-	0	0	0	7/18	
99	60	100	0	0	-	0	0	0	4/10	
04	60	0	100	0	140	0	0	0	9/13	
09	220	9	91	0	-	36	0	0	6/10	
12	420	43	43	14	140	19	71	10	3/6	
Gutierrezia sarothrae										
94	1020	0	96	4	-	0	4	0	8/9	
99	6460	50	50	0	2220	.30	.61	.30	4/4	
04	340	6	94	0	-	6	0	0	6/8	
09	240	42	58	0	-	0	8	0	6/8	
12	6300	98	2	0	20	0	0	0	4/4	
Kochia prostrata										
94	0	0	0	-	-	0	0	0	-/-	
99	0	0	0	-	-	0	0	0	-/-	
04	0	0	0	-	-	0	0	0	-/-	
09	0	0	0	-	-	0	0	0	9/6	
12	300	20	80	-	-	13	67	0	4/9	
Opuntia polyacantha										
94	920	4	91	4	-	0	0	0	3/10	
99	700	14	71	14	40	0	0	6	3/9	
04	740	19	81	0	40	0	0	0	4/12	
09	740	3	86	11	40	0	0	14	3/11	
12	820	10	85	5	-	0	0	5	3/14	
Pediocactus simpsonii										
94	0	0	0	-	-	0	0	0	-/-	
99	0	0	0	-	-	0	0	0	-/-	
04	0	0	0	-	-	0	0	0	-/-	
09	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	4/5	
Pinus edulis										
94	0	0	0	-	-	0	0	0	-/-	
99	20	100	0	-	-	0	0	0	-/-	
04	20	0	100	-	-	0	0	0	-/-	
09	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
Sclerocactus sp.										
94	0	0	0	-	-	0	0	0	-/-	
99	0	0	0	-	-	0	0	0	-/-	
04	0	0	0	-	-	0	0	0	-/-	
09	0	0	0	-	20	0	0	0	2/3	
12	0	0	0	-	-	0	0	0	-/-	

LOWER CEDAR BENCH - TREND STUDY NO. 16R-11-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Upland Loam (Wyoming Big Sagebrush), R047XA312UT

Land Ownership: UDWR

Elevation: 6,800 ft (2,073 m)

Aspect: Northeast

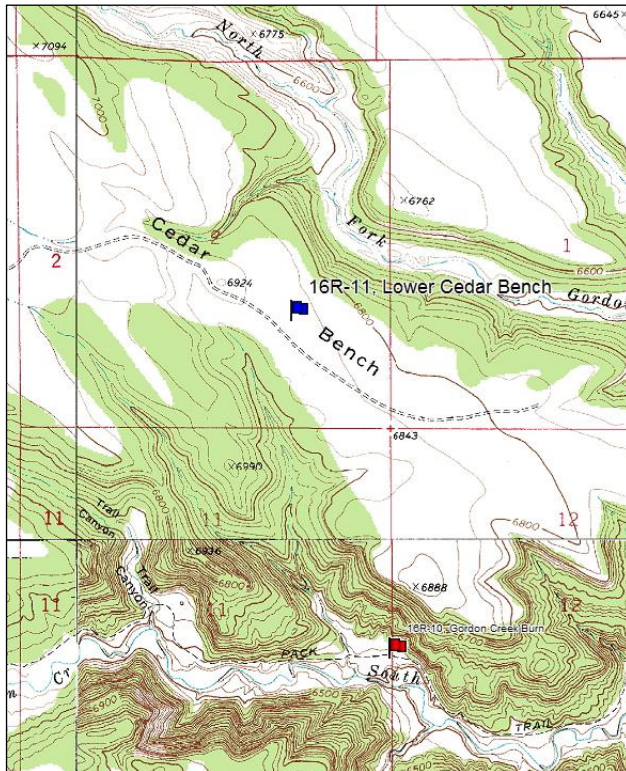
Slope: 3-5%

Transect bearing: 305° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

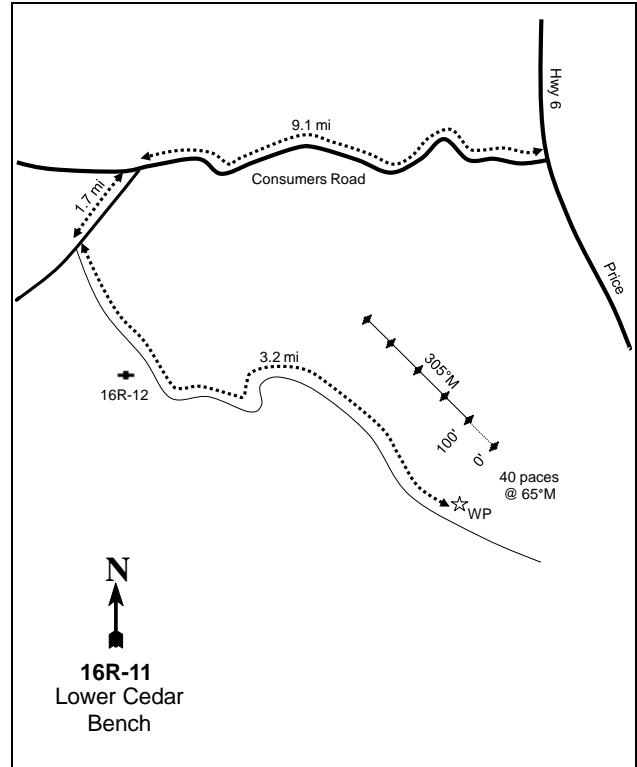
Directions: From Highway 6 north of Price, turn west onto Consumers Road. Travel 9.1 miles to a road that comes in from the left (south). Turn here and follow this road 1.7 miles to another road that comes in from the left. Turn here and travel 1.3 miles to a witness post on the right. Continue 1.9 miles to a witness post on the left side of the road. The 0-foot stake is 40 paces from the witness post at 65°M, and is marked with browse tag #47.

Map Name: Standardville



Township: 14S Range: 8E Section: 2

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 500910 E 4387112 N

LOWER CEDAR BENCH - TREND STUDY NO. 16R-11

Site Information

Site Description: The study is located approximately ten miles west of Price on Cedar Bench and about one mile south of Consumers Road (SSR 139). The study was established in 2004, prior to treatment, on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) to monitor a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) reduction project. The study occurs on the SITLA Gordon Creek Withdrawal allotment. The big game winter range habitat on Cedar Bench has degraded as pinyon-juniper canopy cover increased prior to treatment. Another study, Upper Cedar Bench (16R-12), was established approximately one and half miles to the west, in the same treatment area. In spring 2005, seed (see list below) was hand broadcast on the treatment area, and trees were removed by pushing with D-6 CAT bulldozers. In 2007, when talking to the habitat biologist, it was discussed that the treatment may not have been seeded, although in 2012 there was areas of the treatment area that had good stand of Great Basin wildrye (*Elymus cinereus*), which was in the seed mix. The purpose of the treatment was to open the canopy and establish desirable forage and browse species in the area. Elk pellet groups were sampled in low abundance in 2004 and moderate abundance in 2007 and 2012. Deer pellet groups have been sampled in high abundance in all sample years (Table - Pellet Group Data).

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant key preferred browse species on the site. Sagebrush has increased steadily in abundance and cover on the site following the treatment. Sagebrush is a lightly used population with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population has been good following the treatment. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) has been common on the site (Table - Browse Trends). Prior to the treatment, the project area was dominated by the pinyon and juniper and provided the majority of the cover, but following the treatment cover decreased substantially (Table - Canopy Cover). The stage of woodland succession was in phase II prior to treatment, and following the treatment is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species on the site is needle-and-thread (*Stipa comata*). Other common grass species sampled on the site include bluebunch wheatgrass (*Agropyron spicatum*), blue grama (*Bouteloua gracilis*), Salina wildrye (*Elymus salina*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are not abundant, but are somewhat diverse on the site. No single forb species is dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Chupadera component, which occurs on benches and terraces. The parent material consists of slope alluvium over residuum weathered from sandstone and shale. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is moderate with a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2004 due to pedestalling, rills, and flow patterns. The soil erosion condition was classified as stable in 2007 and in 2012.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush increased 27% from 2,200 plants/acre to 2,800 plants/acre, and canopy cover increased from 4% to 8%. The health of the sagebrush population improved with decadence decreasing from 66% to 24% and plants displaying poor vigor decreasing from 49% to 16%. Recruitment of young sagebrush plants increased from 5% to 39% of the population.

Grasses: The sum of nested frequency of perennial grasses increased three fold, and cover increased from 5% to 15%. There was a significant increase in the nested frequency of many grasses including needle-and-thread, which also increased in cover from 2% to 7%.

Forb: The sum of nested frequency of perennial forbs increased two fold, and cover increased from 1% to 3%.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of Wyoming big sagebrush increased substantially to 8,480 plants/acre, and canopy cover increased to 12%. The health of the sagebrush population improved with decadence decreasing to 4% and plants displaying poor vigor decreasing to 2%. Recruitment of young sagebrush plants remained good within the population.

Grass:

- **2007 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 18%, and cover increased to 17%.

Forb:

- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased 23%, and cover decreased to 1%.

SEED MIX--

Management unit 16R, Study no: 11

Project Name: Cedar Bench			
WRI Database #: PDB			
Application: Broadcast		Acres: 150	
Seed type		lbs in mix	lbs/acre
G	Great Basin Wildrye 'Trailhead'	80	0.53
G	Alfalfa 'Spredor 3'	175	1.17
G	Blue Flax 'Appar'	33	0.22
G	Bitterbrush	54	0.36
F	Fourwing Saltbush	100	0.67
F	Sagebrush, Wyoming	100	0.67
Total Pounds:		542	3.61
PLS Pounds:			2.48

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 11

T y p e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron smithii	9	3	9	.18	.00	.45
G	Agropyron spicatum	a-	a15	b28	.00	1.18	1.08
G	Bouteloua gracilis	ab31	a23	b46	.91	.81	2.52
G	Bromus tectorum (a)	a9	b28	ab25	.16	.27	.29
G	Elymus salina	b26	a2	b34	1.20	.41	3.06
G	Oryzopsis hymenoides	a10	a21	b50	.31	1.28	2.07

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	<i>Poa fendleriana</i>	_a 8	_b 27	_b 25	.06	1.16	.89
G	<i>Poa secunda</i>	_a 6	_a -	_b 9	.09	-	.07
G	<i>Sitanion hystrix</i>	_a 60	_b 113	_a 52	.86	3.02	1.28
G	<i>Stipa comata</i>	_a 71	_b 122	_b 130	1.44	6.64	5.53
Total for Annual Grasses		9	28	25	0.16	0.27	0.29
Total for Perennial Grasses		221	326	383	5.08	14.51	16.98
Total for Grasses		230	354	408	5.24	14.78	17.27
F	<i>Arabis</i> sp.	10	13	2	.03	.06	.00
F	<i>Astragalus convallarius</i>	8	9	1	.36	.31	.00
F	<i>Astragalus tenellus</i>	2	3	4	.00	.07	.15
F	<i>Calochortus nuttallii</i>	3	4	-	.00	.01	-
F	<i>Castilleja linariaefolia</i>	-	2	5	-	.15	.01
F	<i>Chaenactis douglasii</i>	-	5	3	.00	.20	.01
F	<i>Chenopodium fremontii</i> (a)	_b 55	_a 1	_a 3	.16	.00	.00
F	<i>Collinsia parviflora</i> (a)	-	-	-	.00	-	-
F	<i>Descurainia pinnata</i> (a)	13	23	10	.06	.22	.05
F	<i>Eriogonum cernuum</i> (a)	-	1	9	-	.00	.02
F	<i>Gayophytum ramosissimum</i> (a)	_b 38	_a 11	_a 1	.21	.16	.03
F	<i>Lactuca serriola</i> (a)	_a -	_b 88	_a -	-	2.90	-
F	<i>Lappula occidentalis</i> (a)	_b 11	_c 37	_a -	.07	.17	-
F	<i>Lepidium</i> sp. (a)	-	4	-	-	.04	-
F	<i>Lesquerella</i> sp.	7	18	7	.01	.42	.04
F	<i>Machaeranthera canescens</i>	_a 8	_b 20	_{ab} 10	.06	.37	.05
F	<i>Penstemon comarrhenus</i>	3	8	5	.01	.04	.18
F	<i>Penstemon pachyphyllus</i>	10	14	7	.13	.40	.04
F	<i>Phlox longifolia</i>	_a 4	_{ab} 6	_b 13	.03	.01	.03
F	<i>Polygonum douglasii</i> (a)	_c 151	_b 21	_a -	.48	.24	-
F	<i>Schoenocrambe linifolia</i>	3	6	3	.00	.09	.03
F	<i>Sphaeralcea coccinea</i>	_a 16	_{ab} 33	_b 48	.28	.75	.61
Total for Annual Forbs		268	186	23	1.01	3.76	0.10
Total for Perennial Forbs		74	141	108	0.95	2.90	1.19
Total for Forbs		342	327	131	1.96	6.67	1.29

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 11

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	54	59	71	3.33	5.62	8.05
B	Chrysothamnus viscidiflorus viscidiflorus	40	44	52	1.93	2.10	1.56
B	Gutierrezia sarothrae	1	0	1	-	.00	.00
B	Juniperus osteosperma	10	6	5	3.89	1.69	.45
B	Opuntia sp.	19	15	9	.90	.04	.03
B	Pediocactus simpsonii	4	0	1	.00	-	-
B	Pinus edulis	17	7	0	16.00	1.94	-
Total for Browse		145	131	139	26.06	11.41	10.09

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 11

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	4.21	7.75	12.01
Chrysothamnus viscidiflorus viscidiflorus	2.81	3.10	3.36
Juniperus osteosperma	5.80	1.91	1.01
Opuntia sp.	.13	.11	.20
Pediocactus simpsonii	.06	-	-
Pinus edulis	20.95	3.46	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 11

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata wyomingensis	3.8	1.3	0.9

POINT-QUARTER TREE DATA--

Management unit 16R, Study no: 11

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'12	'04	'07	'12
Juniperus osteosperma	82	52	47	3.3	2.9	2.3
Pinus edulis	285	59	48	4.2	3.8	1.2

BASIC COVER--

Management unit 16R, Study no: 11

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	33.28	32.64	29.14
Rock	1.36	.19	1.36
Pavement	.33	.14	.01
Litter	49.95	51.78	60.70
Cryptogams	5.03	1.62	.88
Bare Ground	32.87	29.59	27.20

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 11, Study Name: Lower Cedar Bench

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.3	6.8	45.6	27.2	27.2	1.4	15.0	105.6	0.6

PELLET GROUP DATA--

Management unit 16R, Study no: 11

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	20	41	1	-	-	-
Elk	3	8	9	12 (30)	25 (63)	24 (60)
Deer	33	26	22	119 (294)	94 (231)	72 (179)

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 11

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
04	2200	5	28	66	100	44	34	49	19/23
07	2800	39	36	24	13660	14	11	16	23/31
12	8480	64	33	4	1100	16	10	2	19/27
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
04	2520	3	96	1	-	0	0	.79	9/13
07	2700	10	90	0	740	0	2	0	8/13
12	2820	16	81	3	-	24	31	1	6/13
<i>Gutierrezia sarothrae</i>									
04	20	0	100	-	-	0	0	0	9/11
07	0	0	0	-	40	0	0	0	10/14
12	20	0	100	-	-	0	0	0	8/8
<i>Juniperus osteosperma</i>									
04	220	36	64	-	-	0	0	0	-/-
07	120	33	67	-	20	0	0	50	-/-
12	100	100	0	-	20	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Opuntia</i> sp.										
04	520	15	85	0	-	0	0	0	4/12	
07	320	31	56	13	-	0	0	6	3/9	
12	320	0	100	0	-	0	0	0	3/9	
<i>Pediocactus simpsonii</i>										
04	80	50	50	-	-	0	0	0	2/4	
07	0	0	0	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	4/6	
<i>Pinus edulis</i>										
04	340	47	47	6	-	0	0	6	-/-	
07	160	13	88	0	-	0	0	50	-/-	
12	0	0	0	0	-	0	0	0	-/-	

UPPER CEDAR BENCH - TREND STUDY NO. 16R-12-12

Vegetation Type: Black Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Upland Loam (Wyoming Big Sagebrush), R047XA312UT

Land Ownership: UDWR

Elevation: 7,200 ft (2,195 m)

Aspect: Southwest

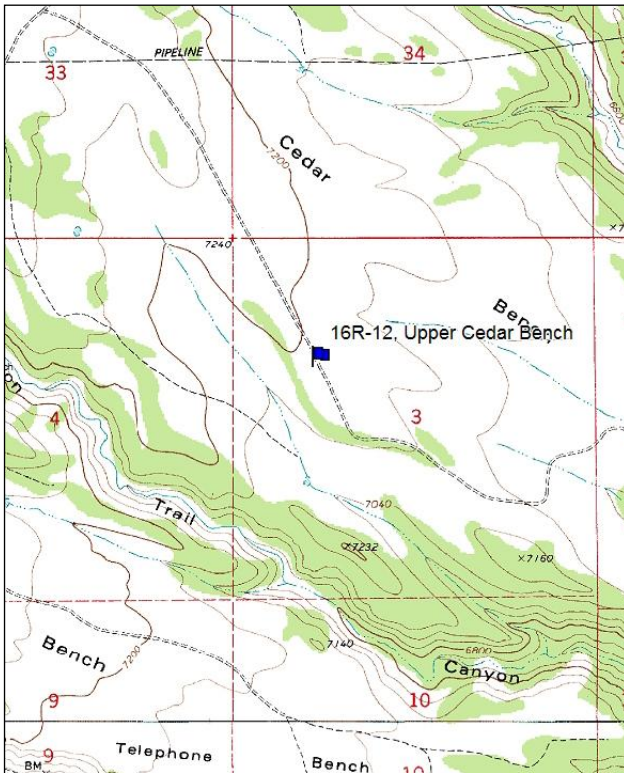
Slope: 3%

Transect bearing: 320° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

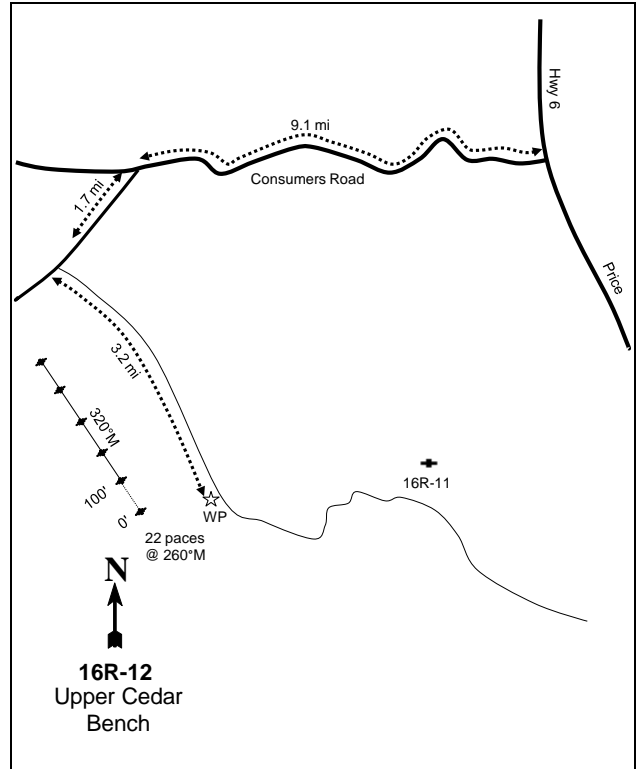
Directions: From Highway 6 north of Price, turn west onto Consumers Road. Travel 9.1 miles to a road that comes in from the left (south). Turn here and follow this road 1.7 miles to another road that comes in from the left. Turn here and travel 1.3 miles to a witness post on the right. The 0-foot stake is 22 paces from the witness post at 260°M, and is marked with browse tag #48.

Map Name: Jump Creek



Township: 14S Range: 8E Section: 3

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 498404 E 4387723 N

UPPER CEDAR BENCH - TREND STUDY NO. 16R-12

Site Information

Site Description: The study is located approximately ten miles west of Price on Cedar Bench. The study was established in 2004, prior to treatment, on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) to monitor a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) reduction project. The study occurs on the SITLA Gordon Creek Withdrawl allotment. The big game winter range habitat on Cedar Bench has degraded as pinyon-juniper canopy cover increased prior to treatment. The treatment area is located about one mile south of Consumers Road (SSR 139) and is located within the Gordon Creek Withdrawl grazing allotment. Another study, Lower Cedar Bench (16R-11), was established approximately one and half miles to the east, in the same treatment area. In spring 2005, seed (see list below) was hand broadcast on the treatment area, and trees were removed by pushing with D-6 CAT bulldozers. In 2007, when talking to the habitat biologist, it was discussed that the treatment may not have been seeded, although in 2012 there was areas of the treatment area that had good stand of Great Basin wildrye (*Elymus cinereus*), which was in the seed mix. The purpose of the treatment was to open the canopy and establish desirable forage and browse species in the area. Elk pellet groups were sampled in moderate abundance in 2007 and high abundance in 2004 and 2012. Deer pellet groups have been sampled in high abundance in all sample years (Table - Pellet Group Data).

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and black sagebrush (*A. nova*) are the dominant key preferred browse species on the site. Sagebrush has increased steadily in abundance and cover on the site following the treatment. Wyoming big sagebrush is a lightly used population with low decadence and good vigor within the population. The black sagebrush is a moderately used population with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population has been good following the treatment. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) has been common on the site (Table - Browse Trends). Prior to the treatment, the project area was dominated by the pinyon and juniper and provided the majority of the cover, but following the treatment cover decreased substantially (Table - Canopy Cover). The stage of woodland succession was in phase II prior to treatment, and following the treatment is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species on the site are mutton bluegrass (*Poa fendleriana*) and Salina wildrye (*Elymus salina*). Other common grass species sampled on the site include bluebunch wheatgrass (*Agropyron spicatum*), needle-and-thread (*Stipa comata*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are not abundant, but are somewhat diverse on the site. No single forb species is dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Chupadera component, which occurs on benches and terraces. The parent material consists of slope alluvium over residuum weathered from sandstone and shale. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is moderately high with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2007 due to pedestalling around plants and rill formation. The soil erosion condition was classified as stable in 2004 and in 2012.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush decreased 41% from 980 plants/acre to 580 plants/acre, and canopy cover decreased from 2% to 1%. The density of black sagebrush decreased 45% from 4,000 plants/acre to 2,200 plants/acre, though canopy cover remained similar at 6%. Recruitment of young plants for both sagebrush species decreased, but remained good within the population.

Grasses: The sum of nested frequency of perennial grasses increased 34%, and cover increased from 14% to 22%. There was a significant increase in the nested frequency of mutton bluegrass, and cover increased from 4% to 10%.

Forb: The sum of nested frequency of perennial forbs increased 42, and cover increased from 3% to 4%.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of Wyoming big sagebrush increased more than two fold to 1,560 plants/acre, and canopy cover increased to 2%. The density of black sagebrush increased three fold to 6,700 plants/acre, and canopy cover remained similar at 5%. Recruitment of young plants for both sagebrush species remained good within the population.

Grass:

- **2007 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 11%, and cover increased to 24%.

Forb:

- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased 51%, and cover decreased to 1%.

SEED MIX--

Management unit 16R, Study no: 12

Project Name: Cedar Bench			
WRI Database #: PDB			
Application: Broadcast		Acres: 150	
Seed type		lbs in mix	lbs/acre
G	Great Basin Wildrye 'Trailhead'	80	0.53
G	Alfalfa 'Spredor 3'	175	1.17
G	Blue Flax 'Appar'	33	0.22
G	Bitterbrush	54	0.36
F	Fourwing Saltbush	100	0.67
F	Sagebrush, Wyoming	100	0.67
Total Pounds:		542	3.61
PLS Pounds:			2.48

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 12

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron smithii	a28	ab46	b70	.23	.43	.82
G	Agropyron spicatum	a17	b97	c137	.45	3.95	6.02
G	Bouteloua gracilis	11	5	10	.36	.15	.13
G	Bromus tectorum (a)	a-	b15	a1	-	.08	.00
G	Elymus salina	b222	a109	b202	7.01	3.99	9.89

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	<i>Oryzopsis hymenoides</i>	6	6	23	.30	.03	.56
G	<i>Poa fendleriana</i>	_a 147	_b 257	_a 130	4.06	10.42	3.23
G	<i>Poa secunda</i>	_a 11	_b 86	_b 74	.05	1.45	1.64
G	<i>Sitanion hystrix</i>	_{ab} 6	_b 16	_a 3	.09	.33	.03
G	<i>Stipa comata</i>	_a 39	_a 32	_b 78	1.11	1.38	1.48
Total for Annual Grasses		0	15	1	0	0.08	0.00
Total for Perennial Grasses		487	654	727	13.67	22.16	23.84
Total for Grasses		487	669	728	13.67	22.24	23.84
F	<i>Agoseris glauca</i>	-	12	-	-	.05	-
F	<i>Arabis</i> sp.	2	-	-	.00	-	-
F	<i>Aster</i> sp.	-	1	5	-	.00	.03
F	<i>Astragalus convallarius</i>	_b 60	_b 55	_a 4	1.36	.68	.01
F	<i>Astragalus tenellus</i>	_a 8	_b 23	_a 12	.21	.67	.07
F	<i>Calochortus nuttallii</i>	2	4	-	.00	.01	-
F	<i>Castilleja linariaefolia</i>	-	9	-	-	.04	-
F	<i>Chaenactis douglasii</i>	-	-	8	-	-	.01
F	<i>Collinsia parviflora</i> (a)	-	3	-	-	.00	-
F	<i>Comandra pallida</i>	_a 64	_b 89	_a 60	.80	1.43	.33
F	<i>Cymopterus</i> sp.	1	1	-	.00	.00	-
F	<i>Descurainia pinnata</i> (a)	-	2	-	-	.00	-
F	<i>Eriogonum racemosum</i>	2	-	3	.04	-	.03
F	<i>Gayophytum ramosissimum</i> (a)	_a 1	_a -	_b 15	.00	-	.05
F	<i>Lactuca serriola</i> (a)	-	2	-	-	.00	-
F	<i>Lappula occidentalis</i> (a)	_a 7	_b 21	_a -	.01	.05	-
F	<i>Machaeranthera canescens</i>	1	5	-	.00	.06	-
F	<i>Penstemon pachyphyllus</i>	9	11	13	.08	.07	.07
F	<i>Phlox longifolia</i>	_a 41	_b 96	_a 59	.10	.45	.16
F	<i>Polygonum douglasii</i> (a)	_b 40	_a -	_a 4	.10	-	.01
F	<i>Schoenocrambe linifolia</i>	_a 1	_b 11	_a -	.00	.13	-
F	<i>Sedum lanceolatum</i>	-	2	-	-	.01	-
F	<i>Senecio multilobatus</i>	_b 43	_b 26	_a 9	.21	.40	.05
F	<i>Sphaeralcea coccinea</i>	8	1	12	.03	.00	.05
F	<i>Tragopogon dubius</i> (a)	1	1	-	.00	.03	-
F	<i>Trifolium</i> sp.	_b 23	_b 30	_a -	.32	.14	-
Total for Annual Forbs		49	29	19	0.13	0.09	0.06
Total for Perennial Forbs		265	376	185	3.20	4.17	0.83
Total for Forbs		314	405	204	3.33	4.27	0.90

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 12

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Amelanchier utahensis	2	2	2	.15	.30	.18
B	Artemisia nova	62	57	66	6.45	5.31	5.88
B	Artemisia tridentata wyomingensis	28	20	31	2.30	.85	1.68
B	Chrysothamnus viscidiflorus viscidiflorus	34	29	27	1.44	1.27	1.29
B	Gutierrezia sarothrae	30	34	13	1.02	.82	.04
B	Juniperus osteosperma	1	0	0	-	-	-
B	Opuntia sp.	5	4	4	-	-	-
B	Pediocactus simpsonii	1	1	2	-	-	-
B	Pinus edulis	6	3	1	7.56	-	-
Total for Browse		169	150	146	18.94	8.56	9.07

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 12

Species	Percent Cover		
	'04	'07	'12
Amelanchier utahensis	-	.30	.16
Artemisia nova	5.18	5.73	5.26
Artemisia tridentata wyomingensis	1.25	.96	1.56
Chrysothamnus viscidiflorus viscidiflorus	1.45	1.43	1.73
Gutierrezia sarothrae	1.68	.88	.08
Juniperus osteosperma	.61	-	-
Opuntia sp.	-	-	.03
Pinus edulis	7.26	-	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 12

Species	Average leader growth (in)		
	'04	'07	'12
Amelanchier utahensis	4.6	3.2	1.2
Artemisia nova	-	1.6	0.5
Artemisia tridentata wyomingensis	2.2	1.9	1.0

POINT-QUARTER TREE DATA--

Management unit 16R, Study no: 12

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'12	'04	'07	'12
Juniperus osteosperma	75	32	27	4.0	2.9	1.4
Pinus edulis	78	36	24	3.7	1.5	0.8

BASIC COVER--

Management unit 16R, Study no: 12

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	36.40	37.54	38.02
Rock	.16	.13	.11
Pavement	1.38	.22	.55
Litter	41.90	41.95	52.60
Cryptogams	3.92	3.57	.70
Bare Ground	33.15	28.03	36.01

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 12, Study Name: Upper Cedar Bench

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.5	7.1	39.6	29.1	31.3	2.1	11.2	70.4	0.6

PELLET GROUP DATA--

Management unit 16R, Study no: 12

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	12	34	-	-	-	-
Elk	28	28	25	53 (131)	29 (71)	86 (212)
Deer	32	20	16	52 (127)	40 (99)	46 (112)
Sheep	-	-	-	-	-	3 (7)

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 12

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Amelanchier utahensis									
04	40	0	100	-	-	0	100	0	25/31
07	40	0	100	-	-	50	50	0	30/36
12	40	0	100	-	-	50	50	0	35/43
Artemisia nova									
04	4000	40	38	22	10400	11	.50	15	12/21
07	2200	9	60	31	8120	21	8	18	12/22
12	6700	64	29	7	700	54	10	2	11/23
Artemisia tridentata wyomingensis									
04	980	27	31	43	440	22	16	39	19/24
07	580	10	34	55	2440	48	17	31	20/31
12	1560	56	33	10	600	14	14	6	18/23
Chrysothamnus viscidiflorus viscidiflorus									
04	1320	5	95	0	-	0	0	0	7/12
07	1340	9	90	1	100	22	0	1	9/16
12	1180	25	68	7	40	22	25	8	6/13

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Gutierrezia sarothrae</i>									
04	2820	4	96	0	-	0	0	0	7/10
07	2080	7	91	2	140	0	0	.96	6/8
12	560	11	89	0	40	0	11	0	5/8
<i>Juniperus osteosperma</i>									
04	20	100	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
04	100	0	100	-	-	0	0	0	3/9
07	100	60	40	-	-	0	0	0	4/9
12	80	0	100	-	-	0	0	25	3/9
<i>Pediocactus simpsonii</i>									
04	20	0	100	-	-	0	0	0	2/2
07	20	100	0	-	-	0	0	0	4/8
12	40	50	50	-	-	0	0	0	1/1
<i>Pinus edulis</i>									
04	120	67	33	-	-	0	0	0	-/-
07	60	33	67	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	-/-

UPPER PORPHYRY - TREND STUDY NO. 16R-13-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Upland Loam (Wyoming Big Sagebrush), R047XA312UT

Land Ownership: Private

Elevation: 6,300 ft (1,920 m)

Aspect: Northwest

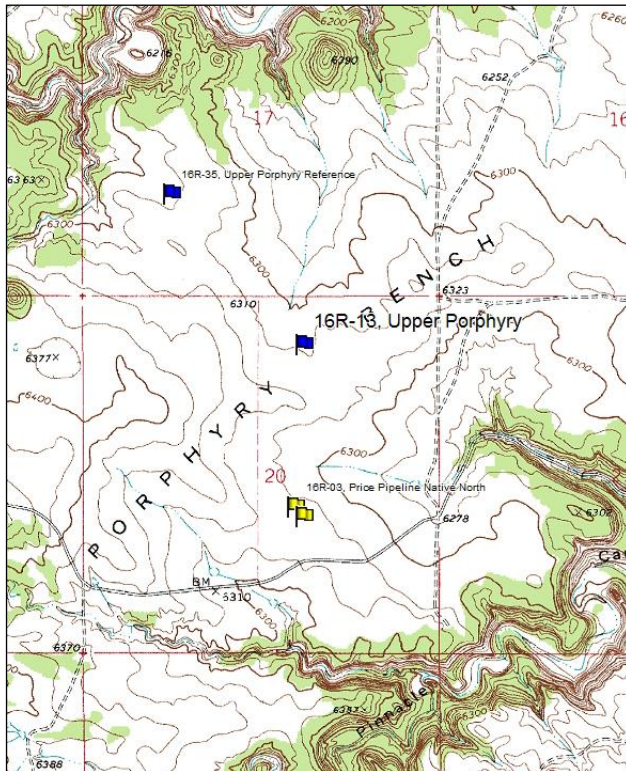
Slope: 2%

Transect bearing: 249° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

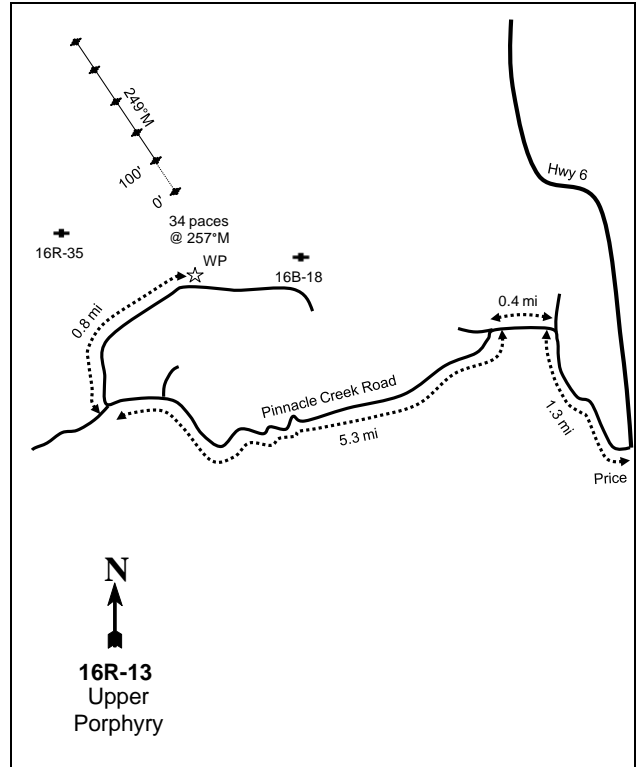
Directions: Take Westwood Blvd (1550 W) northwest out of Price 2.35 miles to a major intersection. Turn left onto Gordon Creek Road and travel 0.45 miles to a fork. Bear left away from Gordon Creek, going 0.1 miles to a gravel pit. Continue 5.5 miles on the pinnacle Peak Road to a 3-way fork at the top of the bench. An oil rig is near this intersection. Take the right fork and drive 0.6 miles to the north past another oil rig, to a witness post on the side of the road. The 0-foot post is 34 paces from the witness post at 257°M, and is marked with browse tag #51.

Map Name: Pinnacle Peak



Township: 14S Range: 9E Section: 20

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 505484 E 4383157 N

Site Description

Site Information: The study is located approximately six and a half miles west of Price on Porphyry Bench on private property. The study was established to monitor a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) stand. The site is referenced by Upper Porphyry Reference (16R-35). The study occurs on the Bureau of Land Management (BLM) Porphyry Bench allotment. In spring 2003, approximately 19,000 acres of sagebrush suffered severe die-off and 24,000 acres suffered moderate die-off within a 50 mile radius of Price. Wyoming big sagebrush showed the largest amount of die-off, compared with other sagebrush species and subspecies. This project, the first of several phases, was designed to rehabilitate 1,160 acres of crucial deer winter range and greater sage-grouse habitat on private and Utah Division of Wildlife Resources (UDWR) land. Goals of this project were to treat 50% of dead and decadent sagebrush with a double drum aerator and seed 1,160 acres in fall 2004 to late spring 2005. Seed mixes containing Forage kochia (*Kochia prostrata*), winterfat (*Ceratoides lanata*), fourwing saltbush (*Atriplex canescens*), and Wyoming big sagebrush were aerially applied in December of 2004 and a mixture of forb grass and browse species was drill seeded during the aerator treatment (WRI Database 2013). Deer pellet groups have been sampled in high abundance in all sample years. Elk pellet groups were sampled in low abundance in 2007, 2009, and 2012. Cattle pellet groups were have been sampled low abundance in all sample years (Table - Pellet Group Data).

Browse: Wyoming big sagebrush is the dominant browse species on the site and has provided the majority of browse canopy cover over the sample years. Prior to treatment the Wyoming big sagebrush population was mostly a decadent population with little recruitment and poor vigor. Since the treatment, decadence and poor vigor of sagebrush has steadily decreased and recruitment of young sagebrush has been excellent. Utilization of sagebrush has been mostly light since the outset of the study. Other preferred browse species sampled on the site include Slenderbush eriogonum (*Eriogonum microthecum*), fourwing saltbush, and dwarf rabbitbrush (*Chrysothamnus depressus*). Forage kochia has been sampled at low density and cover since 2007 (Table - Canopy Cover). Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) is prevalent on the site (Table - Browse Characteristics).

Herbaceous Understory: Prior to the treatment, three native perennial grasses; Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*) were the most common grasses and accounted for the majority of grass cover. Since the treatment, grasses have become more abundant and diverse. Crested Wheatgrass (*Agropyron cristatum*) is the dominant grass species on the site and was the most common seeded species. Other common seeded grass species include Siberian wheatgrass (*A. fragile*), western wheatgrass (*A. smithii*), Indian ricegrass (*Oryzopsis hymenoides*) and Russian wildrye (*Elymus junceus*), though western wheatgrass and Indian ricegrass were present before the treatment. The annual species cheatgrass (*Bromus tectorum*) was sampled following the treatment but has remained with low frequency and cover. Forbs are not overly diverse or abundant. Prior to treatment and shortly after, annual forbs dominated the site. Annual forbs have steadily decreased in cover and frequency since 2004. Perennial forbs increased significantly in frequency following the treatment. The most common forbs are scarlet globemallow (*Sphaeralcea coccinea*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Hernandez family-Atrac complex, which occurs on fan remnants and benches. The parent material consists of alluvium derived from sedimentary rock or sandstone and shale. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a Clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is high though there is a high amount of litter and a moderate of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004, 2010, and 2012, but slight in 2007 and 2009 due to pedestalling, flow patterns, and soil movement.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: Wyoming big sagebrush cover decreased from 6% to 4% and density increased 44% from 2,380 plants/acre to 3,420 plants/acre. The increase in density was primarily due to a large increase in the density of young sagebrush plants from 0% to 37% of the population. Decadence of sagebrush decreased from 96% to 47% and poor vigor decreased from 69% to 30%. Forage kochia was sampled at very low abundance at 60 plants/acre.

Grass: The sum of nested frequency of perennial grasses increased three-fold and cover increased from 1% to 11%. Several seeded species were sampled and included Siberian wheatgrass, crested wheatgrass, western wheatgrass, Indian ricegrass and Russian wildrye. There was a significant increase in the nested frequency of the seeded species crested wheatgrass. Significant increases in nested frequency also occurred for bottlebrush squirreltail, western wheatgrass, and needle-and-thread (*Stipa comata*). Cheatgrass was sampled for the first time at low frequency and cover.

Forb: The sum of nested frequency of perennial forbs increased over two-fold and cover increased from 2% to 3%. There was a slight increase in annual forb sum of nested frequency, but cover decreased from 9% to 5%.

Trend Assessments

Browse

- **2007 to 2009 - slightly up (+1):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Wyoming big sagebrush increased slightly in canopy cover. Dwarf rabbitbrush was sampled for the first time and provided 1% cover. There was a decrease in canopy cover of stickleaf low rabbitbrush from 4% to 2%.
- **2009 to 2010 - stable (0):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Wyoming big sagebrush cover decreased slightly from 6% to 5%. Since 2007, there was only a slight increase in density of sagebrush from 3,420 plants/acre to 3,620 plants/acre. In 2010 the recruitment of young sagebrush plants accounted for 43% of the population. Sagebrush decadence and poor vigor have remained high at 27% and 30%, respectively. Dwarf rabbitbrush provided negligible cover and had a density of 160 plants/acre. Slenderbush eriogonum also provided little cover and had an estimated density of 3,760 plants/acre and 89% of which were mature.
- **2010 to 2012 - slightly up (+1):** The density of Wyoming big sagebrush increased slightly and cover increased to 6%. The recruitment of young sagebrush plants remained similar. Decadence of sagebrush plants remained high, though plants displaying poor vigor decreased to moderate levels.

Grasses

- **2007 to 2009 - slightly up (+1):** The sum of nested frequency of perennial grass remained similar and cover increased from 11% to 17%. Cheatgrass decreased significantly in nested frequency and was rare on the site. Crested wheatgrass increased significantly in frequency and cover increased from 1% to 4%. Bottlebrush squirreltail decreased in frequency, though cover increased from 5% to 7%.
- **2009 to 2010 - down (-2):** The sum of nested frequency of perennial grasses decreased 23% and cover decreased slightly to 16%. Crested wheatgrass increased in cover and provided 7% cover. Bottlebrush squirreltail decreased significantly in frequency and cover decreased to 1%. Indian ricegrass increased in cover slightly from 2% to 3%. Western wheatgrass had a significant increase in nested frequency and cover increased from 1% to 2%. Cheatgrass remained rare on the site.
- **2010 to 2012 - stable (0):** The sum of nested frequency of perennial grasses increased 17% and cover decreased to 10%. Crested wheatgrass decreased in cover to 4%. Indian ricegrass increased significantly in nested frequency, though cover remained similar at 3%. Western wheatgrass had a significant increase in nested frequency and cover remained similar at 2%. Cheatgrass remained rare on the site.

Forbs

- **2007 to 2009 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 40% and cover decreased from 3% to 2%. However, the nested frequency of weedy annual species decreased 83% and cover decreased from 5% to 1%.
- **2009 to 2010 - stable (0):** There was little change in the forb community as cover remained at 2% and the sum of nested frequency perennial forbs remained similar. Weedy annual species were rare. Scarlet globemallow is the most common forb and provided 2% cover.
- **2009 to 2010 - down (-2):** The sum of nested frequency of perennial forbs decreased 33% and cover decreased to 1%. Weedy annual species remained rare. Scarlet globemallow remained similar in nested frequency, though cover decreased to 1% cover.

SEED MIX--

Management unit 16R, Study no: 13

Project Name: Porphyry Bench A*				Project Name: Porphyry Bench C1*			
WRI Database #: 229							
Application: Aerial Seed*		Acres: 1160		Application: Drill Seed*		Acres: 410	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
B	Forage Kochia 'Immigrant'	865	0.75	G	Crested Wheatgrass 'Douglas'	500	1.22
B	Winterfat	75	0.06	G	Russian Wildrye 'Bozoisky'	880	2.15
Total Pounds:		940	0.81	G	Siberian Wheatgrass 'Vavilov'	450	1.10
PLS Pounds:			0.53	F	Small Burnet 'Delar'	215	0.52
Project name: Porphyry Bench B1*				F	Yellow Sweetclover	225	0.55
Application: Drill seed		Acres: 85		B	Fourwing Saltbush	615	1.50
Seed type		lbs in mix	lbs/acre	Total Pounds:		2885	7.04
B	Sagebrush, Wyoming	75	0.88	PLS Pounds:			5.68
Total Pounds:		75	0.88	Project Name: Porphyry Bench C2*			
PLS Pounds:			0.25	Application: Drill Seed*		Acres: 85	
Project name: Porphyry Bench B2*				Seed type		lbs in mix	lbs/acre
Application: Aerial seed*		Acres: 495		G	Great Basin Wildrye 'Trailhead'	90	1.22
Seed type		lbs in mix	lbs/acre	G	Indian Ricegrass 'Rimrock'	85	2.15
B	Sagebrush, Wyoming	440	0.89	G	Sheep Fescue	95	1.10
B	Fourwing Saltbush	128	0.26	G	Western Wheatgrass 'Arriba'	100	0.52
Total Pounds:		568	1.15	F	Blue Flax 'Appar'	9	0.55
PLS Pounds:			0.37	F	Rocky Mountain Beeplant	17	1.50
				B	Fourwing Saltbush	126	0.31
				Total Pounds:		2885	33.94
				PLS Pounds:			5.68

*Seed mix A and B2 were aerially applied. Seed mix B1, C1, and C2 were drill seeded during the aerator treatment.

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 13

Type	Species	Nested Frequency					Average Cover %				
		'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
G	Agropyron cristatum	a1	b34	cd86	d114	c78	.03	.66	4.17	7.27	3.58
G	Agropyron fragile	a-	b51	a3	a-	a-	-	1.38	.01	-	-
G	Agropyron smithii	a9	a17	a15	b51	c78	.16	.61	.48	2.41	1.54
G	Bouteloua gracilis	a1	ab8	ab9	a-	b12	.03	.53	.30	-	.04
G	Bromus tectorum (a)	a-	b38	a7	ab13	a7	-	.22	.01	.03	.09
G	Elymus junceus	a-	b15	b24	b25	b25	-	.13	.75	1.27	.73
G	Oryzopsis hymenoides	a45	a51	a85	a78	b154	.15	.76	2.19	2.47	2.98
G	Poa fendleriana	-	-	-	1	-	-	-	-	.00	-
G	Poa secunda	-	-	-	-	1	-	-	-	-	.03
G	Sitanion hystrix	a59	b217	b175	a47	a52	.70	5.21	6.98	1.00	.85
G	Stipa comata	a32	ab55	b80	ab52	a31	.16	1.45	2.28	1.50	.30
G	Vulpia octoflora (a)	-	5	-	-	-	-	.02	-	-	-
Total for Annual Grasses		0	43	7	13	7	0	0.25	0.01	0.03	0.09
Total for Perennial Grasses		147	448	477	368	431	1.24	10.74	17.19	15.94	10.06
Total for Grasses		147	491	484	381	438	1.24	10.99	17.20	15.97	10.15
F	Arabis sp.	2	4	-	-	-	.03	.00	-	-	-
F	Astragalus convallarius	5	9	3	-	-	.09	.21	.03	-	-
F	Castilleja sp.	4	-	-	-	-	.00	-	-	-	-
F	Chenopodium fremontii (a)	3	-	-	2	-	.21	-	-	.00	-
F	Chenopodium leptophyllum(a)	c184	a-	a1	b24	a1	4.44	-	.00	.08	.00
F	Cordylanthus sp. (a)	c44	ab13	a-	b14	a-	.64	.02	-	.37	-
F	Descurainia pinnata (a)	c53	c43	a-	a-	b12	.46	.15	-	-	.03
F	Draba sp. (a)	-	2	-	3	-	-	.01	-	.00	-
F	Eriogonum cernuum (a)	ab15	b30	ab31	ab25	a3	.16	.12	.26	.14	.03
F	Eriogonum sp.	-	-	1	-	-	-	-	.00	-	-
F	Gayophytum ramosissimum(a)	b50	a-	a-	a-	a1	1.25	-	-	-	.00
F	Gilia sp. (a)	2	-	-	-	-	.00	-	-	-	-
F	Lappula occidentalis (a)	b42	c273	a-	a7	a-	1.03	4.25	-	.02	-
F	Lesquerella sp.	-	7	1	-	4	-	.07	.00	-	.00
F	Penstemon sp.	1	-	-	-	-	.03	-	-	-	-
F	Penstemon sp.	6	15	9	5	8	.07	.08	.04	.03	.01
F	Phlox hoodii	-	3	-	3	-	-	.03	-	.03	-
F	Phlox longifolia	a20	b64	a16	a29	a12	.09	.22	.12	.31	.05
F	Plantago patagonica (a)	b26	c75	a-	a3	a-	.47	.57	-	.00	-
F	Salsola iberica (a)	a8	b27	a5	a2	a-	.31	.05	.01	.00	-
F	Schoenocrambe linifolia	-	4	3	3	-	-	.01	.00	.03	-
F	Sphaeralcea coccinea	a49	b124	b104	b95	b104	1.67	2.31	1.61	1.67	.87
F	Unknown forb-annual (a)	a-	a-	b44	a-	a-	-	-	.70	-	-
Total for Annual Forbs		427	463	81	80	17	9.01	5.18	0.98	0.64	0.07
Total for Perennial Forbs		87	230	137	135	128	1.98	2.95	1.83	2.09	0.94
Total for Forbs		514	693	218	215	145	11.00	8.14	2.81	2.73	1.01

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 13

Type	Species	Strip Frequency				Average Cover %				
		'04	'07	'10	'12	'04	'07	'09	'10	'12
B	Artemisia tridentata wyomingensis	74	78	73	76	4.24	5.75	8.01	7.17	5.76
B	Chrysothamnus viscidiflorus viscidiflorus	45	83	75	74	1.58	3.29	4.94	4.49	1.62
B	Eriogonum microthecum	30	35	31	29	.36	.47	-	1.16	.38
B	Gutierrezia sarothrae	0	28	3	15	-	.10	.18	.06	.11
B	Kochia prostrata	0	3	3	8	-	.00	-	.18	.07
B	Leptodactylon pungens	0	0	1	0	-	-	-	-	-
B	Opuntia sp.	7	13	2	2	.00	.00	.03	.03	.03
Total for Browse		156	240	188	204	6.19	9.63	13.18	13.10	7.98

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 13

Species	Percent Cover				
	'04	'07	'09	'10	'12
Artemisia tridentata wyomingensis	5.78	4.13	6.41	5.10	6.00
Chrysothamnus viscidiflorus viscidiflorus	1.61	3.71	2.75	3.53	2.18
Eriogonum microthecum	.55	.58	-	.71	.15
Gutierrezia sarothrae	-	.18	.25	-	.01
Kochia prostrata	-	.01	.01	-	-
Opuntia sp.	-	-	.06	.06	.06

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 13

Species	Average leader growth (in)				
	'04	'07	'09	'10	'12
Artemisia tridentata wyomingensis	3.5	1.4	1.2	1.5	0.2

BASIC COVER--

Management unit 16R, Study no: 13

Cover Type	Average Cover %				
	'04	'07	'09	'10	'12
Vegetation	19.82	30.82	33.70	30.17	19.26
Rock	0	0	0	.15	.00
Pavement	0	.01	0	.01	0
Litter	26.92	29.48	37.84	31.23	41.99
Cryptogams	4.80	1.99	2.69	.62	1.11
Bare Ground	60.34	52.40	47.35	51.52	51.68

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 13, Study Name: Upper Porphyry Bench

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
12.8	7.1	43.6	28.9	27.5	1.7	8.9	80.0	0.5

PELLET GROUP DATA--

Management unit 16R, Study no: 13

Type	Quadrat Frequency					Days use per acre (ha)				
	'04	'07	'09	'10	'12	'04	'07	'09	'10	'12
Sheep	-	-	-	-	2	-	-	1 (3)	-	2 (5)
Rabbit	56	89	63	44	24	-	-	-	-	-
Grouse	-	-	-	-	1	-	-	-	-	9 groups/acre
Elk	1	6	6	4	2	-	1 (3)	14 (35)	-	8 (20)
Deer	47	52	56	50	34	96 (236)	171 (423)	152 (375)	71 (175)	78 (192)
Cattle	3	2	2	4	2	1 (3)	5 (12)	13 (32)	4 (11)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 13

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia tridentata wyomingensis</i>									
04	2380	0	4	96	-	13	29	69	20/30
07	3420	37	16	47	22960	19	7	30	20/30
09	No Density Collected								15/22
10	3620	43	28	30	260	14	9	27	18/29
12	4140	43	30	26	260	13	79	17	14/22
<i>Chrysothamnus depressus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								7/12
10	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
04	2080	0	100	0	1580	0	0	0	9/13
07	12100	49	51	0	4540	2	6	0	6/9
09	No Density Collected								5/8
10	6000	15	85	0	-	.66	0	8	6/11
12	6160	27	68	5	140	10	75	6	3/8
<i>Eriogonum microthecum</i>									
04	2020	19	81	-	-	0	0	0	6/7
07	4760	42	58	-	6200	3	12	0	4/4
09	No Density Collected								3/7
10	3760	11	89	-	20	0	0	0	4/5
12	3120	15	85	-	40	2	22	0	3/3

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Gutierrezia sarothrae</i>									
04	0	0	0	-	-	0	0	0	-/-
07	1260	35	65	-	940	0	0	0	7/7
09	No Density Collected								9/9
10	100	0	100	-	-	0	0	0	8/10
12	660	85	15	-	140	0	0	0	4/3
<i>Kochia prostrata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	60	67	33	-	40	0	0	0	2/3
09	No Density Collected								6/6
10	120	83	17	-	20	0	0	0	5/5
12	240	8	92	-	-	17	33	0	3/5
<i>Leptodactylon pungens</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
10	20	0	100	-	-	0	0	0	3/5
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
04	140	0	100	0	-	0	0	0	2/8
07	260	38	38	23	-	0	0	0	2/7
09	No Density Collected								4/7
10	40	0	100	0	-	0	0	0	3/9
12	40	50	50	0	-	0	0	50	3/9

CONSUMER BENCH NORTH - TREND STUDY NO. 16R-14-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT

Land Ownership: BLM

Elevation: 6,015 ft (1,833 m)

Aspect: North

Slope: 5%

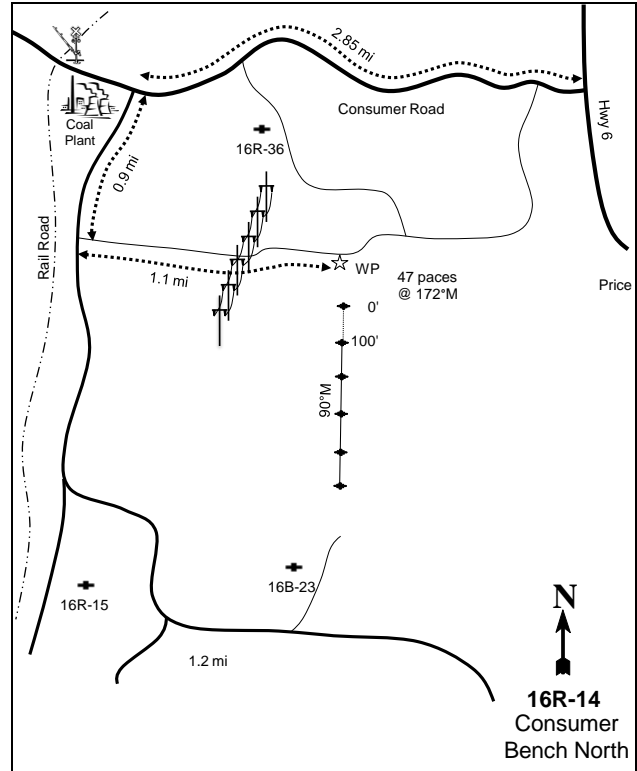
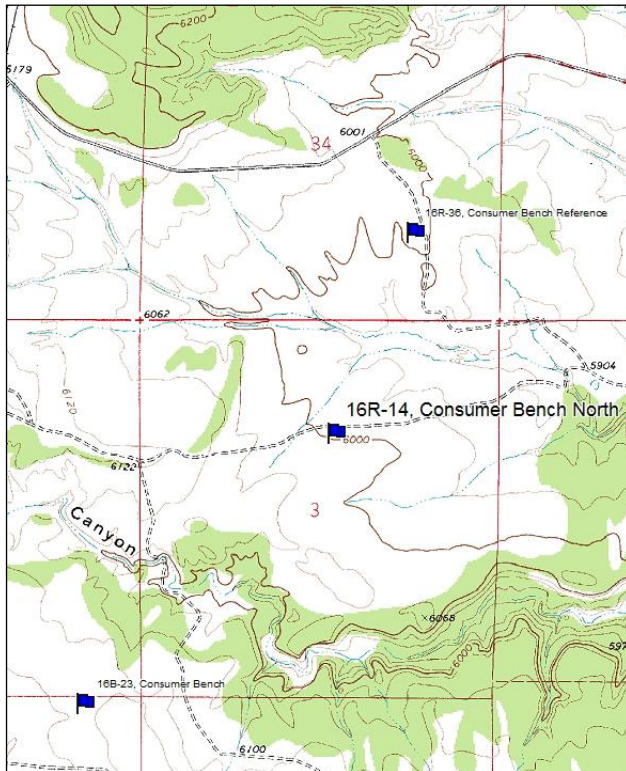
Transect bearing: 190° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: From the junction of US 6 and SRR 139 in Price, drive west on SSR 139 for 2.1 miles to a dirt road on the left (south) side of the road. Make an immediate left and drive 0.3 miles to a fork. Take the right fork at the derrick pup and drive 0.1 miles. Stay left and drive 0.2 miles to a fork and drive another 0.1 miles to another fork. Stay left at the fork and drive 0.3 miles to a fork. Stay left at the fork and drive 0.1 miles to a better road. Turn right and drive 0.1 miles through a dry creek and gully. Proceed through the dry creek can drive 0.4 miles to a fork. Go straight and drive 0.3 miles to the witness post on the left (south) side of the road. Witness post is near a natural gas pipeline sign. From the witness post, walk 47 paces at 172°M to the 0-foot stake. The 0-foot stake is marked with browse tag #63. (Alternate route and probably better route is to drive ~2.8 miles from the junction of US 6 and SSR 139 to a road to the right (south) just before the railroad tracks. Turn on this road and drive ~1.0 mile to Trestle road. Turn left and drive ~0.6 miles to a fork, stay left. Continue east for ~0.6 mile to the witness post on the right (south) side of the road).

Map Name: Standardville

Diagrammatic Sketch:



Township: 14S Range: 9E Section: 3

GPS: NAD 83, UTM 12S 508561 E 4387765 N

Site Description

Site Information: The study is located approximately six miles northwest of Price, on a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, north of Garley Canyon. The study was established prior to treatment in 2005 on land administrated by the Bureau of Land Management (BLM) to monitor a Lawson double drum aerator project. The study occurs on the BLM Consumers Wash allotment. In the fall of 2005, the study site was treated with a Lawson double drum aerator and was seeded with a mix of grass, forb, and browse species. Wyoming big sagebrush and forage kochia (*Kochia prostrata*) were aerially applied to the treatment area in the spring of 2006 (Table - Seed Mix). The objectives of the project are to improve winter range conditions for mule deer, establish drought resistant forage, and improve the health of sagebrush by reducing decadence and diversifying the age-class of the sagebrush community (WRI Database 2013). Pellet groups were sampled in high abundance for deer in 2005, 2008, and 2012. Pellet groups were sampled in moderate abundance for elk in 2005 and light abundance in 2012, though there were no sampled pellet groups in 2008. Pellet groups were sampled in light abundance for cattle in 2008 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is Wyoming big sagebrush. The sagebrush is a moderately used population with high decadence and good vigor within the population, though vigor has been high in prior years. Since the treatment, the recruitment of young sagebrush plants to the population has been fairly good, but recruitment was poor prior to treatment. However, there were a very high number of seedlings sampled in 2005. As a seeded species, fourwing saltbush was sampled for the first time in 2008 in low abundance. Other browse species sampled on the site include low rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Since the outset of the study, grasses have been moderately diverse and abundant, with bottlebrush squirreltail (*Sitanion hystrix*) dominating the herbaceous understory and providing the majority of the grass cover, though in 2012 cover decreased substantially. Indian ricegrass (*Oryzopsis hymenoides*) is the only other grass species on the site to provide notable cover. The annual grass species cheatgrass (*Bromus tectorum*) is present on the site, though occurring in very low abundance. Seeded species sampled on the site include crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. smithii*), Russian wildrye (*Elymus junceus*), and Indian ricegrass (*Oryzopsis hymenoides*). However, Indian ricegrass was present prior to the treatment. Following the treatment, forbs were not abundant or diverse, but prior to the treatment forbs were moderately diverse. The dominant perennial forb species is scarlet globemallow (*Sphaeralcea coccinea*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Hernandez component, which occurs on fan remnants. The parent material consists of alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a slightly alkaline soil reaction (pH 7.4) (Table - Soil Analysis Data). Bare ground cover is high, though with a high amount of litter and moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to rills, and pedestalling around shrubs and perennial species. In 2008 and 2012, the soil erosion condition was classified as slight due to soil movement, pedestalling, and flow patterns.

Pre vs. Three Years Post Treatment, 2005 vs. 2008

Browse: The density of Wyoming big sagebrush decreased slightly by 12% from 4,580 plants/acre to 4,040 plants/acre, and canopy cover decreased slightly from 15% to 14%. The health of the sagebrush population remained in poor condition with decadence decreasing from 75% to 63% and poor vigor increasing from 50%

to 54% of the population. The recruitment of young sagebrush improved from 2% to 28% of the population. Fourwing saltbush was sampled following the treatment at 20 plants/acre.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover decreased from 22% to 16%. Bottlebrush squirreltail remained similar in nested frequency, but decreased in cover from 21% to 13%. Indian ricegrass increased in nested frequency and cover increased from 1% to 2%.

Forbs: The sum of nested frequency of perennial forbs increased substantially by 27%, but cover decreased from 2% to 1%. The diversity of forb species decreased substantially. With the exception of scarlet globemallow, forbs are rare on the site. Scarlet globemallow provided 1% cover in both sample years.

Trend Assessments

Browse:

- **2008 to 2012 - stable (0):** The density of Wyoming big sagebrush remained similar at 4,380 plants/acre, and canopy cover increased to 15%. The health of the sagebrush population improved with decadence decreasing to 31% and plants displaying poor vigor decreasing to 13%. Recruitment of young sagebrush plants remained good within the population.

Grass:

- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial grasses decreased 20%, and cover decreased to 7%. Bottlebrush squirreltail decreased significantly in nested frequency, and decreased in cover to 3%. Indian ricegrass significantly increased in nested frequency and cover increased to 3%.

Forb:

- **2007 to 2012 - down (-2):** Forbs became rare on the site. The sum of nested frequency of perennial forbs decreased 56%, and cover decreased to less than 1%.

SEED MIX--

Management unit 16R, Study no: 14

Project Name: Price West Benches Year 2- Consumers-Airport					
WRI Database #: 228					
Application: Double Aerator Drum		Acres: 1,851		Application: Aerial Seed	
				Acres: 2,750	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Crested Wheatgrass 'Douglas'	1150	0.62	B	Sagebrush, Wyoming
G	Crested Wheatgrass 'Hycrest'	1000	0.54	B	Forage Kochia
G	Indian Ricegrass 'Nezpar'	849	0.46	Total Pounds:	
G	Indian Ricegrass 'Rimrock'	1000	0.54	PLS Pounds:	
G	Russian Wildrye 'Bozoisky'	4115	2.22		
G	Western Wheatgrass	1850	1.00		
F	Alfalfa 'Ladak+'	750	0.41		
F	Alfalfa 'Nomad'	750	0.41		
F	Alfalfa 'Ranger'	750	0.41		
F	Sainfoin 'Eski'	2500	1.35		
F	Small Burnet 'Delar'	1500	0.81		
F	Yellow Sweetclover	416	0.22		
B	Fourwing Saltbush	2000	1.08		
Total Pounds:		18630	10.06		
PLS Pounds:			8.44		

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 14

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	<i>Agropyron cristatum</i>	a ⁻	a ²	b ¹⁸	-	.03	.32
G	<i>Agropyron smithii</i>	-	3	3	-	.00	.00
G	<i>Bromus tectorum</i> (a)	2	3	-	.01	.01	-
G	<i>Elymus junceus</i>	a ⁻	a ²	b ¹³	-	.15	.53
G	<i>Oryzopsis hymenoides</i>	21	45	108	.97	1.91	3.12
G	<i>Poa secunda</i>	-	-	6	-	-	.04
G	<i>Sitanion hystrix</i>	c ³²²	b ²⁸⁶	a ¹³³	20.90	13.18	3.28
G	<i>Sporobolus cryptandrus</i>	1	2	3	.00	.00	.01
G	<i>Stipa comata</i>	1	14	-	.06	.67	-
G	<i>Vulpia octoflora</i> (a)	b ³⁸	a ⁴	a ⁻	.57	.01	-
Total for Annual Grasses		40	7	0	0.58	0.02	0
Total for Perennial Grasses		345	354	284	21.94	15.96	7.32
Total for Grasses		385	361	284	22.53	15.99	7.32
F	<i>Arabis</i> sp.	2	-	-	.00	-	-
F	<i>Astragalus convallarius</i>	3	9	1	.44	.05	.00
F	<i>Castilleja</i> sp.	2	-	-	.03	-	-
F	<i>Chenopodium leptophyllum</i> (a)	b ⁸⁸	a ¹³	a ⁶	.65	.04	.01
F	<i>Descurainia pinnata</i> (a)	b ²⁹	a ⁻	a ³	.37	-	.01
F	<i>Eriogonum ovalifolium</i>	5	-	-	.01	-	-
F	<i>Eriogonum umbellatum</i>	4	-	-	.03	-	-
F	<i>Gayophytum ramosissimum</i> (a)	2	-	-	.00	-	-
F	<i>Gilia</i> sp. (a)	-	-	-	.00	-	-
F	<i>Lappula occidentalis</i> (a)	11	1	-	.05	.00	-
F	<i>Lepidium montanum</i>	8	4	7	.18	.03	.01
F	<i>Machaeranthera canescens</i>	-	-	2	-	-	.00
F	<i>Machaeranthera grindelioides</i>	3	-	-	.15	-	-
F	<i>Penstemon</i> sp.	-	-	-	.01	-	-
F	<i>Phlox longifolia</i>	2	2	-	.00	.00	-
F	<i>Plantago patagonica</i> (a)	1	-	-	.00	-	-
F	<i>Ranunculus testiculatus</i> (a)	1	-	-	.00	-	-
F	<i>Salsola iberica</i> (a)	a ⁻	a ⁻	b ¹⁹	-	-	.03
F	<i>Schoenrambe linifolia</i>	a ⁵	b ³⁵	a ⁻	.04	.33	-
F	<i>Senecio integerrimus</i>	5	-	-	.01	-	-
F	<i>Sphaeralcea coccinea</i>	ab ⁵⁹	b ⁷⁷	a ⁴³	1.30	1.00	.09
F	<i>Townsendia</i> sp.	2	-	3	.00	-	.00
Total for Annual Forbs		132	14	28	1.09	0.05	0.05
Total for Perennial Forbs		100	127	56	2.22	1.43	0.12
Total for Forbs		232	141	84	3.32	1.48	0.17

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 14

Type	Species	Percent Cover			Average Cover %		
		'05	'08	'12	'05	'08	'12
B	Artemisia tridentata wyomingensis	86	80	83	17.22	10.89	12.04
B	Atriplex canescens	0	1	1	-	-	-
B	Chrysothamnus viscidiflorus	8	12	17	.48	.27	.36
B	Gutierrezia sarothrae	14	38	31	.50	1.72	.33
B	Opuntia sp.	11	11	10	.77	.36	.44
Total for Browse		119	142	142	18.97	13.25	13.17

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 14

Species	Percent Cover		
	'05	'08	'12
Artemisia tridentata wyomingensis	14.43	13.58	14.98
Chrysothamnus viscidiflorus	.25	.15	.15
Gutierrezia sarothrae	1.01	1.33	.05
Opuntia sp.	.26	.20	.10

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 14

Species	Average leader growth (in)		
	'05	'08	'12
Artemisia tridentata wyomingensis	2.3	1.5	0.6

BASIC COVER--

Management unit 16R, Study no: 14

Cover Type	Average Cover %		
	'05	'08	'12
Vegetation	37.09	32.66	20.22
Rock	0	0	.03
Pavement	.01	.06	.03
Litter	29.23	41.51	42.76
Cryptogams	3.65	1.40	.82
Bare Ground	43.91	44.06	52.27

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 14, Study Name: Consumer Bench North

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
13.6	7.4	28.0	45.2	26.8	1.3	6.6	118.4	0.4

PELLET GROUP DATA--

Management unit 16R, Study no: 14

Type	Quadrat Frequency			Days use per acre (ha)		
	'05	'08	'12	'05	'08	'12
Rabbit	15	45	18	-	-	-
Elk	11	3	1	28 (69)	-	13 (31)
Deer	38	65	29	48 (119)	84 (207)	70 (174)
Cattle	-	3	-	-	2 (5)	-

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 14

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
05	4580	2	23	75	40600	38	21	50	23/30
08	4040	27	10	63	1100	17	30	54	19/31
12	4380	24	45	31	620	31	47	13	17/29
<i>Atriplex canescens</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	100	0	-	-	0	0	0	41/30
12	20	100	0	-	-	0	100	0	25/23
<i>Chrysothamnus viscidiflorus</i>									
05	320	0	100	-	-	0	38	0	11/15
08	700	46	54	-	-	6	37	6	9/14
12	840	7	93	-	80	17	60	2	5/8
<i>Gutierrezia sarothrae</i>									
05	1500	9	91	0	140	0	0	0	11/12
08	2040	1	94	5	-	2	2	.98	9/11
12	2600	94	6	0	360	.76	0	0	6/5
<i>Opuntia sp.</i>									
05	360	0	100	0	-	0	0	11	5/16
08	260	23	54	23	-	0	0	23	4/15
12	240	25	75	0	-	0	0	0	4/14

CONSUMER BENCH 2 - TREND STUDY NO. 16R-15-12

[Project #228](#)

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT

Land Ownership: BLM

Elevation: 6,126 ft. (1,867 m)

Aspect: Northeast

Slope: 8%

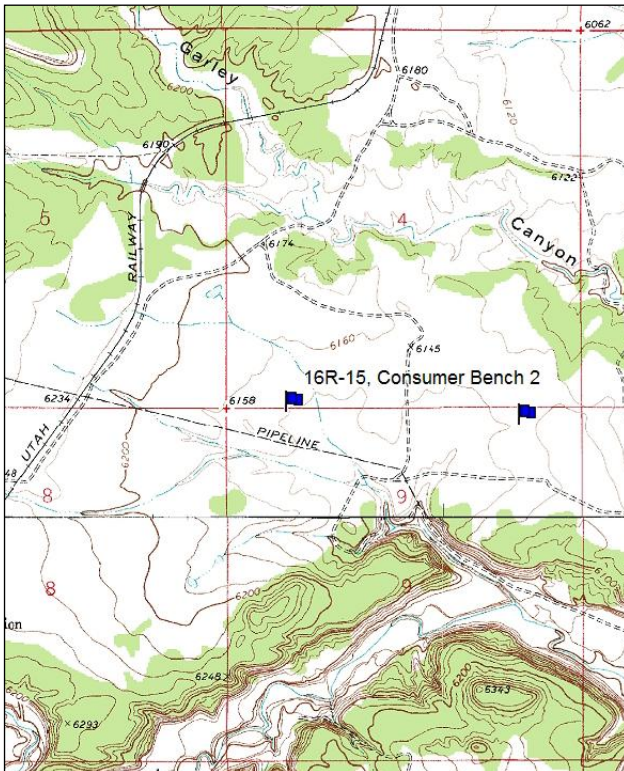
Transect bearing: 309° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:

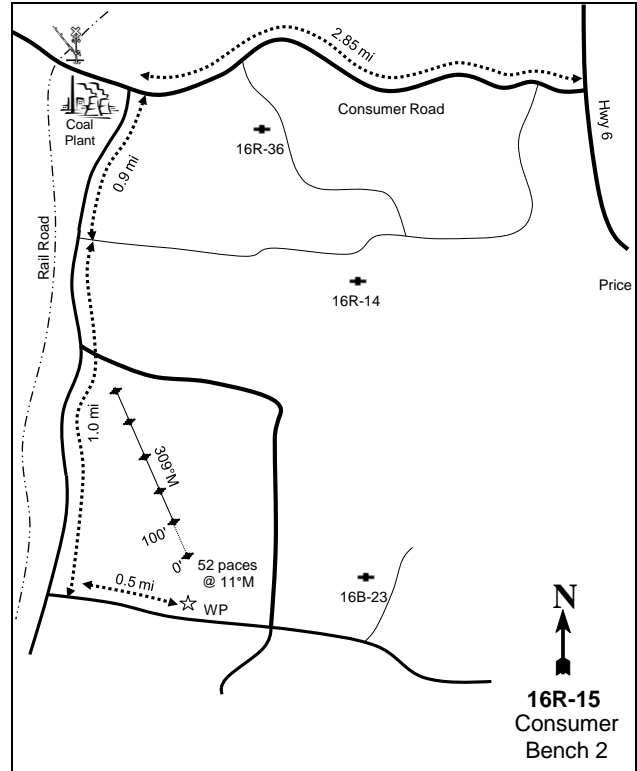
From the junction of US 6 and SSR 139 in Price, drive west on SSR 139 for 2.8 miles to a dirt road on the left (south) side of the road. Drive 0.8 miles on this road that parallels the railroad tracks to a two-track road on the left. Continue straight another 0.1 miles to another side road on the right and left. Continue straight (south) for 1.0 miles passing through a wash and a gas derrick road on the left to fork. Stay left at the fork and drive 0.5 miles to the witness post left (north) side of the road. From the witness post, walk 52 paces at 11°M to the 0' stake. The 0' stake is marked with browse tag #64. (Road to site are not shown or have changed from Topo USA).

Map Name: Standardville



Township: 14S Range: 9E Section: 9

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 506383 E 4386603 N

Site Description

Site Information: The study is located approximately six miles northwest of Price, on a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, north of Garley Canyon. The study was established prior to treatment in 2005 on land administrated by the Bureau of Land Management (BLM) to monitor a Lawson single drum aerator project. The study occurs on the BLM Consumers Wash allotment. In the fall of 2005, the study site was treated with a Lawson single drum aerator and was seeded with a mix of grass, forb, and browse species. Wyoming big sagebrush and forage kochia (*Kochia prostrata*) were aerially applied to the treatment area in the spring of 2006 (Table - Seed Mix). Prior to 2012, a pipeline project removed most of the vegetation from belt1 of the transect. The objectives of the project are to improve winter range conditions for mule deer, establish drought resistant forage, and improve the health of sagebrush by reducing decadence and diversifying the age class of the sagebrush community (WRI Database 2013). Pellet groups were sampled in high abundance for deer in 2005 and 2008, and moderate abundance in 2012. Pellet groups were sampled in light abundance for elk in 2005 and no pellet groups were sampled in 2008 and 2012 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are Wyoming big sagebrush and forage kochia, though forage kochia was sampled in low abundance. Wyoming big sagebrush is the key browse species. Following the aerator treatment, the health of the sagebrush population improved with moderate to low amount of decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was excellent following the treatment, but prior to the treatment recruitment of young plants was very poor. Utilization of sagebrush plants was light to moderate in 2005 and 2008, and was heavy in 2012. After the treatment, the seeded species forage kochia was sampled in the 2008 in low abundance. Other browse species sampled on the site include low rabbitbrush (*Chrysothamnus viscidiflorus*), dwarf rabbitbrush (*C. depressus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: The soil is classified as part of the Hernandez component, which occurs on fan remnants. The parent material consists of alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). Grasses are not diverse, but are moderately abundant. The perennial species bottlebrush squirreltail (*Sitanion hystrix*) and Indian ricegrass (*Oryzopsis hymenoides*) are the dominant species on the site. The annual species cheatgrass (*Bromus tectorum*) is very rare on the site. Forbs are not abundant or diverse on the site. Forbs were fairly abundant and diverse on the site prior to treatment, but have since became rare on the site. The dominant perennial forb species on the site is scarlet globemallow (*Sphaeralcea coccinea*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Hernandez component, which occurs on fan remnants. The parent material consists of alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.6). Phosphorus may have limited availability for plant growth and development at 5.1 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is very high with a moderate amount of litter, vegetation, and cryptograms providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2005 and 2008. The soil erosion condition was classified as slight in 2012 due to surface litter, pedestalling, flow patterns, gully formation, and soil movement.

Pre vs. Three Years Post Treatment, 2005 vs. 2008

Browse: The density of Wyoming big sagebrush increased just over two-fold from 3,420 plants/acre to 7,880 plants/acre, but canopy cover decreased from 10% to 8%. Much of the increase in density was due to a substantial increase in the recruitment of young sagebrush plants from 1% to 63% of the population. The health of the sagebrush population improved with decadence decreasing from 71% to 22% and poor vigor decreasing from 49% to 12% of the population. Forage kochia was sampled following the treatment at 60 plants/acre.

Grasses: The sum of nested frequency of perennial grasses increased markedly by 51% and cover increased from 3% to 9%. Bottlebrush squirreltail remained similar in nested frequency, but increased in cover from 2% to 5%. Indian ricegrass significantly increased in nested frequency, and cover increased from 1% to 3%.

Forbs: The sum of nested frequency of perennial forbs increased substantially by 53%, but cover decreased from 9% to 4%. With the exception of scarlet globemallow and mountain pepperweed (*Lepidium montanum*), forbs are rare on the site. Scarlet globemallow decreased in cover from 9% to 3% and mountain pepperweed was sampled for the first time following the treatment at 1% cover.

Trend Assessments

Browse:

- **2008 to 2012 - stable (0):** The density of Wyoming big sagebrush increased 26% to 9,960 plants/acre, though canopy cover decreased to 7%. The increase in density can be attributed to the increase in recruitment of young plants. The health of the sagebrush population remained good on the site. Recruitment of young sagebrush plants remained good within the population.

Grass:

- **2008 to 2012 - down (-2):** The sum of nested frequency of perennial grasses decreased 21%, and cover decreased to 7%. Bottlebrush squirreltail decreased significantly in nested frequency, and decreased in cover to 1%. Indian ricegrass significantly increased in nested frequency and cover increased to 5%.

Forb:

- **2008 to 2012 - down (-2):** Forbs became rare on the site. The sum of nested frequency of perennial forbs decreased 89%, and cover decreased to less than 1%.

SEED MIX--

Management unit 16R, Study no: 15

Project Name: Price West Benches Year 2- Consumers-Airport						
WRI Database #: 228						
Application: Double Aerator Drum			Acres: 1,851		Application: Aerial Seed	
			Acres: 2,750			
Seed type			lbs in mix	lbs/acre	Seed type	
G	Crested Wheatgrass 'Douglas'		1150	0.62	B	Sagebrush, Wyoming
G	Crested Wheatgrass 'Hycrest'		1000	0.54	B	Forage Kochia
G	Indian Ricegrass 'Nezpar'		849	0.46	Total Pounds:	
G	Indian Ricegrass 'Rimrock'		1000	0.54	PLS Pounds:	
G	Russian Wildrye 'Bozoisky'		4115	2.22		
G	Western Wheatgrass		1850	1.00		
F	Alfalfa 'Ladak+'		750	0.41		
F	Alfalfa 'Nomad'		750	0.41		
F	Alfalfa 'Ranger'		750	0.41		
F	Sainfoin 'Eski'		2500	1.35		
F	Small Burnet 'Delar'		1500	0.81		
F	Yellow Sweetclover		416	0.22		
B	Fourwing Saltbush		2000	1.08		
Total Pounds:			18630	10.06		
PLS Pounds:				8.44		

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 15

T y P e	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	Agropyron cristatum	-	6	5	-	.04	.03
G	Agropyron smithii	-	-	4	-	-	.03
G	Agropyron trachycaulum	a2	b17	a8	.15	.42	.56
G	Bouteloua gracilis	3	-	-	.00	-	-
G	Bromus tectorum (a)	-	-	2	.00	-	.00
G	Elymus junceus	-	2	-	-	.03	-
G	Oryzopsis hymenoides	a52	b86	c117	.35	2.97	4.98
G	Sitanion hystrix	b107	b137	a60	1.96	5.43	1.31
G	Stipa comata	-	-	2	-	-	.00
Total for Annual Grasses		0	0	2	0.00	0	0.00
Total for Perennial Grasses		164	248	196	2.47	8.90	6.92
Total for Grasses		164	248	198	2.48	8.90	6.93
F	Chenopodium fremontii (a)	b360	a3	a6	5.23	.01	.01
F	Chenopodium leptophyllum(a)	c71	b13	a-	.18	.02	-
F	Collomia linearis (a)	4	-	-	.03	-	-
F	Comandra pallida	3	-	-	.18	-	-
F	Cryptantha sp.	b14	a-	a-	.12	-	-
F	Cryptantha sp.(a)	-	7	-	-	.02	-
F	Descurainia pinnata (a)	b193	a2	a-	4.76	.00	-

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
F	Eriogonum cernuum (a)	c104	b29	a11	.33	.07	.02
F	Erodium cicutarium (a)	-	7	-	-	.04	-
F	Lactuca serriola (a)	1	-	-	.03	-	-
F	Lappula occidentalis (a)	c147	b24	a-	2.61	.06	-
F	Lepidium montanum	b68	b74	a1	3.62	.87	.03
F	Mentzelia albicaulis (a)	-	4	-	-	.03	-
F	Salsola iberica (a)	a5	a2	b59	.01	.00	1.44
F	Schoenrambe linifolia	b22	a10	a-	.25	.04	-
F	Sisymbrium altissimum (a)	2	-	-	.01	-	-
F	Sphaeralcea coccinea	b178	c252	a38	8.61	3.18	.12
F	Tragopogon dubius (a)	2	-	-	.03	-	-
Total for Annual Forbs		889	91	76	13.24	0.28	1.46
Total for Perennial Forbs		285	336	39	12.79	4.10	0.15
Total for Forbs		1174	427	115	26.04	4.38	1.62

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 15

Type	Species	Strip Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
B	Artemisia tridentata wyomingensis	79	81	88	9.97	6.69	7.32
B	Chrysothamnus depressus	0	0	1	-	-	.00
B	Chrysothamnus viscidiflorus	16	35	44	1.39	.96	.87
B	Gutierrezia sarothrae	16	46	25	.38	.68	.08
B	Kochia prostrata	0	2	5	-	-	.00
B	Opuntia sp.	7	9	9	.03	.15	.31
Total for Browse		118	173	172	11.78	8.49	8.59

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 15

Species	Percent Cover		
	'05	'08	'12
Artemisia tridentata wyomingensis	10.35	8.26	6.76
Chrysothamnus viscidiflorus	.61	.90	1.00
Gutierrezia sarothrae	.65	1.20	.23
Kochia prostrata	-	-	.11
Opuntia sp.	-	.05	.01

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 15

Species	Average leader growth (in)		
	'05	'08	'12
<i>Artemisia tridentata wyomingensis</i>	2.4	2.6	0.2

BASIC COVER--

Management unit 16R, Study no: 15

Cover Type	Average Cover %		
	'05	'08	'12
Vegetation	29.83	19.66	16.92
Pavement	.06	.05	0
Litter	27.04	22.83	30.31
Cryptogams	6.06	2.30	1.94
Bare Ground	51.23	64.75	61.54

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 15, Study Name: Consumer Bench 2

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.0	7.6	24.4	47.4	28.2	1.0	5.1	86.4	0.4

PELLET GROUP DATA--

Management unit 16R, Study no: 15

Type	Quadrat Frequency			Days use per acre (ha)		
	'05	'08	'12	'05	'08	'12
Rabbit	36	50	17	-	-	-
Elk	4	6	-	3 (8)	-	-
Deer/Sheep	62	58	46	113 (279)	52 (127)	32 (78)

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 15

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
05	3420	1	28	71	53000	39	19	49	24/27
08	7880	63	15	22	12260	14	13	12	21/26
12	9960	66	21	13	1560	18	63	17	17/22
<i>Ceratoides lanata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	19/13
<i>Chrysothamnus depressus</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	100	0	5/4

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Chrysothamnus nauseosus									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	37/37
Chrysothamnus viscidiflorus									
05	740	51	46	3	3920	0	0	0	11/16
08	2420	38	61	1	640	14	9	0	8/11
12	3060	41	58	1	-	10	86	58	4/8
Gutierrezia sarothrae									
05	420	10	86	5	860	0	0	5	12/15
08	4060	16	83	1	80	5	6	0	8/8
12	880	48	52	0	60	0	0	0	4/5
Kochia prostrata									
05	0	0	0	-	-	0	0	0	-/-
08	60	100	0	-	20	0	0	0	-/-
12	120	17	83	-	-	33	67	0	2/5
Opuntia sp.									
05	180	11	78	11	-	0	0	11	4/16
08	200	20	70	10	20	0	0	10	4/18
12	200	10	90	0	40	20	0	30	4/18

BLACK DRAGON BULLHOG - TREND STUDY NO. 16R-25-12

Vegetation Type: Mountain Mahogany

Range Type: Crucial Deer Summer; Substantial Elk Winter

NRCS Ecological Site Description: Mountain Loam (Browse), R047XA420UT

Land Ownership: USFS

Elevation: 7,986 ft (2,434 m)

Aspect: Southeast

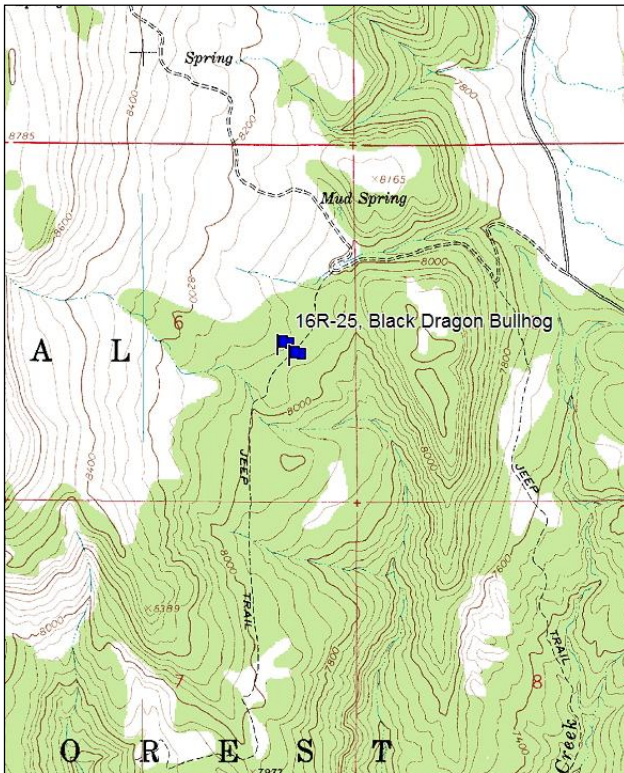
Slope: 11%

Transect bearing: 270° magnetic

Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

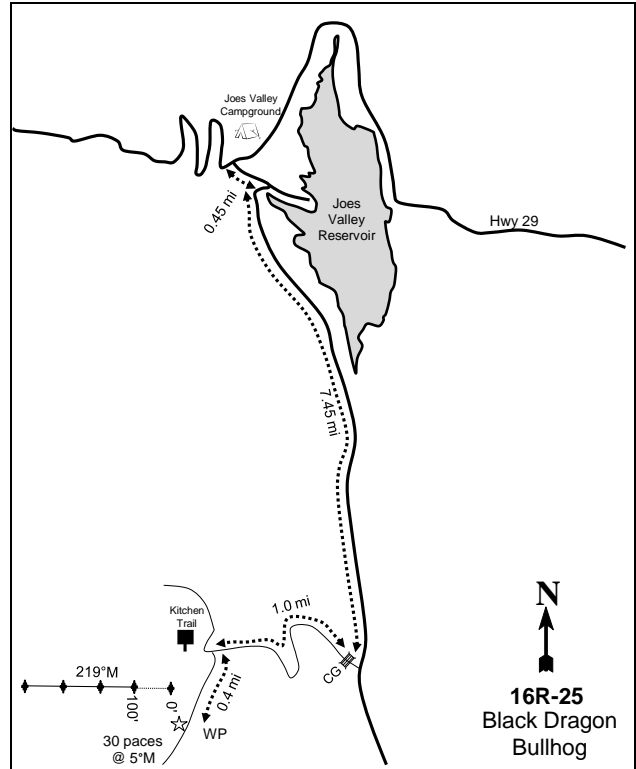
Directions: Drive west on SR 29 to the west side of Joe’s Valley Reservoir. Turn south onto the road that leads to the marina and drive 0.45 miles to a fork and go right. Drive for 7.25 miles to a junction. Turn right and drive 1.0 mile crossing a cattle guard and passing an ATV trail. Turn left onto the road with a sign reading “Kitchen Trail”. Drive for 0.4 miles to a witness post on the right. Walk 30 paces at 5°M to the 0-foot stake marked with browse tag #194.

Map Name: Ferron Canyon



Township: 19S Range: 6E Section: 6

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 475366 E 4338569 N

Site Description

Site Information: The study is located approximately fourteen miles west of Castle Dale within a mountain brush community. The study was established prior to treatment in 2006 on land administrated by the U. S. Forest Service (USFS) to monitor a bullhog project. The study occurs on the USFS Horn Mountain allotment. A total 4,358 acres of a mountain browse and sagebrush (*Artemisia sp.*) communities was treated in 2006-2008 in order to thin and remove encroaching pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) trees and overgrown mountain browse species were trimmed to height of approximately two feet in height. The objective of the project is to winter range for elk, deer, and sage-grouse by thinning pinyon and juniper trees and mountain brush (WRI Database 2013). Deer, elk, and cattle pellet groups were sampled in low abundance on the site in 2006, 2009, and 2012 (Table - Pellet Group Data).

Browse: The preferred browse species sampled on the site are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and true mountain mahogany (*Cercocarpus montanus*). True mountain mahogany is the dominant browse species on the site, providing the majority of the browse canopy cover since the outset of the study. True mountain mahogany is a lightly to moderately used population with low decadence and good vigor within the population (Table - Browse Characteristics). Pinyon pine and Rocky Mountain juniper were scattered across the site in moderate abundance prior to treatment, but following the treatment decreased substantially in size and abundance (Table - Point-Quarter Tree Data). The stage of woodland succession was in phase II prior to treatment, and following the treatment is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Perennial grasses are abundant and diverse on the site. Salina wildrye (*Elymus salina*) and Indian ricegrass (*Oryzopsis hymenoides*) are the most common, with the introduced species intermediate wheatgrass (*Agropyron intermedium*) also being prevalent. The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance on the site in 2012. Forbs are abundant and diverse on the site. Common perennial forb species sampled on the site over the sampled years include wing eriogonum (*Eriogonum alatum*), rayless tansyaster (*Machaeranthera grindelioides*), mat penstemon (*Penstemon caespitosus*), thistleleaf penstemon (*P. pachyphyllus*), and desert phlox (*Phlox austromontana*). Annual forbs species have been rare on the site over the sampled years (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.5) (Table - Soil Analysis Data). Bare ground cover is moderate with a high amount of litter and a moderate amount of vegetation and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2006 and moderate in 2009 due to soil and rock movement, rill and gully formation, pedestalling and flow patterns. The soil erosion condition was classified as stable in 2012.

Pre vs. Three Years Post Treatment, 2006 vs. 2009

Browse: The point-quarter density of pinyon pine decreased from 276 trees/acre to 56 trees/acre and the average diameter decreased from 2.2 inches to 0.8 inches. The average density of juniper remained similar, but the average diameter decreased from 2.4 inches to 0.8 inches. All of the trees sampled of both species following the treatment were less than 4 feet tall. The treatment also reduced the canopy cover of all the preferred browse species. True mountain mahogany had the largest decrease in canopy cover from 17% to 8%.

Grass: Perennial grass sum of nested frequency increased 20% and cover increased from 11% to 14%. Indian ricegrass and bottlebrush squirreltail (*Sitanion hystrix*) increased significantly in nested frequency.

Forb: Perennial forb sum of nested frequency increased 10% and cover increased from 7% to 8%. There was a significant increase in the nested frequency of mat penstemon, bastard toadflax (*Comandra pallida*), and hoary aster (*Machaeranthera canescens*).

Trend Assessments

Browse:

- **2009 to 2012 - slightly up (+1):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. The canopy cover of true mountain mahogany increased to 9%. In comparing the density of true mountain mahogany to the pre treatment data in 2006, the density of mahogany increased from 1,520 plants/acre to 2,180 plants/acre.

Grass:

- **2009 to 2012 - up (+2):** The sum of nested frequency of perennial grasses increased 30%, and cover decreased to 16%. Salina wildrye increased significantly in nested frequency, and cover remained similar at 7%. Indian ricegrass significantly increased in nested frequency and cover increased from 3% to 6%.

Forb:

- **2009 to 2012 - up (+2):** The sum of nested frequency of perennial forbs increased 31%, and cover remained similar at 8%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 25

Type	Species	Nested Frequency			Average Cover %		
		'06	'09	'12	'06	'09	'12
G	Agropyron intermedium	54	53	56	1.43	1.74	2.64
G	Bromus inermis	12	3	3	.18	.03	.03
G	Bromus tectorum (a)	-	-	2	-	-	.00
G	Carex sp.	a8	ab18	b38	.11	.28	.71
G	Elymus salina	ab103	a91	b126	6.16	7.18	6.90
G	Oryzopsis hymenoides	a73	b111	c153	2.60	3.28	5.85
G	Poa secunda	-	-	3	-	-	.03
G	Sitanion hystrix	a-	b18	b11	-	.55	.10
G	Stipa comata	3	17	8	.18	.64	.16
G	Stipa lettermani	6	-	5	.03	-	.00
Total for Annual Grasses		0	0	2	0	0	0.00
Total for Perennial Grasses		259	311	403	10.71	13.71	16.44
Total for Grasses		259	311	405	10.71	13.71	16.44
F	Arabis sp.	8	-	-	.02	-	-
F	Astragalus sp.	1	1	3	.03	.00	.03
F	Astragalus utahensis	12	8	11	.05	.07	.07
F	Calochortus nuttallii	-	3	-	-	.00	-
F	Castilleja linariaefolia	3	11	9	.18	.20	.05
F	Caulanthus crassicaulis	10	16	-	.04	.25	-
F	Chaenactis douglasii	7	9	21	.02	.05	.11
F	Comandra pallida	a12	b30	b40	.08	.39	.44

T y p e	Species	Nested Frequency			Average Cover %		
		'06	'09	'12	'06	'09	'12
F	Cryptantha sp.	-	-	8	-	-	.04
F	Erigeron sp.	9	4	-	.09	.01	-
F	Eriogonum alatum	_{ab} 76	_a 61	_b 89	2.06	1.56	1.01
F	Hymenopappus filifolius	10	15	18	.48	.82	.55
F	Hymenoxys richardsonii	11	6	19	.39	.03	.24
F	Ipomopsis aggregata	_a 6	_a 2	_b 19	.01	.01	.07
F	Lesquerella sp.	_a 4	_b 22	_a 5	.01	.23	.04
F	Machaeranthera canescens	_a -	_b 8	_b 10	-	.63	.10
F	Machaeranthera grindelioides	40	27	38	.85	1.33	1.54
F	Madia glomerata (a)	-	5	-	-	.06	-
F	Oenothera sp.	-	-	3	-	-	.00
F	Penstemon caespitosus	_a 57	_{ab} 74	_b 107	.86	1.07	1.91
F	Penstemon pachyphyllus	_a 23	_{ab} 48	_a 56	.54	.80	.73
F	Penstemon sp.	17	8	-	.49	.23	-
F	Phlox austromontana	24	23	34	.50	.29	1.24
F	Schoenocrambe linifolia	12	8	7	.02	.04	.01
F	Senecio multilobatus	6	-	6	.04	-	.04
F	Taraxacum officinale	1	-	-	.00	-	-
F	Unknown forb-annual (a)	-	1	-	-	.03	-
Total for Annual Forbs		0	6	0	0	0.09	0
Total for Perennial Forbs		349	384	503	6.83	8.07	8.28
Total for Forbs		349	390	503	6.83	8.16	8.28

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 25

T y p e	Species	Strip Frequency		Average Cover %		
		'06	'12	'06	'09	'12
B	Amelanchier utahensis	26	22	2.98	1.45	1.36
B	Artemisia tridentata vaseyana	16	13	.81	.85	1.19
B	Cercocarpus montanus	45	54	11.32	4.52	5.42
B	Chrysothamnus nauseosus albicaulis	1	0	-	.18	-
B	Chrysothamnus viscidiflorus stenophyllus	1	18	.01	-	.45
B	Eriogonum corymbosum	1	1	.00	-	.00
B	Gutierrezia sarothrae	59	18	1.35	1.13	.30
B	Juniperus scopulorum	2	0	.53	-	-
B	Mahonia repens	21	22	.64	.59	.26
B	Pinus edulis	10	4	2.62	-	.00
B	Purshia tridentata	0	1	-	-	-
B	Symphoricarpos oreophilus	3	4	.15	.06	.15
B	Tetradymia canescens	6	10	.03	.03	.33
Total for Browse		191	167	20.47	8.82	9.48

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 25

Species	Percent Cover		
	'06	'09	'12
Amelanchier utahensis	1.75	1.50	1.80
Artemisia nova	-	.18	-
Artemisia tridentata vaseyana	1.15	.50	1.00
Cercocarpus montanus	17.40	7.78	9.18
Chrysothamnus viscidiflorus stenophyllus	-	.18	.68
Eriogonum corymbosum	.06	-	.05
Gutierrezia sarothrae	.93	1.86	.10
Juniperus scopulorum	1.76	-	-
Mahonia repens	.28	.43	.10
Pinus edulis	4.33	-	-
Symphoricarpos oreophilus	.03	.28	.43
Tetradymia canescens	-	.48	.50

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 25

Species	Average leader growth (in)
	'12
Artemisia tridentata vaseyana	0.2

POINT-QUARTER TREE DATA--

Management unit 16R, Study no: 25

Species	Trees per Acre			Average diameter (in)		
	'06	'09	'12	'06	'09	'12
Juniperus osteosperma	30	28	32	2.4	0.8	1.4
Pinus edulis	276	56	87	2.2	0.8	0.8

BASIC COVER--

Management unit 16R, Study no: 25

Cover Type	Average Cover %		
	'06	'09	'12
Vegetation	34.62	28.52	31.67
Rock	7.14	5.77	4.76
Pavement	20.70	8.58	12.38
Litter	33.59	35.20	49.29
Cryptogams	.36	.15	.18
Bare Ground	29.17	29.46	22.03

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 25, Study Name: Black Dragon Bullhog

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.3	7.5	41.2	30.0	28.8	2.3	12.7	137.6	0.6

PELLET GROUP DATA--

Management unit 16R, Study no: 25

Type	Quadrat Frequency			Days use per acre (ha)		
	'06	'09	'12	'06	'09	'12
Rabbit	26	11	6	-	-	-
Elk	4	-	1	2 (5)	9 (23)	5 (13)
Deer	1	-	-	3 (7)	2 (5)	3 (8)
Cattle	1	-	1	1 (2)	2 (4)	-

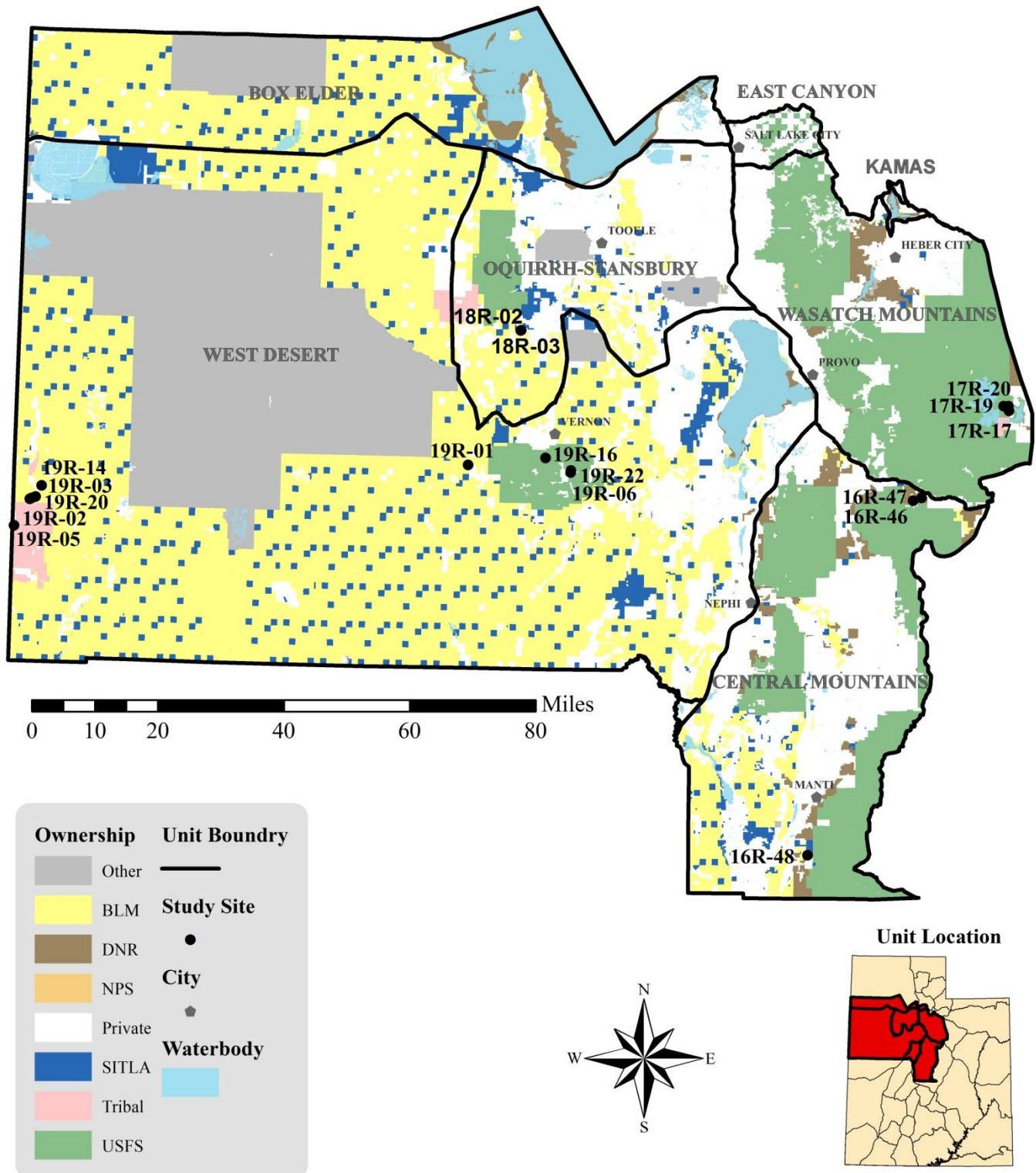
BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 25

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier utahensis</i>									
06	680	38	24	38	20	9	3	29	53/53
09	No Density Collected								25/37
12	680	29	59	12	-	59	18	12	27/32
<i>Artemisia nova</i>									
06	0	0	0	-	-	0	0	0	10/21
09	No Density Collected								10/18
12	0	0	0	-	-	0	0	0	12/19
<i>Artemisia tridentata vaseyana</i>									
06	600	10	70	20	20	3	0	13	14/21
09	No Density Collected								15/22
12	440	45	50	5	-	27	55	0	14/21
<i>Ceanothus velutinus</i>									
06	0	0	0	-	-	0	0	0	14/46
09	No Density Collected								-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Cercocarpus montanus</i>									
06	1520	39	53	8	1500	12	0	4	51/52
09	No Density Collected								27/33
12	2180	41	59	0	80	62	17	11	33/34
<i>Chrysothamnus nauseosus albicaulis</i>									
06	20	100	0	-	-	0	0	0	39/40
09	No Density Collected								7/14
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
06	20	0	100	0	60	0	0	0	5/8
09	No Density Collected								11/17
12	780	10	87	3	-	0	3	10	5/7
<i>Eriogonum corymbosum</i>									
06	40	0	100	-	-	0	0	0	7/10
09	No Density Collected								-/-
12	40	0	100	-	-	0	0	0	6/6

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Gutierrezia sarothrae</i>									
06	3560	12	84	3	40	0	0	1	6/7
09	No Density Collected								8/10
12	480	21	79	0	-	0	0	0	4/6
<i>Juniperus scopulorum</i>									
06	40	0	100	-	20	0	0	0	-/-
09	No Density Collected								-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Mahonia repens</i>									
06	3980	12	88	-	40	0	0	0	3/4
09	No Density Collected								3/4
12	2440	0	100	-	-	0	0	3	3/5
<i>Pinus edulis</i>									
06	220	73	27	-	60	0	0	0	-/-
09	No Density Collected								-/-
12	80	75	25	-	20	0	0	0	-/-
<i>Purshia tridentata</i>									
06	0	0	0	-	-	0	0	0	-/-
09	No Density Collected								-/-
12	20	100	0	-	-	100	0	0	-/-
<i>Symphoricarpos oreophilus</i>									
06	120	17	83	-	20	0	0	0	7/12
09	No Density Collected								7/17
12	80	0	100	-	-	0	0	0	10/19
<i>Tetradymia canescens</i>									
06	160	38	13	50	-	13	0	38	9/16
09	No Density Collected								9/15
12	260	54	46	0	20	23	15	0	9/15

Central Region WRI Studies 2012



DAIRY FORK 1 - TREND STUDY NO. 16R-46-12

Vegetation Type: Pinyon and Juniper

Range Type: Crucial Deer Spring/fall, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Oak\), R047XA432UT](#)

Land Ownership: UDWR

Elevation: 6,332 ft (1,930 m)

Aspect: Southeast

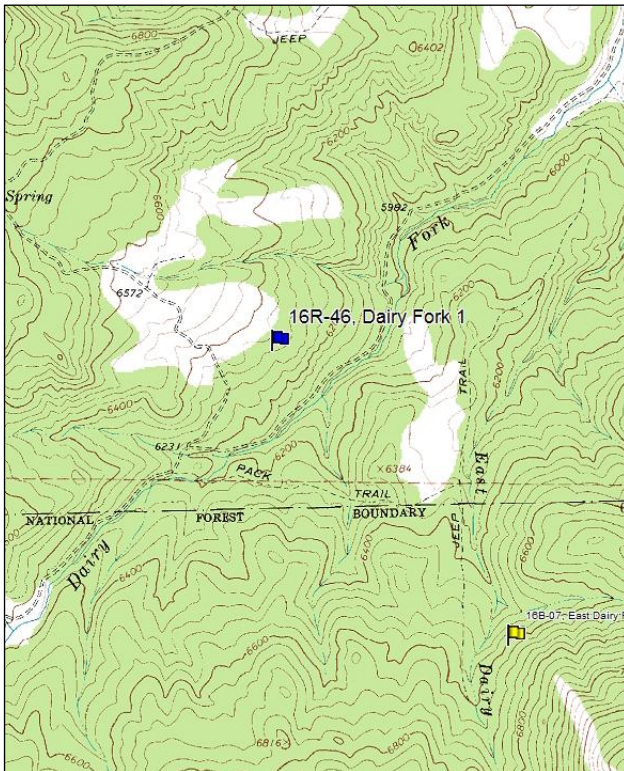
Slope: 9%

Transect bearing: 50° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

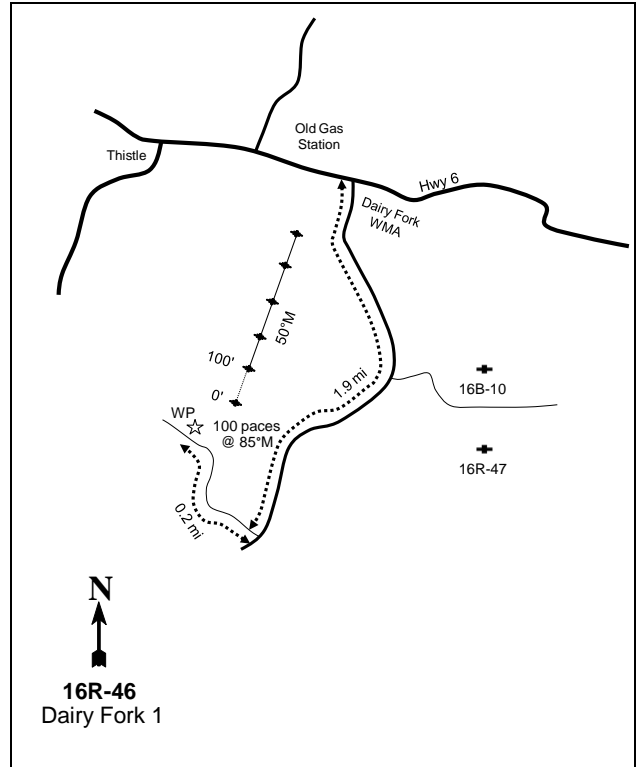
Directions: From the old gas station on hwy 6 near Dairy Fork WMA travel south on FR 066C road. Travel for 1.9 miles to a two track road on the right. Follow the two track road up the hill for 0.2 miles to a witness post on the right side of the road. From the witness post walk 100 paces at 85°M to the 0-foot stake. The 0-foot stake is marked with browse tag #9,166.

Map Name: Mill Fork



Township: 10S Range: 5E Section: 15

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 469674 E 4422067 N

DAIRY FORK 1 - TREND STUDY NO. 16R-46
[Project #2214](#)

Site Information

Site Description: The study is located approximately seven and a half miles to the east of Thistle within pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established prior to treatment in 2012 within the Dairy Fork Wildlife Management Area (WMA) to monitor pinyon and juniper reduction project. Approximately 350 acres were bullhogged during the winter of 2012 through the summer of 2013. Also, approximately 500 acres will be two-way Ely chained in the fall of 2013. Prior to the chaining treatment, the project area will be aerielly seeded with a seed mix of grass, forb, and browse species. An additional seed mix of forb and browse species will be distributed with a seed dribbler during the chaining treatment. The study is located in the bullhog treatment area. An adjacent study Dairy Fork 2 (16R-47) is located within the chaining treatment. The objectives of the project are to decreased pinyon and juniper canopy cover, increased forb and grass cover, and establish preferred browse species (WRI Database 2013). Deer, elk, and cattle pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon pine and Utah juniper were the dominant browse species on the site and provided the majority of the canopy cover prior to treatment. The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), curleaf mountain mahogany (*Cercocarpus ledifolius*), true mountain mahogany (*C. montanus*), antelope bitterbrush (*Purshia tridentata*), and Gambel oak (*Quercus gambelii*). Antelope bitterbrush and Gambel oak were the dominant preferred browse species and provided moderate cover on the site (Table - Browse Trends). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are not overly abundant and are moderately diverse on the site. The dominant grass species is Sandberg bluegrass (*Poa secunda*), though occurring in low abundance. Forbs are not abundant but are fairly diverse on the site. No single forbs species is dominant on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is moderate on the site, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012 due to surface soil movement, soil rock movement, pedestalling around plants, flow patterns, rills, active gully erosion, and soil movement.

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 46

Type	Species	Nested	Average
		Frequency	Cover %
		'12	'12
G	Agropyron spicatum	28	.84
G	Bromus tectorum (a)	6	.01
G	Carex geeyeri	17	.45
G	Oryzopsis hymenoides	17	.40
G	Poa fendleriana	12	.31
G	Poa secunda	77	1.03
G	Sitanion hystrix	22	.52
Total for Annual Grasses		6	0.01
Total for Perennial Grasses		173	3.56
Total for Grasses		179	3.57
F	Alyssum alyssoides (a)	3	.00
F	Antennaria rosea	6	.03
F	Aster chilensis	2	.00
F	Astragalus convallarius	15	.10
F	Astragalus utahensis	23	.22
F	Chaenactis douglasii	4	.01
F	Collinsia parviflora (a)	2	.00
F	Cryptantha sp.	6	.17
F	Cymopterus sp.	13	.06
F	Descurainia pinnata (a)	3	.01
F	Draba sp. (a)	1	.00
F	Eriogonum umbellatum	24	.47
F	Gayophytum ramosissimum(a)	2	.00
F	Lathyrus brachycalyx	9	.01
F	Machaeranthera canescens	5	.02
F	Penstemon caespitosus	19	.38
F	Penstemon watsonii	2	.00
F	Phlox hoodii	13	.36
F	Phlox longifolia	44	.15
F	Physaria sp.	1	.00
F	Ranunculus testiculatus (a)	6	.02
F	Senecio multilobatus	6	.01
F	Veronica biloba (a)	7	.02
Total for Annual Forbs		24	0.07
Total for Perennial Forbs		192	2.05
Total for Forbs		216	2.13

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 46

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Amelanchier utahensis	1	.00
B	Artemisia tridentata vaseyana	8	.00
B	Chrysothamnus viscidiflorus viscidiflorus	2	-
B	Gutierrezia sarothrae	6	.00
B	Juniperus osteosperma	9	13.58
B	Opuntia sp.	10	.83
B	Pinus edulis	8	3.24
B	Purshia tridentata	5	.62
B	Quercus gambelii	17	4.14
B	Symphoricarpos oreophilus	6	.03
B	Tetradymia canescens	1	-
Total for Browse		73	22.48

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 46

Species	Percent Cover '12
Chrysothamnus viscidiflorus viscidiflorus	.01
Gutierrezia sarothrae	.15
Juniperus osteosperma	27.58
Opuntia sp.	.38
Pinus edulis	13.00
Purshia tridentata	2.15
Quercus gambelii	5.51
Symphoricarpos oreophilus	.16

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 46

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	2.3
Cercocarpus montanus	6.9
Purshia tridentata	1.5

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 46

Species	Trees per Acre	Average diameter (in)
	'12	
Juniperus osteosperma	145	9.2
Pinus edulis	73	2.8

BASIC COVER--
Management unit 16R, Study no: 46

Cover Type	Average Cover %
	'12
Vegetation	25.02
Rock	2.42
Pavement	5.98
Litter	54.06
Cryptogams	3.75
Bare Ground	32.72

PELLET GROUP DATA--
Management unit 16R, Study no: 46

Type	Quadrat Frequency	Days use per acre (ha)
	'12	
Rabbit	20	-
Elk	1	2 (5)
Deer	-	1 (2)
Cow	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 46

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)	
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor		
Amelanchier utahensis										
12	20	100	0	-	-	0	0	100	24/34	
Artemisia tridentata vaseyana										
12	160	25	75	-	-	0	0	75	15/19	
Cercocarpus ledifolius										
12	0	0	0	-	-	0	0	0	27/34	
Cercocarpus montanus										
12	0	0	0	-	-	0	0	0	31/33	
Chrysothamnus viscidiflorus viscidiflorus										
12	80	75	25	-	-	0	0	0	6/7	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
12	260	8	85	8	-	0	0	0	6/7	
<i>Juniperus osteosperma</i>										
12	200	40	60	-	20	0	0	0	-/-	
<i>Opuntia sp.</i>										
12	420	10	76	14	-	0	0	10	3/8	
<i>Pinus edulis</i>										
12	160	25	75	-	40	0	0	13	-/-	
<i>Purshia tridentata</i>										
12	220	0	91	9	-	100	0	0	13/39	
<i>Quercus gambelii</i>										
12	2120	61	38	1	80	0	0	.94	35/27	
<i>Symphoricarpos oreophilus</i>										
12	180	11	89	-	-	0	0	0	8/12	
<i>Tetradymia canescens</i>										
12	20	0	100	-	-	0	0	100	10/11	

DAIRY FORK 2 - TREND STUDY NO. 16R-47-12

Vegetation Type: Pinyon and Juniper

Range Type: Crucial Deer Winter/spring, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: UDWR

Elevation: 6,088 ft (1,856 m)

Aspect: North

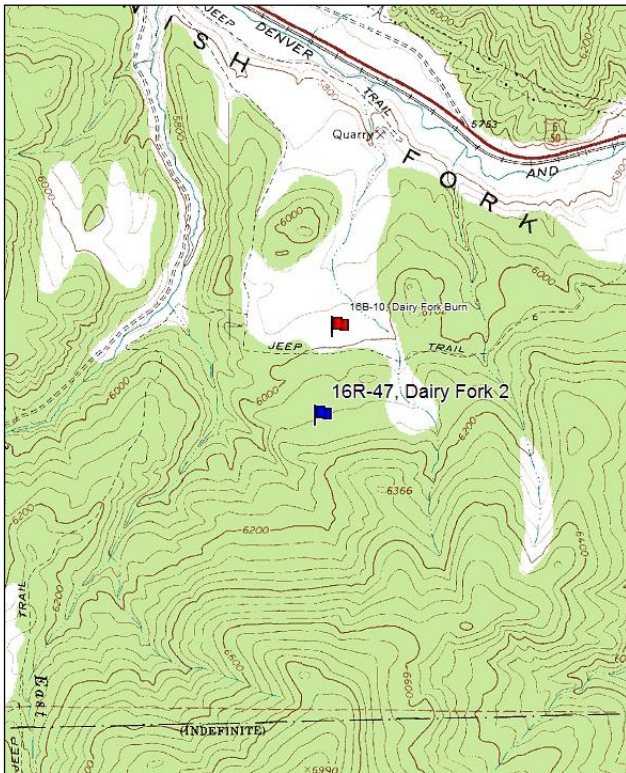
Slope: 7%

Transect bearing: 99° magnetic

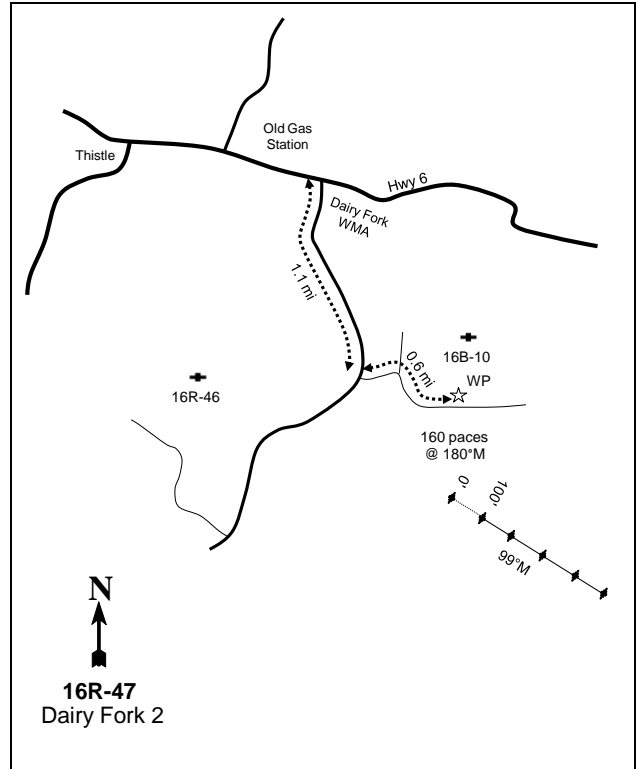
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: From the old gas station on hwy 6 near Dairy Fork WMA travel south on FR 066C road. Travel for 1.9 miles to a two track road on the right.

Map Name: Mill Fork



Diagrammatic Sketch:



Township: 10S Range: 5E Section: 13

GPS: NAD 83, UTM 12S 471854 E 4422727 N

DAIRY FORK 2 - TREND STUDY NO. 16R-47
[Project #2214](#)

Site Information

Site Description: The study is located approximately eight miles to the east of Thistle within pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established prior to treatment in 2012 within the Dairy Fork Wildlife Management Area to monitor pinyon and juniper reduction project. Approximately 350 acres were bullhogged during the winter of 2012 through summer 2013. Also, approximately 500 acres will be two-way Ely chained in the fall of 2013. Prior to the chaining treatment, the project area will be aerially seeded with a seed mix of grass, forb, and browse species. An additional seed mix of forb and browse species will be distributed with a seed dribbler during the chaining treatment. The study is located in the chaining treatment area. An adjacent study Dairy Fork 1 (16R-46) is located within the bullhog treatment. The objectives of the project are to decreased pinyon and juniper canopy cover, increased forb and grass cover, and establish preferred browse species (WRI Database 2013). Deer, elk, and cattle pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon pine and Utah juniper were the dominant browse species on the site and provided the majority of the canopy cover prior to treatment. The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), and blueberry elder (*Sambucus cerulea*). Mountain big sagebrush is the dominant preferred browse species, though occurring in low abundance on the site (Table - Browse Trends). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and fairly diverse on the site. The dominant grass species are mutton bluegrass (*Poa fendleriana*) and bluebunch wheatgrass (*Agropyron spicatum*), which provided the majority of the grass cover prior to treatment. The invasive annual grass species cheatgrass (*Bromus tectorum*) was sample on the site in moderate abundance. Other common grass species sampled on the site include Kentucky bluegrass (*Poa pratensis*) and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are not abundant but are fairly diverse on the site. No single forbs species is dominant on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is moderate on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as moderate in 2012 due to surface soil movement, soil rock movement, pedestalling around plants, flow patterns, rills, and soil movement.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 16R, Study no: 47

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Agropyron spicatum</i>	67	3.97
G	<i>Bromus tectorum</i> (a)	109	2.00
G	<i>Oryzopsis hymenoides</i>	25	.98
G	<i>Poa fendleriana</i>	119	7.58
G	<i>Poa pratensis</i>	17	1.66
G	<i>Poa secunda</i>	39	.53

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Sitanion hystrix</i>	65	1.94
G	<i>Stipa comata</i>	8	.42
Total for Annual Grasses		109	2.00
Total for Perennial Grasses		340	17.09
Total for Grasses		449	19.10
F	<i>Alyssum alyssoides</i> (a)	111	.31
F	<i>Antennaria rosea</i>	6	.18
F	<i>Arabis holboellii</i>	3	.00
F	<i>Astragalus convallarius</i>	20	.13
F	<i>Astragalus utahensis</i>	3	.03
F	<i>Chaenactis douglasii</i>	7	.01
F	<i>Cirsium</i> sp.	3	.00
F	<i>Collinsia parviflora</i> (a)	17	.03
F	<i>Draba</i> sp. (a)	1	.00
F	<i>Epilobium brachycarpum</i> (a)	2	.00
F	<i>Eriogonum umbellatum</i>	6	.15
F	<i>Microsteris gracilis</i> (a)	5	.01
F	<i>Phlox hoodii</i>	24	.80
F	<i>Phlox longifolia</i>	6	.01
F	<i>Ranunculus testiculatus</i> (a)	14	.02
F	<i>Streptanthus cordatus</i>	3	.00
F	<i>Tragopogon dubius</i> (a)	3	.00
Total for Annual Forbs		153	0.39
Total for Perennial Forbs		81	1.34
Total for Forbs		234	1.74

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 47

T y p e	Species	Strip Frequency	Average Cover %
		'12	'12
B	<i>Artemisia tridentata vaseyana</i>	4	1.77
B	<i>Juniperus osteosperma</i>	22	18.16
B	<i>Pinus edulis</i>	2	1.86
B	<i>Symphoricarpos oreophilus</i>	2	.06
Total for Browse		30	21.85

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 47

Species	Percent Cover '12
Artemisia tridentata vaseyana	1.04
Juniperus osteosperma	42.10
Pinus edulis	4.60

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 47

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	2.1

POINT-QUARTER TREE DATA--

Management unit 16R, Study no: 47

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	244	12
Pinus edulis	25	10

BASIC COVER--

Management unit 16R, Study no: 47

Cover Type	Average Cover % '12
Vegetation	40.04
Rock	3.20
Pavement	3.33
Litter	53.62
Cryptogams	10.69
Bare Ground	18.42

PELLET GROUP DATA--

Management unit 16R, Study no: 47

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	4	-
Elk	9	9 (22)
Deer	1	1 (2)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 47

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia tridentata vaseyana</i>									
12	100	20	80	-	-	0	0	0	22/29
<i>Cercocarpus montanus</i>									
12	0	0	0	-	-	0	0	0	25/32
<i>Chrysothamnus nauseosus</i>									
12	0	0	0	-	-	0	0	0	31/30
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
12	0	0	0	-	-	0	0	0	13/17
<i>Gutierrezia sarothrae</i>									
12	0	0	0	-	-	0	0	0	8/7
<i>Juniperus osteosperma</i>									
12	520	19	81	-	20	0	0	4	-/-
<i>Opuntia sp.</i>									
12	0	0	0	-	-	0	0	0	5/20
<i>Pinus edulis</i>									
12	40	100	0	-	40	0	0	0	-/-
<i>Purshia tridentata</i>									
12	0	0	0	-	-	0	0	0	7/38
<i>Quercus gambelii</i>									
12	0	0	0	-	-	0	0	0	28/30
<i>Sambucus cerulea</i>									
12	0	0	0	-	-	0	0	0	65/64
<i>Symphoricarpos oreophilus</i>									
12	60	0	33	67	-	0	0	0	11/18

NORTH HOLLOW - TREND STUDY NO. 16R-48-12

Vegetation Type: Pinyon and Juniper

Range Type: Crucial Deer Winter/spring, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Oak\), R047XA432UT](#)

Land Ownership: UDWR

Elevation: 6,165 ft (1,879 m)

Aspect: West

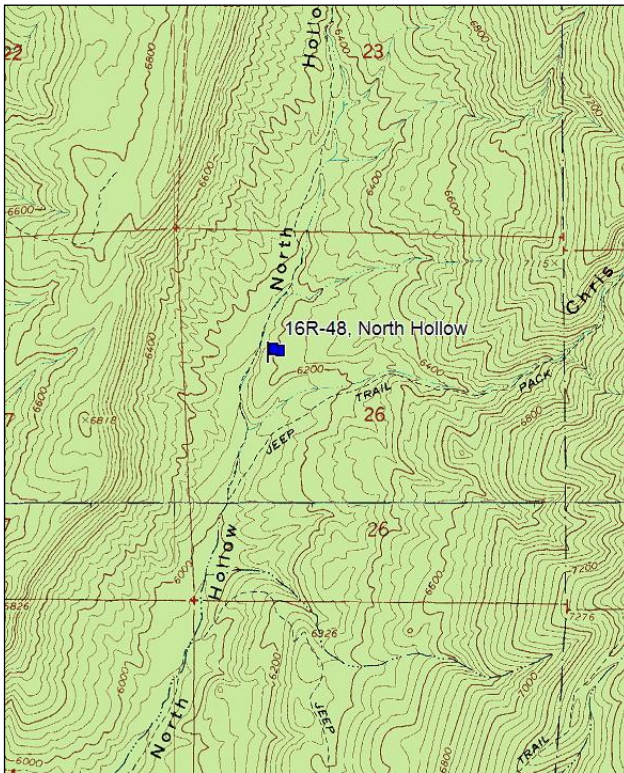
Slope: 7%

Transect bearing: 20° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

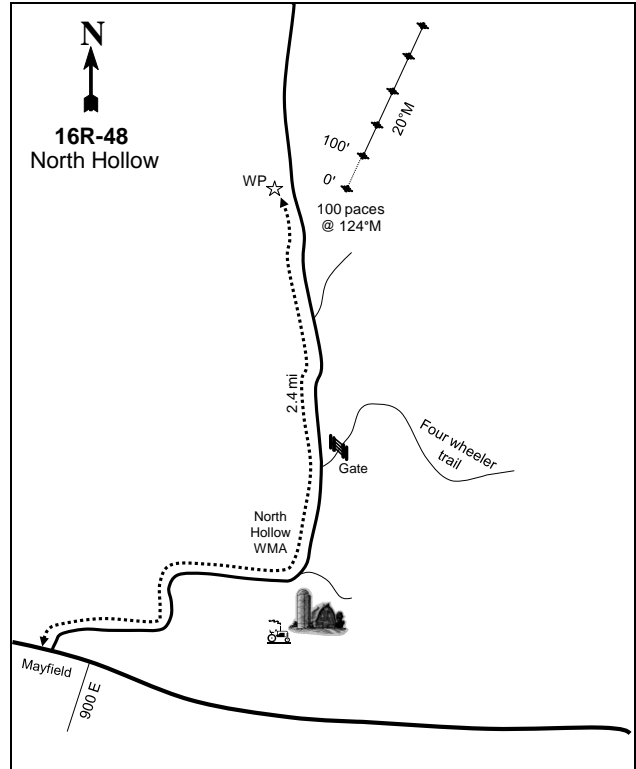
Directions: From the E Canyon Road travel up the canyon and turn left before 900 E onto North Hollow Road. Drive 2.4 miles to a witness post on the right side of the road. The 0-foot stake is 100 paces at 124°M from the witness stake. The 0-foot stake is marked with browse tag #9,168.

Map Name: Sterling



Township: 19S Range: 2E Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 442736 E 4331475 N

NORTH HOLLOW - TREND STUDY NO. 16R-48
[Project #2276](#)

Site Information

Site Description: The site is located two and half miles northeast of Mayfield within an old pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining. The study was established prior to treatment in 2012 within the Mayfield Wildlife Management Area to monitor pinyon and juniper reduction project. Approximately, 392 acres were two-way Ely chained and 124 acres were lopped and scattered in the winter of 2012-2013. Prior to the treatment the project area was aerially seeded with a seed mix of grass, forb, and browse species. An additional seed mix of forb and browse species was distributed with a seed dribbler during the chaining treatment (Table - Seed Mix). The study is located in the chaining treatment area. The objectives of the project are decreased pinyon and juniper canopy cover, increased forb and grass cover, and establish preferred browse species (WRI Database 2013). Deer and cattle pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: The dominant browse species on the site is Gambel Oak (*Quercus gambelii*), which provides the majority of the browse cover on the site. Pinyon pine and Utah juniper were moderately abundant on the site and provided moderate cover on the site. The preferred browse species on the site are black sagebrush (*Artemisia nova*), mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), and Gambel oak. Gambel oak is the dominant preferred browse species and other preferred browse species are rare (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and diverse on the site. The dominant grass species are crested wheatgrass (*Agropyron cristatum*) and bluebunch wheatgrass (*A. spicatum*), which provided the majority of the grass cover on the site. The invasive grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance. Forbs are not abundant but are moderately diverse on the site. No single forbs species is dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Fontreen component, which occurs on alluvial fans and mountains. The parent material consists of alluvium and colluvium derived from limestone, sandstone, shale, and chert. The soils within this classification are characterized as deep, well drained, and with a high permeable restrictively layer. The soil surface texture is a cobbly loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012 due to surface soil movement, soil rock movement, pedestalling around plants, flow patterns, rills, active gully formation, and soil movement.

SEED MIX--

Management unit 16R, Study no: 48

Project Name: North Hollow WMA Habitat Improvement									
WRI Database #: 2276									
Application: Aerial Seed			Acres: 420		Application: Dribbler			Acres: 420	
Seed type			lbs in mix	lbs/acre	Seed type			lbs in mix	lbs/acre
G	Crested Wheatgrass 'CDII'		550	1.31	F	Sainfoin		40	0.10
G	Crested Wheatgrass 'Hycrest'		350	0.83	F	Small Burnet 'Delar'		50	0.00
G	Great Basin Wildrye 'UDWR IntMtn Tetra'		300	0.71	F	Utah Sweetvech 'Timp'		50	0.12
G	Great Basin Wildrye 'Magnar'		87.5	0.21	B	Bitterbrush		40	0.10
G	Indian Ricegrass 'Rimrock'		900	2.14	B	Fourwing Saltbush		32	0.08
G	Orchardgrass 'Paiute'		237.5	0.57	B	Curleaf Mountain Mahogany		50	0.12
G	Pubescent Wheatgrass 'Luna'		475	1.13	Total Pounds:			262	0.62
G	Sandberg Bluegrass 'Mt. Home'		175	0.42	PLS Pounds:				0.33
G	Sandberg Bluegrass		300	0.71					
G	Sheep Fescue 'Covar'		473	1.13					
G	Snake River Wheatgrass 'Secar'		900	2.14					
F	Alfalfa 'Ladak'		262.5	0.63					
F	Alfalfa 'Spreador 4'		400	0.95					
F	Cicer Milkvetch 'Lutana'		475	1.13					
F	Sainfoin 'Eski'		900	2.14					
F	Small Burnet 'Delar'		900	2.14					
F	Yellow Sweetclover		475	1.13					
Total Pounds:			8160.5	19.43					
PLS Pounds:				10.90					

Trend Summary

HERBACEOUS TRENDS--

Management unit 16R, Study no: 48

Type	Species	Frequency		Average Cover %	
		'12	'12	'12	'12
G	Agropyron cristatum	73		1.83	
G	Agropyron intermedium	52		.39	
G	Agropyron spicatum	46		2.00	
G	Bromus inermis	7		.01	
G	Bromus tectorum (a)	56		.13	
G	Carex geyeri	17		.42	
G	Oryzopsis hymenoides	3		.21	
G	Poa secunda	23		.28	
Total for Annual Grasses		56		0.13	
Total for Perennial Grasses		221		5.16	
Total for Grasses		277		5.29	
F	Alyssum alyssoides (a)	96		.56	
F	Astragalus convallarius	8		.03	
F	Astragalus sp.	-		.00	

Type	Species	Nested Frequency	Average Cover %
		'12	'12
F	<i>Collinsia parviflora</i> (a)	3	.01
F	<i>Descurainia pinnata</i> (a)	2	.00
F	<i>Eriogonum brevicaule</i>	2	.00
F	<i>Eriogonum umbellatum</i>	6	.06
F	<i>Lathyrus brachycalyx</i>	26	.10
F	<i>Petradoria pumila</i>	1	.03
F	<i>Phlox austromontana</i>	7	.06
F	<i>Phlox longifolia</i>	3	.00
F	<i>Ranunculus testiculatus</i> (a)	68	.11
F	<i>Senecio multilobatus</i>	2	.01
F	<i>Tragopogon dubius</i> (a)	2	.00
Total for Annual Forbs		171	0.69
Total for Perennial Forbs		55	0.32
Total for Forbs		226	1.01

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 16R, Study no: 48

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	<i>Artemisia nova</i>	13	-
B	<i>Artemisia tridentata vaseyana</i>	11	.83
B	<i>Cercocarpus montanus</i>	2	.01
B	<i>Chrysothamnus viscidiflorus stenophyllus</i>	1	-
B	<i>Gutierrezia sarothrae</i>	1	-
B	<i>Juniperus osteosperma</i>	12	6.88
B	<i>Pinus edulis</i>	3	8.29
B	<i>Quercus gambelii</i>	56	24.38
Total for Browse			40.40

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 48

Species	Percent Cover '12
<i>Artemisia nova</i>	.58
<i>Artemisia tridentata vaseyana</i>	.33
<i>Cercocarpus montanus</i>	.36
<i>Juniperus osteosperma</i>	10.03
<i>Pinus edulis</i>	11.33
<i>Quercus gambelii</i>	37.56

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 48

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	1.0

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 48

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	202	6.2
Pinus edulis	54	6.6

BASIC COVER--
Management unit 16R, Study no: 48

Cover Type	Average Cover % '12
Vegetation	44.75
Rock	2.07
Pavement	7.68
Litter	67.02
Cryptogams	.64
Bare Ground	15.96

PELLET GROUP DATA--
Management unit 16R, Study no: 48

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	7	-
Deer	5	1 (3)
Cattle	-	4 (9)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 48

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier utahensis</i>									
12	0	0	0	-	-	0	0	0	41/23
<i>Artemisia nova</i>									
12	340	0	41	59	-	47	0	59	11/21
<i>Artemisia tridentata vaseyana</i>									
12	340	0	65	35	-	6	0	53	13/21
<i>Cercocarpus ledifolius</i>									
12	0	0	0	-	-	0	0	0	12/19
<i>Cercocarpus montanus</i>									
12	80	50	50	-	-	50	0	0	43/48
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
12	20	0	100	-	-	0	100	100	5/8
<i>Eriogonum heracleoides</i>									
12	0	0	0	-	-	0	0	0	5/11
<i>Gutierrezia sarothrae</i>									
12	20	0	100	-	-	0	0	0	8/9
<i>Juniperus osteosperma</i>									
12	260	23	69	8	-	0	0	0	-/-
<i>Pinus edulis</i>									
12	60	0	100	-	20	0	0	33	-/-
<i>Quercus gambelii</i>									
12	10380	67	26	7	1420	0	.38	7	42/35

STRAWBERRY GROUSE 1 - TREND STUDY NO. 17R-17-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Substantial Deer Summer/fall, Crucial Elk Summer

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: USFS

Elevation: 7,440 ft (2,268 m)

Aspect: Southwest

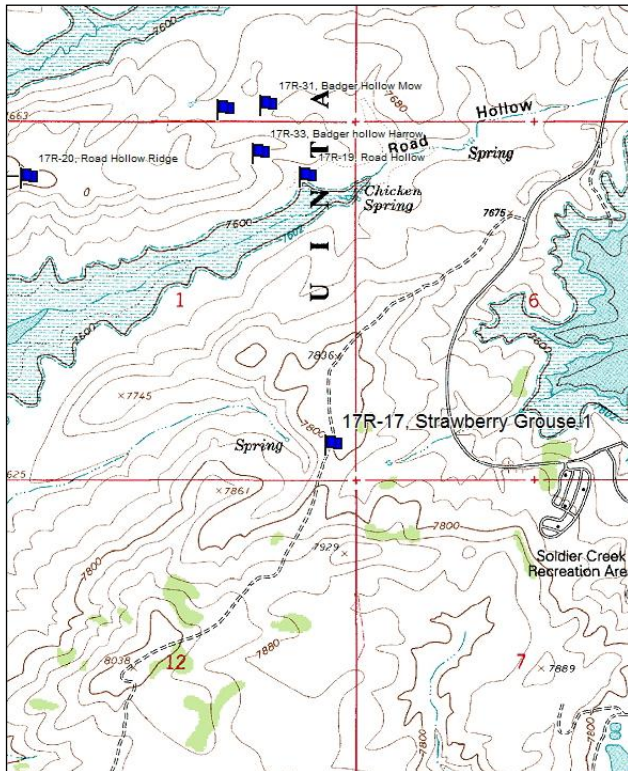
Slope: 8-10%

Transect bearing: 310° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

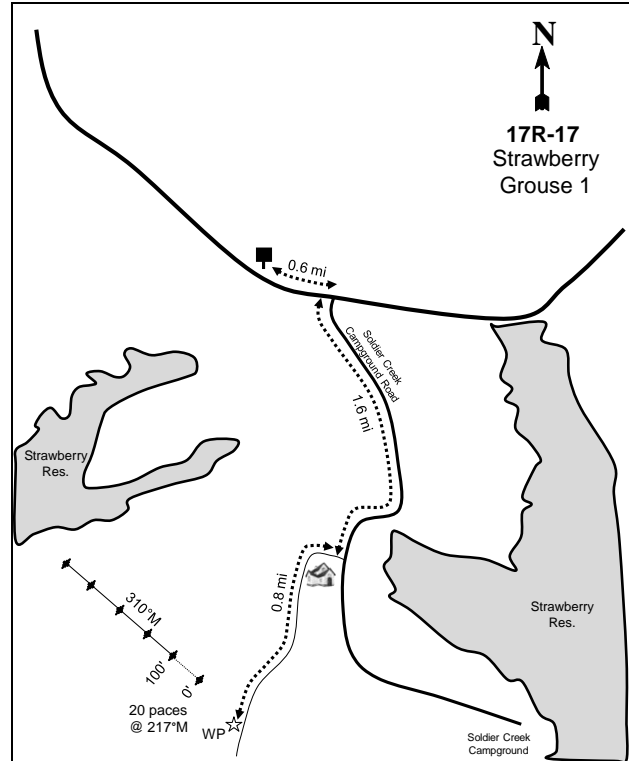
Directions: On US 40, drive past Strawberry Reservoir to mile marker 49 (not positive on mile marker number?). Continue 0.6 miles past the mile marker to Soldier Creek Campground Road (FS 480) on the right (south). Turn right and drive 1.6 miles to a road on the right (west). Turn right and drive 0.1 miles to an intersection, turn left (SW). Drive 0.8 miles on this two-track road to the witness post on the right (NW) side. From the witness post, walk 20 feet at 217°M to the 0-foot stake. The 0-foot stake is marked with browse tag #93.

Map Name: Strawberry Reservoir



Township: 4S Range: 11W Section: 1

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 494219 E 4444987 N

STRAWBERRY GROUSE 1 - TREND STUDY NO. 17R-17

Site Information

Site Description: The study is located approximately twelve miles west of Fruitland on the east side of Strawberry Reservoir. The study was established in 2005 on land administrated by U. S. Forest Service (USFS) to monitor habitat for sage-grouse. In the winter of 2009-2010 part of the study transect was harrowed as part of the Strawberry Valley Sage-Grouse Habitat Improvement Project ([WRI project 1360](#)). The Strawberry Sage Grouse 1 study is one of four established in 2005 to monitor habitat for sage-grouse in the Strawberry Valley and surrounding brood area. In conjunction with Brigham Young University, the data from the four studies will be used to better manage sage-grouse populations in the Strawberry Valley. This study, the Road Hollow (17R-19) study, and the Road Hollow Ridge (17R-20) study are all located within sage-grouse winter and brooding habitat within approximately 1 mile from one another. The fourth study, Wildcat Sage-Grouse (17R-18), is located approximately 5.3 miles east of the other studies in the Wildcat Wildlife Management Area. The Wildcat Sage-Grouse study is located within an area that is strictly sage-grouse brooding habitat. Sage-grouse feathers were found on the site in 2012. Sage-grouse pellet groups were sampled at 200 groups/acre in 2005 and 52 groups/acre in 2012. Deer pellet groups were sampled in low abundance in 2005 and 2012. Elk and cattle pellet groups were sampled in low abundance in 2005 (Table - Pellet Group Data).

Browse: The key browse species on the site is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), which provided the majority of the canopy cover on the site over the sample years (Table - Canopy Cover). Other preferred browse species sampled on the site are fringed sagebrush (*A. frigida*), dwarf rabbitbrush (*Chrysothamnus depressus*), and true mountain mahogany (*Cercocarpus montanus*), though these species occurred in low abundance. The mountain big sagebrush is a lightly used population with moderate amount of decadence and high amount of plants displaying poor vigor within the population. Recruitment of young sagebrush plants to the population has been poor over the sample years (Table - Browse Trends).

Herbaceous Understory: Grasses are abundant and diverse on the site. Crested wheatgrass (*Agropyron cristatum*) is the dominant grass species and has provided the majority of the cover on the site. Other common grass species sampled on the site are thickspike wheatgrass (*A. dasystachyum*), bluebunch wheatgrass (*A. spicatum*), June grass (*Koeleria cristata*), mutton bluegrass (*Poa fendleriana*), and Sandberg bluegrass (*P. secunda*). Forbs are moderately abundant and fairly diverse on the site. Desert phlox (*Phlox austromontana*), rayless tansyaster (*Machaeranthera grindelioides*), and looseflower milkvetch (*Astragalus tenellus*) are the dominant forbs species on the site. Forbs decreased in abundance and species richness on the site in 2012 (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is moderate though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to pedestalling around shrubs and an active gully near the transect. The soil erosion condition was classified as stable in 2012.

Trend Assessments

Browse:

- **2005 to 2012 - down (-2):** The density of mountain big sagebrush decreased 33% form 6,740 plants/acre to 4,520 plants/acre, and canopy cover decreased from 26% to 25%. Part of the decrease in density and cover may be a result of the harrow treatment. Poor vigor of sagebrush increased within the population from 20% to 34%, though decadence decreased from 38% to 17%. Recruitment of young sagebrush plants remained poor.

Grass:

- **2005 to 2012 - stable (0):** The sum of nested frequency of perennial grasses remained similar, and cover increased from 16% to 22%. Crested wheatgrass increased significant in nested frequency, and cover increased from 7% to 14%. Thickspike wheatgrass, June grass, and mutton bluegrass decreased significantly in nested frequency. Thickspike wheatgrass remained similar in cover. June grass increased in cover from 1% to 2%. Mutton bluegrass decreased in cover from 5% to 1%.

Forb:

- **2005 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased 23%, and cover decreased from 14% to 7%. Looseflower milkvetch significant decreased in nested frequency and cover decreased from 5% to 1%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 17R, Study no: 17

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
G	Agropyron cristatum	_a 149	_b 235	6.93	14.19
G	Agropyron dasystachyum	_b 94	_a 61	.74	.94
G	Agropyron spicatum	17	30	.40	1.62
G	Bromus anomalus	2	7	.00	.04
G	Carex sp.	38	39	.71	.35
G	Festuca ovina	4	9	.04	.06
G	Koeleria cristata	_b 56	_a 54	.74	1.59
G	Oryzopsis hymenoides	14	6	.12	.56
G	Poa fendleriana	_b 162	_a 67	4.75	1.11
G	Poa pratensis	13	3	.21	.00
G	Poa secunda	68	78	.73	1.05
G	Stipa comata	15	12	.63	.10
G	Stipa lettermani	8	6	.11	.06
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		640	607	16.14	21.71
Total for Grasses		640	607	16.14	21.71
F	Androsace septentrionalis (a)	2	8	.01	.05
F	Antennaria rosea	11	5	.05	.01
F	Arabis sp.	5	4	.01	.01
F	Aster chilensis	_a -	_b 7	.00	.39
F	Astragalus convallarius	10	5	.05	.03
F	Astragalus kentrophyta	3	-	.03	-
F	Astragalus tenellus	_b 112	_a 55	4.85	.98
F	Calochortus nuttallii	3	-	.00	-
F	Camissonia sp. (a)	6	-	.04	-
F	Chaenactis douglasii	3	7	.00	.04
F	Collinsia parviflora (a)	_b 15	_a 2	.04	.00
F	Comandra pallida	_b 85	_a 50	.77	.22
F	Cryptantha sp.	2	2	.15	.00
F	Eriogonum brevicaule	13	14	.43	.34

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
F	Eriogonum umbellatum	6	3	.09	.01
F	Gayophytum ramosissimum(a)	28	15	.08	.02
F	Lappula occidentalis (a)	10	-	.04	-
F	Lesquerella sp.	3	-	.00	-
F	Lupinus argenteus	-	-	.03	-
F	Machaeranthera grindelioides	47	55	1.62	1.16
F	Orobanche sp.	1	-	.00	-
F	Orthocarpus luteus (a)	7	-	.02	-
F	Orthocarpus tolmiei (a)	_b 17	_a -	.37	-
F	Penstemon caespitosus	_a -	_b 12	-	.18
F	Penstemon sp.	7	5	.07	.01
F	Phlox austromontana	126	116	5.32	3.53
F	Phlox longifolia	3	-	.00	-
F	Polygonum douglasii (a)	_b 34	_a -	.11	-
F	Potentilla gracilis	4	1	.03	.00
F	Senecio multilobatus	1	4	.03	.01
F	Taraxacum officinale	4	-	.01	-
F	Tragopogon dubius (a)	-	-	.00	-
Total for Annual Forbs		119	25	0.72	0.08
Total for Perennial Forbs		449	345	13.61	6.96
Total for Forbs		568	370	14.33	7.04

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 17R, Study no: 17

Type	Species	Strip Frequency		Average Cover %	
		'05	'12	'05	'12
B	Artemisia frigida	40	13	1.08	.10
B	Artemisia tridentata vaseyana	72	66	16.42	18.02
B	Chrysothamnus depressus	2	9	.03	.33
B	Chrysothamnus parryi	29	27	1.06	2.09
B	Chrysothamnus viscidiflorus viscidiflorus	72	67	2.83	4.51
B	Gutierrezia sarothrae	11	6	.37	.18
B	Mahonia repens	3	11	.18	.15
B	Rosa woodsii	0	2	-	-
B	Tetradymia canescens	18	17	1.13	.39
Total for Browse		247	218	23.13	25.79

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 17

Species	Percent Cover	
	'05	'12
Artemisia frigida	1.11	.30
Artemisia tridentata vaseyana	25.66	24.83
Chrysothamnus parryi	.85	2.08
Chrysothamnus viscidiflorus viscidiflorus	4.60	3.68
Gutierrezia sarothrae	.85	.25
Mahonia repens	-	.23
Tetradymia canescens	.43	.40

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17R, Study no: 17

Species	Average leader growth (in)	
	'05	'12
Artemisia tridentata vaseyana	1.8	0.7

BASIC COVER--

Management unit 17R, Study no: 17

Cover Type	Average Cover %	
	'05	'12
Vegetation	46.00	52.32
Rock	4.96	6.51
Pavement	.57	.79
Litter	48.10	45.28
Cryptogams	3.32	.64
Bare Ground	22.49	21.30

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 17, Study Name: Strawberry Sage Grouse 1

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.3	7.3	47.4	34.7	17.9	1.3	10.3	150.4	0.5

PELLET GROUP DATA--

Management unit 17R, Study no: 17

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'12	'05	'12
Rabbit	30	2	-	-
Grouse	17	8	200 groups/acre	52 groups/acre
Elk	4	1	11 (26)	-
Deer	10	2	7 (18)	8 (20)
Cattle	1	-	2 (4)	-

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 17

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia frigida</i>									
05	3880	12	83	5	40	3	0	3	7/10
12	880	0	100	0	20	34	9	14	4/7
<i>Artemisia tridentata vaseyana</i>									
05	6740	3	59	38	-	2	0	20	17/24
12	4520	4	79	17	-	9	.88	34	18/29
<i>Cercocarpus montanus</i>									
05	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	15/35
<i>Chrysothamnus depressus</i>									
05	80	0	100	-	-	0	0	0	7/5
12	340	6	94	-	-	0	0	0	7/10
<i>Chrysothamnus parryi</i>									
05	1860	5	90	4	-	5	1	1	7/11
12	1520	7	93	0	-	0	0	0	6/12
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
05	4660	1	87	12	-	0	.42	5	9/13
12	4160	1	89	10	20	0	0	38	9/11
<i>Gutierrezia sarothrae</i>									
05	1320	17	83	-	-	0	0	0	5/7
12	820	0	100	-	-	0	0	0	7/7
<i>Mahonia repens</i>									
05	720	0	100	-	-	0	0	0	3/3
12	920	0	100	-	-	0	0	0	4/5
<i>Rosa woodsii</i>									
05	0	0	0	-	-	0	0	0	7/8
12	60	0	100	-	-	0	0	0	9/8
<i>Tetradymia canescens</i>									
05	520	8	77	15	-	0	0	8	9/14
12	520	0	69	31	-	0	0	31	10/11

ROAD HOLLOW - TREND STUDY NO. 17R-19-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Substantial Deer Summer/fall, Crucial Elk Summer

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#) and [Fresh Meadow \(Redtop\), R047XA004UT](#)

Land Ownership: USFS

Elevation: 7,600 ft (2,316 m)

Aspect: Southeast

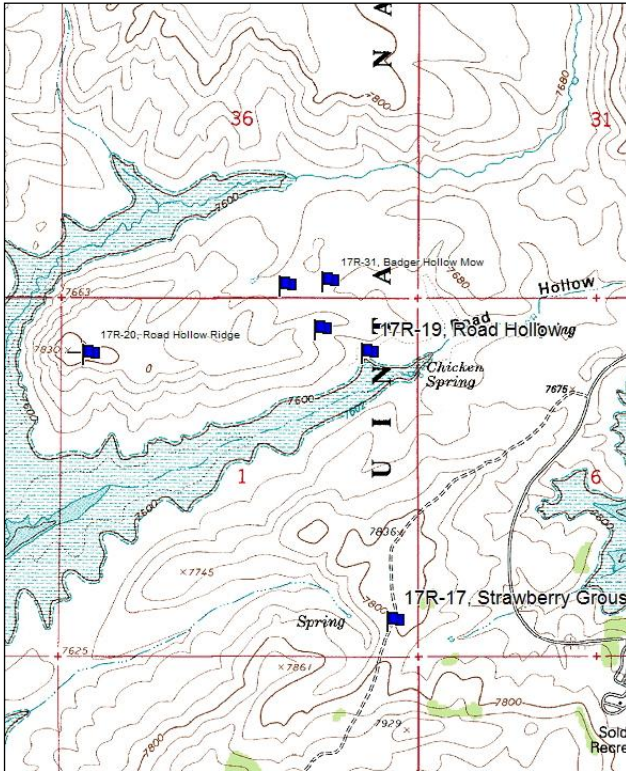
Slope: 5-10%

Transect bearing: 38° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

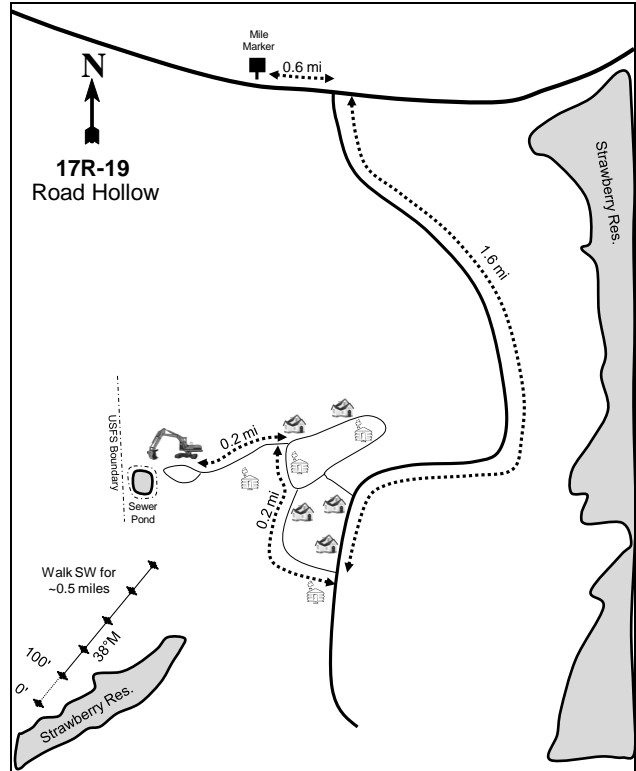
Directions: On US 40, drive east past Strawberry Reservoir to mile marker 49 (not positive on mile marker number?). Continue 0.6 miles past the mile marker to Soldier Creek Campground Road (FS 480) on the right (south). Turn right and drive 1.6 miles to a road on the right (west). Turn right and drive 0.1 miles to an intersection, turn right and drive 0.1 miles to a two-track road on the left (NW). Turn left and drive up to the pump house. From the pump house, walk along the two-track road for 0.54 miles at 250°M to the 0-foot stake. The 0-foot stake is marked with browse tag #138.

Map Name: Strawberry Reservoir NE



Township: 4S Range: 11W Section: 1

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 494105 E 4446193 N

ROAD HOLLOW - TREND STUDY NO. 17R-19

Site Information

Site Description: The study is located approximately twelve miles west of Fruitland on the east side of Strawberry Reservoir. The study was established in 2005 on land administrated by U. S. Forest Service (USFS) to monitor habitat for sage-grouse. In the fall of 2011 part of the study transect was treated by a brush mower as part of the Badger Hollow/Chicken Spring Ridge Habitat Improvement Project ([WRI project 1816](#)). The Road Hollow study is one of four established in 2005 to monitor habitat for sage-grouse in the Strawberry Valley and surrounding brood area. In conjunction with Brigham Young University, the data from the four studies will be used to better manage sage-grouse populations in the Strawberry Valley. This study, the Sage-Grouse 1 (17R-17) study, and the Road Hollow Ridge (17R-20) study are all located within sage-grouse winter and brooding habitat within approximately 1 mile from one another. The fourth study, Wildcat Sage-Grouse (17R-18), is located approximately 5.3 miles east of the other studies in the Wildcat Wildlife Management Area. The Wildcat Sage-Grouse study is located within an area that is strictly sage-grouse brooding habitat. Sage-grouse pellet groups were sampled at 52 groups/acre in 2005 and no pellet groups were in 2012. Deer pellet groups were sampled in low abundance in 2005 and 2012. Cattle pellet groups were sampled in low abundance in 2005 (Table - Pellet Group Data).

Browse: The key browse species on the site is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), which provided the majority of the canopy cover on the site over the sample years (Table - Canopy Cover). The first hundred feet of the transect crosses a solid stand of silver sagebrush (*A. cana*), which is more in a valley bottom. The rest of the transect is on a ridge covered in mountain big sagebrush. The mountain big sagebrush is a lightly used population with high amount of decadence and moderate amount of plants displaying poor vigor within the population. Recruitment of young sagebrush plants to the population has been poor over the sample years (Table - Browse Trends).

Herbaceous Understory: Grasses are abundant and diverse on the site. Tufted hair-grass (*Deschampsia caespitosa*), June grass (*Koeleria cristata*), and Kentucky bluegrass (*Poa pratensis*) are the dominant grass species on the site. Other common grass species sampled on the site are thickspike wheatgrass (*A. dasystachyum*), sheep fescue (*Festuca ovina*), and Letterman Needlegrass (*Stipa lettermani*). Forbs are moderately abundant and fairly diverse on the site. Desert phlox (*Phlox austromontana*) is the dominant forb species on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is moderate though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2005 and 2012.

Pre vs. One Year Post Treatment, 2005 vs. 2012

Browse: The density of mountain big sagebrush decreased 49% form 7,020 plants/acre to 3,580 plants/acre, and canopy cover decreased from 29% to 15%. The decrease in density and cover is a result of the brush mower treatment. The section of the transect that was not treated was the silver sagebrush bottom. The density of silver sagebrush increased 26%, though cover decreased from 8% to 5%. Poor vigor of sagebrush increased within the mountain big sagebrush population from 10% to 22% and remained low within the silver sagebrush population. Decadence of sagebrush remained similar within the mountain big sagebrush population at 35%, while the decadence decreased within the silver sagebrush population from 23% to 2%. Recruitment of young sagebrush plants remained poor for both sagebrush species.

Grass: The sum of nested frequency of perennial grasses remained similar, and cover increased from 14% to 24%. The increase in cover can be attributed to the increase in cover of tufted hair-grass, June grass, and

Kentucky bluegrass, which increased in cover from less than 1%, 2%, and 1% to 5%, 5%, and 7%, respectively.

Forb: The sum of nested frequency of perennial forbs remained similar, and cover decreased from 9% to 6%. Desert phlox decreased in cover from 4% to 3%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 17R, Study no: 19

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
G	<i>Agropyron dasystachyum</i>	a17	b61	.10	2.16
G	<i>Carex geyeri</i>	a-	b22	-	.46
G	<i>Carex obtusata</i>	a-	b52	-	.68
G	<i>Carex sp.</i>	b70	a-	1.35	-
G	<i>Deschampsia caespitosa</i>	14	34	.22	5.26
G	<i>Festuca ovina</i>	b97	a35	3.25	.26
G	<i>Juncus sp.</i>	b24	a-	.27	-
G	<i>Koeleria cristata</i>	118	108	2.16	4.98
G	<i>Poa fendleriana</i>	b45	a17	.70	.25
G	<i>Poa pratensis</i>	80	100	1.11	6.57
G	<i>Poa secunda</i>	a1	b46	.03	1.17
G	<i>Sitanion hystrix</i>	10	21	.27	.18
G	<i>Stipa columbiana</i>	30	1	.89	.00
G	<i>Stipa comata</i>	b10	a7	.24	.16
G	<i>Stipa lettermani</i>	a100	b140	3.05	2.18
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		616	644	13.68	24.34
Total for Grasses		616	644	13.68	24.34
F	<i>Achillea millefolium</i>	-	1	-	.00
F	<i>Androsace septentrionalis (a)</i>	-	3	-	.00
F	<i>Antennaria rosea</i>	44	40	1.65	.62
F	<i>Arenaria fendleri</i>	b67	a52	1.04	.78
F	<i>Aster chilensis</i>	76	63	1.43	.54
F	<i>Astragalus convallarius</i>	-	3	-	.01
F	<i>Astragalus tenellus</i>	-	1	-	.03
F	<i>Chaenactis douglasii</i>	-	5	-	.01
F	<i>Cirsium sp.</i>	2	4	.00	.03
F	<i>Comandra pallida</i>	1	-	.00	-
F	<i>Cymopterus sp.</i>	-	3	-	.06
F	<i>Eriogonum umbellatum</i>	25	26	.82	.84
F	<i>Gayophytum ramosissimum(a)</i>	25	15	.09	.03
F	<i>Gentiana calycosa</i>	6	3	.21	.00
F	<i>Gilia sp. (a)</i>	7	1	.04	.00
F	<i>Lactuca serriola (a)</i>	-	1	-	.00
F	<i>Linum lewisii</i>	2	1	.03	.00
F	<i>Lupinus caespitosus utahensis</i>	-	1	-	.03

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
F	<i>Machaeranthera canescens</i>	2	13	.01	.03
F	<i>Orthocarpus luteus</i> (a)	_b 153	_a 21	2.80	.18
F	<i>Pedicularis groenlandica</i>	_b 15	_a -	.15	-
F	<i>Penstemon caespitosus</i>	5	9	.03	.13
F	<i>Penstemon watsonii</i>	_b 12	_a -	.10	-
F	<i>Phlox austromontana</i>	65	69	3.50	2.54
F	<i>Phlox longifolia</i>	3	-	.00	-
F	<i>Physaria</i> sp.	-	2	-	.00
F	<i>Polygonum douglasii</i> (a)	_b 17	_a -	.04	-
F	<i>Potentilla gracilis</i>	5	10	.01	.07
F	<i>Trifolium</i> sp.	-	3	-	.00
F	<i>Viola</i> sp.	6	-	.06	-
Total for Annual Forbs		202	41	2.97	0.23
Total for Perennial Forbs		336	309	9.08	5.76
Total for Forbs		538	350	12.06	5.99

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 17R, Study no: 19

Type	Species	Strip Frequency		Average Cover %	
		'05	'12	'05	'12
B	<i>Artemisia cana</i>	23	24	5.95	4.66
B	<i>Artemisia tridentata vaseyana</i>	78	69	22.52	12.45
B	<i>Chrysothamnus nauseosus</i>	2	0	.00	-
B	<i>Chrysothamnus parryi</i>	18	16	1.81	.97
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	36	28	1.44	.67
B	<i>Tetradymia canescens</i>	3	3	.03	.00
Total for Browse		160	140	31.76	18.76

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 19

Species	Percent Cover	
	'05	'12
<i>Artemisia cana</i>	7.55	5.23
<i>Artemisia tridentata vaseyana</i>	28.75	14.48
<i>Chrysothamnus parryi</i>	1.61	1.11
<i>Chrysothamnus viscidiflorus viscidiflorus</i>	1.55	.73

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17R, Study no: 19

Species	Average leader growth (in)	
	'05	'12
Artemisia tridentata vaseyana	1.8	1.3

BASIC COVER--

Management unit 17R, Study no: 19

Cover Type	Average Cover %	
	'05	'12
Vegetation	51.51	44.99
Rock	.66	.37
Pavement	.54	.06
Litter	33.17	49.74
Cryptogams	4.17	1.00
Bare Ground	24.63	22.41

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 19, Study Name: Road Hollow

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.3	6.9	54.4	26.8	18.8	2.3	21.8	185.6	0.5

PELLET GROUP DATA--

Management unit 17R, Study no: 19

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'12	'05	'12
Rabbit	8	12	-	-
Grouse	4	-	52 groups/acre	-
Deer	4	-	2 (5)	1 (2)
Cattle	1	-	1 (2)	-

BROWSE CHARACTERISTICS--

Management unit 17R, Study no: 19

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia cana									
05	2220	5	73	23	80	4	0	4	13/22
12	2800	6	92	2	20	0	0	0	10/13
Artemisia tridentata vaseyana									
05	7020	2	66	31	3440	2	17	10	18/28
12	3580	7	59	35	20	0	0	22	13/19

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Chrysothamnus nauseosus</i>										
05	60	67	33	-	-	0	0	0	5/19	
12	0	0	0	-	-	0	0	0	-/-	
<i>Chrysothamnus parryi</i>										
05	1780	1	81	18	-	0	0	16	7/13	
12	2660	5	95	0	-	0	0	0	5/9	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
05	3460	1	81	18	-	0	0	9	7/10	
12	2000	8	92	0	20	0	0	0	5/9	
<i>Tetradymia canescens</i>										
05	60	0	67	33	-	0	0	33	10/10	
12	60	0	100	0	-	0	0	0	6/8	

ROAD HOLLOW RIDGE - TREND STUDY NO. 17R-20-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Substantial Deer Summer/fall, Crucial Elk Summer

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: USFS

Elevation: 7,760 ft (2,365 m)

Aspect: South

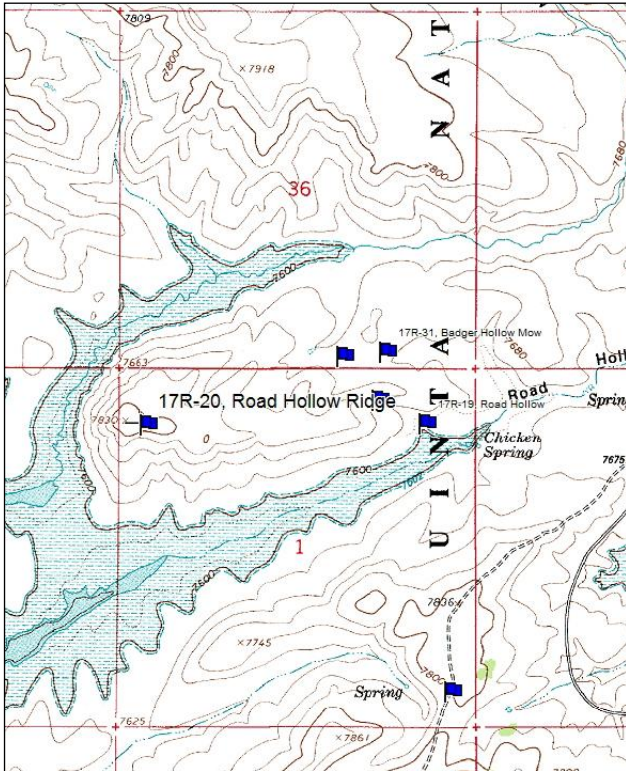
Slope: 25%

Transect bearing: 96° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

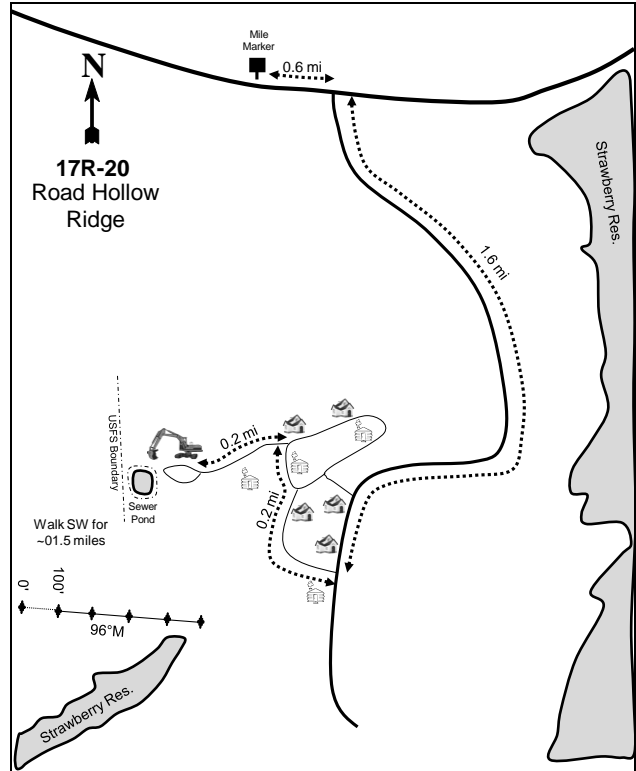
Directions: On US 40, drive east past Strawberry Reservoir to mile marker 49 (not positive on mile marker number?). Continue 0.6 miles past the mile marker to Soldier Creek Campground Road (FS 480) on the right (south). Turn right and drive 1.6 miles to a road on the right (west). Turn right and drive 0.1 miles to an intersection, turn right and drive 0.1 miles to a two-track road on the left (NW). Turn left and drive up to the pump house. From the pump house, walk along the two-track road for 1.3 miles at 260°M to the 0-foot stake. The site is north of the two-track near a rock outcrop. There is also a great basin wildrye patch that the site runs through. The 0-foot stake is marked with browse tag #94.

Map Name: Strawberry Reservoir NE



Township: 4S Range: 11W Section: 1

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 492846 E 4446195 N

ROAD HOLLOW RIDGE - TREND STUDY NO. 17R-20

Site Information

Site Description: The study is located approximately thirteen miles west of Fruitland on the east side of Strawberry Reservoir. The study was established in 2005 on land administrated by U. S. Forest Service (USFS) to monitor habitat for sage-grouse. The Road Hollow Ridge study is one of four established in 2005 to monitor habitat for sage-grouse in the Strawberry Valley and surrounding brood area. In conjunction with Brigham Young University, the data from the four studies will be used to better manage sage-grouse populations in the Strawberry Valley. This study, the Sage-Grouse 1 (17R-17) study, and the Road Hollow (17R-19) study are all located within sage-grouse winter and brooding habitat within approximately 1 mile from one another. The fourth study, Wildcat Sage-Grouse (17R-18), is located approximately 5.3 miles east of the other studies in the Wildcat Wildlife Management Area. The Wildcat Sage-Grouse study is located within an area that is strictly sage-grouse brooding habitat. Sage-grouse pellet groups were sampled at 426 groups/acre in 2005 and 191 groups/acre were in 2012. Deer pellet groups were sampled in low abundance in 2005 and 2012. Elk pellet groups were sampled in low abundance in 2005 (Table - Pellet Group Data).

Browse: The key browse species on the site is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), which provided the majority of the canopy cover on the site over the sample years (Table - Canopy Cover). Other preferred browse species sampled on the site are fringed sagebrush (*A. frigida*), antelope bitterbrush (*Purshia tridentata*), and Woods rose (*Rosa woodsii*), though these species occurred in low abundance. The mountain big sagebrush is a lightly used population with moderate amount of decadence and high amount of plants displaying poor vigor within the population. Recruitment of young sagebrush plants to the population has been poor over the sample years. Other common browse species sampled on the site include Parry rabbitbrush (*Chrysothamnus parryi*), stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), and creeping barberry (*Mahonia repens*) (Table - Browse Trends).

Herbaceous Understory: Grasses are abundant and diverse on the site. Thickspike wheatgrass (*Agropyron dasystachyum*), bluebunch wheatgrass (*A. spicatum*), mutton bluegrass (*Poa fendleriana*), and Letterman needlegrass (*Stipa lettermani*) are the dominant grass species on the site. The study transect passes through a patch of Great Basin wildrye (*Elymus cinereus*), though not being sampled within the quadrats. Forbs are moderately abundant and fairly diverse on the site. Desert phlox (*Phlox austromontana*) is the dominant forbs species on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a slightly alkaline soil reaction (pH 7.4) (Table - Soil Analysis Data). Bare ground cover is moderate though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to pedestalling around shrubs, flow patterns, and active gully erosion. The soil erosion condition was classified as stable in 2012.

Trend Assessments

Browse:

- **2005 to 2012 - stable (0):** The density of mountain big sagebrush remained similar at 3,420 plants/acre, though canopy cover increased from 25% to 27%. Poor vigor of sagebrush increased within the population from 9% to 23%, though decadence decreased from 25% to 16%. Recruitment of young sagebrush plants remained poor.

Grass:

- **2005 to 2012 - stable (0):** The sum of nested frequency of perennial grasses remained similar, and cover increased from 10% to 14%. Bluebunch wheatgrass increased significant in nested frequency,

and cover increased from less than 1% to 6%. Sedge (*Carex sp.*), needle-and-thread (*Stipa comata*), and Letterman needlegrass decreased significantly in nested frequency.

Forb:

- **2005 to 2012 - up (+2):** The sum of nested frequency of perennial forbs increased 24%, though cover decreased from 8% to 3%. The decrease in cover maybe attributed to drought conditions. Desert phlox increased significantly in nested frequency, though cover decreased from 2% to 1%. The weedy annual species pale alyssum (*Alyssum alyssoides*) decreased significantly in nested frequency and cover decreased from 2% to less than 1%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 17R, Study no: 20

T y p e	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
G	Agropyron dasystachyum	55	80	.98	1.21
G	Agropyron spicatum	_a 5	_b 110	.21	6.07
G	Bromus tectorum (a)	40	29	.41	.12
G	Carex sp.	_b 42	_a 16	.90	.16
G	Festuca ovina	15	10	.54	.19
G	Koeleria cristata	23	34	.22	.58
G	Oryzopsis hymenoides	12	25	.68	.66
G	Poa fendleriana	52	48	1.19	1.17
G	Poa pratensis	10	3	.06	.00
G	Poa secunda	-	35	-	.52
G	Sitanion hystrix	1	3	.03	.01
G	Stipa comata	_b 30	_a 1	1.29	.15
G	Stipa lettermani	_b 161	_a 79	4.18	2.86
Total for Annual Grasses		40	29	0.41	0.12
Total for Perennial Grasses		406	444	10.31	13.61
Total for Grasses		446	473	10.72	13.73
F	Allium sp.	_b 61	_a 2	.29	.00
F	Alyssum alyssoides (a)	_b 128	_a 49	2.25	.15
F	Antennaria rosea	11	7	.19	.18
F	Aster sp.	6	3	.03	.03
F	Astragalus convallarius	3	11	.00	.04
F	Astragalus tenellus	16	20	.73	.11
F	Castilleja linariaefolia	_b 9	_a 3	.13	.04
F	Chaenactis douglasii	3	4	.18	.01
F	Cirsium sp.	8	11	.51	.10
F	Collinsia parviflora (a)	3	5	.00	.01
F	Collomia linearis (a)	-	3	-	.03
F	Comandra pallida	12	20	.10	.07
F	Cryptantha sp.	11	13	.36	.05
F	Descurainia pinnata (a)	-	1	-	.00
F	Eriogonum alatum	2	5	.06	.09
F	Eriogonum brevicaule	_a -	_b 14	-	.21

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
F	Eriogonum umbellatum	1	8	.03	.16
F	Gayophytum ramosissimum(a)	1	2	.00	.15
F	Geranium richardsonii	-	1	-	.00
F	Grindelia squarrosa	-	3	-	.03
F	Lappula occidentalis (a)	2	-	.03	-
F	Lesquerella sp.	-	2	-	.00
F	Linum lewisii	4	6	.15	.02
F	Lithospermum ruderales	35	39	1.69	.66
F	Lupinus argenteus	10	9	.81	.04
F	Machaeranthera canescens	-	7	-	.04
F	Machaeranthera grindelioides	_a 8	_b 21	.43	.26
F	Orthocarpus tolmiei (a)	_b 52	_a 2	1.36	.01
F	Penstemon caespitosus	-	1	-	.00
F	Phacelia hastata	-	8	-	.02
F	Phlox austromontana	_a 42	_b 56	1.89	1.02
F	Phlox longifolia	1	-	.03	-
F	Polygonum douglasii (a)	5	6	.00	.01
F	Potentilla gracilis	_a 3	_b 23	.03	.07
F	Schoenrambe linifolia	1	4	.00	.01
F	Senecio multilobatus	-	6	-	.01
F	Tragopogon dubius (a)	1	-	.03	-
Total for Annual Forbs		192	68	3.69	0.36
Total for Perennial Forbs		247	307	7.68	3.34
Total for Forbs		439	375	11.37	3.70

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 17R, Study no: 20

Type	Species	Strip Frequency		Average Cover %	
		'05	'12	'05	'12
B	Artemisia frigida	1	1	.03	.15
B	Artemisia tridentata vaseyana	72	78	20.07	23.83
B	Chrysothamnus parryi	15	15	.93	.22
B	Chrysothamnus viscidiflorus viscidiflorus	84	66	9.13	7.99
B	Eriogonum heracleoides	15	2	.91	.18
B	Gutierrezia sarothrae	8	21	.68	.88
B	Mahonia repens	43	37	2.04	1.84
B	Rosa woodsii	5	2	.03	.03
B	Symphoricarpos oreophilus	5	4	.56	.15
B	Tetradymia canescens	7	6	.18	.00
Total for Browse		255	232	34.58	35.28

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 20

Species	Percent Cover	
	'05	'12
Artemisia tridentata vaseyana	24.75	26.66
Chrysothamnus parryi	2.09	1.23
Chrysothamnus viscidiflorus viscidiflorus	8.70	5.93
Eriogonum heracleoides	1.28	-
Gutierrezia sarothrae	1.03	.43
Mahonia repens	1.06	1.53
Symphoricarpos oreophilus	.21	.05
Tetradymia canescens	.15	.11

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17R, Study no: 20

Species	Average leader growth (in)	
	'05	'12
Artemisia tridentata vaseyana	1.6	1.1

BASIC COVER--

Management unit 17R, Study no: 20

Cover Type	Average Cover %	
	'05	'12
Vegetation	51.83	51.96
Rock	3.44	2.86
Pavement	1.28	.46
Litter	35.62	41.17
Cryptogams	1.26	.38
Bare Ground	23.52	26.09

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 20, Study Name: Road Hollow Ridge

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
12.8	7.4	44.7	33.1	22.2	2.2	9.3	140.8	0.7

PELLET GROUP DATA--

Management unit 17R, Study no: 20

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'12	'05	'12
Rabbit	6	1	-	-
Grouse	6	3	426 groups/acre	191 groups/acre
Elk	1	-	1 (2)	-
Deer	7	1	7 (18)	8 (20)

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 20

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia frigida</i>									
05	40	0	0	100	-	0	0	0	5/11
12	20	0	100	0	-	0	0	0	-/-
<i>Artemisia tridentata vaseyana</i>									
05	3320	1	75	25	-	23	19	9	23/37
12	3420	2	82	16	-	33	5	23	19/35
<i>Chrysothamnus parryi</i>									
05	960	2	98	-	-	0	0	0	6/11
12	780	0	100	-	-	0	0	0	7/10
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
05	5100	6	87	7	20	0	0	2	11/19
12	3420	1	91	9	20	0	0	10	10/18
<i>Eriogonum heracleoides</i>									
05	780	0	100	0	-	10	0	0	6/14
12	40	50	0	50	-	0	0	50	-/-
<i>Gutierrezia sarothrae</i>									
05	820	0	95	5	-	0	0	0	5/8
12	1060	8	92	0	20	0	0	0	5/7
<i>Mahonia repens</i>									
05	9180	2	98	1	-	0	0	0	3/4
12	6300	0	100	0	-	0	0	.63	3/4
<i>Pediocactus simpsonii</i>									
05	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	2/4
<i>Purshia tridentata</i>									
05	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	6/25
<i>Rosa woodsii</i>									
05	180	78	22	-	-	0	22	0	8/5
12	60	0	100	-	-	33	0	0	12/4
<i>Symphoricarpos oreophilus</i>									
05	180	0	44	56	-	0	0	11	16/33
12	140	14	43	43	-	29	14	43	15/19
<i>Tetradymia canescens</i>									
05	220	0	73	27	-	0	0	9	10/21
12	140	0	100	0	-	0	0	0	9/15

CLOVER BULLHOG DRILL - TREND STUDY NO. 18R-2-12

Project #30

Vegetation Type: Pinyon Pine

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: [Upland Shallow Loam \(Utah Juniper-Singleleaf Pinyon\), R028AY324UT](#)

Land Ownership: BLM

Elevation: 5,849 ft. (1,783 m)

Aspect: Northeast

Slope: 71%

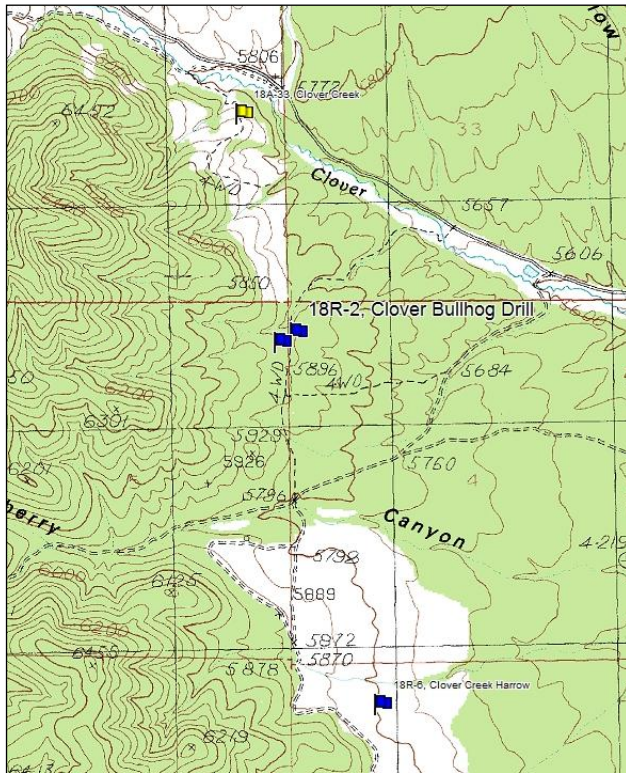
Transect bearing: 105° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59 ft), line 4 (71 ft), line 5 (95 ft)

Directions:

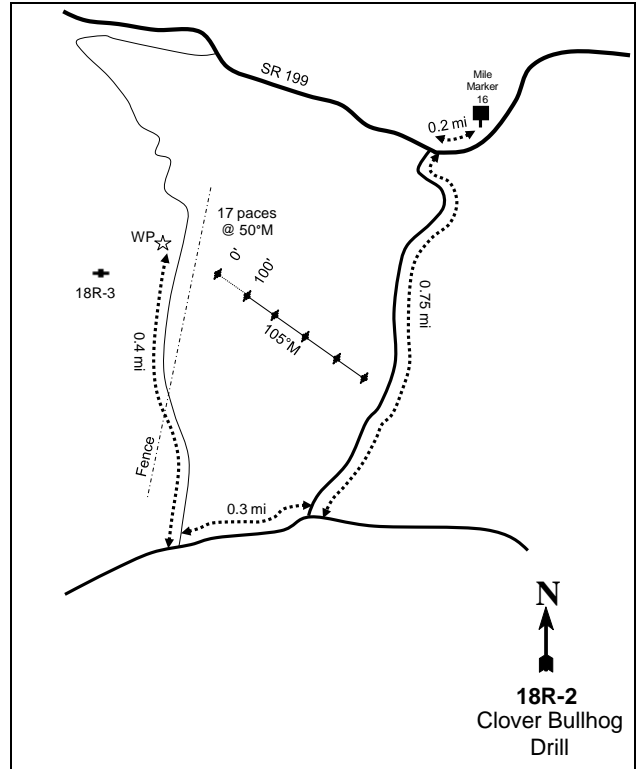
From Lehi, drive west on SR 73 (Main st) to the junction of SR 36. Turn left (south) and drive 3.7 miles to the SR 199. Turn right on SR 199 and drive to mile marker 16. Continue 0.2 miles to a road on the left (south) near a power pole. Turn left and drive 0.75 miles to a fork. Stay right (west) and drive 0.3 miles to an intersection. Turn right (north) and drive 0.4 miles to the witness post on the left (west) side of the road. From the witness post, walk 17 paces at 50°M to the 0' stake. The 0' stake is marked with browse tag #79.

Map Name: Johnson Pass



Township: 6S Range: 6W Section: 4

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 369487 E 4465574 N

CLOVER BULLHOG DRILL - TREND STUDY NO. 18R-2

[Project #30](#)

Site Description

Site Information: The study is located approximately four miles west of Clover, within a Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus monophylla*) woodland, south of Clover Creek, on land administered by the Bureau of Land Management (BLM). The study was established prior to treatment in 2005 to monitor a Bullhog project to thin pinyon pine and Utah juniper. The study occurs on the BLM Onaqui Mountain East allotment. In the fall of 2005, a total of 420 acres of pinyon and juniper woodland were thinned with a bullhog. Prior to the bullhog treatment, a total of 213 acres of the project area were aerially seeded, 181 acres were aerial seeded and harrowed following the bullhog treatment, and 27 acres were drill seeded after the bullhog treatment. The harrow section was originally planned to be drill seeded, but due to circumstances the area was only partially drilled and the rest was aerially seeded. The study was located within the drill seeded area. Following the treatment, forage kochia (*Kochia prostrata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) were aerially seeded over the entire treatment area (Table - Seed Mix). The objectives of the project are to restore the native sagebrush habitat, improve wildlife habitat, increase biodiversity, decrease the risk of wildfire, and slow the continual spread of cheatgrass (WRI Database 2013). Deer and elk pellet groups sampled in low abundance on the site in 2005, 2008, and 2012. Cattle pellet groups were sampled on low abundance in 2005 (Table - Pellet Group Data).

Browse: The preferred browse species sampled on the site include Wyoming big sagebrush, forage kochia, and antelope bitterbrush (*Purshia tridentata*). Wyoming big sagebrush is the key browse species, though occurring in low abundance on the site. Prior to the treatment, palatable browse species were rare on the site, but have become more common with the establishment of seeded browse species, which include Wyoming big sagebrush and forage kochia. The Wyoming big sagebrush is a lightly to moderately used population with low decadence and good vigor, though decadence and poor vigor were high prior to the treatment. Since the treatment, the recruitment of young sagebrush plants to the population has been good. Utilization of forage kochia was moderate in 2008 (Table - Browse Characteristics). Utah juniper decreased in density on the site following the treatment (Table - Point-Quarter Tree Data), but still provided the majority of the cover on the site (Table - Canopy Cover). Juniper trees in the project area were thinned leaving trees at random intervals across the project site. The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse. The dominant grass species on the site are bluebunch wheatgrass (*Agropyron spicatum*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*). The annual species cheatgrass (*Bromus tectorum*) is present on the site, but in low abundance. Seeded species sampled on the site following the treatment include crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. Smithii*), bluebunch wheatgrass (*A. spicatum*), orchard grass (*Dactylis glomerata*), Canby bluegrass (*Poa canbyi*), and Sandberg bluegrass (*P. secunda*); however, bluebunch wheatgrass and Sandberg bluegrass were present prior to the treatment. Forbs are moderately abundant and fairly diverse, but prior to the treatment forbs were not very diverse. The dominant forb species are the perennial species blue flax (*Linum perenne*) and the annual species pale alyssum (*Alyssum alyssoides*). Seeded forb species sampled on the site include western yarrow (*Achillea millefolium*), blue flax, alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Kapod component, which occurs on fan remnants. The parent material consists of alluvium derived from limestone and sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter and a moderate amount of vegetation providing

protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2005, 2008, and 2012.

Pre vs. Three Years Post Treatment, 2005 vs. 2008

Browse: Palatable browse species were rare on the site prior to the treatment, but became more common following the treatment due to the establishment of seeded species. Following the treatment, the seeded species Wyoming big sagebrush increased in density from 40 plants/acre to 640 plants/acre. Forage kochia was sampled for the first time with a density of 520 plants/acre. Utah juniper decreased in density from 402 trees/acre to 239 trees/acre and canopy cover decreased from 30% to 17%, though juniper still provides the majority of the canopy cover on the site.

Grasses: The sum of nested frequency of perennial grasses increased slightly by 17%, and cover increased from 8% to 14%. Bluebunch wheatgrass remained the dominant grass species, though, nested frequency remained the same, and cover increased from 4% to 6%. The nested frequency of Sandberg bluegrass cover decreased from 3% to 2%. Bottlebrush squirreltail increased significantly in nested frequency, and cover increased from 1% to 3%. The seeded species crested wheatgrass, western wheatgrass, orchard grass, and Candy bluegrass were sampled for the first time in 2008, though each species provided less than 1% cover. Cheatgrass remained rare on the site and provided minimal cover.

Forbs: The sum of nested frequency of perennial forbs increased nearly three-fold, and cover increased from less than 1% to just over 2%. The seeded species blue flax became the dominant forb species following treatment and provided nearly 2% cover. Several seeded species were sampled which include western yarrow, blue flax, alfalfa, sainfoin, and small burnet.

Trend Assessments

Browse:

- **2008 to 2012 - slightly up (+1):** The density of mountain big sagebrush increased by 19% to 760 plants/acre, though canopy cover remained similar at 1%. Poor vigor and decadence remained low within the sagebrush population. Recruitment of young sagebrush plants remained good within the population at 11%. Forage kochia was only sampled in height/crown measurements in 2012. Juniper canopy cover decreased to 11%, though density increased to 283 trees/acre.

Grass:

- **2008 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 16%, and cover increased to 18%. Canby bluegrass increased significant in nested frequency, and cover increased from less than 1% to 2%. Bluebunch wheatgrass and Sandberg bluegrass increased in cover to 8% and 5%, respectively.

Forb:

- **2008 to 2012 - up (+2):** The sum of nested frequency of perennial forbs increased 45%, and cover increased to 3%. Blue flax remained similar in nested frequency, though cover decreased to 1%. The weedy annual species pale alyssum (*Alyssum alyssoides*) increased significantly in nested frequency though cover remained similar at 1%.

SEED MIX--

Management unit 18R, Study no: 2

Project Name: Clover Creek WUI						
WRI Database #: 30						
Application: Aerial/Drill Seed			Acres: 230		Application: Aerial Seed	
					Acres: 450	
Seed type			lbs in mix	lbs/acre	Seed type	
G	Bluebunch WG 'P7'		250	1.09	B	Sagebrush, Wyoming
G	Canby Bluegrass 'Canbar'		150	0.65	B	Forage Kochia
G	Crested Wheatgrass 'Hycrest'		200	0.87	Total Pounds:	
G	Orchardgrass 'Paiute'		250	1.09	900	
G	Sandberg Bluegrass 'Toole MT'		100	0.43	PLS Pounds:	
G	Siberian Wheatgrass 'Vavilov'		250	1.09	0.94	
G	Snake River Wheatgrass 'Secar'		250	1.09		
G	Western Wheatgrass		200	0.87		
F	Alfalfa 'Ladak+'		250	1.09		
F	Alfalfa 'Ranger'		250	1.09		
F	Blue Flax		150	0.65		
F	Sainfoin 'Eski'		600	2.61		
F	Small Burnet 'Delar'		600	2.61		
F	Western Yarrow		40	0.17		
Total Pounds:			3540	15.39		
PLS Pounds:				14.00		

Trend Summary

HERBACEOUS TRENDS--

Management unit 18R, Study no: 2

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	Agropyron cristatum	-	24	26	-	.41	.85
G	Agropyron smithii	-	12	11	-	.08	.19
G	Agropyron spicatum	127	119	155	4.13	6.08	8.27
G	Bromus tectorum (a)	27	19	40	.06	.04	.29
G	Dactylis glomerata	a-	c22	b8	-	.77	.27
G	Koeleria cristata	-	-	3	-	-	.00
G	Oryzopsis hymenoides	3	8	8	.21	.20	.60
G	Poa canbyi	a-	b15	c28	-	.80	1.49
G	Poa fendleriana	-	-	2	-	-	.15
G	Poa secunda	170	129	165	2.57	2.27	4.85
G	Secale cereale (a)	-	-	3	-	-	.15
G	Sitanion hystrix	a44	b73	ab60	.92	3.28	1.27
G	Vulpia octoflora (a)	2	-	2	.00	-	.00
Total for Annual Grasses		29	19	45	0.07	0.04	0.45
Total for Perennial Grasses		344	402	466	7.84	13.89	17.97
Total for Grasses		373	421	511	7.91	13.94	18.42
F	Achillea millefolium	-	4	4	-	.07	.04
F	Alyssum alyssoides (a)	b302	a198	b246	1.15	1.29	1.23

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
F	<i>Antennaria rosea</i>	2	-	2	.00	-	.00
F	<i>Astragalus convallarius</i>	1	9	9	.00	.09	.26
F	<i>Astragalus eurekaensis</i>	-	-	3	-	-	.03
F	<i>Chaenactis douglasii</i>	-	3	5	.00	.00	.03
F	<i>Crepis acuminata</i>	-	1	2	-	.00	.01
F	<i>Cryptantha</i> sp.	-	-	-	-	.03	-
F	<i>Descurainia pinnata</i> (a)	b23	a-	a-	.09	-	-
F	<i>Eriogonum ovalifolium</i>	-	1	-	-	.00	-
F	<i>Galium aparine</i> (a)	6	-	-	.19	-	-
F	<i>Gilia</i> sp. (a)	5	-	-	.01	-	-
F	<i>Ipomopsis aggregata</i>	5	-	1	.01	-	.00
F	<i>Lactuca serriola</i> (a)	b16	b18	a-	.05	.06	-
F	<i>Linum perenne</i>	a-	b49	b75	-	1.58	.95
F	<i>Medicago sativa</i>	-	3	10	-	.04	.37
F	<i>Microsteris gracilis</i> (a)	b12	a1	a-	.03	.00	-
F	<i>Onobrychis viciaefolia</i>	-	1	7	-	.03	.43
F	<i>Phlox hoodii</i>	4	4	-	.03	.03	-
F	<i>Phlox longifolia</i>	a31	a36	b66	.28	.18	.43
F	<i>Physaria</i> sp.	3	1	5	.01	.01	.03
F	<i>Ranunculus testiculatus</i> (a)	b86	a6	a5	.20	.02	.01
F	<i>Sanguisorba minor</i>	a-	b13	b11	-	.14	.19
F	<i>Senecio multilobatus</i>	-	1	-	-	.01	-
F	<i>Tragopogon dubius</i> (a)	-	2	6	-	.00	.05
F	<i>Trifolium</i> sp.	-	12	-	-	.10	-
F	<i>Veronica biloba</i> (a)	b37	a1	a-	.09	.00	-
Total for Annual Forbs		487	226	257	1.82	1.39	1.29
Total for Perennial Forbs		46	138	200	0.35	2.34	2.80
Total for Forbs		533	364	457	2.17	3.73	4.10

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 18R, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
B	<i>Artemisia tridentata wyomingensis</i>	2	16	21	-	.36	.52
B	<i>Chrysothamnus nauseosus</i>	0	0	1	-	-	-
B	<i>Eriogonum corymbosum</i>	1	1	0	-	-	-
B	<i>Gutierrezia sarothrae</i>	0	0	1	-	-	.15
B	<i>Juniperus osteosperma</i>	19	14	14	12.13	3.77	6.37
B	<i>Kochia prostrata</i>	0	14	0	-	.03	-
B	<i>Purshia tridentata</i>	4	3	5	.15	.30	.78
B	<i>Symphoricarpos oreophilus</i>	7	6	7	.18	.45	1.41
Total for Browse		33	54	49	12.46	4.92	9.24

CANOPY COVER, LINE INTERCEPT--
 Management unit 18R, Study no: 2

Species	Percent Cover		
	'05	'08	'12
Artemisia tridentata wyomingensis	-	.41	.73
Eriogonum corymbosum	-	.08	-
Juniperus osteosperma	29.45	16.51	10.71
Purshia tridentata	.31	.45	.70
Symphoricarpos oreophilus	.36	.46	.60

KEY BROWSE ANNUAL LEADER GROWTH--
 Management unit 18R, Study no: 2

Species	Average leader growth (in)		
	'05	'08	'12
Artemisia tridentata wyomingensis	-	2.9	0.8
Purshia tridentata	4.6	4.0	1.5

POINT-QUARTER TREE DATA--
 Management unit 18R, Study no: 2

Species	Trees per Acre			Average diameter (in)		
	'05	'08	'12	'05	'08	'12
Juniperus osteosperma	402	239	283	7.4	4.8	5.0

BASIC COVER--
 Management unit 18R, Study no: 2

Cover Type	Average Cover %		
	'05	'08	'12
Vegetation	20.77	21.64	34.09
Rock	2.89	1.02	1.29
Pavement	15.31	13.06	8.08
Litter	40.07	68.71	54.07
Cryptogams	5.05	.61	.07
Bare Ground	29.92	8.11	13.43

SOIL ANALYSIS DATA --

Management unit 18R, Study no: 2, Study Name: Clover Bullhog Drill

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
12.0	7.1	33.7	38.1	28.2	4.4	13.0	185.6	0.7

PELLET GROUP DATA--

Management unit 18R, Study no: 2

Type	Quadrat Frequency		
	'05	'08	'12
Rabbit	47	59	12
Elk	1	3	1
Deer	6	7	4
Cattle	1	-	-

Days use per acre (ha)		
'05	'08	'12
-	-	-
1 (2)	-	1 (2)
7 (18)	11 (28)	13 (33)
-	-	-

BROWSE CHARACTERISTICS--

Management unit 18R, Study no: 2

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
05	40	0	50	50	-	0	0	50	21/21
08	640	59	41	0	20	0	0	13	13/12
12	760	11	89	0	-	24	5	0	17/20
<i>Chrysothamnus nauseosus</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	20	0	0	0	-/-
12	20	0	100	-	-	0	0	0	9/6
<i>Eriogonum corymbosum</i>									
05	20	0	100	-	-	0	0	0	6/7
08	20	0	100	-	-	0	0	0	7/9
12	0	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
05	0	0	0	-	-	0	0	0	8/7
08	0	0	0	-	-	0	0	0	14/17
12	20	0	100	-	-	0	0	0	8/13
<i>Juniperus osteosperma</i>									
05	460	13	78	9	20	0	0	13	-/-
08	320	6	69	25	-	0	0	31	-/-
12	280	43	50	7	-	0	0	14	-/-
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	520	58	42	-	180	27	19	0	4/7
12	0	0	0	-	-	0	0	0	7/11
<i>Purshia tridentata</i>									
05	100	20	80	-	-	80	20	0	33/55
08	60	33	67	-	-	0	33	0	19/43
12	100	0	100	-	-	60	40	0	32/58
<i>Symphoricarpos oreophilus</i>									
05	160	25	75	-	-	0	0	0	17/30
08	180	22	78	-	-	0	0	0	14/26
12	220	18	82	-	-	0	55	0	16/31

CLOVER BULLHOG AERIAL - TREND STUDY NO. 18R-3-12

Project #30

Vegetation Type: Pinyon Pine

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: [Upland Shallow Loam \(Utah Juniper-Singleleaf Pinyon\), R028AY324UT](#)

Land Ownership: BLM

Elevation: 5,854 ft. (1,784 m)

Aspect: Northeast

Slope: 8%

Transect bearing: 270° magnetic

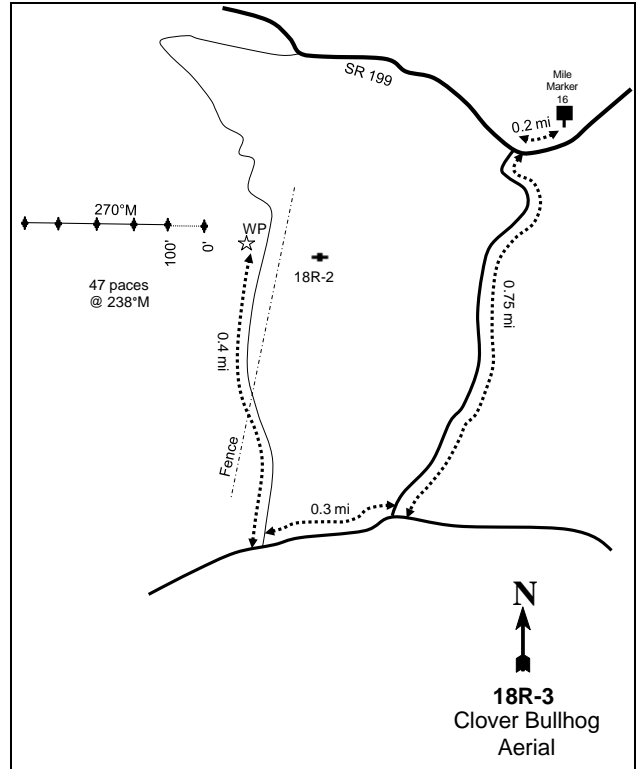
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59 ft), line 4 (71 ft), line 5 (95 ft)

Directions:

From Lehi, drive west on SR 73 (Main st) to the junction of SR 36. Turn left (south) and drive 3.7 miles to the SR 199. Turn right on SR 199 and drive to mile marker 16. Continue 0.3 miles to a road on the left (south) near a power pole. Turn left and drive 0.75 miles to a fork. Stay right (west) and drive 0.3 miles to an intersection. Turn right (north) and drive 0.4 miles to the witness post on the left (west) side of the road. From the witness post, walk 47 paces at 238°M to the 0' stake. Pass over a fence line.

Map Name: Johnson Pass

Diagrammatic Sketch:



Township: 6S Range: 6W Section: 5

GPS: NAD 83, UTM 12S 369414 E 4465533 N

CLOVER BULLHOG AERIAL - TREND STUDY NO. 18R-3

[Project #30](#)

Site Description

Site Information: The study is located approximately four miles west of Clover, within a Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus monophylla*) woodland, south of Clover Creek, on land administered by the Bureau of Land Management (BLM). The study was established prior to treatment in 2005 to monitor a bullhog project to thin pinyon pine and Utah juniper. The study occurs on the BLM Onaqui Mountain East allotment. In the fall of 2005, a total of 420 acres of pinyon and juniper woodland were thinned with a bullhog. Prior to the bullhog treatment, a total of 213 acres of the project area were aerially seeded, 181 acres were aerial seeded and harrowed following the bullhog treatment, and 27 acres were drill seeded after the bullhog treatment. The harrow section was originally planned to be drill seeded, but due to circumstances the area was only partially drilled and the rest was aerially seeded. The study was located within the aerial seeded treatment area. Following the treatment, forage kochia (*Kochia prostrata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) were aerially seeded over the entire treatment area (Table - Seed Mix). The objectives of the project were to restore the native sagebrush habitat, improve wildlife habitat, increase biodiversity, decrease the risk of wildfire, and slow the continual spread of cheatgrass (WRI Database 2013). Deer pellet groups were sampled in low abundance in all sample years. Elk pellet groups were sampled in low abundance from elk in 2005 and 2008 (Table - Pellet Group Data).

Browse: The preferred browse species sampled on the site include Wyoming big sagebrush, forage kochia, Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), slenderbush eriogonum (*Eriogonum microthecum*), and antelope bitterbrush (*Purshia tridentata*). Prior to the treatment, palatable browse species were rare on the site, but have become more common with the establishment of seeded browse species on the site, which include Wyoming big sagebrush and forage kochia. Antelope bitterbrush is the most common palatable browse sampled on the site. The antelope bitterbrush is a moderately used population with low decadence and good vigor, though use was heavy prior to the treatment (Table - Browse Characteristics). Utah juniper decreased in density on the site following the treatment (Table - Point-Quarter Tree Data), but still provided the majority of the cover on the site (Table - Canopy Cover). Juniper trees in the project area were thinned leaving trees at random intervals across the project site. The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species on the site is bluebunch wheatgrass (*Agropyron spicatum*). The annual species cheatgrass (*Bromus tectorum*) is present on the site, but in low abundance. Seeded species sampled on the site following the treatment include crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. Smithii*), bluebunch wheatgrass (*A. spicatum*), orchard grass (*Dactylis glomerata*), Canby bluegrass (*Poa canbyi*), and Sandberg bluegrass (*P. secunda*); however, bluebunch wheatgrass and Sandberg bluegrass were present prior to the treatment. Forbs are not very abundant, but are fairly diverse. Seeded forb species sampled on the site include blue flax (*Linum perenne*) and alfalfa (*Medicago sativa*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Kapod component, which occurs on fan remnants. The parent material consists of alluvium derived from limestone and sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a slightly alkaline soil reaction (pH 7.6) (Table - Soil Analysis Data). Bare ground cover is low though there is a high amount of litter and vegetation and a moderate amount of pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all the sample years.

Pre vs. Three Years Post Treatment, 2005 vs. 2008

Browse: Palatable browse species remained rare on the site. Following the treatment, the seeded species Wyoming big sagebrush decreased in density by 50% from 80 plants/acre to 40 plants/acre. Forage kochia was sampled for the first time with densities of 40 plants/acre. Antelope bitterbrush increased slightly in density by 17% from 120 plants/acre to 140 plants/acre, but canopy cover decreased from 2% to 1%. Utah juniper decreased in density from 219 trees/acre to 109 trees/acre and canopy cover decreased from 30% to 17%.

Grasses: The sum of nested frequency of perennial grasses remained similar, but cover increased slightly from 12% to 14%. Bluebunch wheatgrass remained the dominant grass species, though nested frequency remained similar and cover increased from 11% to 13%. The seeded species western wheatgrass, orchard grass, and Candy bluegrass were sampled for the first time in 2008, but provided little cover. Cheatgrass remained rare on the site and provided minimal cover.

Forbs: The sum of nested frequency of perennial forbs increased 52%, though cover remained similar at 1%. Seeded species sampled include blue flax and alfalfa. No single forb species provided more than 1% cover in either sample year.

Trend Assessments

Browse:

- **2008 to 2012 - stable (0):** Palatable browse species remained rare on the site. The density of mountain big sagebrush remained similar at 80 plants/acre, and canopy cover minimal on the site. Forage kochia was sampled in 2012. Juniper canopy cover remained similar at 17%.

Grass:

- **2008 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 18%, and cover increased to 22%. Sandberg bluegrass increased significant in nested frequency, and cover increased from 1% to 3%. Bluebunch wheatgrass increased in cover to 18%.

Forb:

- **2008 to 2012 - up (+2):** The sum of nested frequency of perennial forbs increased 28%, and cover increased to 2%. No single forb species provided more than 1% cover on the site.

SEED MIX--

Management unit 18R, Study no: 3

Project Name: Clover Creek WUI - Drill Mix						
WRI Database #: 30						
Application: Aerial/Drill Seed			Acres: 201		Application: Aerial Seed	
					Acres: 450	
Seed type			lbs in mix	lbs/acre	Seed type	
G	Bluebunch WG 'Anatone'		250	1.24	B	Sagebrush, Wyoming
G	Canby Bluegrass 'Canbar'		150	0.75	B	Forage Kochia
G	Crested Wheatgrass 'Hycrest'		250	1.24	Total Pounds:	
G	Orchardgrass 'Paiute'		250	1.24	900	
G	Sandberg Bluegrass 'Toole MT'		100	0.50	PLS Pounds:	
G	Siberian Wheatgrass 'Vavilov'		200	1.00	0.94	
G	Snake River Wheatgrass 'Secar'		250	1.24		
G	Western Wheatgrass 'Arriba'		250	1.24		
F	Alfalfa 'Ranger'		500	2.49		
F	Blue Flax		150	0.75		
F	Sainfoin 'Eski'		550	2.74		
F	Small Burnet 'Delar'		550	2.74		
F	Western Yarrow		50	0.25		
Total Pounds:			3500	17.41		
PLS Pounds:				15.58		

Trend Summary

HERBACEOUS TRENDS--

Management unit 18R, Study no: 3

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	Agropyron cristatum	-	-	3	-	-	.03
G	Agropyron smithii	7	8	20	.06	.01	.22
G	Agropyron spicatum	252	252	231	10.81	13.03	17.52
G	Bromus japonicus (a)	1	-	-	.00	-	-
G	Bromus tectorum (a)	18	22	33	.07	.06	.07
G	Dactylis glomerata	-	3	-	-	.00	-
G	Oryzopsis hymenoides	8	3	10	.18	.22	.21
G	Poa bulbosa	8	-	-	.18	-	-
G	Poa canbyi	-	11	5	-	.05	.09
G	Poa pratensis	a1	a1	b7	.03	.03	.33
G	Poa secunda	a110	a94	b166	1.03	.62	3.38
G	Sitanion hystrix	3	5	4	.04	.12	.21
Total for Annual Grasses		19	22	33	0.07	0.06	0.07
Total for Perennial Grasses		389	377	446	12.34	14.11	22.02
Total for Grasses		408	399	479	12.41	14.17	22.10
F	Allium sp.	8	-	-	.03	-	-
F	Alyssum alyssoides (a)	b258	a185	b243	.95	.46	.44
F	Antennaria rosea	-	1	-	-	.03	-
F	Astragalus convallarius	3	4	1	.03	.06	.03

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
F	<i>Astragalus eurekaensis</i>	-	4	6	-	.10	.23
F	<i>Astragalus utahensis</i>	-	-	-	-	.00	-
F	<i>Calochortus nuttallii</i>	8	3	8	.01	.01	.04
F	<i>Chaenactis douglasii</i>	-	1	4	-	.03	.00
F	<i>Collinsia parviflora</i> (a)	3	-	-	.00	-	-
F	<i>Comandra pallida</i>	-	3	2	.00	.00	.00
F	<i>Crepis acuminata</i>	a ⁻	a ⁻	b ⁸	.00	-	.18
F	<i>Descurainia pinnata</i> (a)	12	-	-	.04	-	-
F	<i>Erysimum</i> sp.	-	-	2	-	-	.00
F	<i>Galium aparine</i> (a)	9	-	4	.01	-	.01
F	<i>Gilia</i> sp. (a)	3	-	-	.00	-	-
F	<i>Ipomopsis aggregata</i>	4	1	-	.03	.03	-
F	<i>Lactuca serriola</i> (a)	10	2	2	.02	.03	.00
F	<i>Linum perenne</i>	a ⁻	a ¹¹	b ²⁸	-	.07	.16
F	<i>Medicago sativa</i>	-	-	-	-	.00	-
F	<i>Microsteris gracilis</i> (a)	4	-	3	.01	-	.00
F	<i>Phlox hoodii</i>	2	1	5	.03	.03	.19
F	<i>Phlox longifolia</i>	a ¹²	b ⁴³	b ⁴⁸	.03	.09	.26
F	<i>Ranunculus testiculatus</i> (a)	b ⁴⁰	a ¹³	a ¹¹	.09	.03	.02
F	<i>Senecio multilobatus</i>	-	1	3	-	.00	.15
F	<i>Veronica biloba</i> (a)	b ¹⁸	a ⁻	a ⁻	.07	-	-
F	<i>Vicia americana</i>	55	66	64	.40	.56	.55
F	<i>Zigadenus paniculatus</i>	-	1	-	-	.00	-
Total for Annual Forbs		357	200	263	1.22	0.52	0.49
Total for Perennial Forbs		92	140	179	0.58	1.05	1.82
Total for Forbs		449	340	442	1.80	1.57	2.32

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 18R, Study no: 3

Type	Species	Strip Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
B	<i>Artemisia tridentata wyomingensis</i>	4	2	3	.03	-	.00
B	<i>Chrysothamnus viscidiflorus</i>	0	1	1	-	-	.38
B	<i>Cowania mexicana stansburiana</i>	0	1	1	-	-	.00
B	<i>Eriogonum microthecum</i>	1	1	0	.03	-	-
B	<i>Gutierrezia sarothrae</i>	4	6	8	.16	.01	.03
B	<i>Juniperus osteosperma</i>	10	5	6	15.86	5.80	11.23
B	<i>Kochia prostrata</i>	0	2	0	-	.00	-
B	<i>Purshia tridentata</i>	6	4	4	.18	.03	1.11
B	<i>Symphoricarpos oreophilus</i>	2	1	1	.03	.03	.15
Total for Browse		27	23	24	16.29	5.88	12.90

CANOPY COVER, LINE INTERCEPT--
Management unit 18R, Study no: 3

Species	Percent Cover		
	'05	'08	'12
Cowania mexicana stansburiana	-	-	.20
Gutierrezia sarothrae	-	-	.08
Juniperus osteosperma	29.63	17.43	16.78
Purshia tridentata	1.80	.51	2.20

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 18R, Study no: 3

Species	Average leader growth (in)		
	'05	'08	'12
Artemisia tridentata wyomingensis	1.2	1.5	1.3
Purshia tridentata	1.8	3.1	1.2

POINT-QUARTER TREE DATA--
Management unit 18R, Study no: 3

Species	Trees per Acre			Average diameter (in)		
	'05	'08	'12	'05	'08	'12
Juniperus osteosperma	219	109	113	7.5	9.9	5.2

BASIC COVER--
Management unit 18R, Study no: 3

Cover Type	Average Cover %		
	'05	'08	'12
Vegetation	28.57	21.76	41.00
Rock	1.73	1.63	3.34
Pavement	15.86	16.78	11.42
Litter	38.63	63.83	49.07
Cryptogams	3.86	2.88	2.45
Bare Ground	32.59	6.60	13.77

SOIL ANALYSIS DATA --

Management unit 18R, Study no: 3, Study Name: Clover Bullhog Aerial

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.8	7.6	34.1	39.7	26.2	1.9	7.2	185.6	0.6

PELLET GROUP DATA--
Management unit 18R, Study no: 3

Type	Quadrat Frequency			Days use per acre (ha)		
	'05	'08	'12	'05	'08	'12
Rabbit	43	52	9	-	-	-
Elk	-	-	-	2 (5)	3 (7)	-
Deer	4	3	3	4 (10)	5 (12)	5 (13)

BROWSE CHARACTERISTICS--
Management unit 18R, Study no: 3

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
05	80	0	50	50	-	25	25	50	21/27
08	40	0	50	50	40	0	0	50	18/19
12	80	50	50	0	-	0	0	0	18/21
<i>Chrysothamnus nauseosus</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	13/21
<i>Chrysothamnus viscidiflorus</i>									
05	0	0	0	-	-	0	0	0	10/12
08	20	0	100	-	-	0	0	0	8/10
12	20	0	100	-	-	0	0	0	8/14
<i>Cowania mexicana stansburiana</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	0	100	-	-	100	0	0	13/26
12	20	0	100	-	-	100	0	0	34/43
<i>Eriogonum microthecum</i>									
05	20	0	100	-	-	0	0	0	7/7
08	20	0	100	-	-	0	0	0	8/10
12	0	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
05	100	0	100	-	-	0	0	0	10/10
08	200	50	50	-	-	0	0	0	10/12
12	200	10	90	-	-	0	0	0	8/13
<i>Juniperus osteosperma</i>									
05	200	20	80	-	-	0	0	0	-/-
08	100	20	80	-	40	0	0	20	-/-
12	120	33	67	-	20	0	0	0	-/-
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	40	50	50	-	20	0	50	0	2/2
12	0	0	0	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
05	120	33	50	17	-	17	50	0	29/59
08	140	14	86	0	-	29	14	0	22/43
12	120	0	100	0	-	83	0	0	31/58
<i>Symphoricarpos oreophilus</i>									
05	40	0	100	-	-	0	0	0	18/31
08	20	0	100	-	-	0	0	0	15/24
12	20	100	0	-	20	0	0	0	20/39

WEST LEE'S CREEK - TREND STUDY NO. 19R-1-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: [Upland Stony Loam \(Wyoming Big Sagebrush\), R028AY334UT](#)

Land Ownership: BLM

Elevation: 5,960 ft (1,817 m)

Aspect: North

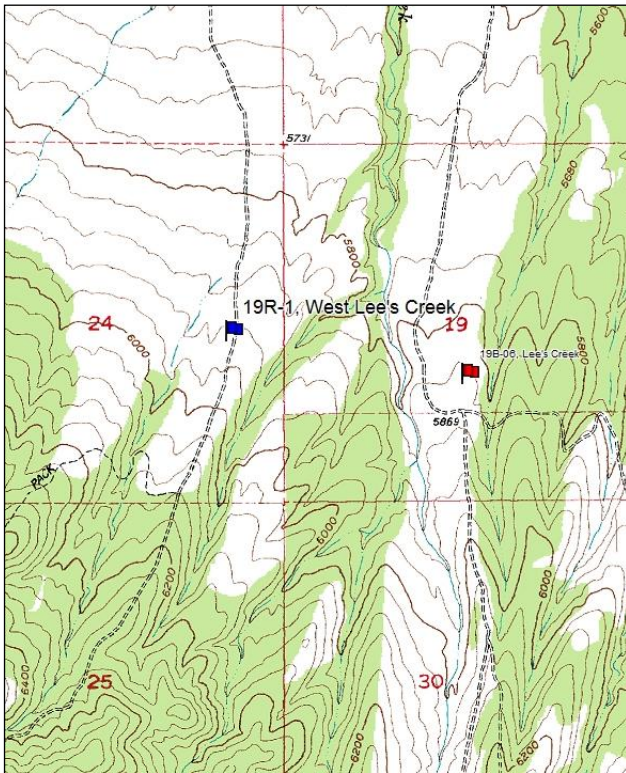
Slope: 6%-8%

Transect bearing: 198° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

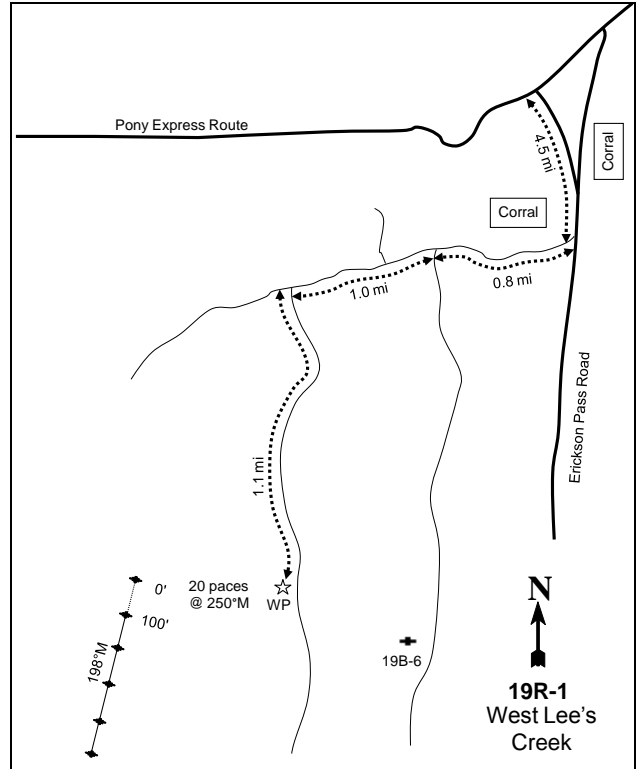
Directions: From the intersection of the Erickson Pass and Pony Express Roads, proceed south on the Erickson Pass Road for 4.5 miles to a road that comes in from the right (west). Turn here and proceed west for 1.8 miles to a road that comes in from the left. Turn here and proceed south for 1.1 miles to a witness post on the right side of the road. The 0-Foot stake is 20 paces from the witness post 250°M, and is marked with browse tag #166.

Map Name: Indians Peaks



Township: 9S Range: 8W Section: 24

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 355943 E 4431206 N

WEST LEE'S CREEK - TREND STUDY NO. 19R-1

Site Information

Site Description: The study is located approximately fifteen miles south of Dugway on the northeast foothills of Simpson Mountains. The study was established prior to treatment in 2004 on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniper osteosperma*) removal project. The study occurs on the BLM Government Creek allotment. The study was established within an old chaining which was dominated by juniper and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). In the fall of 2004 the project area was aerially seeded with two different seed mixes. The northern 350 acres were seeded using the Round Canyon mix, and the southern 350 acres were seeded using the Lee Canyon seed mix (Table - Seed Mix). The study site was likely seed by the Lee Canyon seed mix due to seeded species sampled on the site. In the spring of 2005, pinyon and juniper trees were thinned using bullhog equipment. Following the 2007 sample year and before the 2012 sample year, the study site was retreated with a bullhog, which removed most of the pinyon and juniper trees on the study site. Deer/antelope pellet groups were sampled in low abundance over the sample years. Elk pellet groups were sampled in low abundance in 2007 and cattle pellet groups were sampled in low abundance in 2004 and 2007 (Table - Pellet Group Data).

Browse: The preferred browse species are Wyoming big sagebrush, antelope bitterbrush (*Purshia tridentata*), and forage kochia (*Kochia prostrata*). Wyoming big sagebrush and antelope bitterbrush are the dominant browse species on the site. Forage kochia was first sampled in 2005 following the first treatment, but has not been sampled since then. Both, sagebrush and bitterbrush have increased in abundance and cover on the site following the treatments. Sagebrush is a lightly used population with low decadence and good vigor within the population. Bitterbrush is a moderately used population with low decadence and good vigor, though prior to treatment use was mostly heavy. Recruitment of young plants to the population has fluctuated within both the sagebrush and bitterbrush population, though sagebrush has had higher recruitment. Utah juniper was the dominant species on the site prior to the treatments, but following the second treatment juniper density and cover decreased substantially (Table - Browse Characteristics) (Table - Canopy Cover). The stage of woodland succession was in Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant, but not overly diverse on the site. The dominant grass species on the site are crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*A. spicatum*), and Sandberg bluegrass (*Poa secunda*), which have provided the majority of the grass cover on the site over the sample years. The invasive annual grass species cheatgrass was sampled for the first time on the site in 2007, and has since increased in abundance. Seeded species sampled on the site include crested wheatgrass and bluebunch wheatgrass, though both species were sampled on the site prior to treatment. Forbs are moderately abundant and fairly diverse on the site. No single forb species has been dominant on the site over the sample years (table - Herbaceous Trends).

Soil: The soil is classified as part of the Abela component, which occurs on fan remnants. The parent material consists of alluvium derived from limestone and/or alluvium derived from quartzite. The soils within this classification are characterized as deep, well drained, and with a high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is low though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all the sample years.

Pre vs. Three Years Post Treatment, 2004 vs. 2007 (First Bullhog Treatment)

Browse: The density of Wyoming big sagebrush decreased 34% from 760 plants/acre to 500 plants/acre and canopy cover remained similar at 4%. Antelope bitterbrush decreased in density by 22% from 180 plants/acre to 140 plants/acre, and canopy cover remained similar at 2%. Forage kochia was sampled for the first in

height/crown. Utah juniper decreased in density from 276 trees/acre to 95 trees/acre and canopy cover decreased from 25% to 19%.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover decreased from 13% to 10%. Crested wheatgrass and bluebunch wheatgrass decreased in cover from 6% and 5% to 2% and 3%, respectively. Cheatgrass was samples for the first time in 2005 in low abundance.

Forbs: The sum of nested frequency of perennial forbs increased twofold, and cover remained similar at 1%. No single forb species provided more than 1% cover in either sample year.

Pre vs. Post Treatment, 2007 vs. 2012 (Second Bullhog Treatment)

Browse: The density of Wyoming big sagebrush increased nearly fourfold to 500 plants/acre and canopy cover increased to 5%. Antelope bitterbrush decreased in density threefold to 440 plants/acre, and canopy cover increased at 4%. Utah juniper decreased in density to 31 trees/acre and canopy cover decreased to 1%.

Grasses: The sum of nested frequency of perennial grasses increased 25%, and cover increased to 27%. Crested wheatgrass increased significantly in nested frequency and cover increased to 12%. Cheatgrass increased significantly increased in nested frequency and cover increased to 5%.

Forbs: The sum of nested frequency of perennial forbs increased more than twofold, and cover increased to 5%. No single forb species provided more than 1% cover in either sample year.

SEED MIX--

Management unit 19R, Study no: 1

Project Name: Lee Canyon Seed Mix WRI Database #: PDB				Project Name: Round Canyon Seed Mix WRI Database #: PDB			
Application: Aerial		Acres: 350		Application: Aerial		Acres: 350	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	200	0.57	G	Russian Wildrye 'Bozoisky'	700	2.00
G	Bottlebrush Squirreltail	50	0.14	G	Siberian Wheatgrass 'Vavilov'	700	2.00
G	Canby Bluegrass	150	0.43	G	Western Wheatgrass 'Arriba'	700	2.00
G	Crested Wheatgrass 'Hycrest'	200	0.57	F	Alalfa 'Ladak+'	350	1.00
G	Orchardgrass 'Paiute'	150	0.43	F	Lewis Flax	87.5	0.25
G	Russian Wildrye 'Bozoisky'	150	0.43	F	Western Yarrow	175	0.50
G	Siberian Wheatgrass 'Vavilov'	200	0.57	Total Pounds:		2712.5	7.75
G	Snake River Wheatgrass 'Secar'	150	0.43				
G	Western Wheatgrass 'Arriba'	350	1.00				
F	Western Yarrow	35	0.10				
F	Alalfa 'Ladak+'	350	1.00				
F	Blue Flax 'Appar'	200	0.57				
F	Sainfoin 'Eski'	850	2.43				
F	Small Burnet 'Delar'	700	2.00				
B	Forage Kochia 'Immigrant'	200	0.57				
B	Sagebrush, Wyoming	200	0.57				
Total Pounds:		4135	11.81				
PLS Pounds:			10.25				

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 1

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	_b 171	_a 100	_b 187	5.62	1.81	11.97
G	Agropyron spicatum	104	97	83	5.00	2.71	4.79
G	Bromus tectorum (a)	_a -	_b 14	_c 123	-	.03	4.88
G	Oryzopsis hymenoides	-	1	-	-	.00	-
G	Poa secunda	_a 183	_b 266	_b 295	2.13	5.51	9.45
G	Sitanion hystrix	_a 3	_a 4	_b 16	.03	.03	.52
Total for Annual Grasses		0	14	123	0	0.03	4.88
Total for Perennial Grasses		461	468	581	12.80	10.08	26.76
Total for Grasses		461	482	704	12.80	10.11	31.64
F	Achillea millefolium	-	3	10	-	.03	.13
F	Agoseris glauca	-	-	3	-	-	.03
F	Alyssum alyssoides (a)	_a -	_b 81	_c 229	-	.30	.55
F	Astragalus sp.	_a 4	_b 29	_b 40	.03	.64	1.31
F	Calochortus nuttallii	-	-	2	-	-	.00
F	Chaenactis douglasii	-	-	3	-	-	.03
F	Collinsia parviflora (a)	-	1	-	-	.00	-
F	Crepis acuminata	-	-	5	-	-	.15
F	Cryptantha sp.	-	-	3	-	-	.01
F	Cymopterus sp.	_a -	_a -	_b 15	-	-	.10
F	Descurainia pinnata (a)	_a -	_b 20	_a 2	-	.08	.03
F	Holosteum umbellatum (a)	-	-	1	-	-	.00
F	Lactuca serriola (a)	-	-	1	-	-	.00
F	Linum lewisii	-	-	5	-	-	.34
F	Microsteris gracilis (a)	-	-	6	-	-	.01
F	Petradoria pumila	16	16	27	.37	.25	.94
F	Phlox hoodii	17	11	23	.15	.09	.52
F	Phlox longifolia	_a 2	_{ab} 11	_b 17	.00	.02	.06
F	Ranunculus testiculatus (a)	_a -	_c 183	_b 83	-	.64	.15
F	Tragopogon dubius (a)	-	-	2	-	-	.03
F	Vicia americana	_a 4	_a 14	_b 56	.03	.11	1.12
F	Zigadenus paniculatus	-	6	1	-	.01	.00
Total for Annual Forbs		0	285	324	0	1.02	0.79
Total for Perennial Forbs		43	90	210	0.59	1.16	4.79
Total for Forbs		43	375	534	0.59	2.19	5.58

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	30	22	45	4.87	2.78	2.96
B	Gutierrezia sarothrae	4	1	2	-	.03	.03
B	Juniperus osteosperma	18	9	2	18.88	6.12	1.08
B	Opuntia sp.	0	0	0	-	.00	-
B	Purshia tridentata	7	6	12	2.95	3.58	3.33
Total for Browse		59	38	61	26.71	12.52	7.40

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 1

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	4.38	3.75	5.16
Gutierrezia sarothrae	.15	-	-
Juniperus osteosperma	24.95	18.61	.90
Purshia tridentata	1.93	1.93	4.13

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 1

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata wyomingensis	1.4	1.5	1.2
Purshia tridentata	3.6	2.8	1.1

POINT-QUARTER TREE DATA--

Management unit 19R, Study no: 1

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'12	'04	'07	'12
Juniperus osteosperma	276	95	31	5.6	7.4	5.9

BASIC COVER--

Management unit 19R, Study no: 1

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	38.44	29.01	46.44
Rock	5.35	4.37	6.30
Pavement	11.49	15.61	3.58
Litter	38.15	43.25	56.76
Cryptogams	.43	.80	.01
Bare Ground	25.10	21.24	11.29

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 1, Study Name: West Lee's Creek

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
7.2	6.9	39.3	33.2	27.5	3.3	5.8	217.6	0.8

PELLET GROUP DATA--

Management unit 19R, Study no: 1

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	31	65	1	-	-	-
Elk	-	3	-	-	7 (18)	-
Deer/Antelope	13	3	2	10 (25)	7 (17)	3 (8)
Cattle	1	-	-	4 (9)	8 (20)	-

BROWSE CHARACTERISTICS--

Management unit 19R, Study no: 1

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
04	760	21	61	18	-	18	21	8	24/36
07	500	4	72	24	40	12	20	44	24/34
12	1880	37	63	0	440	1	0	9	19/28
<i>Chrysothamnus nauseosus</i>									
04	0	0	0	-	-	0	0	0	25/24
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	9/8
12	0	0	0	-	-	0	0	0	10/24
<i>Gutierrezia sarothrae</i>									
04	120	0	100	-	-	0	0	0	7/11
07	40	0	100	-	40	0	0	0	7/9
12	40	50	50	-	-	0	0	0	6/8
<i>Juniperus osteosperma</i>									
04	380	0	100	-	-	11	0	0	-/-
07	180	0	100	-	-	0	0	0	-/-
12	40	100	0	-	-	0	0	0	-/-
<i>Kochia prostrata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	5/9
12	0	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Opuntia</i> sp.										
04	0	0	0	-	-	0	0	0	9/19	
07	0	0	0	-	-	0	0	0	8/18	
12	0	0	0	-	-	0	0	0	4/13	
<i>Purshia tridentata</i>										
04	180	11	33	56	-	0	89	11	26/61	
07	140	0	100	0	-	71	29	0	29/61	
12	440	9	91	0	40	68	0	0	22/47	

DEEP CREEK AERATOR - TREND STUDY NO. 19R-2-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Elk Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: BLM

Elevation: 5,842 ft. (1,781 m)

Aspect: Northeast

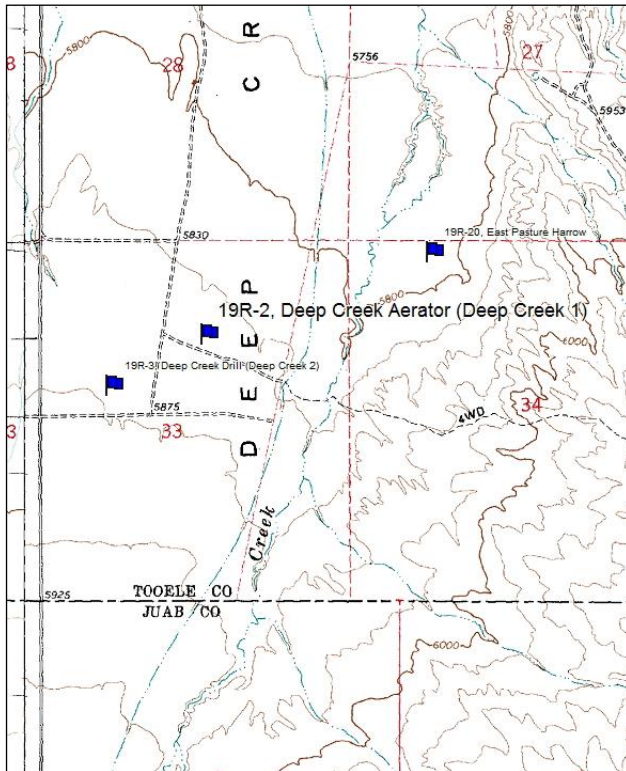
Slope: 2%

Transect bearing: 10° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59 ft), line 4 (71 ft), line 5 (95 ft)

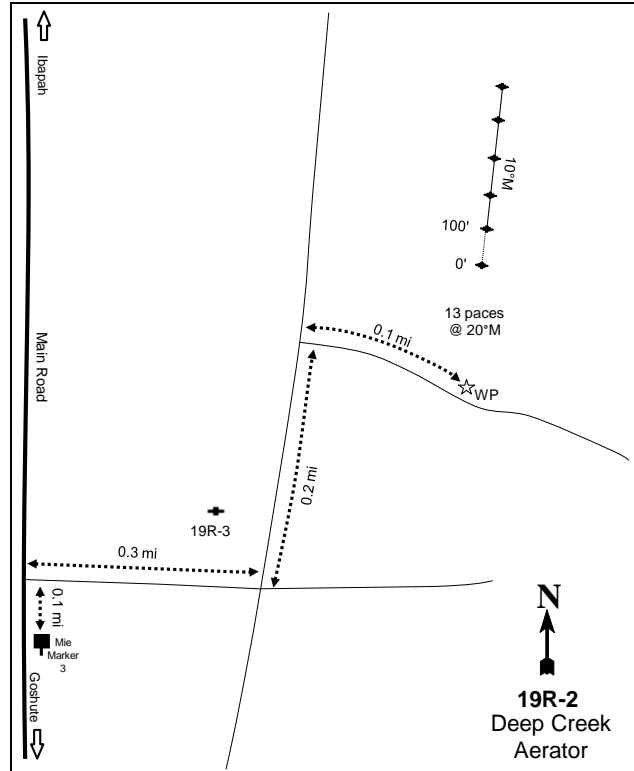
Directions: Drive north of Goshute toward Ibapah to mile marker 3. Drive north of the mile marker 0.1 miles to a two-track road on the right (east) side of the road. Turn right and drive 0.3 miles to a four-way intersection. Turn left at the intersection and drive 0.2 miles to a road on the right. Turn right and drive 0.1 miles to the witness post on the left (north) side of the road. From the witness post, walk 13 paces at 2°M to the 0-foot stake. The 0-foot stake is marked with browse tag #77.

Map Name: Goshute



Township: 10S Range: 19W Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 244318 E 4422757 N

DEEP CREEK AERATOR - TREND STUDY NO. 19R-2

[Project #24](#)

Site Description

Site Information: The study is located approximately three miles north of Goshute, in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, in the Deep Creek Valley. The study was established prior to treatment in 2005 to monitor the effectiveness of the Deep Creek Valley Sagebrush Improvement and Fuels Reduction treatment on land administered by the Bureau of Land Management (BLM). The study occurs on the BLM Ibapah allotment. The treatment project is located within a historic sagebrush steppe on the west side of the Deep Creek Mountains. The sagebrush has become decadent, and cheatgrass (*Bromus tectorum*) has become prevalent in the understory. To improve the health of decadent sagebrush and decrease weedy species, three methods were used to treat the area. The three methods include: Seeding grass, forb, and browse species with a rangeland drill; disturbing the ground and decadent shrubs with a Lawson double drum aerator; and a combination of drill seeding and aerating with the Lawson double drum aerator. The study was established within the aerator and drill seed treatment. In the fall of 2005, a total of 194 acres were one-way aerated and drill seeded. In December 2005, browse species were aerially seeded over the entire treatment area with a fixed wing airplane (Table - Seed Mix). The objectives of the treatment are to decrease fire fuel hazards, and improve habitat for sage-grouse and big game (WRI Database 2013). Sage-grouse pellet groups were sampled at 87 groups/acre in 2005, 104 groups/acre in 2008, and no pellet groups were sampled in 2012. Deer/antelope pellet groups were sampled in low abundance for deer/antelope over the sample years. Cattle pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data). Deer and antelope pellets were combined due to the difficulty of differentiating between these species.

SEED MIX--

Management unit 19R, Study no: 2

Project Name: Deep Creek FM					
WRI Database #: 24					
Application: Drill Seed		Acres: 591		Application: Aerial Seed	
				Acres: 981	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Bluebunch WG 'Anatone'	450	0.76	B	Forage Kochia
G	Great Basin Wildrye 'Trailhead'	300	0.51	B	Sagebrush, Wyoming
G	Orchardgrass 'Paiute'	300	0.51	Total Pounds:	
G	Russian Wildrye 'Bozoisky'	600	1.02	PLS Pounds:	
G	Snake River Wheatgrass 'Secar'	450	0.76		
G	Western Wheatgrass	600	1.02		
F	Alfalfa 'Ladak+'	300	0.51		
F	Alfalfa 'Nomad'	300	0.51		
F	Rocky Mountain Beeplant	293	0.50		
F	Sainfoin 'Eski'	1200	2.03		
F	Small Burnet 'Delar'	1200	2.03		
F	Western Yarrow	50	0.08		
Total Pounds:		6043	10.23		
PLS Pounds:			9.40		

Browse: The preferred browse species on the site are Wyoming big sagebrush and forage kochia (*Kochia prostrata*). The dominant browse species on the site is Wyoming big sagebrush and has provided the majority of the browse cover over the sample years. The Wyoming big sagebrush is a lightly used population, with high decadence and poor vigor within the population. The recruitment of young sagebrush to the population was poor in 2005 and 2008, but was good in 2012. Utilization of forage kochia was light in 2008 and heavy in

2012. Wyoming big sagebrush and forage kochia were seeded on the site and forage kochia was sampled for the first time in 2008 with moderate abundance. Other browse species sampled are narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*) and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are moderately abundant, but are not particularly diverse. The annual species cheatgrass has dominated the herbaceous understory and has provided the majority of the cover over the sample years; however, cover of cheatgrass decreased following the treatment. Sandberg bluegrass (*Poa secunda*) is the most common perennial grass species sampled on the site. Following the treatment, western wheatgrass (*Agropyron smithii*) and bluebunch wheatgrass (*A. spicatum*) are the only seeded grass species sampled on the site, though occurring in low abundance. Forbs are rare on the site. Small burnet (*Sanguisorba minor*) has been the only forb species sampled on the site, though occurring in low abundance. . No single forb species has been dominant on the site over the sample years (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Junkett component, which occurs on fan remnants. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as moderately deep, well drained, and with a low permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is moderate, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all the sample years.

Pre vs. Three Years Post Treatment, 2005 vs. 2008

Browse: The density of Wyoming big sagebrush remained similar at 3,620 plants/acre, but canopy cover decreased from 16% to 9%. The health of the sagebrush population remained similar with decadence decreasing from 53% to 48%, and poor vigor increasing from 24% to 45% of the population. Recruitment of young sagebrush increased from 1% to 6% of the population, but is still considered to be low. Following the treatment, forage kochia was sampled for the first time at 1,040 plants/acre.

Grasses: The sum of nested frequency of perennial grasses increased 43%, but cover decreased from 5% to 2%. Sandberg bluegrass cover decreased from 4% to 1%. The nested frequency of cheatgrass significantly decreased, and cover decreased from 24% to 10%.

Forbs: The sum of nested frequency of perennial forbs increased 18%, but cover remained similar at 1%. Perennial forbs remained rare on the site.

Trend Assessments

Browse:

- **2008 to 2012 - down (-2)**: The density of Wyoming big sagebrush decreased 20% to 2,880 plants/acre, and canopy cover decreased to 8%. The health of the sagebrush population remained similar with decadence decreasing to 27% , and poor vigor decreased to 42% of the population. Recruitment of young sagebrush increased 13% of the population. The density of forage kochia increased by 44% to 1,500 plants/acre, though cover remained minimal on the site.

Grass:

- **2008 to 2012 - up (+2)**: The sum of nested frequency of perennial grasses increased 51%, and cover increased to 7%. Sandberg bluegrass significantly increased in nested frequency, and cover increased from 5%. The nested frequency of cheatgrass significantly decreased, and cover decreased to 9%.

Forb:

- **2008 to 2012 - slightly down (-1):** Forbs remained rare on the site. The sum of nested frequency of perennial forbs decreased 47%, and cover remained similar at less than 1%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 2

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	Agropyron cristatum	-	-	3	-	-	.15
G	Agropyron smithii	-	4	4	-	.01	.06
G	Agropyron spicatum	a-	a-	b31	-	-	.47
G	Bromus tectorum (a)	c469	b433	a343	23.53	9.88	8.49
G	Oryzopsis hymenoides	a-	a-	b20	-	.15	1.08
G	Poa bulbosa	5	4	19	.39	.04	.48
G	Poa secunda	a96	a133	b189	3.69	.91	4.77
G	Sitanion hystrix	b20	b14	a-	.48	.11	-
G	Stipa comata	a8	b30	a13	.53	.85	.19
G	Vulpia octoflora (a)	b21	a2	a-	.04	.01	-
Total for Annual Grasses		490	435	343	23.57	9.89	8.49
Total for Perennial Grasses		129	185	279	5.10	2.08	7.21
Total for Grasses		619	620	622	28.68	11.98	15.70
F	Achillea millefolium	-	-	1	-	-	.00
F	Astragalus beckwithii	6	9	3	.05	.01	.03
F	Chaenactis douglasii	1	-	-	.03	-	-
F	Crepis acuminata	3	-	-	.03	-	-
F	Delphinium nuttallianum	1	-	-	.00	-	-
F	Descurainia pinnata (a)	-	2	-	-	.00	-
F	Erigeron pumilus	-	4	-	-	.01	-
F	Gayophytum ramosissimum(a)	2	-	-	.00	-	-
F	Lactuca serriola (a)	1	-	-	.00	-	-
F	Lomatium sp.	b17	b30	a3	.10	.17	.00
F	Lygodesmia spinosa	-	-	5	.03	.00	.03
F	Microsteris gracilis (a)	b55	a16	a1	.23	.03	.00
F	Phlox hoodii	2	1	-	.03	.00	-
F	Phlox longifolia	b64	ab56	a39	.30	.27	.09
F	Ranunculus testiculatus (a)	11	5	-	.03	.01	-
F	Sanguisorba minor	-	5	6	-	.02	.03
F	Zigadenus paniculatus	a-	b7	ab2	.03	.07	.03
Total for Annual Forbs		69	23	1	0.27	0.04	0.00
Total for Perennial Forbs		94	112	59	0.61	0.56	0.22
Total for Forbs		163	135	60	0.89	0.61	0.22

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
B	Artemisia tridentata wyomingensis	83	73	71	15.62	8.12	9.10
B	Chrysothamnus viscidiflorus stenophyllus	9	9	7	.01	.04	.41
B	Kochia prostrata	0	19	34	-	.17	.50
B	Opuntia sp.	1	1	0	-	-	-
B	Pediocactus simpsonii	0	0	1	-	-	-
Total for Browse		93	102	113	15.63	8.33	10.03

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 2

Species	Percent Cover		
	'05	'08	'12
Artemisia tridentata wyomingensis	16.69	8.70	7.60
Chrysothamnus viscidiflorus stenophyllus	.36	.35	1.31
Kochia prostrata	-	.21	.30

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 2

Species	Average leader growth (in)		
	'05	'08	'12
Artemisia tridentata wyomingensis	1.2	0.9	0.2

BASIC COVER--

Management unit 19R, Study no: 2

Cover Type	Average Cover %		
	'05	'08	'12
Vegetation	45.26	25.24	27.84
Rock	.22	.25	.00
Pavement	3.96	5.30	2.34
Litter	45.94	53.08	53.47
Cryptogams	2.87	2.16	.76
Bare Ground	17.12	26.37	31.80

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 2, Study Name: Deep Creek Aerator

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.3	7.1	37.7	39.1	23.2	1.2	9.2	198.4	0.4

PELLET GROUP DATA--

Management unit 19R, Study no: 2

Type	Quadrat Frequency			Days use per acre (ha)		
	'05	'08	'12	'05	'08	'12
Rabbit	8	50	-	-	-	-
Grouse	2	3	-	87 groups/acre	104 groups/acre	-
Deer/Antelope	1	1	1	3 (7)	8 (20)	9 (23)
Cattle	2	-	-	-	-	5 (13)

BROWSE CHARACTERISTICS--

Management unit 19R, Study no: 2

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia tridentata wyomingensis</i>									
05	3780	1	47	53	-	10	.52	24	26/34
08	3620	6	46	48	200	3	0	45	17/29
12	2880	13	60	27	-	2	0	42	17/27
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
05	180	0	89	11	-	0	0	0	12/19
08	240	0	58	42	-	0	0	8	12/22
12	180	0	100	0	-	0	0	89	13/23
<i>Gutierrezia sarothrae</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	5/11
<i>Kochia prostrata</i>									
05	0	0	0	0	-	0	0	0	-/-
08	1040	60	33	8	560	6	13	0	5/7
12	1500	4	96	0	-	43	39	1	2/4
<i>Opuntia sp.</i>									
05	20	0	100	-	-	0	0	0	6/14
08	20	0	100	-	-	0	0	0	5/6
12	0	0	0	-	-	0	0	0	5/8
<i>Pediocactus simpsonii</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	1/2

DEEP CREEK DRILL - TREND STUDY NO. 19R-3-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Elk Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: BLM

Elevation: 5,867 ft. (1,788 m)

Aspect: Southeast

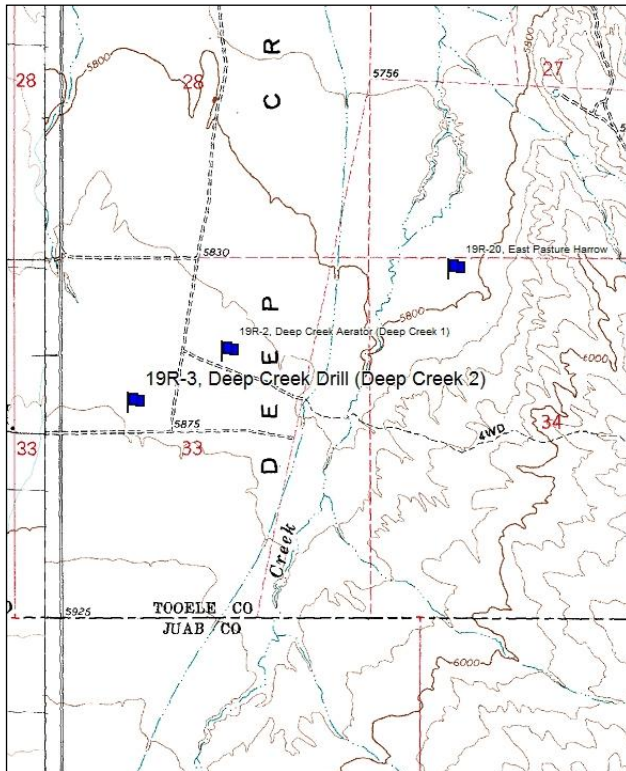
Slope: 1%

Transect bearing: 356° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59 ft), line 4 (71 ft), line 5 (95 ft)

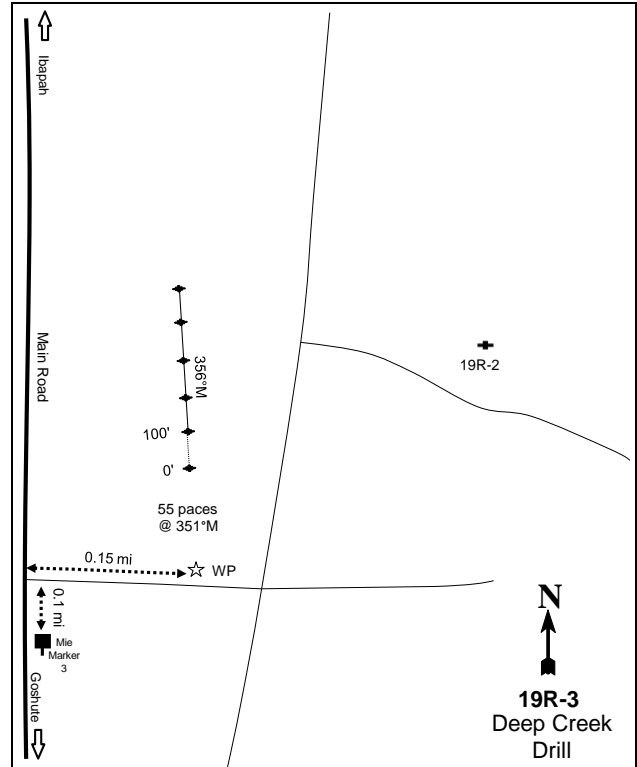
Directions: Drive north of Goshute toward Ibapah to mile marker 3. Drive north of the mile marker 0.1 miles to a two-track road on the right (east) side of the road. Turn right and drive 0.3 miles to a four-way intersection. Turn left at the intersection and drive 0.05 miles to the witness post on the left (west) side of the road. From the witness post, walk 121 paces at 255°M to the 0' stake. The 0' stake is marked with browse tag #78.

Map Name: Goshute



Township: 10S Range: 19W Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 243885 E 4422541 N

DEEP CREEK DRILL - TREND STUDY NO. 19R-3

[Project #24](#)

Site Description

Site Information: The study is located approximately three miles north of Goshute, in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, in the Deep Creek Valley. The study was established prior to treatment in 2005 to monitor the effectiveness of the Deep Creek Valley Sagebrush Improvement and Fuels Reduction treatment on land administered by the Bureau of Land Management (BLM). The study occurs on the BLM Ibapah allotment. The treatment project is located within a historic sagebrush steppe on the west side of the Deep Creek Mountains. The sagebrush had become decadent, and cheatgrass (*Bromus tectorum*) had become prevalent in the understory. To improve the health of decadent sagebrush and decreased weedy species, three methods were used to treat the area. The three methods include: Seeding grass, forb, and browse species with a rangeland drill; disturbing the ground and decadent shrubs with a Lawson double drum aerator; and a combination of drill seeding and aerating with the Lawson double drum aerator. The study was established to monitor the drill seed only treatment. In the fall of 2005, 389 acres were drill seeded. In December 2005, browse species were aerially seeded over the entire treatment area with a fixed wing airplane (Table - Seed Mix). The objectives of the treatment are to decrease fire fuel hazards, and improve habitat for sage-grouse and big game (WRI Database 2013). Deer/antelope pellet groups were sampled in low abundance over the sample years. Cattle pellet groups were sampled in moderate abundance in 2005, and were sampled in low abundance in 2008 and 2012. Sage-grouse were sampled at 9 groups/acre in 2012 (Table - Pellet Group Data). Deer and antelope pellets were combined due to the difficulty of differentiating between these species.

Browse: The preferred browse species on the site are Wyoming big sagebrush and forage kochia (*Kochia prostrata*). The dominant browse species is Wyoming big sagebrush, which provided the majority of the browse cover on the site. The Wyoming big sagebrush is a lightly used population, with high decadence and poor vigor within the population over the sample years. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. Utilization of forage kochia has been moderately heavy following the treatment (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and moderately diverse. The dominant grass species are crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*), which have provided the majority of the grass cover on the site. The annual species cheatgrass has substantially decreased in abundance since the outset of the study. Forbs are not abundant or diverse, and perennial forb species are rare on the site. The weedy species bur buttercup (*Ranunculus testiculatus*) was the dominant forb species at the outset of the study, but decreased substantially following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Junkett component, which occurs on fan remnants. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as moderately deep, well drained, and with a low permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is high, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2005 and 2008. The soil erosion condition was classified as slight in 2012 due to excessive pedestalling around plants and slight surface litter movement.

Pre vs. Three Years Post Treatment, 2005 vs. 2008

Browse: The density of Wyoming big sagebrush remained similar at 3,220 plants/acre, but canopy cover decreased from 13% to 10%. The health of the sagebrush population decreased with decadence increasing from 50% to 70%, and poor vigor increasing from 23% to 34% of the population. Forage kochia was sampled for the first time following the treatment at 80 plants/acre.

Grasses: The sum of nested frequency of perennial grasses increased slightly by 10%, but cover decreased from 16% to 12%. Sandberg bluegrass cover decreased from 4% to 2%. The nested frequency of cheatgrass also significantly decreased, and cover decreased from 2% to less than 1%.

Forbs: Perennial forbs remained rare on the site. The annual species burr buttercup provided nearly all of the forb cover in both sample years. There was a significant decrease in the nested frequency of burr buttercup, following the treatment, with a subsequent decrease in cover from 4% to less than 1%.

Trend Assessments

Browse:

- **2008 to 2012 - stable (0):** The density of Wyoming big sagebrush remained similar at 3,320 plants/acre, and canopy cover increased to 12%. The health of the sagebrush population remained similar with decadence decreasing to 33%, and poor vigor increasing to 60% of the population. The density of forage kochia increased to 480 plants/acre, though cover remained minimal on the site.

Grass:

- **2008 to 2012 - up (+2):** The sum of nested frequency of perennial grasses increased slightly by 13%, and cover increased to 18%. Sandberg bluegrass cover increased from 6%. The nested frequency of cheatgrass also significantly decreased, and cover remained minimal on the site.

Forb:

- **2008 to 2012 - slightly down (-1):** Perennial forbs remained rare on the site. The annual species burr buttercup decreased substantial in nested frequency and cover.

SEED MIX--

Management unit 19R, Study no: 3

Project Name: Deep Creek FM					
WRI Database #: 24					
Application: Drill Seed		Acres: 591		Application: Aerial Seed	
				Acres: 981	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Bluebunch WG 'Anatone'	450	0.76	B	Forage Kochia
G	Great Basin Wildrye 'Trailhead'	300	0.51	B	Sagebrush, Wyoming
G	Orchardgrass 'Paiute'	300	0.51	Total Pounds:	
G	Russian Wildrye 'Bozoisky'	600	1.02	2000	
G	Snake River Wheatgrass 'Secar'	450	0.76	PLS Pounds:	
G	Western Wheatgrass	600	1.02	0.88	
F	Alfalfa 'Ladak+'	300	0.51		
F	Alfalfa 'Nomad'	300	0.51		
F	Rocky Mountain Beeplant	293	0.50		
F	Sainfoin 'Eski'	1200	2.03		
F	Small Burnet 'Delar'	1200	2.03		
F	Western Yarrow	50	0.08		
Total Pounds:		6043	10.23		
PLS Pounds:			9.40		

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 3

T y P e	Species	Nested Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
G	Agropyron cristatum	_b 276	_{ab} 261	_a 247	11.76	9.64	9.82
G	Agropyron spicatum	-	3	2	-	.03	.15
G	Bromus tectorum (a)	_c 190	_b 54	_a 8	1.68	.10	.02
G	Oryzopsis hymenoides	-	-	3	-	-	.15
G	Poa bulbosa	_a 19	_a 20	_b 74	.28	.06	1.32
G	Poa secunda	_a 180	_{ab} 241	_b 267	3.86	2.05	6.07
G	Sitanion hystrix	3	-	-	.00	-	-
G	Vulpia octoflora (a)	_b 58	_a 2	_a 2	.21	.00	.00
Total for Annual Grasses		248	56	10	1.89	0.11	0.02
Total for Perennial Grasses		478	525	593	15.91	11.79	17.51
Total for Grasses		726	581	603	17.81	11.90	17.53
F	Astragalus sp.	2	-	-	.01	-	-
F	Astragalus utahensis	-	-	-	.00	-	-
F	Castilleja sp.	3	-	-	.00	-	-
F	Gayophytum ramosissimum(a)	4	-	-	.01	-	-
F	Lomatium sp.	4	-	-	.01	-	-
F	Microsteris gracilis (a)	_b 57	_a 11	_a -	.18	.01	-
F	Phlox hoodii	6	1	5	.01	.00	.30
F	Phlox longifolia	8	13	9	.07	.02	.01
F	Ranunculus testiculatus (a)	_c 302	_b 159	_a 2	3.90	.42	.00
F	Zigadenus paniculatus	-	-	-	.00	-	-
Total for Annual Forbs		363	170	2	4.09	0.44	0.00
Total for Perennial Forbs		23	14	14	0.12	0.03	0.31
Total for Forbs		386	184	16	4.22	0.47	0.32

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 3

T y P e	Species	Strip Frequency			Average Cover %		
		'05	'08	'12	'05	'08	'12
B	Artemisia tridentata wyomingensis	80	76	80	11.66	10.60	8.87
B	Kochia prostrata	0	3	11	-	.02	.25
Total for Browse		80	79	91	11.66	10.63	9.12

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 3

Species	Percent Cover		
	'05	'08	'12
Artemisia tridentata wyomingensis	12.46	10.38	11.68
Kochia prostrata	-	-	.10

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 3

Species	Average leader growth (in)		
	'05	'08	'12
Artemisia tridentata wyomingensis	1.4	0.8	0.4

BASIC COVER--

Management unit 19R, Study no: 3

Cover Type	Average Cover %		
	'05	'08	'12
Vegetation	31.25	27.46	30.26
Rock	.43	.37	.24
Pavement	5.49	6.30	5.50
Litter	23.17	39.02	30.43
Cryptogams	2.13	1.72	2.05
Bare Ground	50.00	41.82	51.01

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 3, Study Name: Deep Creek Drill

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
9.0	6.9	44.1	37.7	18.2	0.5	10.0	249.6	0.5

PELLET GROUP DATA--

Management unit 19R, Study no: 3

Type	Quadrat Frequency		
	'05	'08	'12
Rabbit	6	35	-
Grouse	1	-	-
Deer	1	-	4
Cattle	4	3	-

Days use per acre (ha)		
'05	'08	'12
-	-	-
-	-	9
		groups/acre
1 (2)	3 (8)	5 (12)
21 (52)	2 (5)	2 (4)

BROWSE CHARACTERISTICS--
 Management unit 19R, Study no: 3

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>									
05	3220	2	48	50	1300	16	4	23	23/32
08	3220	2	27	70	140	1	14	34	18/29
12	3320	5	62	33	20	17	2	60	17/28
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	80	100	0	-	220	0	50	0	2/3
12	480	17	83	-	-	54	25	0	2/4

GOSHUTE CHAINING - TREND STUDY NO. 19R-5-12

Vegetation Type: Black Sagebrush

Range Type: Deer Winter, Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Singleleaf Pinyon-Utah Juniper\), R028AY338UT](#)

Land Ownership: Tribal Land

Elevation: 6,353 ft (1,936 m)

Aspect: Northwest

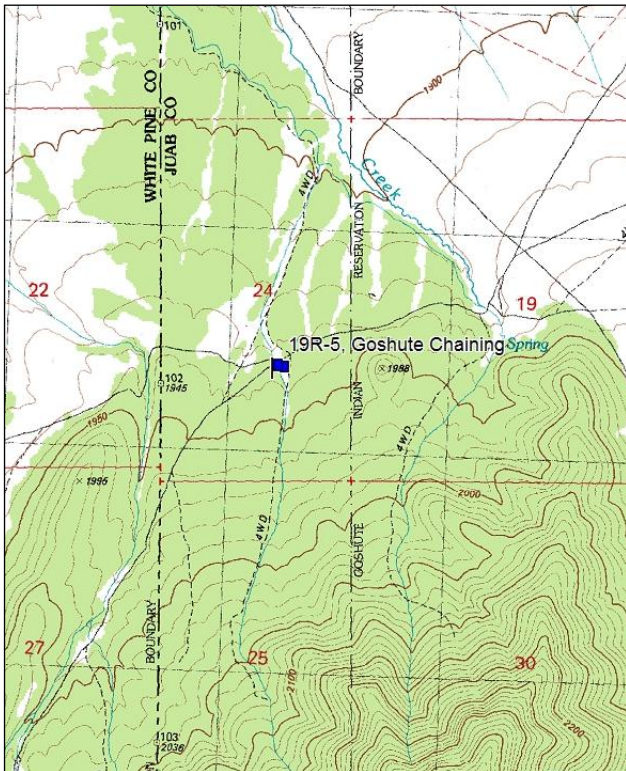
Slope: 6%

Transect bearing: 42° magnetic (0'-100'), 95° magnetic (100'-400')

Belt placement: line 1 (11ft & 71), line 2 (34ft), line 3 (95ft), line 4 (71ft), line 5 (59ft)

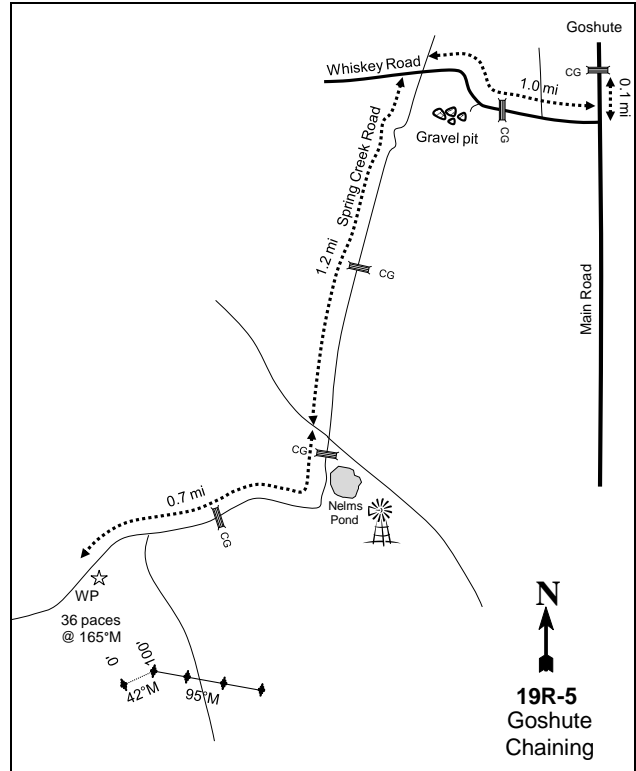
Directions: Driving south on the main road from Ibapah, drive to the turn off to McCurdy Road and continue south to the first cattle guard. From the cattle guard drive 0.6 miles to Whiskey Road. Turn right (west) onto Whiskey Road and drive 0.1 miles to Tempi Poli Lane. Continue on Whiskey Road for approximately 0.7 miles to a gravel pit. Continue 0.2 miles to a junction. Turn left (south west) at the junction and drive 0.7 miles to a cattle guard. From the cattle guard drive 0.5 miles to a junction, cattle guard & sign that reads “Nelms Pond.” Continue straight on the road for 0.5 miles passing a windmill to another cattle guard. From the cattle guard drive 0.1 miles to a junction and continue straight for 0.1 miles to a witness post on the left. Walk 36 paces from the witness post at 165°M to the 0-foot stake marked with browse tag #142.

Map Name: Weaver Canyon



Township: 11S Range: 20W Section: 24

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 753124 E 4415520 N

GOSHUTE CHAINING - TREND STUDY NO. 19R-5

[Project #354](#)

Site Information

Site Description: This study is located on the Goshute Indian Reservation approximately 3 miles southwest of Goshute, near the Nevada border. The study was established prior to treatment in 2006 to monitor the effects of a chaining of a singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) woodland. In summer of 2006, the project site was one-way Ely chained. A seed mix of grass and forbs species were aurally seeded in November of 2006. Following the aerial seeding, the project area was one-way re-chained with a smooth chain and seed dribblers were used to seed browse species on the site (Table - Seed Mix). The objective of the project are to restore sagebrush steppe habitats, improve big game winter range, decrease the risk of wildfire, and increase forage for domestic live stock (WRI Database 2013). Elk, deer, and cattle pellet groups have been sampled in low abundance over the sample years. Horse pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are black sagebrush (*Artemisia nova*), Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), and antelope bitterbrush (*Purshia tridentata*). The dominant preferred browse species is black sagebrush which is fairly abundant on the site. Wyoming big sagebrush, cliffrose, and bitterbrush are not very abundant on the site. Bitterbrush and cliffrose were both seeded on the site. The black sagebrush is a lightly used population with low decadence and good vigor. The recruitment of young black sagebrush plants was good following the treatment. Pinyon and juniper trees dominated the site and provided the majority of the canopy cover prior to treatment. Following the treatment pinyon and juniper trees decreased in abundance and cover (Table - Browse Characteristics; Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site, though prior to treatment grasses were not overly abundant or diverse. Sandberg bluegrass was the only grass species to provide ample cover prior to treatment. Following the treatment, crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass provided the majority of the cover on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) increased in abundance and cover. Other common grass species sampled on the site following the treatment are pubescent wheatgrass (*Agropyron intermedium*), bluebunch wheatgrass (*A. spicatum*), and Indian ricegrass (*Oryzopsis hymenoides*). Seeded grass species sampled on the site include crested wheatgrass, pubescent wheatgrass, bluebunch wheatgrass, Great Basin Wildrye (*Elymus Cinereus*), Russian wildrye (*Elymus junceus*), and Indian ricegrass. Forbs are not abundant or diverse on the site. Alfalfa has been the only seeded forb species sampled on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Borvant component, which occurs on fan remnants. The parent material consists of alluvium derived from limestone. The soils within this classification are characterized as shallow, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a mildly alkaline soil reaction (pH 7.5) (Table - Soil Analysis Data). Bare ground cover is moderate, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable in over the sample years.

Pre vs. Six Years Post Treatment, 2006 vs. 2012

Browse: The density of black sagebrush decreased 22% from 4,180 plants/acre to 3,240 plants/acre, and canopy cover decreased from 6% to 5%. The health of the black sagebrush population improved with decadence decreasing from 31% to 9%, and poor vigor decreasing from 22% to 10% of the population. The recruitment of young black sagebrush plants to the population increased from 4% to 41%. Bitterbrush and cliffrose was sampled for the first time following the treatment, though only being sampled in height/crown

measurements.

Grasses: The sum of nested frequency of perennial grasses increased by 28%, and cover increased from 5% to 13%. Sandberg bluegrass decreased significantly in nested frequency and cover decreased from 4% to 3%. Following the treatment, the seeded species crested wheatgrass, pubescent wheatgrass, and Indian ricegrass provided 6%, 1% and 1% cover, respectively. The nested frequency of cheatgrass also significantly increased, and cover increased from less than 1% to 3%.

Forbs: The sum of nested frequency of perennial forbs decreased 33% and cover decreased from 3% to 1%. American vetch (*Vicia americana*) decreased significantly in nested frequency and cover decreased from 2% to less than 1%. Following the treatment now single forbs species was dominant on the site.

SEED MIX--

Management unit 19R, Study no: 5

Project Name: Goshute PJ Chaining (DWR)				Project Name: Goshute RJ Chaining (NRCS)			
WRI Database #: 354				WRI Database #: 354			
Application:		Acres: 800		Application:		Acres: 800	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	800	1.00	G	Crested Wheatgrass 'Douglas'	1200	1.50
G	Canby Bluegrass 'Canbar'	200	0.25	G	Crested Wheatgrass 'Hycrest'	1200	1.50
G	Orchardgrass 'Paiute'	200	0.25	G	Great Basin Wildrye 'Magnar'	400	0.50
G	Snake River Wheatgrass 'Secar'	400	0.50	G	Indian Ricegrass 'Nezpar'	800	1.00
F	Alfalfa 'Ladak'	200	0.25	G	Pubescent Wheatgrass 'Luna'	1600	2.00
F	Alfalfa 'Ranger'	200	0.25	G	Russian Wildrye 'Swift'	1600	2.00
F	Alfalfa 'Spredor 4'	200	0.25	F	Alfalfa 'Ladak'	400	0.50
Total Pounds:		2200	2.75	F	Small Burnet 'Delar'	2000	2.50
PLS Pounds:			2.52	Total Pounds:		9200	11.50
Application:		Acres: 283					
Seed type		lbs in mix	lbs/acre				
B	Bitterbrush	200	0.71				
B	Stansbury Cliffrose	100	0.35				
Total Pounds:		300	1.06				
PLS Pounds:			0.76				

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 5

Type	Species	Nested Frequency		Average Cover %	
		'06	'12	'06	'12
G	Agropyron cristatum	a-	b112	-	5.54
G	Agropyron intermedium	a-	b18	-	1.24
G	Agropyron smithii	12	21	.07	.39
G	Agropyron spicatum	25	41	.37	1.39
G	Bromus tectorum (a)	a6	b149	.02	3.23
G	Elymus cinereus	-	5	-	.15
G	Elymus junceus	-	2	-	.03
G	Oryzopsis hymenoides	a-	b25	-	.76

Type	Species	Nested Frequency		Average Cover %	
		'06	'12	'06	'12
G	<i>Poa secunda</i>	_b 259	_a 151	4.41	3.33
G	<i>Sitanion hystrix</i>	-	2	-	.03
G	<i>Stipa comata</i>	-	1	-	.03
Total for Annual Grasses		6	149	0.02	3.23
Total for Perennial Grasses		296	378	4.85	12.91
Total for Grasses		302	527	4.87	16.14
F	<i>Antennaria rosea</i>	-	6	-	.06
F	<i>Arabis</i> sp.	4	-	.01	-
F	<i>Arenaria</i> sp.	_b 47	_a 15	.22	.09
F	<i>Astragalus calycosus</i>	3	4	.02	.16
F	<i>Astragalus convallarius</i>	3	-	.00	-
F	<i>Astragalus</i> sp.	4	-	.04	-
F	<i>Collinsia parviflora</i> (a)	4	1	.01	.00
F	Compositae	2	-	.03	-
F	<i>Crepis acuminata</i>	-	-	.00	-
F	<i>Cryptantha</i> sp.	35	35	.31	.65
F	<i>Erigeron</i> sp.	2	-	.03	-
F	<i>Eriogonum ovalifolium</i>	3	-	.00	-
F	<i>Eriogonum</i> sp.	-	6	-	.01
F	<i>Eriogonum umbellatum</i>	5	1	.03	.00
F	<i>Lesquerella</i> sp.	1	-	.00	-
F	<i>Lygodesmia spinosa</i>	_a 1	_b 12	.00	.10
F	<i>Medicago sativa</i>	-	6	-	.01
F	<i>Phlox austromontana</i>	48	37	.34	.10
F	<i>Phlox longifolia</i>	27	20	.11	.04
F	<i>Ranunculus testiculatus</i> (a)	_b 33	_a -	.05	-
F	<i>Senecio multilobatus</i>	-	8	-	.01
F	<i>Townsendia</i> sp.	2	-	.00	-
F	<i>Vicia americana</i>	_b 54	_a 11	1.83	.03
Total for Annual Forbs		37	1	0.06	0.00
Total for Perennial Forbs		241	161	3.02	1.29
Total for Forbs		278	162	3.09	1.30

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 5

Type	Species	Strip Frequency		Average Cover %	
		'06	'12	'06	'12
B	Artemisia nova	49	39	5.36	2.95
B	Artemisia tridentata wyomingensis	2	3	.45	.03
B	Chrysothamnus nauseosus	0	1	-	-
B	Chrysothamnus viscidiflorus stenophyllus	7	9	.21	.74
B	Gutierrezia sarothrae	0	2	-	.03
B	Juniperus osteosperma	21	22	6.93	.90
B	Leptodactylon pungens	16	16	.29	.04
B	Pinus monophylla	6	0	2.34	-
Total for Browse		101	92	15.60	4.69

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 5

Species	Percent Cover	
	'06	'12
Artemisia nova	6.26	4.75
Artemisia tridentata wyomingensis	.81	.03
Chrysothamnus nauseosus	-	.10
Chrysothamnus viscidiflorus stenophyllus	.21	1.21
Gutierrezia sarothrae	-	.10
Juniperus osteosperma	17.06	1.78
Leptodactylon pungens	.30	.31
Pinus monophylla	7.91	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 5

Species	Average leader growth (in)	
	'06	'12
Artemisia nova	1.1	0.3

POINT-QUARTER TREE DATA--

Management unit 19R, Study no: 5

Species	Trees per Acre		Average diameter (in)	
	'06	'12	'06	'12
Juniperus osteosperma	391	134	4.8	2.0
Pinus monophylla	160	27	2.6	0.7

BASIC COVER--

Management unit 19R, Study no: 5

Cover Type	Average Cover %	
	'06	'12
Vegetation	20.04	25.16
Rock	.58	.74
Pavement	19.96	6.87
Litter	31.47	55.71
Cryptogams	7.84	.02
Bare Ground	35.82	25.47

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 5, Study Name: Goshute Chaining

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
12.7	7.5	64.7	25.9	9.4	4.1	13.8	265.6	0.8

PELLET GROUP DATA--

Management unit 19R, Study no: 5

Type	Quadrat Frequency		Days use per acre (ha)	
	'06	'12	'06	'12
Rabbit	28	-	-	-
Horse	-	2	-	4 (10)
Elk	4	1	3 (8)	1 (2)
Deer	3	-	3 (7)	1 (2)
Cattle	1	2	2 (5)	5 (13)

BROWSE CHARACTERISTICS--

Management unit 19R, Study no: 5

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia nova									
06	4180	4	65	31	120	0	0	22	9/15
12	3240	41	50	9	3640	7	.61	10	10/20
Artemisia tridentata wyomingensis									
06	180	0	78	22	-	0	0	67	31/66
12	60	33	67	0	120	0	0	0	13/12
Chrysothamnus nauseosus									
06	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	22/29
Chrysothamnus viscidiflorus stenophyllus									
06	200	20	80	0	-	0	0	0	11/15
12	460	17	74	9	-	0	0	30	13/22

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Cowania mexicana stansburiana</i>										
06	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	11/16	
<i>Gutierrezia sarothrae</i>										
06	0	0	0	-	-	0	0	0	-/-	
12	40	0	100	-	-	0	0	0	8/11	
<i>Juniperus osteosperma</i>										
06	520	65	35	0	400	0	0	8	-/-	
12	580	90	7	3	40	0	0	3	-/-	
<i>Leptodactylon pungens</i>										
06	580	0	93	7	-	0	0	3	7/8	
12	540	7	85	7	20	0	0	85	8/13	
<i>Pediocactus simpsonii</i>										
06	0	0	0	-	-	0	0	0	1/1	
12	0	0	0	-	-	0	0	0	-/-	
<i>Pinus monophylla</i>										
06	180	67	22	11	180	0	0	11	-/-	
12	0	0	0	0	-	0	0	0	-/-	
<i>Purshia tridentata</i>										
06	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	12/13	

SAGE VALLEY DIXIE - TREND STUDY NO. 19R-6-12

Vegetation Type: Stickyleaf Low Rabbitbrush

Range Type: Substantial Deer Spring/Fall

NRCS Ecological Site Description: Upland Loam (Wyoming Big Sagebrush), R028AY309UT

Land Ownership: USFS

Elevation: 6,214 ft. (1,894 m)

Aspect: Northeast

Slope: 2%

Transect bearing: 59° magnetic

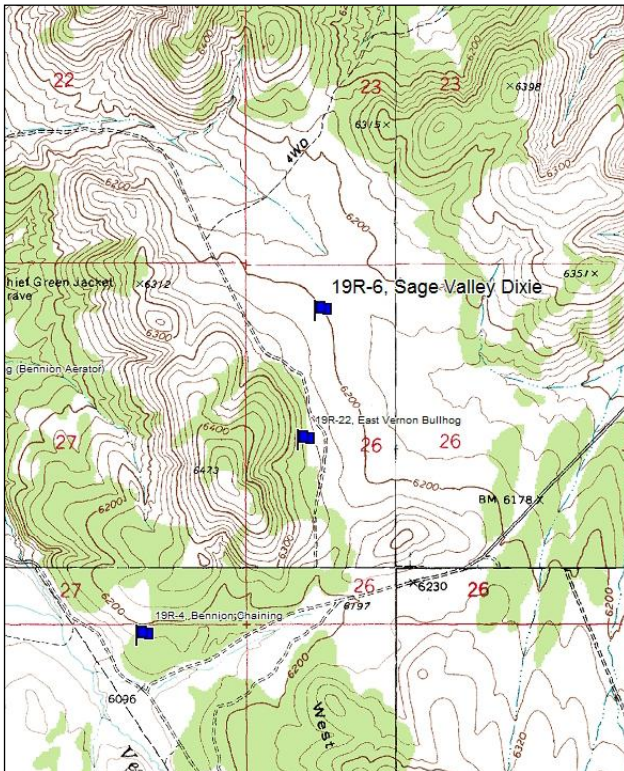
Belt placement: line 1(11 ft), line 2(34 ft), line 3(59 ft), line 4(71 ft), line 5(95 ft)

Notes: No rebar

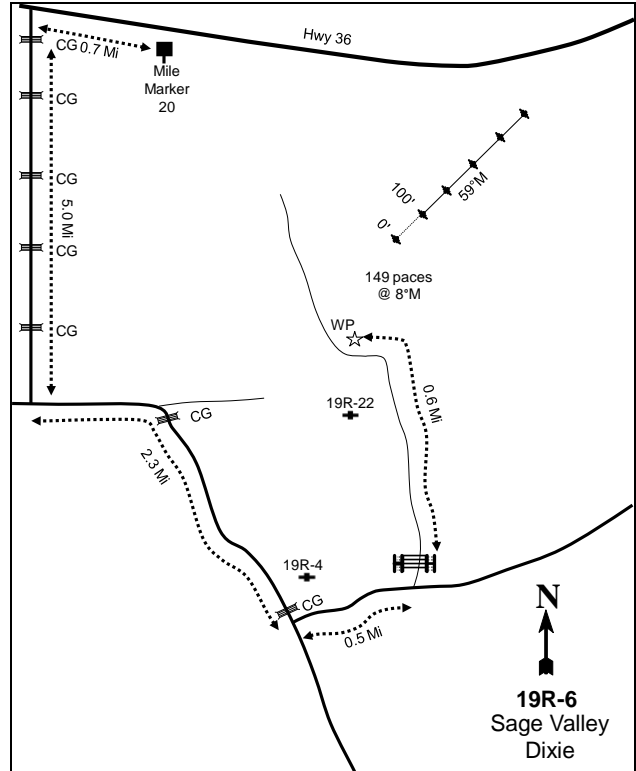
Directions:

From highway 36 south of Vernon, drive to mile marker #20. From there, drive 0.7 miles to a turn off on the left (west). Turn there and drive south for 5.0 miles passing several (4 or 5) cattle guards to a fork. Turn left and drive 0.7 miles to an intersection. Turn right (south) crossing a cattle guard and drive 1.6 miles to another cattle guard. Directly after the cattle guard turn left (east) and drive 0.5 miles to a road and gate on the left. Turn and go through the gate and drive 0.6 miles to a witness post on the right. Walk 149 paces at 8°M to the 0-foot stake marked with browse tag #154.

Map Name: Vernon



Diagrammatic Sketch:



Township: 9S Range: 5W Section: 26

GPS: NAD 83, UTM 12S 382215 E 4429773 N

SAGE VALLEY DIXIE - TREND STUDY NO. 19R-6
[Project #291](#)

Site Description

Site Information: The study is located in an open Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) valley, approximately six miles southeast of Vernon, on U.S. Forest Service (USFS) managed land. The study was established prior to treatment in 2006 to monitor the effects of a seeding and Dixie harrow treatment. The study occurs on the USFS Bennion allotment. Approximately, 162 acres were two-way harrowed on 27 polygons ranging in size from a few acres to 25 acres. Seven polygons were one-way harrowed due to a lower density of sagebrush. One-way harrow treatment was also done around the edge of each two-way harrowed polygon to help blend the borders of the treated areas, and provide a wider range of sagebrush cover. The treatment was implemented in a mosaic pattern in November 2006. A seed mix of grass and forb species were broadcast seeded with the second pass of the harrow treatment (Table - Seed Mix). The study is located within the two-way Dixie harrow portion of the study. The objectives of the project are to increase the herbaceous understory, and increase structural diversity of sagebrush for sage-grouse and mule deer. The area surrounding the project was treated with a lop and scatter treatment in the fall of 2006 (WRI Database 2013). Pellet groups were sampled in light abundance for cattle in all sample years (Table - Pellet Group Data).

Browse: The preferred browse species on the site is Wyoming big sagebrush, though there was a decrease in density of sagebrush following the treatment. Decadence of sagebrush has decreased since the outset of the study. Initially poor vigor increased following the treatment, but has since decreased to low levels. The recruitment of young sagebrush plants to the population has been mostly good over the sample years. Utilization of sagebrush has been mostly light. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and gray horsebrush (*Tetradymia canescens*). Stickyleaf low rabbitbrush has increased in abundance following the treatment (Table - Browse Characteristics). Pinyon and juniper trees have begun to invade the site and the stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species are crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), smooth brome (*Bromus inermis*), and Sandberg bluegrass (*Poa secunda*). The invasive annual species cheatgrass (*Bromus tectorum*) is also common on the site. Seeded species sampled on the site following the treatment include western wheatgrass, bluebunch wheatgrass (*Agropyron spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), and needle-and-thread (*Stipa comata*); however, western wheatgrass and Indian ricegrass were sampled prior to the treatment. Forbs are moderately abundant and diverse on the site. The annual species pale alyssum (*Alyssum alyssoides*) has been common on the site over the sampled years. The low growth form perennial species desert phlox (*Phlox austromontana*) and American vetch (*Vicia americana*) are the dominant perennial forb species on the site. Blue flax (*Linum perenne*) and western yarrow (*Achillea millefolium*) were the only seeded species sampled on the site since the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Erda component, which occurs on lake terraces and fan remnants. The parent material consists of alluvium derived from sedimentary rock and/or lacustrine deposits from sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately low permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a silt loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is moderate, though with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Pre vs. Two Years Post Treatment, 2006 vs. 2008

Browse: The density of Wyoming big sagebrush decreased 52% from 3,440 plants/acre to 1,660 plants/acre, and canopy cover decreased from 21% to 3%. The health of the sagebrush population remained similar with decadence decreasing from 23% to 14% and poor vigor increasing from 17% to 35% of the population.

Grasses: The sum of nested frequency of perennial grasses increased slightly by 13%, and cover increased from 12% to 17%. Sandberg bluegrass and intermediate wheatgrass (*Agropyron intermedium*) significantly increased in nested frequency. Cover of Sandberg bluegrass remained similar at 1% and the cover of intermediate wheatgrass increased from less than 1% to just over 1%. Western wheatgrass remained similar in nested frequency but cover increased from 3% to 7%. The nested frequency of cheatgrass significantly increased and cover remained similar at 1%.

Forbs: The sum of nested frequency of perennial forbs increased by 73%, and cover increased from 2% to 3%. No single forb species provided more than 1% cover in either sample year.

Trend Assessments

Browse:

- **2008 to 2012 - stable (0):** The density of Wyoming big sagebrush remained similar at 1,520 plants/acre, and canopy cover increased from 3% to 5%. The health of the sagebrush population improved with decadence decreasing from 14% to 1% and poor vigor decreasing from 35% to 3% of the population.

Grass:

- **2008 to 2012 - up (+2):** The sum of nested frequency of perennial grasses increased by 22%, and cover increased from 17% to 22%. Cover of crested wheatgrass, Sandberg bluegrass, and intermediate wheatgrass increased to 6%, 2%, and 3%, respectively. Western wheatgrass remained similar in nested frequency but cover decreased to 6%.

Forb:

- **2008 to 2012 - down (-2):** The sum of nested frequency of perennial forbs decreased by 24%, though cover increased to 5%. No single forb species provided more than 1% cover in either sample year.

SEED MIX--

Management unit 19R, Study no: 6

Project Name: Sage Valley			
WRI Database #: 291			
Application: Broadcast Seed		Acres: 300	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	600	2.00
G	Great Basin Wildrye 'Trailhead'	75	0.25
G	Indian Ricegrass 'Rimrock'	600	2.00
G	Needle and Threadgrass	150	0.50
G	Western Wheatgrass 'Arriba'	300	1.00
F	Alfalfa 'Spredor 4'	150	0.50
F	Blue Flax	75	0.25
F	Rocky Mountain Beeplant	154	0.51
F	Sainfoin 'Eski'	300	1.00
F	Small Burnet 'Delar'	450	1.50
F	Western Yarrow 'SID Columbia'	30	0.10
Total Pounds:		2884	9.61
PLS Pounds:			8.76

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 6

T y p e	Species	Nested Frequency			Average Cover %		
		'06	'08	'12	'06	'08	'12
G	<i>Agropyron cristatum</i>	101	68	83	3.91	4.19	5.57
G	<i>Agropyron intermedium</i>	_a 4	_b 42	_b 70	.15	1.33	2.60
G	<i>Agropyron smithii</i>	170	173	152	3.31	7.41	6.08
G	<i>Agropyron spicatum</i>	_a -	_a 3	_b 39	-	.04	1.79
G	<i>Bromus inermis</i>	110	103	106	3.14	2.24	2.45
G	<i>Bromus tectorum</i> (a)	_a 79	_b 108	_b 119	.49	1.28	1.26
G	<i>Elymus junceus</i>	-	-	1	-	.00	.15
G	<i>Oryzopsis hymenoides</i>	_a 4	_a 1	_b 22	.01	.00	.68
G	<i>Poa bulbosa</i>	_a -	_a -	_b 10	-	.00	.06
G	<i>Poa secunda</i>	_a 41	_b 84	_b 103	1.47	1.40	2.43
G	<i>Sitanion hystrix</i>	9	13	6	.26	.37	.07
G	<i>Stipa comata</i>	-	7	10	-	.16	.21
Total for Annual Grasses		79	108	119	0.49	1.28	1.26
Total for Perennial Grasses		439	494	602	12.27	17.18	22.12
Total for Grasses		518	602	721	12.76	18.47	23.39
F	<i>Achillea millefolium</i>	-	-	8	-	-	.91
F	<i>Agoseris glauca</i>	2	-	-	.01	-	-
F	<i>Alyssum alyssoides</i> (a)	225	181	190	.72	1.27	.51
F	<i>Astragalus cibaricus</i>	_b 14	_a -	_b 9	.20	-	.05
F	<i>Astragalus convallarius</i>	4	17	8	.22	.26	.19
F	<i>Chaenactis douglasii</i>	3	1	-	.00	.06	-
F	<i>Collinsia parviflora</i> (a)	5	1	16	.01	.00	.03
F	<i>Crepis acuminata</i>	_a 5	_b 19	_b 21	.06	.38	.61
F	<i>Ipomopsis congesta</i>	-	3	-	-	.00	.00
F	<i>Linum perenne</i>	-	10	3	-	.24	.03
F	<i>Microsteris gracilis</i> (a)	_b 69	_a 12	_a 11	.16	.03	.02
F	<i>Phlox austromontana</i>	38	30	34	1.21	.21	1.36
F	<i>Phlox longifolia</i>	_a 26	_b 81	_a 30	.07	.89	.10
F	<i>Ranunculus testiculatus</i> (a)	_b 112	_a 36	_c 162	.46	.15	1.01
F	<i>Trifolium</i> sp.	3	-	-	.03	-	-
F	<i>Vicia americana</i>	_a 44	_b 79	_b 70	.32	.59	1.23
Total for Annual Forbs		411	230	379	1.36	1.45	1.58
Total for Perennial Forbs		139	240	183	2.13	2.66	4.49
Total for Forbs		550	470	562	3.50	4.12	6.07

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'06	'08	'12	'06	'08	'12
B	Artemisia tridentata wyomingensis	74	40	46	14.45	2.17	4.79
B	Chrysothamnus viscidiflorus viscidiflorus	67	68	72	5.02	6.18	8.85
B	Pinus edulis	0	0	0	.03	-	-
Total for Browse		141	108	118	19.51	8.35	13.66

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 6

Species	Percent Cover		
	'06	'08	'12
Artemisia tridentata wyomingensis	21.21	2.91	4.51
Chrysothamnus viscidiflorus viscidiflorus	5.75	7.30	10.70

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 6

Species	Average leader growth (in)		
	'06	'08	'12
Artemisia tridentata wyomingensis	1.6	2.8	1.5

BASIC COVER--

Management unit 19R, Study no: 6

Cover Type	Average Cover %		
	'06	'08	'12
Vegetation	29.22	31.27	41.35
Rock	.11	.50	.15
Pavement	.97	2.08	1.02
Litter	34.16	38.59	46.00
Cryptogams	.11	0	.00
Bare Ground	50.30	42.32	19.87

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 6, Study Name: Sage Valley Dixie

Effective rooting depth (in)	pH	silt loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
12.8	7.3	32.2	56.0	11.8	2.5	20.3	336.0	0.8

PELLET GROUP DATA--

Management unit 19R, Study no: 6

Type	Quadrat Frequency		
	'06	'08	'12
Rabbit	76	52	2
Deer	-	-	-
Cattle	2	1	5

Days use per acre (ha)		
'06	'08	'12
-	-	-
-	-	1 (2)
5 (13)	-	35 (86)

BROWSE CHARACTERISTICS--

Management unit 19R, Study no: 6

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
06	3440	8	69	23	760	13	0	17	25/32	
08	1660	17	69	14	40	2	0	35	15/21	
12	1520	17	82	1	20	20	0	3	19/23	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
06	4660	8	90	2	-	1	0	.85	11/16	
08	4180	2	95	3	80	0	0	0	11/19	
12	4100	8	90	2	-	.48	0	0	14/24	
<i>Tetradymia canescens</i>										
06	0	0	0	-	-	0	0	0	12/13	
08	0	0	0	-	-	0	0	0	10/15	
12	0	0	0	-	-	0	0	0	12/23	

IBAPAH HARROW - TREND STUDY NO. 19R-14-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Elk Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: BLM

Elevation: 5,900 ft. (1,798 m)

Aspect: West

Slope: 4%

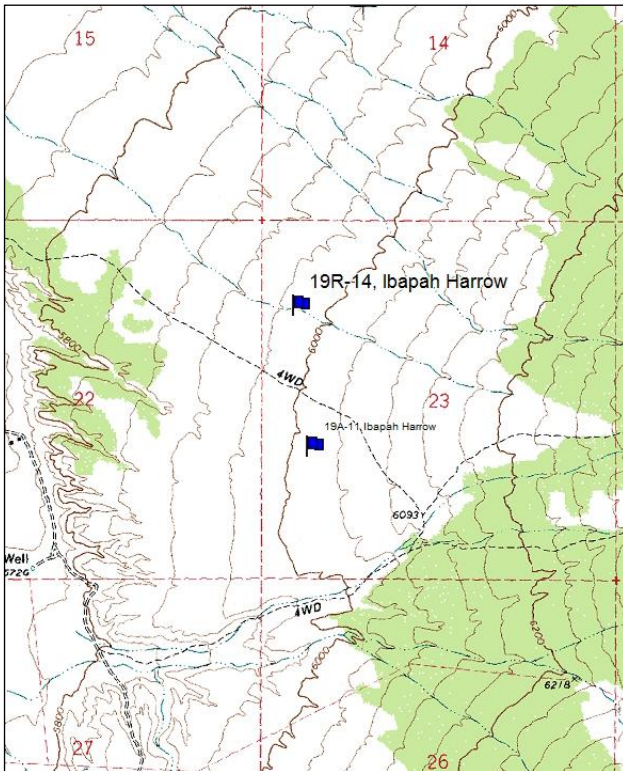
Transect bearing: 125° magnetic

Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

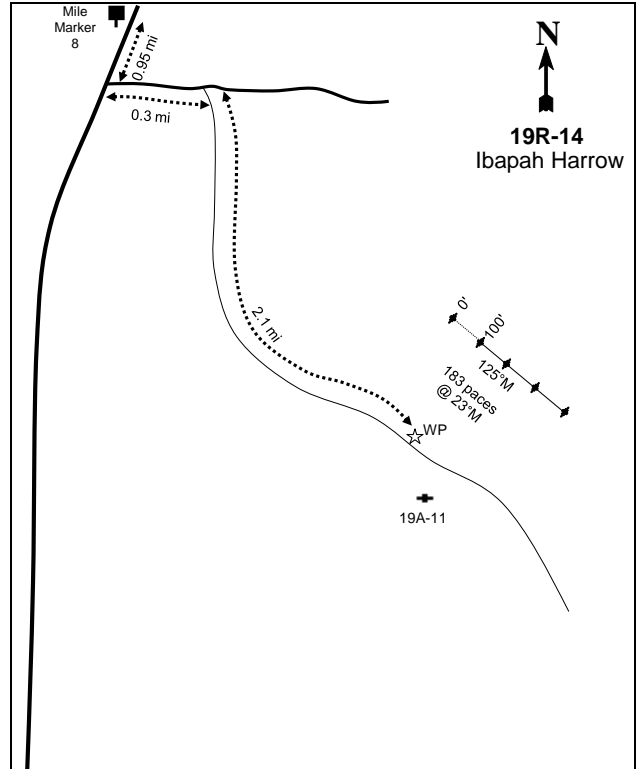
From Ibapah, proceed south to mile marker 8 and continue 0.95 miles to a road on the left (0.05 miles before mile marker 7). Driving east, go 0.3 miles to a road on the right that follows a ridge line. Go 0.3 miles to a fenced pasture and continue 0.7 miles to a fork, keeping left. Drive 0.2 miles to another fork and stay left. Follow the road for 0.2 miles to where the road forks and then meets up again. Drive 0.3 miles to the next fork, keep left, and continue 0.4 miles to the witness post on the left side of the road. The 0-foot stake is 183 paces from the witness post at 23°M. The 0-foot stake is marked with browse tag# 237.

Map Name: Goshute



Township: 10S Range: 19W Section: 23

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 246870 E 4425936 N

IBAPAH HARROW - TREND STUDY NO. 19R-14
[Project #1104](#)

Site Description

Site Information: The study is located approximately six miles south of Ibapah, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, on the west slope of the Deep Creek Mountains, near the mouth of Durse Canyon. The study was established prior to treatment in 2008 to monitor the effects of a two-way Dixie harrow project on land administered by the Bureau of Land Management (BLM). The study occurs on the BLM Ibapah allotment. In fall of 2008, a total of 134 acres were treated with a two-way Dixie harrow. During the second pass of the harrow, a seed mix of grass, forb, and browse species was broadcast seeded (Table - Seed Mix). The project area was treated in mosaic patterns across the treatment area to diversify the age class of the sagebrush plants. The objectives of the project are to improve habitat for big game and sage-grouse by decreasing the canopy cover of Wyoming big sagebrush, increase the diversity of the age-class and size-class of sagebrush plants, decrease the risk of wildfire, and reduce the spread of cheatgrass (WRI Database 2013). Pellet groups have been sampled in low abundance for deer, elk, and cattle over the sample years (Table - Pellet Group Data).

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a lightly used population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population has been poor. A mature population of broom snakeweed (*Gutierrezia sarothrae*) is fairly common on the study site. Other less common browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*) and prickly phlox (*Leptodactylon pungens*). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant perennial grass species on the site is Sandberg bluegrass (*Poa secunda*) and crested wheatgrass (*Agropyron cristatum*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance prior to treatment, but following the treatment has increased substantially on the site. Seeded grass species sampled on the site are crested wheatgrass, pubescent wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), and Indian ricegrass (*Oryzopsis hymenoides*). Other, less common, perennial grass species sampled on the site include bottlebrush squirreltail (*Sitanion hystrix*) and mutton bluegrass (*Poa fendleriana*). Forbs are not particularly abundant, but are somewhat diverse on the site. Perennial forb species were rare on the site prior to treatment, but following the treatment perennial forbs increased in diversity and abundance (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Hilo Peak component, which occurs on fan remnants. The parent material consists of mixed alluvium. The soils within this classification are characterized as deep, well drained, and with a high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.4). Phosphorus may have limited availability for plant growth and development at 3.8 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderately high, though there is a moderate amount of litter and vegetation provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008, and moderate in 2012 due to surface litter, surface rock movement, pedestalling around plants, flow patterns, and soil movement.

Pre vs. Four Years Post Treatment, 2008 vs. 2012

Browse: The density of Wyoming big sagebrush decreased 52% from 5,460 plants/acre to 2,640 plants/acre, and canopy cover decreased from 20% to 6%. The health of the sagebrush population improved with decadence decreasing from 89% to 39% and poor vigor decreasing from 35% to 26% of the population.

Grasses: The sum of nested frequency of perennial grasses increased nearly twofold, and cover increased from 2% to 13%. Cover of the seeded species of crested wheatgrass, bluebunch wheatgrass, and Indian ricegrass

increased from less than 1% to 6%, from less than 1% to 1%, and from 1% to 2%, respectively. The seeded species intermediate wheatgrass and western wheatgrass were both sampled following the treatment in low abundance. Sandberg bluegrass increased in cover from 2% to 4%. The nested frequency of cheatgrass significantly increased and cover increased from less than 1% to 11%.

Forbs: The sum of nested frequency of perennial forbs increased by 47%, and cover increased from 1% to 2%. No single forb species provided more than 1% cover in either sample year.

SEED MIX--

Management unit 19R, Study no: 14

Project Name: Ibapah Harrow - Year 2			
WRI Database #: 1104			
Application: Broadcast Seed		Acres: 120	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	120	1.00
G	Crested Wheatgrass 'Douglas'	120	1.00
G	Crested Wheatgrass 'Hycrest'	120	1.00
G	Indian Ricegrass 'Rimrock'	120	1.00
G	Pubescent Wheatgrass 'Luna'	120	1.00
G	Russian Wildrye 'Bozoisky'	120	1.00
G	Snake River Wheatgrass 'Secar'	120	1.00
G	Western Wheatgrass 'Arriba'	120	1.00
F	Alfalfa 'Ladak'	120	1.00
F	Alfalfa 'Ranger'	120	1.00
F	Blue Flax 'Appar'	60	0.50
F	Sainfoin 'Eski'	240	2.00
F	Small Burnet 'Delar'	240	2.00
F	Western Yarrow	12	0.10
Total Pounds:		1752	14.60
PLS Pounds:			12.76

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 14

Type	Species	Nested Frequency		Average Cover %	
		'08	'12	'08	'12
G	Agropyron cristatum	a3	b124	.00	5.60
G	Agropyron intermedium	a-	b18	-	.52
G	Agropyron smithii	-	10	-	.07
G	Agropyron spicatum	a1	b26	.03	1.13
G	Bromus tectorum (a)	a63	b203	.15	11.26
G	Oryzopsis hymenoides	23	45	.79	1.99
G	Poa fendleriana	5	5	.09	.00
G	Poa secunda	170	137	1.48	3.88
G	Sitanion hystrix	-	1	-	.03
Total for Annual Grasses		63	203	0.15	11.26
Total for Perennial Grasses		202	366	2.39	13.25

T y p e	Species	Nested Frequency		Average Cover %	
		'08	'12	'08	'12
Total for Grasses		265	569	2.54	24.51
F	Alyssum alyssoides (a)	1	-	.00	-
F	Astragalus sp.	3	-	.01	-
F	Balsamorhiza hookeri	9	16	.22	.16
F	Castilleja linariaefolia	_b 15	_a -	.12	-
F	Crepis acuminata	-	1	-	.00
F	Cryptantha sp.	12	11	.16	.28
F	Erigeron pumilus	4	5	.04	.21
F	Eriogonum brevicaule	-	2	-	.00
F	Gilia sp. (a)	4	-	.00	-
F	Linum perenne	_a -	_b 19	-	.31
F	Machaeranthera grindelioides	-	1	-	.00
F	Medicago sativa	-	3	-	.01
F	Phlox hoodii	19	27	.31	.62
F	Phlox longifolia	45	58	.18	.36
F	Ranunculus testiculatus (a)	_b 246	_a 3	.78	.01
F	Sanguisorba minor	_a -	_b 13	-	.20
F	Sphaeralcea coccinea	-	5	-	.01
F	Zigadenus paniculatus	3	1	.02	.03
Total for Annual Forbs		251	3	0.79	0.01
Total for Perennial Forbs		110	162	1.08	2.23
Total for Forbs		361	165	1.87	2.24

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 14

T y p e	Species	Strip Frequency		Average Cover %	
		'08	'12	'08	'12
B	Artemisia tridentata wyomingensis	80	52	9.99	3.75
B	Chrysothamnus viscidiflorus stenophyllus	1	2	-	-
B	Gutierrezia sarothrae	21	27	.33	.96
B	Leptodactylon pungens	4	5	.01	.03
Total for Browse		106	86	10.34	4.75

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 14

Species	Percent Cover	
	'08	'12
Artemisia tridentata wyomingensis	19.46	6.13
Chrysothamnus viscidiflorus stenophyllus	-	.11
Gutierrezia sarothrae	.25	.65
Leptodactylon pungens	.01	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 14

Species	Average leader growth (in)	
	'08	'12
Artemisia tridentata	0.6	1.0

BASIC COVER--

Management unit 19R, Study no: 14

Cover Type	Average Cover %	
	'08	'12
Vegetation	14.56	27.17
Rock	.41	2.00
Pavement	9.13	3.66
Litter	26.18	31.29
Cryptogams	4.81	.08
Bare Ground	39.91	35.55

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 14, Study Name: Ibapah Harrow

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	7.4	30.0	41.4	28.6	1.4	3.8	214.4	0.9

PELLET GROUP DATA--

Management unit 19R, Study no: 14

Type	Quadrat Frequency		Days use per acre (ha)	
	'08	'12	'08	'12
Rabbit	23	3	-	-
Elk	3	3	5 (12)	4 (10)
Deer/Antelope	5	2	1 (3)	7 (17)
Cattle	-	-	3 (7)	1 (2)

BROWSE CHARACTERISTICS--
 Management unit 19R, Study no: 14

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>									
08	5460	1	10	89	60	12	26	35	15/28
12	2640	5	55	39	20	11	0	26	13/21
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
08	20	0	0	100	-	0	0	0	6/6
12	40	0	100	0	-	0	0	0	8/14
<i>Gutierrezia sarothrae</i>									
08	1320	5	76	20	-	0	0	5	6/7
12	1340	9	91	0	60	0	0	3	7/10
<i>Leptodactylon pungens</i>									
08	140	14	57	29	20	0	0	0	10/11
12	100	20	60	20	-	0	0	60	7/8

BENMORE HARROW - TREND STUDY NO. 19R-16-12

Vegetation Type: Perennial Grass

Range Type: Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: USFS

Elevation: 5,699 ft (1,737 m)

Aspect: Northwest

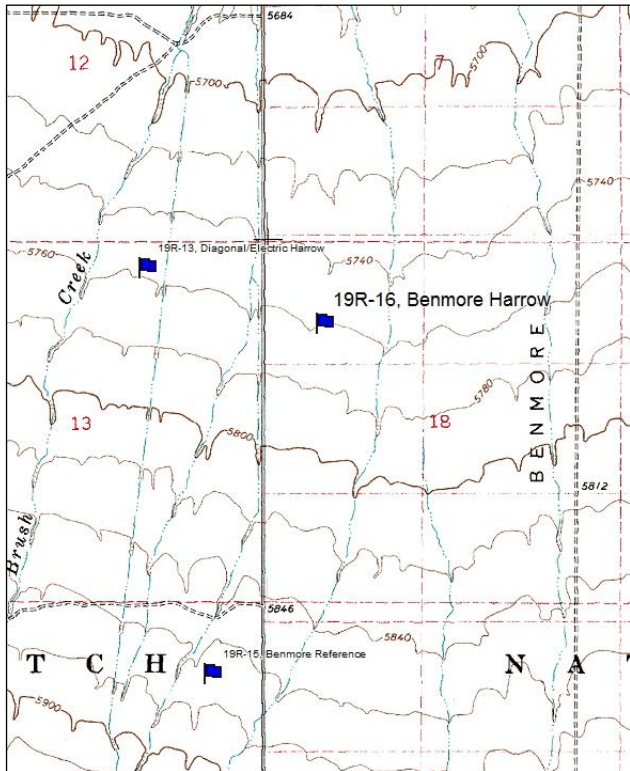
Slope: 2%

Transect bearing: 350° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

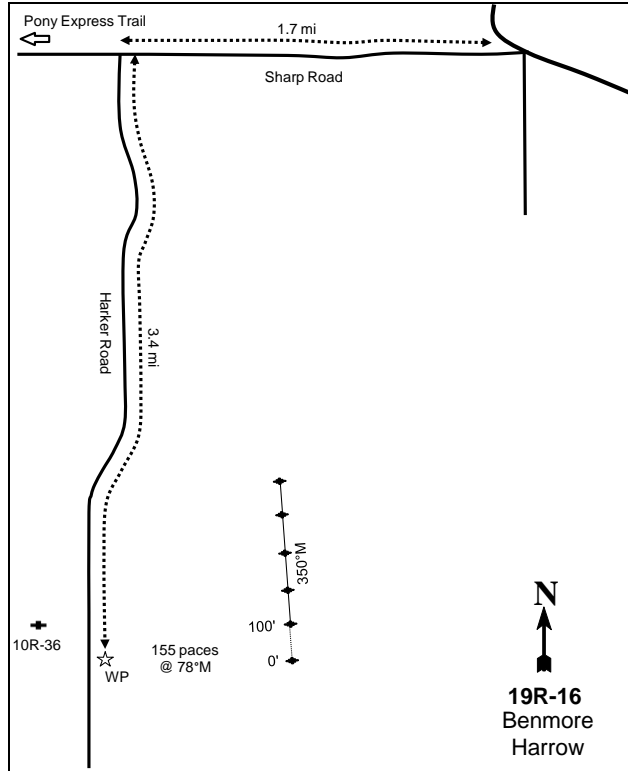
Directions: From Vernon, drive 1.7 miles on Sharp Road (leads to the Pony Express Trail). Turn left onto Harker Road and drive 1.0 miles to a fork. Stay left and drive 0.9 miles to another fork. Keep to the right and drive 1.5 miles to the witness post on the east side of the road. From witness post proceed 155 paces at 78°M to 0-foot stake.

Map Name: Vernon



Township: 9S Range: 5W Section: 18

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 375744 E 4432965 N

BENMORE HARROW - TREND STUDY NO. 19R-16
[Project #1361](#)

Site Description

Site Information: The study is located approximately three and half miles south of Vernon within a Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*) flat. The study was established prior to treatment in 2009 on land administrated by the U.S. Forest Service (USFS) to monitor sagebrush reduction project. The study occurs on the USFS Benmore allotment. In the fall of 2009, a total of 731 acres were treated with a two-way chain harrow in mosaic patterns across the landscape. The outer portion of the treatment polygons were treated only one-way. The treatment area was broadcast seeded with a seed mix of grass and forb species during the second pass of the harrow treatment (Table - Seed Mix). The objectives of the project are to create openings in thick sagebrush cover, establish a mix of native and exotic forbs and native grasses to provide food and attract insects for sage grouse broods, improve sagebrush age-class and vigor by thinning stands and removing decadent plants, and provide forage for livestock grazing (WRI Database 2013). In studies established in 2009, data was collected only along the transect. In subsequent sample years data was collected along the standard sample belts, so there may be slight variation in comparison with the 2009 data. Deer/antelope pellet groups were sampled in low abundance in 2012. Cattle pellet groups were sampled in moderate abundance in 2009. Sage-grouse were sampled at 96 groups/acre in 2012. The pellet frequency of rabbits was very high in 2009 (Table - Pellet Group Data).

Browse: Wyoming big sagebrush is the dominant preferred browse species sampled on the site, which provided the majority of the browse cover over the sample years (Table - Canopy Cover). Wyoming big sagebrush is a lightly used population with a low decadence and good vigor. Recruitment of young sagebrush plant has been good following the treatment. Other browse species was sampled in low abundance on the site (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the site. Prior to treatment only two grass species were sampled crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*). The dominant grass species sampled on the site are crested wheatgrass and bulbous bluegrass (*P. bulbosa*). Crested wheatgrass has provided the majority of the grass cover on the site over the sample years. Bulbous bluegrass was not sampled on the site prior to the treatment. Other common grass species sampled on the site are intermediate wheatgrass (*Agropyron intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), and Sandberg bluegrass. Seed species sampled on the site are western wheatgrass, bluebunch wheatgrass, and Sandberg bluegrass, though Sandberg bluegrass was sampled on the site prior to treatment. Forbs are not overly abundant, but are somewhat diverse on the site. Prior to treatment the dominant forb species was bur buttercup (*Ranunculus testiculatus*), which provided nearly all the forb cover on the site. Following the treatment, the seeded forb species blue flax (*Linum perenne*) and sainfoin (*Onobrychis viciaefolia*) was sampled in moderate abundance, and alfalfa (*Medicago sativa*) was sampled in low abundance (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Taylorsflat component, which occurs on fans remnants and lake terraces. The parent material consists of mixed alluvium and/or mixed lacustrine deposits. The soils within this classification are characterized as deep, well drained, and with a moderately low permeable restrictively layer. The soil surface texture is a loam (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable over the sample years.

Pre vs. Three Years Post Treatment, 2009 vs. 2012

Browse: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. The canopy cover of Wyoming big sagebrush decreased from 8% to 2%. Decadence and plants

displaying poor vigor within the population was low following the treatment. Recruitment of young sagebrush plants to the population was high in 2012.

Grasses: The sum of nested frequency of perennial grasses (perennial grasses minus bulbous bluegrass) increased 27%, and cover increased from 13% to 23%. Crested wheatgrass decreased significantly in nested frequency, cover increased from 12% to 16%. Several new species were sampled on the site following the treatment, including the seeded species western wheatgrass and bluebunch wheatgrass which provided 3% and 2 % cover, respectively. Bulbous bluegrass was sampled in moderately high abundance and provided 7% cover.

Forbs: Prior to the treatment perennial forbs were rare on the site. Perennial forb increased in abundance on the site following the treatment. The seed forbs species, blue flax and sainfoin, each were sampled at 1% cover. The annual forb species bur buttercup decreased significantly in nested frequency and cover decreased from 11% to 1%.

SEED MIX--

Management unit 19R, Study no: 16

Project Name: Benmore Pastures Dixie Harrow			
WRI Database #: 1361			
Application: Broadcast Seed		Acres:	900
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	1800	2.00
G	Great Basin Wildrye 'Trailhead'	900	1.00
G	Indian Ricegrass 'Rimrock'	900	1.00
G	Sandberg Bluegrass	225	0.25
G	Snake River Wheatgrass 'Secar'	900	1.00
G	Western Wheatgrass 'Arriba'	1800	2.00
F	Alfalfa 'Ladak'	1800	2.00
F	Blue Flax 'Appar'	450	0.50
F	Sainfoin 'Eski'	1800	2.00
F	Small Burnet 'Delar'	1800	2.00
F	Western Yarrow	100	0.11
F	Rocky Mountain Beeplant	431	0.48
Total Pounds:		12906	14.34
PLS Pounds:			12.93

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 16

T y p e	Species	Nested Frequency		Average Cover %	
		'09	'12	'09	'12
G	Agropyron cristatum	_b 307	_a 236	11.73	15.58
G	Agropyron intermedium	_a -	_b 25	-	1.62
G	Agropyron smithii	_a -	_b 66	-	2.74
G	Agropyron spicatum	_a -	_b 51	-	1.67
G	Bromus tectorum (a)	-	4	-	.01
G	Poa bulbosa	_a -	_b 305	-	7.26
G	Poa secunda	70	100	1.29	1.76

Type	Species	Nested Frequency		Average Cover %	
		'09	'12	'09	'12
	Total for Annual Grasses	0	4	0	0.01
	Total for Perennial Grasses	377	783	13.02	30.65
	Total for Grasses	377	787	13.02	30.66
F	Alyssum alyssoides (a)	_a 56	_b 317	.26	.71
F	Astragalus cibaricus	1	7	.00	.21
F	Calochortus nuttallii	-	2	-	.00
F	Comandra pallida	-	1	-	.00
F	Linum perenne	_a -	_b 34	-	1.09
F	Medicago sativa	-	3	-	.04
F	Onobrychis viciaefolia	_a -	_b 31	-	.71
F	Ranunculus testiculatus (a)	_b 329	_a 198	10.62	.96
F	Sanguisorba minor	_a -	_b 12	-	.34
	Total for Annual Forbs	385	515	10.89	1.67
	Total for Perennial Forbs	1	90	0.00	2.41
	Total for Forbs	386	605	10.90	4.08

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 16

Type	Species	Strip Frequency	Average Cover %	
			'09	'12
B	Artemisia tridentata wyomingensis	48	6.16	2.29
B	Chrysothamnus nauseosus	4	-	.30
B	Chrysothamnus viscidiflorus	0	.03	-
B	Gutierrezia sarothrae	4	.81	.09
	Total for Browse	56	7.00	2.68

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 16

Species	Percent Cover	
	'09	'12
Artemisia tridentata wyomingensis	7.88	2.08
Chrysothamnus nauseosus	-	.08
Gutierrezia sarothrae	1.56	.36

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 16

Species	Average leader growth (in)
	'12
Artemisia tridentata wyomingensis	1.7

BASIC COVER--

Management unit 19R, Study no: 16

Cover Type	Average Cover %	
	'09	'12
Vegetation	29.65	39.14
Rock	.14	.26
Pavement	1.58	1.08
Litter	25.32	39.69
Cryptogams	3.34	.01
Bare Ground	52.53	26.70

PELLET GROUP DATA--

Management unit 19R, Study no: 16

Type	Quadrat Frequency		Days use per acre (ha)	
	'09	'12	'09	'12
Rabbit	64	7	-	-
Grouse	-	1	-	96 groups/acre
Deer/Antelope	2	4	-	1 (2)
Cattle	11	-	19 (47)	-

BROWSE CHARACTERISTICS--

Management unit 19R, Study no: 16

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia tridentata wyomingensis</i>									
09	No Density Collected								25/29
12	2540	76	23	2	260	4	0	0	12/13
<i>Chrysothamnus nauseosus</i>									
09	No Density Collected								13/13
12	120	0	100	-	-	0	0	0	15/13
<i>Chrysothamnus viscidiflorus</i>									
09	No Density Collected								16/22
12	0	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
09	No Density Collected								9/11
12	140	29	71	-	-	0	0	0	9/10

EAST PASTURE HARROW - TREND STUDY NO. 19R-20-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Elk Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: BLM

Elevation: 5,800 ft (1,768 m)

Aspect: West

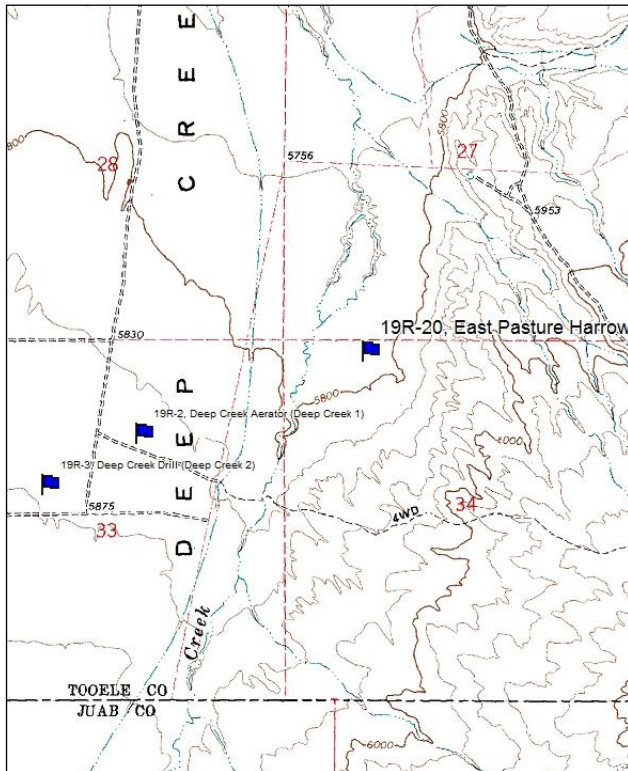
Slope: 2%

Transect bearing: 15° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

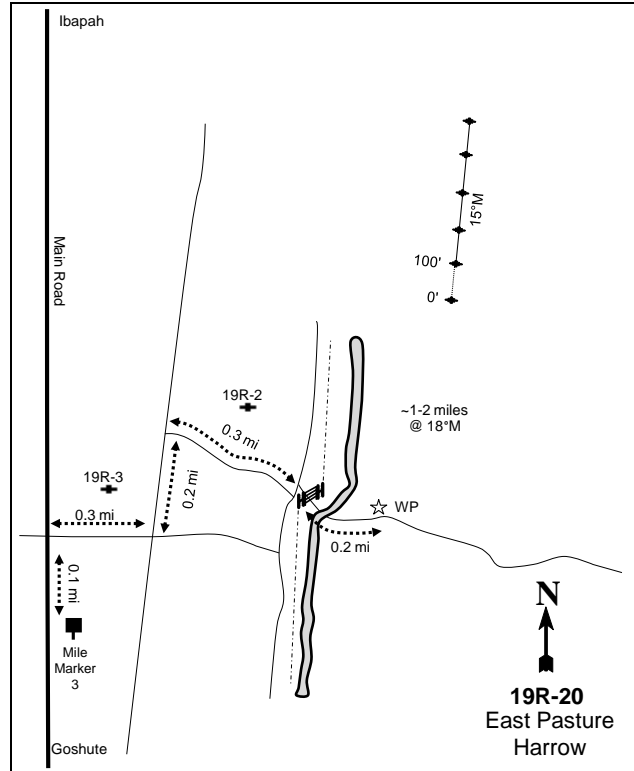
Directions: Drive north of Goshute toward Ibapah to mile marker 3. Drive north of the mile marker 0.1 miles to a 2-track road on the right (east) side of the road. Turn right and drive 0.3 miles to a four-way intersection. Turn left at the intersection and drive 0.2 miles to a road on the right. Turn right and drive 0.1 miles to the witness post on the left (north) side of the road for the Deep Creek Aerator study site (19R-2). Continue for 0.2 miles to a gate. From the gate travel 0.2 miles to a witness post on the left side of the road. From the witness post the 0-foot stake is 0.5 mile (485 paces) at 18 degrees magnetic, and is marked with browse tag #192.

Map Name: Goshute



Township: 10S Range: 19W Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 245351 E 4423091 N

EAST PASTURE HARROW - TREND STUDY NO. 19R-20
[Project #662](#)

Site Information

Site Description: The study is located approximately 8 miles southeast of Ibapah within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat. The study was established prior to treatment in 2007 on land administrated by the Bureau of Land Management (BLM) to monitor a sagebrush habitat improvement project. The study occurs on the BLM Ibapah allotment. The sagebrush habitat on the western slope of the Deep Creek Mountains has become decadent. The native vegetation is being invaded by juniper in some areas, and cheatgrass (*Bromus tectorum*) has become dominant after wildfire events. Additionally, continuous stands of decadent sagebrush create a wildfire hazard which may ultimately eliminate the sagebrush component. In the fall of 2007, a total of 145 acres of sagebrush was treated by a two-way Dixie harrow in a mosaic pattern. A broadcast seeder was mounted on the tractor and seed was applied after the first pass of the two-way harrow treatment (Table - Seed Mix). The objectives of the project are to decrease the threat of catastrophic fire, and reduce the spread of cheatgrass (WRI Database 2013). Deer/antelope and cattle pellet groups have been sampled in low abundance since the outset of the study (Table - Pellet Group Data).

Browse: The dominant browse species on the site is Wyoming big sagebrush, which has provided the majority of the browse cover on the site over the sample years. Wyoming big sagebrush is a lightly used population with low decadence and good vigor within the population, though vigor and decadence was high, use was moderate prior to treatment. The recruitment of young plants to the population improved following the treatment. Other browse species were not common the site (Table - Browse Characteristic).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The dominant perennial grass species is Sandberg bluegrass (*Poa secunda*), which substantially decreased in abundance on the site following the treatment. The invasive annual grass species cheatgrass increased in abundance on the site following the treatment. Seeded species sampled on the site are crested wheatgrass (*Agropyron cristatum*), pubescent wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), and Indian ricegrass (*Oryzopsis hymenoides*), though crested wheatgrass was sampled on the site prior to treatment. Forbs are not abundant or diverse on the site. No single forbs species was dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Medburn component, which occurs on fans remnants and lake terraces. The parent material consists of alluvium and/or lacustrine deposits derived from sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a high permeable restrictively layer. The soil surface texture is a loam (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is moderately high, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2007 due to pedestalling around plants, the formation of flow patterns and rills, and evidence of soil movement. The soil erosion condition was classified as slight in 2012 due to surface litter and pedestalling around plants.

Pre vs. Five Years Post Treatment, 2007 vs. 2012

Browse: The density of Wyoming big sagebrush increased 66% from 6,200 plants/acre to 10,280 plants/acre, though canopy cover decreased from 21% to 14%. The increase in density is from the increase in young plants. Recruitment of young sagebrush plants to the population increased from 4% to 45%. The health of the sagebrush population improved with decadence decreasing from 55% to 3% and plant displaying poor vigor decreasing from 23% to 3% of the population.

Grasses: The sum of nested frequency of perennial grasses decreased 45%, and cover decreased from 11% to

4%. Sandberg bluegrass decreased significantly in nested frequency, cover decreased from 9% to 2%. Cheatgrass remained similar in nested frequency, though cover increased from 2% to 14%.

Forbs: Perennial forbs remained rare on the site. No single forb species provided more than 1% cover in either sample year.

SEED MIX--

Management unit 19R, Study no: 20

Project Name: East Pasture			
WRI Database #: 662			
Application: Broadcast Seed		Acres: 150	
Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	50	0.33
G	Crested Wheatgrass 'Douglas'	150	1.00
G	Crested Wheatgrass 'Hycrest'	150	1.00
G	Great Basin Wildrye 'Trailhead'	150	1.00
G	Indian Ricegrass 'Rimrock'	150	1.00
G	Pubescent Wheatgrass	300	2.00
G	Russian Wildrye	150	1.00
G	Western Wheatgrass 'Arriba'	150	1.00
F	Alfalfa 'Ladak'	100	0.67
F	Alfalfa 'Ranger'	100	0.67
F	Alfalfa 'Spredor 4'	100	0.67
F	Blue Flax 'Appar'	50	0.33
F	Sainfoin 'Eski'	300	2.00
F	Small Burnet 'Delar'	300	2.00
F	Western Yarrow	13	0.09
Total Pounds:		2213	14.75
PLS Pounds:			13.29

Trend Summary

HERBACEOUS TRENDS--

Management unit 19R, Study no: 20

T y P e	Species	Nested Frequency		Average Cover %	
		'07	'12	'07	'12
G	Agropyron cristatum	_a 8	_b 34	.09	.53
G	Agropyron intermedium	_a -	_b 16	-	.22
G	Agropyron smithii	-	8	-	.10
G	Bromus tectorum (a)	313	401	2.06	14.22
G	Oryzopsis hymenoides	-	10	.03	.91
G	Poa secunda	_b 309	_a 120	9.20	1.68
G	Sitanion hystrix	_b 27	_a -	.52	-
G	Stipa comata	3	2	.30	.03
G	Stipa lettermani	4	2	.38	.03
G	Vulpia octoflora (a)	_b 56	_a 4	.16	.01
Total for Annual Grasses		369	405	2.22	14.24
Total for Perennial Grasses		351	192	10.52	3.50

Type	Species	Nested Frequency		Average Cover %	
		'07	'12	'07	'12
Total for Grasses		720	597	12.74	17.75
F	Arabis sp.	5	-	.01	-
F	Cryptantha sp.	-	6	-	.09
F	Delphinium nuttallianum	2	-	.06	-
F	Draba sp. (a)	3	-	.00	-
F	Gayophytum ramosissimum(a)	_b 19	_a -	.06	-
F	Ipomopsis aggregata	-	2	-	.00
F	Microsteris gracilis (a)	5	3	.01	.00
F	Ranunculus testiculatus (a)	6	5	.02	.01
F	Sphaeralcea coccinea	-	3	-	.01
Total for Annual Forbs		33	8	0.09	0.01
Total for Perennial Forbs		7	11	0.07	0.11
Total for Forbs		40	19	0.17	0.13

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 20

Type	Species	Strip Frequency		Average Cover %	
		'07	'12	'07	'12
B	Artemisia tridentata wyomingensis	97	96	17.42	16.03
B	Gutierrezia sarothrae	2	7	.00	.06
B	Leptodactylon pungens	1	0	-	-
B	Opuntia sp.	1	0	.03	-
Total for Browse		101	103	34.91	16.09

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 20

Species	Percent Cover	
	'07	'12
Artemisia tridentata wyomingensis	20.93	13.75
Gutierrezia sarothrae	-	.28

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 20

Species	Average leader growth (in)	
	'07	'12
Artemisia tridentata wyomingensis	0.8	0.4

BASIC COVER--

Management unit 19R, Study no: 20

Cover Type	Average Cover %	
	'07	'12
Vegetation	33.08	34.39
Rock	0	.04
Pavement	8.72	3.11
Litter	25.57	50.05
Cryptogams	5.18	0
Bare Ground	36.35	27.78

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 20, Study Name: East Pasture Harrow

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
-	6.8	33.4	46.0	20.6	1.0	9.8	380.8	0.5

PELLET GROUP DATA--

Management unit 19R, Study no: 20

Type	Quadrat Frequency		Days use per acre (ha)	
	'07	'12	'07	'12
Rabbit	36	1	-	-
Deer/Antelope	4	1	2 (5)	3 (7)
Cattle	2	5	12 (29)	7 (16)

BROWSE CHARACTERISTICS--

Management unit 19R, Study no: 20

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
07	6200	4	41	55	2420	33	7	23	21/33	
12	10280	45	52	3	2120	3	0	3	14/18	
<i>Chrysothamnus viscidiflorus</i>										
07	0	0	0	-	-	0	0	0	10/7	
12	0	0	0	-	-	0	0	0	-/-	
<i>Gutierrezia sarothrae</i>										
07	40	0	100	-	-	50	0	50	5/7	
12	300	7	93	-	-	0	0	0	6/10	
<i>Leptodactylon pungens</i>										
07	20	0	100	-	-	0	0	0	8/6	
12	0	0	0	-	-	0	0	0	-/-	
<i>Opuntia sp.</i>										
07	20	0	100	-	-	0	0	0	3/5	
12	0	0	0	-	-	0	0	0	-/-	

EAST VERNON BULLHOG - TREND STUDY NO. 19R-22-12

Vegetation Type: Juniper

Range Type: Substantial Deer Spring/Fall

NRCS Ecological Site Description: [Upland Shallow Loam \(Utah Juniper-Singleleaf Pinyon\), R028AY324UT](#)

Land Ownership: USFS

Elevation: 6,289 ft (1,917 m)

Aspect: Northeast

Slope: 13%

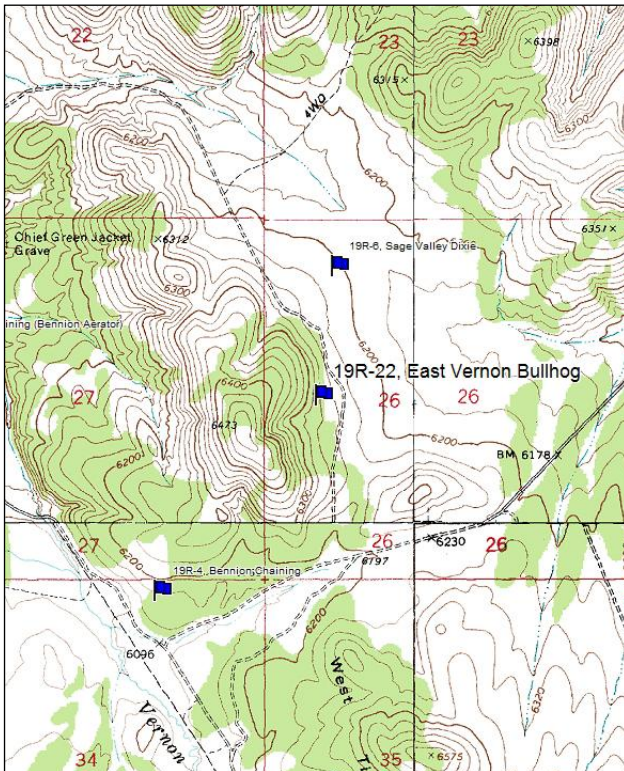
Transect bearing: 330° magnetic

Belt placement: line 1 (11ft), line 2 (34ft) (98 feet), line 3 (59ft) (90 feet), line 4 (71ft), line 5 (95ft)

Note: No Rebar

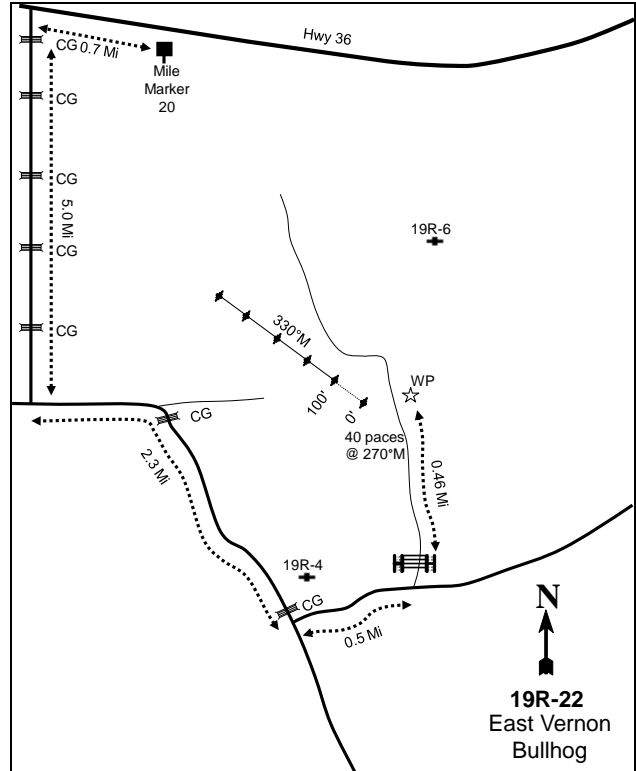
Directions: From highway 36 south of Vernon, drive to mile marker #20. From there, drive 0.7 miles to a turn off on the left (west). Turn there and drive south for 5.0 miles passing several (4 or 5) cattle guards to a fork. Turn left and drive 0.7 miles to an intersection. Turn right (south) crossing a cattle guard and drive 1.6 miles to another cattle guard. Directly after the cattle guard turn left (east) and drive 0.5 miles to a road and gate on the left. Turn and go through the gate and drive 0.45 miles to a witness post. Walk ~40 paces at 270°M to the 0-foot stake marked with browse tag #154.

Map Name: Vernon



Township: 9S Range: 5W Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 382131 E 4429191 N

EAST VERNON BULLHOG - TREND STUDY NO. 19R-22
[Project #2292](#)

Site Information

Site Description: The study is located approximately six miles southeast of Vernon within a singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established prior to treatment in 2012 on land administrated by the U.S. Forest Service (USFS) to monitor the effects of a pinyon and juniper reduction project. The study occurs on the USFS Bennion allotment. In the winter of 2012-2013, approximately 415 acres of pinyon and juniper trees were thinned by a bullhog implement. Small islands of trees were left along natural contours to provide cover for wildlife. Seed was not used on the project site. The objectives of the project are to improve greater sage-grouse winter and brood rearing habitat, improve spring/fall mule deer habitat, watershed conditions, and reduce hazardous fuels (WRI Database 2013). Deer and elk pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). The site was dominated by pinyon and juniper prior to treatment, which provided the majority of the canopy cover on the site in 2012 (Table - Canopy Cover). Mountain big sagebrush is a relatively small population with high decadence and a high amount of plants displaying poor vigor within the population. Recruitment of young sagebrush plants to the population was poor prior to treatment. Pricklypear cactus (*Opuntia* sp.) was sampled on the site in low abundance (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant, but are not particularly diverse on the site. Sandberg bluegrass (*Poa secunda*) is the dominant grass species on the site, which provides the majority of the grass cover on the site. The invasive grass species cheatgrass (*Bromus tectorum*) was sampled on the site in low abundance. Other grass species sampled on the site are bluebunch wheatgrass (*Agropyron spicatum*) and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are not overly abundant, but are somewhat diverse on the site. Perennial forb species are rare on the site. The annual forb species pale alyssum (*Alyssum alyssoides*) is fairly abundant on the site (Table - Herbaceous Trends)

Soil: The soil is classified as part of the Reywat-Broad-Rock outcrop association and is likely part of the Reywat component, which occurs on mountainsides and hillsides. The parent material consists of residuum and colluvium derived from quartzite and igneous rock. The soils within this classification are characterized as shallow, well drained, and with a moderately permeable restrictively layer. The soil surface texture is a very cobbly loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of litter, pavement, and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 19R, Study no: 22

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Agropyron spicatum</i>	58	1.57
G	<i>Bromus tectorum</i> (a)	30	.39
G	<i>Poa secunda</i>	315	14.65
G	<i>Sitanion hystrix</i>	18	.28
Total for Annual Grasses		30	0.39

Type	Species	Nested Frequency	Average Cover %
		'12	'12
Total for Perennial Grasses		391	16.50
Total for Grasses		421	16.89
F	Alyssum alyssoides (a)	216	1.75
F	Antennaria rosea	3	.06
F	Arabis sp.	1	.03
F	Astragalus sp.	43	.45
F	Collinsia parviflora (a)	4	.00
F	Crepis acuminata	3	.03
F	Epilobium brachycarpum (a)	3	.00
F	Holosteum umbellatum (a)	2	.01
F	Lactuca serriola (a)	1	.00
F	Lesquerella sp.	3	.00
F	Microsteris gracilis (a)	3	.00
F	Phlox hoodii	12	.45
F	Phlox longifolia	14	.03
F	Ranunculus testiculatus (a)	14	.02
F	Sisymbrium altissimum (a)	20	.38
Total for Annual Forbs		263	2.18
Total for Perennial Forbs		79	1.07
Total for Forbs		342	3.25

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 19R, Study no: 22

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata vaseyana	16	.92
B	Juniperus osteosperma	15	23.64
B	Opuntia sp.	14	.06
B	Pinus monophylla	2	.30
Total for Browse		47	24.92

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 22

Species	Percent Cover
	'12
Artemisia tridentata vaseyana	.56
Juniperus osteosperma	42.63
Pinus monophylla	.13

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 19R, Study no: 22

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	0.6

POINT-QUARTER TREE DATA--
Management unit 19R, Study no: 22

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	447	7.8
Pinus edulis	27	5.1

BASIC COVER--
Management unit 19R, Study no: 22

Cover Type	Average Cover % '12
Vegetation	38.87
Rock	9.23
Pavement	19.17
Litter	45.73
Cryptogams	2.21
Bare Ground	8.41

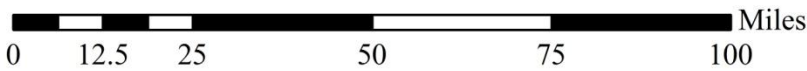
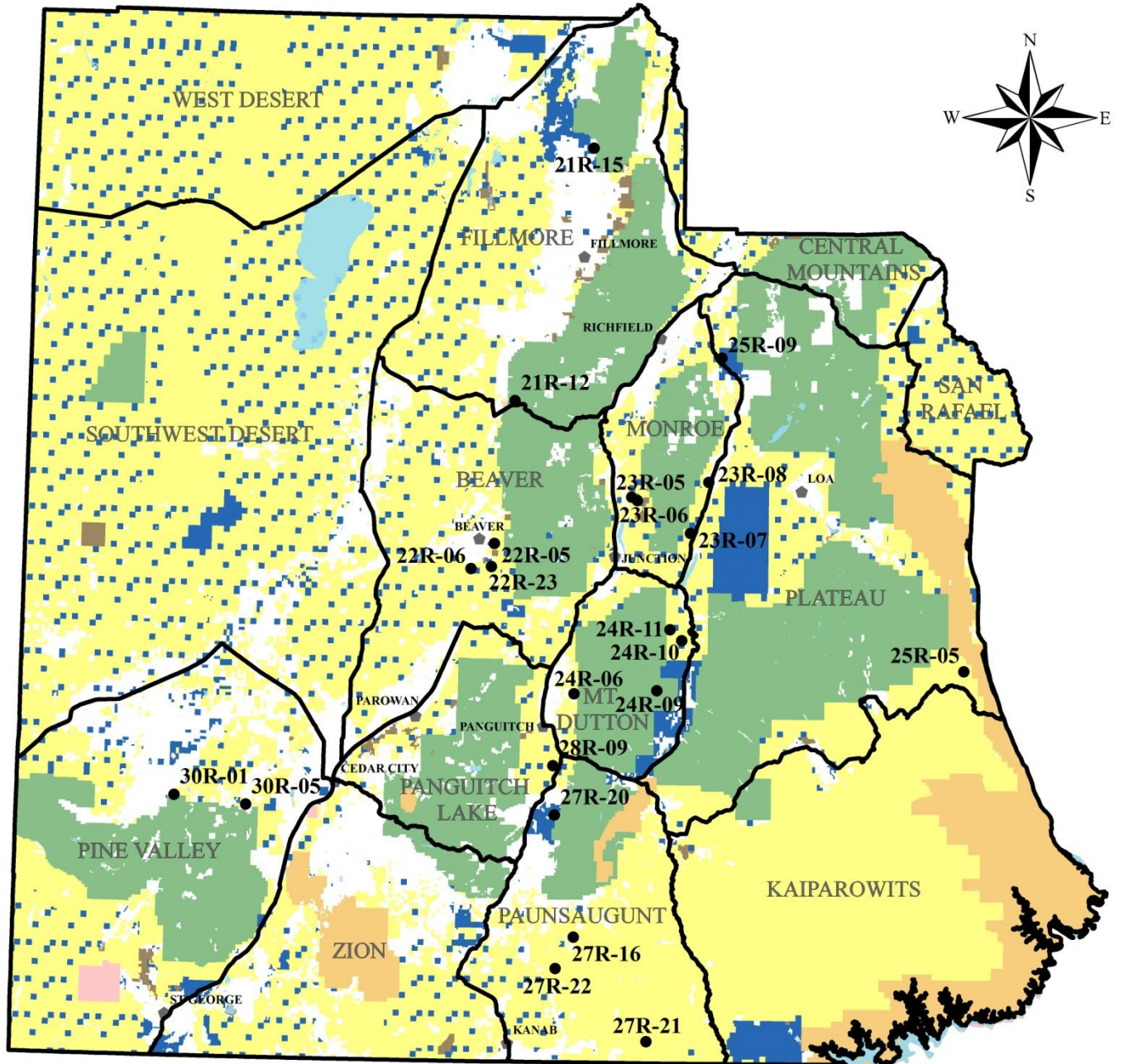
PELLET GROUP DATA--
Management unit 19R, Study no: 22

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	9	-
Elk	-	1 (2)
Deer	-	3 (7)

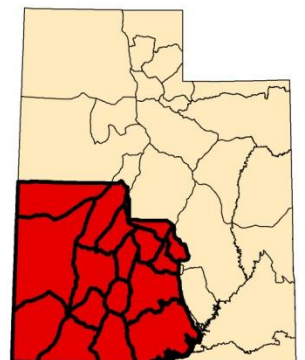
BROWSE CHARACTERISTICS--
 Management unit 19R, Study no: 22

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>									
12	480	0	50	50	-	17	4	92	12/19
<i>Juniperus osteosperma</i>									
12	300	7	87	7	20	0	0	7	-/-
<i>Opuntia sp.</i>									
12	280	0	100	-	-	0	0	0	4/12
<i>Pinus monophylla</i>									
12	60	100	0	-	-	0	0	0	-/-

Southern Region WRI Studies 2012



Unit Location



Ownership	Private	Unit Boundary	City
BLM	SITLA	Study Site	Waterbody
DNR	Tribal		
NPS	USFS		

WATER CANYON - TREND STUDY NO. 21R-12-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Substantial Deer Winter

NRCS Ecological Site Description: Upland Shallow Loam (Mountain Big Sagebrush), R047XA334UT

Land Ownership: USFS

Elevation: 6,479 ft (1,974 m)

Aspect: South

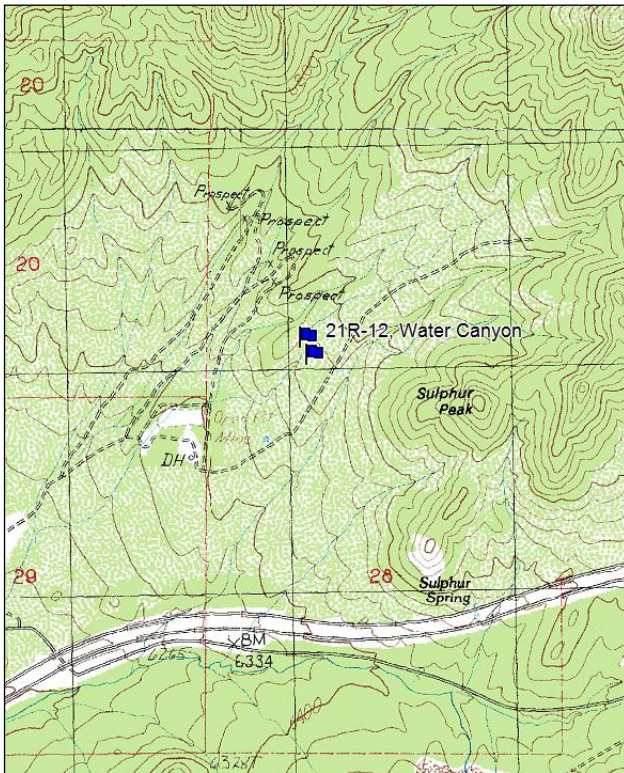
Slope: 4%

Transect bearing: 222° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

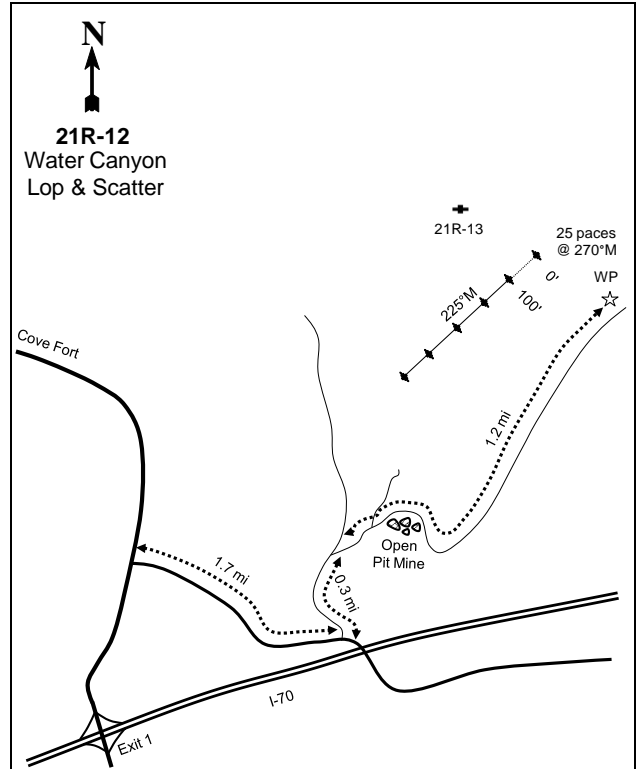
Directions: From Cove Fort turn east at the road opposite the barn. Drive 1.7 miles to a left turn. Continue for 0.3 miles and take the right fork. Drive another 1.4 miles, staying to the right. There is no witness post, please place one. The sites run parallel to the hill side.

Map Name: Cove Fort



Township: 25S Range: 6W Section: 21

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 366012 E 4275219 N

WATER CANYON - TREND STUDY NO. 21R-12

Site Description

Site Information: The study is located approximately two and half miles east of Cove Fort within sagebrush flat that was invaded by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). The study was established in 2009 on land administrated by the U.S. Forest Service (USFS) to monitor the Water Canyon Forage Enhancement Phase #1 ([WRI Project #1493](#)). The study occurs on the USFS Grass Creek allotment. The project was cancelled as a Watershed Restoration Initiative project, but the USFS finished the brushsaw/bullhog portion of the treatment. Initially a seeding was planned for project area, but the seeding was cancelled. The brushsaw/bullhog treatment was completed in the spring of 2009, prior to the establishment of the study. The objective of the project are to improve wildlife habitat, decrease pinyon and juniper cover, and increase desirable forb, grass, and browse species (WRI Database 2013). In studies established in 2009, data was collected only along the transect. In subsequent sample years data was collected along the standard sample belts, so there may be slight variation in comparison with the 2009 data. A reference study site, Water Canyon Reference 21R-13, is located 200 yard to the northwest of the study site within an untreated pinyon and juniper woodland. Deer, elk, and cattle pellet groups have been sampled in low abundance on the site since the outset of the study (Table - Pellet Group Data).

Browse: The preferred browses species sampled on the site are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*). Mountain big sagebrush is a lightly used population with low decadence and good vigor within the population. Although density was not sampled in 2009, sagebrush has increased in abundance on the site. The recruitment of young sagebrush plants to the population was good. Bitterbrush is sparse on the site but provide additional forage. The pinyon and juniper trees were treated prior to the establishment of the study, but appeared to be fairly dense on the site (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase I after the treatment. It was likely in phase II prior to treatment (Tausch et al. 2009).

Herbaceous Understory: Grasses are fairly abundant and diverse on the site. The dominant perennial grass species on the site is intermediate wheatgrass (*Agropyron intermedium*). The invasive annual grass species cheatgrass (*Bromus tectorum*) has increased substantially in cover since the outset of the study and provided the majority of the cover in 2012. Other grass species sampled have remained in relatively low abundance on the site. Forbs are somewhat abundant and moderately diverse on the site. The dominant forb species is Bonneville pea (*Lathyrus brachycalyx*), which has provided the majority of the forb cover over the sampled period. The annual forb species pale alyssum (*Alyssum alyssoides*) has been fairly common on the site. Other forb species sampled have been rare on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable over the sample years.

Trend Assessments

Browse:

- **2009 to 2012 - stable (0):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Canopy cover of mountain big sagebrush increased from 5% to 6%. Juniper increased in cover from 1% to 4%.

Grass:

- **2009 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses increased by 13%, and cover increased from 4% to 9%. Intermediate wheatgrass increased in cover from 2% to 7%. Cheatgrass increased significantly in nested frequency and cover increased from 1% to 11%.

Forb:

- **2009 to 2012 - up (+2):** The sum of nested frequency of perennial forbs increased by 69%, and cover increased from 2% to 6%. Bonneville pea remained similar in nested frequency and cover increased from 2% to 5%. Pale alyssum increased significantly in nested frequency and cover increased from 1% to 3%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 21R, Study no: 12

Type	Species	Nested Frequency		Average Cover %	
		'09	'12	'09	'12
G	Agropyron cristatum	10	13	.07	.75
G	Agropyron intermedium	_a 69	_b 102	1.94	6.60
G	Agropyron spicatum	_b 22	_a 11	.42	.53
G	Bromus inermis	_b 14	_a 2	.10	.03
G	Bromus tectorum (a)	_a 49	_b 286	.76	11.32
G	Poa fendleriana	_b 13	_a 1	.25	.15
G	Poa secunda	27	27	.11	.44
G	Sitanion hystrix	21	42	.91	.66
Total for Annual Grasses		49	286	0.76	11.32
Total for Perennial Grasses		176	198	3.82	9.18
Total for Grasses		225	484	4.58	20.51
F	Alyssum alyssoides (a)	_a 112	_b 261	.53	3.31
F	Arabis sp.	-	2	-	.03
F	Astragalus beckwithii	_a -	_b 15	-	.25
F	Chaenactis douglasii	-	5	-	.01
F	Cirsium sp.	-	3	-	.15
F	Collinsia parviflora (a)	32	11	.10	.02
F	Eriogonum umbellatum	2	-	.03	-
F	Gayophytum ramosissimum(a)	7	-	.19	-
F	Lactuca serriola (a)	-	2	-	.00
F	Lathyrus brachycalyx	85	117	1.58	5.04
F	Lithospermum ruderales	-	1	-	.15
F	Microsteris gracilis (a)	3	6	.00	.01
F	Penstemon sp.	2	4	.00	.00
F	Phlox longifolia	-	2	-	.00
F	Polygonum douglasii (a)	4	-	.01	-
F	Ranunculus testiculatus (a)	_a 8	_b 31	.02	.12
Total for Annual Forbs		166	311	0.86	3.48
Total for Perennial Forbs		89	149	1.62	5.66
Total for Forbs		255	460	2.48	9.14

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 21R, Study no: 12

Type	Species	Strip Frequency	Average Cover %	
			'09	'12
B	Artemisia tridentata vaseyana	59	2.71	6.66
B	Chrysothamnus nauseosus	4	.01	.03
B	Gutierrezia sarothrae	1	-	-
B	Juniperus osteosperma	12	.69	2.45
B	Opuntia sp.	1	-	-
B	Purshia tridentata	0	.18	-
Total for Browse		77	3.59	9.15

CANOPY COVER, LINE INTERCEPT--

Management unit 21R, Study no: 12

Species	Percent Cover	
	'09	'12
Artemisia tridentata vaseyana	4.86	6.38
Gutierrezia sarothrae	-	.06
Juniperus osteosperma	1.26	3.65
Purshia tridentata	.41	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 21R, Study no: 12

Species	Average leader growth (in)
	'12
Artemisia tridentata vaseyana	2.4
Purshia tridentata	3.9

POINT-QUARTER TREE DATA--

Management unit 21R, Study no: 12

Species	Trees per Acre		Average diameter (in)	
	'09	'12	'09	'12
Juniperus osteosperma	118	83	1.8	2.4
Pinus edulis	19	20	5.9	5.3

BASIC COVER--

Management unit 21R, Study no: 12

Cover Type	Average Cover %	
	'09	'12
Vegetation	12.32	37.93
Rock	2.18	2.07
Pavement	8.53	.79
Litter	59.95	69.36
Bare Ground	19.03	11.65

PELLET GROUP DATA--

Management unit 21R, Study no: 12

Type	Quadrat Frequency		Days use per acre (ha)	
	'09	'12	'09	'12
Rabbit	22	14	-	-
Elk	1	-	1 (3)	2 (5)
Deer	3	1	3 (7)	2 (5)
Cattle	2	-	3 (7)	6 (14)

BROWSE CHARACTERISTICS--

Management unit 21R, Study no: 12

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
09	No Density Collected								21/27
12	3500	62	35	3	240	7	0	4	24/31
<i>Chrysothamnus nauseosus</i>									
09	No Density Collected								10/5
12	80	50	50	-	-	0	0	0	17/22
<i>Gutierrezia sarothrae</i>									
09	No Density Collected								11/10
12	20	0	100	-	-	0	0	0	12/14
<i>Juniperus osteosperma</i>									
09	No Density Collected								-/-
12	320	56	44	-	40	0	0	13	-/-
<i>Opuntia sp.</i>									
09	No Density Collected								5/17
12	20	0	100	-	-	0	0	0	6/11
<i>Purshia tridentata</i>									
09	No Density Collected								14/30
12	0	0	0	-	-	0	0	0	31/67

DUGGINS CREEK - TREND STUDY NO. 21R-15-12

Vegetation Type: Wyoming Big Sagebrush/Cliffrose

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Upland Stony Loam (Wyoming Big Sagebrush), R028AY334UT

Land Ownership: SITLA

Elevation: 5,579 ft (1,701 m)

Aspect: Southwest

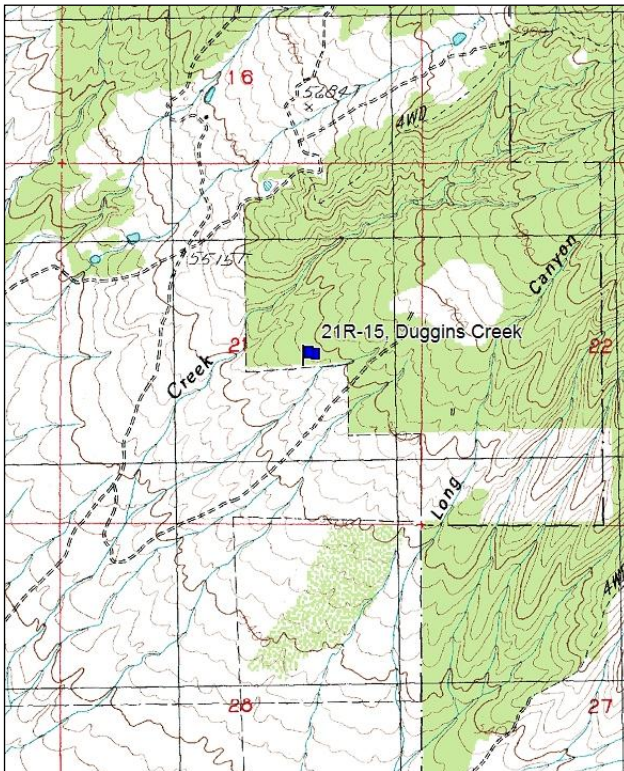
Slope: 6%

Transect bearing: 208° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

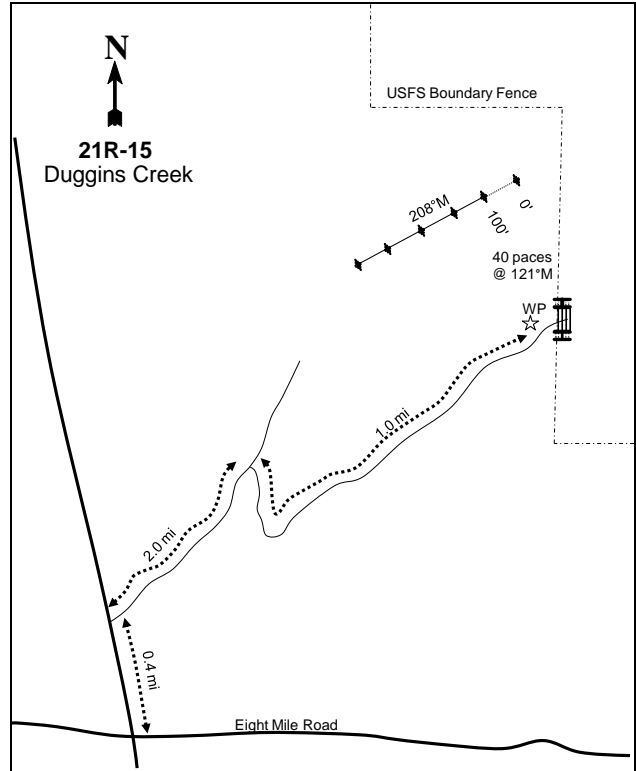
Directions: From the Eight Mile Road Drive north 0.4 miles and turn right and continue for 2.0 miles. Turn right and drive 1.0 mile to gate and witness post on the right, and park. From the witness post walk 40 paces at 121°M to the 0-foot stake. The 0-foot stake is not marked with a browse tag.

Map Name: Duggins Creek



Township: 18S Range: 4W Section: 21

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 387523 E 4343629 N

DUGGINS CREEK - TREND STUDY NO. 21R-15

[Project #2197](#)

Site Information

Site Description: The study is located approximately nine and half miles south of Oak City within a Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) ridge. The study was established in 2012 on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) to monitor the effects pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) reduction project. The study occurs on the U.S. Forest Service (USFS) Grass Creek allotment. Approximately 1,900 acres of pinyon and juniper trees were lop and scattered in the summer of 2012, prior to the establishment of the study site. The objective of the project is to remove small to medium age-class pinyon and juniper trees that are encroaching within an older chaining project that occurred in the early 1980s (WRI Database 2013). Deer pellet groups were sampled in low abundance and cattle pellet groups were sampled in moderate abundance in 2012 (Table - Pellet Group Data). A small deer antler was found on the site in 2012.

Browse: The preferred browse species sampled on the site are Wyoming big sagebrush (*Artemisia tridentata*), Stansbury cliffrose, green ephedra (*Ephedra viridis*), antelope bitterbrush (*Purshia tridentata*), and skunk bush sumac (*Rhus trilobata*). Wyoming big sagebrush and antelope bitterbrush are the dominant preferred browse species on the site, which provide the majority of the browse cover on the site. Both, cliffrose and sagebrush are moderately used populations with low decadence and have moderate amount of plants displaying poor vigor within the population. The pinyon and juniper trees were treated a few weeks prior to the placement of the study. In order to have some measurement for cover and density of pinyon and juniper trees, any green part of the cut trees were considered in cover measurement and recently cut stumps were counted in density. This will give some baseline to what the tree cover and density were prior to the treatment (Table - Browse Characteristics). The stage of woodland succession was in phase I transitioning into Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses abundant and somewhat diverse on the site. The dominant grass species on the site is intermediate wheatgrass (*Agropyron intermedium*), which provided the majority of the grass cover on the site. Other common grass species sampled on the site are crested wheatgrass (*A. cristatum*) and Sandberg bluegrass (*Poa secunda*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in moderately high abundance on the site in 2012. Forbs are very rare on the site. Only two annual forb species were sampled on the site in 2012, pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Runculus testiculatus*), which were sampled in low abundance (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Borvant-Jardal complex and is likely part of the Jardal component, which occurs on fans remnants. The parent material consists of alluvium derived from quartzite, sandstone, and conglomerate. The soils within this classification are characterized as moderately deep, well drained, and with a high permeable restrictively layer. The soil surface texture is a very gravelly loam (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 21R, Study no: 15

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	Agropyron cristatum	77	4.24
G	Agropyron intermedium	274	16.40
G	Agropyron spicatum	-	.00
G	Bromus tectorum (a)	269	6.89
G	Poa secunda	135	3.05
G	Vulpia octoflora (a)	3	.00
Total for Annual Grasses		272	6.89
Total for Perennial Grasses		486	23.70
Total for Grasses		758	30.59
F	Alyssum alyssoides (a)	24	.05
F	Ranunculus testiculatus (a)	7	.01
Total for Annual Forbs		31	0.06
Total for Perennial Forbs		0	0
Total for Forbs		31	0.06

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 21R, Study no: 15

T y p e	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata wyomingensis	11	2.96
B	Chrysothamnus viscidiflorus stenophyllus	5	.18
B	Cowania mexicana stansburiana	9	4.35
B	Ephedra viridis	1	.00
B	Gutierrezia sarothrae	11	.89
B	Juniperus osteosperma	2	3.10
B	Leptodactylon pungens	1	-
B	Opuntia sp.	1	-
B	Purshia tridentata	1	.63
Total for Browse		42	12.14

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 15

Species	Percent Cover '12
Artemisia tridentata wyomingensis	3.20
Chrysothamnus viscidiflorus stenophyllus	.40
Cowania mexicana stansburiana	5.75
Gutierrezia sarothrae	.61
Juniperus osteosperma	4.98
Leptodactylon pungens	.05
Purshia tridentata	.88

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 21R, Study no: 15

Species	Average leader growth (in) '12
Artemisia tridentata wyomingensis	0.8
Purshia tridentata	0.6

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 15

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	60	4.2

BASIC COVER--
Management unit 21R, Study no: 15

Cover Type	Average Cover % '12
Vegetation	38.48
Rock	3.13
Pavement	7.42
Litter	51.40
Cryptogams	.06
Bare Ground	20.70

PELLET GROUP DATA--

Management unit 21R, Study no: 15

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	36	-
Deer	7	8 (20)
Cattle	2	21 (52)

BROWSE CHARACTERISTICS--

Management unit 21R, Study no: 15

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
12	260	15	77	8	-	62	8	15	33/52	
<i>Chrysothamnus viscidiflorus stenophyllus</i>										
12	120	33	33	33	-	0	0	67	17/30	
<i>Cowania mexicana stansburiana</i>										
12	200	0	90	10	-	40	0	20	75/72	
<i>Ephedra viridis</i>										
12	20	0	100	-	-	0	0	100	22/26	
<i>Gutierrezia sarothrae</i>										
12	480	0	92	8	-	0	0	13	10/14	
<i>Juniperus osteosperma</i>										
12	40	50	50	-	-	0	0	0	-/-	
<i>Leptodactylon pungens</i>										
12	20	0	100	-	-	0	0	100	5/9	
<i>Opuntia sp.</i>										
12	20	0	100	-	-	0	0	0	5/12	
<i>Purshia tridentata</i>										
12	20	0	100	-	-	0	100	100	26/49	
<i>Rhus trilobata</i>										
12	0	0	0	-	-	0	0	0	29/30	

BLACK MOUNTAIN - TREND STUDY NO. 22R-5-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Gravelly Loam \(Bonneville Big Sagebrush\), R028AY306UT](#)

Land Ownership: Private

Elevation: 6,350 ft (1,935 m)

Aspect: Southwest

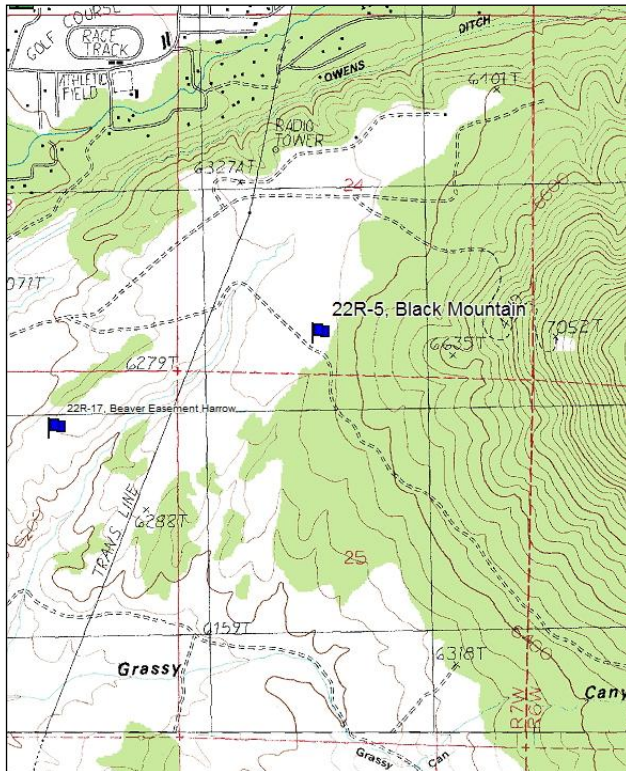
Slope: 3%

Transect bearing: 2° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

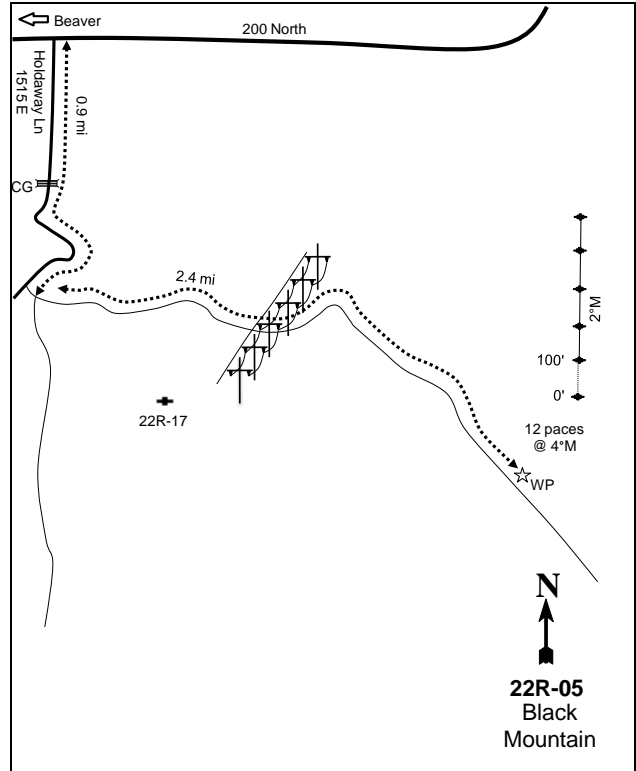
Directions: From Beaver head east on 200 North. Holdaway lane (1515 East) comes in from the south. Turn onto this road and drive 0.9 miles to a road coming on the left. Turn onto this road and travel 1.0 mile to the power lines. At the power lines turn south and travel 0.1 miles to a fork. At the fork go left and travel 0.4 miles to a witness post on the left side of the road. The 0-foot stake is 12 paces from the witness post at 4°M, and is marked with browse tag #42.

Map Name: Black Ridge



Township: 29S Range: 7W Section: 24

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 360425 E 4236500 N

BLACK MOUNTAIN - TREND STUDY NO. 22R-5
[Project #1294](#)

Site Information

Site Description: The study is located approximately one mile southeast of Beaver within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat. The study was established prior to treatment in 2004 on private land to monitor a forb enhancement project. The study occurs on the Bureau of Land Management (BLM) Lee Springs allotment. The project was sponsored by the Utah Sportsmen for Wildlife. In February 2004, a mix of forb seed was applied aerially over the treatment area with no ground disturbance prior to the seeding. Since the establishment of the study other habitat projects have treated the study site. It appeared that a lop and scatter treatment was also conducted between 2004 and 2007. In the fall of 2008, a total of 205 acres were two-way Dixie harrow and a seed mix of grass, forb, and browse species were broadcast on the second pass of the harrow. Forager kochia (*Kochia prostrata*) and alfalfa (*Medicago sativa*) was aerially seeded onto the snow later in the winter (Table - Seed Mix). The objectives of the projects are to increased forage for big game and improve species diversity (WRI Database 2013). Deer pellet groups were sampled in moderate abundance in 2004 and 2007, and were sampled in low abundance in 2012. Cattle pellet groups were sampled in low abundance in 2004 and 2007 (Table - Pellet Group Data).

Browse: The preferred browse species sampled on the site are Wyoming big sagebrush, fourwing saltbush (*Atriplex canescens*), and forage kochia. Wyoming big sagebrush is the dominant browse species and has provided the majority of the browse cover on the site (Table - Canopy Cover). Sagebrush is a moderately used population with moderate amount of decadence and high amount of plants displaying poor vigor within the population. Recruitment of young was poor prior to the harrow treatment, but was good in the 2012. Forage kochia was seeded in 2008 and was sampled in the 2012 sample year in low abundance. Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) trees were removed from the site after the 2004 sample year. The stage of woodland succession was in phase I transitioning into Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The dominant grass species on the site is Indian ricegrass (*Oryzopsis hymenoides*), which has provided the majority of the grass cover on the site over the sampled years. The invasive annual grass species cheatgrass (*Bromus tectorum*) has increased in abundance on the site since the outset of the study. Forbs are moderately abundant and diverse on the site. Scarlet globemallow (*Sphaeralcea coccinea*) and heath aster (*Leucelene ericoides*) are the dominant perennial forb species on the site. The weedy annual forb species pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*) are fairly common the common the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Pharo component, which occurs on fans remnants and terraces. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.4) (Table - Soil Analysis Data). Bare ground cover is moderate, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004. The soil erosion condition was classified as slight in 2007 and 2012 due to surface litter, pedestalling around plants, and soil movement.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush decreased 18% from 3,860 plants/acre to 3,160 plants/acre, though canopy cover remained similar at 17%. Recruitment of young sagebrush plants to the population remained poor on the site. Sagebrush decadence and plant displaying poor vigor remained high within the population. Forage kochia was sampled on the site in low density in 2007. The density of juniper and pinyon trees remained similar, but canopy cover decreased from 1% and 3% to less than 1%, respectively.

Grasses: The sum of nested frequency of perennial grasses increased 14%, and cover increased from 4% to 5%. Indian ricegrass remained similar in nested frequency, cover increased from 3% to 4%. Cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 2%.

Forbs: The sum of nested frequency of perennial forbs increased 11%, though cover remained similar at 1%. No single perennial forb species provided more than 1% cover in either sample year. The annual species bur buttercup increased significantly in nested frequency and cover increased from 1% to 3%.

Pre vs. Four Years Post Treatment, 2007 vs. 2012

Browse: The density of Wyoming big sagebrush increased 16% to 3,680 plants/acre, though canopy cover remained similar at 18%. Recruitment of young sagebrush plants to the population improved on the site to 38% of the population. Decadence of sagebrush decreased from 34% to 13%, while plant displaying poor vigor increased from 24% to 40%. The density of forage kochia increased substantially to 2,120 plants, though cover remained minimal on the site.

Grasses: The sum of nested frequency of perennial grasses increased 15%, and cover increased to 13%. Indian ricegrass remained similar in nested frequency, cover increased to 10%. Cheatgrass decreased significantly in nested frequency, though cover increased to 5%.

Forbs: The sum of nested frequency of perennial forbs increased 22%, and cover increased to 3%. The cover of heath aster increased in cover to 2%. The annual species bur buttercup decreased significantly in nested frequency and cover decreased to 1%. Pale alyssum increased significantly in nested frequency and cover increased to 1%.

SEED MIX--

Management unit 22R, Study no: 5

Project Name: Beaver Easement (2008)				Project Name: Black Mountain (2004)			
WRI Database #: 1294				WRI Database #: PDB			
Application: Broadcast Seed		Acres: 210		Application:		Acres: 591	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Indian Ricegrass 'Rimrock'	450	2.14	F	Alfalfa 'Ladak'	2800	4.74
G	Intermediate Wheatgrass 'Oahe'	450	2.14	F	Small Burnet 'Delar'	2238	3.79
G	Bluebunch WG 'Anatone'	300	1.43	F	Yellow Sweetclover	3025	5.12
F	Sainfoin 'Eski'	650	3.10	B	Forage Kochia	1952	3.30
F	Small Burnet 'Delar'	400	1.90	Total Pounds:		10015	16.95
F	Gooseberryleaf Globemallow	25	0.12	PLS Pounds:			14.9
F	Yellow Sweetclover	100	0.48				
F	Alfalfa 'Ladak'	300	1.43				
F	Rocky Mountain Beeplant	100	0.48				
Total Pounds:		2775	13.21				
PLS Pounds:			11.85				
Application: Aerial seed		Acres: 200					
Seed type		lbs in mix	lbs/acre				
F	Alfalfa 'Ladak 65'	200	1.00				
B	Forage Kochia	200	1.00				
Total Pounds:		400	2.00				
PLS Pounds:			1.55				

Trend Summary

HERBACEOUS TRENDS--
Management unit 22R, Study no: 5

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	<i>Agropyron smithii</i>	_a 24	_a 27	_b 44	.14	.24	1.51
G	<i>Agropyron spicatum</i>	6	15	4	.03	.09	.18
G	<i>Bromus tectorum</i> (a)	_a 16	_c 260	_b 210	.03	2.25	4.47
G	<i>Hilaria jamesii</i>	9	-	5	.04	-	.21
G	<i>Oryzopsis hymenoides</i>	148	168	176	2.84	3.60	9.75
G	<i>Poa secunda</i>	-	5	5	-	.00	.01
G	<i>Sitanion hystrix</i>	_a 4	_a 26	_b 54	.07	.20	.70
G	<i>Stipa comata</i>	52	35	29	.91	.97	.64
Total for Annual Grasses		16	260	210	0.03	2.25	4.47
Total for Perennial Grasses		243	276	317	4.04	5.12	13.00
Total for Grasses		259	536	527	4.07	7.37	17.48
F	<i>Alyssum alyssoides</i> (a)	_a -	_b 96	_c 173	-	.22	.75
F	<i>Astragalus calycosus</i>	-	2	6	-	.00	.04
F	<i>Astragalus lentiginosus</i>	-	2	5	-	.00	.01
F	<i>Collinsia parviflora</i> (a)	-	8	3	.00	.01	.00
F	<i>Cryptantha</i> sp.	-	-	5	-	-	.01
F	<i>Descurainia pinnata</i> (a)	10	-	-	.02	-	-
F	<i>Draba</i> sp. (a)	5	-	-	.01	-	-
F	<i>Gilia</i> sp. (a)	_c 56	_b 12	_a -	.16	.02	-
F	<i>Leucelene ericoides</i>	52	44	70	.46	.38	1.84
F	<i>Orobanche fasciculata</i>	-	-	5	-	-	.01
F	<i>Penstemon comarrhenus</i>	-	-	3	-	-	.00
F	<i>Phlox hoodii</i>	11	16	10	.07	.08	.19
F	<i>Phlox longifolia</i>	23	35	29	.11	.10	.06
F	<i>Ranunculus testiculatus</i> (a)	_a 193	_c 404	_b 228	.88	3.18	1.02
F	<i>Sanguisorba minor</i>	-	2	-	-	.00	-
F	<i>Sphaeralcea coccinea</i>	75	77	84	.58	.56	.92
Total for Annual Forbs		264	520	404	1.08	3.44	1.78
Total for Perennial Forbs		161	178	217	1.23	1.14	3.11
Total for Forbs		425	698	621	2.31	4.59	4.90

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 22R, Study no: 5

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	85	80	83	14.77	12.53	11.49
B	Chrysothamnus viscidiflorus viscidiflorus	0	0	2	-	.00	-
B	Gutierrezia sarothrae	0	0	1	-	-	-
B	Juniperus osteosperma	3	2	1	.98	.00	.03
B	Kochia prostrata	0	0	29	-	.01	.40
B	Pinus edulis	1	0	0	1.23	-	-
Total for Browse		89	82	116	16.98	12.55	11.93

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 5

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	17.65	17.33	17.50
Juniperus osteosperma	1.40	-	-
Kochia prostrata	-	-	.28
Pinus edulis	3.31	-	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 5

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata wyomingensis	1.7	0.7	1.5

POINT-QUARTER TREE DATA--

Management unit 22R, Study no: 5

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'12	'04	'07	'12
Juniperus osteosperma	28	34	27	2.9	2.0	1.2
Pinus edulis	9	20	20	3.5	1.3	1.2

BASIC COVER--

Management unit 22R, Study no: 5

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	23.12	27.37	38.43
Rock	2.92	3.85	4.45
Pavement	20.58	16.42	5.56
Litter	28.73	26.25	52.20
Cryptogams	.43	.36	.04
Bare Ground	39.30	34.39	22.52

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 5, Study Name: Black Mountain Forb Seeding

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
10.9	7.4	41.0	31.5	27.5	2.2	5.6	163.2	0.7

PELLET GROUP DATA--

Management unit 22R, Study no: 5

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	4	58	8	-	-	-
Deer	11	7	2	27 (68)	22 (55)	1 (2)
Cattle	3	1	-	5 (13)	12 (28)	-

BROWSE CHARACTERISTICS--

Management unit 22R, Study no: 5

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia tridentata wyomingensis</i>									
04	3860	1	62	38	60	32	11	17	19/29
07	3160	0	66	34	-	25	31	24	20/32
12	3680	38	49	13	160	15	0	40	18/31
<i>Atriplex canescens</i>									
04	0	0	0	-	-	0	0	0	27/37
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
04	0	0	0	-	-	0	0	0	13/15
07	0	0	0	-	40	0	0	0	-/-
12	60	0	100	-	-	0	0	0	9/14
<i>Gutierrezia sarothrae</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	6/4
<i>Juniperus osteosperma</i>									
04	60	67	33	-	-	0	0	0	-/-
07	40	50	50	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	-/-
<i>Kochia prostrata</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	40	0	0	0	-/-
12	2120	40	60	-	640	5	58	12	4/7

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Leptodactylon pungens										
04	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	6/17	
Pinus edulis										
04	20	0	100	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	

GREENVILLE BENCH BULLHOG - TREND STUDY NO. 22R-6-12

Vegetation Type: Annual/Perennial Grass

Range Type: Deer Winter

NRCS Ecological Site Description: [Upland Gravelly Loam \(Bonneville Big Sagebrush\), R028AY306UT](#)

Land Ownership: BLM

Elevation: 6,000 ft (1,890 m)

Aspect: Northeast

Slope: 5-10%

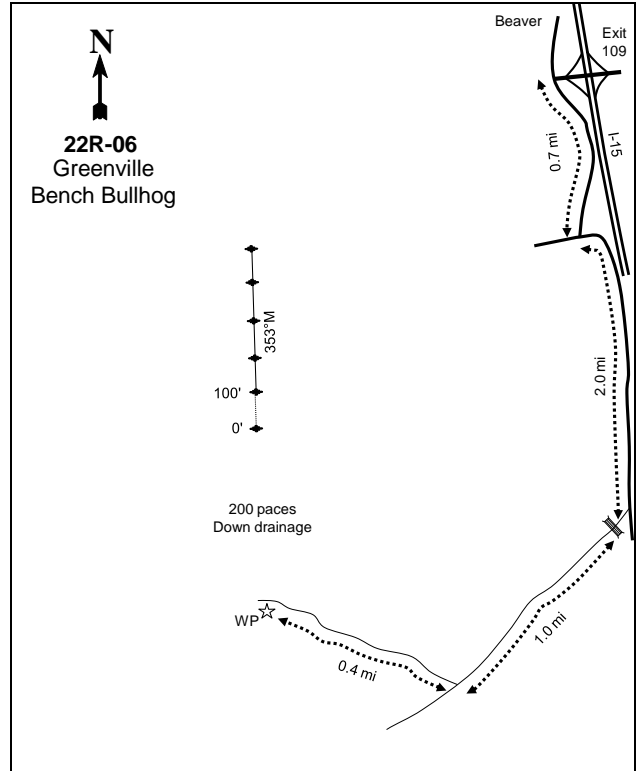
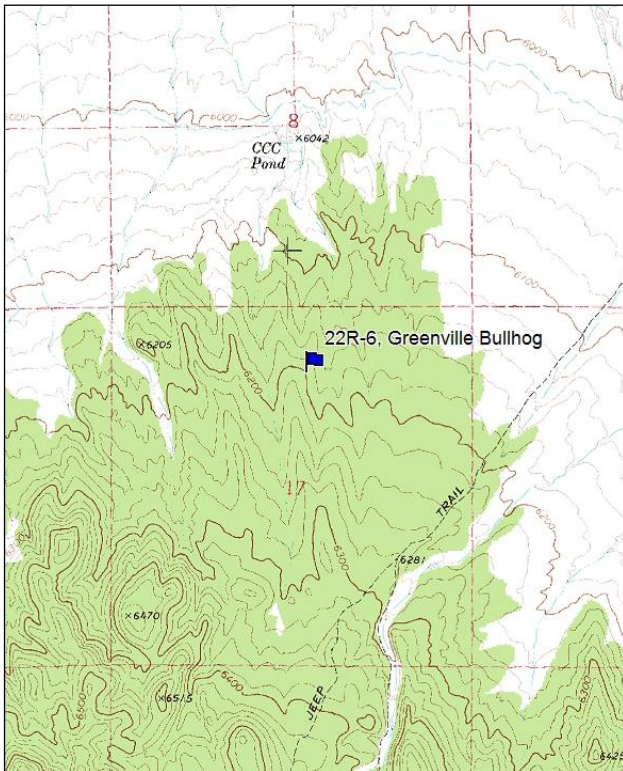
Transect bearing: 353° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: Take Exit 109 off of I-15 and go west on the overpass toward a Chevron Station. From the Chevron Station, travel South on 600 west for 0.7 miles to the motor-cross track and turn left. Stay on the left and travel south for 2.0 miles. Turn right and travel 1.0 miles to another road that comes in from the right. Turn west here and travel 0.4 miles to a drainage. Stop here and walk 200 paces north down the drainage to the baseline off to the left. The 0-foot stake is marked with browse tag #188.

Map Name: Greenville Bench

Diagrammatic Sketch:



Township: 30S Range: 7W Section: 17

GPS: NAD 83, UTM 12S 354093 E 4229694 N

GREENVILLE BENCH BULLHOG - TREND STUDY NO. 22R-6

Site Information

Site Description: The study is located approximately 5 miles south of Beaver within an invaded Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). The study was established in 2004 on land administered by the Bureau of Land Management (BLM) to monitor a pinyon and juniper reduction project. The study occurs on the BLM Sand Hollow allotment. In November 2004, approximately 1,500 acres dominated by pinyon and juniper were treated with a bullhog, and then seeded with a rangeland drill. Following the bullhog treatment, Wyoming big sagebrush seed was aerially applied to the treated area. The objectives of the project are to decrease pinyon and juniper cover, improve herbaceous understory, and increase palatable browse species on the site. Deer pellet groups were sampled in low abundance in 2004 and 2007, and were sampled in moderate abundance in 2012. Cattle pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are Wyoming big sagebrush, slenderbush eriogonum (*Eriogonum microthecum*), and antelope bitterbrush (*Purshia tridentata*). At the outset of the study the overstory was dominated by pinyon and juniper, and sagebrush plants were mostly dead on the site and other browse species were rare. Following the treatment and seeding, sagebrush and bitterbrush increased in abundance on the site. Bitterbrush is mostly found in drill rows across the site. Sagebrush is a moderately used population with low decadence though a high amount of plants display poor vigor within the population. Bitterbrush is mostly a moderately used population with low decadence and good vigor within the population. Recruitment of young plants for both sagebrush and bitterbrush has been good on the site following the treatment. The size of bitterbrush and sagebrush plants has increased substantially on the site, though cover of each species is low on the site (Table - Browse Characteristics) (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. Prior to treatment grasses were rare and following the treatment, grasses increased substantially and diversity increased due to the seeding of several grass species. Seed grass species sampled on the site are crested wheatgrass (*Agropyron cristatum*), pubescent wheatgrass (*A. intermedium*), Snake River wheatgrass (*Elymus wawawaiensis*), and Indian ricegrass (*Oryzopsis hymenoides*). Snake River wheatgrass is the dominant grass species, while crested wheatgrass, pubescent wheatgrass, and bottlebrush squirreltail (*Sitanion hystrix*) are common on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) has been fairly abundant on the site following the treatment. Forbs are not abundant or overly diverse on the site. No single forb species has been dominant on the site. Seeded forb species sampled on the site are blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Phage-Red Butter association, which occurs on hills and mountain slopes. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as deep, excessively drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is moderate, though there is a high amount of litter and moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2004 and 2007 due to moderate pedestalling around shrubs, moderate litter and soil movement, and the formation of flow patterns between drill furrows in 2007. The soil erosion condition was classified as stable in 2012.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush increased nearly threefold from 180 plants/acre to 500 plants/acre, and canopy cover remained minimal at less than 1%. Recruitment of young sagebrush plants to

the population was high following the treatment and consisted of 76% of the population. The health of the sagebrush improved with decadence decreasing from 89% to 0% and plants displaying poor vigor decreasing from 78% to 0%. Bitterbrush was seeded onto the site and was sampled at 1,320 plants/acre, though most plants were young and provided minimal cover. The density of pinyon and juniper decreased from 102 trees/acre with an average diameter of 5.2 inches to 27 trees/acre with an average diameter of 1.9 inches, and 133 trees/acre with an average diameter of 8.8 to 34 trees/acre with an average diameter of 5.3 inches, respectively.

Grasses: The sum of nested frequency of perennial grasses increased substantially, and cover increased from near 0% to 7%. Seeded species constituted the major increase in nested frequency and cover on the site, though bottlebrush squirreltail increased in cover to 2%. Pubescent wheatgrass and Snake River wheatgrass provided 1% and 3% cover. Cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 10%.

Forbs: The sum of nested frequency of perennial forbs increased on the site, and cover increased to 2%. No single perennial forb species provided more than 1% cover in either sample year.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of Wyoming big sagebrush increased by 40% to 700 plants/acre, and canopy cover increased to 2%. Recruitment of young sagebrush plants to the population remained good and consisted of 43% of the population. Decadence of sagebrush remained at 0%, and plants displaying poor vigor increased to 37% of the population. The density of bitterbrush increased 15% to 1,520 plants/acre and cover increased to 2%. The average size of bitterbrush and sagebrush increased from a height/crown of 4 inches/5 inches to 13 inches/16 inches and 13 inches/14 inches to 21 inches/26 inches, respectively

Grass:

- **2007 to 2012 - up (+2):** The sum of nested frequency of perennial grasses increased by 53%, and cover increased to 16%. Snake River wheatgrass and crested wheatgrass increased significantly in nested frequency and cover increased to 8% and 4%, respectively. Cheatgrass increased significantly in nested frequency though cover decreased to 6%.

Forb:

- **2007 to 2012 - up (+2):** Perennial forbs remained minimal on the site and cover decreased to 1%. No single forb species provided more than 1% cover on the site.

SEED MIX--

Management unit 22R, Study no: 6

Project Name: Greenville Bench					
WRI Database #: PDB					
Application: Rangeland Drill		Acres: 1500		Application: Aerial Seed	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Crested Wheatgrass 'Hycrest'	1700	1.13	B	Sagebrush, Wyoming
G	Indian Ricegrass 'Nezpar'	1600	1.07	Total Pounds: 400 0.27	
G	Pubescent Wheatgrass	2980	1.99	PLS Pounds: 0.03	
G	Sandberg Bluegrass 'SID MT'	375	0.25		
G	Snake River Wheatgrass 'Secar'	3000	2.00		
F	Alalfa 'Ladak+'	1500	1.00		
F	Blue Flax 'Appar'	1200	0.80		
F	Small Burnet 'Delar'	1450	0.97		
F	Western Yarrow	150	0.10		
F	Yellow Sweetclover	100	0.07		
B	Bitterbrush	375	0.25		
Total Pounds:		14430	9.62		
PLS Pounds:			8.65		

Trend Summary

HERBACEOUS TRENDS--

Management unit 22R, Study no: 6

T y p e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	a-	b15	c76	-	.28	4.13
G	Agropyron spicatum	-	9	-	-	.24	-
G	Agropyron intermedium	-	54	49	-	1.20	.95
G	Bromus tectorum (a)	a10	c372	b270	.02	9.54	6.20
G	Elymus junceus	a-	b10	b10	-	.66	.49
G	Elymus wawawaiensis	a-	b73	c126	-	2.57	7.50
G	Oryzopsis hymenoides	-	5	4	-	.01	.07
G	Sitanion hystrix	a6	b66	b89	.01	1.88	2.19
Total for Annual Grasses		10	372	270	0.02	9.54	6.20
Total for Perennial Grasses		6	232	354	0.01	6.86	15.35
Total for Grasses		16	604	624	0.03	16.40	21.55
F	Astragalus lentiginosus	8	6	12	.01	.01	.22
F	Chaenactis douglasii	a-	b10	a3	-	.16	.00
F	Collinsia parviflora (a)	-	-	2	-	-	.03
F	Cryptantha sp.	-	-	2	-	-	.01
F	Descurainia pinnata (a)	a-	b8	a1	-	.04	.03
F	Eriogonum cernuum (a)	b24	a-	a6	.18	-	.01
F	Eriogonum ovalifolium	1	-	1	.03	-	.15
F	Euphorbia sp.	1	4	-	.00	.01	-
F	Gayophytum ramosissimum(a)	1	-	-	.00	-	-
F	Gilia sp. (a)	1	4	-	.00	.01	-

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	Lactuca serriola (a)	-	12	4	-	.10	.03
F	Lappula occidentalis (a)	-	2	6	.00	.03	.06
F	Linum lewisii	a-	b19	a-	-	.59	-
F	Medicago sativa	-	5	-	-	.06	-
F	Penstemon leiophyllus	-	2	2	-	.15	.03
F	Salsola iberica (a)	-	4	-	-	.03	.03
F	Sanguisorba minor	a-	b22	b16	-	.45	.31
F	Sisymbrium altissimum (a)	a-	b10	a-	-	.10	-
F	Streptanthus cordatus	4	-	-	.01	.00	-
F	Tragopogon dubius (a)	-	4	6	-	.00	.03
Total for Annual Forbs		26	44	25	0.19	0.34	0.23
Total for Perennial Forbs		14	68	36	0.06	1.45	0.74
Total for Forbs		40	112	61	0.25	1.80	0.97

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 22R, Study no: 6

T y P e	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	8	13	20	.15	.03	.41
B	Chrysothamnus nauseosus albicaulis	0	0	1	-	-	.15
B	Eriogonum microthecum	7	2	8	.03	.00	.21
B	Gutierrezia sarothrae	55	59	58	1.31	6.54	1.51
B	Juniperus osteosperma	8	0	1	11.61	1.54	.71
B	Opuntia sp.	1	0	1			
B	Pinus edulis	4	1	1	7.80	.15	.38
B	Polygala subspinoso subspinoso	9	0	6	.02	-	.01
B	Purshia tridentata	0	27	37	-	.35	2.15
Total for Browse		92	102	133	20.93	8.62	5.55

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 6

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	-	.31	1.95
Chrysothamnus nauseosus albicaulis	-	-	.48
Eriogonum microthecum	-	-	.03
Gutierrezia sarothrae	1.04	5.73	1.15
Juniperus osteosperma	18.79	2.91	3.91
Pinus edulis	13.45	-	.20
Purshia tridentata	-	.15	1.78

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 6

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata wyomingensis	2.6	2.8	2.0
Purshia tridentata	-	2.7	2.7

POINT-QUARTER TREE DATA--

Management unit 22R, Study no: 6

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'12	'04	'07	'12
Juniperus osteosperma	133	34	52	8.8	5.3	3.8
Pinus edulis	102	27	28	5.2	1.9	1.6

BASIC COVER--

Management unit 22R, Study no: 6

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	21.38	29.67	30.91
Rock	7.48	5.42	3.29
Pavement	31.97	6.39	2.07
Litter	39.84	46.12	63.05
Cryptogams	.96	.33	.00
Bare Ground	24.25	23.03	19.72

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 6, Study Name: Greenville Bench Bullhog

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
13.6	7.3	61.7	20.5	17.8	2.5	6.8	99.2	0.6

PELLET GROUP DATA--

Management unit 22R, Study no: 6

Type	Quadrat Frequency		
	'04	'07	'12
Rabbit	10	75	9
Elk	-	1	-
Deer	4	7	4
Cattle	-	-	1

Days use per acre (ha)		
'04	'07	'12
-	-	-
-	-	-
8 (20)	15 (38)	21 (53)
-	-	2 (4)

BROWSE CHARACTERISTICS--

Management unit 22R, Study no: 6

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
04	180	0	11	89	20	33	22	78	19/23
07	500	76	24	0	60	4	4	4	13/14
12	700	43	57	0	40	23	0	37	21/26
<i>Chrysothamnus nauseosus albicaulis</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	22/36
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	9/7
<i>Eriogonum microthecum</i>									
04	360	0	100	-	-	39	28	0	3/4
07	40	50	50	-	-	50	50	0	6/6
12	280	7	93	-	20	7	21	0	6/12
<i>Gutierrezia sarothrae</i>									
04	2600	25	75	0	20	0	0	0	6/8
07	2840	4	94	1	440	0	0	1	11/16
12	3720	24	73	4	640	0	0	38	7/9
<i>Juniperus osteosperma</i>									
04	180	56	44	-	-	0	0	0	-/-
07	0	0	0	-	40	0	0	0	-/-
12	20	100	0	-	80	0	0	0	-/-
<i>Opuntia sp.</i>									
04	20	0	100	-	-	0	0	0	5/10
07	0	0	0	-	-	0	0	0	4/13
12	20	0	100	-	-	0	0	0	4/11
<i>Pinus edulis</i>									
04	80	25	75	-	-	0	0	0	-/-
07	20	100	0	-	-	0	0	0	-/-
12	20	100	0	-	20	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Polygala subspinosa subspinosa</i>										
04	260	0	100	0	-	8	0	0	2/3	
07	0	0	0	0	-	0	0	0	-/-	
12	120	17	67	17	-	17	0	0	4/6	
<i>Purshia tridentata</i>										
04	0	0	0	-	-	0	0	0	-/-	
07	1320	100	0	-	100	42	48	0	4/5	
12	1520	33	67	-	-	63	7	0	13/16	

SOUTH BEAVER YEAR 7 - TREND STUDY NO. 22R-23-12

Vegetation Type: Pinyon Pine and Utah Juniper

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Gravelly Loam \(Bonneville Big Sagebrush\), R028AY306UT](#)

Land Ownership: BLM

Elevation: 6,352 ft (1,936 m)

Aspect: Northwest

Slope: 4%

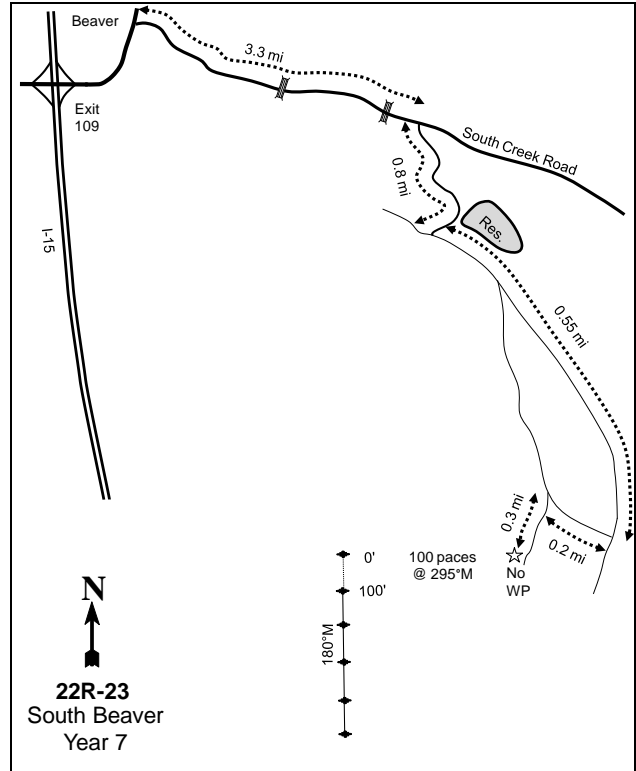
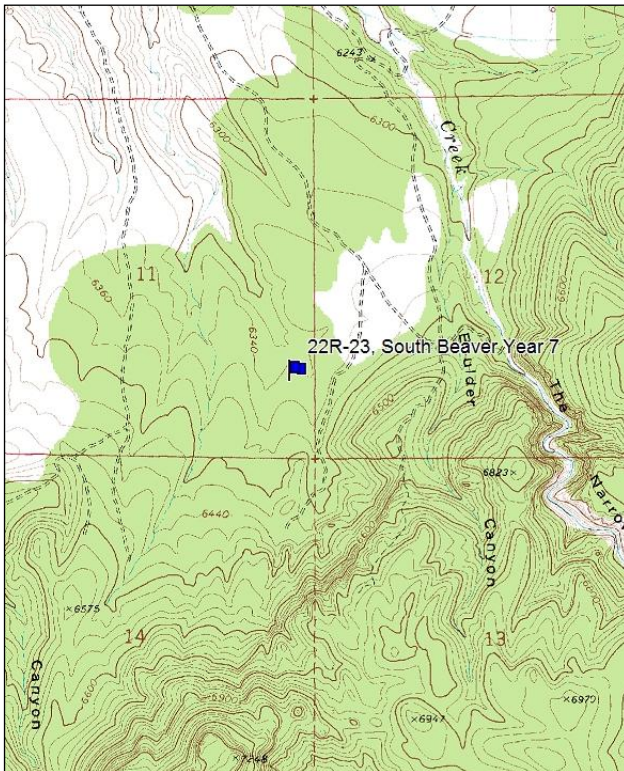
Transect bearing: 180° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: Travel 3.3 miles east on the South Creek Road. Turn right and travel 0.8 miles to an intersection. Turn right and travel 0.55 miles. Turn right and travel 0.2 miles. Turn left and travel 0.3 miles. There is no witness post. Walk 100 paces to the 0-foot stake at 295°M. There may be other routes that are closer to the 0-foot stake. There is no browse tag.

Map Name: Kane Canyon

Diagrammatic Sketch:



Township: 30S Range: 7W Section: 11

GPS: NAD 83, UTM 12S 359623 E 4230217 N

SOUTH BEAVER YEAR 7 - TREND STUDY NO. 22R-23

[Project #2227](#)

Site Information

Site Description: The study is located approximately five miles south of Beaver within a Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) invaded sagebrush community. The study was established in 2012 on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon and juniper reduction project. The study occurs on the BLM Lee Springs allotment. In the winter of 2013/2014, approximately 1,367 acres will be treated using a bullhog to mechanically mulch or chip pinyon and juniper trees. Corridors and islands of trees will be left for wildlife throughout the area. Prior to mulching, the project will be aerially seeded in areas with little or no understory vegetation with a diverse seed mix. The objectives of the project are to reduce pinyon and juniper cover, improve herbaceous understory, increase palatable browse species, decrease hazardous fuels and the threat of catastrophic fire; and reduce erosion potential and sediment into the Beaver River Watershed (WRI Database 2013). Deer pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: The site is dominated by pinyon and juniper trees, which provides the majority of the canopy cover on the site (Table - Canopy Cover). The preferred browse species sampled on the site are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and slenderbush eriogonum (*Eriogonum microthecum*). Wyoming big sagebrush is not an overly dense population, though it is a lightly to moderately used with high decadence and a high amount of plants displaying poor vigor within the population. The recruitment of young sagebrush plants to the population is poor (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase II transiting into Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are not abundant or diverse on the site. Bottlebrush squirreltail (*Sitanion hystrix*) and the invasive grass species cheatgrass (*Bromus tectorum*) were the only grass species sampled on the site. Forbs are not abundant or diverse on the site. No single forb species was dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Phage-Red Butter association, which occurs on hills and mountain slopes. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as deep, excessively drained, and with a moderately high permeable restrictively layer. The soil surface texture is a cobbly loam (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter and pavement and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--

Management unit 22R, Study no: 23

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Bromus tectorum</i> (a)	37	.08
G	<i>Sitanion hystrix</i>	25	.36
Total for Annual Grasses		37	0.08
Total for Perennial Grasses		25	0.36
Total for Grasses		62	0.44
F	<i>Alyssum alyssoides</i> (a)	4	.01

Type	Species	Nested Frequency	Average Cover %
		'12	'12
F	Astragalus lentiginosus	18	.34
F	Chaenactis douglasii	16	.13
F	Collinsia parviflora (a)	9	.02
F	Cryptantha sp.	4	.01
F	Descurainia pinnata (a)	3	.00
F	Penstemon sp.	8	.05
F	Phlox austromontana	7	.06
F	Ranunculus testiculatus (a)	15	.03
F	Sphaeralcea coccinea	5	.01
F	Streptanthus cordatus	3	.03
Total for Annual Forbs		31	0.07
Total for Perennial Forbs		61	0.65
Total for Forbs		92	0.72

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 22R, Study no: 23

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata wyomingensis	58	5.67
B	Chrysothamnus viscidiflorus stenophyllus	1	-
B	Eriogonum microthecum	3	-
B	Gutierrezia sarothrae	20	.32
B	Juniperus osteosperma	6	5.90
B	Opuntia sp.	4	.03
B	Pinus edulis	12	8.23
Total for Browse		104	20.16

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 23

Species	Percent Cover '12
Artemisia tridentata wyomingensis	6.05
Gutierrezia sarothrae	.28
Juniperus osteosperma	6.18
Opuntia sp.	.03
Pinus edulis	17.35

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 22R, Study no: 23

Species	Average leader growth (in) '12
Artemisia tridentata wyomingensis	0.8

POINT-QUARTER TREE DATA--
Management unit 22R, Study no: 23

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	217	2.7
Pinus edulis	116	6.7

BASIC COVER--
Management unit 22R, Study no: 23

Cover Type	Average Cover % '12
Vegetation	19.93
Rock	5.44
Pavement	17.45
Litter	42.36
Cryptogams	1.10
Bare Ground	27.93

PELLET GROUP DATA--
Management unit 22R, Study no: 23

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	13	-
Deer	1	1 (2)

BROWSE CHARACTERISTICS--
 Management unit 22R, Study no: 23

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
12	2340	6	45	49	120	25	0	66	15/21	
<i>Chrysothamnus viscidiflorus stenophyllus</i>										
12	20	0	100	-	-	0	0	0	5/5	
<i>Eriogonum microthecum</i>										
12	80	50	50	-	-	0	0	0	6/12	
<i>Gutierrezia sarothrae</i>										
12	720	42	58	-	40	0	0	3	7/8	
<i>Juniperus osteosperma</i>										
12	120	17	83	-	-	0	0	0	-/-	
<i>Opuntia sp.</i>										
12	120	0	100	-	-	0	0	0	4/10	
<i>Pinus edulis</i>										
12	260	62	38	-	-	0	0	0	-/-	

ELBOW RANCH 1 - TREND STUDY NO. 23R-5-12

Vegetation Type: Annual Forb

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Semidesert Gravelly Loam \(Wyoming Big Sagebrush\) south, R028AY214UT](#)

Land Ownership: UDWR

Elevation: 6,142 ft (1,872 m)

Aspect: West

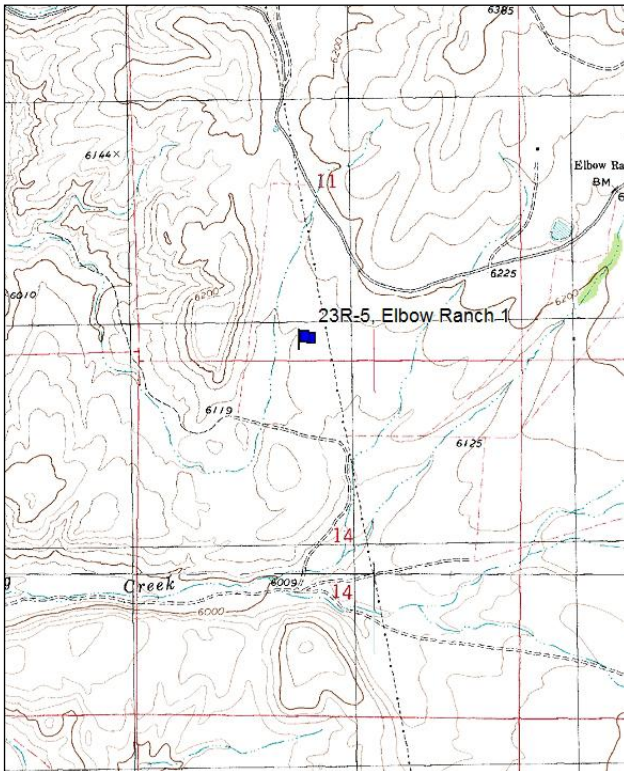
Slope: 2%

Transect bearing: 172° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

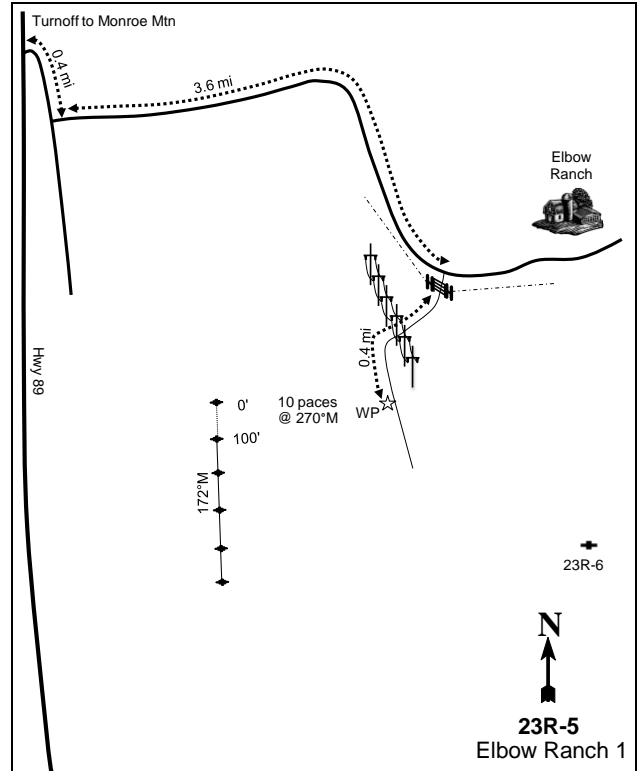
Directions: From US 89, just south of Marysville, take the turnoff to Monroe Mountain. Travel 0.4 miles to a road that will come in from the east (left). Turn onto this road and travel 3.6 miles to the WMA gate before Elbow Ranch. From here drive 0.4 miles at 176°M to the 0-foot stake of the baseline.

Map Name: Marysville



Township: 28S Range: 3W Section: 11

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 397703 E 4249075 N

ELBOW RANCH 1 - TREND STUDY NO. 23R-5
[Project #800](#)

Site Information

Site Description: The study is located approximately five and half miles southeast of Marysvale within abandoned cropland flat. The study was established in 2004 on Elbow Ranch Wildlife Management Area (WMA) to monitor a wildlife habitat improvement project. In November of 2005, two 150 acre plots were one-way harrowed, and a seed mix of browse species was broadcasted and a seed mix of grass species was drill seeded. In the fall of 2007 as part of the Elbow Ranch WMA Habitat Improvement project ([WRI Project #800](#)), the study site was rangeland drill seeded with a seed mix of grass, forb, and browse species (Table - Seed Mix). The objective of the project is to establish drought tolerant vegetation for wintering mule deer (WRI Database 2013). Deer pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Browse species are rare on the site. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is found on the hills surrounding the study site, but within the old agricultural fields there is little to no browse species growing. Only a few forage kochia (*Kochia prostrata*) plants have been sampled on the site (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is in poor condition and is dominated by weedy annual species. No grass species have been sampled on the site. No perennial forb species have been sampled on the site. Russian thistle (*Salsola iberica*) and halogeton (*Halogeton glomerata*) are the dominant grass species on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy loam with a slightly alkaline soil reaction (pH 7.7) (Table - Soil Analysis Data). Bare ground cover is high, though there is a high amount of pavement and moderate amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2012, but could greatly increased with large rain storms due to the high ground cover on the site.

Pre vs. Eight Years Post Treatment, 2004 vs. 2012

Browse: Browse species remained rare on the site. Forage kochia was sampled at 40 plants/acre in 2012.

Grasses: No grass species have been sampled on the site.

Forbs: No perennial forb species have been sampled on the site. The sum of nested frequency of annual forbs decreased substantially, and cover decreased from 36% to 6%. Halogeton and Russian thistle decreased significantly in nested frequency and cover decreased from 11% to 1% and 22% to 5%, respectively.

SEED MIX--

Management unit 23R, Study no: 5

Project Name: Elbow Ranch Drill (2005)				Project Name: Elbow Ranch (2007)			
WRI Database #: PDB				WRI Database #: 800			
Application: Rangeland Drill		Acres: 300		Application: Rangeland Drill		Acres: 200	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Bottlebrush Squirreltail	100	0.33	G	Big Bluegrass 'Sherman'	100	0.50
G	Crested Wheatgrass 'Hycrest'	450	1.50	G	Canby Bluegrass 'Canbar'	54	0.27
G	Hard Fescue 'Durar'	300	1.00	G	Crested Wheatgrass 'Douglas'	200	1.00
G	Indian Ricegrass 'Rimrock'	450	1.50	G	Crested Wheatgrass 'Hycrest'	200	1.00
G	Pubescent Wheatgrass	450	1.50	G	Hard Fescue 'Durar'	179	0.90
G	Russian Wildrye	450	1.50	G	Indian Ricegrass 'Rimrock'	300	1.50
G	Sandberg Bluegrass 'Toole MT'	150	0.50	G	Russian Wildrye	450	2.25
G	Siberian Wheatgrass 'Vavilov'	450	1.50	G	Siberian Wheatgrass 'Vavilov'	400	2.00
G	Snake River Wheatgrass 'Secar'	450	1.50	G	Snake River Wheatgrass 'Secar'	350	1.75
Total Pounds:		3250	10.83	G	Thickspike Wheatgrass 'Bannock'	200	1.00
PLS Pounds:			9.77	G	Western Wheatgrass 'Arriba'	200	1.00
Project Name: Elbow Ranch Drill (2005)				Project Name: Elbow Ranch (2007)			
WRI Database #: PDB				WRI Database #: 800			
Application: Broadcast		Acres: 300		Application: Broadcast		Acres: 300	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
B	Forage Kochia	300	1.00	F	Yellow Sweetclover	100	0.50
B	Sagebrush, Wyoming	200	0.67	B	Forage Kochia 'Immigrant'	400	2.00
Total Pounds:		500	1.67	B	Fourwing Saltbush	200	1.00
PLS Pounds:			0.95	B	Sagebrush, Wyoming	100	0.50
Total Pounds:				Total Pounds:		3433	17.17
PLS Pounds:				PLS Pounds:			14.61

Trend Summary

HERBACEOUS TRENDS--

Management unit 23R, Study no: 5

T y p e	Species	Nested Frequency		Average Cover %	
		'04	'12	'04	'12
F	Chenopodium album (a)	7	-	.01	-
F	Descurainia sophia (a)	5	2	.04	.03
F	Halogeton glomeratus (a)	_b 150	_a 42	10.81	.71
F	Lappula occidentalis (a)	-	3	-	.00
F	Mentzelia albicaulis (a)	_b 155	_a -	3.07	-
F	Salsola iberica (a)	_b 291	_a 91	21.64	4.78
Total for Annual Forbs		608	138	35.59	5.53
Total for Perennial Forbs		0	0	0	0
Total for Forbs		608	138	35.59	5.53

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 23R, Study no: 5

Type	Species	Strip Frequency		Average Cover %	
		'04	'12	'04	'12
B	Kochia prostrata	0	2	0	2
Total for Browse		0	2	0	2

BASIC COVER--

Management unit 23R, Study no: 5

Cover Type	Average Cover %	
	'04	'12
Vegetation	35.34	5.51
Rock	3.16	4.96
Pavement	25.93	13.44
Litter	4.94	23.12
Bare Ground	41.21	57.67

SOIL ANALYSIS DATA --

Management unit 23R, Study no: 5, Study Name: Elbow Ranch 1

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.2	7.7	65.1	17.4	17.5	1.3	16.5	985.6	0.8

PELLET GROUP DATA--

Management unit 23R, Study no: 5

Type	Quadrat Frequency		Days use per acre (ha)	
	'04	'12	'04	'12
Rabbit	11	2	-	-
Deer	-	-	-	1 (3)

BROWSE CHARACTERISTICS--

Management unit 23R, Study no: 5

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Kochia prostrata									
04	0	0	0	-	-	0	0	0	-/-
12	40	0	100	-	-	0	50	0	7/13

ELBOW RANCH 2 - TREND STUDY NO. 23R-6-12

Vegetation Type: Forage Kochia

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Semidesert Gravelly Loam \(Wyoming Big Sagebrush\) south, R028AY214UT](#)

Land Ownership: UDWR

Elevation: 6,194 ft (1,888 m)

Aspect: West

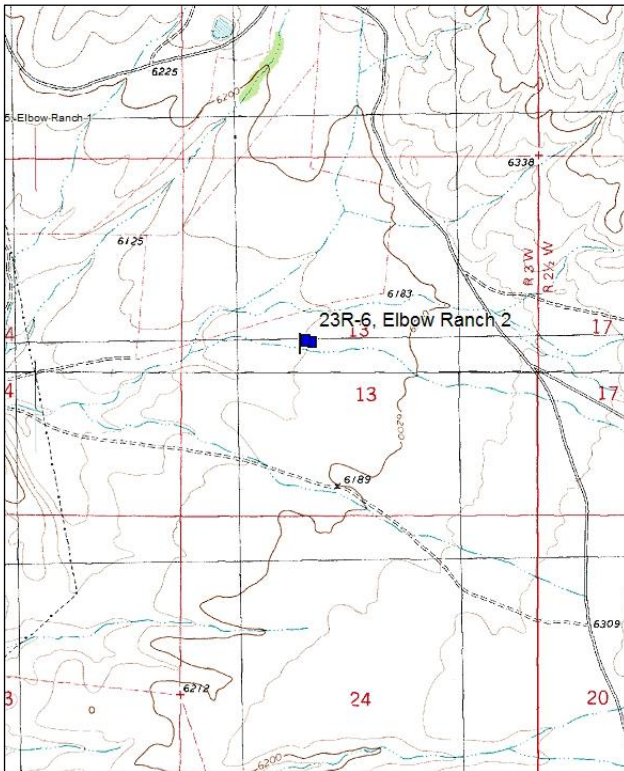
Slope: 4%

Transect bearing: 80° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

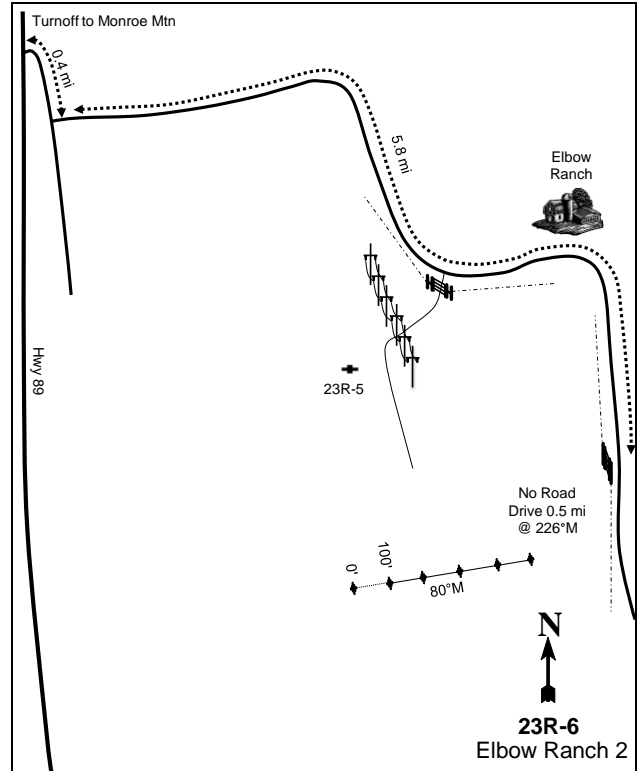
Directions: From US 89, just south of Marysvale, take the turnoff to Monroe Mountain. Travel 0.4 miles to a road that will come in from the east (left). Turn onto this road and travel 5.8 miles pass Elbow ranch to the WMA gate. From here drive 0.5 miles at 166°M to the 0-foot stake of the baseline.

Map Name: Marysvale



Township: 28S Range: 3W Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 399221 E 4248430 N

ELBOW RANCH 2 - TREND STUDY NO. 23R-6

Site Information

Site Description: The study is located approximately six and half miles southeast of Marysvale within abandoned cropland flat. The study was established in 2004 on Elbow Ranch Wildlife Management Area (WMA) to monitor a wildlife habitat improvement project. The area was proposed to be one-way harrowed and broadcast seeded in November of 2005, but was not treated. Elk and cattle pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: The key preferred browse species sampled on the site is forage kochia (*Kochia prostrata*), which provides the majority of the browse cover on the site (Table - Canopy Cover). Other browse species sampled on the site are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and fourwing saltbush (*Atriplex canescens*), though each species occurs in low abundance on the site. There are good stands of sagebrush near the site. The forage kochia is a dense, lightly used population with low decadence and a high amount of plants displaying poor vigor within the population. Recruitment of young kochia plants was extremely high in 2012 (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is in poor condition, and is dominated by weedy annual forb species. An unknown perennial grass species was sampled in 2004 and no grass species were sampled in 2012. In 2004, the site was dominated by Russian thistle (*Salsola iberica*) and halogeton (*Halogeton glomerata*). Forbs were rare in 2012 (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a slightly alkaline soil reaction (pH 7.8) (Table - Soil Analysis Data). Bare ground cover is high, though there is a high amount of pavement and rock and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2012, but could greatly increased with large rain storms due to the high ground cover on the site.

Trend Assessments

Browse:

- **2004 to 2012 - up (+2):** The density of forage kochia increased substantially, and cover increased from 12% to 26%. In 2012, young plants were extremely high at an estimated density of 110,240 plants/acre.

Grass:

- **2004 to 2012 - stable (0):** Grasses remained rare on the site.

Forb:

- **2004 to 2012 - down (-2):** Forbs remained rare on the site. The sum of nested frequency of annual forbs decrease substantially, and cover decreased from 13% to 1%. Scarlet globemallow decreased significantly in nested frequency and cover decreased from 3% to less than 1%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 23R, Study no: 6

Type	Species	Nestled Frequency		Average Cover %	
		'04	'12	'04	'12
G	Unknown grass - perennial	6	-	1.14	-
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		6	0	1.14	0
Total for Grasses		6	0	1.14	0
F	Astragalus lentiginosus	8	4	.07	.03
F	Chenopodium album (a)	_b 23	_a -	.55	-
F	Chorispora tenella (a)	-	9	-	.69
F	Convolvulus arvensis	1	-	.00	-
F	Descurainia sophia (a)	10	1	.13	.00
F	Draba sp. (a)	-	1	-	.00
F	Halogeton glomeratus (a)	_b 96	_a -	4.46	-
F	Lappula occidentalis (a)	_b 36	_a -	.42	-
F	Navarretia intertexta (a)	1	-	.03	-
F	Phlox longifolia	3	-	.00	-
F	Salsola iberica (a)	_b 163	_a 2	7.83	.00
F	Sphaeralcea coccinea	_b 26	_a 4	2.50	.01
Total for Annual Forbs		329	13	13.42	0.70
Total for Perennial Forbs		38	8	2.58	0.04
Total for Forbs		367	21	16.00	0.75

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 23R, Study no: 6

Type	Species	Strip Frequency		Average Cover %	
		'04	'12	'04	'12
B	Artemisia tridentata wyomingensis	0	2	-	-
B	Kochia prostrata	56	99	6.01	18.18
Total for Browse		56	101	6.01	18.18

CANOPY COVER, LINE INTERCEPT--

Management unit 23R, Study no: 6

Species	Percent Cover	
	'04	'12
Kochia prostrata	11.73	26.26

BASIC COVER--

Management unit 23R, Study no: 6

Cover Type	Average Cover %	
	'04	'12
Vegetation	22.52	19.58
Rock	5.68	7.12
Pavement	28.17	11.17
Litter	4.78	12.31
Bare Ground	48.45	55.61

SOIL ANALYSIS DATA --

Management unit 23R, Study no: 6, Study Name: Elbow Ranch 2

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
8.0	7.8	49.0	30.5	20.5	0.9	9.5	809.6	0.8

PELLET GROUP DATA--

Management unit 23R, Study no: 6

Type	Quadrat Frequency		Days use per acre (ha)	
	'04	'12	'04	'12
Rabbit	49	59	-	-
Elk	-	-	-	1 (2)
Cattle	-	2	-	-

BROWSE CHARACTERISTICS--

Management unit 23R, Study no: 6

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia tridentata wyomingensis									
04	0	0	0	-	-	0	0	0	-/-
12	40	50	50	-	-	0	0	0	21/26
Atriplex canescens									
04	0	0	0	-	-	0	0	0	25/38
12	0	0	0	-	-	0	0	0	-/-
Kochia prostrata									
04	2640	25	75	0	20	0	0	0	21/35
12	124320	89	11	0	27220	.51	0	69	9/17

SOUTH NARROWS - TREND STUDY NO. 23R-7-12

Vegetation Type: Annual Forb

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\) south, R028AY220UT](#)

Land Ownership: BLM

Elevation: 6,700 ft (2,042 m)

Aspect: South

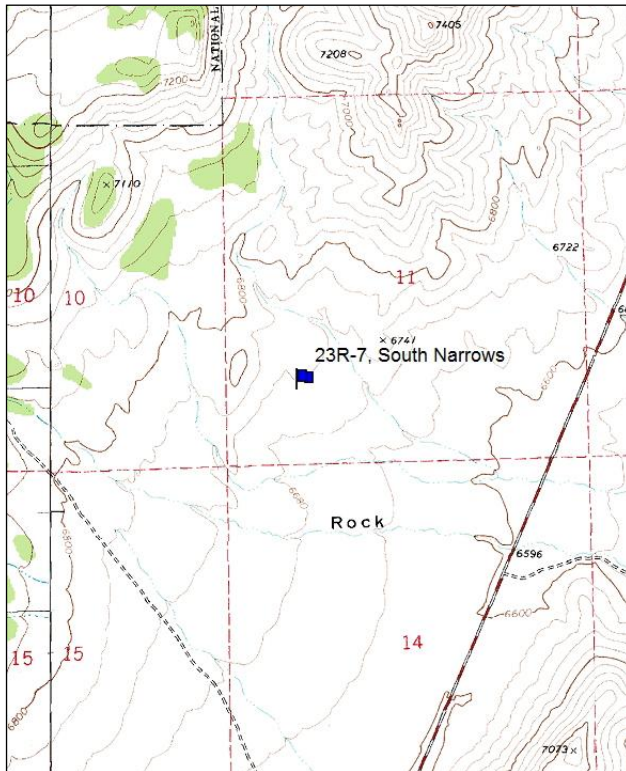
Slope: 4-5%

Transect bearing: 336° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

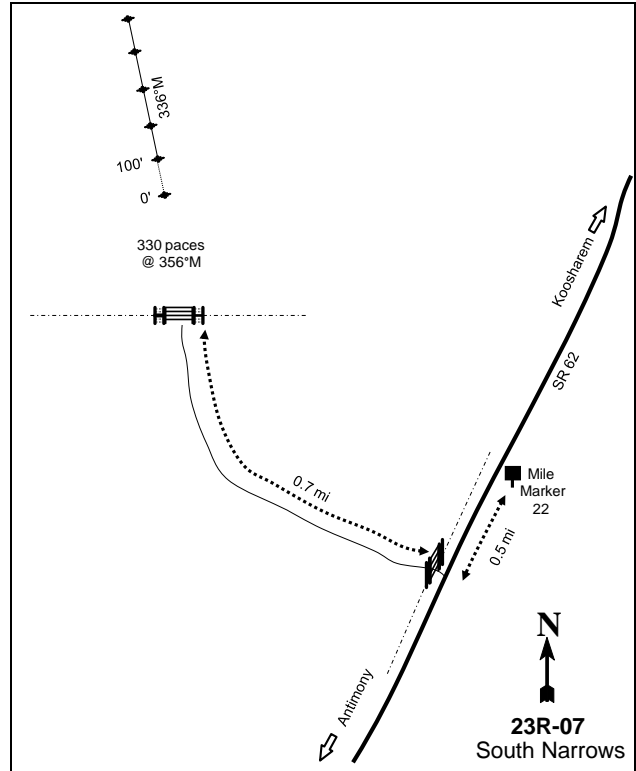
Directions: From State Route 62, south of Koosharem, there will be a road coming in from the west 0.5 mile south of mile marker 22. Turn onto this road, passing through a gate, and travel 0.7 miles to another fence with a gate. From here walk about 1,000 feet at 356°M to the 0-foot stake with browse tag #191.

Map Name: Parker Knoll



Township: 29S Range: 2W Section: 11

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 413606 E 4239186 N

SOUTH NARROWS - TREND STUDY NO. 23R-7

Site Information

Site Description: The study is located approximately three and half miles north of Otter Creek Reservoir within a treated Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat. The study was established in 2004 on land administered by the Bureau of Land Management to monitor a sagebrush treatment project. The study occurs on the BLM South Narrows allotment. In 1996 prior to the establishment of the study, the project area was two-way harrowed and seeded. In December 2005, approximately 2,300 acres were reseeded and two-way harrowed. The seeder was attached to the back of the tractor and the Dixie harrow was pulled behind. Browse species were seeded during the second swath with the harrow (Table - Seed Mix). The objectives of the project are to improve herbaceous understory species and create an uneven age-class sagebrush stand. Deer, elk, and cattle pellet groups were sampled in low abundance in 2004, cattle pellet groups were in low abundance in 2007, and deer pellet groups were sampled in low abundance in 2012. (Table - Pellet Group Data)

Browse: The preferred browse species sampled on the site are Wyoming big sagebrush and forage kochia, though occurring in low abundance on the site. Nearly all the sagebrush was removed from the site in the 1996 harrow treatment. Forage kochia was seeded on the site in the 2005 reseeding harrow treatment (Table - Seed Mix). Other browse species sampled on the site are rubber rabbitbrush (*Chrysothamnus nauseosus*) and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are rare on the site. Prior to the 2012 sample year, bottle brush squirreltail was the only grass species sampled on the site. Crested wheatgrass (*Agropyron cristatum*) and Russian wildrye (*Elymus junceus*) were in the 2005 seed mix and were sampled on the site in 2012. The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance in 2012. Forbs are abundant and fairly diverse on the site, but are dominated by weedy annual species. Perennial forbs are rare on the site. The dominant forb species are stickseed (*Lappula occidentalis*) and pinnate tansymustard (*Descurainia pinnata*). Two forb species were sampled on the site, blue flax (*Linum perenne*) was in the 2005 seed mix and western yarrow (*Achillea millefolium*) was likely seeded on the site (Table - Seed Mix; Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy loam with a slightly alkaline soil reaction (pH 7.8) (Table - Soil Analysis Data). Bare ground cover is low, though there is a high amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable since the outset of the study.

Pre vs. Two Years Post Treatment, 2004 vs. 2007

Browse: Browse species remained rare on the site. Forage kochia was sampled at 20 plants/acre in 2007.

Grasses: Grasses remained rare on the site.

Forbs: Perennial forb species remained rare on the site. The sum of nested frequency of annual forbs increased substantially, and cover decreased from 8% to 15%. Stickseed and pinnate tansymustard increased significantly in nested frequency and cover increased from 1% to 9% and less than 1% to 4%, respectively.

Trend Assessments

Browse:

- **2007 to 2012 - stable (0):** Browse species remained rare on the site.

Grass:

- **2007 to 2012 - stable (0):** Grasses remained rare on the site.

Forb:

- **2007 to 2012 - slightly up (+1):** Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs increased by 47%, and cover increased to 16%. Scarlet globemallow increased significantly in nested frequency and cover decreased to 1%.

SEED MIX--

Management unit 23R, Study no: 7

Project Name: South Narrows			
WRI Database #: N/A			
Application: Broadcast seed		Acres: 2300	
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Douglas'	1150	0.50
G	Crested Wheatgrass 'Hycrest'	1150	0.50
G	Great Basin Wildrye 'Trailhead'	1750	0.76
G	Pubescent Wheatgrass	4600	2.00
G	Russian Wildrye	2300	1.00
G	Sandberg Bluegrass 'SID OR'	930	0.40
G	Sheep Fescue 'Covar'	2300	1.00
F	Alfalfa 'Ladak+'	2300	1.00
F	Annual Sunflower	750	0.33
F	Blue Flax	1045	0.45
F	Sainfoin 'Eski'	3450	1.50
F	Small Burnet 'Delar'	4600	2.00
F	Yellow Sweetclover	1300	0.57
B	Fourwing Saltbush	1285	0.56
Total Pounds:		28910	12.57
PLS Pounds:			10.77

Trend Summary

HERBACEOUS TRENDS--

Management unit 23R, Study no: 7

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Agropyron cristatum	-	-	10	-	-	.44
G	Bromus tectorum (a)	-	-	3	-	-	.00
G	Elymus junceus	-	-	3	-	-	.01
G	Oryzopsis hymenoides	-	-	3	-	-	.03
G	Sitanion hystrix	16	8	13	.09	.01	.06
Total for Annual Grasses		0	0	3	0	0	0.00
Total for Perennial Grasses		16	8	29	0.09	0.01	0.55
Total for Grasses		16	8	32	0.09	0.01	0.55
F	Achillea millefolium	-	-	-	-	-	.00
F	Astragalus lentiginosus	_b 38	_a 13	_a 1	3.97	.03	.15
F	Chenopodium leptophyllum(a)	11	-	2	2.53	-	.00

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	Descurainia pinnata (a)	a ⁴	c ¹¹⁵	b ⁷²	.06	4.25	1.46
F	Eriogonum cernuum (a)	a ³	b ⁴⁵	a ⁻	.06	.23	-
F	Euphorbia sp.	-	-	2	-	-	.01
F	Helianthus annuus (a)	a ⁻	a ⁻	b ¹²	-	-	.07
F	Lactuca serriola (a)	a ⁻	a ³	b ¹⁴⁶	-	.01	1.10
F	Lappula occidentalis (a)	a ⁵	b ²³⁰	c ³⁶⁷	.51	9.00	8.18
F	Linum perenne	-	6	-	-	.01	-
F	Nicotiana attenuata (a)	-	-	-	.19	-	-
F	Salsola iberica (a)	a ²²	b ²⁶²	b ²⁷⁶	3.57	.91	2.99
F	Sisymbrium altissimum (a)	a ⁻	a ³	b ⁹⁵	-	.15	1.99
F	Solanum triflorum (a)	14	4	-	1.25	.01	-
F	Sphaeralcea grossulariifolia	a ⁻	a ⁻	b ⁹⁷	.79	-	.65
F	Tragopogon dubius (a)	-	-	3	-	-	.03
Total for Annual Forbs		59	662	973	8.19	14.58	15.85
Total for Perennial Forbs		38	19	100	4.76	0.04	0.81
Total for Forbs		97	681	1073	12.96	14.62	16.66

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 23R, Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Amelanchier utahensis	0	0	1	-	-	-
B	Artemisia tridentata wyomingensis	1	1	3	.15	-	.15
B	Kochia prostrata	0	1	0	-	.02	-
Total for Browse		1	2	4	0.15	0.02	0.15

CANOPY COVER, LINE INTERCEPT--

Management unit 23R, Study no: 7

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	-	-	.20

BASIC COVER--

Management unit 23R, Study no: 7

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	14.13	14.36	18.17
Rock	7.82	5.38	4.60
Pavement	21.52	7.98	11.48
Litter	22.57	45.67	55.60
Cryptogams	.34	.20	.04
Bare Ground	44.06	35.06	15.31

SOIL ANALYSIS DATA --

Management unit 23R, Study no: 7, Study Name: South Narrows

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
14.4	7.5	55.0	27.5	17.5	1.1	12.5	604.8	0.7

PELLET GROUP DATA--

Management unit 23R, Study no: 7

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	70	97	29	-	-	-
Elk	1	-	-	3 (8)	-	-
Deer	1	-	3	5 (12)	-	2 (5)
Cattle	1	2	-	1 (4)	-	-

BROWSE CHARACTERISTICS--

Management unit 23R, Study no: 7

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Amelanchier utahensis									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	-/-
Artemisia tridentata wyomingensis									
04	40	0	50	50	-	0	0	50	18/26
07	20	0	0	100	-	0	0	100	-/-
12	80	75	25	0	-	25	0	0	9/13
Chrysothamnus nauseosus									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	23/30
Kochia prostrata									
04	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	200	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
Opuntia sp.									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	6/15

BROWNS CANYON DRILL - TREND STUDY NO. 23R-8-12

Vegetation Type: Forage Kochia

Range Type: Substantial Deer Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: SITLA

Elevation: 6,870 ft (2,094 m)

Aspect: East

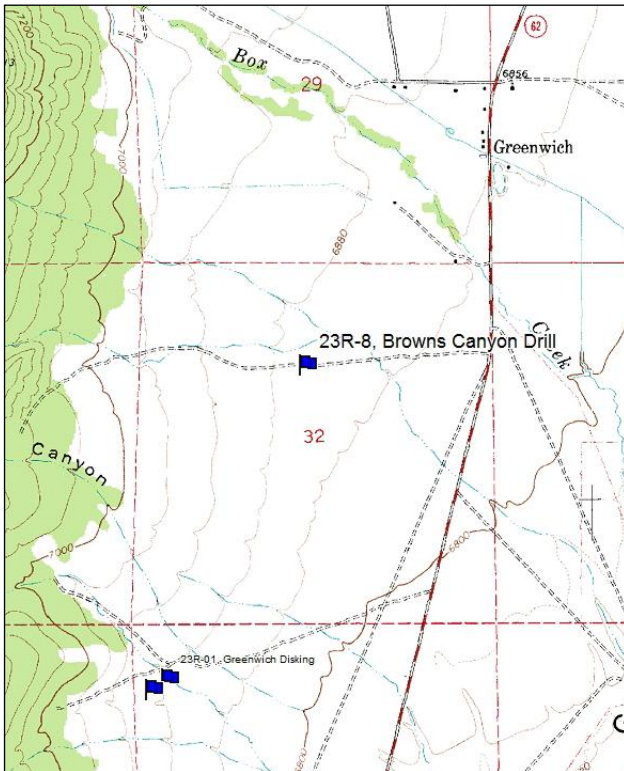
Slope: 2%

Transect bearing: 170° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

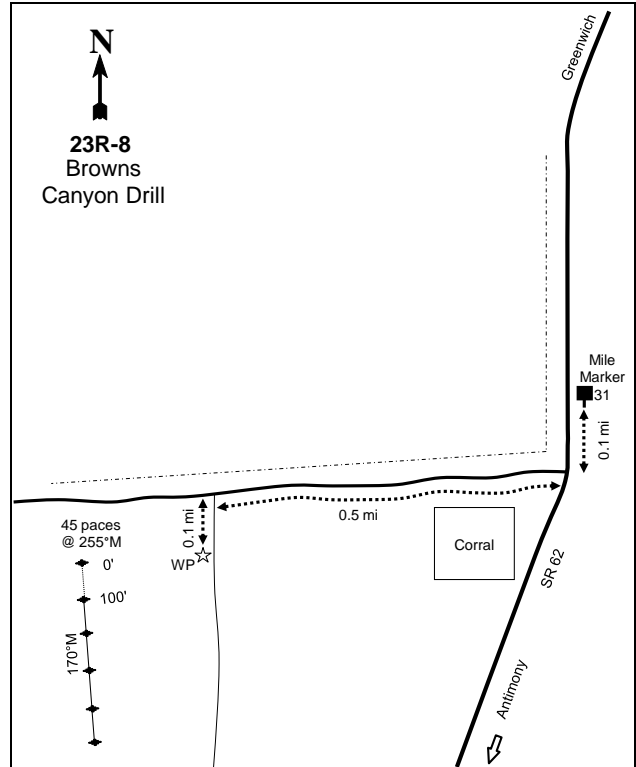
Directions: Travel south of Greenwich on State Route 62. From mile marker 31 travel 0.1 miles north to a road that will come in from the west. Turn onto this road and travel 0.5 miles to a road that will come in from the left (south). Turn onto this road and drive 100 feet to a witness post on the right side of the road. From the witness post walk 45 paces at 255°M to the 0-foot stake that is marked with browse tag #54.

Map Name: Greenwich



Township: 27S Range: 1W Section: 32

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 418604 E 4253012 N

BROWNS CANYON DRILL - TREND STUDY NO. 23R-8

Site Information

Site Description: The study is located approximately a half mile southwest of Greenwich within a treated Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). The study was established in 2004 on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) to monitor the effects of a sagebrush treatment. The area was treated during the fall of 1996 to enhance herbaceous understory vegetation. Long narrow areas were disked (200 ft to 300 ft in width) and seeded leaving large areas of undisturbed sagebrush. Following the disking treatment, the vegetation composition after the treatment consisted of only weedy annual species. In October of 2003, approximately 275 acres were seeded with grass, forb and browse species using a Truax drill (Table - Seed Mix). Cattle pellet group have been sampled in low abundance on the site over the sample years. Deer pellet groups were sampled in low abundance in 2012 and elk were sampled in low abundance in 2004. Rabbit pellet quadrat frequency has been sampled in high abundance on the site over the sample years (Table - Pellet Group Data).

Browse: The preferred browse species are Wyoming big sagebrush, fourwing saltbush (*Atriplex canescens*), and forage kochia (*Kochia prostrata*). Forage kochia has been the dominant browse species and has provided the majority of the canopy cover on the site over the sample years (Table - Canopy Cover). Fourwing saltbush and Wyoming big sagebrush are not common within the treatment. Forage kochia is a dense, moderately to heavily used population with low decadence and good vigor within the population. Recruitment of young forage kochia plants to the population has been over the sample years. Pricklypear cactus (*Opuntia* sp.) is the only other browse species sampled on the site and was sampled in low abundance (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not abundant or diverse on the site. Only three species of grasses have been sampled, which are orchardgrass (*Dactylis glomerata*), Russian wildrye (*Elymus junceus*), and bottlebrush squirreltail (*Sitanion hystrix*). Russian wildrye and orchardgrass were seeded on the site in 2003 (Table - Seed Mix). Forbs are not abundant or diverse on the site. Annual forb species were dominant on the site at the outset of the study, but have decreased in abundance since the over the sample years (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy clay loam with a slightly alkaline soil reaction (pH 7.4) (Table - Soil Analysis Data). Bare ground cover is high, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2007, and was classified as slight in 2012 due to surface litter, pedestalling around plants, rills, and soil movement.

Trend Assessments

Browse:

- **2004 to 2007 - up (+2):** The density of forage kochia increased substantially from 5,360 plants/acre to 53,720 plants/acre, though cover decreased from 31% to 17%. Decadence and poor vigor of kochia plants remained low within the populations. Recruitment of young kochia plants was poor in 2004 at 1% and good in 2007 at 31% of the population.
- **2007 to 2012 - stable (0):** The density of forage kochia decreased 34% to 35,700 plants/acre, though cover increased to 26%. Decadence and poor vigor of kochia plants remained low within the populations. Recruitment of young kochia plants remained good at 43% of the population. There was a high amount of seedlings sampled in 2012 at 94,940 plants/acre.

Grass:

- **2004 to 2007 - stable (0):** Grasses remained rare on the site.

- **2007 to 2012 - stable (0):** Grasses are rare on the site. Russian wildrye was sampled in 2012 for the first time at 1% cover.

Forb:

- **2004 to 2007 - down (-2):** The sum of nested frequency of Perennial forbs decreased and became rare on the site. The sum of nested frequency of annual forbs increased by 40%, though cover decreased from 14% to 2%.
- **2004 to 2007 - slightly down (-1):** Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs decreased by 84%, and cover decreased from to 1%.

SEED MIX--

Management unit 23R, Study no: 8

Project Name: Greenwich Disking							
WRI Database #: PDB							
Application: Drill		Acres: 275		Application: Drill		Acres: 275	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Crested WG, "Douglas"	550	2.00	B	Forage Kochia	500	1.82
G	Great Basin Wildrye "Trailhead"	300	1.09	B	Sagebrush, Wyoming	320	1.16
G	Orchardgrass "Paiute"	150	0.55	Total Pounds:		820	2.98
G	Pubescent Wheatgrass	550	2.00	PLS Pounds:			0.67
G	Russian Wildrye "Bozoisky"	550	2.00				
G	Snake River Wheatgrass "Secar"	300	1.09				
G	Western Wheatgrass "Arriba"	400	1.45				
F	Alalfa "Ladak+"	300	1.09				
F	Blue Flax "Appar"	100	0.36				
F	Yellow Sweetclover	100	0.36				
Total Pounds:		3300	12.00				
PLS Pounds:			10.72				

Trend Summary

HERBACEOUS TRENDS--

Management unit 23R, Study no: 8

T y p e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Dactylis glomerata	2	-	3	.00	-	.30
G	Elymus junceus	a-	a-	b16	-	-	.57
G	Sitanion hystrix	1	7	1	.00	.02	.00
Total for Annual Grasses		0	0	0	0	0	0
Total for Perennial Grasses		3	7	20	0.01	0.02	0.88
Total for Grasses		3	7	20	0.01	0.02	0.88
F	Agastache urticifolia	b15	a-	a-	.26	-	-
F	Astragalus sp.	b57	a2	a-	.89	.01	-
F	Cirsium sp.	-	1	-	-	.00	-
F	Cleome serrulata (a)	4	-	-	.83	-	-
F	Descurainia pinnata (a)	a-	b74	a3	.03	.21	.03
F	Lactuca serriola (a)	-	4	-	-	.00	-

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	Lappula occidentalis (a)	_a 5	_c 270	_b 28	.08	1.53	.10
F	Marrubium vulgare	-	1	-	-	.15	-
F	Nicotiana attenuata (a)	_b 16	_a -	_a -	.12	-	-
F	Salsola iberica (a)	_c 90	_b 11	_a -	9.09	.03	-
F	Sisymbrium altissimum (a)	_a -	_b 21	_b 29	-	.21	.45
F	Solanum triflorum (a)	_b 157	_a -	_a -	3.86	-	-
F	Sphaeralcea grossulariifolia	-	3	-	-	.00	-
F	Unknown forb-perennial	_b 21	_a -	_a -	.18	-	-
Total for Annual Forbs		272	380	60	14.02	2.00	0.59
Total for Perennial Forbs		93	7	0	1.33	0.17	0
Total for Forbs		365	387	60	15.35	2.17	0.59

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 23R, Study no: 8

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Atriplex canescens	1	0	0	.15	-	-
B	Kochia prostrata	100	100	100	21.04	18.90	22.25
B	Opuntia sp.	3	1	2	.00	-	.00
Total for Browse		104	101	102	21.20	18.90	22.25

CANOPY COVER, LINE INTERCEPT--

Management unit 23R, Study no: 8

Species	Percent Cover		
	'04	'07	'12
Kochia prostrata	30.91	16.53	26.20
Opuntia sp.	.01	-	-

BASIC COVER--

Management unit 23R, Study no: 8

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	38.31	19.50	23.60
Rock	4.68	5.84	4.85
Pavement	3.91	5.39	3.30
Litter	21.70	28.97	27.34
Cryptogams	.06	.03	.06
Bare Ground	45.29	51.26	51.76

SOIL ANALYSIS DATA --

Management unit 23R, Study no: 8, Study Name: Browns Canyon Drill

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.8	7.4	51.0	26.8	22.2	1.1	15.7	249.6	0.7

PELLET GROUP DATA--

Management unit 23R, Study no: 8

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	55	98	68	-	-	-
Elk	3	-	-	7 (17)	-	-
Deer	-	-	2	-	-	19 (48)
Cattle	-	3	6	3 (8)	15 (38)	12 (30)

BROWSE CHARACTERISTICS--

Management unit 23R, Study no: 8

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Artemisia tridentata wyomingensis									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	29/24
Atriplex canescens									
04	20	100	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
Kochia prostrata									
04	5360	1	99	0	-	9	0	0	13/15
07	53720	31	69	0	-	1	98	.07	4/9
12	35700	43	57	0	94940	30	37	.05	6/13
Opuntia sp.									
04	80	0	75	25	-	0	0	0	4/12
07	20	0	0	100	-	0	0	100	5/17
12	40	0	100	0	-	0	0	0	5/18

PANGUITCH EAST BENCH HARROW - TREND STUDY NO. 24R-6-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Substantial Deer Winter

NRCS Ecological Site Description: Semidesert Gravelly Loam (Wyoming Big Sagebrush), R047XB214UT

Land Ownership: BLM

Elevation: 7,000 ft (2,134 m)

Aspect: West

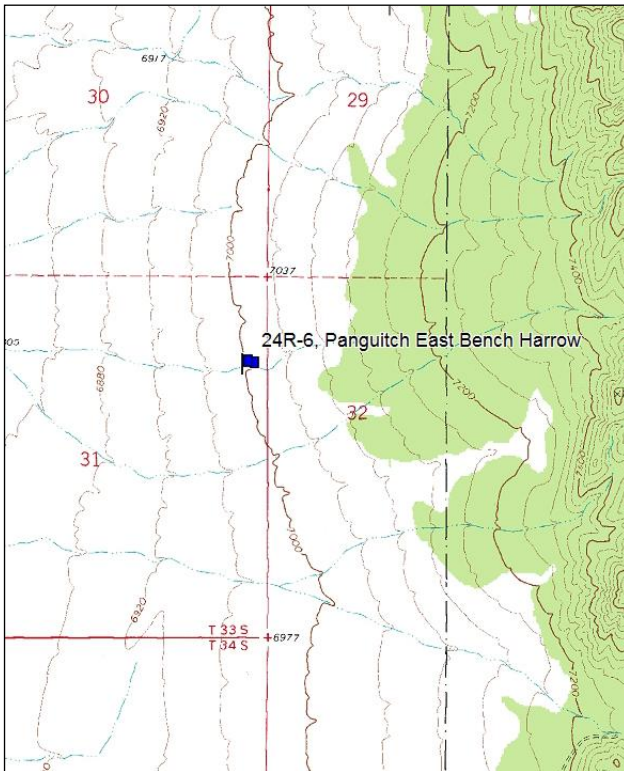
Slope: 7%

Transect bearing: 255° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

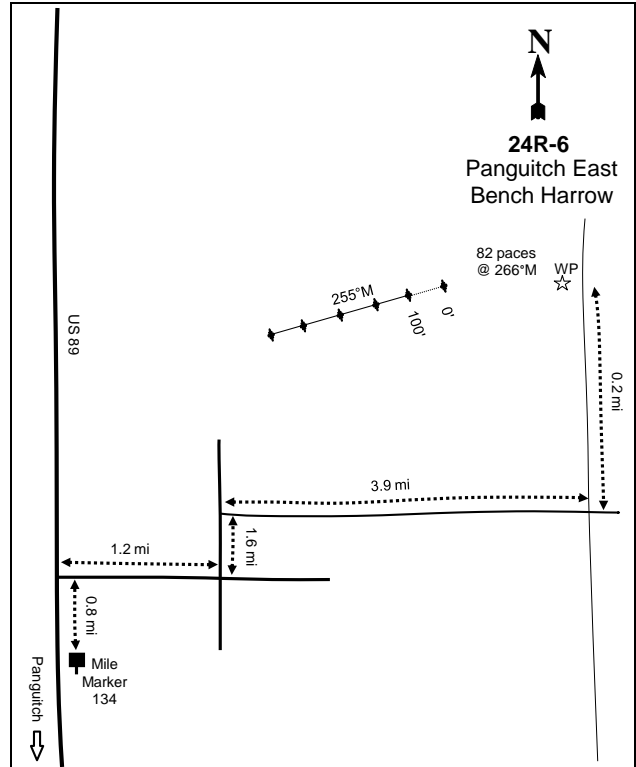
Directions: Travel north of Panguitch on US 89 to mile marker 134. Continue 0.8 miles north of the mile marker to a road that comes in from the right (east). Turn onto this road and travel 1.2 miles to an intersection. Turn left and travel 1.6 miles to a 90°M turn. Continue 3.9 miles to a road that comes in from the left (north). Turn here and travel 0.2 miles to two witness posts that are right next to each other. From the witness posts walk 82 paces at 266°M to the 0-foot stake that is marked with browse tag #41.

Map Name: Blind Spring Mountain



Township: 33S Range: 4¹/₂ Section: 31

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 382047 E 4195730 N

PANGUITCH EAST BENCH HARROW - TREND STUDY NO. 24R-6

Site Information

Site Description: The study is located approximately eight miles northwest of Panguitch within a Wyoming big sagebrush flat (*Artemisia tridentata* ssp. *wyomingensis*) flat. The study was established in 2004 on land administrated by the Bureau of Land Management (BLM) to monitor a sagebrush treatment project. The study occurs on the BLM Sanford Bench allotment. In October of 2004 approximately 300 acres were one-way Dixie harrowed and seed mix of grass and forb species was broadcasted during the treatment. In December of 2004, forage kochia (*Kochia prostrata*) was aerially seed on the site (Table - Seed Mix). Deer/Antelope have been sampled in low abundance on the site over the course of the study. Cattle pellet groups were sampled in low abundance in 2012. Rabbit pellets were sampled in high frequency within the quadrat in 2007 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is Wyoming big sagebrush. Wyoming big sagebrush is the dominant browse species sampled on the site and has provided the majority of the canopy cover on the site over the sampled years (Table - Canopy Cover). The sagebrush is a fairly dense, lightly used population with low decadence and good vigor within the population. Decadence and poor vigor of sagebrush were high at the outset of the study. Recruitment of young sagebrush plants to the population has been good following the treatment, but prior was poor. Other browse species are rare on the study site (Table - Browse Characteristics).

Herbaceous Understory: Grasses are fairly abundant and diverse. Blue grama (*Bouteloua gracilis*) is the dominant grass species on the site and has provided the majority of the grass cover on the site over the sampled years. Following the treatment, species richness increased with several seed grass species being sampled which include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), Russian wildrye (*Elymus junceus*), Snake River wheatgrass (*Elymus wawawaiensis*), hard fescue (*Festuca ovina* ssp. *duriuscula*), Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*), though bottlebrush squirreltail was sampled on the site prior to treatment. Forbs are not abundant or overly diverse on the site. Only two of the seeded forbs species have been sampled on the site Rocky Mountain beeplant (*Cleome serrulata*) and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Notter component, which occurs on alluvial fans. The parent material consists of alluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a slightly alkaline soil reaction (pH 7.6) (Table - Soil Analysis Data). Bare ground cover is high, though there is a moderate amount of litter, pavement, and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2007, and was classified as slight in 2012 due to surface litter, pedestalling around plants, rills, and soil movement.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush decreased by 65% from 6,960 plants/acres to 2,460 plants/acre, and canopy cover decreased from 20% to 5%. The health of the sagebrush improved with decadence decreasing from 45% to 5% and plants displaying poor vigor decreasing from 26% to 15% of the population.

Grasses: The sum of nested frequency of perennial grasses remained similar and cover increased from 5% to 6%. Bottlebrush squirreltail decreased significantly in nested frequency and cover decreased from 1% to less than 1%. Blue grama remained similar in nested frequency, though cover increased from 4% to 6%.

Forbs: Forbs remained rare on the site.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2)**: The density of Wyoming big sagebrush increased substantially to 15,400 plants/acre, and canopy cover increased from 5% to 16%. Decadence and plants displaying poor vigor remained low within the population. Recruitment of young sagebrush plants increased from 10% to 82%.

Grass:

- **2007 to 2012 - up (+2)**: The sum of nested frequency of perennial grasses increased 35% and cover increased to 11%. Blue grama remained similar in nested frequency, though cover increased to 9%.

Forb:

- **2007 to 2012 - stable (0)**: Perennial forbs remained rare on the site.

SEED MIX--

Management unit 24R, Study no: 6

Project Name: Panguitch East Bench					
WRI Database #: PDB					
Application: Broadcast		Acres: 300		Application: Aerial	
				Acres: 300	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Bottlebrush Squirreltail	40	0.13	B	Forage Kochia 'Immigrant'
G	Crested Wheatgrass 'Douglas'	150	0.50	Total Pounds: 300 1.00	
G	Crested Wheatgrass 'Hycrest'	150	0.50	PLS Pounds: 0.67	
G	Hard Fescue	150	0.50		
G	Indian Ricegrass 'Rimrock'	150	0.50		
G	Intermediate Wheatgrass	150	0.50		
G	Needle and Threadgrass	35	0.12		
G	Newhy WG	150	0.50		
G	Russian Wildrye 'Bozoisky'	150	0.50		
G	Snake River Wheatgrass 'Secar'	350	1.17		
F	Alalfa 'Ladak+'	300	1.00		
F	Blue Flax 'Appar'	50	0.17		
F	Rocky Mountain Beeplant	150	0.50		
F	Sainfoin	800	2.67		
F	Small Burnet 'Delar'	500	1.67		
F	Western Yarrow	20	0.07		
F	Yellow Sweetclover	13	0.04		
Total Pounds:		3308	11.03		
PLS Pounds:			10.28		

Trend Summary

HERBACEOUS TRENDS--
Management unit 24R, Study no: 6

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	<i>Agropyron cristatum</i>	-	7	8	-	.04	.36
G	<i>Agropyron intermedium</i>	-	1	-	-	.00	-
G	<i>Bouteloua gracilis</i>	148	148	154	4.30	6.22	8.70
G	<i>Elymus junceus</i>	-	2	17	-	.03	.42
G	<i>Elymus wawawaiensis</i>	-	-	1	-	-	.03
G	<i>Festuca ovina duriuscula</i>	a-	a-	b18	-	-	.51
G	<i>Oryzopsis hymenoides</i>	-	3	15	-	.03	.54
G	<i>Poa secunda</i>	5	3	3	.01	.00	.00
G	<i>Sitanion hystrix</i>	b38	a8	ab14	1.02	.07	.22
G	<i>Stipa comata</i>	-	2	4	-	.00	.00
Total for Annual Grasses		0	0	0	0	0	0
Total for Perennial Grasses		191	174	234	5.34	6.42	10.80
Total for Grasses		191	174	234	5.34	6.42	10.80
F	<i>Arabis</i> sp.	-	4	11	-	.00	.04
F	<i>Astragalus</i> sp.	3	7	-	.03	.01	-
F	<i>Chenopodium fremontii</i> (a)	-	4	-	-	.00	-
F	<i>Cleome serrulata</i> (a)	-	9	-	-	.20	-
F	<i>Descurainia pinnata</i> (a)	a16	b60	a33	.10	.87	.06
F	<i>Eriogonum cernuum</i> (a)	a-	b22	c44	-	.04	.24
F	<i>Euphorbia</i> sp.	-	-	8	-	-	.02
F	<i>Gilia</i> sp. (a)	-	1	-	-	.00	-
F	<i>Lactuca serriola</i> (a)	-	4	1	-	.00	.00
F	<i>Lappula occidentalis</i> (a)	-	2	4	-	.01	.01
F	<i>Salsola iberica</i> (a)	a-	a-	b29	-	-	.30
F	<i>Sanguisorba minor</i>	-	1	1	-	.03	.00
F	<i>Sphaeralcea coccinea</i>	-	-	2	-	-	.00
Total for Annual Forbs		16	102	111	0.10	1.14	0.63
Total for Perennial Forbs		3	12	22	0.02	0.04	0.07
Total for Forbs		19	114	133	0.13	1.18	0.70

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 24R, Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	98	55	85	18.24	7.73	18.41
B	Chrysothamnus viscidiflorus	0	0	0	-	.15	-
B	Gutierrezia sarothrae	2	0	0	.06	-	-
B	Opuntia sp.	2	1	1	-	.00	-
B	Pediocactus simpsonii	0	0	1	-	-	-
Total for Browse		102	56	87	18.30	7.88	18.41

CANOPY COVER, LINE INTERCEPT--

Management unit 24R, Study no: 6

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	19.46	4.66	15.91

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 24R, Study no: 6

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata wyomingensis	0.4	1.7	0.5

BASIC COVER--

Management unit 24R, Study no: 6

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	23.31	16.06	30.37
Rock	4.09	5.02	3.31
Pavement	22.95	9.12	11.16
Litter	23.92	28.44	26.07
Cryptogams	3.38	.07	.56
Bare Ground	36.83	50.07	38.23

SOIL ANALYSIS DATA --

Management unit 24R, Study no: 6, Study Name: Panguitch East Bench Harrow

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
13.2	7.6	55.0	23.4	21.6	1.4	7.8	611.2	0.7

PELLET GROUP DATA--

Management unit 24R, Study no: 6

Type	Quadrat Frequency		
	'04	'07	'12
Rabbit	26	91	32
Deer/Antelope	1	1	-
Cattle	-	-	2

Days use per acre (ha)		
'04	'07	'12
-	-	-
1 (3)	4 (10)	2 (5)
-	-	8 (20)

BROWSE CHARACTERISTICS--
 Management unit 24R, Study no: 6

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
04	6960	7	48	45	60	3	0	26	17/26	
07	2460	10	67	23	80	22	7	15	15/22	
12	15400	82	18	1	9160	8	.12	1	19/28	
<i>Gutierrezia sarothrae</i>										
04	140	71	29	-	-	0	0	0	5/7	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	4/5	
<i>Opuntia sp.</i>										
04	40	0	100	-	-	0	0	0	4/9	
07	20	0	100	-	-	0	0	0	1/2	
12	20	0	100	-	-	0	0	0	4/6	
<i>Pediocactus simpsonii</i>										
04	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	100	0	-	-	0	0	0	1/1	

JOHNS VALLEY 2 - TREND STUDY NO. 24R-9-12

Vegetation Type: Basin Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Loam \(Mountain Big Sagebrush\), R047XB308UT](#)

Land Ownership: USFS

Elevation: 7,742 ft (2,360 m)

Aspect: East

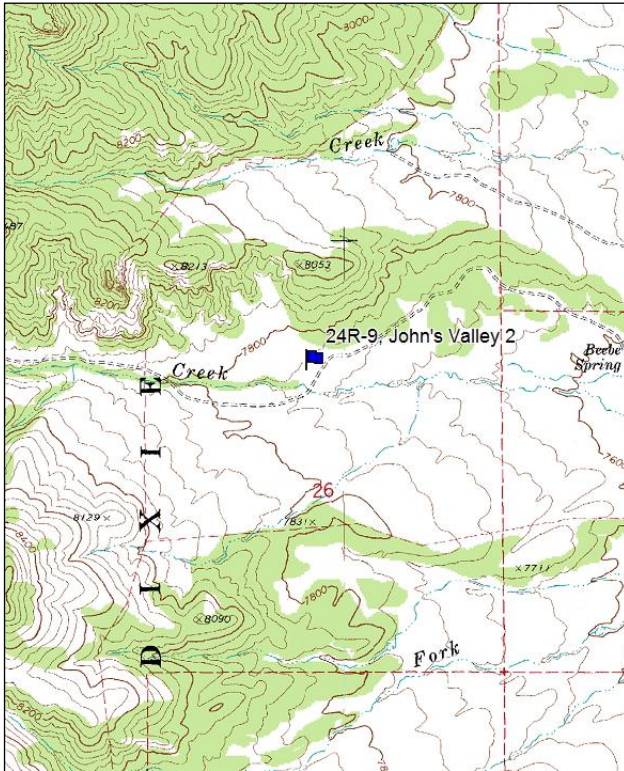
Slope: 8%

Transect bearing: 285° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

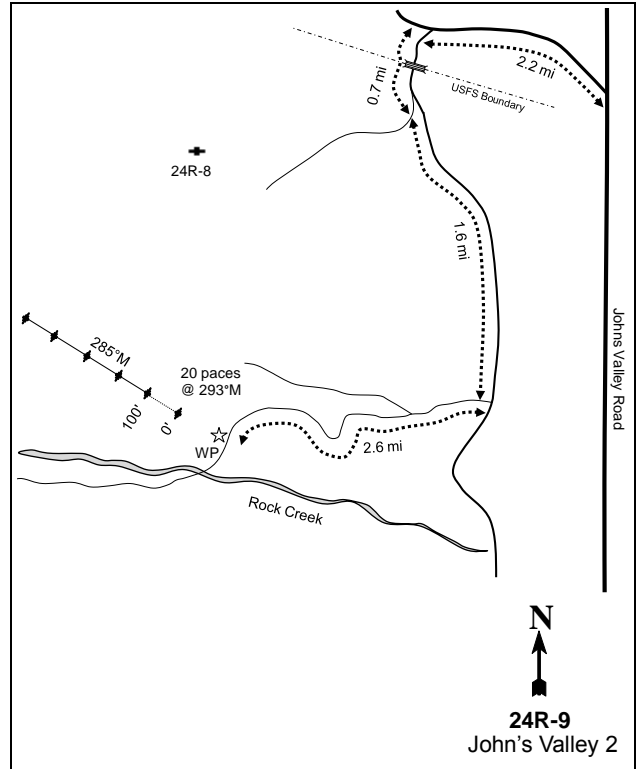
Directions: From the Johns Valley Road, Travel west on the Cottonwood road. Travel for 2.2 miles and turn right. Travel 0.3 miles to the U.S. Forest Service boundary. Continue for 0.4 miles to a fork in the road. Stay left and continue for 1.6 miles and turn right. Travel for 2.6 miles to a witness post on the right. Walk 20 paces at 293°M to the 0-foot stake. The 0-foot stake is marked with 9,153.

Map Name: Cow Creek



Township: 33S Range: 3W Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 404537 E 4196535 N

JOHNS VALLEY 2 - TREND STUDY NO. 24R-9
[Project #2400](#) and [Project #2677](#)

Site Description

Site Information: The study is located approximately seven miles northwest of Widtsoe Junction within a basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) flat. The study was established in 2012 on land administrated by the U.S. Forest Service (USFS) to monitor the effects of a pinyon and juniper reduction project. The study occurs on the USFS Widtsoe C&H allotment. The project will be treated with a bullhog to thin pinyon and juniper trees within the treatment area. The project area will not be seeded. The objectives of the project are to enhance sage-steppe habitat, restore function to sagebrush ecosystems, and riparian areas (WRI Database 2013). Deer and elk pellet groups were sampled on low abundance, and cattle pellet groups were sampled in high abundance in 2012 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are basin big sagebrush and fringed sagebrush (*Artemisia frigida*). The dominant preferred browse species is basin big sagebrush which provides the majority of the canopy cover on the site (Table - Canopy Cover). Basin big sagebrush is moderately dense population, with low decadence and good vigor within the population. Utilization of big sagebrush plants was moderate. The recruitment of young big sagebrush plants to the population was poor. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous*), stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia* sp.), gray horsebrush (*Tetradymia canescens*), and mountain snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics). Prior to the treatment, pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) provided the moderate amount of the cover on the site (Table - Canopy Cover). The stage of woodland succession was in Phase I transitioning to Phase II prior to treatment (Tausch et al. 2009).

Herbaceous Trends: Grasses are abundant but are not overly diverse on the site. The dominant grass species is crested wheatgrass (*Agropyron cristatum*). Other grass species were sampled in low abundance on the site are western wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*), sedge (*Carex* sp.), and Indian ricegrass (*Oryzopsis hymenoides*). Forbs are not overly abundant or diverse on the site. The dominant forb species is silvery lupine (*Lupinus argenteus*) which provides the majority of the forb cover on the site (Table - Herbaceous Trends)

Soil: The soil is classified as part of the Guben-Showalter complex, which is found on pediments. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictive layer. The soil surface texture is a gravelly loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a high amount of vegetation and moderate amount litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012, due to surface litter, soil movement, rock movement, pedestalling, flow patterns, and rills.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 24R, Study no: 9

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Agropyron cristatum</i>	294	13.36
G	<i>Agropyron smithii</i>	71	1.22
G	<i>Bouteloua gracilis</i>	3	.03
G	<i>Carex</i> sp.	4	.38

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Oryzopsis hymenoides</i>	6	.06
Total for Annual Grasses		0	0
Total for Perennial Grasses		378	15.07
Total for Grasses		378	15.07
F	<i>Aster</i> sp.	2	.03
F	<i>Castilleja chromosa</i>	9	.18
F	<i>Erigeron pumilus</i>	5	.00
F	<i>Lupinus argenteus</i>	20	3.27
F	<i>Lygodesmia spinosa</i>	3	.15
F	<i>Medicago sativa</i>	2	.15
F	<i>Penstemon</i> sp.	11	.05
F	<i>Phlox longifolia</i>	6	.03
F	<i>Senecio multilobatus</i>	2	.00
F	<i>Sphaeralcea coccinea</i>	2	.00
Total for Annual Forbs		0	0
Total for Perennial Forbs		62	3.88
Total for Forbs		62	3.88

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 24R, Study no: 9

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	<i>Artemisia frigida</i>	4	.15
B	<i>Artemisia tridentata tridentata</i>	53	9.96
B	<i>Chrysothamnus nauseosus</i>	49	7.51
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	63	4.23
B	<i>Gutierrezia sarothrae</i>	24	.82
B	<i>Juniperus scopulorum</i>	4	3.22
B	<i>Opuntia</i> sp.	4	.56
B	<i>Pinus edulis</i>	1	.00
B	<i>Symphoricarpos oreophilus</i>	1	.38
B	<i>Tetradymia canescens</i>	4	.00
Total for Browse		207	26.84

CANOPY COVER, LINE INTERCEPT--
Management unit 24R, Study no: 9

Species	Percent Cover '12
Artemisia frigida	.06
Artemisia tridentata tridentata	10.78
Chrysothamnus nauseosus	11.10
Chrysothamnus viscidiflorus viscidiflorus	5.38
Gutierrezia sarothrae	1.16
Juniperus scopulorum	3.53
Opuntia sp.	.33
Pinus edulis	.03
Symphoricarpos oreophilus	.43

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 24R, Study no: 9

Species	Average leader growth (in) '12
Artemisia tridentata tridentata	1.3

POINT-QUARTER TREE DATA--
Management unit 24R, Study no: 9

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	55	9.3
Pinus edulis	20	2.6

BASIC COVER--
Management unit 24R, Study no: 9

Cover Type	Average Cover % '12
Vegetation	41.17
Rock	.58
Pavement	.79
Litter	33.93
Cryptogams	1.14
Bare Ground	40.59

PELLET GROUP DATA--

Management unit 24R, Study no: 9

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	2	-
Elk	2	6 (15)
Deer	8	-
Cattle	8	33 (81)

BROWSE CHARACTERISTICS--

Management unit 24R, Study no: 9

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia frigida</i>										
12	80	0	100	-	-	0	0	0	6/8	
<i>Artemisia tridentata tridentata</i>										
12	1540	4	87	9	40	30	6	3	35/46	
<i>Chrysothamnus nauseosus</i>										
12	1260	6	76	17	-	10	0	0	40/44	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
12	2200	3	93	5	-	3	0	8	15/21	
<i>Gutierrezia sarothrae</i>										
12	660	6	94	-	-	0	0	0	10/13	
<i>Juniperus scopulorum</i>										
12	100	20	80	-	-	0	0	0	-/-	
<i>Opuntia sp.</i>										
12	100	0	100	-	-	0	0	0	5/13	
<i>Pinus edulis</i>										
12	20	100	0	-	-	0	0	0	-/-	
<i>Symphoricarpos oreophilus</i>										
12	20	0	100	-	-	0	0	0	16/27	
<i>Tetradymia canescens</i>										
12	80	25	75	-	-	0	0	0	9/15	

ANTIMONY LOP AND SCATTER - TREND STUDY NO. 24R-10-12

Vegetation Type: Pinyon Pine and Utah Juniper

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Pinyon-Utah Juniper\), R047XB333UT](#)

Land Ownership: BLM

Elevation: 7,154 ft (7,154 m)

Aspect: Southeast

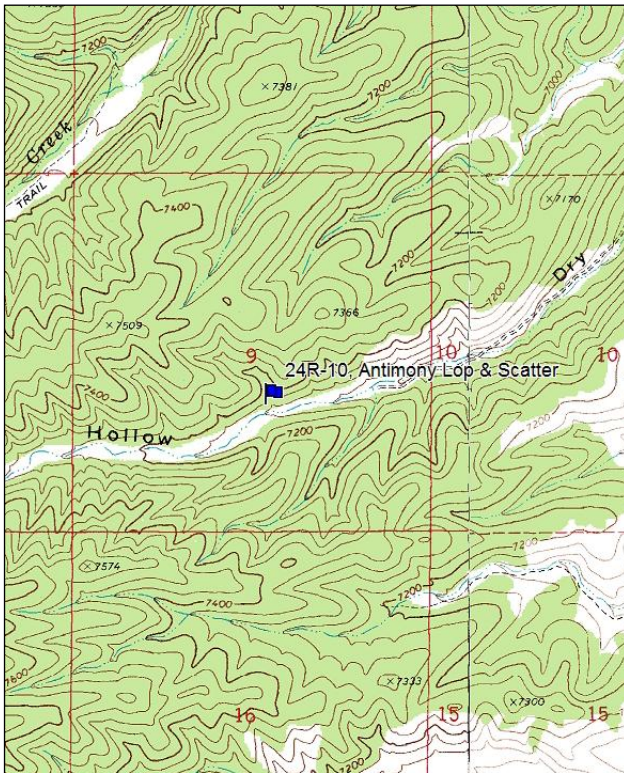
Slope: 33%

Transect bearing: 283° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

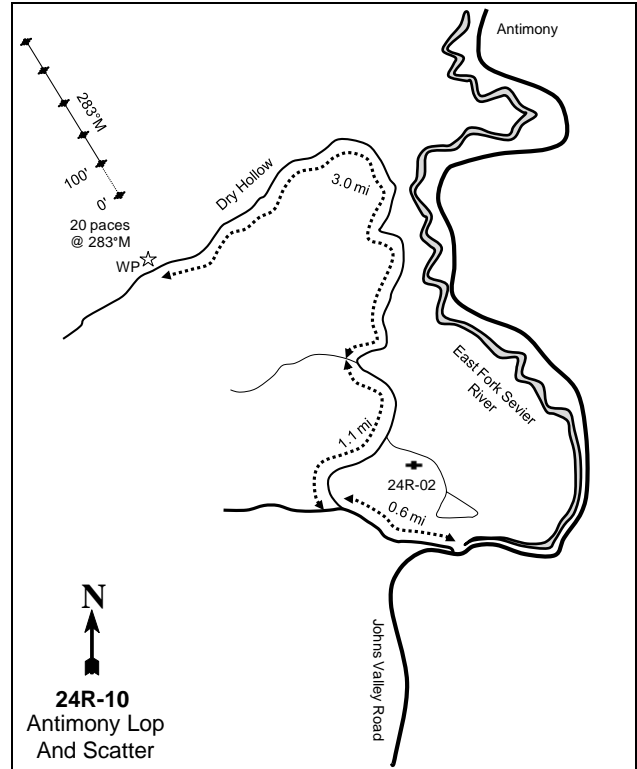
Directions: From the Johns Valley Road travel 0.6 miles and turn right. Travel 1.1 mile and continue for 3.0 miles to a witness post on the right. Walk 20 paces at 283°M to the 0-foot stake. The 0-foot stake is marked with browse tag 9,170.

Map Name: Deep Creek



Township: 32S Range: 2W Section: 8

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 411267 E 4210148 N

ANTIMONY LOP AND SCATTER - TREND STUDY NO. 24R-10
[Project #2597](#)

Site Information

Site Description: The study is located approximately five miles south of Antimony within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established in 2012 on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon and juniper reduction project. The study occurs on the BLM Pine Creek Antimony allotment. Prior to the establishment of the study, pinyon and juniper trees were lop and scattered. The study transect was placed within an untreated island due to the trees being already treated to gather pre-treatment data. The subsequent sampling period, a new transect will be place within the treatment area. Approximately 586 acres were lop and scattered in the summer of 2012. In the fall of 2013, lop and scatter tree debris will be burned, then the area will be seeded and chained after the burning is complete. The objectives of the project are to improve herbaceous understory and increase palatable browse (WRI Database 2013). Deer pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon and juniper are the dominant browse species, and provide the majority of the canopy cover on the site (Table - Canopy Cover). The preferred browse species on the site is mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*). Mountain big sagebrush is sparse, lightly used population with high decadence and moderate amount of plants displaying poor vigor within the population. Other browse species sampled on the site are sparse which are stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant, but are not diverse on the site. The dominant grass species on the site is blue grama (*Bouteloua gracilis*) which provides the majority of the grass cover. Only two other grass species were sampled on the site in 2012, sedge (*Carex* sp.) and needle-and-thread (*Stipa comata*). Forbs are not abundant or diverse on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Bruman component, which is found on hillslopes and mountain slopes. The parent material consists of alluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictive layer. The soil surface texture is a cobbly loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of pavement and rock and a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012 due to surface litter, surface rock movement, gully formation, and soil movement.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 24R, Study no: 10

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Bouteloua gracilis</i>	132	4.35
G	<i>Carex</i> sp.	4	.03
G	<i>Stipa comata</i>	9	.12
Total for Annual Grasses		0	0
Total for Perennial Grasses		145	4.51

Type	Species	Nested Frequency	Average Cover %
		'12	'12
Total for Grasses		145	4.51
F	Arabis sp.	6	.01
F	Astragalus lentiginosus	26	.60
F	Descurainia pinnata (a)	35	.15
F	Eriogonum alatum	4	.00
F	Euphorbia sp.	6	.01
Total for Annual Forbs		35	0.15
Total for Perennial Forbs		42	0.63
Total for Forbs		77	0.79

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 24R, Study no: 10

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata vaseyana	11	1.13
B	Gutierrezia sarothrae	7	.21
B	Juniperus osteosperma	5	4.36
B	Opuntia sp.	0	.03
B	Pinus edulis	5	11.70
Total for Browse		28	17.43

CANOPY COVER, LINE INTERCEPT--

Management unit 24R, Study no: 10

Species	Percent Cover '12
Artemisia tridentata vaseyana	1.65
Juniperus osteosperma	6.86
Pinus edulis	18.79

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 24R, Study no: 10

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	1.1

POINT-QUARTER TREE DATA--
Management unit 24R, Study no: 10

Species	Trees per Acre	Average diameter (in)
	'12	
Juniperus osteosperma	40	19.4
Pinus edulis	166	9.0

BASIC COVER--
Management unit 24R, Study no: 10

Cover Type	Average Cover %
	'12
Vegetation	22.24
Rock	32.75
Pavement	30.00
Litter	29.15
Cryptogams	.03
Bare Ground	10.87

PELLET GROUP DATA--
Management unit 24R, Study no: 10

Type	Quadrat Frequency	Days use per acre (ha)
	'12	
Rabbit	2	-
Deer	3	7 (17)

BROWSE CHARACTERISTICS--
Management unit 24R, Study no: 10

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)	
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor		
Artemisia tridentata vaseyana										
12	220	0	64	36	-	9	18	18	20/30	
Chrysothamnus viscidiflorus viscidiflorus										
12	0	0	0	-	-	0	0	0	4/5	
Gutierrezia sarothrae										
12	440	55	45	-	-	0	0	0	7/10	
Juniperus osteosperma										
12	100	0	100	-	-	0	0	20	-/-	
Opuntia sp.										
12	0	0	0	-	-	0	0	0	3/11	
Pinus edulis										
12	100	20	80	-	-	0	0	0	-/-	

ANTIMONY PJ REDUCTION - TREND STUDY NO. 24R-11-12

Vegetation Type: Pinyon Pine and Utah Juniper

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Pinyon-Utah Juniper\), R047XB333UT](#)

Land Ownership: BLM

Elevation: 7,841 ft (2,390 m)

Aspect: Northeast

Slope: 4%

Transect bearing: 44° magnetic

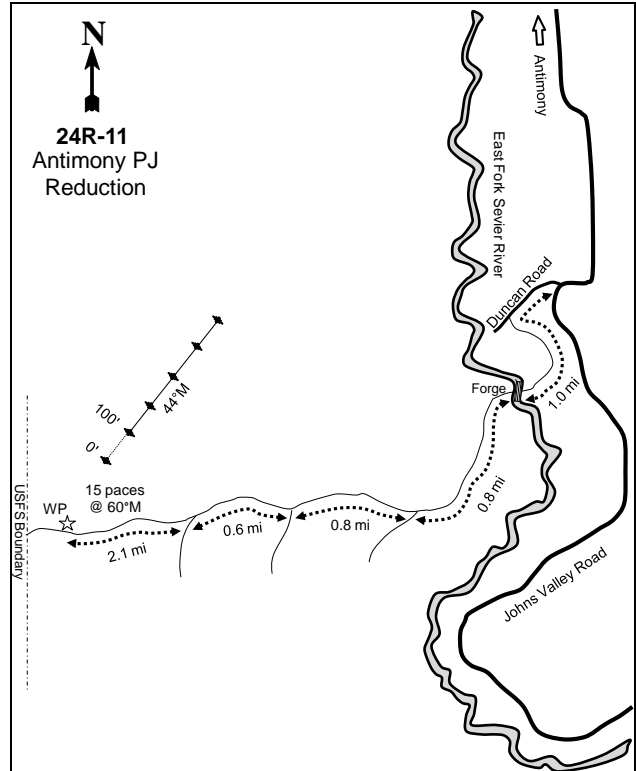
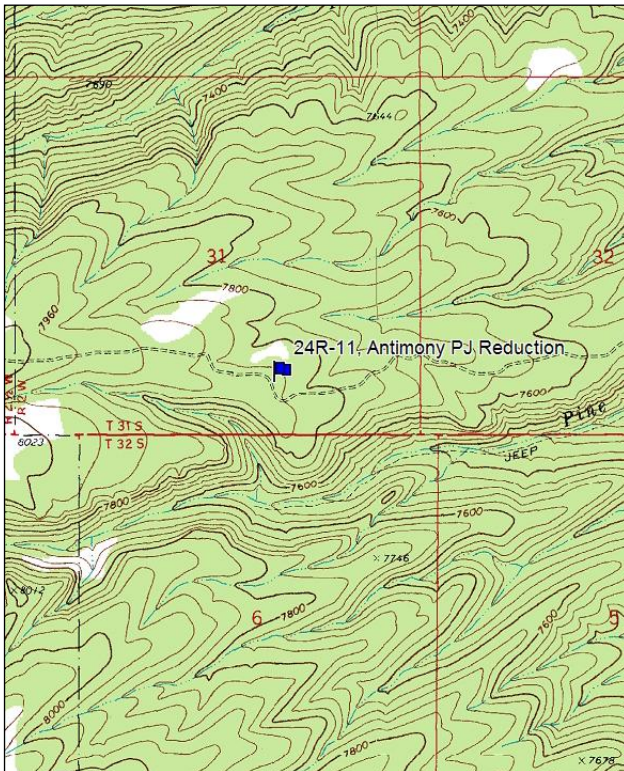
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Note: No Rebar

Directions: From the Johns Valley Road south of Antimony travel to the Duncan Road. Travel to 1.0 mile to the forge crossing the Sevier River. Continue 0.8 miles and stay left. Continue 0.6 and stay left. Continue 2.1 miles to the witness post on the right. From the witness post walk 15 paces at 60°M to the 0-foot stake. The 0-foot stake is marked with tag #9,156.

Map Name: Deep Creek

Diagrammatic Sketch:



Township: 31S Range: 2W Section: 31

GPS: NAD 83, UTM 12S 408097 E 4213076 N

ANTIMONY PJ REDUCTION - TREND STUDY NO. 24R-11

[Project #2239](#)

Site Information

Site Description: The study is located approximately four and half miles south of Antimony within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon and juniper reduction project. The study occurs on the BLM Pine Creek Antimony allotment. Approximately 616 acres of pinyon and juniper were bullhogged in the fall of 2012. A seed mix of grass and forb species was applied aerially prior to mastication. The objectives of the project are to improve herbaceous understory and increase palatable browse within the project area (WRI Database 2013). Deer and elk pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon and juniper are the dominant browse species, and provide the majority of the canopy cover on the site (Table - Canopy Cover). The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*), black sagebrush (*A. nova*), and antelope bitterbrush (*Purshia tridentata*). Mountain big sagebrush and black sagebrush are sparse, lightly used populations with low decadence and high amount of plants displaying poor vigor. Antelope bitterbrush are scattered across the site in low to moderate abundance with high decadence and poor vigor. Recruitment of young sagebrush and bitterbrush plants are poor on the site (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are not abundant but are diverse on the site. The dominant grass species is blue grama (*Bouteloua gracilis*), and provides the majority of grass cover on the site. Other grass species occurred in low abundance. Forbs are not abundant but are moderately diverse. No single forb species are dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the widtsoe component, which is found on ridges and mountain slopes. The parent material consists of alluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictive layer. The soil surface texture is a gravelly sandy loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of pavement, litter, and rock and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

SEED MIX--

Management unit 24R, Study no: 11

Project Name: Antimony PJ Reduction			
WRI Database #: 2239			
Application: Aerial		Acres: 1207	
Seed type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone	900	0.75
G	Sheep Fescue 'Covar'	300	0.25
F	Alfalfa 'Ladak DL'	600	0.50
F	Annual Sunflower	900	0.75
F	Blue Flax 'Appar'	600	0.50
F	Sainfoin 'Eski'	2450	2.03
F	Small Burnet 'Delar'	2450	2.03
F	Yellow Sweetclover	600	0.50
Total Pounds:		8800	7.29
PLS Pounds:			6.39

Trend Summary

HERBACEOUS TRENDS--

Management unit 24R, Study no: 11

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	Agropyron cristatum	3	.15
G	Agropyron smithii	1	.00
G	Bouteloua gracilis	66	1.22
G	Oryzopsis hymenoides	4	.00
G	Poa fendleriana	30	.47
G	Poa secunda	3	.03
G	Sitanion hystrix	3	.01
G	Stipa comata	3	.00
Total for Annual Grasses		0	0
Total for Perennial Grasses		113	1.90
Total for Grasses		113	1.90
F	Arabis sp.	14	.02
F	Astragalus sp.	1	.03
F	Descurainia pinnata (a)	4	.01
F	Eriogonum alatum	3	.00
F	Euphorbia sp.	1	.00
F	Ipomopsis aggregata	3	.01
F	Penstemon sp.	1	.00
F	Senecio multilobatus	1	.00
F	Trifolium sp.	1	.00
Total for Annual Forbs		4	0.01
Total for Perennial Forbs		25	0.09
Total for Forbs		29	0.10

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 24R, Study no: 11

T y p e	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia nova	23	1.22
B	Artemisia tridentata vaseyana	22	1.58
B	Gutierrezia sarothrae	1	.00
B	Juniperus osteosperma	6	1.86
B	Pinus edulis	19	17.18
B	Purshia tridentata	14	3.32
B	Tetradymia canescens	1	-
Total for Browse		86	25.18

CANOPY COVER, LINE INTERCEPT--

Management unit 24R, Study no: 11

Species	Percent Cover '12
Artemisia nova	1.45
Artemisia tridentata vaseyana	1.06
Juniperus osteosperma	2.70
Pinus edulis	33.86
Purshia tridentata	5.61

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 24R, Study no: 11

Species	Average leader growth (in) '12
Artemisia nova	1.0
Artemisia tridentata vaseyana	1.5
Purshia tridentata	2.2

POINT-QUARTER TREE DATA--

Management unit 24R, Study no: 11

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	96	5.2
Pinus edulis	230	6.8

BASIC COVER--

Management unit 24R, Study no: 11

Cover Type	Average Cover % '12
Vegetation	27.95
Rock	12.96
Pavement	25.70
Litter	55.33
Cryptogams	1.16
Bare Ground	3.35

PELLET GROUP DATA--

Management unit 24R, Study no: 11

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	2	-
Elk	-	2 (5)
Deer	-	4 (10)

BROWSE CHARACTERISTICS--
Management unit 24R, Study no: 11

		Age class distribution					Utilization			
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia nova</i>										
12	820	2	88	10	-	12	7	20	9/17	
<i>Artemisia tridentata vaseyana</i>										
12	680	18	68	15	-	15	9	47	13/22	
<i>Gutierrezia sarothrae</i>										
12	40	100	0	-	-	0	0	0	7/4	
<i>Juniperus osteosperma</i>										
12	160	50	50	-	220	0	0	0	-/-	
<i>Opuntia sp.</i>										
12	0	0	0	-	-	0	0	0	4/9	
<i>Pediocactus simpsonii</i>										
12	0	0	0	-	-	0	0	0	3/2	
<i>Pinus edulis</i>										
12	440	50	50	-	80	0	0	0	-/-	
<i>Purshia tridentata</i>										
12	360	6	50	44	-	22	6	28	27/42	
<i>Tetradymia canescens</i>										
12	20	0	100	-	-	0	0	0	8/7	

LAMP STAND - TREND STUDY NO. 25R-5-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R035XY209UT](#)

Land Ownership: BLM

Elevation: 6,360 ft (1,939 m)

Aspect: West

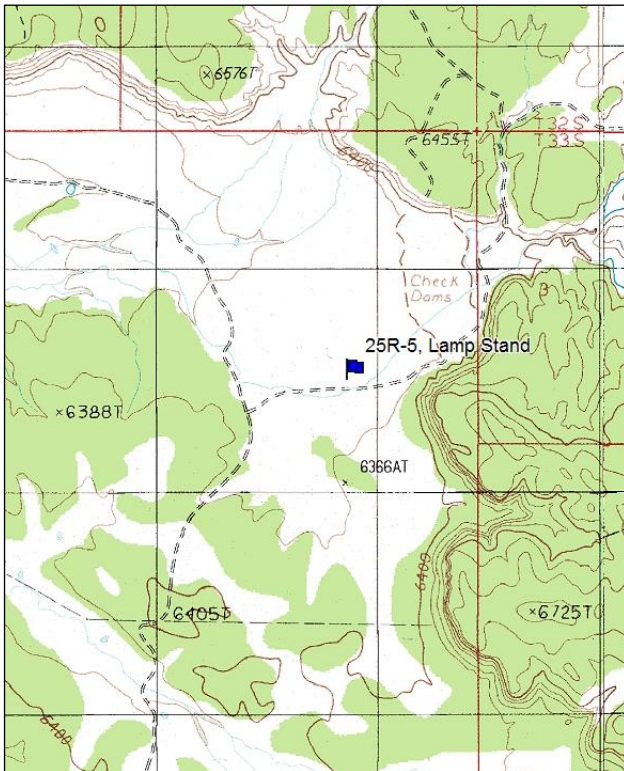
Slope: 1%

Transect bearing: 310° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

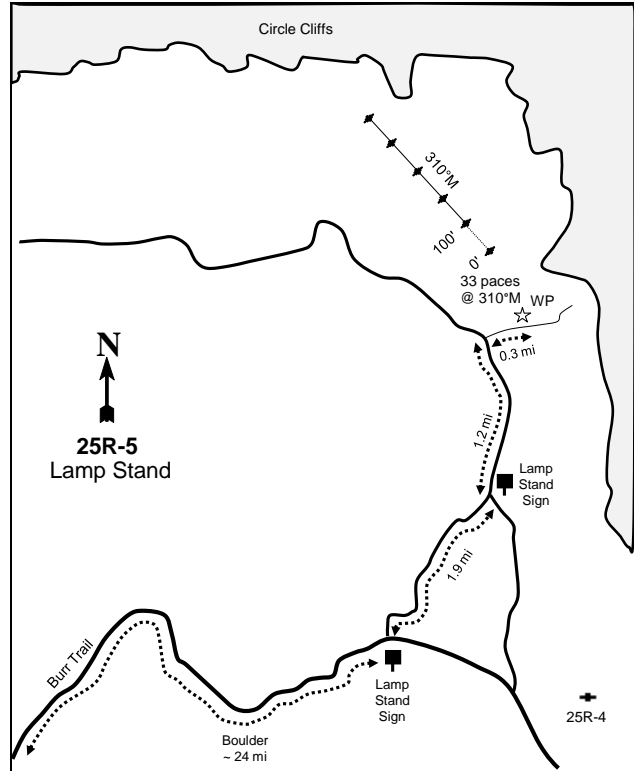
Directions: From Burr Trail take the turnoff to Lamp Stand. Travel 1.9 miles to another sign for Lamp Stand. Continue north 1.2 miles to a road on the right. Turn onto this road and travel 0.3 miles to a witness post on the left side of the road. From here the 0-foot stake is 100 feet away at 310°M and is marked with browse tag #53.

Map Name: Lamp Stand



Township: 33S Range: 7E Section: 4

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 487803 E 4201695 N

LAMP STAND - TREND STUDY NO. 25R-5

Site Information

Site Description: The study is located fifteen and half miles east of Boulder within a weedy annual dominated flat. The study was established in 2004 on land administrated by the Bureau of Land Management to monitor a seeding project. This study is part of the Circle Cliffs range seeding project. The study occurs on the BLM Circle Cliffs allotment. The site was established prior to treatment. The area was drill seeded with a Truax drill in November of 2004. The goal of the seeding project was to establish perennial grass, forb, and browse species to improve the rangeland for wildlife and livestock use. Elk and cattle pellet groups were sampled in low abundance on the site in 2007 and 2012 (Table - Pellet Group Data).

Browse: Browse species are rare on the site. The preferred browse species sampled on the site are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and fourwing saltbush (*Atriplex canescens*), though each of these species have occurred in low abundance on the site over the sampled years (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not overly abundant, but are moderately diverse on the site. The dominant grass species on the site is crested wheatgrass (*Agropyron cristatum*) which has provided the majority of the grass cover following the seeding treatment. The invasive annual grass species cheatgrass (*Bromus tectorum*) initially increased in abundance following the treatment, but subsequently has decreased and was not sampled in 2012. Other common grass species sampled on the site are blue grama (*Bouteloua gracilis*) and sand dropseed (*Sporobolus cryptandrus*). Seeded grass species sampled on the site are crested wheatgrass, western wheatgrass (*A. smithii*), Indian ricegrass (*Oryzopsis hymenoides*), and sand dropseed, though Indian ricegrass was sample on the site prior to treatment. Forbs are not overly abundant or diverse on the site, and are dominated by weedy annual species. Perennial forbs have been rare on the site over the sample site. Russian thistle (*Salsola iberica*) dominated the site prior to the treatment and has decreased over the sample period.

Soil: The soil is classified as part of the Barx-Radnik, moist-Progresso, dry complex component and is likely part of Barx component, which occurs on alluvial flats, valleys, and fans remnants. The parent material consists of alluvium. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a moderately alkaline soil reaction (pH 7.9) (Table - Soil Analysis Data). Bare ground cover is high, though there is a high amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004, 2007, and 2012 despite some evidence of overland flow.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: Browse species are rare on the site. The seeded browse species Wyoming big sagebrush and fourwing saltbush were both sampled on the site following the treatment in low abundance.

Grasses: The sum of nested frequency of perennial grasses increased substantially, and cover increased from less than 1% to 12%. Crested wheatgrass was sampled at 11% cover following the treatment. Blue grama increased in nested frequency, though cover remained similar at 1%. Cheatgrass increased significantly in nested frequency and cover increased to 2%.

Forbs: Perennial forbs increased substantially, though cover remained similar at 1%. The sum of nested frequency of annual forbs decreased increased 70%, though cover decreased from 28% to 26%. Russian thistle decreased significantly in nested frequency and cover decreased from 24% to 1%.

Trend Assessments

Browse:

- **2007 to 2012 - stable (0):** Browse species remained rare on the site. Sagebrush density increased from 40 plants/acre to 80 plants/acre.

Grass:

- **2007 to 2012 - up (+2):** The sum of nested frequency of perennial grasses remained similar, though cover decreased to 7%. Blue grama increased in nested frequency, and cover increased to 2%. Crested wheatgrass decreased in nested frequency and cover decreased to 3%. Cheatgrass decreased on the site and was not sample on the site in 2012.

Forb:

- **2007 to 2012 - stable (0):** Perennial forbs decreased substantially on the site and became rare on the site. Annual forbs decreased 83% and cover decreased to 4%.

SEED MIX--

Management unit 25R, Study no: 5

Project Name: Circle Cliffs							
WRI Database #: PDB							
Application: Drill		Acres: 1080		Application: Drill		Acres: 1100	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	*Crested Wheatgrass 'Nordan'	2660	2.46	B	Sagebrush, Wyoming	280	0.25
G	*Great Basin Wildrye 'Megnar'	344	0.32	B	*Sagebrush, Wyoming	280	0.25
G	*Indian Ricegrass 'Rimrock'	1330	1.23	B	*Winterfat	340	0.31
G	*Sand Dropseed	639	0.59	Total Pounds:		900	0.82
G	*Siberian Wheatgrass 'P27'	2660	2.46				
G	*Thickspike Wheatgrass 'Critana'	100	0.09				
G	*Thickspike Wheatgrass 'Schwendimar'	96	0.09				
G	*Western Wheatgrass 'Ariba'	3985	3.69				
F	*Alfalfa 'Ladak+'	270	0.25				
F	Alfalfa 'Nomad'	300	0.28				
F	Blue Flax 'Appar'	98	0.09				
F	Munroe Globemallow	69	0.06				
F	Palmer Penstemon	48	0.04				
F	*Small Burnett 'Delar'	90	0.08				
F	*Yellow Sweetclover 'Madrid'	580	0.54				
B	*Antelope Bitterbrush	96	0.09				
B	Bitterbrush	100	0.09				
B	*Fourwing Saltbush	1330	1.23				
B	Green Ephedra	51	0.05				
Total Pounds:		14846	13.75				

*Seed provided by the BLM

Trend Summary

HERBACEOUS TRENDS--

Management unit 25R, Study no: 5

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	<i>Agropyron cristatum</i>	a ⁻	c ²²⁸	b ¹³¹	-	10.53	3.32
G	<i>Agropyron smithii</i>	-	-	17	-	-	.17
G	<i>Bouteloua gracilis</i>	a ¹⁰	b ³⁰	c ⁴⁶	.24	.60	1.53
G	<i>Bromus tectorum</i> (a)	a ⁻	b ¹⁰⁶	a ⁻	.00	1.68	-
G	<i>Oryzopsis hymenoides</i>	a ⁴	b ¹⁷	ab ¹³	.00	.65	.27
G	<i>Sitanion hystrix</i>	-	2	-	-	.15	-
G	<i>Sporobolus cryptandrus</i>	a ⁻	a ⁻	b ⁵⁰	-	-	1.47
G	<i>Vulpia octoflora</i> (a)	-	13	2	-	.07	.03
Total for Annual Grasses		0	119	2	0.00	1.75	0.03
Total for Perennial Grasses		14	277	257	0.24	11.94	6.78
Total for Grasses		14	396	259	0.25	13.70	6.81
F	<i>Alyssum alyssoides</i> (a)	-	2	2	-	.00	.00
F	<i>Calochortus nuttallii</i>	-	-	-	-	.00	-
F	<i>Chenopodium fremontii</i> (a)	b ³³	a ²	a ⁻	.22	.00	-
F	<i>Chenopodium leptophyllum</i> (a)	7	-	-	.04	-	-
F	<i>Chorispora tenella</i> (a)	a ⁴⁴	c ¹⁸⁷	b ¹⁰⁴	.91	6.71	2.29
F	<i>Cryptantha</i> sp.(a)	-	-	5	-	-	.04
F	<i>Descurainia pinnata</i> (a)	a ⁴	b ²¹¹	a ⁷	.01	3.04	.04
F	<i>Gilia</i> sp. (a)	2	3	-	.03	.00	-
F	<i>Helianthus annuus</i> (a)	b ²⁴	a ⁻	a ⁻	.14	-	-
F	<i>Lactuca serriola</i> (a)	-	3	-	-	.00	-
F	<i>Lappula occidentalis</i> (a)	b ¹⁹⁵	c ³³⁸	a ²	3.10	6.29	.00
F	<i>Machaeranthera canescens</i>	a ⁻	b ¹⁵⁹	a ⁻	-	.75	-
F	<i>Mentzelia albicaulis</i> (a)	b ³⁴	a ⁻	a ⁻	.27	-	-
F	<i>Plantago patagonica</i> (a)	a ²³	b ³⁸⁰	a ¹⁵	.07	9.32	.11
F	<i>Ranunculus testiculatus</i> (a)	-	2	5	-	.00	.02
F	<i>Salsola iberica</i> (a)	c ⁴⁰⁴	b ¹⁷⁷	a ⁸⁰	23.60	.56	1.27
F	<i>Sphaeralcea grossulariifolia</i>	b ⁴⁴	b ⁷⁴	a ¹	.67	.67	.00
Total for Annual Forbs		770	1305	220	28.41	25.96	3.79
Total for Perennial Forbs		44	233	1	0.67	1.43	0.00
Total for Forbs		814	1538	221	29.09	27.39	3.79

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 25R, Study no: 5

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	0	2	3	-	.00	.63
B	Chrysothamnus nauseosus	0	0	1	-	-	-
B	Chrysothamnus viscidiflorus	1	1	0	.15	.38	-
B	Opuntia sp.	1	0	0	-	-	-
Total for Browse		2	3	4	0.15	0.38	0.63

CANOPY COVER, LINE INTERCEPT--

Management unit 25R, Study no: 5

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	-	-	.31

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 25R, Study no: 5

Species	Average leader growth (in)
Artemisia tridentata wyomingensis	'12 1.4

BASIC COVER--

Management unit 25R, Study no: 5

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	30.74	37.92	11.83
Rock	.03	.03	.02
Pavement	3.42	1.09	.52
Litter	10.07	30.89	51.47
Cryptogams	0	0	.00
Bare Ground	63.43	41.94	43.96

SOIL ANALYSIS DATA --

Management unit 25R, Study no: 5, Study Name: Lamp Stand

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
11.7	7.9	54.3	23.5	22.2	0.8	10.9	534.4	1.0

PELLET GROUP DATA--
 Management unit 25R, Study no: 5

Type	Quadrat Frequency		
	'04	'07	'12
Rabbit	46	86	1
Elk	-	17	13
Deer	-	-	1
Cattle	6	2	-

Days use per acre (ha)		
'04	'07	'12
-	-	-
-	16 (40)	9 (22)
-	-	-
-	4 (10)	6 (14)

BROWSE CHARACTERISTICS--
 Management unit 25R, Study no: 5

		Age class distribution					Utilization		
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>									
04	0	0	0	0	-	0	0	0	-/-
07	40	100	0	0	20	0	0	0	-/-
12	80	25	25	50	-	0	50	75	19/26
<i>Atriplex canescens</i>									
04	0	0	0	-	-	0	0	0	33/30
07	0	0	0	-	-	0	0	0	29/29
12	0	0	0	-	-	0	0	0	31/53
<i>Chrysothamnus nauseosus</i>									
04	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	-/-
12	20	0	0	100	-	0	0	100	26/34
<i>Chrysothamnus viscidiflorus</i>									
04	20	0	100	-	-	0	0	0	13/14
07	20	0	100	-	-	0	0	0	33/40
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
04	20	0	100	-	-	0	0	0	4/22
07	0	0	0	-	-	0	0	0	4/23
12	0	0	0	-	-	0	0	0	5/19

SAND LEDGES - TREND STUDY NO. 25R-9
[Project #2334](#)

Site Information

Site Description: The study is located approximately five miles east of Glenwood within an old pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining. The study was established in 2012 on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) to monitor a pinyon and juniper reduction project. The study occurs on the SITLA Gypsum allotment. In 2013, approximately 2,090 acres of pinyon and juniper trees will be lop and scattered. The treatment area will not be seed. The objectives of the project are to decrease pinyon and juniper cover, increase herbaceous understory, and increase palatable browse cover (WRI Database 2013). Elk, deer, and cattle pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon and juniper are the dominant browse species, and provide the majority of the canopy cover on the site, prior to treatment (Table - Canopy Cover). The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*), winterfat (*Ceratoides lanata*), and antelope bitterbrush (*Purshia tridentata*). Mountain big sagebrush is semi-sparse, moderately used populations with low decadence and good vigor within the population. Recruitment of young sagebrush plants is considered good within the population. Antelope bitterbrush are scattered across the site in low to moderate abundance with high decadence and moderate vigor within the population. Recruitment of young bitterbrush plants is poor on the site (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The dominant grass species are intermediate wheatgrass (*Agropyron intermedium*) and bluebunch wheatgrass (*A. spicatum*), which provided the majority of the grass cover prior to treatment. The invasive grass species cheatgrass (*Bromus tectorum*) was sampled in moderate abundance on the site in 2012. Forbs are not abundant, but are somewhat diverse on the site. No single forb species was dominant on the site prior to treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Pass Canyon-Red butte complex and is likely part of the Red Butte component, which is found on hills. The parent material consists of colluvium and/or slope alluvium derived from igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictive layer. The soil surface texture is a very gravelly sandy loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of pavement and rock and a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 25R, Study no: 9

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Agropyron cristatum</i>	28	.48
G	<i>Agropyron intermedium</i>	96	1.80
G	<i>Agropyron spicatum</i>	92	2.92
G	<i>Bromus inermis</i>	6	.04
G	<i>Bromus tectorum</i> (a)	195	.89
G	<i>Elymus junceus</i>	6	.03

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	Oryzopsis hymenoides	5	.03
G	Poa secunda	40	.24
Total for Annual Grasses		195	0.89
Total for Perennial Grasses		273	5.57
Total for Grasses		468	6.46
F	Arabis sp.	11	.03
F	Aster sp.	8	.04
F	Astragalus lentiginosus	11	.02
F	Chaenactis douglasii	4	.01
F	Descurainia pinnata (a)	1	.00
F	Euphorbia sp.	1	.00
F	Lactuca serriola (a)	2	.00
F	Penstemon sp.	4	.01
F	Polygonum douglasii (a)	15	.02
F	Senecio multilobatus	1	.00
F	Streptanthus cordatus	1	.00
Total for Annual Forbs		18	0.03
Total for Perennial Forbs		41	0.12
Total for Forbs		59	0.16

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 25R, Study no: 9

T y p e	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata vaseyana	27	3.99
B	Ceratoides lanata	1	-
B	Chrysothamnus nauseosus	2	.15
B	Juniperus osteosperma	18	14.45
B	Pinus edulis	6	5.73
B	Purshia tridentata	7	2.44
Total for Browse		61	26.77

CANOPY COVER, LINE INTERCEPT--

Management unit 25R, Study no: 9

Species	Percent Cover '12
Artemisia tridentata vaseyana	6.35
Chrysothamnus nauseosus	.48
Juniperus osteosperma	14.20
Pinus edulis	6.28
Purshia tridentata	4.11

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 25R, Study no: 9

Species	Average leader growth (in) '12
Artemisia tridentata vaseyana	1.8
Purshia tridentata	6.4

POINT-QUARTER TREE DATA--
Management unit 25R, Study no: 9

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus osteosperma	240	13.4
Pinus edulis	65	5.0

BASIC COVER--
Management unit 25R, Study no: 9

Cover Type	Average Cover % '12
Vegetation	31.43
Rock	16.21
Pavement	38.08
Litter	34.80
Cryptogams	.62
Bare Ground	5.18

PELLET GROUP DATA--
Management unit 25R, Study no: 9

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	5	-
Elk	1	7 (18)
Deer	2	5 (13)
Cattle	-	2 (4)

BROWSE CHARACTERISTICS--
Management unit 25R, Study no: 9

		Age class distribution					Utilization			
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata vaseyana</i>										
12	840	33	57	10	40	26	0	2	21/33	
<i>Ceratoides lanata</i>										
12	20	0	100	-	-	100	0	0	-/-	
<i>Chrysothamnus nauseosus</i>										
12	40	0	100	-	-	0	0	50	39/54	
<i>Juniperus osteosperma</i>										
12	380	21	79	-	-	5	0	0	-/-	
<i>Opuntia sp.</i>										
12	0	0	0	-	-	0	0	0	6/15	
<i>Pediocactus simpsonii</i>										
12	0	0	0	-	-	0	0	0	6/11	
<i>Pinus edulis</i>										
12	120	50	50	-	-	0	0	0	-/-	
<i>Purshia tridentata</i>										
12	140	0	71	29	-	0	43	14	29/62	

ALTON/MILL CREEK LS - TREND STUDY NO. 27R-16-12

Vegetation Type: Perennial Grass

Range Type: Substantial Deer Winter, Year-long Elk Substantial

NRCS Ecological Site Description: Upland Loam (Mountain Big Sagebrush), R035XY308UT

Land Ownership: Private

Elevation: 6,221 ft (1,896 m)

Aspect: South

Slope: 6%

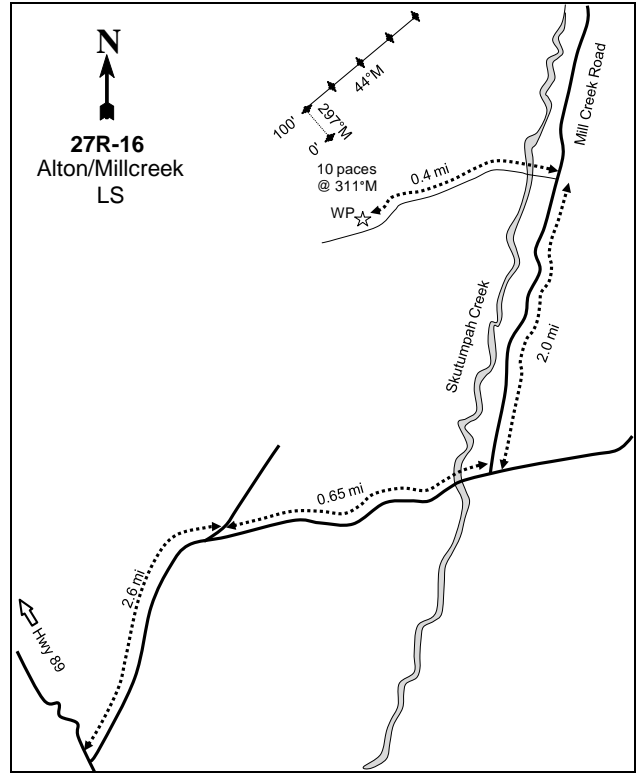
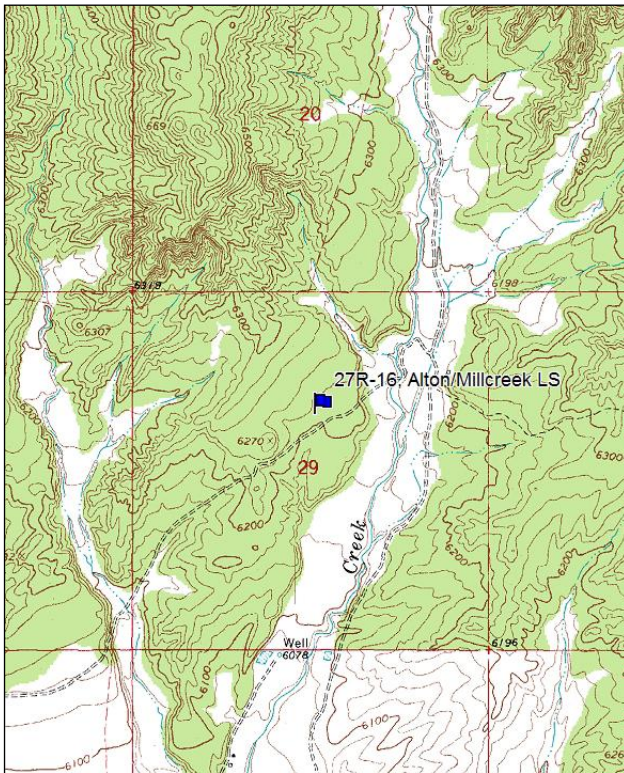
Transect bearing: 297° magnetic (Line 1), 44° magnetic (Line 2-5)

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions: From the junction of US 89 and 300 north (Glendale Bench Road) in Glendale, drive east on 300 north for 14.9 miles to a fork or a road going northeast (there is a sign that says Deer Spring Ranch and Cannonville). Turn left and drive 2.6 miles to fork with a sign reading “Deer Spring Ranch”. Stay right and drive 0.65 miles to a road on the left with a stop sign. Turn left (north) and drive 2.0 miles passing two cattle guards to a fork. Turn left (west) (far left of three-way fork) on a two track road and drive 0.2 miles through a wash to a fork. Stay right after the wash and drive another 0.2 miles up a hill to the witness post on the right (north) side of the road. From the witness post, walk 35 paces at 311°M to the 0-foot stake. The 0-foot stake is marked with browse tag #69.

Map Name: Skutumpah Creek

Diagrammatic Sketch:



Township: 40S Range: 4W Section: 29

GPS: NAD 83, UTM 12S 381869 E 4129728 N

Site Information

Site Description: The study is located approximately sixteen miles east of Orderville within a treated pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established in 2005 on private property to monitor the effects of a pinyon and juniper reduction project. The study occurs on the Bureau of Land Management (BLM) Mill Creek allotment. Originally the study was proposed as a lop and scatter treatment but the study was not treated by a lop and scatter treatment. The study site was treated by another treatment sometime following the 2005 sample year. It appears the treatment occurred in 2009-2011. The study site was treated by pushing pinyon and juniper trees with a dozer into piles, burning the piles, and seeding. Several seeded species were sampled on the site following the treatment in 2012. The specific seed mix for the site was unavailable. Following the treatment in 2012, part of the study transect was not treated and as a result the study transect was moved to be within the treatment area. Elk and deer pellet groups were sampled in low abundance on the site in 2005 and 2012. Cattle pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: Following the treatment, browse species have been uncommon on the site. The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*), fourwing saltbush (*Atriplex canescens*), green ephedra (*Ephedra viridis*), forage kochia (*Kochia prostrata*), and antelope bitterbrush (*Purshia tridentata*) (Table - Browse Characteristics). Pinyon and juniper were the dominant browse species, and provided the majority of the canopy cover on the site, prior to treatment (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species sampled on the site is intermediate wheatgrass (*Agropyron intermedium*), which accounted for nearly half the grass cover following the treatment. Other common grass species sampled on the site are crested wheatgrass (*A. cristatum*), bluebunch wheatgrass (*Agropyron spicatum*), smooth brome (*Bromus inermis*), and Indian ricegrass (*Oryzopsis hymenoides*). The invasive annual grass species cheatgrass was sampled on the site following the treatment in low abundance. Only two perennial grass species were sampled on the site prior to the treatment and following the treatment there were several seed species sampled on the site. Forbs are moderately abundant and fairly diverse on the site. Forb species richness increased on the site following the treatment. Prior to treatment annual forbs were dominant (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a slightly acidic soil reaction (pH 6.3) (Table - Soil Analysis Data). Bare ground cover is high, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

Pre vs. Three Years Post Treatment, 2005 vs. 2012

Browse: Browse species are rare on the site.

Grasses: The sum of nested frequency of perennial grasses increased substantially, and cover increased from less than 1% to 21%. Intermediate wheatgrass, crested wheatgrass, bluebunch wheatgrass, smooth brome, and Indian ricegrass were sampled at 9%, 3%, 2%, 4%, and 3% cover following the treatment, respectively.

Forbs: Perennial forbs remained similar in nested frequency, and cover remained similar at 2%. The sum of nested frequency of annual forbs decreased increased 60%, and cover decreased from 6% to 2%.

Trend Summary

HERBACEOUS TRENDS--

Management unit 27R, Study no: 16

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
G	Agropyron cristatum	a-	b74	-	2.73
G	Agropyron intermedium	a-	b212	-	9.39
G	Agropyron spicatum	a-	b39	-	2.00
G	Bouteloua gracilis	1	-	.00	-
G	Bromus inermis	a-	b108	-	3.54
G	Bromus tectorum (a)	a-	b20	-	.12
G	Elymus junceus	-	2	-	.15
G	Festuca ovina	-	5	-	.00
G	Oryzopsis hymenoides	a-	b33	-	3.22
G	Poa secunda	-	3	-	.03
G	Sitanion hystrix	1	-	.00	-
G	Sporobolus cryptandrus	a-	b12	-	.22
G	Stipa comata	-	4	-	.00
G	Vulpia octoflora (a)	84	119	.24	.96
Total for Annual Grasses		84	139	0.24	1.08
Total for Perennial Grasses		2	492	0.00	21.30
Total for Grasses		86	631	0.25	22.39
F	Astragalus sp.	-	3	-	.06
F	Cryptantha sp.	7	-	.01	-
F	Cryptantha sp.(a)	-	4	-	.01
F	Dalea searlsiae	3	2	.15	.00
F	Descurainia pinnata (a)	1	8	.00	.02
F	Draba sp. (a)	3	-	.03	-
F	Erigeron sp.	-	1	-	.03
F	Eriogonum cernuum (a)	39	32	.24	.93
F	Eriogonum umbellatum	b86	a3	1.77	.03
F	Gayophytum ramosissimum(a)	b96	a46	.25	.40
F	Gilia sp. (a)	b295	a-	5.06	-
F	Lactuca serriola (a)	a-	b27	-	.22
F	Lepidium densiflorum (a)	-	2	-	.00
F	Lotus utahensis	a-	b11	-	.30
F	Lupinus argenteus	-	1	-	.00
F	Machaeranthera canescens	a-	b8	-	.33
F	Medicago sativa	-	2	-	.00
F	Microsteris gracilis (a)	b12	a1	.66	.00
F	Phlox longifolia	-	2	-	.00
F	Polygonum douglasii (a)	b48	a6	.17	.01
F	Salsola iberica (a)	a-	b38	-	.78
F	Sanguisorba minor	-	1	-	.00
F	Sphaeralcea parvifolia	a-	b53	-	1.51
F	Tragopogon dubius (a)	-	4	-	.01

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
	Total for Annual Forbs	494	168	6.43	2.41
	Total for Perennial Forbs	96	87	1.94	2.29
	Total for Forbs	590	255	8.38	4.71

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 27R, Study no: 16

Type	Species	Strip Frequency		Average Cover %	
		'05	'12	'05	'12
B	Artemisia tridentata vaseyana	9	2	.00	.15
B	Juniperus osteosperma	10	0	6.69	-
B	Opuntia sp.	2	1	-	.15
B	Pinus edulis	4	0	5.26	-
B	Purshia tridentata	0	1	-	-
	Total for Browse	25	4	11.95	0.30

CANOPY COVER, LINE INTERCEPT--

Management unit 27R, Study no: 16

Species	Percent Cover	
	'05	'12
Artemisia tridentata vaseyana	.36	.31
Juniperus osteosperma	15.36	-
Opuntia sp.	-	.01
Pinus edulis	9.46	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 27R, Study no: 16

Species	Average leader growth (in)	
	'05	'12
Artemisia tridentata vaseyana	1.1	1.9

POINT-QUARTER TREE DATA--

Management unit 27R, Study no: 16

Species	Trees per Acre		Average diameter (in)	
	'05	'12	'05	'12
Juniperus osteosperma	268	21	8.2	0.8
Pinus edulis	46	<18	3.5	-

BASIC COVER--

Management unit 27R, Study no: 16

Cover Type	Average Cover %	
	'05	'12
Vegetation	18.45	28.84
Rock	.00	.04
Pavement	.07	.07
Litter	25.70	25.51
Cryptogams	16.25	0
Bare Ground	54.39	57.83

SOIL ANALYSIS DATA --

Management unit 27R, Study no: 16, Study Name: Alton/Millcreek Lop and Scatter

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
17.7	6.3	48.4	41.8	9.8	0.6	9.7	64.0	0.2

PELLET GROUP DATA--

Management unit 27R, Study no: 16

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'12	'05	'12
Rabbit	35	9	-	-
Elk	1	1	2 (5)	5 (13)
Deer	6	6	8 (20)	4 (10)
Cattle	-	-	-	4 (11)

BROWSE CHARACTERISTICS--

Management unit 27R, Study no: 16

		Age class distribution					Utilization		
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>									
05	180	0	22	78	20	0	22	56	19/19
12	40	0	100	0	-	0	0	0	18/16
<i>Atriplex canescens</i>									
05	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	20/15
<i>Ephedra viridis</i>									
05	0	0	0	-	-	0	0	0	26/30
12	0	0	0	-	-	0	0	0	30/21
<i>Gutierrezia sarothrae</i>									
05	0	0	0	-	-	0	0	0	9/7
12	0	0	0	-	-	0	0	0	-/-

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Juniperus osteosperma</i>									
05	220	9	91	-	20	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	15/18
<i>Opuntia sp.</i>									
05	40	0	100	-	-	0	0	0	3/12
12	40	0	100	-	-	0	0	0	3/6
<i>Pinus edulis</i>									
05	120	67	33	-	60	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
05	0	0	0	-	-	0	0	0	26/50
12	20	100	0	-	-	100	0	0	7/14

HATCH BENCH - TREND STUDY NO. 27R-20-12

Vegetation Type: Pinyon Pine and Utah Juniper

Range Type: Crucial Deer Summer, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Pinyon-Utah Juniper\), R047XB333UT](#)

Land Ownership: SITLA

Elevation: 7,511 ft (2,289 m)

Aspect: Northwest

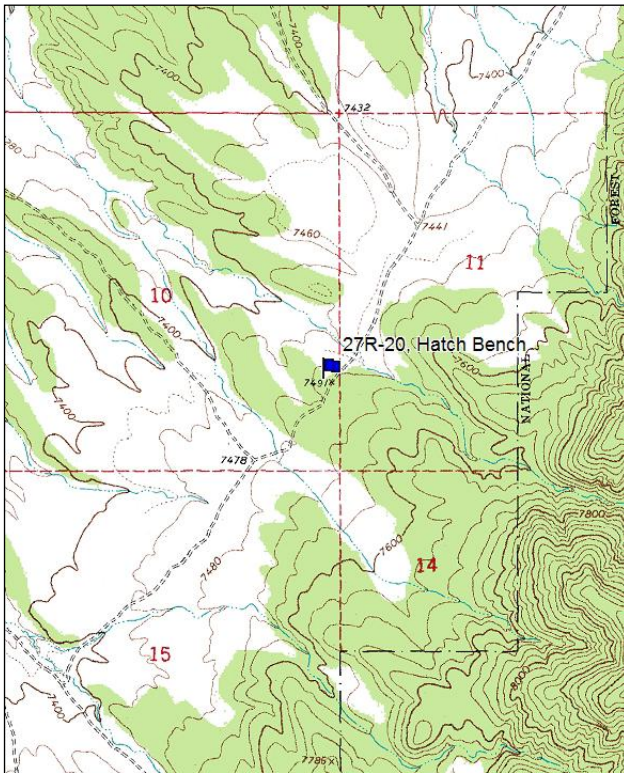
Slope: 6%

Transect bearing: 300° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

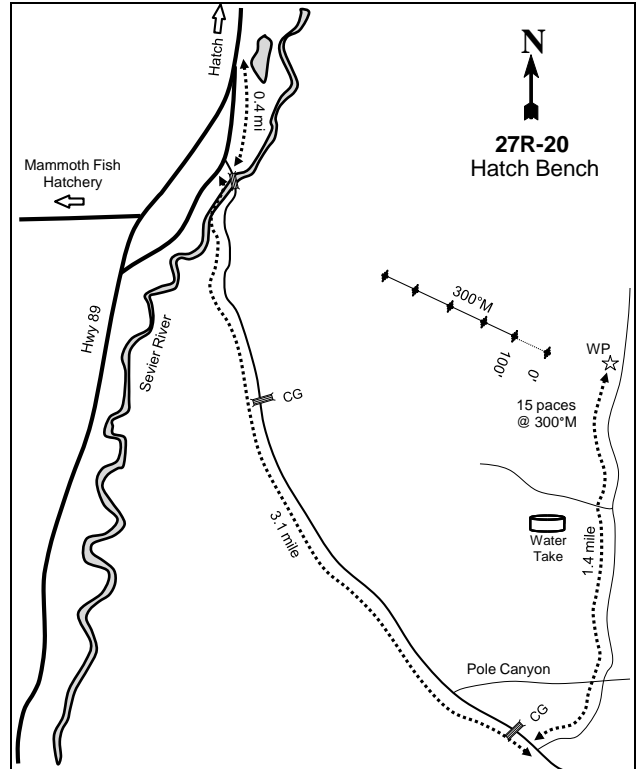
Directions: From Hwy 89 drive 0.4 miles and turn left (east). Continue 3.1 miles and turn left. Travel for 1.4 miles to the witness post on the right. The 0-foot stake is 15 paces at 300°M. There is no browse tag.

Map Name: George Mountain



Township: 37S Range: 5W Section: 10

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 376709 E 4162864 N

HATCH BENCH - TREND STUDY NO. 27R-20
[Project #2069](#)

Site Information

Site Description: The study is located approximately three and half miles southeast of Hatch within a pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) woodland. The study was established in 2012 on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA) to monitor pinyon and juniper reduction project. In the fall of 2012, approximately 1,200 acres were two-way Ely chained and a seed mix of grass forb and browse species was aerially seeded prior to the second pass of the chain. The objectives of the project are to decrease pinyon and juniper cover, increase herbaceous understory, and increase palatable browse cover (WRI Database 2013). Elk pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data)

SEED MIX--

Management unit 27R, Study no: 20

Project Name: Hatch Bench Vegetation Enhancement							
WRI Database #: 2069							
Application: Aerial		Acres: 1134		Application: Aerial		Acres: 1134	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone'	600	0.53	F	Small Burnet 'Delar'	200	0.18
G	Canby Bluegrass 'Canbar'	550	0.49	F	Arrowleaf Balsamroot	40	0.04
G	Crested Wheatgrass 'Douglas'	550	0.49	B	Bitterbrush	225	0.20
G	Crested Wheatgrass 'Hycrest II'	600	0.53	B	Green Ephedra	120	0.11
G	Indian Ricegrass 'Rimrock'	850	0.75	Total Pounds:		585	0.52
G	Tall Wheatgrass 'Alkar'	355	0.31	PLS Pounds:			0.45
G	Tall Wheatgrass 'Alkar'	775	0.68				
F	Alfalfa 'Ladak DL'	2250	1.98				
F	Cicer Milkvetch 'Lutana'	1715	1.51				
F	Palmer Penstemon	275	0.24				
F	Small Burnet 'Delar'	2100	1.85				
F	Western Yarrow 'Eagle Mountain'	115	0.10				
F	Yellow Sweetclover	600	0.53				
Total Pounds:		11335	10.00				
PLS Pounds:			8.72				

Browse: Pinyon and juniper are the dominant browse species, and provides the majority of the canopy cover on the site, prior to treatment (Table - Canopy Cover). The preferred browse species on the site are black sagebrush (*Artemisia nova*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), and antelope bitterbrush (*Purshia tridentata*). Black sagebrush is semi-sparse, moderately used populations with high decadence and poor vigor within the population. Recruitment of young sagebrush plants is considered poor within the population (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: The herbaceous understory is sparse. Grasses are rare on the site. Only Indian ricegrass (*Oryzopsis hymenoides*) and bottlebrush squirreltail (*Sitanion hystrix*) were sampled on the site prior to treatment in very low abundance. Forbs are also rare on the site (Table - Herbaceous Trend).

Soil: The soil is classified as part of the Tirdell component, which is found on alluvial fans. The parent material consists of alluvium derived from igneous rock and sedimentary rock. The soils within this

classification are characterized as deep, well drained, and with a moderately high permeable restrictive layer (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of pavement and a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as critical in 2012, due to surface litter, surface rock movement, pedestalling, flow patterns, rills, gully formation, and soil movement.

Trend Summary

HERBACEOUS TRENDS--

Management unit 27R, Study no: 20

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Oryzopsis hymenoides</i>	-	.00
G	<i>Sitanion hystrix</i>	1	.00
Total for Annual Grasses		0	0
Total for Perennial Grasses		1	0.01
Total for Grasses		1	0.01
F	<i>Arabis</i> sp.	2	.01
F	<i>Astragalus argophyllus</i>	10	.07
F	<i>Chaenactis douglasii</i>	8	.01
F	<i>Cryptantha</i> sp.	6	.03
F	<i>Eriogonum racemosum</i>	3	.03
F	<i>Euphorbia albomarginata</i>	18	.09
F	<i>Lygodesmia spinosa</i>	2	.01
F	<i>Penstemon comarrhenus</i>	1	.00
F	<i>Senecio multilobatus</i>	7	.04
F	<i>Streptanthus cordatus</i>	4	.01
Total for Annual Forbs		0	0
Total for Perennial Forbs		61	0.32
Total for Forbs		61	0.32

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 27R, Study no: 20

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	<i>Artemisia nova</i>	33	1.65
B	<i>Gutierrezia sarothrae</i>	2	
B	<i>Juniperus scopulorum</i>	3	2.50
B	<i>Opuntia</i> sp.	1	.15
B	<i>Pinus edulis</i>	24	11.00
B	<i>Symphoricarpos oreophilus</i>	2	
B	<i>Yucca</i> sp.	4	.09
Total for Browse		69	15.41

CANOPY COVER, LINE INTERCEPT--

Management unit 27R, Study no: 20

Species	Percent Cover '12
Artemisia nova	1.60
Juniperus scopulorum	2.16
Opuntia sp.	.18
Pinus edulis	27.41
Yucca sp.	.03

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 27R, Study no: 20

Species	Average leader growth (in) '12
Artemisia nova	0.4
Purshia tridentata	0.8

POINT-QUARTER TREE DATA--

Management unit 27R, Study no: 20

Species	Trees per Acre '12	Average diameter (in) '12
Juniperus scopulorum	63	5.9
Pinus edulis	666	2.9
Pinus ponderosa	<18	8.9

BASIC COVER--

Management unit 27R, Study no: 20

Cover Type	Average Cover % '12
Vegetation	17.35
Rock	.74
Pavement	29.22
Litter	37.97
Cryptogams	2.89
Bare Ground	31.16

PELLET GROUP DATA--

Management unit 27R, Study no: 16

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Elk	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 27R, Study no: 20

		Age class distribution					Utilization			
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia nova</i>										
12	1100	4	47	49	-	60	2	31	12/17	
<i>Cowania mexicana stansburiana</i>										
12	0	0	0	-	-	0	0	0	-/-	
<i>Gutierrezia sarothrae</i>										
12	40	0	100	-	-	0	0	0	7/6	
<i>Juniperus scopulorum</i>										
12	60	100	0	-	40	0	0	0	-/-	
<i>Opuntia sp.</i>										
12	20	0	100	-	-	0	0	100	3/8	
<i>Pinus edulis</i>										
12	560	54	39	7	200	0	0	14	-/-	
<i>Purshia tridentata</i>										
12	0	0	0	-	-	0	0	0	14/29	
<i>Symphoricarpos oreophilus</i>										
12	40	0	100	-	-	0	0	0	7/15	
<i>Yucca sp.</i>										
12	140	57	43	-	-	0	0	0	9/10	

BUCKSKIN LOP AND SCATTER - TREND STUDY NO. 27R-21-12

Vegetation Type: Utah Juniper

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Upland Loam (Mountain Big Sagebrush), R035XY308UT

Land Ownership: BLM

Elevation: 6,066 ft (1,849 m)

Aspect: North

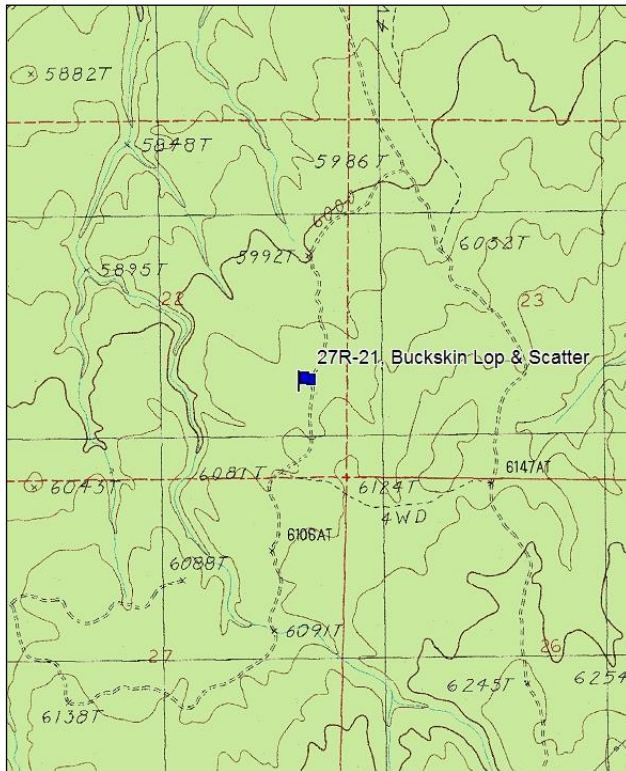
Slope: 4%

Transect bearing: 280° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

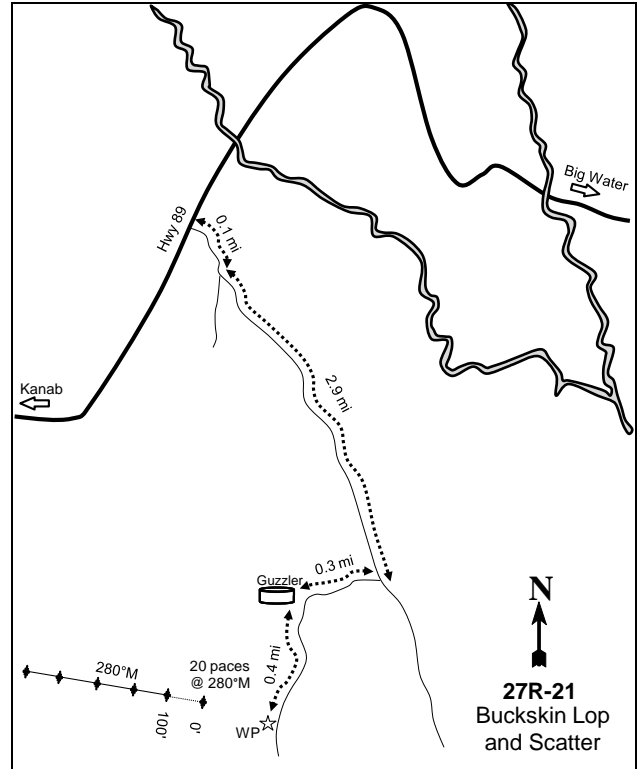
Directions: From Hwy 89 drive south 0.1 miles and stay left and drive 2.9 miles and turn right. Drive 0.3 miles to a guzzler and stay left and drive 0.4 miles to a witness post on the right. The 0-foot stake is 20 paces 260°M. The 0-foot stake is not marked with a browse tag.

Map Name: Pine Hollow Canyon



Township: 43S Range: 3W Section: 22

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 401564 E 4101400 N

BUCKSKIN LOP AND SCATTER - TREND STUDY NO. 27R-21
[Project #2383](#)

Site Information

Site Description: The study is located approximately 23 miles east of Kanab within a treated pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established in 2012 on land administrated by the Bureau of Land Management (BLM) to monitor the effects of a pinyon and juniper reduction project. The study occurs on the BLM Mollies Nipple allotment. In 2013, approximately 630 acres were lop and scattered to remove pinyon and juniper trees. The treatment polygons changed and as a result the study will likely not be treated. The objectives of the project are to decrease pinyon and juniper cover, increase herbaceous understory, and increase palatable browse cover (WRI Database 2013). Deer and cattle pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Utah juniper is the dominant browse species, and provides the majority of the canopy cover on the site, prior to treatment (Table - Canopy Cover). The preferred browse species on the site are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), ephedra (*Ephedra viridis*), and slenderbush eriogonum (*Eriogonum microthecum*). Wyoming big sagebrush is moderately dense and moderately used populations with low decadence and good vigor within the population. Recruitment of young sagebrush plants is considered good within the population (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: The herbaceous understory is sparse. Grasses are rare on the site. Bottlebrush squirreltail (*Sitanion hystrix*) was the only perennial grass species sampled on the site prior to treatment in 2012. The invasive annual grass species cheatgrass was sampled in low abundance on the site. Forbs are also rare on the site (Table - Herbaceous Trend).

Soil: The soil is classified as part of the Timpoweap-Evpark-Atarque complex and is likely part of the Atarque component, which is found on plateaus, dip slopes on cuestas. The parent material consists of limestone residuum. The soils within this classification are characterized as moderately deep, well drained, and with a moderately high permeable restrictive layer. The soil surface texture is a gravelly fine sandy loam (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter and a moderate amount of vegetation and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012, due to surface litter, surface rock movement, pedestalling, flow patterns, rills, gully formation, and soil movement.

Trend Summary

HERBACEOUS TRENDS--
 Management unit 27R, Study no: 21

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	Bromus tectorum (a)	4	.01
G	Sitanion hystrix	16	.17
G	Vulpia octoflora (a)	32	.07
Total for Annual Grasses		36	0.08
Total for Perennial Grasses		16	0.17
Total for Grasses		52	0.25
F	Cryptantha sp.(a)	22	.08

Type	Species	Nested Frequency	Average Cover %
		'12	'12
F	Descurainia pinnata (a)	6	.01
F	Eriogonum umbellatum	24	.10
F	Holosteum umbellatum (a)	26	.06
F	Sphaeralcea parvifolia	1	.00
Total for Annual Forbs		54	0.15
Total for Perennial Forbs		25	0.10
Total for Forbs		79	0.26

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 27R, Study no: 21

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata wyomingensis	27	4.81
B	Cowania mexicana stansburiana	4	.88
B	Ephedra viridis	4	.09
B	Eriogonum microthecum	2	.00
B	Gutierrezia sarothrae	7	.03
B	Juniperus osteosperma	9	22.87
B	Opuntia sp.	6	-
Total for Browse		59	28.70

CANOPY COVER, LINE INTERCEPT--

Management unit 27R, Study no: 21

Species	Percent Cover '12
Artemisia tridentata wyomingensis	3.44
Cowania mexicana stansburiana	1.13
Ephedra viridis	.63
Gutierrezia sarothrae	.01
Juniperus osteosperma	31.71
Opuntia sp.	.01

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 27R, Study no: 21

Species	Average leader growth (in) '12
Artemisia tridentata wyomingensis	0.9
Cowania mexicana stansburiana	2.2

POINT-QUARTER TREE DATA--
Management unit 27R, Study no: 21

Species	Trees per Acre	Average diameter (in)
	'12	
Juniperus osteosperma	176	13.0
Pinus edulis	18	2.0

BASIC COVER--
Management unit 27R, Study no: 21

Cover Type	Average Cover %
	'12
Vegetation	28.07
Rock	.36
Pavement	13.74
Litter	48.70
Cryptogams	5.57
Bare Ground	29.90

PELLET GROUP DATA--
Management unit 27R, Study no: 21

Type	Quadrat Frequency	Days use per acre (ha)
	'12	
Rabbit	10	-
Deer	6	10 (25)
Cattle	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 27R, Study no: 21

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
12	7760	94	6	1	-	78	20	1	14/18
<i>Cowania mexicana stansburiana</i>									
12	100	80	20	-	20	60	0	20	49/46
<i>Ephedra viridis</i>									
12	160	13	75	13	-	0	0	0	29/47
<i>Eriogonum microthecum</i>									
12	40	0	100	-	20	50	50	0	3/6
<i>Gutierrezia sarothrae</i>									
12	180	11	67	22	-	0	0	22	6/8

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Juniperus osteosperma									
12	200	10	90	-	-	0	0	0	-/-
Opuntia sp.									
12	180	22	78	-	-	0	0	0	5/13
Opuntia whipplei									
12	0	0	0	-	-	0	0	0	7/15
Yucca sp.									
12	0	0	0	-	-	0	0	0	17/25

PINE POINT HANDTHIN - TREND STUDY NO. 27R-22-12

Vegetation Type: Pinyon Pine and Utah Juniper

Range Type: Substantial Deer Winter, Substantial Elk Year-long

NRCS Ecological Site Description: Upland Loam (Mountain Big Sagebrush), R035XY308UT

Land Ownership: BLM

Elevation: 6,400 ft (1951 m)

Aspect: Northeast

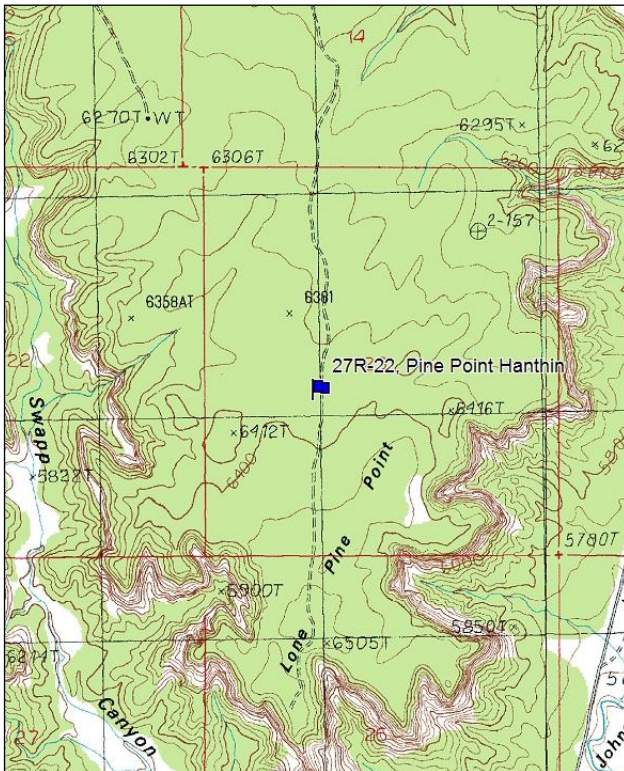
Slope: 4%

Transect bearing: 345° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

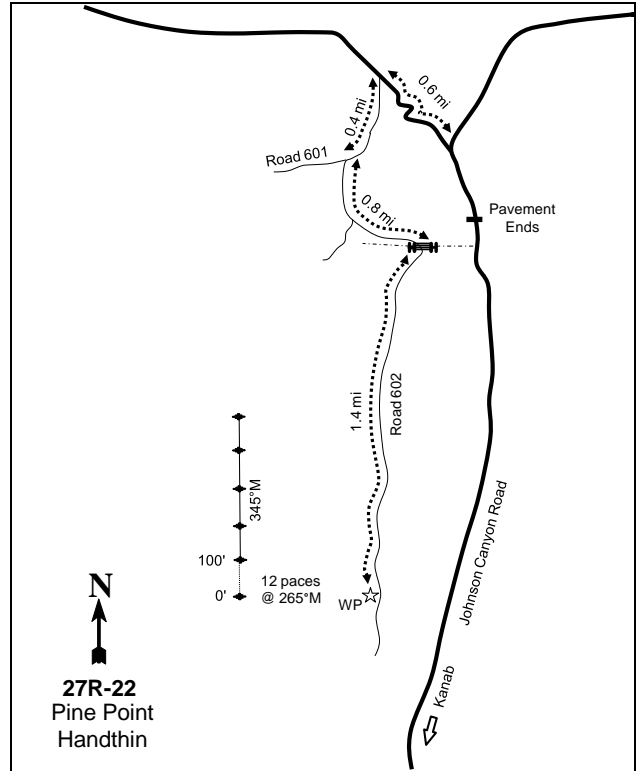
Directions: On Road 601, drive south 0.4 miles and turn onto Road 602. Drive 0.8 miles to a gate. Continue for 1.4 miles to a witness post on the left. The 0-foot stake is 12 paces at 265°M from the witness post. There is no browse tag.

Map Name: Cutler Point



Township: 41S Range: 5W Section: 23

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 376910 E 4121269 N

Site Information

Site Description: The study is located approximately fourteen and a half miles northeast of Kanab within an encroached mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). The study was established in 2012 on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon and juniper reduction project. The study occurs on the BLM Pine Point allotment. In the winter of 2012-2013 approximately 2,500 acres of pinyon and juniper trees were lop and scattered. Prior to the treatment, the project area was aerially seed with a seed mix of grass, forb, and browse species. The objectives of the project are remove pinyon and juniper trees, increase herbaceous understory, and increase palatable browse species on the site (WRI Database 2013). Deer, elk, and cattle were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Utah juniper is the dominant browse species, and provides the majority of the canopy cover on the site, prior to treatment. The preferred browse species sampled on the site are serviceberry (*Amelanchier utahensis*), mountain big sagebrush, green ephedra (*Ephedra viridis*), antelope bitterbrush (*Purshia tridentata*), and Gambel oak (*Quercus gambelii*). Mountain big sagebrush is the dominant preferred browse species and provides the majority of the palatable canopy cover on the site (Table - Canopy Cover). Mountain big sagebrush is a moderately dense, lightly used population with low decadence and good vigor within the population. Young sagebrush plants constituted the majority of the sagebrush population in 2012 (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are not overly abundant but are fairly diverse on the site. Intermediate wheatgrass (*Agropyron intermedium*) was the most abundant perennial grass species sampled on the site in 2012. The invasive grass species cheatgrass (*Bromus tectorum*) was sampled on the site in moderately low abundance on the site. Forbs are not abundant but are fairly diverse on the site. No single forb species were dominant on the site in 2012 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Parkelei-Plumasano, moist-Pinepoint complex and is likely part of the Pinepoint component, which is found on sand sheets on structural benches, plateaus. The parent material consists of eolian sand. The soils within this classification are characterized as deep, excessively drained, and with a very high permeable restrictive layer. The soil surface texture is a loamy fine sand (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012, due to surface litter, pedestalling around plants, flow patterns, and soil movement.

SEED MIX--

Management unit 27R, Study no: 22

Project Name: Pine Point Handthin			
WRI Database #: 2359			
Application: Aerial		Acres: 1280	
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Nordan'	2550	1.99
G	Indian Ricegrass 'Rimrock'	1900	1.48
G	Intermediate Wheatgrass 'Clarke'	2550	1.99
G	Russian Wildrye	1000	0.78
G	Sand Dropseed	200	0.16
G	Snake River Wheatgrass 'Secar'	1600	1.25
G	Thickspike Wheatgrass 'Critana'	1250	0.98
F	Alfalfa 'Ladak +'	650	0.51
F	Blue Flax 'Appar'	250	0.20
F	Small Burnet 'Delar'	1300	1.02
B	Bitterbrush	200	0.16
B	Forage Kochia	600	0.47
B	Fourwing Saltbush	200	0.16
Total Pounds:		14250	11.13
PLS Pounds:			9.94

Trend Summary

HERBACEOUS TRENDS--

Management unit 27R, Study no: 22

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	Agropyron intermedium	40	.98
G	Agropyron smithii	23	.50
G	Bromus tectorum (a)	99	1.04
G	Oryzopsis hymenoides	3	.06
G	Poa secunda	4	.00
G	Sitanion hystrix	13	.22
G	Sporobolus cryptandrus	32	.22
G	Stipa comata	48	.45
G	Vulpia octoflora (a)	237	4.42
Total for Annual Grasses		336	5.47
Total for Perennial Grasses		163	2.46
Total for Grasses		499	7.93
F	Arabis sp.	1	.00
F	Compositae	4	.01
F	Descurainia pinnata (a)	4	.01
F	Draba sp. (a)	3	.01
F	Erigeron pumilus	5	.07
F	Erigeron sp.	39	.12
F	Eriogonum racemosum	3	.03

Type	Species	Nested Frequency	Average Cover %
		'12	'12
F	Eriogonum umbellatum	2	.03
F	Euphorbia sp.	3	.00
F	Holosteum umbellatum (a)	1	.00
F	Lotus utahensis	7	.05
F	Penstemon comarrhenus	3	.03
F	Phlox austromontana	8	.04
F	Phlox longifolia	3	.01
F	Plantago patagonica (a)	4	.01
F	Senecio multilobatus	4	.01
F	Senecio spartioides	3	.00
Total for Annual Forbs		12	0.03
Total for Perennial Forbs		85	0.43
Total for Forbs		97	0.47

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 27R, Study no: 22

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata vaseyana	56	6.64
B	Ephedra viridis	1	.15
B	Gutierrezia sarothrae	1	.00
B	Juniperus osteosperma	8	7.45
B	Pinus edulis	1	1.51
B	Purshia tridentata	2	.03
Total for Browse		69	15.79

CANOPY COVER, LINE INTERCEPT--

Management unit 27R, Study no: 22

Species	Percent Cover
	'12
Artemisia tridentata vaseyana	6.50
Juniperus osteosperma	13.96
Pinus edulis	2.58
Purshia tridentata	.01

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 27R, Study no: 22

Species	Average leader growth (in)
	'12
Artemisia tridentata vaseyana	0.5

POINT-QUARTER TREE DATA--
Management unit 27R, Study no: 22

Species	Trees per Acre	Average diameter (in)
	'12	
Juniperus osteosperma	113	10.3
Pinus edulis	34	7.9

BASIC COVER--
Management unit 27R, Study no: 22

Cover Type	Average Cover %
	'12
Vegetation	22.70
Rock	.01
Litter	39.34
Cryptogams	.06
Bare Ground	56.43

PELLET GROUP DATA--
Management unit 27R, Study no: 22

Type	Quadrat Frequency	Days use per acre (ha)
	'12	
Rabbit	15	-
Elk	1	-
Deer	2	-
Cattle	-	4 (9)

BROWSE CHARACTERISTICS--
Management unit 27R, Study no: 22

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)	
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor		
Amelanchier utahensis										
12	0	0	0	-	-	0	0	0	209/308	
Artemisia tridentata vaseyana										
12	6600	87	12	1	1280	0	0	2	29/42	
Chrysothamnus viscidiflorus viscidiflorus										
12	0	0	0	-	-	0	0	0	29/36	
Ephedra viridis										
12	80	100	0	-	-	0	0	0	38/62	
Gutierrezia sarothrae										
12	20	100	0	-	-	0	0	0	-/-	
Juniperus osteosperma										
12	160	0	100	-	-	0	0	0	-/-	

		Age class distribution					Utilization			
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Opuntia sp.										
12	0	0	0	-	-	0	0	0	3/6	
Pinus edulis										
12	20	0	100	-	-	0	0	0	-/-	
Purshia tridentata										
12	40	0	0	100	-	50	0	50	24/56	
Quercus gambelii										
12	0	0	0	-	-	0	0	0	137/104	

SOUTH CANYON 2 - TREND STUDY NO. 28R-9-12

Vegetation Type: Pinyon Pine

Range Type: Substantial Deer Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Pinyon-Utah Juniper\), R047XB333UT](#)

Land Ownership: BLM

Elevation: 7,143 ft (2,177 m)

Aspect: North

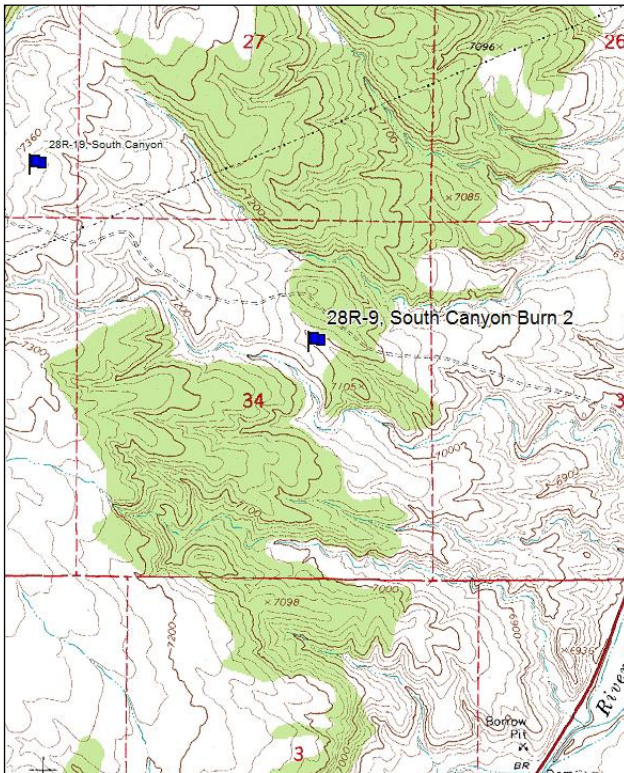
Slope: 3%

Transect bearing: 298° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

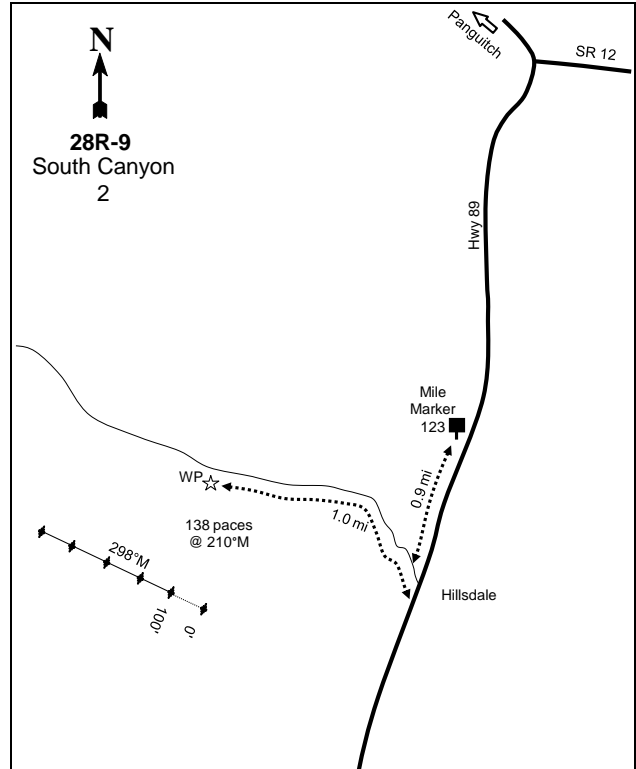
Directions: From Panguitch, drive west on US 89 to mile marker 123. Continue 0.9 miles to a dirt road on the left (west) with a cattle guard. Turn left and drive 1.0 miles to the witness post on the left (south) side of the road. From the witness post, walk 138 paces at 210°M to the 0-foot stake. The site is across drainage on the top of a ridge to the south of the road. The 0-foot stake is marked with browse tag #70.

Map Name: Hatch



Township: 35S Range: 5W Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 4176050 E 376355 N

SOUTH CANYON 2 - TREND STUDY NO. 28R-9
[Project #2311](#)

Site Information

Site Description: The study is located approximately one mile west of Hillsdale within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The Study was established in 2005 on land administrated by the Bureau of Land Management to monitor a pinyon and juniper reduction project. The study occurs on the BLM South Canyon allotment. Originally the study site was to be treated by a bullhog and prescribed fire as part of the South Canyon Rx Burn ([WRI Project #82](#)), but the project was cancelled. In the winter of 2012-2013, approximately 2,700 acres were treated with a bullhog to remove pinyon and juniper. Prior to treatment the project area was aerially seed with a seed mix of grass and forb species. The objectives of the project are remove pinyon and juniper trees, increase herbaceous understory, and increase palatable browse species on the site (WRI Database 2013). Deer, elk, and cattle were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon pine is the dominant browse species, and provides the majority of the canopy cover on the site, prior to treatment. The preferred browse species sampled on the site are black sagebrush (*Artemisia nova*), winterfat (*Ceratoides lanata*), and antelope bitterbrush (*Purshia tridentata*). Black sagebrush is the dominant preferred browse species and provides the majority of the palatable canopy cover on the site (Table - Canopy Cover). Black sagebrush is a moderately dense, lightly used population with moderately high decadence and poor vigor within the population (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are overly abundant or diverse on the site. The dominant grass species on the site is blue grama (*Bouteloua gracilis*) and has provided the majority of the grass cover on the site over the sample years. Other grass species have been rare on the site. Forbs are not abundant or diverse on the site. No single forb species has been dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Waltershow and Ipson components, which are found on hillslopes, fan terraces and mountain slopes. The parent material consists of alluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a slightly acidic soil reaction (pH 6.5) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of litter, pavement, and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012, due to surface litter, surface rock movement, pedestalling around plants, and soil movement.

Trend Assessments

Browse:

- **2007 to 2012 - stable (0):** The density of black sagebrush remained similar at 1,860 plants/acre, and canopy cover remained similar at 2%. Recruitment of young sagebrush plants to the population increased from 4% to 17% of the population. Sagebrush decadence decreased from 42% to 18% and plants displaying poor vigor increased from 28% to 34%. The density of pinyon and juniper remained similar 21 trees/acre and 315 trees/acre, respectively.

Grass:

- **2007 to 2012 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased slightly by 10%, and cover remained similar at 3%. Blue grama remained similar in nested frequency, though cover increased from 2% to 3%.

Forb:

- **2007 to 2012 - stable (0):** Perennial forbs remained rare on the site.

SEED MIX--

Management unit 28R, Study no: 9

Project Name: South Canyon - Hillsdale			
WRI Database #: 2359			
Application: Aerial		Acres: 2000	
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Nordan'	1000	0.50
G	Crested Wheatgrass 'CDII'	2000	1.00
G	Indian Ricegrass 'Nezpar'	706	0.35
G	Indian Ricegrass 'Rimrock'	3291	1.65
G	Pubescent Wheatgrass 'Luna'	3000	1.50
G	Russian Wildrye	2000	1.00
G	Sandberg Bluegrass	1000	0.50
G	Snake River Wheatgrass 'Secar'	3000	1.50
F	Alfalfa 'Nomad'	1000	0.50
F	Alfalfa 'Ladak DL'	1000	0.50
F	Blue Flax 'Appar'	2000	1.00
F	Palmer Penstemon	563	0.28
F	Sainfoin 'Eski'	2013	1.01
F	Small Burnet 'Delar'	2000	1.00
Total Pounds:		24573	12.29
PLS Pounds:			10.76

Trend Summary

HERBACEOUS TRENDS--

Management unit 28R, Study no: 9

T y p e	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
G	Bouteloua gracilis	104	122	2.19	3.17
G	Carex sp.	3	-	.00	-
G	Oryzopsis hymenoides	_b 20	_a 3	.18	.03
G	Poa secunda	3	-	.03	-
G	Sitanion hystrix	32	21	.23	.16
G	Stipa comata	1	-	.03	-
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		163	146	2.67	3.37
Total for Grasses		163	146	2.67	3.37
F	Arabis holboellii	2	5	.00	.02
F	Astragalus sp.	-	3	-	.04
F	Chenopodium leptophyllum(a)	1	-	.00	-
F	Cryptantha sp.	9	3	.08	.06
F	Descurainia pinnata (a)	7	6	.02	.02
F	Euphorbia albomarginata	_a -	_b 37	-	.09
F	Gayophytum ramosissimum(a)	_b 61	_a -	.28	-

Type	Species	Nested Frequency		Average Cover %	
		'05	'12	'05	'12
F	Lotus sp.	1	-	.00	-
F	Phlox longifolia	2	3	.00	.00
F	Trifolium sp.	-	2	-	.00
Total for Annual Forbs		69	6	0.30	0.02
Total for Perennial Forbs		14	53	0.09	0.23
Total for Forbs		83	59	0.39	0.25

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 28R, Study no: 9

Type	Species	Strip Frequency		Average Cover %	
		'05	'12	'05	'12
B	Artemisia nova	55	46	3.31	2.64
B	Chrysothamnus viscidiflorus stenophyllus	0	1	-	.15
B	Gutierrezia sarothrae	2	1	.01	.00
B	Opuntia sp.	4	2	.18	-
B	Pediocactus simpsonii	1	2	-	.00
B	Pinus edulis	37	23	27.89	25.65
Total for Browse		99	75	31.39	28.45

CANOPY COVER, LINE INTERCEPT--

Management unit 28R, Study no: 9

Species	Percent Cover	
	'05	'12
Artemisia nova	2.46	2.23
Pinus edulis	48.98	41.98

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 28R, Study no: 9

Species	Average leader growth (in) '12
Artemisia nova	0.4

POINT-QUARTER TREE DATA--

Management unit 28R, Study no: 9

Species	Trees per Acre		Average diameter (in)	
	'05	'12	'05	'12
Juniperus scopulorum	-	21	-	2.8
Pinus edulis	365	315	5.4	5.9

BASIC COVER--

Management unit 28R, Study no: 9

Cover Type	Average Cover %	
	'05	'12
Vegetation	35.37	33.45
Rock	9.08	5.76
Pavement	17.13	22.09
Litter	54.74	53.34
Cryptogams	1.57	3.65
Bare Ground	15.20	14.23

SOIL ANALYSIS DATA --

Management unit 28R, Study no: 9, Study Name: South Canyon Burn 2

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
9.1	6.5	45.1	33.1	21.8	2.4	15.2	150.4	0.5

PELLET GROUP DATA--

Management unit 28R, Study no: 9

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'12	'05	'12
Rabbit	36	4	-	-
Elk	-	-	1 (2)	1 (2)
Deer	2	-	3 (8)	3 (7)
Cattle	1	-	2 (4)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 28R, Study no: 9

		Age class distribution					Utilization		
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia nova</i>									
05	1940	4	54	42	40	2	0	28	13/21
12	1860	17	65	18	120	14	0	34	11/17
<i>Ceratoides lanata</i>									
05	0	0	0	-	-	0	0	0	7/10
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus nauseosus</i>									
05	0	0	0	-	-	0	0	0	17/21
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
05	0	0	0	-	-	0	0	0	-/-
12	60	0	100	-	-	0	0	0	10/10

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Gutierrezia sarothrae</i>									
05	60	67	33	-	60	0	0	0	11/9
12	60	33	67	-	-	0	0	0	12/6
<i>Juniperus osteosperma</i>									
05	0	0	0	-	20	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
05	80	0	100	-	-	25	0	0	6/13
12	40	0	100	-	-	0	0	0	6/10
<i>Pediocactus simpsonii</i>									
05	20	0	100	-	-	0	0	0	1/2
12	40	0	100	-	-	0	0	0	2/3
<i>Pinus edulis</i>									
05	960	21	77	2	40	0	2	0	-/-
12	580	31	69	0	40	0	0	0	-/-
<i>Purshia tridentata</i>									
05	0	0	0	-	-	0	0	0	51/108
12	0	0	0	-	-	0	0	0	55/76

NEWCASTLE BULLHOG - TREND STUDY NO. 30R-1-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Loam \(Wyoming Big Sagebrush\), R028XY309UT](#)

Land Ownership: BLM

Elevation: 5,560 ft (1,695 m)

Aspect: Northwest

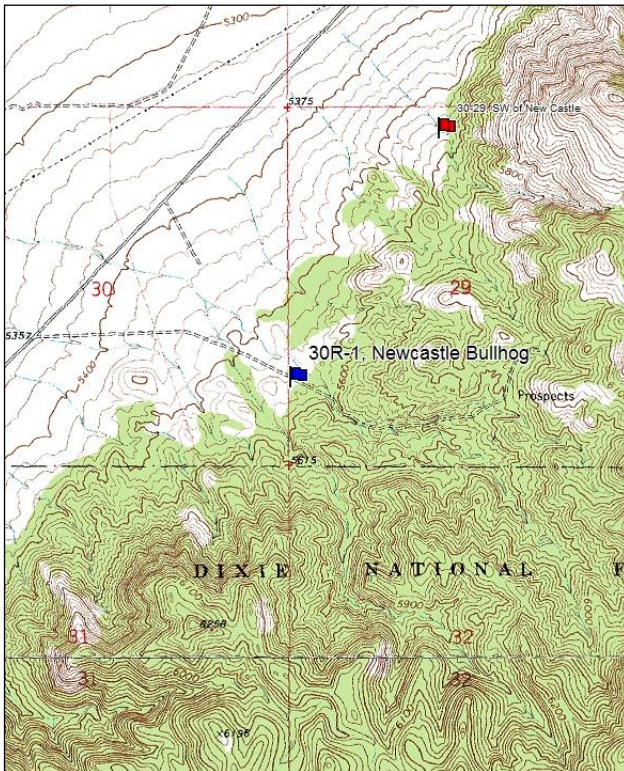
Slope: 5-10%

Transect bearing: 174° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

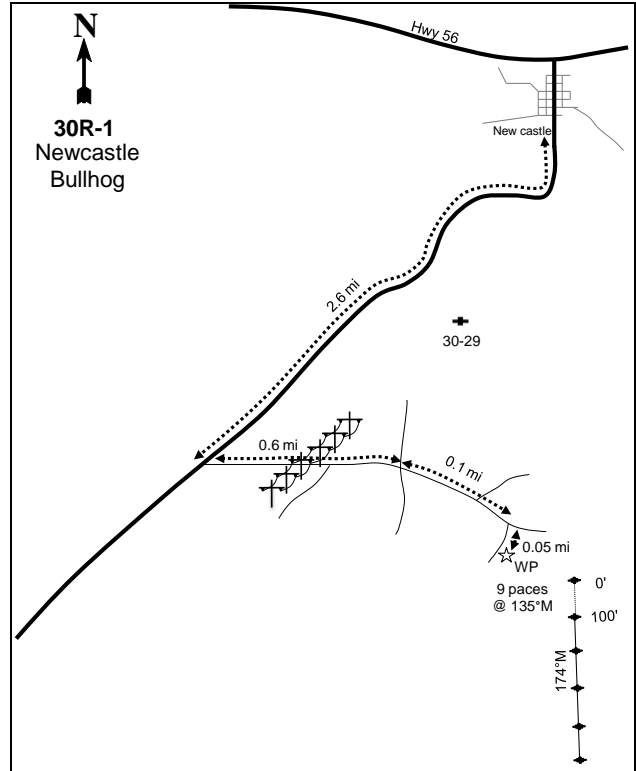
Directions: From Pinto Canyon Road in New Castle travel south on Main Street, which turns into Bench Road, for 2.6 miles to a road that comes in from the left (east)? Turn onto this road and drive 0.6 miles to the intersection. Continue through the intersection to a road that comes in from the right (south). Turn onto this road and drive 150 feet to a witness post on the left side of the road. From the witness post walk 9 paces at 135°M to the 0-foot stake that is marked with browse tag #44.

Map Name: Newcastle



Township: 36S Range: 15W Section: 29

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 273534 E 4168516 N

NEWCASTLE BULLHOG - TREND STUDY NO. 30R-1

Site Information

Site Description: The study is located approximately 2 miles southwest of Newcastle within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat. The study was established in 2004 on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) reduction project. The study occurs on the BLM Pinto Creek allotment. In October 2004, approximately 900 acres were bullhogged to remove the pinyon and juniper trees. The project was not seeded. Deer pellet groups were sampled in high abundance in 2004, moderate abundance in 2007, and low abundance in 2012. Cattle pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data)

Browse: The preferred browse species sampled on the site are Wyoming big sagebrush, Stansbury cliffrose (*Cowania mexicana* spp. *stansburiana*), and green ephedra (*Ephedra viridis*). Wyoming big sagebrush is the dominant preferred browse species and provides the majority of the canopy cover on the site (Table - Canopy Cover). Wyoming big sagebrush is a moderately dense, lightly used population with decadence and poor vigor within the population, though decadence was high in prior sample years (Table - Browse Characteristics). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and fairly diverse on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species on the site and provides the majority of the grass cover on the site. Cheatgrass has increased substantially on the site. Perennial grass species has fluctuated over the sample years. Galleta (*Hilaria jamesii*) and Indian ricegrass (*Oryzopsis hymenoides*) have been the most abundant perennial grass species on the site. Forbs are not abundant or very diverse on the site. No single forb species has been dominant on the site over the sampled years (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Checkett component. The parent material consists of colluvium derived from igneous rock and/or residuum weathered from igneous rock. The soils within this classification are characterized as shallow, well drained, and with a moderately high permeable restrictively layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is low, though there is a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in all sample years, due to surface litter, surface rock movement, pedestalling around plants, flow patterns, and soil movement.

Pre vs. Three Years Post Treatment, 2004 vs. 2007

Browse: The density of Wyoming big sagebrush remained similar at 2,480 plants/acre, and canopy cover remained minimal at less than 1%. Recruitment of young sagebrush plants to the population was poor prior to treatment and increased to 12% of the population following the treatment. The health of the sagebrush improved with decadence decreasing from 40% to 23% and plants displaying poor vigor decreasing from 29% to 17%. The density of pinyon and juniper decreased from 64 trees/acre with an average diameter of 2.8 inches to 25 trees/acre with an average diameter of 1.1 inches, and 116 trees/acre with an average diameter of 8.2 to 26 trees/acre with an average diameter of 1.0 inches, respectively.

Grasses: The sum of nested frequency of perennial grasses increased 39%, and cover increased from 6% to 9%. Galleta remained similar in nested frequency, though cover increased from 4% to 6%. Cheatgrass increased significantly in nested frequency and cover increased from less than 1% to 16%.

Forbs: Perennial forbs remained rare on the site.

Trend Assessments

Browse:

- **2007 to 2012 - up (+2):** The density of Wyoming big sagebrush increased 29% to 3,200 plants/acre, and canopy cover decreased slightly to 9%. Recruitment of young sagebrush plants to the population remained good within the population. Sagebrush decadence decreased to 6% and plants displaying poor vigor increased to 34%. The density of pinyon and juniper decreased remained similar.

Grass:

- **2007 to 2012 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased slightly by 10%, and cover decreased to 4%. Galleta remained similar in nested frequency, though cover decreased to 2%. Cheatgrass increased significantly in nested frequency and cover increased to 34%.

Forb:

- **2007 to 2012 - stable (0):** Perennial forbs remained rare on the site.

Trend Summary

HERBACEOUS TRENDS--

Management unit 30R, Study no: 1

T y P e	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
G	Bromus tectorum (a)	_a 33	_b 415	_c 456	.12	16.14	34.22
G	Hilaria jamesii	112	135	120	3.89	6.35	1.95
G	Oryzopsis hymenoides	35	58	47	1.58	2.00	1.66
G	Sitanion hystrix	8	26	26	.04	.46	.71
G	Sporobolus cryptandrus	2	-	3	.03	-	.03
G	Stipa comata	3	3	5	.00	.03	.04
G	Vulpia octoflora (a)	_a -	_b 59	_a 2	-	.27	.00
Total for Annual Grasses		33	474	458	0.12	16.41	34.22
Total for Perennial Grasses		160	222	201	5.55	8.85	4.39
Total for Grasses		193	696	659	5.68	25.26	38.62
F	Arabis sp.	1	3	-	.00	.00	-
F	Astragalus sp.	-	4	1	-	.03	.15
F	Castilleja sp.	-	1	-	-	.00	-
F	Chaenactis douglasii	-	-	2	-	-	.01
F	Collinsia parviflora (a)	-	-	3	-	-	.00
F	Cordylanthus sp. (a)	_a -	_b 17	_a 4	-	.14	.01
F	Cryptantha sp.	-	5	7	-	.03	.06
F	Descurainia pinnata (a)	-	10	-	-	.10	-
F	Draba sp. (a)	_a -	_b 16	_a -	-	.03	-
F	Eriogonum cernuum (a)	5	2	-	.01	.00	-
F	Euphorbia sp.	-	-	1	-	-	.00
F	Frasera albomarginata	_a 1	_{ab} 11	_b 26	.00	.40	.13
F	Gilia sp. (a)	-	2	-	-	.00	-
F	Holosteum umbellatum (a)	-	1	8	-	.00	.01
F	Lupinus sp.	2	-	-	.00	-	-

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
F	Penstemon leiophyllus	-	-	3	-	-	.06
F	Penstemon pachyphyllus	1	-	-	.01	-	-
F	Penstemon sp.	1	3	-	.00	.01	-
F	Phlox longifolia	3	7	2	.00	.02	.01
F	Ranunculus testiculatus (a)	-	-	4	-	-	.00
F	Sisymbrium altissimum (a)	-	4	-	-	.04	-
F	Streptanthus cordatus	7	14	7	.01	.10	.04
Total for Annual Forbs		5	52	19	0.01	0.33	0.03
Total for Perennial Forbs		16	48	49	0.04	0.61	0.48
Total for Forbs		21	100	68	0.05	0.94	0.51

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 30R, Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'12	'04	'07	'12
B	Artemisia tridentata wyomingensis	57	62	64	5.91	7.26	11.94
B	Chrysothamnus viscidiflorus stenophyllus	6	3	3	.41	-	-
B	Cowania mexicana stansburiana	1	2	2	.18	.18	.88
B	Ephedra viridis	3	6	5	-	.45	.53
B	Gutierrezia sarothrae	0	2	5	-	-	-
B	Juniperus osteosperma	7	2	5	6.78	.06	1.26
B	Opuntia sp.	4	0	0	.18	-	-
B	Pinus edulis	7	1	0	3.37	.63	.85
Total for Browse		85	78	84	16.84	8.59	15.46

CANOPY COVER, LINE INTERCEPT--

Management unit 30R, Study no: 1

Species	Percent Cover		
	'04	'07	'12
Artemisia tridentata wyomingensis	4.36	9.84	8.53
Cowania mexicana stansburiana	.08	.15	.55
Ephedra viridis	-	.28	.11
Gutierrezia sarothrae	-	-	.11
Juniperus osteosperma	15.91	4.35	4.25
Opuntia sp.	.08	-	-
Pinus edulis	7.18	1.80	1.06

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 30R, Study no: 1

Species	Average leader growth (in)		
	'04	'07	'12
Artemisia tridentata wyomingensis	1.6	2.3	1.6

POINT-QUARTER TREE DATA--

Management unit 30R, Study no: 1

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'12	'04	'07	'12
Juniperus osteosperma	116	26	28	8.2	1.0	1.2
Pinus edulis	64	25	27	2.8	1.1	1.7

BASIC COVER--

Management unit 30R, Study no: 1

Cover Type	Average Cover %		
	'04	'07	'12
Vegetation	21.57	35.62	51.00
Rock	3.06	2.47	2.77
Pavement	38.32	17.81	8.62
Litter	32.66	41.48	55.55
Cryptogams	.66	.12	.00
Bare Ground	18.23	12.91	12.42

SOIL ANALYSIS DATA --

Management unit 30R, Study no: 1, Study Name: New Castle Bullhog

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
12.9	7.3	63.0	18.8	18.2	2.3	7.8	182.4	0.8

PELLET GROUP DATA--

Management unit 30R, Study no: 1

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'12	'04	'07	'12
Rabbit	47	80	9	-	-	-
Deer	23	12	9	72 (177)	23 (56)	3 (8)
Cattle	-	-	1	-	-	-

BROWSE CHARACTERISTICS--

Management unit 30R, Study no: 1

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
04	2580	0	60	40	-	41	26	29	16/24
07	2480	12	65	23	1480	23	27	17	16/24
12	3200	36	58	6	380	45	10	34	19/35
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
04	120	0	100	0	-	17	33	0	8/10
07	60	0	67	33	-	67	33	67	12/20
12	60	0	100	0	-	0	0	33	8/11
<i>Cowania mexicana stansburiana</i>									
04	20	0	0	100	-	0	100	0	71/75
07	40	0	100	0	-	0	100	0	40/43
12	40	0	100	0	-	0	0	0	39/48
<i>Ephedra viridis</i>									
04	100	0	80	20	-	0	100	0	18/25
07	160	13	63	25	-	13	13	25	16/27
12	140	0	57	43	-	29	29	43	25/34
<i>Gutierrezia sarothrae</i>									
04	0	0	0	-	-	0	0	0	9/9
07	40	0	100	-	-	0	0	0	12/18
12	180	0	100	-	-	0	0	11	7/11
<i>Juniperus osteosperma</i>									
04	140	29	71	-	-	0	0	0	-/-
07	40	50	50	-	40	0	0	0	-/-
12	100	60	40	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
04	80	0	100	-	-	0	0	0	5/10
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Pinus edulis</i>									
04	140	57	43	-	-	0	0	0	-/-
07	20	100	0	-	40	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Polygala subspinoso subspinoso</i>									
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	3/5

DUNCAN CREEK/HWY 56 - TREND STUDY NO. 30R-5-12

Vegetation Type: Pinyon Pine and Utah Juniper/Mountain Browse

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Loam \(Shrub\), R047XB310UT](#)

Land Ownership: BLM

Elevation: 6,260 ft (1,908 m)

Aspect: Northwest

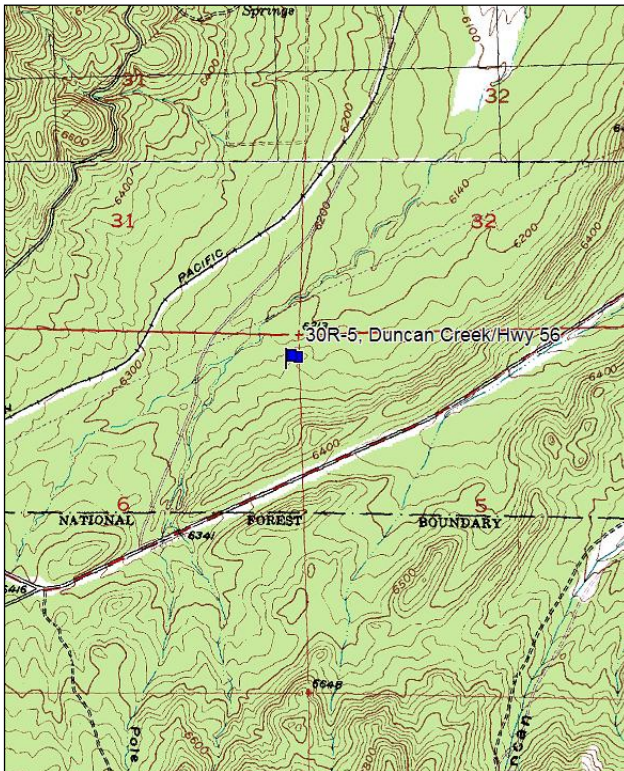
Slope: 10%

Transect bearing: 220° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

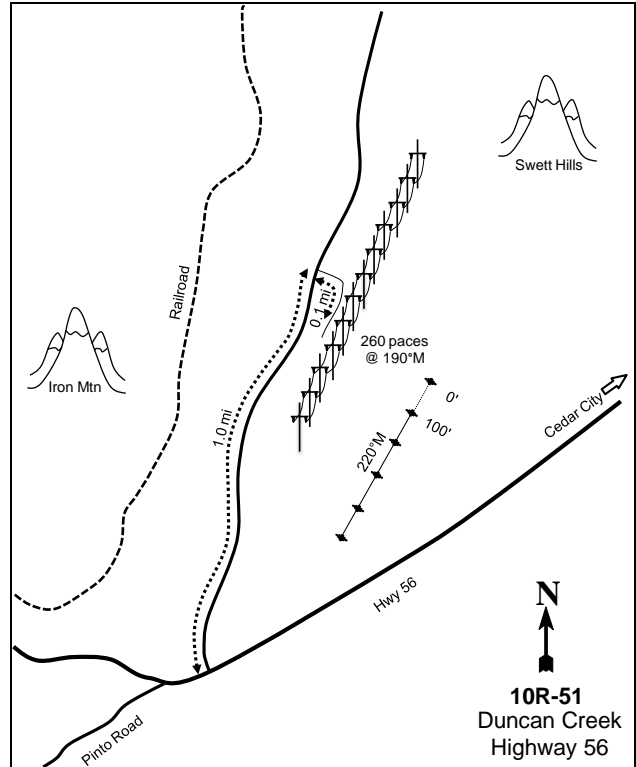
Directions: From Hwy 56 turn north on Iron Mountain Road drive 1.0 miles and turn right. Drive 0.1 miles to a witness post. From the witness post walk 260 paces at 190°M to the 0-foot stake. The 0-foot stake is not marked with a browse tag.

Map Name: Stoddard Mountain



Township: 37S Range: 13W Section: 6

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 292948 E 4165857 N

DUNCAN CREEK/HWY 56 - TREND STUDY NO. 30R-5
[Project #2303](#)

Site Information

Site Description: The study is located approximately fourteen miles west of Cedar City within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study was established in 2012 on land administrated by the Bureau of Land Management (BLM) to monitor a pinyon and juniper reduction project. In the winter of 2012-2013, approximately 1,115 acres were treated with a bullhog to remove pinyon and juniper trees. Prior to treatment the project area was aerially seed with a seed mix of grass, and browse species. The objectives of the project are remove pinyon and juniper trees, increase herbaceous understory, and increase palatable browse species on the site (WRI Database 2013). Deer pellet groups were sampled in low abundance on the site in 2012 (Table - Pellet Group Data).

Browse: Pinyon pine and Utah juniper are the dominant browse species, and provides the majority of the canopy cover on the site, prior to treatment. The preferred browse species sampled on the site are Utah serviceberry (*Amelanchier utahensis*), true mountain mahogany (*Cercocarpus montanus*), wild crab apple (*Peraphyllum ramosissimum*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus Gambelii*), and current (*Ribes sp.*). Serviceberry and mountain mahogany are the dominant preferred browse species, which provide the majority of the palatable canopy cover on the site (Table - Canopy Cover) (Table - Browse Characteristics). The stage of woodland succession is considered to be within Phase III (Tausch et al. 2009).

Herbaceous Understory: Grasses are rare on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) was the only grass species sampled on the site, though occurring in low abundance. Forbs are not abundant but are fairly diverse on the site. The dominant forb species on the site is dwarf lousewort (*Pedicularis centranthera*). Other forbs species were rare on the site (Table - Herbaceous Understory).

Soil: The soil is classified as part of the Sackett component. The parent material consists of alluvium derived from sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately high permeable restrictive layer (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter and rock and a moderate amount of pavement and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as moderate in 2012, due to surface litter, surface rock movement, pedestalling around plants, flow patterns, gully formation, and soil movement.

SEED MIX--

Management unit 30R, Study no: 5

Project Name: Duncan Creek/HWY 56 Interface Phase I															
WRI Database #: 2303															
Application: Aerial				Acres: 2080		Application: Aerial				Acres: 2080					
Seed type				lbs in mix		lbs/acre		Seed type				lbs in mix		lbs/acre	
G	Bluebunch WG 'P-7'			3150		1.51		F	Alfalfa 'Spreador 4'			2100		1.01	
G	Crested Wheatgrass 'Hycrest II'			3100		1.49		B	Forage Kochia			2100		1.01	
G	Indian Ricegrass			1113		0.54		Total Pounds:				4200		2.02	
G	Indian Ricegrass 'Nezpar'			1000		0.48		PLS Pounds:						1.35	
G	Sandberg Bluegrass			1050		0.50									
G	Thickspike Wheatgrass 'Critana'			2100		1.01									
G	Western Wheatgrass 'Arriba'			2085		1.00									
F	Blue Flax 'Appar'			2100		1.01									
F	Small Burnet 'Delar'			2100		1.01									
F	Yellow Sweetclover			1039		0.50									
Total Pounds:				18837		9.06									
PLS Pounds:						8.15									

Trend Summary

HERBACEOUS TRENDS--

Management unit 30R, Study no: 5

Type	Species	Nested Frequency	Average Cover %
		'12	'12
G	Bromus tectorum (a)	22	.04
Total for Annual Grasses		22	0.04
Total for Perennial Grasses		0	0
Total for Grasses		22	0.04
F	Arabis sp.	1	.00
F	Collinsia parviflora (a)	28	.06
F	Comandra pallida	3	.00
F	Cryptantha sp.	1	.00
F	Cymopterus sp.	2	.00
F	Descurainia pinnata (a)	7	.01
F	Draba cuneifolia (a)	27	.05
F	Eriogonum umbellatum	7	.16
F	Holosteum umbellatum (a)	7	.04
F	Lactuca serriola (a)	1	.00
F	Pedicularis centranthera	42	1.10
F	Penstemon caespitosus	7	.18
F	Penstemon leiophyllus	2	.06
F	Phlox austromontana	3	.03
F	Phlox longifolia	1	.00
F	Physaria chambersii	3	.01
F	Ranunculus testiculatus (a)	17	.06
F	Streptanthus cordatus	3	.01

Type	Species	Nested Frequency	Average Cover %
		'12	'12
	Total for Annual Forbs	87	0.23
	Total for Perennial Forbs	75	1.58
	Total for Forbs	162	1.81

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS--

Management unit 30R, Study no: 5

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Amelanchier utahensis	24	1.47
B	Cercocarpus montanus	14	3.73
B	Juniperus osteosperma	17	13.83
B	Opuntia sp.	9	.18
B	Peraphyllum ramosissimum	5	.93
B	Pinus edulis	22	7.29
B	Purshia tridentata	1	-
B	Quercus gambelii	2	.15
	Total for Browse	94	27.61

CANOPY COVER, LINE INTERCEPT--

Management unit 30R, Study no: 5

Species	Percent Cover
	'12
Amelanchier utahensis	2.03
Cercocarpus montanus	5.66
Juniperus osteosperma	29.15
Peraphyllum ramosissimum	.35
Pinus edulis	15.93
Pinus monophylla	.23
Quercus gambelii	.58

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 30R, Study no: 5

Species	Average leader growth (in)
	'12
Amelanchier utahensis	0.3
Cercocarpus montanus	0.5

POINT-QUARTER TREE DATA--
Management unit 30R, Study no: 5

Species	Trees per Acre	Average diameter (in)
	'12	
Juniperus osteosperma	224	11.9
Pinus edulis	326	1.9

BASIC COVER--
Management unit 30R, Study no: 5

Cover Type	Average Cover %
	'12
Vegetation	28.60
Rock	9.63
Pavement	7.21
Litter	51.17
Cryptogams	2.36
Bare Ground	19.82

PELLET GROUP DATA--
Management unit 30R, Study no: 5

Type	Quadrat Frequency	Days use per acre (ha)
	'12	
Rabbit	6	-
Deer	2	12 (30)

BROWSE CHARACTERISTICS--
Management unit 30R, Study no: 5

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Amelanchier utahensis									
12	680	53	41	6	80	9	0	3	25/27
Cercocarpus montanus									
12	320	0	88	13	-	38	6	6	47/55
Echinocereus sp.									
12	0	0	0	-	-	0	0	0	7/19
Juniperus osteosperma									
12	360	17	78	6	20	0	0	0	-/-
Opuntia sp.									
12	200	0	60	40	-	0	0	40	5/12
Peraphyllum ramosissimum									
12	120	17	83	-	-	0	0	0	20/26
Pinus edulis									
12	480	50	50	-	280	0	0	0	-/-

		Age class distribution			Utilization				
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Purshia tridentata									
12	20	100	0	-	-	100	0	0	12/27
Quercus gambelii									
12	180	100	0	-	-	0	0	0	30/29
Ribes sp.									
12	0	0	0	-	-	0	0	0	-/-

Monitoring Summary of Skutumpah Terrace Sagebrush Treatment Proposal (WRI project 2361)

The UDWR range monitoring crew visited the Alton area on August 15-16, 2012 to collect information on the condition of sagebrush for the Skutumpah Terrace Sagebrush Treatment project ([WRI project 2361](#)), as agreed upon during the field tour from May 17. At the end of the tour, the group agreed to gather additional data and then allowed the project to move forward with two stipulations: 1) only conduct the project if there is enough sagebrush winter habitat for a severe winter, and 2) if there is enough habitat, conduct the project over a three-year period to measure the effect of the Spike treatment each year. The project managers agreed to look at the highest snowfall levels for the project area in the last 30 years as a snow height for evaluating available winter habitat. (This is because sage-grouse rely on tall sagebrush above the snow for winter survival.) The group agreed that the project could be carried out if it would not reduce sagebrush canopy cover to <10% sagebrush ABOVE the 30-year high snowfall line in any of the project polygons (Connelly et al 2000).

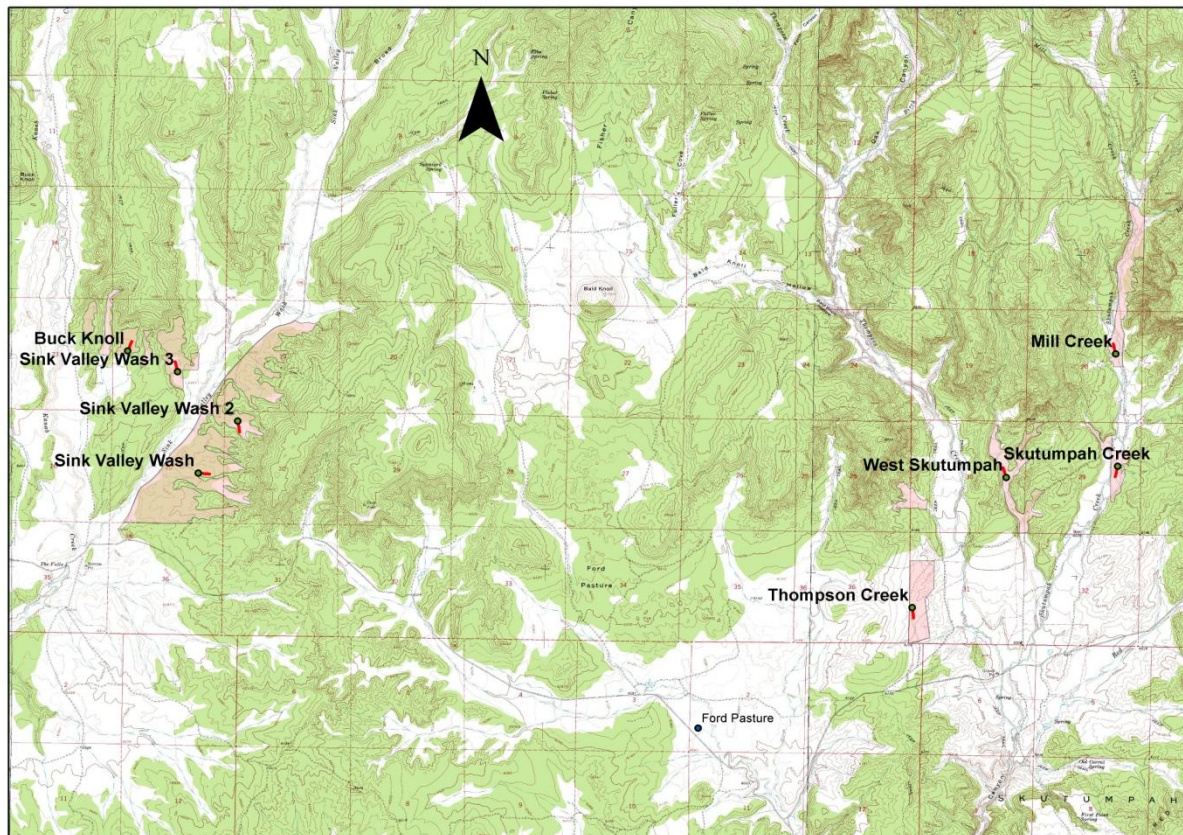


Figure 1 Skutumpah proposed treatment areas and UDWR vegetation monitoring transects.

We established eight transects within the proposed treatment polygons and one transect at Ford Pasture where sage-grouse are known to winter (Figure 1). The transects were placed at random locations. Each baseline transect was 500 feet long. To collect sagebrush data, five 100 foot cross transects were placed at random numbers along the main 500 foot baseline. The data collected were shrub cover using the line intercept method, average shrub height, shrub age classification, and herbaceous cover and nested frequency.

The line intercept cover method is recommended for monitoring sage-grouse habitat (Connelly et al. 2003).

We used five 100 foot cross transects to get average shrub cover across the site. We measured overall shrub cover, shrub cover above 26 inches, and shrub cover above 46 inches. The measurements above 26 and 46 inches were taken to get the values of canopy coverage for shrubs exposed above the snow. The sage-grouse management guidelines (Connelly et al. 2000) recommend shrub cover of at least 10-30%, 10 inches above the

snow. For the Skutumpah Terrace, it was reported (Julander et al. 2012) that the average annual peak snow depth is 16 inches. For this snow depth we took canopy cover measurements above 26 inches. The snow report also noted that in 2010 there was likely 36 days with greater than 36 inches. For this snow depth we took canopy cover measurements above 46 inches.

Shrub height and age classification was taken by measuring and classifying the sagebrush plant nearest to the measuring tape every five feet. Age classification was split into three groups, young, mature, and decadent. Seedlings were not classified. Young plants were defined as plants with stems less than 0.5 inches in diameter. Mature plants are larger, also any plants with seed heads were considered. Plants were classified as decadent if 25% or more of the crown is dead.

Herbaceous cover and nested frequency data were taken by using 20 modified Daubenmire quadrats along the first cross transect. See UDWR Range Trend project methods for details of cover and nested frequency methods (<http://wildlife.utah.gov/range/pdf/2011%20Methods.pdf>).

The Ecological Site Description (ESD) for the proposed treatment area is [Upland Loam \(Mountain Big Sagebrush\), R035XY308UT](#) (NRCS 2011). This site, located in the Colorado Plateau major land resource area, occurs on structural benches, dip slopes, and remnant streams. The ESD state and transition model has four potential states: shrubland, perennial grassland, perennial shrubland/grassland, PJ encroached shrubland. The eight transects we established would be characterized in the shrubland state. The Ford Pasture transect would fit in the perennial shrubland/grassland state.

The monitoring sites are all characterized by the dominance of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) or basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). Seven of the eight transects had clearly been seeded in the past. Seeded species present were crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), and Russian wildrye (*Psathyrostachys juncea*). The treatment area we called Thompson Creek showed no evidence of being previously disturbed or seeded.

Total sagebrush cover (Figure 2) varied between 16% at Mill Creek and 33% at Sink Valley Wash 3. Sagebrush cover above 26 inches was only above 10% cover at the West Skutumpah site.

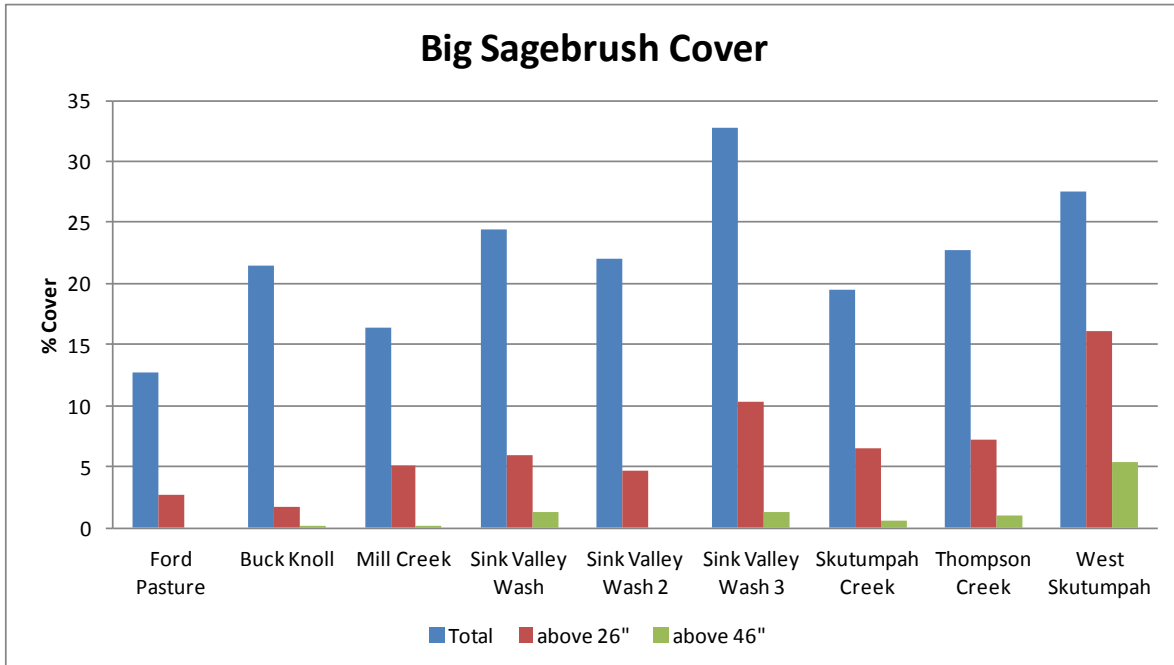


Figure 2 Average percent big sagebrush cover above 26 inches, 46 inches, and total cover.

Average height of mature sagebrush plants varied between 20 inches at the Buck Knoll site and 42 inches at West Skutumpah. The median mature height was 29.4 inches.

Age classifications for sagebrush showed mostly mature stands, with 7 of the 9 transects with 75-95% mature plants (Figure 3). Ford pasture had a much higher component of young plants at 42%, while Thompson Creek had the highest proportion of decadent plants at 34% of the sample. Thompson Creek was also the only surveyed area that showed no sign of past treatment.

Perennial grass cover varied greatly from site to site (Figure 4). Ford pasture had the highest grass cover at 29%, composed solely of crested wheatgrass. Thompson Creek was the lowest at 1%. Crested wheatgrass, smooth brome, and Russian wildrye were the most common species. Bottlebrush squirreltail (*Elymus elymoides*) was the most common native grass species. Forbs were rare, with the exception of Thompson Creek, where seven different perennial forbs were sampled and perennial forb cover was 3.3%. Buck Knoll had five perennial forbs and cover of 1.2%. Perennial forbs were very rare at the other seven transects with less than 0.2% cover on each site.

Sage-grouse pellets were found at Ford Pasture, which is a known winter habitat location. A few sage-grouse pellet groups were also found at the Thompson Creek transect (see photos below).

It was noted that pinyon and juniper encroachment was abundant in the area, and there is ample opportunity to increase grasses, forbs, and sagebrush habitat by doing pinyon and juniper removal projects.

Sagebrush Age Classification by Percent

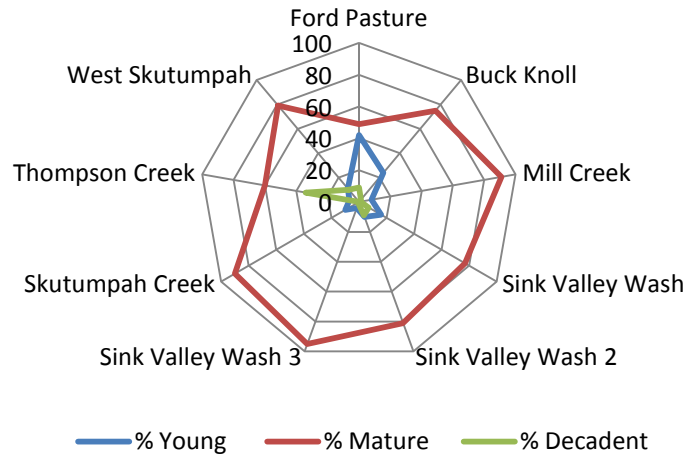


Figure 3 Radar chart of sagebrush age classification by percent.

Perennial Grass Cover (%)

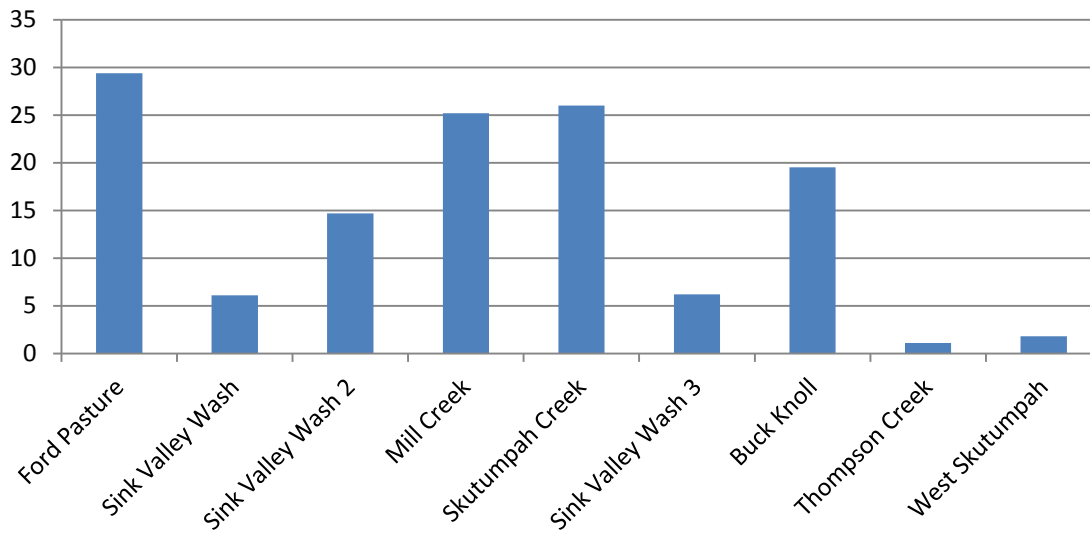


Figure 4 Percent perennial grass cover for each transect.

Ford Pasture



Sink Valley Wash



Sink Valley Wash 2



Mill Creek



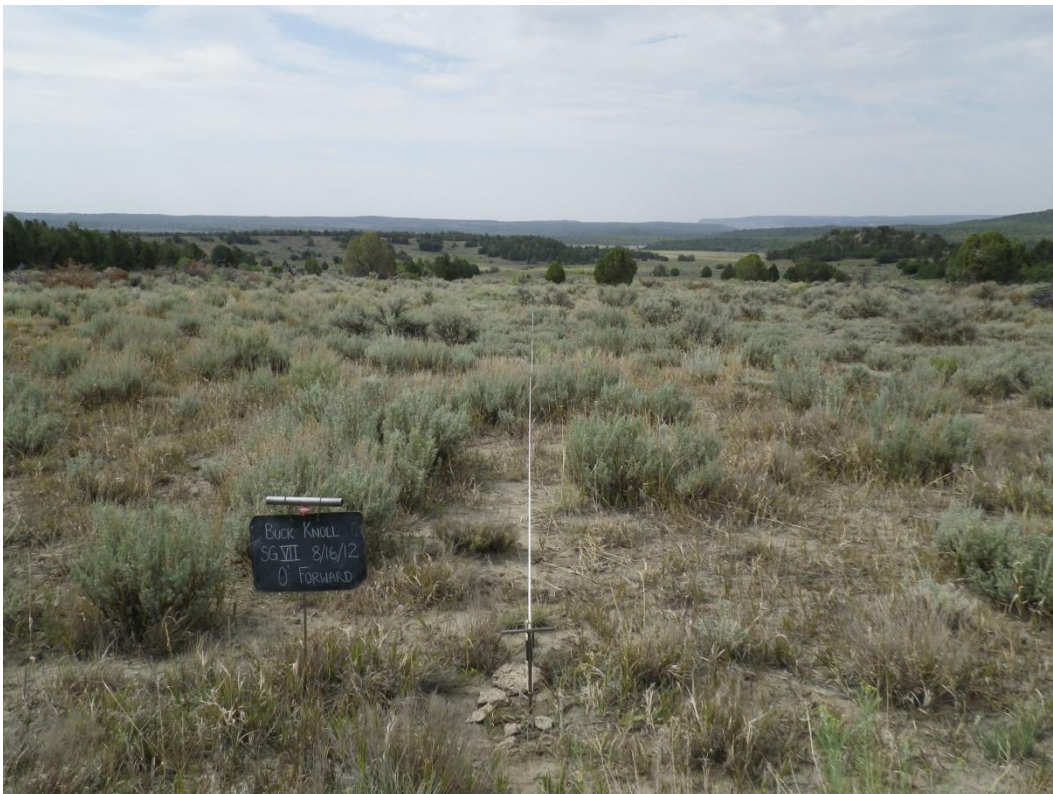
Skutumpah Creek



Sink Valley Wash 3



Buck Knoll



Thompson Creek



Sage-grouse sign at Thompson Creek



West Skutumpah



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