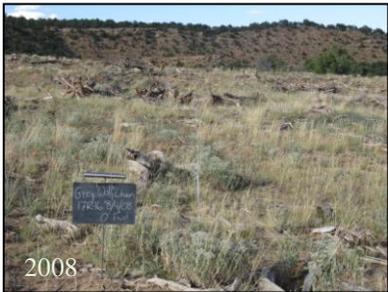
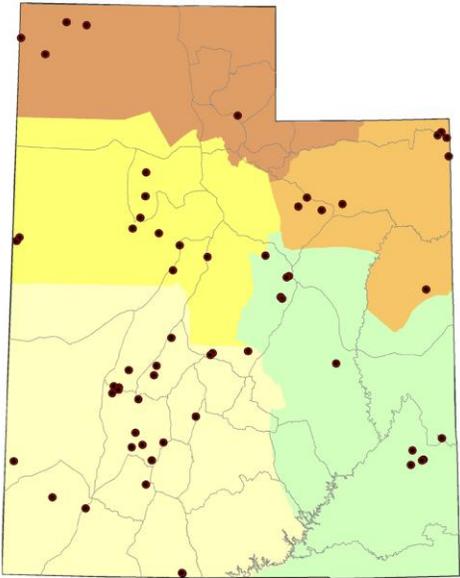


2008 Watershed Restoration Initiative Vegetation Monitoring Report



PUBLICATION NUMBER
REPORT FOR FEDERAL AID PROJECT W-82-R-53

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

2008 Watershed Restoration Initiative Vegetation Monitoring Report

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Performance Report for Federal Aid Project W-82-R-53

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UTAH DEPARTMENT OF NATURAL RESOURCES
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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-53

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.

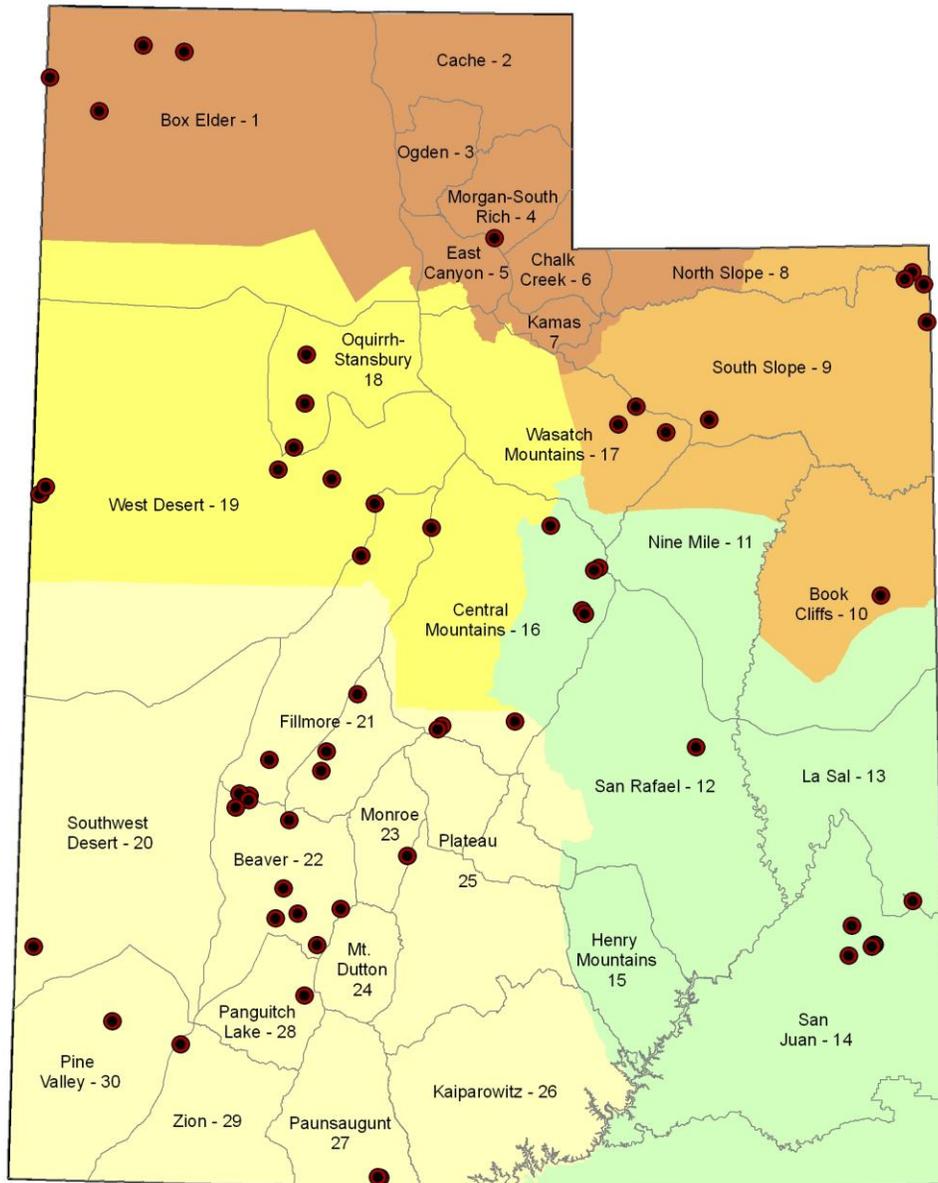
Expected Results and Benefits: WRI range trend studies in each region will be reread, and vegetation condition and trend assessments will be made for project areas. DWR biologists, land management personnel from the United States Forest Service (USFS) and Bureau of Land Management (BLM), and private 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 2008 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 2008



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.

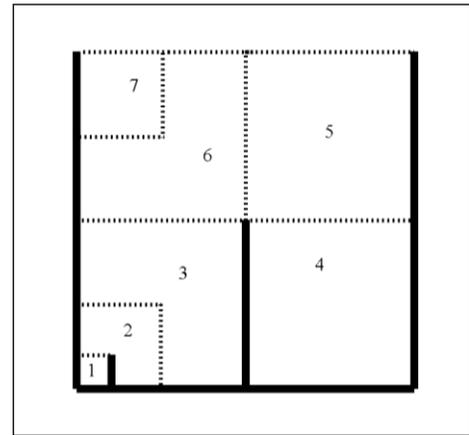


Figure 1. Cover classes of the 1/4 m² sampling quadrat.

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.

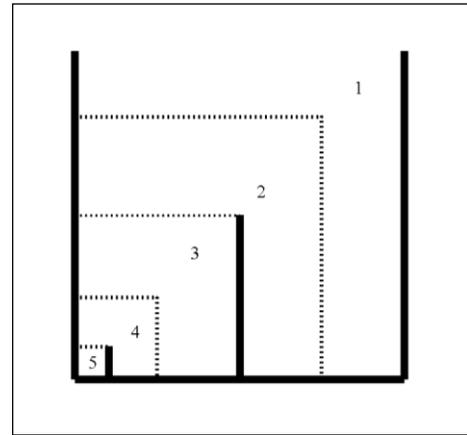


Figure 2. Nested frequency sub-quadrats of the 1/4 m² sampling quadrat.

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	Agropyron cristatum	b135	ab106	ab100	ab112	a81	2.46	2.50	4.81	2.00
G	Agropyron intermedium	-	-	3	2	3	-	.03	.00	.03
G	Bouteloua gracilis	15	19	17	13	17	1.07	.14	.53	.30
G	Bromus inermis	75	67	63	68	92	.63	2.40	1.00	1.35
G	Bromus tectorum (a)	-	-	3	-	-	-	.00	-	-
G	Hilaria jamesii	-	-	-	2	-	-	-	.03	-
G	Koeleria cristata	b61	a3	a19	a3	a-	.03	.18	.01	-
G	Oryzopsis hymenoides	-	3	3	3	8	.00	.00	.03	.07
G	Poa bulbosa	b220	b256	b250	a129	a136	7.14	8.01	2.43	2.86
G	Poa fendleriana	a-	b16	d53	cd55	bc24	.06	.38	1.24	.33
G	Sitanion hystrix	6	1	-	-	-	.00	-	-	-
G	Stipa comata	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	Astragalus convallarius	b40	bc17	ab25	b37	a9	.10	.42	.99	.10
F	Calochortus nuttallii	8	-	-	1	-	-	-	.00	-
F	Castilleja chromosa	b38	a4	a-	a-	a-	.01	-	-	-
F	Castilleja linariaefolia	-	2	1	-	-	.01	.03	-	-
F	Comandra pallida	-	-	-	3	-	-	-	.01	-
F	Cordylanthus sp. (a)	-	-	-	5	5	-	-	.16	.01
F	Crepis acuminata	b14	a6	a-	a-	a-	.03	-	-	-
F	Erigeron flagellaris	-	-	3	-	1	-	.15	-	.00
F	Erigeron pumilus	b111	a21	a43	a20	a12	.07	.51	.53	.08
F	Eriogonum racemosum	b63	a30	a34	a25	a28	.14	.30	.35	.21
F	Hymenoxys acaulis	3	-	3	1	-	-	.00	.03	-
F	Lomatium triternatum	b31	a-	a-	a-	a-	-	-	-	-
F	Lupinus argenteus	d162	c57	b20	a-	a-	3.64	.14	-	-
F	Machaeranthera canescens	1	-	2	-	-	-	.01	-	-
F	Penstemon caespitosus	85	2	6	6	5	.01	.03	.07	.02
F	Petradoria pumila	-	-	5	-	-	-	.06	-	-
F	Phlox longifolia	c67	bc53	ab31	a7	a17	.14	.06	.05	.10
F	Polygonum douglasii (a)	-	-	-	-	6	-	-	-	.01
F	Senecio multilobatus	-	1	1	-	-	.00	.00	-	-
F	Sphaeralcea coccinea	58	55	52	49	48	1.24	.38	.60	.59
F	Tragopogon dubius	6	-	-	-	-	-	-	-	-
F	Trifolium gymnocarpon	-	3	3	2	-	.00	.00	.00	-
F	Zigadenus paniculatus	-	-	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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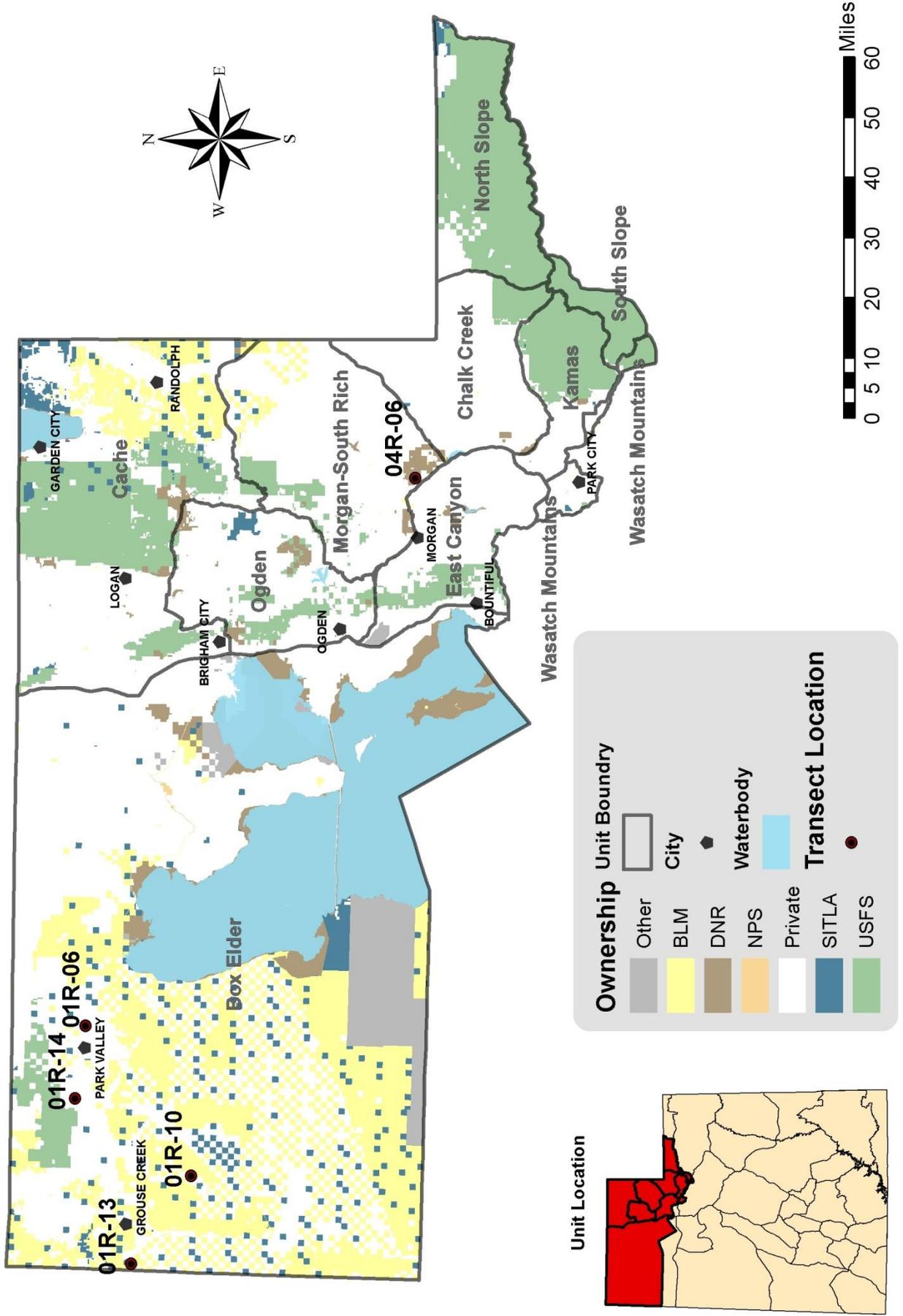
REPORT FORMAT

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.

Northern Region WRI Studies 2008



HEREFORD 1 - TREND STUDY NO. 1R-6-08

[Project #348](#)

Vegetation Type: Basin Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: Private

Elevation: 5,371 ft. (1,637 m)

Aspect: Southwest

Slope: 3%

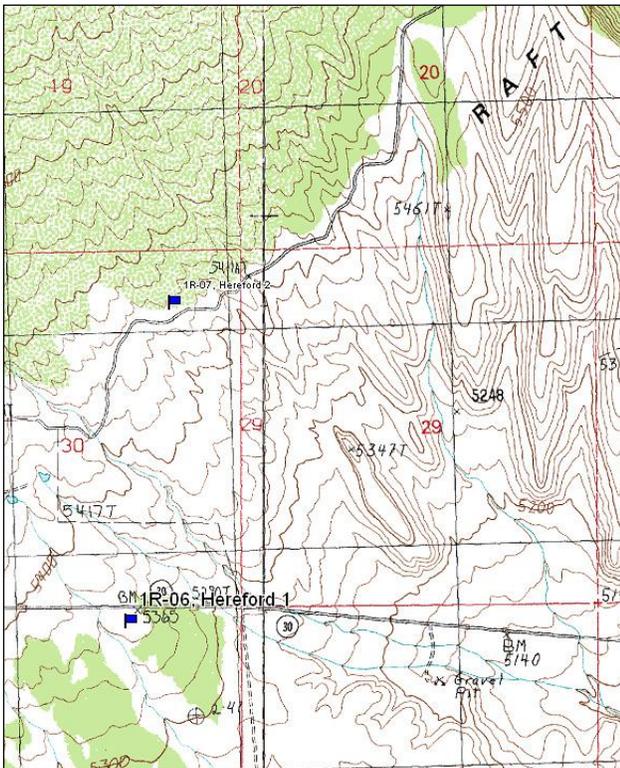
Transect bearing: 254° magnetic

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

Directions:

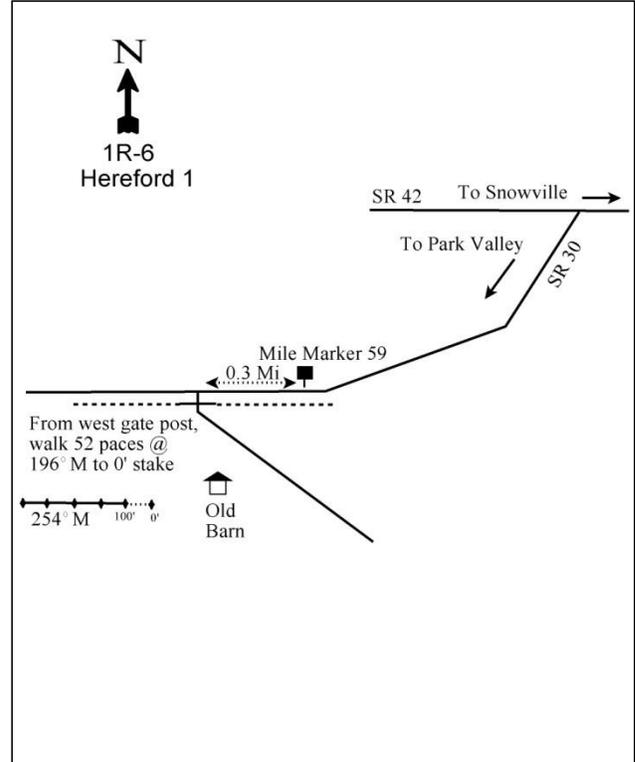
Head west on SR-42 from Snowville, UT to Curlew Junction and turn south (left) onto SR-30 and drive toward Park Valley, UT. Drive to mile marker 59 and proceed another 0.3 miles to a gate on the south (left) side of the road with a “No Trespassing” sign. There is a small burn area just inside the gate. From the west (right) post, walk 52 paces at 196°M to the 0' stake. The 0' stake is marked with browse tag #58.

Map Name: Park Valley



Township: 13 N Range: 12 W Section: 31

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 312425 E 4631864 N

HEREFORD 1 - WRI STUDY 1R-6
[Project #348](#)

Site Description

Site Information: The study is located three and half miles east of Park Valley, just south of SR-30, on private land. The study was established in 2005 to monitor a basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) dominated system which was originally prescribed to be disked and drill seeded in the fall of 2005 ([WRI project #250](#)), but was burned in the Park Valley fire in July of 2005. The study was established prior to the Park Valley fire. The fire burned 18,000 acres on private, Utah State Institutional Trust Land (SITLA), and Bureau of Land Management (BLM) land southeast of Park Valley. The burn was drill seeded in fall of 2005. Forage kochia (*Kochia prostrata*) was aerially seeded (Table - Seed Mix) and chained with a smooth chain in January of 2006. The objectives of the project are to rehabilitate the burnt area to provide habitat for wintering deer and sage-grouse (WRI Database 2011). Pellet group data estimated light use by deer and elk, and light to moderate use by cattle in all sample years.

SEED MIX--

Management unit 01R, Study no: 6

Project Name: Hereford Grazing Association					
WRI Database #: 348					
Application: *Drill Seed		Acres: 1,200		Application: *Aerial Seed	
Acres: 1,920					
Seed type		lbs in mix	lbs/acre	Seed type	
G	Crested Wheatgrass 'Hycrest'	2970	2.48	B	Forage Kochia
G	Great Basin Wildrye 'Trailhead'	1390	1.16	Total Pounds:	
G	Russian Wildrye 'Bozoisky'	1400	1.17	1920	
G	Siberian Wheatgrass 'Vavilov'	1200	1.00	PLS Pounds:	
F	Alfalfa 'Ladak+'	1400	1.17	0.74	
F	Sainfoin 'Eski'	2800	2.33		
F	Small Burnet	2800	2.33		
B	Forage Kochia	1050	0.88		
B	Fourwing Saltbush	1375	1.15		
Total Pounds:		16385	13.65		
PLS Pounds:			12.16		

*The Drill Seed mix was applied to the project in October to December of 2005. The Aerial Seed mix was completed in January of 2006.

Browse: Historically, basin big sagebrush dominated the site prior to the fire in 2005, which nearly eradicated the population from the site. Following the fire, the preferred browse species are forage kochia, fourwing saltbush (*Atriplex canescens*) and basin big sagebrush. Forage kochia is the dominant browse species on the site. Fourwing saltbush and forage kochia were seeded as part of the fire rehab. Forage kochia has established a moderate size population whereas fourwing saltbush has established a small population on the site. The forage kochia population is a moderately used population with low decadence and good vigor. The recruitment of young forage kochia plants to the population has been good since being seeded to the site. Since the fire, the basin big sagebrush has been a relatively small population with low decadence and good vigor within the population, but prior to the fire poor vigor and decadence was moderately high within the population. The recruitment of young sagebrush plants to the population has been meager over the sample years, but reproduction (seedlings) was very high in 2005, but was minimal in 2008. Utilization of sagebrush has been light since the outset of the study (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and fairly diverse, though most of the grass species are rare on the site. The dominant perennial grass species is crested wheatgrass (*Agropyron cristatum*), which has

provided the majority of the perennial grass cover in all the sample years. Prior to the fire, cheatgrass (*Bromus tectorum*) was the dominate grass species on the site, but since the fire, cheatgrass has reduced considerably in abundance. Sandberg bluegrass (*Poa secunda*) was negatively affected by the fire and has become very rare on the site. Seeded species sampled on the site following the fire include crested wheatgrass and Russian wildrye (*Elymus junceus*), though crested wheatgrass was present prior to the seeding. Forbs are rare on the site. Prior to the fire, bur buttercup (*Ranunculus testiculatus*) dominated the forb component, but has become rare on the site following the fire. The weedy species halogeton (*Halogeton glomerata*) was sampled on the site following the fire, though it occurred in low abundance (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a slightly alkaline soil reaction (pH 7.5) (Table - Soil Analysis Data). Bare ground cover is very high with a moderate amount of vegetation, litter, and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to gully formation, soil movement, and pedestalling around shrubs. The soil erosion condition was classified as slight in 2008 due to slight litter and soil movement, pedestalling around shrubs, flow patterns, rills, and active gullies that cross the baseline transect.

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

Browse: The density of basin big sagebrush decreased 43% from 2,540 plants/acre to 1,460 plants/acre and canopy cover decreased from 14% to 1%. The health of the sagebrush population improved with decadence decreasing from 36% to 0% and poor vigor decreasing from 18% to 0%. Forage kochia and fourwing saltbush were seeded following the fire and forage kochia was sampled at 8,220 plants/acre and 11% canopy cover in 2008, and fourwing saltbush was sampled at 100 plants/acre.

Grasses: The sum of nested frequency of perennial grasses decreased 14%, but cover increased slightly from 8% to 9%. The annual grass species cheatgrass significantly decreased in the sum of nested frequency (83%) and cover decreased from 7% to 1%. Crested wheatgrass increased in cover from 6% to 9%. Sandberg bluegrass became very rare on the site with a significant decrease in nested frequency, and a decrease in cover from 2% to 0%.

Forbs: Perennial forbs remained rare on the site. The sum of nested frequency of perennial forbs increased 54% and cover increased to 1%. However, no single perennial forb provided more than 1% cover in either sample year. Annual forbs decreased significantly in sum of nested frequency (86%) and cover decreased from 28% to 1%. The majority of the change can be attributed to bur butter cup which decreased substantially in nested frequency (93%) and cover decreased from 28% to 0% and became rare on the site.

HERBACEOUS TRENDS-- Management unit 01R, Study no: 6

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	193	221	5.94	8.47
G	Agropyron dasystachyum	-	5	.00	.01
G	Bromus tectorum (a)	_b 328	_a 55	7.27	.99
G	Elymus junceus	-	1	-	.15
G	Oryzopsis hymenoides	21	4	.03	.01
G	Poa bulbosa	1	-	.00	-
G	Poa secunda	_b 57	_a 13	1.50	.02
G	Sitanion hystrix	_b 12	_a 1	.14	.00
Total for Annual Grasses		328	55	7.27	0.99
Total for Perennial Grasses		284	245	7.62	8.68

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
Total for Grasses		612	300	14.90	9.67
F	Allium sp.	1	-	.00	-
F	Alyssum alyssoides (a)	4	-	.01	-
F	Calochortus nuttallii	-	-	.00	-
F	Descurainia pinnata (a)	_b 32	_a 1	.13	.00
F	Gilia sp. (a)	1	-	.00	-
F	Halogeton glomeratus (a)	_a -	_b 14	-	.43
F	Iva axillaris	13	14	.10	.81
F	Lactuca serriola (a)	1	3	.00	.01
F	Lepidium sp. (a)	5	-	.06	-
F	Medicago sativa	-	10	-	.17
F	Microsteris gracilis (a)	7	-	.04	-
F	Onobrychis viciaefolia	-	5	-	.07
F	Phlox longifolia	8	-	.02	-
F	Ranunculus testiculatus (a)	_b 435	_a 32	27.82	.09
F	Salsola iberica (a)	_a 2	_b 22	.00	.55
F	Sanguisorba minor	-	5	-	.06
F	Zigadenus paniculatus	1	-	.03	-
Total for Annual Forbs		487	72	28.08	1.09
Total for Perennial Forbs		23	34	0.16	1.11
Total for Forbs		510	106	28.25	2.21

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

BROWSE TRENDS--

Management unit 01R, Study no: 6

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata tridentata	75	23	12.73	.26
B	Atriplex canescens	0	5	-	.03
B	Chrysothamnus nauseosus	9	1	.48	-
B	Chrysothamnus nauseosus albicaulis	0	1	-	-
B	Chrysothamnus nauseosus hololeucus	2	0	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	1	.03	.00
B	Juniperus osteosperma	0	0	.41	-
B	Kochia prostrata	0	61	-	10.34
B	Opuntia sp.	1	0	-	-
B	Sarcobatus vermiculatus	4	1	2.00	.38
Total for Browse		92	93	15.67	11.03

CANOPY COVER, LINE INTERCEPT--

Management unit 01R, Study no: 6

Species	Percent Cover	
	'05	'08
Artemisia tridentata tridentata	14.39	.63
Atriplex canescens	-	.35
Chrysothamnus nauseosus	.53	.20
Chrysothamnus viscidiflorus viscidiflorus	.18	-
Juniperus osteosperma	.65	-
Kochia prostrata	-	10.78
Sarcobatus vermiculatus	2.50	.51

BASIC COVER--

Management unit 01R, Study no: 6

Cover Type	Average Cover %	
	'05	'08
Vegetation	52.07	21.25
Rock	.31	.21
Pavement	4.68	5.87
Litter	22.42	22.73
Cryptogams	.71	0
Bare Ground	35.41	60.87

SOIL ANALYSIS DATA --

Management unit 1R, Study no: 6, Study Name: Hereford 1

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.6	7.5	37.2	39.0	23.8	1.5	6.5	640.0	0.6

PELLET GROUP DATA--

Management unit 01R, Study no: 6

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	35	32	-	-
Elk	1	-	-	-
Deer	7	2	-	1 (2)
Cattle	10	6	-	23 (56)

BROWSE CHARACTERISTICS--
Management unit 01R, 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 tridentata</i>									
05	2540	5	59	36	20660	5	0	18	36/41
08	1460	8	92	0	60	5	0	0	11/10
<i>Atriplex canescens</i>									
05	0	0	0	0	-	0	0	0	-/-
08	100	0	80	20	-	0	0	20	18/24
<i>Chrysothamnus nauseosus</i>									
05	180	11	89	-	40	22	11	0	23/35
08	20	0	100	-	-	0	0	0	16/16
<i>Chrysothamnus nauseosus albicaulis</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	100	0	-	-	0	0	0	-/-
<i>Chrysothamnus nauseosus hololeucus</i>									
05	40	50	50	-	-	0	0	0	19/21
08	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
05	20	0	100	-	-	0	0	0	14/20
08	20	0	100	-	-	0	0	0	11/22
<i>Kochia prostrata</i>									
05	0	0	0	0	-	0	0	0	-/-
08	8220	5	91	4	39000	4	26	3	12/17
<i>Opuntia sp.</i>									
05	20	0	100	-	-	0	0	0	9/11
08	0	0	0	-	-	0	0	0	-/-
<i>Sarcobatus vermiculatus</i>									
05	120	33	67	-	620	0	0	0	34/47
08	60	0	100	-	-	0	0	0	22/39

CHOKECHERRY BULLHOG - TREND STUDY NO. 1R-10-08

[Project #155](#)

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: BLM

Elevation: 6,292 ft. (1,918 m)

Aspect: East

Slope: 6%

Transect bearing: 96° magnetic

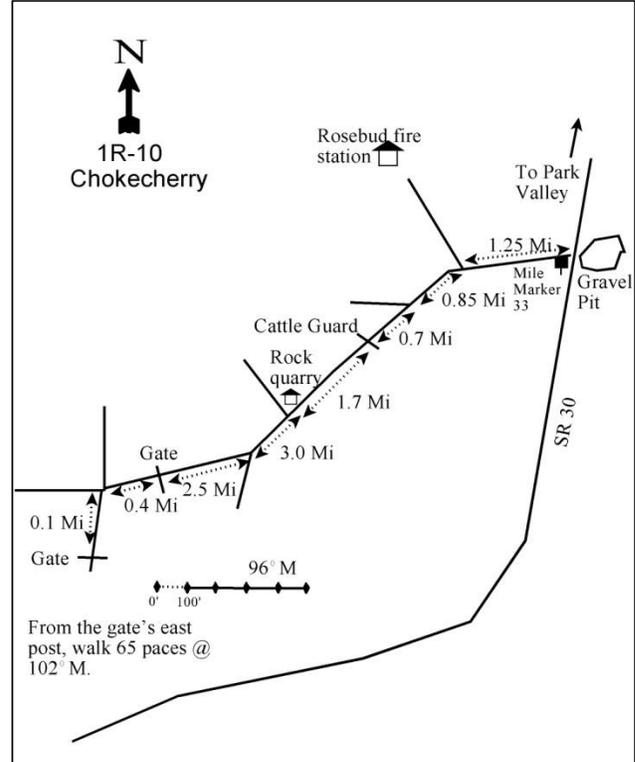
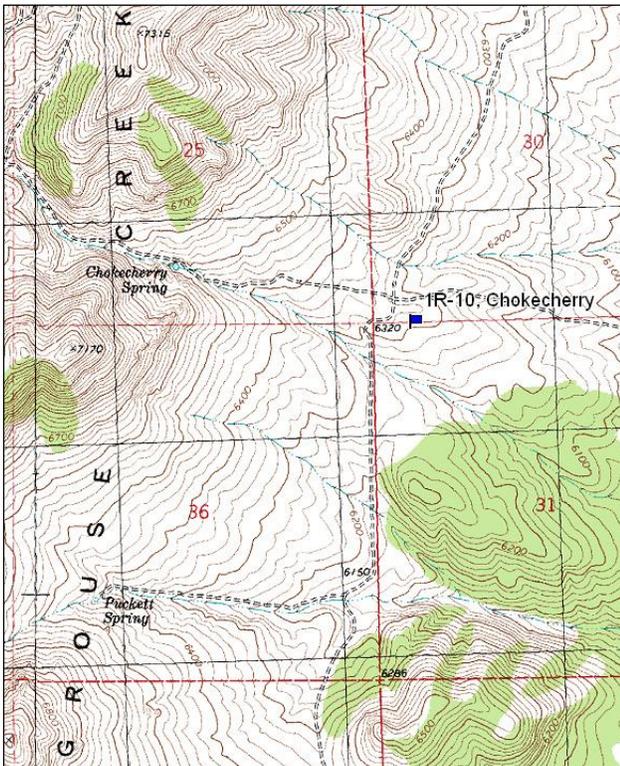
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:

Head west on SR-42 from Snowville, UT to Curlew Junction, turn south (left) onto SR-30, and drive past Park Valley, UT. Turn right (west) just before mile marker 33. On the road is a mailbox for the Rosebud fire station. Drive on the main road for 1.25 miles to a fork. Stay left at the fork. Drive 0.85 miles to a large fork in the road, and go left after a man-made ditch. Drive another 0.7 miles to a cattle guard. Continue for 1.7 miles to a fork in the road before a rock quarry. Stay left and drive southwest for 3.0 miles to a fork. Turn right (east) at the fork and proceed 2.5 miles to a gate. Continue past the gate for 0.4 miles to a cross road. Turn left and drive south for 0.1 miles to a gate. From the gate's east most post, walk 65 paces at 102°M to the 0' stake. The 0' stake is marked with browse tag #62.

Map Name: Emigrant Pass

Diagrammatic Sketch:



Township: 10N Range: 16W Section: 31

GPS: NAD 83, UTM 12T 272286 E 4603683 N

CHOKECHERRY BULLHOG - WRI STUDY 1R-10

[Project #155](#)

Site Description

Site Information: The study is located approximately twenty-seven miles southwest of Park Valley and one mile east of Chokecherry Spring, within a Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*) woodland, on land administrated by the Bureau of Land Management (BLM). The study was established in 2005, prior to treatment, to monitor a bullhog thinning project of Utah juniper trees. Prior to the bullhog treatment the area was aerially seeded with a seed mix of grass and forb species in June of 2005 (Table - Seed Mix). Following the seeding, the area was treated with a bullhog in the fall of 2005. The objectives of the project were to improve greater sage-grouse, pygmy rabbit, and mule deer habitat by enhancing the herbaceous understory and increasing cover of preferred browse species (WRI Database 2011). Pellet group data estimated moderate use by deer, and light use by elk and cattle in 2005. In 2008, estimated use was light for deer and cattle. No elk pellets were sampled in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 01R, Study no: 10

Project Name: Choke Cherry			
WRI Database #: 155			
Application: Aerial Seed		Acres: 550	
Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass	300	0.55
G	Indian Ricegrass	550	1.00
G	Indian Ricegrass 'Rimrock'	6	0.01
G	Orchardgrass 'Paiute'	550	1.00
G	Sandberg Bluegrass 'SID MT'	50	0.09
G	Sandberg Bluegrass 'SID OR'	250	0.45
G	Snake River Wheatgrass 'Secar'	1136	2.07
F	Alfalfa 'Ladak+'	1150	2.09
F	Blue Flax 'Appar'	300	0.55
F	Sainfoin 'Eski'	1700	3.09
F	Small Burnet 'Delar'	1150	2.09
F	Western Yarrow	50	0.09
Total Pounds:		7192	13.08
PLS Pounds:			12.12

Browse: The preferred browse species on the site are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and antelope bitterbrush (*Purshia tridentata*). The dominant browse species on the site is Wyoming big sagebrush. Decadence and poor vigor of sagebrush have been high over the sample years. The recruitment of young sagebrush plants to the population has been poor since the outset of the study in 2005. Utilization of sagebrush has been light to moderate. Prior to treatment, the small antelope bitterbrush population displayed moderate to heavy use, but with low decadence and good vigor. Following the treatment, the population displayed light to moderate use, but with high decadence and poor vigor within the population (Table - Browse Characteristics). The Utah juniper density and canopy cover were moderate prior to the treatment, but both were reduced considerably following the treatment (Table - Point-Quarter Tree Data and Table - Canopy Cover).

Herbaceous Understory: Grasses are fairly abundant and diverse on the site. The dominant grass species is Sandberg bluegrass (*Poa secunda*), which has provided the majority of the cover since the outset of the study. The annual species cheatgrass (*Bromus tectorum*) was very abundant prior to the treatment, but has decreased substantially in abundance since the bullhog treatment. Other common perennial grass species sampled on the

site include subalpine needlegrass (*Stipa columbiana*), western wheatgrass (*Agropyron smithii*), and bluebunch wheatgrass (*A. spicatum*). Seeded grass species sampled after the treatment include Indian ricegrass (*Oryzopsis hymenoides*) and Sandberg bluegrass, though each species was also sampled prior to the treatment. Forbs are not particularly abundant, but are moderately diverse. Forb species decreased in abundance and diversity following the treatment, though most of the decrease was due to a decrease in annual forbs (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a slightly alkaline soil reaction (pH 7.7) (Table - Soil Analysis Data). Bare ground cover is low with 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 2005 and 2008.

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

Browse: The density of Wyoming big sagebrush decreased by 12% from 3,940 plants/acre to 3,480 plants/acre and canopy cover decreased from 20% to 17%. The health of the sagebrush population decreased with decadence increasing from 29% to 63% and poor vigor increasing from 14% to 32%. Utah juniper decreased in density from 69 trees/acre to 20 trees/acre and canopy cover decreased from 8% to 0%.

Grasses: The sum of nested frequency of perennial grasses slightly decreased 11%, and cover decreased from 12% to 8%. The annual grass species cheatgrass significantly decreased in the sum of nested frequency (87%) and cover decreased from 4% to less than 1%. Sandberg bluegrass decreased in cover from 8% to 3%.

Forbs: The sum of nested frequency of perennial forbs increased 55%, though cover decreased from 3% to 2%. Annual forbs decreased significantly in sum of nested frequency (84%) and cover decreased from 7% to less than 1%. Annual forbs became rare on the site. No single perennial forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--

Management unit 01R, Study no: 10

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron smithii</i>	64	58	.70	1.01
G	<i>Agropyron spicatum</i>	40	41	1.40	.88
G	<i>Bromus tectorum</i> (a)	_b 296	_a 40	4.21	.09
G	<i>Carex</i> sp.	3	-	.03	-
G	<i>Oryzopsis hymenoides</i>	10	21	.22	.38
G	<i>Poa secunda</i>	241	195	7.51	3.35
G	<i>Sitanion hystrix</i>	_b 28	_a 6	.38	.33
G	<i>Stipa columbiana</i>	43	40	1.75	1.29
G	<i>Stipa comata</i>	_a -	_b 19	-	.58
G	<i>Vulpia octoflora</i> (a)	_b 25	_a -	.08	-
Total for Annual Grasses		321	40	4.30	0.09
Total for Perennial Grasses		429	380	12.01	7.85
Total for Grasses		750	420	16.31	7.94
F	<i>Agoseris glauca</i>	2	1	.00	.00
F	<i>Allium</i> sp.	_b 101	_a 19	.84	.08
F	<i>Androsace septentrionalis</i> (a)	2	-	.00	-
F	<i>Apiaceae</i> sp.	2	-	.01	-

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Astragalus sp.	_b 17	_a 7	.32	.04
F	Astragalus utahensis	5	-	.03	-
F	Chaenactis douglasii	4	-	.01	-
F	Collinsia parviflora (a)	_b 229	_a 29	5.84	.12
F	Collomia linearis (a)	1	2	.00	.01
F	Comandra pallida	2	5	.06	.01
F	Crepis acuminata	2	-	.00	-
F	Cryptantha sp.	_b 76	_a 10	.38	.12
F	Delphinium nuttallianum	5	-	.10	-
F	Gayophytum ramosissimum(a)	38	21	.18	.14
F	Gilia sp. (a)	13	1	.05	.00
F	Lappula occidentalis (a)	1	3	.00	.00
F	Lupinus argenteus	9	11	.56	.92
F	Lygodesmia sp.	1	-	.03	-
F	Lygodesmia spinosa	-	2	-	.00
F	Microsteris gracilis (a)	_b 133	_a 11	1.12	.01
F	Navarretia intertexta (a)	_b 16	_a 4	.05	.01
F	Phlox longifolia	_a 54	_b 72	.26	.25
F	Ranunculus testiculatus (a)	2	-	.00	-
F	Unknown forb-annual (a)	9	-	.04	-
Total for Annual Forbs		444	71	7.31	0.31
Total for Perennial Forbs		280	127	2.62	1.45
Total for Forbs		724	198	9.94	1.76

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

BROWSE TRENDS--

Management unit 01R, Study no: 10

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia nova	1	0	-	-
B	Artemisia tridentata wyomingensis	88	78	19.52	13.71
B	Chrysothamnus viscidiflorus viscidiflorus	29	35	2.21	1.98
B	Juniperus osteosperma	2	4	5.35	-
B	Leptodactylon pungens	11	5	.22	.07
B	Opuntia sp.	7	8	.00	-
B	Purshia tridentata	4	4	1.24	.83
B	Symphoricarpos oreophilus	3	3	.63	.15
Total for Browse		145	137	29.18	16.75

CANOPY COVER, LINE INTERCEPT--

Management unit 01R, Study no: 10

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	19.53	16.73
Chrysothamnus viscidiflorus viscidiflorus	3.08	1.88
Juniperus osteosperma	8.25	.06
Leptodactylon pungens	-	.05
Opuntia sp.	-	.05
Purshia tridentata	1.75	1.54
Symphoricarpos oreophilus	1.10	.21

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 01R, Study no: 10

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	1.2	1.0
Purshia tridentata	0.8	0.7

POINT-QUARTER TREE DATA--

Management unit 01R, Study no: 10

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	69	20	7.3	6.4

BASIC COVER--

Management unit 01R, Study no: 10

Cover Type	Average Cover %	
	'05	'08
Vegetation	50.80	23.89
Rock	.47	.16
Pavement	19.16	18.08
Litter	32.20	59.70
Cryptogams	.12	.18
Bare Ground	14.99	9.47

SOIL ANALYSIS DATA --

Management unit 1R, Study no: 10, Study Name: Chokecherry

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
19.3	7.7	58.2	24.0	17.8	1.1	11.5	297.6	0.6

PELLET GROUP DATA--

Management unit 01R, Study no: 10

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	32	26	-	-
Grouse	-	1	-	-
Elk	-	1	2 (5)	-
Deer	21	13	27 (68)	17 (43)
Cattle	6	4	7 (18)	9 (23)

BROWSE CHARACTERISTICS--

Management unit 01R, Study no: 10

		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	20	0	100	-	60	0	0	0	-/-	
08	0	0	0	-	-	0	0	0	-/-	
<i>Artemisia tridentata wyomingensis</i>										
05	3940	6	65	29	8640	12	4	14	25/37	
08	3480	2	36	63	40	24	.57	32	21/32	
<i>Chrysothamnus nauseosus</i>										
05	0	0	0	-	-	0	0	0	19/17	
08	0	0	0	-	-	0	0	0	22/23	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
05	960	0	94	6	-	2	0	4	11/20	
08	1240	3	74	23	80	0	0	18	10/15	
<i>Juniperus osteosperma</i>										
05	40	50	50	-	40	0	0	0	-/-	
08	80	100	0	-	-	0	0	0	-/-	
<i>Leptodactylon pungens</i>										
05	380	0	95	5	-	0	0	0	8/10	
08	140	0	71	29	-	0	0	0	6/6	
<i>Opuntia sp.</i>										
05	140	0	100	0	-	0	0	0	4/9	
08	180	0	67	33	-	0	0	33	5/11	
<i>Purshia tridentata</i>										
05	80	0	100	0	-	50	50	0	33/56	
08	80	0	25	75	-	25	0	25	31/55	
<i>Symphoricarpos oreophilus</i>										
05	60	33	67	-	-	0	0	0	29/66	
08	80	50	50	-	-	0	0	0	28/56	

DAIRY VALLEY GIP 2 - TREND STUDY NO. 1R-13-08

[Project #992](#)

Vegetation Type: Perennial Grass

Range Type: Substantial Deer Winter, Crucial Elk Year-Long

NRCS Ecological Site Description: [Upland Juniper Savanna \(Utah Juniper\), R025XY322UT](#)

Land Ownership: Private

Elevation: 5,676 ft. (1,730 m)

Aspect: Northeast

Slope: 8%

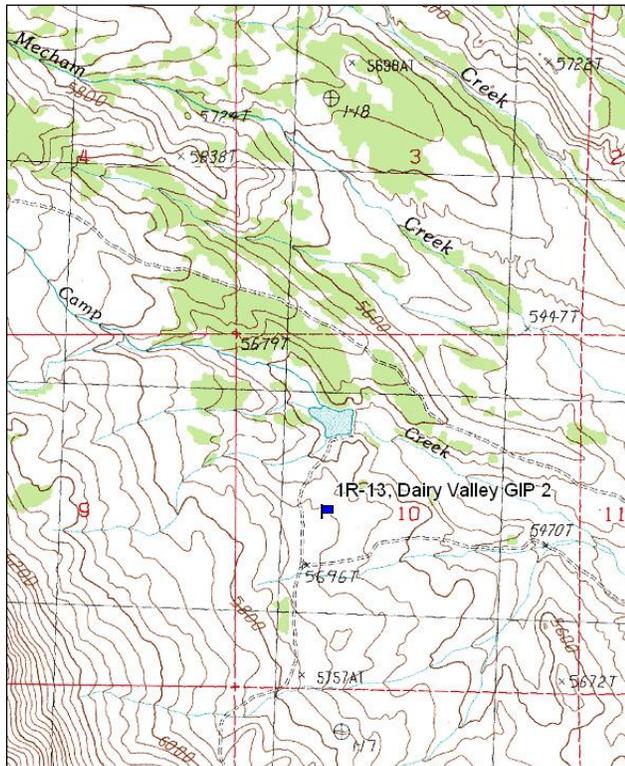
Transect bearing: 87° magnetic

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

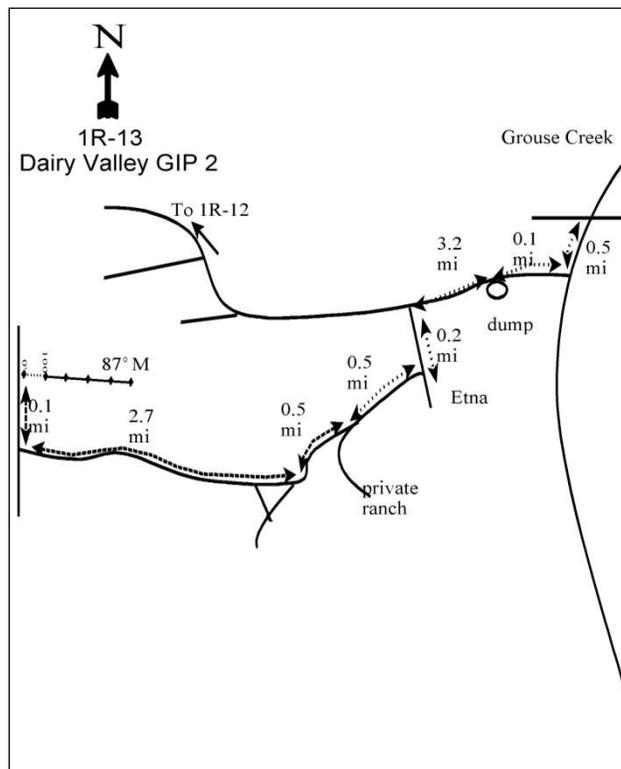
Directions:

From Grouse Creek, follow the Grouse Creek Road south out of town until the pavement ends. From the pavement, drive 0.5 miles to a right turn, and then go 0.1 miles to a dump on the left side of the road. Continue 3.2 miles and take the road on the left (78800 W). Drive for 0.2 miles to Etna, turn right in front of the mailboxes and continue for 0.2 miles to a gate with a private ranch on the left. From the gate, go 0.3 miles to a fork and stay right. Drive 0.1 miles to another gate and continue 0.4 miles passed it, staying right at the fork. From the fork, go 1.3 miles to the next gate and drive 0.3 miles to another gate. Continue 0.9 miles to the next gate. Go 0.2 miles, turn right and drive 0.1 miles to the witness post on the right side of the road. From the witness post go to the 0' stake at 71° M. The 0' stake is marked with browse tag # 250.

Map Name: Grouse Creek



Diagrammatic Sketch:



Township: 11N Range: 19S Section: 9

GPS: NAD 83, UTM 12T 248768 E 4619741 N

DAIRY VALLEY GIP 2 - WRI STUDY 1R-13

[Project #992](#)

Site Description

Site Information: The study is located approximately three miles southwest of Etna Reservoir, within a burned Utah juniper (*Juniperus osteosperma*) woodland, south of Camp creek, on private land. The study was established in 2008 to monitor the effects of a fire rehabilitation project. In July of 2007, the Dairy Valley fire burned 30,793 acres of Bureau of Land Management (BLM), Utah State Institutional Trust Land (SITLA), and private land. This area is crucial habitat for greater sage-grouse, mule deer, and elk. In December of 2007, a total of 6,900 acres of private and SITLA land were aerially seeded with a diverse seed mix of forb, grass, and browse species (Table - Seed Mix). In May of 2008, a total of 2,700 acres of private and SITLA lands were one-way Ely chained to remove burned Utah juniper trees. The objectives of the project are to rehabilitate crucial habitat for the greater sage-grouse and mule deer, and reduce the potential for noxious weed and annual grass establishment (WRI Database 2011). Pellet group data estimated light use by cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 01R, Study no: 13

Project Name: Dairy Valley			
WRI Database #: 992			
Application: Aerial Seed		Acres: 6300	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'P-7'	6300	1.00
G	Canby Bluegrass 'Canbar'	2239	0.36
G	Crested Wheatgrass 'Hycrest'	5500	0.87
G	Crested Wheatgrass 'Nordan'	5500	0.87
G	Great Basin Wildrye 'Trailhead'	3400	0.54
G	Intermediate Wheatgrass 'Oahe'	6300	1.00
G	Orchardgrass 'Paiute'	3200	0.51
G	Pubescent Wheatgrass	6300	1.00
G	Snake River Wheatgrass 'Secar'	6300	1.00
F	Alfalfa 'Ladak'	7100	1.13
F	Alfalfa 'Ranger'	2350	0.37
F	Sainfoin 'Eski'	6301	1.00
F	Small Burnet 'Delar'	6296	1.00
F	Yellow Sweetclover	3200	0.51
B	Forage Kochia 'Immigrant'	2300	0.37
Total Pounds:		72586	11.52
PLS Pounds:			10.29

Browse: Browse species are rare on the site following the Dairy Valley wildfire. The only preferred browse species sampled is forage kochia (*Kochia prostrata*). The forage kochia was seeded as part of the fire rehabilitation project and was sampled in low density on the study site. Other browse species sampled on the site include a small population of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and pricklypear cactus (*Opuntia* sp.). Serviceberry (*Amelanchier utahensis*) is present in small numbers on the site, but was only sampled in the height/crown measurements (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not particularly abundant, but are fairly diverse. The dominant grass species on the site is Sandberg bluegrass (*Poa secunda*). Other perennial grass species sampled on the site include western wheatgrass (*A. smithii*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail

(*Sitanion hystrix*). The annual grass species cheatgrass (*Bromus tectorum*) was also sampled, but in low abundance on the site. Bluebunch wheatgrass (*Agropyron spicatum*) was the only seeded grass species sampled on the study site, but may have been present before the seeding. Forbs are not particularly abundant, but are also fairly diverse. The dominant forb species is longleaf phlox (*Phlox longifolia*). The only seeded forb species sampled on the site since the treatment is alfalfa (*Medicago sativa*) (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a slightly acidic soil reaction (pH 6.5) (Table - Soil Analysis Data). Bare ground cover is high with a very high amount of pavement and a moderate amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008, but has a high potential for erosion due to the effects of the wildfire.

HERBACEOUS TRENDS--

Management unit 01R, Study no: 13

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron smithii	7	.02
G	Agropyron spicatum	20	.17
G	Bromus tectorum (a)	14	.03
G	Oryzopsis hymenoides	23	.42
G	Poa secunda	134	1.23
G	Sitanion hystrix	19	.17
Total for Annual Grasses		14	0.03
Total for Perennial Grasses		203	2.02
Total for Grasses		217	2.05
F	Alyssum alyssoides (a)	9	.03
F	Antennaria rosea	2	.00
F	Aster sp.	16	.13
F	Astragalus convallarius	3	.06
F	Balsamorhiza hookeri	5	.03
F	Collomia linearis (a)	1	.01
F	Comandra pallida	12	.22
F	Crepis acuminata	11	.19
F	Descurainia pinnata (a)	7	.04
F	Gilia sp. (a)	4	.01
F	Lappula occidentalis (a)	-	.00
F	Medicago sativa	1	.00
F	Penstemon sp.	1	.00
F	Phlox hoodii	6	.01
F	Phlox longifolia	95	.38
F	Taraxacum officinale	2	.03
Total for Annual Forbs		21	0.10
Total for Perennial Forbs		154	1.08
Total for Forbs		175	1.18

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

BROWSE TRENDS--

Management unit 01R, Study no: 13

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Chrysothamnus viscidiflorus viscidiflorus	16	.12
B	Kochia prostrata	1	.01
B	Opuntia sp.	11	.16
Total for Browse		28	0.29

CANOPY COVER, LINE INTERCEPT--

Management unit 01R, Study no: 13

Species	Percent Cover
	'08
Chrysothamnus viscidiflorus viscidiflorus	.01

POINT-QUARTER TREE DATA--

Management unit 01R, Study no: 13

Species	Trees per Acre	Average diameter (in)
	'08	'08
Juniperus osteosperma	18	4.7

BASIC COVER--

Management unit 01R, Study no: 13

Cover Type	Average Cover %
	'08
Vegetation	3.69
Rock	3.87
Pavement	57.06
Litter	18.77
Bare Ground	28.95

SOIL ANALYSIS DATA --

Management unit 1R, Study no: 13, Study Name: Dairy Valley GIP 2

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	6.5	36.0	29.4	34.6	2.5	15.9	352.0	0.7

PELLET GROUP DATA--

Management unit 01R, Study no: 13

Type	Quadrat Frequency	Days use per acre (ha)
	'08	'08
Rabbit	6	-
Cattle	-	3 (7)

BROWSE CHARACTERISTICS--

Management unit 01R, Study no: 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)	
Amelanchier utahensis										
08	0	0	0	-	-	0	0	0	9/20	
Chrysothamnus viscidiflorus viscidiflorus										
08	400	10	90	-	-	0	0	0	6/8	
Kochia prostrata										
08	20	0	100	-	40	0	0	0	2/7	
Opuntia sp.										
08	280	29	21	50	-	0	0	57	4/10	

MORRIS GIP - TREND STUDY NO. 1R-14-08
[Project #1503](#)

Vegetation Type: Black sagebrush, Pinyon/Juniper

Range Type: Greater Sage Grouse Brood

NRCS Ecological Site Description: [Upland Gravelly Loam \(Bonneville Big Sagebrush\), R028AY306UT](#)

Land Ownership: Private

Elevation: 5,914 ft. (1,803 m)

Aspect: South

Slope: 6%

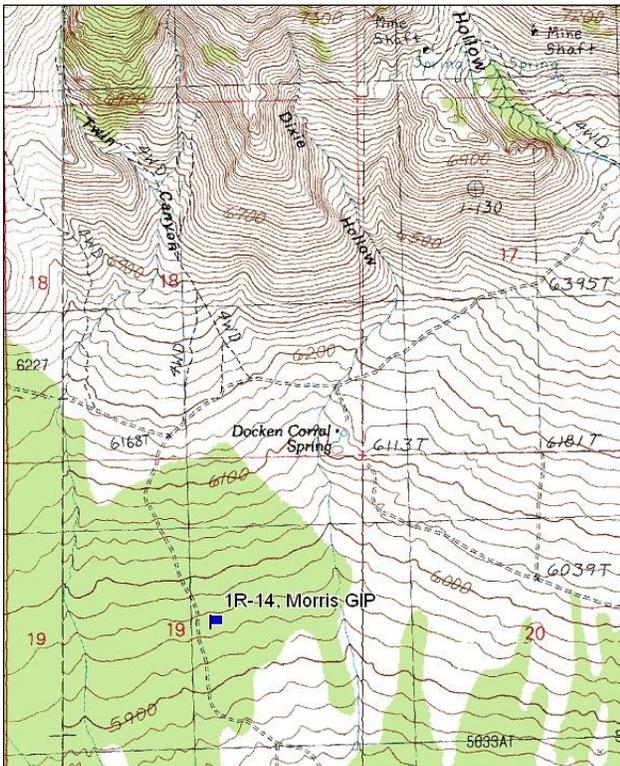
Transect bearing: 90° magnetic

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

Directions:

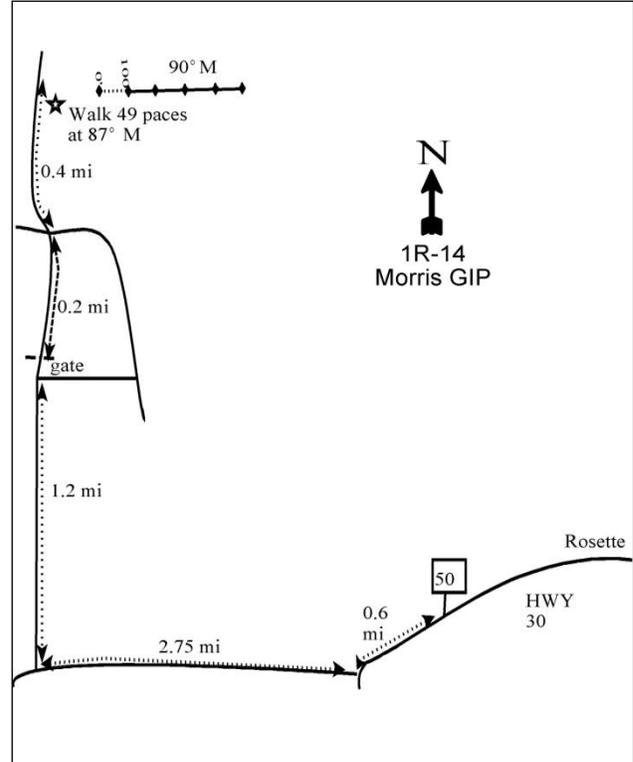
Head west on SR-42 from Snowville, UT to Curlew Junction and turn south (left) onto SR-30 toward Park Valley, UT. Continue on SR-30 passed Rosette, and turn right 0.6 miles after mile marker 50 by the sign to Lynn (onto 17600 N). Drive 2.75 miles to a gate on the right. From the gate, go 1.2 miles north to another gate. Drive 0.2 miles to a fork, stay to the right, and go 0.4 miles to the witness post on the right. The 0' stake is 49 paces from the witness post at 87° M. The 0' stake is marked with browse tag #241.

Map Name: Rosette



Township: 13N Range: 14W Section: 19

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 293027 E 4634751 N

MORRIS GIP - WRI STUDY 1R-14
[Project #1503](#)

Site Description

Site Information: The study is located approximately four miles northwest of Rosette, on private land, within a Utah juniper (*Juniperus osteosperma*) woodland. The study was established in 2008, prior to treatment, to monitor the effects of a Utah juniper treatment project. In the fall of 2008, a total of 1,200 acres were treated of which 512 acres were two-way Ely chained and aerially seeded and 798 acres were bulldozed and drill seeded. The juniper trees were pushed into wind rows and then burned, although some of the juniper trees were left for windbreaks and cover habitat. The study site was drill seeded with a mix of grass, forb, and browse species (Table - Seed Mix). The objectives of the project are to improve the herbaceous understory and preferred browse cover for sage-grouse and mule deer (WRI Database 2011). Pellet group data estimated light use by deer and cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 01R, Study no: 14

Project Name: Morris Ranch			
WRI Database #: 1503			
Application: Rangeland Drill		Acres: 450	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	450	1.00
G	Crested Wheatgrass 'Nordan'	900	2.00
G	Pubescent Wheatgrass 'Luna'	900	2.00
G	Siberian Wheatgrass 'Vavilov'	450	1.00
G	Snake River Wheatgrass 'Secar'	900	2.00
F	Alfalfa 'Ladak'	200	0.44
F	Alfalfa 'Ranger'	250	0.56
F	Sainfoin 'Eski'	892	1.98
F	Small Burnet 'Delar'	450	1.00
B	Forage Kochia	450	1.00
B	Fourwing Saltbush	450	1.00
Total Pounds:		6292	13.98
PLS Pounds:			11.92

Browse: The preferred browse species on the site are black sagebrush (*Artemisia nova*) and slender eriogonum (*Eriogonum microthecum*). Black sagebrush is the key browse species. The black sagebrush population is a moderately used population, with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor in 2008. The slender eriogonum is a moderately used population with low decadence and good vigor. The recruitment of young eriogonum plants to the population was good in 2008. Other browse species sampled on the site were prickly phlox (*Leptodactylon pungens*) and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not particularly abundant, though they are fairly diverse on the study. The dominant grass species on the site is Sandberg bluegrass (*Poa secunda*) which provides the majority of the grass cover. Other perennial grass species sampled on the site were western wheatgrass (*Agropyron smithii*), bluebunch wheatgrass (*A. spicatum*), and bottlebrush squirreltail (*Sitanion hystrix*). The annual grass species cheatgrass (*Bromus tectorum*) was also sampled on the site in low abundance. Forbs are neither abundant nor diverse. Long leaf phlox (*Phlox longifolia*) and sulfur eriogonum (*Eriogonum umbellatum*) are the most common forb species sampled on the site, but perennial forbs combined provide less than 1% cover (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a moderately acidic soil reaction (pH 5.6) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to slight litter, rock, and soil movement; pedestalling, and flow patterns.

HERBACEOUS TRENDS--

Management unit 01R, Study no: 14

Type	Species	Nested	Average
		Frequency '08	Cover % '08
G	Agropyron smithii	29	.05
G	Agropyron spicatum	9	.05
G	Bromus tectorum (a)	74	.17
G	Poa secunda	195	2.41
G	Sitanion hystrix	28	.16
G	Vulpia octoflora (a)	2	.00
Total for Annual Grasses		76	0.17
Total for Perennial Grasses		261	2.69
Total for Grasses		337	2.86
F	Chaenactis douglasii	5	.04
F	Collinsia parviflora (a)	3	.00
F	Cryptantha sp.	3	.01
F	Eriogonum shockleyi	12	.06
F	Eriogonum umbellatum	34	.58
F	Microsteris gracilis (a)	24	.04
F	Penstemon sp.	1	.00
F	Phlox longifolia	77	.21
F	Polygonum douglasii (a)	4	.00
F	Ranunculus testiculatus (a)	3	.01
Total for Annual Forbs		34	0.05
Total for Perennial Forbs		132	0.91
Total for Forbs		166	0.97

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

BROWSE TRENDS--

Management unit 01R, Study no: 14

Type	Species	Strip	Average
		Frequency '08	Cover % '08
B	Artemisia nova	63	2.48
B	Eriogonum microthecum	11	.02
B	Juniperus osteosperma	30	7.99
B	Leptodactylon pungens	8	.21
B	Opuntia sp.	14	.01
B	Purshia tridentata	-	.03
Total for Browse		126	10.77

CANOPY COVER, LINE INTERCEPT--

Management unit 01R, Study no: 14

Species	Percent Cover '08
Artemisia nova	3.08
Juniperus osteosperma	38.61
Leptodactylon pungens	.18
Opuntia sp.	.06

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 01R, Study no: 14

Species	Average leader growth (in) '08
Artemisia nova	1.2
Purshia tridentata	1.3

POINT-QUARTER TREE DATA--

Management unit 01R, Study no: 14

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	872	8.1

BASIC COVER--

Management unit 01R, Study no: 14

Cover Type	Average Cover % '08
Vegetation	15.04
Rock	3.65
Pavement	26.92
Litter	54.11
Cryptogams	.35
Bare Ground	13.47

SOIL ANALYSIS DATA --

Management unit 1R, Study no: 14, Study Name: Morris GIP 1

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	5.6	48.4	28.1	23.5	1.7	9.2	208.0	0.5

PELLET GROUP DATA--

Management unit 01R, Study no: 14

Type	Quadrat Frequency	Days use per acre (ha)
	'08	'08
Rabbit	72	-
Deer	3	3 (7)
Cattle	1	2 (5)

BROWSE CHARACTERISTICS--

Management unit 01R, 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 nova</i>									
08	2800	6	32	61	140	25	20	38	10/18
<i>Eriogonum microthecum</i>									
08	480	13	88	-	-	38	29	0	5/7
<i>Juniperus osteosperma</i>									
08	700	23	77	-	160	0	0	0	-/-
<i>Leptodactylon pungens</i>									
08	280	14	79	7	-	0	0	0	4/7
<i>Opuntia sp.</i>									
08	340	12	65	24	-	0	0	12	4/12
<i>Purshia tridentata</i>									
08	0	0	0	-	-	0	0	0	15/44
<i>Symphoricarpos oreophilus</i>									
08	0	0	0	-	-	0	0	0	17/32

HARRIS CANYON DIXIE - TREND STUDY NO. 4R-6-08
[Project #1471](#)

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Gravelly Loam \(Mountain Big Sagebrush\), R047XA406UT](#)

Land Ownership: UDWR

Elevation: 5,599 ft. (1,707 m)

Aspect: Northwest

Slope: 5%

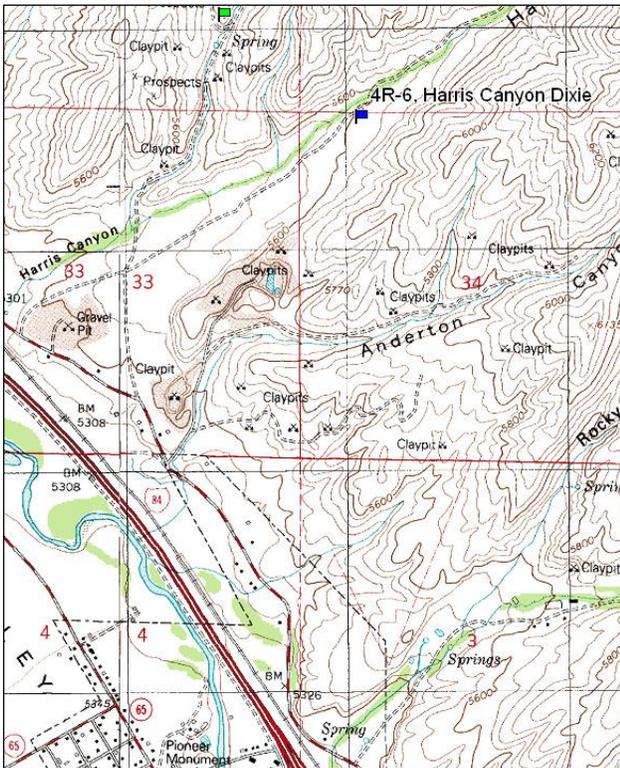
Transect bearing: 225° magnetic

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

Directions:

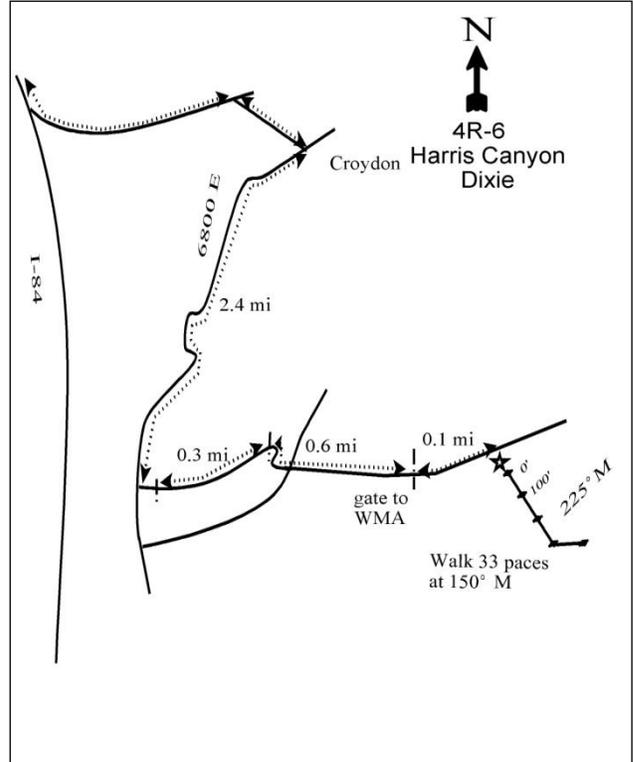
Drive west on 1-84 toward Ogden. Take Exit 111 onto Lost Creek Road; then take a slight right at N Lost Creek Road, and another right onto E 1900 N to Croydon. From Croydon, turn right onto 6800 E for 2.4 miles passed a ruined old house to a gate. From the gate, go 0.3 miles to another gate with a group of trees on the left. From this gate, go 0.6 miles to a gate to a Wildlife Management Area. Go through the gate 0.1 miles to the witness post on the right. The 0' stake is 33 paces from the witness post at 150° M. The 0' stake is marked with browse tag #236.

Map Name: Henefer



Township: 4N Range: 4E Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 458988 E 4543777 N

HARRIS CANYON DIXIE - WRI STUDY 4R-6
[Project #1471](#)

Site Description

Site Information: The study is located approximately two miles north of Henefer, in the bottom of Harris Canyon, in a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat. The study was established in 2008 to monitor a disking and Dixie harrow project in Henefer-Echo Wildlife Management Area (WMA). The sagebrush in Harris canyon has had a large die-off due to the infestation of the sagebrush defoliator moth. The condition of the remaining sagebrush plants was poor at the time of study establishment. The project will disk the bottom of Harris Canyon, and browse species will be planted to increase winter habitat for mule deer. The area will also be planted with forbs to accommodate brood rearing habitat for sage-grouse. The area on the benches above Harris Canyon will be Dixie harrowed to create mosaics within the sagebrush stand. The objectives of the project are to improve the health of sagebrush plants, improve crucial winter range habitat for big game animals, and improve sage-grouse spring and summer habitat (WRI Database 2011). Pellet group data estimated moderate use by elk, moderately heavy use by deer, and heavy use by cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 04R, Study no: 6

Project Name: Henefer Echo WMA - Bottoms			
WRI Database #: 1471			
Application: Rangeland Drill		Acres: 95	
Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	20	0.21
G	Great Basin Wildrye 'Trailhead'	100	1.05
G	Slender Wheatgrass 'San Luis'	100	1.05
G	Snake River Wheatgrass 'Secar'	100	1.05
G	Western Wheatgrass 'Arriba'	100	1.05
F	Alfalfa 'Ranger'	100	1.05
F	Blue Flax 'Appar'	20	0.21
F	Cicer Milkvetch 'Lutana'	100	1.05
F	Sainfoin 'Eski'	200	2.11
F	Small Burnet 'Delar'	200	2.11
B	Forage Kochia	100	1.05
B	Sagebrush, Basin Big	40	0.42
B	Sagebrush, Mountain	50	0.53
B	Saskatoon Serviceberry	50	0.53
Total Pounds:		1280	13.47
PLS Pounds:			10.79

Browse: The preferred browse species on the site are mountain big sagebrush and Utah serviceberry (*Amelanchier utahensis*). The key browse species is mountain big sagebrush. The mountain big sagebrush is a heavily used population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor in 2008. The serviceberry population is relatively small, but sampled plants display heavy use. Other browse species on the site include rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *hololeucus*) and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant, but are not diverse and are dominated by the invasive grass species bulbous bluegrass (*Poa bulbosa*). The only other grass species sampled on the site were intermediate

wheatgrass (*Agropyron intermedium*), which was fairly common, and crested wheatgrass (*A. cristatum*), which was rare on the site. Forbs are also not diverse or abundant on the site. The dominant forb species sampled on the site is alfalfa (*Medicago sativa*). Although each species is sampled in very low abundance, the only other forb species sampled on the site are bastard toadflax (*Comandra pallida*) and silvery lupine (*Lupinus argenteus*), (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a moderately acidic soil reaction (pH 5.6) (Table - Soil Analysis Data). Bare ground cover is low, with a high amount of vegetation and a moderate amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 04R, Study no: 6

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	Agropyron cristatum	22	.26
G	Agropyron intermedium	365	12.61
G	Poa bulbosa	467	38.50
Total for Annual Grasses		0	0
Total for Perennial Grasses		854	51.37
Total for Grasses		854	51.37
F	Comandra pallida	1	.15
F	Lupinus argenteus	4	.53
F	Medicago sativa	73	3.00
Total for Annual Forbs		0	0
Total for Perennial Forbs		78	3.68
Total for Forbs		78	3.68

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

BROWSE TRENDS--

Management unit 04R, Study no: 6

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Amelanchier utahensis	1	.15
B	Artemisia tridentata vaseyana	39	6.11
B	Chrysothamnus nauseosus hololeucus	5	.38
B	Chrysothamnus viscidiflorus viscidiflorus	1	-
Total for Browse		46	6.65

CANOPY COVER, LINE INTERCEPT--

Management unit 04R, Study no: 6

Species	Percent Cover '08
Artemisia tridentata vaseyana	6.40
Chrysothamnus nauseosus hololeucus	1.16
Chrysothamnus viscidiflorus viscidiflorus	.03

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 04R, Study no: 6

Species	Average leader growth (in) '08
Artemisia tridentata vaseyana	1.4

BASIC COVER--

Management unit 04R, Study no: 6

Cover Type	Average Cover % '08
Vegetation	64.75
Rock	3.07
Pavement	1.98
Litter	31.46
Cryptogams	.18
Bare Ground	11.15

SOIL ANALYSIS DATA --

Management unit 4R, Study no: 6, Study Name: Harris Canyon Dixie

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	5.9	31.0	44.4	24.6	3.0	35.8	246.4	0.7

PELLET GROUP DATA--

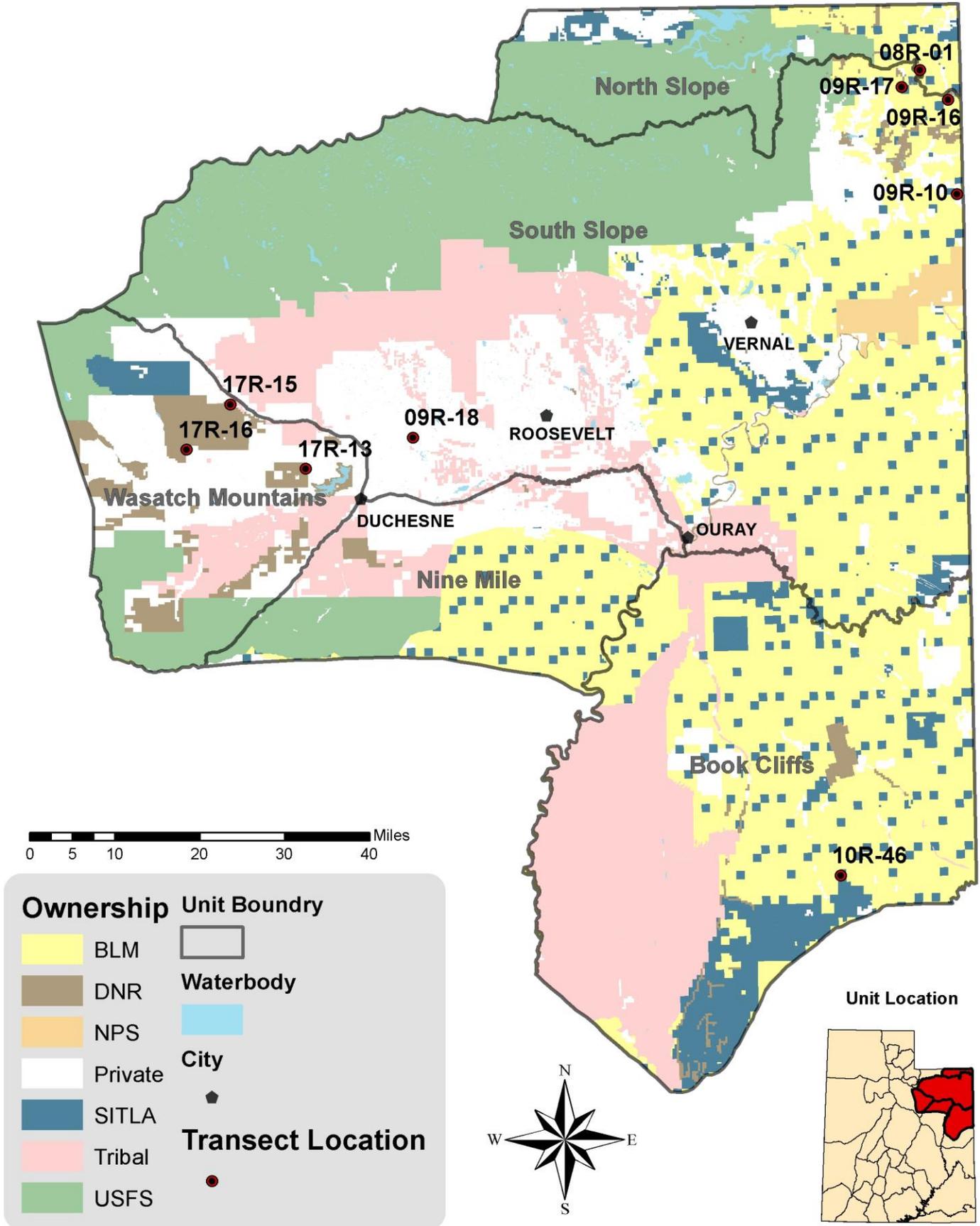
Management unit 04R, Study no: 6

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	6	-
Grouse	1	-
Elk	7	23 (58)
Deer	12	39 (96)
Cattle	30	54 (134)

BROWSE CHARACTERISTICS--
 Management unit 04R, 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)	
Amelanchier utahensis										
08	20	0	100	-	-	0	100	0	73/6	
Artemisia tridentata vaseyana										
08	1000	2	4	94	20	14	52	60	26/42	
Chrysothamnus nauseosus hololeucus										
08	100	0	100	-	-	0	20	0	29/43	
Chrysothamnus viscidiflorus viscidiflorus										
08	20	0	100	-	-	100	0	0	10/13	

Northeastern Region WRI Studies 2008



BROWN'S PARK DOUBLE DRUM - TREND STUDY NO. 8R-1-08

Project #26

Vegetation Type: Greasewood, Basin Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Sandy Loam \(Fourwing Saltbush\), R035XY215UT](#)

Land Ownership: UDWR

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

Aspect: Southwest

Slope: 2%

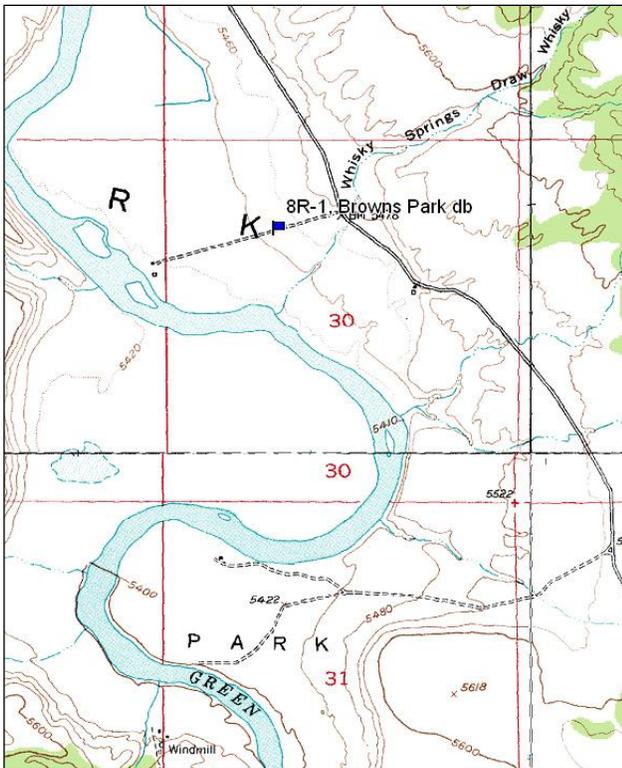
Transect bearing: 160° magnetic

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

Directions:

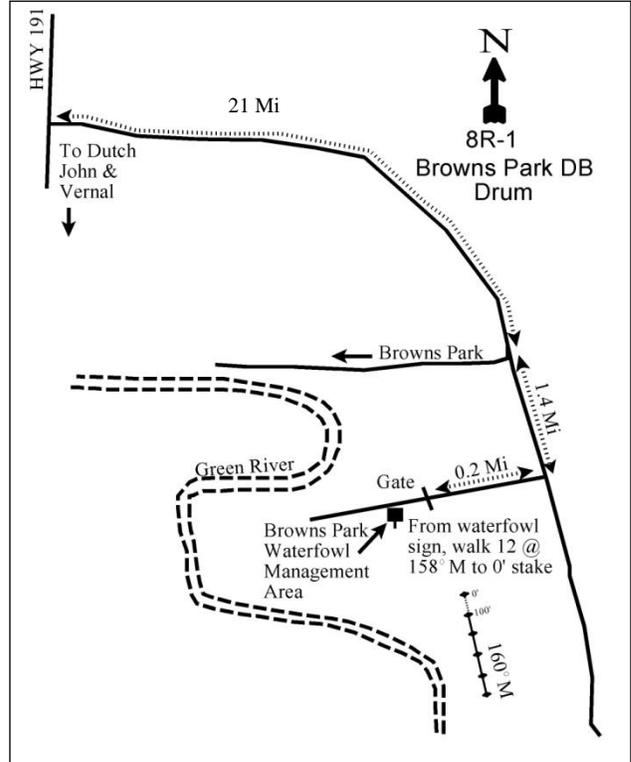
From Dutch John, proceed north towards Antelope Flat on Highway U.S. 191 for approximately 8 miles. Turn east onto the Antelope Flat Road toward Goslin Mountain, before the Wyoming border. Drive for 21 miles to a fork. Continue south on the main road for 1.4 miles to a fork. Turn right (west) and drive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

Map Name: Clay Basin



Township: 2N Range: 25E Section: 30

Diagrammatic Sketch:



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

BROWN'S PARK DOUBLE DRUM - WRI STUDY 8R-1
[Project #26](#)

Site Description

Site Information: 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, 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 2011). Pellet group data estimated light deer use and moderately heavy elk use in 2005, with light elk use and lightly moderate deer use in 2008 (Table - Pellet Group Data).

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				

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*), Russian wildrye (*Elymus junceus*), and Great Basin wildrye (*E. Cinereus*). Forbs are not diverse, but are fairly 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. The dominant annual forb species is annual kochia (*Kochia scoparia*), which increased substantially in abundance on the site following the treatment (Table - Herbaceous Trends).

Soil: 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 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 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 five-fold, and cover increased from 2% to 26%.

HERBACEOUS TRENDS--

Management unit 08R, Study no: 1

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	-	1	-	.01
G	Elymus cinereus	-	1	-	.15
G	Elymus junceus	a-	b11	-	.17
G	Sitanion hystrix	3	7	.01	.17
G	Vulpia octoflora (a)	5	7	.01	.04
Total for Annual Grasses		5	7	0.00	0.03
Total for Perennial Grasses		3	20	0.00	0.50
Total for Grasses		8	27	0.01	0.54
F	Alyssum alyssoides (a)	b63	a19	1.03	.12
F	Chenopodium album (a)	b66	a2	1.55	.00
F	Chenopodium leptophyllum(a)	6	-	.04	-
F	Descurainia pinnata (a)	b17	a-	.24	-
F	Eriogonum cernuum (a)	6	-	.06	-
F	Kochia scoparia (a)	a65	b335	2.42	25.56
F	Lepidium latifolium	14	-	.64	-
F	Salsola iberica (a)	2	6	.00	.16
F	Sisymbrium altissimum (a)	-	2	-	.00
Total for Annual Forbs		225	364	5.36	25.85
Total for Perennial Forbs		14	0	0.63	0
Total for Forbs		239	364	6.00	25.85

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	'05	'08
B	Atriplex canescens	0	1	-	.00
B	Atriplex confertifolia	9	1	.66	-
B	Chrysothamnus nauseosus	0	0	.15	-
B	Chrysothamnus viscidiflorus viscidiflorus	5	0	.03	-
B	Gutierrezia sarothrae	5	6	.01	.04
B	Opuntia sp.	2	1	.15	-
B	Sarcobatus vermiculatus	71	25	28.56	7.95
Total for Browse		92	34	29.58	8.00

CANOPY COVER, LINE INTERCEPT--

Management unit 08R, Study no: 1

Species	Percent Cover	
	'05	'08
Atriplex confertifolia	.43	.18
Chrysothamnus viscidiflorus viscidiflorus	.50	-
Gutierrezia sarothrae	.21	-
Opuntia sp.	.08	-
Sarcobatus vermiculatus	38.98	9.39

BASIC COVER--

Management unit 08R, Study no: 1

Cover Type	Average Cover %	
	'05	'08
Vegetation	33.61	33.49
Rock	.16	.18
Pavement	.06	.23
Litter	66.20	49.99
Cryptogams	3.62	.57
Bare Ground	20.72	29.80

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	'05	'08
Rabbit	40	56	-	1 (3)
Elk	3	1	44 (107)	15 (38)
Deer	10	6	5 (13)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 08R, 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 tridentata tridentata</i>									
05	0	0	0	-	-	0	0	0	26/22
08	0	0	0	-	-	0	0	0	-/-
<i>Atriplex canescens</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	100	0	-	-	0	0	0	-/-
<i>Atriplex confertifolia</i>									
05	220	0	73	27	20	0	0	55	14/20
08	20	0	100	0	-	0	0	0	13/8
<i>Chrysothamnus nauseosus</i>									
05	0	0	0	-	-	0	0	0	26/35
08	0	0	0	-	-	0	0	0	-/-
<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
<i>Gutierrezia sarothrae</i>									
05	400	65	30	5	-	0	0	5	10/11
08	260	0	100	0	-	0	0	0	12/13
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	7/5
<i>Opuntia sp.</i>									
05	120	0	100	0	-	0	0	0	4/16
08	60	0	67	33	-	0	0	33	3/6
<i>Sarcobatus vermiculatus</i>									
05	2700	2	36	61	-	1	0	100	48/61
08	660	12	85	3	-	0	0	12	35/51

RUPLE CABIN - TREND STUDY NO. 9R-10-08
[Project #178](#)

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XC430UT](#)

Land Ownership: Private

Elevation: 6,994 ft. (2,132 m)

Aspect: North

Slope: 8%

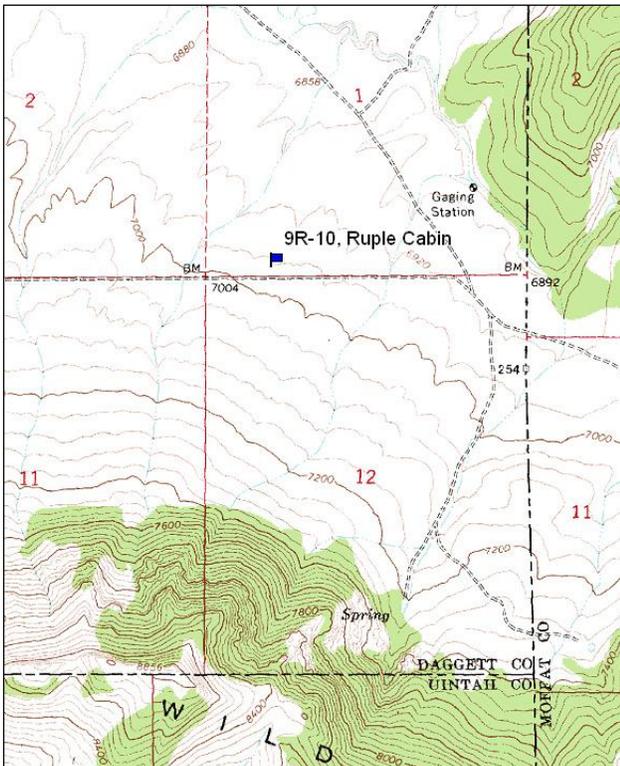
Transect bearing: 65° magnetic

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

Directions:

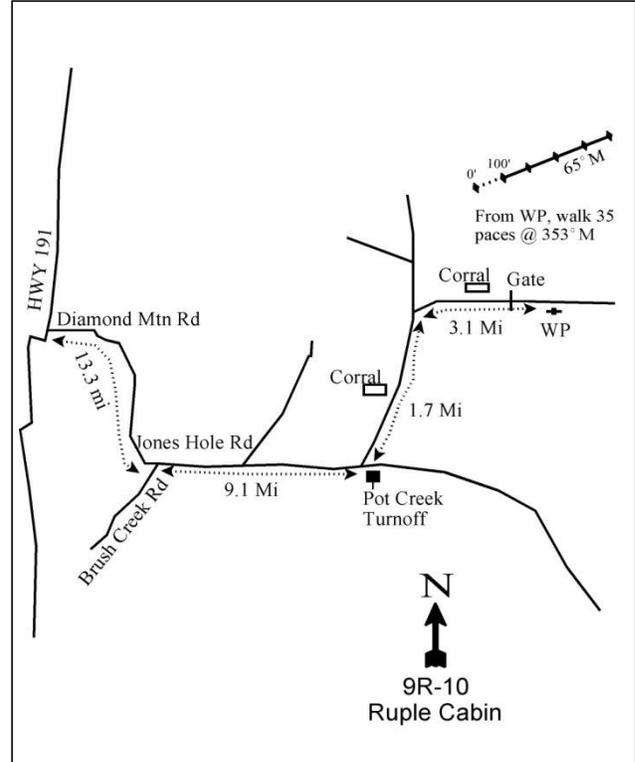
From Vernal, drive north on US 191. Turn right (east) on to Diamond Mountain road. Drive for 13.3 miles to a fork. Take the left fork and drive east on Jones Hole Rd for 9.1 miles to a fork to the right. There is a sign that says Pot Creek turnoff. Turn right and drive 1.7 miles to a fork. Stay right at the fork and drive 3.1 miles passing through a gate to the witness post on the right (south) side of the road. From the witness post, walk 35 paces at 353°M to the 0' stake. The 0' stake is marked with browse tag #83.

Map Name: Hoy Mountain



Township: 2S Range: 25E Section: 1

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 663742 E 4503958 N

RUPLE CABIN - WRI STUDY 9R-10

[Project #178](#)

Site Description

Site Information: The study is located 26 miles northeast of Vernal, near the Colorado state line, south of Hoy Mountain, north of Wild Mountain on land administrated by the Bureau of Land Management (BLM). The study site was established in the summer of 2005, prior to treatment, within the Ruple Cabin Sage-grouse Range Enhancement project area to monitor an aerator treatment of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). The project consisted of 1,850 acres which were seeded aerially (Table - Seed Mix) and then treated with a Lawson double drum aerator in September and October of 2005. The project covered private, State of Utah, and BLM land. The purpose of the project is to improve decadent sagebrush habitat for the greater sage-grouse (WRI Database 2011). Pellet group data estimated light use by deer and elk in all sample years. Sage-grouse pellets were estimated at 26 pellets/acre in 2005 and 9 pellets/acre in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 09R, Study no: 10

Project Name: Ruple Cabin Uplands			
WRI Database #: 178			
Application: Aerial seed		Acres:	1,650
Seed type		lbs in mix	lbs/acre
G	Big Bluegrass 'Sherman'	450	0.27
G	Bluebunch WG 'Anatone'	300	0.18
G	Bluebunch WG 'Goldar'	560	0.34
G	Canby Bluegrass 'Canbar'	450	0.27
G	Crested Wheatgrass 'Hycrest'	800	0.48
G	Orchardgrass 'Paiute'	550	0.33
G	Russian Wildrye	1650	1.00
G	Sandberg Bluegrass 'SID OR'	450	0.27
G	Snake River Wheatgrass 'Secar'	850	0.52
G	Thickspike Wheatgrass 'Critana'	1650	1.00
F	Alfalfa 'Ladak+'	900	0.55
F	Alfalfa 'Nomad'	900	0.55
F	Blue Flax	450	0.27
F	Sainfoin 'Eski'	4950	3.00
F	Small Burnet 'Delar'	3150	1.91
F	Western Yarrow	183	0.11
B	Bitterbrush	450	0.27
Total Pounds:		18693	11.33
PLS Pounds:			10.39

Browse: The key browse species on the site is mountain big sagebrush. The mountain big sagebrush has been the dominant browse species on the site since the outset of the study; however, the aerator treatment reduced the cover of sagebrush substantially (Table - Canopy Cover). Prior to the treatment, utilization of sagebrush plants was moderately heavy, with moderate decadence and good vigor within the population. After the treatment, utilization of sagebrush has been mostly light with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. Other less common palatable browse species sampled on the site include slenderbush eriogonum (*Eriogonum microthecum*) and antelope bitterbrush (*Purshia tridentata*). Utilization of antelope bitterbrush has been moderate to heavy over the sample period. Less desirable browse species occur in low numbers and

consist of rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse. The dominant perennial grass species is Sandberg bluegrass (*Poa secunda*), though this species decreased in abundance after the treatment. Other common grass species sampled on the site include mutton bluegrass (*P. fendleriana*), Kentucky bluegrass (*P. pratensis*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). The weedy annual species cheatgrass (*Bromus tectorum*) has been present since the outset of the study and has increased in abundance since the treatment. Seeded grass species sampled on the site include thickspike wheatgrass (*Agropyron dasystachyum*) and Sandberg bluegrass (*Poa secunda*). Forbs are highly diverse and fairly abundant on the study site. Perennial forbs are evenly diversified across the study site with no single species dominating the forb understory. The most common species sampled on the study site include timber poisonvetch (*Astragalus convallarius*), hairy false goldenaster (*Heterotheca villosa*), rock goldenrod (*Petradoria pumila*), and lobeleaf groundsel (*Senecio multilobatus*). Lewis flax (*Linum lewisii*) is the only seeded forb species sampled, though this species was present prior to the treatment.

Soil: The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). Bare ground cover is low with 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 and flow patterns. The soil erosion condition was classified as stable in 2008.

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

Browse: The density of mountain big sagebrush decreased 43% from 9,360 plants/acre to 5,380 plants/acre and canopy cover decreased from 35% to 15%. The health of the sagebrush population decreased with decadence increasing from 22% to 58% and poor vigor increasing from 3% to 60% of the population. The recruitment of young plants remained poor at 1% of the population. Antelope bitterbrush decreased slightly in density by 15% from 780 plants/acre to 660 plants/acre although canopy cover increased from 2% to 3%.

Grasses: The sum of nested frequency of perennial grasses increased substantially by 35%, and cover increased from 12% to 18%. Sandberg bluegrass significantly decreased in nested frequency and cover decreased from 10% to 6%. Mutton bluegrass was sampled for the first time, in 2008, following the treatment with relatively moderate abundance and a cover of 4%. Mutton blue grass may have been identified as Sandberg bluegrass, in 2005, due to the similarities of the two species. Cheatgrass significantly increased in nested frequency, and cover increased to 1%, though cheatgrass remained a minor part of the grass component. Needle-and-thread, bottlebrush squirreltail, and Kentucky bluegrass each increased significantly in nested frequency, and also increased in cover.

Forbs: The sum of nested frequency of perennial forbs increased substantially by 27%, and cover increased from 6% to 8%. Forbs are diverse on the site and no single forb species provided more than 1% cover in either sample year. The seeded species Lewis flax provided 1% cover following the treatment.

HERBACEOUS TRENDS--

Management unit 09R, Study no: 10

T y p e	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron dasystachyum</i>	56	51	.40	.51
G	<i>Agropyron smithii</i>	a-	b53	-	.49
G	<i>Bromus tectorum</i> (a)	a13	b73	.02	1.16
G	<i>Carex</i> sp.	a32	b7	.13	.18
G	<i>Koeleria cristata</i>	b20	a35	.15	.88
G	<i>Oryzopsis hymenoides</i>	-	-	-	.00
G	<i>Poa fendleriana</i>	a-	b102	-	3.89
G	<i>Poa pratensis</i>	a10	b57	.33	1.11
G	<i>Poa secunda</i>	a339	a244	9.67	6.03
G	<i>Sitanion hystrix</i>	a39	b85	.26	1.72
G	<i>Stipa comata</i>	a41	b88	.66	2.85
Total for Annual Grasses		13	73	0.02	1.16
Total for Perennial Grasses		537	722	11.62	17.69
Total for Grasses		550	795	11.64	18.85
F	<i>Agoseris glauca</i>	3	8	.00	.04
F	<i>Antennaria rosea</i>	17	19	.34	.41
F	<i>Arabis</i> sp.	11	10	.05	.02
F	<i>Aster</i> sp.	2	-	.02	-
F	<i>Astragalus convallarius</i>	30	32	.97	.75
F	<i>Astragalus tenellus</i>	14	15	.30	1.03
F	<i>Calochortus nuttallii</i>	-	1	-	.00
F	<i>Chaenactis douglasii</i>	a1	b27	.00	.07
F	<i>Collinsia parviflora</i> (a)	35	52	.14	.10
F	<i>Collomia linearis</i> (a)	a20	b39	.04	.08
F	<i>Comandra pallida</i>	14	15	.20	.11
F	<i>Cryptantha</i> sp.	2	3	.06	.01
F	<i>Delphinium nuttallianum</i>	-	3	-	.00
F	<i>Descurainia pinnata</i> (a)	a6	b18	.01	.04
F	<i>Draba</i> sp. (a)	a-	b19	-	.05
F	<i>Erigeron eatonii</i>	12	1	.27	.00
F	<i>Eriogonum alatum</i>	-	-	.00	-
F	<i>Eriogonum umbellatum</i>	20	10	.28	.48
F	<i>Gayophytum ramosissimum</i> (a)	8	5	.01	.01
F	<i>Grindelia squarrosa</i>	-	9	-	.02
F	<i>Heterotheca villosa</i>	b36	a11	.99	.91
F	<i>Lappula occidentalis</i> (a)	-	3	-	.01
F	<i>Linum lewisii</i>	13	47	.17	.56
F	<i>Lithospermum ruderales</i>	-	2	-	.03
F	<i>Lomatium</i> sp.	5	8	.01	.02
F	<i>Lupinus</i> sp.	a3	b19	.03	.36
F	<i>Machaeranthera canescens</i>	2	-	.00	-
F	<i>Microsteris gracilis</i> (a)	37	58	.14	.16
F	<i>Orthocarpus</i> sp. (a)	-	-	-	.00

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Penstemon sp.	a ⁻	b ¹⁴	-	.03
F	Penstemon sp.	12	5	.08	.03
F	Petradoria pumila	46	40	.93	.91
F	Phlox austromontana	11	7	.23	.03
F	Phlox longifolia	55	65	.33	.36
F	Polygonum douglasii (a)	17	9	.04	.02
F	Schoenocrambe linifolia	2	-	.03	-
F	Senecio multilobatus	a ²⁷	b ⁷⁰	.06	.95
F	Sphaeralcea coccinea	25	22	.15	.16
F	Tragopogon dubius (a)	1	1	.00	.00
F	Trifolium sp.	28	29	.11	.11
F	Zigadenus paniculatus	7	12	.05	.07
Total for Annual Forbs		124	204	0.40	0.50
Total for Perennial Forbs		398	504	5.75	7.54
Total for Forbs		522	708	6.15	8.04

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

BROWSE TRENDS--

Management unit 09R, Study no: 10

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata vaseyana	100	86	29.64	12.14
B	Chrysothamnus nauseosus	3	5	.03	.01
B	Eriogonum microthecum	1	1	-	.03
B	Gutierrezia sarothrae	10	7	.12	.21
B	Opuntia sp.	7	2	.03	.06
B	Purshia tridentata	33	27	1.25	2.76
B	Tetradymia canescens	1	1	-	-
Total for Browse		155	129	31.08	15.23

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 10

Species	Percent Cover	
	'05	'08
Artemisia tridentata vaseyana	34.48	14.81
Gutierrezia sarothrae	.11	.05
Opuntia sp.	-	.01
Purshia tridentata	1.46	2.71
Tetradymia canescens	.35	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 09R, Study no: 10

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata vaseyana	1.4	1.6
Purshia tridentata	4.4	2.3

BASIC COVER--

Management unit 09R, Study no: 10

Cover Type	Average Cover %	
	'05	'08
Vegetation	45.31	44.04
Rock	2.66	2.90
Pavement	1.55	.97
Litter	36.33	48.26
Cryptogams	2.00	.19
Bare Ground	31.04	18.69

SOIL ANALYSIS DATA --

Management unit 9R, Study no: 10, Study Name: Ruple Cabin

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
12.0	6.7	51.1	27.1	21.8	2.5	13.1	137.6	0.7

PELLET GROUP DATA--

Management unit 09R, Study no: 10

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	30	6	-	-
Grouse	-	3	-	9/acre
Elk	8	3	11 (26)	-
Deer	6	9	11 (28)	8 (20)
Cattle	5	2	11 (27)	3 (7)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 10

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>									
05	9360	5	73	22	-	28	29	3	24/30
08	5380	1	41	58	20	2	1	60	19/26
<i>Chrysothamnus nauseosus</i>									
05	60	33	0	67	-	33	0	33	23/31
08	100	0	100	0	-	0	0	0	18/26
<i>Eriogonum microthecum</i>									
05	20	0	100	-	-	0	0	0	6/6
08	20	0	100	-	-	0	0	0	7/11
<i>Gutierrezia sarothrae</i>									
05	260	8	92	-	-	0	0	0	9/10
08	340	41	59	-	-	0	0	0	10/12
<i>Opuntia sp.</i>									
05	220	18	64	18	-	0	0	9	3/10
08	80	0	25	75	-	0	0	0	4/11
<i>Pediocactus simpsonii</i>									
05	0	0	0	-	-	0	0	0	2/3
08	0	0	0	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
05	780	15	77	8	-	28	44	5	10/22
08	660	0	85	15	-	18	15	12	12/26
<i>Tetradymia canescens</i>									
05	20	0	100	0	-	100	0	0	12/23
08	20	0	0	100	-	0	0	0	-/-

BROWN'S FIELD - TREND STUDY NO. 9R-16-08

[Project #1152](#)

Vegetation Type: Annual Forb, Annual Grass

Range Type: Crucial Deer Winter

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

Land Ownership: UDWR

Elevation: 5,606 ft. (1,709 m)

Aspect: Northeast

Slope: 5%

Transect bearing: 75° magnetic

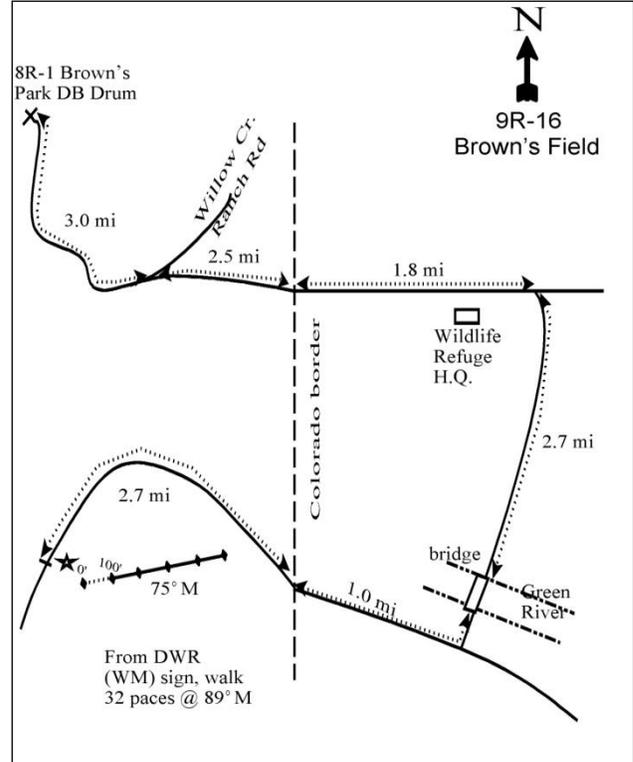
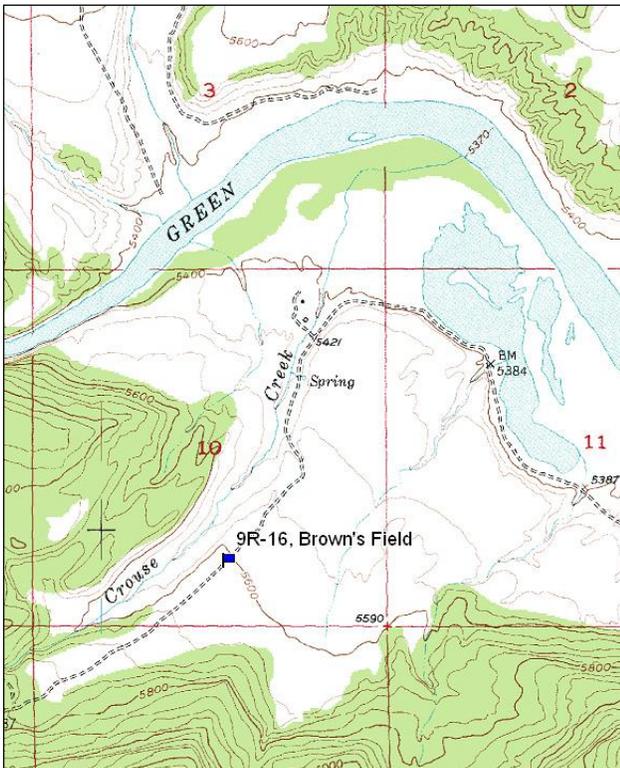
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:

From Dutch John, proceed north toward Antelope Flat on Highway U.S. 191 for approximately 8 miles. Turn east on the Antelope Flat Road, before the Wyoming border. Drive for 21 miles to a fork. Continue south on the main road for 1.4 miles to the turnoff to Brown's Park DB Drum. Continue 3 miles to the Willow Creek Ranch road intersection and stay right. Drive for 2.5 miles on a dirt road to a cattle guard (on the state line). From the cattle guard drive 1.8 miles on paved road and turn right at the Wildlife Refuge Headquarters. Go 2.7 miles to the bridge crossing Green river and turn right. Drive 1.0 mile to a cattle guard (on the state line) and go 2.7 miles, passing the Brown's Park DWR Field Station on the right, to the witness post on the left side. The 0' stake is 32 paces from the DWR (Wildlife Management) sign at 89° M. The 0' stake is marked with browse tag # 232.

Map Name: Swallow Canyon

Diagrammatic Sketch:



Township: 1N Range: 25E Section: 10

GPS: NAD 83, UTM 12T 662108 E 4521860 N

BROWN'S FIELD - WRI STUDY 9R-16
[Project #1152](#)

Site Description

Site Information: The study is located approximately one mile southwest of Kings Point, within Browns Park, on the south side of the Green River, in the Three Corners Wildlife Management Area (WMA). The study site was established in 2008, prior to treatment, to monitor the effects of a rangeland drill seeding and Plateau (Imazapic) herbicide application, within an abandoned agricultural field, on Crouse bench. The project treatment area is within crucial and substantial habitat areas for several species including elk, deer, moose, bighorn sheep, pronghorn, and sage-grouse. In the fall of 2008, a total of 143 acres were treated with Plateau herbicide to control cheatgrass. In January of 2009, the project area was seeded using a rangeland drill. Prior to the establishment of the trend study, several efforts were made at reseeding Crouse bench. Drought conditions and lack of precipitation precluded seed establishment on the 225 acre project in 2003. In the fall of 2006, Crouse bench was reseeded (Table - Seed Mix) using a Truax rangeland drill as part of the Browns Park Ag Field Rehabilitation project ([WRI Project #26](#)). The objectives of the projects are to improve the vegetation component, provide additional forage, and valuable habitat for wildlife species (WRI Database 2011). Pellet group data estimated very heavy use by deer and moderate use by elk in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 09R, Study no: 16

Project Name: Brown's Park Fields WRI Database #: 1152				Project Name: Crouse Bench WRI Database #: 26			
Application: Rangeland Drill		Acres: 161		Application: Rangeland Drill		Acres: 225	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	100	0.62	G	Thickspike Wheatgrass 'Bannock'	225	1.40
G	Bottlebrush Squirreltail 'Toe Jam'	50	0.31	G	Orchardgrass 'Paiute'	55	0.34
G	Canby Bluegrass 'Canbar'	50	0.31	G	Canby Bluegrass 'Canbar'	55	0.34
G	Crested Wheatgrass 'Douglas'	100	0.62	F	Alfalfa 'Nomad'	450	2.80
G	Crested Wheatgrass 'Hycrest'	100	0.62	F	Sainfoin 'Eski'	900	5.59
G	Crested Wheatgrass 'Nordan'	100	0.62	F	Small Burnet 'Delar'	675	4.19
G	Intermediate Wheatgrass 'Oahe'	200	1.24	B	Sagebrush, Wyoming	225	1.40
G	Russian Wildrye 'Bozoisky'	150	0.93	B	Forage Kochia	225	1.40
G	Siberian Wheatgrass 'Vavilov'	150	0.93	Total Pounds:		2810	12.49
G	Snake River Wheatgrass 'Secar'	100	0.62	PLS Pounds:			10.57
G	Western Wheatgrass 'Arriba'	200	1.24				
F	Alfalfa 'Ladak'	150	0.93				
F	Alfalfa 'Ranger'	200	1.24				
B	Forage Kochia	157	0.98				
B	Fourwing Saltbush	50	0.31				
B	Sagebrush, Wyoming	160	0.99				
Total Pounds:		2017	12.53				
PLS Pounds:			10.15				

Browse: Browse species are very rare on the site.

Herbaceous Understory: Grasses are abundant and somewhat diverse on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) dominated the grass component and provided the majority of the grass cover. Crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) were the most common perennial grass species sampled on the site. Forbs are abundant, but are not diverse and are

dominated by weedy annual species which include annual kochia (*Kochia scoparia*), Russian thistle (*Salsola iberica*), and tumbled mustard (*Sisymbrium altissimum*) (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is high with a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 09R, Study no: 16

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron cristatum	57	1.24
G	Agropyron intermedium	199	5.67
G	Bromus tectorum (a)	371	9.93
G	Elymus junceus	6	.19
G	Oryzopsis hymenoides	2	.15
G	Sporobolus cryptandrus	36	.38
Total for Annual Grasses		371	9.93
Total for Perennial Grasses		300	7.64
Total for Grasses		671	17.57
F	Chenopodium leptophyllum(a)	1	.00
F	Iva axillaris	13	.22
F	Kochia scoparia (a)	269	5.28
F	Medicago sativa	1	.00
F	Penstemon sp.	25	.13
F	Salsola iberica (a)	163	.32
F	Sisymbrium altissimum (a)	164	2.90
F	Sphaeralcea coccinea	2	.01
F	Tragopogon dubius (a)	3	.03
Total for Annual Forbs		600	8.55
Total for Perennial Forbs		41	0.36
Total for Forbs		641	8.92

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

BROWSE TRENDS--

Management unit 09R, Study no: 16

Type	Species	Percent	Average
		Cover	Cover %
		'08	'08
B	Opuntia sp.	.06	.15
Total for Browse		0.06	0.15

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 16

Species	Percent Cover '08
Kochia prostrata	.06

BASIC COVER--

Management unit 09R, Study no: 16

Cover Type	Average Cover % '08
Vegetation	35.77
Rock	.30
Pavement	.61
Litter	33.20
Bare Ground	43.50

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 16, Study Name: Browns Field

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.2	64.0	16.4	19.6	0.8	5.9	198.4	0.8

PELLET GROUP DATA--

Management unit 09R, Study no: 16

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	69	-
Elk	31	28 (69)
Deer	61	86 (213)

BROWSE CHARACTERISTICS--
 Management unit 09R, 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>Atriplex canescens</i>									
08	0	0	0	-	-	0	0	0	21/28
<i>Chrysothamnus nauseosus</i>									
08	0	0	0	-	-	0	0	0	26/50
<i>Gutierrezia sarothrae</i>									
08	0	0	0	-	-	0	0	0	8/13
<i>Kochia prostrata</i>									
08	0	0	0	-	-	0	0	0	3/9
<i>Opuntia sp.</i>									
08	100	0	100	-	-	0	0	0	3/8

TOLIVER CREEK BULLHOG - TREND STUDY NO. 9R-17-08
[Project #1084](#)

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Pinyon-Utah Juniper\), R047XC335UT](#)

Land Ownership: SITLA

Elevation: 6,057 ft. (1,846 m)

Aspect: Northeast

Slope: 4%

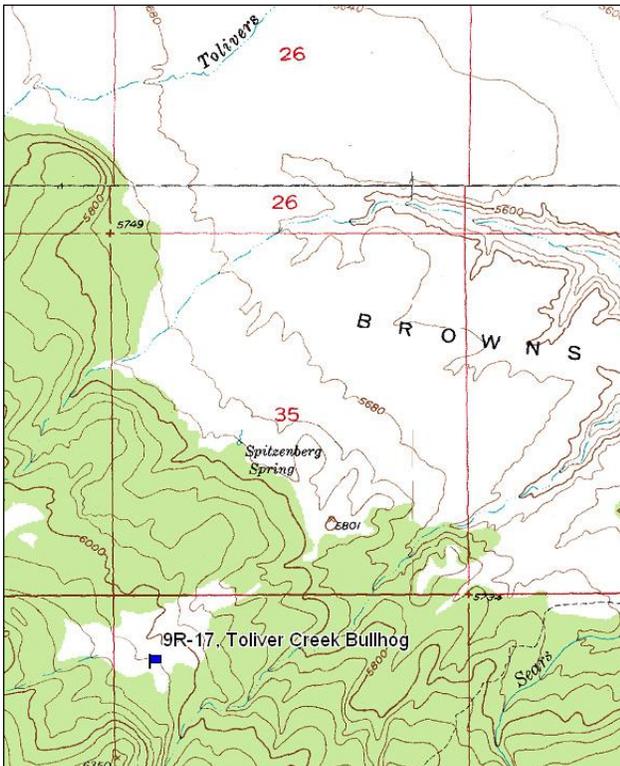
Transect bearing: 183° magnetic

Belt placement: line 1 (11ft and 95), line 2 (54ft), line 3 (only 85 ft long) (34 and 71 ft)

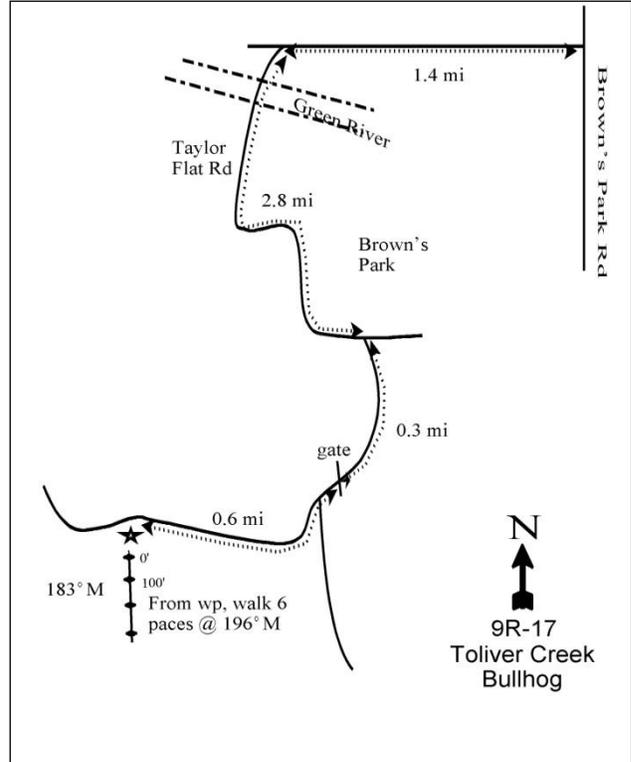
Directions:

From Brown's Park Road, turn west and drive 1.4 miles toward Toliver Flat Road. Following Toliver Flat Road, cross the bridge over the Green River and continue 2.8 miles to an intersection, passing Bridge Hollow campground and Brown's Park on the left. Stay right at the intersection and drive 0.3 miles to a gate. From the gate, take the road to the right (not Outlaw Trail) and drive 0.6 miles to the half-high witness post on the left. The 0' stake is 6 paces from the witness post at 196° M. The 0' stake is marked with browse tag # 261.

Map Name: Warren Draw



Diagrammatic Sketch:



Township: 1N Range: 24E Section: 2

GPS: NAD 83, UTM 12T 653279 E 4524287 N

TOLIVER CREEK BULLHOG - WRI STUDY 9R-17
[Project #1084](#)

Site Description

Site Information: The study is located approximately a half mile south of Spitzenberg Spring, on a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) bench, west of Browns Park, on Utah State Institutional Trust Land (SITLA). The study was established in 2008, prior to treatment, to monitor the effects of a bullhog project to remove pinyon and juniper trees within an old chaining in the Browns Park area. The project area is crucial winter range for elk and mule deer, and is crucial year-round habitat for bighorn sheep. Portions of the project are also crucial sage-grouse brood-rearing habitat. Shortly after bullhog operations began in the fall of 2008, the area was aerially seeded with a seed mix of grass, forb, and browse species (Table - Seed Mix). The project was completed in the end of December of 2008. The objectives of the project are to increase the amount of available forage by reducing competition from pinyon and juniper trees and establishing desirable seeded species (WRI Database 2011). Pellet group data estimated heavy use by deer and moderate use by elk and cattle in 2008 (Table - Pellet Group Data).

SEED MIX--
 Management unit 09R, Study no: 17

Project Name: Toliver Creek Bullhog			
WRI Database #: 1084			
Application: Aerial Seed		Acres:	250
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	250	1.00
G	Indian Ricegrass 'Rimrock'	250	1.00
G	Sand Dropseed	13	0.05
G	Sandberg Bluegrass	63	0.25
G	Snake River Wheatgrass 'Secar'	250	1.00
G	Western Wheatgrass 'Arriba'	375	1.50
F	Alfalfa 'Ladak'	175	0.70
F	Alfalfa 'Ranger'	200	0.80
B	Fourwing Saltbush	250	1.00
B	Sagebrush, Wyoming	250	1.00
Total Pounds:		2076	8.30
PLS Pounds:			6.07

Browse: The preferred browse species is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), which provided the majority of the cover prior to the treatment in 2008 (Table - Canopy Cover). The mountain big sagebrush is a heavily used population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor in 2008. Other browse species sampled on the site include pricklypear cactus (*Opuntia sp.*) and woods rose (*Rosa woodsii*) (Table - Browse Characteristics). On the site prior to the treatment in 2008, pinyon pine and Utah juniper trees were common at 53 trees/acre and 77 trees/acre, respectively (Table - Point-Quarter Tree Data).

Herbaceous Understory: Grasses are fairly abundant and diverse. The dominant perennial grass species are western wheatgrass (*Agropyron smithii*), Sandberg bluegrass (*Poa secunda*) and needle-and-thread (*Stipa comata*), which provide the majority of the grass cover on the study site. The weedy annual grass species cheatgrass (*Bromus tectorum*) and the native annual grass species sixweeks fescue (*Vulpia octoflora*) are also common on the site. Other grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), sedge (*Carex sp.*), Indian ricegrass (*Oryzopsis hymenoides*), mutton bluegrass (*Poa fendleriana*),

bottlebrush squirreltail (*Sitanion hystrix*) and alkali sacaton (*Sporobolus airoides*). Forbs are not diverse or abundant, with very few forbs being sampled (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a slightly acidic soil reaction (pH 6.4) (Table - Soil Analysis Data). Bare ground cover is high, with a high amount of litter and moderate amount of vegetation and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 09R, Study no: 17

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron cristatum	18	.36
G	Agropyron smithii	108	1.28
G	Bromus tectorum (a)	172	1.67
G	Carex sp.	39	.94
G	Oryzopsis hymenoides	14	.07
G	Poa fendleriana	2	.01
G	Poa secunda	90	1.21
G	Sitanion hystrix	2	.06
G	Sporobolus airoides	7	.01
G	Stipa comata	94	2.22
G	Vulpia octoflora (a)	104	.26
Total for Annual Grasses		276	1.93
Total for Perennial Grasses		374	6.20
Total for Grasses		650	8.13
F	Alyssum alyssoides (a)	12	.03
F	Cymopterus sp.	1	.00
F	Descurainia pinnata (a)	2	.01
F	Gilia sp. (a)	8	.05
F	Iva axillaris	15	.02
F	Lappula occidentalis (a)	3	.01
F	Orobancha fasciculata	5	.02
F	Sphaeralcea coccinea	20	.20
Total for Annual Forbs		25	0.11
Total for Perennial Forbs		41	0.25
Total for Forbs		66	0.36

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

BROWSE TRENDS--

Management unit 09R, Study no: 17

Type	Species	Strip Frequency '08	Average Cover % '08
B	Artemisia tridentata vaseyana	74	10.82
B	Gutierrezia sarothrae	18	.45
B	Juniperus osteosperma	5	7.64
B	Opuntia sp.	17	.79
B	Pinus edulis	6	3.64
Total for Browse		120	23.35

CANOPY COVER, LINE INTERCEPT--

Management unit 09R, Study no: 17

Species	Percent Cover '08
Artemisia tridentata vaseyana	12.41
Gutierrezia sarothrae	.35
Juniperus osteosperma	5.90
Opuntia sp.	.58
Pinus edulis	4.34

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 09R, Study no: 17

Species	Average leader growth (in) '08
Artemisia tridentata vaseyana	1.2

POINT-QUARTER TREE DATA--

Management unit 09R, Study no: 17

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	77	9.0
Pinus edulis	53	5.2

BASIC COVER--

Management unit 09R, Study no: 17

Cover Type	Average Cover % '08
Vegetation	29.12
Rock	.07
Pavement	6.01
Litter	42.22
Cryptogams	1.98
Bare Ground	42.22

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 17, Study Name: Toliver Creek Bullhog and Seed

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	6.4	62.0	19.4	18.6	0.8	8.0	140.8	0.6

PELLET GROUP DATA--

Management unit 09R, Study no: 17

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	73	-
Elk	10	26 (65)
Deer	20	76 (187)
Cattle	7	27 (66)

BROWSE CHARACTERISTICS--

Management unit 09R, 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 tridentata vaseyana</i>									
08	4120	3	63	33	160	21	65	17	14/23
<i>Gutierrezia sarothrae</i>									
08	420	0	90	10	-	0	5	5	7/9
<i>Juniperus osteosperma</i>									
08	120	17	67	17	-	0	0	33	-/-
<i>Opuntia sp.</i>									
08	660	6	88	6	40	0	0	3	4/15
<i>Pinus edulis</i>									
08	120	17	83	-	-	0	0	0	-/-
<i>Rosa woodsii</i>									
08	0	0	0	-	-	0	0	0	14/14

BROTHERSON CHAINING - TREND STUDY NO. 9R-18-08
[Project #1150](#)

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: Private

Elevation: 6,284 ft. (1,915 m)

Aspect: Northeast

Slope: 2%

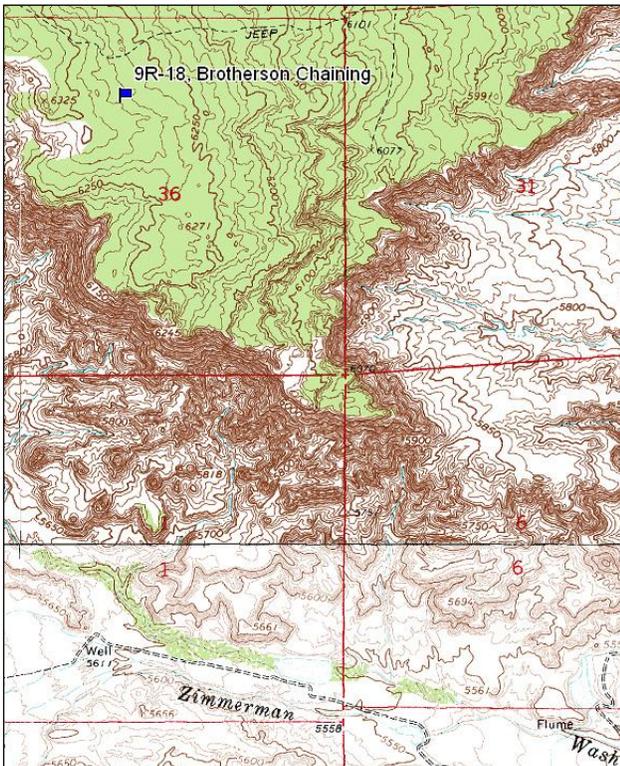
Transect bearing: 227° magnetic

Belt placement: line 1 (11ft and 95), line 2 (54ft), line 3 (34 and 71 ft)

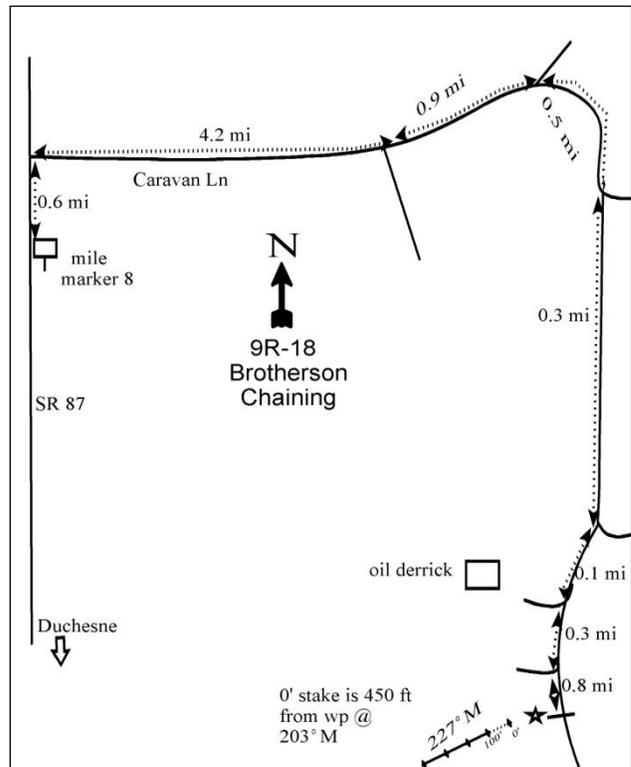
Directions:

From Duchesne, drive north on SR 87. Drive 0.6 miles passed mile marker 8 to Caravan Lane on the east side of the road. Drive 4.2 miles on Caravan Lane to an intersection. Stay left, and go 0.9 miles to another intersection. Stay right and go 0.5 miles, passing some gas tanks on the left to a fork. Stay right and drive 0.3 miles, heading south, to the next fork. Keep right and go 0.1 miles passed an oil derrick. Drive 0.3 miles to a fork, keeping left, and then drive 0.8 miles to the half-high witness post on the right side of the road. The 0' stake is 450 ft from the witness post at 203° M. The 0' stake is marked with browse tag # 252.

Map Name: Altamont



Diagrammatic Sketch:



Township: 2S Range: 4W Section: 36

GPS: NAD 83, UTM 12T 560622 E 4457742 N

BROTHERSON CHAINING - WRI STUDY 9R-18
[Project #1150](#)

Site Description

Site Information: The study is located approximately three and half miles west of Upalco, on a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) bench, overlooking Zimmerman Wash. The study was established in 2008, prior to treatment, to monitor a two-way Ely chaining project on private property. The project area is considered substantial brooding habitat for sage-grouse, and winter range for elk and deer. In November of 2008, a total of 347 acres were two-way chained using an Ely chain. After the first pass with the chain, a seed mix of grass and forb species was aerially applied to the project. Forage kochia (*Kochia prostrata*) was aerially seeded (Table - Seed Mix) on the project after the completion of the chaining treatment. Adjacent property to the project area has been chained in the past with success. The objectives of the project are to improve winter habitat for deer, sage-grouse, and elk by removing encroaching pinyon and juniper trees and to increase vegetation for livestock grazing (WRI Database 2011). Pellet group data estimated moderately heavy use by deer, and light use by elk and cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 09R, Study no: 18

Project Name: Brotherson Chaining					
WRI Database #: 1150					
Application: *Aerial Seed 1		Acres: 200		Application: *Aerial Seed 2	
				Acres: 200	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Blue Grama	40	0.20	B	Forage Kochia
G	Bluebunch WG 'Goldar'	200	1.00	Total Pounds:	
G	Crested Wheatgrass 'Nordan'	200	1.00	350	
G	Indian Ricegrass 'Rimrock'	200	1.00	PLS Pounds:	
G	Russian Wildrye 'Bozoisky'	200	1.00	1.16	
G	Sand Dropseed	10	0.05		
G	Sandberg Bluegrass	50	0.25		
G	Thickspike Wheatgrass 'Critana'	200	1.00		
F	Blue Flax 'Appar'	50	0.25		
F	Western Yarrow	10	0.05		
Total Pounds:		1160	5.80		
PLS Pounds:			5.04		

*Aerial Seed 1 was seeded between the chaining passes. Aerial Seed 2 was aerially seeded following the completion of the chaining project.

Browse: The preferred browse species are black sagebrush (*Artemisia nova*) and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). The black sagebrush is a lightly used population with moderately high decadence and good vigor within the population. The basin big sagebrush is a lightly used population with high decadence and poor vigor within the population. The recruitment of young black sagebrush and basin big sagebrush plants was poor in 2008. Other browse species sampled on the site include spiny hopsage (*Grayia spinosa*) and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics). Prior to the treatment, Utah juniper dominated the overstory vegetation with an estimated 77 trees/acre (Table - Point-Quarter Tree Data) and canopy cover of 16% (Table - Canopy Cover).

Herbaceous Understory: Grasses are not abundant or diverse, and are in poor condition on the site. Perennial grass species were very rare on the site and no perennial grass species were sampled in 2008. The grass composition consisted of the invasive annual species cheatgrass (*Bromus tectorum*) and the native annual species sixweeks fescue (*Vulpia octoflora*). Forbs are moderately abundant, but are not particularly diverse. Perennial forbs are not very common the site with the most common perennial forb species being Douglas

chaenactis (*Chaenactis douglasii*). Annual forbs are common within the sample area. The most abundant forb species are pinnate tansymustard (*Descurainia pinnata*) and nodding eriogonum (*Eriogonum cernuum*) (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is high 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 2008 due to surface litter, rock and soil movement; pedestalling, flow patterns, and rills.

HERBACEOUS TRENDS--

Management unit 09R, Study no: 18

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	Bromus tectorum (a)	15	.03
G	Vulpia octoflora (a)	5	.01
Total for Annual Grasses		20	0.03
Total for Perennial Grasses		0	0
Total for Grasses		20	0.03
F	Arabis sp.	3	.03
F	Chaenactis douglasii	78	1.18
F	Chenopodium leptophyllum(a)	42	.42
F	Descurainia pinnata (a)	70	1.18
F	Eriogonum cernuum (a)	93	1.27
F	Gilia sp. (a)	18	.07
F	Lappula occidentalis (a)	7	.04
F	Schoenrambe linifolia	7	.24
F	Sisymbrium altissimum (a)	4	.00
Total for Annual Forbs		234	3.00
Total for Perennial Forbs		88	1.46
Total for Forbs		322	4.47

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

BROWSE TRENDS--

Management unit 09R, Study no: 18

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia nova	19	2.48
B	Artemisia tridentata tridentata	24	1.62
B	Grayia spinosa	8	.60
B	Juniperus osteosperma	8	6.42
B	Opuntia sp.	66	10.94
Total for Browse		125	22.07

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 18

Species	Percent Cover '08
Artemisia nova	2.51
Artemisia tridentata tridentata	2.78
Grayia spinosa	.75
Juniperus osteosperma	15.83
Opuntia sp.	7.96

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 09R, Study no: 18

Species	Average leader growth (in) '08
Artemisia nova	0.5
Artemisia tridentata tridentata	2.6

POINT-QUARTER TREE DATA--
Management unit 09R, Study no: 18

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	77	14.1

BASIC COVER--
Management unit 09R, Study no: 18

Cover Type	Average Cover % '08
Vegetation	27.33
Pavement	.93
Litter	39.40
Cryptogams	2.47
Bare Ground	45.99

SOIL ANALYSIS DATA --

Management unit 9R, Study no: 18, Study Name: Brotherson Chaining

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
7.1	70.0	12.4	17.6	0.3	3.9	121.6	0.9	

PELLET GROUP DATA--

Management unit 09R, Study no: 18

Type	Quadrat Frequency	Days use per acre (ha)
	'08	
Rabbit	54	-
Elk	-	3 (8)
Deer	5	38 (93)
Cattle	-	1 (2)

BROWSE CHARACTERISTICS--

Management unit 09R, Study no: 18

		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>									
08	920	2	78	20	80	0	0	7	9/19
<i>Artemisia tridentata tridentata</i>									
08	700	0	57	43	-	9	0	23	24/36
<i>Ephedra viridis</i>									
08	0	0	0	-	-	0	0	0	21/29
<i>Grayia spinosa</i>									
08	160	0	50	50	-	25	13	13	22/29
<i>Juniperus osteosperma</i>									
08	160	13	88	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
08	3740	9	79	10	20	0	0	4	4/27
<i>Sarcobatus vermiculatus</i>									
08	0	0	0	-	-	0	0	0	59/64

SEEP RIDGE CHAINING - TREND STUDY NO. 10R-46-08

[Project #1951](#)

Vegetation Type: Pinyon-Juniper, Basin Big Sagebrush

Range Type: Substantial Deer Summer, Crucial Elk Summer

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

Land Ownership: SITLA

Elevation: 7,711 ft. (2,350 m)

Aspect: Northeast

Slope: 2%

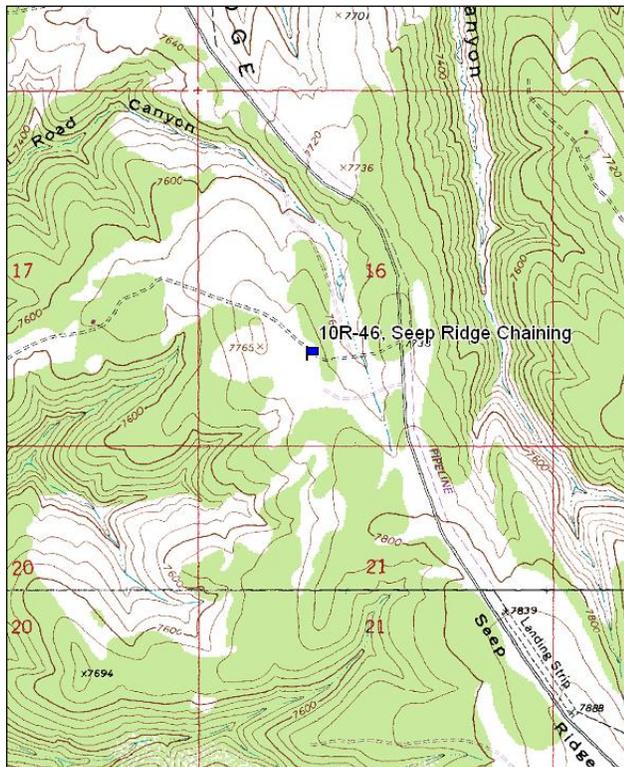
Transect bearing: 271° magnetic

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

Directions:

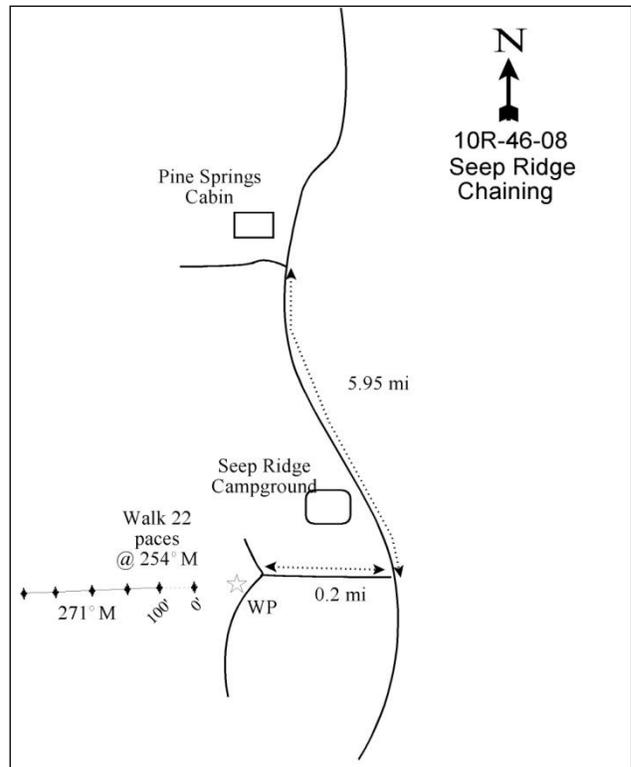
From the Pine Springs Cabin in the Book Cliffs, drive south on Seep Ridge Road for 5.95 miles, passing the Seep Ridge Campground on the right. Turn right and head west for 0.2 miles to a fork, and go left to the witness post on the right. The 0' stake is 22 paces from the witness post at 254° M. The 0' stake is marked with browse tag # 279.

Map Name: Seep Canyon



Township: 15S Range: 23E Section: 16

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 641736 E 4374599 N

SEEP RIDGE CHAINING - WRI STUDY 10R-46
[Project #1951](#)

Site Description

Site Information: The study is located near the head of Seep Canyon and Berry Canyon, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, on Seep Ridge. Originally, the study was established in 2008 to monitor the effects of a bullhog project on Utah State Institutional Trust Land (SITLA), but the study site was not treated. In the fall of 2011, the study site will be treated in the Seep Ridge Chaining project. Prior to the treatment, the project area will be aerially seeded with a seed mix of grass and forb species. Following the aerial seeding, an estimated 770 acres of pinyon and juniper trees will be two-way chained and browse seed will be distributed with seed dribblers over the project treatment area. After the completion of the chaining project, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) will be aerially applied over the treatment area (Table - Seed Mix). The objectives of the project are to increase the cover of grass, forb, and browse species through seeding and reduce competition from conifers to improve habitat for mule deer and elk (WRI Database 2011). Pellet group data estimated moderately light use by elk and cattle, and light use by deer in 2008 (Table - Pellet Group Data).

SEED MIX--
 Management unit 10R, Study no: 46

Project Name: Seep Ridge Chaining WRI Database #: 1951				Project Name: Seep Ridge Chaining - Dribbler Mix WRI Database #: 1951			
Application: Aerial Seed 1		Acres: 370		Application: Seed Dribbler		Acres: 370	
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Big Bluegrass 'Sherman'	75	0.20	B	Bitterbrush	150	0.41
G	Bluebunch WG 'P-7'	450	1.22	B	True Mountain Mahogany	50	0.14
G	Canby Bluegrass 'Canbar'	75	0.20	Total Pounds:		200	0.54
G	Great Basin Wildrye 'Trailhead'	250	0.68	PLS Pounds:			0.38
G	Green Needlegrass 'Lodorm'	300	0.81	Project Name: Seep Ridge Chaining			
G	Indian Ricegrass	400	1.08	WRI Database #: 1951			
G	Sandberg Bluegrass	75	0.20	Application: Aerial Seed 2		Acres: 770	
G	Slender Wheatgrass 'San Luis'	550	1.49	Seed Type		lbs in mix	lbs/acre
G	Thickspike Wheatgrass 'Critana'	450	1.22	B	Sagebrush, Wyoming	770	1
F	Alfalfa 'Nomad'	250	0.68	Total Pounds:		770	1
F	Alfalfa 'Ranger'	300	0.81	PLS Pounds:			0.19
F	Blue Flax 'Appar'	200	0.54				
F	Sainfoin 'Eski'	750	2.03				
F	Small Burnet 'Delar'	750	2.03				
Total Pounds:		4875	13.18				
PLS Pounds:			11.73				

*Aerial Seed 1 was seeded prior to the chaining passes. Aerial Seed 2 was aerially seeded following the completion of the chaining project.

Browse: The preferred browse species are basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and dwarf rabbitbrush (*Chrysothamnus depressus*). The basin big sagebrush is a moderately used population with very high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor in 2008. The dwarf rabbitbrush is a relatively small population with use being mostly light. Other browse species sampled on the site include beehive cactus (*Coryphantha* sp.), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*), and pricklypear cactus (*Opuntia* sp.), though stickyleaf low rabbitbrush and pricklypear cactus were only sampled in the height/crown measurements (Table - Browse Characteristics). Prior to treatment, pinyon pine and Utah juniper trees had a very high estimated density of

223 trees/acre and 123 tree/acre, respectively (Point-Quarter Tree Data) and provided the majority of the canopy cover on the site (Table - Canopy Cover).

Herbaceous Understory: Grasses are only moderately abundant, but are diverse on the site. The dominant grass species on the site is blue grama (*Bouteloua gracilis*). Other common perennial grass species sampled on the site include thickspike wheatgrass (*Agropyron dasystachyum*), sedge (*Carex sp.*), mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*P. secunda*) and bottlebrush squirreltail (*Sitanion hystrix*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was also sampled on the site in very low abundance. Forbs are not particularly abundant, but are also fairly diverse. No single forb species dominated the forb understory (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a moderately acidic soil reaction (pH 6.0) (Table - Soil Analysis Data). Bare ground cover is moderately high, with a high amount of litter and moderate amount of vegetation providing protective ground cover. Cryptograms provide a moderately high amount of protective ground cover, as well (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 10R, Study no: 46

Type	Species	Nested Frequency '08	Average Cover % '08
G	<i>Agropyron dasystachyum</i>	31	.33
G	<i>Bouteloua gracilis</i>	58	1.18
G	<i>Bromus tectorum</i> (a)	21	.04
G	<i>Carex sp.</i>	38	.11
G	<i>Koeleria cristata</i>	12	.09
G	<i>Poa fendleriana</i>	47	.45
G	<i>Poa secunda</i>	95	.49
G	<i>Sitanion hystrix</i>	90	.80
G	<i>Stipa comata</i>	17	.09
Total for Annual Grasses		21	0.03
Total for Perennial Grasses		388	3.55
Total for Grasses		409	3.59
F	<i>Agoseris glauca</i>	17	.04
F	<i>Antennaria rosea</i>	28	.11
F	<i>Arabis sp.</i>	11	.05
F	<i>Aster sp.</i>	7	.07
F	<i>Astragalus convallarius</i>	3	.03
F	<i>Calochortus nuttallii</i>	7	.02
F	<i>Camelina microcarpa</i> (a)	16	.09
F	<i>Castilleja flava</i>	2	.03
F	<i>Comandra pallida</i>	2	.03
F	<i>Cryptantha sp.</i>	17	.12
F	<i>Erigeron sp.</i>	21	.11
F	<i>Eriogonum alatum</i>	5	.09
F	<i>Gayophytum ramosissimum</i> (a)	13	.02
F	<i>Holosteum umbellatum</i> (a)	17	.03
F	<i>Ipomopsis aggregata</i>	10	.08
F	<i>Oenothera pallida</i>	1	.00

Type	Species	Nested Frequency	Average Cover %
		'08	'08
F	Penstemon sp.	-	.03
F	Penstemon sp.	2	.00
F	Phlox longifolia	14	.04
F	Polygonum douglasii (a)	1	.00
F	Ranunculus testiculatus (a)	6	.01
F	Senecio multilobatus	9	.04
Total for Annual Forbs		53	0.16
Total for Perennial Forbs		156	0.92
Total for Forbs		209	1.08

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

BROWSE TRENDS--

Management unit 10R, Study no: 46

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia tridentata tridentata	69	7.75
B	Chrysothamnus depressus	13	.01
B	Coryphantha sp.	1	.00
B	Juniperus osteosperma	5	5.03
B	Pinus edulis	23	15.72
B	Symphoricarpos oreophilus	3	.18
Total for Browse		114	28.71

CANOPY COVER, LINE INTERCEPT--

Management unit 10R, Study no: 46

Species	Percent Cover '08
Artemisia tridentata tridentata	11.51
Chrysothamnus depressus	.08
Juniperus osteosperma	8.30
Pinus edulis	34.59

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 10R, Study no: 46

Species	Average leader growth (in) '08
Artemisia tridentata tridentata	1.6

POINT-QUARTER TREE DATA--
 Management unit 10R, Study no: 46

Species	Trees per Acre	Average diameter (in)
	'08	'08
Juniperus osteosperma	123	3.9
Pinus edulis	223	4.0

BASIC COVER--
 Management unit 10R, Study no: 46

Cover Type	Average Cover % '08
Vegetation	31.95
Rock	2.27
Pavement	.11
Litter	60.34
Cryptogams	4.57
Bare Ground	29.87

SOIL ANALYSIS DATA --
 Management unit 10R, Study no: 46, Study Name: Seep Ridge Bullhog

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	6.0	54.0	25.4	20.6	1.4	4.6	86.4	0.4

PELLET GROUP DATA--
 Management unit 10R, Study no: 46

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	41	-
Elk	5	16 (40)
Deer	7	5 (13)
Cattle	-	14 (34)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 46

		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)	
Artemisia tridentata tridentata										
08	3220	5	17	78	200	34	1	40	26/32	
Chrysothamnus depressus										
08	540	0	85	15	-	0	15	15	4/8	
Chrysothamnus viscidiflorus										
08	0	0	0	-	-	0	0	0	16/11	
Coryphantha sp.										
08	20	0	100	-	-	0	0	0	-/-	
Juniperus osteosperma										
08	100	20	80	-	40	0	0	0	-/-	
Opuntia sp.										
08	0	0	0	-	-	0	0	0	3/10	
Pediocactus simpsonii										
08	0	0	0	-	-	0	0	0	1/1	
Pinus edulis										
08	500	56	44	-	60	8	0	0	-/-	
Symphoricarpos oreophilus										
08	60	0	100	-	-	0	0	0	8/11	

RABBIT GULCH CHAINING - TREND STUDY NO. 17R-13-08

Project #66

Vegetation Type: Greasewood, Basin Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: UDWR

Elevation: 5,841 ft. (1,780 m)

Aspect: South

Slope: 3%

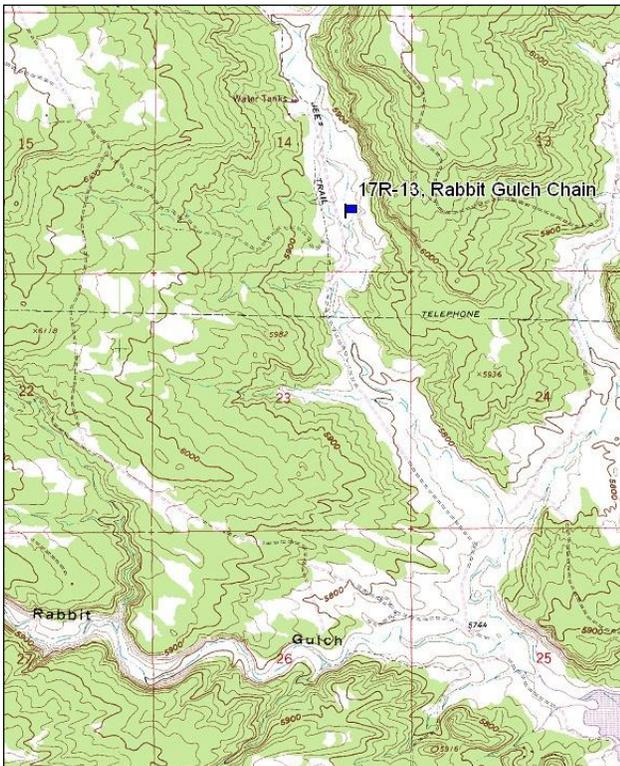
Transect bearing: 333° magnetic

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

Directions:

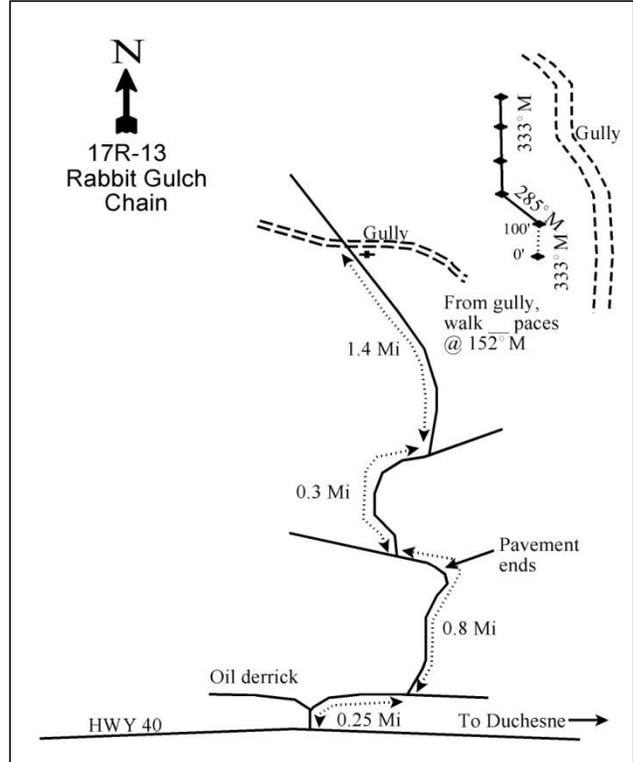
From Strawberry River Rd on US 40, drive east 1.3 miles to a road on the left (north) side of the road (If coming from the east drive 1.5 miles from the bridge over Starvation reservoir). Turn left (north) on this road, and make an immediate right, then drive 0.25 miles to a road on the left. Turn left and drive 0.8 miles to a fork, the pavement will end. From the fork, stay right and drive 0.3 miles to another fork. Stay left at the fork and drive 1.4 miles to the witness post on the right (east) side of the road. From the witness post, walk 150 feet at 152°M to the 0' stake. The 0' stake is marked with browse tag #137.

Map Name: Rabbit Gulch



Township: 3S Range: 6W Section: 14

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 540348 E 4451794 N

RABBIT GULCH CHAINING - WRI STUDY 17R-13
[Project # 66](#)

Site Description

Site Information: The study is located within the boundaries of the Rabbit Gulch Wildlife Management Area (WMA), approximately seven miles northwest of Duchesne. The treatment area is located in a valley bottom which was originally a sagebrush (*Artemisia sp.*) community, but is now dominated by black greasewood (*Sarcobatus vermiculatus*). To prevent greasewood from competing with desired seeded species, the greasewood was sprayed with a mixture of 2,4-D (2,4-Dichlorophenoxyacetic acid) and Tordon (picloram) during the second week in June of 2005. Following the herbicide treatment, but prior to the chaining treatment, the study was established in July of 2005 to monitor an Ely chaining treatment. Prior to the chaining treatment, a mixture of grass, forb, and browse species were aerially distributed over the treatment area. In January 2006, the area was one-way Ely chained. The chain was chosen because the terrain was too difficult to maneuver with a Lawson aerator. The treatment area was then aerially seeded with a browse seed mix in February of 2006 (Table - Seed Mix). The objectives of the project are to recover and enhance winter habitat for mule deer and elk, and reestablish the sagebrush steppe habitat type in the area (WRI Database 2011). Pellet group data estimated light use by elk, and heavy use by deer in 2005. In 2008, use was estimated to be light for elk, and moderate for deer (Table - Pellet Group Data).

SEED MIX--

Management unit 17R, Study no: 13

Project Name: Rabbit Gulch Greasewood							
WRI Database #: 66							
Application: Aerial Seed		Acres: 300		Application: Aerial Seed		Acres: 190	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Douglas'	600	2.00	B	Forage Kochia	200	1.05
G	Great Basin Wildrye 'Trailhead'	600	2.00	B	Whitestem Rubber Rabbitbrush	85	0.45
G	Russian Wildrye	600	2.00	Total Pounds:		285	1.50
G	Thickspike Wheatgrass 'Critana'	575	1.92	PLS Pounds:			0.82
F	Alfalfa 'Spredor 4'	300	1.00				
F	Small Burnet	325	1.08				
F	Small Burnet 'Delar'	300	1.00				
B	Fourwing Saltbush	450	1.50				
Total Pounds:		3750				12.50	
PLS Pounds:						9.94	

Browse: The dominant browse species is black greasewood, although the treatment reduced the population considerably. Prior to the treatment the greasewood population was unhealthy with high decadence and poor vigor within the population. However, following the treatment, the sampled black greasewood was a healthy population with low decadence and good vigor. The preferred browse species on the site is basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). The sagebrush is a relatively small, healthy population with low decadence and good vigor, though decadence and poor vigor were high prior to treatment. The recruitment of young sagebrush plants to the population has been good over the course of the study. Utilization of sagebrush plants has been light since the outset of the study. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not abundant, but are moderately diverse. The annual grass species sixweeks fescue (*Vulpia octoflora*) is the dominant grass species on the site, but provides less than 1% cover.

Seeded species sampled following the treatment include Russian wildrye (*Elymus junceus*) and crested wheatgrass (*Agropyron cristatum*), though each species provided very little cover. Perennial forb species are rare on the site. The forb composition consists of nearly of all annual species, which provide the majority of the vegetation cover on the site. The dominant forb species on the site are Russian thistle (*Salsola iberica*), annual stickseed (*Lappula occidentalis*), and halogeton (*Halogeton glomeratus*) (Table - Herbaceous Trends).

Soil: The soil texture is a loamy sand with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is moderate, though with a high amount of litter, vegetation, and cryptograms providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as moderate in 2005 due to active gully formation, rills, mild flow patterns, mild pedestalling, and surface litter and soil movement; and was classified as slight in 2008 due to surface litter, rock and soil movement, pedestalling, flow patterns, and rills

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

Browse: The density of basin big sagebrush decreased 48% from 540 plants/acre to 280 plants/acre; however, canopy cover remained similar at 1%. The health of the sagebrush population improved with decadence decreasing from 33% to 0% and poor vigor decreasing from 26% to 0%. The recruitment of young sagebrush plants was excellent and remained similar at 64% of the population. The density of black greasewood decreased 56% from 720 plants/acre to 320 plants/acre, and canopy cover decreased from 8% to 6%.

Grasses: Grasses remained rare on the site. Perennial grasses provided only 1% cover.

Forbs: Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs decreased by 21%, though cover increased from 13% to 35%. Russian thistle substantially increased in nested frequency, and cover increased from 2% to 25%.

HERBACEOUS TRENDS--

Management unit 17R, Study no: 13

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron cristatum</i>	-	5	-	.18
G	<i>Bromus tectorum</i> (a)	3	3	.15	.04
G	<i>Elymus junceus</i>	-	7	-	.03
G	<i>Sitanion hystrix</i>	4	4	.18	.04
G	<i>Sporobolus cryptandrus</i>	12	15	.33	.25
G	<i>Stipa comata</i>	5	3	.53	.15
G	<i>Vulpia octoflora</i> (a)	63	78	.60	.59
Total for Annual Grasses		66	81	0.75	0.63
Total for Perennial Grasses		21	34	1.04	0.67
Total for Grasses		87	115	1.80	1.31
F	<i>Alyssum alyssoides</i> (a)	_b 18	_a -	.16	-
F	<i>Chenopodium fremontii</i> (a)	_b 153	_a 5	2.84	.01
F	<i>Chenopodium leptophyllum</i> (a)	_b 23	_a 1	.09	.00
F	<i>Cleome lutea</i> (a)	5	1	.03	.03
F	<i>Collinsia parviflora</i> (a)	_b 41	_a -	.14	-
F	<i>Descurainia pinnata</i> (a)	_b 141	_a 11	1.99	.08
F	<i>Epilobium brachycarpum</i> (a)	-	1	-	.00
F	<i>Eriogonum cernuum</i> (a)	12	4	.05	.06

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Halogeton glomeratus (a)	a ₅	b ₈₉	.04	4.87
F	Kochia scoparia (a)	1	9	.00	.33
F	Lappula occidentalis (a)	b ₂₀₀	a ₁₁₃	4.79	3.82
F	Malcolmia africana	b ₄₀	a ₋	1.21	-
F	Mentzelia albicaulis (a)	a ₉	b ₃₁	.19	1.60
F	Oenothera sp.	b ₄₄	a ₁	.77	.38
F	Plantago patagonica (a)	3	4	.00	.00
F	Ranunculus testiculatus (a)	1	-	.00	-
F	Salsola iberica (a)	a ₇₄	b ₂₇₅	2.18	24.51
F	Sisymbrium altissimum (a)	-	1	-	.03
Total for Annual Forbs		686	545	12.57	35.38
Total for Perennial Forbs		84	1	1.98	0.38
Total for Forbs		770	546	14.56	35.76

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

BROWSE TRENDS--

Management unit 17R, Study no: 13

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata tridentata	10	5	.49	.49
B	Atriplex confertifolia	-	-	-	.15
B	Opuntia sp.	14	1	.84	-
B	Sarcobatus vermiculatus	25	13	5.06	3.92
Total for Browse		49	19	6.40	4.56

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 13

Species	Percent Cover	
	'05	'08
Artemisia tridentata tridentata	.28	.73
Opuntia sp.	1.51	-
Sarcobatus vermiculatus	8.28	5.48

BASIC COVER--

Management unit 17R, Study no: 13

Cover Type	Average Cover %	
	'05	'08
Vegetation	18.56	40.32
Rock	.15	0
Pavement	.15	.07
Litter	44.67	42.81
Cryptogams	18.47	6.38
Bare Ground	28.46	25.46

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 13, Study Name: Rabbit Gulch Greasewood Chaining

Effective rooting depth (in)	pH	loamy sand			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
24.5	7.6	77.7	15.1	7.2	0.2	6.9	80.0	0.7

PELLET GROUP DATA--

Management unit 17R, Study no: 13

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	70	54	-	-
Elk	7	-	11 (26)	19 (48)
Deer	15	13	52 (129)	25 (61)

BROWSE CHARACTERISTICS--

Management unit 17R, Study no: 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>Artemisia tridentata tridentata</i>									
05	540	63	4	33	5340	0	0	26	32/30
08	280	64	36	0	-	0	0	0	25/26
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
05	0	0	0	-	-	0	0	0	24/27
08	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
05	820	0	88	12	-	0	0	7	7/27
08	20	0	0	100	-	0	0	100	-/-
<i>Sarcobatus vermiculatus</i>									
05	720	11	36	53	420	0	0	94	48/63
08	320	13	88	0	-	0	0	0	33/45

GOLDEN STAIRS CHAINING - TREND STUDY NO. 17R-15-08

Project #52

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Year-long (Fawning habitat), Crucial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: UDWR

Elevation: 6,767 ft. (2,063 m)

Aspect: East

Slope: 5%

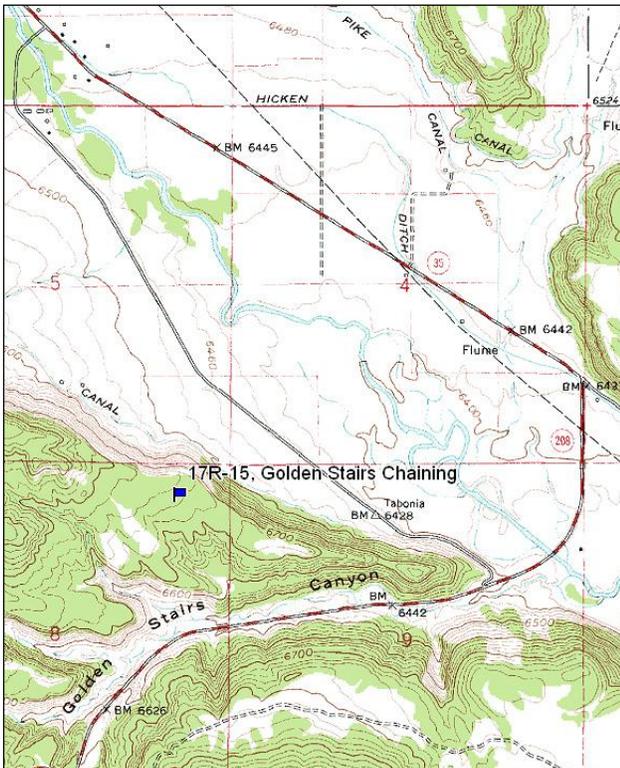
Transect bearing: 297° magnetic

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

Directions:

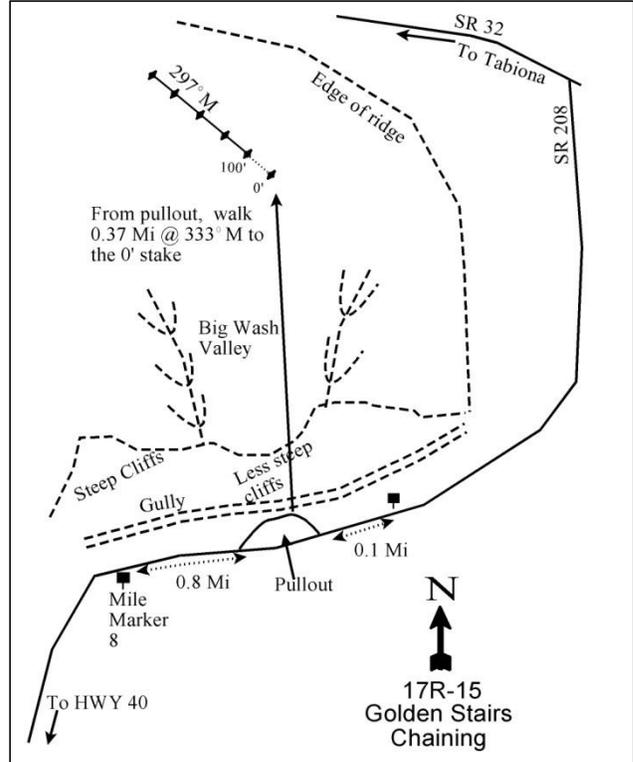
From the junction of US 40 and SR 208, drive north on SR 208 to mile marker 8. Drive 0.8 miles past the mile marker to a pullout on the left (north) side of the road. Park at this pullout (there is a sign just 0.1 miles north of the pullout). From the pullout, walk 0.37 miles at 333°M to the 0' stake. There are some steep cliffs to the right and some less steep cliffs on the left. Go between the cliffs to a big wash valley. The 0' stake is marked with browse tag #85.

Map Name: Tabiona



Township: 6S Range: 11E Section: 3

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 562077 E 4464013 N

GOLDEN STAIRS CHAINING - WRI STUDY 17R-15
[Project #52](#)

Site Description

Site Information: The study is located approximately two mile southeast of Tabiona, on a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) bench, just north of Golden Stairs Canyon. The study was established in 2005, prior to treatment, to monitor a pinyon and juniper chaining project. The chaining treated 185 acres of pinyon and juniper that dominated crucial mule deer, elk, and sage-grouse winter habitat within the Tabby Mountain Wildlife Management Area (WMA). Prior to the chaining treatment, the area was aerially seeded with grass and forb species in September of 2005. Later that fall the treatment area was two-way Ely chained. An estimated 55 acres of scattered islands of pinyon pine and Utah juniper were left unchained within the treatment area to provided wildlife with protective cover. During the chaining, a browse seed mix was seeded using a dribbler attached to the Caterpillar tractors. Then in December of 2005, a browse species seed mix was aerially seeded over the treatment area (Table - Seed Mix). The objectives of the project are to recover and enhance winter habitat for mule deer and elk; and reestablish the sagebrush steppe habitat type in the area by increasing grass, forb, and browse species, primarily Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) (WRI Database 2011). The study transect ran through an untreated island of the treatment, thus parts of belts two and three were not treated. Pellet group data estimated light use by deer and cattle, and moderately heavy use by elk in 2005. In 2008, moderate use was estimated for deer and elk (Table - Pellet Group Data).

SEED MIX--

Management unit 17R, Study no: 15

Project Name: Golden Stairs P/J Chaining					
WRI Database #: 52					
Application: Aerial Seed 1*		Acres: 190		Application: Aerial Seed 2*	
Acres: 190				Acres: 190	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Canby Bluegrass 'Canbar'	50	0.26	B	Forage Kochia
G	Crested Wheatgrass 'Hycrest'	150	0.79	B	Sagebrush, Wyoming
G	Orchardgrass 'Paiute'	100	0.53	Total Pounds:	
G	Russian Wildrye	200	1.05	PLS Pounds:	
G	Snake River Wheatgrass 'Secar'	100	0.53	Application: Seed Dribbler*	
G	Thickspike Wheatgrass 'Critana'	200	1.05	Acres: 190	
F	Alfalfa 'Ladak+'	100	0.53	Seed type	
F	Blue Flax	50	0.26	B	Bitterbrush
F	Sainfoin 'Eski'	400	2.11	B	Fourwing Saltbush
F	Small Burnet 'Delar'	200	1.05	B	Green Ephedra
B	Fourwing Saltbush	200	1.05	B	True Mountain Mahogany
Total Pounds:		1750 9.21		Total Pounds:	
PLS Pounds:		7.98		PLS Pounds:	
				100 0.53	
				0.32	

*Three different seed mixes were applied to the site. Aerial Seed 1 was applied by a fixed wing aircraft in September of 2005. The Seed Dribbler mix was applied during the chaining treatment in November of 2005. The Aerial Seed 2 mix was applied in December of 2005, following the chaining treatment.

Browse: The preferred browse species on the site consist of the seeded species Wyoming big sagebrush, fourwing saltbush (*Atriplex canescens*), true mountain mahogany (*Cercocarpus montanus*), and forage kochia (*Kochia prostrata*), although true mountain mahogany was sampled prior to the treatment. The populations of palatable browse species are small and mostly young. Prior to the treatment, palatable browse species were rare on the site; however, the site was dominated by pinyon pine and Utah juniper (Table - Browse

Characteristics). Pinyon and juniper trees were notably decreased in the treatment areas (Table - Point-Quarter Tree Data). Other browse species sampled on the site include corymbled eriogonum (*Eriogonum corymbosum*), broom snakeweed (*Gutierrezia sarothrae*), prickly phlox (*Leptodactylon pungens*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse. The dominant grass species on the site is slender wheatgrass (*Agropyron trachycaulum*), which has provided the majority of the grass cover over the sample years. Other common grass species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*) and needle-and-thread (*Stipa comata*). The annual grass species cheatgrass (*Bromus tectorum*) is present on the site and has increased in abundance since the treatment, but remains a minor part of the grass component on the site. Seeded species sampled on the site include crested wheatgrass (*Agropyron cristatum*), thickspike wheatgrass (*A. dasystachyum*), and Russian wildrye (*Elymus junceus*). Forbs are not particularly abundant, but are fairly diverse. Perennial forbs provide limited cover, but cover did increase following the treatment. The seeded species blue flax (*Linum lewisii*) and small burnet (*Sanguisorba minor*) were both sampled at low frequency (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a slightly alkaline soil reaction (pH 7.6). Phosphorus may have limited availability for plant growth and development at 3.5 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high, though 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 2005 due to rills, pedestalling, soil movement, and flow patterns. The soil erosion condition was classified as stable in 2008.

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, fourwing saltbush, and forage kochia were sampled for the first time with densities of 20 plants/acre, 1,020 plants/acre, and 1,100 plants/acre, respectively. The density of true mountain mahogany decreased 33% from 60 plants/acre to 40 plants/acre. The canopy cover of preferred browse species remained less than 1% for each species. Utah juniper decreased in density from 87 trees/acre to 55 trees/acre and canopy cover decreased from 12% to 1%. Pinyon pine density decreased from 252 trees/acre to 133 trees/acre and canopy cover decreased from 11% to 3%.

Grasses: The sum of nested frequency of perennial grasses increased slightly by 17%, and cover increased from 9% to 16%. The nested frequency of slender wheatgrass significantly decreased, but cover increased from 6% to 7%. The nested frequency of cheatgrass increased significantly, but cover remained less than 1%. The seeded species crested wheatgrass and thickspike wheatgrass were sampled for the first time in 2008, and each species provided about 1% cover.

Forbs: Perennial forbs increased in diversity on the site, but no single forb species provided more than 1% cover in either sample year. Perennial forb cover increased from 1% to 2%. The sum of nested frequency of annual forbs decreased 52%, though cover remained similar at 2%.

HERBACEOUS TRENDS--

Management unit 17R, Study no: 15

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	a-	b47	-	.87
G	Agropyron dasystachyum	a-	b23	-	.67
G	Agropyron smithii	41	51	.21	.68
G	Agropyron trachycaulum	b211	a154	6.19	7.36
G	Bromus inermis	-	1	-	.15
G	Bromus tectorum (a)	a18	b70	.26	.56
G	Carex sp.	8	17	.60	.96
G	Elymus junceus	-	1	-	.06
G	Oryzopsis hymenoides	a26	b77	.45	2.64
G	Poa secunda	30	20	.66	.29
G	Stipa comata	68	57	.95	1.91
Total for Annual Grasses		18	70	0.26	0.56
Total for Perennial Grasses		384	448	9.08	15.60
Total for Grasses		402	518	9.34	16.17
F	Arabis sp.	7	3	.16	.00
F	Astragalus convallarius	-	-	.03	-
F	Calochortus nuttallii	-	1	-	.01
F	Chenopodium fremontii (a)	b15	a-	.45	-
F	Chenopodium leptophyllum(a)	10	20	.16	.24
F	Collinsia parviflora (a)	b96	a6	.37	.01
F	Cryptantha sp.	20	9	.12	.73
F	Descurainia pinnata (a)	b55	a8	.49	.05
F	Draba sp. (a)	b36	a4	.18	.01
F	Eriogonum cernuum (a)	13	24	.04	.24
F	Ipomopsis congesta	11	13	.07	.05
F	Lappula occidentalis (a)	a25	b53	.24	.56
F	Lepidium montanum	2	4	.33	.03
F	Lesquerella sp.	3	-	.03	-
F	Leucelene ericoides	4	1	.06	.03
F	Linum lewisii	a-	b20	-	.37
F	Lygodesmia grandiflora	a-	b9	-	.03
F	Polygonum douglasii (a)	19	7	.05	.01
F	Salsola iberica (a)	-	6	-	.45
F	Sanguisorba minor	-	2	-	.03
F	Schoenrambe linifolia	12	17	.22	.25
F	Townsendia sp.	-	2	-	.03
Total for Annual Forbs		269	128	2.02	1.59
Total for Perennial Forbs		59	81	1.05	1.58
Total for Forbs		328	209	3.07	3.17

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

BROWSE TRENDS--

Management unit 17R, Study no: 15

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata wyomingensis	0	1	-	-
B	Atriplex canescens	0	8	-	-
B	Cercocarpus montanus	3	2	.15	.00
B	Eriogonum corymbosum	8	15	.44	.55
B	Gutierrezia sarothrae	13	17	.06	.40
B	Juniperus osteosperma	5	3	3.24	1.00
B	Kochia prostrata	0	19	-	.52
B	Leptodactylon pungens	8	6	-	.00
B	Opuntia sp.	34	26	.74	.40
B	Pinus edulis	11	10	9.44	2.04
Total for Browse		82	107	14.08	4.94

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 15

Species	Percent Cover	
	'05	'08
Atriplex canescens	-	.30
Cercocarpus montanus	.98	.38
Eriogonum corymbosum	1.18	.93
Gutierrezia sarothrae	-	.48
Juniperus osteosperma	12.11	.41
Kochia prostrata	-	.46
Leptodactylon pungens	-	.06
Opuntia sp.	.41	.13
Pinus edulis	10.69	2.86

POINT-QUARTER TREE DATA--

Management unit 17R, Study no: 15

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	87	55	10.3	10.3
Pinus edulis	252	133	5.0	1.7

BASIC COVER--

Management unit 17R, Study no: 15

Cover Type	Average Cover %	
	'05	'08
Vegetation	22.96	20.38
Rock	1.25	1.99
Pavement	1.55	1.18
Litter	39.20	47.91
Cryptogams	6.65	2.45
Bare Ground	40.43	39.01

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 15, Study Name: Golden Stairs Chaining

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.3	7.6	57.0	27.4	15.6	2.0	3.5	89.6	0.8

PELLET GROUP DATA--

Management unit 17R, Study no: 15

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	56	30	-	-
Elk	22	15	42 (103)	27 (66)
Deer	6	20	13 (33)	31 (76)
Cattle	-	-	4 (11)	-

BROWSE CHARACTERISTICS--
Management unit 17R, 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	0	0	0	-	-	0	0	0	19/21
08	20	0	100	-	-	0	0	0	12/6
<i>Atriplex canescens</i>									
05	0	0	0	-	-	0	0	0	-/-
08	1020	27	73	-	260	0	0	0	21/22
<i>Cercocarpus montanus</i>									
05	60	0	0	100	-	0	100	33	44/36
08	40	0	0	100	-	100	0	0	28/30
<i>Eriogonum corymbosum</i>									
05	260	0	92	8	80	31	0	8	17/27
08	980	18	82	0	200	0	0	0	14/22
<i>Gutierrezia sarothrae</i>									
05	480	4	96	0	20	0	0	0	6/8
08	760	0	97	3	20	0	0	0	7/10
<i>Juniperus osteosperma</i>									
05	120	67	0	33	20	0	0	33	-/-
08	60	33	67	0	-	0	0	0	-/-
<i>Kochia prostrata</i>									
05	0	0	0	0	-	0	0	0	-/-
08	1100	5	93	2	180	7	0	0	9/9
<i>Leptodactylon pungens</i>									
05	300	0	93	7	-	13	0	0	3/5
08	160	0	100	0	-	0	0	0	4/6
<i>Opuntia sp.</i>									
05	1380	12	78	10	40	0	0	1	5/13
08	1020	6	57	37	60	0	2	10	4/11
<i>Pinus edulis</i>									
05	260	69	31	-	60	0	0	0	-/-
08	200	70	30	-	40	0	0	30	-/-

GREY WOLF CHAINING - TREND STUDY NO. 17R-16-08

[Project #93](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: Private

Elevation: 6,821 ft. (2,079 m)

Aspect: Southwest

Slope: 2-4%

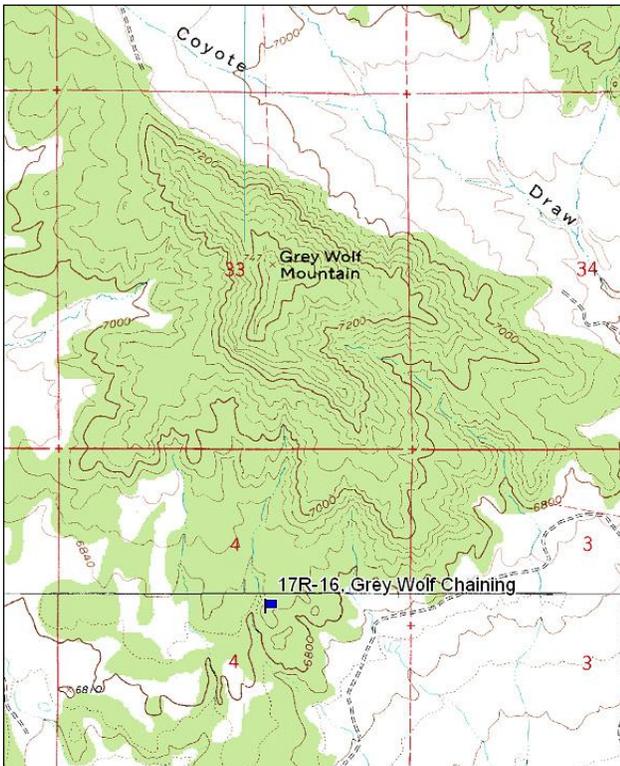
Transect bearing: 35° magnetic

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

Directions:

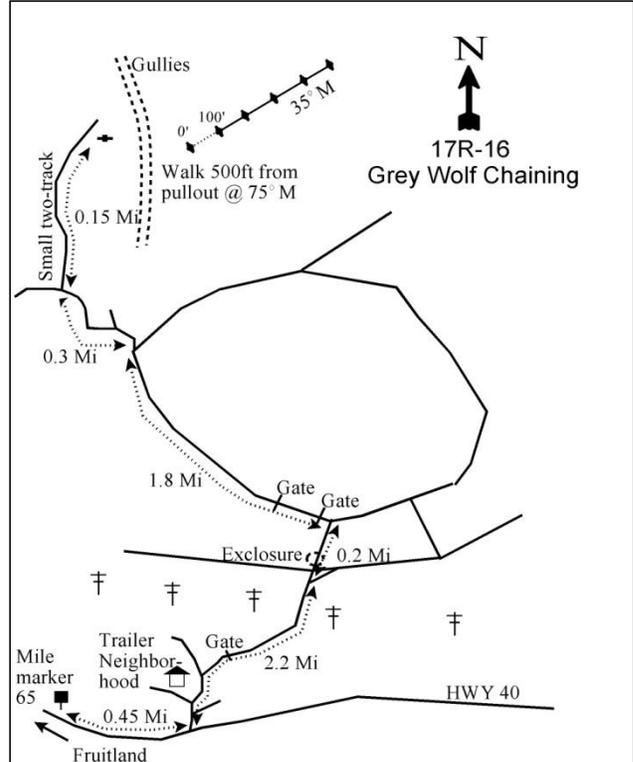
From Fruitland, drive east on US 40 to mile marker 65. Continue 0.45 miles past the mile marker to a road on the left (north). Turn on this road and drive 2.2 miles past several trailers and through a gate to a fork. Stay left at the fork and drive 0.2 miles passing through an enclosure to a fork. Take the left fork and drive 1.8 miles through a gate to road on the left (west) side. Turn left and drive 0.3 miles to a two-track on the right (may be hard to see). Turn right (north) on the two-track and drive 0.15 miles to the witness post on the right (east). From the witness post, walk 520 feet at 75°M to the 0' stake. The 0' stake is marked with browse tag #86.

Map Name: Fruitland



Township: 6S Range: 10E Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 517755 E 4455435 N

GREY WOLF CHAINING - WRI STUDY 17R-16
[Project #93](#)

Site Description

Site Information: The study is located approximately three and half miles northeast of Fruitland, on a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus Osteosperma*) ridge, south of Grey Wolf Mountain. The study was established in 2005, prior to treatment, to monitor a pinyon and juniper chaining project. The chaining treated 463 acres of pinyon and juniper dominated crucial mule deer, elk, and sage-grouse winter habitat within the Tabby Mountain Wildlife Management Area (WMA). Before the pinyon and juniper trees were removed, the area was aerially seeded with grass and forb species in October of 2005. At the end of October and beginning of November 2005, the treatment area was two-way Ely chained. Scattered islands of pinyon and juniper trees were left unchained within the treatment area to provide wildlife with protective cover. During the chaining, a browse seed mix was seeded using a seed dribbler attached to Caterpillar tractors. Then in February 2006, a seed mix of browse species was aerially seeded over the treatment area (Table - Seed Mix). The treatment area is located within 1,000 feet of the Lower Red Creek sage-grouse lek within the Alan Smith property. The objectives of the project are to recover and enhance winter habitat for sage-grouse, mule deer, and elk, and reestablish the sagebrush steppe habitat type in the area (WRI Database 2011). Pellet group data estimated moderate use by elk, and light use by deer in 2005. In 2008, light use was estimated for elk, cattle, and deer (Table - Pellet Group Data).

SEED MIX--
 Management unit 17R, Study no: 16

Project Name: Grey Wolf Mtn. P/J Chaining							
WRI Database #: 93							
Application: Aerial Seed 1*		Acres: 775		Application: Seed Dribbler*		Acres: 775	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	200	0.26	B	Bitterbrush	25	0.03
G	Crested Wheatgrass 'Douglas'	750	0.97	B	Green Ephedra	50	0.06
G	Orchardgrass 'Paiute'	372	0.48	B	True Mountain Mahogany	25	0.03
G	Russian Wildrye	750	0.97	B	Fourwing Saltbush	50	0.06
G	Snake River Wheatgrass 'Secar'	400	0.52	Total Pounds:		150	0.19
G	Thickspike Wheatgrass 'Critana'	800	1.03	PLS Pounds:			0.11
F	Alfalfa 'Ladak+'	400	0.52	Application: Aerial Seed 2*		Acres: 610	
F	Blue Flax	200	0.26	Seed type		lbs in mix	lbs/acre
F	Sainfoin 'Eski'	1850	2.39	B	Forage Kochia	610	1.00
F	Small Burnet 'Delar'	1550	2.00	B	Sagebrush, Wyoming	610	1.00
B	Fourwing Saltbush	700	0.90	Total Pounds:		1220	2.00
Total Pounds:		7972	10.29	PLS Pounds:			0.93
PLS Pounds:			8.95				

*Three different seed mixes were applied to the site. Aerial Seed 1 was applied by a fixed wing aircraft in October of 2005. The Seed Dribbler mix was applied during the chaining treatment in November of 2005. The Aerial Seed 2 mix was applied in February of 2006, following the chaining treatment.

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 preferred browse species on the site included a moderately dense population of forage kochia (*Kochia prostrata*), a small population of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), a small population of fourwing saltbush (*Atriplex canescens*), and a small population of true mountain mahogany (*Cercocarpus montanus*). Each of these species was seeded during the treatment, though true mountain mahogany was

sampled prior to treatment. Utilization of browse species has been mostly light with the exception of true mountain mahogany, which displayed heavy use over the sample years. Prior to the treatment, palatable browse species were rare on the site and the site was dominated by pinyon pine and Utah juniper (Table - Browse Characteristics). Following the treatment, pinyon and juniper trees notably decreased in the treatment areas (Table - Point-Quarter Tree Data).

Herbaceous Understory: Grasses are diverse and abundant. The dominant grass species on the site are Indian ricegrass (*Oryzopsis hymenoides*) and thickspike wheatgrass (*Agropyron dasystachyum*). Following the treatment, the annual species cheatgrass (*Bromus tectorum*) was sampled in low abundance. Seeded species sampled following the treatment include crested wheatgrass (*A. cristatum*), slender wheatgrass (*A. dasystachyum*), orchard grass (*Dactylis glomerata*), and Russian wildrye (*Elymus junceus*). Forbs are moderately abundant and fairly diverse. The dominant forb species is the annual species Russian thistle (*Salsola iberica*). Perennial species are diverse, but no single perennial species have dominated the forb composition. Seeded forb species sampled on the site following the treatment include blue flax (*Linum perenne*), Sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trend).

Soil: The soil texture is a loam with a slightly alkaline soil reaction (pH 7.6) (Table - Soil Analysis Data). Bare ground cover is high, with a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as moderate due to active gully formation, moderately deep rills, surface litter movement, slight pedestalling, and flow patterns. The soil erosion condition was classified as stable in 2008.

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, fourwing saltbush, and forage kochia were sampled for the first time with densities of 100 plants/acre, 80 plants/acre, and 1,740 plants/acre, respectively. Forage kochia provided 3% canopy cover. The density of true mountain mahogany decreased 40% from 200 plants/acre to 120 plants/acre, and canopy cover decreased from 2% to less than 1%. Utah juniper decreased in density from 72 trees/acre to 21 trees/acre, and canopy cover decreased from 15% to 0%. Pinyon pine density decreased from 50 trees/acre to 23 trees/acre and canopy cover decreased from 7% to 0%.

Grasses: The sum of nested frequency of perennial grasses increased 60%, and cover increased from 2% to 14%. The nested frequency of slender wheatgrass significantly decreased and cover was minimal. The seeded species crested wheatgrass, thickspike wheatgrass, orchard grass, and Russian wildrye were sampled for the first time in 2008. Thickspike wheatgrass became the dominant grass species and provided 5% cover. Crested wheatgrass and Russian wildrye also provided a good amount of cover at 1% and 3%, respectively. Indian ricegrass remained similar in nested frequency, but cover increased from 1% to 3%. Needle-and-thread remained similar in nested frequency, and cover remained at 1%. Cheatgrass was sampled for the first time after the treatment with low abundance and minimal cover.

Forbs: The sum of nested frequency of perennial forbs increased slightly by 15%, and cover increased from 1% to 3%. However, no single forb species provided more than 1% cover in either sample year with the exception of Russian thistle, which provided 2% cover following the treatment.

HERBACEOUS TRENDS--

Management unit 17R, Study no: 16

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	a-	b44	-	1.27
G	Agropyron dasystachyum	a-	b87	-	5.44
G	Agropyron smithii	2	5	.00	.03
G	Agropyron spicatum	a3	b13	.00	.67
G	Agropyron trachycaulum	b61	a3	.90	.18
G	Bromus tectorum (a)	-	4	-	.03
G	Carex sp.	6	-	.01	-
G	Dactylis glomerata	-	3	-	.03
G	Elymus junceus	a-	b43	-	2.55
G	Oryzopsis hymenoides	88	77	.82	2.58
G	Poa secunda	10	5	.07	.06
G	Sitanion hystrix	-	3	-	.06
G	Stipa comata	21	23	.51	1.33
Total for Annual Grasses		0	4	0	0.03
Total for Perennial Grasses		191	306	2.33	14.24
Total for Grasses		191	310	2.33	14.27
F	Arenaria sp.	6	6	.03	.06
F	Astragalus utahensis	4	1	.00	.00
F	Caulanthus crassicaulis	-	7	-	.15
F	Chenopodium fremontii (a)	20	14	.53	.23
F	Chenopodium leptophyllum(a)	40	25	.33	.12
F	Chorispora tenella (a)	-	3	-	.03
F	Collinsia parviflora (a)	b71	a-	.49	-
F	Cryptantha sp.	21	9	.14	.37
F	Cymopterus sp.	-	1	-	.00
F	Descurainia pinnata (a)	11	10	.10	.03
F	Eriogonum cernuum (a)	17	24	.02	.29
F	Eriogonum umbellatum	3	3	.15	.15
F	Gilia sp. (a)	8	18	.02	.07
F	Hedysarum boreale	13	7	.75	.25
F	Ipomopsis congesta	-	-	-	.00
F	Lappula occidentalis (a)	10	13	.02	.05
F	Lepidium sp. (a)	12	7	.16	.04
F	Lesquerella sp.	-	2	-	.00
F	Linum perenne	a-	b15	-	.16
F	Machaeranthera grindelioides	-	3	-	.03
F	Onobrychis viciaefolia	-	5	-	.19
F	Penstemon sp.	1	5	.00	.01
F	Phlox austromontana	13	9	.10	.06
F	Polygonum douglasii (a)	1	1	.00	.00
F	Salsola iberica (a)	a-	b67	-	1.53
F	Sanguisorba minor	a-	b15	-	.50
F	Schoenrambe linifolia	7	9	.01	.04

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Senecio multilobatus	12	13	.05	.05
F	Sisymbrium altissimum (a)	-	1	-	.03
F	Thelypodium integrifolium	_b 18	_a 2	.15	.36
F	Townsendia sp.	-	1	-	.03
Total for Annual Forbs		190	183	1.70	2.45
Total for Perennial Forbs		98	113	1.41	2.48
Total for Forbs		288	296	3.11	4.93

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

BROWSE TRENDS--

Management unit 17R, Study no: 16

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata wyomingensis	0	4	-	-
B	Atriplex canescens	0	3	-	.03
B	Cercocarpus montanus	10	4	.33	.00
B	Chrysothamnus viscidiflorus	1	2	-	.04
B	Eriogonum corymbosum	36	49	1.59	3.05
B	Gutierrezia sarothrae	13	12	.55	.78
B	Juniperus osteosperma	2	1	.72	-
B	Kochia prostrata	0	27	-	1.45
B	Opuntia sp.	4	2	.03	-
B	Pinus edulis	6	0	.03	.00
Total for Browse		72	104	3.25	5.36

CANOPY COVER, LINE INTERCEPT--

Management unit 17R, Study no: 16

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	-	.01
Atriplex canescens	-	.18
Cercocarpus montanus	1.75	.35
Eriogonum corymbosum	1.10	2.43
Gutierrezia sarothrae	.20	.91
Juniperus osteosperma	14.56	-
Kochia prostrata	-	3.00
Pinus edulis	6.88	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17R, Study no: 16

Species	Average leader growth (in)	
	'05	'08
Cercocarpus montanus	4.4	3.9

POINT-QUARTER TREE DATA--

Management unit 17R, Study no: 16

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	72	21	22.9	12.2
Pinus edulis	50	23	8.7	1.4

BASIC COVER--

Management unit 17R, Study no: 16

Cover Type	Average Cover %	
	'05	'08
Vegetation	8.07	29.37
Rock	1.93	1.64
Pavement	1.89	1.43
Litter	38.46	36.87
Cryptogams	2.73	0
Bare Ground	52.04	41.93

SOIL ANALYSIS DATA --

Management unit 17R, Study no: 16, Study Name: Grey Wolf Chaining

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.5	7.6	49.4	32.7	17.9	2.4	8.4	115.2	0.4

PELLET GROUP DATA--

Management unit 17R, Study no: 16

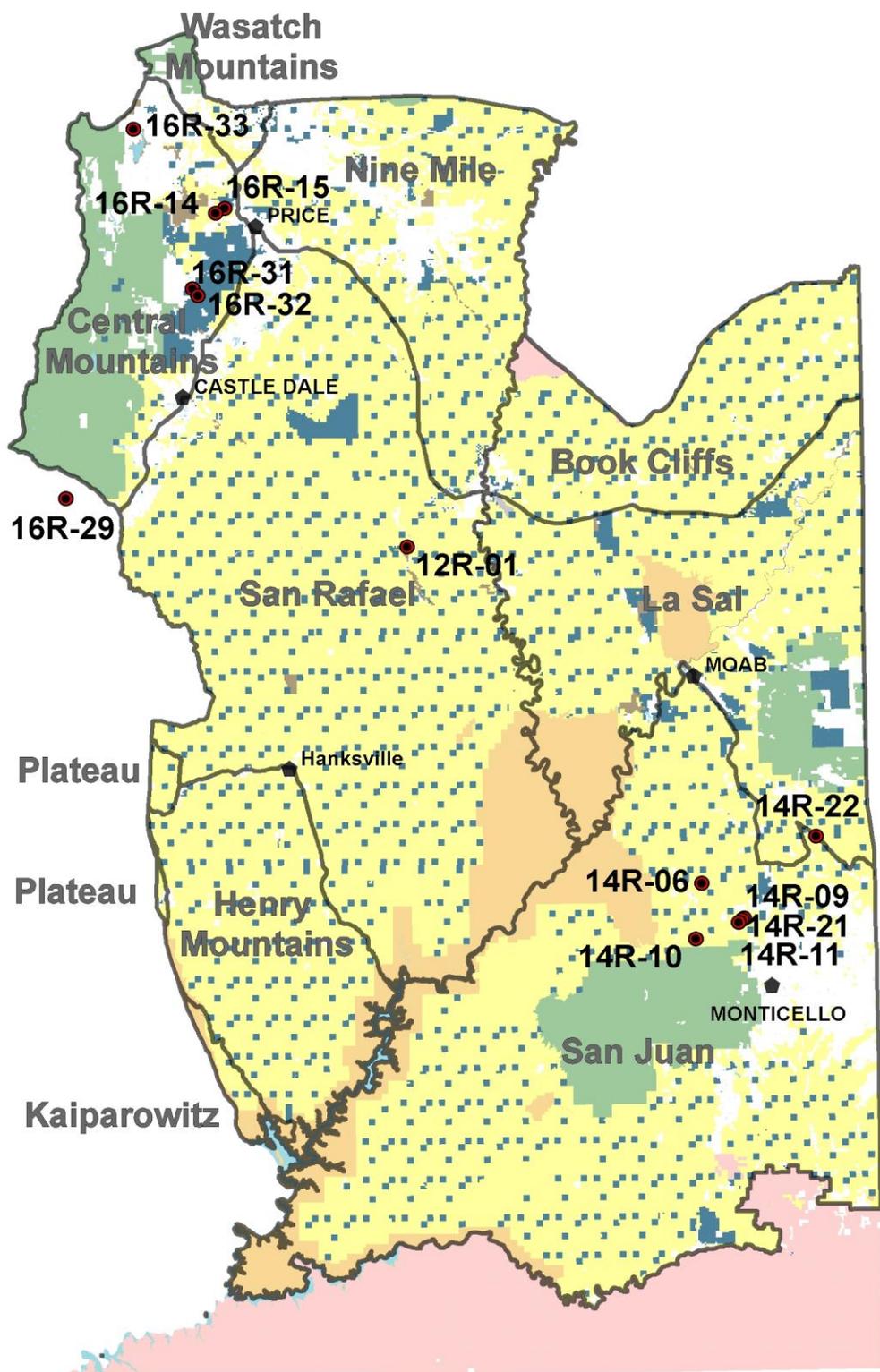
Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	56	34	-	-
Elk	22	16	35 (86)	13 (31)
Deer	12	17	7 (17)	5 (13)
Cattle	-	2	-	-

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 16

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 nova</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	6/14
<i>Artemisia tridentata wyomingensis</i>									
05	0	0	0	-	-	0	0	0	11/12
08	100	100	0	-	20	0	0	0	11/15
<i>Atriplex canescens</i>									
05	0	0	0	0	-	0	0	0	-/-
08	80	50	25	25	-	0	0	0	29/24
<i>Cercocarpus montanus</i>									
05	200	0	100	0	-	20	80	0	41/40
08	120	17	67	17	-	33	50	0	26/31
<i>Chrysothamnus viscidiflorus</i>									
05	20	0	100	-	-	0	0	0	6/11
08	40	0	100	-	60	0	0	0	11/13
<i>Cowania mexicana stansburiana</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	17/14
<i>Eriogonum corymbosum</i>									
05	1300	35	62	3	480	22	11	0	15/19
08	3560	38	57	5	980	0	0	0	12/18
<i>Gutierrezia sarothrae</i>									
05	880	7	89	5	-	0	0	0	6/8
08	720	8	92	0	-	0	0	0	7/13
<i>Juniperus osteosperma</i>									
05	40	50	50	-	-	0	0	0	-/-
08	20	100	0	-	20	0	0	0	-/-
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	1740	26	74	-	100	2	1	0	18/19
<i>Leptodactylon pungens</i>									
05	0	0	0	-	-	0	0	0	3/5
08	0	0	0	-	-	0	0	0	4/7
<i>Opuntia sp.</i>									
05	80	0	75	25	-	0	0	25	3/16
08	40	100	0	0	-	0	0	0	3/8
<i>Pinus edulis</i>									
05	120	67	33	-	40	0	0	0	-/-
08	0	0	0	-	40	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)	
Purshia tridentata										
05	0	0	0	-	-	0	0	0	9/61	
08	0	0	0	-	-	0	0	0	-/-	

Southeastern Region WRI Studies 2008



Ownership

- Other
- BLM
- DNR
- NPS
- Private
- SITLA
- Tribal
- USFS

Waterbody

-

Cities

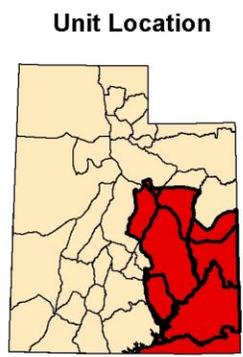
-

Unit Boundry

-

Transect Location

-



SAN RAFAEL TAMARISK REMOVAL - TREND STUDY NO. 12R-1-08

[Project #867](#)

Vegetation Type: Tamarisk

Range Type: Substantial Deer Year-Long

NRCS Ecological Site Description: Not available

Land Ownership: UDWR

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

Aspect: Southeast

Slope: 1-3%

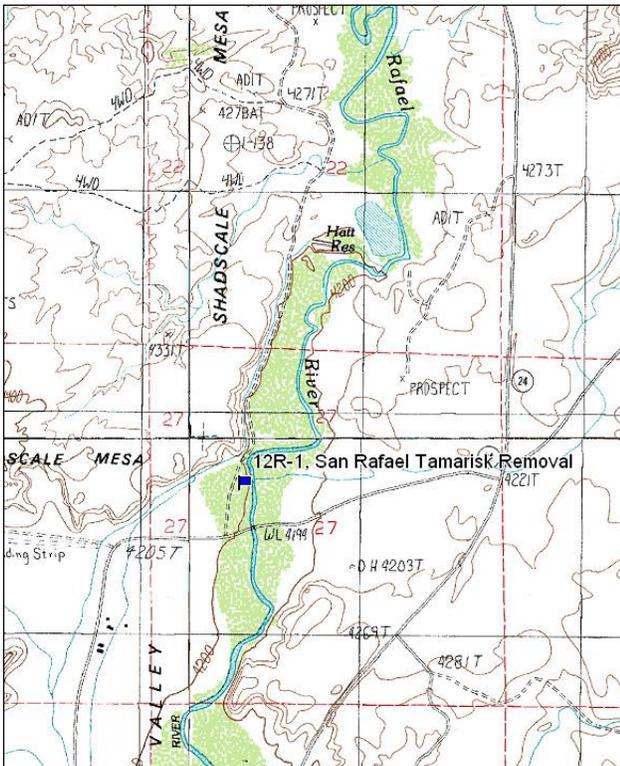
Transect bearing: 195° magnetic

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

Directions:

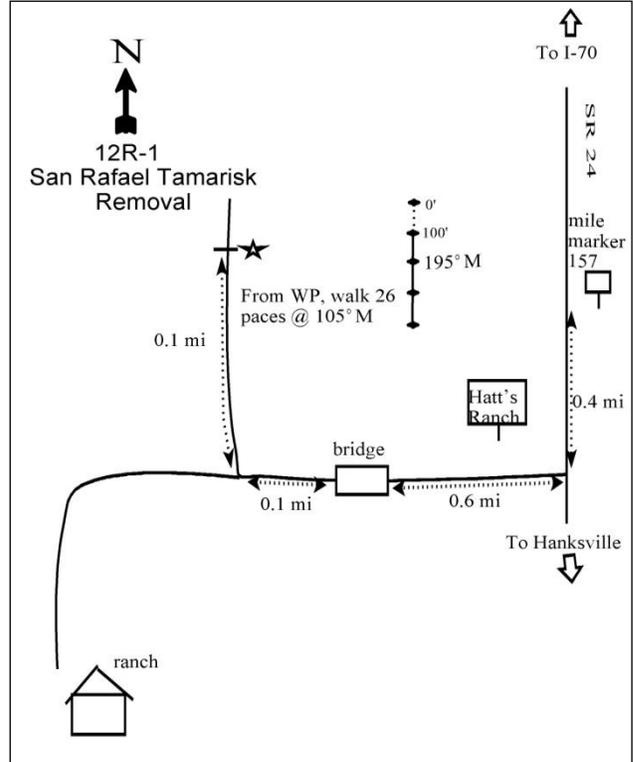
From I-70, take SR 24 south toward Hanksville. Go 0.4 miles passed mile marker 157, and then turn right near the Hatt's Ranch sign. Continue 0.6 miles passed a gate to a bridge, and then go 0.1 miles to a right turn. Drive 0.1 miles to the witness post on the right. The 0' stake is 26 paces from the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

Map Name: Horse Bench West



Township: 22S Range: 14E Section: 27

Diagrammatic Sketch:



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

SAN RAFAEL TAMARISK REMOVAL - WRI STUDY 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). 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 tamarisks 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 2011). Pellet group data estimated moderate deer/antelope use, and light cattle use in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 12R, Study no: 1

Project Name: San Rafael Tamarisk Removal - Hatt Ranch			
WRI Database #: 867			
Application:		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

Browse: The browse component is dominated by tamarisk and black greasewood (*Sarcobatus vermiculatus*). Palatable browse species are rare on the site (Table - Browse Characteristics).

Herbaceous Understory: Grasses are rare on the site. Grass species sampled on the site include saltgrass (*Distichlis spicata*), common reed (*Phragmites communis*) and alkali sacaton (*Sporobolus airoides*). 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*), Russian thistle (*Salsola iberica*), and Fremont goosefoot (*Chenopodium fremontii*) (Table - Herbaceous Trends).

Soil: 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.

HERBACEOUS TRENDS--

Management unit 12R, Study no: 1

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Distichlis spicata</i>	14	.16
G	<i>Phragmites communis</i>	6	.16
G	<i>Sporobolus airoides</i>	3	.71
Total for Annual Grasses		0	0
Total for Perennial Grasses		23	1.03
Total for Grasses		23	1.03
F	<i>Chenopodium fremontii</i> (a)	55	.98
F	<i>Halogeton glomeratus</i> (a)	2	.03
F	<i>Kochia scoparia</i> (a)	251	9.05
F	<i>Salsola iberica</i> (a)	9	.30
Total for Annual Forbs		317	10.36
Total for Perennial Forbs		0	0
Total for Forbs		317	10.36

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

BROWSE TRENDS--

Management unit 12R, Study no: 1

Type	Species	Strip	Average
		Frequency	Cover %
		'08	'08
B	<i>Chrysothamnus nauseosus</i>	6	.07
B	<i>Sarcobatus vermiculatus</i>	27	10.53
B	<i>Tamarix chinensis</i>	54	24.70
Total for Browse		87	35.30

CANOPY COVER, LINE INTERCEPT--

Management unit 12R, Study no: 1

Species	Percent
	Cover
	'08
<i>Chrysothamnus nauseosus</i>	1.08
<i>Sarcobatus vermiculatus</i>	12.73
<i>Tamarix chinensis</i>	38.26

BASIC COVER--

Management unit 12R, Study no: 1

Cover Type	Average Cover % '08
Vegetation	47.96
Pavement	.52
Litter	55.37
Bare Ground	31.47

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 '08	Days use per acre (ha) '08
Rabbit	30	-
Deer/antelope	3	21 (51)
Cattle	-	2 (4)

BROWSE CHARACTERISTICS--

Management unit 12R, 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	
Chrysothamnus nauseosus									
08	320	0	100	-	-	0	0	0	49/63
Sarcobatus vermiculatus									
08	1520	37	62	1	-	0	0	3	42/55
Tamarix chinensis									
08	3400	9	91	-	-	10	0	0	82/64

HART DRAW DUGOUT - TREND STUDY NO. 14R-6-08
[Project #246](#)

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Loam \(Basin Big Sagebrush\), R035XY306UT](#)

Land Ownership: BLM

Elevation: 6,540 ft. (1,993 m)

Aspect: Northwest

Slope: 5%

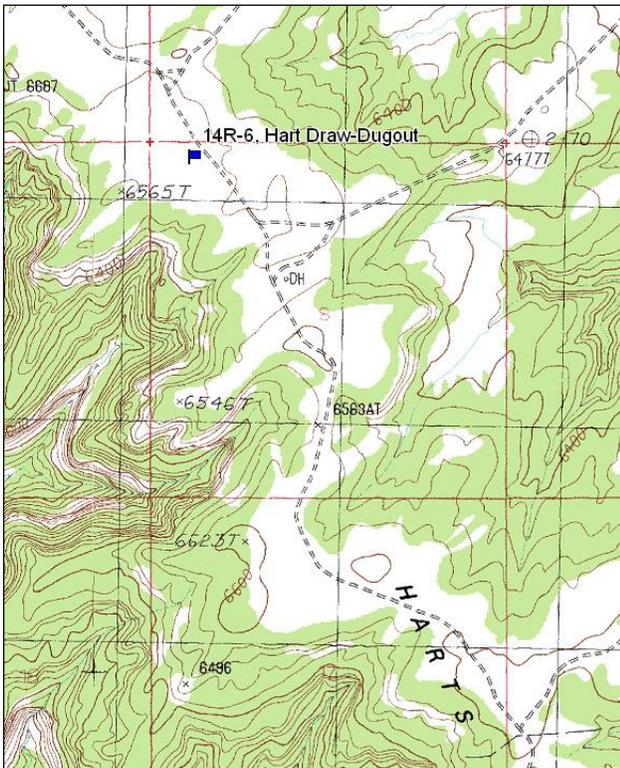
Transect bearing: 285° magnetic

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

Directions:

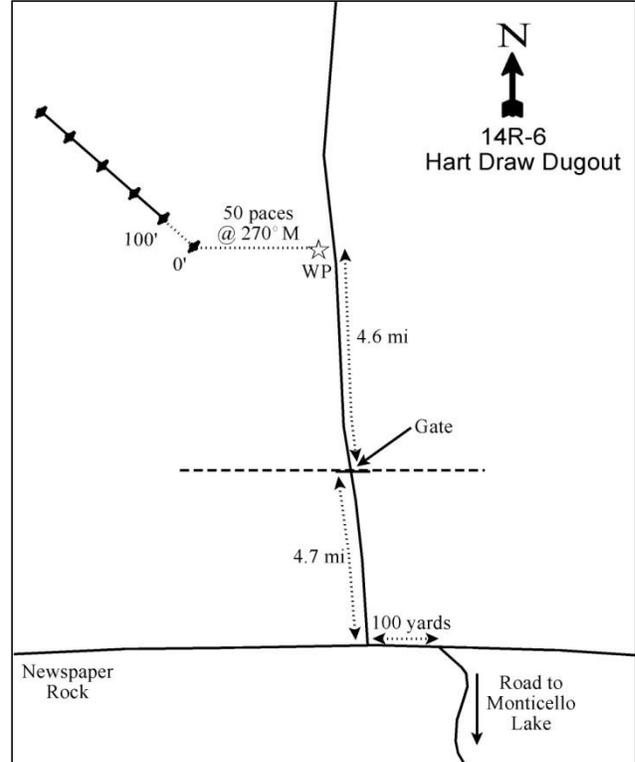
From Highway 211, about 2.4 miles east of News Paper Rock, turn north on a road that is about 100 yards west of a paved road (SJ County Road #101) that goes south toward Monticello Lake. Follow this road 4.7 miles to a gate. Passing through the gate, continue 4.6 miles to a witness post on the left side of the road. The 0-foot stake is 50 paces from the witness post at 270°M, and is marked with browse tag #28.

Map Name: Harts Point South



Township: 31S Range: 22E Section: 8

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 6283238 E 4218367 N

HART DRAW DUGOUT - WRI STUDY 14R-6
[Project #246](#)

Site Description

Site Information: The study is located approximately nineteen miles northwest of Monticello, west of SR-211, on Harts Point bench. The study was established in 2004, prior to treatment, to monitor a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat within the first phase of Hart Draw Sagebrush Restoration project. The Bureau of Land Management (BLM) proposed to restore sagebrush steppe habitat in decadent and dead sagebrush stands within the Harts Draw and Harts Point areas in three phases using various methods of treatment. The total project area incorporated over 3,000 acres which were treated over a five year span. The first phase of the project treated 629 acres of areas which received the worst sagebrush mortality. The study site was treated with a Lawson single drum aerator during the first phase of treatment in the fall of 2005. A seed mix of grass, forb, and browse species was distributed from a hopper mounted on top of the drum (Table - Seed Mix). The objective of the project is to improve habitat for elk, mule deer, sagebrush steppe birds, and pronghorn (WRI Database 2011). Pellet group data estimated moderate use by deer and cattle throughout the sample periods (Table - Pellet Group Data).

SEED MIX--

Management unit 14R, Study no: 6

Project Name: Hart Draw			
WRI Database #: 246			
Application: Single Drum Aerator		Acres:	517
Seed type		lbs in mix	lbs/acre
G	Indian Ricegrass 'Rimrock'	500	0.97
G	Needle and Threadgrass	250	0.48
G	Orchardgrass 'Paiute'	250	0.48
G	Sand Dropseed	150	0.29
G	Siberian Wheatgrass 'Vavilov'	550	1.06
G	Western Wheatgrass	493	0.95
F	Alfalfa 'Nomad'	250	0.48
F	Alfalfa 'Spredor 4'	250	0.48
F	Blue Flax	100	0.19
F	Sainfoin 'Eski'	1050	2.03
F	Small Burnet 'Delar'	1050	2.03
B	Fourwing Saltbush	535	1.03
B	Sagebrush, Wyoming	500	0.97
Total Pounds:		5928	11.47
PLS Pounds:			9.50

Browse: The preferred browse species on the site are Wyoming big sagebrush and winterfat (*Ceratoides lanata*). The Wyoming big sagebrush is the key browse species. The sagebrush is a moderately used population, with a high amount of decadence and poor vigor within the population over the sample periods. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. Winterfat is also found in low abundance on the site. Following the treatment, poor vigor and decadence within the population of winterfat were high, but prior to the treatment decadence and poor vigor were low. Utilization of winterfat has been mostly heavy over the sample years. The recruitment of young winterfat plants to the population has been poor over the study years. Other browse species sampled on the site include low rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia* sp.), and mountain ball cactus (*Pediocactus simpsonii*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and fairly diverse. The dominant grass species on the site is blue grama (*Bouteloua gracilis*), which has provided the majority of the grass cover since the outset of the study. Following the treatment, annual grass species sixweeks fescue (*Vulpia octoflora*) and cheatgrass (*Bromus tectorum*) increased substantially in frequency and cover becoming common on the site. Seeded species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*) and needle-and-thread (*Stipa comata*), although each of these species was present prior to the treatment. Forbs are not overly diverse or abundant on the site. Prior to the treatment, forbs were extremely rare on the site, but following the treatment the annual forb species woolly plantain (*Plantago patagonica*) increased substantially in nested frequency and cover. Woolly plantain is the dominant forb species on the site. Perennial forbs remained rare on the site following the treatment (Table - herbaceous Trends).

Soil: The soil texture is a sandy loam with a neutral soil reaction (pH 6.9) (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 stable in all sample years.

Pre vs. Four Years Post Treatment, 2004 vs. 2008

Browse: The density of Wyoming big sagebrush decreased 27% from 2,360 plants/acre to 1,720 plants/acre and canopy cover decreased from 9% to 6%. The health of the sagebrush population remained poor with decadence decreasing slightly from 94% to 83%, and plants displaying poor vigor remaining similar at 53% of the population. The recruitment of young plants remained poor at 1% of the population. Winterfat increased in density 25% from 320 plants/acre to 400 plants/acre, but canopy cover remained the same at 1%.

Grasses: The sum of nested frequency of perennial grasses increased slightly by 12%, but cover decreased from 26% to 16%. The majority of the decrease in cover is attributed to the decrease in the cover of blue grama which decreased from 24% to 15%, though the nested frequency remained similar. The annual species cheatgrass and sixweeks fescue both increased significantly in nested frequency, and cover increased from less than 1% to 3% for each species.

Forbs: The sum of nested frequency of perennial forbs increased by 61%, although perennial forb species remained rare on the site. With the exception of woolly plantain, no single forb provided more than 1% cover in either sample year. Woolly plantain significantly increased in nested frequency, and cover increased to 6% after the treatment.

HERBACEOUS TRENDS--
Management unit 14R, Study no: 6

Type	Species	Nested Frequency		Average Cover %	
		'04	'08	'04	'08
G	Agropyron cristatum	a-	b13	-	.08
G	Bouteloua gracilis	329	323	23.93	14.92
G	Bromus tectorum (a)	a40	b268	.14	2.59
G	Oryzopsis hymenoides	7	7	.13	.12
G	Sitanion hystrix	11	27	.25	.56
G	Stipa comata	a52	b75	1.18	.66
G	Vulpia octoflora (a)	a7	b315	.02	2.55
Total for Annual Grasses		47	583	0.15	5.15
Total for Perennial Grasses		399	445	25.50	16.36
Total for Grasses		446	1028	25.65	21.52
F	Calochortus nuttallii	2	-	.00	-

Type	Species	Nested Frequency		Average Cover %	
		'04	'08	'04	'08
F	Chenopodium sp. (a)	1	-	.00	-
F	Delphinium nuttallianum	6	1	.04	.00
F	Descurainia pinnata (a)	-	7	-	.02
F	Erodium cicutarium (a)	_a 1	_b 33	.00	.79
F	Gilia sp. (a)	_b 75	_a 40	.26	.11
F	Lappula occidentalis (a)	_a 1	_b 22	.00	.07
F	Linum perenne	-	-	-	.00
F	Machaeranthera canescens	-	3	-	.00
F	Oenothera sp.	-	11	-	.02
F	Phacelia sp.	_a -	_b 14	-	.05
F	Plantago patagonica (a)	_a 66	_b 359	.19	5.48
F	Senecio multilobatus	3	3	.09	.01
F	Sphaeralcea coccinea	30	34	.33	.45
Total for Annual Forbs		144	461	0.47	6.48
Total for Perennial Forbs		41	66	0.47	0.55
Total for Forbs		185	527	0.94	7.03

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

BROWSE TRENDS--

Management unit 14R, Study no: 6

Type	Species	Strip Frequency		Average Cover %	
		'04	'08	'04	'08
B	Artemisia tridentata wyomingensis	68	63	10.48	6.11
B	Atriplex canescens	-	-	.15	-
B	Ceratoides lanata	9	10	.03	.06
B	Chrysothamnus viscidiflorus	0	1	-	-
B	Gutierrezia sarothrae	4	3	.18	.03
B	Opuntia sp.	4	5	.15	.15
B	Pediocactus simpsonii	1	0	-	-
Total for Browse		86	82	10.99	6.36

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 6

Species	Percent Cover	
	'04	'08
Artemisia tridentata wyomingensis	9.13	5.90
Ceratoides lanata	.46	.50
Gutierrezia sarothrae	.20	.16
Opuntia sp.	.28	.08

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 6

Species	Average leader growth (in)	
	'04	'08
<i>Artemisia tridentata wyomingensis</i>	1.7	2.2
<i>Ceratoides lanata</i>	3.4	5.4

BASIC COVER--

Management unit 14R, Study no: 6

Cover Type	Average Cover %	
	'04	'08
Vegetation	36.74	34.69
Pavement	.00	.39
Litter	18.75	39.09
Cryptogams	3.30	1.26
Bare Ground	49.56	36.78

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 6, Study Name: Hart Draw-Dugout

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
18.3	6.9	61.3	25.4	13.3	0.6	9.0	80.0	0.7

PELLET GROUP DATA--

Management unit 14R, Study no: 6

Type	Quadrat Frequency		Days use per acre (ha)	
	'04	'08	'04	'08
Rabbit	11	65	-	-
Deer	29	38	38 (94)	29 (73)
Cattle	4	8	25 (63)	20 (48)

BROWSE CHARACTERISTICS--

Management unit 14R, 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 tridentata wyomingensis</i>									
04	2360	0	6	94	40	38	6	55	20/32
08	1720	1	16	83	-	58	19	53	16/25
<i>Ceratoides lanata</i>									
04	320	0	100	0	-	31	63	0	7/11
08	400	0	60	40	-	0	85	20	11/12
<i>Chrysothamnus viscidiflorus</i>									
04	0	0	0	0	-	0	0	0	-/-
08	20	0	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)	
<i>Gutierrezia sarothrae</i>										
04	220	0	91	9	-	9	0	0	11/12	
08	520	46	54	0	40	0	0	0	8/8	
<i>Opuntia sp.</i>										
04	120	0	67	33	-	0	0	0	4/13	
08	180	0	44	56	-	0	0	22	4/11	
<i>Pediocactus simpsonii</i>										
04	20	0	100	-	-	0	0	0	-/-	
08	0	0	0	-	-	0	0	0	1/2	

HART DRAW FLAT 1 - TREND STUDY NO. 14R-9-08

Project #246

Vegetation Type: Greasewood, Basin Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Sandy Loam \(Fourwing Saltbush\), R035XY215UT](#)

Land Ownership: BLM

Elevation: 6,333 ft. (1,930 m)

Aspect: North

Slope: 3%

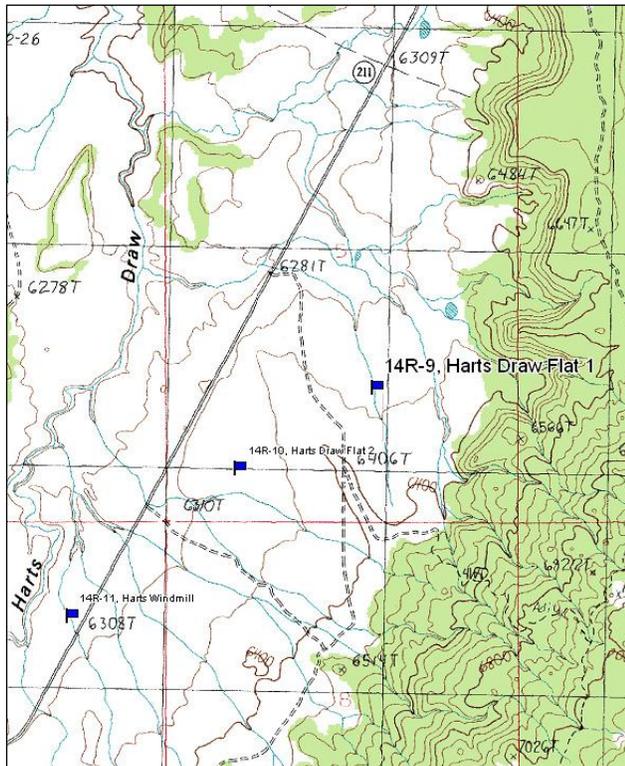
Transect bearing: 347° magnetic

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

Directions:

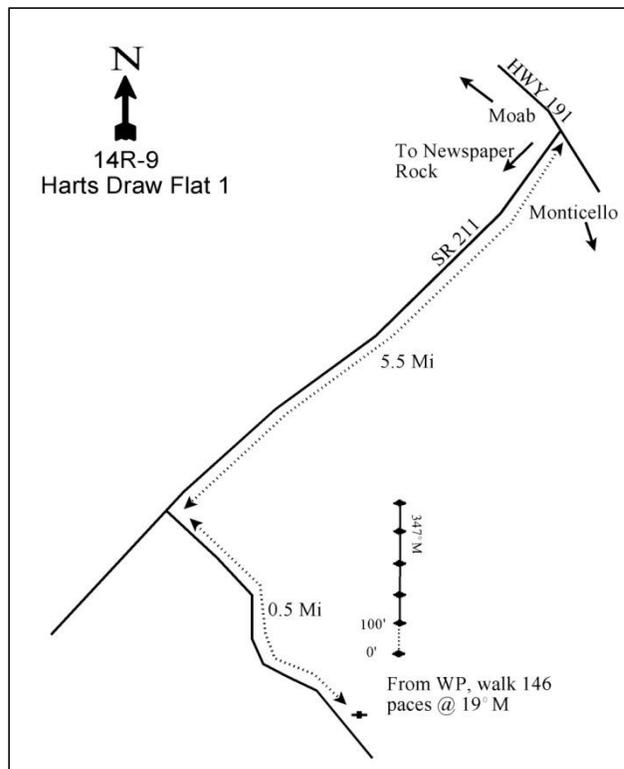
From the junction of US 191 and SR 211, north of Monticello, drive 5.5 miles on SR 211 to a dirt road on the left (south) side of the road. Drive 0.5 miles to the witness post on the left (east) side of the road. From the witness post, walk 146 paces at 19°M to the 0' stake. The 0' stake is marked with browse tag #65.

Map Name: Photograph Gap



Township: 32S Range: 23E Section: 5

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 638863 E 4209556 N

HARTS DRAW FLAT 1 - WRI STUDY 14R-9

[Project #246](#)

Site Description

Site Information: The study is located approximately twelve miles northwest of Monticello, within a basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and black greasewood (*Sarcobatus vermiculatus*) flat, in Harts Draw. The study was established in 2005, prior to treatment, to monitor effects of a Lawson single drum aerator sagebrush improvement project. The Bureau of Land Management (BLM) proposed to restore the sagebrush steppe habitat by revitalizing decadent and dead sagebrush stands. The treatment consists of three phases that include various treatment methods within the Harts Draw and Harts Point areas. The total project area incorporated over 3,000 acres, which were treated over a five year span. The first phase of the project treated 629 acres of areas which received the worst sagebrush mortality. The study site was treated with a Lawson single drum aerator during the first phase of treatment in the fall of 2005. A seed mix of grass, forb, and browse species was distributed from a hopper mounted on top of the drum (Table - Seed Mix). The objective of the project is to improve habitat for elk, mule deer, sagebrush steppe birds, and pronghorn (WRI Database 2011). Pellet group data estimated light use by deer, cattle, and horse in 2005. Pellet group data estimated moderate use by cattle, and light use by deer and elk in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 14R, Study no: 9

Project Name: Hart Draw			
WRI Database #: 246			
Application: Single Drum Aerator		Acres:	517
Seed type		lbs in mix	lbs/acre
G	Indian Ricegrass 'Rimrock'	500	0.97
G	Needle and Threadgrass	250	0.48
G	Orchardgrass 'Paiute'	250	0.48
G	Sand Dropseed	150	0.29
G	Siberian Wheatgrass 'Vavilov'	550	1.06
G	Western Wheatgrass	493	0.95
F	Alfalfa 'Nomad'	250	0.48
F	Alfalfa 'Spredor 4'	250	0.48
F	Blue Flax	100	0.19
F	Sainfoin 'Eski'	1050	2.03
F	Small Burnet 'Delar'	1050	2.03
B	Fourwing Saltbush	535	1.03
B	Sagebrush, Wyoming	500	0.97
Total Pounds:		5928	11.47
PLS Pounds:			9.50

Browse: The dominant browse species on the site is black greasewood. The preferred browse species are basin big sagebrush and shadscale (*Atriplex confertifolia*). The basin big sagebrush is a relatively small, unhealthy population, with high amounts of decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. Prior to the treatment, utilization of sagebrush plants was heavy, but has since been light. Following the treatment in 2008, shadscale was sampled in the density strip for the first time. The sampled shadscale is a small, healthy population, with good vigor and low decadence. Utilization of shadscale has been light over the study years. Half of the shadscale population was classified as young plants in 2008. The black greasewood population is moderately healthy population with low decadence and good vigor over the sample years. Other browse species sampled

on the site include: Arizona spinystar (*Coryphantha vivipara* ssp. *arizonica*), pricklypear cactus (*Opuntia* sp.), and broom snakeweed (*Gutierrezia sarothrae*) (Table - Herbaceous Trends).

Herbaceous Understory: Grasses are abundant and fairly diverse. The dominant grass species are galleta (*Hilaria jamesii*) and the annual species cheatgrass (*Bromus tectorum*). These two dominant species provide nearly all of the grass cover on the site. Following the treatment, two seeded grass species were sampled on the site, western wheatgrass (*Agropyron smithii*) and sand dropseed (*Sporobolus cryptandrus*). However, each of these species was also present before the treatment. Forbs are very rare on the site. Prior to the treatment, bur buttercup (*Ranunculus testiculatus*) and storksbill (*Erodium cicutarium*) were prevalent on the site, but have since become rare.

Soil: The soil texture is a sandy clay loam with a slightly alkaline soil reaction (pH 7.7). Phosphorus may have limited availability for plant growth and development at 3.4 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high on the site, though with a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to moderate pedestalling around shrubs and two large gullies east and west of the baseline transect. The soil erosion condition was classified as slight in 2008 due to soil and litter movement, flow patterns, and gully formation.

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

Browse: The density of basin big sagebrush decreased 55% from 220 plants/acre to 100 plants/acre and canopy cover remained similar at less than 1%. The health of the sagebrush population improved slightly, but remained poor, with decadence decreasing from 73% to 60% and poor vigor decreasing from 82% to 60% of the population. The recruitment of young sagebrush remained poor at 0% of the population. Shadscale was sampled in the density strip for the first time following the treatment at 240 plants/acre and provided minimal cover. Black greasewood remained similar in density at 1,360 plants/acre, but canopy cover decreased from 5% to 3%.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover increased from 9% to 12%. Galleta remained similar in nested frequency, but increased in cover from 8% to 11%. The annual species cheatgrass increased significantly in nested frequency, but cover decreased from 10% to 6%.

Forbs: Perennial forbs are rare on the site. The sum of nested frequency of annual forbs decreased substantially by 79%, and cover decreased from 8% to 1%. Bur buttercup and storksbill dominated the forb understory prior to the treatment, but significantly decreased in nested frequency after the treatment and became rare on the site. Bur buttercup cover decreased from 6% to less than 1%.

HERBACEOUS TRENDS-- Management unit 14R, Study no: 9

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron smithii	_b 60	_a 38	.75	.64
G	Bromus tectorum (a)	_a 355	_b 393	9.73	6.02
G	Hilaria jamesii	238	260	8.00	10.65
G	Hordeum glaucum	25	11	.41	.19
G	Poa pratensis	5	1	.15	.00
G	Sitanion hystrix	10	3	.04	.03
G	Sporobolus cryptandrus	_a 6	_b 24	.06	.51
G	Vulpia octoflora (a)	20	18	.12	.03

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
	Total for Annual Grasses	375	411	9.85	6.06
	Total for Perennial Grasses	344	337	9.42	12.03
	Total for Grasses	719	748	19.27	18.10
F	<i>Calochortus nuttallii</i>	9	1	.02	.00
F	<i>Descurainia pinnata</i> (a)	_b 53	_a -	.53	-
F	<i>Eriogonum cernuum</i> (a)	1	-	.00	-
F	<i>Erodium cicutarium</i> (a)	_b 51	_a 9	1.05	.05
F	<i>Euphorbia</i> sp.	-	1	-	.00
F	<i>Gilia</i> sp. (a)	-	3	.00	.00
F	<i>Lappula occidentalis</i> (a)	_b 78	_a 15	.63	.04
F	<i>Ranunculus testiculatus</i> (a)	_b 326	_a 79	5.70	.31
F	<i>Sphaeralcea coccinea</i>	4	4	.03	.03
	Total for Annual Forbs	509	106	7.93	0.41
	Total for Perennial Forbs	13	6	0.05	0.04
	Total for Forbs	522	112	7.99	0.46

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

BROWSE TRENDS--

Management unit 14R, Study no: 9

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	<i>Artemisia tridentata tridentata</i>	11	5	1.11	.46
B	<i>Atriplex confertifolia</i>	0	4	-	.18
B	<i>Coryphantha vivipara arizonica</i>	1	0	-	-
B	<i>Gutierrezia sarothrae</i>	0	1	-	-
B	<i>Opuntia</i> sp.	1	3	-	-
B	<i>Sarcobatus vermiculatus</i>	39	43	4.75	2.09
	Total for Browse	52	56	5.86	2.74

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 9

Species	Percent Cover	
	'05	'08
<i>Artemisia tridentata tridentata</i>	1.11	.35
<i>Atriplex confertifolia</i>	-	.05
<i>Sarcobatus vermiculatus</i>	4.75	2.58

BASIC COVER--

Management unit 14R, Study no: 9

Cover Type	Average Cover %	
	'05	'08
Vegetation	28.07	22.95
Rock	.00	.07
Pavement	.32	1.07
Litter	34.79	38.99
Cryptogams	.11	.18
Bare Ground	51.06	46.61

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 9, Study Name: Harts Draw Flat 1

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.5	7.7	50.7	23.5	25.8	0.7	3.4	131.2	0.5

PELLET GROUP DATA--

Management unit 14R, Study no: 9

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	33	82	-	-
Horse	-	-	4 (10)	-
Elk	-	-	-	1 (2)
Deer	16	8	4 (10)	1 (2)
Cattle	12	13	18 (45)	40 (99)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 9

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 tridentata									
05	220	0	27	73	-	18	64	82	21/29
08	100	0	40	60	-	0	0	60	21/19
Atriplex confertifolia									
05	0	0	0	-	-	0	0	0	6/11
08	240	50	50	-	200	0	0	0	5/6
Coryphantha vivipara arizonica									
05	20	0	100	-	-	0	0	0	5/4
08	0	0	0	-	-	0	0	0	-/-
Gutierrezia sarothrae									
05	0	0	0	-	-	0	0	0	7/9
08	20	0	100	-	-	0	0	0	7/8

		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.										
05	20	0	100	-	-	0	0	0	5/9	
08	60	0	100	-	20	0	0	0	4/10	
Sarcobatus vermiculatus										
05	1360	25	53	22	60	44	28	6	21/28	
08	1360	18	74	9	60	0	0	15	19/24	

HART DRAW FLAT 2 - TREND STUDY NO. 14R-10-08

[Project #246](#)

Vegetation Type: Basin Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Loam \(Basin Big Sagebrush\), R035XY306UT](#)

Land Ownership: BLM

Elevation: 6,342 ft. (1,933 m)

Aspect: Southwest

Slope: 3%

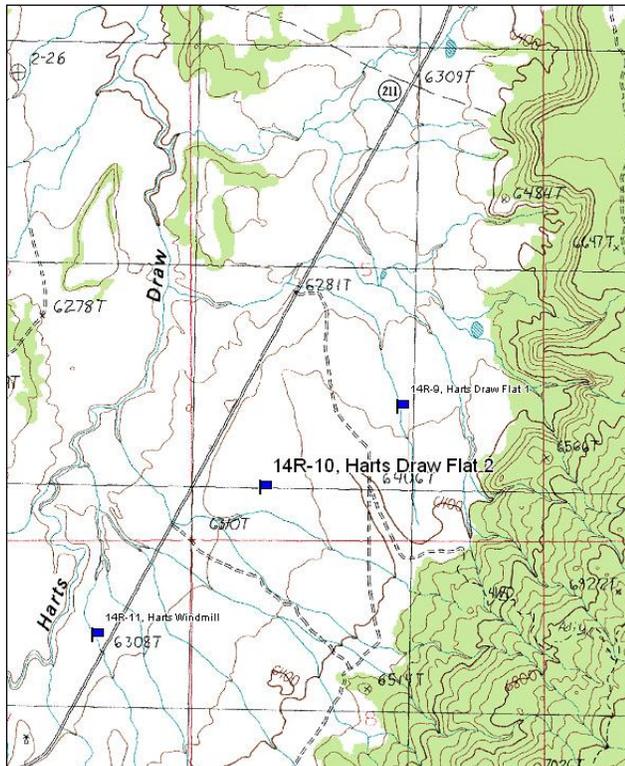
Transect bearing: 129° magnetic

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

Directions:

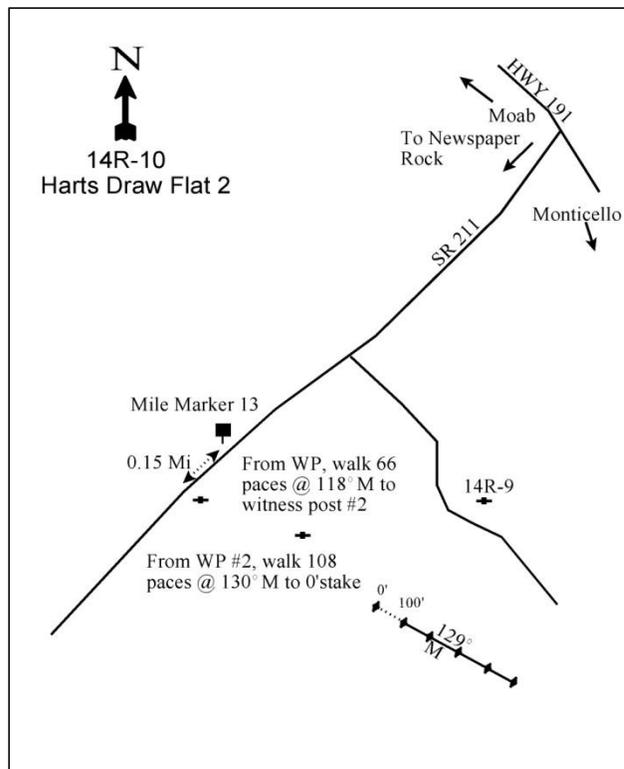
From the junction of US 191 and SR 211, north of Monticello, drive past 14R-9 to mile marker 13. Continue 0.15 miles to the witness post on the left (SE) side of the road (about 20 feet off the road). From the witness post, walk 66 paces at 118°M to a second witness post. From the second witness post, walk 108 paces at 130°M to the 0' stake. The 0' stake is marked with browse tag #66.

Map Name: Photograph Gap



Township: 32S Range: 23E Section: 5

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 638248 E 4209181 N

HARTS DRAW FLAT 2 - WRI STUDY 14R-10

[Project #246](#)

Site Description

Site Information: The study is located approximately twelve miles northwest of Monticello, within a basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) flat, in Harts Draw. The study was established in 2005, prior to treatment, to monitor effects of a Lawson single drum aerator sagebrush improvement project. The Bureau of Land Management (BLM) proposed to restore the sagebrush steppe habitat by revitalizing decadent and dead sagebrush stands. The treatment consists of three phases that include various treatment methods within the Harts Draw and Harts Point areas. The total project area incorporated over 3,000 acres, which were treated over a five year span. The first phase of the project treated 629 acres of areas which received the worst sagebrush mortality. The study site was treated with a Lawson single drum aerator during the first phase of treatment in the fall of 2005. A seed mix of grass, forb, and browse species was distributed from a hopper mounted on top of the drum (Table - Seed Mix). The objective of the project is to improve habitat for elk, mule deer, sagebrush steppe birds, and pronghorn (WRI Database 2011). Pellet group data estimated light use by deer and moderately heavy use by cattle in 2005; with heavy use by cattle and light use by deer and elk in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 14R, Study no: 10

Project Name: Hart Draw			
WRI Database #: 246			
Application: Single Drum Aerator		Acres:	517
Seed type		lbs in mix	lbs/acre
G	Indian Ricegrass 'Rimrock'	500	0.97
G	Needle and Threadgrass	250	0.48
G	Orchardgrass 'Paiute'	250	0.48
G	Sand Dropseed	150	0.29
G	Siberian Wheatgrass 'Vavilov'	550	1.06
G	Western Wheatgrass	493	0.95
F	Alfalfa 'Nomad'	250	0.48
F	Alfalfa 'Spredor 4'	250	0.48
F	Blue Flax	100	0.19
F	Sainfoin 'Eski'	1050	2.03
F	Small Burnet 'Delar'	1050	2.03
B	Fourwing Saltbush	535	1.03
B	Sagebrush, Wyoming	500	0.97
Total Pounds:		5928	11.47
PLS Pounds:			9.50

Browse: The browse component is marginal on the site. The preferred browse species on the site is basin big sagebrush. The basin big sagebrush is an unhealthy, small population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. Utilization of sagebrush has been mostly moderate to heavy. Other browse species sampled on the site include winterfat (*Ceratoides lanata*) and broom snakeweed (*Gutierrezia sarothrae*), but both of these species were rare (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant but are not particularly diverse. The annual grass species cheatgrass (*Bromus tectorum*) is the dominant species on the site and has provided the majority of cover over the sample years. Crested wheatgrass (*Agropyron cristatum*) is the dominant perennial grass species and

provides most of the remaining grass cover. Seeded species sampled on the site include sand dropseed (*Sporobolus cryptandrus*) and western wheatgrass (*Agropyron smithii*), though sand dropseed was present prior to the seeding. The forb understory is dominated by the annual forb species Russian thistle (*Salsola iberica*), which has provided the majority of the cover over the sample years. Perennial forbs are rare on the site (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.7). Phosphorus may have limited availability for plant growth and development at 5.5 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderate 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 stable in all of the sample years.

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

Browse: The density of basin big sagebrush decreased 77% from 600 plants/acre to 140 plants/acre and canopy cover decreased to less than 1%. The health of the sagebrush population improved slightly, but remained in poor condition, with decadence decreasing from 73% to 57% and poor vigor decreasing from 60% to 43% of the population. The recruitment of young sagebrush plants remained poor with recruitment decreasing from 7% to 0% of the population.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover decreased from 8% to 5%. Crested wheatgrass remained similar in nested frequency, but decreased in cover from 7% to 4%. The annual species cheatgrass increased significantly in nested frequency, but cover remained similar at 12%.

Forbs: Perennial forbs are rare on the site. The sum of nested frequency of annual forbs decreased substantially by 27%, and cover decreased from 17% to 12%. Russian thistle remained similar in nested frequency, but cover decreased from 15% to 12%.

HERBACEOUS TRENDS--

Management unit 14R, Study no: 10

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron cristatum</i>	155	164	6.66	4.21
G	<i>Agropyron smithii</i>	-	1	-	.00
G	<i>Agropyron triticeum</i>	-	3	-	.01
G	<i>Bromus tectorum</i> (a)	_a 279	_b 383	11.59	11.57
G	<i>Hilaria jamesii</i>	_a 7	_b 19	.18	.25
G	<i>Oryzopsis hymenoides</i>	_b 16	_a -	.17	-
G	<i>Sitanion hystrix</i>	_b 26	_a 3	.93	.00
G	<i>Sporobolus cryptandrus</i>	5	16	.06	.60
G	<i>Vulpia octoflora</i> (a)	2	-	.00	-
Total for Annual Grasses		281	383	11.59	11.57
Total for Perennial Grasses		209	206	8.01	5.08
Total for Grasses		490	589	19.61	16.66
F	<i>Chenopodium album</i> (a)	8	-	.01	-
F	<i>Chenopodium fremontii</i> (a)	_b 38	_a 15	.23	.03
F	<i>Descurainia pinnata</i> (a)	_b 39	_a -	1.04	-
F	<i>Euphorbia</i> sp.	-	1	-	.00
F	<i>Lappula occidentalis</i> (a)	46	29	.98	.21

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Ranunculus testiculatus (a)	_b 33	_a 10	.09	.02
F	Salsola iberica (a)	352	323	14.57	11.50
F	Sisymbrium altissimum (a)	2	3	.21	.01
F	Sphaeralcea coccinea	25	21	1.27	.54
F	Sphaeralcea grossulariifolia	-	3	-	.03
Total for Annual Forbs		518	380	17.15	11.77
Total for Perennial Forbs		25	25	1.27	0.57
Total for Forbs		543	405	18.42	12.35

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

BROWSE TRENDS--

Management unit 14R, Study no: 10

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata tridentata	20	6	2.91	.15
B	Gutierrezia sarothrae	1	1	-	-
Total for Browse		21	7	2.91	0.15

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 10

Species	Percent Cover	
	'05	'08
Artemisia tridentata tridentata	1.39	.46

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 10

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata tridentata	2.9	1.2

BASIC COVER--

Management unit 14R, Study no: 10

Cover Type	Average Cover %	
	'05	'08
Vegetation	36.50	33.02
Rock	.39	.01
Pavement	.07	.07
Litter	33.32	39.68
Cryptogams	.04	.01
Bare Ground	38.83	36.99

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 10, Study Name: Harts Draw Flat 2

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
16.9	7.7	28.4	36.8	34.8	1.0	5.5	364.8	0.5

PELLET GROUP DATA--

Management unit 14R, Study no: 10

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	52	91	-	-
Elk	-	1	-	1 (3)
Deer	10	19	5 (13)	11 (26)
Cattle	12	31	41 (100)	63 (156)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 10

		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</i>										
05	600	7	20	73	-	30	23	60	25/26	
08	140	0	43	57	-	29	43	43	23/30	
<i>Ceratoides lanata</i>										
05	0	0	0	-	-	0	0	0	20/11	
08	0	0	0	-	-	0	0	0	-/-	
<i>Gutierrezia sarothrae</i>										
05	20	0	100	-	-	0	0	0	5/9	
08	20	0	100	-	-	0	0	0	6/6	

HARTS WINDMILL - TREND STUDY NO. 14R-11-08
[Project #246](#)

Vegetation Type: Annual Forb, Annual Grass

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Sand \(Fourwing Saltbush\), R035XY212UT](#)

Land Ownership: BLM

Elevation: 6,313 ft. (1,924 m)

Aspect: West

Slope: 1%

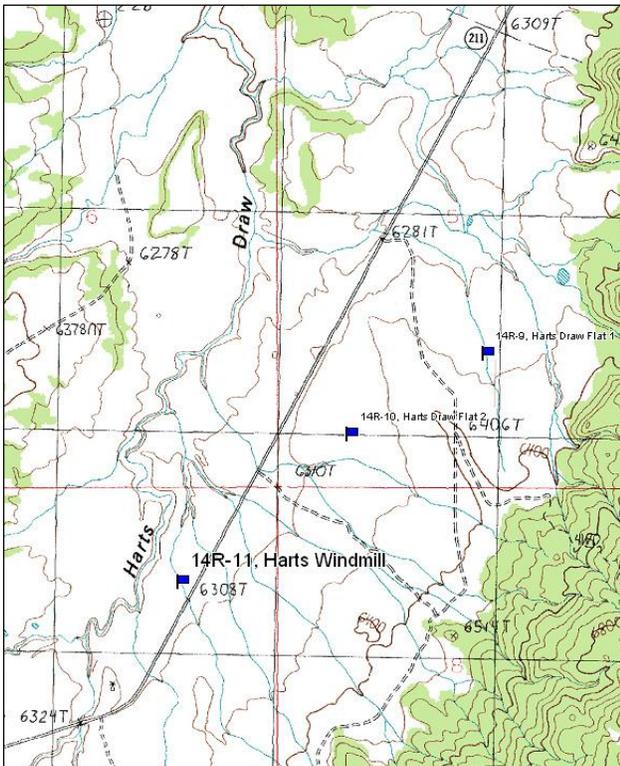
Transect bearing: 204° magnetic

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

Directions:

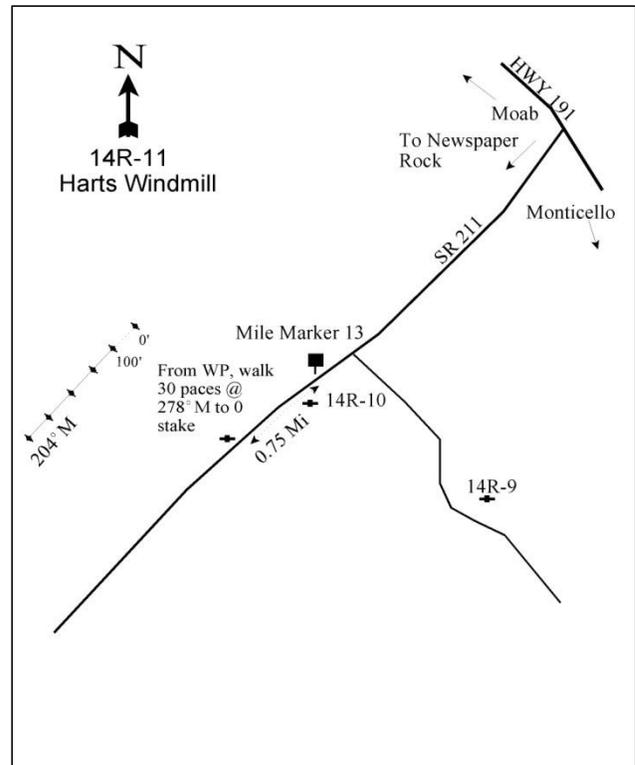
From the junction of US 191 and SR 211, north of Monticello, drive past 14R-9 to mile marker 13. Continue 0.75 miles to the witness post on the right (NW) side of the road (about 20 feet off the road). From the witness post, walk 30 paces at 278°M to the 0' stake.

Map Name: Photograph Gap



Township: 32S Range: 23E Section: 7

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 637497 E 4208499 N

HARTS WINDMILL - WRI STUDY 14R-11
[Project #246](#)

Site Description

Site Information: The study is located approximately twelve miles northwest of Monticello, on flat dominated by the annual species Russian thistle (*Salsola iberica*) and annual wheatgrass (*Agropyron triticeum*), within Harts Draw. The study was established in 2005, prior to the treatment, to monitor effects of a Lawson single drum aerator sagebrush improvement project. The Bureau of Land Management (BLM) proposed to restore the sagebrush steppe habitat by revitalizing decadent and dead sagebrush stands. The treatment consists of three phases that include various treatment methods within the Harts Draw and Harts Point areas. The total project area incorporated over 3,000 acres which were treated over a five year span. The first phase of the project treated 629 acres of areas which received the worst sagebrush mortality. The study site was treated with a Lawson single drum aerator during the first phase of treatment in the fall of 2005. A seed mix of grass, forb, and browse species was distributed from a hopper mounted on top of the drum (Table - Seed Mix). The objective of the project is to improve habitat for elk, mule deer, sagebrush steppe birds, and pronghorn (WRI Database 2011). Pellet group data estimated moderate use by cattle in 2005; with heavy use by cattle and light use by elk in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 14R, Study no: 11

Project Name: Hart Draw			
WRI Database #: 246			
Application: Single Drum Aerator		Acres:	517
Seed type		lbs in mix	lbs/acre
G	Indian Ricegrass 'Rimrock'	500	0.97
G	Needle and Threadgrass	250	0.48
G	Orchardgrass 'Paiute'	250	0.48
G	Sand Dropseed	150	0.29
G	Siberian Wheatgrass 'Vavilov'	550	1.06
G	Western Wheatgrass	493	0.95
F	Alfalfa 'Nomad'	250	0.48
F	Alfalfa 'Spredor 4'	250	0.48
F	Blue Flax	100	0.19
F	Sainfoin 'Eski'	1050	2.03
F	Small Burnet 'Delar'	1050	2.03
B	Fourwing Saltbush	535	1.03
B	Sagebrush, Wyoming	500	0.97
Total Pounds:		5928	11.47
PLS Pounds:			9.50

Browse: No browse species were sampled in density or cover measurements. Fourwing saltbush (*Atriplex canescens*) and broom snakeweed (*Gutierrezia sarothrae*) were measured in the height/crown measurements (Table - Browse Characteristics). Black greasewood (*Sarcobatus vermiculatus*), Wyoming big sagebrush (*Artemisia tridentata* ssp *wyomingensis*), and basin big sagebrush (*A. tridentata* ssp. *tridentata*) were not sampled on the site, but are growing in areas surrounding the treatment area.

Herbaceous Understory: The Herbaceous understory is in poor condition with annual species being the dominant component of the understory vegetation. Annual wheatgrass is the dominant grass species on the site, and has provided the majority of the grass cover over the sample years. Cheatgrass (*Bromus tectorum*) was sampled in low abundance throughout the sample years. Perennial grasses are rare on the site. Sand

dropseed (*Sporobolus cryptandrus*) was the only seeded species sampled, though it was sampled in very low abundance and was present prior to the treatment. The forb component is dominated by annual species with no perennial forb species sampled. Russian thistle is the dominant forb species and increased substantially on the site following the treatment (Table - Herbaceous Trends).

Soil: The soil texture is a clay with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is high, though with a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all of the sample years.

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

Browse: No browse species were sampled in density or canopy cover measurements. Fourwing saltbush and broom snakeweed were measured in the height/crown measurements.

Grasses: Perennial grasses are extremely rare on the site. The sum of nested frequency of annual grasses remained similar, but cover decreased from 44% to 8%. Annual wheatgrass significantly decreased in nested frequency, and decreased in cover from 44% to 8%. The annual species cheatgrass increased significantly in nested frequency, but cover remained minimal at less than 1%.

Forbs: Perennial forbs were not sampled in either sample year. The sum of nested frequency for annual forbs increased just under three-fold, and cover increased from 2% to 21%. The increase in nested frequency and cover is directly related to the increase of Russian thistle. Russian thistle increased significantly in nested frequency, and cover increased from 1% to 21%.

HERBACEOUS TRENDS--
Management unit 14R, Study no: 11

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron cristatum</i>	-	1	-	.00
G	<i>Agropyron triticeum</i> (a)	445	397	43.96	8.21
G	<i>Bromus tectorum</i> (a)	12	67	.07	.29
G	<i>Sporobolus cryptandrus</i>	1	5	.03	.06
Total for Annual Grasses		457	464	44.03	8.50
Total for Perennial Grasses		1	6	0.02	0.06
Total for Grasses		458	470	44.06	8.56
F	<i>Erodium cicutarium</i> (a)	3	2	.03	.00
F	<i>Helianthus annuus</i> (a)	-	126	-	.51
F	<i>Lappula occidentalis</i> (a)	15	7	.28	.03
F	<i>Ranunculus testiculatus</i> (a)	47	-	1.24	-
F	<i>Salsola iberica</i> (a)	117	391	1.06	20.51
Total for Annual Forbs		182	526	2.61	21.06
Total for Perennial Forbs		0	0	0	0
Total for Forbs		182	526	2.61	21.06

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

BASIC COVER--

Management unit 14R, Study no: 11

Cover Type	Average Cover %	
	'05	'08
Vegetation	45.95	31.96
Rock	.02	.01
Pavement	.14	1.63
Litter	27.96	26.15
Cryptogams	.00	.03
Bare Ground	40.37	51.16

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 11, Study Name: Harts Windmill

Effective rooting depth (in)	pH	caly			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
16.1	7.6	20.7	37.5	41.8	1.3	6.8	496.0	0.5

PELLET GROUP DATA--

Management unit 14R, Study no: 11

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	43	78	-	-
Elk	-	-	-	1 (2)
Deer	4	2	-	-
Cattle	9	16	23 (57)	46 (113)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 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>Atriplex canescens</i>									
05	0	0	0	-	-	0	0	0	28/35
08	0	0	0	-	-	0	0	0	37/35
<i>Gutierrezia sarothrae</i>									
05	0	0	0	-	-	0	0	0	4/7
08	0	0	0	-	-	0	0	0	-/-

SHAY MESA BULLHOG - TREND STUDY NO. 14R-21-08
[Project #1091](#)

Vegetation Type: Pinyon-Juniper, Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Upland Loam \(Basin Big Sagebrush\), R035XY306UT](#)

Land Ownership: BLM

Elevation: 6,997 ft. (2,133 m)

Aspect: Northwest

Slope: 6%

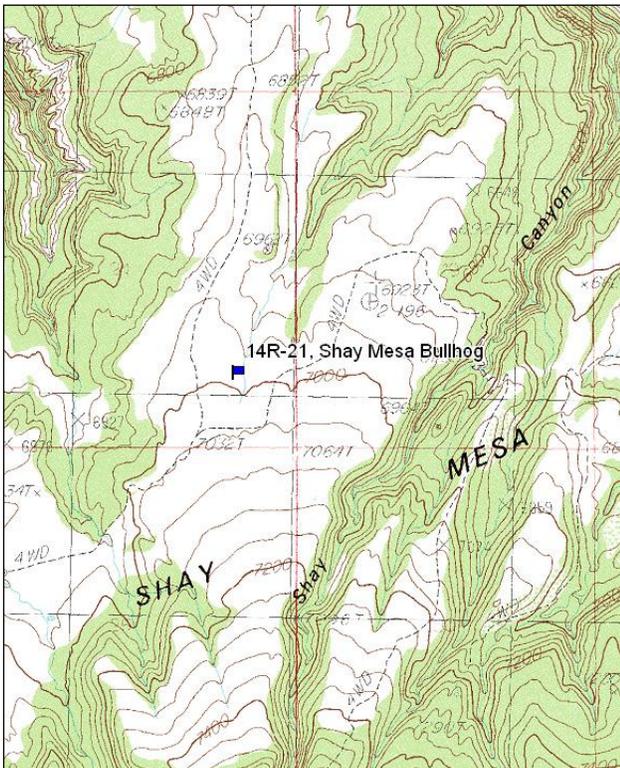
Transect bearing: 289° magnetic

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

Directions:

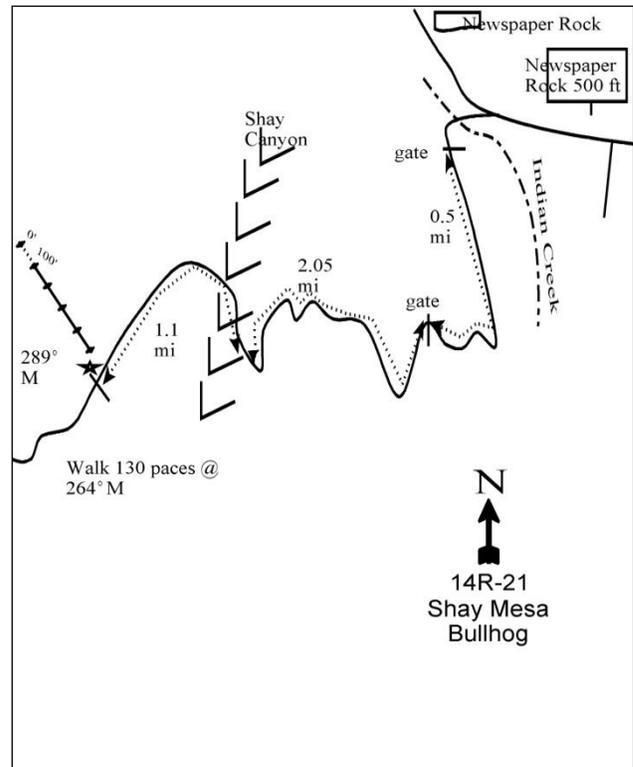
Between Newspaper Rock and the 'Newspaper Rock 500 ft' sign, turn west onto a road that crosses Indian Creek and leads to a gate. From the gate, go 0.5 miles to second gate. From this gate, drive 2.05 miles to the first sharp turn in Shay Canyon (will probably have to back down the switchback). From here continue 1.1 miles to the witness post on the right side of the road. The 0' stake is 130 paces from the witness post at 264° M. The 0' stake is marked with browse tag # 245.

Map Name: Shay Mountain



Township: 32S Range: 21E Section: 24

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 626732 E 4204297 N

SHAY MESA BULLHOG - WRI STUDY 14R-21
[Project #1091](#)

Site Description

Site Information: The study is located on the north side of Shay Mountain, within an old chaining of pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland on Shay Mesa, west of Shay Canyon. The study was established in 2008, prior to treatment, to monitor a bullhog project to remove pinyon and juniper trees. Large areas of Shay Mesa were chained and seeded in 1959. Although the 1991 Bureau of Land Management (BLM) San Juan Resource Area Management Plan identified maintenance of the Shay Mesa chained area, project maintenance was not conducted over the next decade due to conflicting project priorities and budget constraints. The lack of maintenance has resulted in a regeneration of pinyon and juniper forest, along with sections of heavy dead and downed slash from the 1950's chaining. This combination has created a buildup of hazardous fuels with an accompanying reduction in grass and forb production. In the summer of 2009, a total of 545 acres of the pinyon and juniper trees were masticated with a bullhog. A seed mix of grass, forb, and browse species was aerially seeded prior to the start of the bullhog work (Table - Seed Mix). The objectives of the project are to reduce hazardous fuel loads and improve wildlife habitat by removing encroaching pinyon and juniper trees and to increase browse and herbaceous production and diversity (WRI Database 2011). Pellet group data estimated moderate use by elk, and light use by deer, cattle, and horses (Table - Pellet Group Data).

SEED MIX--

Management unit 14R, Study no: 21

Project Name: Shay Mesa phase II - Winterfat/Sage			
WRI Database #: 1091			
Application: Aerial Seed		Acres: 483	
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Douglas'	400	0.83
G	Indian Ricegrass 'White River'	750	1.55
G	Needle and Thread	250	0.52
G	Sandberg Bluegrass	250	0.52
G	Western Wheatgrass 'Arriba'	927	1.92
F	Blue Flax 'Appar'	250	0.52
F	Cicer Milkvetch 'Lutana'	500	1.04
F	Sainfoin 'Eski'	750	1.55
F	Yellow Sweetclover	500	1.04
B	Sagebrush, Mountain	440	0.91
B	Winterfat	504	1.04
B	Bitterbrush	446	0.92
Total Pounds:		5967	12.35
PLS Pounds:			9.55

Browse: The preferred browse species are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), dwarf rabbitbrush (*Chrysothamnus depressus*), and slender eriogonum (*Eriogonum microthecum*). The dominant preferred browse species is mountain big sagebrush. The mountain big sagebrush is a lightly used population with moderately low decadence and good vigor within the population. The recruitment of young sagebrush plants was good. Utilization of dwarf rabbitbrush plants was heavy and use was mostly light for slender eriogonum. Decadence and poor vigor were high for dwarf rabbitbrush, and low for slender eriogonum. The recruitment of young dwarf rabbitbrush and slender eriogonum plants to the population was poor. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*) and broom snakeweed (*Gutierrezia sarothrae*) (Table - Browse Characteristics). Prior to the bullhog treatment, pinyon

pine and Utah juniper trees were moderately abundant on the site at an estimated 67 trees/acre and 50 trees/acre, respectively (Table - Point-Quarter Tree Data), and pinyon pine provided the majority of the canopy cover (Table - Canopy Cover).

Herbaceous Understory: Grasses are not particularly abundant, but are moderately diverse. The invasive annual grass species cheatgrass (*Bromus tectorum*) dominates the grass component and provides the majority of the grass cover. Crested wheatgrass (*Agropyron cristatum*) is the most common perennial grass species sampled on the site. Other perennial grass species sampled include galleta (*Hilaria jamesii*), Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). However, all perennial grass species are rare on the site. Forbs are not abundant or diverse on the site, and perennial forbs are rare (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 7.0). Phosphorus may have limited availability for plant growth and development at 4.2 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). While bare ground cover is high, a high amount of litter and a moderate amount of vegetation and pavement provide protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to surface litter, rock, and soil movement; pedestalling, flow patterns, and rills.

HERBACEOUS TRENDS--

Management unit 14R, Study no: 21

Type	Species	Nested Frequency '08	Average Cover % '08
G	<i>Agropyron cristatum</i>	78	.49
G	<i>Bromus tectorum</i> (a)	141	2.31
G	<i>Hilaria jamesii</i>	3	.00
G	<i>Oryzopsis hymenoides</i>	1	.00
G	<i>Sitanion hystrix</i>	10	.13
G	<i>Stipa comata</i>	12	.06
Total for Annual Grasses		141	2.31
Total for Perennial Grasses		104	0.69
Total for Grasses		245	3.01
F	<i>Agoseris glauca</i>	5	.00
F	<i>Astragalus</i> sp.	14	.09
F	<i>Chenopodium leptophyllum</i> (a)	3	.00
F	<i>Descurainia pinnata</i> (a)	11	.08
F	<i>Lappula occidentalis</i> (a)	20	.06
F	<i>Phlox austromontana</i>	7	.04
F	<i>Ranunculus testiculatus</i> (a)	32	.10
Total for Annual Forbs		66	0.25
Total for Perennial Forbs		26	0.13
Total for Forbs		92	0.39

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

BROWSE TRENDS--

Management unit 14R, Study no: 21

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia tridentata vaseyana	46	5.84
B	Chrysothamnus depressus	3	.01
B	Chrysothamnus nauseosus	1	.15
B	Eriogonum microthecum	8	.03
B	Gutierrezia sarothrae	77	5.17
B	Juniperus osteosperma	1	1.52
B	Pinus edulis	9	11.06
Total for Browse		145	23.80

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 21

Species	Percent Cover '08
Artemisia tridentata vaseyana	6.76
Eriogonum microthecum	.05
Gutierrezia sarothrae	6.61
Juniperus osteosperma	1.58
Pinus edulis	21.21

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 21

Species	Average leader growth (in) '08
Artemisia tridentata vaseyana	1.6

POINT-QUARTER TREE DATA--

Management unit 14R, Study no: 21

Species	Trees per Acre	Average diameter (in)
	'08	'08
Juniperus osteosperma	50	9.9
Pinus edulis	67	6.6

BASIC COVER--

Management unit 14R, Study no: 21

Cover Type	Average Cover % '08
Vegetation	26.22
Rock	.11
Pavement	5.65
Litter	46.15
Cryptogams	.39
Bare Ground	40.77

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 21, Study Name: Shay Mesa Bullhog

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.0	44.0	33.4	22.6	2.1	4.2	76.8	1.1

PELLET GROUP DATA--

Management unit 14R, Study no: 21

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	43	-
Horse	-	1 (1)
Elk	12	25 (63)
Deer	2	5 (12)
Cattle	3	5 (13)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 21

		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>									
08	2400	16	73	12	3380	14	7	3	24/30
<i>Chrysothamnus depressus</i>									
08	60	0	33	67	-	0	100	67	3/4
<i>Chrysothamnus nauseosus</i>									
08	20	0	100	-	-	0	0	0	17/16
<i>Ephedra viridis</i>									
08	0	0	0	-	-	0	0	0	15/11
<i>Eriogonum microthecum</i>									
08	240	42	58	-	20	17	0	0	7/5
<i>Gutierrezia sarothrae</i>									
08	9400	24	73	4	920	0	0	.42	9/12

		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										
08	20	0	100	-	-	0	0	0	-/-	
Pinus edulis										
08	180	0	100	-	-	0	0	0	-/-	

LISBON VALLEY GIP - TREND STUDY NO. 14R-22-08

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

Land Ownership: BLM

Elevation: 6,781 ft. (2,066 m)

Aspect: West

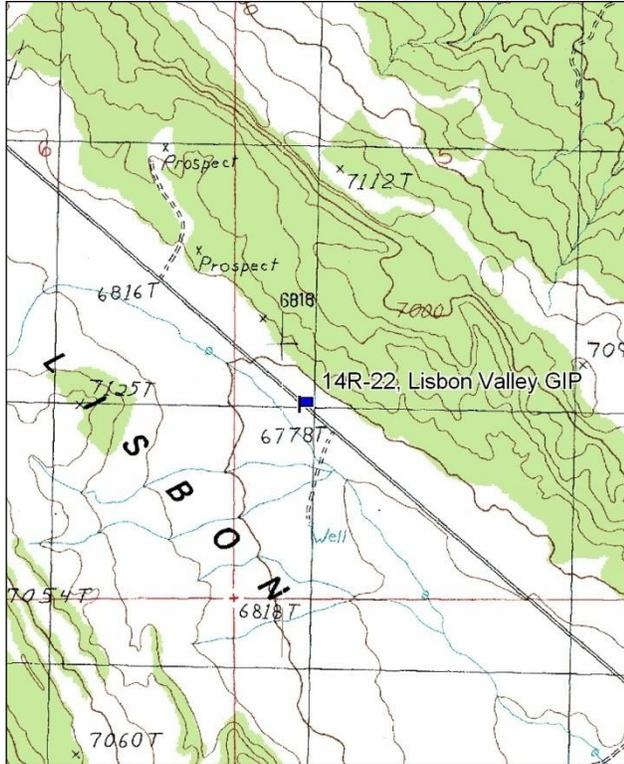
Slope: 3%

Transect bearing: Lines 1 & 2 297°, Lines 3 295°, and Lines 4 & 5 302° magnetic

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

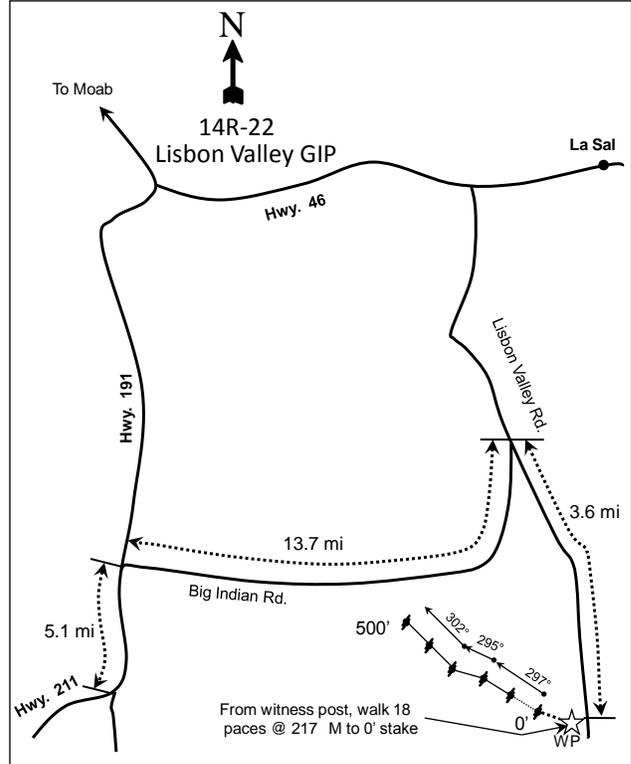
Directions: From the intersection of highway 211 and highway 191, drive north towards Moab 5.1 miles. Turn right (east) on to Big Indian Road, and proceed 13.7 miles. Then turn right (south) onto Lisbon Valley Road and drive 3.6 miles to a witness post on the left side of the road. The 0` stake is 18 paces from the witness post at 217° M.

Map Name: Lisbon Valley



Township: 30S Range: 25E Section: 5

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 656878 E 4230178 N

LISBON VALLEY GIP - WRI STUDY 14R-24

Site Description

Site Information: The study is located approximately thirteen miles southeast of La Sal Junction, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and crested wheatgrass (*Agropyron cristatum*) flat, in Lisbon Valley. The study was established in 2008, prior to treatment, on land administrated by the Bureau of Land Management (BLM). The project entails laying eight separate pipelines connected to troughs and tanks across private, federal, and state lands. The pipeline will total 150,146 linear feet. Project work has not started due to delays in implementation and other issues. It is anticipated the project work will begin in the fall of 2011 or spring of 2012. Pellet group data estimated heavy use by cattle, and light use by elk and deer in 2008 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a relatively young population with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was excellent and utilization was light. Broom snakeweed (*Gutierrezia sarothrae*) and rubber rabbitbrush (*Chrysothamnus nauseosus*) are the only other browse species sampled on the site. Broom snakeweed occurred in low abundance and rubber rabbitbrush was only sampled in the height/crown measurements (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant, but are not particularly diverse. The dominant grass species sampled on the site is crested wheatgrass, which provides the majority of the grass cover on the site. Other perennial grass species sampled on the site include intermediate wheatgrass (*Agropyron intermedium*), blue grama (*Bouteloua gracilis*), and Indian ricegrass (*Oryzopsis hymenoides*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site in low abundance and cover. Forbs are not abundant or diverse on the site. Only three forb species were sampled in the 2008 sample year which included annual stickseed (*Lappula occidentalis*), scarlet globemallow (*Sphaeralcea coccinea*), and yellow salsify (*Tragopogon dubius*) (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 7.1). Phosphorus may have limited availability for plant growth and development at 4.1 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high with a moderate amount of litter, vegetation, and pavement providing protective ground cover (Table - Basic Cover). Despite the high amount of bare ground cover, the soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--
Management unit 14R, Study no: 24

Type	Species	Nested Frequency '08	Average Cover % '08
G	Agropyron cristatum	328	24.88
G	Agropyron intermedium	2	.00
G	Bouteloua gracilis	12	.12
G	Bromus tectorum (a)	56	.65
G	Oryzopsis hymenoides	-	.03
Total for Annual Grasses		56	0.65
Total for Perennial Grasses		342	25.04
Total for Grasses		398	25.70
F	Lappula occidentalis (a)	23	.03
F	Sphaeralcea coccinea	28	.10
F	Tragopogon dubius (a)	7	.03

Type	Species	Nested Frequency	Average Cover %
		'08	'08
	Total for Annual Forbs	30	0.07
	Total for Perennial Forbs	28	0.09
	Total for Forbs	58	0.17

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

BROWSE TRENDS--

Management unit 14R, Study no: 24

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	<i>Artemisia tridentata wyomingensis</i>	66	4.03
B	<i>Gutierrezia sarothrae</i>	10	.04
	Total for Browse	76	4.07

CANOPY COVER, LINE INTERCEPT--

Management unit 14R, Study no: 24

Species	Percent Cover '08
<i>Artemisia tridentata wyomingensis</i>	3.36
<i>Gutierrezia sarothrae</i>	.05

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 14R, Study no: 24

Species	Average leader growth (in) '08
<i>Artemisia tridentata wyomingensis</i>	1.2

BASIC COVER--

Management unit 14R, Study no: 24

Cover Type	Average Cover % '08
Vegetation	30.82
Rock	.86
Pavement	.16
Litter	23.25
Cryptogams	.52
Bare Ground	55.27

SOIL ANALYSIS DATA --

Management unit 14R, Study no: 24, Study Name: Lisbon Valley

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.1	31.0	38.4	30.6	1.0	4.1	156.8	0.8

PELLET GROUP DATA--

Management unit 14R, Study no: 24

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	83	-
Elk	4	19 (46)
Deer	5	3 (8)
Cattle	9	51 (125)

BROWSE CHARACTERISTICS--

Management unit 14R, Study no: 24

		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	10480	73	24	3	1420	2	1	.57	18/24
<i>Chrysothamnus nauseosus</i>									
08	0	0	0	-	-	0	0	0	20/23
<i>Gutierrezia sarothrae</i>									
08	240	67	25	8	40	0	0	0	7/7

CONSUMER BENCH NORTH - TREND STUDY NO. 16R-14-08
[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: 6,015 ft. (1,833 m)

Aspect: North

Slope: 5%

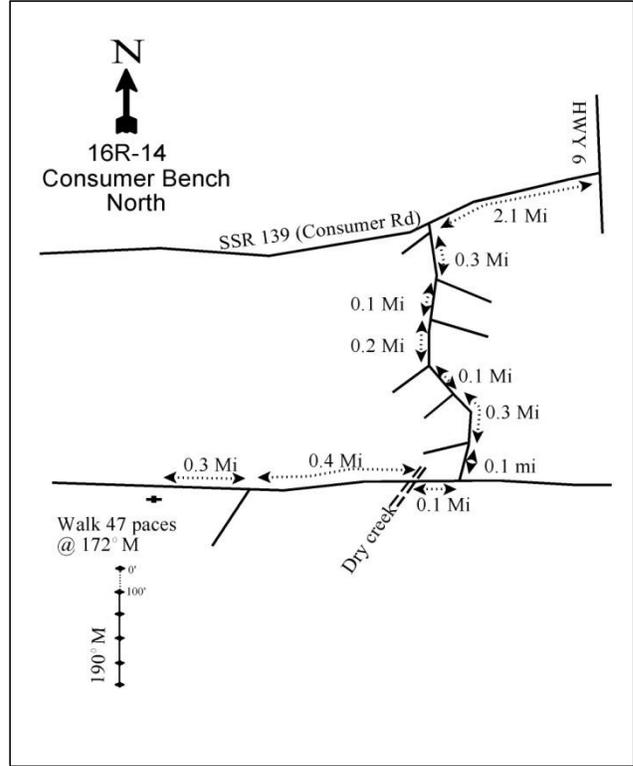
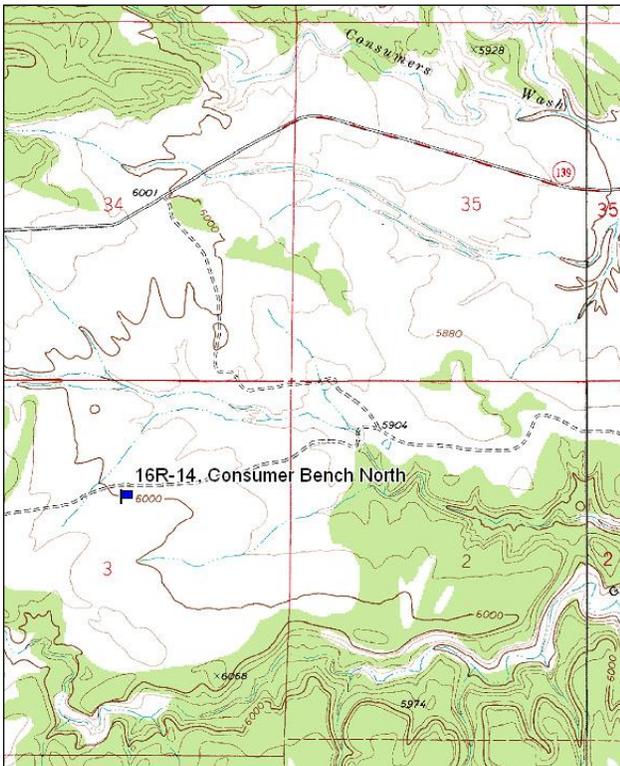
Transect bearing: 190° magnetic

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 SSR 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 pump 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 and 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' stake. The 0' stake is marked with browse tag #63. (Alternative 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 Rd. 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

CONSUMER BENCH NORTH - WRI STUDY 16R-14
[Project #228](#)

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 in 2005, prior to treatment, to monitor a Lawson double drum aerator project. 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 2011). Pellet group data estimated heavy use by deer in 2005 and 2008. Use was estimated to be moderate for elk in 2005, with no sampled use in 2008. Estimated cattle use was light in 2008 (Table - Pellet Group Data).

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		

Browse: The preferred browse species on the site is Wyoming big sagebrush. The sagebrush is a moderately used population with high decadence and poor vigor over the sample 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).

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. 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 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 and cryptogams 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, the soil erosion condition was classified as slight due to surface rock and 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 significantly 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.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 14

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron cristatum</i>	-	2	-	.03
G	<i>Agropyron smithii</i>	-	3	-	.00
G	<i>Bromus tectorum</i> (a)	2	3	.01	.01
G	<i>Elymus junceus</i>	-	2	-	.15
G	<i>Oryzopsis hymenoides</i>	_a 21	_b 45	.97	1.91
G	<i>Sitanion hystrix</i>	322	286	20.90	13.18
G	<i>Sporobolus cryptandrus</i>	1	2	.00	.00
G	<i>Stipa comata</i>	_a 1	_b 14	.06	.67
G	<i>Vulpia octoflora</i> (a)	_b 38	_a 4	.57	.01
Total for Annual Grasses		40	7	0.58	0.02
Total for Perennial Grasses		345	354	21.94	15.96
Total for Grasses		385	361	22.52	15.98
F	<i>Arabis</i> sp.	2	-	.00	-
F	<i>Astragalus convallarius</i>	3	9	.44	.05
F	<i>Castilleja</i> sp.	2	-	.03	-
F	<i>Chenopodium leptophyllum</i> (a)	_b 88	_a 13	.65	.04

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Descurainia pinnata (a)	_b 29	_a -	.37	-
F	Eriogonum ovalifolium	5	-	.01	-
F	Eriogonum umbellatum	4	-	.03	-
F	Gayophytum ramosissimum(a)	2	-	.00	-
F	Gilia sp. (a)	-	-	.00	-
F	Lappula occidentalis (a)	11	1	.05	.00
F	Lepidium montanum	8	4	.18	.03
F	Machaeranthera grindelioides	3	-	.15	-
F	Penstemon sp.	-	-	.01	-
F	Phlox longifolia	2	2	.00	.00
F	Plantago patagonica (a)	1	-	.00	-
F	Ranunculus testiculatus (a)	1	-	.00	-
F	Schoenrambe linifolia	_a 5	_b 35	.04	.33
F	Senecio integerrimus	5	-	.01	-
F	Sphaeralcea coccinea	59	77	1.29	1.00
F	Townsendia sp.	2	-	.00	-
Total for Annual Forbs		132	14	1.09	0.05
Total for Perennial Forbs		100	127	2.22	1.43
Total for Forbs		232	141	3.31	1.48

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

BROWSE TRENDS--

Management unit 16R, Study no: 14

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata wyomingensis	86	80	17.22	10.89
B	Atriplex canescens	0	1	-	-
B	Chrysothamnus viscidiflorus	8	12	.48	.27
B	Gutierrezia sarothrae	14	38	.50	1.72
B	Opuntia sp.	11	11	.77	.36
Total for Browse		119	142	18.97	13.25

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 14

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	14.43	13.58
Chrysothamnus viscidiflorus	.25	.15
Gutierrezia sarothrae	1.01	1.33
Opuntia sp.	.26	.20

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 14

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	2.3	1.5

BASIC COVER--

Management unit 16R, Study no: 14

Cover Type	Average Cover %	
	'05	'08
Vegetation	37.09	32.66
Pavement	.01	.06
Litter	29.22	41.51
Cryptogams	3.65	1.39
Bare Ground	43.91	44.06

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	'05	'08
Rabbit	15	45	-	-
Elk	11	3	28 (69)	-
Deer	38	65	48 (119)	84 (207)
Cattle	-	3	-	2 (5)

BROWSE CHARACTERISTICS--
 Management unit 16R, 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>									
05	4580	2	23	75	40600	38	21	50	23/30
08	4040	27	10	63	1100	17	30	54	19/31
<i>Atriplex canescens</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	100	0	-	-	0	0	0	41/30
<i>Chrysothamnus viscidiflorus</i>									
05	320	0	100	-	-	0	38	0	11/15
08	700	46	54	-	-	6	37	6	9/14
<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
<i>Opuntia sp.</i>									
05	360	0	100	0	-	0	0	11	5/16
08	260	23	54	23	-	0	0	23	4/15

CONSUMER BENCH 2 - TREND STUDY NO. 16R-15-08

[Project #228](#)

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Semidesert Shallow Loam (Utah Juniper-Pinyon), R034XY212UT

Land Ownership: BLM

Elevation: 6,126 ft. (1,867 m)

Aspect: Northeast

Slope: 8%

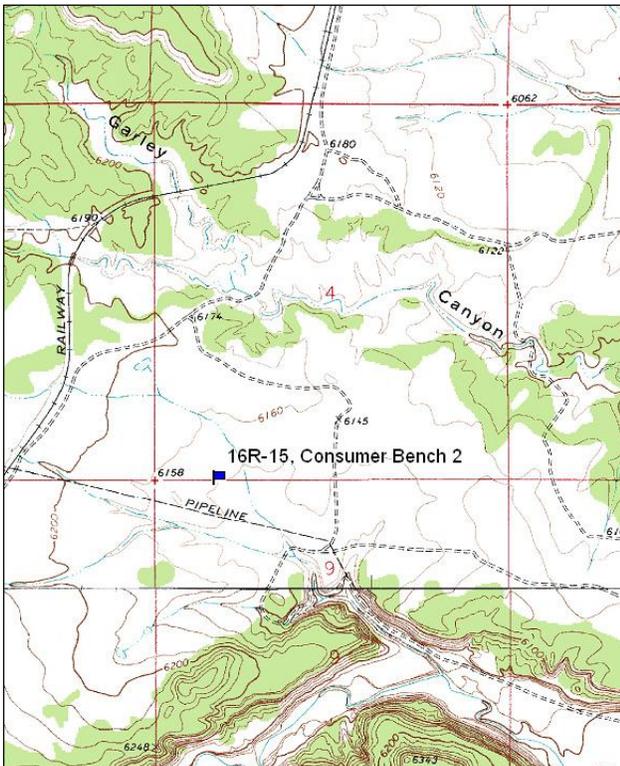
Transect bearing: 309° magnetic

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

Directions:

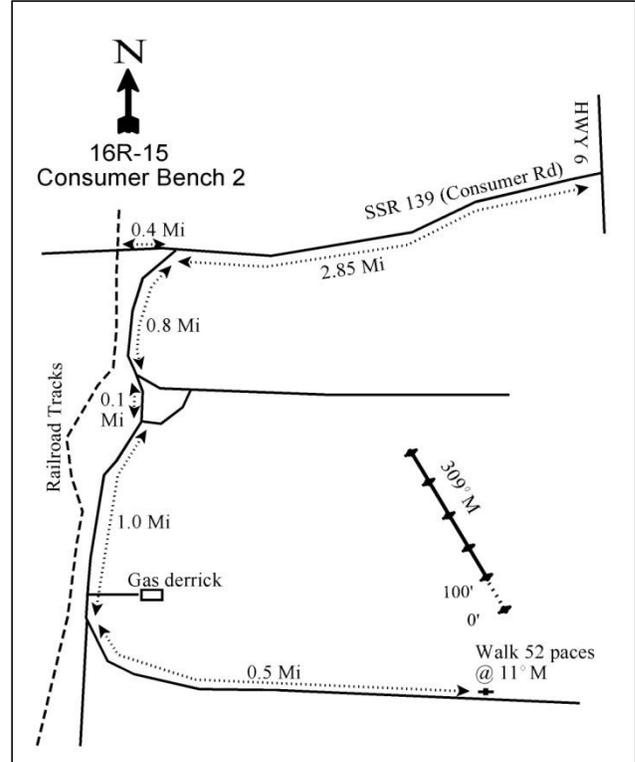
From the junction of US 6 and SSR 139 in Price, drive west on SSR 139 for 2.8 miles to a dirt road on the left (south) side of the road. Drive 0.8 miles on this road that parallels the railroad tracks to a two-track road on the left. Continue straight another 0.1 miles to another side road on the right 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.

Map Name: Standardville



Township: 14S Range: 9E Section: 9

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 506383 E 4386603 N

CONSUMER BENCH 2 - WRI STUDY 16R-15

[Project #228](#)

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 in 2005, prior to treatment, to monitor a Lawson single drum aerator project. 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). 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 2011). Pellet group data estimated heavy use by deer in 2005 and 2008. Use was estimated to be light for elk in 2005 with no sampled use in 2008 (Table - Pellet Group Data).

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		

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 to the population was excellent following the treatment, but prior to the treatment recruitment of young plants was very poor. Since the outset of the study, utilization of sagebrush plants has been mostly light to moderate. 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*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not diverse, but are moderately abundant. The perennial species bottlebrush squirreltail (*Sitanion hystrix*) is the dominant species on the site. Indian ricegrass (*Oryzopsis*

hymenoides) is moderately abundant and provides additional forage on the site. The annual species cheatgrass (*Bromus tectorum*) is very rare on the site. Forbs are moderately abundant, but are not particularly diverse. Annual species were very abundant prior to the treatment, but have since become rare on the site. The dominant forb species on the site is scarlet globemallow (*Sphaeralcea coccinea*), which provides the majority of the forb cover on the site (Table - Herbaceous Trends).

Soil: 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 all the sample years.

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.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 15

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	-	6	-	.04
G	Agropyron trachycaulum	a2	b17	.15	.42
G	Bouteloua gracilis	3	-	.00	-
G	Bromus tectorum (a)	-	-	.00	-
G	Elymus junceus	-	2	-	.03
G	Oryzopsis hymenoides	a52	b86	.35	2.97
G	Sitanion hystrix	107	137	1.96	5.43
Total for Annual Grasses		0	0	0.00	0
Total for Perennial Grasses		164	248	2.47	8.90
Total for Grasses		164	248	2.48	8.90
F	Chenopodium fremontii (a)	b360	a3	5.23	.01
F	Chenopodium leptophyllum(a)	b71	a13	.18	.02
F	Collomia linearis (a)	4	-	.03	-
F	Comandra pallida	3	-	.18	-
F	Cryptantha sp.	b14	a-	.12	-

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Cryptantha sp.(a)	-	7	-	.02
F	Descurainia pinnata (a)	_b 193	_a 2	4.76	.00
F	Eriogonum cernuum (a)	_b 104	_a 29	.33	.07
F	Erodium cicutarium (a)	-	7	-	.04
F	Lactuca serriola	1	-	.03	-
F	Lappula occidentalis (a)	_b 147	_a 24	2.61	.06
F	Lepidium montanum	_a -	_b 74	-	.87
F	Lepidium sp. (a)	_b 68	_a -	3.62	-
F	Mentzelia albicaulis (a)	-	4	-	.03
F	Salsola iberica (a)	5	2	.01	.00
F	Schoenocrambe linifolia	_b 22	_a 10	.25	.04
F	Sisymbrium altissimum (a)	2	-	.01	-
F	Sphaeralcea coccinea	_a 178	_b 252	8.61	3.18
F	Tragopogon dubius	2	-	.03	-
Total for Annual Forbs		954	91	16.79	0.28
Total for Perennial Forbs		220	336	9.24	4.09
Total for Forbs		1174	427	26.04	4.38

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	'05	'08
B	Artemisia tridentata wyomingensis	79	81	9.97	6.69
B	Chrysothamnus viscidiflorus	16	35	1.39	.96
B	Gutierrezia sarothrae	16	46	.38	.68
B	Kochia prostrata	0	2	-	-
B	Opuntia sp.	7	9	.03	.15
Total for Browse		118	173	11.78	8.48

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 15

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	10.35	8.26
Chrysothamnus viscidiflorus	.61	.90
Gutierrezia sarothrae	.65	1.20
Opuntia sp.	-	.05

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 15

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	2.4	2.6

BASIC COVER--

Management unit 16R, Study no: 15

Cover Type	Average Cover %	
	'05	'08
Vegetation	29.83	19.66
Pavement	.06	.05
Litter	27.04	22.83
Cryptogams	6.06	2.30
Bare Ground	51.23	64.75

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	'05	'08
Rabbit	36	50	-	-
Elk	4	6	3 (8)	-
Deer	62	58	113 (279)	52 (127)

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		
Artemisia tridentata wyomingensis									
05	3420	1	28	71	53000	39	19	49	24/27
08	7880	63	15	22	12260	14	13	12	21/26
Chrysothamnus viscidiflorus									
05	740	51	46	3	3920	0	0	0	11/16
08	2420	38	61	1	640	14	9	0	8/11
Gutierrezia sarothrae									
05	420	10	86	5	860	0	0	5	12/15
08	4060	16	83	1	80	5	6	0	8/8

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Kochia prostrata									
05	0	0	0	-	-	0	0	0	-/-
08	60	100	0	-	20	0	0	0	-/-
Opuntia sp.									
05	180	11	78	11	-	0	0	11	4/16
08	200	20	70	10	20	0	0	10	4/18

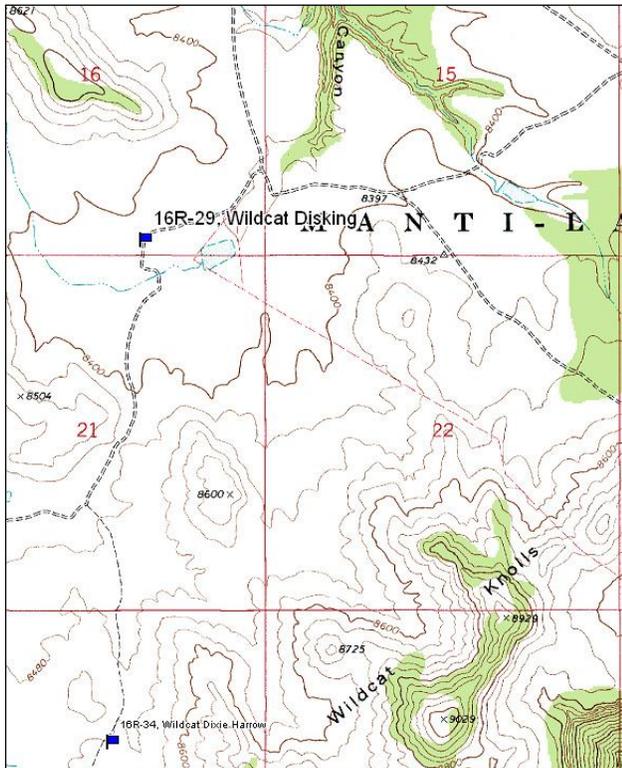
WILDCAT DISKING (UNTREATED) - TREND STUDY NO. 16R-29-08

Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Not available
Land Ownership: USFS
Elevation: 8,388 ft. (2,557 m)
Aspect: East
Slope: 3%
Transect bearing: 265° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

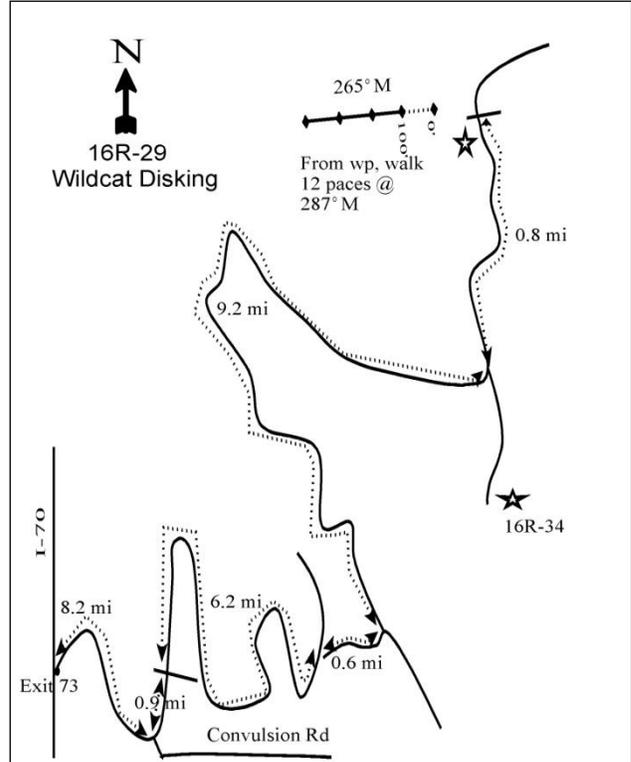
From Exit 73 on I-70, drive 8.2 miles to a road on the left and continue 0.9 miles. On Convulsion Road, drive 6.2 miles to a left turn. Go straight for 0.6 miles to a fork. Go left and continue for 9.2 miles to the two track turn off to 16R-34. Go left for 0.8 miles to the witness post on the left. The 0' stake is 12 paces from the witness post at 287° M. The 0' stake is marked with browse tag #251.

Map Name: Emery West



Township: 21S Range: 5E Section: 16

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 468789 E 4314931 N

WILDCAT DISKING (UNTREATED) - WRI STUDY 16R-29

Site Description

Site Information: The study is located approximately seven miles northwest of Emery, in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and crested wheatgrass (*Agropyron cristatum*) flat, on the northwest side of Wildcat Knolls, within the Manti-La Sal National Forest. The study was originally established in 2008 to monitor a disking project ([WRI project #1161](#)) which was to occur in fall of 2008, but the study site was not treated. In the 2009 sampling year, the Wildcat Disking (16R-37) was established within the disking treatment site approximately one mile south of this study. Pellet group data estimated heavy use by cattle, and light use by deer in 2008 (Table - Pellet Group Data).

Browse: The preferred browse species sampled on the site are Wyoming big sagebrush and a small population of mature black sagebrush (*Artemisia nova*). The Wyoming big sagebrush is a moderately used population with high decadence and good vigor within the population. The recruitment of young Wyoming big sagebrush plants to the population was good in 2008. Utilization of black sagebrush was mostly moderate to heavy in 2008. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses on the site are abundant and fairly diverse, but is dominated by the grass species crested wheatgrass which provides the majority of the grass cover. Other perennial grass species sampled on the site include western wheatgrass (*Agropyron smithii*), sedge (*Carex* sp.), prairie junegrass (*Koeleria cristata*), Sandberg bluegrass (*Poa secunda*), needle-and-thread (*Stipa comata*), and letterman needlegrass (*S. lettermani*). Each of these perennial species provides little cover on the site. Forbs are both moderately abundant and moderately diverse on the site. The dominant forb species sampled on the site are aster (*Aster* sp.) and pingue hymenoxys (*Hymenoxys richardsonii*) (Table - Herbaceous Trends).

Soil: The soil texture is clay with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). While bare ground cover is high, there is a high amount of vegetation cover and a moderate amount of litter that provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 29

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	Agropyron cristatum	369	27.22
G	Agropyron smithii	14	.19
G	Carex sp.	76	.48
G	Koeleria cristata	40	.86
G	Poa secunda	37	.74
G	Stipa comata	32	.46
G	Stipa lettermani	19	.25
Total for Annual Grasses		0	0
Total for Perennial Grasses		587	30.23
Total for Grasses		587	30.23
F	Antennaria rosea	40	.83
F	Aster sp.	158	2.45
F	Astragalus convallarius	3	.00

Type	Species	Nested Frequency	Average Cover %
		'08	'08
F	Astragalus sp.	118	.93
F	Castilleja linariaefolia	8	.21
F	Eriogonum racemosum	5	.03
F	Hymenoxys richardsonii	61	1.84
F	Linum lewisii	15	.06
F	Orobancha sp.	3	.03
F	Orthocarpus sp. (a)	2	.00
F	Penstemon sp.	5	.00
F	Taraxacum officinale	11	.05
F	Tragopogon dubius (a)	1	.03
Total for Annual Forbs		3	0.03
Total for Perennial Forbs		427	6.48
Total for Forbs		430	6.51

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

BROWSE TRENDS--

Management unit 16R, Study no: 29

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia nova	4	.38
B	Artemisia tridentata vaseyana	66	6.34
B	Chrysothamnus nauseosus	59	2.85
B	Chrysothamnus viscidiflorus	16	.39
B	Chrysothamnus viscidiflorus viscidiflorus	43	1.54
B	Tetradymia canescens	1	-
Total for Browse		189	11.51

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 29

Species	Percent Cover '08
Artemisia nova	.25
Artemisia tridentata vaseyana	5.73
Chrysothamnus nauseosus	4.18
Chrysothamnus viscidiflorus	.35
Chrysothamnus viscidiflorus viscidiflorus	1.26
Tetradymia canescens	.05

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 29

Species	Average leader growth (in) '08
Artemisia tridentata vaseyana	0.6

BASIC COVER--
Management unit 16R, Study no: 29

Cover Type	Average Cover % '08
Vegetation	54.20
Rock	.04
Pavement	.48
Litter	20.54
Cryptogams	.04
Bare Ground	43.89

SOIL ANALYSIS DATA --
Management unit 16R, Study no: 29, Study Name: Wildcat Disking (Untreated)

Effective rooting depth (in)	pH	clay			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.1	23.6	23.8	52.6	1.7	3.0	230.4	1.0

PELLET GROUP DATA--
Management unit 16R, Study no: 29

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	22	-
Elk	20	12 (30)
Deer	5	-
Cattle	21	47 (116)

BROWSE CHARACTERISTICS--
 Management unit 16R, Study no: 29

		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)	
Artemisia nova										
08	120	0	33	67	-	33	33	33	12/23	
Artemisia tridentata vaseyana										
08	3320	14	42	44	140	39	16	14	15/26	
Chrysothamnus nauseosus										
08	3440	5	36	59	-	5	2	15	16/17	
Chrysothamnus viscidiflorus										
08	680	6	91	3	-	9	6	0	5/9	
Chrysothamnus viscidiflorus viscidiflorus										
08	3580	23	72	5	80	2	0	1	7/9	
Tetradymia canescens										
08	20	0	100	-	-	0	0	0	-/-	

MOHRLAND ROLLER CHOPPER 1 - TREND STUDY NO. 16R-31-08

[Project #1083](#)

Vegetation Type: Pinyon-Juniper, Black Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Upland Very Steep Shallow Clay Loam (Utah Juniper-Pinyon), R034XY330UT

Land Ownership: SITLA

Elevation: 6,979 ft. (2,127 m)

Aspect: Southeast

Slope: 6%

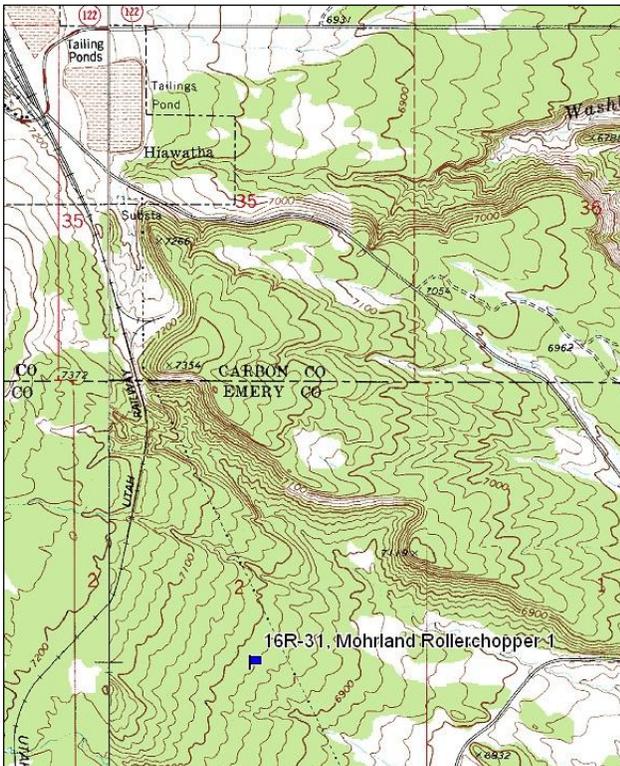
Transect bearing: 280° magnetic

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

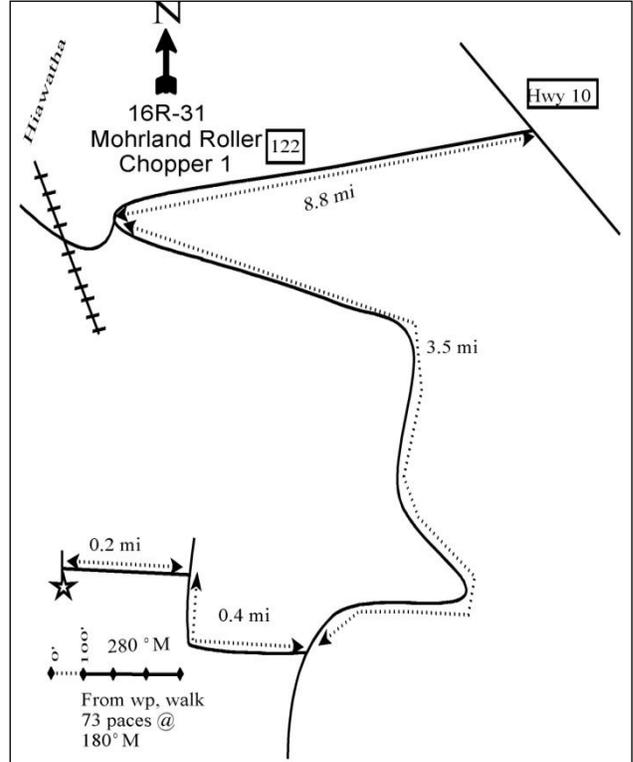
Directions:

From Hwy 10, turn onto Hwy 122 and drive 8.8 miles to a road on the left, just before the railroad crossing near Hiawatha. Continue on this road for 3.5 miles to a fork and go right. Drive 0.4 miles to a road on the left and go 0.2 miles to the half-high witness post. The 0' stake is 73 paces from the witness post at 180° M. The 0' stake is marked with browse tag #262.

Map Name: Poison Spring Bench



Diagrammatic Sketch:



Township: 16S Range: 8E Section: 2

GPS: NAD 83, UTM 12T 500581 E 4367602 N

MOHRLAND ROLLER CHOPPER 1 - WRI STUDY 16R-31
[Project #1083](#)

Site Description

Site Information: The study is located approximately two miles southeast of Hiawatha, within an old pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining, on the west end of Poison Spring Bench, south of Sand Wash, on Utah State Institutional Trust Land (SITLA). The study was established in 2008, prior to treatment, to monitor the effects of a roller chopper project to remove pinyon and juniper trees. In the 1960's, the area was two-way chained to remove pinyon and juniper trees and to improve the herbaceous understory. Over time, the pinyon pine and Utah juniper trees began to reestablish within the chained area. In November of 2008, a total of 743 acres were treated with a roller chopper to remove pinyon and juniper trees. Seed dribblers were used to distribute a seed mix of browse species behind a bulldozer. Prior to the roller chopper treatment in October, a seed mix of grass, forb, and browse species were aerially applied (Table - Seed Mix). The objective of the project is to improve wildlife habitat by removing pinyon and juniper trees, increasing the browse and herbaceous production, and increasing diversity (WRI Database 2011). Pellet group data estimated moderate use by deer and light use by elk and cattle (Table - Pellet Group Data).

SEED MIX--

Management unit 16R, Study no: 31

Project Name: Mohrland PJ Removal					
WRI Database #: 1083					
Application: Aerial Seed		Acres: 847		Application: Seed Dribbler	
				Acres: 847	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Bottlebrush Squirreltail 'Toe Jam'	250	0.30	B	Fourwing Saltbush
G	Bottlebrush Squirreltail	150	0.18	B	True Mountain Mahogany
G	Canby Bluegrass 'Canbar'	400	0.47	Total Pounds:	
G	Crested Wheatgrass 'Hycrest'	650	0.77	PLS Pounds:	
G	Crested Wheatgrass 'Nordan'	600	0.71		
G	Indian Ricegrass	250	0.30		
G	Intermediate Wheatgrass 'Rush'	900	1.06		
G	Needle and Thread	200	0.24		
G	Pubescent Wheatgrass	1600	1.89		
G	Snake River Wheatgrass 'Secar'	850	1.00		
G	Western Wheatgrass 'Arriba'	1250	1.48		
F	Blue Flax 'Appar'	450	0.53		
F	Scarlet Globemallow	20	0.02		
F	Western Yarrow	50	0.06		
B	Fourwing Saltbush	500	0.59		
Total Pounds:		8120	9.59		
PLS Pounds:			8.03		

Browse: The preferred browse species are black sagebrush (*Artemisia nova*) and true mountain mahogany (*Cercocarpus montanus*), though true mountain mahogany is rare on the site and is mostly found in the drainages. The black sagebrush is a moderately used population with high decadence and good vigor. The recruitment of young sagebrush plants to the population was good. Utilization of the true mountain mahogany plants sampled on the site was heavy. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), prickly phlox (*Leptodactylon pungens*), and pricklypear cactus (*Opuntia sp.*), however, each of these species was sampled in low abundance on the site (Table - Browse Characteristics). Prior to the treatment in 2008, pinyon pine and Utah juniper trees

were common on the site with a density of 51 trees/acre and 107 trees/acre, respectively (Table - Point-Quarter Tree Data), and provided a large amount of the canopy cover (Table - Canopy Cover).

Herbaceous Understory: Grasses are very limited on the site, and only a small population of crested wheatgrass (*Agropyron cristatum*) was sampled in 2008. Forbs are not very abundant or diverse on the site. The dominant forb species sampled on the site was euphorbia (*Euphorbia sp.*) (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). While bare ground cover is high, there is also a high amount of litter and a moderate amount of vegetation, rock, and pavement that provide protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to surface litter, rock, and soil movement; pedestalling, flow patterns, rills, and gullies.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 31

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Agropyron cristatum</i>	71	.26
Total for Annual Grasses		0	0
Total for Perennial Grasses		71	0.26
Total for Grasses		71	0.26
F	<i>Antennaria rosea</i>	-	.38
F	<i>Arabis sp.</i>	1	.03
F	<i>Astragalus convallarius</i>	5	.07
F	<i>Eriogonum cernuum (a)</i>	17	.08
F	<i>Euphorbia sp.</i>	38	1.27
F	<i>Ipomopsis aggregata</i>	1	.03
F	<i>Penstemon sp.</i>	3	.03
F	<i>Salsola iberica (a)</i>	2	.00
F	<i>Senecio multilobatus</i>	1	.03
Total for Annual Forbs		19	0.08
Total for Perennial Forbs		49	1.84
Total for Forbs		68	1.93

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

BROWSE TRENDS--

Management unit 16R, Study no: 31

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia nova	75	12.39
B	Cercocarpus montanus	2	.15
B	Chrysothamnus nauseosus	7	1.63
B	Gutierrezia sarothrae	20	.03
B	Juniperus osteosperma	8	5.88
B	Leptodactylon pungens	4	.03
B	Opuntia sp.	2	.00
B	Pinus edulis	1	3.04
Total for Browse		119	23.17

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 31

Species	Percent Cover
	'08
Artemisia nova	13.76
Cercocarpus montanus	.56
Chrysothamnus nauseosus	1.89
Juniperus osteosperma	7.11
Opuntia sp.	.21
Pinus edulis	6.15

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 31

Species	Average leader growth (in)
	'08
Artemisia nova	0.6
Cercocarpus montanus	4.4

POINT-QUARTER TREE DATA--

Management unit 16R, Study no: 31

Species	Trees per Acre	Average diameter (in)
	'08	
Juniperus osteosperma	107	4.7
Pinus edulis	51	6.5

BASIC COVER--

Management unit 16R, Study no: 31

Cover Type	Average Cover % '08
Vegetation	26.13
Rock	7.36
Pavement	7.96
Litter	37.48
Cryptogams	.09
Bare Ground	40.54

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 31, Study Name: Mohrland Roller Chopper

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	6.9	53.6	25.8	20.6	3.2	13.0	172.8	0.9

PELLET GROUP DATA--

Management unit 16R, Study no: 31

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	54	-
Elk	1	3 (7)
Deer	41	34 (84)
Cattle	3	2 (5)

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 31

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									
08	8620	23	42	35	2940	32	12	6	9/22
Cercocarpus montanus									
08	40	0	100	-	-	100	0	0	48/56
Chrysothamnus nauseosus									
08	200	10	90	-	-	0	0	10	27/40
Gutierrezia sarothrae									
08	800	10	83	8	20	0	5	8	6/6
Juniperus osteosperma									
08	180	22	78	-	-	0	0	0	-/-
Leptodactylon pungens									
08	120	50	33	17	-	0	0	0	2/4

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Opuntia sp.									
08	40	0	100	-	-	0	0	0	3/15
Pinus edulis									
08	20	0	100	-	-	0	0	0	-/-

MOHRLAND ROLLER CHOPPER 2 - TREND STUDY NO. 16R-32-08

[Project #1083](#)

Vegetation Type: Pinyon-Juniper, Black Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Upland Very Steep Shallow Clay Loam (Utah Juniper-Pinyon), R034XY330UT

Land Ownership: SITLA

Elevation: 6,732 ft. (2,052 m)

Aspect: East

Slope: 7-9%

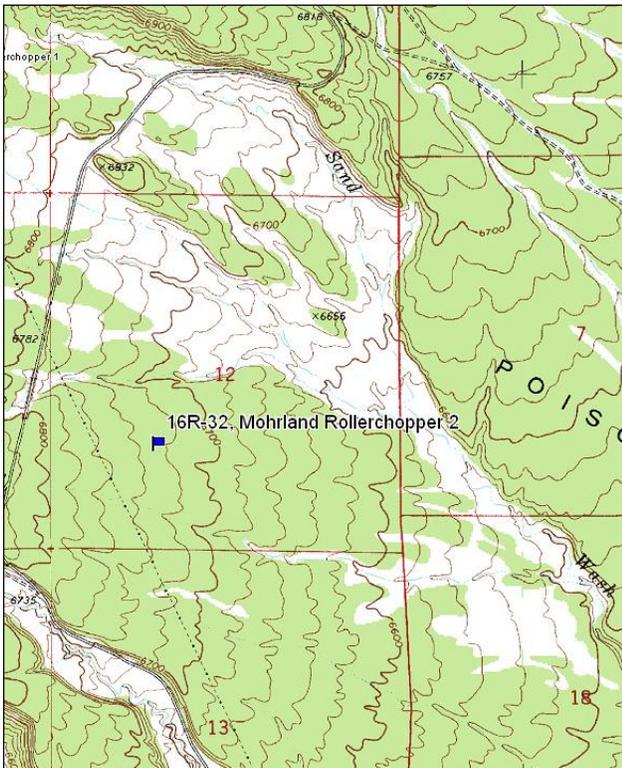
Transect bearing: 300° magnetic

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

Directions:

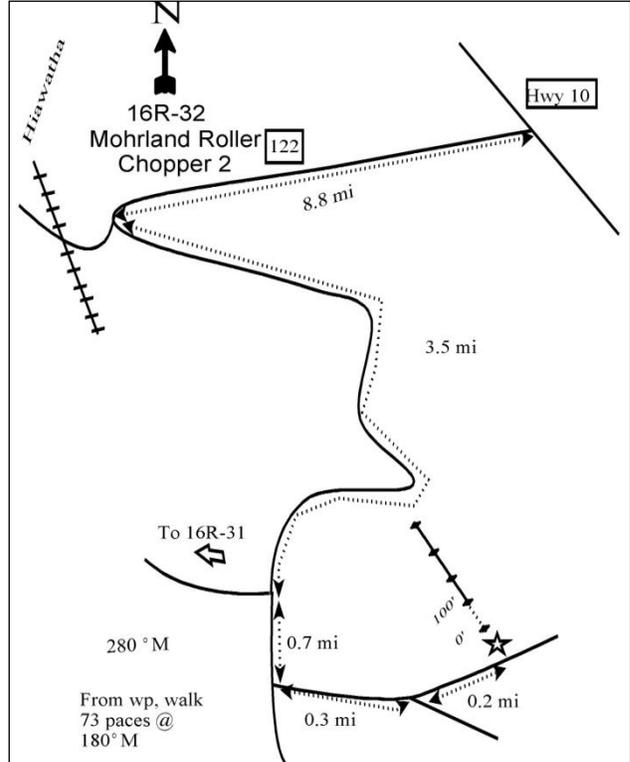
From Hwy 10, turn onto Hwy 122 and drive 8.8 miles to a road on the left, just before the railroad crossing near Hiawatha. Continue on this road for 3.5 miles to the r fork that leads to 16R-31. Continue straight for 0.7 miles to a left turn, and follow this road for 0.3 miles to a fork. Go left and drive 0.2 miles to the witness post. The 0' stake is 42 paces from the witness post at 302° M. The 0' stake is marked with browse tag # 254.

Map Name: Poison Spring Bench



Township: 16S Range: 8E Section: 12

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 501847 E 4365934 N

MOHRLAND ROLLER CHOPPER 2 - WRI STUDY 16R-32
[Project #1083](#)

Site Description

Site Information: The study is located approximately three miles southeast of Hiawatha, in an old pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining, on the southwest portion of Poison Spring Bench, north of Cedar Creek, on Utah State Institutional Trust Land (SITLA). The study was established in 2008, prior to treatment, to monitor the effects of a roller chopper treatment to remove pinyon and juniper trees. In the 1960's, the area was two-way chained to remove pinyon and juniper trees and to improve the herbaceous understory vegetation. Over time, the pinyon pine and Utah juniper trees began to reestablish within the chained area. In November of 2008, a total of 743 acres were treated with a roller chopper to remove pinyon and juniper trees. Seed dribblers were used to distribute a seed mix of browse species behind a bulldozer. Prior to the roller chopper treatment in October, a seed mix of grass, forb, and browse species were aerially applied (Table - Seed Mix). The objectives of the project are to improve wildlife habitat by increasing browse and herbaceous production and increasing diversity by removing pinyon and juniper trees (WRI Database 2011). Pellet group data estimated moderate use by deer and light use by elk and cattle (Table - Pellet Group Data).

SEED MIX--

Management unit 16R, Study no: 32

Project Name: Mohrland PJ Removal					
WRI Database #: 1083					
Application: Aerial Seed		Acres: 847		Application: Seed Dribbler	
				Acres: 847	
Seed type		lbs in mix	lbs/acre	Seed type	
G	Bottlebrush Squirreltail 'Toe Jam'	250	0.30	B	Fourwing Saltbush
G	Bottlebrush Squirreltail	150	0.18	B	True Mountain Mahogany
G	Canby Bluegrass 'Canbar'	400	0.47	Total Pounds:	
G	Crested Wheatgrass 'Hycrest'	650	0.77	PLS Pounds:	
G	Crested Wheatgrass 'Nordan'	600	0.71		
G	Indian Ricegrass	250	0.30		
G	Intermediate Wheatgrass 'Rush'	900	1.06		
G	Needle and Thread	200	0.24		
G	Pubescent Wheatgrass	1600	1.89		
G	Snake River Wheatgrass 'Secar'	850	1.00		
G	Western Wheatgrass 'Arriba'	1250	1.48		
F	Blue Flax 'Appar'	450	0.53		
F	Scarlet Globemallow	20	0.02		
F	Western Yarrow	50	0.06		
B	Fourwing Saltbush	500	0.59		
Total Pounds:		8120	9.59		
PLS Pounds:			8.03		

Browse: The preferred browse species is black sagebrush (*Artemisia nova*). The black sagebrush is a moderately used population with high decadence, but good vigor, within the population. The recruitment of young sagebrush plants to the population was moderate in 2008. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp.*), though each of these species is sampled in low abundance. Pinyon pine and Utah juniper trees were common on the site prior to the treatment in 2008 with a density of 156 trees/acre and 122 trees/acre, respectively (Table - Browse Characteristics).

Herbaceous Understory: Grasses are very limited on the site and only a small population of crested wheatgrass (*Agropyron cristatum*) was sampled in 2008. Forbs are very limited on the site. Cryptantha (*Cryptantha sp.*) and euphorbia (*Euphorbia sp.*) were the only perennial forb species sampled on the site in 2008 (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). While bare ground cover is moderately high, there is also a high amount of pavement and a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 32

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	<i>Agropyron cristatum</i>	77	.73
Total for Annual Grasses		0	0
Total for Perennial Grasses		77	0.73
Total for Grasses		77	0.73
F	<i>Cryptantha sp.</i>	2	.00
F	<i>Eriogonum cernuum</i> (a)	14	.07
F	<i>Euphorbia sp.</i>	16	.12
F	<i>Salsola iberica</i> (a)	4	.01
Total for Annual Forbs		18	0.08
Total for Perennial Forbs		18	0.12
Total for Forbs		36	0.21

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

BROWSE TRENDS--

Management unit 16R, Study no: 32

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	<i>Artemisia nova</i>	81	14.13
B	<i>Gutierrezia sarothrae</i>	5	-
B	<i>Juniperus osteosperma</i>	8	.68
B	<i>Pinus edulis</i>	7	2.76
Total for Browse		101	17.57

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 32

Species	Percent Cover
	'08
<i>Artemisia nova</i>	20.11
<i>Juniperus osteosperma</i>	.66
<i>Pinus edulis</i>	8.81

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 32

Species	Average leader growth (in) '08
Artemisia nova	.05

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 32

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	122	2.5
Pinus edulis	156	4.4

BASIC COVER--
Management unit 16R, Study no: 32

Cover Type	Average Cover % '08
Vegetation	19.01
Rock	2.71
Pavement	21.88
Litter	22.14
Cryptogams	.17
Bare Ground	34.17

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 32, Study Name: Mohrland Roller Chopper 2

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.0	52.0	27.4	20.6	2.5	9.7	121.6	0.7

PELLET GROUP DATA--

Management unit 16R, Study no: 32

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	44	-
Elk	1	1 (3)
Deer	41	30 (74)
Cattle	-	5 (13)

BROWSE CHARACTERISTICS--
 Management unit 16R, Study no: 32

		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)	
Artemisia nova										
08	7180	7	57	36	3460	33	8	8	8/22	
Gutierrezia sarothrae										
08	160	0	100	-	-	0	0	0	5/5	
Juniperus osteosperma										
08	160	100	0	-	-	0	0	0	-/-	
Opuntia sp.										
08	0	0	0	-	-	0	0	0	3/17	
Pinus edulis										
08	140	29	71	-	-	0	0	0	-/-	

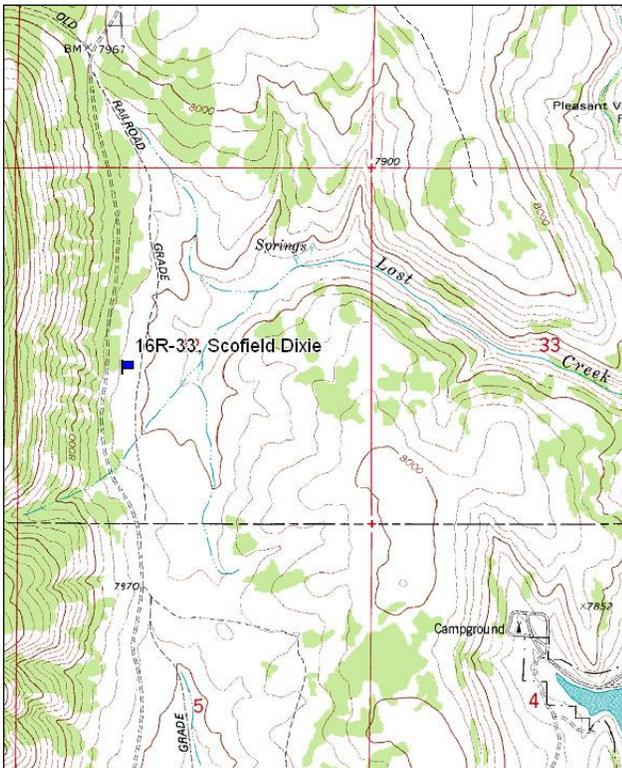
SCOFIELD DIXIE - TREND STUDY NO. 16R-33-08
[Project #1085](#)

Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Year-Long
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 7,822 ft. (2,384 m)
Aspect: Northeast
Slope: 10%
Transect bearing: 168° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

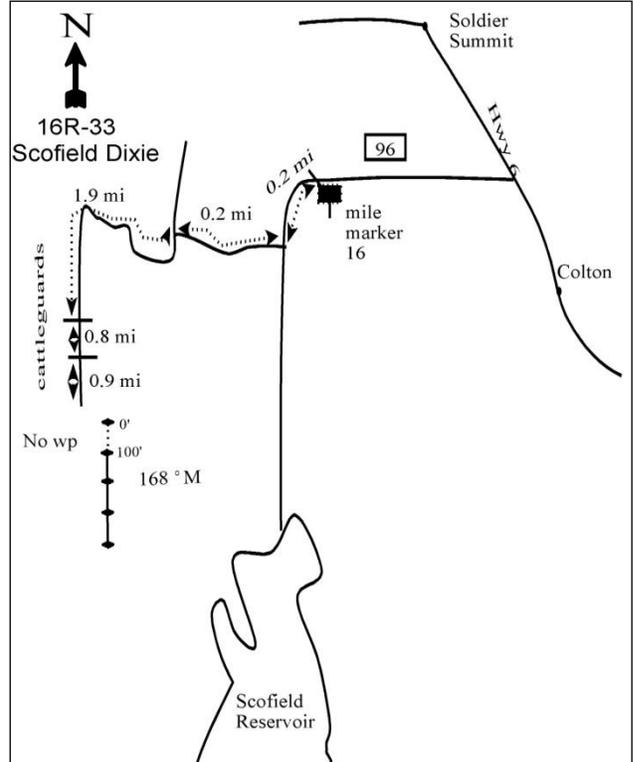
Directions:

From Hwy 6, turn onto US 96 at the Scofield turnoff. Follow US 96 to mile marker 16, and go 0.2 miles passed it to a right turn. Drive 0.2 miles to the power lines, and then go 1.9 miles to a cattle guard. Continue 0.8 miles to another cattle guard, and then go 0.9 miles. There is no witness post. Cross the fence on the left side of the road to go to the site. The 0' stake is marked with browse tag# 191.

Map Name: Scofield Reservoir



Diagrammatic Sketch:



Township: 11S Range: 7E Section: 32

GPS: NAD 83, UTM 12T 485683 E 4407694 N

SCOFIELD DIXIE - WRI STUDY 16R-33

[Project #1085](#)

Site Description

Site Information: The study is located approximately one and a half miles northwest of Scofield Reservoir, in a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat, near the headwaters of Lost Creek, on private land. The study was established in 2008, prior to treatment, to monitor a Dixie harrow project designed to reduce the density and cover of mountain big sagebrush. The Scofield area provides wintering and brood rearing habitat for greater sage-grouse. The area once supported a historic lek about two miles south of the treatment, which was lost with the construction of the Scofield Reservoir. Mule deer and elk also use the area for summer and transition habitat. In November of 2008, the project area (150 acres) was two-way Dixie harrowed and a seed mix of grass and forb species was broadcast seeded during the second pass with the harrow (Table - Seed Mix). The objectives of the project are to increase greater sage-grouse and mule deer habitat by thinning mountain big sagebrush and seeding grass and forb species into the herbaceous understory (WRI Database 2011). Pellet group data estimated moderate use by cattle and light use by deer and elk (Table - Pellet Group Data).

SEED MIX--

Management unit 16R, Study no: 33

Project Name: Scofield Sage-Grouse			
WRI Database #: 1085			
Application: Broadcast Seeded		Acres:	150
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	75	0.50
G	Prairie junegrass	72	0.48
F	American Vetch	25	0.17
F	Arrowleaf Balsamroot	50	0.33
F	Blue Flax 'Appar'	50	0.33
F	Cicer Milkvetch 'Lutana'	100	0.67
F	Sainfoin 'Eski'	50	0.33
F	Silvery Lupine	10	0.07
F	Small Burnet 'Delar'	50	0.33
F	Strawberry Clover	20	0.13
F	Strawberry Clover 'Palestine'	80	0.53
F	Sweetanise	10	0.07
F	Western Yarrow	15	0.10
Total Pounds:		607	4.05
PLS Pounds:			3.46

Browse: The preferred browse species are mountain big sagebrush and antelope bitterbrush (*Purshia tridentata*). The dense stand of mountain big sagebrush provided the majority of the canopy cover in the 2008 sample year at 45% (Table - Canopy Cover). The mountain big sagebrush is a moderately used population with high decadence, but good vigor, within the population. The recruitment of young sagebrush plants to the population was poor in 2008. The antelope bitterbrush is a relatively small population of mostly mature plants with moderate to heavy use within the population. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), creeping barberry (*Mahonia repens*), and mountain snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are fairly abundant and fairly diverse on the site. The dominant grass species on the site are Kentucky bluegrass (*Poa pratensis*) and letterman needlegrass (*Stipa lettermani*). Other

common perennial grass species sampled on the site include prairie junegrass (*Koeleria cristata*), needle-and-thread (*Stipa comata*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are abundant and fairly diverse. The dominant perennial forbs species on the site is silvery lupine (*Lupinus argenteus*) which provided the majority of the forb cover. Other common perennial forb species sampled include peavine (*Lathyrus brachycalyx*) and Utah lupine (*Lupinus caespitosus* var. *utahensis*). The annual forb species blue-eyed Mary (*Collinsia parviflora*) and Douglas knotweed (*Polygonum douglasii*) were also fairly abundant on the site in 2008 (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a moderately acidic soil reaction (pH 5.7) (Table - Soil Analysis Data). Bare ground cover is moderate with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 33

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron smithii	26	.16
G	Bromus carinatus	7	.21
G	Carex sp.	20	.14
G	Juncus sp.	8	.04
G	Koeleria cristata	42	.52
G	Poa fendleriana	8	.07
G	Poa pratensis	284	6.58
G	Sitanion hystrix	54	.65
G	Sporobolus sp.	23	.27
G	Stipa comata	36	.81
G	Stipa lettermani	185	2.41
Total for Annual Grasses		0	0
Total for Perennial Grasses		693	11.89
Total for Grasses		693	11.89
F	Achillea millefolium	9	.44
F	Agoseris glauca	7	.01
F	Androsace septentrionalis (a)	5	.01
F	Antennaria rosea	29	.78
F	Arabis sp.	3	.00
F	Aster sp.	9	.09
F	Castilleja chromosa	4	.03
F	Chaenactis douglasii	7	.07
F	Collinsia parviflora (a)	98	.23
F	Collomia linearis (a)	4	.01
F	Cordylanthus sp. (a)	52	.89
F	Erigeron pumilus	3	.03
F	Eriogonum umbellatum	12	.33
F	Helianthus annuus (a)	1	.03
F	Heracleum lanatum	2	.00
F	Lathyrus brachycalyx	21	1.39
F	Lupinus argenteus	105	8.10
F	Lupinus caespitosus utahensis	49	1.03

Type	Species	Nested Frequency	Average Cover %
		'08	'08
F	<i>Machaeranthera canescens</i>	54	.97
F	<i>Orobanche</i> sp.	2	.03
F	<i>Phlox hoodii</i>	13	.25
F	<i>Polygonum douglasii</i> (a)	161	.57
F	<i>Taraxacum officinale</i>	22	.21
F	<i>Tragopogon dubius</i> (a)	-	.00
F	<i>Verbascum thapsus</i>	2	.00
F	<i>Vicia americana</i>	2	.03
F	<i>Viguiera multiflora</i>	2	.00
Total for Annual Forbs		321	1.76
Total for Perennial Forbs		357	13.84
Total for Forbs		678	15.60

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

BROWSE TRENDS--

Management unit 16R, Study no: 33

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	<i>Artemisia cana</i>	2	-
B	<i>Artemisia tridentata vaseyana</i>	100	28.14
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	23	.65
B	<i>Mahonia repens</i>	3	.15
B	<i>Purshia tridentata</i>	9	.91
B	<i>Symphoricarpos oreophilus</i>	1	.15
Total for Browse		138	30.02

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 33

Species	Percent Cover '08
<i>Artemisia tridentata vaseyana</i>	45.25
<i>Chrysothamnus viscidiflorus viscidiflorus</i>	.60
<i>Purshia tridentata</i>	1.26

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 33

Species	Average leader growth (in) '08
<i>Artemisia tridentata vaseyana</i>	0.9
<i>Purshia tridentata</i>	3.0

BASIC COVER--

Management unit 16R, Study no: 33

Cover Type	Average Cover % '08
Vegetation	60.32
Rock	.63
Pavement	.96
Litter	44.31
Bare Ground	17.24

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 33, Study Name: Scofeild Dixie

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	5.7	44.7	36.7	18.6	2.7	37.0	329.6	0.4

PELLET GROUP DATA--

Management unit 16R, Study no: 33

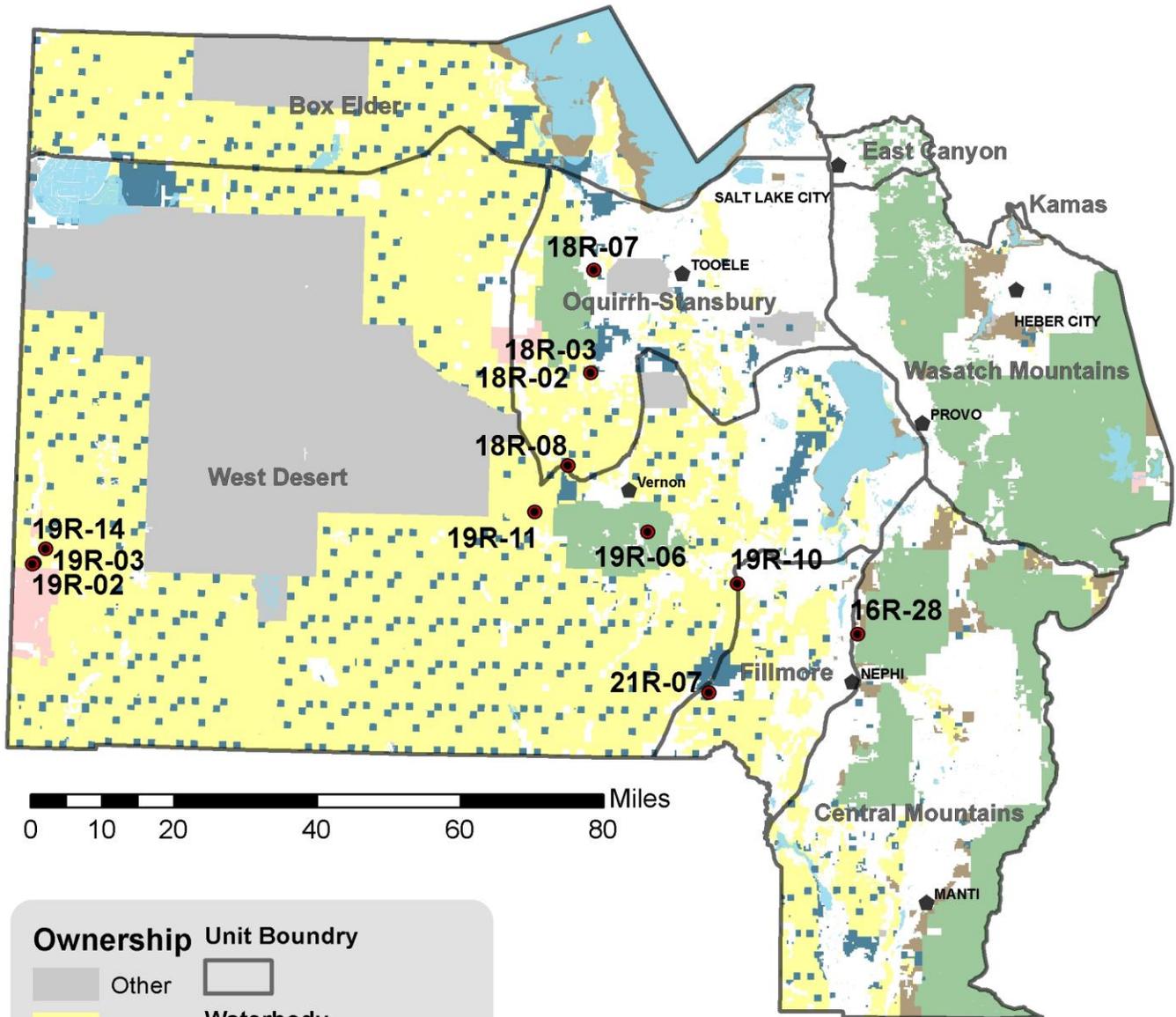
Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	2	-
Elk	-	1 (3)
Deer	10	1 (3)
Cattle	6	23 (56)

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 33

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 cana</i>									
08	40	50	50	-	-	0	0	0	6/16
<i>Artemisia tridentata vaseyana</i>									
08	10680	4	54	42	300	27	8	13	21/29
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
08	900	18	67	16	-	0	0	7	11/12
<i>Mahonia repens</i>									
08	440	0	100	-	-	0	0	0	4/3
<i>Purshia tridentata</i>									
08	200	0	90	10	-	40	60	10	14/33
<i>Symphoricarpos oreophilus</i>									
08	20	0	100	-	-	0	0	0	14/18

Central Region WRI Studies 2008



Ownership		Unit Boundary
Other	Unit Boundary	
BLM	Waterbody	Waterbody
DNR	City	City
NPS	Transect Location	
Private	Transect Location	
SITLA		
Tribal		
USFS		



WILLOW CREEK PLAUTEAU - TREND STUDY NO. 16R-28-08
[Project #1101](#)

Vegetation Type: Grass, Annual Forb

Range Type: Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Gravelly Loam \(Oak\), R047XA410UT](#)

Land Ownership: Private

Elevation: 5,385 ft. (1,641 m)

Aspect: West

Slope: 12%

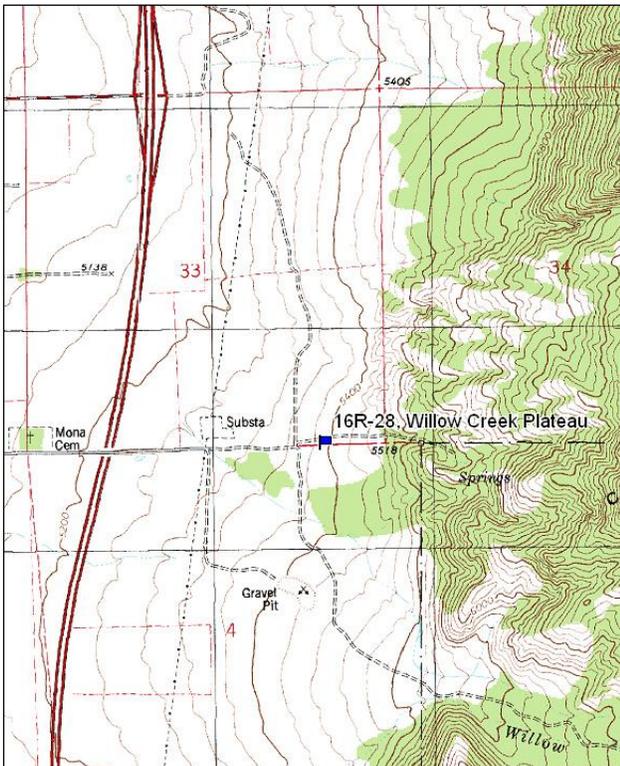
Transect bearing: 160° magnetic

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

Directions:

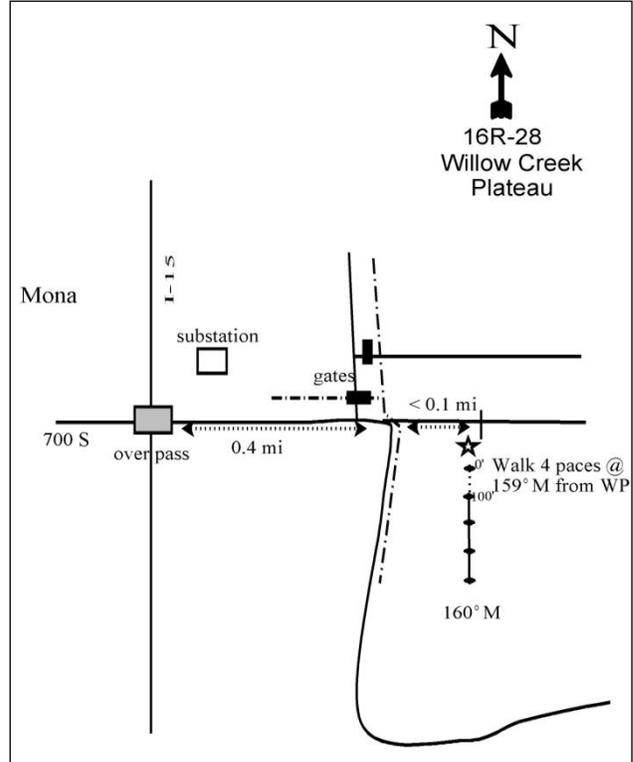
Go west on 700 S in Mona, passed a cemetery on the left, and then to an I-15 overpass. From the overpass, drive 0.4 miles passed a substation to a gate on the left. Go through this gate, turn right, and go through another gate to two, 2-track roads. Take the road on the south (right), and drive 0.1 miles to the witness post. The 0' stake is 4 paces from the witness post at 159° M. The 0' stake is marked with browse tag #255.

Map Name: Mona



Township: 12S Range: 1E Section: 4

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 429424 E 4406654 N

WILLOW CREEK PLATEAU - WRI STUDY 16R-28
[Project #1101](#)

Site Description

Site Information: The study is located approximately one and half miles west of Mona, on an annual dominated flat, at the base of Cedar Ridge, on private land. The study was originally established in 2008, prior to the treatment, to monitor a herbicide treatment of Plateau (Imazapic) and seeding with a rangeland drill. However, because of scheduling conflicts the site was neither sprayed or drill seeded. In late fall of 2008, the project area was one-way Dixie harrowed and broadcast seeded with a seed mix of grass and forb species (Table - Seed Mix). The objective of the project is to reduce the risk of wildfire by reducing the prevalence of cheatgrass (*Bromus tectorum*) and annual weeds, and by establishing desirable perennial grass, forb, and browse species (WRI Database 2011). Pellet group data estimated moderate cattle use in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 16R, Study no: 28

Project Name: Willow Creek Habitat Improvement			
WRI Database #: 1101			
Application: Broadcast Seeded		Acres: 100	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	100	1.00
G	Canby Bluegrass 'Canbar'	50	0.50
G	Crested Wheatgrass 'Nordan'	300	3.00
G	Indian Ricegrass 'Rimrock'	100	1.00
G	Intermediate Wheatgrass 'Oahe'	100	1.00
G	Pubescent Wheatgrass 'Luna'	100	1.00
G	Sandberg Bluegrass	50	0.50
G	Western Wheatgrass 'Arriba'	100	1.00
F	Alfalfa 'Ladak'	100	1.00
F	Blue Flax 'Appar'	50	0.50
F	Sainfoin 'Eski'	200	2.00
F	Small Burnet 'Delar'	25	0.25
Total Pounds:		1275	12.75
PLS Pounds:			12.18

Browse: Browse species are rare on the site.

Herbaceous Understory: Grasses are abundant and moderately diverse on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species and provides the majority of the grass cover. The dominant perennial grass species is purple three-awn (*Aristida purpurea*). Other grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Agropyron intermedium*), rattail fescue (*Festuca myuros*), and bulbous bluegrass (*Poa bulbosa*), though each of these species occurs in low abundance. Forbs are abundant, but are not particularly diverse and are in poor condition. The annual species storksbill (*Erodium cicutarium*) dominates the site and provides the majority of the cover. The noxious weed field bindweed (*Convolvulus arvensis*) is the dominant perennial forb species on the site (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is low with 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 2008.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 28

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	Agropyron cristatum	1	.00
G	Agropyron intermedium	4	.18
G	Aristida purpurea	206	3.71
G	Bromus tectorum (a)	412	4.67
G	Festuca myuros (a)	8	.18
G	Poa bulbosa	19	.29
Total for Annual Grasses		420	4.86
Total for Perennial Grasses		230	4.20
Total for Grasses		650	9.06
F	Alyssum alyssoides (a)	4	.01
F	Convolvulus arvensis	117	1.13
F	Erodium cicutarium (a)	414	14.70
F	Euphorbia sp.	5	.03
F	Lactuca serriola (a)	38	.16
F	Leucelene ericoides	10	.04
F	Sisymbrium altissimum (a)	2	.01
F	Sphaeralcea coccinea	6	.04
F	Tragopogon dubius (a)	21	.07
Total for Annual Forbs		479	14.96
Total for Perennial Forbs		138	1.26
Total for Forbs		617	16.22

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

BASIC COVER--

Management unit 16R, Study no: 28

Cover Type	Average Cover % '08
Vegetation	29.25
Rock	3.31
Pavement	9.10
Litter	59.23
Cryptogams	.01
Bare Ground	8.30

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 28, Study Name: Willow Creek Plateau

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.0	36.0	40.4	23.6	4.2	9.1	169.6	0.9

PELLET GROUP DATA--

Management unit 16R, Study no: 28

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	4	-
Elk	1	-
Deer	1	
Cattle	16	25 (63)

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 28

		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>									
08	0	0	0	-	-	0	0	0	10/10

CLOVER BULLHOG DRILL - TREND STUDY NO. 18R-2-08

[Project #30](#)

Vegetation Type: Pinyon-Juniper, Wyoming Big Sage

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: Not available

Land Ownership: BLM

Elevation: 5,849 ft. (1,783 m)

Aspect: Northeast

Slope: 71%

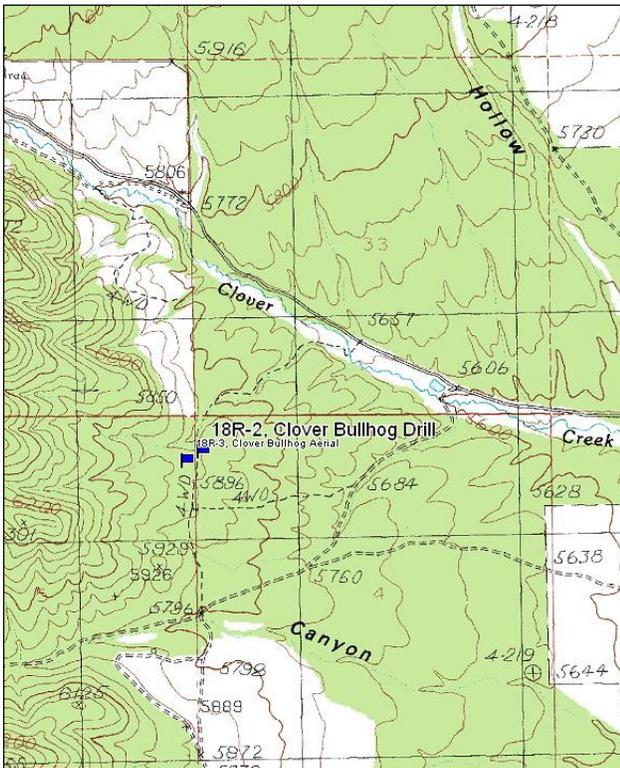
Transect bearing: 105° magnetic

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

Directions:

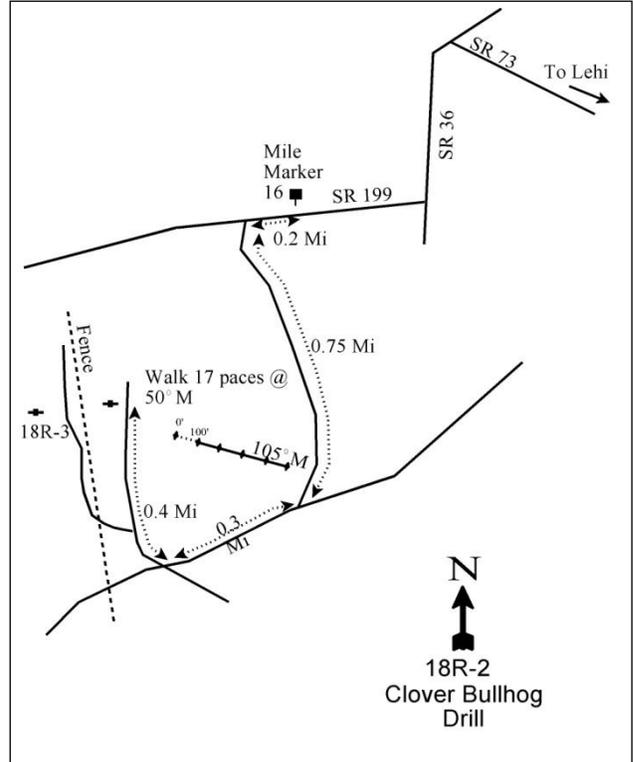
From Lehi, drive west on SR 73 (Main st) to the junction of SR 36. Turn left (south) and drive 3.7 miles to the SR 199. Turn right on SR 199 and drive to mile marker 16. Continue 0.2 miles to a road on the left (south) near a power pole. Turn left and drive 0.75 miles to a fork. Stay right (west) and 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 12T 369487 E 4465574 N

CLOVER BULLHOG DRILL - WRI STUDY 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 edulis*) woodland, south of Clover Creek, on land administered by the Bureau of Land Management (BLM). The study was established in 2005, prior to treatment, to monitor a Bullhog project to thin pinyon pine and Utah juniper. Historically, the area was sagebrush steppe habitat, but the area had been encroached by pinyon and juniper. In the fall of 2005, a total of 420 acres of pinyon and juniper woodland were treated 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 2011). Pellet group data estimated light use by deer, elk, and cattle in 2005; and in 2008, use was light for deer and elk (Table - Pellet Group Data).

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	
					lbs in mix	lbs/acre
G	Bluebunch WG 'P7'	250	1.09	B	Sagebrush, Wyoming	450
G	Canby Bluegrass 'Canbar'	150	0.65	B	Forage Kochia	450
G	Crested Wheatgrass 'Hycrest'	200	0.87	Total Pounds:		900
G	Orchardgrass 'Paiute'	250	1.09	PLS Pounds:		0.94
G	Sandberg Bluegrass 'Toole MT'	100	0.43			
G	Siberian Wheatgrass 'Vavilov'	250	1.09			
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		

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. 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 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 has been moderate (Table - Browse Characteristics). Utah juniper trees were reduced 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).

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*), Lewis flax, alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: 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 and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2005 and 2008.

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 significantly decreased, and 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 Lewis 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.

HERBACEOUS TRENDS--

Management unit 18R, Study no: 2

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	a-	b ²⁴	-	.41
G	Agropyron smithii	a-	b ¹²	-	.08
G	Agropyron spicatum	127	119	4.13	6.08
G	Bromus tectorum (a)	27	19	.06	.04
G	Dactylis glomerata	a-	b ²²	-	.77
G	Oryzopsis hymenoides	3	8	.21	.20
G	Poa canbyi	a-	b ¹⁵	-	.80
G	Poa secunda	b ¹⁷⁰	a ¹²⁹	2.57	2.27
G	Sitanion hystrix	a ⁴⁴	b ⁷³	.92	3.27
G	Vulpia octoflora (a)	2	-	.00	-
Total for Annual Grasses		29	19	0.07	0.04
Total for Perennial Grasses		344	402	7.84	13.89
Total for Grasses		373	421	7.91	13.94
F	Achillea millefolium	-	4	-	.07
F	Alyssum alyssoides (a)	b ³⁰²	a ¹⁹⁸	1.14	1.28
F	Antennaria rosea	2	-	.00	-
F	Astragalus convallarius	1	9	.00	.09
F	Chaenactis douglasii	-	3	.00	.00
F	Crepis acuminata	-	1	-	.00
F	Cryptantha sp.	-	-	-	.03
F	Descurainia pinnata (a)	b ²³	a-	.09	-
F	Eriogonum ovalifolium	-	1	-	.00
F	Galium aparine (a)	6	-	.19	-
F	Gilia sp. (a)	5	-	.01	-
F	Ipomopsis aggregata	5	-	.01	-
F	Lactuca serriola (a)	16	18	.05	.06
F	Linum perenne	a-	b ⁴⁹	-	1.58
F	Medicago sativa	-	3	-	.04
F	Microsteris gracilis (a)	b ¹²	a ¹	.03	.00
F	Onobrychis viciaefolia	-	1	-	.03
F	Phlox hoodii	4	4	.03	.03
F	Phlox longifolia	31	36	.28	.18
F	Physaria sp.	3	1	.01	.01
F	Ranunculus testiculatus (a)	b ⁸⁶	a ⁶	.20	.02
F	Sanguisorba minor	a-	b ¹³	-	.14
F	Senecio multilobatus	-	1	-	.01
F	Tragopogon dubius (a)	-	2	-	.00
F	Trifolium sp.	-	12	-	.10
F	Veronica biloba (a)	b ³⁷	a ¹	.09	.00
Total for Annual Forbs		487	226	1.82	1.39
Total for Perennial Forbs		46	138	0.35	2.34
Total for Forbs		533	364	2.17	3.73

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	'05	'08
B	Artemisia tridentata wyomingensis	2	16	-	.36
B	Eriogonum corymbosum	1	1	-	-
B	Juniperus osteosperma	19	14	12.13	3.76
B	Kochia prostrata	0	14	-	.03
B	Purshia tridentata	4	3	.15	.30
B	Symphoricarpos oreophilus	7	6	.18	.45
Total for Browse		33	54	12.46	4.92

CANOPY COVER, LINE INTERCEPT--

Management unit 18R, Study no: 2

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	-	.41
Eriogonum corymbosum	-	.08
Juniperus osteosperma	29.45	16.51
Purshia tridentata	.31	.45
Symphoricarpos oreophilus	.36	.46

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18R, Study no: 2

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	-	2.9
Purshia tridentata	4.6	4.0

POINT-QUARTER TREE DATA--

Management unit 18R, Study no: 2

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	402	239	7.4	4.8

BASIC COVER--

Management unit 18R, Study no: 2

Cover Type	Average Cover %	
	'05	'08
Vegetation	20.77	21.63
Rock	2.89	1.01
Pavement	15.31	13.05
Litter	40.06	68.70
Cryptogams	5.05	.61
Bare Ground	29.92	8.11

PELLET GROUP DATA--

Management unit 18R, Study no: 2

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	47	59	-	-
Elk	1	3	1 (2)	-
Deer	6	7	7 (18)	11 (28)
Cattle	1	-	-	-

BROWSE CHARACTERISTICS--

Management unit 18R, 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	40	0	50	50	-	0	0	50	21/21
08	640	59	41	0	20	0	0	13	13/12
<i>Chrysothamnus nauseosus</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	20	0	0	0	-/-
<i>Eriogonum corymbosum</i>									
05	20	0	100	-	-	0	0	0	6/7
08	20	0	100	-	-	0	0	0	7/9
<i>Gutierrezia sarothrae</i>									
05	0	0	0	-	-	0	0	0	8/7
08	0	0	0	-	-	0	0	0	14/17
<i>Juniperus osteosperma</i>									
05	460	13	78	9	20	0	0	13	-/-
08	320	6	69	25	-	0	0	31	-/-
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	520	58	42	-	180	27	19	0	4/7
<i>Purshia tridentata</i>									
05	100	20	80	-	-	80	20	0	33/55
08	60	33	67	-	-	0	33	0	19/43
<i>Symphoricarpos oreophilus</i>									
05	160	25	75	-	-	0	0	0	17/30
08	180	22	78	-	-	0	0	0	14/26

CLOVER BULLHOG AERIAL - TREND STUDY NO. 18R-3-08

[Project #30](#)

Vegetation Type: Pinyon-Juniper, Wyoming Big Sage

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: Not available

Land Ownership: BLM

Elevation: 5,854 ft. (1,784 m)

Aspect: Northeast

Slope: 8%

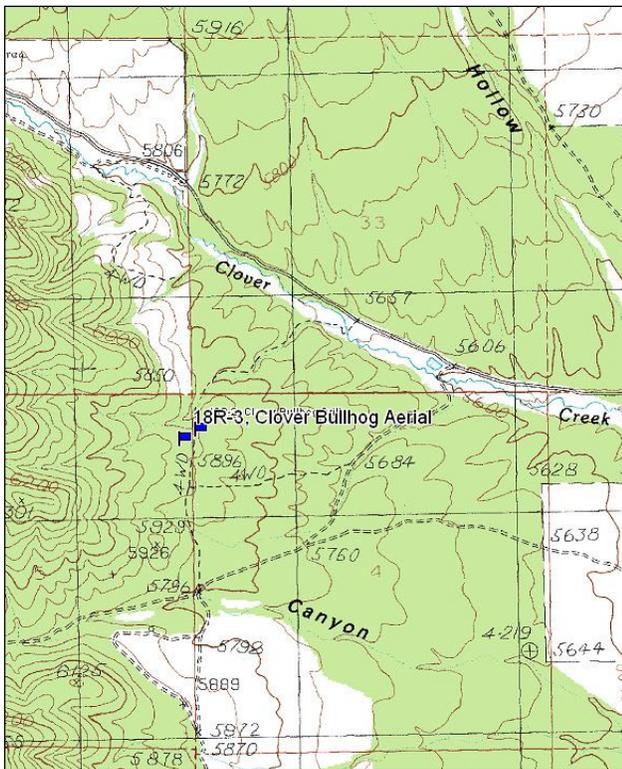
Transect bearing: 270° magnetic

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

Directions:

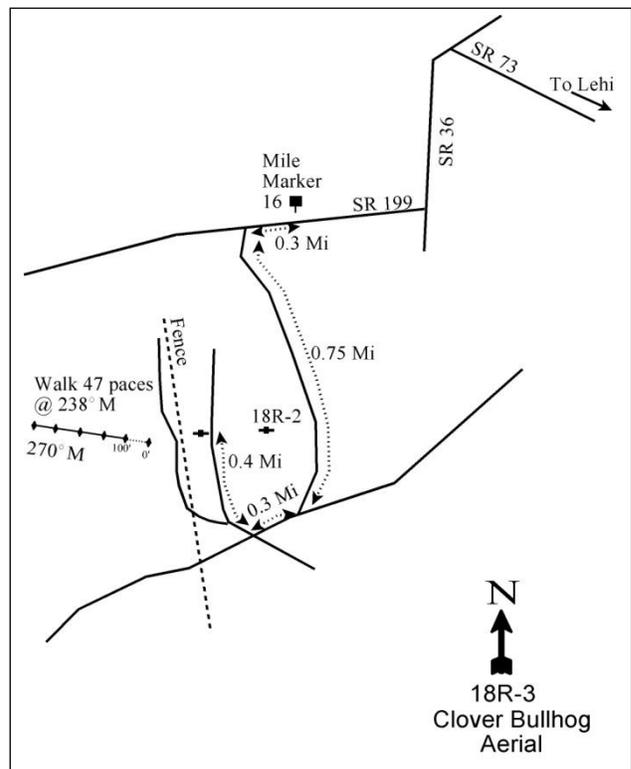
From Lehi, drive west on SR 73 (Main St) to the junction of SR 36. Turn left (south) and drive 3.7 miles to the SR 199. Turn right on SR 199 and drive to mile marker 16. Continue 0.3 miles to a road on the left (south) near a power pole. Turn left and drive 0.75 miles to a fork. Stay right (west) and 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, passing over a fence line, at 238°M to the 0' stake.

Map Name: Johnson Pass



Township: 6S Range: 6W Section: 5

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 369414 E 4465533 N

CLOVER BULLHOG AERIAL - WRI STUDY 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 edulis*) woodland, south of Clover Creek, on land administered by the Bureau of Land Management (BLM). The study was established in 2005, prior to treatment, to monitor a bullhog project to thin pinyon pine and Utah juniper. Historically, the area was sagebrush steppe habitat, but the area had been encroached by pinyon and juniper. In the fall of 2005, a total of 420 acres of pinyon and juniper woodland were treated 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 2011). Pellet group data estimated light use by deer and elk in all sample years (Table - Pellet Group Data).

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		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	250	1.24	B	Sagebrush, Wyoming	450	1.00
G	Canby Bluegrass 'Canbar'	150	0.75	B	Forage Kochia	450	1.00
G	Crested Wheatgrass 'Hycrest'	250	1.24	Total Pounds:		900	2.00
G	Orchardgrass 'Paiute'	250	1.24	PLS Pounds:			0.94
G	Sandberg Bluegrass 'Toole MT'	100	0.50				
G	Siberian Wheatgrass 'Vavilov'	200	1.00				
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				

Browse: The preferred browse species sampled on the site include Wyoming big sagebrush, forage kochia, Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), 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. The recruitment of young bitterbrush plants to the population has been good over the sample years. Following

the treatment, utilization of forage kochia was heavy in 2008 (Table - Browse Characteristics). Utah juniper trees were reduced in density on the site following the treatment (Table - Point-Quarter Tree Data), but still provided the majority of the canopy cover on the site (Table - Canopy Cover).

Herbaceous Understory: Grasses are abundant and diverse. 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 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 texture is a loam with a slightly alkaline soil reaction (pH 7.6) (Table - Soil Analysis Data). Bare ground cover is low 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 stable in all the sample years.

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

Browse: Prior to the treatment, palatable browse species were rare on the site, but became more common following the treatment. 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 39%, 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.

HERBACEOUS TRENDS--

Management unit 18R, Study no: 3

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron smithii</i>	7	8	.06	.01
G	<i>Agropyron spicatum</i>	252	252	10.81	13.03
G	<i>Bromus japonicus</i> (a)	1	-	.00	-
G	<i>Bromus tectorum</i> (a)	18	22	.07	.06
G	<i>Dactylis glomerata</i>	-	3	-	.00
G	<i>Oryzopsis hymenoides</i>	8	3	.18	.22
G	<i>Poa bulbosa</i>	8	-	.18	-
G	<i>Poa canbyi</i>	a-	b11	-	.05
G	<i>Poa pratensis</i>	1	1	.03	.03

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Poa secunda</i>	110	94	1.03	.62
G	<i>Sitanion hystrix</i>	3	5	.04	.12
Total for Annual Grasses		19	22	0.07	0.06
Total for Perennial Grasses		389	377	12.34	14.10
Total for Grasses		408	399	12.41	14.17
F	<i>Allium</i> sp.	8	-	.03	-
F	<i>Alyssum alyssoides</i> (a)	_b 258	_a 185	.95	.46
F	<i>Antennaria rosea</i>	-	1	-	.03
F	<i>Astragalus convallarius</i>	3	4	.03	.06
F	<i>Astragalus eurekaensis</i>	-	4	-	.10
F	<i>Astragalus utahensis</i>	-	-	-	.00
F	<i>Calochortus nuttallii</i>	8	3	.01	.01
F	<i>Chaenactis douglasii</i>	-	1	-	.03
F	<i>Collinsia parviflora</i> (a)	3	-	.00	-
F	<i>Comandra pallida</i>	-	3	.00	.00
F	<i>Crepis acuminata</i>	-	-	.00	-
F	<i>Descurainia pinnata</i> (a)	_b 12	_a -	.04	-
F	<i>Galium aparine</i> (a)	9	-	.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	.02	.03
F	<i>Linum perenne</i>	-	11	-	.07
F	<i>Medicago sativa</i>	-	-	-	.00
F	<i>Microsteris gracilis</i> (a)	4	-	.01	-
F	<i>Phlox austromontana</i>	2	1	.03	.03
F	<i>Phlox longifolia</i>	_a 12	_b 43	.03	.09
F	<i>Ranunculus testiculatus</i> (a)	_b 40	_a 13	.09	.03
F	<i>Senecio multilobatus</i>	-	1	-	.00
F	<i>Veronica biloba</i> (a)	_b 18	_a -	.07	-
F	<i>Vicia americana</i>	55	66	.40	.56
F	<i>Zigadenus paniculatus</i>	-	1	-	.00
Total for Annual Forbs		357	200	1.22	0.52
Total for Perennial Forbs		92	140	0.58	1.05
Total for Forbs		449	340	1.80	1.57

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	'05	'08
B	Artemisia tridentata wyomingensis	4	2	.03	-
B	Chrysothamnus viscidiflorus	0	1	-	-
B	Cowania mexicana stansburiana	0	1	-	-
B	Eriogonum microthecum	1	1	.03	-
B	Gutierrezia sarothrae	4	6	.16	.01
B	Juniperus osteosperma	10	5	15.86	5.80
B	Kochia prostrata	0	2	-	.00
B	Purshia tridentata	6	4	.18	.03
B	Symphoricarpos oreophilus	2	1	.03	.03
Total for Browse		27	23	16.29	5.88

CANOPY COVER, LINE INTERCEPT--

Management unit 18R, Study no: 3

Species	Percent Cover	
	'05	'08
Juniperus osteosperma	29.63	17.43
Purshia tridentata	1.79	.51

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18R, Study no: 3

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	1.2	1.5
Purshia tridentata	1.8	3.1

POINT-QUARTER TREE DATA--

Management unit 18R, Study no: 3

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	219	109	7.5	9.9

BASIC COVER--

Management unit 18R, Study no: 3

Cover Type	Average Cover %	
	'05	'08
Vegetation	28.57	21.76
Rock	1.73	1.63
Pavement	15.86	16.78
Litter	38.63	63.83
Cryptogams	3.85	2.88
Bare Ground	32.59	6.60

PELLET GROUP DATA--

Management unit 18R, Study no: 3

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	43	52	-	-
Elk	-	-	2 (5)	3 (7)
Deer	4	3	4 (10)	5 (12)

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
<i>Chrysothamnus viscidiflorus</i>									
05	0	0	0	-	-	0	0	0	10/12
08	20	0	100	-	-	0	0	0	8/10
<i>Cowania mexicana stansburiana</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	0	100	-	-	100	0	0	13/26
<i>Eriogonum microthecum</i>									
05	20	0	100	-	-	0	0	0	7/7
08	20	0	100	-	-	0	0	0	8/10
<i>Gutierrezia sarothrae</i>									
05	100	0	100	-	-	0	0	0	10/10
08	200	50	50	-	-	0	0	0	10/12
<i>Juniperus osteosperma</i>									
05	200	20	80	-	-	0	0	0	-/-
08	100	20	80	-	40	0	0	20	-/-
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	40	50	50	-	20	0	50	0	2/2
<i>Purshia tridentata</i>									
05	120	33	50	17	-	17	50	0	29/59
08	140	14	86	0	-	29	14	0	22/43
<i>Symphoricarpos oreophilus</i>									
05	40	0	100	-	-	0	0	0	18/31
08	20	0	100	-	-	0	0	0	15/24

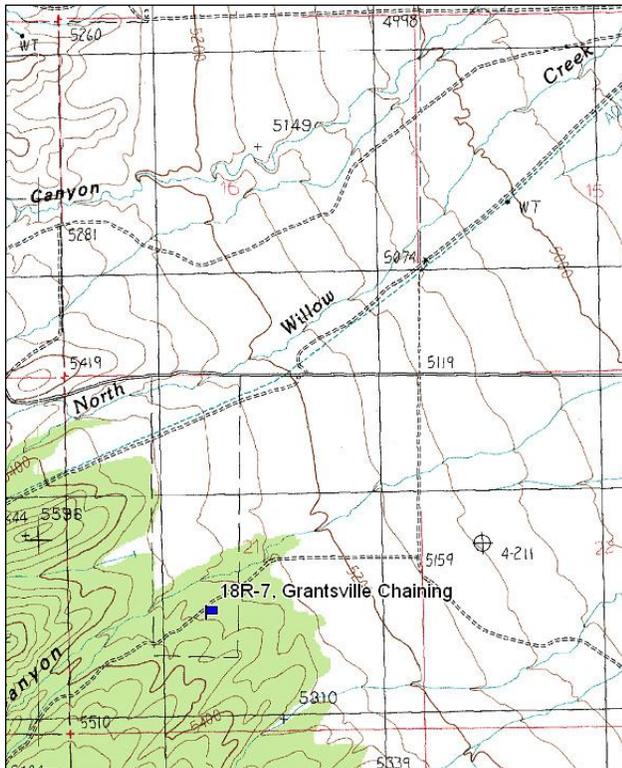
GRANTSVILLE CHAINING - TREND STUDY NO. 18R-7-08
[Project #1117](#)

Vegetation Type: Pinyon-Juniper
Range Type: Deer Winter/Spring
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 5,364 ft. (1,635 m)
Aspect: Northeast
Slope: 12%
Transect bearing: 84° magnetic
Belt placement: line 1 (11ft and 59ft), line 2 (34ft), line 3 (71ft), line 4 (95ft)

Directions:

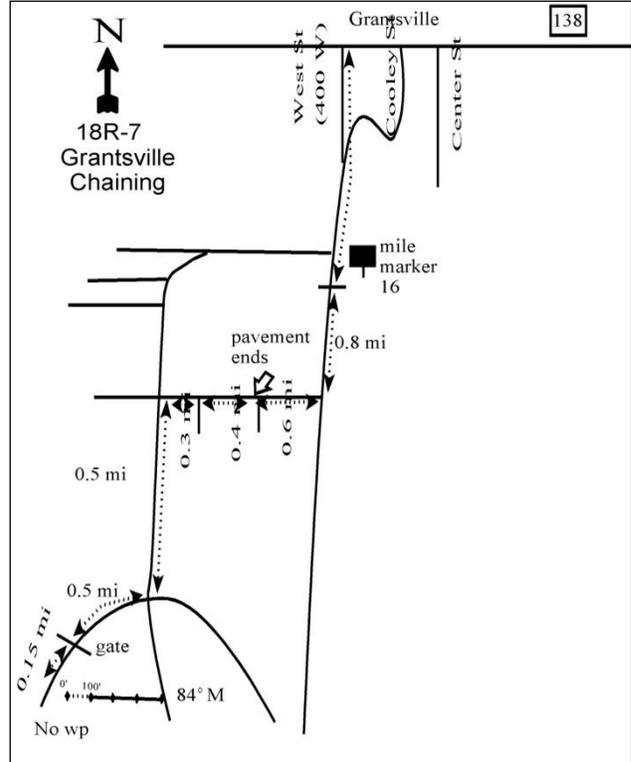
From Center Street in Grantsville, drive west and turn south on Cooley Street. Follow this road for 0.8 miles passed mile marker 16, and then turn onto a road on the right. Drive 0.6 miles (pavement ends) and then drive 0.4 miles to a fork; continue on the main road. Drive 0.3 miles to a fence line and turn left. Follow the road along the fence line for 0.5 miles to a fork and stay right. Go 0.2 miles to another fork, stay right and then continue 0.3 miles to a gate. Go 0.15 miles passed the gate to the site on the right side of the road. There is no witness post. The 0' stake is marked with browse tag # 248.

Map Name: North Willow Canyon



Township: 3S Range: 6W Section: 21

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 370139 E 4488644 N

GRANTSVILLE CHAINING - WRI STUDY 18R-7
[Project #1117](#)

Site Description

Site Information: The study is located approximately five miles southwest of Grantsville, on privately owned land, in a Utah juniper (*Juniperus osteosperma*) woodland, near the mouth of Coal Pit Canyon. The study was established in 2008, prior to treatment, to monitor the effects of a two-way chaining project designed to remove pinyon and juniper trees. The foothills of this area are comprised of historic greater sage-grouse and big game habitat, as well as historic grazed rangeland. Encroachment of pinyon pine and Utah juniper has decreased the mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and herbaceous understory vegetation component. In the fall of 2008, a total of 304 acres were two-way chained using an Ely chain on the first pass and a smooth chain on the second pass. Prior to the second pass with the smooth chain, a seed mix of grass and forb species was aerially seeded over the project area. During the second pass with the smooth chain, a seed mix of browse species was seeded with a seed dribbler (Table - Seed Mix). The objectives of the project are to decrease the density of Utah juniper, increase cover and diversity of the herbaceous understory, and increase the cover of Wyoming big sagebrush (WRI Database 2011). Pellet group data estimated light use by sheep and cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 18R, Study no: 7

Project Name: Grantsville Chaining							
WRI Database #: 1117							
Application: Aerial Seed		Acres: 335		Application: Seed Dribbler		Acres: 335	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	250	0.75	F	Small Burnet 'Delar'	100	0.30
G	Canby Bluegrass 'Canbar'	150	0.45	B	Bitterbrush	50	0.15
G	Crested Wheatgrass 'Douglas'	350	1.04	B	Fourwing Saltbush	50	0.15
G	Crested Wheatgrass 'Nordan'	300	0.90	Total Pounds:		200	0.60
G	Indian Ricegrass 'Rimrock'	350	1.04	PLS Pounds:			0.44
G	Orchardgrass 'Paiute'	150	0.45				
G	Pubescent Wheatgrass 'Luna'	150	0.45				
G	Russian Wildrye 'Bozoisky'	250	0.75				
G	Snake River Wheatgrass 'Secar'	350	1.04				
G	Western Wheatgrass 'Arriba'	500	1.49				
F	Alfalfa 'Ladak'	300	0.90				
F	Alfalfa 'Ranger'	350	1.04				
F	Blue Flax 'Appar'	150	0.45				
F	Sainfoin 'Eski'	650	1.94				
F	Small Burnet 'Delar'	650	1.94				
F	Western Yarrow	35	0.10				
Total Pounds:		4935	14.73				
PLS Pounds:			12.63				

Browse: The preferred browse species is mountain big sagebrush, which provided minimal cover on the site in 2008 (Table - Canopy Cover). The mountain big sagebrush is a relatively small population with high decadence and poor vigor within the population. In 2008, a large portion of the mountain big sagebrush plants sampled were dead and the recruitment of young sagebrush plants to the population was poor. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). Utah juniper trees were very dense on the site prior to the treatment in

2008 with an estimated density of 547 trees/acre (Table - Point-Quarter Tree Data), and juniper trees also dominated the canopy cover (Table - Canopy Cover).

Herbaceous Understory: Grasses are moderately abundant, but not particularly diverse. The dominant grass species sampled on the site is Sandberg bluegrass (*Poa secunda*). Other grass species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). The invasive annual species cheatgrass (*Bromus tectorum*) was sampled with low abundance and little cover. Perennial forb species are rare on the site. The forb understory is dominated by the weedy annual species bur buttercup (*Ranunculus testiculatus*) (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is moderately high, but with a high amount of litter and pavement, and moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to surface litter, rock, and soil movement; pedestalling, flow patterns, rills, and gullies.

HERBACEOUS TRENDS--

Management unit 18R, Study no: 7

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Bromus tectorum</i> (a)	45	.27
G	<i>Oryzopsis hymenoides</i>	2	.04
G	<i>Poa secunda</i>	255	3.19
G	<i>Sitanion hystrix</i>	14	.10
G	<i>Stipa comata</i>	1	.00
Total for Annual Grasses		45	0.27
Total for Perennial Grasses		272	3.34
Total for Grasses		317	3.61
F	<i>Allium</i> sp.	2	.00
F	<i>Antennaria rosea</i>	4	.01
F	<i>Astragalus</i> sp.	1	.00
F	<i>Crepis acuminata</i>	2	.03
F	<i>Cryptantha</i> sp.	4	.01
F	<i>Descurainia pinnata</i> (a)	2	.00
F	<i>Lappula occidentalis</i> (a)	6	.01
F	<i>Microsteris gracilis</i> (a)	1	.00
F	<i>Phlox longifolia</i>	24	.05
F	<i>Ranunculus testiculatus</i> (a)	269	.86
Total for Annual Forbs		278	0.89
Total for Perennial Forbs		37	0.11
Total for Forbs		315	1.00

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

BROWSE TRENDS--

Management unit 18R, Study no: 7

Type	Species	Strip Frequency '08	Average Cover % '08
B	Artemisia tridentata vaseyana	4	-
B	Gutierrezia sarothrae	1	-
B	Juniperus osteosperma	18	16.98
Total for Browse		23	16.98

CANOPY COVER, LINE INTERCEPT--

Management unit 18R, Study no: 7

Species	Percent Cover '08
Artemisia tridentata vaseyana	.15
Gutierrezia sarothrae	.10
Juniperus osteosperma	31.25

POINT-QUARTER TREE DATA--

Management unit 18R, Study no: 7

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	547	8.4

BASIC COVER--

Management unit 18R, Study no: 7

Cover Type	Average Cover % '08
Vegetation	23.39
Rock	1.87
Pavement	21.56
Litter	42.62
Cryptogams	1.49
Bare Ground	29.63

PELLET GROUP DATA--

Management unit 18R, Study no: 7

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	79	-
Sheep	-	1 (3)
Elk	1	-
Deer	2	-
Cattle	-	1 (2)

BROWSE CHARACTERISTICS--
 Management unit 18R, Study no: 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>Artemisia tridentata vaseyana</i>										
08	80	0	0	100	-	0	0	25	10/18	
<i>Gutierrezia sarothrae</i>										
08	20	0	100	-	-	0	0	0	5/4	
<i>Juniperus osteosperma</i>										
08	400	20	80	-	40	0	0	5	-/-	
<i>Opuntia sp.</i>										
08	0	0	0	-	-	0	0	0	6/12	

WEST ONAQUI BULLHOG - TREND STUDY NO. 18R-08-08

[Project #1133](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: Not available

Land Ownership: BLM

Elevation: 5,659 ft. (1,725 m)

Aspect: Northwest

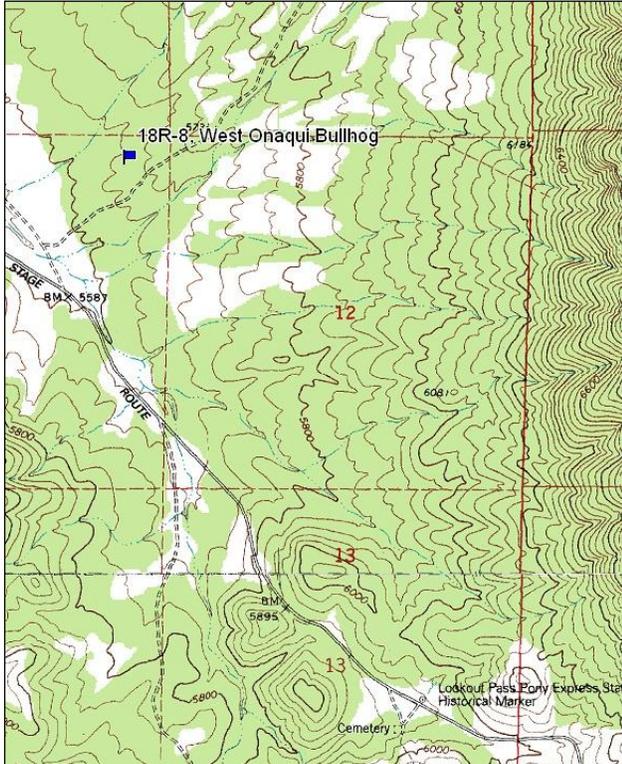
Slope: 7%

Transect bearing: 263° magnetic

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

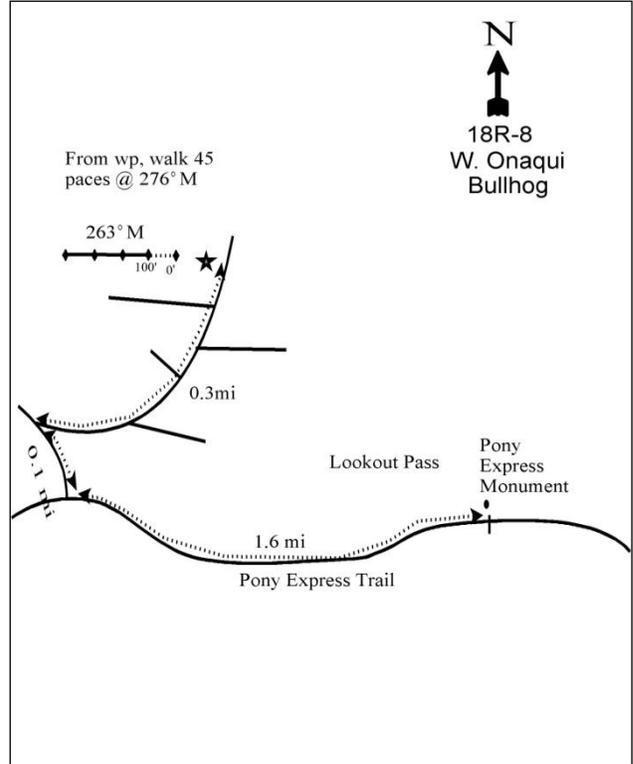
Directions: From the Pony Express Monument in Lookout Pass, drive 1.6 miles west. Turn right (north) and drive 0.1 miles, then turn right again (east) and drive 0.3 miles to a witness post on the left side of road. From the witness post, walk 45 paces at 276° M to the 0` stake.

Map Name: Onaqui Mountains South



Township: 8S Range: 7W Section: 11

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 364355 E 4444695 N

WEST ONAQUI BULLHOG - WRI STUDY 18R-8
[Project #1133](#)

Site Description

Site Information: The study is located approximately nine miles northwest of Vernon, in a Utah juniper (*Juniperus osteosperma*) woodland, on the west slope of the Onaqui Mountains, near Dry Creek, on land administrated by the Bureau of Land Management (BLM). The study was established in 2008, prior to treatment, to monitor the effects of a bullhog treatment to remove juniper trees. The sagebrush ecosystem in the West Onaqui area is being heavily encroached by juniper, and the native grass, forb, and browse species are being replaced by juniper. The area is habitat for greater sage-grouse and mule deer. In the spring of 2009, a total of 512 acres were treated with a bullhog. There were a few isolated bands of trees that were left along drainages and small clumps were left for wildlife escape cover. The study site was not seeded. The objectives of the project are to decrease the canopy cover and density of Utah juniper, increase the diversity of the herbaceous understory, and decrease the risk of catastrophic fire events (WRI Database 2011). Pellet group data estimated little or no use by wildlife and livestock in 2008; however, quadrat frequency estimated heavy use by rabbits (Table - Pellet Group Data).

Browse: The preferred browse species is black sagebrush (*Artemisia nova*). The black sagebrush is a heavily used population with high decadence and poor vigor within the population. In 2008, a large portion of the black sagebrush plants sampled were dead. The recruitment of young sagebrush plants to the population was also poor (Table - Browse Characteristics). Utah juniper was the dominant browse species prior to the treatment in 2008 with a very high estimated density of 1,426 trees/acre (Table - Point-Quarter Data) and providing nearly all of the canopy cover (Table - Canopy Cover).

Herbaceous Understory: Grasses on the site are neither abundant nor diverse. The dominant grass species on the site is Sandberg bluegrass (*Poa secunda*). Other perennial grass species sampled on the site include western wheatgrass (*Agropyron smithii*), blue bunch wheatgrass (*A. spicatum*), and bottlebrush squirreltail (*Sitanion hystrix*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance and provided little cover in 2008. Forbs are not abundant or diverse. Perennial forbs are rare; however, the weedy annual species bur buttercup (*Ranunculus testiculatus*) and pale alyssum (*Alyssum alyssoides*) are the dominant forb specie on the site (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter, cryptograms, and pavement, and moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to surface litter, rock, and soil movement; pedestalling, and flow patterns.

HERBACEOUS TRENDS--
 Management unit 18R, Study no: 8

T y p e	Species	Nested Frequency	Average Cover %
		'08	'08
G	Agropyron smithii	5	.04
G	Agropyron spicatum	14	.23
G	Bromus tectorum (a)	6	.02
G	Poa secunda	229	2.44
G	Sitanion hystrix	36	.49
Total for Annual Grasses		6	0.01
Total for Perennial Grasses		284	3.20
Total for Grasses		290	3.22

Type	Species	Nested Frequency	Average Cover %
		'08	'08
F	Alyssum alyssoides (a)	89	.18
F	Antennaria rosea	4	.06
F	Chaenactis douglasii	1	.00
F	Collinsia parviflora (a)	4	.00
F	Phlox austromontana	5	.07
F	Ranunculus testiculatus (a)	272	.48
F	Vicia americana	42	.29
F	Zigadenus paniculatus	1	.00
Total for Annual Forbs		365	0.66
Total for Perennial Forbs		53	0.43
Total for Forbs		418	1.10

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

BROWSE TRENDS--

Management unit 18R, Study no: 8

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia nova	12	.28
B	Juniperus osteosperma	40	11.39
Total for Browse		52	11.67

CANOPY COVER, LINE INTERCEPT--

Management unit 18R, Study no: 8

Species	Percent Cover
	'08
Juniperus osteosperma	31.03

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18R, Study no: 8

Species	Average leader growth (in)
	'08
Artemisia nova	1.1

POINT-QUARTER TREE DATA--

Management unit 18R, Study no: 8

Species	Trees per Acre	Average diameter (in)
	'08	
Juniperus osteosperma	1426	4.3

BASIC COVER--

Management unit 18R, Study no: 8

Cover Type	Average Cover % '08
Vegetation	17.59
Rock	1.95
Pavement	22.40
Litter	41.47
Cryptogams	20.73
Bare Ground	14.44

PELLET GROUP DATA--

Management unit 18R, Study no: 8

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	84	-
Deer	4	-

BROWSE CHARACTERISTICS--

Management unit 18R, Study no: 8

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									
08	340	6	12	82	-	0	53	82	9/16
Juniperus osteosperma									
08	1000	42	48	10	100	2	2	4	-/-

DEEP CREEK AERATOR - TREND STUDY NO. 19R-2-08
[Project #24](#)

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%

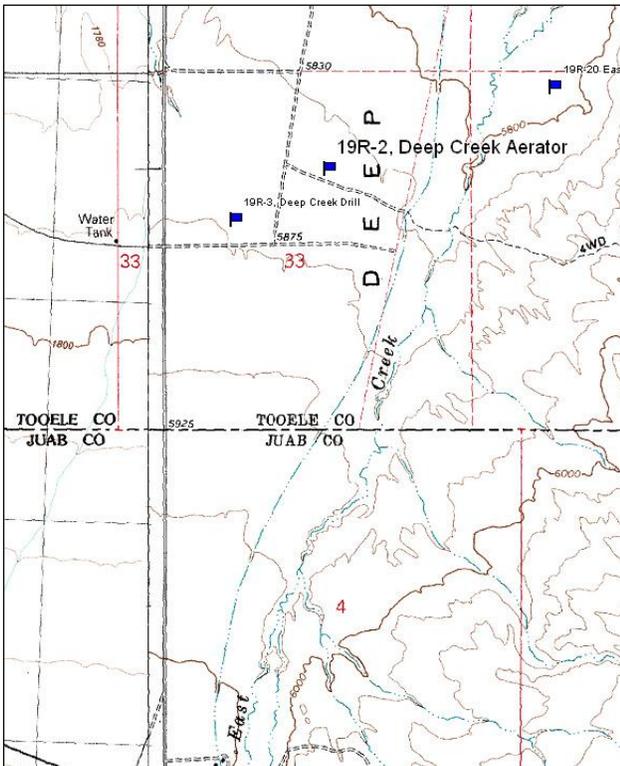
Transect bearing: 10° magnetic

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

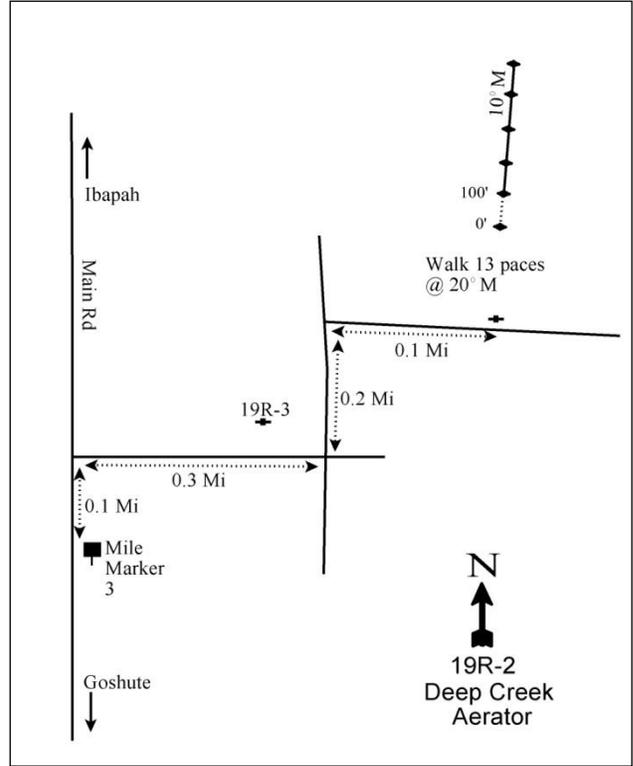
Directions:

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' stake. The 0' stake is marked with browse tag #77.

Map Name: Goshute



Diagrammatic Sketch:



Township: 10S Range: 19W Section: 33

GPS: NAD 83, UTM 12S 244318 E 4422757 N

DEEP CREEK AERATOR - WRI STUDY 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 in 2005, prior to treatment, 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 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, 194 acres were one-way aerated and drill seeded, 389 acres were drill seeded, and 63 acres were one-way aerated. 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 2011). Pellet group data estimated heavy use by sage-grouse, and light use by deer/antelope over the sample years (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 'Bozoiisky'	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		

Browse: The preferred browse species on the site are Wyoming big sagebrush and forage kochia (*Kochia prostrata*). The key browse species is Wyoming big sagebrush. The Wyoming big sagebrush is a fairly dense, lightly used population, with high decadence and poor vigor within the population. The recruitment of young sagebrush to the population has been poor since the outset of the study. Utilization of forage kochia was light in 2008. 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 include: 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 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*) was the only seeded grass species sampled on the site, at low abundance. Forbs are rare on the site, though the seeded species small burnet (*Sanguisorba minor*) was sampled on the site in low abundance (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is moderate, but 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 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 significantly increased in nested frequency, but cover decreased from 4% to 1%. The nested frequency of cheatgrass remained similar, but cover decreased from 24% to 10%.

Forbs: The sum of nested frequency of perennial forbs increased 18%, but cover remained similar at under 1%. Perennial forbs remained rare on the site.

HERBACEOUS TRENDS--
Management unit 19R, Study no: 2

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron smithii	-	4	-	.01
G	Bromus tectorum (a)	469	433	23.53	9.88
G	Oryzopsis hymenoides	-	-	-	.15
G	Poa bulbosa	5	4	.39	.04
G	Poa secunda	_a 96	_b 133	3.69	.91
G	Sitanion hystrix	20	14	.48	.11
G	Stipa columbiana	_a -	_b 30	-	.85
G	Stipa comata	_b 8	_a -	.53	-
G	Vulpia octoflora (a)	_b 21	_a 2	.04	.01
Total for Annual Grasses		490	435	23.57	9.89
Total for Perennial Grasses		129	185	5.10	2.08
Total for Grasses		619	620	28.68	11.97
F	Astragalus sp.	6	9	.05	.01
F	Chaenactis douglasii	1	-	.03	-

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	<i>Crepis acuminata</i>	3	-	.03	-
F	<i>Delphinium nuttallianum</i>	1	-	.00	-
F	<i>Descurainia pinnata</i> (a)	-	2	-	.00
F	<i>Erigeron pumilus</i>	-	4	-	.01
F	<i>Gayophytum ramosissimum</i> (a)	2	-	.00	-
F	<i>Lactuca serriola</i>	1	-	.00	-
F	<i>Lomatium</i> sp.	17	30	.10	.17
F	<i>Lygodesmia</i> sp.	-	-	.03	.00
F	<i>Microsteris gracilis</i> (a)	_b 55	_a 16	.23	.03
F	<i>Phlox hoodii</i>	2	1	.03	.00
F	<i>Phlox longifolia</i>	64	56	.30	.27
F	<i>Ranunculus testiculatus</i> (a)	11	5	.03	.01
F	<i>Sanguisorba minor</i>	-	5	-	.02
F	<i>Zigadenus paniculatus</i>	_a -	_b 7	.03	.07
Total for Annual Forbs		68	23	0.27	0.04
Total for Perennial Forbs		95	112	0.62	0.56
Total for Forbs		163	135	0.89	0.61

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	'05	'08
B	<i>Artemisia tridentata wyomingensis</i>	83	73	15.62	8.11
B	<i>Chrysothamnus viscidiflorus stenophyllus</i>	9	9	.01	.04
B	<i>Kochia prostrata</i>	0	19	-	.17
B	<i>Opuntia</i> sp.	1	1	-	-
Total for Browse		93	102	15.63	8.33

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 2

Species	Percent Cover	
	'05	'08
<i>Artemisia tridentata wyomingensis</i>	16.70	8.69
<i>Chrysothamnus viscidiflorus stenophyllus</i>	.36	.35
<i>Kochia prostrata</i>	-	.21

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 2

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	1.2	0.9

BASIC COVER--

Management unit 19R, Study no: 2

Cover Type	Average Cover %	
	'05	'08
Vegetation	45.26	25.23
Rock	.22	.25
Pavement	3.96	5.30
Litter	45.94	53.07
Cryptogams	2.87	2.16
Bare Ground	17.12	26.37

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	'05	'08
Rabbit	8	50	-	-
Grouse	2	3	87/acre	104/acre
Deer/Antelope	1	1	3 (7)	8 (20)
Cattle	2	-	-	-

BROWSE CHARACTERISTICS--

Management unit 19R, 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 tridentata wyomingensis									
05	3780	1	47	53	-	10	.52	24	26/34
08	3620	6	46	48	200	3	0	45	17/29
Chrysothamnus viscidiflorus stenophyllus									
05	180	0	89	11	-	0	0	0	12/19
08	240	0	58	42	-	0	0	8	12/22
Kochia prostrata									
05	0	0	0	0	-	0	0	0	-/-
08	1040	60	33	8	560	6	13	0	5/7

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Opuntia sp.										
05	20	0	100	-	-	0	0	0	6/14	
08	20	0	100	-	-	0	0	0	5/6	

DEEP CREEK DRILL - TREND STUDY NO. 19R-3-08
[Project #24](#)

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%

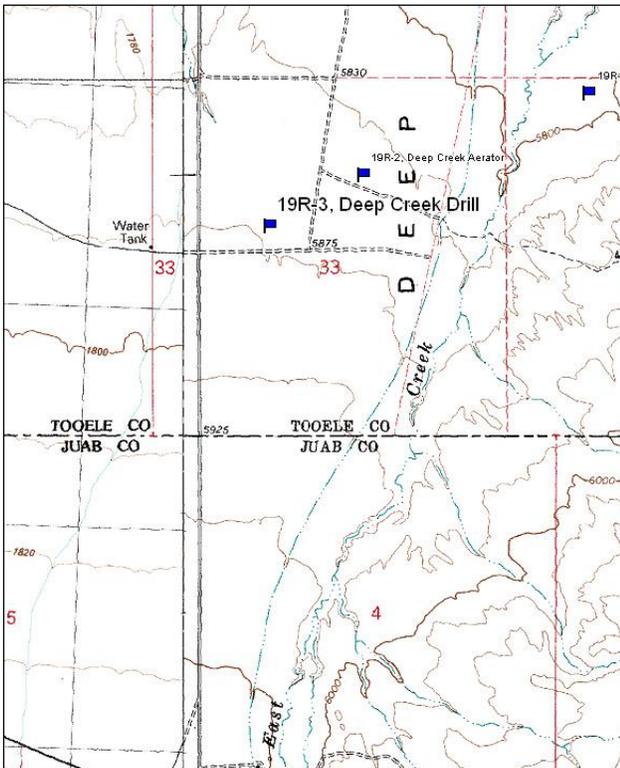
Transect bearing: 356° magnetic

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

Directions:

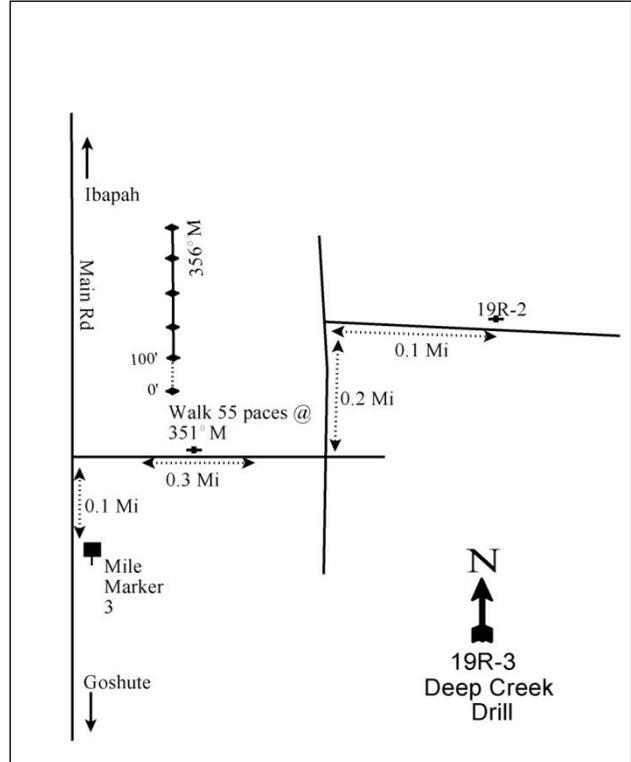
Drive north of Goshute toward Ibapah to mile marker 3. Drive north of the mile marker 0.1 miles to a two-track road on the right (east) side of the road. Turn right and drive 0.3 miles to a four-way intersection. Turn left at the intersection and drive 0.05 miles to the witness post on the left (west) 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 - WRI STUDY 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 in 2005, prior to treatment, 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 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. In the fall of 2005, 194 acres were one-way aerated and drill seeded, 389 acres were drill seeded, and 63 acres were one-way aerated. In December 2005, browse species were aerially seeded over the entire treatment area with a fixed wing airplane (Table - Seed Mix). The study was established to monitor the drill seed only treatment. The objectives of the treatment are to decrease fire fuel hazards, and improve habitat for sage-grouse and big game (WRI Database 2011). In 2005, pellet group data estimated moderate use by cattle, and light use by deer/antelope. In 2008, light use was estimated for both deer/antelope and cattle (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: 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 'Bozoiisky'	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		

Browse: The preferred browse species on the site are Wyoming big sagebrush and forage kochia (*Kochia prostrata*). The key browse species is Wyoming big sagebrush. 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 to the population has been poor since the outset of the study. Utilization of forage kochia was moderately heavy in 2008 (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and moderately diverse. The dominant grass species on the site are crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*). 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*) is the dominant forb species, but decreased substantially following the treatment (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is high, but with a moderately 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, 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 significantly increased in nested frequency, but 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%.

HERBACEOUS TRENDS--
Management unit 19R, Study no: 3

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Agropyron cristatum</i>	276	261	11.76	9.64
G	<i>Agropyron smithii</i>	-	3	-	.03
G	<i>Bromus tectorum</i> (a)	_b 190	_a 54	1.68	.10
G	<i>Poa bulbosa</i>	19	20	.28	.06
G	<i>Poa secunda</i>	_a 180	_b 241	3.86	2.04
G	<i>Sitanion hystrix</i>	3	-	.00	-
G	<i>Vulpia octoflora</i> (a)	_b 58	_a 2	.21	.00
Total for Annual Grasses		248	56	1.89	0.10
Total for Perennial Grasses		478	525	15.91	11.78
Total for Grasses		726	581	17.81	11.89
F	<i>Astragalus</i> sp.	2	-	.01	-
F	<i>Astragalus utahensis</i>	-	-	.00	-
F	<i>Castilleja</i> sp.	3	-	.00	-
F	<i>Gayophytum ramosissimum</i> (a)	4	-	.01	-
F	<i>Lomatium</i> sp.	4	-	.01	-
F	<i>Microsteris gracilis</i> (a)	_b 57	_a 11	.18	.01
F	<i>Phlox hoodii</i>	6	1	.01	.00
F	<i>Phlox longifolia</i>	8	13	.07	.02

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Ranunculus testiculatus (a)	_b 302	_a 159	3.90	.42
F	Zigadenus paniculatus	-	-	.00	-
Total for Annual Forbs		363	170	4.09	0.43
Total for Perennial Forbs		23	14	0.12	0.03
Total for Forbs		386	184	4.22	0.47

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

BROWSE TRENDS--

Management unit 19R, Study no: 3

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata wyomingensis	80	76	11.66	10.60
B	Kochia prostrata	0	3	-	.02
Total for Browse		80	79	11.66	10.63

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 3

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	12.46	10.38

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 3

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	1.4	0.8

BASIC COVER--

Management unit 19R, Study no: 3

Cover Type	Average Cover %	
	'05	'08
Vegetation	31.25	27.46
Rock	.43	.37
Pavement	5.48	6.30
Litter	23.17	39.02
Cryptogams	2.13	1.72
Bare Ground	50.00	41.82

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		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	6	35	-	-
Grouse	1	-	-	-
Deer	1	-	1 (2)	3 (8)
Cattle	4	3	21 (52)	2 (5)

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
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	80	100	0	-	220	0	50	0	2/3

SAGE VALLEY DIXIE - TREND STUDY NO. 19R-6-08

Project #291

Vegetation Type: Wyoming Big Sagebrush

Range Type: Substantial Deer Spring/Fall

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

Land Ownership: USFS

Elevation: 6,214 ft. (1,894 m)

Aspect: Northeast

Slope: 2%

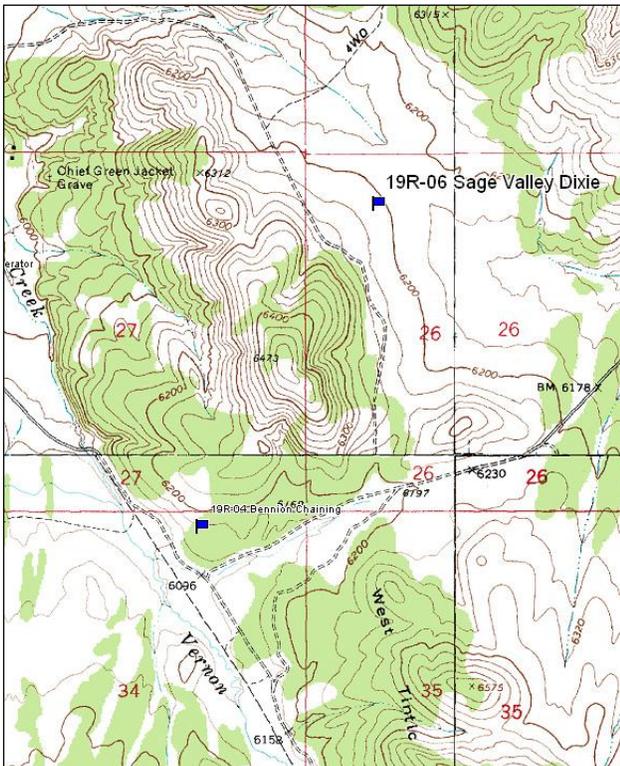
Transect bearing: 59° magnetic

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

Directions:

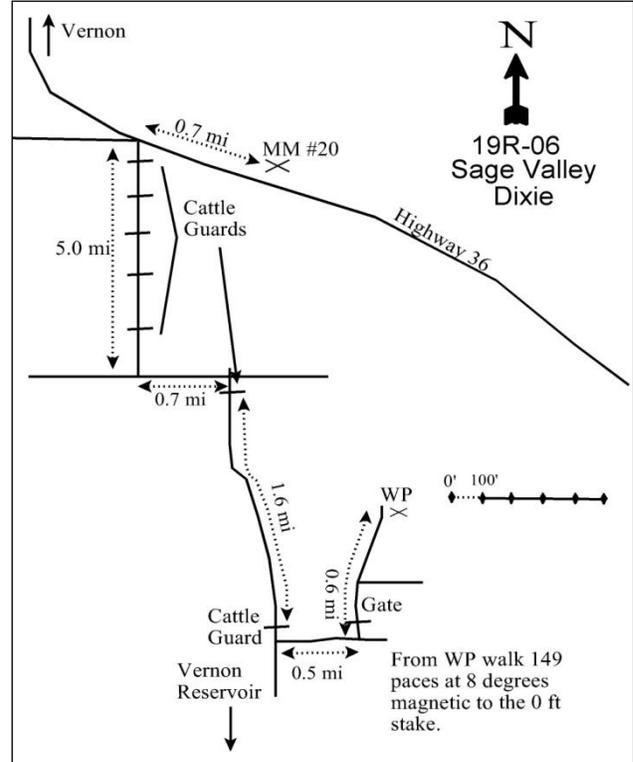
From highway 36 south of Vernon, drive to mile marker #20. From there, drive 0.7 miles to a turn off on the left (west). Turn there and drive south for 5.0 miles, passing several (4 or 5) cattle guards to a fork. Turn left and drive 0.7 miles to an intersection. Turn right (south) crossing a cattle guard 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



Township: 9S Range: 5W Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 382215 E 4429773 N

SAGE VALLEY DIXIE - WRI STUDY 19R-6

[Project #291](#)

Site Description

Site Information: This study is located in an open Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) valley, approximately six miles southeast of Vernon, on US Forest Service managed land. The study was established in 2006, prior to treatment, to monitor the effects of a seeding and Dixie harrow treatment. 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 2011). Pellet group data estimated light use by cattle in all sample years (Table - Pellet Group Data).

SEED MIX--

Management unit 19R, Study no: 6

Project Name: Sage Valley			
WRI Database #: 291			
Application: Broadcast Seeder		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

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 been moderate since the outset of the study. Prior to the treatment, poor vigor was moderate, but poor vigor was high following the treatment. 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*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse. The dominant grass species are crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. smithii*), smooth brome (*Bromus inermis*), and Sandberg bluegrass (*Poa secunda*). The 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. The dominant forb species is the annual species pale alyssum (*Alyssum alyssoides*), but prior to treatment, the low growth form perennial species desert phlox (*Phlox austromontana*) provided the majority of the cover. Blue flax (*Linum perenne*) was the only seeded species sampled on the site since the treatment (Table - Herbaceous Trends).

Soil: The soil texture is a silt loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is high, though with a moderately 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 near 0% 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.

HERBACEOUS TRENDS--
Management unit 19R, Study no: 6

Type	Species	Nested Frequency		Average Cover %	
		'06	'08	'06	'08
G	Agropyron cristatum	_b 101	_a 68	3.90	4.19
G	Agropyron intermedium	_a 4	_b 42	.15	1.33
G	Agropyron smithii	170	173	3.31	7.41
G	Agropyron spicatum	-	3	-	.04
G	Bromus inermis	110	103	3.13	2.24
G	Bromus tectorum (a)	_a 79	_b 108	.49	1.28
G	Elymus junceus	-	-	-	.00
G	Oryzopsis hymenoides	4	1	.01	.00
G	Poa bulbosa	-	-	-	.00
G	Poa secunda	_a 41	_b 84	1.47	1.40
G	Sitanion hystrix	9	13	.26	.37
G	Stipa comata	-	7	-	.16
Total for Annual Grasses		79	108	0.49	1.28
Total for Perennial Grasses		439	494	12.27	17.18
Total for Grasses		518	602	12.76	18.47
F	Agoseris glauca	2	-	.01	-
F	Alyssum alyssoides (a)	225	181	.72	1.26
F	Astragalus cibaricus	_b 14	_a -	.20	-

Type	Species	Nested Frequency		Average Cover %	
		'06	'08	'06	'08
F	Astragalus convallarius	a ⁴	b ¹⁷	.22	.26
F	Chaenactis douglasii	3	1	.00	.06
F	Collinsia parviflora (a)	5	1	.01	.00
F	Crepis acuminata	a ⁵	b ¹⁹	.06	.38
F	Ipomopsis congesta	-	3	-	.00
F	Linum perenne	a ⁻	b ¹⁰	-	.24
F	Microsteris gracilis (a)	b ⁶⁹	a ¹²	.16	.03
F	Phlox austromontana	38	30	1.21	.21
F	Phlox longifolia	a ²⁶	b ⁸¹	.07	.89
F	Ranunculus testiculatus (a)	b ¹¹²	a ³⁶	.46	.15
F	Trifolium sp.	3	-	.03	-
F	Vicia americana	a ⁴⁴	b ⁷⁹	.32	.59
Total for Annual Forbs		411	230	1.36	1.45
Total for Perennial Forbs		139	240	2.13	2.66
Total for Forbs		550	470	3.50	4.12

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	'06	'08
B	Artemisia tridentata wyomingensis	74	40	14.44	2.17
B	Chrysothamnus viscidiflorus viscidiflorus	67	68	5.02	6.18
B	Pinus edulis	-	-	.03	-
Total for Browse		141	108	19.51	8.35

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 6

Species	Percent Cover	
	'06	'08
Artemisia tridentata wyomingensis	21.21	2.91
Chrysothamnus viscidiflorus viscidiflorus	5.75	7.30

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 6

Species	Average leader growth (in)	
	'06	'08
Artemisia tridentata wyomingensis	1.6	2.8

BASIC COVER--

Management unit 19R, Study no: 6

Cover Type	Average Cover %	
	'06	'08
Vegetation	29.22	31.27
Rock	.11	.50
Pavement	.97	2.08
Litter	34.16	38.59
Cryptogams	.11	0
Bare Ground	50.30	42.31

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		Days use per acre (ha)	
	'06	'08	'06	'08
Rabbit	76	52	-	-
Cattle	2	1	5 (13)	-

BROWSE CHARACTERISTICS--

Management unit 19R, 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>									
06	3440	8	69	23	760	13	0	17	25/32
08	1660	17	69	14	40	2	0	35	15/21
<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
<i>Tetradymia canescens</i>									
06	0	0	0	-	-	0	0	0	12/13
08	0	0	0	-	-	0	0	0	10/15

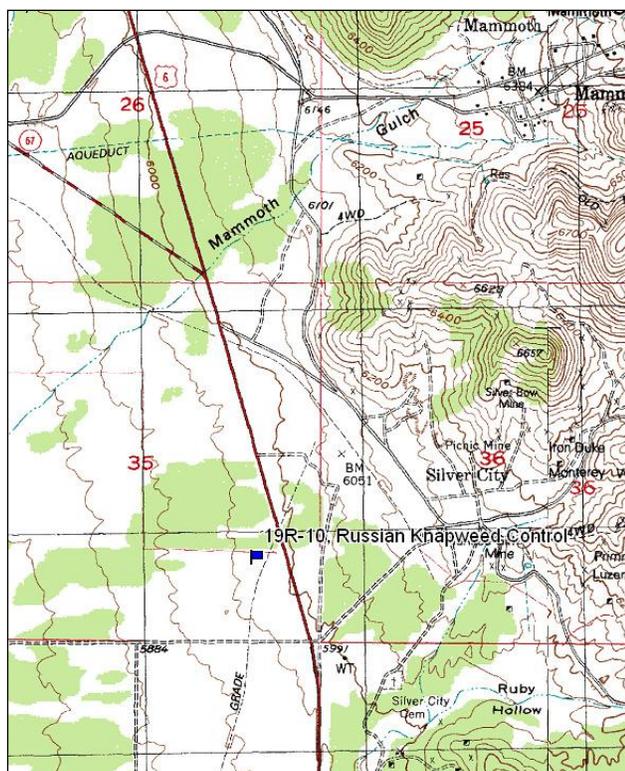
RUSSIAN KNAPWEED CONTROL - TREND STUDY NO. 19R-10-08
[Project #1102](#)

Vegetation Type: Weeds
Range Type: Deer Winter/Spring
NRCS Ecological Site Description: [Upland Loam \(Mountain Big Sagebrush\), R028AY310UT](#)
Land Ownership: Private
Elevation: 5,900 ft. (1,798 m)
Aspect: West
Slope: 4%
Transect bearing: 247° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:

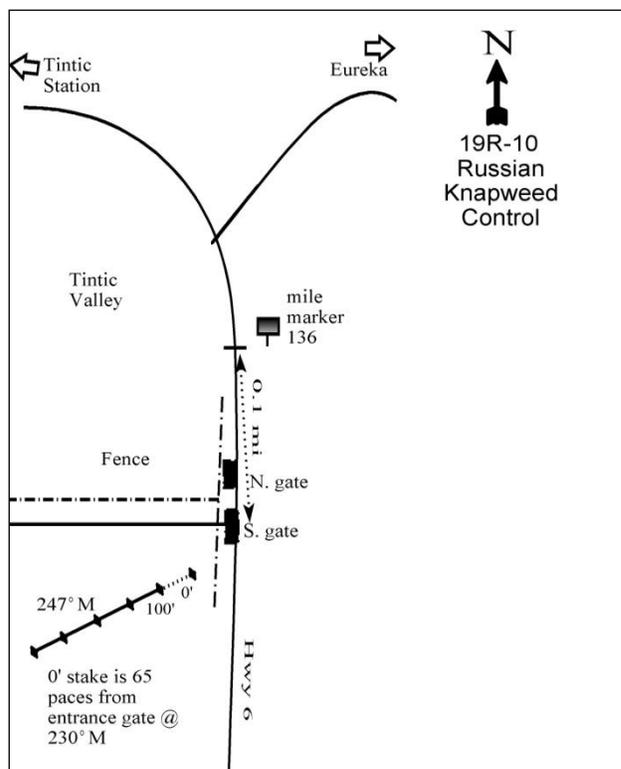
From Eureka, follow Hwy 6 for 0.1 miles passed mile marker 136. On the right are two gates side by side on the fence line. Take the southern of the two gates. The 0' stake is 65 paces from the entrance gate at 230° M. The 0' stake is marked with browse tag# 218.

Map Name: Tintic Junction



Township: 10S Range: 3W Section: 35

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 402426 E 4418060 N

RUSSIAN KNAPWEED CONTROL - WRI STUDY 19R-10
[Project #1102](#)

Site Description

Site Information: The study is located approximately a half mile west of Silver City, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, west of Highway 6, on private land. The study was established in 2008, prior to treatment, to monitor a Russian knapweed (*Centaurea repens*) control project. Historic greater sage-grouse habitat and mule deer winter range have been degraded by the spread of squarrose knapweed (*Centaurea maculosa*) and Russian knapweed in the Tintic valley. In October of 2008, two attempts to burn the project area (310 acres) were unsuccessful and only a portion of the project area was treated. As a result, the project area was decreased to the portions (55 acres) that were treated. The study site is located within the treated area. Prior to the burn treatment, the entire project area was sprayed with 2,4-D (2,4-Dichlorophenoxyacetic acid) to control the growth of knapweed. In November of 2008, the private landowners drill seeded the areas that were burned with a grass seed mix (Table - Seed Mix). In the spring of 2009, the treated portion of the project was sprayed again with 2,4-D to control the growth of knapweed. The objectives of the project are to control knapweed and establish desirable perennial grass, forb, and browse species within the treatment areas (WRI Database 2011). Pellet group data estimated little or no use by wildlife and livestock in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 19R, Study no: 10

Project Name: Tintic Junction Knapweed			
WRI Database #: 1102			
Application: Drill Seed		Acres: 70	
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Goldar'	70	1.00
G	Canby Bluegrass 'Canbar'	35	0.50
G	Crested Wheatgrass 'Nordan'	150	2.14
G	Great Basin Wildrye 'Trailhead'	70	1.00
G	Indian Ricegrass 'Rimrock'	70	1.00
G	Pubescent Wheatgrass 'Luna'	150	2.14
G	Russian Wildrye 'Bozoisky'	70	1.00
G	Sandberg Bluegrass	35	0.50
G	Snake River Wheatgrass 'Secar'	70	1.00
G	Western Wheatgrass 'Arriba'	70	1.00
Total Pounds:		790	11.29
PLS Pounds:			9.96

Browse: The preferred browse species is Wyoming big sagebrush. The Wyoming big sagebrush is a relatively small, lightly used population, with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was poor in 2008. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*) and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*), though each of these species occurred in low abundance (Table - Browse Characteristics).

Herbaceous Understory: Grasses are moderately abundant, but are not particularly diverse. The invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species. Perennial grass species were not very abundant. Intermediate wheatgrass (*Agropyron intermedium*) and smooth brome (*Bromus inermis*) were the most common perennial grass species sampled on the site. Other grass species sampled on the site included crested wheatgrass (*Agropyron cristatum*) and bottlebrush squirreltail (*Sitanion hystrix*); however, both species were sampled in low abundance. Forbs are not abundant or diverse, and are in poor condition.

Two noxious weed forb species, hoary cress (*Cardaria draba*) and Russian knapweed were sampled on the study site. Russian knapweed provided the majority of the forb cover in 2008 (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is high with a high amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 19R, Study no: 10

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron cristatum	4	.06
G	Agropyron intermedium	19	1.11
G	Bromus inermis	37	.66
G	Bromus tectorum (a)	203	7.07
G	Sitanion hystrix	1	.00
Total for Annual Grasses		203	7.07
Total for Perennial Grasses		61	1.84
Total for Grasses		264	8.91
F	Alyssum desertorum (a)	68	.79
F	Calochortus nuttallii	1	.03
F	Cardaria draba	7	.18
F	Centaurea repens	16	2.59
F	Ranunculus testiculatus (a)	38	.11
Total for Annual Forbs		106	0.90
Total for Perennial Forbs		24	2.80
Total for Forbs		130	3.70

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

BROWSE TRENDS--

Management unit 19R, Study no: 10

Type	Species	Strip	Average
		Frequency	Cover %
		'08	'08
B	Artemisia tridentata wyomingensis	10	.63
B	Chrysothamnus nauseosus	2	.00
B	Chrysothamnus viscidiflorus	20	1.11
Total for Browse		32	1.75

CANOPY COVER, LINE INTERCEPT--
Management unit 19R, Study no: 10

Species	Percent Cover '08
Artemisia tridentata wyomingensis	1.33
Chrysothamnus viscidiflorus	.46

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 19R, Study no: 10

Species	Average leader growth (in) '08
Artemisia tridentata wyomingensis	1.8

BASIC COVER--
Management unit 19R, Study no: 10

Cover Type	Average Cover % '08
Vegetation	14.25
Rock	.01
Pavement	.14
Litter	60.72
Cryptogams	.04
Bare Ground	36.51

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 10, Study Name: Russian Knapweed Control

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.0	36.0	34.4	29.6	1.1	10.7	400.0	0.6

PELLET GROUP DATA--
Management unit 19R, Study no: 10

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	40	-
Horse	1	-
Elk	1	-
Deer	1	-

BROWSE CHARACTERISTICS--
 Management unit 19R, Study no: 10

		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>									
08	220	9	82	9	-	18	0	9	22/32
<i>Chrysothamnus nauseosus</i>									
08	40	0	50	50	-	0	100	50	19/23
<i>Chrysothamnus viscidiflorus</i>									
08	720	0	92	8	-	19	0	6	14/21

JAMES RANCH BULLHOG - TREND STUDY NO. 19R-11-08

[Project #1131](#)

Vegetation Type: Pinyon-Juniper, Wyoming Big Sagebrush

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: Not available

Land Ownership: BLM

Elevation: 5,456 ft. (1,663 m)

Aspect: North

Slope: 3%

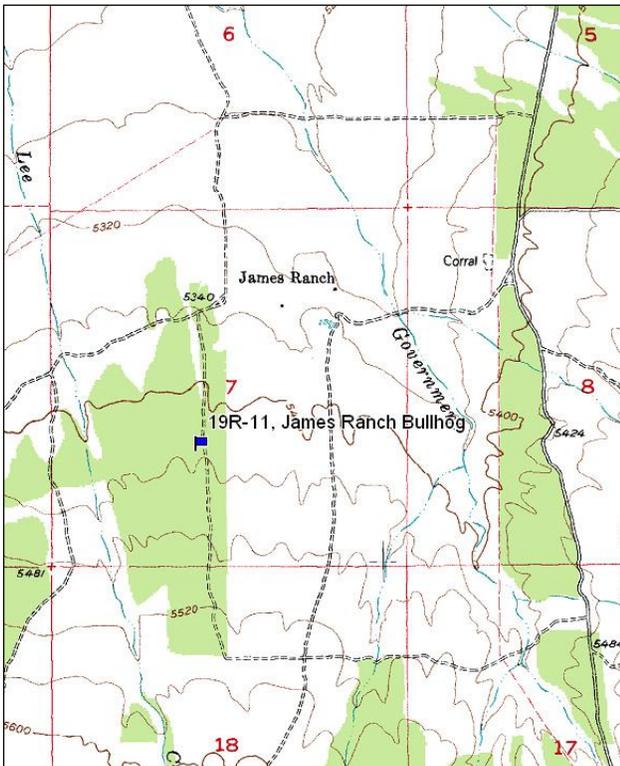
Transect bearing: 233° magnetic

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

Directions:

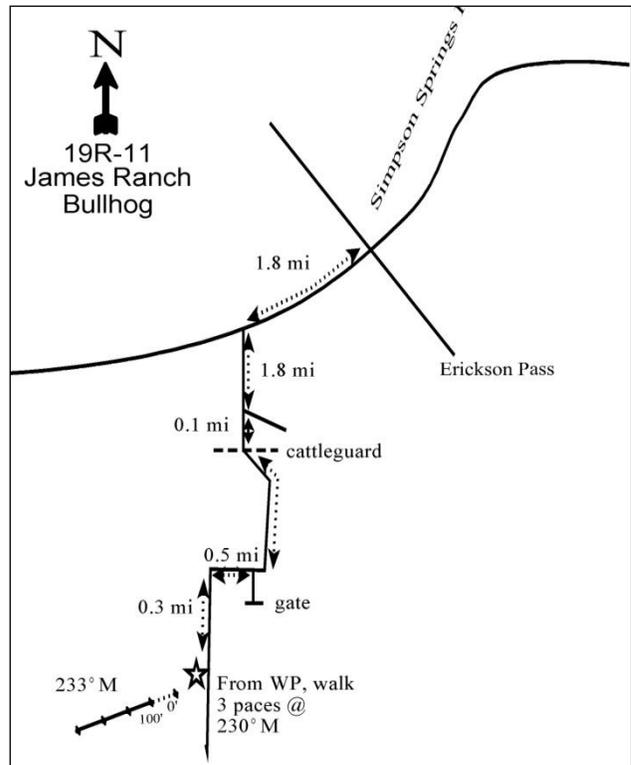
From the intersection of Erickson Pass and Simpson Springs Road, proceed west on Simpson Springs Road for 1.8 miles to a road on the left. Follow this road 1.8 miles to a fork, keeping right. Go 0.1 miles to a cattle guard, and then drive 0.5 miles to a fork and go right (the left fork leads to a gate). From here, go 0.5 miles and stay left at the fork. Drive 0.3 miles to the witness post on the right side of the road. The 0' stake is 3 paces from the witness post at 230° M. The 0' stake is marked with browse tag# 230.

Map Name: Indian Peaks



Township: 9S Range: 7W Section: 7

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 356907 E 4434230 N

JAMES RANCH BULLHOG - WRI STUDY 19R-11
[Project #1131](#)

Site Description

Site Information: The study is located approximately a half mile south of James Ranch, in a Utah juniper (*Juniperus osteosperma*) woodland, east of Lee Creek, on land administrated by the Bureau Land Management (BLM). The study was established in 2008, prior to the treatment, to monitor the effects of a bullhog project to remove juniper trees. The Wyoming big sagebrush (*Artemisia tridentata* ssp *wyomingensis*) ecosystem in the James Ranch area has been heavily encroached by juniper. In the spring of 2009, a total of 473 acres of juniper were masticated using a bullhog. Seed was not applied to the project area. The objectives of the project are to decrease the canopy cover and density of Utah juniper, increase the diversity of the herbaceous understory, and decrease the risk of catastrophic fire events (WRI Database 2011). Pellet group data estimated light use by cattle and deer in 2008 (Table - Pellet Group Data).

Browse: Prior to the bullhog treatment, Utah juniper was the dominant browse on the site with an estimated density of 107 trees/acre (Table - Point-Quarter Tree Data) and provided the majority of the canopy cover (Table - Canopy Cover). The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a moderately used population with high decadence and poor vigor within the population. In 2008, a large portion of the sagebrush plants sampled were dead, and the recruitment of young sagebrush plants to the population was poor. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*) and prickly phlox (*Leptodactylon pungens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are fairly abundant, but are not particularly diverse. The dominant grass species sampled on the site is Sandberg bluegrass (*Poa secunda*), which provides the majority of the grass cover. Other perennial grass species sampled on the site include bluebunch wheatgrass (*Agropyron cristatum*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance and provided little cover on the site. Forbs are not abundant, but are moderately diverse. Perennial forbs are rare on the site; however, the most common forb species is the weedy annual forb species bur buttercup (*Ranunculus testiculatus*) (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 7.0). Phosphorus may have limited availability for plant growth and development at 5.6 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderately high with a high amount of litter and pavement, and a moderate amount of vegetation and cryptograms providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to pedestalling, flow patterns, gullies, and soil movement.

HERBACEOUS TRENDS--
 Management unit 19R, Study no: 11

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	Agropyron spicatum	18	.64
G	Bromus tectorum (a)	58	.28
G	Oryzopsis hymenoides	11	.37
G	Poa secunda	248	5.33
G	Sitanion hystrix	68	2.15
Total for Annual Grasses		58	0.28
Total for Perennial Grasses		345	8.50

Type	Species	Nested Frequency	Average Cover %
		'08	'08
Total for Grasses		403	8.78
F	Alyssum desertorum (a)	33	.15
F	Antennaria rosea	6	.01
F	Astragalus sp.	1	.00
F	Calochortus nuttallii	3	.00
F	Descurainia pinnata (a)	1	.00
F	Eriogonum ovalifolium	3	.03
F	Gilia sp. (a)	4	.00
F	Petrorhiza pumila	1	.15
F	Phlox hoodii	7	.07
F	Phlox longifolia	3	.00
F	Ranunculus testiculatus (a)	206	.40
F	Zigadenus paniculatus	4	.01
Total for Annual Forbs		244	0.56
Total for Perennial Forbs		28	0.29
Total for Forbs		272	0.86

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

BROWSE TRENDS--

Management unit 19R, Study no: 11

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia tridentata wyomingensis	35	3.41
B	Chrysothamnus viscidiflorus	5	.00
B	Juniperus osteosperma	6	11.55
Total for Browse		46	14.97

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 11

Species	Percent Cover '08
Artemisia tridentata wyomingensis	4.38
Chrysothamnus viscidiflorus	.23
Juniperus osteosperma	24.13

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 11

Species	Average leader growth (in) '08
Artemisia tridentata wyomingensis	1.4

POINT-QUARTER TREE DATA--

Management unit 19R, Study no: 11

Species	Trees per Acre	Average diameter (in)
	'08	'08
Juniperus osteosperma	107	10.9

BASIC COVER--

Management unit 19R, Study no: 11

Cover Type	Average Cover %
	'08
Vegetation	24.40
Rock	1.10
Pavement	12.67
Litter	44.70
Cryptogams	6.34
Bare Ground	31.07

SOIL ANALYSIS DATA --

Management unit 19R, Study no: 11, Study Name: James Ranch Bullhog

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.0	34.0	31.4	34.6	1.7	5.6	198.4	0.7

PELLET GROUP DATA--

Management unit 19R, Study no: 11

Type	Quadrat Frequency	Days use per acre (ha)
	'08	'08
Rabbit	86	-
Deer	2	7 (18)
Cattle	4	4 (11)

BROWSE CHARACTERISTICS--
 Management unit 19R, Study no: 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>Artemisia tridentata wyomingensis</i>										
08	860	7	19	74	60	16	23	63	18/25	
<i>Chrysothamnus viscidiflorus</i>										
08	140	0	57	43	-	0	29	14	8/9	
<i>Juniperus osteosperma</i>										
08	120	0	50	50	-	0	0	17	-/-	
<i>Leptodactylon pungens</i>										
08	0	0	0	-	-	0	0	0	10/11	

IBAPAH HARROW - TREND STUDY NO. 19R-14-08
Project #1104

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Elk Winter

NRCS Ecological Site Description: [Semidesert Gravelly Loam \(Wyoming Big Sagebrush\) North, R028AY215UT](#)

Land Ownership: BLM

Elevation: 5,900 ft. (1,798 m)

Aspect: West

Slope: 4%

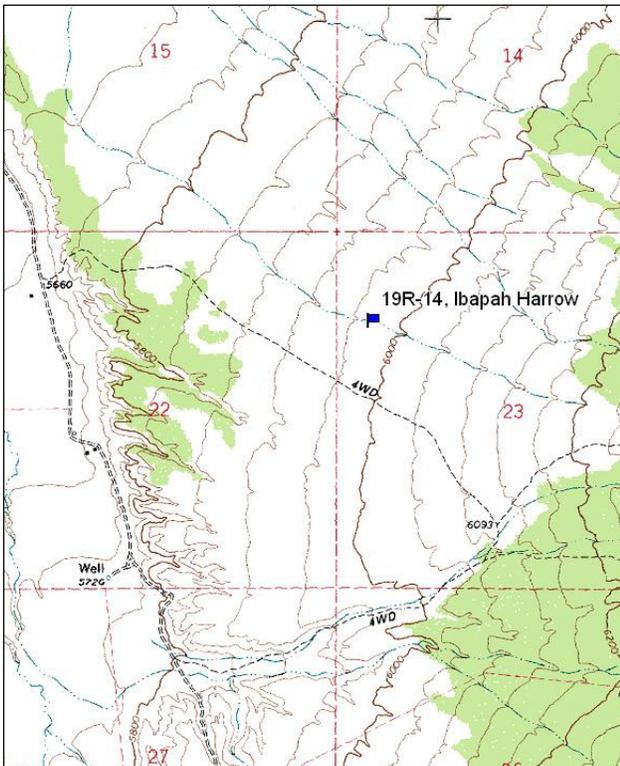
Transect bearing: 125° magnetic

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

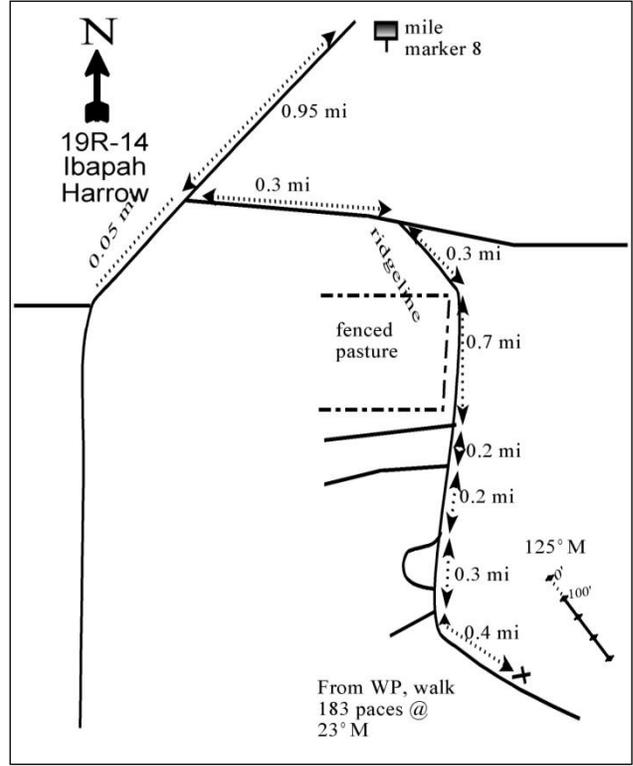
Directions:

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' stake is 183 paces from the witness post at 23°M. The 0' stake is marked with browse tag #237.

Map Name: Goshute



Diagrammatic Sketch:



Township: 10S Range: 19W Section: 23

GPS: NAD 83, UTM 12T 246870 E 4425936 N

IBAPAH HARROW - WRI STUDY 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 in 2008, prior to treatment, to monitor the effects of a two-way Dixie harrow project on land administrated by the Bureau of Land Management (BLM). In fall of 2008, a total of 134 acres were treated with a 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 2011). Pellet group data estimated light use by deer, elk, and cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 19R, Study no: 14

Project Name: Ibapah Harrow - Year 2			
WRI Database #: 1104			
Application: Broadcast seeded		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

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a moderately used, decadent population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was 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*).

Herbaceous Understory: Grasses are not particularly abundant, but are somewhat diverse on the site. The dominant grass species on the site is Sandberg bluegrass (*Poa secunda*). Other, less common, perennial grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*A. spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), and mutton bluegrass (*Poa fendleriana*). The invasive

annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance and provided little cover. Forbs are not particularly abundant or diverse. Perennial forb species are rare on the site; however, the weedy annual forb species bur buttercup (*Ranunculus testiculatus*) is the dominant forb species (Table - Herbaceous Trends).

Soil: 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 high, but a moderate amount of litter, cryptograms, and pavement provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 19R, Study no: 14

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron cristatum	3	.00
G	Agropyron spicatum	1	.03
G	Bromus tectorum (a)	63	.15
G	Oryzopsis hymenoides	23	.79
G	Poa fendleriana	5	.09
G	Poa secunda	170	1.48
Total for Annual Grasses		63	0.15
Total for Perennial Grasses		202	2.39
Total for Grasses		265	2.54
F	Alyssum alyssoides (a)	1	.00
F	Astragalus sp.	3	.01
F	Balsamorhiza hookeri	9	.22
F	Castilleja linariaefolia	15	.12
F	Cryptantha sp.	12	.16
F	Erigeron pumilus	4	.04
F	Gilia sp. (a)	4	.00
F	Phlox austromontana	19	.31
F	Phlox longifolia	45	.18
F	Ranunculus testiculatus (a)	246	.78
F	Zigadenus paniculatus	3	.02
Total for Annual Forbs		251	0.79
Total for Perennial Forbs		110	1.08
Total for Forbs		361	1.87

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

BROWSE TRENDS--

Management unit 19R, Study no: 14

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia tridentata wyomingensis	80	9.99
B	Chrysothamnus viscidiflorus	1	-
B	Gutierrezia sarothrae	21	.33
B	Leptodactylon pungens	4	.01
Total for Browse		106	10.34

CANOPY COVER, LINE INTERCEPT--

Management unit 19R, Study no: 14

Species	Percent Cover
	'08
Artemisia tridentata wyomingensis	19.46
Gutierrezia sarothrae	.25
Leptodactylon pungens	.01

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 19R, Study no: 14

Species	Average leader growth (in)
	'08
Artemisia tridentata wyomingensis	0.6

BASIC COVER--

Management unit 19R, Study no: 14

Cover Type	Average Cover %
	'08
Vegetation	14.56
Rock	.41
Pavement	9.13
Litter	26.18
Cryptogams	4.81
Bare Ground	39.91

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

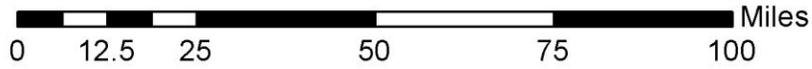
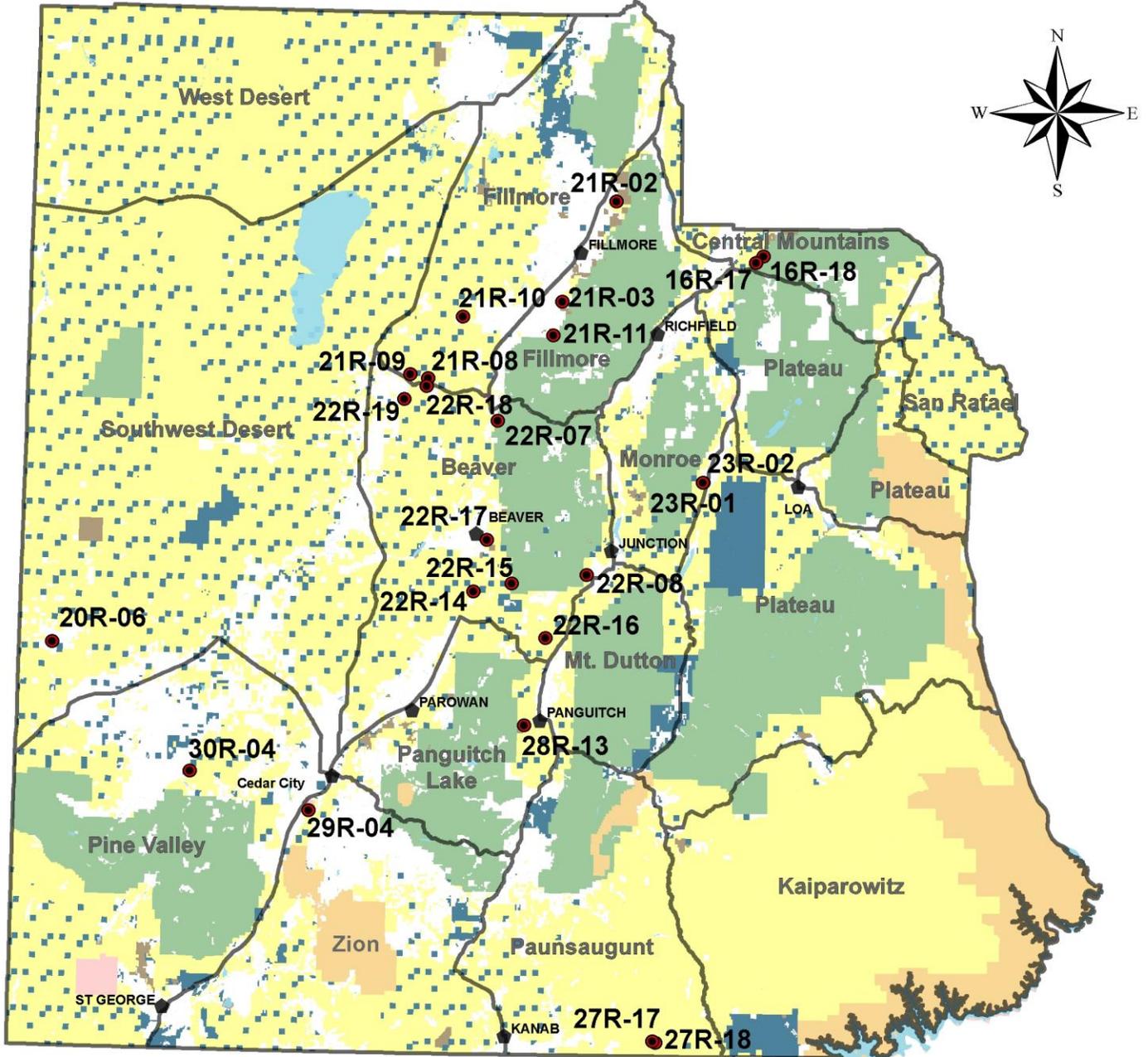
Type	Quadrat Frequency	Days use per acre (ha)
	'08	'08
Rabbit	23	-
Elk	3	5 (12)
Deer	5	1 (3)
Cattle	-	3 (7)

BROWSE CHARACTERISTICS--

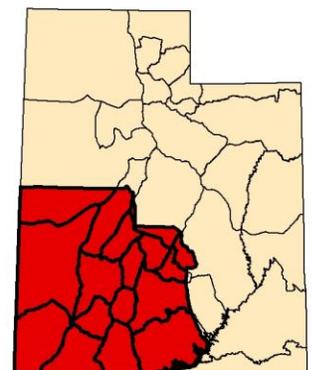
Management unit 19R, Study no: 14

		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
<i>Chrysothamnus viscidiflorus</i>									
08	20	0	0	100	-	0	0	0	6/6
<i>Gutierrezia sarothrae</i>									
08	1320	5	76	20	-	0	0	5	6/7
<i>Leptodactylon pungens</i>									
08	140	14	57	29	20	0	0	0	10/11

Southern Region WRI Studies 2008



Unit Location



CEDAR MOUNTAIN BRUSHSAW - TREND STUDY NO. 16R-17-08

[Project #216](#)

Vegetation Type: Pinyon-Juniper, Perennial Grass

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: USFS

Elevation: 6,956 ft. (2,120 m)

Aspect: Southeast

Slope: 8%

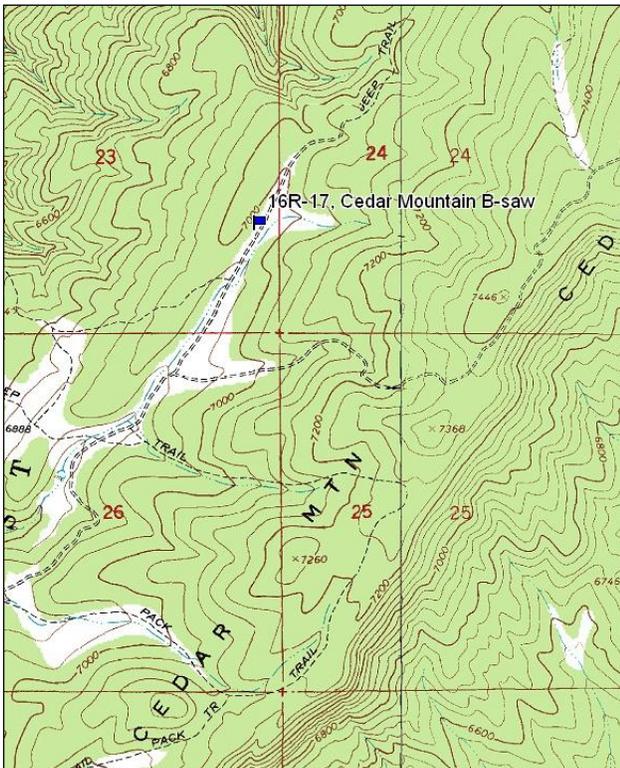
Transect bearing: 293° magnetic

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

Directions:

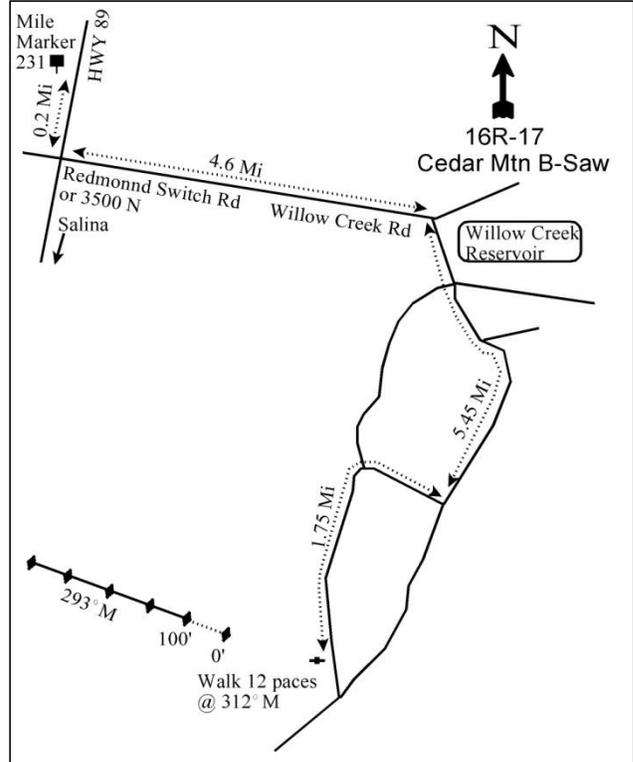
From Salina, drive north on US 89 to Redmond Switch Rd, which is on the right (east) side of the road, 0.2 miles before mile marker 231. Turn right on this road and drive 4.6 miles to a road on the right (south) just before Willow Creek Reservoir. Turn on this road and drive 5.6 miles to a road to the right (north). Turn right and drive 1.7 miles to the witness post on the right hand side of the road. From the witness post, walk 12 paces at 312°M to the 0' stake. The 0' stake is marked with browse tag #88.

Map Name: Salina



Township: 21S Range: 1E Section: 23

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 434294 E 4313140 N

CEDAR MOUNTAIN BRUSHSAW - WRI STUDY 16R-17
[Project #216](#)

Site Description

Site Information: The study is located five and half miles east of Salina, on Cedar Mountain, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, within the Fishlake National Forest. The study was established in 2005, prior to treatment, to monitor a brushsaw project to remove pinyon pine and Utah juniper. Historically, the area was chained, but over time pinyon and juniper trees reestablished within the old chaining site. The study site was treated using a tracked skid-steer loader equipped with a brush saw attachment in the fall of 2005 and all of 2006. The study site was not seeded due to the good herbaceous understory present on the site. The objectives of the project are to improve big game habitat by removing reestablishing pinyon and juniper trees, invigorate the herbaceous understory, and increase preferred browse forage (WRI Database 2011). Pellet group data estimated light use by deer and elk in all the sample years (Table - Pellet Group Data).

Browse: The key preferred browse species on the site are Gambel oak (*Quercus gambelii*) and black sagebrush (*Artemisia nova*). The black sagebrush is a relatively small population with high decadence and poor vigor over the sample years. Since the outset of the study, the recruitment of young sagebrush plants to the population has been mostly poor. Utilization of sagebrush plants was moderate to heavy before the treatment, but was mostly light following the treatment. The health of the Gambel oak population has been good with low decadence and good vigor over the sample years. Prior to treatment, utilization was mostly heavy, but since the treatment, has been light. The recruitment of young oak plants to the population has been good over the course of the study. Other less common, palatable browse species sampled on the site include Utah serviceberry (*Amelanchier utahensis*), dwarf rabbitbrush (*Chrysothamnus depressus*), green ephedra (*Ephedra viridis*), and mountain snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics). Pinyon pine and Utah juniper remained common in density and cover due to the brushsaw imperfectly cutting the stand (Table - Point-Quarter Tree Data and Table - Canopy Cover).

Herbaceous Understory: Grasses are abundant and fairly diverse. The dominant grass species on the site are crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*). Following the treatment, the annual grass species cheatgrass (*Bromus tectorum*) increased in abundance on the site, but cover remained low. Forbs are diverse, but are not particularly abundant on the site. The annual species bur buttercup (*Ranunculus testiculatus*) is the dominant forb species on the site, though no single forb species provides more than 1% cover (Table - Herbaceous Trends).

Soil: The soil texture is a silt loam with a slightly alkaline soil reaction (pH 7.6) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter, rock, and pavement and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

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

Browse: The density of black sagebrush decreased 43% from 280 plants/acre to 160 plants/acre, and canopy cover remained less than 1%. The health of the sagebrush population remained similar with decadence decreasing from 43% to 38% and poor vigor increasing from 36% to 63% of the population. The recruitment of young sagebrush decreased from 14% to 0% of the population. The density of Gambel oak increased just under three-fold from 500 plants/acre to 1,380 plants/acre, and canopy cover increased from 2% to 3%. The recruitment of young oak plants to the population increased from 16% to 20%. Utah juniper decreased in density from 194 trees/acre to 117 trees/acre, and canopy cover decreased from 7% to 2%. Pinyon pine decreased in density from 166 trees/acre to 27 trees/acre, and canopy cover decreased from 9% to 4%.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover increased from 11% to 22%. Intermediate wheatgrass remained similar in nested frequency, but increased in cover from 3% to 14%. Crested wheatgrass significantly decreased in nested frequency, but cover increased slightly from 7% to 8%.

Forbs: The sum of nested frequency of perennial forbs increased four-fold, though perennial forb cover remained less than 1%. Annual forbs are common, but provide little cover. No single forb species provided over 1% cover except bur buttercup which provided 2% cover prior to treatment, but decreased to less than 1% following the treatment.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 17

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	_b 181	_a 145	7.39	7.56
G	Agropyron intermedium	177	198	3.06	13.70
G	Agropyron spicatum	1	-	.00	.00
G	Bromus inermis	-	3	-	.09
G	Bromus tectorum (a)	_a 26	_b 116	.31	1.17
G	Oryzopsis hymenoides	3	16	.15	.05
G	Poa fendleriana	3	-	.03	-
G	Poa secunda	27	28	.33	.30
Total for Annual Grasses		26	116	0.31	1.17
Total for Perennial Grasses		392	390	10.96	21.72
Total for Grasses		418	506	11.27	22.90
F	Alyssum alyssoides (a)	_a 33	_b 115	.13	.33
F	Arenaria sp.	2	1	.00	.00
F	Astragalus convallarius	-	1	-	.00
F	Astragalus utahensis	1	8	.00	.04
F	Calochortus nuttallii	_a 3	_b 16	.00	.06
F	Caulanthus crassicaulis	6	7	.06	.06
F	Chaenactis douglasii	-	2	-	.03
F	Cirsium sp.	_a -	_b 12	-	.03
F	Collinsia parviflora (a)	15	24	.02	.04
F	Descurainia pinnata (a)	_b 22	_a 6	.08	.02
F	Ipomopsis congesta	7	3	.01	.01
F	Lactuca serriola (a)	-	7	-	.02
F	Lomatium sp.	_a -	_b 17	-	.07
F	Microsteris gracilis (a)	41	51	.16	.18
F	Phlox austromontana	1	12	.00	.16
F	Phlox longifolia	4	3	.06	.03
F	Ranunculus testiculatus (a)	_b 192	_a 117	1.85	.42
F	Trifolium sp.	1	1	.00	.00
F	Veronica biloba (a)	1	5	.00	.01
F	Zigadenus paniculatus	-	2	-	.03
Total for Annual Forbs		304	325	2.25	1.02
Total for Perennial Forbs		25	85	0.16	0.55

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
Total for Forbs		329	410	2.41	1.58

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

BROWSE TRENDS--

Management unit 16R, Study no: 17

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Amelanchier utahensis	1	0	.03	-
B	Artemisia nova	8	4	.59	.30
B	Chrysothamnus depressus	1	1	-	-
B	Ephedra viridis	0	1	-	-
B	Juniperus osteosperma	17	6	5.23	1.00
B	Pinus edulis	7	2	4.40	1.25
B	Purshia tridentata	0	0	.15	.38
B	Quercus gambelii	3	4	1.23	1.63
B	Symphoricarpos oreophilus	2	1	.44	.53
Total for Browse		39	19	12.08	5.11

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 17

Species	Percent Cover	
	'05	'08
Artemisia nova	.38	.23
Juniperus osteosperma	7.08	2.00
Pinus edulis	8.96	3.53
Quercus gambelii	2.36	2.75
Symphoricarpos oreophilus	.91	.30

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16R, Study no: 17

Species	Average leader growth (in)	
	'05	'08
Artemisia nova	1.3	1.4

POINT-QUARTER TREE DATA--

Management unit 16R, Study no: 17

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	194	117	4.4	5.4
Pinus edulis	166	27	5.6	4.3

BASIC COVER--

Management unit 16R, Study no: 17

Cover Type	Average Cover %	
	'05	'08
Vegetation	21.29	31.12
Rock	9.22	9.50
Pavement	22.17	12.87
Litter	37.58	39.82
Cryptogams	.40	0
Bare Ground	19.92	16.95

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 17, Study Name: Cedar Mtn Brush Saw

Effective rooting depth (in)	pH	silt loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
9.5	7.6	30.0	56.4	13.6	5.0	8.4	236.8	0.7

PELLET GROUP DATA--

Management unit 16R, Study no: 17

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	70	61	-	--
Elk	10	3	5 (12)	7 (17)
Deer	11	6	15 (38)	9 (22)

BROWSE CHARACTERISTICS--

Management unit 16R, 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	
Amelanchier utahensis									
05	20	0	100	-	-	0	100	0	-/-
08	0	0	0	-	-	0	0	0	-/-
Artemisia nova									
05	280	14	43	43	-	21	36	36	14/20
08	160	0	63	38	-	13	0	63	13/24
Artemisia tridentata vaseyana									
05	0	0	0	-	-	0	0	0	19/28
08	0	0	0	-	-	0	0	0	20/34
Cercocarpus montanus									
05	0	0	0	-	-	0	0	0	13/18
08	0	0	0	-	-	0	0	0	14/16
Chrysothamnus depressus									
05	20	0	100	-	-	0	100	0	4/9
08	20	0	100	-	-	100	0	0	5/10

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 nauseosus</i>									
05	0	0	0	-	-	0	0	0	19/13
08	0	0	0	-	-	0	0	0	-/-
<i>Ephedra viridis</i>									
05	0	0	0	-	-	0	0	0	24/24
08	20	0	100	-	-	100	0	0	27/27
<i>Gutierrezia sarothrae</i>									
05	0	0	0	-	-	0	0	0	10/11
08	0	0	0	-	-	0	0	0	-/-
<i>Juniperus osteosperma</i>									
05	400	50	50	0	-	0	0	0	-/-
08	120	67	17	17	20	0	0	67	-/-
<i>Pinus edulis</i>									
05	140	29	71	0	40	0	0	0	-/-
08	40	0	50	50	-	0	0	50	-/-
<i>Purshia tridentata</i>									
05	0	0	0	-	-	0	0	0	18/51
08	0	0	0	-	-	0	0	0	25/62
<i>Quercus gambelii</i>									
05	500	16	76	8	-	0	64	0	36/27
08	1380	20	75	4	-	0	0	1	47/32
<i>Symphoricarpos oreophilus</i>									
05	80	0	100	-	-	0	0	0	12/18
08	60	0	100	-	-	0	0	0	17/28

CEDAR MOUNTAIN DIXIE - TREND STUDY NO. 16R-18-08

[Project #216](#)

Vegetation Type: Pinyon-Juniper, Perennial Grass

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: USFS

Elevation: 6,829 ft. (2,081 m)

Aspect: Southwest

Slope: 4%

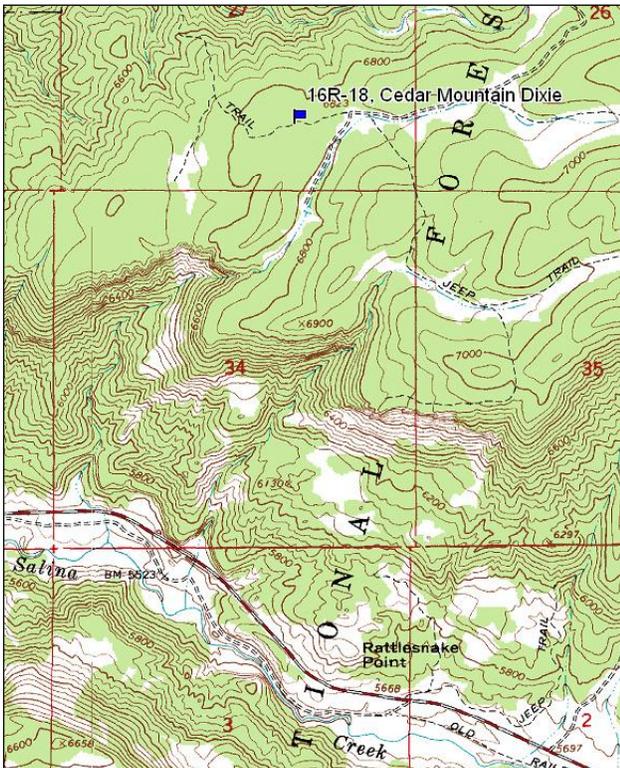
Transect bearing: 164° magnetic

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

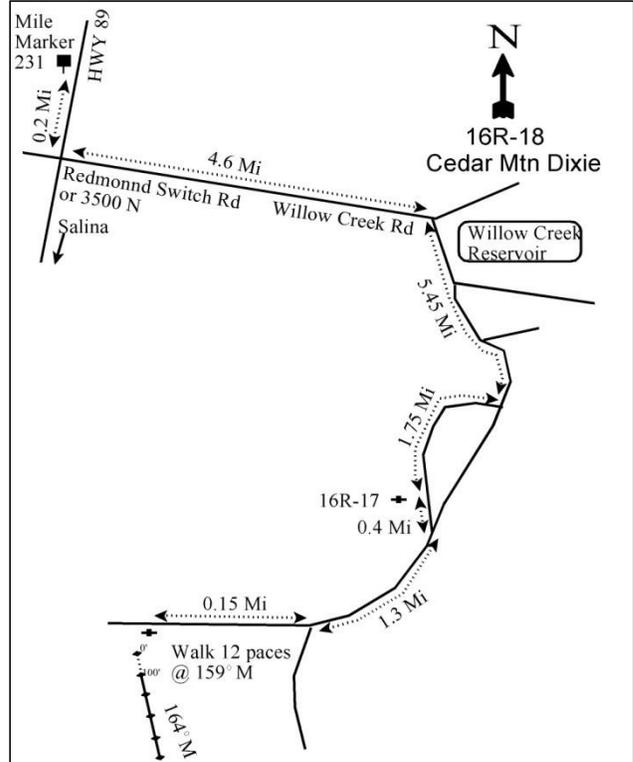
Directions:

From Salina, drive north on US 89 to Redmond Switch Rd, which is on the right (east) side of the road, 0.2 miles before mile marker 231. Turn right on this road and drive 4.6 miles to a road on the right (south) just before Willow Creek Reservoir. Turn on this road and drive 5.5 miles to a road to the right (north). Turn right and drive 1.7 miles to the witness post of 16R-17 on the right hand side of the road. Continue driving another 0.4 miles to a fork. Turn right and drive 1.3 miles to another fork. Stay right at the fork and drive 0.15 miles to the witness post on the left (south) side of the road. From the witness post, walk 12 paces at 159°M to the 0' stake. The 0' stake is marked with browse tag #89.

Map Name: Salina



Diagrammatic Sketch:



Township: 21S Range: 1E Section: 27

GPS: NAD 83, UTM 12S 432256 E 4311372 N

CEDAR MOUNTAIN DIXIE - WRI STUDY 16R-18
[Project #216](#)

Site Description

Site Information: The study is located four miles east of Salina, on Cedar Mountain, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, within the Fishlake Nation Forest. The study was established in 2005, prior to treatment, to monitor a brushsaw project to remove pinyon pine and Utah juniper. Historically, the area was chained, but over time pinyon and juniper trees reestablished within the old chaining site. The study site was treated using Dixie harrow in the fall of 2005 and 2006. Belts three and four of the study transect were not treated; as a result, the trend data is not representative of the treated area. The study site was not seeded due to the good herbaceous understory present on the site. The objectives of the project are to improve big game habitat by removing reestablishing pinyon and juniper trees, invigorate the herbaceous understory, and increase preferred browse forage (WRI Database 2011). Pellet group data estimated light use by deer and elk in all the sample years (Table - Pellet Group Data).

Browse: Palatable browse species are rare on the site. A very small population of black sagebrush (*Artemisia nova*) and mountain big sagebrush (*A. tridentata ssp. vaseyana*) are the preferred browse sampled on the site. Both of these species occurred in low density (Table - Browse Characteristics). Pinyon pine and Utah juniper are the dominant browse species on the site. Despite several of the sample belts having not been treated, each of the tree species population densities were reduced after the treatment (Table - Point-Quarter Tree Data)

Herbaceous Understory: Grasses are abundant and fairly diverse, but are dominated by the introduced species crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), and smooth brome (*Bromus inermis*). The annual grass species cheatgrass (*B. tectorum*) is present on the site in very low abundance. The only native grass species sampled on the site were in low abundance and include Sandberg bluegrass (*Poa secunda*), mutton bluegrass (*P. fendleriana*), and bluebunch wheatgrass (*Agropyron spicatum*). Forbs are not overly abundant or diverse. Perennial forbs are rare on the site, though diversity of forb species increased following the treatment. The annual forb species pale alyssum (*Alyssum alyssoides*) is the dominant forb species on the site, which provided the majority of the forb cover over the sample years (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a slightly alkaline soil reaction (pH 7.7) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter, vegetation, and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

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

Browse: Palatable browse species are rare on the site. The density of black sagebrush decreased by 33 % from 60 plants/acre to 40 plants/acre, and canopy cover remained less than 1%. Mountain big sagebrush was sampled for the first time following the treatment at a density of 20 plants/acre. Utah juniper decreased in density from 293 trees/acre to 128 trees/acre, and canopy cover decreased from 4% to 1%. Pinyon pine density decreased from 45 trees/acre to 31 trees/acre and canopy cover decreased from 6% to 5%.

Grasses: The sum of nested frequency of perennial grasses increased slightly by 11%, and cover increased from 18% to 31%. The nested frequency of intermediate grass, crested wheatgrass, and smooth brome remained similar, but cover increased substantially from 9% to 15%, 7% to 10%, and 1% to 5%, respectively. Native grass species remained rare on the site.

Forbs: Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs decreased 40% and cover decreased from 9% to 2%. Pale alyssum was the dominant forb species in both sample year, though it decreased in nested frequency, and cover decreased from 5% to 2%.

HERBACEOUS TRENDS--

Management unit 16R, Study no: 18

T y p e	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	158	174	6.84	10.11
G	Agropyron intermedium	253	256	9.39	14.66
G	Agropyron spicatum	7	1	.41	.03
G	Bromus inermis	77	102	.62	5.02
G	Bromus tectorum (a)	15	15	.32	.03
G	Elymus junceus	2	5	.33	.71
G	Poa fendleriana	-	3	.00	.15
G	Poa secunda	29	42	.44	.40
Total for Annual Grasses		15	15	0.31	0.03
Total for Perennial Grasses		526	583	18.05	31.10
Total for Grasses		541	598	18.37	31.13
F	Agoseris glauca	-	8	-	.04
F	Alyssum alyssoides (a)	_b 336	_a 286	4.67	1.58
F	Astragalus sp.	-	3	-	.03
F	Astragalus utahensis	-	1	-	.00
F	Collinsia parviflora (a)	-	3	-	.04
F	Descurainia pinnata (a)	_b 38	_a -	.49	-
F	Gayophytum ramosissimum(a)	-	2	-	.00
F	Lappula occidentalis (a)	-	1	-	.03
F	Lomatium sp.	-	6	-	.09
F	Microsteris gracilis (a)	2	1	.03	.00
F	Phlox austromontana	11	14	.27	.22
F	Ranunculus testiculatus (a)	_b 254	_a 83	3.89	.29
F	Trifolium sp.	3	10	.00	.08
Total for Annual Forbs		630	376	9.09	1.96
Total for Perennial Forbs		14	42	0.28	0.46
Total for Forbs		644	418	9.37	2.42

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

BROWSE TRENDS--

Management unit 16R, Study no: 18

T y p e	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia nova	3	2	.00	.18
B	Artemisia tridentata vaseyana	0	1	-	.03
B	Juniperus osteosperma	9	5	3.87	.98
B	Pinus edulis	4	3	3.23	4.44
Total for Browse		16	11	7.12	5.63

CANOPY COVER, LINE INTERCEPT--

Management unit 16R, Study no: 18

Species	Percent Cover	
	'05	'08
Artemisia nova	.35	.35
Juniperus osteosperma	4.40	1.31
Pinus edulis	5.73	4.58

POINT-QUARTER TREE DATA--

Management unit 16R, Study no: 18

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	293	128	6.3	5.0
Pinus edulis	45	31	5.7	4.2

BASIC COVER--

Management unit 16R, Study no: 18

Cover Type	Average Cover %	
	'05	'08
Vegetation	32.23	37.31
Rock	1.98	2.25
Pavement	16.88	16.79
Litter	36.46	40.95
Cryptogams	.20	.06
Bare Ground	26.15	15.72

SOIL ANALYSIS DATA --

Management unit 16R, Study no: 18, Study Name: Cedar Mtn Dixie

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.7	7.7	32.0	45.4	22.6	5.1	15.1	233.6	0.6

PELLET GROUP DATA--

Management unit 16R, Study no: 18

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	72	64	-	-
Elk	48	23	12 (30)	5 (12)
Deer	15	18	15 (38)	4 (10)
Cattle	7	3	-	-

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 18

		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	60	0	33	67	-	0	0	0	17/31	
08	40	0	50	50	-	50	50	0	18/29	
<i>Artemisia tridentata vaseyana</i>										
05	0	0	0	-	-	0	0	0	16/23	
08	20	0	100	-	-	100	0	0	20/25	
<i>Chrysothamnus nauseosus</i>										
05	0	0	0	-	-	0	0	0	33/33	
08	0	0	0	-	-	0	0	0	-/-	
<i>Ephedra viridis</i>										
05	0	0	0	-	-	0	0	0	26/27	
08	0	0	0	-	-	0	0	0	23/33	
<i>Gutierrezia sarothrae</i>										
05	0	0	0	-	-	0	0	0	-/-	
08	0	0	0	-	-	0	0	0	13/16	
<i>Juniperus osteosperma</i>										
05	200	50	40	10	60	0	0	10	-/-	
08	120	67	17	17	-	0	0	17	-/-	
<i>Pinus edulis</i>										
05	80	0	100	-	-	0	0	0	-/-	
08	60	0	100	-	20	0	0	0	-/-	
<i>Purshia tridentata</i>										
05	0	0	0	-	-	0	0	0	26/57	
08	0	0	0	-	-	0	0	0	27/67	

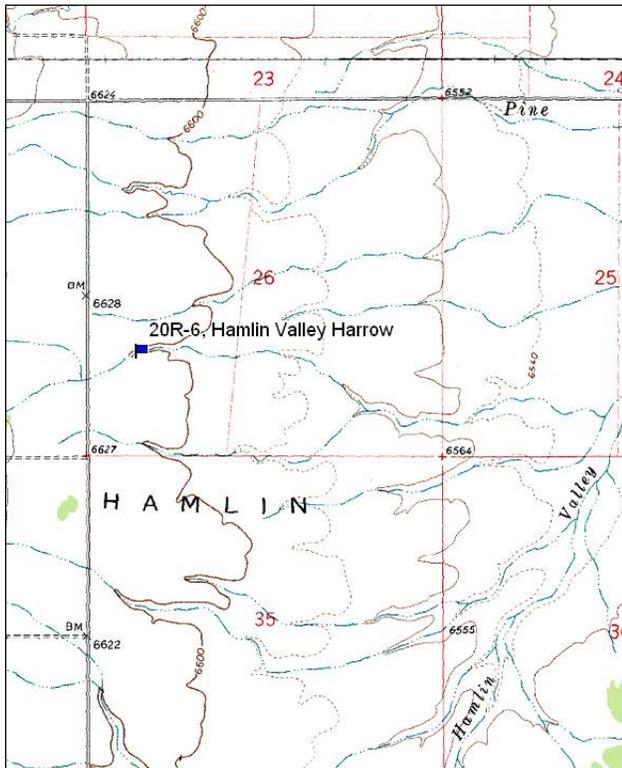
HAMLIN VALLEY HARROW - TREND STUDY NO. 20R-6-08
Project #1185

Vegetation Type: Wyoming Big Sagebrush
Range Type: Substantial Deer Summer, Substantial Elk Year-Long
NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)
Land Ownership: Private
Elevation: 6,627 ft. (2,020 m)
Aspect: East
Slope: 0-1%
Transect bearing: 163° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5(95ft)

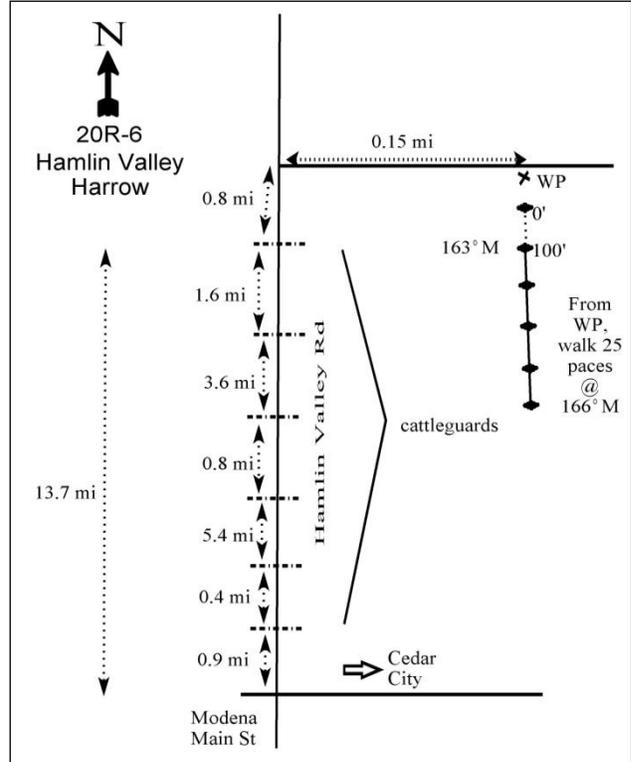
Directions:

From Modena Main Street, proceed north onto Hamblin Valley Road, driving 0.9 miles passed the turnoff to Cedar City to a cattle guard. Drive 0.4 miles to another cattle guard, and 5.4 miles to the next. Continue 0.8 miles, 3.6 miles, and 1.6 miles to each of the next cattle guards. Drive 0.8 miles to a road on the right and drive 0.15 miles on this road to the witness post. The 0' stake is 25 paces from the witness post at 166°M. The 0' stake is marked with browse tag #101.

Map Name: Eightmile Spring



Diagrammatic Sketch:



Township: 32S Range: 19W Section: 26

GPS: NAD 83, UTM 12T 241035 E 4208561 N

HAMLIN VALLEY HARROW - WRI STUDY 20R-6
[Project #1185](#)

Site Description

Site Information: The study is located approximately thirteen miles north of Modena, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, on the south end of Hamlin Valley, on private land. The study was established in 2008, prior to treatment, to monitor the effects of a two-way Dixie harrow project. The harrow project treated 560 acres in two phases. The first phase was treated in the fall of 2008, which consisted of 240 acres that were two-way Dixie harrowed in a mosaic pattern. During the second pass, a seed mix of grass and forb species was broadcast seeded (Table - Seed Mix). The second phase was treated in the same manner as the first; however, 320 acres were treated in the fall of 2009. The study site was treated in the second phase. The objectives of the project are to reduce sagebrush cover, increase soil stability, and increase the diversity of the herbaceous understory (WRI Database 2011). Pellet group data estimated light use by cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 20R, Study no: 6

Project Name: Hamlin Valley			
WRI Database #: 1185			
Application: Broadcast seeded		Acres: 320	
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Nordan'	250	0.78
G	Great Basin Wildrye 'Trailhead'	200	0.63
G	Indian Ricegrass 'Rimrock'	350	1.09
G	Intermediate Wheatgrass 'Oahe'	300	0.94
G	Pubescent Wheatgrass 'Luna'	350	1.09
G	Russian Wildrye 'Bozoisky'	350	1.09
G	Sandberg Bluegrass	150	0.47
G	Siberian Wheatgrass 'Vavilov'	200	0.63
G	Western Wheatgrass 'Arriba'	650	2.03
F	Alfalfa 'Ladak'	100	0.31
F	Alfalfa 'Ranger'	200	0.63
F	Blue Flax 'Appar'	100	0.31
F	Cicer Milkvetch 'Lutana'	150	0.47
F	Sainfoin 'Eski'	850	2.66
F	Small Burnet 'Delar'	650	2.03
F	Yellow Sweetclover	100	0.31
Total Pounds:		4950	15.47
PLS Pounds:			14.04

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a lightly used population with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was excellent in 2008. The overall age-class diversity of the sagebrush plants was good with a fairly even mixture of seedling, young, and mature plants within the population. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*) are common on the site. The stickyleaf low rabbitbrush exhibited moderate utilization in 2008. Other less common browse species sampled on the site include Parry rabbitbrush (*Chrysothamnus parryi*), prickly phlox (*Leptodactylon pungens*), pricklypear cactus (*Opuntia* sp.), mountain ball cactus (*Pediocactus simpsonii*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are fairly abundant and moderately diverse. The dominant grass species on the site is crested wheatgrass (*Agropyron cristatum*), which provides the majority of the grass cover. Sandberg bluegrass (*Poa secunda*) is also fairly common on the site. Other perennial grass species sampled on the site included blue grama (*Bouteloua gracilis*), prairie junegrass (*Koeleria cristata*), and Letterman's needlegrass (*Stipa lettermani*), though each of these species was sampled in low abundance. The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site in low abundance and provided little cover. Forbs are not particularly abundant, but are fairly diverse. The most common forb species sampled on the site was longleaf phlox (*Phlox longifolia*) (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is high, but a high amount of pavement and moderate amount of litter and vegetation provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to surface litter, rock, and soil movement; pedestalling, flow patterns, and rills.

HERBACEOUS TRENDS--

Management unit 20R, Study no: 6

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Agropyron cristatum</i>	219	8.36
G	<i>Bouteloua gracilis</i>	9	.19
G	<i>Bromus tectorum</i> (a)	5	.01
G	<i>Koeleria cristata</i>	14	.72
G	<i>Poa secunda</i>	109	2.01
G	<i>Stipa lettermani</i>	6	.21
Total for Annual Grasses		5	0.01
Total for Perennial Grasses		357	11.51
Total for Grasses		362	11.53
F	<i>Astragalus convallarius</i>	1	.03
F	<i>Astragalus utahensis</i>	4	.01
F	<i>Crepis acuminata</i>	1	.00
F	<i>Cryptantha</i> sp.	7	.03
F	<i>Cymopterus</i> sp.	12	.04
F	<i>Erigeron pumilus</i>	16	.09
F	<i>Eriogonum</i> sp.	1	.00
F	<i>Lupinus argenteus</i>	-	.15
F	<i>Lygodesmia</i> sp.	5	.04
F	<i>Microsteris gracilis</i> (a)	1	.00
F	<i>Oenothera</i> sp.	3	.00
F	<i>Penstemon</i> sp.	8	.02
F	<i>Phlox austromontana</i>	33	.65
F	<i>Phlox longifolia</i>	130	.45
F	<i>Ranunculus testiculatus</i> (a)	2	.00
F	<i>Sphaeralcea coccinea</i>	2	.00
F	<i>Trifolium</i> sp.	14	.04
Total for Annual Forbs		3	0.00
Total for Perennial Forbs		237	1.60
Total for Forbs		240	1.61

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

BROWSE TRENDS--

Management unit 20R, Study no: 6

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia tridentata wyomingensis	82	14.88
B	Chrysothamnus parryi	11	.33
B	Chrysothamnus viscidiflorus	36	1.53
B	Gutierrezia sarothrae	81	2.77
B	Leptodactylon pungens	6	.18
B	Tetradymia canescens	1	-
Total for Browse		217	19.71

CANOPY COVER, LINE INTERCEPT--

Management unit 20R, Study no: 6

Species	Percent Cover '08
Artemisia tridentata wyomingensis	11.85
Chrysothamnus viscidiflorus	.40
Gutierrezia sarothrae	1.53
Leptodactylon pungens	.06

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 20R, Study no: 6

Species	Average leader growth (in) '08
Artemisia tridentata wyomingensis	0.8

BASIC COVER--

Management unit 20R, Study no: 6

Cover Type	Average Cover % '08
Vegetation	30.75
Rock	.36
Pavement	23.79
Litter	23.32
Cryptogams	.40
Bare Ground	38.62

SOIL ANALYSIS DATA --

Management unit 20R, Study no: 6, Study Name: Hamblin Valley Harrow

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
6.8		42.0	28.4	29.6	0.8	6.3	243.2	0.8

PELLET GROUP DATA--

Management unit 20R, Study no: 6

Type	Quadrat Frequency	Days use per acre (ha)
	'08	'08
Rabbit	60	-
Cattle	3	14 (34)

BROWSE CHARACTERISTICS--

Management unit 20R, 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>									
08	5040	41	46	13	3600	8	.79	8	25/37
<i>Chrysothamnus parryi</i>									
08	520	15	85	-	-	0	0	0	4/12
<i>Chrysothamnus viscidiflorus</i>									
08	1280	5	91	5	20	30	28	3	6/12
<i>Gutierrezia sarothrae</i>									
08	9640	4	91	5	42780	1	1	3	6/6
<i>Leptodactylon pungens</i>									
08	220	0	91	9	-	9	0	0	4/9
<i>Opuntia sp.</i>									
08	0	0	0	-	-	0	0	0	4/4
<i>Pediocactus simpsonii</i>									
08	0	0	0	-	20	0	0	0	1/3
<i>Tetradymia canescens</i>									
08	20	0	100	-	-	0	0	0	6/7

WIDE CANYON BULLHOG - TREND STUDY NO. 21R-2-08

Project #85

Vegetation Type: Pinyon-Juniper, Cliffrose

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: UDWR

Elevation: 5,680 ft. (1,731 m)

Aspect: West

Slope: 5%

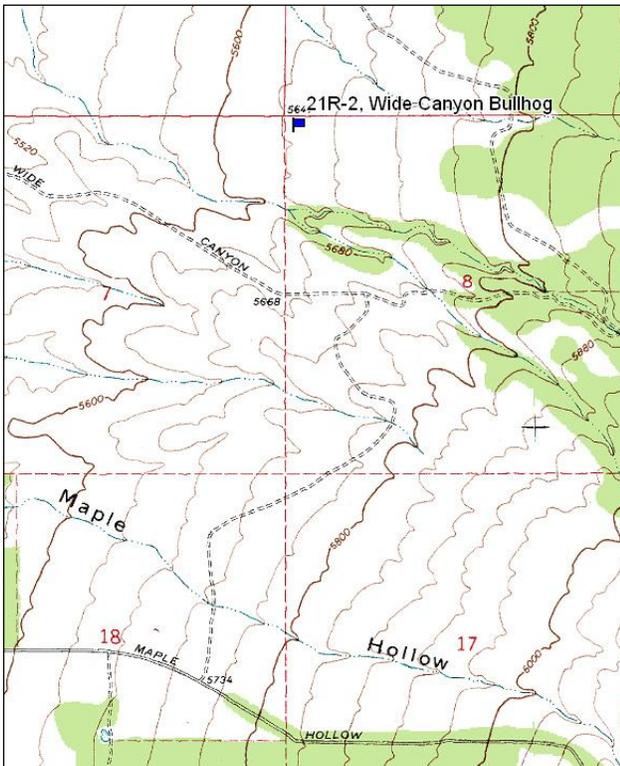
Transect bearing: 51° magnetic

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

Directions:

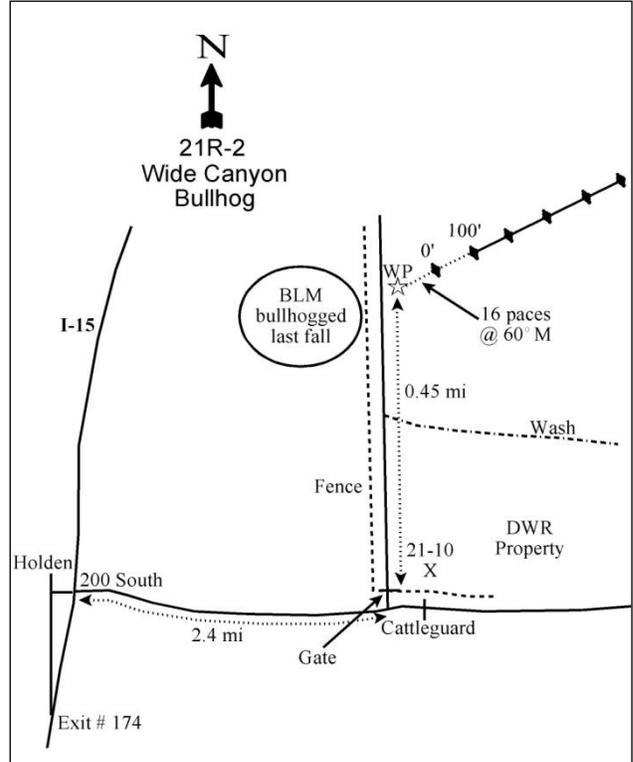
From the south Holden exit off I-15 (#174), go north into town and turn right at 200 South. Follow the road 1 block east, then north a few yards, then immediately east again up the hill to an overpass. From the overpass go 2.4 miles east to the fence corner of DWR property. Turn left passing through the gate and travel 0.45 miles to a witness post on the right side of the road. The 0-foot stake is 16 paces from the witness post at 60°M.

Map Name: Coffee Peak



Township: 20S Range: 3W Section: 8

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 394351 E 4328066 N

WIDE CANYON BULLHOG - WRI STUDY 21R-2
[Project #85](#)

Site Description

Site Information: The study is located two and a half miles east of Holden, on land managed by the Utah Division of Wildlife Resources (UDWR) for wintering mule deer and elk. The range type is an association of Utah juniper (*Juniperus osteosperma*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), and a perennial grass understory. The study was established in 2004, prior to treatment, to monitor the effects of bullhog project to remove encroaching juniper trees. The Fillmore Wildlife Management Area (WMA) Bullhog study, like much of the area along the west side of the Pahvant Range, was cabled, chained and/or hula dozed in the late 1950's. Over the years, juniper encroachment has begun to crowd out important forage species for wintering mule deer. A 650 acre bullhog treatment was completed in April of 2005. No seed mix was applied to the treated area due to the good herbaceous understory growth. The objectives of the project are to improve crucial elk and mule deer winter range habitat by removing juniper trees to promote herbaceous understory growth, and increase preferred browse species on the site. The land to the west is managed by the Bureau of Land Management and was bullhogged during the fall of 2003 (WRI Database 2011). Pellet group data estimated heavy use by deer, and light use by elk and cattle in 2004 and 2008. Estimated use by deer was particularly heavy in 2004 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are Wyoming big sagebrush, Stansbury cliffrose, true mountain mahogany (*Cercocarpus montanus*), and antelope bitterbrush (*Purshia tridentata*). The key browse species on the site is Wyoming big sagebrush. The sagebrush is a moderate to heavily used population, with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population has been good since the treatment; however, recruitment was poor prior to the treatment. The Stansbury cliffrose and antelope bitterbrush are relatively small, healthy populations with low decadence and good vigor within the population. Utilization of cliffrose and bitterbrush has been mostly heavy since the outset of the study. Other species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and prickly phlox (*Leptodactylon pungens*) (Table - Browse Characteristics). Utah juniper trees were substantially reduced, but are still present on the site in low density (Table - Point-Quarter Tree Data).

Herbaceous Understory: Grasses are abundant and fairly diverse. The invasive perennial species bulbous bluegrass (*Poa bulbosa*) is the dominant grass species which has provided the majority of the cover since the outset of the study. Other common perennial grass species sampled on the site include intermediate wheatgrass (*Agropyron intermedium*) and bluebunch wheatgrass (*A. spicatum*). The annual grass species cheatgrass (*Bromus tectorum*) has been sampled on the site with moderate abundance over the sample years. Forbs were rare on the site prior to the treatment, but diversity increased following the treatment. Cover of perennial forbs increased following the treatment, but still remains relatively low (Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is low, 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. Four Years Post Treatment, 2004 vs. 2008

Browse: The density of Wyoming big sagebrush decreased 21% from 1,060 plants/acre to 840 plants/acre, and canopy cover decreased from 4% to 3%. Decadence and poor vigor remained high with little change within the sagebrush population. The density and canopy cover of Stansbury cliffrose remained similar. The weedy browse specie broom snakeweed increased seven-fold from 620 plants/acre to 4,360 plants/acre, and cover increased from less than 1% to 4%. Utah juniper decreased in density from 72 trees/acre to 35 trees/acre, and canopy cover decreased from 14% to 0%.

Grasses: The sum of nested frequency of perennial grasses slightly increased by 17%, and cover increased from 36% to 40%. Bluebunch wheatgrass and intermediate wheatgrass significantly increased in nested frequency, and cover increased from 3% to 7% and 2% to 5%, respectively. Bulbous bluegrass remained similar in nested frequency, but cover decreased slightly from 30% to 27%. The nested frequency of cheatgrass significantly increased and cover increased from 3% to 5%.

Forbs: Forbs remained fairly rare on the site, but diversity increased. The sum of nested frequency of perennial forbs increased two-fold, and cover remained similar at 1%. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--

Management unit 21R, Study no: 2

Type	Species	Nested Frequency		Average Cover %	
		'04	'08	'04	'08
G	Agropyron cristatum	_b 38	_a 9	1.14	.28
G	Agropyron intermedium	_a 82	_b 150	2.11	5.37
G	Agropyron spicatum	_a 81	_b 148	2.92	7.38
G	Bromus tectorum (a)	_a 98	_b 149	2.91	4.51
G	Poa bulbosa	403	378	29.68	26.65
G	Poa secunda	_a 10	_b 34	.19	.40
G	Sitanion hystrix	-	1	-	.03
Total for Annual Grasses		98	149	2.91	4.51
Total for Perennial Grasses		614	720	36.06	40.13
Total for Grasses		712	869	38.97	44.65
F	Alyssum alyssoides (a)	16	17	.05	.03
F	Astragalus sp.	-	1	-	.00
F	Calochortus nuttallii	-	8	-	.01
F	Collinsia parviflora (a)	5	-	.01	-
F	Convolvulus arvensis	-	7	-	.06
F	Cryptantha sp.	-	3	.00	.04
F	Descurainia pinnata (a)	-	4	-	.00
F	Erodium cicutarium (a)	_a 4	_b 33	.03	.27
F	Holosteum umbellatum (a)	5	-	.01	-
F	Lactuca serriola (a)	-	4	-	.15
F	Petradoria pumila	20	20	.55	.72
F	Phlox austromontana	12	15	.10	.11
F	Ranunculus testiculatus (a)	_b 18	_a 7	.04	.04
F	Sphaeralcea coccinea	-	3	-	.00
F	Streptanthus cordatus	1	-	.00	-
F	Tragopogon dubius (a)	_a -	_b 11	-	.26
F	Vicia americana	2	4	.00	.01
Total for Annual Forbs		48	76	0.14	0.76
Total for Perennial Forbs		35	61	0.66	0.97
Total for Forbs		83	137	0.80	1.74

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

BROWSE TRENDS--

Management unit 21R, Study no: 2

Type	Species	Strip Frequency		Average Cover %	
		'04	'08	'04	'08
B	Artemisia tridentata wyomingensis	34	29	3.29	2.88
B	Cercocarpus montanus	0	1	-	-
B	Chrysothamnus viscidiflorus	18	17	.40	.88
B	Cowania mexicana stansburiana	8	8	2.79	2.73
B	Gutierrezia sarothrae	18	48	.26	4.30
B	Juniperus osteosperma	4	0	10.50	-
B	Leptodactylon pungens	13	13	.43	.69
B	Purshia tridentata	1	1	.38	.15
Total for Browse		96	117	18.07	11.63

CANOPY COVER, LINE INTERCEPT--

Management unit 21R, Study no: 2

Species	Percent Cover	
	'04	'08
Artemisia tridentata wyomingensis	4.44	2.75
Chrysothamnus viscidiflorus	1.33	1.35
Cowania mexicana stansburiana	5.00	4.68
Gutierrezia sarothrae	.40	3.83
Juniperus osteosperma	14.43	-
Leptodactylon pungens	.31	.30
Purshia tridentata	.31	.20

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 21R, Study no: 2

Species	Average leader growth (in)	
	'04	'08
Artemisia tridentata wyomingensis	1.5	2.1
Cowania mexicana stansburiana	3.4	3.5

POINT-QUARTER TREE DATA--

Management unit 21R, Study no: 2

Species	Trees per Acre		Average diameter (in)	
	'04	'08	'04	'08
Juniperus osteosperma	72	35	6.1	2.8

BASIC COVER--

Management unit 21R, Study no: 2

Cover Type	Average Cover %	
	'04	'08
Vegetation	56.72	56.37
Rock	1.56	1.09
Pavement	3.18	3.03
Litter	32.65	43.11
Cryptogams	1.07	2.37
Bare Ground	18.92	9.10

SOIL ANALYSIS DATA --

Management unit 21R, Study no: 2, Study Name: Fillmore WMA Bullhog

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.4	7.2	48.4	22.1	29.5	2.7	9.4	188.8	0.6

PELLET GROUP DATA--

Management unit 21R, Study no: 2

Type	Quadrat Frequency		Days use per acre (ha)	
	'04	'08	'04	'08
Rabbit	42	52	-	-
Elk	-	2	5 (12)	1 (2)
Deer	51	42	190 (469)	66 (162)
Cattle	5	2	11 (27)	4 (11)

BROWSE CHARACTERISTICS--
Management unit 21R, 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>									
04	1060	4	57	40	-	34	49	32	28/34
08	840	12	48	40	140	10	38	36	23/30
<i>Cercocarpus montanus</i>									
04	0	0	0	-	-	0	0	0	-/-
08	20	100	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus</i>									
04	420	0	95	5	-	10	5	0	11/19
08	460	9	87	4	40	26	17	0	15/26
<i>Cowania mexicana stansburiana</i>									
04	220	18	82	-	-	0	100	0	75/81
08	200	10	90	-	40	10	50	0	77/97
<i>Ephedra nevadensis</i>									
04	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	100/96
<i>Gutierrezia sarothrae</i>									
04	620	39	61	0	-	0	0	0	8/8
08	4360	3	94	3	220	0	0	.91	9/14
<i>Juniperus osteosperma</i>									
04	80	0	100	-	-	25	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
<i>Leptodactylon pungens</i>									
04	540	0	100	-	-	0	0	0	6/11
08	660	0	100	-	-	0	0	0	9/13
<i>Purshia tridentata</i>									
04	20	0	100	-	-	0	100	0	40/59
08	20	0	100	-	-	0	100	0	32/69

DRY CREEK - TREND STUDY NO. 21R-3-08

[Project #86](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Mountain Big Sagebrush\), R028AY334UT](#)

Land Ownership: Private

Elevation: 5,220 ft. (1,591 m)

Aspect: Northwest

Slope: 4%

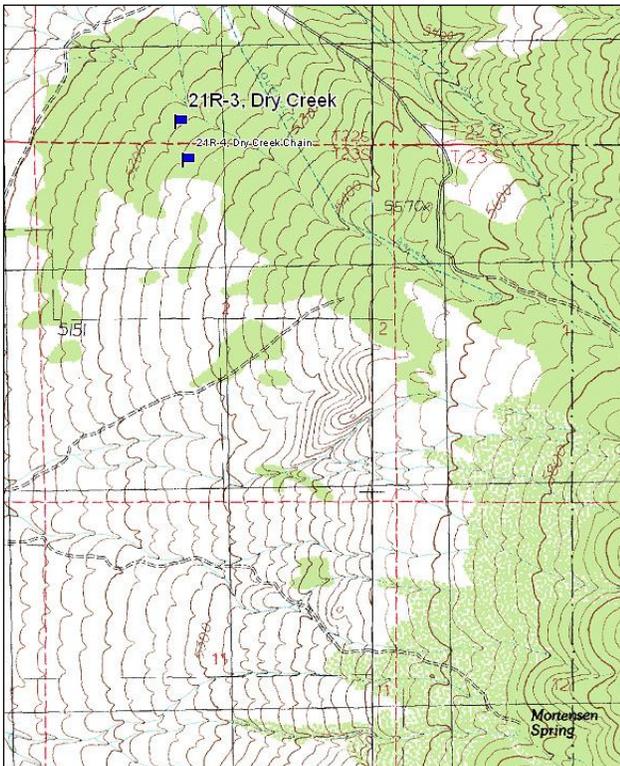
Transect bearing: 145° magnetic

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

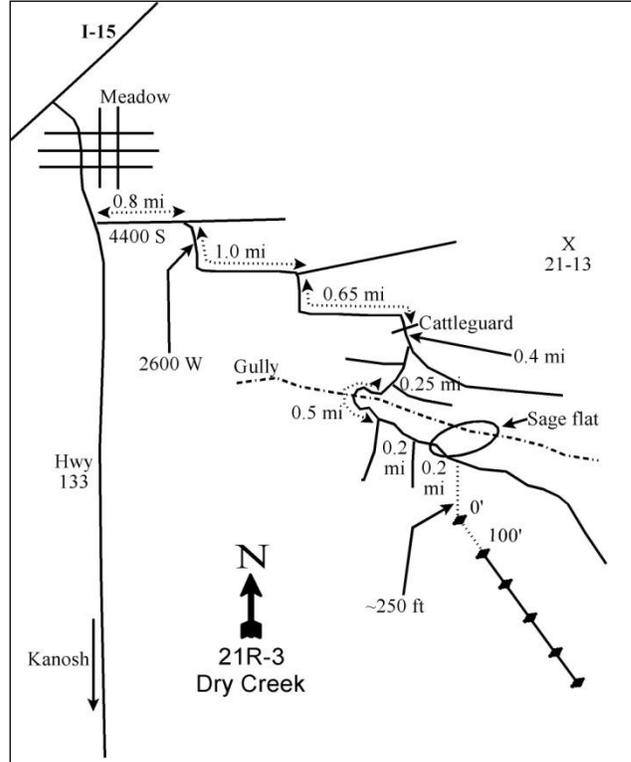
Directions:

Go south from Meadow (southwest of Fillmore) on SR 133 to mile marker 6. Go approximately 0.05 miles further south on SR 133 and turn east on a gravel road (4400 South). Go east 0.8 miles to a junction. Turn right onto 200 West and follow this road for 1 mile around several bends until the main road turns back to the south. Follow this main road for another 0.65 miles to a cattleguard. Continue 0.4 miles to a road that will come in on the right. Turn right onto this road and drive 0.25 miles staying left at the first fork and going right at the second fork. From the second fork continue 0.5 miles around a 90 degree bend to another fork. From this fork stay left and continue 0.2 miles staying to the left. From this point use the GPS and walk to the 0-foot stake.

Map Name: Kanosh



Diagrammatic Sketch:



Township: 22S Range: 5W Section: 35

GPS: NAD 83, UTM 12S 379727 E 4300833 N

DRY CREEK - WRI STUDY 21R-3

[Project #86](#)

Site Description

Site Information: The study is located approximately three miles southeast of Meadow, within a Utah juniper (*Juniperus osteosperma*) woodland, on private land. The study was originally established, in 2004, to monitor The Dry Creek chaining project, but was not treated; as a result a new study was established Dry Creek Chaining 21R-4 within the chaining treatment. This study site is a reference site for the treated area. The treated site was two-way Ely chained in the winter of 2006-07 and seed was aurally applied between chaining passes. The objectives of the project are to improve winter range conditions for mule deer and elk by increasing the diversity of vegetation on the site while maintaining adequate escape cover, and to establish vegetation to protect soil from erosion and improve water infiltration and retention (WRI Database 2011). Between the 2004 and 2008 sample years, a small fire burnt several trees between belt one and belt three. In 2004, pellet group data estimated light use by deer and elk. In 2008, use was estimated to be heavy for deer, and light for elk and cattle (Table - Pellet Group Data).

Browse: The preferred browse species on the site is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). The Wyoming big sagebrush is a relatively small population, with high decadence and poor vigor within the population. Utilization of sagebrush plants has been moderate to heavy over the sample years. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*), and sumac (*Rhus sp.*) (Table - Browse Trends). Utah juniper was a dense population at the outset of the study, but density was reduced following the fire (Table - Point-Quarter Tree Data). Canopy cover of juniper was also reduced by the fire, but remained the dominant browse cover on the site (Table - Canopy Cover).

Herbaceous Understory: The herbaceous understory is dominated by the weedy annual species cheatgrass (*Bromus tectorum*), which has provided the majority of the herbaceous cover since the outset of the study. Perennial grass species are rare on the site. Sandberg bluegrass is the most common perennial grass species sampled on the site. Forbs are rare on the site, and the composition of forb species is dominated by annual species (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a neutral soil reaction (pH 6.6) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter, vegetation, cryptogams, and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in all sample years.

Trend Assessments

Browse

- **2004 to 2008 - down (-2):** The density of Wyoming big sagebrush decreased 58% from 240 plants/acre to 100 plants/acre, and canopy cover decreased from 1% to near 0%. Decadence of sagebrush decreased from 83% to 60%, but is still considered high. Poor vigor within the population of sagebrush increased from 50% to 60%. Utah juniper decreased in density from 346 trees/acre to 92 trees/acre and canopy cover decreased from 39% to 26%. The decrease in density and canopy cover of Utah juniper resulted from a fire that burnt part of the site between belts one and belt three.

Grass

- **2004 to 2008 - slightly down (-1):** Perennial grass remained rare on the site. The sum of nested frequency of perennial grasses significantly decreased 24%, and cover decreased from 2% to 1%. The sum of nested frequency of annual grasses increased 45%, and cover increased from 25% to 27%. The nested frequency and cover measurements of cheatgrass remained similar. Sixweeks fescue (*Vulpia octoflora*) significantly increased in nested frequency and cover increased from near 0% to 2%.

Forb

- **2004 to 2008 - stable (0):** Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs significantly increased seven-fold and cover increased to 1%.

HERBACEOUS TRENDS--

Management unit 21R, Study no: 3

T y p e	Species	Nested Frequency		Average Cover %	
		'04	'08	'04	'08
G	<i>Aristida purpurea</i>	-	7	-	.33
G	<i>Bromus tectorum</i> (a)	422	441	24.74	24.49
G	<i>Festuca ovina</i>	5	-	.00	-
G	<i>Poa secunda</i>	99	73	1.53	1.00
G	<i>Sitanion hystrix</i>	4	2	.04	.03
G	<i>Vulpia octoflora</i> (a)	_a 4	_b 177	.01	2.36
Total for Annual Grasses		426	618	24.75	26.85
Total for Perennial Grasses		108	82	1.58	1.36
Total for Grasses		534	700	26.34	28.22
F	<i>Alyssum alyssoides</i> (a)	_a 6	_b 66	.01	.37
F	<i>Descurainia pinnata</i> (a)	2	-	.00	-
F	<i>Draba</i> sp. (a)	5	9	.00	.02
F	<i>Erodium cicutarium</i> (a)	_a -	_b 23	-	.27
F	<i>Gilia</i> sp. (a)	3	4	.01	.00
F	<i>Holosteum umbellatum</i> (a)	-	9	-	.02
F	<i>Lactuca serriola</i> (a)	-	6	-	.02
F	<i>Microsteris gracilis</i> (a)	_a 4	_b 30	.01	.06
F	<i>Polygonum douglasii</i> (a)	1	7	.00	.02
F	<i>Ranunculus testiculatus</i> (a)	_a 2	_b 16	.01	.06
F	<i>Tragopogon dubius</i> (a)	-	2	-	.00
Total for Annual Forbs		23	172	0.05	0.86
Total for Perennial Forbs		0	0	0	0
Total for Forbs		23	172	0.05	0.86

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

BROWSE TRENDS--

Management unit 21R, Study no: 3

T y p e	Species	Strip Frequency		Average Cover %	
		'04	'08	'04	'08
B	<i>Artemisia tridentata wyomingensis</i>	11	5	.68	.03
B	<i>Gutierrezia sarothrae</i>	3	4	.38	.21
B	<i>Juniperus osteosperma</i>	21	12	7.12	10.71
B	<i>Rhus</i> sp.	0	1	-	-
Total for Browse		35	22	8.18	10.95

CANOPY COVER, LINE INTERCEPT--

Management unit 21R, Study no: 3

Species	Percent Cover	
	'04	'08
Artemisia tridentata wyomingensis	.45	-
Gutierrezia sarothrae	-	.06
Juniperus osteosperma	39.00	26.43

POINT-QUARTER TREE DATA--

Management unit 21R, Study no: 3

Species	Trees per Acre		Average diameter (in)	
	'04	'08	'04	'08
Juniperus osteosperma	346	92	6.9	10.8

BASIC COVER--

Management unit 21R, Study no: 3

Cover Type	Average Cover %	
	'04	'08
Vegetation	33.34	39.01
Rock	8.55	9.57
Pavement	3.32	3.90
Litter	52.87	46.00
Cryptogams	3.18	8.37
Bare Ground	16.13	7.41

SOIL ANALYSIS DATA --

Management unit 21R, Study no: 3, Study Name: Dry Creek

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
8.5	6.6	61.4	25.1	13.5	1.9	14.2	134.4	0.6

PELLET GROUP DATA--

Management unit 21R, Study no: 3

Type	Quadrat Frequency		Days use per acre (ha)	
	'04	'08	'04	'08
Rabbit	21	53	-	-
Elk	7	2	8 (20)	4 (10)
Deer	16	37	13 (31)	116 (288)
Cattle	1	1	-	6 (14)

BROWSE CHARACTERISTICS--
Management unit 21R, 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>									
04	240	0	17	83	-	50	33	50	17/22
08	100	0	40	60	-	20	60	60	15/17
<i>Gutierrezia sarothrae</i>									
04	60	0	100	-	-	0	0	0	9/12
08	140	0	100	-	-	0	0	0	10/12
<i>Juniperus osteosperma</i>									
04	520	50	50	0	20	0	4	4	-/-
08	320	31	63	6	40	0	0	6	-/-
<i>Rhus sp.</i>									
04	0	0	0	-	-	0	0	0	-/-
08	20	100	0	-	-	0	0	0	7/11

GILSON MOUNTAIN SAGE-GROUSE - TREND STUDY NO. 21R-7-08

[Project #1103](#)

Vegetation Type: Annual Grass

Range Type: Deer Winter/Spring

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#)

Land Ownership: Private

Elevation: 5,350 ft. (1,631 m)

Aspect: Northwest

Slope: 6%

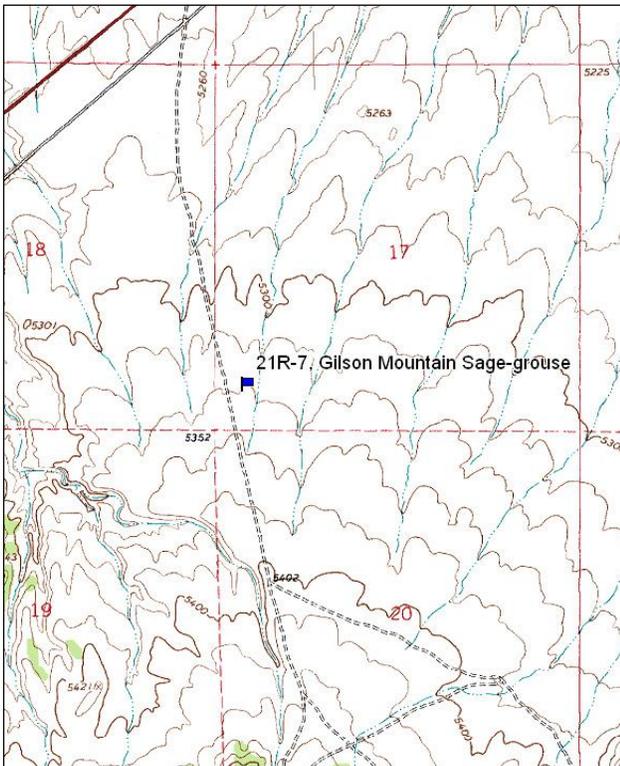
Transect bearing: 0° magnetic

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

Directions:

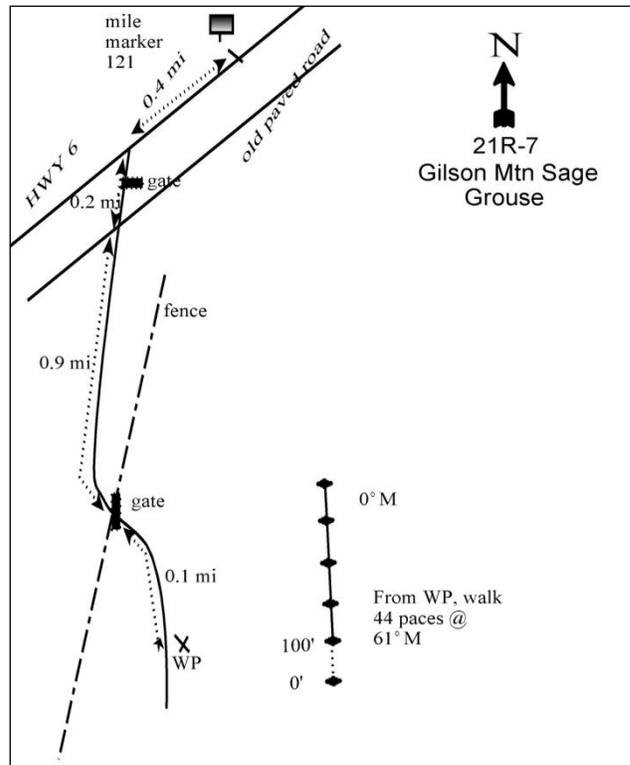
Drive south on Hwy 6 for 0.4 miles passed mile marker 21 to a gate on the left. From the gate, drive 0.2 miles to an old paved road. Continue straight 0.9 miles to another gate. Drive 0.1 miles to the witness post on the left. The 0' stake is 44 paces from the witness post at 61°M. The 0' stake is marked with browse tag# 228.

Map Name: Jericho



Township: 13S Range: 3W Section: 17

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 395994 E 4393581 N

GILSON MOUNTAIN SAGE-GROUSE - WRI STUDY 21R-7
[Project #1103](#)

Site Description

Site Information: The study is located approximately fourteen mile northeast of Lynndyl, in a historic Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, on the north side of the Gilson Mountains, on private land. The area burned in a wildfire in 1996 and has converted to mostly annual weeds. The study was established in 2008, prior to treatment, to monitor the effects of a Plateau (Imazapic) herbicide and rangeland drill seeding project. Historically, the project area was greater sage-grouse habitat, but following a wildfire, the site has since converted to cheatgrass (*Bromus tectorum*) and weedy annuals. In the beginning of September of 2008, section 17 (657 acres) of the Gilson mountain project was sprayed with plateau herbicide to control cheatgrass. Following the herbicide treatment, a seed mix of grass, forb, and browse species (Table - Seed Mix) was applied with a rangeland drill beginning in November of 2008 and finished in the spring of 2009. It was noted that grasshoppers were extremely abundant during the first growing season following the treatment. The objectives of the project are to improve sage-grouse habitat, mule deer winter range, livestock grazing and distribution (WRI Database 2011). Pellet group data estimated light use by deer and cattle in 2008 (Table- Pellet Group Data).

SEED MIX--

Management unit 21R, Study no: 7

Project Name: Gilson Mountain			
WRI Database #: 1103			
Application: Drill Seed		Acres:	640
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	650	1.02
G	Crested Wheatgrass 'Hycrest'	1900	2.97
G	Great Basin Wildrye 'Trailhead'	300	0.47
G	Pubescent Wheatgrass 'Luna'	1300	2.03
G	Russian Wildrye 'Bozoisky'	650	1.02
G	Western Wheatgrass 'Arriba'	650	1.02
F	Alfalfa 'Ladak'	950	1.48
F	Scarlet Globemallow	20	0.03
F	Yellow Sweetclover	150	0.23
B	Forage Kochia	650	1.02
B	Fourwing Saltbush	350	0.55
B	Sagebrush, Wyoming	350	0.55
Total Pounds:		7920	12.38
PLS Pounds:			10.35

Browse: Browse species are rare on the site. Wyoming big sagebrush was sampled only in the height/crown measurements. Small populations of rubber rabbitbrush (*Chrysothamnus nauseosus*) and pricklypear cactus (*Opuntia sp.*) were sampled in low abundance on the site in 2008 (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is in poor condition. Grasses are abundant, but not diverse. The invasive annual grass species cheatgrass is the dominant grass species and provides the majority of the grass cover. Perennial grass species are rare on the site and consist of western wheatgrass (*Agropyron smithii*), crested wheatgrass (*A. cristatum*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are abundant and marginally diverse, but are dominated by annual species. Perennial forbs are rare. The dominant forb species on the site is Russian thistle (*Salsola iberica*), which provided the majority of the forb cover. Desert

madwort (*Alyssum desertorum*), storksbill (*Erodium cicutarium*), and tumbled mustard (*Sisymbrium altissimum*) are also common the site (Table - Herbaceous trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 7.1). Phosphorus may have limited availability for plant growth and development at 4.8 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderate, but a moderately high amount of pavement, litter, and vegetation provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 21R, Study no: 7

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	Agropyron cristatum	4	.15
G	Agropyron smithii	23	1.33
G	Bromus tectorum (a)	344	6.50
G	Sitanion hystrix	13	.13
Total for Annual Grasses		344	6.50
Total for Perennial Grasses		40	1.61
Total for Grasses		384	8.11
F	Alyssum alyssoides (a)	24	.26
F	Alyssum desertorum (a)	312	4.03
F	Chenopodium fremontii (a)	2	.00
F	Cryptantha sp.	2	.00
F	Erodium cicutarium (a)	47	1.21
F	Lactuca serriola (a)	3	.01
F	Phlox longifolia	5	.03
F	Plantago patagonica (a)	1	.00
F	Salsola iberica (a)	452	17.84
F	Sisymbrium altissimum (a)	90	.98
F	Sphaeralcea munroana	9	.11
F	Tragopogon dubius (a)	28	.50
Total for Annual Forbs		959	24.85
Total for Perennial Forbs		16	0.14
Total for Forbs		975	25.00

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

BROWSE TRENDS--

Management unit 21R, Study no: 7

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Chrysothamnus nauseosus	1	-
B	Opuntia sp.	2	-
Total for Browse		3	0

BASIC COVER--

Management unit 21R, Study no: 7

Cover Type	Average Cover % '08
Vegetation	36.70
Rock	.33
Pavement	10.52
Litter	31.39
Cryptogams	1.07
Bare Ground	31.47

SOIL ANALYSIS DATA --

Management unit 21R, Study no: 7, Study Name: Goslin Mountain Sage-Grouse

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.1	44.0	29.4	26.6	0.7	4.8	320.0	0.6

PELLET GROUP DATA--

Management unit 21R, Study no: 7

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	3	-
Deer	3	4 (10)
Cattle	11	5 (13)

BROWSE CHARACTERISTICS--

Management unit 21R, 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		
Artemisia tridentata wyomingensis									
08	0	0	0	-	-	0	0	0	15/18
Chrysothamnus nauseosus									
08	20	0	100	-	-	0	0	100	15/21
Chrysothamnus viscidiflorus									
08	0	0	0	-	-	0	0	0	7/8
Opuntia sp.									
08	40	50	50	-	-	0	0	0	7/17

A&F AERIAL SEEDING (GIP) - TREND STUDY NO. 21R-8-08
[Project #1007](#)

Vegetation Type: Annual Grass

Range Type: Deer Winter

NRCS Ecological Site Description: [Semidesert Stony Loam \(Black Sagebrush\), R028AY252UT](#)

Land Ownership: Private

Elevation: 5,381 ft. (1,640 m)

Aspect: Flat

Slope: 0%

Transect bearing: 358° magnetic

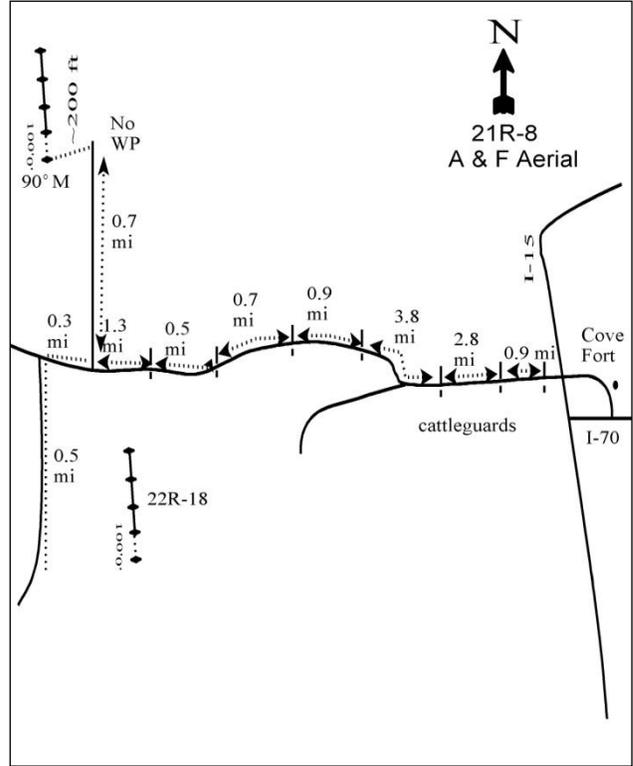
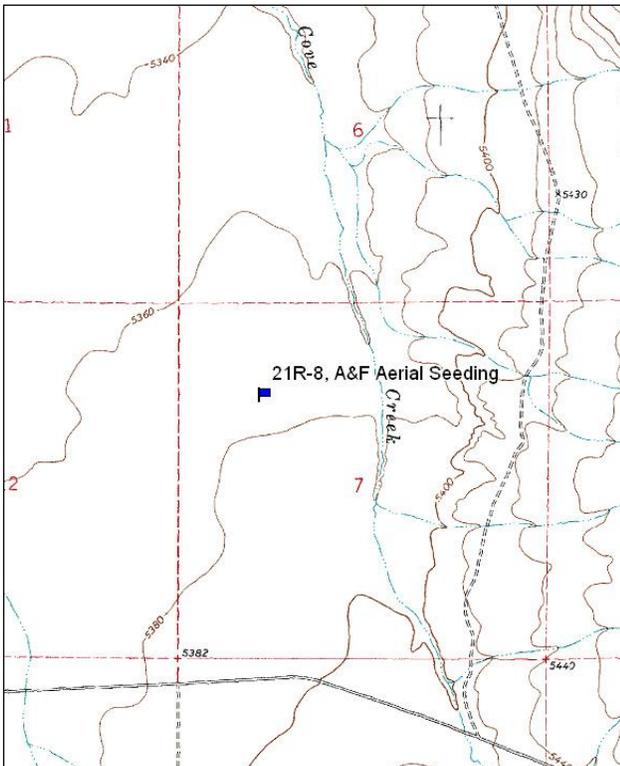
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

Take the Cove Fort exit on I-15 and proceed west on Black Rock Road for 0.9 miles to a cattle guard, and then continue 2.8 miles to the next cattle guard. Drive 3.8 miles, 0.9 miles, 0.7 miles, and 0.5 miles to the next cattle guards. From here, drive 1.3 miles to a fence line on the right. Take the road along the fence line 0.7 miles to the site. There is no witness post, so go 200 feet to the 0' stake on the left side of the road. There is no browse tag; go to the southern most white post.

Map Name: Antelope Spring

Diagrammatic Sketch:



Township: 25S Range: 8W Section: 7

GPS: NAD 83, UTM 12T 343214 E 4280040 N

A&F AERIAL SEEDING (GIP) - WRI STUDY 21R-8
[Project #1007](#)

Site Description

Site Information: The study is located approximately ten miles southeast of Black Rock, in a grass flat, north of Antelope Mountain, near Cove Creek, on private land. The study was established in 2008 to monitor the effects of a seeding treatment following the Milford Flat Fire that burned approximately 390,000 acres in the summer of 2007. Several thousand acres of private land were burned in agricultural areas as well as sagebrush steppe. Drill seeding occurred in both areas with the use of thirty foot grain drills, and aerial seeding was also applied in areas where drills could not be used. Also aerial seeding was used in an area where drill seeding was to occur, but due to timing and late winter storms in this area, the landowner and Utah Division of Wildlife Resources (UDWR) agreed that aerial seeding would be justified (Table - Seed Mix). The study site was located within the drill seed polygon. The objectives of the project are to reestablish vegetation through reseeding efforts following the wildfire of 2007, and rehabilitate crucial wildlife and livestock habitats (WRI Database 2011). Pellet group data estimated little or no use by wildlife or livestock in 2008 (Table - Pellet Group Data).

SEED MIX--
 Management unit 21R, Study no: 8

Project Name: Missouri Flat Black Rock Road 1&2			
WRI Database #: 1007			
Application: Drill seeded		Acres: 2500	
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Ephraim'	1150	0.46
G	Crested Wheatgrass 'Hycrest'	5270	2.11
G	Indian Ricegrass 'Rimrock'	700	0.28
G	Intermediate Wheatgrass 'Rush'	2750	1.10
G	Pubescent Wheatgrass	7625	3.05
G	Russian Wildrye	7677	3.07
G	Siberian Wheatgrass 'Vavilov'	1900	0.76
B	Forage Kochia	700	0.28
B	Fourwing Saltbush	700	0.28
Total Pounds:		28472	11.39
PLS Pounds:			9.76

Browse: No browse species were sampled on the study site in 2008.

Herbaceous Understory: Grasses are not very abundant or diverse. The dominant grass species on the site is galleta (*Hilaria Jamesii*) which provides the majority of the grass cover. Other perennial grass species sampled were purple three-awn (*Aristida purpurea*) and Indian ricegrass (*Oryzopsis hymenoides*). The invasive annual grass species cheatgrass was sampled in low abundance and provided very little cover on the site in 2008. Forbs are not abundant or diverse. The dominant forb species is longleaf phlox (*Phlox longifolia*) (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a neutral soil reaction (pH 7.1). Phosphorus may have limited availability for plant growth and development at 4.5 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is low with an extremely high amount of pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to surface litter, rock, and soil movement.

HERBACEOUS TRENDS--

Management unit 21R, Study no: 8

Type	Species	Nested Frequency '08	Average Cover % '08
G	Aristida purpurea	1	.03
G	Bromus tectorum (a)	4	.01
G	Hilaria jamesii	35	1.79
G	Oryzopsis hymenoides	5	.25
Total for Annual Grasses		4	0.01
Total for Perennial Grasses		41	2.07
Total for Grasses		45	2.09
F	Erodium cicutarium (a)	1	.00
F	Leucelene ericoides	7	.02
F	Phlox longifolia	84	.22
F	Sphaeralcea coccinea	3	.15
Total for Annual Forbs		1	0.00
Total for Perennial Forbs		94	0.39
Total for Forbs		95	0.40

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

BASIC COVER--

Management unit 21R, Study no: 8

Cover Type	Average Cover % '08
Vegetation	2.92
Rock	.55
Pavement	94.58
Litter	.78
Cryptogams	.98
Bare Ground	3.25

SOIL ANALYSIS DATA --

Management unit 21R, Study no: 8, Study Name: A&F Aerial Seeding

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.1	61.4	19.8	18.8	0.7	4.5	233.6	0.6

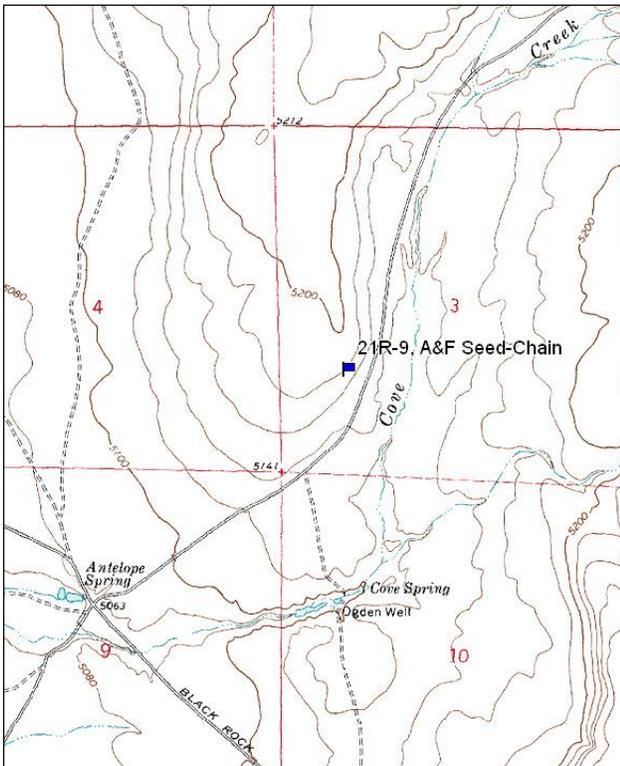
A&F SEED-CHAINING (GIP) - TREND STUDY NO. 21R-9-08
[Project #1010](#)

Vegetation Type: Grassland
Range Type: Deer Winter
NRCS Ecological Site Description: [Desert Loam \(Shadscale\), R028AY124UT](#)
Land Ownership: Private
Elevation: 5,172 ft. (1,576 m)
Aspect: East
Slope: 9%
Transect bearing: 13° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

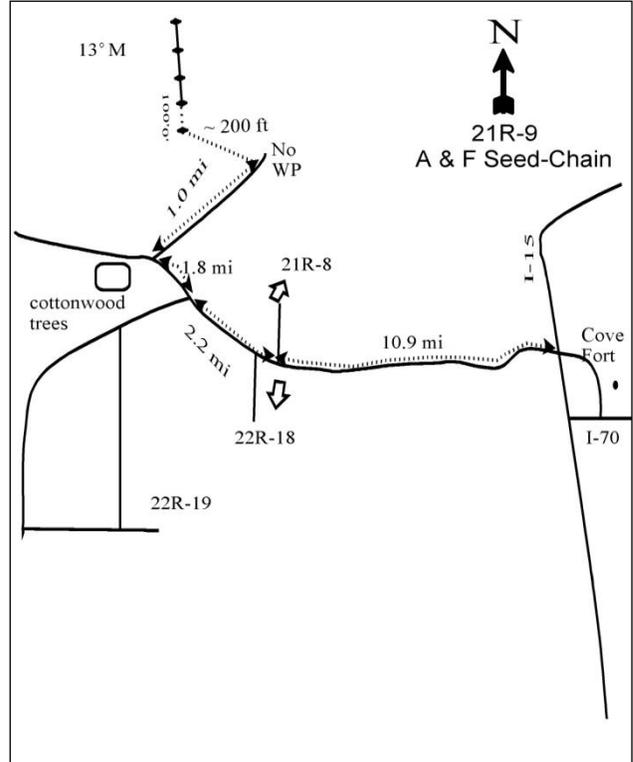
Take the Cove Fort exit on I-15 and proceed west on Black Rock Road for 0.9 miles to a cattle guard, and then continue 2.8 miles to the next cattle guard. Drive 3.8 miles, 0.9 miles, 0.7 miles, and 0.5 miles to the next cattle guards. From here, drive 1.3 miles to a fence line on the right (the turnoff to 21R-8). Drive 0.7 miles to a cattle guard, proceed 1.8 miles to a fork, and go right to another cattle guard. From here, drive 1.8 miles to a fork with some cottonwood trees, and go right 1.0 miles to the site. There is no witness post; go 200 feet to the 0' stake on the left side of the road. The 0' stake is marked with browse tag #242.

Map Name: Antelope Spring



Township: 25S Range: 9W Section: 3

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 338402 E 4281119 N

A&F SEED-CHAINING (GIP) - WRI STUDY 21R-9
[Project #1010](#)

Site Description

Site Information: The study is located approximately seven miles southeast of Black Rock, in a grass flat, north of Antelope Mountain, north of Cove Spring, on private land. The study was established in 2008 to monitor the effects of a seeding treatment following the Milford Flat Fire that burned approximately 390,000 acres in the summer of 2007. Several thousand acres of private land were burned in agricultural areas as well as sagebrush steppe. In the spring of 2008, private landowner drill seeded 530 acres with the use of a private grain drill and an additional 256 acres were aerially seeded (Table - Seed Mix). The study was located in the aerial seeded portion of the project. The objectives of the project are to reestablish vegetation through reseeding efforts following the wildfire of 2007, and rehabilitate crucial wildlife and livestock habitats (WRI Database 2011). Pellet group data estimated little or no use by wildlife or livestock in 2008, though quadrat data estimated use by rabbits to be heavy (Table - Pellet Group Data).

SEED MIX--

Management unit 21R, Study no: 9

Project Name: Milford Fire JK			
WRI Database #:1010			
Application: Aerial Seed		Acres: 270	
Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	100	0.37
G	Crested Wheatgrass 'Hycrest'	200	0.74
G	Intermediate Wheatgrass 'Oahe'	450	1.67
G	Pubescent Wheatgrass 'Luna'	600	2.22
G	Russian Wildrye	250	0.93
G	Siberian Wheatgrass 'Vavilov'	100	0.37
G	Western Wheatgrass 'Arriba'	600	2.22
F	Yellow Sweetclover	150	0.56
B	Forage Kochia	200	0.74
B	Fourwing Saltbush	100	0.37
Total Pounds:		2750	10.19
PLS Pounds:			8.68

Browse: Browse species are rare on the site. Small populations of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*) and Nevada ephedra (*Ephedra nevadensis*) occurred in low abundance on the site. Winterfat (*Ceratoides lanata*) was also sampled, but only in the height/crown measurements (Table - Browse Characteristics).

Herbaceous Understory: Grasses are marginally abundant, but are somewhat diverse. The invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species on the site. The most common perennial grass species on the site is needle-and-thread (*Stipa comata*). Other less common perennial grass species sampled on the site include purple three-awns (*Aristida purpurea*), galleta (*Hilaria jamesii*), and Indian ricegrass (*Oryzopsis hymenoides*). Forbs are moderately abundant, but are not particularly diverse. Annual forb species comprise the majority of the forb species sampled on the site and perennial forbs are rare. The dominant forb species are storksbill (*Erodium cicutarium*), whitestem mentzelia (*Mentzelia albicaulis*), and Russian thistle (*Salsola iberica*) (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is high, but a high amount of pavement and a moderate amount of rock provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 21R, Study no: 9

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Aristida purpurea</i>	4	.03
G	<i>Bromus tectorum</i> (a)	275	1.52
G	<i>Hilaria jamesii</i>	16	.51
G	<i>Oryzopsis hymenoides</i>	8	.21
G	<i>Sitanion hystrix</i>	13	.05
G	<i>Stipa comata</i>	43	1.32
G	Unknown grass - perennial	1	.00
Total for Annual Grasses		275	1.52
Total for Perennial Grasses		85	2.15
Total for Grasses		360	3.67
F	<i>Alyssum desertorum</i> (a)	8	.05
F	<i>Eriogonum cernuum</i> (a)	23	.46
F	<i>Erodium cicutarium</i> (a)	127	1.72
F	<i>Halogeton glomeratus</i> (a)	3	.00
F	<i>Lappula occidentalis</i> (a)	4	.01
F	<i>Lygodesmia</i> sp.	1	.03
F	<i>Mentzelia albicaulis</i> (a)	125	2.09
F	<i>Ranunculus testiculatus</i> (a)	3	.01
F	<i>Salsola iberica</i> (a)	24	1.66
F	<i>Sisymbrium altissimum</i> (a)	28	.35
F	<i>Sphaeralcea coccinea</i>	8	.22
Total for Annual Forbs		345	6.38
Total for Perennial Forbs		9	0.25
Total for Forbs		354	6.64

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

BROWSE TRENDS--

Management unit 21R, Study no: 9

Type	Species	Strip	Average
		Frequency	Cover %
		'08	'08
B	<i>Chrysothamnus viscidiflorus</i>	1	.03
B	<i>Ephedra nevadensis</i>	3	.15
Total for Browse		4	0.18

CANOPY COVER, LINE INTERCEPT--

Management unit 21R, Study no: 9

Species	Percent Cover '08
Ephedra nevadensis	.43

BASIC COVER--

Management unit 21R, Study no: 9

Cover Type	Average Cover % '08
Vegetation	12.82
Rock	5.80
Pavement	48.83
Litter	10.76
Bare Ground	35.24

SOIL ANALYSIS DATA --

Management unit 21R, Study no: 9, Study Name: A&F Seed Chaining

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.2	63.1	18.1	18.8	0.5	12.1	275.2	2.0

PELLET GROUP DATA--

Management unit 21R, Study no: 9

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	68	-

BROWSE CHARACTERISTICS--

Management unit 21R, Study no: 9

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Ceratoides lanata									
08	0	0	0	-	-	0	0	0	9/16
Chrysothamnus viscidiflorus									
08	40	100	0	-	-	0	0	100	-/-
Ephedra nevadensis									
08	480	0	100	-	-	0	0	75	10/19

A&F DRILL 3 (GIP) - TREND STUDY NO. 21R-10-08
[Project #1006](#)

Vegetation Type: Burn

Range Type: Deer Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Mountain Big Sagebrush\), R028AY334UT](#)

Land Ownership: Private

Elevation: 4,842 ft. (1,476 m)

Aspect: Flat

Slope: 0%

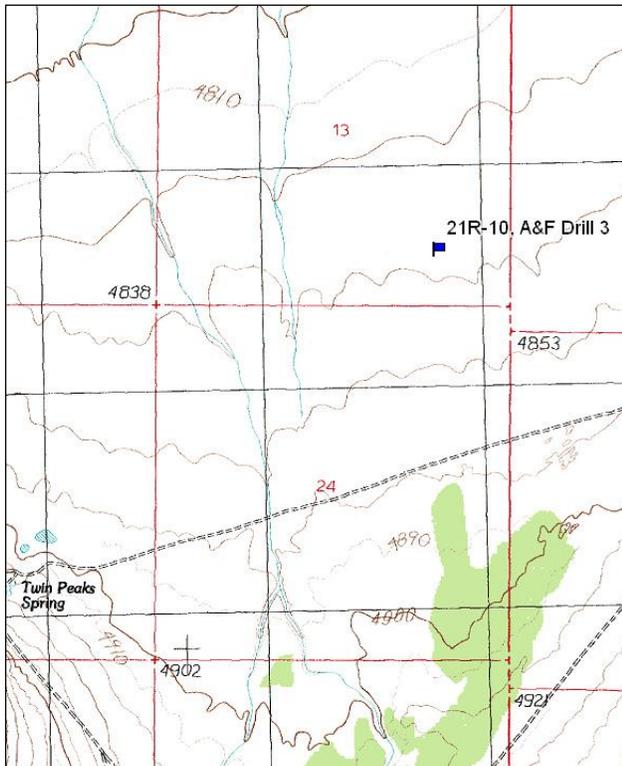
Transect bearing: 5° magnetic

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

Directions:

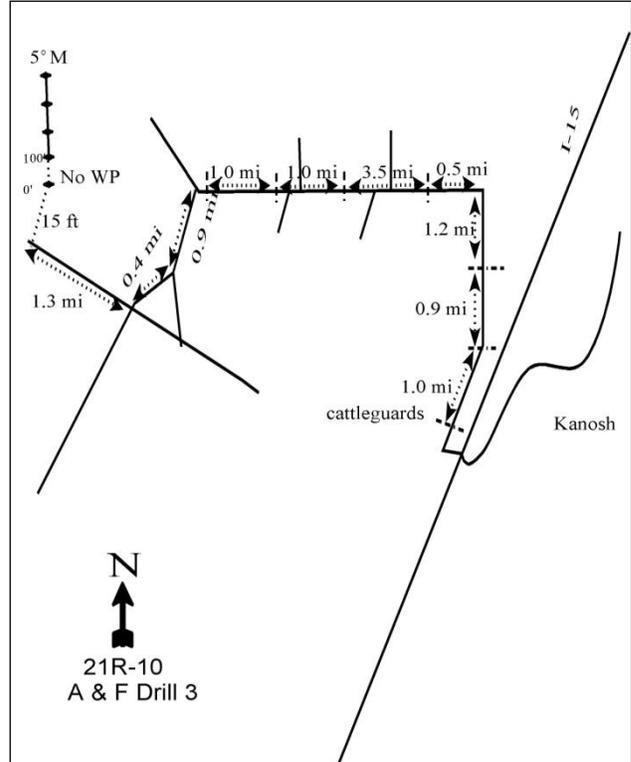
Proceed south from Kanosh on the main road. Drive under the I-15 overpass and turn right at the cattle guard (pavement ends). Go 1.0 miles to a cattle guard; continue 0.9 miles, and 0.4 miles to the next cattle guards. Drive 1.2 miles to a fork and turn left, driving 0.5 miles to a cattle guard. Continue on this road 3.5 miles, 1.0 mile, and 1.0 mile to each of the next cattle guards. Go left at the fork and drive 0.9 miles to another fork, keeping right. Drive 0.4 miles to a faint 2-track on the right. Follow the 2-track 1.3 miles to the site. There is no witness post; go 15 feet to the 0' stake on the right side of the road. The 0' stake is marked with browse tag #273.

Map Name: Black Point



Township: 23S Range: 8W Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 352720 E 4296793 N

A&F DRILL 3 (GIP) - WRI STUDY 21R-10
[Project #1006](#)

Site Description

Site Information: The study is located approximately sixteen miles west of Meadow, in a Russian thistle (*Salsola iberica*) flat, northwest of Lava Ridge, on private land. The study was established in 2008 to monitor the effects of a seeding treatment following the Milford Flat Fire that burned approximately 390,000 acres in the summer of 2007. Several thousand acres of private land were burned in agricultural areas as well as sagebrush steppe. In the fall of 2007, a total of 2,897 acres were seeded using a rangeland drill. The seed mix consisted of grass and browse species (Table - Seed Mix). The objectives of the project are to reestablish vegetation through reseeding efforts following the wildfire of 2007, and rehabilitate crucial wildlife and livestock habitats (WRI Database 2011). Pellet group data estimated little or no use by wildlife or livestock in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 21R, Study no: 10

Project Name: Milford Flat Fire B. George (Mix A&B)			
WRI Database #: 1006			
Application: Drill Seed		Acres:	2897
Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	550	0.19
G	Crested Wheatgrass 'Douglas'	3800	1.31
G	Crested Wheatgrass 'Hycrest'	1400	0.48
G	Crested Wheatgrass 'Nordan'	3750	1.29
G	Indian Ricegrass 'Rimrock'	1950	0.67
G	Russian Wildrye	5600	1.93
G	Siberian Wheatgrass 'Vavilov'	4325	1.49
G	Thickspike Wheatgrass 'Critana'	2850	0.98
G	Western Wheatgrass 'Arriba'	4850	1.67
B	Forage Kochia 'Immigrant'	900	0.31
B	Fourwing Saltbush	981	0.34
Total Pounds:		30956	10.69
PLS Pounds:			9.13

Browse: Browse species are rare on the site. The seeded species forage kochia (*Kochia prostrata*) was the only browse species sampled on the site in 2008, though occurring in very low abundance (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is in poor condition. Grasses are extremely rare on the site. Needle-and-thread (*Stipa comata*) and an unknown perennial species of grass were the only perennial grass species sampled on the site in 2008, though each species was very rare. The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in very low abundance. Forbs are abundant, but are not diverse. Perennial forb species are rare on the site. The site is dominated by the weedy annual forb species Russian thistle (*Salsola iberica*), which was abundant on the site and provides the majority of the vegetation cover (Table - Herbaceous Trends).

Soil: According to the NRCS soil maps, the soil surface texture is a very gravelly sandy loam (Soil Survey Staff 2011). Bare ground cover is extremely high, but a moderate amount of vegetation provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008, but it was noted that wind had eroded up to two and half inches of soil from the site after the burn.

HERBACEOUS TRENDS--

Management unit 21R, Study no: 10

Type	Species	Nested Frequency '08	Average Cover % '08
G	Bromus tectorum (a)	11	.02
G	Stipa comata	1	.00
G	Unknown grass - perennial	12	.03
Total for Annual Grasses		11	0.02
Total for Perennial Grasses		13	0.03
Total for Grasses		24	0.06
F	Alyssum alyssoides (a)	5	.03
F	Alyssum desertorum (a)	70	.31
F	Amaranthus albus	2	.03
F	Halogeton glomeratus (a)	18	.35
F	Salsola iberica (a)	62	14.85
Total for Annual Forbs		155	15.55
Total for Perennial Forbs		2	0.03
Total for Forbs		157	15.58

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

BROWSE TRENDS--

Management unit 21R, Study no: 10

Type	Species	Strip Frequency '08	Average Cover % '08
B	Kochia prostrata	3	-
Total for Browse		3	-

BASIC COVER--

Management unit 21R, Study no: 10

Cover Type	Average Cover % '08
Vegetation	17.20
Pavement	.87
Litter	2.11
Bare Ground	89.47

BROWSE CHARACTERISTICS--

Management unit 21R, 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	
08	60	67	33	-	-	0	0	0	5/11

KANOSH LOP AND SCATTER - TREND STUDY NO. 21R-11-08

[Project #408](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Mountain Big Sagebrush\), R028AY334UT](#)

Land Ownership: UDWR

Elevation: 5,598 ft. (1,706 m)

Aspect: Northwest

Slope: 13%

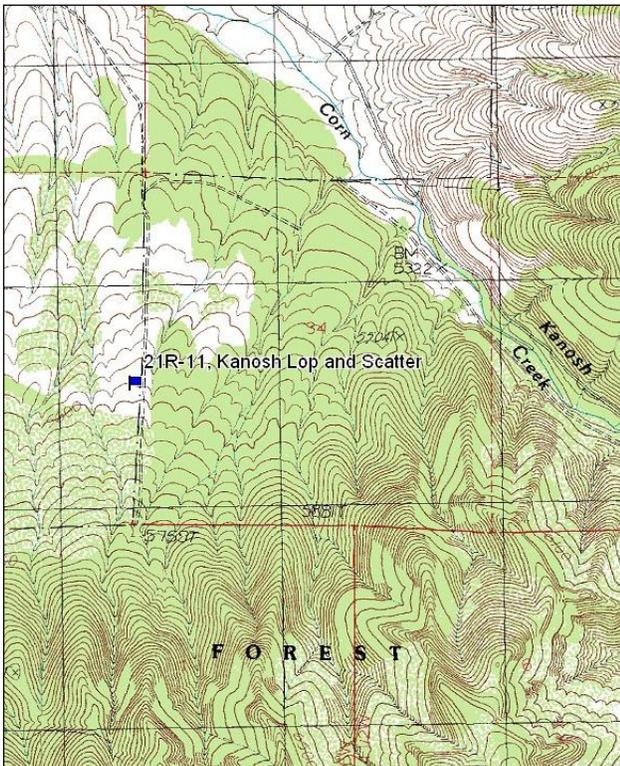
Transect bearing: 190° magnetic

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

Directions:

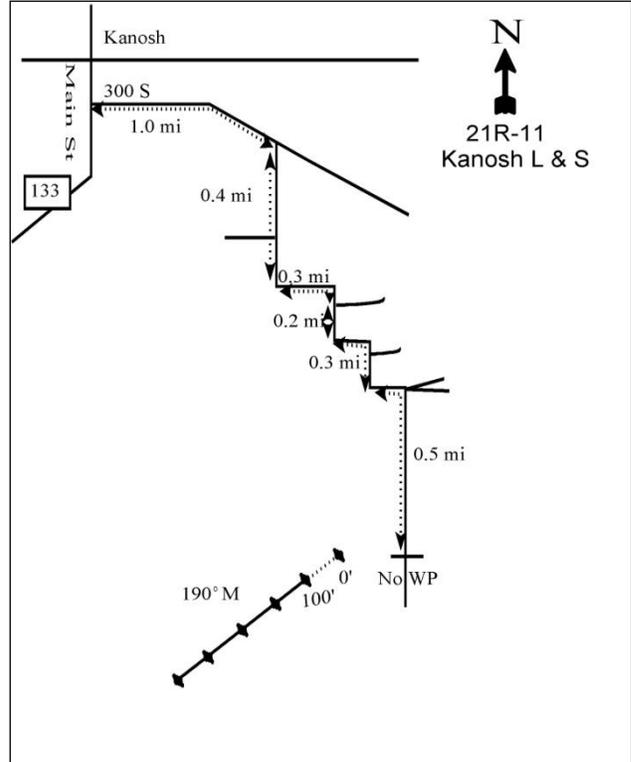
From Main Street in Kanosh, turn onto 300 south and drive 1.0 mile to a road on the right. Follow this road 0.4 miles to where the road turns sharply to the left. From this point, drive 0.3 miles to a fork and stay right; drive on the main road 0.2 miles to a gate. Continue driving straight along a fence line 0.3 miles to another gate. Turn right and drive 0.5 miles to the site on the right side of the road. There is no witness post or browse tag; use GPS to locate the 0' stake.

Map Name: Kanosh



Township: 23S Range: 5W Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 377260 E 4291726 N

KANOSH LOP AND SCATTER - WRI STUDY 21R-11
[Project #408](#)

Site Description

Site Information: The study is located approximately two and half miles southeast of Kanosh, in a 1960's chaining treatment, which removed encroaching pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) south of Corn Creek. The study was established in 2008, prior to the treatment, to monitor a lop and scatter treatment on the Kanosh (Corn Creek) Unit of the Fillmore Wildlife Management Area (WMA) complex. Much of the Fillmore WMA was chained in the 1960's, but over time, pinyon and juniper trees have reestablished. Annual herbaceous species have increased in abundance and are out competing desirable forage species and reducing the productivity of the area. The area is valuable winter range for mule deer and elk. In the spring of 2009, a hand crew completed a 575 acre lop and scatter treatment. Seed was not applied to the lop and scatter treatment due to the good herbaceous understory. The objectives of the project are to increase the productivity of desirable forage species by removing pinyon and juniper trees, and to improve winter range for deer and elk (WRI Database 2011). Pellet group data estimated very heavy use by deer, and light use by elk in 2008 (Table - Pellet Group Data).

Browse: The preferred browse species sampled on the site include mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), skunk bush (*Rhus trilobata*), and current (*Ribes* sp.). The key browse species is mountain big sagebrush. The mountain 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 was poor in 2008. Decadence and poor vigor of antelope bitterbrush was high, and utilization was moderate. The utilization of Gambel oak, skunk bush, and current was light (Table - Browse Characteristics). Utah juniper were common on the site prior to the lop and scatter treatment in 2008 at an estimated density of 220 trees/acre (Table - Point-Quarter Data).

Herbaceous Understory: Grasses are abundant and moderately diverse on the site. However, the invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species on the site. Sandberg bluegrass (*Poa secunda*) is the most common perennial grass species. Other common perennial grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), and bottle brush squirreltail (*Sitanion hystrix*). Forbs are moderately abundant, but are not particularly diverse. Perennial forbs are rare on the site. The most common perennial forb species is sandwort (*Arenaria* sp.), which provides the majority of the forb cover. The annual forb species pale alyssum (*Alyssum alyssoides*) was abundant on the site in 2008 (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 6.6) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 21R, Study no: 11

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron cristatum	24	1.00
G	Agropyron intermedium	22	1.39
G	Agropyron spicatum	14	.91
G	Bromus tectorum (a)	310	4.23
G	Festuca ovina	22	.06
G	Poa secunda	157	2.47
G	Sitanion hystrix	77	1.33
Total for Annual Grasses		310	4.23
Total for Perennial Grasses		316	7.18
Total for Grasses		626	11.41
F	Alyssum alyssoides (a)	104	.32
F	Arenaria sp.	20	1.62
F	Astragalus sp.	10	.16
F	Collinsia parviflora (a)	12	.02
F	Eriogonum racemosum	1	.00
F	Eriogonum umbellatum	5	.04
F	Lithospermum ruderales	2	.03
F	Microsteris gracilis (a)	5	.03
F	Phlox longifolia	15	.08
F	Polygonum douglasii (a)	8	.02
F	Ranunculus testiculatus (a)	10	.04
F	Zigadenus paniculatus	16	.21
Total for Annual Forbs		139	0.43
Total for Perennial Forbs		69	2.15
Total for Forbs		208	2.59

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

BROWSE TRENDS--

Management unit 21R, Study no: 11

Type	Species	Strip	Average
		Frequency	Cover %
		'08	'08
B	Artemisia tridentata vaseyana	57	8.42
B	Gutierrezia sarothrae	6	.33
B	Juniperus osteosperma	9	7.98
B	Purshia tridentata	19	6.57
B	Quercus gambelii	5	.49
B	Rhus trilobata	1	1.00
B	Ribes sp.	1	.38
Total for Browse		98	25.19

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 11

Species	Percent Cover '08
Artemisia tridentata vaseyana	10.50
Gutierrezia sarothrae	.11
Juniperus osteosperma	19.29
Purshia tridentata	10.39
Quercus gambelii	2.20
Rhus trilobata	1.08
Ribes sp.	.48

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 21R, Study no: 11

Species	Average leader growth (in) '08
Artemisia tridentata vaseyana	0.9
Purshia tridentata	6.4

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 11

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	220	5.3

BASIC COVER--
Management unit 21R, Study no: 11

Cover Type	Average Cover % '08
Vegetation	42.48
Rock	3.92
Pavement	6.14
Litter	58.27
Cryptogams	1.16
Bare Ground	11.80

SOIL ANALYSIS DATA --
Management unit 21R, Study no: 11, Study Name: Kanosh L&S

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	6.6	41.1	35.1	23.8	1.6	15.2	150.4	0.7

PELLET GROUP DATA--

Management unit 21R, Study no: 11

Type	Quadrat Frequency	Days use per acre (ha) '08
	'08	
Rabbit	30	-
Elk	1	1 (2)
Deer	44	203 (501)

BROWSE CHARACTERISTICS--

Management unit 21R, Study no: 11

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>									
08	1580	0	34	66	-	13	4	49	23/34
<i>Chrysothamnus viscidiflorus</i>									
08	0	0	0	-	-	0	0	0	11/23
<i>Gutierrezia sarothrae</i>									
08	160	0	75	25	-	0	0	13	9/12
<i>Juniperus osteosperma</i>									
08	180	0	100	-	20	0	0	0	-/-
<i>Purshia tridentata</i>									
08	560	0	43	57	-	79	7	54	37/66
<i>Quercus gambelii</i>									
08	280	7	93	-	-	0	0	0	35/25
<i>Rhus trilobata</i>									
08	40	0	50	50	-	0	0	50	35/51
<i>Ribes sp.</i>									
08	20	0	0	100	-	0	0	0	37/118

SULPHURDALE - TREND STUDY NO. 22R-7-08

Vegetation Type: Pinyon-Juniper, Wyoming Big Sage

Range Type: Crucial Deer Winter, Substantial Elk Winter

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

Land Ownership: BLM

Elevation: 6,322 ft. (1,927 m)

Aspect: West

Slope: 10-15%

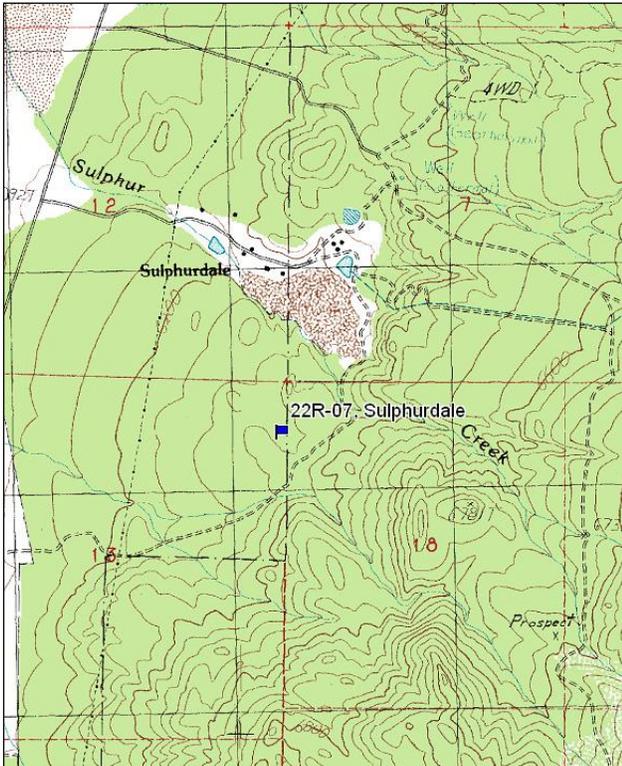
Transect bearing: 274° magnetic

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

Directions:

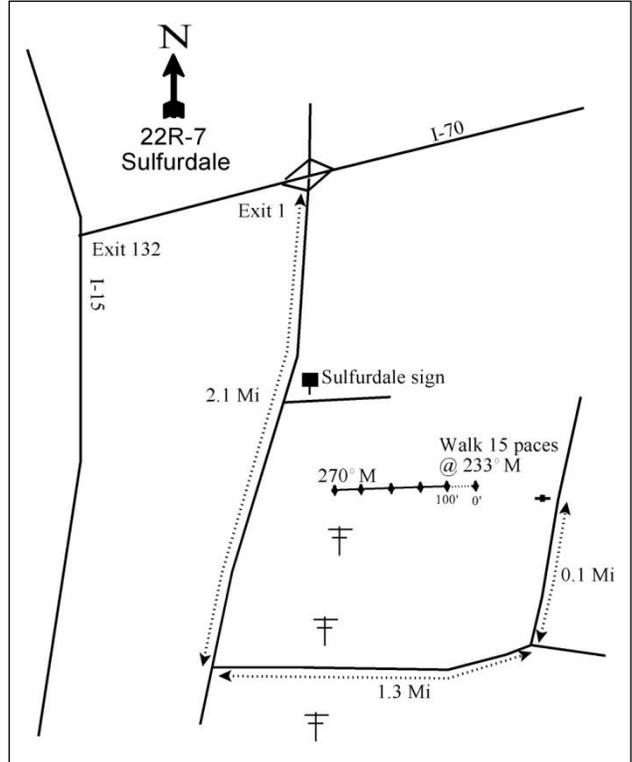
From Exit 1 off of I-70, proceed south on HWY 161 for 2.1 miles to a road on the left (east). Turn left and drive 1.3 miles to a fork. Take the left fork and drive 0.1 miles to the witness post on the left (west) side of the road. From the witness post, walk 15 paces at 233°M to the 0' stake. The 0' stake is marked with browse tag #71.

Map Name: Cove Fort



Township: 26S Range: 7W Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 362125 E 4268439 N

SULPHURDALE - WRI STUDY 22R-07

Site Description

Site Information: The study is located approximately a half a mile south of Sulphurdale, on land administrated by the Bureau of Land Management (BLM), near the US Forest Service boundary line. The study was established in 2005, prior to treatment, to monitor a lop and scatter project to remove Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*). The pinyon and juniper woodland has increased its range and expanded into areas historically dominated by sagebrush (*Artemisia sp.*) and mountain brush species. The project area was chained in the 50's and 60's and over time pinyon and juniper have encroached back into the area reducing the forage available to the wintering mule deer and elk. Originally the project was part of the Sulphurdale PJ Thin and Seed [WRI project #105](#), but the project was cancelled and the BLM completed the project without WRI funding. The project was completed in the fall of 2005. The objective of the project is to improve the forage available for wintering deer and elk. In 2005, pellet group data estimated moderate use by deer, and light use by elk and cattle. In 2008, heavy use was estimated for deer, and light use was estimated for elk and cattle (Table - Pellet Group Data).

Browse: The preferred browse species are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and antelope bitterbrush (*Purshia tridentata*). The Wyoming big sagebrush is a moderately used population with low decadence and good vigor over the sample years. The recruitment of young sagebrush plants to the population has been good since the outset of the study. Antelope bitterbrush is a moderate to heavily used population, with low decadence and good vigor within the population over the sample years. The recruitment of young bitterbrush plants has been good. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus* and *C. nauseosus* ssp. *hololeucus*), stickyleaf low rabbitbrush (*C. viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). Following the treatment, Utah juniper trees were reduced in density (Table - Point-Quarter Tree Data) and canopy cover (Table - Canopy Cover).

Herbaceous Understory: The invasive annual grass species cheatgrass (*B. tectorum*) has provided the majority of the grass cover since the outset of the study. The dominant perennial grass species is smooth brome (*Bromus inermis*). Other common perennial grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are fairly abundant and diverse. The dominant forb species is the annual species pale alyssum (*Alyssum alyssoides*). The most common perennial forb species is desert phlox (*Phlox austromontana*) (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 7.0) (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 all sample years.

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

Browse: The density of Wyoming big sagebrush slightly decreased by 14% from 860 plants/acre to 740 plants/acre, but canopy cover remained similar at 3%. The decadence and poor vigor remained low with little change within the sagebrush population. The density of antelope bitterbrush slightly decreased by 10% from 400 plants/acre to 360plants/acre, and cover remained similar at 6%. Utah juniper decreased in density from 252 trees/acre to 30 trees/acre, and canopy cover decreased from 15% to 0%. Pinyon pine decreased in density from 30 trees/acre to 18 trees/acre and canopy cover remained minimal.

Grasses: The sum of nested frequency of perennial grasses remained similar, but cover increased from 8% to 14%. Smooth brome remained similar in nested frequency, but cover increased from 4% to 8%. The nested frequency of cheatgrass remained similar, and cover decreased from 8% to 7%.

Forbs: The sum of nested frequency of perennial forbs decreased by 22%, but cover increased slightly from 3% to 4%. Desert phlox cover increased from less than 1% to 2% cover and became the most common perennial forb species. The annual species pale alyssum significantly decreased in nested frequency, and cover decreased from 4% to 1%.

HERBACEOUS TRENDS--

Management unit 22R, Study no: 7

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	93	62	1.68	1.25
G	Agropyron dasystachyum	9	-	.07	-
G	Agropyron intermedium	24	42	.44	.93
G	Agropyron spicatum	3	-	.00	.00
G	Bromus inermis	147	160	3.94	7.88
G	Bromus japonicus (a)	3	-	.01	-
G	Bromus tectorum (a)	282	299	7.98	6.78
G	Elymus junceus	-	2	-	.18
G	Oryzopsis hymenoides	5	-	.00	.00
G	Poa bulbosa	-	2	-	.15
G	Poa secunda	49	62	.73	1.31
G	Sitanion hystrix	53	67	.63	1.88
Total for Annual Grasses		285	299	7.99	6.78
Total for Perennial Grasses		383	397	7.52	13.62
Total for Grasses		668	696	15.51	20.41
F	Agoseris glauca	-	1	-	.00
F	Alyssum alyssoides (a)	359	195	4.38	1.09
F	Antennaria rosea	1	-	.03	-
F	Astragalus convallarius	10	8	.36	.26
F	Astragalus utahensis	-	3	-	.03
F	Collinsia parviflora (a)	8	-	.04	-
F	Cryptantha sp.	33	24	.27	.69
F	Descurainia pinnata (a)	18	-	.37	-
F	Eriogonum shockleyi	-	11	-	.14
F	Eriogonum sp.	31	-	.32	-
F	Eriogonum umbellatum	4	-	.00	-
F	Erodium cicutarium (a)	-	6	-	.03
F	Gayophytum ramosissimum(a)	4	1	.01	.03
F	Gilia sp. (a)	37	-	.12	-
F	Hedysarum boreale	8	32	.05	.66
F	Lactuca serriola (a)	2	1	.00	.00
F	Lomatium sp.	-	1	-	.00
F	Machaeranthera canescens	3	1	.03	.03
F	Microsteris gracilis (a)	41	-	.13	-
F	Petradoria pumila	11	4	.60	.51
F	Phlox austromontana	45	58	.38	1.63
F	Phlox hoodii	38	-	1.21	-
F	Phlox longifolia	1	-	.00	-
F	Polygonum douglasii (a)	3	-	.01	-

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	Ranunculus testiculatus (a)	69	60	.64	.78
F	Senecio multilobatus	2	4	.01	.03
F	Sphaeralcea coccinea	4	1	.01	.03
F	Tragopogon dubius (a)	-	2	-	.03
Total for Annual Forbs		541	265	5.73	1.98
Total for Perennial Forbs		191	148	3.29	4.05
Total for Forbs		732	413	9.02	6.03

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

BROWSE TRENDS--

Management unit 22R, Study no: 7

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata wyomingensis	15	19	2.09	3.18
B	Chrysothamnus nauseosus	6	1	.78	-
B	Chrysothamnus nauseosus hololeucus	2	3	.00	.91
B	Chrysothamnus viscidiflorus	0	4	-	1.53
B	Gutierrezia sarothrae	16	13	.48	.37
B	Juniperus osteosperma	19	1	9.80	.00
B	Opuntia sp.	3	3	-	.00
B	Pinus edulis	2	0	.00	-
B	Purshia tridentata	15	14	3.10	4.17
Total for Browse		78	58	16.28	10.20

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 7

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	2.51	3.33
Chrysothamnus nauseosus	.45	-
Chrysothamnus nauseosus hololeucus	.26	.65
Chrysothamnus viscidiflorus	-	1.61
Gutierrezia sarothrae	.08	.61
Juniperus osteosperma	15.14	-
Pinus edulis	.05	-
Purshia tridentata	5.58	5.51

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 7

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	2.9	1.7
Purshia tridentata	5.4	2.4

POINT-QUARTER TREE DATA--

Management unit 22R, Study no: 7

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	252	30	6.1	1.6
Pinus edulis	30	18	4.5	-

BASIC COVER--

Management unit 22R, Study no: 7

Cover Type	Average Cover %	
	'05	'08
Vegetation	35.00	32.44
Rock	4.94	4.38
Pavement	17.04	12.61
Litter	34.26	51.81
Cryptogams	.15	.15
Bare Ground	19.90	11.85

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 7, Study Name: Sulphurdale

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
9.7	7.0	49.4	28.4	22.2	3.6	15.2	374.4	0.7

PELLET GROUP DATA--

Management unit 22R, Study no: 7

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	59	59	-	-
Elk	12	8	6 (15)	17 (41)
Deer	19	24	21 (53)	57 (141)
Cattle	2	6	8 (20)	7 (16)

BROWSE CHARACTERISTICS--
Management unit 22R, Study no: 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>Artemisia tridentata wyomingensis</i>									
05	860	30	65	5	100	40	0	2	29/40
08	740	35	62	3	160	24	8	5	24/35
<i>Chrysothamnus nauseosus</i>									
05	140	0	100	-	-	0	0	0	29/36
08	20	100	0	-	-	100	0	0	39/27
<i>Chrysothamnus nauseosus hololeucus</i>									
05	40	0	100	-	20	0	0	0	22/31
08	60	0	100	-	40	33	33	0	21/28
<i>Chrysothamnus viscidiflorus</i>									
05	0	0	0	-	-	0	0	0	-/-
08	200	0	100	-	-	40	40	0	17/30
<i>Gutierrezia sarothrae</i>									
05	620	6	94	0	-	0	0	0	10/10
08	720	8	89	3	20	0	0	3	12/14
<i>Juniperus osteosperma</i>									
05	400	30	70	-	-	0	0	0	-/-
08	20	100	0	-	40	0	0	0	-/-
<i>Leptodactylon pungens</i>									
05	0	0	0	-	-	0	0	0	7/7
08	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
05	80	0	100	-	-	0	0	0	6/11
08	60	0	100	-	-	0	0	0	7/11
<i>Pinus edulis</i>									
05	40	100	0	-	20	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
05	400	15	80	5	-	20	65	0	30/59
08	360	17	78	6	-	6	50	6	37/71
<i>Quercus gambelii</i>									
05	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	29/18

P-HILL DIXIE - TREND STUDY NO. 22R-8-08
[Project #119](#)

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Not available

Land Ownership: BLM

Elevation: 6,283 ft. (1,915 m)

Aspect: East

Slope: 6%

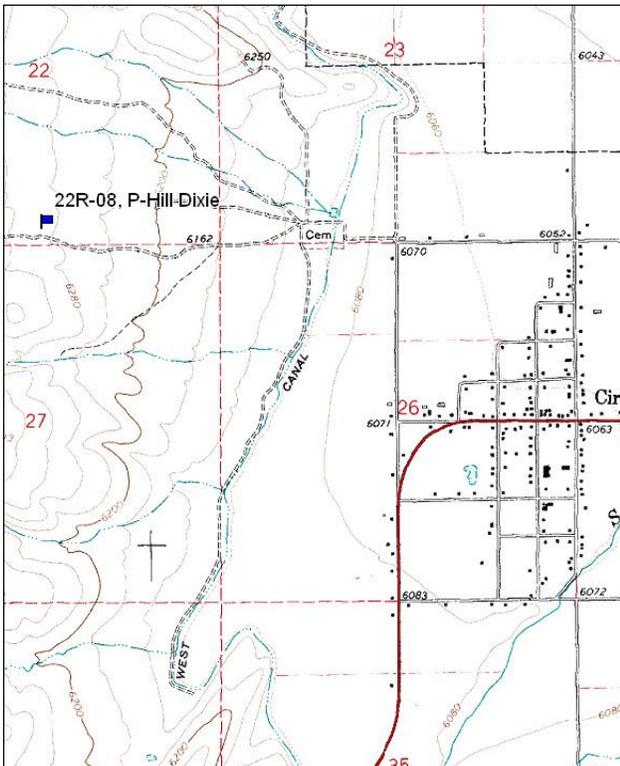
Transect bearing: 325° magnetic

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

Directions:

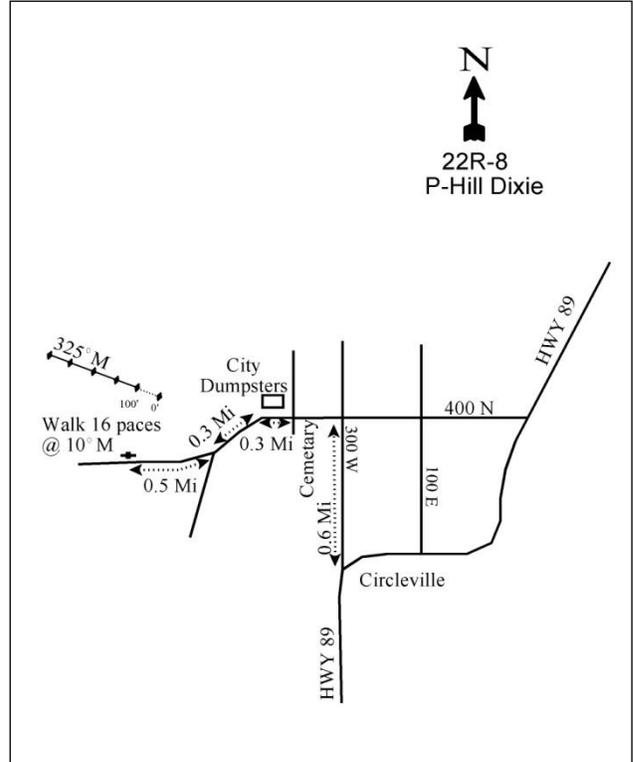
Heading north into Circleville, UT on US 89, continue north on 300 west when US 89 bends east (just past 300 south). Drive north on 300 west for 0.6 miles to an intersection. Turn left (west) and drive past the cemetery. On the NW corner of the cemetery is an intersection, continue straight for 0.3 miles to a two-track road on the right (west). Turn right on the two-track and drive 0.5 miles to the half-high witness post on the right (north). From the half-high witness post, walk 16 paces at 10°M to the 0' stake. The 0' stake is marked with browse tag #73.

Map Name: Circleville



Township: 30S Range: 4W Section: 22

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 386309 E 4226532 N

P-HILL DIXIE - WRI STUDY 22R-8
[Project #119](#)

Site Description

Site Information: The study is located approximately one mile northwest of Circleville, within a Wyoming big sagebrush flat, on land administered by the Bureau of Land Management (BLM). The study was established in 2005, prior to treatment, to monitor a two-way Dixie harrow project. Years of drought, and pressure from both wildlife and livestock, have left the project area in need of active restoration. Sagebrush die-off, combined with an over mature population and little or no understory, have decreased this area's value to wintering populations of both mule deer and elk. To improve the herbaceous understory and sagebrush composition, a total of 1,784 acres of Wyoming big sagebrush were two-way harrowed from October of 2005 through February of 2006. A seed mix of grass, forb, and browse species was broadcast seeded on the site during the second pass with the harrow (Table - Seed Mix). The project was treated in a mosaic pattern over the entire project area, as a result, part of the study transect was not treated by the harrow project or was only one-way harrowed. The objective of the project is to improve the winter range condition by altering the composition of the Wyoming big sagebrush and increasing the diversity of the herbaceous understory (WRI Database 2011). In 2005, pellet group data estimated moderate use by deer, and light use by elk. In 2008, moderately heavy use was estimated for deer, and light use was estimated for elk (Table - Pellet Group Data).

SEED MIX--

Management unit 22R, Study no: 8

Project Name: P-Hill			
WRI Database #: 119			
Application: Broadcast seeder		Acres:	3,500
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Hycrest'	3500	1.00
G	Great Basin Wildrye 'Magnar'	3500	1.00
G	Pubescent Wheatgrass 'Luna'	7000	2.00
G	Russian Wildrye 'Bozoisky'	3500	1.00
G	Sandberg Bluegrass 'Blue Mt.'	5250	1.50
G	Sheep Fescue 'Covar'	3500	1.00
F	Alfalfa 'Ladak'	1750	0.50
F	Annual Sunflower	3500	1.00
F	Small Burnet 'Delar'	7000	2.00
F	Sainfoin 'Esk'	3500	1.00
F	Lewis Flax 'Appar'	5250	1.50
F	Yellow Sweetclover 'Madrid'	3500	1.00
F	*Annual Sunflower	1900	0.54
B	Forage Kochia 'Immigrant'	5250	1.50
B	Fourwing Saltbush	3500	1.00
Total Pounds:		61400	17.54

*The Bureau of Land Management (BLM) provided the grass, forb, and browse species seed mix and the DWR provided annual sunflower (*Helianthus annuus*) seed for the project.

Browse: The preferred browse species on the site is Wyoming big sagebrush. Wyoming big sagebrush is a moderately used population, with high decadence and poor vigor over the sample years. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. Pricklypear cactus (*Opuntia sp.*) was the only other browse species sample on the site (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory has been very limited over the sample years. Grasses are rare on the site. Grass species sampled on the site include purple three-awn (*Aristida purpurea*), blue grama (*Bouteloua gracilis*), and sixweeks fescue (*Vulpia octoflora*). Forbs are also rare on the site. The seeded species common sunflower (*Helianthus annuus*) and blue flax (*Linum perenne*) were sampled following the treatment in low abundance on the site (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). Bare ground cover is high, with a moderate amount of litter and a high amount of pavement and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to slight soil, litter, and rock movement; pedestalling, and gully formation. The soil erosion condition was classified as stable in 2008.

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

Browse: The density of sagebrush decreased by 55% from 5,340 plants/acre to 2,420 plants/acre . The Harrow project decreased the canopy cover of Wyoming big sagebrush from 25% to 6%. . Decadence of sagebrush increased from 42% to 52%, and poor vigor increased from 14% to 31%. The recruitment of young sagebrush plants to the population remained poor; however, recruitment increased from 0% to 6%.

Grasses: Grasses remained rare on the site.

Forbs: Forbs remained rare on the site.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 8

T y p e	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	<i>Aristida purpurea</i>	9	11	.09	.12
G	<i>Bouteloua gracilis</i>	-	3	-	.00
G	<i>Sitanion hystrix</i>	-	-	-	.00
G	<i>Stipa comata</i>	-	-	.00	-
G	<i>Vulpia octoflora</i> (a)	3	-	.00	-
Total for Annual Grasses		3	0	0.00	0
Total for Perennial Grasses		9	14	0.10	0.13
Total for Grasses		12	14	0.10	0.13
F	<i>Astragalus lentiginosus</i>	_b 20	_a -	.11	-
F	<i>Descurainia pinnata</i> (a)	_b 80	_a -	.89	-
F	<i>Eriogonum cernuum</i> (a)	5	-	.02	-
F	<i>Gayophytum ramosissimum</i> (a)	_b 17	_a -	.07	-
F	<i>Gilia</i> sp. (a)	6	-	.01	-
F	<i>Helianthus annuus</i> (a)	-	5	-	.16
F	<i>Lappula occidentalis</i> (a)	4	11	.00	.37
F	<i>Linum perenne</i>	-	1	-	.00
F	<i>Lygodesmia</i> sp.	-	-	.00	-
F	<i>Salsola iberica</i> (a)	_a -	_b 37	-	.26
F	<i>Sisymbrium altissimum</i> (a)	-	6	-	.62
F	<i>Solanum</i> sp.	-	-	-	.00
Total for Annual Forbs		112	59	0.99	1.42

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
Total for Perennial Forbs		20	1	0.11	0.00
Total for Forbs		132	60	1.11	1.43

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

BROWSE TRENDS--

Management unit 22R, Study no: 8

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	Artemisia tridentata wyomingensis	89	42	25.43	6.44
B	Opuntia sp.	4	0	.15	-
Total for Browse		93	42	25.58	6.44

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 8

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	29.20	8.03
Opuntia sp.	.01	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 8

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	2.1	1.5

BASIC COVER--

Management unit 22R, Study no: 8

Cover Type	Average Cover %	
	'05	'08
Vegetation	25.67	8.21
Rock	9.88	13.39
Pavement	23.56	16.59
Litter	26.93	30.39
Cryptogams	.46	.24
Bare Ground	33.50	42.40

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 8, Study Name: P-Hill Dixie

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
9.7	6.7	64.4	23.8	11.8	0.3	17.2	240.0	0.4

PELLET GROUP DATA--

Management unit 22R, Study no: 8

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	36	93	-	-
Elk	2	-	1 (2)	1 (2)
Deer	14	20	28 (69)	44 (107)

BROWSE CHARACTERISTICS--

Management unit 22R, 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		
<i>Artemisia tridentata wyomingensis</i>									
05	5340	0	58	42	200	14	25	14	25/35
08	2420	6	42	52	20	36	23	31	16/24
<i>Opuntia sp.</i>									
05	80	0	100	-	-	0	0	25	5/16
08	0	0	0	-	-	0	0	0	5/13

SOUTH BEAVER ROCKY WASH - TREND STUDY NO. 22R-14-08
[Project #1224](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: Not available

Land Ownership: BLM

Elevation: 7,104 ft. (2,165 m)

Aspect: Southwest

Slope: 4%

Transect bearing: 25° magnetic

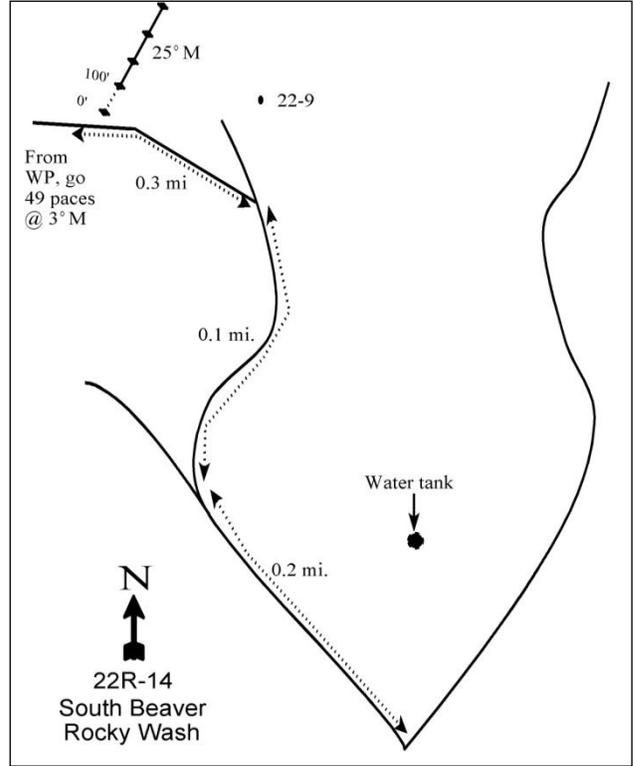
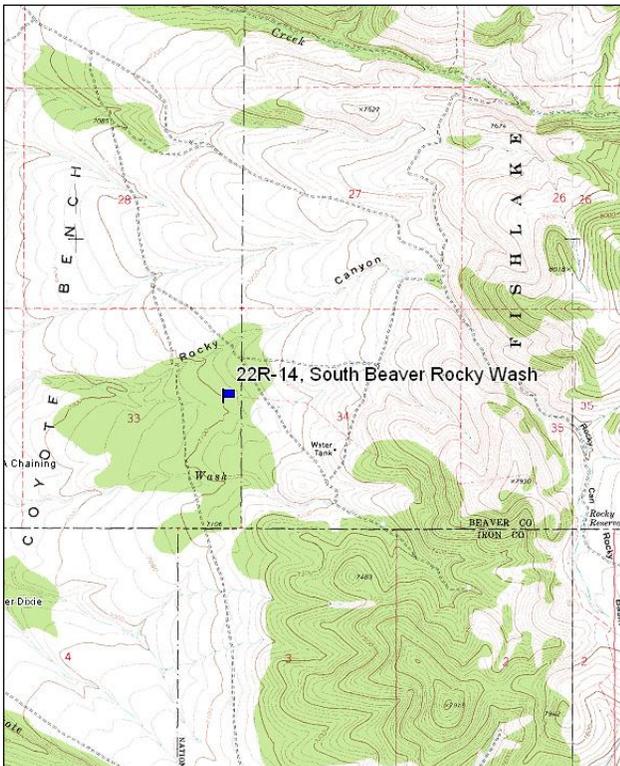
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

Begin on I-15 at exit #100, 9 miles south of Beaver. On the east side of the freeway there is a frontage road and a road going east. Go east 6.3 miles up Fremont Wash to a faint road on the left. Go 0.6 miles up the road which has several switchbacks to the top to a gate. Continue straight for 0.7 miles to a four-way intersection. Go straight 0.65 miles to a fork. Take the middle fork for 0.8 miles to a fork with 1002 and 1003. Go right for 1 mile on 1002 to a stock pond. Go up a steep hill 0.1 miles to a fork, turn left (1005), and go 0.2 miles to another fork. Stay right and go another 0.1 miles to another fork, and go left 0.3 miles to the witness post on the right side of the road. From the witness post, walk 49 paces to the 0' stake at 3°M. The 0' stake is marked with browse tag #109.

Map Name: Kane Canyon

Diagrammatic Sketch:



Township: 30S Range: 6W Section: 33

GPS: NAD 83, UTM 12T 365946 E 4224198 N

SOUTH BEAVER ROCKY WASH - WRI STUDY 22R-14

[Project #1224](#)

Site Description

Site Information: The study is located approximately ten miles southeast of Beaver, in a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, south of Rocky Canyon, on land managed by Bureau of Land Management (BLM) near the Fishlake National Forest boundary line. The study was established in 2008, prior to the treatment, to monitor the effects of a bullhog treatment to remove pinyon and juniper trees. The pinyon and juniper woodlands have increased their range and expanded into areas historically dominated by the sagebrush-steppe ecosystem. The increase in pinyon and juniper trees on the landscape has reduced the quality and quantity of greater sage-grouse habitat, as well as forage available to mule deer and elk herds. These areas are used heavily by deer and elk, and greater sage-grouse were once located throughout the project area. In the fall of 2008, and into the summer of 2009, a total of 1,528 acres of pinyon and juniper trees were treated with bullhog implements. A seed mix of grass and forb species was aerially applied to 1,358 acres of the project area prior to the bullhog treatment (Table - Seed Mix), with the remainder of the unseeded acres deemed to have a sufficient understory for establishment. The objectives of the project are to restore and enhance important big game and sage-grouse habitat, create wildlife corridors, reduce hazardous fuels, and improve watershed conditions and water quality (WRI Database 2011). Pellet group data estimated moderate use by deer, and light use by elk and cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 22R, Study no: 14

Project Name: South Beaver Vegetation Enhancement			
WRI Database #: 1224			
Application: Aerial Seed		Acres:	1480
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	1430	0.97
G	Bluebunch WG 'Goldar'	50	0.03
G	Crested Wheatgrass 'Douglas'	1150	0.78
G	Crested Wheatgrass 'Nordan'	1150	0.78
G	Indian Ricegrass 'Rimrock'	1500	1.01
G	Intermediate Wheatgrass 'Oahe'	750	0.51
G	Pubescent Wheatgrass 'Luna'	3000	2.03
G	Sandberg Bluegrass	400	0.27
G	Siberian Wheatgrass 'Vavilov'	2250	1.52
G	Snake River Wheatgrass 'Secar'	2250	1.52
F	Alfalfa 'Ladak 65'	750	0.51
F	Alfalfa 'Ranger'	750	0.51
F	Blue Flax 'Appar'	750	0.51
F	Palmer Penstemon	150	0.10
F	Sainfoin 'Eski'	750	0.51
F	Small Burnet 'Delar'	1500	1.01
F	Yellow Sweetclover	750	0.51
Total Pounds:		19330	13.06
PLS Pounds:			11.65

Browse: The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*). The mountain big sagebrush is a heavily used population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor in 2008. A good portion of the sagebrush plants sampled in 2008 were dead.

The antelope bitterbrush is relatively small population with moderate decadence, but good vigor within the population. Utilization of bitterbrush plants was mostly heavy. The recruitment of young bitterbrush plants to the population was also poor in 2008 (Table - Browse Characteristics). Pinyon pine and Utah juniper were fairly common on the study site in 2008, prior to the treatment, with an estimated density of 27 trees/acre and 128 trees/acre, respectively (Table - Point-Quarter Tree Data). Utah juniper also provided the majority of the canopy on the site prior to the treatment (Table - Canopy Cover).

Herbaceous Understory: Grasses are fairly abundant and diverse on the site. The dominant grass species are bluebunch wheatgrass (*Agropyron spicatum*) and bottle brush squirreltail (*Sitanion hystrix*). Other perennial grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. smithii*), Indian ricegrass (*Oryzopsis hymenoides*), mutton bluegrass (*Poa fendleriana*), and Sandberg bluegrass (*P. secunda*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance and provided very little cover on the site. Forbs are not particularly abundant, but are fairly diverse. The most common forb species on the site is longleaf phlox (*Phlox longifolia*) (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). While bare ground cover is moderately high, there is also a moderate amount of vegetation, and a high amount of litter, rock, and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 22R, Study no: 14

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Agropyron cristatum</i>	13	.37
G	<i>Agropyron smithii</i>	20	.24
G	<i>Agropyron spicatum</i>	88	3.13
G	<i>Bromus tectorum</i> (a)	36	.25
G	<i>Oryzopsis hymenoides</i>	5	.04
G	<i>Poa fendleriana</i>	37	.81
G	<i>Poa secunda</i>	23	.28
G	<i>Sitanion hystrix</i>	58	1.47
Total for Annual Grasses		36	0.25
Total for Perennial Grasses		244	6.36
Total for Grasses		280	6.61
F	<i>Agoseris glauca</i>	10	.05
F	<i>Antennaria rosea</i>	2	.01
F	<i>Arabis</i> sp.	3	.01
F	<i>Astragalus convallarius</i>	2	.00
F	<i>Astragalus</i> sp.	1	.03
F	<i>Calochortus nuttallii</i>	3	.01
F	<i>Collinsia parviflora</i> (a)	4	.00
F	<i>Cymopterus</i> sp.	9	.05
F	<i>Delphinium nuttallianum</i>	7	.02
F	<i>Erigeron</i> sp.	3	.01
F	<i>Gayophytum ramosissimum</i> (a)	29	.06
F	<i>Lomatium</i> sp.	43	.21
F	<i>Lupinus argenteus</i>	3	.00

Type	Species	Nested Frequency	Average Cover %
		'08	'08
F	Microsteris gracilis (a)	51	.10
F	Phlox longifolia	96	.52
F	Polygonum douglasii (a)	11	.04
F	Ranunculus testiculatus (a)	16	.03
F	Senecio multilobatus	6	.04
F	Zigadenus paniculatus	4	.05
Total for Annual Forbs		111	0.25
Total for Perennial Forbs		192	1.04
Total for Forbs		303	1.29

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

BROWSE TRENDS--

Management unit 22R, Study no: 14

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia tridentata vaseyana	81	7.03
B	Juniperus osteosperma	5	11.55
B	Pinus edulis	1	1.23
B	Purshia tridentata	18	3.73
Total for Browse		105	23.55

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 14

Species	Percent Cover '08
Artemisia tridentata vaseyana	8.56
Juniperus osteosperma	17.61
Pinus edulis	1.96
Purshia tridentata	3.48

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 14

Species	Average leader growth (in) '08
Artemisia tridentata vaseyana	0.9
Purshia tridentata	0.6

POINT-QUARTER TREE DATA--
 Management unit 22R, Study no: 14

Species	Trees per Acre	Average diameter (in)
	'08	'08
Juniperus osteosperma	128	9.3
Pinus edulis	27	3.1

BASIC COVER--
 Management unit 22R, Study no: 14

Cover Type	Average Cover % '08
Vegetation	27.11
Rock	11.03
Pavement	10.92
Litter	39.56
Cryptogams	.04
Bare Ground	32.01

SOIL ANALYSIS DATA --
 Management unit 22R, Study no: 14, Study Name: SB Rocky Wash

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	6.7	29.1	36.1	34.8	2.0	13.4	217.6	0.9

PELLET GROUP DATA--
 Management unit 22R, Study no: 14

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	90	-
Elk	7	13 (31)
Deer	14	29 (73)
Cattle	1	1 (2)

BROWSE CHARACTERISTICS--
 Management unit 22R, 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)	
Amelanchier utahensis										
08	0	0	0	-	20	0	0	0	-/-	
Artemisia tridentata vaseyana										
08	3440	3	19	77	240	19	49	54	17/21	
Juniperus osteosperma										
08	100	40	60	-	100	0	0	0	-/-	
Pinus edulis										
08	20	0	100	-	40	0	0	0	-/-	
Purshia tridentata										
08	420	5	76	19	120	24	71	10	31/47	

SOUTH BEAVER BULLHOG YEAR 4 - TREND STUDY NO. 22R-15-08

[Project #1224](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Upland Stony Loam \(Pinyon-Utah Juniper\), R047XB333UT](#)

Land Ownership: BLM

Elevation: 6,494 ft. (1,979 m)

Aspect: East

Slope: 12%

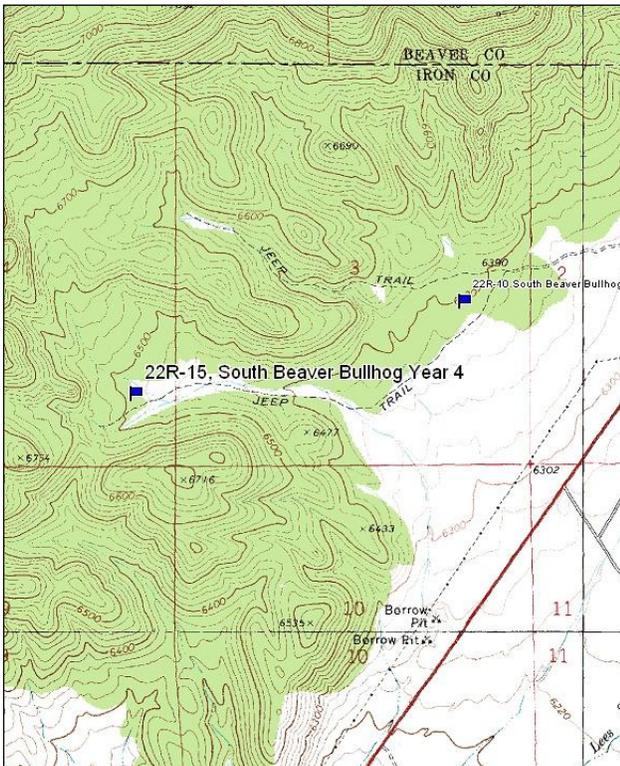
Transect bearing: 305° magnetic

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

Directions:

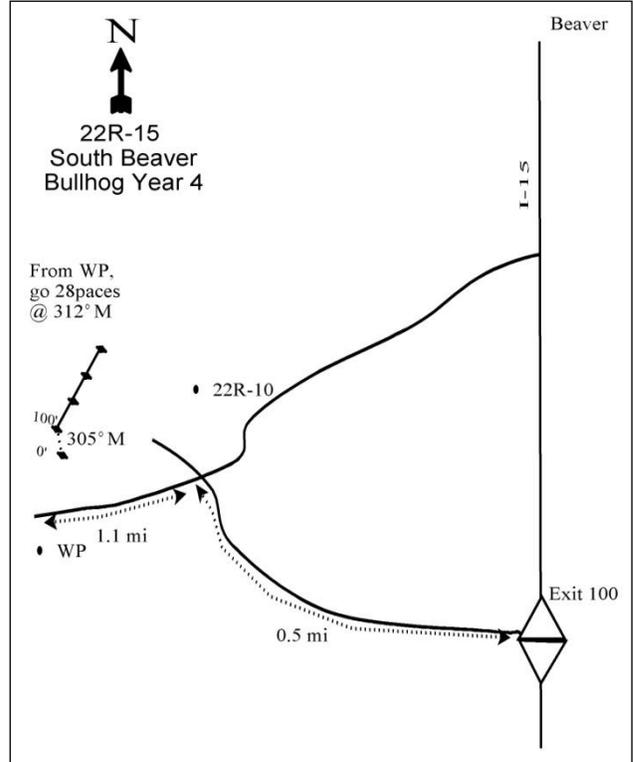
Proceed south of Beaver on I-15 to Exit 100. From the off ramp, turn right and drive west 0.5 miles to a left turn on a jeep trail that is difficult to see (right turn leads to 22R-10). Drive 1.1 miles on this road to the witness post on the left. From the witness post, walk 28 paces to the 0' stake at 312°M (across the road). The 0' stake is marked with browse tag # 106

Map Name: Greenville Bench



Township: 31S Range: 7W Section: 4

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 355468 E 4222011 N

SOUTH BEAVER BULLHOG YEAR 4 - WRI STUDY 22R-15
[Project #1224](#)

Site Description

Site Information: The study is located approximately nine and a half miles south of Beaver, in a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, west of I-15, on land managed by Bureau of Land Management (BLM). The study was established in 2008, prior to the treatment, to monitor the effects of a bullhog treatment to remove pinyon and juniper trees. The pinyon and juniper woodland has increased its range and expanded into areas historically dominated by the sagebrush-steppe ecosystem. The increase in pinyon and juniper trees on the landscape has reduced the quality and quantity of greater sage-grouse habitat, as well as forage available to mule deer and elk herds. These areas are used heavily by deer and elk, and greater sage-grouse were once located throughout the project area. In the fall of 2008, and into the summer of 2009, a total of 1,528 acres of pinyon and juniper trees were treated with bullhog implements. A seed mix of grass and forb species (Table - Seed Mix) was aerially applied to 1,358 acres of the project area prior to the bullhog treatment, with the remainder of the unseeded acres deemed to have a sufficient understory for establishment. The objectives of the project were to restore and enhance important big game and sage-grouse habitat, create wildlife corridors, reduce hazardous fuels, and improve watershed conditions and water quality (WRI Database 2011). Pellet group data estimated little or no use by wildlife or livestock in 2008, though quadrat data estimated use by rabbits to be heavy (Table - Pellet Group Data).

SEED MIX--

Management unit 22R, Study no: 15

Project Name: South Beaver Vegetation Enhancement			
WRI Database #: 1224			
Application: Aerial Seed		Acres:	1480
Seed type		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	1430	0.97
G	Bluebunch WG 'Goldar'	50	0.03
G	Crested Wheatgrass 'Douglas'	1150	0.78
G	Crested Wheatgrass 'Nordan'	1150	0.78
G	Indian Ricegrass 'Rimrock'	1500	1.01
G	Intermediate Wheatgrass 'Oahe'	750	0.51
G	Pubescent Wheatgrass 'Luna'	3000	2.03
G	Sandberg Bluegrass	400	0.27
G	Siberian Wheatgrass 'Vavilov'	2250	1.52
G	Snake River Wheatgrass 'Secar'	2250	1.52
F	Alfalfa 'Ladak 65'	750	0.51
F	Alfalfa 'Ranger'	750	0.51
F	Blue Flax 'Appar'	750	0.51
F	Palmer Penstemon	150	0.10
F	Sainfoin 'Eski'	750	0.51
F	Small Burnet 'Delar'	1500	1.01
F	Yellow Sweetclover	750	0.51
Total Pounds:		19330	13.06
PLS Pounds:			11.65

Browse: The preferred browse species on the site is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). 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 was poor in 2008. A small population of fringed sagebrush (*A. frigida*) and a moderate population of broom snakeweed

(*Gutierrezia sarothrae*) were sampled on the site in 2008. Other less common browse species sampled include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*), prickly phlox (*Leptodactylon pungens*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). Prior to the treatment, pinyon pine and Utah juniper were common on the site in 2008 with an estimated density of 260 trees/acre and 57 trees/acre, respectively (Table - Point Quarter Tree Data). The two tree species also provided the majority of the canopy cover sampled in 2008 (Table - Canopy Cover).

Herbaceous Understory: Grasses are not abundant or diverse on the site. Only three grass species were sampled on the site in 2008, which included blue grama (*Bouteloua gracilis*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). Forb species are also rare on the site (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a slightly acidic soil reaction (pH 6.5) (Table - Soil Analysis Data). Bare ground cover is moderate, but a high amount of litter and pavement, and a moderate amount of vegetation and rock provides protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 15

Type	Species	Nested Frequency '08	Average Cover % '08
G	<i>Bouteloua gracilis</i>	3	.03
G	<i>Oryzopsis hymenoides</i>	1	.03
G	<i>Sitanion hystrix</i>	34	.07
Total for Annual Grasses		0	0
Total for Perennial Grasses		38	0.14
Total for Grasses		38	0.14
F	<i>Agoseris glauca</i>	-	.00
F	<i>Chaenactis douglasii</i>	6	.01
F	<i>Cryptantha sp.</i>	3	.03
F	<i>Cymopterus sp.</i>	4	.01
F	<i>Eriogonum umbellatum</i>	1	.00
F	<i>Ipomopsis aggregata</i>	2	.03
F	<i>Lotus sp.</i>	10	.04
F	<i>Lupinus argenteus</i>	5	.59
F	<i>Penstemon sp.</i>	9	.03
F	<i>Salsola iberica (a)</i>	1	.00
Total for Annual Forbs		1	0.00
Total for Perennial Forbs		40	0.78
Total for Forbs		41	0.78

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

BROWSE TRENDS--

Management unit 22R, Study no: 15

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia frigida	1	-
B	Artemisia tridentata wyomingensis	72	9.88
B	Gutierrezia sarothrae	21	.28
B	Juniperus osteosperma	2	6.05
B	Leptodactylon pungens	2	-
B	Opuntia sp.	1	-
B	Pinus edulis	7	4.61
Total for Browse		106	20.83

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 15

Species	Percent Cover '08
Artemisia tridentata wyomingensis	8.61
Gutierrezia sarothrae	.06
Juniperus osteosperma	14.60
Pinus edulis	12.86

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 15

Species	Average leader growth (in) '08
Artemisia tridentata wyomingensis	1.0

POINT-QUARTER TREE DATA--

Management unit 22R, Study no: 15

Species	Trees per Acre	Average diameter (in)
	'08	'08
Juniperus osteosperma	57	9.0
Pinus edulis	260	2.6

BASIC COVER--

Management unit 22R, Study no: 15

Cover Type	Average Cover % '08
Vegetation	20.32
Rock	5.94
Pavement	30.22
Litter	44.09
Cryptogams	.21
Bare Ground	20.28

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 15, Study Name: South Beaver Bullhog Year 4

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	6.5	52.0	29.4	18.6	1.2	13.4	256.0	0.6

PELLET GROUP DATA--

Management unit 22R, Study no: 15

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	80	-

BROWSE CHARACTERISTICS--

Management unit 22R, 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 frigida</i>									
08	20	0	0	100	-	0	0	100	-/-
<i>Artemisia tridentata wyomingensis</i>									
08	3600	4	22	74	60	9	3	31	19/24
<i>Chrysothamnus viscidiflorus</i>									
08	0	0	0	-	20	0	0	0	8/10
<i>Gutierrezia sarothrae</i>									
08	960	10	69	16	120	27	17	0	6/5
<i>Juniperus osteosperma</i>									
08	40	0	100	-	40	0	0	0	-/-
<i>Leptodactylon pungens</i>									
08	40	0	50	50	-	0	50	50	6/8
<i>Opuntia sp.</i>									
08	20	0	100	-	-	0	0	0	4/11

		Age class distribution						Utilization	
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Pinus edulis									
08	200	80	20	-	180	0	0	0	-/-

SPRY SAGEBRUSH RESTORATION - TREND STUDY NO. 22R-16-08

[Project #1173](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Shallow Hardpan \(Black Sagebrush\), R047XB316UT](#)

Land Ownership: SITLA

Elevation: 7,300 ft. (2,225 m)

Aspect: East

Slope: 2%

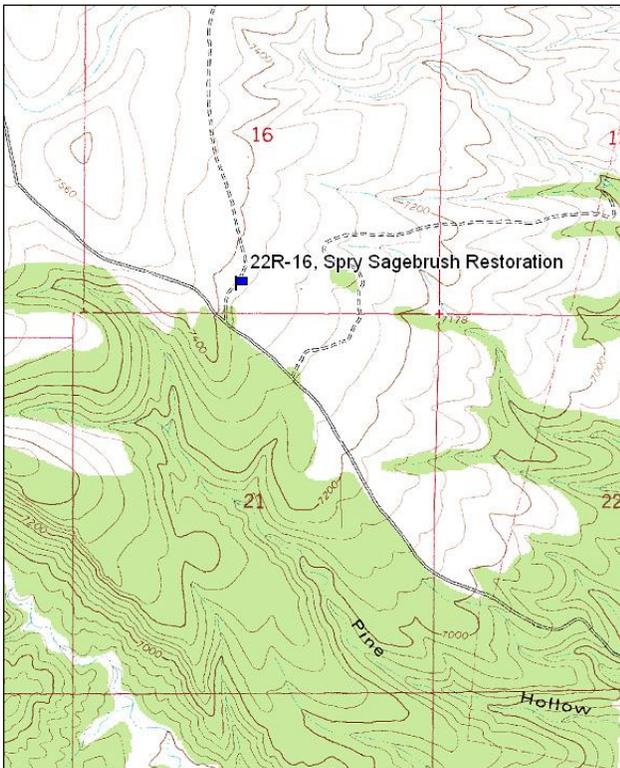
Transect bearing: 76° magnetic

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

Directions:

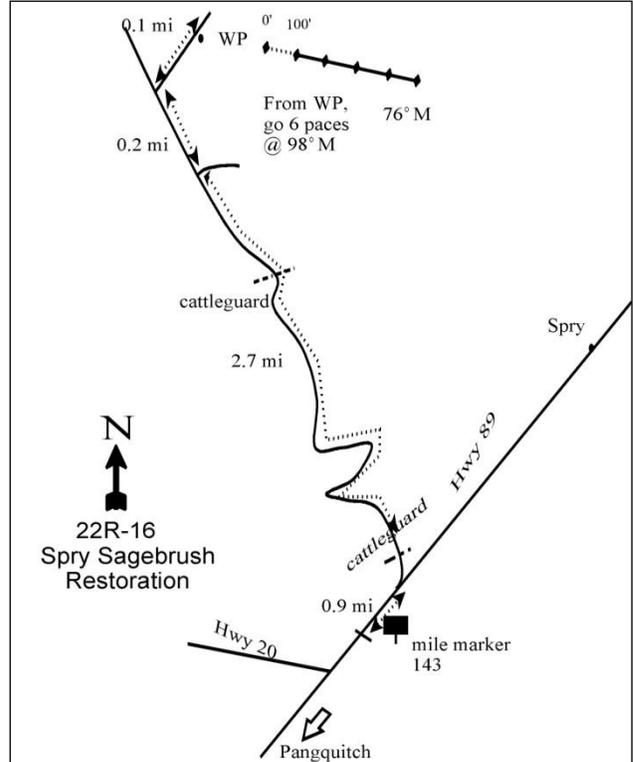
From the junction of Hwy 20 and Hwy 89 north of Panguitch, proceed north on Hwy 89 to 0.9 miles passed mile marker 143 to a road on the left. From the cattle guard, drive 2.7 miles (passed a second cattle guard) to a fork and stay left. From the fork, go 0.2 miles to a fork and go right 0.1 miles to the witness post on the right. From the witness post, walk 6 paces to the 0' stake at 98°M. The 0' stake is marked with browse tag # 107.

Map Name: Fremont Bench



Township: 32S Range: 5W Section: 16

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 375116 E 4209325 N

SPRY SAGEBRUSH RESTORATION - WRI STUDY 22R-16

[Project #1173](#)

Site Description

Site Information: The study is located approximately four miles north of the Bear Valley Junction, in a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat, near the head of Pine Hollow, on Utah State Institutional Trust Land (SITLA). The study was established in 2008, prior to the treatment, to monitor a lop and scatter treatment to remove pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). The Spry Sagebrush Restoration project area was originally chained and seeded in the fall of 1966, but over time pinyon and juniper trees reestablished within the chained area. In the spring of 2009, the project area was treated by a lop and scatter method. Seed was not applied to the treatment area. The objectives of the project are to improve mule deer winter range, brooding habitat for greater sage-grouse, and habitat for antelope by removing encroaching pinyon pine and Utah juniper trees (WRI Database 2011). Pellet group data estimated light use by deer, elk, and cattle (Table - Pellet Group Data).

Browse: The preferred browse species are mountain big sagebrush and antelope bitterbrush (*Purshia tridentata*). The sagebrush on the site is likely a hybrid of mountain big sagebrush and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), but was all classified as mountain big sagebrush for the sake of this study. The mountain big sagebrush is a lightly used population with high decadence, but good vigor within the population. The recruitment of young sagebrush to the population was poor in 2008. The antelope bitterbrush is a heavily used, small population with high decadence and moderate vigor within the population. The recruitment of young bitterbrush plants to the population was poor in 2008. Broom snakeweed (*Gutierrezia sarothrae*) is fairly common on the site (Table - Browse Characteristics). Prior to the lop and scatter treatment, pinyon pine and Utah juniper were fairly common on the site in 2008 with an estimated density of 76 trees/acre and 27 trees/acre, respectively (Table - Point-Quarter Tree Data).

Herbaceous Understory: Grasses are abundant and diverse, with crested wheatgrass (*Agropyron cristatum*) being dominant grass species. Other perennial grass species on the site are rare and occur in low abundance, which include western wheatgrass (*A. smithii*), blue grama (*Bouteloua gracilis*), sedge (*Carex sp.*), Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). Forbs are not abundant, but are moderately diverse. The most common forb species sampled on the site is clover (*Trifolium sp.*) (Table - Herbaceous Trends).

Soil: The soil texture is a clay loam with a neutral soil reaction (pH 7.3). Phosphorus may have limited availability for plant growth and development at 5.9 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderate, with a high amount of rock and pavement, and a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 22R, Study no: 16

Type	Species	Nested Frequency	Average Cover %
		'08	'08
G	Agropyron cristatum	332	12.99
G	Agropyron smithii	6	.06
G	Bouteloua gracilis	10	.56
G	Bromus tectorum (a)	2	.00
G	Carex sp.	7	.04
G	Oryzopsis hymenoides	3	.03
G	Sitanion hystrix	3	.00

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Stipa comata</i>	9	.07
Total for Annual Grasses		2	0.00
Total for Perennial Grasses		370	13.77
Total for Grasses		372	13.77
F	<i>Agoseris glauca</i>	9	.05
F	<i>Astragalus calycosus</i>	4	.01
F	<i>Astragalus lentiginosus</i>	7	.09
F	<i>Calochortus nuttallii</i>	1	.00
F	<i>Cryptantha</i> sp.	8	.02
F	<i>Erigeron</i> sp.	2	.00
F	<i>Gayophytum ramosissimum</i> (a)	2	.01
F	<i>Lappula occidentalis</i> (a)	2	.00
F	<i>Lomatium</i> sp.	2	.01
F	<i>Lygodesmia</i> sp.	2	.03
F	<i>Phlox austromontana</i>	1	.00
F	<i>Phlox longifolia</i>	4	.03
F	<i>Sphaeralcea coccinea</i>	2	.01
F	<i>Trifolium</i> sp.	10	.18
F	<i>Zigadenus paniculatus</i>	7	.04
Total for Annual Forbs		4	0.01
Total for Perennial Forbs		59	0.50
Total for Forbs		63	0.51

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

BROWSE TRENDS--

Management unit 22R, Study no: 16

Type	Species	Strip	Average
		Frequency	Cover %
		'08	'08
B	<i>Artemisia tridentata vaseyana</i>	50	6.42
B	<i>Gutierrezia sarothrae</i>	27	.34
B	<i>Juniperus osteosperma</i>	1	1.48
B	<i>Opuntia</i> sp.	2	.04
B	<i>Pinus edulis</i>	3	1.58
B	<i>Purshia tridentata</i>	6	.93
Total for Browse		89	10.81

BROWSE TRENDS--

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 16

Species	Percent Cover '08
Artemisia tridentata vaseyana	9.06
Gutierrezia sarothrae	.20
Juniperus osteosperma	1.20
Pinus edulis	.71
Purshia tridentata	.56

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 16

Species	Average leader growth (in) '08
Artemisia tridentata vaseyana	1.3
Purshia tridentata	0.8

POINT-QUARTER TREE DATA--

Management unit 22R, Study no: 16

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	27	6.9
Pinus edulis	76	5.8

BASIC COVER--

Management unit 22R, Study no: 16

Cover Type	Average Cover % '08
Vegetation	23.52
Rock	9.94
Pavement	19.85
Litter	30.97
Cryptogams	.86
Bare Ground	27.67

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 16, Study Name: Spry Sagebrush Restoration

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	7.3	40.0	27.4	30.6	1.1	5.9	105.6	0.6

PELLET GROUP DATA--

Management unit 22R, Study no: 16

Type	Quadrat Frequency	Days use per acre (ha) '08
	'08	
Rabbit	95	-
Elk	-	1 (3)
Deer	18	5 (12)
Cattle	11	14 (34)

BROWSE CHARACTERISTICS--

Management unit 22R, Study no: 16

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>									
08	1640	1	62	37	300	16	13	15	28/33
<i>Gutierrezia sarothrae</i>									
08	1660	2	87	11	280	8	0	5	6/5
<i>Juniperus osteosperma</i>									
08	20	0	100	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
08	40	0	100	-	40	0	0	0	5/13
<i>Pinus edulis</i>									
08	60	100	0	-	40	0	0	0	-/-
<i>Purshia tridentata</i>									
08	120	0	67	33	-	0	100	17	18/41

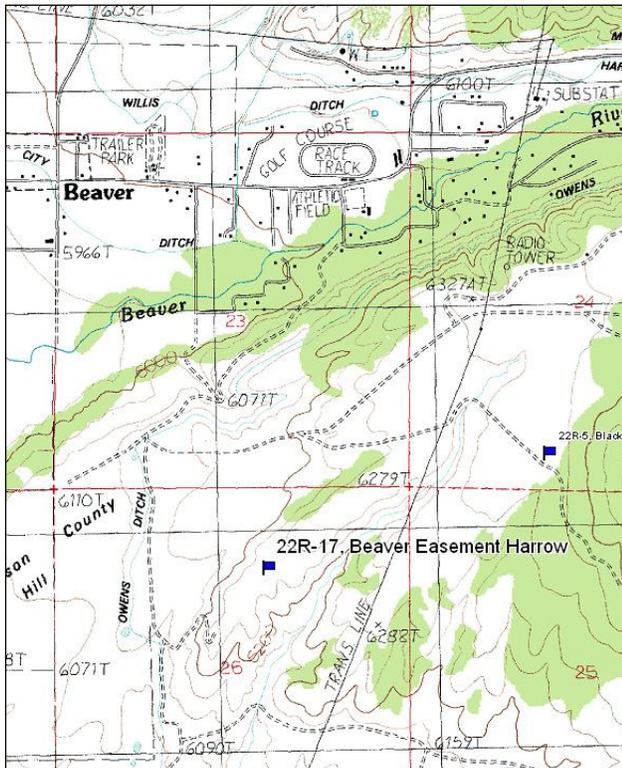
BEAVER EASEMENT HARROW - TREND STUDY NO. 22R-17-08
[Project #1294](#)

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 6,256 ft. (1,907 m)
Aspect: South
Slope: 1%
Transect bearing: 198° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

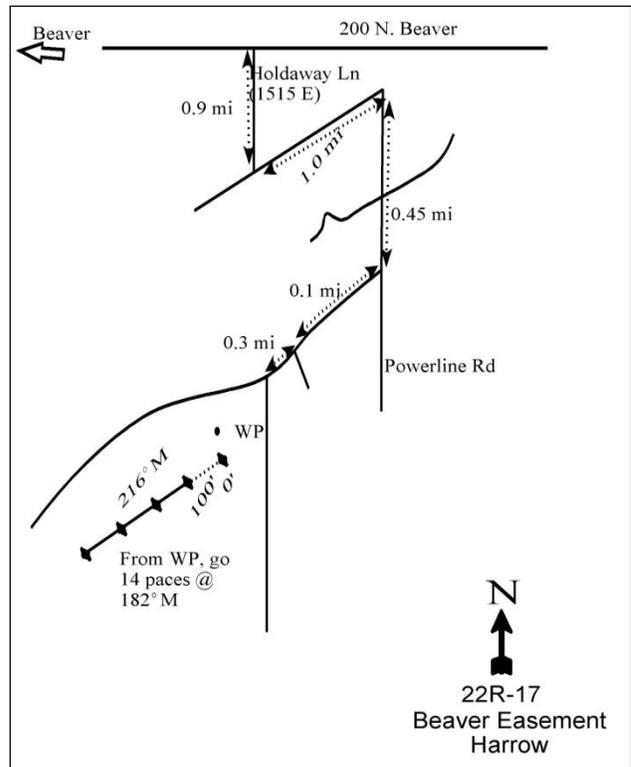
Directions:

Proceed East on 200 N. in Beaver to Holdaway Lane (1515 E). Drive 0.9 miles on Holdaway Lane (turns into a dirt road) to a left turn. Drive 1.0 miles to a road on the right and drive south 0.45 miles on Powerline Road. Turn right, drive 0.1 miles to a fork, and keep right. Drive 0.3 miles to a road on the left and continue to the witness post on the right. From the witness post, walk 14 paces to the 0' stake at 182°M. The 0' stake is marked with browse tag #104.

Map Name: Black Ridge



Diagrammatic Sketch:



Township: 29S Range: 7W Section: 26

GPS: NAD 83, UTM 12T 359224 E 4236094 N

BEAVER EASEMENT HARROW - WRI STUDY 22R-17
[Project #1294](#)

Site Description

Site Information: The study is located approximately one and a half miles southeast of Beaver, in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, west of Black Mountain, within the Beaver Easement property. The study was established in 2008, prior to the treatment, to monitor the effects of a two-way Dixie harrow project. The Beaver Easement property was purchased several years ago and subsequently an aerial seeding treatment was conducted in an effort to increase big game forage productivity. That effort did not show much result in increased productivity. In the fall of 2008, a total of 205 acres were two-way Dixie harrowed, and a seed mix of grass and forb species was broadcast seeded during the second pass of the harrow. Later that winter, a seed mix of forage kochia (*Kochia prostrata*) and alfalfa (*Medicago sativa*) (Table - Seed Mix) were aerially applied on top of snow over the project area. The objective of the project is to increase big game forage productivity (WRI Database 2011). Pellet group data estimated heavy use by deer, and light use by elk and cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 22R, Study no: 17

Project Name: Beaver Easement						
WRI Database #: 1294						
Application: Broadcast seeded			Acres: 210		Application: Aerial seed	
					Acres: 200	
Seed type			lbs in mix	lbs/acre	Seed type	
G	Bluebunch WG 'Anatone'		300	1.43	F	Alfalfa 'Ladak 65'
G	Indian Ricegrass 'Rimrock'		450	2.14	B	Forage Kochia
G	Intermediate Wheatgrass 'Oahe'		450	2.14	Total Pounds:	
F	Alfalfa 'Ladak'		300	1.43	PLS Pounds:	
F	Gooseberryleaf Globemallow		25	0.12		
F	Rocky Mountain Beeplant		100	0.48		
F	Sainfoin 'Eski'		650	3.10		
F	Small Burnet 'Delar'		400	1.90		
F	Yellow Sweetclover		100	0.48		
Total Pounds:			2775	13.21		
PLS Pounds:				11.85		

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a lightly used population, with moderate decadence, and good vigor within the population. The recruitment of young sagebrush plants to the population was good, and sagebrush seedlings were abundant on the site in 2008. Other browse species sampled on site include stickyleaf rabbitbrush (*Chrysothamnus viscidiflorus*) and mountain ball cactus (*Pediocactus simpsonii*), though each of these species occurred in low abundance (Table - Browse Characteristics).

Herbaceous Understory: Grasses on the site are abundant and diverse. The dominant perennial grass species are galleta (*Hilaria jamesii*) and needle-and-thread (*Stipa comata*). The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site in high abundance and provided moderate cover. Other less common grass species sampled on the site include blue grama (*Bouteloua gracilis*), Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and sixweeks fescue (*Vulpia octoflora*). Forbs are abundant and moderately diverse on the site, though the majority of the forb species were annual species. The dominant perennial forb species is scarlet globemallow (*Sphaeralcea coccinea*). Annual forbs

are abundant on the site, which include annual stickseed (*Lappula occidentalis*) and bur buttercup (*Ranunculus testiculatus*) (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 7.0). Phosphorus may have limited availability for plant growth and development at 3.2 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is low with 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 stable in 2008.

HERBACEOUS TRENDS--

Management unit 22R, Study no: 17

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Bouteloua gracilis</i>	42	.31
G	<i>Bromus tectorum</i> (a)	359	3.38
G	<i>Hilaria jamesii</i>	193	3.37
G	<i>Oryzopsis hymenoides</i>	9	.60
G	<i>Sitanion hystrix</i>	21	.32
G	<i>Stipa comata</i>	177	7.14
G	<i>Vulpia octoflora</i> (a)	7	.01
Total for Annual Grasses		366	3.39
Total for Perennial Grasses		442	11.75
Total for Grasses		808	15.15
F	<i>Alyssum alyssoides</i> (a)	97	.26
F	<i>Astragalus</i> sp.	7	.04
F	<i>Chenopodium fremontii</i> (a)	3	.00
F	<i>Collinsia parviflora</i> (a)	2	.00
F	<i>Descurainia pinnata</i> (a)	4	.01
F	<i>Draba</i> sp. (a)	3	.00
F	<i>Gilia</i> sp. (a)	49	.29
F	<i>Lappula occidentalis</i> (a)	102	2.73
F	<i>Leucelene ericoides</i>	3	.15
F	<i>Lupinus</i> sp.	19	.15
F	<i>Phlox longifolia</i>	12	.05
F	<i>Ranunculus testiculatus</i> (a)	357	2.76
F	<i>Sphaeralcea coccinea</i>	72	3.81
Total for Annual Forbs		617	6.08
Total for Perennial Forbs		113	4.21
Total for Forbs		730	10.29

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

BROWSE TRENDS--

Management unit 22R, Study no: 17

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia tridentata wyomingensis	76	11.62
B	Chrysothamnus viscidiflorus	1	-
B	Pediocactus simpsonii	1	-
Total for Browse		78	11.62

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 17

Species	Percent Cover '08
Artemisia tridentata wyomingensis	15.26

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 22R, Study no: 17

Species	Average leader growth (in) '08
Artemisia tridentata wyomingensis	1.7

BASIC COVER--

Management unit 22R, Study no: 17

Cover Type	Average Cover % '08
Vegetation	33.69
Rock	2.53
Pavement	21.73
Litter	50.02
Cryptogams	.08
Bare Ground	8.96

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 17, Study Name: Beaver Easement Harrow

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	7.0	40.0	33.4	26.6	1.7	3.2	323.2	0.8

PELLET GROUP DATA--

Management unit 22R, Study no: 17

Type	Quadrat Frequency	Days use per acre (ha)
	'08	'08
Rabbit	89	-
Elk	1	1 (2)
Deer	30	59 (146)
Cattle	14	13 (32)

BROWSE CHARACTERISTICS--

Management unit 22R, Study no: 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)
<i>Artemisia tridentata wyomingensis</i>									
08	4980	39	39	22	21360	11	16	12	22/34
<i>Chrysothamnus viscidiflorus</i>									
08	20	0	100	-	-	0	100	0	-/-
<i>Pediocactus simpsonii</i>									
08	20	0	100	-	-	0	0	0	3/3

A&F DRILL 1 (GIP) - TREND STUDY NO. 22R-18-08
[Project #1007](#)

Vegetation Type: Grassland

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Stony Loam \(Black Sagebrush\), R028AY252UT](#)

Land Ownership: Private

Elevation: 5,330 ft. (1,625 m)

Aspect: South

Slope: 2%

Transect bearing: 3° magnetic

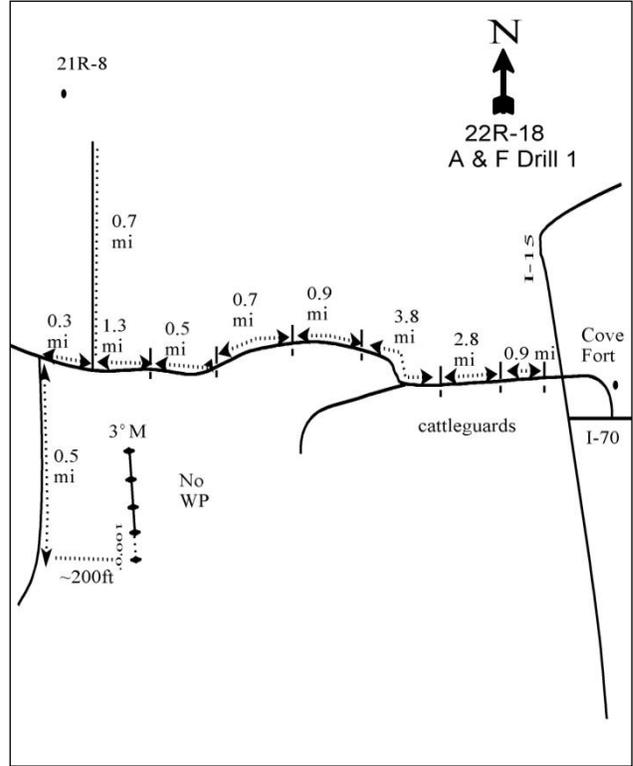
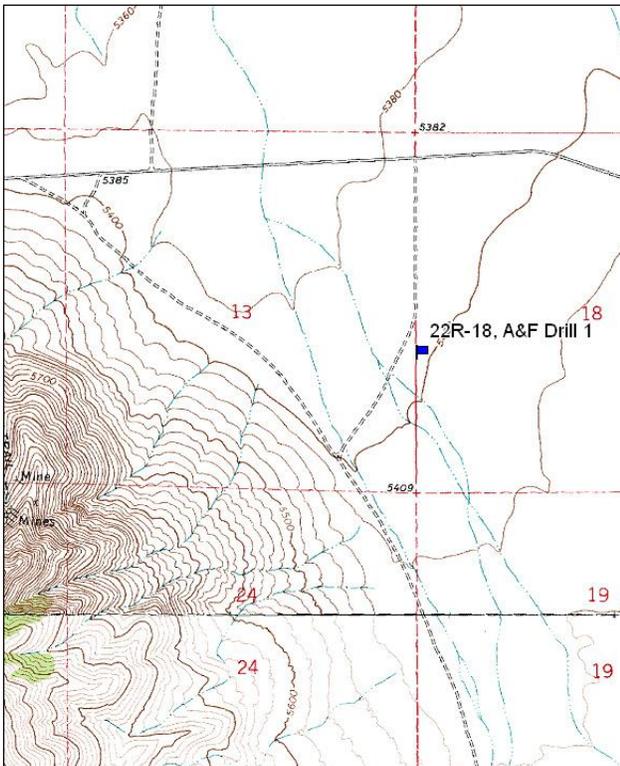
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

Take the Cove Fort exit on I-15 and proceed west on Black Rock Road 0.9 miles to a cattle guard, and continue 2.8 miles to the next cattle guard. Drive 3.8 miles, 0.9 miles, 0.7 miles, and 0.5 miles to the next cattle guards. From here, drive 1.3 miles to a fence line on the right (turn off to 21R-8). Continue 0.3 miles to a road on the left. Drive 0.5 miles to the site. There is no witness post; go 200 feet to the 0' stake on the left side of the road. The 0' stake is marked with browse tag #258.

Map Name: Antelope Spring

Diagrammatic Sketch:



Township: 25S Range: 8W Section: 18

GPS: NAD 83, UTM 12T 342810 E 4277860 N

A&F DRILL 1 (GIP) - WRI STUDY 22R-18
[Project #1007](#)

Site Description

Site Information: The study is located approximately ten miles southeast of Black Rock, in a grass flat, northeast of Antelope Mountain, south of the Black Rock road, on private land. The study was established in 2008 to monitor the effects of a seeding treatment, following the Milford Flat Fire that burned approximately 390,000 acres in the summer of 2007. Several thousand acres of private land were burned in agricultural areas as well as sagebrush steppe. Drill seeding occurred in both areas with the use of thirty foot grain drills, and aerial seeding was also applied in areas where drills could not be used. Also, aerial seeding was used in an area where drill seeding was to occur, but due to timing and late winter storms in this area the landowner and Utah Division of Wildlife Resources (UDWR) agreed that aerial seeding would be justified. The study site was located within the drill seeded portion of the project (the drill rows are clearly visible in the photographs). The objectives of the project are to rehabilitate crucial wildlife and livestock habitats, and reestablish vegetation through reseeding efforts following the wildfire of 2007 (WRI Database 2011). Pellet group data estimated little or no use by wildlife or livestock in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 22R, Study no: 18

Project Name: Missouri Flat Black Rock Road 1&2			
WRI Database #: 1007			
Application: Drill seeded		Acres:	2500
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Ephraim'	1150	0.46
G	Crested Wheatgrass 'Hycrest'	5270	2.11
G	Indian Ricegrass 'Rimrock'	700	0.28
G	Intermediate Wheatgrass 'Rush'	2750	1.10
G	Pubescent Wheatgrass	7625	3.05
G	Russian Wildrye	7677	3.07
G	Siberian Wheatgrass 'Vavilov'	1900	0.76
B	Forage Kochia	700	0.28
B	Fourwing Saltbush	700	0.28
Total Pounds:		28472	11.39
PLS Pounds:			9.76

Browse: Browse species are rare on the site. The seeded species forage kochia (*Kochia prostrata*) and fourwing saltbush (*Atriplex canescens*) were the only browse species sampled on the site in 2008, though both species occurred in low abundance (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant, but are not particularly diverse on the site. The dominant grass species on the site is an unknown perennial grass species, which was seeded on the site. The unknown grass species provided the majority of the cover in 2008. The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled in moderate abundance and cover. Other less common grass species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*), crested wheatgrass (*Agropyron cristatum*), and bottlebrush squirreltail (*Sitanion hystrix*), though Indian ricegrass and crested wheatgrass were seeded in the drill treatment. Forbs are not abundant or diverse, and perennial forbs are rare on the site (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is low with a very high amount of pavement providing protective ground cover (Table -

Basic Cover). The soil erosion condition was classified as stable in 2008, but there was evidence of wind erosion following the fire.

HERBACEOUS TRENDS--

Management unit 22R, Study no: 18

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	Agropyron cristatum	11	.06
G	Bromus tectorum (a)	109	1.02
G	Oryzopsis hymenoides	3	.15
G	Sitanion hystrix	3	.03
G	Unknown grass - perennial	187	4.15
Total for Annual Grasses		109	1.02
Total for Perennial Grasses		204	4.39
Total for Grasses		313	5.42
F	Alyssum desertorum (a)	52	1.11
F	Amaranthus albus	-	.41
F	Astragalus sp.	3	.04
F	Melilotus officinalis	-	.00
F	Phlox longifolia	10	.03
F	Solanum triflorum (a)	1	.41
F	Verbena bracteata	2	.15
Total for Annual Forbs		53	1.52
Total for Perennial Forbs		15	0.64
Total for Forbs		68	2.17

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

BROWSE TRENDS--

Management unit 22R, Study no: 18

Type	Species	Strip	Average
		Frequency	Cover %
		'08	'08
B	Atriplex canescens	1	-
B	Kochia prostrata	19	.05
Total for Browse		20	0.05

CANOPY COVER, LINE INTERCEPT--

Management unit 22R, Study no: 18

Species	Percent
	Cover
	'08
Kochia prostrata	.76

BASIC COVER--

Management unit 22R, Study no: 18

Cover Type	Average Cover % '08
Vegetation	7.59
Rock	2.85
Pavement	86.88
Litter	.76
Bare Ground	10.00

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 18, Study Name: A&F Drill 1

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	7.2	56.0	21.4	22.6	0.5	5.2	326.4	1.0

PELLET GROUP DATA--

Management unit 22R, Study no: 18

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	5	-

BROWSE CHARACTERISTICS--

Management unit 22R, 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	
Atriplex canescens									
08	20	100	0	-	20	0	0	0	-/-
Kochia prostrata									
08	440	0	100	-	-	5	0	0	9/18

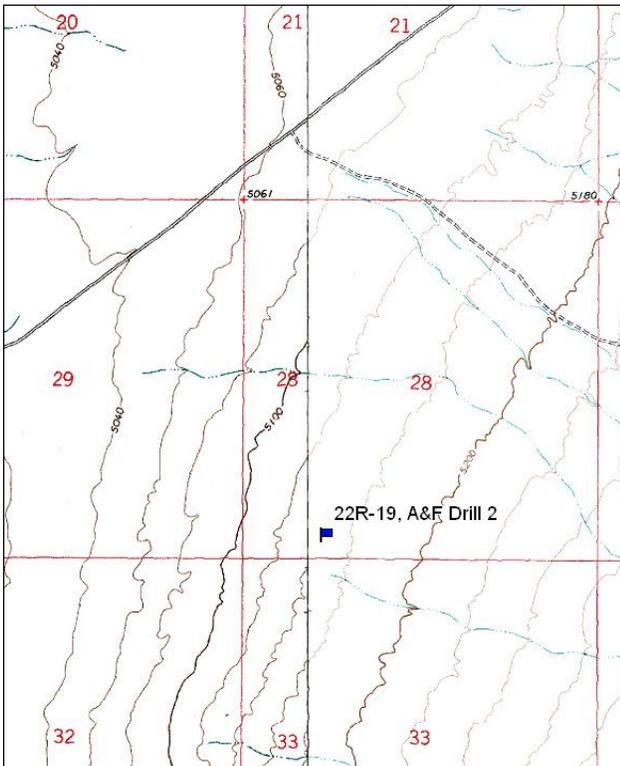
A&F DRILL 2 (GIP) - TREND STUDY NO. 22R-19-08
[Project #1010](#)

Vegetation Type: Annual Grass
Range Type: Deer Winter
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 5,146 ft. (1,569 m)
Aspect: West
Slope: 3%
Transect bearing: 90° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

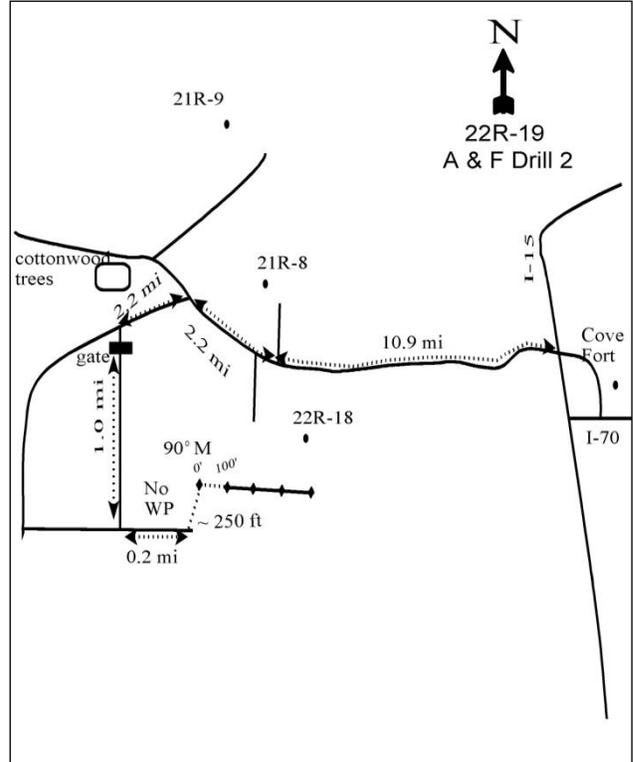
Take the Cove Fort exit on I-15 and proceed west on Black Rock Road 0.9 miles to a cattle guard, and continue 2.8 miles to the next cattle guard. Drive 3.8 miles, 0.9 miles, 0.7 miles, and 0.5 miles to the next cattle guards. From here, drive 1.3 miles to a fence line on the right (the turnoff to 21R-8). Drive 0.7 miles to a cattle guard; proceed 1.8 miles to a fork, and go left (right fork leads to 21R-9). Drive 2.2 miles to a road on the left, and drive 0.1 miles to a gate. From the gate, drive 1.0 mile to a road on the left, and go 0.2 miles to the site. There is no witness post; go 250 feet to the 0' stake on the left side of the road. The 0' stake is marked with browse tag #227.

Map Name: Antelope Spring



Township: 25S Range: 9W Section: 28

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 336723 E 4274322 N

A&F DRILL 2 (GIP) - WRI STUDY 22R-19
[Project #1010](#)

Site Description

Site Information: The study is located approximately nine miles southeast of Black Rock, in a grass flat, west of Antelope Mountain, on private land. The study was established in 2008 to monitor the effects of a seeding treatment following the Milford Flat Fire that burned approximately 390,000 acres in the summer of 2007. Several thousand acres of private land were burned in agricultural areas as well as sagebrush steppe. In the spring of 2008, the private landowner drill seeded 530 acres with the use of a private grain drill and an additional 256 acres were aerially seeded (Table - Seed Mix). The study was located in the drill seeded portion of the project. The objectives of the project are to rehabilitate crucial wildlife and livestock habitats, and reestablish vegetation through reseeding efforts following the wildfire of 2007 (WRI Database 2011). Pellet group data estimated little or no use by wildlife or livestock in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 22R, Study no: 19

Project Name: Milford Fire JK Drill			
WRI Database #: 1010			
Application: Drill Seed		Acres: 530	
Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	100	0.19
G	Crested Wheatgrass 'Hycrest'	800	1.51
G	Crested Wheatgrass 'Nordan'	800	1.51
G	Indian Ricegrass 'Rimrock'	250	0.47
G	Russian Wildrye	1050	1.98
G	Siberian Wheatgrass 'Vavilov'	750	1.42
G	Thickspike Wheatgrass 'Critana'	500	0.94
G	Western Wheatgrass 'Arriba'	700	1.32
F	Yellow Sweetclover	300	0.57
B	Forage Kochia	200	0.38
B	Fourwing Saltbush	231	0.44
Total Pounds:		5681	10.72
PLS Pounds:			9.10

Browse: No browse species were sampled on the study site in 2008.

Herbaceous Understory: Grasses are moderately abundant, but are not diverse and are in poor condition. Perennial grass species are rare on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species and provides the majority of the grass cover. Other less common grass species sampled on the site include purple three-awn (*Aristida purpurea*), galleta (*Hilaria jamesii*), and needle-and-thread (*Stipa comata*). Forbs are moderately abundant, but are not particularly diverse. Perennial forbs are rare on the site, and the annual forb species nodding eriogonum (*Eriogonum cernuum*) and storksbill (*Erodium cicutarium*) are the dominant forb species providing the majority of the forb cover.

Soil: The soil texture is a sandy loam with a slightly alkaline soil reaction (pH 7.7) (Table - Soil Analysis Data). Bare ground cover is moderate with an extremely high amount of pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 22R, Study no: 19

Type	Species	Nested Frequency '08	Average Cover % '08
G	<i>Aristida purpurea</i>	5	.18
G	<i>Bromus tectorum</i> (a)	242	5.60
G	<i>Hilaria jamesii</i>	4	.15
G	<i>Stipa comata</i>	2	.00
Total for Annual Grasses		242	5.60
Total for Perennial Grasses		11	0.33
Total for Grasses		253	5.94
F	<i>Alyssum desertorum</i> (a)	3	.00
F	<i>Argemone</i> sp.	5	.15
F	<i>Astragalus</i> sp.	11	.05
F	<i>Eriogonum cernuum</i> (a)	46	3.64
F	<i>Erodium cicutarium</i> (a)	77	2.79
F	<i>Lappula occidentalis</i> (a)	3	.03
F	<i>Lygodesmia</i> sp.	1	.15
F	<i>Mentzelia albicaulis</i> (a)	3	.03
F	<i>Oenothera</i> sp.	3	.15
F	<i>Salsola iberica</i> (a)	3	.00
F	<i>Sisymbrium altissimum</i> (a)	11	.06
F	<i>Sphaeralcea coccinea</i>	3	.19
Total for Annual Forbs		146	6.56
Total for Perennial Forbs		23	0.70
Total for Forbs		169	7.26

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

BASIC COVER--

Management unit 22R, Study no: 19

Cover Type	Average Cover % '08
Vegetation	15.45
Rock	.36
Pavement	74.23
Litter	2.78
Bare Ground	15.80

SOIL ANALYSIS DATA --

Management unit 22R, Study no: 19, Study Name: A&F Drill Seed

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	7.7	72.0	15.4	12.6	0.7	8.4	233.6	0.8

PELLET GROUP DATA--

Management unit 22R, Study no: 19

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	9	-
Deer	4	-
Cattle	1	-

GREENWICH DISKING - TREND STUDY NO. 23R-1-08

Vegetation Type: Perennial Grass/Forb

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Not available

Land Ownership: BLM

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

Aspect: Northeast

Slope: 5%

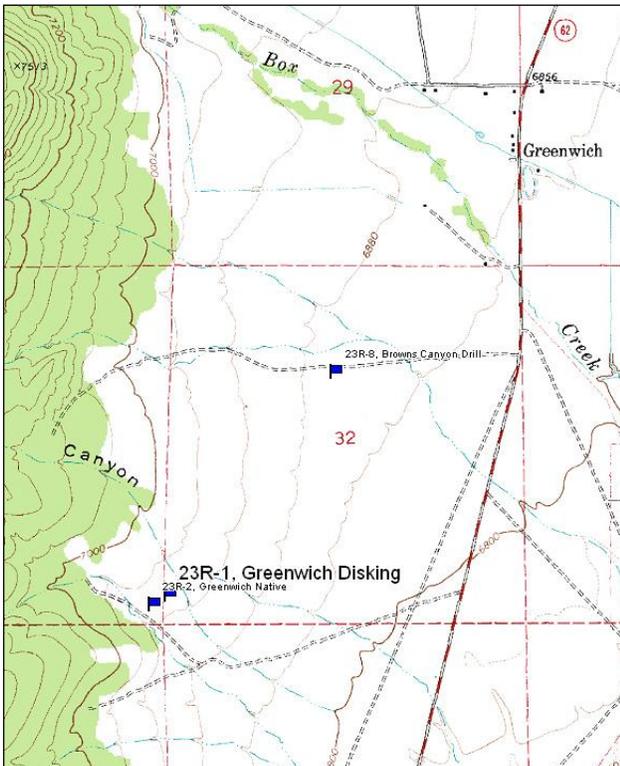
Transect bearing: 86° magnetic

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

Directions:

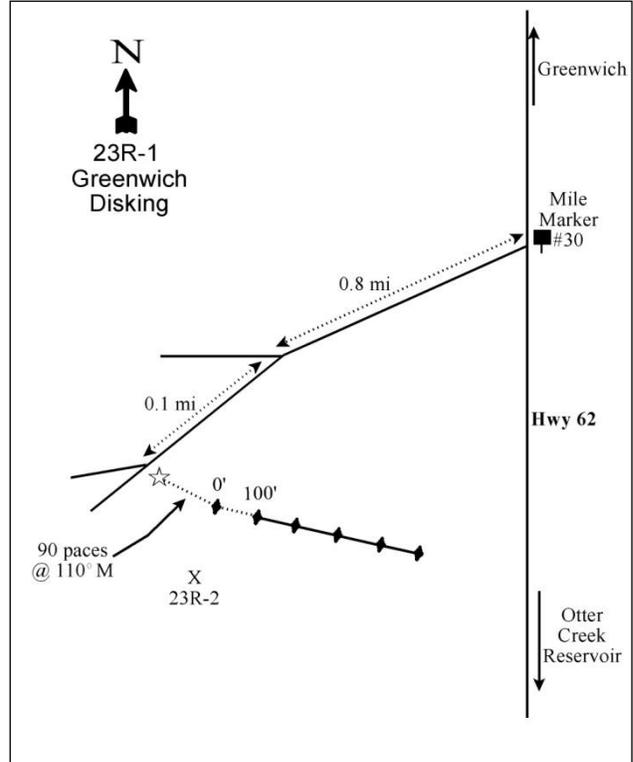
Start on Highway 62 between Greenwich and Otter Creek Reservoir. At 0.5 miles north of mile marker 30 there is a road going west. Take this road for 0.8 miles to a fork. Stay left and go 0.1 mile to a witness post on the left (south) side of the road. Walk 90 paces at 110 degrees magnetic into the disking to the 0-foot stake. The 0' stake is marked with browse tag #103.

Map Name: Greenwich



Township: 28S Range: 1W Section: 5

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 417968 E 4251602 N

GREENWICH DISKING - WRI STUDY 23R-1

Site Description

Site Information: The study is located on big game winter range, two miles southwest of Greenwich and west of Highway 62, on land administered by the Bureau of Land Management (BLM). The study was established in 1997, following the treatment, to monitor the effects of a Wyoming big sagebrush (*Artemisia tridentata* ssp *wyomingensis*) disking and seeding treatment. The area was treated during the fall of 1996 to enhance herbaceous vegetation. Long narrow areas were disked (200 ft to 300 ft in width) and seeded leaving large areas of undisturbed sagebrush. After the first year, seeded perennial grasses, forbs, and shrubs were observed growing in the treated strips. The site was reread in 2003 and browse species were not growing within the strips and cutleaf nightshade (*Solanum triflorum*) was nearly the only herbaceous species encountered. The study site was reread in 2004 prior to an additional treatment project. Greenwich Native trend study 23R-2 was established as a control in 1997 and the vegetation composition had overly mature sagebrush with little understory vegetation. In November of 2004, a second project (Narrows Project) was undertaken to establish grass, forb, and browse species on the previous treated areas and untreated areas. The Greenwich Disking site was broadcasted seeded with grass, forb, and browse species, and then one-way harrowed in the previous strips left from the disking treatment in 1996. As part of the Narrows Project a portion of the Greenwich Native study site was two-way harrowed and seeded with grass, forb, and browse species. The seed was applied after the first pass of the harrow (Table - Seed Mix). A total of 3,600 acres were treated. Pellet group data has estimated light use by elk since 1997, and light for deer in 1997 and 2004. Use was estimated light by cattle in 2003 and 2004 (Table - Pellet Group Data).

SEED MIX--

Management unit 23R, Study no: 1

Project Name: Narrows Project					
WRI Database #: None					
Application: Broadcast Seeder		Acres: 3,600		Application: Broadcast Seeder	
				Acres: 1,100	
Seed type		lbs in mix	lbs/acre	Seed type	
G	*Basin Wildrye	1800	0.50	B	*Forage Kochia 'Immigrant'
G	*Crested Wheatgrass	3600	1.00	B	Sagebrush, Wyoming
G	*Indian Ricegrass	2550	0.71	Total Pounds:	
				1650 1.50	
G	*Pubescent Wheatgrass	7200	2.00		
G	*Russian Wildrye	3600	1.00		
G	*Sandberg Bluegrass	3600	1.00		
G	*Sheep Fescue	3600	1.00		
F	*Lewis Flax	3550	0.99		
F	*Small Burnet	7200	2.00		
F	*Yellow Sweetclover	3600	1.00		
F	Alfalfa 'Ladak+'	5400	1.50		
F	Annual Sunflower	150	0.04		
F	Cicer Milkvetch 'Lutana'	525	0.15		
F	Prickly Lettuce	48	0.01		
F	Sainfoin	5400	1.50		
F	Western Yarrow	250	0.07		
B	*Four-wing Saltbush	3600	1.00		
Total Pounds:		55673	15.46		

*Seed provided by the Bureau of Land Management (BLM).

Browse: The preferred browse species on the site is Wyoming big Sagebrush. The Wyoming sagebrush population was treated prior to the establishment of the study site, and the remaining sagebrush population was

sampled at low density in 1997. The sagebrush density decreased further with few to no plants sampled in 2003 or 2004. However, sagebrush has increased in abundance since the reseeding and harrow project in 2004. The sagebrush population following the 2004 treatment is a relatively small population with low decadence and good vigor. The recruitment of young sagebrush plants to the population was excellent following the 1996 and 2004 treatments, but was low in the 2003 and 2004 sample years due to the low density of the population. Utilization of sagebrush plants has been mostly light over the sample years. Other browse species sampled on the site include fourwing saltbush (*Atriplex canescens*) and pricklypear cactus (*Opuntia sp.*). Following the 1996 treatment, there was a flush of young fourwing saltbush plants sampled in 1997, though in subsequent sample year's fourwing saltbush has been rare on the site with little to no plants being sampled (Table - Browse Characteristics).

Herbaceous Understory: Grasses were moderately abundant and fairly diverse following the 2004 treatment, although most of the sample years, grass species were rare and not diverse. There were no grass species sampled in 2003 or 2004. Grass species increased in diversity and abundance following the Narrows Project treatment in 2004. The dominant grass species sample on the site was the seeded species Russian wildrye (*Elymus junceus*). At the outset of the study, crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) were the dominant grass species on the site. Following the Narrows Project harrow treatment, seeded species sampled on the site in 2008 included crested wheatgrass, intermediate wheatgrass, Great Basin wildrye (*Elymus cinereus*), sheep fescue (*Festuca ovina*), and Russian wildrye; however, all the seeded perennial species other than Russian wildrye were sampled at low frequency and cover. Crested wheatgrass and intermediate wheatgrass were also sampled on the site prior to the 2004 treatment. Perennial forb species were moderately abundant at the outset of the study due to the seeded species alfalfa (*Medicago sativa*), but other perennial forb species were rare. Alfalfa decreased substantially in abundance, and was not sampled in 2003 or 2008. Alfalfa was extremely rare in 2004. The seeded species Lewis flax (*Linum lewisii*) was sampled in 2008, following the treatment, and provided nearly all of the perennial forb cover on the site. Annual forbs have dominated the forb component at times, but cover and frequency have fluctuated markedly over the sample years. The most common annual forb species sampled on the site include cutleaf nightshade, Russian thistle (*Salsola iberica*), and annual stickseed (*Lappula occidentalis*) (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a slightly acidic soil reaction (pH 6.4) (Table - Soil Analysis Data). Bare ground cover is high, with a moderate amount of litter, pavement, and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2003 and 2008 due litter and soil movement, flow patterns, rills, and gullies. The soil erosion condition was classified as stable in 2004.

Trend Assessments

Browse

- **1997 to 2003 - down (-2):** The density of Wyoming big sagebrush decreased from 740 plants/acre to 0 plants/acre. Fourwing saltbush decreased in density from 720 plants/acre to 0 plants/acre.
- **2003 to 2004 - stable (0):** The density of Wyoming big sagebrush increased to 20 plants/acre. The density of fourwing saltbush increased to 20 plants/acre.
- **2004 to 2008 - up (+2):** The density of Wyoming big sagebrush increased fifteen-fold to 300 plants/acre, but cover remained minimal.

Grass

- **1997 to 2003 - down (-2):** Perennial grasses became very rare with no grasses sampled on the site. The sum of nested frequency of perennial grasses significantly decreased 100% and cover decreased from 5% to 0%.
- **2003 to 2004 - stable (0):** No grass species was sampled in either sample year.
- **2004 to 2008 - up (+2):** The sum of nested frequency of perennial grasses increased substantially, and cover increased to 8%. The seeded species Russian wildrye provided 6% cover.

Forb

- **1997 to 2003 - down (-2):** Perennial forbs became very rare on the site with no perennial forbs sampled on the site in 2003. The sum of nested frequency of perennial forbs significantly decreased 100% and decreased from 6% to 0%. Alfalfa decreased significantly in nested frequency and cover decreased from 6% to 0%.
- **2003 to 2004 - stable (0):** Perennial forbs remained rare on the site, though several perennial species were sampled. The sum of nested frequency of annual forbs significantly increased and cover increased from 5% to 33%. Cutleaf nightshade increased significantly in nested frequency and cover increased from 5% to 31%.
- **2004 to 2008 - slightly up (+1):** Perennial forbs remained rare on the site. The sum of nested frequency of perennial forbs increased five-fold and cover increased to 4% due to the seeded species Lewis flax. The sum of nested frequency of annual forbs increased 79%, but cover decreased to 4%.

HERBACEOUS TRENDS--

Management unit 23R, Study no: 1

Type	Species	Nested Frequency				Average Cover %			
		'97	'03	'04	'08	'97	'03	'04	'08
G	Agropyron cristatum	c209	a-	a-	b21	3.49	-	-	.09
G	Agropyron intermedium	b83	a-	a-	a5	1.22	-	-	.07
G	Bromus tectorum (a)	2	-	-	-	.00	-	-	-
G	Elymus cinereus	-	-	-	2	-	-	-	.15
G	Elymus junceus	a-	a-	a-	b159	-	-	-	6.32
G	Festuca ovina	a-	a-	a-	b64	-	-	-	.63
G	Oryzopsis hymenoides	-	-	-	6	-	-	-	.09
G	Poa secunda	a-	a-	a-	b41	-	-	-	.12
G	Sitanion hystrix	a-	a-	a-	b12	-	-	-	.06
Total for Annual Grasses		2	0	0	0	0.00	0	0	0
Total for Perennial Grasses		292	0	0	310	4.71	0	0	7.54
Total for Grasses		294	0	0	310	4.71	0	0	7.54
F	Astragalus sp.	2	-	-	-	.03	-	.03	-
F	Cleome sp. (a)	-	-	4	-	-	-	1.21	-
F	Descurainia pinnata (a)	-	-	-	-	-	-	.03	-
F	Epilobium brachycarpum (a)	7	-	-	-	.07	-	-	-
F	Eriogonum cernuum (a)	-	-	-	4	-	-	-	.01
F	Kochia scoparia (a)	b156	a-	a-	a-	5.71	-	-	-
F	Lappula occidentalis (a)	a-	a-	a1	b107	-	-	.00	2.24
F	Linum lewisii	a-	a-	a-	b34	-	-	-	4.15
F	Marrubium vulgare	-	-	-	-	-	-	-	.06
F	Medicago sativa	b226	a-	a6	a-	6.09	-	.21	-
F	Mentzelia albicaulis (a)	-	-	-	3	-	-	-	.03
F	Nicotiana attenuata (a)	-	-	1	-	-	-	.15	-
F	Salsola iberica (a)	a-	a-	a6	b233	-	-	.19	1.33
F	Sanguisorba minor	b33	a-	a-	a-	.22	-	-	-
F	Solanum triflorum (a)	a-	a5	b152	a-	-	4.94	31.43	-
Total for Annual Forbs		163	5	164	347	5.78	4.94	33.02	3.62
Total for Perennial Forbs		261	0	6	34	6.36	0	0.24	4.22
Total for Forbs		424	5	170	381	12.14	4.94	33.26	7.85

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

BROWSE TRENDS--

Management unit 23R, Study no: 1

Type	Species	Strip Frequency				Average Cover %			
		'97	'03	'04	'08	'97	'03	'04	'08
B	Artemisia tridentata wyomingensis	24	0	1	13	.58	-	-	.75
B	Atriplex canescens	21	0	1	0	.02	-	-	-
B	Atriplex confertifolia	-	-	-	-	.11	-	-	-
B	Opuntia sp.	1	0	0	0	.15	-	-	-
Total for Browse		46	0	2	13	0.86	0	0	0.75

CANOPY COVER, LINE INTERCEPT--

Management unit 23R, Study no: 1

Species	Percent Cover '08
Artemisia tridentata wyomingensis	.01

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 23R, Study no: 1

Species	Average leader growth (in) '08
Artemisia tridentata wyomingensis	2.4

BASIC COVER--

Management unit 23R, Study no: 1

Cover Type	Average Cover %			
	'97	'03	'04	'08
Vegetation	15.51	5.21	33.64	15.24
Rock	4.41	9.32	4.32	5.22
Pavement	4.51	3.75	5.36	4.11
Litter	20.42	36.52	22.22	35.11
Cryptogams	.18	.11	.01	0
Bare Ground	51.62	49.48	46.60	53.69

SOIL ANALYSIS DATA --

Management unit 23R, Study no: 1, Study Name: Greenwich Disking

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
14.8	6.4	57.6	25.1	17.3	1.0	22.7	288.0	0.5

PELLET GROUP DATA--

Management unit 23R, Study no: 1

Type	Quadrat Frequency			
	'97	'03	'04	'08
Rabbit	11	91	64	94
Elk	-	4	3	2
Deer	6	-	3	-
Cattle	-	1	-	-

Days use per acre (ha)		
'03	'04	'08
-	-	-
2 (1)	7 (18)	6 (15)
-	-	-
-	3 (7)	-

BROWSE CHARACTERISTICS--

Management unit 23R, 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>									
97	740	65	30	5	20	0	0	0	14/23
03	0	0	0	0	-	0	0	0	21/31
04	20	100	0	0	20	0	0	0	18/24
08	300	20	80	0	20	20	0	20	13/18
<i>Atriplex canescens</i>									
97	720	100	0	-	20	0	0	0	11/9
03	0	0	0	-	-	0	0	0	-/-
04	20	100	0	-	-	0	100	0	-/-
08	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
97	0	0	0	-	-	0	0	0	-/-
03	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	15/17
<i>Opuntia sp.</i>									
97	20	0	100	-	-	0	0	0	6/11
03	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-

GREENWICH NATIVE - TREND STUDY NO. 23R-2-08

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Not available

Land Ownership: BLM

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

Aspect: Northeast

Slope: 5%

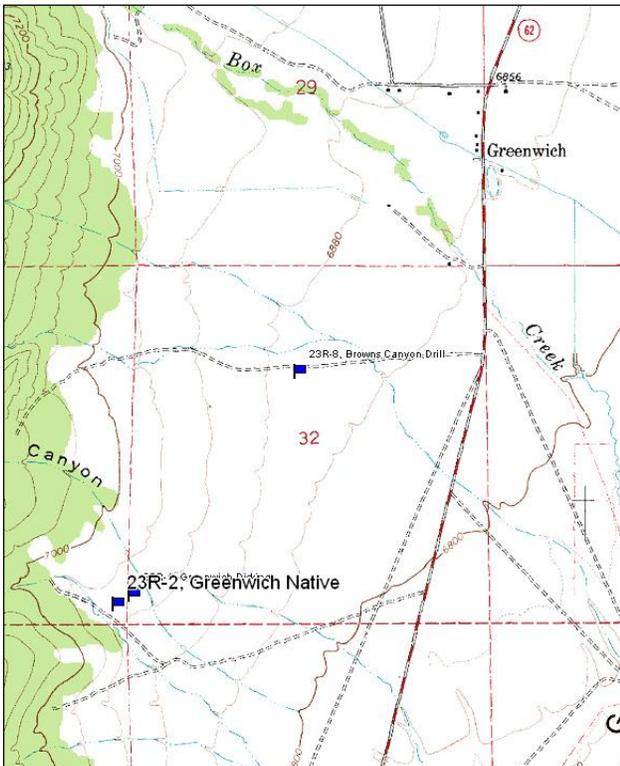
Transect bearing: 79° magnetic

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

Directions:

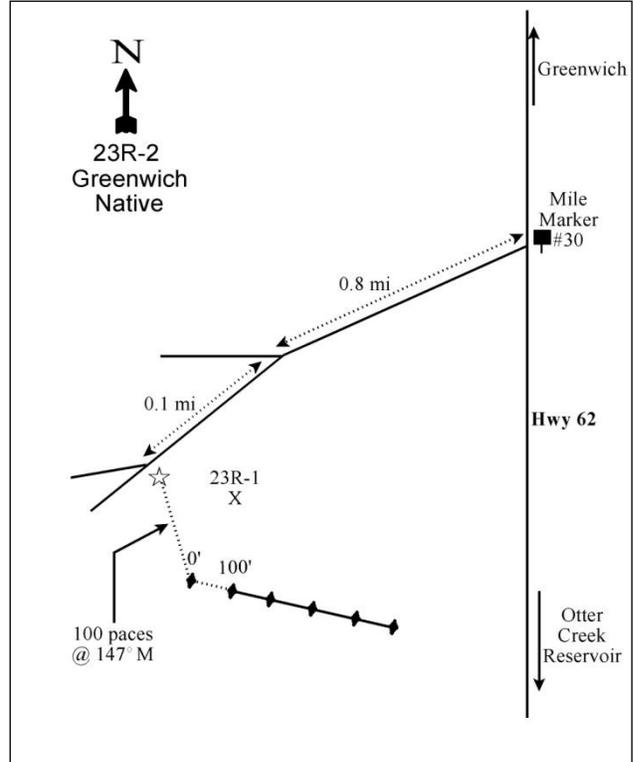
Start on Highway 62 between Greenwich and Otter Creek Reservoir. At 0.5 miles north of mile marker 30 there is a road going west. Take this road for 0.8 miles to a fork. Stay left and go 0.1 mile to a witness post on the left (south) side of the road. From the witness post walk 100 paces at 147 degrees magnetic to the 0-foot stake. The 0' stake is marked with browse tag #102.

Map Name: Greenwich



Township: 28S Range: 1W Section: 5

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 417894 E 4251555 N

GREENWICH NATIVE - WRI STUDY 23R-2

Site Description

Site Information: The study was established as a reference site to the Greenwich Disking trend study (23R-1) in 1997 in an undisturbed Wyoming big sagebrush (*Artemisia tridentata* ssp *wyomingensis*) site adjacent to the disking and seeding treatment. The area is considered big game winter range two miles southwest of Greenwich and west of Highway 62 on land administered by the Bureau of Land Management (BLM). In November of 2004, a second project (Narrows Project) was undertaken to establish grass, forb, and browse species on the previous treated areas and untreated areas. The Greenwich Disking site was broadcasted seeded with grass, forb, and browse species and then one-way harrowed in the previous strips left from the disking treatment in 1996. As part of the Narrows Project, a portion of the Greenwich Native (23R-2) study site was two-way harrowed and seeded with grass, forb, and browse species. The seed was applied after the first pass of the harrow (Table - Seed Mix). A total of 3,600 acres were treated. Since 1997, pellet group data has estimated light use by elk. In 2008, use was estimated to be light for cattle, and in 1997 and 2004 use was light for deer (Table - Pellet Group Data).

SEED MIX--

Management unit 23R, Study no: 2

Project Name: Narrows Project					
WRI Database #: None					
Application: Broadcast Seeder		Acres: 3,600		Application: Broadcast Seeder	
Acres: 1,100					
Seed type		lbs in mix	lbs/acre	Seed type	
G	*Basin Wildrye	1800	0.50	B	*Forage Kochia 'Immigrant'
G	*Crested Wheatgrass	3600	1.00	B	Sagebrush, Wyoming
G	*Indian Ricegrass	2550	0.71	Total Pounds:	
				1650	1.50
G	*Pubescent Wheatgrass	7200	2.00		
G	*Russian Wildrye	3600	1.00		
G	*Sandberg Bluegrass	3600	1.00		
G	*Sheep Fescue	3600	1.00		
F	*Lewis Flax	3550	0.99		
F	*Small Burnet	7200	2.00		
F	*Yellow Sweetclover	3600	1.00		
F	Alfalfa 'Ladak+'	5400	1.50		
F	Annual Sunflower	150	0.04		
F	Cicer Milkvetch 'Lutana'	525	0.15		
F	Prickly Lettuce	48	0.01		
F	Sainfoin	5400	1.50		
F	Western Yarrow	250	0.07		
B	*Four-wing Saltbush	3600	1.00		
Total Pounds:		55673	15.46		

*Seed provided by the Bureau of Land Management (BLM).

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a light to moderately used population, with moderate to high decadence and poor vigor within the population over the sample years. Except in 2008, the recruitment of young sagebrush plants to the population has been poor since the outset of the study. In 2008, recruitment was excellent following the Narrows project treatment. The only other browse species sampled on the site is pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not abundant or diverse. Grass species have been rare on the site since the outset of the study, but have become more common following the Narrows Project harrow treatment. Blue grama (*Bouteloua gracilis*) and bottlebrush squirreltail (*Sitanion hystrix*) have been the most commonly sampled grass over the sample years. Seeded species sampled after the treatment include Russian wildrye (*Elymus junceus*), sheep fescue (*Festuca ovina*), and Indian ricegrass (*Oryzopsis hymenoides*). Forbs have been rare on the site since the outset of the study. Lewis flax (*Linum lewisii*) was the only seeded species sampled following the treatment (Table - Herbaceous Trends).

Soil: The soil texture is a sandy loam with a slightly acidic soil reaction (pH 6.3) (Table - Soil Analysis Data). While bare ground cover is high, there is also a moderate amount of litter, pavement, and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2003 and 2008 due to litter and soil movement, pedestalling, flow patterns, rills, and gullies. The soil erosion condition was classified as stable in 2004.

Trend Assessments

Browse

- **1997 to 2003 - down (-2):** The density of Wyoming big sagebrush remained similar at 4,220 and provided 17% canopy cover. The health of the sagebrush population decreased with decadence increasing from 17% to 82%, and poor vigor increasing from 7% to 40% of the population.
- **2003 to 2004 - slightly up (+1):** The density of Wyoming big sagebrush remained similar at 4,280 plants/acre, and canopy cover increased to 21%. The health of the sagebrush population improved slightly, but still remained poor with decadence decreasing to 57%, and poor vigor decreasing to 29% of the population.
- **2004 to 2008 - slightly up (+1):** Following the treatment, the density of Wyoming big sagebrush increased 44% to 6,160 plants/acre, but canopy cover decreased to 12%. The health of the sagebrush population improved to moderate with decadence decreasing to 30%, and poor vigor decreasing to 13%. The recruitment of young sagebrush plants increased substantially from 4% to 31% of the population.

Grass

- **1997 to 2003 - slightly down (-1):** Perennial grass became very rare on the site. The sum of nested frequency of perennial grasses decreased 66%, but grasses were already rare on the site. Cover of perennial grasses decreased from just below 1% to near 0%.
- **2003 to 2004 - stable (0):** Perennial grasses remained rare on the site.
- **2004 to 2008 - up (+2):** The sum of nested frequency of perennial grasses increased substantially, nearly eleven-fold, and cover increased to near 2%.

Forb

- **1997 to 2003 - stable (0):** Perennial forbs were very rare on the site.
- **2003 to 2004 - stable (0):** Perennial forbs remained rare on the site.
- **2004 to 2008 - slightly up (+1):** The sum of nested frequency of perennial forbs increased substantially, and cover increased to 3% due to the seeded species Lewis flax.

HERBACEOUS TRENDS--

Management unit 23R, Study no: 2

T y P e	Species	Nested Frequency				Average Cover %			
		'97	'03	'04	'08	'97	'03	'04	'08
G	<i>Bouteloua gracilis</i>	b17	ab9	ab10	a3	.27	.07	.04	.03
G	<i>Elymus junceus</i>	a-	a-	a-	b41	-	-	-	.92
G	<i>Festuca ovina</i>	a-	a-	a-	b24	-	-	-	.15
G	<i>Oryzopsis hymenoides</i>	-	-	-	1	-	-	-	.00

Type	Species	Nested Frequency				Average Cover %			
		'97	'03	'04	'08	'97	'03	'04	'08
G	<i>Sitanion hystrix</i>	c42	b11	a-	c38	.49	.05	-	.49
Total for Annual Grasses		0	0	0	0	0	0	0	0
Total for Perennial Grasses		59	20	10	107	0.76	0.12	0.04	1.60
Total for Grasses		59	20	10	107	0.76	0.12	0.04	1.60
F	<i>Astragalus</i> sp.	2	-	-	-	.03	-	-	-
F	<i>Cryptantha</i> sp.	-	-	-	-	-	-	.00	-
F	<i>Descurainia pinnata</i> (a)	a-	a-	b14	a1	-	-	.10	.01
F	<i>Lappula occidentalis</i> (a)	-	-	-	6	-	-	-	.01
F	<i>Linum lewisii</i>	a-	a-	a-	b41	-	-	-	3.26
F	<i>Phlox longifolia</i>	-	-	-	1	-	-	-	.00
F	<i>Salsola iberica</i> (a)	a-	a-	a-	b19	-	-	-	.04
F	<i>Solanum triflorum</i> (a)	-	1	-	-	-	.00	-	-
F	Unknown forb-perennial	-	-	-	-	-	-	.00	-
Total for Annual Forbs		0	1	14	26	0	0.00	0.10	0.07
Total for Perennial Forbs		2	0	0	42	0.03	0	0.01	3.27
Total for Forbs		2	1	14	68	0.03	0.00	0.11	3.34

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

BROWSE TRENDS--

Management unit 23R, Study no: 2

Type	Species	Strip Frequency				Average Cover %			
		'97	'03	'04	'08	'97	'03	'04	'08
B	<i>Artemisia tridentata wyomingensis</i>	88	86	88	91	22.94	21.12	19.82	14.43
B	<i>Opuntia</i> sp.	1	0	1	1	.06	-	-	.00
Total for Browse		89	86	89	92	23.00	21.12	19.82	14.43

CANOPY COVER, LINE INTERCEPT--

Management unit 23R, Study no: 2

Species	Percent Cover		
	'03	'04	'08
<i>Artemisia tridentata wyomingensis</i>	16.56	21.36	11.89
<i>Opuntia</i> sp.	-	.06	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 23R, Study no: 2

Species	Average leader growth (in)		
	'03	'04	'08
<i>Artemisia tridentata wyomingensis</i>	2.0	2.1	1.6

BASIC COVER--

Management unit 23R, Study no: 2

Cover Type	Average Cover %			
	'97	'03	'04	'08
Vegetation	24.26	21.27	19.88	19.06
Rock	22.26	19.95	9.39	10.75
Pavement	37.05	18.17	30.99	14.98
Litter	23.88	22.29	27.65	39.42
Cryptogams	12.39	7.34	2.51	2.46
Bare Ground	25.52	21.89	27.09	30.23

SOIL ANALYSIS DATA --

Management unit 23R, Study no: 2, Study Name: Greenwich Native

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.8	6.3	55.3	26.2	18.6	1.2	17.7	147.2	0.4

PELLET GROUP DATA--

Management unit 23R, Study no: 2

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'03	'04	'08	'03	'04	'08
Rabbit	1	64	42	87	-	-	-
Elk	-	-	-	1	1 (3)	5 (12)	3 (8)
Deer	3	-	1	-	-	1 (2)	-
Cattle	-	-	-	-	-	-	1 (2)

BROWSE CHARACTERISTICS--

Management unit 23R, 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>									
97	4200	6	77	17	160	42	.47	7	27/41
03	4220	4	14	82	-	11	1	40	22/28
04	4280	4	40	57	5500	2	1	29	24/34
08	6160	31	40	30	4940	17	17	13	20/26
<i>Gutierrezia sarothrae</i>									
97	0	0	0	-	-	0	0	0	-/-
03	0	0	0	-	-	0	0	0	8/6
04	0	0	0	-	-	0	0	0	10/6
08	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
97	40	0	100	0	-	0	0	0	-/-
03	0	0	0	0	-	0	0	0	5/13
04	20	0	100	0	-	0	0	0	5/15
08	20	0	0	100	20	0	0	100	5/13

BUCKSKIN 2 - TREND STUDY NO. 27R-17-08
[Project #112](#) and [Project #453](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Upland Shallow Loam (Cliffrose), R035XY313UT

Land Ownership: BLM

Elevation: 6,367 ft. (1,941 m)

Aspect: South

Slope: 1%

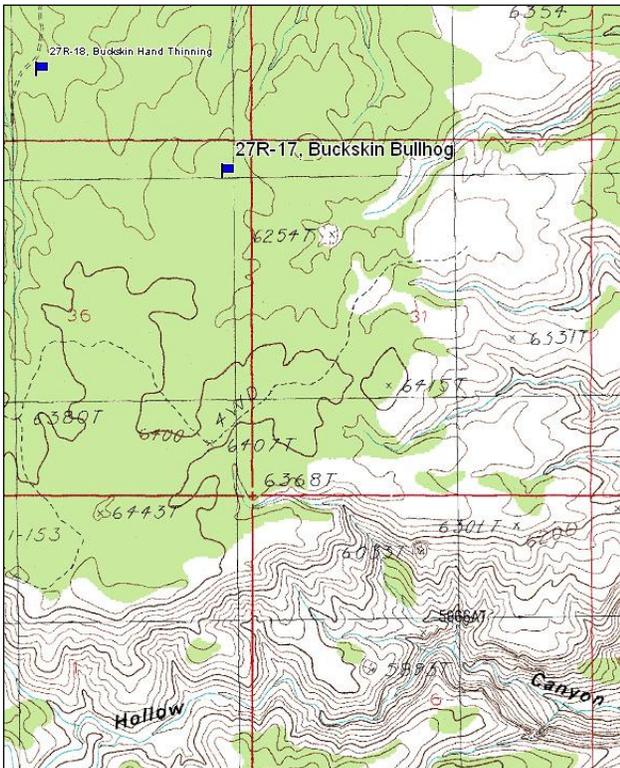
Transect bearing: 109° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59 ft), line 4 (71 ft), line 5 (93 ft)

Directions:

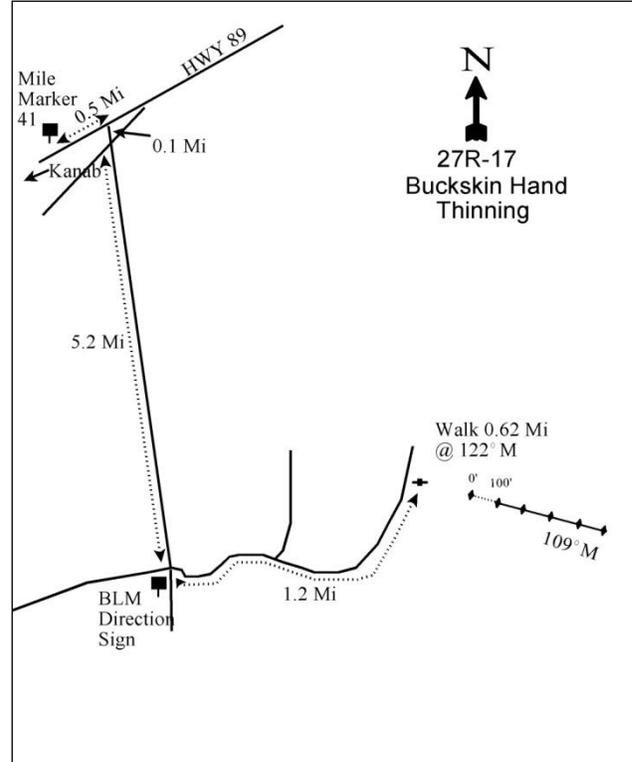
From Kanab, drive west on US 89 to mile maker 41. Continue past the mile marker 0.5 miles to a road on the right (south). Turn right and drive 0.1 miles to a road. Continue on the main road for 5.2 miles to a three-way intersection. Turn left and then drive 1.2 miles to the witness post on right (east) side of the road. From the witness post, walk 0.62 miles at 122°M to the 0' stake (use GPS). The 0' stake is marked with browse tag #90.

Map Name: Pine Hollow Canyon



Township: 43S Range: 3W Section: 36

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 404886 E 4099205 N

BUCKSKIN 2 - WRI STUDY 27R-17
[Project #112](#) and [Project #453](#)

Site Description

Site Information: The study is located approximately twenty five miles east of Kanab, in a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, on land administered by the Bureau of Land Management (BLM), on Buckskin Mountain. The study was originally established in 2005 , prior to treatment, to monitor the effects of a lop and scatter and seeding project ([Project #112](#)) completed in November of 2005, but in the summer of 2006 a wildfire (Buckskin Fire) burned 1,437 acres including the study site. A seed mix of grass, forb and browse species was aerially applied to the study site after the lop and scatter treatment in November of 2005. A chaining and seeding project was implemented following the Buckskin Fire. The entire study site was burned, but only half of the study site was chained during the post fire treatment. Most of the burnt area was one-way Ely chained in the fall of 2007. A seed mix of grass and forb species was aerially applied prior to the chaining treatment; and following the chaining treatment, forage kochia (*Kochia prostrata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) were aerially seeded on the project area (Table - Seed Mix). The objectives of the project are to reestablish vegetation within the burned areas for wildlife habitat and soil stabilization (WRI Database 2011). In 2005, pellet group data estimated heavy use by elk, and light use by deer and cattle. In 2008, use was estimated to be light for elk, deer, and cattle (Table - Pellet Group Data).

SEED MIX--

Management unit 27R, Study no: 17

Project Name: Buckskin PJ Thinning WRI Database #: 112				Project Name: Buckskin Fire Aerial #1 WRI Database #: 453			
Application: Aerial Seed 1		Acres: 420		Application: Aerial Seed 2		Acres: 1400	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Blue Grama	480	1.14	G	Canby Bluegrass 'Canbar'	700	0.50
G	Blue Grama 'Bad River'	155	0.37	G	Crested Wheatgrass 'CDII'	700	0.50
G	Indian Ricegrass 'Rimrock'	450	1.07	G	Crested Wheatgrass 'Douglas'	1400	1.00
G	Needle and Threadgrass	100	0.24	G	Crested Wheatgrass 'Hycrest'	700	0.50
G	Sandberg Bluegrass 'Toole MT'	350	0.83	G	Indian Ricegrass 'Rimrock'	1400	1.00
G	Western Wheatgrass	450	1.07	G	Newhy Wheatgrass	887	0.63
F	Palmer Penstemon	100	0.24	G	Pubescent Wheatgrass	1400	1.00
B	Black Sagebrush	171	0.41	G	Russian Wildrye	956	0.68
B	Green Ephedra	175	0.42	G	Russian Wildrye 'Bozoisky'	1850	1.32
B	Stansbury Cliffrose	198	0.47	G	Siberian Wheatgrass 'Vavilov'	1388	0.99
Total Pounds:		2629	6.26	G	Sideoats Grama 'Pierre'	140	0.10
PLS Pounds:			4.21	G	Snake River Wheatgrass 'Secar'	2780	1.99
Project Name: Buckskin Fire Aerial #2 WRI Database #: 453							
Application: Aerial Seed 3		Acres: 1400					
Seed type		lbs in mix	lbs/acre				
B	Sagebrush, Wyoming	1400	1.00	G	Thickspike Wheatgrass 'Bannock'	1367	0.98
B	Forage Kochia	1400	1.00	G	Western Wheatgrass 'Arriba'	1400	1.00
Total Pounds:		2800	2.00	F	Alfalfa 'Ladak'	700	0.50
PLS Pounds:			0.86	F	Palmer Penstemon	200	0.14
				F	Small Burnet 'Delar'	700	0.50
				Total Pounds:		18668	13.33
				PLS Pounds:			11.69

*Aerial seed 1 was applied in 2005 prior to the lop and scatter treatment. Aerial seed 2 was applied to the project area after the buckskin fire and prior to the chaining project in the fall of 2007. Aerial seed 3 was applied to the project area following the chaining treatment.

Browse: The preferred browse species on the site include Wyoming big sagebrush, green ephedra (*Ephedra viridis*), Stansbury cliffrose (*Cowania mexicana stansburiana*), and forage kochia. The wildfire in 2006 reduced the population of browse within the study site. Following the wildfire, the most common browse species sampled on the site was the seeded species forage kochia. Forage kochia is a heavily used population with low decadence and good vigor. The recruitment of young forage kochia plants to the population was excellent. The Wyoming big sagebrush is a relatively young, small population, with high decadence, and mostly good vigor within the population over the sample years. Utilization of sagebrush plants has been light to moderate. Utilization of the Stansbury cliffrose and green ephedra population has been moderately heavy since the outset of the study. Other browse species sampled on the site include Parry rabbitbrush (*Chrysothamnus parryi*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). The Utah juniper and pinyon pine densities and canopy cover were substantially reduced by the wildfire and projects on the site (Table - Point-Quarter Tree Data and Table - Canopy Cover).

Herbaceous Understory: Grasses are not abundant or diverse on the site. Perennial grass species are rare. Prior to the wildfire, the annual species cheatgrass (*Bromus tectorum*) was prevalent, but has become rare on the site following the fire. Seeded species that were sampled following the treatment include needle-and-thread (*Stipa comata*) and intermediate wheatgrass (*Agropyron intermedium*). Forbs are not abundant, but are fairly diverse. However, annual forb species dominate the forb composition. Perennial forbs are rare on the site (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a slightly alkaline soil reaction (pH 7.5) (Table - Soil Analysis Data). Bare ground cover is high, though with a high amount of pavement and rock 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 wildfire substantially reduced the cover of browse on the site. The density of Wyoming big sagebrush decreased 90% from 580 plants/acre to 60 plants/acre, but cover was already low. The density of Stansbury cliffrose decreased 71% from 140 plants/acre to 40 plants/acre and cover decreased from 2% to less than 1%. The seeded species forage kochia was sampled for the first time in 2008 at 3,200 plants/acre and provided 2% cover. Utah juniper decreased in density from 156 trees/acre to less than 18 trees/acre, and canopy cover decreased from 22% to 0%. Pinyon pine density decreased from 266 trees/acre to less than 18 trees/acre, and canopy cover decreased from 17% to 0%.

Grasses: Grasses remained rare on the site. Cheatgrass significantly decreased in nested frequency, and cover decreased from 2% to less than 1%.

Forbs: Perennial forbs remained rare on the site. There was a substantial decrease in the sum of nested frequency of annual forbs and cover decreased from 6% to 2%.

HERBACEOUS TRENDS--

Management unit 27R, Study no: 17

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron intermedium	-	5	-	.00
G	Bromus tectorum (a)	_b 169	_a 30	1.58	.15
G	Poa fendleriana	3	-	.01	-
G	Sitanion hystrix	6	2	.02	.01
G	Stipa comata	4	2	.00	.01
G	Vulpia octoflora (a)	12	3	.05	.01
Total for Annual Grasses		181	33	1.63	0.16
Total for Perennial Grasses		13	9	0.03	0.02
Total for Grasses		194	42	1.67	0.18
F	Astragalus utahensis	1	1	.00	.00
F	Chaenactis douglasii	1	-	.00	-
F	Chenopodium fremontii (a)	1	2	.00	.00
F	Collinsia parviflora (a)	_b 25	_a -	.04	-
F	Cordylanthus sp. (a)	_b 96	_a 1	3.94	.00
F	Cryptantha sp.(a)	-	5	-	.02
F	Descurainia pinnata (a)	_a -	_b 17	-	.25
F	Draba sp. (a)	_b 144	_a 20	.72	.06
F	Eriogonum cernuum (a)	5	4	.01	.01
F	Eriogonum sp.	9	-	.01	-
F	Erodium cicutarium (a)	4	-	.04	-
F	Euphorbia sp.	5	-	.06	.03
F	Gayophytum ramosissimum(a)	_b 11	_a 1	.03	.00
F	Gilia sp. (a)	_b 178	_a 6	.98	.01
F	Ipomopsis aggregata	3	-	.00	-
F	Lappula occidentalis (a)	_b 62	_a -	.16	-
F	Lesquerella sp.	4	-	.00	-
F	Mentzelia albicaulis (a)	-	7	-	.09
F	Microsteris gracilis (a)	4	3	.01	.01
F	Nicotiana attenuata (a)	_a -	_b 8	-	.05
F	Penstemon sp.	11	-	.04	-
F	Penstemon sp.	_b 8	_a -	.08	-
F	Penstemon sp. (a)	-	2	-	.03
F	Petradoria pumila	_b 19	_a -	.61	-
F	Phacelia sp.	-	8	-	.06
F	Phlox longifolia	18	8	.04	.01
F	Salsola iberica (a)	_a -	_b 33	-	.97
F	Senecio multilobatus	3	-	.04	-
F	Streptanthus cordatus	2	5	.00	.01
F	Swertia albomarginata	-	-	.00	.03
Total for Annual Forbs		530	109	5.96	1.53
Total for Perennial Forbs		84	22	0.92	0.15
Total for Forbs		614	131	6.89	1.69

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

BROWSE TRENDS--

Management unit 27R, Study no: 17

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	<i>Artemisia tridentata wyomingensis</i>	22	3	1.58	.16
B	<i>Cercocarpus montanus</i>	1	0	-	-
B	<i>Chrysothamnus parryi</i>	0	1	-	-
B	<i>Cowania mexicana stansburiana</i>	7	2	.18	.18
B	<i>Echinocereus sp.</i>	1	0	.15	-
B	<i>Ephedra viridis</i>	7	4	.62	.06
B	<i>Gutierrezia sarothrae</i>	5	5	.18	.01
B	<i>Juniperus osteosperma</i>	9	0	3.13	-
B	<i>Kochia prostrata</i>	0	35	-	1.19
B	<i>Opuntia sp.</i>	17	1	.70	.03
B	<i>Pinus edulis</i>	11	0	7.40	-
B	<i>Yucca baccata</i>	1	0	.03	-
Total for Browse		81	51	13.98	1.63

CANOPY COVER, LINE INTERCEPT--

Management unit 27R, Study no: 17

Species	Percent Cover	
	'05	'08
<i>Artemisia tridentata wyomingensis</i>	.78	.01
<i>Cowania mexicana stansburiana</i>	1.71	-
<i>Echinocereus sp.</i>	.13	-
<i>Ephedra viridis</i>	.76	-
<i>Gutierrezia sarothrae</i>	.06	.10
<i>Juniperus osteosperma</i>	21.81	-
<i>Kochia prostrata</i>	-	2.11
<i>Opuntia sp.</i>	.31	.16
<i>Pinus edulis</i>	16.79	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 27R, Study no: 17

Species	Average leader growth (in)	
	'05	'08
<i>Artemisia tridentata wyomingensis</i>	2.8	-
<i>Cowania mexicana stansburiana</i>	3.5	-

POINT-QUARTER TREE DATA--
Management unit 27R, Study no: 17

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	156	<18	10.2	-
Pinus edulis	266	<18	2.7	-

\BASIC COVER--
Management unit 27R, Study no: 17

Cover Type	Average Cover %	
	'05	'08
Vegetation	20.96	3.26
Rock	9.51	17.51
Pavement	22.19	42.73
Litter	45.40	13.68
Cryptogams	5.35	.45
Bare Ground	16.32	32.05

SOIL ANALYSIS DATA --
Management unit 27R, Study no: 17, Study Name: Buckskin Hand Thinning

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
7.4	7.5	36.4	46.8	16.8	3.4	13.0	92.8	0.6

PELLET GROUP DATA--
Management unit 27R, Study no: 17

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	32	68	-	-
Elk	-	-	48 (117)	1 (2)
Deer	15	3	12 (30)	7 (17)
Cattle	-	1	1 (2)	3 (7)

BROWSE CHARACTERISTICS--
Management unit 27R, 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	
Amelanchier utahensis									
05	0	0	0	-	-	0	0	0	43/35
08	0	0	0	-	-	0	0	0	-/-
Artemisia tridentata wyomingensis									
05	580	7	41	52	40	14	0	34	27/31
08	60	67	0	33	160	33	33	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>Cercocarpus montanus</i>									
05	20	0	0	100	-	100	0	0	-/-
08	0	0	0	0	-	0	0	0	-/-
<i>Chrysothamnus parryi</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	0	100	-	-	0	0	0	-/-
<i>Coryphantha sp.</i>									
05	0	0	0	-	-	0	0	0	2/2
08	0	0	0	-	-	0	0	0	-/-
<i>Cowania mexicana stansburiana</i>									
05	140	14	43	43	-	29	57	14	48/44
08	40	0	50	50	20	50	50	50	7/9
<i>Echinocereus sp.</i>									
05	20	0	100	-	-	0	0	0	6/13
08	0	0	0	-	-	0	0	0	-/-
<i>Ephedra viridis</i>									
05	260	23	77	0	40	54	0	0	27/29
08	100	40	40	20	-	0	40	20	9/21
<i>Gutierrezia sarothrae</i>									
05	140	0	100	-	-	0	0	0	9/12
08	220	0	100	-	40	0	0	0	7/9
<i>Juniperus osteosperma</i>									
05	180	22	78	-	80	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
<i>Kochia prostrata</i>									
05	0	0	0	0	-	0	0	0	-/-
08	3200	25	74	1	3120	8	58	1	6/10
<i>Opuntia sp.</i>									
05	680	0	94	6	-	0	0	3	6/18
08	20	0	100	0	-	0	0	0	8/20
<i>Pinus edulis</i>									
05	260	46	46	8	200	0	0	0	-/-
08	0	0	0	0	-	0	0	0	-/-
<i>Yucca baccata</i>									
05	20	0	100	-	-	0	0	0	16/29
08	0	0	0	-	-	0	0	0	-/-

BUCKSKIN 1 - TREND STUDY NO. 27R-18-08

[Project #453](#)

Vegetation Type: Pinyon-Juniper, Wyoming Big Sage

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Upland Shallow Loam (Cliffrose), R035XY313UT

Land Ownership: BLM

Elevation: 6,303 ft. (1,921 m)

Aspect: North

Slope: 5%

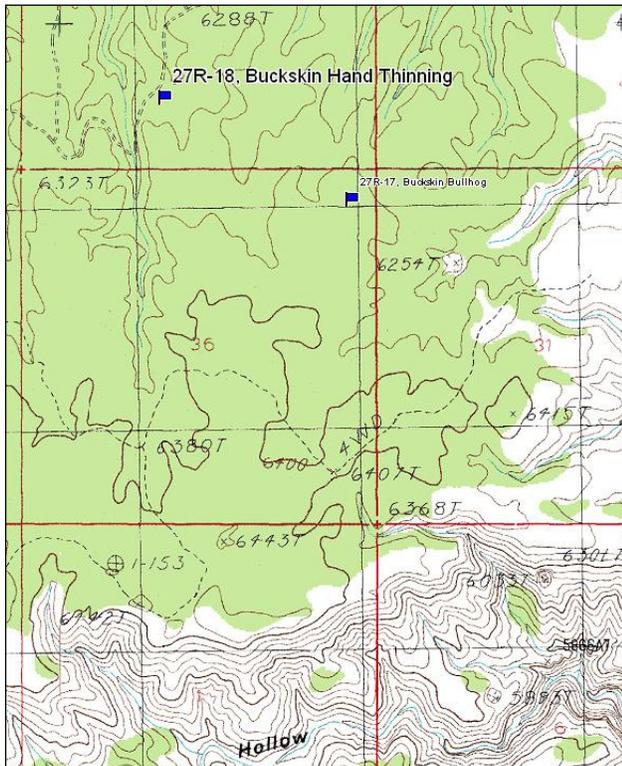
Transect bearing: 138° magnetic

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

Directions:

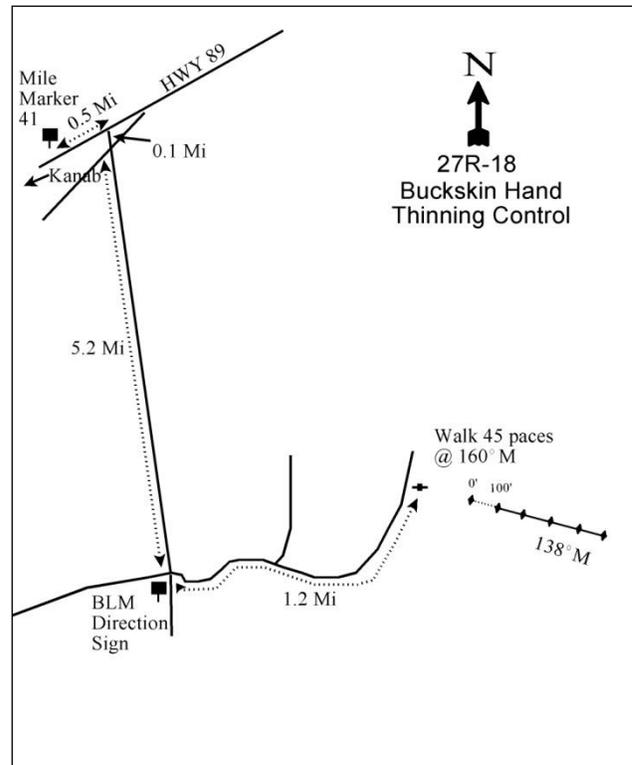
From Kanab, drive west on US 89 to mile maker 41. Continue past the mile marker 0.5 miles to a road on the right (south). Turn right and drive 0.1 miles to a road. Continue on the main road for 5.2 miles to a three-way intersection. Turn left and then drive 1.2 miles to the witness post on right (east) side of the road. From the witness post, walk 45 paces at 160°M to the 0' stake. The 0' stake is marked with browse tag #91.

Map Name: Pine Hollow Canyon



Township: 43S Range: 3W Section: 36

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 404046 E 4099673 N

BUCKSKIN 1 - WRI STUDY 27R-18

[Project #453](#)

Site Description

Site Information: The study is located approximately twenty five miles east of Kanab, within a treated pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, on land administered by the Bureau of Land Management (BLM), on Buckskin Mountain. The study was originally established in 2005 as a reference site to the Buckskin 2 (27R-17) to monitor the effects of a lop and scatter and seeding project ([Project #112](#)) completed in November of 2005, but in the summer of 2006 a wildfire (Buckskin Fire) burned 1,437 acres including the study site. A chaining and seeding project was implemented following the Buckskin Fire. Most of the burnt area was one-way Ely chained in the fall of 2007. A seed mix of grass and forb species was aerially applied prior to the chaining treatment; and following the chaining treatment, forage kochia (*Kochia prostrata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) were aerially seeded on the project area. The objectives of the project are to reestablish vegetation within the burned areas for wildlife habitat and soil stabilization (WRI Database 2011). In 2005, pellet group data estimated heavy use by elk, and light use by deer and cattle. In 2008, use was estimated to be heavy for elk, and light for cattle (Table - Pellet Group Data).

SEED MIX--

Management unit 27R, Study no: 18

Project Name: Buckskin Fire Aerial #1 WRI Database #: 453				Project Name: Buckskin Fire Aerial #2 WRI Database #: 453			
Application: Aerial Seed		Acres: 1400		Application: Aerial Seed		Acres: 1400	
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	700	0.50	B	Sagebrush, Wyoming	1400	1.00
G	Crested Wheatgrass 'CDII'	700	0.50	B	Forage Kochia	1400	1.00
G	Crested Wheatgrass 'Douglas'	1400	1.00	Total Pounds:		2800	2.00
G	Crested Wheatgrass 'Hycrest'	700	0.50	PLS Pounds:			0.86
G	Indian Ricegrass 'Rimrock'	1400	1.00				
G	Newhy Wheatgrass	887	0.63				
G	Pubescent Wheatgrass	1400	1.00				
G	Russian Wildrye	956	0.68				
G	Russian Wildrye 'Bozoisky'	1850	1.32				
G	Siberian Wheatgrass 'Vavilov'	1388	0.99				
G	Sideoats Grama 'Pierre'	140	0.10				
G	Snake River Wheatgrass 'Secar'	2780	1.99				
G	Thickspike Wheatgrass 'Bannock'	1367	0.98				
G	Western Wheatgrass 'Arriba'	1400	1.00				
F	Alfalfa 'Ladak'	700	0.50				
F	Palmer Penstemon	200	0.14				
F	Small Burnet 'Delar'	700	0.50				
Total Pounds:		18668	13.33				
PLS Pounds:			11.69				

Browse: The preferred browse species on the site include Wyoming big sagebrush, true mountain mahogany (*Cercocarpus montanus*), green ephedra (*Ephedra viridis*), Stansbury cliffrose (*Cowania mexicana stansburiana*), and forage kochia. The wildfire in 2006 removed the canopy cover of Utah juniper and pinyon pine within the study site. The most common preferred browse species on the site are forage kochia and

Wyoming big sagebrush. The Wyoming big sagebrush is a lightly used population, with low decadence and good vigor. The recruitment of young sagebrush plants to the population has been good since the treatment. Prior to the wildfire and chaining treatment, decadence and poor vigor were high, and recruitment of young plants to the sagebrush population was good. Forage kochia is a heavily used population with low decadence, and good vigor within the population, since being seeded on the site in 2007. The recruitment of young forage kochia plants to the population was excellent in 2008. Other common browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp.* and *O. whipplei*) (Table - Browse Characteristics). The Utah juniper and pinyon pine population were substantially reduced in density (Table - Point-Quarter Tree Data) and canopy cover (Table - Canopy Cover) by the wildfire and projects on the site.

Herbaceous Understory: The annual grass species cheatgrass is the dominant grass species and has provided the majority of the grass cover over the sample years. The most common perennial grass species on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), thickspike wheatgrass (*A. trachycaulum*), and bottlebrush squirreltail (*Sitanion hystrix*). Most of these species were seeded species sampled on the site following the fire rehabilitation project. No single perennial species provided more than 1% cover in 2008. Forbs are moderately abundant and fairly diverse. Prior to the wildfire and chaining treatment, annual forb species dominated the forb composition. After the treatment, perennial forb species have become more common, and annual forb species decreased in abundance on the site. The most common perennial forb species sample on the site include indigo bush (*Dalea sp.*), sulfur eriogonum (*Eriogonum umbellatum*), and Douglas chaenactis (*Chaenactis douglasii*). Seeded species sampled following the treatment include alfalfa (*Medicago sativa*), Palmer's penstemon (*Penstemon palmeri*), and small burnet (*Sanguisorba minor*), though each of these species occurred at low frequency and cover (Table - Herbaceous Trend).

Soil: The soil texture is a sandy clay with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is low, with a high amount of litter, pavement, and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2005 due to surface litter movement, pedestalling, and small rills. The soil erosion condition was classified as stable in 2008.

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

Browse: The wildfire substantially reduced the cover of browse on the site. The density of Wyoming big sagebrush increased over three-fold from 340 plants/acre to 1,220 plants/acre, but cover remained minimal. The recruitment of young sagebrush plants to the population increased from 12% to 93%. The density of Stansbury cliffrose decreased 60% from 100 plants/acre to 40 plants/acre. The seeded species forage kochia was sampled at 9,220 plants/acre and provided 1% cover. Utah juniper decreased in density from 127 trees/acre to 28 trees/acre, and canopy cover decreased from 21% to 0%. Pinyon pine density decreased from 77 trees/acre to less than 18 trees/acre and canopy cover decreased from 13% to 0%.

Grasses: The sum of nested frequency of perennial grasses increased over seven-fold, and cover increased from less than 1% to 2%. The increase in nested frequency of perennial grasses was primarily due to the establishment of seeded species on the site which include crested wheatgrass, intermediate wheatgrass, western wheatgrass, thickspike wheatgrass, and Indian ricegrass; however, none of the species provides more than 1% cover. The annual grass species cheatgrass increased significantly in nested frequency and cover increased from 1% to 8%.

Forbs: The sum of nested frequency of perennial forbs increased 66%, and cover increased from 2% to 3%. The sum of nested frequency of annual forbs decreased 91%, and cover decrease from 9% to less than 1%. No single forb species provided more than 1% cover in either sample year with the exception of the annual species birdbeak (*Cordylanthus sp.*) which provided 7% cover in 2005, but became very rare on the site in 2008.

HERBACEOUS TRENDS--

Management unit 27R, Study no: 18

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	a-	b46	-	.33
G	Agropyron intermedium	a-	b36	-	.37
G	Agropyron smithii	a-	b9	-	.07
G	Agropyron spicatum	-	7	-	.07
G	Agropyron trachycaulum	a-	b38	-	.40
G	Bromus tectorum (a)	a179	b306	1.13	8.21
G	Oryzopsis hymenoides	a-	b12	-	.07
G	Poa secunda	2	-	.01	-
G	Sitanion hystrix	24	45	.26	.39
G	Vulpia octoflora (a)	34	16	.11	.02
Total for Annual Grasses		213	322	1.25	8.24
Total for Perennial Grasses		26	193	0.27	1.72
Total for Grasses		239	515	1.52	9.96
F	Arabis sp.	b31	a8	.10	.03
F	Astragalus sp.	b19	a7	.41	.06
F	Calochortus nuttallii	3	2	.00	.00
F	Chaenactis douglasii	13	25	.11	.37
F	Cordylanthus sp. (a)	b128	a4	6.75	.01
F	Cryptantha sp.	a-	b29	-	.19
F	Cymopterus sp.	8	22	.02	.32
F	Dalea spp	a-	b25	-	.73
F	Descurainia pinnata (a)	4	2	.01	.01
F	Draba sp. (a)	b126	a3	.48	.01
F	Eriogonum sp.	b10	a-	.15	-
F	Eriogonum umbellatum	b12	a40	.45	.56
F	Erodium cicutarium (a)	b16	a-	.53	-
F	Gayophytum ramosissimum(a)	13	7	.02	.01
F	Gilia sp. (a)	b124	a	.51	.03
F	Ipomopsis aggregata	2	-	.01	-
F	Lappula occidentalis (a)	b99	a6	.29	.01
F	Lesquerella sp.	3	-	.01	-
F	Medicago sativa	-	5	-	.04
F	Mentzelia albicaulis (a)	-	4	-	.03
F	Microsteris gracilis (a)	7	6	.02	.01
F	Penstemon caespitosus	-	2	-	.01
F	Penstemon palmeri	-	4	-	.05
F	Penstemon sp.	7	-	.07	-
F	Penstemon sp.	1	-	.03	-
F	Petradoria pumila	7	6	.18	.06
F	Phlox hoodii	-	-	.00	.00
F	Polygonum douglasii (a)	2	-	.00	-
F	Ranunculus testiculatus (a)	5	5	.01	.01
F	Salsola iberica (a)	-	2	-	.00

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	<i>Sanguisorba minor</i>	-	2	-	.01
F	<i>Senecio multilobatus</i>	-	5	.00	.04
F	<i>Sphaeralcea grossulariifolia</i>	a-	b11	-	.20
F	<i>Swertia albomarginata</i>	2	3	.15	.03
F	Unknown forb-annual (a)	b33	a-	.15	-
Total for Annual Forbs		557	50	8.80	0.14
Total for Perennial Forbs		118	196	1.74	2.76
Total for Forbs		675	246	10.54	2.90

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

BROWSE TRENDS--

Management unit 27R, Study no: 18

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	<i>Artemisia tridentata wyomingensis</i>	12	16	.45	.02
B	<i>Cercocarpus montanus</i>	0	2	-	.00
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	0	1	-	.00
B	<i>Coryphantha sp.</i>	3	0	.00	-
B	<i>Cowania mexicana stansburiana</i>	4	2	.18	.00
B	<i>Ephedra viridis</i>	1	1	-	.03
B	<i>Gutierrezia sarothrae</i>	9	7	.52	.36
B	<i>Juniperus osteosperma</i>	12	2	2.02	.00
B	<i>Kochia prostrata</i>	0	61	-	1.39
B	<i>Opuntia sp.</i>	14	2	.96	.15
B	<i>Opuntia whipplei</i>	7	5	.63	.30
B	<i>Pediocactus simpsonii</i>	1	0	.00	-
B	<i>Pinus edulis</i>	1	0	.87	-
B	<i>Yucca baccata</i>	2	0	.45	-
B	<i>Yucca sp.</i>	0	1	-	.03
Total for Browse		66	100	6.11	2.30

CANOPY COVER, LINE INTERCEPT--

Management unit 27R, Study no: 18

Species	Percent Cover	
	'05	'08
Artemisia tridentata wyomingensis	1.10	.31
Cowania mexicana stansburiana	.13	.05
Ephedra viridis	-	.01
Gutierrezia sarothrae	.61	.18
Juniperus osteosperma	21.04	-
Kochia prostrata	-	1.08
Opuntia sp.	.53	-
Opuntia whipplei	-	.03
Pinus edulis	12.50	-
Yucca baccata	.73	-
Yucca sp.	-	.51

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 27R, Study no: 18

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	3.4	1.4
Cowania mexicana stansburiana	4.7	0.9

POINT-QUARTER TREE DATA--

Management unit 27R, Study no: 18

Species	Trees per Acre		Average diameter (in)	
	'05	'08	'05	'08
Juniperus osteosperma	127	28	13.2	7.0
Pinus edulis	77	-	4.5	-

BASIC COVER--

Management unit 27R, Study no: 18

Cover Type	Average Cover %	
	'05	'08
Vegetation	14.80	15.69
Rock	9.67	7.90
Pavement	21.84	6.21
Litter	45.95	66.65
Cryptogams	2.75	.07
Bare Ground	18.84	12.20

SOIL ANALYSIS DATA --

Management unit 27R, Study no: 18, Study Name: Buckskin Hand Thinning Control

Effective rooting depth (in)	pH	sandy clay			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
8.8	7.2	45.1	18.1	36.8	1.4	18.0	108.8	0.5

PELLET GROUP DATA--

Management unit 27R, Study no: 18

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	69	54	-	-
Elk	2	5	54 (132)	-
Deer	23	18	3 (8)	44 (109)
Cattle	1	1	3 (7)	7 (16)

BROWSE CHARACTERISTICS--

Management unit 27R, Study no: 18

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>									
05	0	0	0	-	-	0	0	0	53/44
08	0	0	0	-	-	0	0	0	6/15
<i>Artemisia tridentata wyomingensis</i>									
05	340	12	59	29	80	18	0	24	17/23
08	1220	93	5	2	120	3	2	0	13/18
<i>Cercocarpus montanus</i>									
05	0	0	0	-	-	0	0	0	9/12
08	60	100	0	-	-	0	0	0	3/2
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
05	0	0	0	-	-	0	0	0	-/-
08	20	0	100	-	-	0	0	0	9/12
<i>Coryphantha sp.</i>									
05	60	0	100	-	-	0	0	0	1/2
08	0	0	0	-	-	0	0	0	-/-
<i>Cowania mexicana stansburiana</i>									
05	100	0	80	20	-	0	100	0	49/45
08	40	100	0	0	20	0	0	0	6/7
<i>Ephedra viridis</i>									
05	20	0	100	0	-	100	0	0	25/31
08	80	0	50	50	-	0	100	0	13/16
<i>Gutierrezia sarothrae</i>									
05	600	0	100	-	60	0	0	0	7/10
08	940	4	96	-	20	0	0	0	5/6
<i>Juniperus osteosperma</i>									
05	240	25	67	8	60	0	0	0	-/-
08	60	67	0	33	60	0	0	67	-/-
<i>Kochia prostrata</i>									
05	0	0	0	-	-	0	0	0	-/-
08	9220	48	52	-	940	3	55	0	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)	
Opuntia sp.										
05	680	3	91	6	20	0	0	6	6/17	
08	40	0	100	0	-	0	0	0	6/20	
Opuntia whipplei										
05	180	11	89	0	-	0	0	0	7/23	
08	180	22	44	33	-	0	0	11	6/20	
Pediocactus simpsonii										
05	20	100	0	-	-	0	0	0	-/-	
08	0	0	0	-	-	0	0	0	-/-	
Pinus edulis										
05	40	0	100	-	80	0	0	0	-/-	
08	0	0	0	-	-	0	0	0	-/-	
Yucca baccata										
05	120	17	83	-	-	0	0	0	17/27	
08	0	0	0	-	-	0	0	0	-/-	
Yucca sp.										
05	0	0	0	-	-	0	0	0	-/-	
08	20	0	100	-	-	0	0	0	15/23	

BUCKSKIN VALLEY HIGHWAY 20 (DIXIE) - TREND STUDY NO. 28R-10-08
[Project #242](#)

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Loam \(Mountain Big Sagebrush-Indian Ricegrass\),R047XB308UT](#)

Land Ownership: BLM

Elevation: 7,100 ft. (2,164 m)

Aspect: West

Slope: 5%

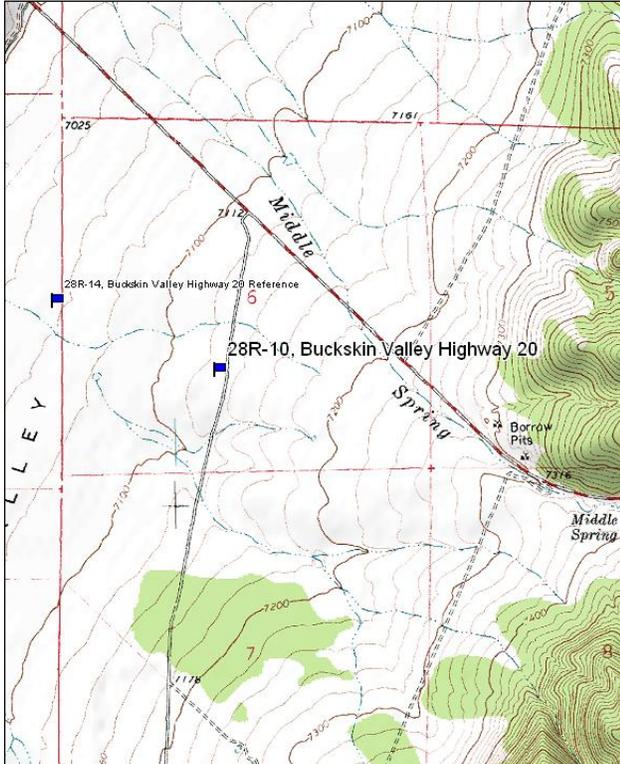
Transect bearing: 280° magnetic

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

Directions:

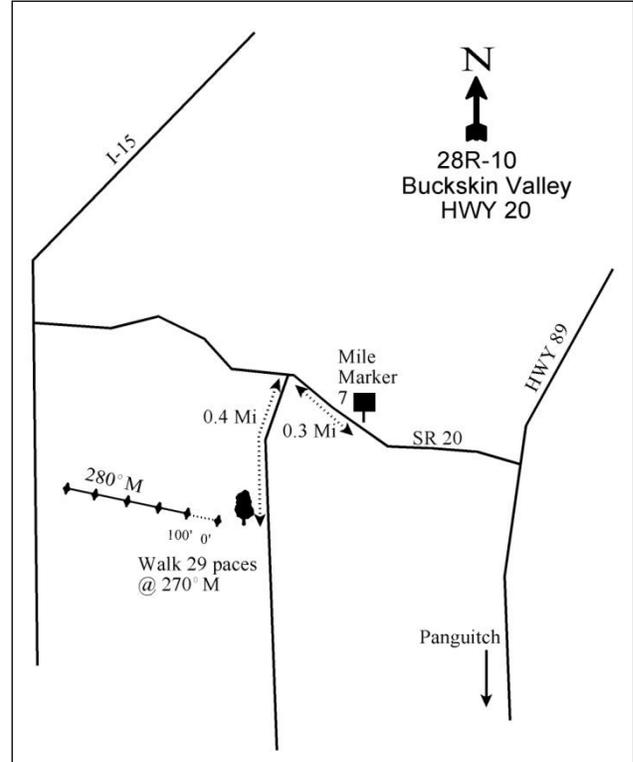
From Panguitch, drive north on US 89 to the junction of SR 20. Turn left (west) on SR 20 and drive to mile marker 7. Continue west 0.3 miles to a dirt road on the left (south). Turn left and drive 0.4 miles to the only big Juniper on the right (west) side of the road. From the big juniper, walk 29 paces at 270°M to the 0' stake. The 0' stake is marked with browse tag #74.

Map Name: Burnt Peak



Township: 32S Range: 7W Section: 6

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 361181 E 4212201 N

BUCKSKIN VALLEY HIGHWAY 20 (DIXIE) - WRI STUDY 28R-10
[Project #242](#)

Site Description

Site Information: The study is located approximately 16 miles southeast of Beaver, in Buckskin Valley, just south of SR-20, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, on land administered by the Bureau of Land Management (BLM). The study was established in 2005, prior to treatment, to monitor the effects of a Dixie harrow treatment within the Buckskin Utah prairie dog complex. The treatment was designed to improve Utah prairie dog habitat for possible natural expansions of existing complexes. Ideal habitat requires little to no shrub cover, and high grass and forb species diversity. Improvement of patches of native grasses and forbs could also improve existing sage-grouse populations. In September of 2005, a total of 270 acres were two-way Dixie pipe harrowed and seeded. A seed mix of forb, grass, and browse species was broadcast seeded during the second pass of the harrow (Table - Seed Mix) (WRI Database 2011). In 2005, pellet group data estimated light use by deer, and moderately heavy use by cattle. In 2008, use was estimated to be moderate for cattle, and light use by deer and elk (Table - Pellet Group Data).

SEED MIX--

Management unit 28R, Study no: 10

Project Name: Buckskin Highway 20			
WRI Database #: 242			
Application: Broadcast Seeder		Acres: 270	
Seed type		lbs in mix	lbs/acre
G	*Blue Grama 'Alma'	200	0.74
G	Bottlebrush Squirreltail	100	0.37
G	*Bottlebrush Squirreltail	50	0.19
G	Canby Bluegrass 'Canbar'	100	0.37
G	Galleta	140	0.52
G	*Indian Ricegrass 'Nezpar'	400	1.48
G	*Sand Dropseed	50	0.19
G	*Sandberg Bluegrass	100	0.37
G	*Snake River Wheatgrass 'Secar'	250	0.93
G	*Western Wheatgrass 'Rosana'	152	0.56
F	*Alfalfa 'Ladak'	200	0.74
F	*Lewis Flax 'Appar'	250	0.93
F	Palmer Penstemon	50	0.19
F	*Rocky Mtn. Penstemon	50	0.19
F	*Sainfoin 'Eski'	500	1.85
F	Small Burnet 'Delar'	100	0.37
F	*Small Burnet	150	0.56
F	*Western Yarrow	30	0.11
B	Winterfat	125	0.46
Total Pounds:		2997	11.10
PLS Pounds:			8.06

*Seed provided by Cedar City Bureau of Land Management (BLM)

Browse: The preferred browse species on the site is Wyoming big sagebrush. The sagebrush is a lightly used population, with high decadence and poor vigor within the population since the harrow treatment. Prior to the treatment, use of sagebrush was moderately high, with moderate decadence and good vigor within the population. Prior to the treatment, the recruitment of young sagebrush plants to the population was poor, but

recruitment was good in 2008, following the treatment. Other browse species sampled on the site following the treatment include broom snakeweed (*Gutierrezia sarothrae*) and prickly phlox (*Leptodactylon pungens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant, but are not particularly diverse. Crested wheatgrass (*Agropyron cristatum*) is the dominant grass species and has provided the majority of the grass cover since the outset of the study. Following the treatment, species diversity increased with the establishment of seeded species on the site which included blue grama (*Bouteloua gracilis*), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*). However, all of the seeded species occurred in low frequency and cover on the site. Forbs are fairly abundant and diverse on the site. Scarlet globemallow (*Sphaeralcea coccinea*) and longleaf phlox (*Phlox longifolia*) are the dominant perennial forb species on the site. Seeded forb species sampled on the site following the treatment include blue flax (*Linum perenne*), Palmer penstemon (*Penstemon palmeri*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil texture is a loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is moderately high, though with a high amount of litter, pavement, and vegetation and a moderate amount of rock 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 Dixie harrow treatment reduced the density of the sagebrush population. The density of Wyoming big sagebrush decreased 67% from 6,640 plants/acre to 2,180 plants/acre, and cover decreased from 21% to 3%. Decadence of sagebrush increased from 20% to 47% and poor vigor increased from 7% to 59%. The proportion of young plants increased from 6% of the population to 13% of the population.

Grasses: The sum of nested frequency of perennial grasses remained similar, but cover increased from 15% to 22%. Crested wheatgrass provided nearly all of the increase in cover.

Forbs: The sum of nested frequency of perennial forbs increased 75%, and cover increased from 2% to 3%. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 28R, Study no: 10

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
G	Agropyron cristatum	350	353	14.94	22.24
G	Bouteloua gracilis	6	3	.06	.03
G	Oryzopsis hymenoides	-	2	-	.00
G	Poa fendleriana	-	6	-	.01
G	Poa secunda	-	3	-	.00
G	Sitanion hystrix	-	2	-	.00
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		356	369	15.00	22.29
Total for Grasses		356	369	15.00	22.29
F	Achillea millefolium	-	5	-	.04
F	Astragalus convallarius	4	-	.06	.00
F	Astragalus utahensis	-	2	-	.00

Type	Species	Nested Frequency		Average Cover %	
		'05	'08	'05	'08
F	<i>Calochortus nuttallii</i>	-	4	-	.01
F	<i>Comandra pallida</i>	6	-	.01	-
F	<i>Cryptantha</i> sp.	9	3	.02	.04
F	<i>Cymopterus</i> sp.	_a 8	_b 35	.01	.16
F	<i>Eriogonum alatum</i>	4	-	.03	-
F	<i>Eriogonum racemosum</i>	16	24	.10	.06
F	<i>Gayophytum ramosissimum</i> (a)	20	7	.07	.03
F	<i>Lappula occidentalis</i> (a)	1	5	.00	.01
F	<i>Linum perenne</i>	_a -	_b 83	-	.57
F	<i>Lotus</i> sp.	11	14	.03	.09
F	<i>Lupinus argenteus</i>	8	11	.21	.08
F	<i>Medicago sativa</i>	-	6	-	.01
F	<i>Onobrychis viciaefolia</i>	_a -	_b 8	-	.03
F	<i>Penstemon palmeri</i>	-	-	-	.00
F	<i>Penstemon strictus</i>	_a -	_b 16	-	.08
F	<i>Phlox longifolia</i>	80	97	.32	.34
F	<i>Polygonum douglasii</i> (a)	8	15	.01	.02
F	<i>Ranunculus testiculatus</i> (a)	3	1	.03	.00
F	<i>Sanguisorba minor</i>	-	5	-	.04
F	<i>Sphaeralcea coccinea</i>	96	118	.66	.93
F	<i>Trifolium</i> sp.	8	10	.02	.07
F	<i>Zigadenus paniculatus</i>	2	1	.00	.00
Total for Annual Forbs		32	28	0.12	0.07
Total for Perennial Forbs		252	442	1.49	2.62
Total for Forbs		284	470	1.61	2.69

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

BROWSE TRENDS--

Management unit 28R, Study no: 10

Type	Species	Strip Frequency		Average Cover %	
		'05	'08	'05	'08
B	<i>Artemisia tridentata vaseyana</i>	91	56	18.35	5.28
B	<i>Gutierrezia sarothrae</i>	12	3	.06	.03
B	<i>Leptodactylon pungens</i>	1	1	.00	-
Total for Browse		104	60	18.42	5.31

CANOPY COVER, LINE INTERCEPT--

Management unit 28R, Study no: 10

Species	Percent Cover	
	'05	'08
<i>Artemisia tridentata vaseyana</i>	20.45	3.25
<i>Gutierrezia sarothrae</i>	.08	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 28R, Study no: 10

Species	Average leader growth (in)	
	'05	'08
Artemisia tridentata wyomingensis	1.6	1.0

BASIC COVER--

Management unit 28R, Study no: 10

Cover Type	Average Cover %	
	'05	'08
Vegetation	31.26	26.74
Rock	1.11	4.11
Pavement	22.16	13.92
Litter	19.10	32.24
Cryptogams	.63	0
Bare Ground	40.09	33.23

SOIL ANALYSIS DATA --

Management unit 28R, Study no: 10, Study Name: Buckskin Valley Hwy 20

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.2	6.9	47.1	31.1	21.8	2.2	11.3	131.2	0.6

PELLET GROUP DATA--

Management unit 28R, Study no: 10

Type	Quadrat Frequency		Days use per acre (ha)	
	'05	'08	'05	'08
Rabbit	46	89	-	-
Elk	-	1	-	-
Deer	2	7	1 (2)	-
Cattle	6	5	36 (90)	29 (72)

BROWSE CHARACTERISTICS--
 Management unit 28R, Study no: 10

		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	6640	6	74	20	20	22	39	7	21/28
08	2180	13	40	47	140	3	0	59	13/16
<i>Gutierrezia sarothrae</i>									
05	300	7	93	0	-	0	0	0	9/6
08	60	0	67	33	-	0	33	0	3/5
<i>Juniperus osteosperma</i>									
05	0	0	0	-	20	0	0	0	-/-
08	0	0	0	-	-	0	0	0	-/-
<i>Leptodactylon pungens</i>									
05	20	0	100	0	-	0	0	0	4/3
08	60	33	0	67	-	0	0	0	5/6
<i>Opuntia sp.</i>									
05	0	0	0	-	-	0	0	0	7/13
08	0	0	0	-	-	0	0	0	3/8

PANGUITCH CREEK - TREND STUDY NO. 28R-13-08

[Project #1206](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Shallow Hardpan \(Pinyon-Utah Juniper\), R047XB318UT](#)

Land Ownership: UDWR

Elevation: 7,100 ft. (2,164 m)

Aspect: North

Slope: 2%

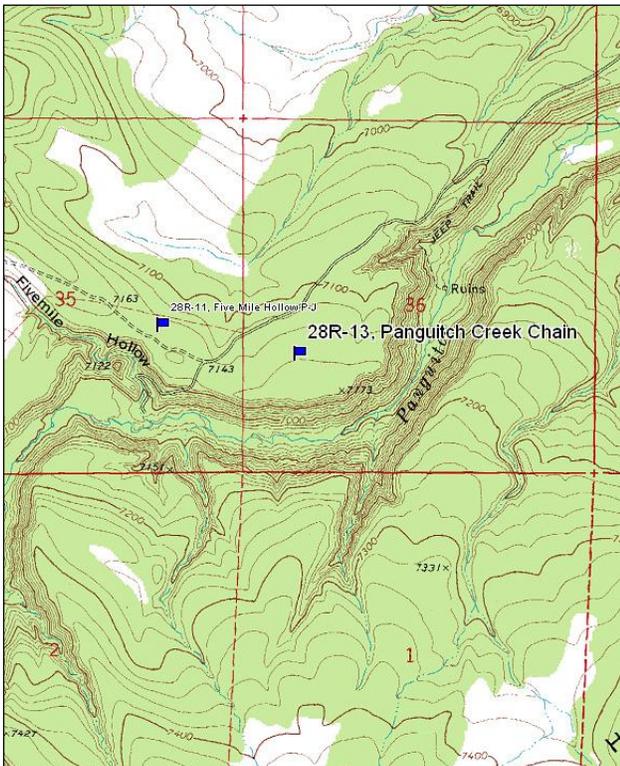
Transect bearing: 88° magnetic

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

Directions:

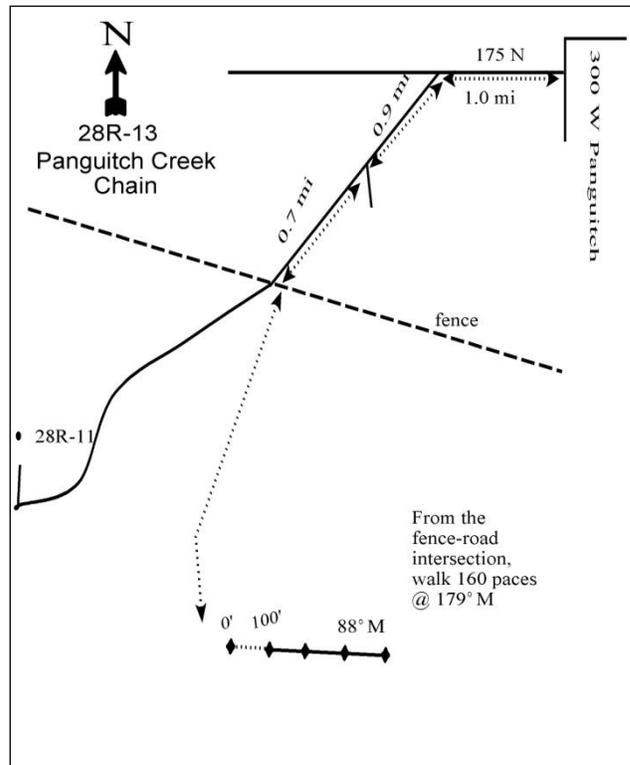
From US 89 in Panguitch, head west on 200 north. Drive to 300 west, turn left (south) and make an immediate right (west) onto 175 north (Industrial Park Rd). Drive 0.5 miles to a four-way intersection. Continue straight (west) for 0.5 miles to a fork in the road. Take the left fork and drive 0.9 miles to another fork in the road. Take the right fork and drive 0.7 miles to a fence; continue straight (right fork leads to 28R-11) to the site. The 0' stake is 160 paces (960ft) from where the fence and road meet at 179°M. The 0' stake is marked with browse tag #108.

Map Name: Panguitch



Township: 34S Range: 6W Section: 36

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 369328 E 4185566 N

PANGUITCH CREEK - WRI STUDY 28R-13

[Project #1206](#)

Site Description

Site Information: The study is located approximately three miles west of Panguitch, on a pinyon pine (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*) bench, north of Panguitch Creek, on the Panguitch Creek Wildlife Management Area (WMA). The study was established in 2008, prior to the treatment, to monitor a two-way chaining and seeding project of 600 acres. Due to access issues, terrain, and cultural resource avoidance only 383 acres were treated, and part of the project area (28 acres) were treated with a bullhog. The study site is located in the portion of the project that was treated with a bullhog. The project area was treated in the spring of 2009. Prior to the start of the bullhog work and before the second pass with the chain, the project area was aerially seeded in November of 2008 (Table - Seed Mix). The objectives of the project are to increase use by game species by providing beneficial forage, increasing beneficial browse and herbaceous understory, and decreasing the pinyon pine and Utah juniper overstory (WRI Database 2011). Pellet group data estimated light use by deer in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 28R, Study no: 13

Project Name: Panguitch Creek WMA PJ Chain/Bullhog			
WRI Database #: 1206			
Application: Aerial Seed		Acres:	383
Seed type		lbs in mix	lbs/acre
G	Bottlebrush Squirreltail 'Toe Jam'	50	0.13
G	Canby Bluegrass 'Canbar'	150	0.39
G	Indian Ricegrass 'Rimrock'	350	0.91
G	Intermediate Wheatgrass 'Oahe'	600	1.57
G	Russian Wildrye 'Bozoisky'	400	1.04
G	Snake River Wheatgrass 'Secar'	400	1.04
F	Alfalfa 'Ladak'	200	0.52
F	Alfalfa 'Ranger'	200	0.52
F	Blue Flax 'Appar'	150	0.39
F	Palmer Penstemon	100	0.26
F	Small Burnet 'Delar'	450	1.17
B	Forage Kochia 'Immigrant'	200	0.52
B	Sagebrush, Mountain	200	0.52
Total Pounds:		3450	9.01
PLS Pounds:			7.34

Browse: Pinyon pine is the dominant browse species on the site providing the majority of the canopy cover and limiting the growth of the other more preferred browse species on the site. Utah juniper was not common on the site and provided little cover (Table - Canopy Cover). The estimated density of pinyon pine in 2008, prior to the treatment, was very high at 483 trees/acre (Table - Point-Quarter Tree Data). The preferred browse species is black sagebrush (*Artemisia nova*). The black sagebrush is a moderately used population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor. Most of the black sagebrush population sampled in 2008 was either decadent or dead. Other less common browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia sp.*) and skunk bush (*Rhus trilobata*) (Table - Browse Characteristics).

Herbaceous Understory: Grass and forb species are rare on the site. *Cryptantha* (*Cryptantha sp.*) was the only herbaceous species sampled in 2008, though it occurred in low abundance and provided very little cover (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is moderate with high amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 28R, Study no: 13

T y p e	Species	Nested Frequency	Average Cover %
		'08	'08
F	<i>Cryptantha sp.</i>	12	.09
Total for Annual Forbs		0	0
Total for Perennial Forbs		12	0.09
Total for Forbs		12	0.09

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

BROWSE TRENDS--

Management unit 28R, Study no: 13

T y p e	Species	Strip Frequency	Average Cover %
		'08	'08
B	<i>Artemisia nova</i>	19	.89
B	<i>Gutierrezia sarothrae</i>	15	.03
B	<i>Opuntia sp.</i>	3	-
B	<i>Pinus edulis</i>	30	16.34
Total for Browse		67	17.27

CANOPY COVER, LINE INTERCEPT--

Management unit 28R, Study no: 13

Species	Percent Cover '08
<i>Artemisia nova</i>	.75
<i>Juniperus osteosperma</i>	.03
<i>Pinus edulis</i>	39.09

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 28R, Study no: 13

Species	Average leader growth (in) '08
<i>Artemisia nova</i>	0.8

POINT-QUARTER TREE DATA--
 Management unit 28R, Study no: 13

Species	Trees per Acre '08	Average diameter (in) '08
Juniperus osteosperma	24	3.5
Pinus edulis	483	3.1

BASIC COVER--
 Management unit 28R, Study no: 13

Cover Type	Average Cover % '08
Vegetation	17.67
Rock	2.67
Pavement	17.22
Litter	59.86
Cryptogams	.28
Bare Ground	22.34

SOIL ANALYSIS DATA --
 Management unit 28R, Study no: 13, Study Name: Panguitch Creek Chaining

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
	7.1	52.0	23.4	24.6	2.3	2.0	163.2	0.8

PELLET GROUP DATA--
 Management unit 28R, Study no: 13

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	67	-
Deer	14	16 (40)

BROWSE CHARACTERISTICS--
 Management unit 28R, Study no: 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)	
Artemisia nova										
08	600	0	13	87	20	23	23	73	8/17	
Gutierrezia sarothrae										
08	740	11	89	-	400	0	0	0	3/2	
Juniperus osteosperma										
08	0	0	0	-	20	0	0	0	-/-	
Opuntia sp.										
08	80	0	75	25	20	0	0	0	4/13	
Pinus edulis										
08	1000	46	52	2	80	0	0	0	-/-	
Rhus trilobata										
08	0	0	0	-	-	0	0	0	20/22	

NORTH HILLS BULLHOG - TREND STUDY NO. 29R-4-08

[Project #1190](#)

Vegetation Type: PJ

Range Type: Substantial Deer Winter, Substantial Elk Winter

NRCS Ecological Site Description: [Upland Shallow Hardpan \(Pinyon-Utah Juniper\), R028AY320UT](#)

Land Ownership: Tribal

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

Aspect: South

Slope: 4%

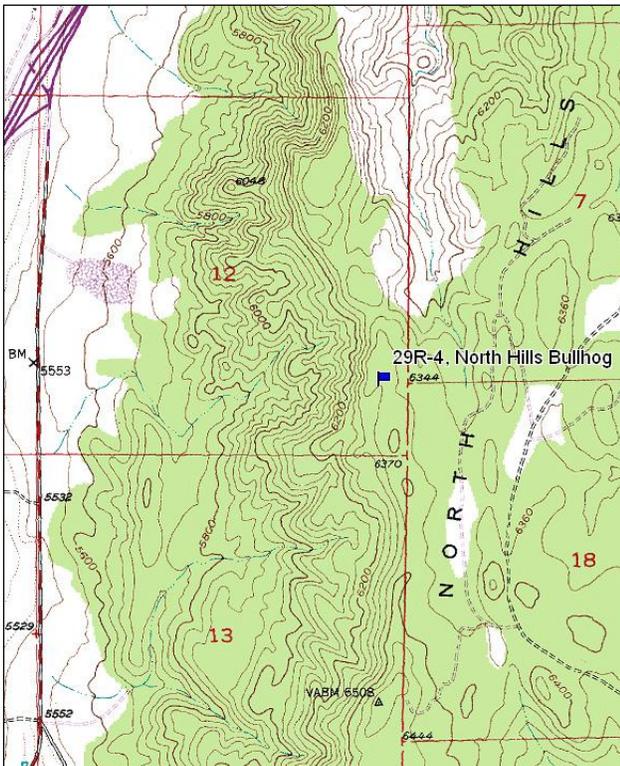
Transect bearing: 180° magnetic

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

Directions:

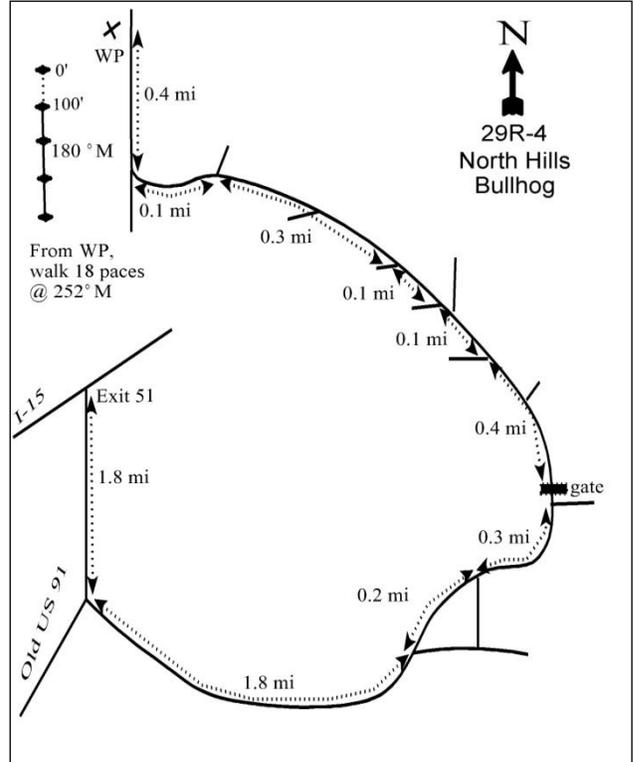
From I-15 Exit 51 (Hamilton Fort), cross under the highway and proceed south on the east side of the freeway for 1.8 miles. Turn left and go 1.8 miles to a corral. Stay left for 0.5 miles to a gate; continue 0.4 miles to a fork, and stay right. Drive 0.1 miles and then take the left fork. Go another 0.1 miles, keeping right, and drive 0.3 miles to a left turn. Drive 0.1 miles to a right turn and go 0.4 miles to the witness post on the left. The 0' stake is 18 paces from the witness post at 252°M. The 0' stake is marked with browse tag #238.

Map Name: Kanarraville



Township: 37S Range: 12W Section: 12

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 310717 E 4162489 N

NORTH HILLS BULLHOG - WRI STUDY 29R-4
[Project #1190](#)

Site Description

Site Information: The study is located approximately four miles northeast of Kanarrville, within an old chaining project encroached by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*), on top of the North Hills, within the Paiute Indian Reservation. The study was established in 2008, prior to the treatment, to monitor the effects of a bullhog treatment to remove pinyon pine and juniper trees. The area was chained several years ago and has been encroached with the reestablishment of pinyon pine and Utah juniper. Due to the surrounding habitat being developed for residential housing, the area is crucial winter range for mule deer. In the fall of 2008, a total of 150 acres were treated with a bullhog implement and aerially seeded with a seed mix of grass, forb, and browse species (Table - Seed Mix). The seed mix was applied to the project area prior to the bullhog treatment. The objectives of the project are to reduce the cover of pinyon and juniper trees, increase the soil stability, and increase forb diversity (WRI Database 2011). Pellet group data estimated moderate use by deer, and light use by elk in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 29R, Study no: 4

Project Name: North Hills Bullhog - Indian Peak Band			
WRI Database #: 1190			
Application: Aerial Seed		Acres:	150
Seed type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Hycrest'	100	0.67
G	Indian Ricegrass 'White River'	75	0.50
G	Intermediate Wheatgrass 'Rush'	300	2.00
G	Pubescent Wheatgrass	200	1.33
G	Sand Dropseed	50	0.33
G	Western Wheatgrass 'Arriba'	150	1.00
F	Alfalfa 'Ladak'	300	2.00
F	Blue Flax 'Appar'	50	0.33
F	Palmer Penstemon	25	0.17
F	Small Burnet 'Delar'	250	1.67
B	Fourwing Saltbush	50	0.33
B	Bitterbrush	50	0.33
Total Pounds:		1600	10.67
PLS Pounds:			9.34

Browse: Prior to the treatment, pinyon pine and Utah juniper provided the majority of the canopy cover on the site in 2008 (Table - Canopy Cover), and the estimated density was 102 tree/acre for both species (Table - Point-Quarter Tree Data). The preferred browse species sampled on the site are Utah serviceberry (*Amelanchier utahensis*), black sagebrush (*Artemisia nova*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), green ephedra (*Ephedra viridis*), and antelope bitterbrush (*Purshia tridentata*). Black sagebrush and antelope bitterbrush are the key preferred browse species on the site because the other preferred browse species occur in low abundance (Table - Browse Characteristics) and provided little cover (Table - Canopy Cover). The black sagebrush is a moderately used population of mature plants with high decadence and moderate vigor within the population. The recruitment of young black sagebrush plants to the population was poor in 2008. The antelope bitterbrush is a moderately used population with low decadence and good vigor within the population. The recruitment of young bitterbrush plants was good in 2008. The weedy species broom snakeweed (*Gutierrezia sarothrae*) is fairly

abundant on the site, with half of the population sampled being young plants in 2008 (Table - Browse Characteristics).

Herbaceous Understory: Grasses are moderately abundant, but are not diverse. The dominant perennial grass species is crested wheatgrass (*Agropyron cristatum*), which provided the majority of the grass cover. The invasive annual grass species cheatgrass (*Bromus tectorum*) is fairly common on the site, but provides little cover. Other less common grass species sampled on the site include intermediate wheatgrass (*Agropyron intermedium*), mutton bluegrass (*Poa fendleriana*), and bottlebrush squirreltail (*Sitanion hystrix*). Forb species are rare on the site (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). While bare ground cover is moderate, there is a high amount of litter and moderate amount of pavement, rock and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008.

HERBACEOUS TRENDS--

Management unit 29R, Study no: 4

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Agropyron cristatum</i>	140	2.85
G	<i>Agropyron intermedium</i>	1	.03
G	<i>Bromus tectorum</i> (a)	157	.79
G	<i>Poa fendleriana</i>	1	.03
G	<i>Sitanion hystrix</i>	3	.03
Total for Annual Grasses		157	0.79
Total for Perennial Grasses		145	2.95
Total for Grasses		302	3.74
F	<i>Astragalus</i> sp.	3	.03
F	<i>Euphorbia</i> sp.	15	.06
F	<i>Ranunculus testiculatus</i> (a)	19	.06
F	<i>Sphaeralcea grossulariifolia</i>	1	.00
F	<i>Streptanthus cordatus</i>	3	.00
Total for Annual Forbs		19	0.06
Total for Perennial Forbs		22	0.09
Total for Forbs		41	0.15

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

BROWSE TRENDS--

Management unit 29R, Study no: 4

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Amelanchier utahensis	2	1.36
B	Artemisia nova	34	4.32
	Artemisia tridentata vaseyana	1	
B	Cercocarpus montanus	1	1.16
B	Ephedra viridis	5	.93
B	Gutierrezia sarothrae	40	.50
B	Juniperus osteosperma	5	6.01
B	Opuntia sp.	2	-
B	Pinus edulis	6	8.48
B	Purshia tridentata	8	3.40
Total for Browse		104	26.19

CANOPY COVER, LINE INTERCEPT--

Management unit 29R, Study no: 4

Species	Percent Cover '08
Amelanchier utahensis	2.16
Artemisia nova	5.00
Artemisia tridentata vaseyana	.10
Cercocarpus montanus	.50
Ephedra viridis	.91
Gutierrezia sarothrae	.61
Juniperus osteosperma	10.68
Pinus edulis	11.08
Purshia tridentata	4.94

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 29R, Study no: 4

Species	Average leader growth (in) '08
Artemisia nova	0.9
Artemisia tridentata vaseyana	1.4
Purshia tridentata	2.9

POINT-QUARTER TREE DATA--

Management unit 29R, Study no: 4

Species	Trees per Acre	Average diameter (in)
	'08	'08
Juniperus osteosperma	102	6.7
Pinus edulis	102	6.8

BASIC COVER--

Management unit 29R, Study no: 4

Cover Type	Average Cover % '08
Vegetation	28.82
Rock	4.57
Pavement	8.18
Litter	61.55
Cryptogams	.26
Bare Ground	22.33

SOIL ANALYSIS DATA --

Management unit 29R, Study no: 4, Study Name: North Hills Bullhog

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	6.9	69.0	4.4	26.6	1.4	8.9	118.4	1.4

PELLET GROUP DATA--

Management unit 29R, Study no: 4

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	71	-
Elk	1	1 (2)
Deer	41	37 (91)
Cattle	2	-

NORTH NEWCASTLE BULLHOG - TREND STUDY NO. 30R-4-08

[Project #446](#)

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Semidesert Shallow Loam \(Black Sagebrush\), R028AY236UT](#)

Land Ownership: BLM

Elevation: 5,478 ft. (1,670 m)

Aspect: Southeast

Slope: 4%

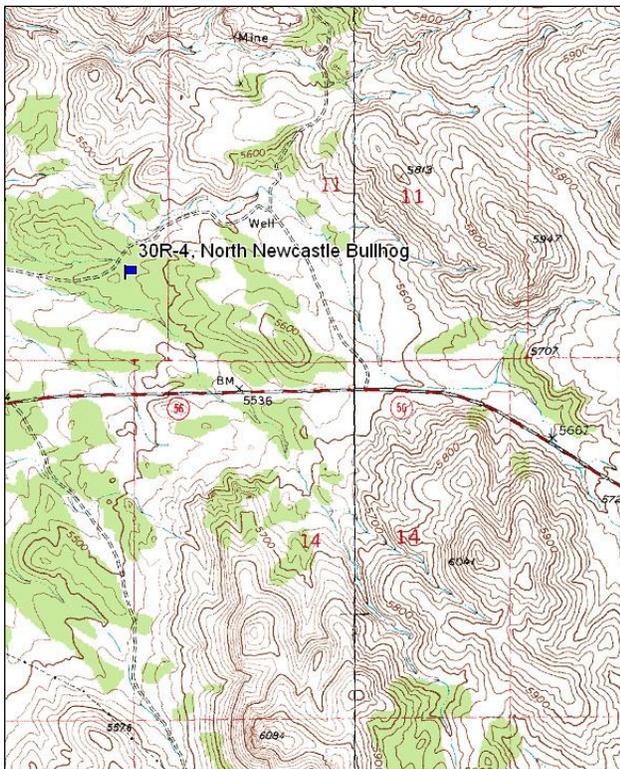
Transect bearing: 94° magnetic

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

Directions:

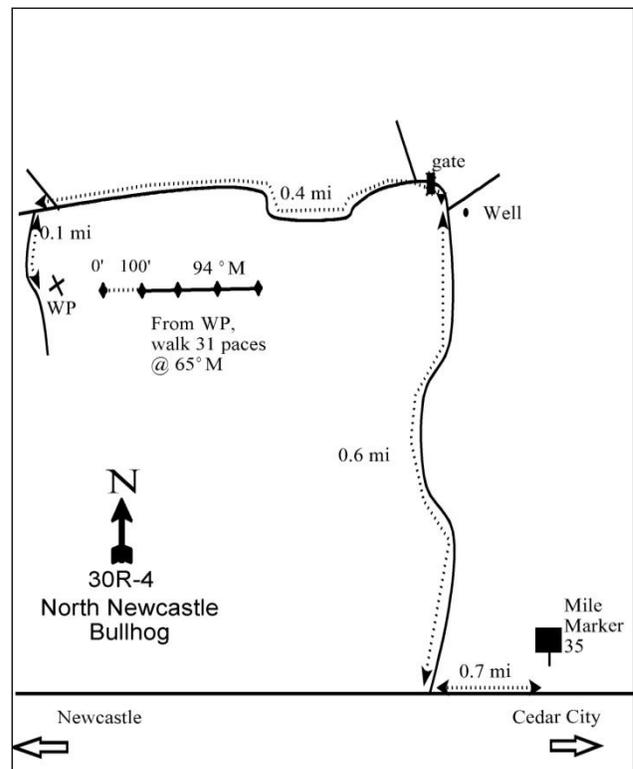
From Cedar City, head west on Hwy 56 to a right turn 0.7 miles after mile marker 35. Drive 0.6 miles to a well on the right. Take the left fork to a gate, stay left, and drive 0.1 miles to another fork. Stay left, drive 0.3 miles to a left turn, and continue 0.1 miles to the witness post on the right. The 0' stake is 31 paces from the witness post at 65°M. The 0' stake is marked with browse tag #217.

Map Name: Newcastle



Township: 36S Range: 15W Section: 10

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 278431 E 4173311 N

NORTH NEWCASTLE BULLHOG - WRI STUDY 30R-4
[Project #446](#)

Site Description

Site Information: The study is located approximately two mile northeast of Newcastle, in a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, north of Highway 56, on land administrated by the Bureau of Land Management (BLM). The study was established in 2008, prior to the treatment, to monitor the effects of a bullhog project. The project area is located within crucial mule deer winter range habitat. In the winter of 2008-09, a total of 870 acres were treated with a bullhog implement. Prior to the bullhog work, a seed mix of grass and forb species were aerially applied to the project area (Table - Seed Mix). The objectives of the project are to improve mule deer winter range habitat and reduce hazardous fuel loads (WRI Database 2011). Pellet group data estimated lightly moderate use by deer, and light use by cattle in 2008 (Table - Pellet Group Data).

SEED MIX--

Management unit 30R, Study no: 4

Project Name: North Newcastle			
WRI Database #: 446			
Application: Aerial Seed		Acres:	1000
Seed type		lbs in mix	lbs/acre
G	Big Bluegrass 'Sherman'	500	0.50
G	Crested Wheatgrass 'Douglas'	500	0.50
G	Crested Wheatgrass 'Hycrest'	550	0.55
G	Intermediate Wheatgrass 'Rush'	122	0.12
G	Intermediate Wheatgrass 'Oahe'	1350	1.35
G	Snake River Wheatgrass 'Secar'	1000	1.00
G	Western Wheatgrass 'Arriba'	1000	1.00
F	Alfalfa 'Ladak'	500	0.50
F	Alfalfa 'Ranger'	500	0.50
F	Sainfoin 'Eski'	2000	2.00
F	Small Burnet 'Delar'	1500	1.50
F	Western Yarrow	100	0.10
Total Pounds:		9622	9.62
PLS Pounds:			8.45

Browse: The preferred browse species are black sagebrush (*Artemisia nova*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), Nevada ephedra (*Ephedra nevadensis*), and slenderbush eriogonum (*Eriogonum microthecum*). The black sagebrush and mountain big sagebrush are moderately used populations with high decadence and poor vigor. The recruitment of young sagebrush plants to the population was poor for both species of sagebrush in 2008. The Nevada ephedra is a heavily used population with high decadence and poor vigor within the population. The slenderbush eriogonum is a mature population with mostly heavy utilization. The recruitment of young ephedra and eriogonum plants to the population was poor in 2008. A fairly abundant population of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*) is present on the study site. Other less common browse species sampled on the site include pricklypear cactus (*Opuntia* sp.) and purple sage (*Salvia dorrii*) (Table - Browse Characteristics). Prior to the bullhog treatment, pinyon pine and Utah juniper were fairly abundant on the site in 2008 with an estimated density of 19 trees/acre and 69 trees/acre, respectively (Table - Point-Quarter Tree Data).

Herbaceous Understory: Grasses are fairly abundant but are not particularly diverse. The dominant grass species is galleta (*Hilaria jamesii*), which provides the majority of the grass cover. The invasive grass species

cheatgrass is present on the site, but was sampled in low abundance and provides little cover. Other less common grass species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). Forbs are not very abundant, but are moderately diverse. Perennial forbs are not very common on the site. The annual species birdbeak (*Cordylanthus sp.*) is the most common species on the site (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.0). Phosphorus may have limited availability for plant growth and development at 5.5 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). While bare ground cover is high, there is also a high amount of pavement, and moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 due to pedestalling, flow patterns, rills, gully formation, and soil movement.

HERBACEOUS TRENDS--

Management unit 30R, Study no: 4

Type	Species	Nested	Average
		Frequency	Cover %
		'08	'08
G	<i>Bromus tectorum</i> (a)	153	.39
G	<i>Hilaria jamesii</i>	148	4.07
G	<i>Oryzopsis hymenoides</i>	53	.73
G	<i>Sitanion hystrix</i>	20	.11
G	<i>Stipa comata</i>	6	.10
Total for Annual Grasses		153	0.39
Total for Perennial Grasses		227	5.02
Total for Grasses		380	5.42
F	<i>Astragalus calycosus</i>	-	.00
F	<i>Astragalus sp.</i>	-	.03
F	<i>Chaenactis douglasii</i>	1	.00
F	<i>Cordylanthus sp.</i> (a)	68	.60
F	<i>Cryptantha sp.</i>	1	.00
F	<i>Eriogonum cernuum</i> (a)	43	.15
F	<i>Euphorbia sp.</i>	16	.13
F	<i>Gilia sp.</i> (a)	3	.00
F	<i>Ipomopsis congesta</i>	1	.00
F	<i>Leucelene ericoides</i>	41	.42
F	<i>Lygodesmia sp.</i>	2	.03
F	<i>Penstemon sp.</i>	2	.01
F	<i>Phlox longifolia</i>	6	.02
F	<i>Streptanthus cordatus</i>	3	.01
Total for Annual Forbs		114	0.76
Total for Perennial Forbs		73	0.68
Total for Forbs		187	1.44

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

BROWSE TRENDS--

Management unit 30R, Study no: 4

Type	Species	Strip Frequency	Average Cover %
		'08	'08
B	Artemisia nova	18	.82
B	Artemisia tridentata vaseyana	9	1.94
B	Chrysothamnus viscidiflorus	43	1.37
B	Ephedra nevadensis	22	.67
B	Eriogonum microthecum	30	.05
B	Gutierrezia sarothrae	49	3.58
B	Juniperus osteosperma	1	1.86
B	Pinus edulis	1	1.00
Total for Browse		173	11.32

CANOPY COVER, LINE INTERCEPT--

Management unit 30R, Study no: 4

Species	Percent Cover
	'08
Artemisia nova	1.54
Artemisia tridentata vaseyana	1.18
Chrysothamnus viscidiflorus	.80
Ephedra nevadensis	1.56
Eriogonum microthecum	.20
Gutierrezia sarothrae	3.11
Juniperus osteosperma	2.66
Pinus edulis	1.23

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 30R, Study no: 4

Species	Average leader growth (in)
	'08
Artemisia nova	1.1
Artemisia tridentata vaseyana	1.0

POINT-QUARTER TREE DATA--

Management unit 30R, Study no: 4

Species	Trees per Acre	Average diameter (in)
	'08	
Juniperus osteosperma	69	15.2
Pinus edulis	19	4.7

BASIC COVER--

Management unit 30R, Study no: 4

Cover Type	Average Cover % '08
Vegetation	18.29
Rock	2.00
Pavement	31.17
Litter	22.45
Cryptogams	.06
Bare Ground	39.39

SOIL ANALYSIS DATA --

Management unit 30R, Study no: 4, Study Name: North Newcastle Bullhog

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
	7.0	58.0	17.4	24.6	1.4	5.5	262.4	0.9

PELLET GROUP DATA--

Management unit 30R, Study no: 4

Type	Quadrat Frequency '08	Days use per acre (ha) '08
Rabbit	95	-
Elk	2	-
Deer	13	8 (20)
Cattle	5	1 (2)

BROWSE CHARACTERISTICS--
Management unit 30R, 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 nova</i>										
08	480	4	38	58	40	25	13	54	15/28	
<i>Artemisia tridentata vaseyana</i>										
08	200	0	80	20	-	30	0	20	18/29	
<i>Chrysothamnus viscidiflorus</i>										
08	1740	1	69	30	60	26	44	24	7/10	
<i>Ephedra nevadensis</i>										
08	860	2	65	33	-	0	95	28	14/27	
<i>Eriogonum microthecum</i>										
08	1220	3	97	-	-	13	72	0	5/6	
<i>Gutierrezia sarothrae</i>										
08	4440	0	99	1	-	0	0	0	7/10	
<i>Juniperus osteosperma</i>										
08	20	100	0	-	-	0	0	0	-/-	
<i>Opuntia sp.</i>										
08	0	0	0	-	-	0	0	0	6/15	
<i>Pinus edulis</i>										
08	20	0	100	-	-	0	0	0	-/-	
<i>Salvia dorrii</i>										
08	0	0	0	-	-	0	0	0	9/22	

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