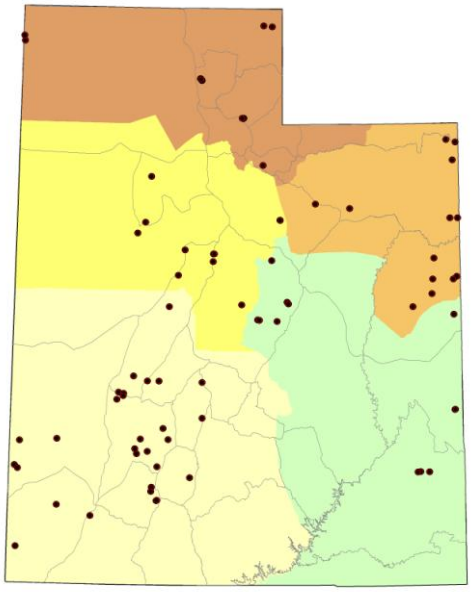
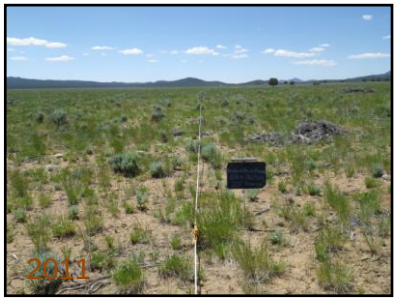
2011 Watershed Restoration Initiative Vegetation Monitoring Report





PUBLICATION NUMBER 12-16
REPORT FOR FEDERAL AID PROJECT W-82-R-56

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

2011 Watershed Restoration Initiative Vegetation Monitoring Report

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Performance Report for Federal Aid Project W-82-R-56

Publication No. 12-16

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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-56

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.

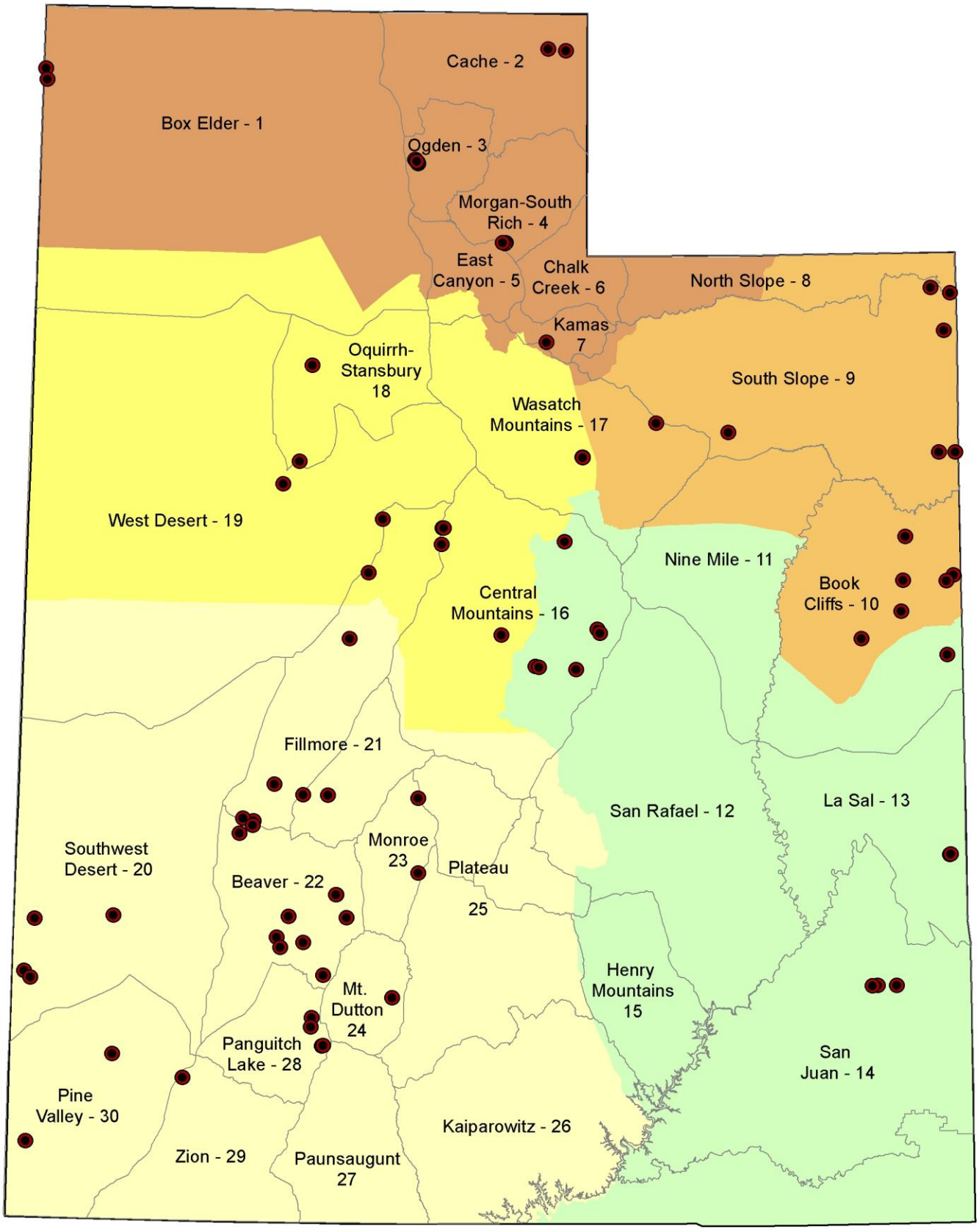
Expected Results and Benefits: WRI range trend studies in each region will be reread, and vegetation condition and trend assessments will be made for project areas. DWR biologists, land management personnel from the United States Forest Service (USFS) and Bureau of Land Management (BLM), and private 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 2011 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 2011



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.

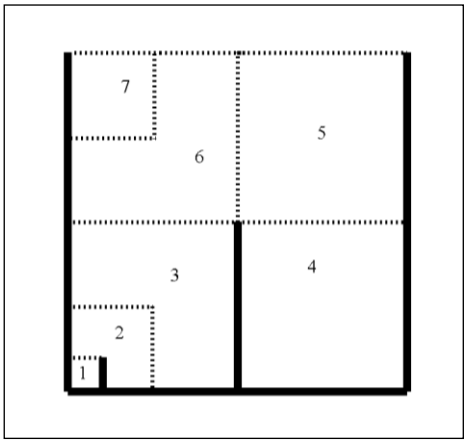


Figure 1. Cover classes of the 1/4 m^2 sampling quadrat.

Total canopy cover of shrubs or trees is also estimated using the line- intercept method ([1]U.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).

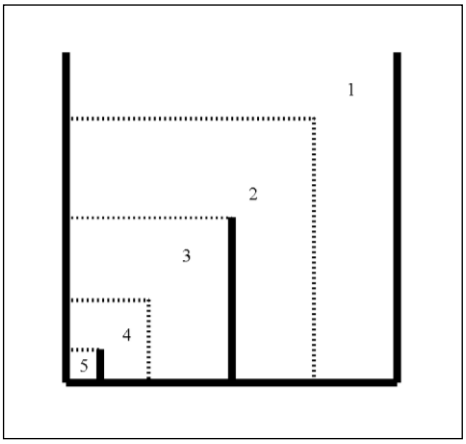


Figure 2. Nested frequency sub-quadrats of the 1/4 m^2 sampling quadrat.

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.

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 ([2]U.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	$_{b}$135	$_{ab}$106	$_{ab}$100	$_{ab}$112	$_{a}$81	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	$_{b}$61	$_{a}$3	$_{a}$19	$_{a}$3	$_{a}$-	.03	.18	.01	-
G	Oryzopsis hymenoides	-	3	3	3	8	.00	.00	.03	.07
G	Poa bulbosa	$_{b}$220	$_{b}$256	$_{b}$250	$_{a}$129	$_{a}$136	7.14	8.01	2.43	2.86
G	Poa fendleriana	$_{a}$-	$_{b}$16	$_{d}$53	$_{cd}$55	$_{bc}$24	.06	.38	1.24	.33
G	Sitanion hystrix	6	1	-	-	-	.00	-	-	-
G	Stipa comata	$_{b}$48	$_{a}$14	$_{bc}$24	$_{bc}$30	$_{a}$21	.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	$_{b}$40	$_{bc}$17	$_{ab}$25	$_{b}$37	$_{a}$9	.10	.42	.99	.10
F	Calochortus nuttallii	8	-	-	1	-	-	-	.00	-
F	Castilleja chromosa	$_{b}$38	$_{a}$4	$_{a}$-	$_{a}$-	$_{a}$-	.01	-	-	-
F	Castilleja linariaefolia	-	2	1	-	-	.01	.03	-	-
F	Comandra pallida	-	-	-	3	-	-	-	.01	-
F	Cordylanthus sp. (a)	-	-	-	5	5	-	-	.16	.01
F	Crepis acuminata	$_{b}$14	$_{a}$6	$_{a}$-	$_{a}$-	$_{a}$-	.03	-	-	-
F	Erigeron flagellaris	-	-	3	-	1	-	.15	-	.00
F	Erigeron pumilus	$_{b}$111	$_{a}$21	$_{a}$43	$_{a}$20	$_{a}$12	.07	.51	.53	.08
F	Eriogonum racemosum	$_{b}$63	$_{a}$30	$_{a}$34	$_{a}$25	$_{a}$28	.14	.30	.35	.21
F	Hymenoxys acaulis	3	-	3	1	-	-	.00	.03	-
F	Lomatium triternatum	$_{b}$31	$_{a}$-	$_{a}$-	$_{a}$-	$_{a}$-	-	-	-	-
F	Lupinus argenteus	$_{d}$162	$_{c}$57	$_{b}$20	$_{a}$-	$_{a}$-	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	$_{c}$67	$_{bc}$53	$_{ab}$31	$_{a}$7	$_{a}$17	.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 1/4m^2 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	Amelanchier utahensis	18	18	16	20	2.25	3.74	6.50	5.30
B	Artemisia tridentata vaseyana	86	82	85	85	16.28	9.40	10.65	9.94
B	Chrysothamnus depressus	12	26	23	23	.66	.72	1.46	.87
B	Chrysothamnus viscidiflorus viscidiflorus	86	81	72	72	3.62	4.96	5.00	6.14
B	Coryphantha vivipara arizonica	0	2	5	5	-	.00	.00	.00
B	Eriogonum microthecum	10	16	10	9	.01	.53	.12	.12
B	Gutierrezia sarothrae	0	4	8	4	.01	.04	.15	.03
B	Juniperus osteosperma	0	0	0	0	-	-	-	.15
B	Opuntia sp.	36	35	41	45	.32	.56	1.12	1.33
B	Pinus edulis	0	16	14	10	2.92	3.53	7.21	8.53
B	Purshia tridentata	0	1	1	1	-	.00	.00	.00
B	Quercus gambelii	0	3	3	2	.76	.63	1.48	.76
B	Symphoricarpos oreophilus	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 1/4m^2 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
Amelanchier utahensis	.80	7.25	9.48
Artemisia tridentata vaseyana	-	13.21	13.93
Chrysothamnus depressus	-	1.04	.58
Chrysothamnus viscidiflorus viscidiflorus	-	4.73	7.25
Eriogonum microthecum	-	.11	.06
Opuntia sp.	-	.65	.71
Pinus edulis	3.59	11.86	13.43
Quercus gambelii	-	1.23	1.43
Symphoricarpos oreophilus	-	-	.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
Amelanchier utahensis	1.8	1.7
Artemisia tridentata vaseyana	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		
	'99	'04	'09
Pinus edulis	201	175	213

Average diameter (in)		
'99	'04	'09
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)
Artemisia tridentata vaseyana									
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			%0M	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, $100ft^2$ circular plots which are placed through the study area. These are usually two parallel transects of 25 plots on each side of the vegetation transect which runs 400 feet to 500 feet in length. The number of recent pellet groups for wildlife (usually deer and elk) and pats for cattle are recorded. That number is then converted to days use per acre (hectare) (Neff 1968). Rabbit pellet groups are not included in this sample. In the example, elk days use/acre was estimated at 70 in 1999 and decreased steadily to 4 elk days use/acre in 2009.

PELLET GROUP DATA--
Management unit 13A, Study no: 1

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

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

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REPORT FORMAT

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

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

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

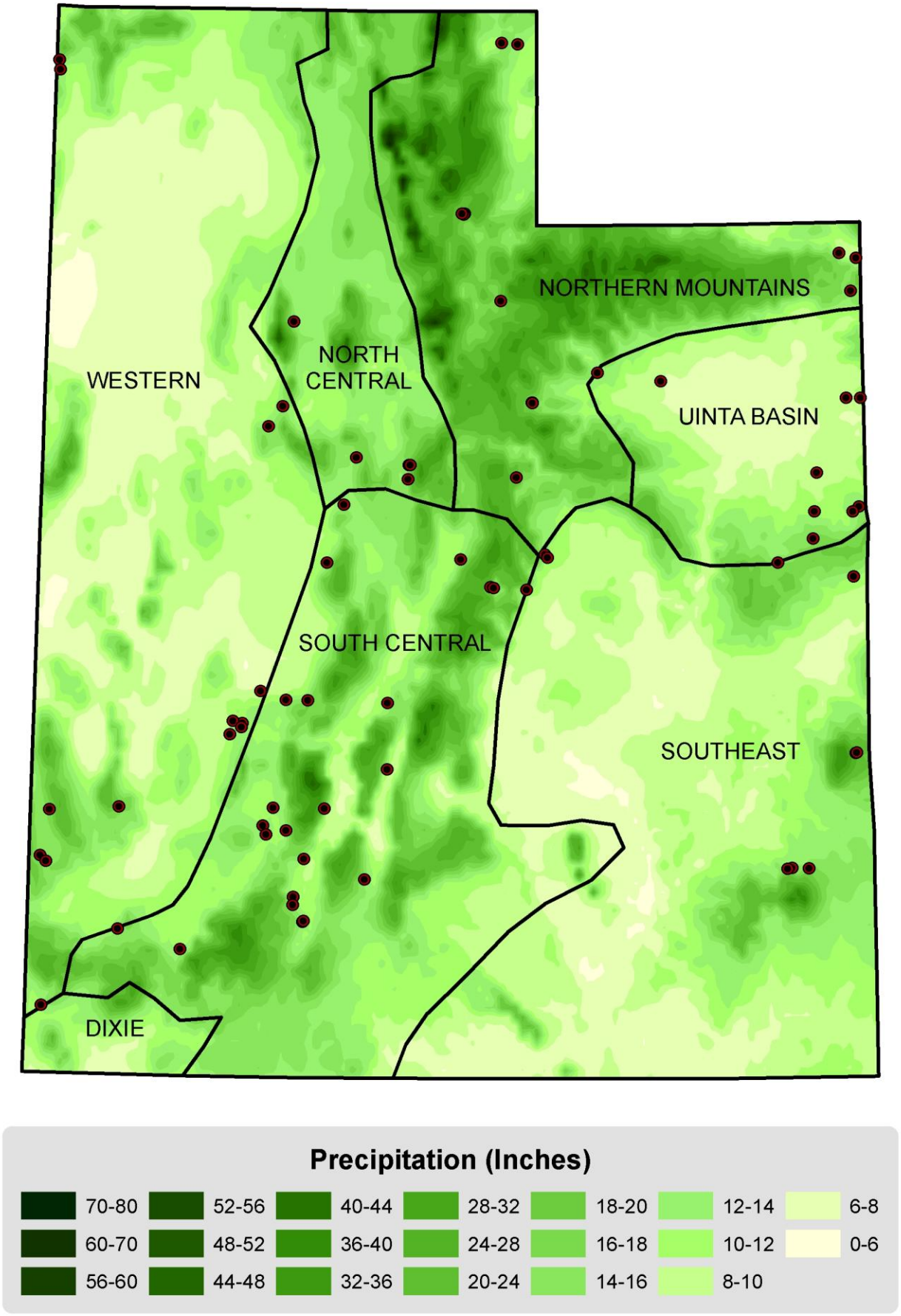
SUMMARY OF STUDY TREATMENT TYPES

Northern Region	**Treatment Type**	**WRI ID#**
1R-12 Dairy Valley GIP 1	*Fire Rehab One-Way Chaining	Project #992
1R-13 Dairy Valley GIP 2	*Fire Rehab One-Way Chaining	Project #992
2R-06 Duck Creek 3 Low	**Aerator	PDB
2R-08 Duck Creek 1	**Aerator	PDB
4R-03 Claypit North Slope	Aroga Moth Study	PDB
4R-04 Claypit South Slope	Aroga Moth Study	PDB
4R-05 Croydon Cemetery	Aroga Moth Study	PDB
7R-02 Kamas SFH	*Herbicide (Plateau)	Project #1195
Northeastern Region		
9R-03 Deadman Greenstrip	**Aerator, ***Herbicide (Plateau)	Project #1081
9R-14 Pot Creek Chaining	*Fire Rehab One-Way Chaining	Project #608
9R-16 Brown's Field	***Herbicide (Plateau)	Project #1152
9R-17 Toliver Creek Bullhog	*Bullhog	Project #1084
9R-18 Brotherson Chaining	*Two-Way Ely Chaining	Project #1150
9R-24 Raven Ridge	**One-Way Chain Harrow/Plateau	Project #1989
10R-28 Indian Ridge 2	***Herbicide (Plateau)	Project #1952
10R-39 Indian Springs Bullhog	*Bullhog/Fire Rehab	Project #1885
10R-40 Indian Springs Bullhog 3	*Bullhog	Project #677
10R-51 Archy Bench	*One-Way Ely Chaining/Plateau	Project #2050
10R-52 Seep Ridge Bullhog	*Bullhog	Project #1950
10R-53 Moon Ridge	Proposed Chaining	Project #2218
17R-27 Two Bar-Blacktail Chaining	*Two-Way Ely Chaining	Project #368
Southeastern Region		
10R-50 Bitter Creek	***Herbicide (Plateau)	Project #1606
13R-05 La Sal Aspen Exclosure	Aspen Regeneration/Exclosure	Project #1990
13R-06 La Sal Aspen	Aspen Regeneration	Project #1990
14-11 Shay Mesa	Bullhog	Project #1091
14R-21 Shay Mesa Bullhog	*Bullhog	Project #1091
14R-25 Peters Point BLM	Bullhog	Project #1944
16R-31 Mohrland Roller Chopper 1	*Roller Chopper	Project #1083
16R-32 Mohrland Roller Chopper 2	*Roller Chopper	Project #1083
16R-33 Scofield Dixie	**Two-Way Dixie Harrow	Project #1085
16R-43 Swasey Mtn Brush Bullhog	Bullhog	Project #2091
16R-44 Swasey Bullhog	Bullhog	Project #2091
16R-45 Grimes Wash	*Two-Way Chaining	Project #1946
Central Region		
16R-28 Willow Creek Dixie	**One-Way Dixie Harrow	Project #1101
16R-40 Mona Bench	**Chain Harrow/*Plateau/Milestone	Project #1934
16R-41 Mona Bench 2	**Chain Harrow/*Plateau	Project #1934
16R-42 Canal Canyon	*Two-Way Ely Chaining/Plateau	Project #1921
17R-31 Badger Hollow Mow	Brush Mower	Project #1816
17R-32 Badger Hollow Control	Control	Project #1816
17R-33 Badger Hollow Harrow	Two-Way Chain Harrow	Project #1816
18R-07 Grantsville Chaining	*Two-Way Ely Chaining	Project #1117
18R-08 West Onaqui Bullhog	Bullhog	Project #1133
19R-10 Russian Knapweed Control	***Prescribe Burn/2,4-D	Project #1102
19R-11 James Ranch Bullhog	Bullhog	Project #1131

Central Region	**Treatment Type**	**WRI ID#**
19R-21 Gilson Mountain Sage-Grouse	***Herbicide (Plateau)	Project #1103
Southern Region		
20R-03 Bowler Chaining	*Two-Way Ely Chaining	Project #563
20R-04 Blawn Wash Dixie	**One-Way Dixie Harrow	Project #391
20R-05 Salt Cabin	*Two-Way Ely Chaining	Project #479
20R-06 Hamblin Valley Harrow	**Two-Way Dixie Harrow	Project #1185
21R-06 Anderson Dixie	**One-Way Dixie Harrow	Project #797
21R-08 A&F Aerial Seeding (GIP)	***Fire Rehab	Project #1007
21R-09 A&F Aerial Seeding 2 (GIP)	*Fire Rehab	Project #1010
21R-10 A&F Drill 3 (GIP)	***Fire Rehab	Project #1006
21R-11 Kanosh Lop and Scatter	Lop and Scatter	Project #408
21R-14 Widemouth Canyon	*Two-Way Ely Chaining	Project #1972
22R-13 Greenville Bench Bullhog	*Bullhog	Project #993
22R-14 South Beaver Rocky Wash	*Bullhog	Project #1224
22R-15 South Beaver Year 4	*Bullhog	Project #1224
22R-16 Spry Sagebrush Restoration	Lop and Scatter	Project #1173
22R-17 Beaver Easement Harrow	**Two-Way Dixie Harrow	Project #1294
22R-18 A&F Drill (GIP)	***Fire Rehab	Project #1007
22R-19 A&F Drill 2 (GIP)	***Fire Rehab	Project #1007
22R-24 City Creek	Bullhog	Project #1995
23R-11 Box Creek Dixie	**Two-Way Dixie Harrow	NA
23R-12 Glenwood Chaining	*Two-Way Ely Chaining	Project #1941
24R-08 Johns Valley	Bullhog	Project #2055
28-19 DD Hollow	**Bullhog	PDB
28R-12 Five Mile 2	Lop and Scatter	Project #901
28R-13 Panguitch Creek	*Bullhog	Project #1206
28R-19 South Canyon	*Bullhog	Project #2027
29R-04 North Hills Bullhog	*Bullhog	Project #1190
30R-02 Square Fire Rehab	*Fire Rehab One-Way Chaining	PDB
30R-04 North New Castle	*Bullhog	Project #446

*Aerial Seeding
**Broadcast Seeding
***Drill Seeding

NOAA Preciptation Divisions



PRECIPITATION SUMMARY

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

Western Division

There are fourteen study sites located in the Western Division, which include Dairy Valley GIP (1R-12), Dairy Valley GIP 2 (1R-13), West Onaqui Bullhog (18R-8), James Ranch Bullhog (19R-11), Bowler Chaining (20R-3), Blawn Wash Dixie (20R-4), Salt Cabin Dixie (20R-5), Hamblin Valley Harrow (20R-6), A&F Aerial Seeding (21R-8), A&F Aerial Seeding 2 (21R-9), A&F Drill 3 (21R-10) A&F Drill 1 (22R-18), A&F Drill 2 (22R-19), and Square Fire Rehab (30R-2). The Western Division had a historic annual mean precipitation of 8.69 inches from 1895 to 2011. The mean annual PDSI of Western Utah displayed predominance to drought in the division from 1982 to 2011. Wetter than normal years in Western Utah included 1983-1984, 2005, and 2011; and drought years included 1989-1992, 1996, 1999-2004 and 2007-2009 (Figure 1 and Figure 2) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 8-10 in. on the A&F Drill 3 study; 10-12 in. on the A&F Aerial Seeding, A&F Aerial Seeding 2, and A&F Drill 2 studies; 12-14 in. on the Dairy Valley GIP 2, West Onaqui Bullhog, James Ranch Bullhog, A&F Drill 1, and Square Fire Rehab studies; 14-16 in. on the Dairy Valley GIP 1, Bowler Chaining, and Hamblin Valley Harrow studies; 16-18 in. on the Salt Cabin Dixie study; and 18-20 in. on the Blawn Wash Dixie study (PRISM Climate Group 2011).

North Central Division

There are five study sites located in the North Central Division, which include Willow Creek Dixie (16R-28), Mona Bench (16R-40), Mona Bench 2 (16R-41), Grantsville Chaining (18R-07), and Russian Knapweed Control (19R-10). The North Central Division had a historic annual mean precipitation of 16.51 inches from 1895 to 2011. The mean annual PDSI of North Central displayed cycles of wetter than normal years proceeded by dryer than normal years from 1982 to 2011. Wetter than normal years in North Central included 1983-1986, 1993, 1995, 1997-1998, 2005, and 2011; and drought years included 1987-1990, 1996, 2000-2003 and 2007 (Figure 3 and Figure 4) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 14-16 in. on the Grantsville Chaining and Russian Knapweed Control studies; 16-18 in. on the Willow Creek Dixie and Mona Bench studies; and 18-20 in. on the Mona Bench 2 study (PRISM Climate Group 2011).

South Central Division

There are 23 study sites located in the South Central Division, which include Canal Canyon (16R-42), Swasey Mountain Brush Bullhog (16R-43), Swasey Bullhog (16R-44), Grimes Wash (16R-45), Gilson Mountain Sage-Grouse (19R-21), Anderson Dixie (21R-6), Kanosh Lop and Scatter (21R-11), Wide Mouth Canyon (21R-14), Greenville Bench Bullhog 2 (22R-13) South Beaver Rocky Wash (22R-14), South Beaver Bullhog Year 4 (22R-15), Spry Sagebrush Restoration (22R-16), Beaver Easement Harrow (22R-17), City Creek (22R-24), Box Creek Dixie (23R-11), Glenwood Chaining (23R-12), Johns Valley (24R-8), DD Hollow (28-19) Five Mile 2 (28R-12) Panguitch Creek (28R-13), South Canyon (28R-19), North Hills Bullhog, and North New Castle (30R-4). The South Central Division had a historic annual mean precipitation of 12.52 inches from 1895 to 2011. The mean annual PDSI of South Central displayed cycles of wetter than normal years proceeded by dryer than normal years from 1982 to 2011. Wetter than normal years in South Central included 1982-1985, 1993, 1995, 1997-1999, 2005, and 2011; and drought years included 1989-1991 and 2002 (Figure 5 and Figure 6) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 10-12 in. on the Box Creek Dixie and Five Mile 2 studies; 12-

14 in. on the Canal Canyon, Grimes Wash, Anderson Dixie, Gilson Mountain Sage-Grouse, Wide Mouth Canyon, Greenville Bench Bullhog 2, South Beaver Rocky Wash, South Beaver Bullhog Year 4, Spry sagebrush Restoration, Beaver Easement Harrow, Glenwood Chaining, DD Hollow, Panguitch Creek, South Canyon, and North hills Bullhog studies; 14-16 in. on the Swasey Bullhog, Johns Valley, and North New Castle studies; 16-18 in. on the Kanosh Lop and Scatter and City Creek study; and 18-20 in. on the Swasey Mountain Brush Bullhog study (PRISM Climate Group 2011).

Northern Mountains Division

There are thirteen study sites located in the Northern Mountains Division, which include Duck Creek 3 Low (2R-6), Duck Creek 1 (2R-8), Claypit North Slope (4R-3), Claypit South Slope (4R-4), Croydon Cemetery (4R-5), Kamas SFH (7R-2), Pot Creek Chaining (9R-14), Brown's Field (9R-16), Toliver Creek Bullhog (9R-17), Scofield Dixie (16R-33, Badger Hollow Mow (17R-31), Badger Hollow Control (17R-32), and Badger Hollow Harrow (17R-33). The Northern Mountains Division had a historic annual mean precipitation of 19.16 inches from 1895 to 2011. The mean annual PDSI of the Northern Mountains displays a cycle of several wet years followed by several drought years from 1982 to 2011. Wetter than normal years in the Northern Mountains included 1982-1986, 1993, 1995-1999, 2005, and 2011. Drought years included 1987-1992, 2000-2003 and 2007 (Figure 7 and Figure 8) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 8-10 in. on the Brown's Field study; 10-12 in. on the Toliver Creek Bullhog study; 12-14 in. on the Duck Creek 3 Low study; 14-16 in. Duck Creek 1 and Pot Creek Chaining studies; 16-18 in. on the Badger Hollow Mow, Badger Hollow Control, and Badger Hollow Harrow studies; 18-20 in. on the Claypit South Slope and Kamas SFH studies; and 20-24 in. on the Croydon Cemetery, Scofield Dixie, Claypit North Slope studies (PRISM Climate Group 2011).

Uintah Basin Division

There are nine study sites located in the Uintah Basin Division, which include Deadman Greenstrip (9R-3), Brotherson Chaining (9R-18), Indian Ridge 2 (10R-28), Indian Springs Bullhog 2 (10R-39), Indian Springs Bullhog 3 (10R-40), Archy Bench (10R-51), Seep Ridge Bullhog (10R-52), Two Bar/Blacktail Chaining (17R-27), and Raven Ridge (19R-24). The Uintah Basin Division had a historic annual mean precipitation of 8.00 inches from 1895 to 2011. The mean annual PDSI of Uintah Basin displayed a cycle of several wet years followed by several drought years from 1982 to 2011. Wetter than normal years in Uintah Basin included 1982-1984, 1993, 1997, 2005, and 2011; and drought years included 1989-1991 and 2000-2003 (Figure 9 and Figure 10) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 8-10 in. on the Deadman Greenstrip, Raven Ridge, Brotherson Chaining, and Archy Bench studies; 10-12 in. on the Indian Ridge 2 study; 12-14 in. on the Two Bar/Blacktail Chaining, Indian Springs Bullhog 2 and Indian Springs Bullhog 3 studies; 14-16 in. on the Seep Ridge Bullhog study (PRISM Climate Group 2011).

South East Division

There are nine study sites located in the South East Division, which include La Sal Aspen Exclosure (13R-5), La Sal Aspen (13R-6), Shay Mesa (14-11), Shay Mesa Bullhog (14R-21), Peters Point BLM (14R-25), Bitter Creek (10R-50), Moon Ridge (10R-53), Mohrland Roller Chopper 1 (16R-31), and Mohrland Roller Chopper 2 (16R-32). The South East Division had a historic annual mean precipitation of 9.06 inches from 1895 to 2011. The mean annual PDSI of the South East displays a cycle of several wet years followed by several drought years from 1982 to 2011. Wetter than normal years in the South East included 1983-1985, 1993, 2005, and 2010. Drought years included 1989-1990, 2000, and 2002-2003 (Figure 11 and Figure 12) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 10-12 in. on the Bitter Creek study; 12-14 in. on the Mohrland Roller Chopper 1 and Mohrland Roller Chopper 2 studies; 14-16 in. on the Shay Mesa and Shay Mesa Bullhog studies; 16-18 in. on the Moon Ridge and Peters Point BLM studies; 20-24 in. on the La Sal Aspen study; and 24-28 in. on the La Sal Aspen Exclosure study (PRISM Climate Group 2011).

Western Utah Division

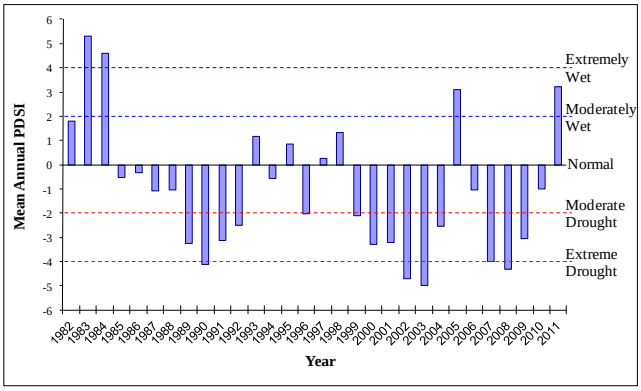


Figure 1. The 30 year mean annual Palmer Drought Severity Index (PDSI) for Western Utah (Division 1). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

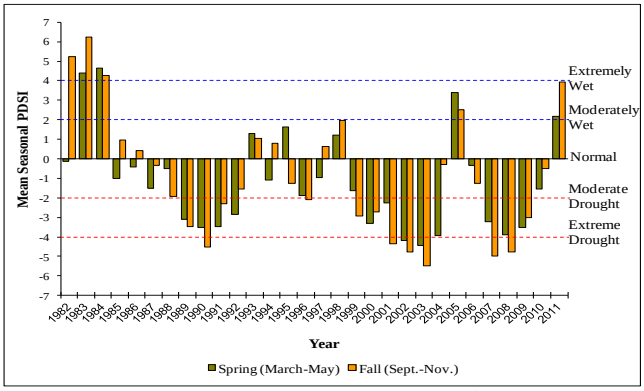


Figure 2. The 30 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for Western Utah (Division 1). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

North Central Division

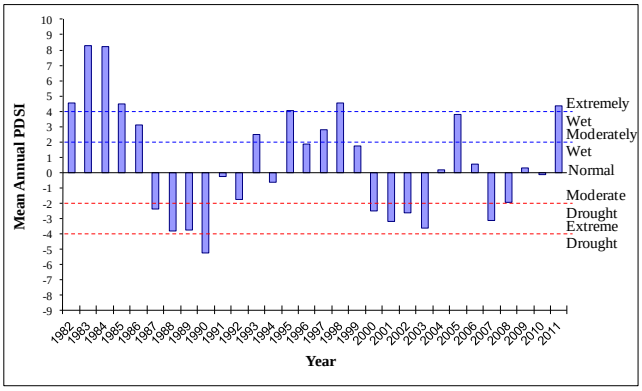


Figure 3. The 30 year mean annual Palmer Drought Severity Index (PDSI) for North Central (Division 3). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

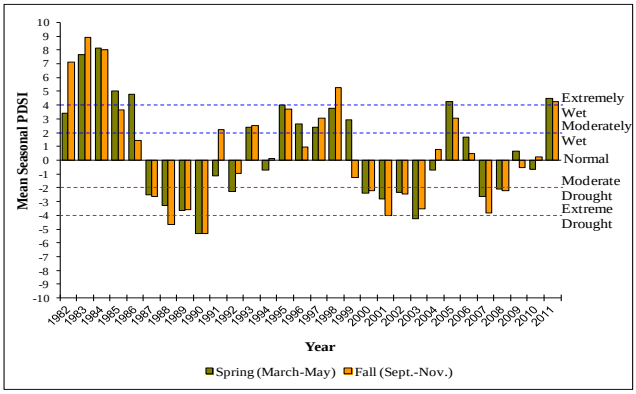


Figure 4. The 30 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for North Central (Division 3). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

South Central Division

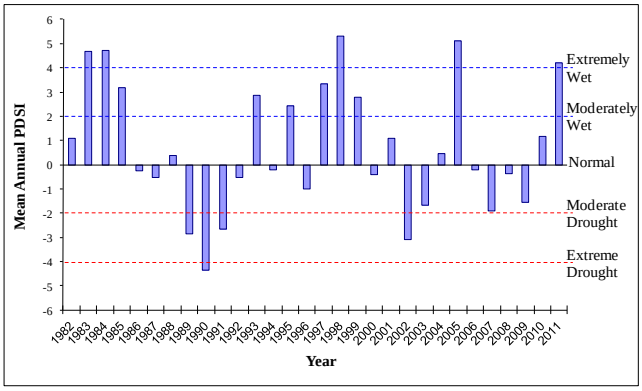


Figure 5. The 30 year mean annual Palmer Drought Severity Index (PDSI) for South Central (Division 4). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

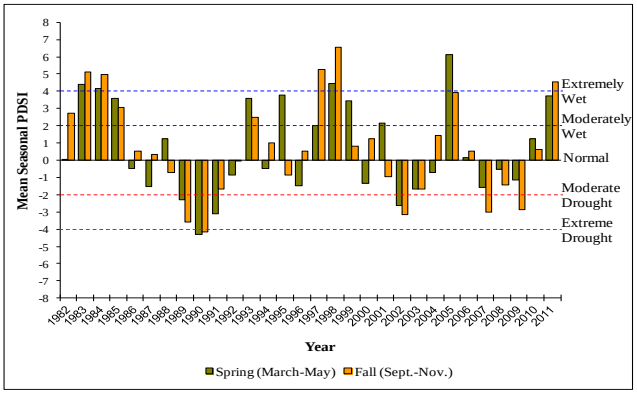


Figure 6. The 30 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for South Central (Division 4). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

Northern Mountains Division

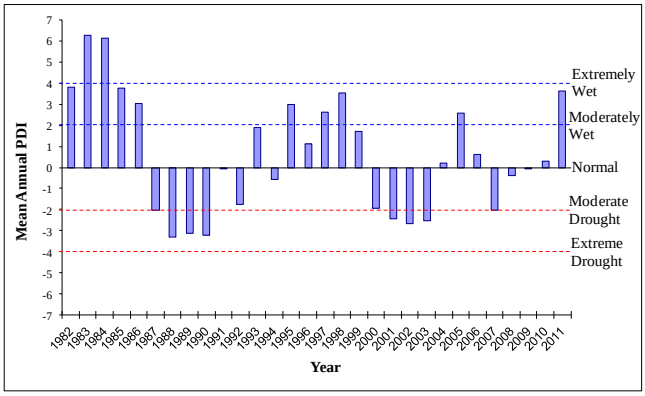


Figure 7. The 30 year mean annual Palmer Drought Severity Index (PDSI) for the Northern Mountains (Division 5). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

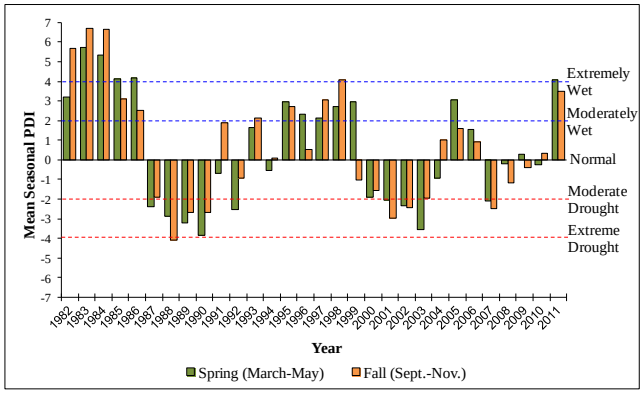


Figure 8. The 30 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for the Northern Mountains (Division 5). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

Uintah Basin

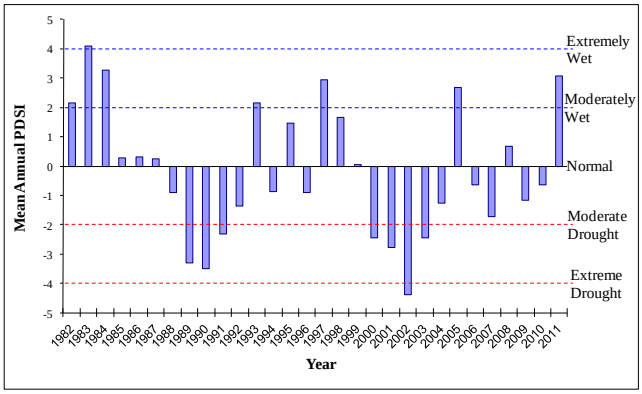


Figure 9. The 30 year mean annual Palmer Drought Severity Index (PDSI) for Uintah Basin (Division 6). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

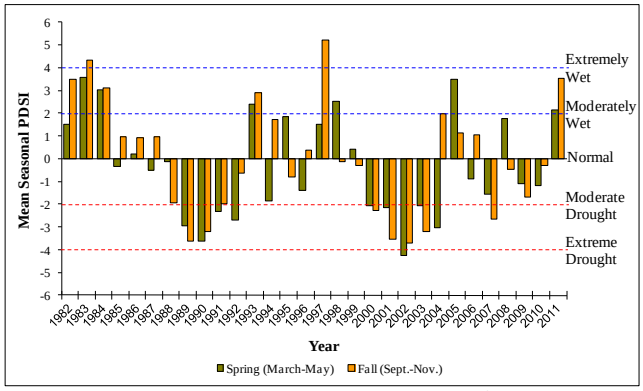


Figure 10. The 30 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for Uintah Basin (Division 6). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

South East Division

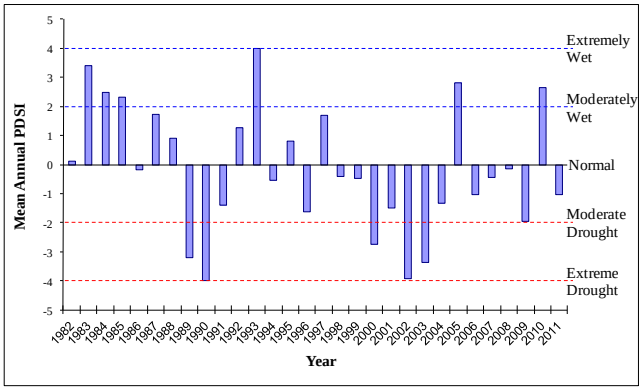


Figure 11. The 30 year mean annual Palmer Drought Severity Index (PDSI) for South East (Division 7). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

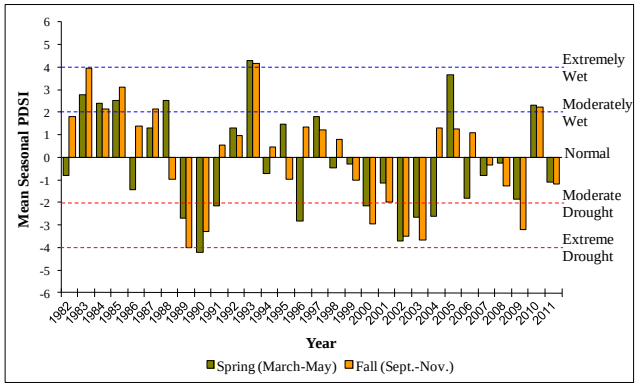
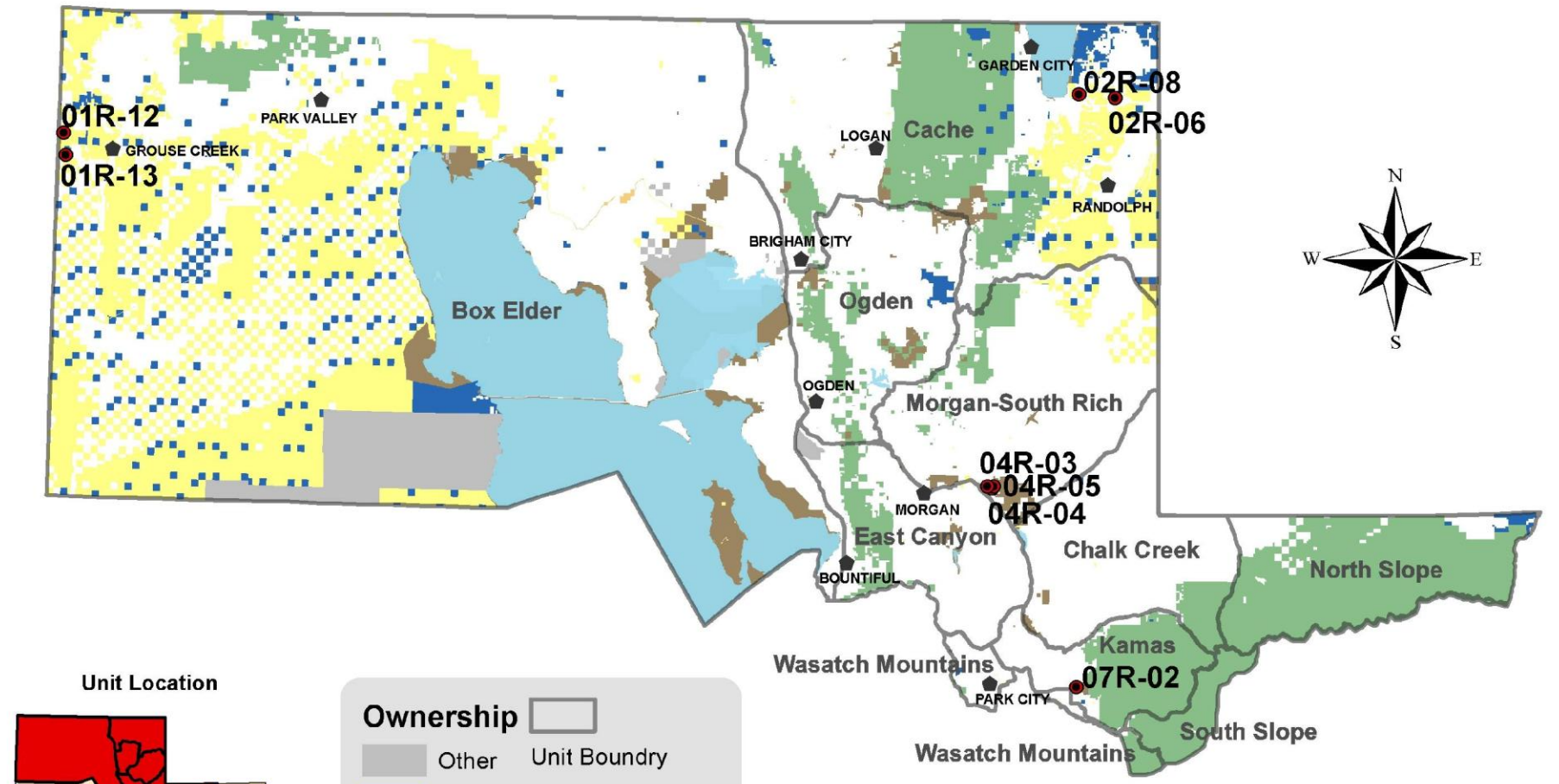
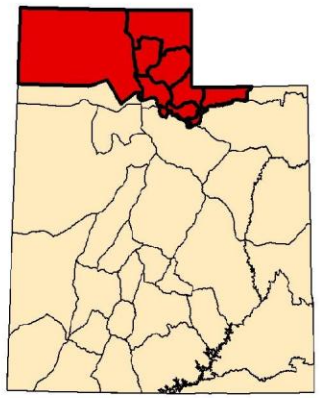


Figure 12. The 30 year mean spring (March-May) and fall (Sept-Nov.) Palmer Drought Severity Index (PDSI) for South East (Division 7). The PDSI is based on climate data gathered from 1895 to 2011. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is ≥4.0 = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and ≤-4.0 = Extreme Drought (Time Series Data 2012).

Northern Region WRI Studies 2011



Unit Location



Ownership

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

Unit Boundry

City

Waterbody

Transect Location

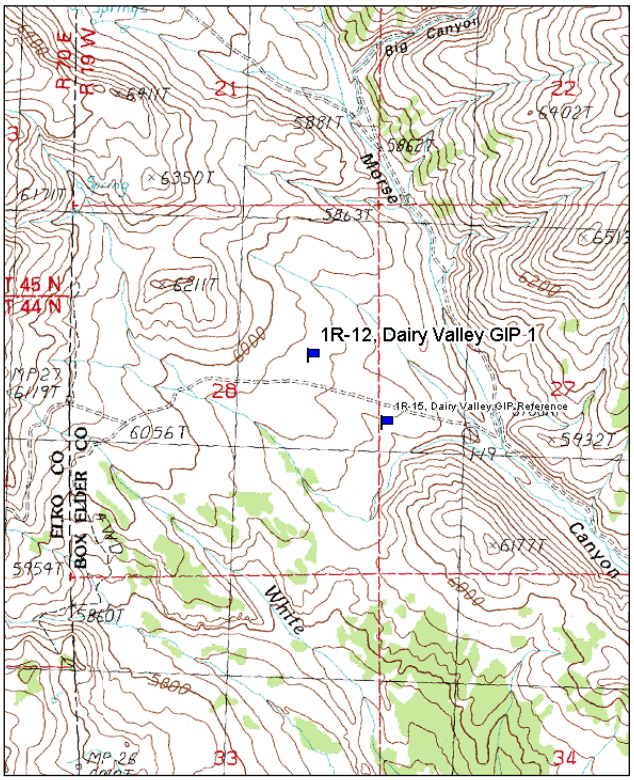
0 5 10 20 30 40 50 60 Miles

DAIRY VALLEY GIP 1 - TREND STUDY NO. 1R-12-11
Project #992

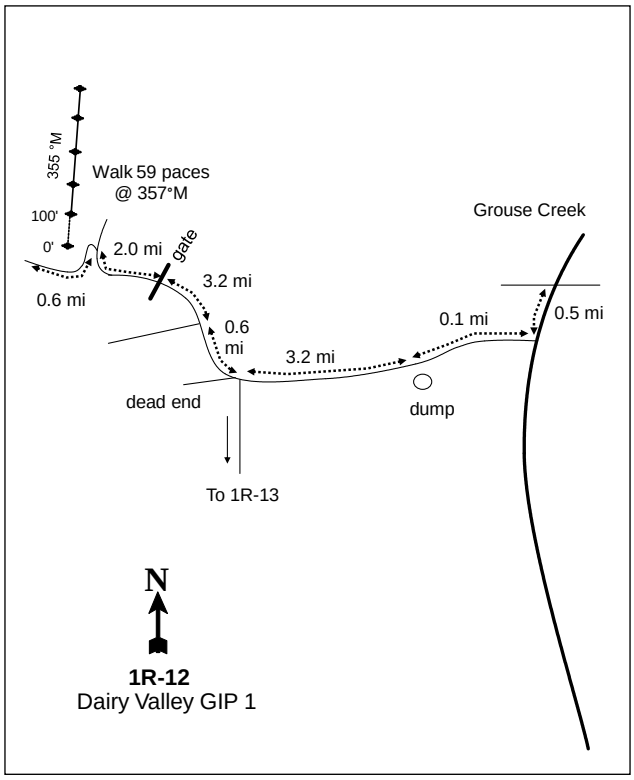
Vegetation Type: Perennial Grass
Range Type: Substantial Deer Winter, Crucial Elk Year-Long
NRCS Ecological Site Description: Upland Juniper Savanna (Utah Juniper), R025XY322UT
Land Ownership: SITLA
Elevation: 5,933 ft (1,808 m)
Aspect: Southeast
Slope: 3%
Transect bearing: 335° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:
Head west on SR-42 from Snowville to Curlew Junction, turn south (left) onto SR-30, and drive toward Park Valley. Turn left onto Grouse Creek Road and follow it 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 to the road leading to 1R-13 and stay to the right. Drive 0.6 miles to another fork and stay on the main road (right). Go 1.7 miles, take the right fork, and continue 1.5 miles to a gate. From the gate, go 2.0 miles, staying left at the fork. Drive 0.6 miles to a witness post on the right side of the road. From the witness post, walk 59 paces at 357° M to the 0' stake. The 0' stake is marked with browse tag # 247.

Map Name: Grouse Creek



Diagrammatic Sketch:



Township: 12N Range: 19W Section: 28

GPS: NAD 83, UTM 12T 248235 E 4624739 N

DAIRY VALLEY GIP 1 - WRI STUDY 1R-12
Project #992

Site Description

Site Information: The study is located approximately four miles northwest of Etna Reservoir, within a burned mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat, west of Morse Canyon on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). 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), 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 (*Juniperus osteosperma*) trees. The study was established within the chained and seed portion of the project following the treatment. The project area was rested from livestock grazing for two growing seasons following the treatment. The objectives of the project are to rehabilitate crucial habitat for the greater sage-grouse and mule deer, and reduce the potential for noxious weeds and annual grass establishment (WRI Database 2012). Deer pellet groups were sampled in low abundance in 2008, and elk pellet groups were sampled in low abundance in 2009. Cattle sign was sampled in low abundance in 2008, moderate abundance in 2009, and high abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 01R, Study no: 12

Project Name: Dairy Valley WRI Database #: 992			
Application: Aerial Seed		Acres:	6300
Seed type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass '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: The study site is dominated by the weedy species stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) which has provided the majority of the cover since the establishment of the study. The preferred browse species on the site are mountain big sagebrush, black sagebrush (*Artemisia nova*), slenderbush eriogonum (*Eriogonum microthecum*), and antelope bitterbrush (*Purshia tridentata*). Mountain big sagebrush and black sagebrush are the key browse species on the site. Slenderbush eriogonum and antelope bitterbrush have been sampled in low abundance and have provided minimal cover (Table - Canopy

Cover). The mountain big sagebrush is a relatively low density, young population of mostly smaller plants. Utilization of the mountain big sagebrush population has been mostly moderate to light. Decadence has been low and vigor has been good within the population, though decadence and vigor were high at the outset of the study. The black sagebrush is sparsely populated and displays mostly light use. The black sagebrush population has low decadence and good vigor. Most of the mature plants of mountain big sagebrush and black sagebrush are located near the five hundred foot end of the transect line. The recruitment of young mountain big sagebrush and black sagebrush plants to the population has been good over the sample years. The antelope bitterbrush and slenderbush eriogonum are relatively small populations with low decadence and good vigor. Utilization of bitterbrush plants has been moderate since the outset of the study. Black sagebrush, slenderbush eriogonum, and forage kochia (*Kochia prostrata*) were sampled for the first time in 2011. The identification of black sagebrush may have been misidentified as mountain big sagebrush prior to the 2011 sample year due to some hybridization between the two species. Forage kochia was seeded on the site in 2008 following the Dairy Valley fire and has been rare on the site. Other browse species sampled on the site include corymbed eriogonum (*Eriogonum corymbosum*) and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). The tree species Utah juniper has been sampled in low abundance and has consisted mostly of young trees over the sample years (Table - Point-Quarter Tree Data). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species is Sandberg bluegrass (*Poa secunda*), which has provided the majority of cover over the sample years. The annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance and cover, though being more abundant in the 2008 sample year. Other common perennial grass species sampled on the site include western wheatgrass (*Agropyron smithii*) and bottlebrush squirreltail (*Sitanion hystrix*), though bottlebrush squirreltail was fairly rare on the site in 2011. Seeded grass species sampled on the site include bluebunch wheatgrass (*Agropyron spicatum*), crested wheatgrass (*Agropyron cristatum*), and intermediate wheatgrass (*Agropyron intermedium*). Forbs are abundant and diverse. The dominant perennial forb species are longleaf phlox (*Phlox longifolia*), wild onion (*Allium sp.*), and lambstongue groundsel (*Senecio integerrimus*). Long leaf phlox has provided the majority of the forb cover over the sample years; however, cover was less preponderant in 2011. Annual forb species have become more abundant on the site with several species being sampled over the sample years. Blue-eyed Mary (*Collinsia parviflora*) was sampled for the first time in 2011 and provided the majority of the annual forb cover (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Dahar-Codquin complex, and is most likely part of the Dahar component, which is found on hillslopes. The parent material consists of alluvium and colluvium derived from sandstone and limestone. The soils within this classification are characterized as moderately deep and well drained with a highly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is a high amount of vegetation and a moderate amount of litter providing protective ground cover. Since the outset of the study, bare ground cover has slightly decreased with the establishment of vegetation cover on the site following the fire (Table - Basic Cover). The soil erosion condition has been classified as stable over the sample years.

Trend Assessments

Browse

- **2008 to 2009 - up (+2):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. The cover of mountain big sagebrush increased from 4% to 7% and stickyleaf low rabbitbrush cover decreased from 18% to 15%. The cover of antelope bitterbrush remained similar at 1%.
- **2009 to 2011 - slightly down (-1):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. The cover of mountain big sagebrush decreased to 2%. Black sagebrush was sampled for the first time in 2011 with 3% cover. Black

sagebrush may have been identified as mountain big sagebrush in previous sample years due to hybridization between the two sagebrush species. In comparing the *Artemisia sp*. there still was a decrease in canopy cover from 7% to 5%.

Grass

- **2008 to 2009 - stable (0):** The sum of nested frequency of perennial grasses remained similar and cover increased from 8% to 17%. Sandberg bluegrass remained similar in nested frequency and cover increased from 6% to 13%. Intermediate wheatgrass was sampled for the first time in 2009 at 2% cover. There was a significant increase in the nested frequency of cheatgrass, and cover increased from less than 1% to 2%. Bluebunch wheatgrass increased significantly in nested frequency, though cover remained minimal.
- **2009 to 2011 - stable (0):** The sum of nested frequency of perennial grasses remained similar, though cover decreased to 10%. The cover of Sandberg bluegrass decreased to 9%, though the frequency remained similar. The frequency of intermediate wheatgrass significantly decreased, and cover decreased to less than 1%. The weedy annual grass species cheatgrass significantly decreased in nested frequency, and cover decreased to less than 1%. Some of the decrease in cover may be attributed to the cold late spring in 2011, which may have suppressed plant growth at the time of sampling.

Forb

- **2008 to 2009 - stable (0)**: The sum of nested frequency of perennial forbs remained similar, though cover increased from 7% to 13%. The dominant forb species long leaf phlox decreased significantly in nested frequency, but cover increased from 6% to 10%. The sum of nested frequency of annual forbs significantly increased, and cover increased from 1% to 3%. The palatable annual species prickly lettuce (*Lactuca serriola*) increased significantly in frequency, and provided 1% cover.
- **2009 to 2011 - up (+2)**: The sum of nested frequency of perennial forbs increased two-fold, and cover increased substantially to 22%. The increase in cover and frequency can be partially attributed to pale agoseris (*Agoseris glauca*) and lambstongue groundsel. Pale agoseris significantly increased in nested frequency, and cover increased from less than 1% to 5%. Lambstongue groundsel was sampled for the first time in 2011 and provided 4% cover. The sum of nested frequency of annual forbs increased four-fold and cover increased to 7%. Blue-eyed Mary was sampled for the first time in 2011 and provided 4% cover.

HERBACEOUS TRENDS--
Management unit 01R, Study no: 12

Type	Species	Nested Frequency			Average Cover %		
		'08	'09	'11	'08	'09	'11
G	Agropyron cristatum	-	3	4	-	.30	.04
G	Agropyron intermedium	a-	b53	a8	-	1.94	.16
G	Agropyron smithii	b77	a23	b71	1.26	.65	1.10
G	Agropyron spicatum	a5	b18	a1	.01	.17	.00
G	Bromus tectorum (a)	b60	c137	a18	.29	2.24	.11
G	Koeleria cristata	a5	b19	a-	.04	.45	-
G	Oryzopsis hymenoides	4	1	-	.01	.03	-
G	Poa fendleriana	3	-	2	.15	-	.15
G	Poa secunda	232	239	260	5.59	12.57	8.55
G	Sitanion hystrix	b39	ab25	a15	.48	1.06	.08
Total for Annual Grasses		60	137	18	0.28	2.24	0.11
Total for Perennial Grasses		365	381	361	7.56	17.19	10.09

Type	Species	Nested Frequency '08	'09	'11	Average Cover % '08	'09	'11
Total for Grasses		425	518	379	7.85	19.43	10.20
F	Achillea millefolium	3	-	-	.00	-	-
F	Agoseris glauca	$_{b}$96	$_{a}$22	$_{c}$278	.99	.04	5.27
F	Allium sp.	$_{a}$40	$_{b}$133	$_{c}$171	.10	1.96	1.62
F	Alyssum desertorum (a)	-	-	3	-	-	.15
F	Antennaria rosea	-	-	1	-	-	.00
F	Aster sp.	9	-	3	.02	-	.01
F	Astragalus convallarius	4	10	-	.05	.06	-
F	Astragalus sp.	$_{a}$14	$_{a}$3	$_{b}$33	.10	.06	.68
F	Camelina microcarpa (a)	$_{a}$4	$_{b}$15	$_{a}$-	.00	.11	-
F	Chaenactis douglasii	$_{a}$3	$_{b}$23	$_{ab}$13	.04	.14	.17
F	Chenopodium leptophyllum(a)	5	-	-	.01	-	-
F	Cirsium sp.	1	2	7	.00	.04	.02
F	Collinsia parviflora (a)	$_{a}$-	$_{a}$-	$_{b}$287	-	-	3.60
F	Collomia linearis (a)	$_{a}$-	$_{a}$-	$_{b}$22	-	-	.23
F	Comandra pallida	18	21	15	.14	.25	.11
F	Cordylanthus sp. (a)	$_{a}$-	$_{b}$9	$_{a}$-	-	.26	-
F	Crepis acuminata	5	7	13	.04	.06	.13
F	Cryptantha sp.	-	-	6	-	-	.01
F	Descurainia pinnata (a)	$_{a}$-	$_{b}$13	$_{b}$14	-	.52	.03
F	Epilobium brachycarpum (a)	$_{a}$-	$_{a}$-	$_{b}$25	-	-	.13
F	Gayophytum ramosissimum(a)	$_{a}$3	$_{b}$11	$_{a}$-	.00	.05	-
F	Hackelia patens	-	-	4	-	-	.03
F	Lactuca serriola (a)	$_{a}$8	$_{b}$80	$_{a}$10	.05	1.10	.02
F	Lappula occidentalis (a)	$_{a}$5	$_{b}$12	$_{ab}$5	.00	.22	.04
F	Lomatium triternatum	-	-	12	-	-	.02
F	Microsteris gracilis (a)	$_{a}$-	$_{a}$-	$_{b}$121	-	-	.63
F	Onobrychis viciaefolia	-	-	6	-	-	.03
F	Orogenia linearifolia	$_{a}$-	$_{a}$-	$_{b}$13	-	-	.08
F	Penstemon sp.	16	14	16	.12	.13	.08
F	Phlox hoodii	$_{a}$-	$_{a}$-	$_{b}$23	-	-	.78
F	Phlox longifolia	$_{b}$356	$_{a}$288	$_{a}$282	5.78	9.81	7.96
F	Polygonum douglasii (a)	$_{ab}$18	$_{b}$20	$_{a}$7	.04	.12	.01
F	Ranunculus testiculatus (a)	$_{a}$1	$_{a}$-	$_{b}$42	.00	-	.87
F	Senecio integerrimus	$_{a}$-	$_{a}$-	$_{b}$81	-	-	3.64
F	Taraxacum officinale	$_{a}$7	$_{a}$1	$_{b}$28	.01	.03	.43
F	Tragopogon dubius (a)	$_{ab}$25	$_{a}$5	$_{b}$37	.32	.09	.68
F	Veronica biloba (a)	$_{b}$25	$_{a}$-	$_{c}$67	.12	-	.93
F	Viola sp.	$_{a}$-	$_{a}$-	$_{b}$66	-	-	.94
Total for Annual Forbs		94	165	640	0.57	2.50	7.35
Total for Perennial Forbs		572	524	1071	7.43	12.62	22.08
Total for Forbs		666	689	1711	8.01	15.13	29.44

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

BROWSE TRENDS--
Management unit 01R, Study no: 12

Type	Species	Strip Frequency			Average Cover %		
		'08	'09	'11	'08	'09	'11
B	Artemisia nova	0	-	14	-	-	2.50
B	Artemisia tridentata vaseyana	32	-	31	2.95	5.05	2.70
B	Chrysothamnus nauseosus	0	-	0	-	-	.03
B	Chrysothamnus viscidiflorus viscidiflorus	97	-	84	13.61	17.56	12.53
B	Eriogonum corymbosum	1	-	0	.03	-	-
B	Eriogonum microthecum	0	-	1	-	-	.15
B	Opuntia sp.	5	-	3	.03	.03	.15
B	Purshia tridentata	3	-	3	-	.15	.03
Total for Browse		138	0	136	16.64	22.80	18.11

CANOPY COVER, LINE INTERCEPT--
Management unit 01R, Study no: 12

Species	Percent Cover		
	'08	'09	'11
Artemisia nova	-	-	2.93
Artemisia tridentata vaseyana	3.93	7.31	2.38
Chrysothamnus viscidiflorus viscidiflorus	17.81	15.39	13.21
Purshia tridentata	.36	.63	.36

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 01R, Study no: 12

Species	Average leader growth (in)		
	'08	'09	'11
Artemisia tridentata vaseyana	1.7	-	1.4

POINT-QUARTER TREE DATA--
Management unit 01R, Study no: 12

Species	Trees per Acre		
	'08	'09	'11
Juniperus osteosperma	<18	<18	19

Average diameter (in)		
'08	'09	'11
1.5	2.4	5.2

BASIC COVER--
Management unit 01R, Study no: 12

Cover Type	Average Cover %		
	'08	'09	'11
Vegetation	32.54	48.25	55.19
Rock	2.27	.43	.41
Pavement	11.18	10.32	1.16
Litter	24.38	24.23	13.12
Cryptogams	.03	0	.03
Bare Ground	42.15	35.30	33.32

SOIL ANALYSIS DATA --

Management unit 1R, Study no: 12, Study Name: Dairy Valley GIP 1

pH	clay			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.7	21.4	36.1	42.5	3.6	14.9	441.6	0.8

PELLET GROUP DATA--

Management unit 01R, Study no: 12

Type	Quadrat Frequency			Days use per acre (ha)		
	'08	'09	'11	'08	'09	'11
Sheep	-	1	-	-	-	-
Rabbit	2	4	1	-	-	-
Horse	1	-	-	-	-	-
Deer	1	2	1	1 (3)	-	-
Cattle	20	7	6	4 (9)	28 (68)	34 (84)
Elk	-	-	-	-	1 (3)	-

BROWSE CHARACTERISTICS--

Management unit 01R, Study no: 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)
Amelanchier utahensis									
08	**0**	0	0	-	-	0	0	0	22/24
09	**0**	0	0	-	-	0	0	0	31/34
11	**0**	0	0	-	-	0	0	0	30/41
Artemisia nova									
08	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**3540**	23	77	-	-	0	0	9	7/13
Artemisia tridentata vaseyana									
08	**3320**	19	49	31	2580	37	8	13	13/19
09	**0**	0	0	0	-	0	0	0	13/19
11	**3380**	37	63	1	140	0	0	4	13/15
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	28/35
09	**0**	0	0	-	-	0	0	0	20/27
11	**0**	0	0	-	-	0	0	0	29/36
Chrysothamnus viscidiflorus viscidiflorus									
08	**14340**	24	69	6	3740	.69	0	2	11/18
09	**0**	0	0	0	-	0	0	0	11/19
11	**8220**	27	53	20	1000	13	0	12	12/19
Eriogonum corymbosum									
08	**80**	0	100	-	20	0	0	0	8/13
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-

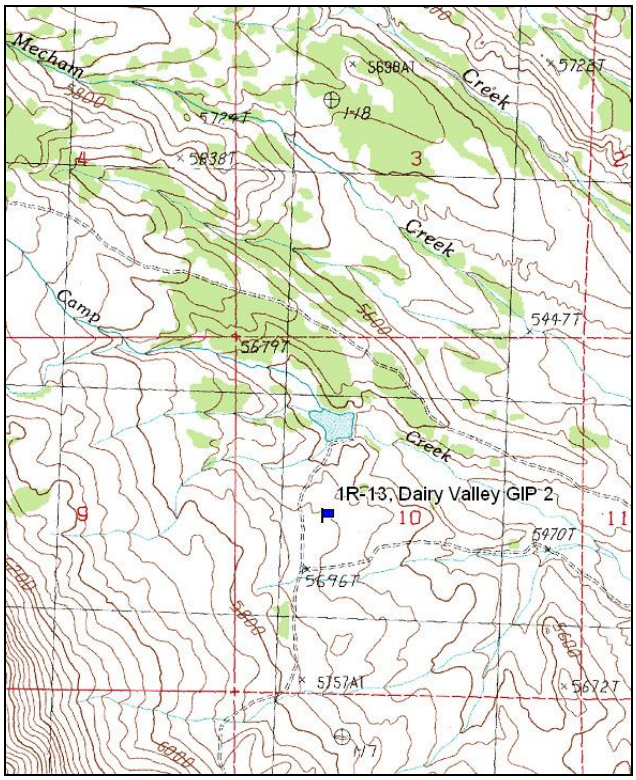
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Eriogonum microthecum									
08	**0**	0	0	0	-	0	0	0	-/-
09	**0**	0	0	0	-	0	0	0	-/-
11	**40**	0	50	50	-	0	0	0	4/5
Kochia prostrata									
08	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	7/14
Opuntia sp.									
08	**140**	0	43	57	-	0	0	57	4/11
09	**0**	0	0	0	-	0	0	0	5/13
11	**60**	0	100	0	-	0	0	0	4/14
Purshia tridentata									
08	**60**	33	67	-	20	33	33	0	14/38
09	**0**	0	0	-	-	0	0	0	15/31
11	**120**	0	100	-	-	83	0	0	17/48
Symphoricarpos oreophilus									
08	**0**	0	0	-	-	0	0	0	6/15
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	11/30

DAIRY VALLEY GIP 2 - TREND STUDY NO. 1R-13-11
Project #992

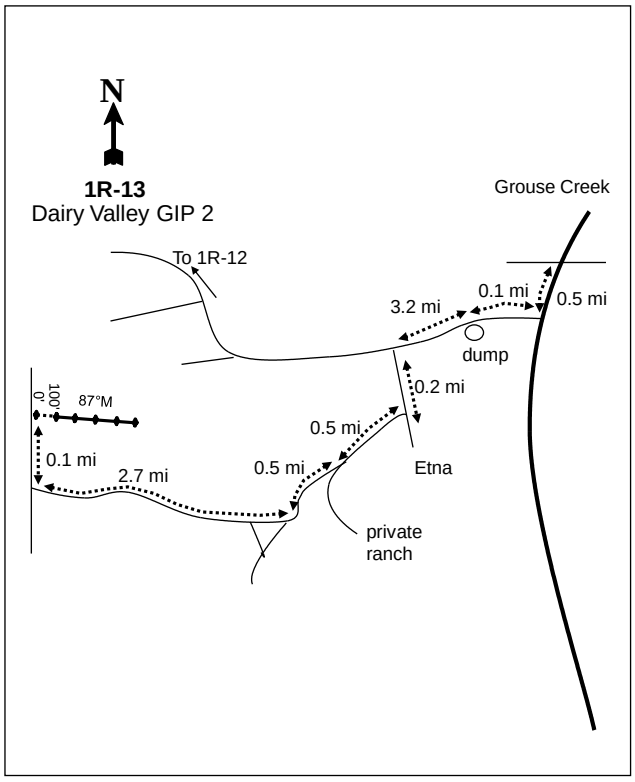
Vegetation Type: Perennial Grass
Range Type: Substantial Deer Winter, Crucial Elk Year-Long
NRCS Ecological Site Description: Upland Juniper Savanna (Utah Juniper), R025XY322UT
Land Ownership: Private
Elevation: 5,676 ft (1,730 m)
Aspect: Northeast
Slope: 8%
Transect bearing: 87° magnetic
Belt placement: 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 96 pace 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 land administrated by the Bureau of Land Management (BLM), Utah School and Institutional Trust Lands Administration (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 study was established within the chained and seeded portion of the project following the treatment. The project area was rested from livestock grazing for two growing seasons following the treatment. 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 2012). Cattle pats were sampled in low abundance in 2008 and 2011 (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 Wheatgrass '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 preferred browse species are forage kochia (*Kochia prostrata*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Forage kochia was seeded as part of the fire rehabilitation project and has been sampled in low abundance on the study site since the outset of the study. Mountain big sagebrush was sampled for the first time in 2011in low abundance. Other browse species sampled on the site include a small population of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and pricklypear cactus (*Opuntia sp.*). The preferred browse species Utah serviceberry (*Amelanchier utahensis*) and antelope bitterbrush (*Purshia tridentata*) have been sampled, but are very rare on the site (Table - Browse Characteristics). The tree species Utah juniper has been

sampled in low abundance and consists mostly of young trees over the sample years (Table - Point-Quarter Tree Data). The stage of woodland succession is considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse. The dominant perennial grass species on the site is Sandberg bluegrass (*Poa secunda*). The annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance on the site in 2008, but has since been fairly abundant. Seeded grass species sampled on the site include bluebunch wheatgrass (*Agropyron spicatum*), crested wheatgrass (*A. cristatum*), and intermediate wheatgrass (*A. intermedium*). Other grass species sampled on the site include western wheatgrass (*A. smithii*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). The weedy annual species cheatgrass (*Bromus tectorum*) has steadily increased in abundance on the site since the outset of the study. Forbs have become moderately abundant and fairly diverse. The dominant perennial forb species is longleaf phlox (*Phlox longifolia*). Alfalfa (*Medicago sativa*), small burnet (*Sanguisorba minor*), and sainfoin (*Onobrychis viciaefolia*) are the seeded forb species sampled on the site since the treatment, but have occurred in low abundance (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Dahar-Codquin complex, and is most likely part of the Dahar component, which is found on hillslopes. The parent material consists of alluvium and colluvium derived from sandstone and limestone. The soils within this classification are characterized as moderately deep and well drained with a highly permeable restrictive layer (Soil Survey Staff 2011). 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 on the site, though there is a high amount of vegetation and a moderate amount of pavement and litter providing protective ground cover. Pavement has decreased substantially on the site with the establishment of vegetation on the site following the fire (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Trend Assessments

Browse

- **2008 to 2011 - stable (0):** Browse species are rare on the site.

Grass

- **2008 to 2011 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 63%, and cover increased from 2% to 9%. Sandberg bluegrass remained similar in nested frequency but cover increased from 1% to 4%. The seeded grass species crested wheatgrass and intermediate wheatgrass were both sampled for the first time in the 2011 sample year at 2% and 1% cover, respectively. The weedy annual species cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 10%.

Forb

- **2008 to 2011 - up (+2)**: The sum of nested frequency of perennial forbs increased two-fold and cover increased from 1 % to 4%.

HERBACEOUS TRENDS--
Management unit 01R, Study no: 13

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a-	b70	-	1.98
G	Agropyron intermedium	a-	b33	-	.89
G	Agropyron smithii	7	8	.02	.19
G	Agropyron spicatum	20	20	.17	.70
G	Bromus tectorum (a)	a14	b372	.03	9.49
G	Oryzopsis hymenoides	23	25	.42	.86
G	Poa secunda	134	156	1.23	3.79
G	Sitanion hystrix	19	18	.17	.38
Total for Annual Grasses		14	372	0.03	9.49
Total for Perennial Grasses		203	330	2.02	8.82
Total for Grasses		217	702	2.05	18.31
F	Agoseris glauca	a-	b27	-	.42
F	Allium sp.	-	7	-	.02
F	Alyssum alyssoides (a)	a9	b314	.03	2.61
F	Antennaria rosea	2	12	.00	.21
F	Aster sp.	16	22	.13	.84
F	Astragalus convallarius	3	3	.06	.01
F	Astragalus miser	-	3	-	.00
F	Astragalus sp.	a-	b14	-	.06
F	Astragalus utahensis	-	3	-	.03
F	Balsamorhiza hookeri	a5	b19	.03	.21
F	Chaenactis douglasii	-	3	-	.01
F	Collinsia parviflora (a)	a-	b191	-	.77
F	Collomia linearis (a)	1	-	.01	-
F	Comandra pallida	12	10	.22	.08
F	Crepis acuminata	a11	b31	.19	.50
F	Cryptantha sp.	a-	b8	-	.05
F	Descurainia pinnata (a)	a7	b179	.04	1.22
F	Gayophytum ramosissimum(a)	-	4	-	.01
F	Gilia sp. (a)	a4	b82	.01	.26
F	Heterotheca villosa	-	4	-	.01
F	Lactuca serriola (a)	a-	b14	-	.08
F	Lappula occidentalis (a)	a-	b17	.00	.18
F	Lomatium sp.	-	7	-	.16
F	Lomatium triternatum	-	5	-	.01
F	Medicago sativa	1	-	.00	-
F	Microsteris gracilis (a)	a-	b28	-	.05
F	Onobrychis viciaefolia	a-	b13	-	.05
F	Penstemon sp.	1	8	.00	.01
F	Phlox hoodii	6	5	.01	.18
F	Phlox longifolia	95	94	.38	.91
F	Ranunculus testiculatus (a)	a-	b51	-	.65
F	Sanguisorba minor	-	1	-	.00

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Sisymbrium altissimum (a)	[a]-	[b]127	-	2.78
F	Taraxacum officinale	2	1	.03	.00
F	Townsendia sp.	-	2	-	.00
Total for Annual Forbs		21	1007	0.10	8.65
Total for Perennial Forbs		154	302	1.08	3.82
Total for Forbs		175	1309	1.18	12.47

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

BROWSE TRENDS--
Management unit 01R, Study no: 13

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia tridentata vaseyana	0	1	-	.00
B	Chrysothamnus viscidiflorus viscidiflorus	16	17	.12	.18
B	Kochia prostrata	1	1	.01	-
B	Opuntia sp.	11	3	.16	-
Total for Browse		28	22	0.29	0.18

CANOPY COVER, LINE INTERCEPT--
Management unit 01R, Study no: 13

Species	Percent Cover '08	'11
Chrysothamnus viscidiflorus viscidiflorus	.01	.26

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 01R, Study no: 13

Species	Average leader growth (in) '08	'11
Artemisia tridentata vaseyana	-	1.2

POINT-QUARTER TREE DATA--
Management unit 01R, Study no: 13

Species	Trees per Acre '08	'11	Average diameter (in) '08	'11
Juniperus osteosperma	18	17	4.7	3.1

BASIC COVER--
Management unit 01R, Study no: 13

Cover Type	Average Cover % '08	'11
Vegetation	3.69	31.24
Rock	3.87	2.34
Pavement	57.06	9.58
Litter	18.77	19.90
Cryptogams	0	0
Bare Ground	28.95	29.64

SOIL ANALYSIS DATA --
Management unit 1R, Study no: 13, Study Name: Dairy Valley GIP 2

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 '08	'11
Rabbit	6	-
Cattle	-	7

Days use per acre (ha) '08	'11
-	-
3 (7)	14 (34)

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
11	**0**	0	0	-	-	0	0	0	15/21
Artemisia tridentata vaseyana									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	9/12
Chrysothamnus viscidiflorus viscidiflorus									
08	**400**	10	90	0	-	0	0	0	6/8
11	**360**	11	83	6	-	6	0	0	10/17
Kochia prostrata									
08	**20**	0	100	-	40	0	0	0	2/7
11	**60**	33	67	-	-	0	67	0	2/7
Opuntia sp.									
08	**280**	29	21	50	-	0	0	57	4/10
11	**80**	25	75	0	-	0	0	0	2/6

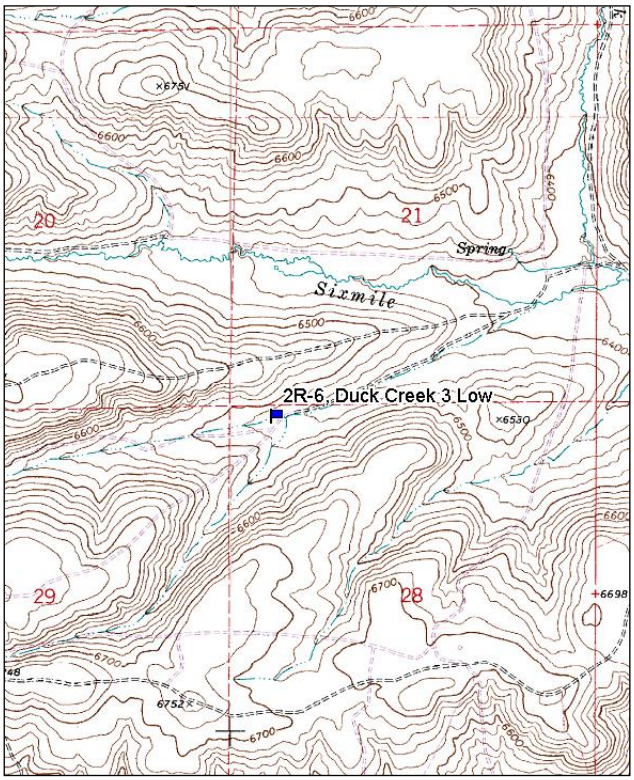
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Purshia tridentata									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	5/17

DUCK CREEK 3 LOW - TREND STUDY NO. 2R-06-11

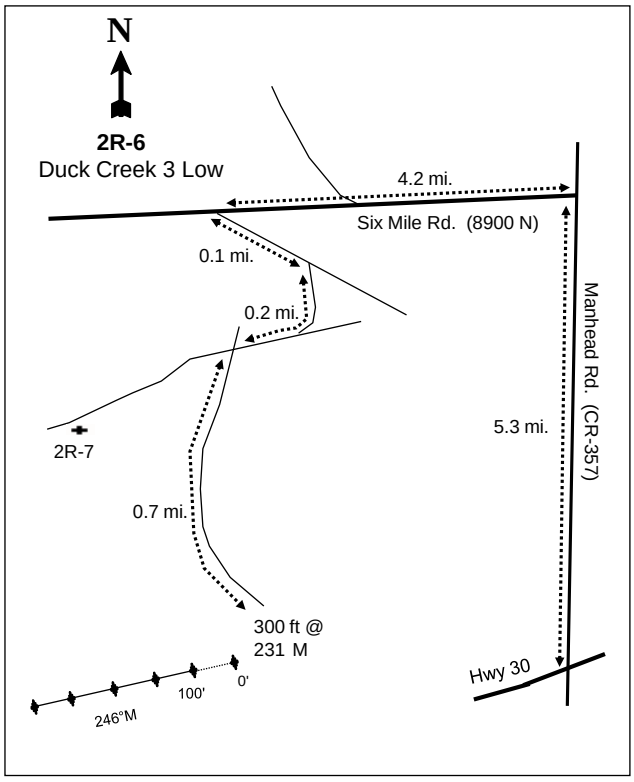
Vegetation Type: Basin Big Sagebrush
Range Type: Crucial Deer Summer (Fawning habitat), Substantial Elk Winter
NRCS Ecological Site Description: Upland Stony Loam (Wyoming Big Sagebrush), R047XA338UT
Land Ownership: Private
Elevation: 6,470 ft (1,972 m)
Aspect: Northeast
Slope: 3%
Transect bearing: 246° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the junction of Hwy 30 and Manhead Rd. (CR-357) drive north 5.3 miles to Six Mile Road (8900 N). Turn left and drive 4.2 miles to a road going left (south east). Drive on this road for 0.1 miles to a right turn. Take the right turn and drive 0.2 miles to another intersection. Turn left (south) and drive 0.7 miles (There may be an old sheep trailer there). Park here and walk ~ 300 feet at 231 degrees magnetic to the 0-foot stake.

Map Name: Sage Creek



Diagrammatic Sketch:



Township: 13N Range: 7E Section: 28

GPS: NAD 83, UTM 12S 486275 E 4632615 N

DUCK CREEK 3 LOW - WRI STUDY 2R-6

Site Description

Site Information: This study is located on private land, east of Bear Lake, in the bottom of a side canyon of Sixmile Creek. The study was established in the fall of 2003 within a basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) dominated flat. In the spring of 2004, approximately 2,850 acres were treated with a single pass of a Lawson Pasture Aerator and a seed mix of grass, forb, and browse species were broadcast seeded during the aeration treatment (Table - Seed Mix). The objectives of the project were to decrease competition of woody species, increase herbaceous diversity and production to benefit sage-grouse and pygmy rabbit habitat, add mosaic patterns within the sagebrush to provide varying age classes within the sagebrush population, and to increase understory production. The aerator project is referenced within the Duck Creek Allotment NFWF Grant project (WRI project #1321), but was not part of that project (WRI Database 2012). Cattle pats have been sampled in high abundance since 2003. Deer/pronghorn, elk, and horse sign have all been sampled in low abundance in various years. Sage-grouse pellets were estimated at 9 pellet groups/acre in 2003 and 26 groups/acre in 2006. No sage-grouse pellets were sampled in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 02R, Study no: 6

Project Name: Duck Creek C WRI Database #: PDB				Project Name: Duck Creek B WRI Database #: PDB			
Application: Broadcast Seed		Acres:	2000	Application: Broadcast Seed		Acres:	650
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Goldar'	2000	0.76	G	Bluebunch Wheatgrass 'Goldar'	669	1.03
G	Great Basin Wildrye 'Trailhead'	2066	1.00	G	Great Basin Wildrye 'Trailhead'	650	1.00
G	Indian Ricegrass 'Nezpar'	1000	1.03	G	Indian Ricegrass, 'Rimrock'	325	0.50
G	Orchardgrass 'Paiute'	2000	0.50	G	Orchardgrass 'Paiute'	650	1.00
G	Russian Wildrye 'Bozoisky'	1518	1.00	G	Russian Wildrye 'Bozoisky'	650	1.00
F	Alfalfa 'Ladak'	2500	1.25	F	Alfalfa 'Ranger'	650	1.00
F	Cicer Milkvetch 'Windsor'	1500	0.75	F	Sainfoin	1300	2.00
F	Sainfoin	4000	2.00	F	Small Burnet 'Delar'	1300	2.00
F	Small Burnet 'Delar'	2500	1.25	F	Yellow Sweetclover	170	0.26
F	Yellow Sweetclover	500	0.25	B	Bitterbrush	86	0.13
B	Forage Kochia 'Immigrant'	200	0.10	B	Fourwing Saltbush	335	0.52
Total Pounds:		19784	9.89	Total Pounds:		6785	10.44
PLS Pounds:			9.02	PLS Pounds:			9.25

Browse: Basin big sagebrush is the preferred browse species and is the dominant browse species on the site. The basin big sagebrush is a relatively abundant, lightly utilized population with low decadence and good vigor within the population over the sample years. The recruitment of young sagebrush plants to the population has been good in all the sample years, but was very high in 2011 (Table - Browse Characteristics). The canopy cover of sagebrush initially decreased in the 2006 sample year following the aerator treatment, but in the 2011 sample year, the canopy cover was greater than the pretreatment sample year (Table - Canopy Cover). Other browse species sampled on the study site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), rubber rabbitbrush (*Chrysothamnus nauseous*), and gray horsebrush (*Tetradymia canescens*) (Table- Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse. Western wheatgrass (*Agropyron smithii*), sedge (*Carex sp.*), and Kentucky bluegrass (*Poa pratensis*) have been the most abundant grass species on the site over the sample years, though Kentucky bluegrass was not very common on the site in the 2011 sample year. Two seeded grass species western wheatgrass and Indian ricegrass (*Oryzopsis Hymenoides*) were sampled

following treatment, though western wheatgrass was sampled prior to treatment with moderate abundance. Other grass species sampled on the site include timothy (*Phleum pratensis*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and Letterman needlegrass (*Stipa lettermani*). Forbs are abundant and moderately diverse with western yarrow (*Achillea millefolium*) being the dominant species. Western yarrow has been fairly abundant each sample year. Other common forb species sampled on the site include rose pussytoes (*Antennaria rosea*), aster (*Aster sp.*), and longleaf phlox (*phlox longifolia*). Two species which were common on the site prior to the treatment, aster (*Aster sp.*) and dandelion (*Taraxacum officinale*), have become rare on the site following the treatment, and were not sampled in 2011. Alfalfa (*Medicago Sativa*) has been the only seeded forb species sampled, and was only sampled in the 2006 sample year (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Falula-Kearl complex, which is found on hillslopes and flood plains. The parent material consists of colluvium and/or slope alluvium over residuum weathered from conglomerate and sandstone. The soils within this classification are characterized as shallow to moderately deep, and well to excessively drained, with a highly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.6). Soil phosphorus is low at 5.4 ppm, which can limit plant growth and development (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high on the site, though there is a high amount of vegetation and litter providing protective ground cover. Pavement, rock, and cryptogram cover has been minimal over the sample years (Table - Basic Cover). The soil erosion condition was classified as stable in 2003, 2006, and 2011.

Pre vs. Two Years Post Treatment, 2003 vs. 2006

Browse: Basin big sagebrush density decreased 44% from 5,880 plants/acre to 3,280 plants/acre and canopy cover decreased from 10% to 5%. The health of the sagebrush population remained relatively good, though decadence increased slightly from 11% to 16%, and plants displaying poor vigor slightly increased from 4% to 5%. The recruitment of young plants to the population increased after the treatment from 10% to 19% of the population. Seedlings were very abundant in 2006 with over 3,000 seedlings/acre, compared to 100 seedlings/acre in 2003. Stickyleaf low rabbitbrush density increased 36% from 1,320 plants/acre to 1,800 plants/acre and canopy cover remained similar at 2%. Rubber rabbitbrush increased 19% in density from 1,760 plants/acre to 2,100 plants/acre, though canopy cover decreased slightly from 4% to 3%.

Grasses: The sum of nested frequency of perennial grasses increased 10%, and cover increased from 18% to 21%. Western wheatgrass nested frequency significantly increased after the treatment, and cover increased from 3% to 6%. The sedge species showed a significant decrease in nested frequency, but remained very abundant in 2006 with 86% quadrat frequency, though cover decreased from 12% to 8%. Kentucky bluegrass remained similar in nested frequency, but cover increased from 3% to 6%. Bluebunch wheatgrass and Indian ricegrass were the only seeded grass species to be sampled, and were found in 1% and 2% of the quadrats, respectively. No annual grasses were sampled either sample year.

Forbs: The sum of nested frequency of perennial forbs decreased 14%, and cover remained similar at 11%. Western yarrow decreased substantially in nested frequency, and cover decreased from 6% to 3%. Aster species remained similar in nested frequency, but cover increased from 2% to 4%. Dandelion significantly decreased in nested frequency, and cover decreased from 2% to less than 1%. Western yarrow and dandelion each had significantly lower nested frequencies after the treatment. Hood's phlox and longleaf phlox each increased significantly in nested frequency after the treatment. The seeded species alfalfa was sampled in only one quadrat in 2006.

Trend Assessments

Browse

- **2006 to 2011 - up (+2):** The density of basin big sagebrush increased nearly three-fold from 3,200 plants/acre to 8,660 plants/acre, and canopy cover increased from 5% to 23%. The recruitment of

young plants to the population increased from 19% to 43%. Seedling production was exceptionally high with 44,220 seedlings/acre sampled in 2011.

Grass

- **2006 to 2011 - stable (0):** The sum of nested frequency of perennial grasses remained similar, but cover decreased to 16%. Western wheatgrass increased significantly in nested frequency, but cover decreased slightly to 5%. Sedge increased significantly in nested frequency, and cover increased to 10%. Kentucky bluegrass became uncommon on the site with a significant decrease in nested frequency, and cover decreased to 1%. The seeded species Indian ricegrass remained rare on the site, and blue bunch wheatgrass was not sampled in 2011.

Forb

- **2006 to 2011 - down (-2)**: The sum of the nested frequency of perennial forbs decreased 38% and cover decreased to 8%. The downward trend of forbs can be attributed to aster and dandelion. Both species were not sampled in the 2011 sample year despite both species being significant components of the forb community prior to treatment. Western yarrow increased significantly in nested frequency, and cover increased to 4%.

HERBACEOUS TRENDS--
Management unit 02R, Study no: 6

Type	Species	Nested Frequency			Average Cover %		
		'03	'06	'11	'03	'06	'11
G	Agropyron smithii	a175	b261	c351	2.58	5.96	4.72
G	Agropyron spicatum	-	3	-	-	.00	-
G	Carex sp.	b391	a325	ab376	11.45	7.97	9.78
G	Oryzopsis hymenoides	-	3	2	-	.06	.03
G	Poa pratensis	b214	b222	a26	3.44	6.49	.45
G	Poa secunda	a1	b52	b84	.00	.45	.95
G	Sitanion hystrix	3	2	1	.00	.03	.00
G	Stipa lettermani	a3	a-	b16	.06	-	.49
Total for Annual Grasses		0	0	0	0	0	0
Total for Perennial Grasses		787	868	856	17.55	20.98	16.44
Total for Grasses		787	868	856	17.55	20.98	16.44
F	Achillea millefolium	c293	a181	b222	5.98	2.84	4.25
F	Antennaria rosea	38	34	48	1.41	1.64	2.15
F	Arabis sp.	-	-	1	-	-	.00
F	Aster sp.	158	179	-	1.52	4.44	-
F	Astragalus sp.	a2	b20	a1	.01	.07	.00
F	Cirsium sp.	1	1	-	.03	.03	-
F	Collinsia parviflora (a)	-	2	-	-	.00	-
F	Cordylanthus ramosus (a)	a-	a-	b16	-	.00	.60
F	Eriogonum umbellatum	a-	a1	b15	-	.03	.18
F	Medicago sativa	-	2	-	-	.00	-
F	Phlox hoodii	62	84	68	.94	1.31	1.76
F	Phlox longifolia	a9	b38	a2	.04	.43	.00
F	Potentilla gracilis	3	-	-	.00	-	-
F	Ranunculus testiculatus (a)	-	-	2	-	-	.00
F	Senecio multilobatus	-	-	2	-	-	.03

Type	Species	Nested Frequency			Average Cover %		
		'03	'06	'11	'03	'06	'11
F	Taraxacum officinale	$_{c}$116	$_{b}$35	$_{a}$-	1.86	.18	-
F	Trifolium sp.	-	14	4	-	.02	.01
Total for Annual Forbs		0	2	18	0	0.00	0.60
Total for Perennial Forbs		682	589	363	11.81	11.02	8.40
Total for Forbs		682	591	381	11.81	11.03	9.01

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

BROWSE TRENDS--
Management unit 02R, Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'03	'06	'11	'03	'06	'11
B	Artemisia tridentata tridentata	83	73	92	10.89	4.70	13.39
B	Chrysothamnus nauseosus	40	44	48	2.97	2.35	3.75
B	Chrysothamnus viscidiflorus viscidiflorus	35	40	43	1.39	1.66	2.60
B	Tetradymia canescens	0	1	1	-	-	.03
Total for Browse		158	158	184	15.26	8.72	19.79

CANOPY COVER, LINE INTERCEPT--
Management unit 02R, Study no: 6

Species	Percent Cover		
	'03	'06	'11
Artemisia tridentata tridentata	10.38	4.91	23.13
Chrysothamnus nauseosus	4.21	3.18	5.26
Chrysothamnus viscidiflorus viscidiflorus	2.06	2.13	3.51

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 02R, Study no: 6

Species	Average leader growth (in)		
	'03	'06	'11
Artemisia tridentata tridentata	2.7	1.7	2.2

BASIC COVER--
Management unit 02R, Study no: 6

Cover Type	Average Cover %		
	'03	'06	'11
Vegetation	44.93	48.20	39.15
Rock	.02	.04	0
Pavement	.07	.19	.09
Litter	39.39	32.02	37.46
Cryptogams	.30	.01	0
Bare Ground	29.12	31.35	39.47

SOIL ANALYSIS DATA --

Management unit 2R, Study no: 6, Study Name: Duck Creek 3 Low

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
17.6	7.6	26.6	40.7	32.7	4.1	5.4	643.2	0.8

PELLET GROUP DATA--

Management unit 02R, Study no: 6

Type	Quadrat Frequency			Days use per acre (ha)		
	'03	'06	'11	'03	'06	'11
Sheep	-	1	-	-	-	-
Rabbit	28	44	45	-	-	-
Horse	-	-	-	2 (4)	-	1 (2)
Grouse	7	2	-	9 Groups/ Acre	26 Groups/ Acre	-
Elk	-	-	5	-	-	5 (13)
Deer/Pronghorn	4	5-	8	-	2 (5)	1 (2)
Cattle	23	27	10	30 (75)	67 (165)	38 (95)

BROWSE CHARACTERISTICS--

Management unit 02R, Study no: 6

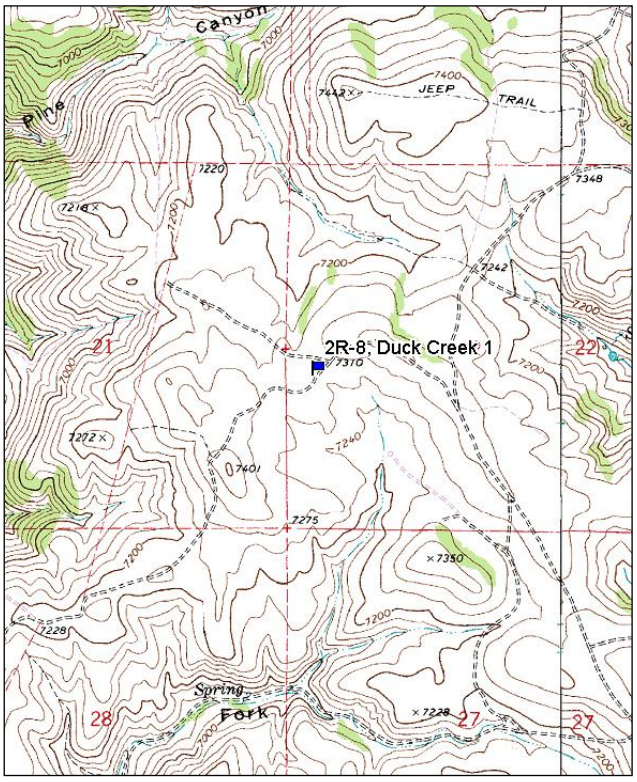
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% Moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata tridentata									
03	**5880**	10	80	11	100	.68	0	4	25/24
06	**3280**	19	65	16	3140	9	0	5	23/22
11	**8660**	43	56	1	44220	7	0	2	24/27
Chrysothamnus nauseosus									
03	**1760**	30	60	10	160	1	0	1	19/24
06	**2100**	33	64	3	80	16	7	3	18/23
11	**2800**	30	66	4	20	.71	0	4	22/21
Chrysothamnus viscidiflorus viscidiflorus									
03	**1320**	3	85	12	-	2	0	2	9/15
06	**1800**	16	80	4	20	7	0	2	9/15
11	**2220**	15	77	7	20	.90	0	5	9/16
Tetradymia canescens									
03	**0**	0	0	0	-	0	0	0	-/-
06	**20**	100	0	0	-	100	0	0	-/-
11	**20**	0	0	100	-	0	100	100	4/7

DUCK CREEK 1 - TREND STUDY NO. 2R-8-11

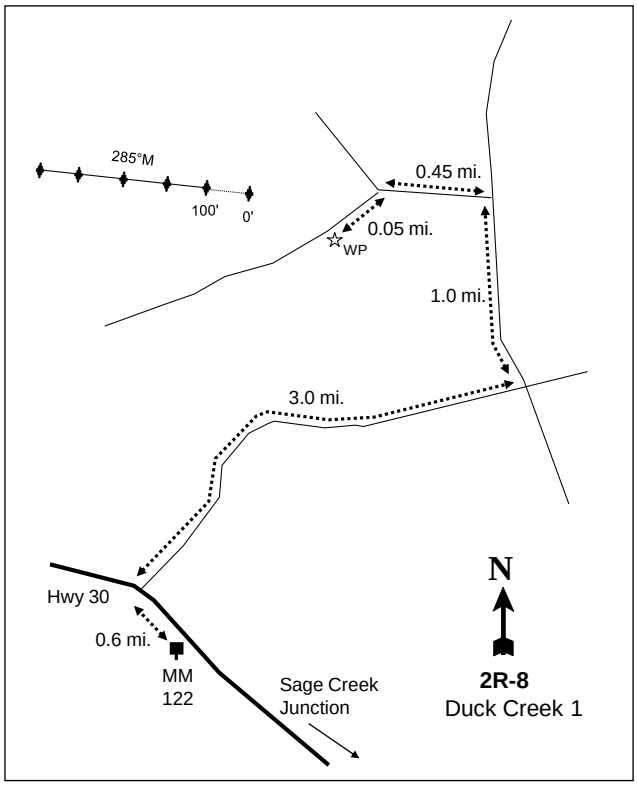
Vegetation Type: Basin Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Upland Loam (Wyoming Big Sagebrush), R025XY314UT
Land Ownership: Private
Elevation: 7,300 ft (2,225 m)
Aspect: Northwest
Slope: 3%
Transect bearing: 285° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: On Hwy 30 drive to mile marker 122, continue north 0.6 miles to a road to the right (East). Take this road for 3.0 miles to an intersection. At the intersection turn left (North) and drive 1.0 miles to a fork. Take the left fork for 0.45 miles to another fork. Take the left fork for 0.05 miles to the witness post on the right side of the road. The zero post is 13 paces at 311°M. The browse tag is #9151

Map Name: Laketown



Diagrammatic Sketch:



Township: 13N Range: 6E Section: 22

GPS: NAD 83, UTM 12S 478101 E 4633415 N

DUCK CREEK 1 - WRI STUDY 2R-8

Site Description

Site Information: This study is located on private land, on top of the ridge east of Bear Lake. The study was established in the fall of 2003 within a basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) dominated flat. In the spring of 2004, approximately 2,850 acres were treated with a single pass of a Lawson Pasture Aerator and a seed mix of grass, forb, and browse species were broadcast seeded during the aeration treatment (Table - Seed Mix). The objectives of the project were to decrease competition of woody species, increase herbaceous diversity and production to benefit sage-grouse and pygmy rabbit habitat, add mosaic patterns within the sagebrush to provide varying age classes within the sagebrush population, and to increase understory production. The aerator project is referenced within the Duck Creek Allotment NFWF Grant project (WRI project #1321), but was not part of that project (WRI Database 2012). Pellet groups were moderate in abundance for cattle, but low in abundance for deer in 2003, 2006, and 2011. Sheep sign was sampled in low abundance in 2006, and elk pellets were sampled in low abundance elk in 2011. Sage-grouse pellets were estimated at 17 pellet groups/acre in 2006. No sage-grouse pellets were sampled in 2003 or 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 02R, Study no: 8

Project Name: Duck Creek A WRI Database #: PDB				Project Name: Duck Creek B WRI Database #: PDB			
Application: Broadcast Seed		Acres:	325	Application: Broadcast Seed		Acres:	650
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Goldar'	325	1.00	G	Bluebunch Wheatgrass 'Goldar'	669	1.03
G	Great Basin Wildrye 'Trailhead'	342	1.05	G	Great Basin Wildrye 'Trailhead'	650	1.00
G	Indian Ricegrass, 'Nezpar'	165	0.51	G	Indian Ricegrass, 'Rimrock'	325	0.50
G	Orchardgrass 'Paiute'	325	1.00	G	Orchardgrass 'Paiute'	650	1.00
G	Russian Wildrye 'Bozoisky'	325	1.00	G	Russian Wildrye 'Bozoisky'	650	1.00
F	Alfalfa 'Ranger'	325	1.00	F	Alfalfa 'Ranger'	650	1.00
F	Sainfoin	650	2.00	F	Sainfoin	1300	2.00
F	Small Burnet 'Delar'	650	2.00	F	Small Burnet 'Delar'	1300	2.00
F	Yellow Sweetclover	85	0.26	F	Yellow Sweetclover	170	0.26
B	Bitterbrush	50	0.15	B	Bitterbrush	86	0.13
B	Fourwing Saltbush	165	0.51	B	Fourwing Saltbush	335	0.52
Total Pounds:		3407	10.48	Total Pounds:		6785	10.44
PLS Pounds:			9.24	PLS Pounds:			9.25

Browse: Basin big sagebrush is the key browse species on the site. The basin big sagebrush is a relatively abundant, healthy population, with good vigor and moderately low decadence within the population, though decadence was high prior to the treatment. The use of sagebrush plants has increased over the sample years with mostly light utilization prior to treatment, and more moderate utilization observed following the treatment. The recruitment of young plants to the population was poor prior to the treatment, but improved following the treatment with good recruitment within the population. Other preferred browse species sampled on the site include Utah serviceberry (*Amelanchier utahensis*), black sagebrush (*Artemisia nova*), fourwing saltbush (*Atriplex canescens*), true mountain mahogany (*Cercocarpus montanus*), slenderbush eriogonum (*Eriogonum microthecum*), and antelope bitterbrush (*Purshia tridentata*). Each of these species has been sampled in low abundance (Table - Browse Characteristics), and has provided little cover since the establishment of the study in 2003 (Table - Canopy Cover). Fourwing saltbush and bitterbrush were both seeded on the site, and have been sampled following the treatment in low abundance. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), Wyeth

eriogonum (*Eriogonum heracleoides*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse with western wheatgrass (*Agropyron smithii*), Sandberg bluegrass (*Poa secunda*), sedge (*Carex sp*.), and Letterman needlegrass (*Stipa lettermani*) being the dominant grass species on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) was sampled for the first time in 2011 sample year in low abundance. Seeded grass species sampled on the site include bluebunch wheatgrass (*Agropyron spicatum*), orchardgrass (*Dactylis glomerata*), and Russian wildrye (*Elymus junceus*), though bluebunch wheatgrass was sampled on the site prior to the treatment. Seeded grass species have been rare on the site over the course of the study years. Other grass species sampled on the site include prairie junegrass (*Koeleria cristata*), mutton bluegrass (*Poa fendleriana*), Kentucky bluegrass (*P. pratensis*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). Forbs are fairly abundant and diverse on the site with rose pussytoes (*Antennaria rosea*), bush birdbeak (*Cordylanthus ramosus*), and Eaton fleabane (*Erigeron eatonii*) being the dominant forb species. These species have steadily increased in abundance on the site since the outset of the study. Prior to the treatment, the annual species bush birdbeak was not sampled. Other forb species that have increased in prevalence include western yarrow (*Achillea millefolium*), aster (*Aster sp*.), and silvery lupine (*Lupinus argenteus*). Prior to treatment, aster and silvery lupine were not sampled on the site. Milkvetch (*Astragalus sp*.) has become rare on the site. Small burnet (*Sanguisorba minor*) has been the only seeded forb species sampled on the site, but was only sampled in 2006. Annual forb species were rare on the site prior to treatment, and annual forbs initially remained rare following the treatment; however, annual forb species increased substantially in abundance in 2011. The increase in abundance of annual species can solely be attributed to the increased abundance of bush birdbeak (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Kearl component, which is found on hillslopes. The parent material consists of colluvium and/or slope alluvium over residuum weathered from sandstone. The soils within this classification are characterized as moderately deep and well drained, with a highly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of vegetation and a moderate amount of litter providing protective ground cover (Table - Basic cover). Due to erosion along cattle trails, litter movement, and flow patterns the soil erosion condition was classified as slight in 2006. . The soil erosion condition was classified as stable in 2011.

Pre vs. Two Years Post Treatment, 2003 vs. 2006

Browse: Basin big Sagebrush decreased in density 64% from 12,100 plants/acre to 4,360 plants/acre, and canopy cover decreased from 32% to 9% after the aerator treatment. The recruitment of young sagebrush plants to the population improved from 5% to 11%. The health of the sagebrush population improved slightly but remained moderately poor. Decadence of sagebrush plants decreased from 31% to 23% of the population. Plants displaying poor vigor remained low at 9% of the population. The density of stickyleaf low rabbitbrush increased slightly after treatment from 5,100 plants/acre to 5,840 plants/acre, and canopy cover increased from 5% to 7%.

Grasses: The sum of nested frequency of perennial grasses increased 18%, and cover increased from 10% to 16%. Western wheatgrass and sedge increased significantly in nested frequency, and cover increased from 2% to 5% and 1% to 2%, respectively. Sandberg bluegrass decreased significantly in nested frequency and cover decreased slightly from 3% to 2%. Letterman needlegrass remained similar in nested frequency, but cover increased from 2% to 4%. Orchardgrass and bluebunch wheatgrass were the only seeded grass species sampled on the site, though bluebunch wheatgrass was sampled prior to treatment and each of these species have been rare on the site. No annual grasses have been sampled.

Forbs: The sum of nested frequency of perennial forbs increased 15%, and cover slightly increased from 8% to 9%. Western yarrow and Eaton fleabane were the only two forb species to have a significantly higher nested

frequency. Western yarrow remained similar in cover at less than 1%, though Eaton fleabane increased in cover from 2% to 3%. Lobeleaf groundsel (*Senecio multilobatus*) decreased significantly in nested frequency and became very rare on the site. The seeded species small burnet was sampled in 4% of the quadrats and contributed little to cover.

Trend Assessments

Browse

- **2006 to 2011 - up (+2):** The density of basin big sagebrush increased 34% to 5,840 plants/acre, and canopy cover increased to 19%. The recruitment of young sagebrush plants to the population remained good, with recruitment of young increasing to 16% of the population. The health of the sagebrush population improved with decadence decreasing to 13%, and plants displaying poor vigor decreasing slightly to 3% of the population. Stickyleaf low rabbitbrush remained similar in nested frequency, though canopy cover increased to 11%. Mountain snowberry (*Symphoricarpos oreophilus*) increased in nested frequency 64% from 280 plants/acre to 460 plants/acre, and canopy cover increased from 1% to 5%. Wyeth eriogonum (*Eriogonum heracleoides*) increased in nested frequency 38% from 2,560 plants/acre to 3,520 plants/acre, and canopy cover increased from 1% to 3%.

Grass

- **2006 to 2011 - slightly up (+1):** The sum of nested frequency of perennial grasses increased slightly to 10%, and cover increased to 19%. Western wheatgrass and sedge remained similar in nested frequency and cover. Sandberg bluegrass and Letterman needlegrass increased significantly in nested frequency, and cover increased to 4% and 7%, respectively. The seeded species bluebunch wheatgrass increased significantly in nested frequency, but remained rare on the site. Russian wildrye was sampled for the first time in very low abundance on the site.

Forb

- **2006 to 2011 - up (+2)**: The sum of the nested frequency of perennial forbs increased 17%, and cover increased to 18%. Western yarrow and Eaton fleabane remained similar in nested frequency, but cover of each species increased to 1% and 8%, respectively. Aster species and silvery lupine increased significantly in nested frequency, and each provided 1% cover. The annual species bush birdbeak increased substantially in nested frequency, and cover increased from 1% to 8%.

HERBACEOUS TRENDS--
Management unit 02R, Study no: 8

Type	Species	Nested Frequency			Average Cover %		
		'03	'06	'11	'03	'06	'11
G	Agropyron smithii	$_{a}$206	$_{b}$267	$_{b}$315	2.02	4.45	4.58
G	Agropyron spicatum	$_{a}$1	$_{a}$5	$_{b}$15	.03	.15	.14
G	Bromus tectorum (a)	-	-	2	-	-	.00
G	Carex sp.	$_{a}$35	$_{b}$73	$_{ab}$71	.66	1.77	2.67
G	Dactylis glomerata	-	22	-	-	.12	-
G	Elymus junceus	-	-	6	-	-	.01
G	Koeleria cristata	24	51	28	.34	.93	.36
G	Poa fendleriana	63	84	63	.56	1.18	.54
G	Poa pratensis	-	23	8	-	.57	.07
G	Poa secunda	$_{b}$187	$_{a}$127	$_{b}$178	3.69	2.71	3.67
G	Sitanion hystrix	2	5	3	.01	.00	.03
G	Stipa comata	4	1	1	.03	.00	.00
G	Stipa lettermani	$_{a}$135	$_{a}$119	$_{b}$170	2.29	3.75	6.75

Type	Species	Nested Frequency			Average Cover %		
		'03	'06	'11	'03	'06	'11
Total for Annual Grasses		0	0	2	0	0	0.00
Total for Perennial Grasses		657	777	858	9.64	15.68	18.84
Total for Grasses		657	777	860	9.64	15.68	18.85
F	Achillea millefolium	$_{a}$12	$_{b}$24	$_{b}$23	.07	.14	1.39
F	Antennaria rosea	120	135	147	4.50	4.19	5.52
F	Arabis sp.	5	1	10	.01	.00	.02
F	Aster sp.	$_{a}$-	$_{a}$2	$_{b}$46	-	.00	.87
F	Astragalus convallarius	2	7	-	.00	.04	-
F	Astragalus sp.	$_{b}$40	$_{b}$41	$_{a}$6	.92	.89	.03
F	Calochortus nuttallii	-	6	-	-	.01	-
F	Cirsium sp.	-	1	-	-	.00	-
F	Collinsia parviflora (a)	$_{a}$9	$_{a}$8	$_{b}$56	.04	.02	.10
F	Cordylanthus ramosus (a)	$_{a}$-	$_{a}$32	$_{b}$159	$_{a}$-	.62	8.00
F	Descurainia pinnata (a)	3	-	-	.00	-	-
F	Erigeron eatonii	$_{a}$168	$_{b}$214	$_{b}$291	1.68	2.77	8.37
F	Eriogonum umbellatum	-	-	3	-	-	.15
F	Ipomopsis aggregata	-	-	3	-	-	.03
F	Lupinus argenteus	$_{a}$-	$_{a}$5	$_{b}$40	-	.18	1.14
F	Phlox hoodii	21	22	16	.57	.63	.42
F	Phlox longifolia	$_{b}$51	$_{b}$39	$_{a}$14	.33	.16	.03
F	Polygonum douglasii (a)	$_{a}$2	$_{a}$-	$_{b}$32	.00	-	.07
F	Ranunculus testiculatus (a)	-	-	7	-	-	.01
F	Sanguisorba minor	-	7	-	-	.02	-
F	Senecio integerrimus	-	5	-	-	.06	-
F	Senecio multilobatus	$_{b}$28	$_{a}$-	$_{a}$-	.10	.00	-
F	Veronica biloba (a)	-	-	2	-	-	.00
F	Zigadenus paniculatus	-	3	-	-	.06	-
Total for Annual Forbs		14	40	256	0.04	0.63	8.19
Total for Perennial Forbs		447	512	599	8.21	9.20	18.01
Total for Forbs		461	552	855	8.26	9.84	26.20

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

BROWSE TRENDS--
Management unit 02R, Study no: 8

Type	Species	Strip Frequency			Average Cover %		
		'03	'06	'11	'03	'06	'11
B	Amelanchier utahensis	3	2	1	.00	.15	.00
B	Artemisia nova	0	1	1	-	-	-
B	Artemisia tridentata tridentata	98	84	94	36.54	8.24	14.45
B	Atriplex canescens	0	0	1	-	-	.15
B	Chrysothamnus viscidiflorus viscidiflorus	75	86	81	4.93	5.57	5.80
B	Eriogonum heracleoides	43	45	48	1.38	1.95	4.18
B	Eriogonum microthecum	0	0	2	-	-	-
B	Symphoricarpos oreophilus	11	10	15	1.12	1.38	1.64
B	Tetradymia canescens	17	22	21	.48	1.03	.99
Total for Browse		247	250	264	44.47	18.35	27.24

CANOPY COVER, LINE INTERCEPT--
Management unit 02R, Study no: 8

Species	Percent Cover		
	'03	'06	'11
Amelanchier utahensis	-	-	.08
Artemisia tridentata tridentata	32.23	9.18	18.64
Chrysothamnus viscidiflorus viscidiflorus	4.80	6.69	11.00
Eriogonum heracleoides	-	.46	2.98
Symphoricarpos oreophilus	.83	.98	4.56
Tetradymia canescens	.30	1.06	1.26

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 02R, Study no: 8

Species	Average leader growth (in)		
	'03	'06	'11
Artemisia tridentata tridentata	1.7	1.7	1.8

BASIC COVER--
Management unit 02R, Study no: 8

Cover Type	Average Cover %		
	'03	'06	'11
Vegetation	56.02	43.70	62.58
Rock	.50	.43	.40
Pavement	.42	.25	.10
Litter	57.84	48.21	35.25
Cryptogams	.26	.16	.04
Bare Ground	9.88	19.33	12.66

SOIL ANALYSIS DATA --

Management unit 2R, Study no: 8, Study Name: Duck Creek 1

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
13.6	7.1	40.6	35.2	24.2	2.5	32.0	512.0	0.7

PELLET GROUP DATA--

Management unit 02R, Study no: 8

Type	Quadrat Frequency			Days use per acre (ha)		
	'03	'06	'11	'03	'06	'11
Sheep	-	18	-	-	21 (53)	-
Rabbit	19	9	10	-	-	-
Grouse	-	1	-	-	17 Groups/ Acre	-
Elk	-	-	10	-	-	3 (8)
Deer	2	3	8	1 (2)	3 (8)	1 (2)
Cattle	10	8	5	24 (59)	29 (72)	28 (69)

BROWSE CHARACTERISTICS--

Management unit 02R, Study no: 8

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
03	**60**	100	0	-	-	0	0	0	62/77
06	**60**	100	0	-	-	0	0	0	47/42
11	**20**	0	100	-	-	0	0	0	28/33
Artemisia nova									
03	**0**	0	0	-	-	0	0	0	-/-
06	**20**	0	100	-	-	0	0	0	7/14
11	**20**	0	100	-	-	0	0	0	10/20
Artemisia tridentata tridentata									
03	**12100**	5	63	31	200	0	0	7	24/27
06	**4360**	11	65	23	780	21	2	9	17/21
11	**5840**	16	71	13	2180	32	1	3	18/25
Atriplex canescens									
03	**0**	0	0	-	-	0	0	0	-/-
06	**0**	0	0	-	-	0	0	0	-/-
11	**20**	0	100	-	-	100	0	0	15/25
Cercocarpus montanus									
03	**0**	0	0	-	-	0	0	0	-/-
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	40	0	0	0	-/-
Chrysothamnus viscidiflorus viscidiflorus									
03	**5100**	0	98	1	-	0	0	.39	10/13
06	**5840**	10	89	2	100	.34	0	.34	10/14
11	**6340**	11	86	2	-	3	0	.94	9/13

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Eriogonum heracleoides									
03	**1960**	4	95	1	20	0	0	1	3/8
06	**2560**	8	88	5	100	2	2	2	3/12
11	**3520**	0	100	0	-	0	0	0	4/13
Eriogonum microthecum									
03	**0**	0	0	-	-	0	0	0	-/-
06	**0**	0	0	-	-	0	0	0	7/9
11	**40**	0	100	-	-	50	0	0	6/12
Purshia tridentata									
03	**0**	0	0	-	-	0	0	0	-/-
06	**0**	0	0	-	40	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	23/60
Symphoricarpos oreophilus									
03	**380**	16	84	-	-	0	0	0	15/20
06	**280**	7	93	-	-	14	0	0	19/39
11	**460**	9	91	-	-	39	0	0	17/28
Tetradymia canescens									
03	**400**	5	75	20	-	0	0	5	12/11
06	**880**	27	68	5	40	7	0	5	9/13
11	**800**	18	75	8	20	0	0	8	10/14

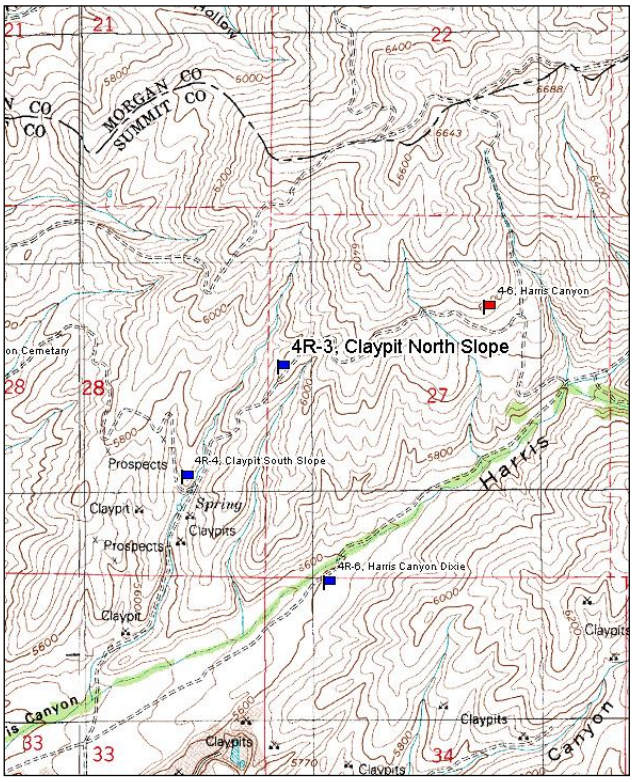
CLAYPIT NORTH SLOPE - TREND STUDY NO. 4R-3-11

Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Mountain Stony Loam (Mountain Big Sagebrush), R047XA461UT
Land Ownership: UDWR
Elevation: 5,940 ft (1,811 m)
Aspect: Northwest
Slope: 30%
Transect bearing: 215° magnetic
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

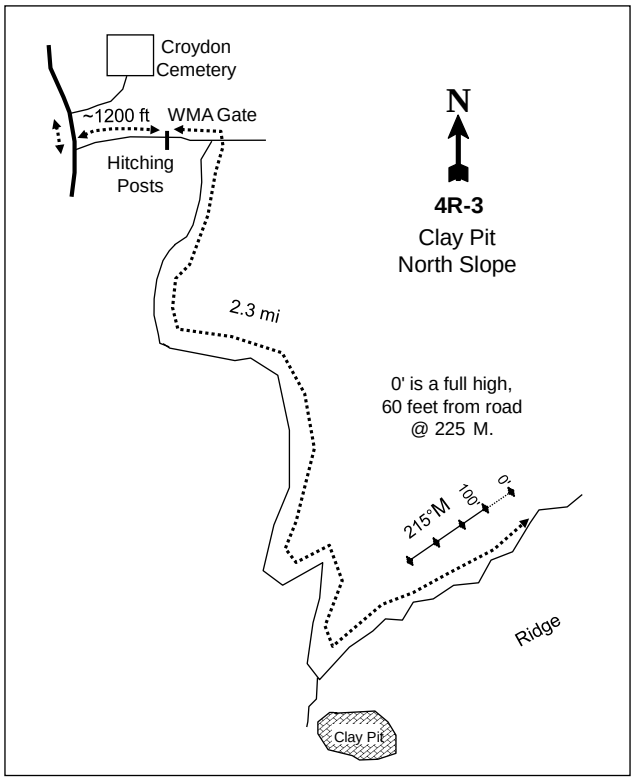
***Only read cover and nested frequency on belt 1

Directions: About 250 feet from the Croydon cemetery road, turn left onto a dirt road and drive approximately 1,200 feet to a WMA gate. From the WMA gate, drive 2.3 miles staying right through the first fork in the road immediately after the WMA gate, then where the road splits to the right to a clay mine about 1.8 miles stay to left to a full high zero foot stake on the left about 60 feet from the road. No browse tag.

Map Name: Henefer



Diagrammatic Sketch:



Township: 4N Range: 4E Section: 27

GPS: NAD 83, UTM 12S 458791 E 4544720 N

CLAYPIT NORTH SLOPE - WRI STUDY 4R-3

Site Description

Site Information: The study is located approximately one and half miles southeast of Croydon, in the Echo-Henefer Wildlife Management Area (WMA), north of Harris Canyon. The study samples a mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*) community. The study was established in 2006 to monitor the effects of the sagebrush defoliator moth (*Aroga websteri*) on the sagebrush population. The defoliator moth had affected several sagebrush populations in northern Utah and the study was established to monitor the long-term effects of the moth. Two other studies, Claypit South Slope (4R-4) and Croydon Cemetery (4R-5), were also established in the area. On all three study sites, browse density and line intercept cover were read on all five belts, but cover and nested frequency were only read on belt 1. The area is heavily occupied by big game. Deer pellet groups were sampled in high abundance in 2006 and 2011. Elk and cattle sign were sampled in low abundance 2006 and 2011 (Table - Pellet Group Data).

Browse: The key preferred browse species on the site is mountain big sagebrush, which has provided the majority of the browse cover over the sample years (Table - Canopy Cover). The mountain big sagebrush is a relatively dense, moderately used population with high decadence and poor vigor within the population. The recruitment of young plants to the population has been poor over the sample years, though in the 2011 there was high amount of seedlings sampled. In 2006, a majority of the sagebrush plants sampled were infested with the sagebrush defoliator moth, and were in poor health from effects of the moth. In the 2011 sample year, the sagebrush defoliator moth was not present on the site and the health of the sagebrush had improved, though decadence and poor vigor remained high. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* spp. *viscidiflorus*) has been sampled on the site in moderate abundance. Other browse species sampled on the site are white rubber rabbitbrush (*C. nauseosus* ssp. *albicaulis*) and broom snakeweed (*Gutierrezia sarothrae*), though each of these species have been sampled in very low abundance on the site (Table - Browse Characteristics).

Herbaceous Understudy: The herbaceous understory was not completely sampled due to only sampling belt 1. Perennial grass species are abundant and moderately diverse with crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*) being the dominant grass species. Other grass species sampled on the site include intermediate wheatgrass (*Agropyron intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), oniongrass (*Melica bulbosa*), and Kentucky bluegrass (*Poa pratensis*). Perennial forb species are moderately diverse, but are not very abundant with the exception of American vetch (*Vicia americana*), which has been the dominate forb species over the sample years. Annual forb species are diverse and fairly abundant. Several of the annual forb species were sampled for the first time in the 2011 sample year with moderate abundance (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Horrocks-Cutoff complex, which is found on mountain slopes. The parent material consists of colluvium derived from conglomerate, sandstone, quartzite, and andesite. The soils within this classification are characterized as moderately deep and well drained with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2006 and 2011.

Trend Assessments

Browse

- **2006 to 2011 - slightly down (-1):** The density of mountain big sagebrush decreased by 24% from 2,800 plants/acre to 2,140 plants/acre, though canopy cover increased from 13% to 18%. The health of the sagebrush population improved, but remained in poor condition, with decadence increasing from 36% to 43% of the population, but plants displaying poor vigor decreased from 83% to 29%. In

this study, plants infested with the sagebrush defoliator moth were considered to have poor vigor. The poor health of the sagebrush population can be attributed to the sagebrush defoliator moth. The moth had infested 64% of the population (1,780 plants/acre) in 2006. The density of stickyleaf low rabbitbrush increased 23% from 1,600 plants/acre to 1,960 plants/acre, and canopy cover increased from 3% to 5%.

Grass

- **2006 to 2011 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 19%, and cover decreased from 26% to 24%. Crested wheatgrass and Sandberg bluegrass decreased significantly in nested frequency, and cover decreased from 16% to 12% and 9% to 6%, respectively. Bluebunch wheatgrass increased significantly in nested frequency, and cover increased from 1% to 4%. The weedy annual grass species cheatgrass was sampled on the site in 2011 in low abundance, and provided less than 1% cover.

Forb

- **2006 to 2011 - up (+2)**: The sum of the nested frequency of perennial forbs increased more than two-fold, and cover increased from 4% to 14%. American vetch and wild onion (*Allium sp*.) increased significantly in nested frequency, and cover increased from 3% to 10% and less than 1% to 3%, respectively. The sum of the nested frequency of annual forbs increased four-fold and cover increased from 1% to 15%. Blue-eyed Mary (*Collinsia parviflora*), tansymustard (*Descurainia sp*.), draba (*Draba sp*.), and jagged chickweed (*Holosteum umbellatum*) accounted for the majority of the increase in the composition of the annual species on the site. Moreover, each of these species increased significantly in nested frequency, and cover increased from less than 1% to 3% with the exception of jagged chickweed which increased to 5% cover.

HERBACEOUS TRENDS--
Management unit 04R, Study no: 3

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	$_{b}$260	$_{a}$190	15.80	12.25
G	Agropyron intermedium	20	20	.30	1.90
G	Agropyron smithii	-	-	.03	-
G	Agropyron spicatum	$_{a}$4	$_{b}$100	1.20	4.00
G	Bromus tectorum (a)	-	15	-	0.05
G	Melica bulbosa	-	5	-	.18
G	Poa pratensis	5	-	.15	-
G	Poa secunda	$_{b}$255	$_{a}$155	8.78	5.75
Total for Annual Grasses		0	15	0	0.05
Total for Perennial Grasses		580	470	26.26	24.08
Total for Grasses		580	485	26.26	24.13
F	Achillea millefolium	-	5	-	.15
F	Allium sp.	$_{a}$30	$_{b}$180	.08	3.15
F	Alyssum alyssoides (a)	70	95	.15	.20
F	Arabis sp.	$_{b}$25	$_{a}$-	.33	.03
F	Calochortus nuttallii	-	20	-	.03
F	Collinsia parviflora (a)	135	160	.35	3.38
F	Collomia linearis (a)	20	55	.05	.18
F	Crepis acuminata	-	15	-	.03
F	Cryptantha sp.	-	-	.03	-

Type	Species	Nested Frequency '06	'11	Average Cover % '06	'11
F	Cymopterus sp.	25	-	.45	-
F	Descurainia sp. (a)	$_{a}$-	$_{b}$165	-	2.56
F	Draba sp. (a)	$_{a}$-	$_{b}$225	-	3.00
F	Gayophytum ramosissimum(a)	15	-	.03	-
F	Holosteum umbellatum (a)	$_{a}$-	$_{b}$270	-	4.75
F	Lomatium triternatum	$_{a}$-	$_{b}$55	-	.40
F	Microsteris gracilis (a)	-	40	-	.38
F	Tragopogon dubius (a)	-	20	-	.20
F	Trifolium sp.	-	15	-	.15
F	Vicia americana	$_{a}$205	$_{b}$310	2.75	9.80
F	Viola sp.	$_{a}$-	$_{b}$45	-	.45
F	Zigadenus paniculatus	10	-	.15	-
Total for Annual Forbs		240	1030	0.58	14.65
Total for Perennial Forbs		295	645	3.79	14.19
Total for Forbs		535	1675	4.37	28.84

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

BROWSE TRENDS--
Management unit 04R, Study no: 3

Type	Species	Strip Frequency '06	'11	Average Cover % '06	'11
B	Artemisia tridentata vaseyana	74	72	22.95	20.65
B	Chrysothamnus nauseosus albicaulis	2	4	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	43	48	1.80	3.08
Total for Browse		119	124	24.75	23.73

CANOPY COVER, LINE INTERCEPT--
Management unit 04R, Study no: 3

Species	Percent Cover '06	'11
Artemisia tridentata vaseyana	12.98	17.75
Chrysothamnus nauseosus albicaulis	1.76	.08
Chrysothamnus viscidiflorus viscidiflorus	2.68	4.55

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 04R, Study no: 3

Species	Average leader growth (in) '06	'11
Artemisia tridentata vaseyana	2.6	2.9

BASIC COVER--
Management unit 04R, Study no: 3

Cover Type	Average Cover % '06	'11
Vegetation	58.13	66.63
Rock	4.60	1.08
Pavement	4.43	2.93
Litter	51.03	54.08
Cryptogams	5.80	0.30
Bare Ground	8.10	9.95

SOIL ANALYSIS DATA --
Management unit 4R, Study no: 3, Study Name: Clay Pit North Slope

pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
7.0	53.3	21.8	24.9	2.1	29.1	364.8	0.7

PELLET GROUP DATA--
Management unit 04R, Study no: 3

Type	Quadrat Frequency '06	'11	Days use per acre (ha) '06	'11
Rabbit	50	10	-	-
Elk	25	10	15 (38)	11 (26)
Deer	60	65	96 (236)	62 (152)
Cattle	15	5	3 (7)	18 (45)

BROWSE CHARACTERISTICS--
Management unit 04R, Study no: 3

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
06	**2800**	7	57	36	140	26	5	19	37/47
11	**2140**	3	54	43	3340	35	2	29	34/47
Chrysothamnus nauseosus albicaulis									
06	**40**	0	100	0	20	0	0	0	30/38
11	**80**	50	0	50	-	0	0	50	27/32
Chrysothamnus viscidiflorus viscidiflorus									
06	**1600**	3	96	1	40	0	0	0	13/16
11	**1960**	8	92	0	-	0	0	0	14/18
Gutierrezia sarothrae									
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	17/19

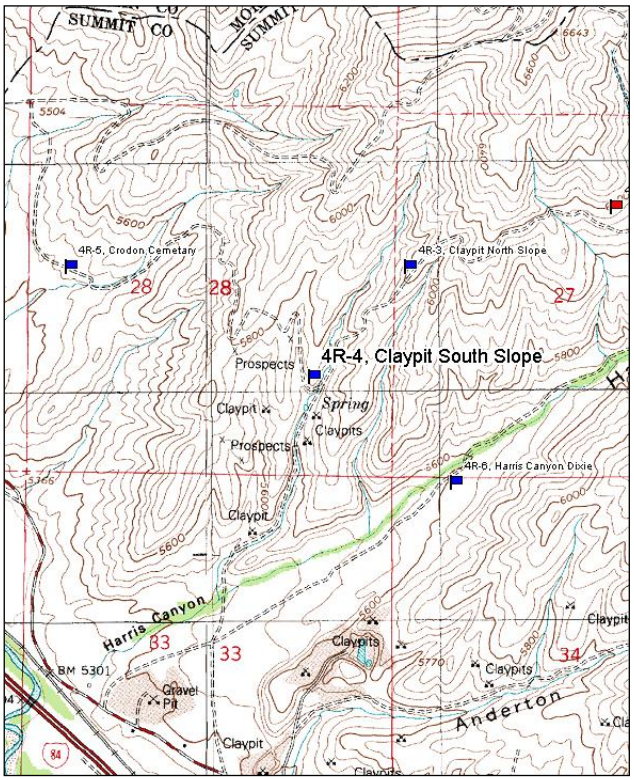
CLAYPIT SOUTH SLOPE - TREND STUDY NO. 4R-4-11

Vegetation Type: Mountain Big sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Mountain Stony Loam (Mountain Big Sagebrush), R047XA461UT
Land Ownership: UDWR
Elevation: 5,700 ft (1,737 m)
Aspect: Southeast
Slope: 20%
Transect bearing: 0 ft - 100 ft is 15° magnetic 100 ft - 500 ft is 5° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

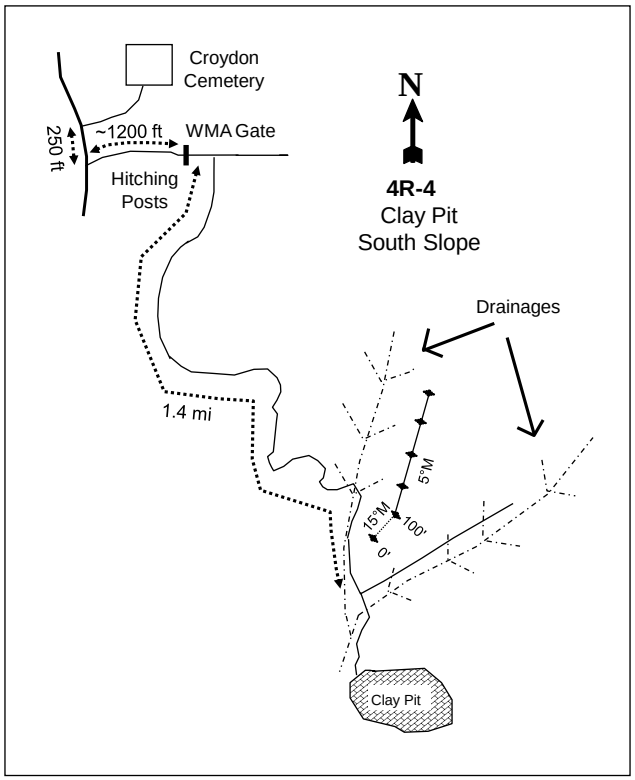
***Only read cover and nested frequency on belt 1

Directions: About 250 feet from the Croydon cemetery road turn left onto a dirt road and drive approximately 1,200 feet to a WMA gate. From the WMA gate, drive 1.4 miles staying right through the first fork in the road immediately after the WMA gate, stop where two drainages meet and the road takes a sharp bend. The zero foot stake is a full high on the ridge to the left. No browse tag.

Map Name: Henefer



Diagrammatic Sketch:



Township: 4N Range: 4E Section: 28

GPS: NAD 83, UTM 12S 458370 E 4544241 N

CLAYPIT SOUTH SLOPE - WRI STUDY 4R-4

Site Description

Site Information: The study is located approximately one and half miles southeast of Croydon, in the Echo-Henefer Wildlife Management Area (WMA), north of Harris Canyon. The study samples a mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*) community within the WMA. The study was established in 2006 to monitor the effects of the sagebrush defoliator moth (*Aroga websteri*) on the sagebrush population. The defoliator moth had affected several sagebrush populations in northern Utah, and the study was established to monitor the long-term effects of the moth. Two other studies, Claypit North Slope (4R-3) and Croydon Cemetery (4R-5), were also established in the area. On all three study sites, browse density and line intercept cover were read on all five belts, but cover and nested frequency were only read on belt 1. The area is heavily occupied by big game. In 2006, deer and elk pellet groups were sampled in high abundance, but cattle sign was sampled in low abundance. In 2011, deer, elk, and cattle pellet groups were sampled in low abundance (Table - Pellet Group Data).

Browse: The key preferred browse species on the site is mountain big sagebrush, which has provided the majority of the browse cover over the sample years (Table - Canopy Cover). The mountain big sagebrush is a relatively small, moderately used population, with high decadence and poor vigor within the population. The recruitment of young plants to the population has been poor over the sample years. More than half of the sagebrush plants sampled in 2006 were sampled as dead plants. Also, in 2006, a majority of the live sagebrush plants sampled were infested with the sagebrush defoliator moth, and were in poor health from the effects of the moth. In the 2011 sample year, the sagebrush defoliator moth was not present on the site and the health of the sagebrush plants improved, though decadence and poor vigor remained high. Other species of browse sampled on the site are white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), pricklypear cactus (*Opuntia sp.*), and broom snakeweed (*Gutierrezia sarothrae*), though each of these species have been sampled in very low abundance on the site (Table - Browse Characteristics).

Herbaceous Understudy: The herbaceous understory was not completely sampled due to only sampling belt 1. Perennial grass species are abundant and moderately diverse on the site. The dominant perennial grass species is western wheatgrass (*Agropyron smithii*) which provides the majority of the perennial grass cover. Several species are present on the site in moderate abundance which include intermediate wheatgrass (*A. intermedium*), crested wheatgrass (*A. cristatum*), bluebunch wheatgrass (*A. spicatum*), and Sandberg bluegrass (*Poa secunda*). The weedy annual grass species cheatgrass (*Bromus tectorum*) has been sampled in high abundance on the site over the course of the study. Perennial forb species are not overly diverse or very abundant on the site. No perennial forb species provided more than 1% cover in either sample year. Annual forb species are diverse, and were not overly abundant at the outset of the study, though annual forbs increased in 2011 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Horrocks-Cutoff complex, which is found on mountain slopes. The parent material consists of colluvium derived from conglomerate, sandstone, quartzite, and andesite. The soils within this classification are characterized as moderately deep and well drained, with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2006, but stable in 2011.

Trend Assessments

Browse

- **2006 to 2011 - down (-2):** The density of mountain big sagebrush decreased by 39% from 1,240 plants/acre to 760 plants/acre, and canopy cover decreased from 5% to 3%. The health of the sagebrush population improved, but remained in poor condition, with decadence decreasing from 48%

to 45% of the population, and plants displaying poor vigor decreased from 97% to 39%. In this study plants infested with the sagebrush defoliator moth were considered to have poor vigor. The poor health of the sagebrush population can be attributed to the sagebrush defoliator moth. In 2006, the moth had infested 81% of the sagebrush plants (1,000 plants/acre) still living when the study was read and 1,280 plants/acre were killed (or apparently killed) by the moth. Sagebrush average leader growth was 1.9 inches in 2006 and 3.9 inches in 2011. This study was more severely impacted by the moth than the Claypit North Slope (4R-3) study.

Grass

- **2006 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased 37%, and cover increased from 14% to 26%. Intermediate wheatgrass decreased significantly in nested frequency, and cover decreased from 6% to 3%. Western wheatgrass increased significantly in nested frequency, and cover increased from 2% to 17%. Cheatgrass remained similar in nested frequency, and cover remained similar at 12%.

Forb

- **2006 to 2011 - up (+2):** The sum of the nested frequency of perennial forbs increased twelve-fold and cover increased from near 0% to 2%. No perennial forb species provided more than 1% cover in either sample year. The sum of the nested frequency of annual forbs increased eleven-fold, and cover increased from less than 1% to 5%.

HERBACEOUS TRENDS--
Management unit 04R, Study no: 4

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	25	40	2.20	1.80
G	Agropyron intermedium	b165	a25	6.30	3.15
G	Agropyron smithii	a55	b285	2.25	17.05
G	Agropyron spicatum	45	30	2.55	1.53
G	Bromus japonicus (a)	a-	b65	-	.58
G	Bromus tectorum (a)	405	380	11.55	12.38
G	Poa secunda	120	180	.98	2.08
G	Vulpia octoflora (a)	10	-	.03	-
Total for Annual Grasses		415	445	11.58	12.96
Total for Perennial Grasses		410	560	14.28	25.61
Total for Grasses		825	1005	25.86	38.57
F	Allium sp.	a15	b100	.03	.48
F	Alyssum alyssoides (a)	-	95	-	.43
F	Astragalus sp.	-	5	-	.03
F	Astragalus utahensis	-	5	-	.03
F	Cirsium undulatum	-	15	-	.75
F	Collinsia parviflora (a)	b65	a-	.15	-
F	Collomia linearis (a)	-	25	-	.23
F	Cymopterus sp.	a-	b55	-	.25
F	Descurainia sp. (a)	a-	b220	-	1.23
F	Draba sp. (a)	a15	b235	.05	1.25
F	Helianthus annuus (a)	5	-	.03	-
F	Holosteum umbellatum (a)	a5	b290	.03	1.25
F	Lactuca serriola (a)	-	25	-	.48

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
F	Microsteris gracilis (a)	-	40	-	.05
F	Ranunculus testiculatus (a)	a-	b65	-	.13
Total for Annual Forbs		90	995	0.26	5.05
Total for Perennial Forbs		15	180	0.03	1.54
Total for Forbs		105	1175	0.29	6.59

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

BROWSE TRENDS--
Management unit 04R, Study no: 4

Type	Species	Strip Frequency '06	Strip Frequency '11	Average Cover % '06	Average Cover % '11
B	Artemisia tridentata vaseyana	38	24	4.78	2.63
B	Chrysothamnus nauseosus albicaulis	5	7	3.13	.93
B	Gutierrezia sarothrae	10	7	.18	.90
B	Opuntia sp.	9	7	-	-
Total for Browse		62	45	8.09	4.46

CANOPY COVER, LINE INTERCEPT--
Management unit 04R, Study no: 4

Species	Percent Cover '06	Percent Cover '11
Artemisia tridentata vaseyana	5.44	3.20
Chrysothamnus nauseosus albicaulis	.36	2.01
Opuntia sp.	-	.06

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 04R, Study no: 4

Species	Average leader growth (in) '06	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.9	3.9

BASIC COVER--
Management unit 04R, Study no: 4

Cover Type	Average Cover % '06	Average Cover % '11
Vegetation	34.68	46.25
Rock	10.60	11.00
Pavement	7.78	10.88
Litter	44.13	41.00
Cryptogams	.50	.03
Bare Ground	11.88	13.10

SOIL ANALYSIS DATA --

Management unit 4R, Study no: 4, Study Name: Clay Pit South Slope

pH	loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
7.1	43.3	31.8	24.9	2.2	26.8	368.0	0.7

PELLET GROUP DATA--

Management unit 04R, Study no: 4

Type	Quadrat Frequency		Days use per acre (ha)	
	'06	'11	'06	'11
Rabbit	40	-	-	-
Elk	15	-	36 (88)	6 (15)
Deer	75	-	47 (116)	13 (31)
Cattle	25	10	6 (14)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 04R, 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)
Artemisia tridentata vaseyana									
06	**1240**	3	48	48	-	37	10	16	24/37
11	**760**	5	50	45	-	26	16	39	23/38
Chrysothamnus nauseosus albicaulis									
06	**140**	14	86	0	-	0	0	0	28/29
11	**160**	0	75	25	-	13	0	38	25/35
Gutierrezia sarothrae									
06	**200**	0	100	-	-	0	0	0	9/10
11	**140**	0	100	-	-	0	0	0	12/13
Opuntia sp.									
06	**220**	18	82	0	-	0	0	0	5/10
11	**180**	22	67	11	-	0	0	0	3/5

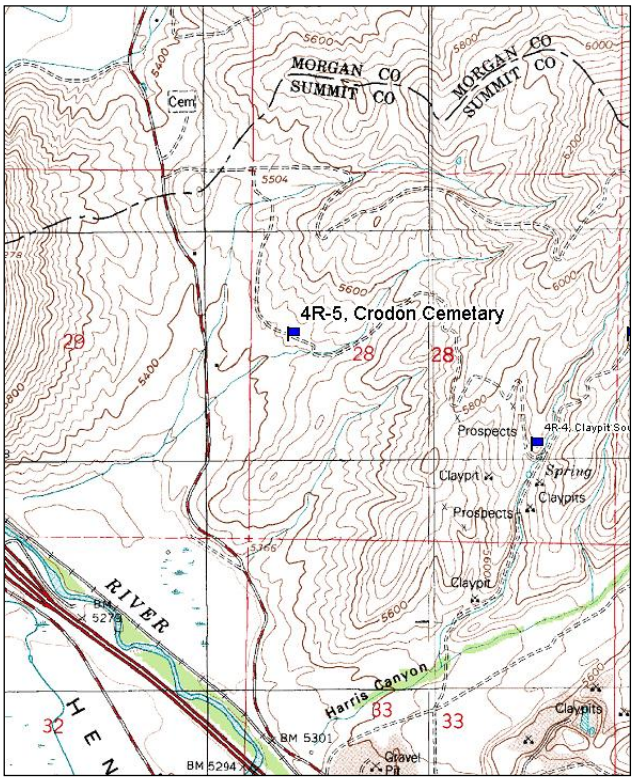
CROYDON CEMETERY - TREND STUDY NO. 4R-5-11

Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Mountain Loam (Mountain Big Sagebrush), R047XA430UT
Land Ownership: UDWR
Elevation: 5,450 ft (1,661 m)
Aspect: Southwest
Slope: 5%
Transect bearing: 266° magnetic
Belt placement: line 1 (11ft & 95 ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)
Rebar: Belts 1-4 are on the 0 ft and Belt 5 is on the 1ft

***Only read cover and nested frequency on belt 1

Directions: About 250 feet from the Croydon cemetery road turn left onto a dirt road and drive approximately 1,200 feet to a WMA gate. From the WMA gate, drive 0.5 miles staying right through the first fork in the road immediately after the WMA gate. The zero foot stake is a full high 55 feet off the road. No browse tag.

Map Name: Devils Slide



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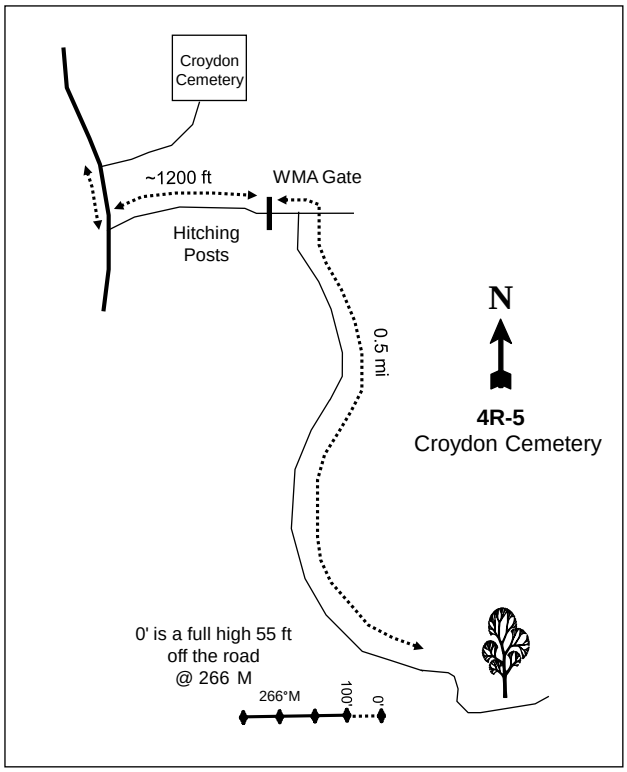


Township: 4N Range: 4E Section: 28

GPS: NAD 83, UTM 12S 457305 E 4544722 N

CROYDON CEMETERY - WRI STUDY 4R-5

Site Description

Site Information: The study is located approximately one mile southeast of Croydon, in the Echo-Henefer Wildlife Management Area (WMA), north of the mouth of Harris Canyon. The study samples a mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*) community in the WMA. The study was established in 2006 to monitor the effects of the sagebrush defoliator moth (*Aroga websteri*) on the sagebrush population. The defoliator moth had affected several sagebrush populations in northern Utah and the study was established to monitor the long-term effects of the moth. Two other studies, Claypit North Slope (4R-3) and Claypit South Slope (4R-4), were also established in the area. On all three study sites, browse density and line intercept cover were read on all five belts, but cover and nested frequency were only read on belt 1. The area is heavily occupied by big game. In 2006, deer pellet groups were sampled in high abundance, while elk and cattle sign were sampled in low abundance. Deer and cattle sign were sampled in low abundance in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is mountain big sagebrush, which has provided the majority of the browse cover over the sample years (Table - Canopy Cover). The mountain big sagebrush is a relatively dense, moderately used population, with high decadence and poor vigor within the population. The recruitment of young plants to the population has been poor over the sample years. About a third of the sagebrush plants sampled in 2006 were sampled as dead plants. Also, in 2006, a majority of the live sagebrush plants sampled were infested with the sagebrush defoliator moth and were in poor health from the effects of the moth. In the 2011 sample year, the sagebrush defoliator moth was not present on the site and the health of the sagebrush plants had improved, though decadence and poor vigor remained high. A moderate population of broom snakeweed (*Gutierrezia sarothrae*) has been sampled on the site over the sample years. Other species of browse sampled on the site are white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) and stickyleaf low rabbitbrush (*C. viscidiflorus* spp. *viscidiflorus*), though each of these species have been sampled in very low abundance on the site (Table - Browse Characteristics).

Herbaceous Understudy: The herbaceous understory was not completely sampled due to only sampling belt 1. Perennial grass species are abundant, but are not overly diverse on the site. The dominant perennial grass species are crested wheatgrass (*Agropyron cristatum*) and the weedy species bulbous bluegrass (*Poa bulbosa*), which have provided the majority of the grass cover. The weedy annual grass species cheatgrass (*Bromus tectorum*) and Japanese chess (*B. japonicus*) were sampled on the site in low abundance for the first time in 2011. Perennial forb species are not overly diverse or very abundant on the site. No perennial forb species provided more than 1% cover in either sample year. Annual forb species are diverse, but are not overly abundant. Several of the annual forb species were sampled for the first time in the 2011 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Manila-Ant Flat complex, which is found on fan remnants. The parent material consists of slope alluvium derived from conglomerate, sandstone and shale. The soils within this classification are characterized as deep and well drained with a slightly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a mildly alkaline soil reaction (pH 7.7) (Table - Soil Analysis Data). Bare ground cover is moderately high on the site, though there is a high amount of vegetation and a moderate amount of litter providing protective ground cover (Table - Basic Cover). Due to an active gully near the study and a large amount of active erosion on the study, the soil erosion condition was classified as moderate in 2006, but stable in 2011.

Trend Assessments

Browse

- **2006 to 2011 - down (-2):** The density of mountain big sagebrush decreased by 21% from 3,380 plants/acre to 2,660 plants/acre, though canopy cover increased from 16% to 20%. The health of the

sagebrush population improved, but remained in poor condition with decadence decreasing from 58% to 47% of the population, and plants displaying poor vigor decreased from 91% to 26%. In this study, plants infested with the sagebrush defoliator moth were considered to have poor vigor. The poor health of the sagebrush population can be attributed to the sagebrush defoliator moth. In 2006, the moth had infested 73% of the sagebrush plants (2,460 plants/acre) still living when the study was read and 1,280 plants/acre were likely killed by the moth. Sagebrush average leader growth was 2.2 inches in 2006 and 1.9 inches in 2011. This study was more severely impacted by the moth than the Claypit North Slope (4R-3) study, but less impacted than Claypit South Slope (4R-4).

Grass

- **2006 to 2011 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 11%, and cover increased from 32% to 39%. Crested wheatgrass and bulbous bluegrass remained similar in nested frequency, but cover increased from 11% to 18% and 20% to 21%, respectively. Cheatgrass and Japanese chess were sampled for the first time in 2011 in low frequency and cover.

Forb

2006 to 2011 - stable (0): Perennial Forbs are rare on the site. The sum of the nested frequency of annual forbs increased by six-fold, and cover increased from 1% to 3%.

HERBACEOUS TRENDS--
Management unit 04R, Study no: 5

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	280	315	11.15	17.50
G	Bromus japonicus (a)	-	5	-	.03
G	Bromus tectorum (a)	-	15	-	.18
G	Poa bulbosa	295	355	20.28	21.35
G	Poa secunda	35	5	.03	.15
Total for Annual Grasses		0	20	0	0.21
Total for Perennial Grasses		610	675	31.73	39.00
Total for Grasses		610	695	31.73	39.21
F	Alyssum alyssoides (a)	$_{a}$10	$_{b}$90	.03	.18
F	Cirsium undulatum	-	5	-	.80
F	Collomia linearis (a)	-	5	-	.03
F	Cordylanthus sp. (a)	$_{a}$20	$_{b}$90	.45	2.13
F	Hackelia patens	-	10	-	.08
F	Helianthus annuus (a)	10	15	.03	.08
F	Holosteum umbellatum (a)	-	15	-	.05
F	Ranunculus testiculatus (a)	-	45	-	.18
F	Tragopogon dubius (a)	-	-	.03	-
Total for Annual Forbs		40	260	0.50	2.65
Total for Perennial Forbs		0	25	0.03	0.88
Total for Forbs		40	285	0.54	3.53

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

BROWSE TRENDS--
Management unit 04R, Study no: 5

Type	Species	Strip Frequency '06	Strip Frequency '11	Average Cover % '06	Average Cover % '11
B	Artemisia tridentata vaseyana	86	78	14.10	17.18
B	Chrysothamnus nauseosus albicaulis	1	2	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	6	8	-	-
B	Gutierrezia sarothrae	28	55	.60	3.15
Total for Browse		121	143	14.70	20.33

CANOPY COVER, LINE INTERCEPT--
Management unit 04R, Study no: 5

Species	Percent Cover '06	Percent Cover '11
Artemisia tridentata vaseyana	15.69	20.16
Gutierrezia sarothrae	.75	3.96

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 04R, Study no: 5

Species	Average leader growth (in) '06	Average leader growth (in) '11
Artemisia tridentata vaseyana	2.2	1.9

BASIC COVER--
Management unit 04R, Study no: 5

Cover Type	Average Cover % '06	Average Cover % '11
Vegetation	28.70	53.38
Rock	.35	0
Pavement	.55	.43
Litter	32.35	36.35
Cryptogams	1.10	0.23
Bare Ground	28.70	30.83

SOIL ANALYSIS DATA --
Management unit 4R, Study no: 5, Study Name: Croydon Cemetery

pH	clay loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
7.7	28.0	42.7	29.3	1.9	31.1	323.2	0.7

PELLET GROUP DATA--
Management unit 04R, Study no: 5

Type	Quadrat Frequency '06	'11	Days use per acre (ha) '06	'11
Rabbit	5	10	-	-
Elk	-	-	3 (7)	-
Deer	75	5	46 (114)	3 (7)
Cattle	5	-	12 (29)	10 (25)

BROWSE CHARACTERISTICS--
Management unit 04R, Study no: 5

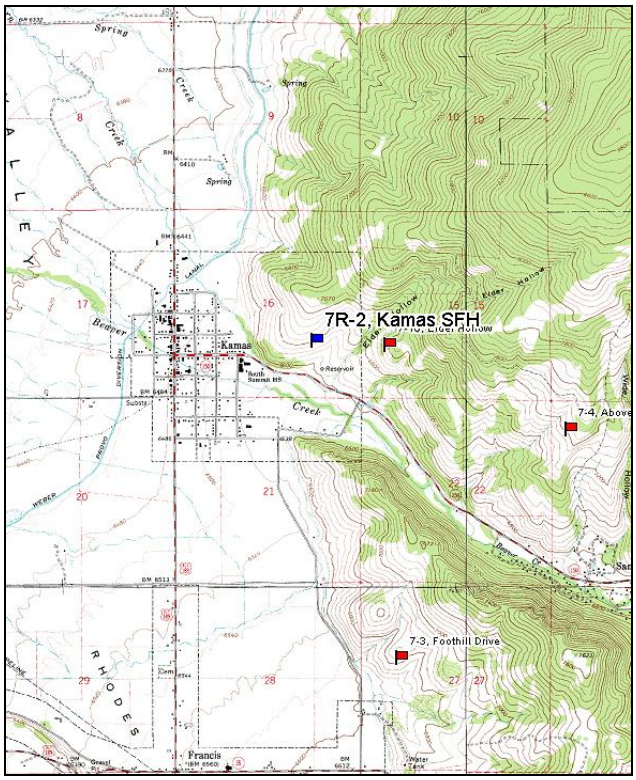
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
06	**3380**	2	40	58	140	30	5	18	28/34
11	**2660**	5	48	47	-	48	0	26	30/38
Chrysothamnus nauseosus albicaulis									
06	**20**	100	0	-	-	0	0	0	56/74
11	**40**	0	100	-	-	0	0	0	25/46
Chrysothamnus viscidiflorus viscidiflorus									
06	**140**	0	100	-	-	43	29	0	10/13
11	**200**	0	100	-	-	0	0	0	13/20
Gutierrezia sarothrae									
06	**1040**	6	94	0	20	0	0	0	8/10
11	**2800**	7	91	2	-	0	0	.71	12/14

KAMAS SFH - TREND STUDY NO. 7R-2-11
Project #1195

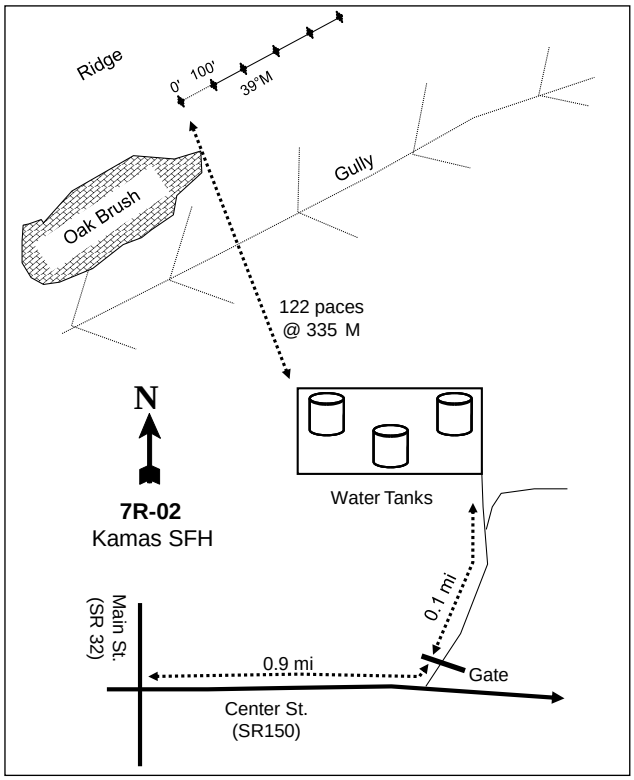
Vegetation Type: Annual Grass
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Mountain Stony Loam (Mountain Big Sagebrush), R047XA461UT
Land Ownership: Private
Elevation: 6,800 ft (2,073 m)
Aspect: Southeast
Slope: 30%
Transect bearing: 39° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
No rebar

Directions: From the intersection of Main street (SR 32) and Center Street (SR 150) in Kamas, turn east onto Center Street for 0.9 miles. Turn left (North) where you'll come to a gate. Through the gate drive 0.1 miles to the southeast corner of a fenced in water tanks. From there walk to the northwest corner and walk 122 paces at a bearing of 335 degrees magnetic to the 0 foot stake with browse tag #177.

Map Name: Kamas



Diagrammatic Sketch:



Township: 2S Range: 6E Section: 16

GPS: NAD 83, UTM 12S 477454 E 4499249 N

KAMAS SFH - WRI STUDY 7R-2
Project #1195

Site Description

Site Information: The study is located approximately a quarter mile east of Kamas, near the mouth of Elder Hollow, on private land. The study was established in 2006 to monitor an aerial seeding and Plateau (Imazapic) herbicide treatment on Sportsman for Fish and Wildlife land in the foothills east of Kamas. Historically, the vegetation component appears to have been dominated by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), but is now dominated by weedy grass and forb species. In September of 2008, a total of 55 acres were aerially sprayed with the herbicide Plateau to remove cheatgrass (*Bromus tectorum*) and bulbous bluegrass (*Poa bulbosa*). In February of 2009, a seed mix of grass, forb, and browse species was aerially seeded over the project area (Table - Seed Mix). The objective is to restore habitat and increase the carrying capacity of the site for wintering mule deer (WRI Database 2012). In 2006, deer and elk pellet groups were sampled in high abundance, while cattle sign was sample in low abundance. In 2011, pellet groups were sampled in low abundance for elk, high abundance for deer, and moderate abundance for cattle (Table - Pellet Group Data).

SEED MIX--
Management unit 07R, Study no: 2

Project Name: Kamas SFH Property WRI Database #: 1195			
Application: Aerial Seed		Acres:	55
Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Goldar'	52	0.95
G	Snake River Wheatgrass 'Secar'	50	0.91
F	Alfalfa 'Ranger'	100	1.82
F	Small Burnet 'Delar'	50	0.91
B	Forage Kochia	150	2.73
B	Sagebrush, Mountain	50	0.91
Total Pounds:		452	8.22
PLS Pounds:			6.12

Browse: Browse is limited on the site. The preferred browse species on the site is mountain big sagebrush and Saskatoon serviceberry (*Amelanchier alnifolia*), though both species were sampled in very low density. The mountain big sagebrush is a small population, with low decadence and good vigor within the population. Only one mountain big sagebrush plant has been sampled on the site since the outset of the study. Serviceberry was only measured in the height/crown measurements. Utilization of sagebrush and serviceberry has been moderate over the sample years. Other browse species sampled include rubber rabbitbrush (*Chrysothamnus nauseous*), stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), hawthorn (*Crataegus sp.*), broom snakeweed (*Gutierrezia sarothrae*), Oregon grape (*Mahonia repens*), pricklypear cactus (*Opuntia sp.*), mountain snowberry (*Symphoricarpos oreophilus*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by weedy species. Desired perennial grass species are rare on the site. The site is dominated by the weedy perennial grass species bulbous bluegrass and the annual grass species cheatgrass, which have provided the majority of the grass cover since the outset of the study. Other perennial grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*) and Kentucky bluegrass (*Poa pratensis*). Perennial forbs are abundant and moderately diverse. The dominant forb species are Louisiana sagebrush (*Artemisia ludoviciana*), hairy goldenaster (*Heterotheca villosa*), and silvery lupine (*Lupinus argenteus*). Annual forb species are abundant and diverse on the site with storksbill (*Erodium cicutarium*) being the dominant annual forb species. No seeded grass or forb species were sampled on the site

(Table - Herbaceous Trends).

Soil: The soil is classified as part of the Horrocks-Cutoff complex, which is found on mountain slopes. The parent material consists of colluvium derived from conglomerate, sandstone, quartzite, and andesite. The soils within this classification are characterized as moderately deep and well drained with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a moderate amount of litter, and a high amount of vegetation and rock providing protective ground cover. The soil erosion condition was classified as stable in 2006 and 2011.

Pre vs. Three Years Post Treatment, 2006 vs. 2011

Browse: Palatable browse species are rare on the site. Mountain big sagebrush remained similar in density at 20 plants/acre and cover of 1%. The density of broom snakeweed decreased 57% from 1,980 plants/acre to 860 plants/acre, and cover decreased from 2% to less than 1%.

Grasses: The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, increased 65%, though cover remained similar at 2%, and each species was fairly rare on the site. Bulbous bluegrass increased significantly in nested frequency, and cover increased from 15% and 18%. Cheatgrass significantly increased in nested frequency, but cover remained similar at 10%.

Forbs: The sum of the nested frequency of perennial forbs increased 22%, though cover decreased from 18% to 14%. Both silvery lupine and Louisiana sagebrush increased in nested frequency, though cover remained similar at 3% and 4%, respectively. Hairy goldenaster remained similar in nested frequency, but cover decreased from 9% to 5%. The sum of nested frequency of annual forbs slightly increased in nested frequency, and cover increased from 7% to 9%.

HERBACEOUS TRENDS--
Management unit 07R, Study no: 2

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	44	38	1.34	.55
G	Bromus tectorum (a)	a349	b398	10.29	10.05
G	Poa bulbosa	a287	b325	15.02	18.43
G	Poa pratensis	5	15	.33	.62
G	Poa secunda	a-	b28	-	.28
Total for Annual Grasses		349	398	10.29	10.05
Total for Perennial Grasses		336	406	16.69	19.89
Total for Grasses		685	804	26.98	29.94
F	Alyssum alyssoides (a)	b220	a124	.98	.51
F	Arabis sp.	3	-	.00	-
F	Artemisia ludoviciana	a72	b93	3.81	3.90
F	Camelina microcarpa (a)	3	7	.00	.06
F	Cirsium sp.	-	2	-	.15
F	Cirsium undulatum	a3	b23	.07	.82
F	Collinsia parviflora (a)	57	39	.09	.16
F	Draba sp. (a)	37	60	.06	.09
F	Epilobium brachycarpum (a)	a71	b110	1.25	.96
F	Eriogonum cernuum (a)	5	-	.01	-

Type	Species	Nested Frequency '06	'11	Average Cover % '06	'11
F	Eriogonum racemosum	9	8	.33	.04
F	Erodium cicutarium (a)	$_{a}$187	$_{b}$339	3.98	6.90
F	Helianthella uniflora	6	1	.03	.15
F	Heterotheca villosa	181	179	9.28	5.19
F	Holosteum umbellatum (a)	$_{b}$106	$_{a}$50	.35	.08
F	Lactuca serriola (a)	$_{a}$1	$_{b}$28	.00	.11
F	Lithospermum ruderale	$_{a}$-	$_{b}$6	.00	.01
F	Lupinus argenteus	$_{a}$21	$_{b}$56	2.59	2.63
F	Phlox longifolia	1	-	.00	-
F	Ranunculus testiculatus (a)	$_{a}$5	$_{b}$25	.01	.07
F	Salsola iberica (a)	7	-	.07	-
F	Sisymbrium altissimum (a)	1	-	.00	-
F	Solidago sp.	$_{b}$15	$_{a}$-	1.36	-
F	Tragopogon dubius (a)	6	2	.06	.03
F	Veronica biloba (a)	-	2	-	.00
F	Viguiera multiflora	6	20	.48	.77
Total for Annual Forbs		706	786	6.92	9.00
Total for Perennial Forbs		317	388	17.99	13.68
Total for Forbs		1023	1174	24.91	22.68

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

BROWSE TRENDS--
Management unit 07R, Study no: 2

Type	Species	Strip Frequency '06	'11	Average Cover % '06	'11
B	Artemisia tridentata vaseyana	1	1	.63	.85
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	-	.00
B	Crataegus sp.	1	1	-	-
B	Gutierrezia sarothrae	53	23	1.97	.08
B	Mahonia repens	6	7	.48	.48
B	Opuntia sp.	9	17	.24	.38
B	Symphoricarpos oreophilus	1	2	-	.03
Total for Browse		71	52	3.32	1.83

CANOPY COVER, LINE INTERCEPT--
Management unit 07R, Study no: 2

Species	Percent Cover '06	'11
Artemisia tridentata vaseyana	.65	.56
Crataegus sp.	.11	.01
Gutierrezia sarothrae	1.64	.28
Mahonia repens	.25	.40
Opuntia sp.	.60	.40
Symphoricarpos oreophilus	.03	-

BASIC COVER--
Management unit 07R, Study no: 2

Cover Type	Average Cover % '06	'11
Vegetation	55.41	54.34
Rock	29.02	30.59
Pavement	3.23	3.94
Litter	16.53	16.88
Cryptogams	.42	.07
Bare Ground	8.78	5.74

SOIL ANALYSIS DATA --
Management unit 7R, Study no: 2, Study Name: Kamas SFH

pH	loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.8	43.0	32.7	24.3	3.8	46.5	560.0	0.7

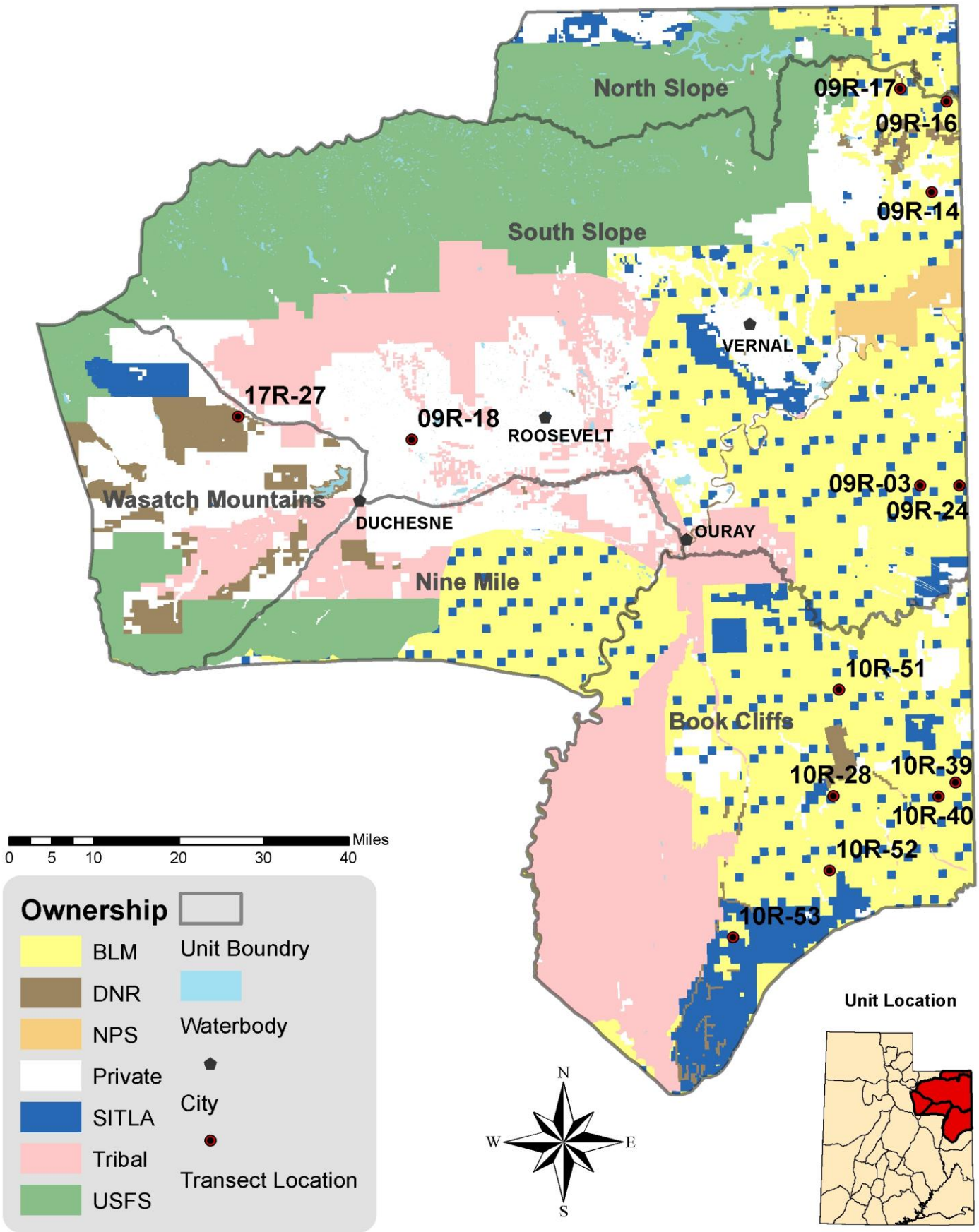
PELLET GROUP DATA--
Management unit 07R, Study no: 2

Type	Quadrat Frequency '06	'11	Days use per acre (ha) '06	'11
Rabbit	26	8	-	-
Elk	18	3	32 (78)	8 (20)
Deer	42	22	102 (251)	60 (147)
Cattle	1	5	9 (22)	18 (45)

BROWSE CHARACTERISTICS--
Management unit 07R, Study no: 2

		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 alnifolia									
06	**0**	0	0	-	-	0	0	0	49/51
11	**0**	0	0	-	-	0	0	0	55/58
Artemisia tridentata vaseyana									
06	**20**	0	100	-	-	100	0	0	24/40
11	**20**	0	100	-	-	100	0	0	29/51
Chrysothamnus nauseosus									
06	**0**	0	0	-	-	0	0	0	28/42
11	**0**	0	0	-	-	0	0	0	34/50
Chrysothamnus viscidiflorus viscidiflorus									
06	**0**	0	0	-	-	0	0	0	11/28
11	**20**	100	0	-	-	0	0	0	8/13
Crataegus sp.									
06	**20**	100	0	-	-	0	0	0	41/21
11	**20**	0	100	-	-	0	0	0	70/49
Gutierrezia sarothrae									
06	**1980**	22	76	2	20	0	0	1	8/11
11	**860**	30	70	0	20	0	0	0	7/7
Mahonia repens									
06	**2600**	11	89	-	-	0	0	0	3/4
11	**3640**	5	95	-	-	0	0	0	2/4
Opuntia sp.									
06	**200**	30	60	10	-	0	0	10	5/15
11	**360**	0	100	0	-	0	0	0	6/17
Symphoricarpos oreophilus									
06	**20**	0	100	-	-	0	0	0	25/53
11	**40**	0	100	-	-	0	50	0	26/51
Tetradymia canescens									
06	**0**	0	0	-	-	0	0	0	15/44
11	**0**	0	0	-	-	0	0	0	-/-

Northeastern Region
WRI Studies 2011

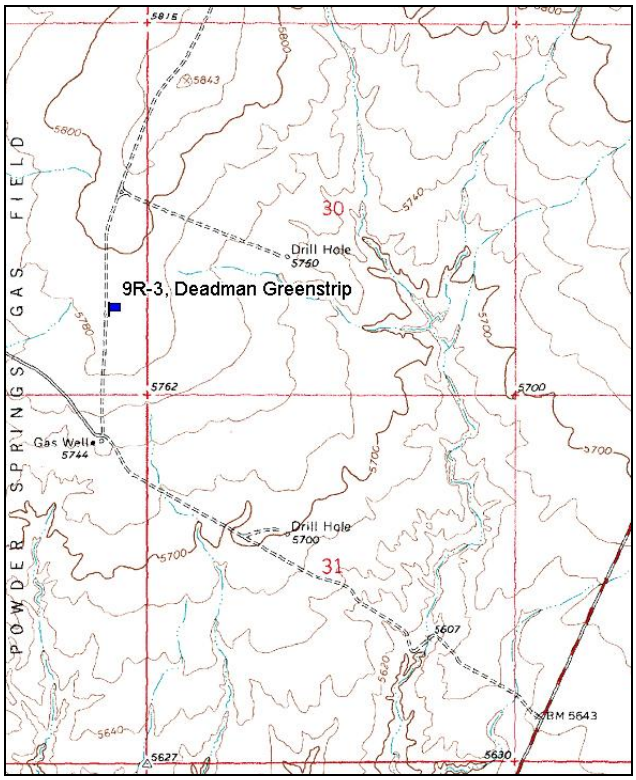


DEADMAN GREENSTRIP - TREND STUDY NO. 9R-3-11
Project #1081

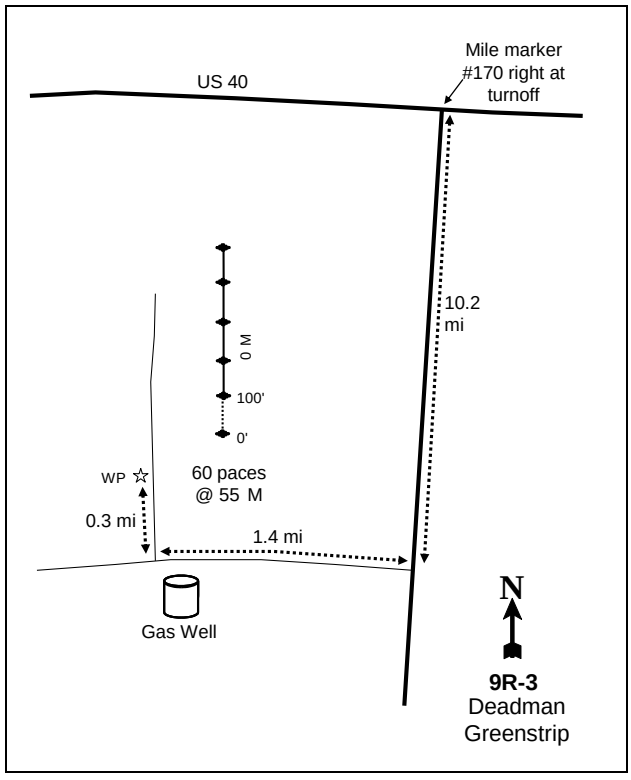
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Antelope Year-long (fawning habitat)
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT
Land Ownership: BLM
Elevation: 5,800 ft (1,767 m)
Aspect: South
Slope: 1%
Transect bearing: 0° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From US 40 turn right (south) at the turnoff after mile marker 168. Drive south for 10.2 miles to a road that comes in from the right (west). Turn here and travel 1.4 miles, passing an gas well on the left, to a road on the right. Take this road 0.3 miles to a witness post on the right side of the road. The 0-foot stake is about 14 paces from the witness post at 60°M, and is marked with browse tag #135.

Map Name: Dinosaur NW



Diagrammatic Sketch:



Township: 7S Range: 24E Section: 25

GPS: NAD 83, UTM 12S 657087 E 4448956 N

DEADMAN GREENSTRIP - WRI STUDY 9R-3
Project #1081

Site Description

Site Information: The study is located approximately sixteen miles southeast of Jensen, within a treated Wyoming big sagebrush (*Artemisia tridentata* ssp. *tridentata*) portion of Deadman Bench, east of Kennedy Wash. The area is administrated by the Bureau of Land Management (BLM) as part of the Horned Toad allotment. Prior to treatment, the study was established in 2004 to monitor a greenstrip project. In the fall of 2004, the area was treated with a single drum aerator followed by a land imprinter. The treatment missed most of the original study, so in 2007 the study was moved inside the treated area approximately 100 feet (30 m) to the west of the original site. Following the treatment, cheatgrass (*Bromus tectorum*) increased substantially within the treated area, and as a result, an additional treatment was implemented in the fall of 2008. In September of 2008, a total of 523 acres were treated with Plateau (Imazapic) herbicide. Following the herbicide treatment, a seed mix of grass, forb, and browse species was drill seeded (Table - Seed Mix). The objectives of the project are to reduce the risk of potential wildfires, control cheatgrass, and establish a desirable vegetation component within the treated areas to improve habitat, forage for wildlife, and livestock grazing (WRI Database 2012). Deer/pronghorn pellet groups were sampled in low abundance in 2004 and 2011, and moderate abundance in 2007. Elk pellets were sampled in low abundance in 2011. Horse pellets were sampled in low abundance in 2004 (Table - Pellet Group Data).

SEED MIX--
Management unit 09R, Study no: 3

Project Name: Deadman Bench (2004) WRI Database #: PDB			
Application: Aerator		Acres:	680
	Seed Type	lbs in mix	lbs/acre
G	Crested Wheatgrass 'Douglas'	250	0.37
G	Crested Wheatgrass 'Ephraim'	500	0.74
G	Crested Wheatgrass 'Hycrest'	1130	1.66
G	Siberian Wheatgrass 'Vavilov'	370	0.54
G	Western Wheatgrass 'Arriba'	650	0.96
F	Alfalfa 'Ladak+'	720	1.06
F	Alfalfa 'Nomad'	630	0.93
F	Alfalfa 'Spredor 3'	720	1.06
F	Sainfoin 'Eski'	680	1.00
F	Small Burnet 'Delar'	680	1.00
B	Forage Kochia 'Immigrant'	1385	2.04
B	Fourwing Saltbush	721	1.06
Total Pounds:		8436	12.41
PLS Pounds:			10.37

Project Name: Deadman Bench - Kochia (2008) WRI Database #: 1081			
Application: Drill		Acres:	725
	Seed Type	lbs in mix	lbs/acre
B	Forage Kochia	1153	1.59
Total Pounds:		1153	1.59
PLS Pounds:			1.09

Project Name: Deadman Bench Mix (2008) WRI Database #: 1081			
Application: Drill		Acres: 725, 525, 200	
	Seed Type	lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone'	750	1.03
G	Bottlebrush Squirreltail 'Toe Jam'	350	0.48
G	Canby Bluegrass 'Canbar'	200	0.28
G	(1)Crested Wheatgrass 'Douglas'	150	0.75
G	(3)Crested Wheatgrass 'Ephraim'	400	0.76
G	(3)Crested Wheatgrass 'Hycrest'	400	0.76
G	(1)Crested Wheatgrass 'Nordan'	150	0.75
G	(2)Russian Wildrye 'Bozoisky'	200	1.00
G	(2)Siberian Wheatgrass 'Vavilov'	200	1.00
G	(2)Western Wheatgrass 'Arriba'	200	1.00
F	(1)Alfalfa 'Ladak'	300	1.50
F	(1)Alfalfa 'Ranger'	300	1.50
F	(3)Alfalfa 'Spredor'	1575	3.00
F	Blue Flax 'Appar'	200	0.28
F	Western Yarrow	70	0.10
B	Fourwing Saltbush	200	0.28
Total Pounds:		7745	10.68
PLS Pounds:			*8.35

The BLM provided a total of 4,475 pounds of seed of species (2) and (3). Seeded species (1) was provided by the Great Basin Research Center (GBRC) and seeded on 200 acres. Seeded species (2) was provided by the BLM and GBRC which were seeded onto 725 acres. Seeded species (3) was provided by the BLM and seeded on 525 acres. *The PLS is calculated based solely on the seed provided by the GBRC.

Browse: The preferred browse species on the site are Wyoming big sagebrush and forage kochia (*Kochia prostrata*). Wyoming big sagebrush has been the dominant browse species on the site since the outset of the study, even though the treatment decreased the density of sagebrush by half. The Wyoming big sagebrush is a relatively small, healthy population, with good vigor and low decadence within the population. The recruitment of young sagebrush plants to the population was excellent in 2011, with a very high amount of seedlings being sampled. In the sample years prior to 2011, recruitment was poor. Utilization of sagebrush plants has been light to moderate over the sample years. Forage kochia was seeded on the site in each of the treatments. The forage kochia is a small, healthy population with good vigor and low decadence within the population. Utilization of forage kochia has been mostly light to moderate over the sample period. Other browse species sampled on the site include dwarf rabbitbrush (*Chrysothamnus depressus*), stickyleaf low rabbitbrush (*C. viscidiflorus*), spiny hopsage (*Grayia spinosa*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: The perennial grass community is abundant and diverse. Crested wheatgrass (*Agropyron* cristatum) and western wheatgrass (*A.* smithii) are the dominant grass species on the site. The weedy annual grass species cheatgrass has been sampled with fluctuation in abundance over the sample years. Cheatgrass dominated the site in 2007, but when read in 2011; cheatgrass had decreased in abundance on the site following the herbicide treatment. Several seeded species have been sampled on the site following the treatments which include crested wheatgrass, Siberian wheatgrass (*Agropyron. fragile*), western wheatgrass, bluebunch wheatgrass (*A. spicatum*), Russian wildrye (*Elymus junceus*), and bottlebrush squirreltail (*Sitanion hystrix*), though bottlebrush squirreltail and western wheatgrass were present prior to initial treatment. Forbs are rare on the site. The seeded forb species alfalfa (*Medicago sativa*) has been sampled in low abundance on the site since 2007 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Solirec-Abracon-Begay complex, which is found on fan remnants. The parent material consists of eolian deposits over slope alluvium derived from sandstone and shale and/or slope alluvium derived from sandstone, limestone, shale, and quartzite and/or eolian deposits over alluvium derived from sandstone. The soils within this classification are characterized as deep and well drained, with a moderately to highly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a slightly alkaline soil reaction (pH 7.5) (Table - Soil Analysis Data). Bare ground cover is high on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2007, but was classified as slight in 2011.

Pre vs. Three Years Post Treatment, 2004 vs. 2007 (Aerator Treatment)

Browse: The density of Wyoming big sagebrush decreased 49% from 5,420 plants/acre to 2,760 plants/acre, and cover decreased from 16% to 4%. The health of the sagebrush population decreased with poor vigor increasing from 30% to 72%, and decadence increasing from 59% to 72% of the population. The recruitment of young sagebrush plants remained poor. The average size of the sagebrush decreased from a height/crown of 24/30 inches to 15/19 inches. Forage kochia was sampled for the first time in 2007 at a density of 240 plants/acre.

Grasses: The sum of nested frequency of perennial grasses decreased 41%, and cover decreased from 5% to 2%. The decrease in cover and frequency can be attributed to western wheatgrass and bottlebrush squirreltail which both decreased significantly in nested frequency, and cover decreased from 2% to 1% and 3% to 1%, respectively. Crested wheatgrass, western wheatgrass, and bottlebrush squirreltail were the only seeded species sampled on the site following treatment, though bottlebrush squirreltail and western wheatgrass were sampled on the site prior to the treatment. Crested wheatgrass was sampled in low abundance and provided less than 1% cover. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased 3% to 26%.

Forbs: Perennial forbs were rare on the site. The sum of nested frequency of annual forbs increased

substantially, and cover increased from less than 1% to 2%. Alfalfa was the only seeded forb species sampled, though it was sampled in low abundance.

Pre vs. Three Years Post Treatment, 2007 vs. 2011 (Herbicide Treatment)

Browse: The density of Wyoming big sagebrush remained similar in density at 2,660 plants/acre, but cover increased from 4% to 7%. The health of the sagebrush population improved with plants displaying poor vigor decreasing from 72% to 11% of the population, and decadence decreasing from 72% to 9% of the population. The recruitment of young sagebrush plants improved from 1% to 26%. The average size of the sagebrush remained similar at a height/crown of 13/18 inches. Forage kochia increased in density four-fold to 960 plants/acre.

Grasses: The sum of nested frequency of perennial grasses increased two-fold, and cover increased to 20%. The increase in frequency and cover can be largely attributed to crested wheatgrass and western wheatgrass. Crested wheatgrass and western wheatgrass increased significantly in nested frequency, and cover increased to 7% and 10%, respectively. Bottlebrush squirreltail remained similar in nested frequency, though cover increased to 2%. Siberian wheatgrass, blue bunch wheatgrass, and Russian wildrye were seeded species sampled for the first time in 2011 in low abundance. Cheatgrass decreased significantly in nested frequency, and cover decreased to 4%.

Forbs: Forbs remained rare on the site. No single forb species provided more than 1% cover in either sample year. The seeded species alfalfa remained rare on the site.

HERBACEOUS TRENDS--
Management unit 09R, Study no: 3

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'11	'04	'07	'11
G	Agropyron cristatum	a-	a9	b156	-	.01	7.21
G	Agropyron fragile	-	-	8	-	-	.33
G	Agropyron smithii	ab163	a71	b206	2.07	.95	9.51
G	Agropyron spicatum	a-	a-	b9	-	-	.39
G	Bromus tectorum (a)	ab276	b459	a253	3.11	25.87	4.16
G	Elymus junceus	-	-	5	-	-	.03
G	Poa secunda	3	2	2	.01	.00	.03
G	Sitanion hystrix	92	70	74	3.23	.97	2.13
G	Vulpia octoflora (a)	ab1	b13	a-	.00	.05	-
Total for Annual Grasses		277	472	253	3.12	25.92	4.16
Total for Perennial Grasses		258	152	460	5.32	1.93	19.64
Total for Grasses		535	624	713	8.44	27.86	23.81
F	Agoseris glauca	-	-	2	-	-	.00
F	Alyssum alyssoides (a)	a3	b109	b122	.00	.68	.60
F	Astragalus sp.	-	3	-	-	.03	-
F	Collinsia parviflora (a)	-	1	-	-	.00	-
F	Descurainia pinnata (a)	a-	c27	b13	-	.07	.02
F	Gilia sp. (a)	-	116	-	-	.52	-
F	Lappula occidentalis (a)	36	126	4	.10	.93	.00
F	Lupinus sp.	10	3	-	.02	.00	-
F	Medicago sativa	-	2	3	-	.00	.03
F	Phlox hoodii	-	1	-	-	.03	-

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'11	'04	'07	'11
F	Phlox longifolia	-	3	1	-	.00	.00
F	Ranunculus testiculatus (a)	-	1	-	-	.03	-
F	Schoencrambe linifolia	-	3	2	-	.06	.00
F	Sisymbrium altissimum (a)	-	-	3	-	-	.03
F	Sphaeralcea coccinea	32	25	15	.17	.10	.35
F	Trifolium sp.	3	-	-	.00	-	-
Total for Annual Forbs		39	380	142	0.10	2.24	0.65
Total for Perennial Forbs		45	40	23	0.19	0.23	0.39
Total for Forbs		84	420	165	0.30	2.48	1.05

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

BROWSE TRENDS--
Management unit 09R, Study no: 3

Type	Species	Strip Frequency			Average Cover %		
		'04	'07	'11	'04	'07	'11
B	Artemisia tridentata wyomingensis	94	75	66	15.15	3.77	6.00
B	Chrysothamnus depressus	-	-	1	-	.03	-
B	Chrysothamnus viscidiflorus	1	-	-	-	-	-
B	Grayia spinosa	1	-	-	.15	-	-
B	Kochia prostrata	-	8	32	-	.04	.78
B	Opuntia sp.	24	13	11	.28	.04	.15
Total for Browse		120	96	110	15.59	3.88	6.93

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 3

Species	Percent Cover		
	'04	'07	'11
Artemisia tridentata wyomingensis	16.04	3.96	7.15
Kochia prostrata	-	-	1.06
Opuntia sp.	.21	.05	.08

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 09R, Study no: 3

Species	Average leader growth (in)		
	'04	'07	'11
Artemisia tridentata wyomingensis	0.7	2.2	1.3

BASIC COVER--
Management unit 09R, Study no: 3

Cover Type	Average Cover %		
	'04	'07	'11
Vegetation	26.31	33.18	32.70
Pavement	.02	.02	.01
Litter	29.87	38.54	34.93
Cryptogams	10.39	1.12	.07
Bare Ground	44.65	38.71	39.62

SOIL ANALYSIS DATA --
Management unit 9R, Study no: 3, Study Name: Deadman Greenstrip

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
12.7	7.5	50.3	25.5	24.2	1.0	7.1	131.2	0.6

PELLET GROUP DATA--
Management unit 09R, Study no: 3

Type	Quadrat Frequency			Days use per acre (ha)		
	'04	'07	'11	'04	'07	'11
Rabbit	71	84	28	-	-	-
Elk	-	2	6	-	-	9 (22)
Deer/Pronghorn	19	34	28	19(46)	36 (89)	6 (15)
Horse	-	-	-	3 (7)	-	-
Cattle	-	2	-	-	-	-

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 3

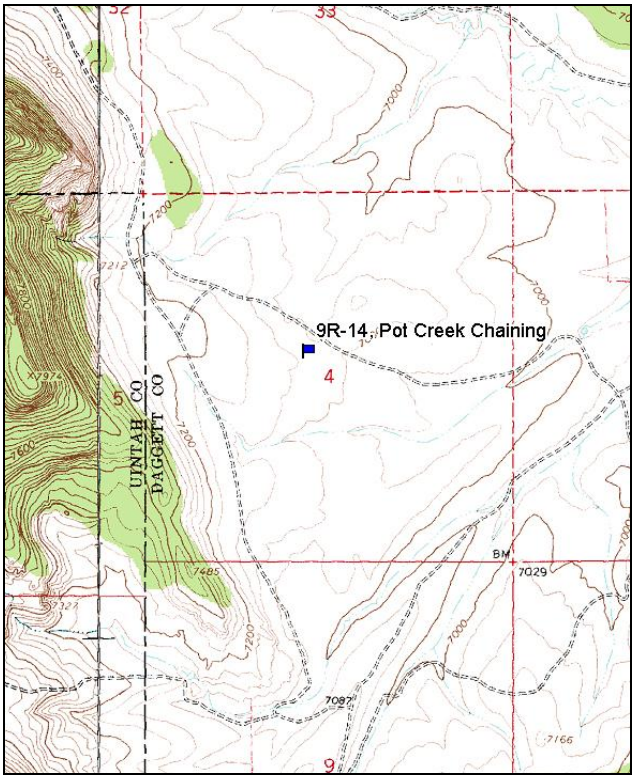
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
04	**5420**	2	39	59	-	31	1	30	24/30
07	**2760**	1	27	72	20	25	18	72	15/19
11	**2660**	26	65	9	52920	31	5	11	13/18
Chrysothamnus depressus									
04	**0**	0	0	-	-	0	0	0	-/-
07	**0**	0	0	-	-	0	0	0	-/-
11	**20**	0	100	-	-	100	0	0	2/6
Chrysothamnus viscidiflorus									
04	**20**	0	0	100	-	0	100	100	-/-
07	**0**	0	0	0	-	0	0	0	-/-
11	**0**	0	0	0	-	0	0	0	-/-
Grayia spinosa									
04	**20**	0	100	-	-	100	0	0	16/21
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Kochia prostrata									
04	**0**	0	0	-	-	0	0	0	-/-
07	**240**	67	33	-	140	0	0	0	2/3
11	**960**	29	71	-	1200	25	4	0	8/14
Opuntia sp.									
04	**740**	0	59	41	-	0	0	8	4/9
07	**320**	19	44	38	-	0	0	25	3/5
11	**320**	0	100	0	-	0	0	0	4/10

POT CREEK CHAINING - TREND STUDY NO. 9R-14-11
Project #608

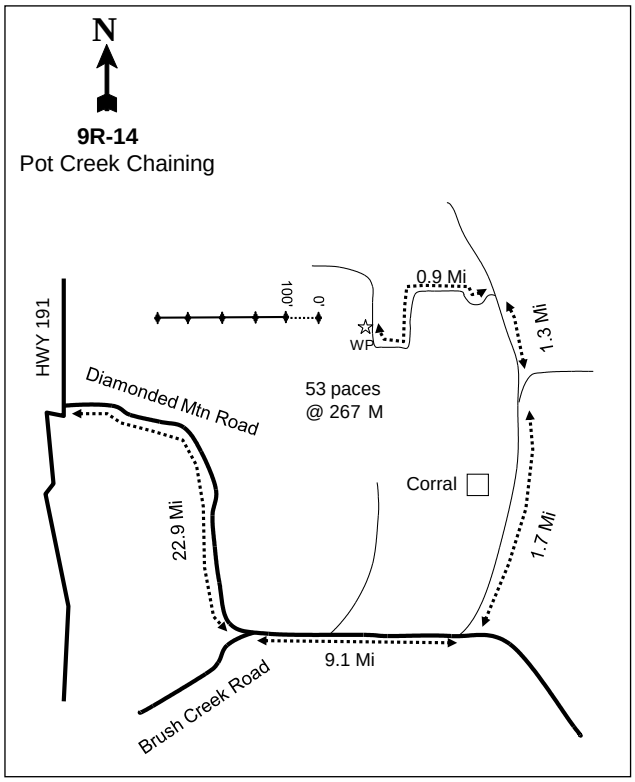
Vegetation Type: Perennial Grass
Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Winter
NRCS Ecological Site Description: Mountain Loam (Mountain Big Sagebrush), R047XC430UT
Land Ownership: BLM
Elevation: 7,078 ft (2,157 m)
Aspect: Northeast
Slope: 2%
Transect bearing: 239° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From Vernal, drive north on US 191 to mile marker 225. Turn right (east) to the Diamond Mountain road. Drive for 13.6 miles to a fork. Take the left fork and drive east on Jones Hole road for 9.1 miles to a fork to the right and a sign that reads "Pot Creek Turnoff". Turn left and drive 1.7 miles to a fork. Stay left at the fork and drive 1.3 miles to a faint road on the left. Turn left and go 0.9 miles to the witness post. From the witness post, the 0-foot stake is 53 paces at 267 degrees magnetic, and marked with browse tag # 132.

Map Name: Hoy Mountain



Diagrammatic Sketch:



Township: 2S Range: 25E Section: 4

GPS: NAD 83, UTM 12S 659297 E 4504681 N

POT CREEK CHAINING - WRI STUDY 9R-14
Project #608

Site Description

Study Information: The study is located approximately four and half miles southeast of Crouse Reservoir, within a burned mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat, in the southwest corner of the Ruple Cabin/Pot Creek basin. The area is administrated by Bureau of Land Management (BLM) as part of the Ruple Cabin allotment. The study was established in 2007 following the Pot Hole Wildfire that burned 1,396 acres in 2006, and was established following the rehabilitation treatment. The area is important peripheral breeding and brood-rearing habitat for the Diamond Mountain sage-grouse population. In September of 2006, a seed mix of grass and forb species was aerially seeded, and an Ely chaining was used to cover the seed. A seed dribbler was used to distribute antelope bitterbrush (*Purshia tridentata*) and small burnet (*Sanguisorba minor*) seed during the chaining treatment. In December of 2006, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) seed mix was aerial seeded (Table - Seed Mix). The objectives of the project are to prevent the spread of cheatgrass, reestablish a sagebrush/bitterbrush canopy, and create a diverse understory to benefit sage-grouse, big game, and cattle grazing (WRI Database 2012). In 2007, deer, elk, and cattle pellet groups were sampled in low abundance. In 2011, elk pellet groups were moderate in abundance, while cattle and deer pellet groups were low in abundance (Table - Pellet Group Data).

SEED MIX--
Management unit 09R, Study no: 14

Project Name: Ruple Cabin Wildfire Rehabilitation WRI Database #: 608			
Application: Aerial Seed		Acres:	1200
Seed Type		lbs in mix	lbs/acre
G	Big Bluegrass 'Sherman'	250	0.21
G	Bluebunch Wheatgrass 'Goldar'	601	0.50
G	Canby Bluegrass 'Canbar'	250	0.21
G	Hard Fescue	300	0.25
G	Hard Fescue 'Durar'	30	0.03
G	Orchardgrass 'Paiute'	300	0.25
G	Snake River Wheatgrass 'Secar'	600	0.50
F	Alfalfa 'Ladak'	900	0.75
F	Alfalfa 'Nomad'	900	0.75
F	Cicer Milkvetch 'Lutana'	900	0.75
F	Sainfoin 'Eski'	6217	5.18
F	Small Burnet 'Delar'	3000	2.50
F	Western Yarrow 'SID Columbia'	50	0.04
Total Pounds:		14298	11.92
PLS Pounds:			10.85

Project Name: Ruple Cabin Wildfire Rehabilitation Dribbler WRI Database #: 608			
Application: Dribbler		Acres:	1200
Seed Type		lbs in mix	lbs/acre
B	Bitterbrush	181	0.15
B	Small Burnet 'Delar'	300	0.25
Total Pounds:		481	0.40
PLS Pounds:			0.35

Project Name: Ruple Cabin Sagebrush WRI Database #: 608			
Application: Aerial Seed		Acres:	1150
Seed Type		lbs in mix	lbs/acre
B	Sagebrush, Wyoming	1151	1.00
Total Pounds:		1151	1.00
PLS Pounds:			0.23

Browse: Browse species are limited on the site. Prior to the fire, the site was a mountain big sagebrush community, and following the fire, Wyoming big sagebrush was seeded onto the site. Due to the size and difficulty of distinguishing between the two big sagebrush subspecies, plants were classified as mountain big sagebrush for the purpose of this study. The big sagebrush is not very dense and consists mostly of small, young plants, with good vigor and low decadence within the population. Recruitment of young sagebrush plants to the population has been good since the outset of the study. Other palatable browse species sampled on the site include antelope bitterbrush, slenderbush eriogonum (*Eriogonum* microthecum), and mountain

snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are abundant and diverse on the site. The dominant perennial grass species are thickspike wheatgrass (*Agropyron dasystachyum*), hard fescue (*Festuca ovina* ssp. *duriuscula*), and Sandberg bluegrass (*Poa secunda*). Three seeded species have been sampled on the site which include bluebunch wheatgrass (*Agropyron spicatum*), orchardgrass (*Dactylis glomerata*), and hard fescue. Orchardgrass and bluebunch wheatgrass were sampled in low abundance on the site. Other grass species sampled on the site include sedge (*Carex sp.*), prairie junegrass (*Koeleria cristata*), mutton bluegrass (*Poa* fendleriana), and bottlebrush squirreltail (*Sitanion hystrix*), though each of these species have been rare on the site. The weedy annual grass species cheatgrass has been sampled on the site, but has remained rare over the sample years. Perennial forbs are abundant and diverse on the site. The dominant forb species is timber poisonvetch (*Astragalus convallarius*). Other common perennial forb species include western yarrow (*Achillea millefolium*), pale agoseris (*Agoseris glauca*), tapertip hawksbeard (*Crepis acuminata*), alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), longleaf phlox (*Phlox longifolia*), and small burnet. Four seeded forb species have been sampled on the site and occurred in moderate abundance, which included western yarrow, alfalfa, sainfoin, and small burnet. Annual forb species are diverse, but are not overly abundant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Cortyzack-Flynncove association, which is found on hills and fan remnants. The parent material consists of eolian deposits over slope alluvium derived from sandstone, limestone, shale, and quartzite and/or slope alluvium derived from sandstone and quartzite. The soils within this classification are characterized as deep and well drained, with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.6). Bare ground cover is moderate on the site, though there is a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2007 and 2011.

Trend Assessments

Browse

- **2007 to 2011 - up (+2):** Browse species remained limited on the site. The density of mountain big sagebrush increased substantially from 20 plants/acre to 620 plants/acre, and cover increased to 1%. The health of the sagebrush population remained good with low decadence and good vigor within the population. The recruitment of young sagebrush plants remained good at 45% of the population.

Grass

- **2007 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased 22%, and cover increased from 17 % to 26%. Western wheatgrass increased significantly in nested frequency, and the cover increased from 7% to 16%. Sandberg bluegrass remained similar in nested frequency, though cover decreased slight from 9% to 8%. Hard fescue, bluebunch wheatgrass, and orchardgrass were the seeded species sampled on the site, though bluebunch wheatgrass was sampled prior to the treatment. Hard fescue provided 2% cover in 2011. The weedy annual grass species cheatgrass was sampled on the site, but has provided very little cover.

Forb

- **2007 to 2011 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 16%, though cover increased from 11% to 25%. The dominant perennial forb species timber poisonvetch remained similar in nested frequency, but cover increased from 4% to 9%. Four seeded species were sampled on the site, which include western yarrow, alfalfa, sainfoin, and small burnet. Western yarrow increased significantly in nested frequency, and cover increased slightly from less than 1% to 2%. Alfalfa, sainfoin, and small burnet decreased significantly in nested frequency, but, increased in cover from less than 1% to 1%, from 2% to 3%, and from 1% to 2%, respectively.

HERBACEOUS TRENDS--
Management unit 09R, Study no: 14

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
G	Agropyron dasystachyum	$_{a}$278	$_{b}$364	7.35	15.52
G	Agropyron spicatum	11	19	.05	.70
G	Bromus tectorum (a)	$_{a}$4	$_{b}$20	.04	.06
G	Carex sp.	28	13	.10	.08
G	Dactylis glomerata	-	3	-	.00
G	Festuca ovina duriuscula	$_{a}$-	$_{b}$34	-	1.66
G	Koeleria cristata	-	1	-	.03
G	Poa fendleriana	$_{b}$30	$_{a}$3	.40	.03
G	Poa secunda	216	251	9.01	7.61
G	Sitanion hystrix	-	1	-	.03
Total for Annual Grasses		4	20	0.03	0.06
Total for Perennial Grasses		563	689	16.92	25.69
Total for Grasses		567	709	16.96	25.75
F	Achillea millefolium	$_{a}$14	$_{b}$81	.11	2.07
F	Agoseris glauca	70	94	.91	2.23
F	Arabis sp.	3	-	.00	-
F	Aster sp.	5	-	.01	-
F	Astragalus convallarius	140	147	4.14	9.22
F	Astragalus tenellus	-	3	-	.15
F	Calochortus nuttallii	$_{b}$31	$_{a}$2	.13	.01
F	Castilleja linariaefolia	7	-	.01	-
F	Chaenactis douglasii	-	1	-	.00
F	Chorispora tenella (a)	$_{b}$18	$_{a}$1	.71	.00
F	Collinsia parviflora (a)	$_{a}$223	$_{b}$179	2.84	.90
F	Collomia linearis (a)	$_{a}$7	$_{b}$28	.09	.24
F	Crepis acuminata	$_{a}$13	$_{b}$39	.45	1.13
F	Cymopterus sp.	7	4	.07	.05
F	Delphinium nuttallianum	$_{b}$41	$_{a}$-	.17	-
F	Descurainia pinnata (a)	1	2	.00	.03
F	Erigeron eatonii	-	5	-	.06
F	Eriogonum sp.	-	3	-	.03
F	Gayophytum ramosissimum(a)	7	4	.22	.03
F	Lactuca serriola (a)	-	2	-	.01
F	Lepidium sp. (a)	3	-	.00	-
F	Lupinus argenteus	-	1	-	.15
F	Machaeranthera grindelioides	-	4	-	.04
F	Medicago sativa	$_{b}$49	$_{a}$14	.36	1.20
F	Microsteris gracilis (a)	$_{a}$21	$_{b}$62	.18	.69
F	Onobrychis viciaefolia	$_{b}$122	$_{a}$54	1.83	2.92
F	Phlox austromontana	5	11	.04	.27
F	Phlox longifolia	149	150	1.10	2.73
F	Polygonum douglasii (a)	$_{a}$41	$_{b}$101	.23	.40
F	Sanguisorba minor	$_{b}$82	$_{a}$62	.65	1.74

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
F	Sisymbrium altissimum (a)	-	7	-	.15
F	Sphaeralcea coccinea	$_{a}$14	$_{b}$34	.41	.65
F	Tragopogon dubius (a)	$_{a}$-	$_{b}$64	-	1.59
F	Trifolium sp.	$_{b}$101	$_{a}$4	.45	.01
F	Zigadenus paniculatus	1	7	.06	.04
Total for Annual Forbs		321	450	4.28	4.07
Total for Perennial Forbs		854	720	10.96	24.76
Total for Forbs		1175	1170	15.24	28.84

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

BROWSE TRENDS--
Management unit 09R, Study no: 14

Type	Species	Strip Frequency '07	Strip Frequency '11	Average Cover % '07	Average Cover % '11
B	Artemisia tridentata vaseyana	1	19	.01	.39
B	Eriogonum microthecum	1	1	-	-
B	Opuntia sp.	2	0	.00	-
B	Purshia tridentata	1	1	.38	.38
B	Tetradymia canescens	0	1	-	.03
Total for Browse		5	22	0.39	0.79

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 14

Species	Percent Cover '07	Percent Cover '11
Artemisia tridentata vaseyana	-	1.08
Purshia tridentata	.05	.05

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 09R, Study no: 14

Species	Average leader growth (in) '07	Average leader growth (in) '11
Artemisia tridentata vaseyana	-	3.2

BASIC COVER--
Management unit 09R, Study no: 14

Cover Type	Average Cover % '07	'11
Vegetation	33.59	50.52
Rock	.05	.03
Pavement	.73	.09
Litter	11.78	36.95
Cryptogams	.05	2.09
Bare Ground	65.52	22.72

SOIL ANALYSIS DATA --
Management unit 9R, Study no: 14, Study Name: Pot Creek Chaining

pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.6	50.2	25.4	24.4	2.6	17.4	195.2	0.6

PELLET GROUP DATA--
Management unit 09R, Study no: 14

Type	Quadrat Frequency '07	'11	Days use per acre (ha) '07	'11
Rabbit	8	1	-	-
Elk	6	3	3 (8)	12 (30)
Deer	1	6	3 (8)	6 (15)
Cattle	2	14	2 (4)	7 (18)

BROWSE CHARACTERISTICS--
Management unit 09R, 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)
Artemisia tridentata vaseyana									
07	**20**	100	0	-	340	0	0	0	-/-
11	**620**	45	55	-	-	0	0	0	13/14
Eriogonum microthecum									
07	**20**	0	100	-	-	0	0	0	7/9
11	**20**	0	100	-	-	0	0	0	7/10
Opuntia sp.									
07	**40**	0	100	-	20	0	0	0	3/7
11	**0**	0	0	-	-	0	0	0	3/8
Purshia tridentata									
07	**20**	0	100	-	-	0	100	0	6/28
11	**20**	0	100	-	-	0	100	0	17/40

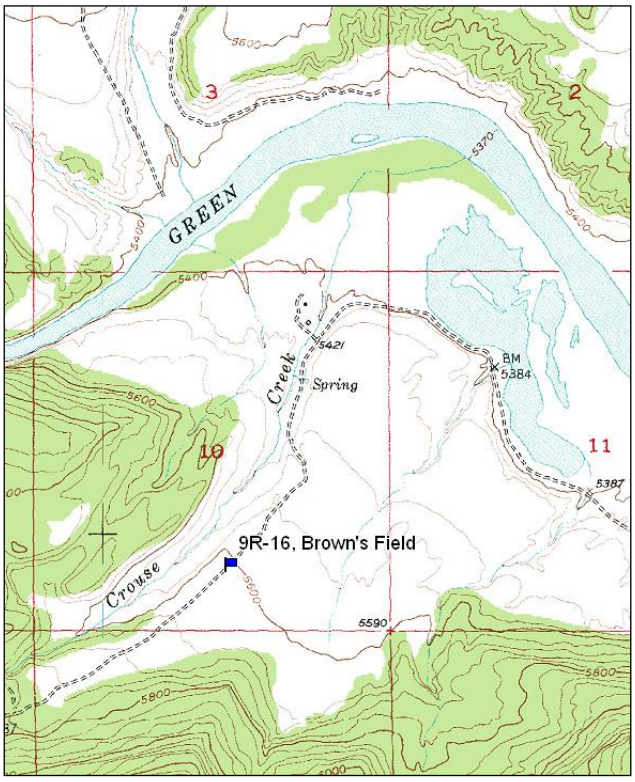
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Symphoricarpos oreophilus									
07	**0**	0	0	-	-	0	0	0	19/35
11	**0**	0	0	-	-	0	0	0	19/38
Tetradymia canescens									
07	**0**	0	0	-	-	0	0	0	9/12
11	**40**	0	100	-	-	0	0	0	12/25

BROWN'S FIELD - TREND STUDY NO. 9R-16-11
Project #1152

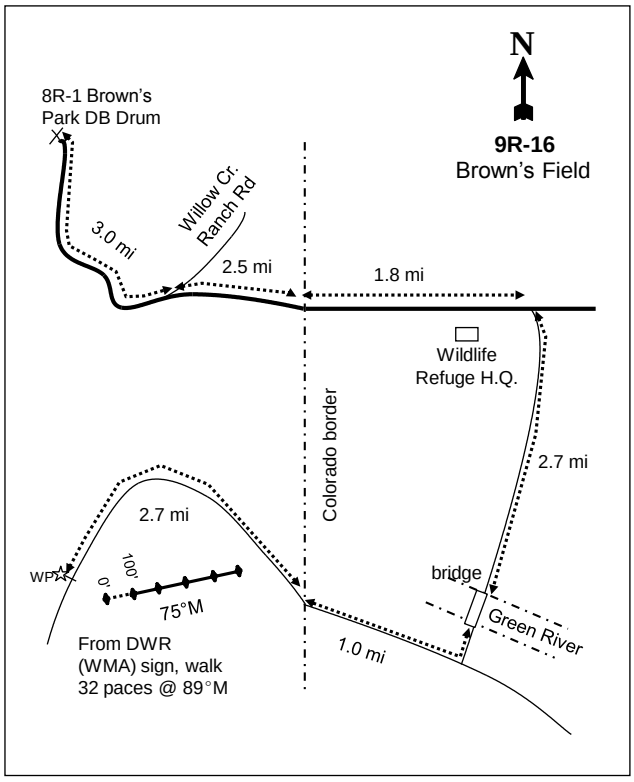
Vegetation Type: Annual Forb, Annual Grass
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT
Land Ownership: UDWR
Elevation: 5,606 ft. (1,709 m)
Aspect: Northeast
Slope: 5%
Transect bearing: 75° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:
From Dutch John, proceed north towards Antelope Flat on Highway U.S. 191 for approximately 8 miles, and before the Wyoming border, turn east on the Antelope Flat Road. 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 Area) 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). Prior to treatment, the study site was established in 2008 to monitor the effects of a rangeland drill seeding and Plateau (Imazapic) herbicide treatment 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 add valuable habitat for wildlife species (WRI Database 2012). In 2008, deer pellet groups were sampled in high abundance, while elk pellet groups were sampled in moderate abundance. In 2011, deer pellet groups were sampled in low abundance, while elk pellet groups were sampled in moderate abundance (Table - Pellet Group Data).

SEED MIX--
Management unit 09R, Study no: 16

Project Name: Brown's Park Fields (2009) WRI Database #: 1152			
Application: Rangeland Drill		Acres:	161
Seed type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone'	100	0.62
G	Bottlebrush Squirreltail 'Toe Jam'	50	0.31
G	Canby Bluegrass 'Canbar'	50	0.31
G	Crested Wheatgrass 'Douglas'	100	0.62
G	Crested Wheatgrass 'Hycrest'	100	0.62
G	Crested Wheatgrass 'Nordan'	100	0.62
G	Intermediate Wheatgrass 'Oahe'	200	1.24
G	Russian Wildrye 'Bozoisky'	150	0.93
G	Siberian Wheatgrass 'Vavilov'	150	0.93
G	Snake River Wheatgrass 'Secar'	100	0.62
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

Project Name: Crouse Bench (2006) WRI Database #: 26			
Application: Rangeland Drill		Acres:	225
Seed type		lbs in mix	lbs/acre
G	Thickspike Wheatgrass 'Bannock'	225	1.40
G	Orchardgrass 'Paiute'	55	0.34
G	Canby Bluegrass 'Canbar'	55	0.34
F	Alfalfa 'Nomad'	450	2.80
F	Sainfoin 'Eski'	900	5.59
F	Small Burnet 'Delar'	675	4.19
B	Sagebrush, Wyoming	225	1.40
B	Forage Kochia	225	1.40
Total Pounds:		2810	12.49
PLS Pounds:			10.57

Browse: Browse species are very rare on the site. Forage kochia (*Kochia prostrata*), fourwing saltbush (*Atriplex canescens*), and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) are the three species that were seeded on the site, though each of these species were sampled in low abundance on the site. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and somewhat diverse on the site, though the invasive annual grass species cheatgrass (*Bromus tectorum*) dominates the grass component and provides the majority of the grass cover. Crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. smithii*), and intermediate wheatgrass (*A. intermedium*) were the most common perennial grass species sampled on the site. Forbs are abundant, but are not diverse and have been dominated by weedy annual species that include annual kochia (*Kochia scoparia*), Russian thistle (*Salsola iberica*), and tumblemustard (*Sisymbrium altissimum*), though Russian thistle and tumble mustard were not abundant on the site following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Solirec component, which is found on fan remnants. The parent material consists of eolian deposits over slope alluvium derived from sandstone and shale. The soils within this classification are characterized as deep and well drained, with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is high on the site, though there is a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: Browse species remained limited on the site. The seeded species Wyoming big sagebrush, forage kochia, and fourwing saltbush have been sampled on the site in low abundance. Wyoming big sagebrush was sampled for the first time in 2011 at 20 plants/acre. Forage kochia and fourwing saltbush were sampled in both sample years. Forage kochia was sampled in the density strips for the first time in 2011 at 20 plants/acre. Fourwing saltbush has been only sampled in height/crown measurements.

Grasses: The sum of nested frequency of perennial grasses decreased 29%, though cover remained similar at 8%. Intermediate wheatgrass decreased significantly in nested frequency, and cover decreased from 6% to 3%. Western wheatgrass was sampled for the first time in 2011 at a cover of 3%. Crested wheatgrass remained similar in nested frequency and provided 2% cover. Cheatgrass decreased significantly in nested frequency, though cover remained similar at 10%.

Forbs: Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs decreased 72%, but cover increased from 9% to 17%. The changes in nested frequency and cover of annual forbs can be attributed to annual kochia, which decreased significantly in nested frequency, but cover increased from 5% to 15%.

HERBACEOUS TRENDS--
Management unit 09R, Study no: 16

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	57	61	1.24	1.47
G	Agropyron fragile	-	1	-	.15
G	Agropyron intermedium	$_{b}$199	$_{a}$57	5.67	2.54
G	Agropyron smithii	$_{a}$-	$_{b}$89	-	3.34
G	Bromus tectorum (a)	$_{b}$371	$_{a}$202	9.93	9.69
G	Elymus junceus	6	5	.19	.19
G	Oryzopsis hymenoides	2	-	.15	-
G	Sitanion hystrix	-	-	-	.00
G	Sporobolus cryptandrus	$_{b}$36	$_{a}$-	.38	-
Total for Annual Grasses		371	202	9.93	9.69

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
Total for Perennial Grasses		300	213	7.64	7.71
Total for Grasses		671	415	17.57	17.40
F	Chenopodium fremontii (a)	-	2	-	.03
F	Chenopodium leptophyllum(a)	1	8	.00	.55
F	Helianthus annuus (a)	-	6	-	.21
F	Iva axillaris	$_{a}$13	$_{b}$26	.22	1.08
F	Kochia scoparia (a)	$_{b}$269	$_{a}$136	5.28	14.89
F	Medicago sativa	1	-	.00	-
F	Penstemon sp.	$_{b}$25	$_{a}$-	.13	-
F	Salsola iberica (a)	$_{b}$163	$_{a}$8	.32	.60
F	Sisymbrium altissimum (a)	$_{b}$164	$_{a}$5	2.90	.23
F	Sphaeralcea coccinea	2	3	.01	.03
F	Tragopogon dubius (a)	3	-	.03	-
Total for Annual Forbs		600	165	8.55	16.53
Total for Perennial Forbs		41	29	0.36	1.11
Total for Forbs		641	194	8.92	17.65

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

BROWSE TRENDS--
Management unit 09R, Study no: 16

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia tridentata wyomingensis	0	1	-	-
B	Kochia prostrata	0	1	.00	-
B	Opuntia sp.	3	3	.15	.15
Total for Browse		3	5	0.15	0.15

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 16

Species	Percent Cover '08	Percent Cover '11
Kochia prostrata	.06	.20
Opuntia sp.	-	.18

BASIC COVER--
Management unit 09R, Study no: 16

Cover Type	Average Cover % '08	'11
Vegetation	35.77	33.79
Rock	.30	.00
Pavement	.61	0
Litter	33.20	24.56
Bare Ground	43.50	43.91

SOIL ANALYSIS DATA --
Management unit 9R, Study no: 16, Study Name: Brown's Field

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	'11	Days use per acre (ha) '08	'11
Rabbit	69	1	-	-
Elk	31	12	28 (69)	23 (56)
Deer	61	15	86 (213)	11 (28)

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)
Artemisia tridentata wyomingensis									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	-/-
Atriplex canescens									
08	**0**	0	0	-	-	0	0	0	21/28
11	**0**	0	0	-	-	0	0	0	34/42
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	26/50
11	**0**	0	0	-	-	0	0	0	24/36
Gutierrezia sarothrae									
08	**0**	0	0	-	-	0	0	0	8/13
11	**0**	0	0	-	-	0	0	0	-/-
Kochia prostrata									
08	**0**	0	0	-	-	0	0	0	3/9
11	**20**	0	100	-	-	0	0	0	-/-

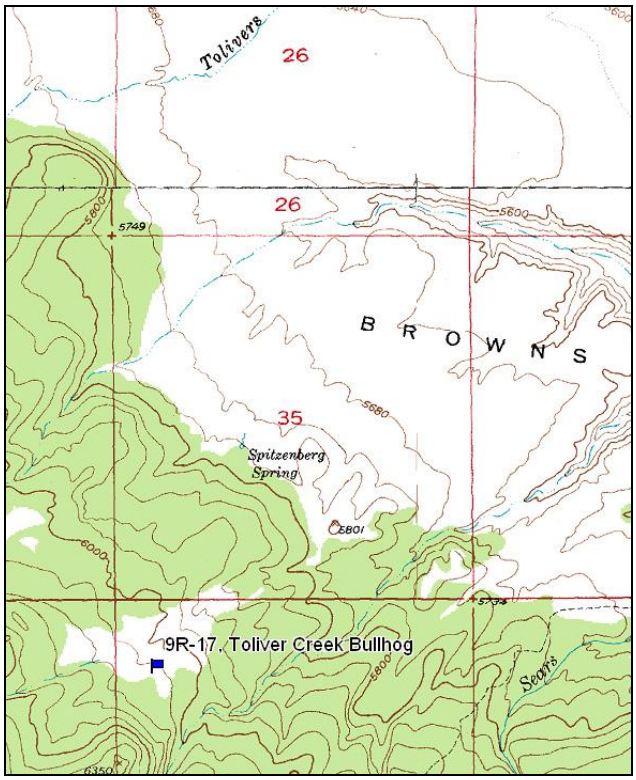
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Opuntia sp.									
08	**100**	0	100	-	-	0	0	0	3/8
11	**80**	0	100	-	-	0	0	0	4/15

TOLIVER CREEK BULLHOG - TREND STUDY NO. 9R-17-11
Project #1084

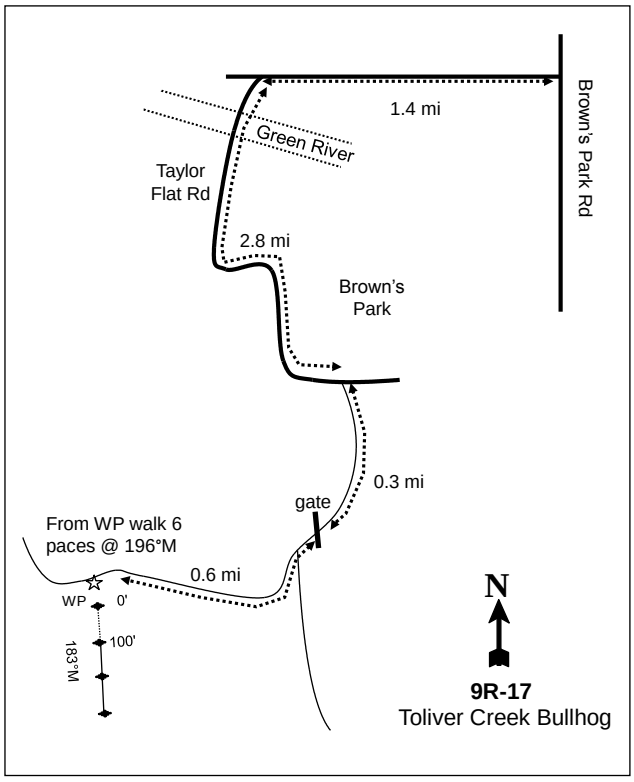
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Stony Loam (Pinyon-Utah Juniper), R047XC335UT
Land Ownership: SITLA
Elevation: 6,057 ft. (1,846 m)
Aspect: Northeast
Slope: 4%
Transect bearing: 183° magnetic
Belt placement: 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). Prior to treatment, the study was established in 2008 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. The area was aerially seeded with a seed mix of grass, forb, and browse species (Table - Seed Mix) shortly after bullhog operations began in the fall of 2008. 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 2012). Deer pellet groups were sampled in high abundance in 2008 and 2011. Elk pellet groups were sampled in moderate abundance in 2008, but elk pellet groups were low in abundance in 2011. Sampled cattle sign was moderate in 2008, but was absent in 2011 (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 Wheatgrass '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 are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), Utah serviceberry (*Amelanchier utahensis*), and skunk bush (*Rhus trilobata*). Mountain big sagebrush is the dominant browse species and has provided the majority of the canopy cover on the site over the sample years (Table - Canopy Cover). The mountain big sagebrush is a moderate to heavily used population with low decadence and good vigor within the population, though decadence and poor vigor were high prior to the treatment. The recruitment of young sagebrush plants to the population was poor in 2008, but was good in 2011. Other browse species sampled on the site include pricklypear cactus (*Opuntia sp.*), rubber rabbitbrush (*Chrysothamnus nauseous*), broom snakeweed (*Gutierrezia sarothrae*), and woods rose (*Rosa woodsii*) (Table - Browse Characteristics). Pinyon pine and Utah juniper trees were common on the site in 2008, but following treatment decreased in abundance and size (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase II prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Perennial grasses are fairly abundant and diverse. The dominant perennial grass

species are western wheatgrass (*Agropyron smithii*) and needle-and-thread (*Stipa comata*) which provides the majority of the grass cover on the study site. Seeded species sampled on the site include western wheatgrass, bluebunch wheatgrass (*A. spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), and Sandberg bluegrass (*Poa secunda*), though western wheatgrass, Sandberg bluegrass, and Indian ricegrass were present on the site prior to the treatment. Other grass species sampled on the site include crested wheatgrass (*A. cristatum*), sheep fescue (*Festuca ovina*), sedge (*Carex sp*.), Sandberg bluegrass, mutton bluegrass (*P. fendleriana*), bottlebrush squirreltail (*Sitanion hystrix*) and alkali sacaton (*Sporobolus airoides*). The weedy annual grass species cheatgrass (*Bromus tectorum*) and the native annual grass species sixweeks fescue (*Vulpia octoflora*) were also common on the site, though sixweeks fescue decreased in abundance following the treatment. Forbs are rare on the site, though diversity increased following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Tridell-Waterhill association, which is found on hills and fan remnants. The parent material consists of slope alluvium derived from sandstone, limestone, shale, and quartzite. The soils within this classification are characterized as deep and well drained with a moderately permeable restrictive layer (Soil Survey Staff 2011). 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 on the site, though there is a high amount of litter and moderate amount of vegetation and pavement that provide protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: The density of mountain big sagebrush increased by 17%, and canopy cover increased from 12% to 15%. The health of the sagebrush population improved with decadence decreasing from 33% to 6%, and plants displaying poor vigor decreasing from 17% to 6%. The recruitment of young sagebrush plants to the population improved from 3% to 14%. Pinyon pine and Utah juniper decreased in density from 53 trees/acre to 8 trees/acre and 77 trees/acre to 21 trees/acre, respectively. The average trunk diameter of pinyon and juniper trees decreased from 5.2 inches to 2.1 inches and 9.0 inches to 4.5 inches, respectively. Canopy cover of pinyon and juniper trees decreased from 4% and 6% to less than 1%, respectively.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover increased from 6% to 13%. Western wheatgrass increased significantly in nested frequency, and cover increased from 1% to 3%. Needle-and-thread remained similar in nested frequency, but cover increased from 2% to 5%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from 2% to 8%.

Forbs: Perennial forbs remained rare on the site, though the sum of nested frequency increased two-fold, and cover increased from less than 1% to 2%. Annual forbs remained rare on the site. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 09R, Study no: 17

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	18	22	.36	1.10
G	Agropyron smithii	$_{a}$108	$_{b}$155	1.28	2.94
G	Agropyron spicatum	-	14	-	.34
G	Bromus tectorum (a)	$_{a}$172	$_{b}$325	1.67	7.80
G	Carex obtusata	39	44	.94	.93
G	Festuca ovina	-	11	-	.02
G	Oryzopsis hymenoides	14	9	.07	1.15

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Poa fendleriana	2	-	.01	-
G	Poa secunda	$_{b}$90	$_{a}$31	1.21	.63
G	Sitanion hystrix	2	11	.06	.36
G	Sporobolus airoides	7	-	.01	-
G	Stipa comata	94	111	2.22	5.14
G	Vulpia octoflora (a)	$_{b}$104	$_{a}$44	.26	.16
Total for Annual Grasses		276	369	1.93	7.97
Total for Perennial Grasses		374	408	6.20	12.63
Total for Grasses		650	777	8.13	20.60
F	Alyssum alyssoides (a)	$_{a}$12	$_{b}$45	.03	.19
F	Astragalus convallarius	-	9	-	.60
F	Calochortus nuttallii	-	7	-	.03
F	Chenopodium leptophyllum(a)	-	8	-	.02
F	Cirsium sp.	-	1	-	.03
F	Cymopterus sp.	1	-	.00	-
F	Descurainia pinnata (a)	2	4	.01	.01
F	Gayophytum ramosissimum(a)	$_{a}$-	$_{b}$21	-	.05
F	Gilia sp. (a)	8	20	.05	.04
F	Iva axillaris	$_{a}$15	$_{b}$37	.02	.63
F	Lactuca serriola (a)	-	2	-	.00
F	Lappula occidentalis (a)	3	-	.01	-
F	Mentzelia albicaulis (a)	-	2	-	.00
F	Orobanche fasciculata	5	-	.02	-
F	Plantago patagonica (a)	-	2	-	.01
F	Sphaeralcea coccinea	20	42	.20	.42
F	Tragopogon dubius (a)	-	2	-	.03
Total for Annual Forbs		25	106	0.11	0.36
Total for Perennial Forbs		41	96	0.25	1.72
Total for Forbs		66	202	0.36	2.08

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	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Amelanchier utahensis	0	1	-	.03
B	Artemisia tridentata vaseyana	74	81	10.82	9.68
B	Gutierrezia sarothrae	18	23	.45	1.08
B	Juniperus osteosperma	5	1	7.64	-
B	Opuntia sp.	17	24	.79	.51
B	Pinus edulis	6	1	3.64	-
B	Rhus trilobata	0	1	-	-
Total for Browse		120	132	23.35	11.30

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 17

Species	Percent Cover	
	'08	'11
Artemisia tridentata vaseyana	12.41	14.69
Gutierrezia sarothrae	.35	1.20
Juniperus osteosperma	5.90	.23
Opuntia sp.	.58	.60
Pinus edulis	4.34	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 09R, Study no: 17

Species	Average leader growth (in)	
	'08	'11
Artemisia tridentata vaseyana	1.2	1.8

POINT-QUARTER TREE DATA--
Management unit 09R, Study no: 17

Species	Trees per Acre		Average diameter (in)	
	'08	'11	'08	'11
Juniperus osteosperma	77	21	9.0	4.5
Pinus edulis	53	8	5.2	2.1

BASIC COVER--
Management unit 09R, Study no: 17

Cover Type	Average Cover %	
	'08	'11
Vegetation	29.12	32.37
Rock	.07	.06
Pavement	6.01	.09
Litter	42.22	38.32
Cryptogams	1.98	1.41
Bare Ground	42.22	36.63

SOIL ANALYSIS DATA --
Management unit 9R, Study no: 17, Study Name: Toliver Creek Bullhog

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	'11	Days use per acre (ha) '08	'11
Rabbit	73	10	-	-
Elk	10	12	26 (65)	12 (30)
Deer	20	25	76 (187)	46 (114)
Cattle	7	-	27 (66)	-

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 17

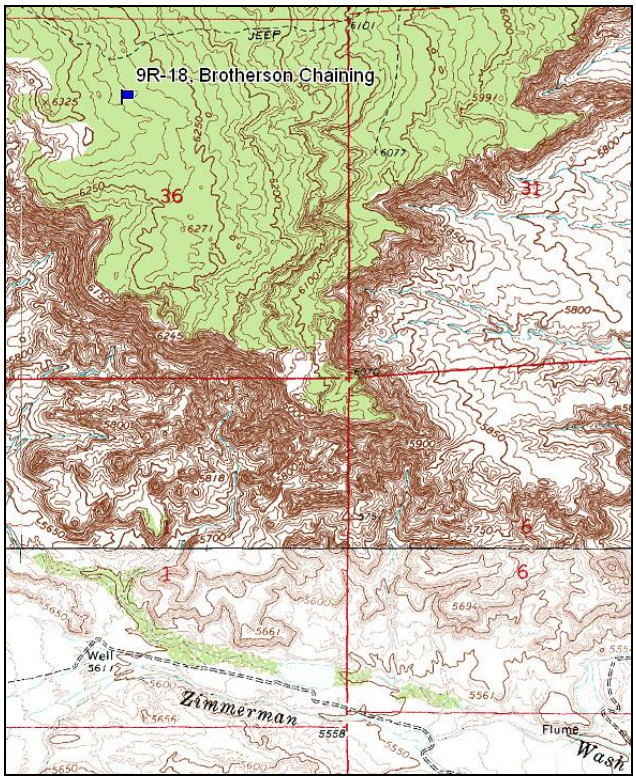
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	22/26
Artemisia tridentata vaseyana									
08	**4120**	3	63	33	160	21	65	17	14/23
11	**4800**	14	80	6	240	27	30	6	13/23
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	14/15
Gutierrezia sarothrae									
08	**420**	0	90	10	-	0	5	5	7/9
11	**860**	9	84	7	-	0	0	9	8/13
Juniperus osteosperma									
08	**120**	17	67	17	-	0	0	33	-/-
11	**20**	0	100	0	-	0	0	0	-/-
Opuntia sp.									
08	**660**	6	88	6	40	0	0	3	4/15
11	**660**	0	100	0	-	0	0	0	4/11
Pinus edulis									
08	**120**	17	83	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	-/-
Rhus trilobata									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	6/5
Rosa woodsii									
08	**0**	0	0	-	-	0	0	0	14/14
11	**0**	0	0	-	-	0	0	0	11/9

BROTHERSON CHAINING - TREND STUDY NO. 9R-18-11
Project #1150

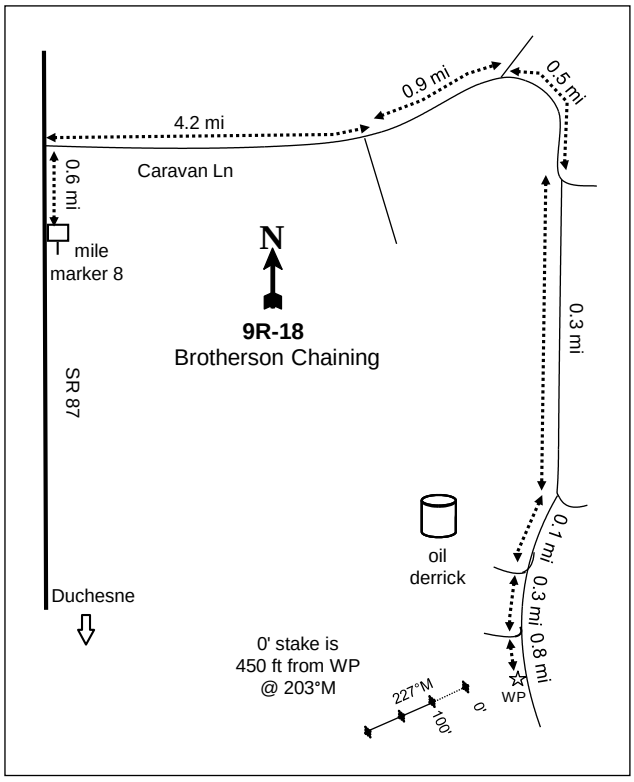
Vegetation Type: Perennial Grass
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 6,284 ft. (1,915 m)
Aspect: Northeast
Slope: 2%
Transect bearing: 227° magnetic
Belt placement: line 1 (11ft and 95), line 2 (54ft), 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. Prior to treatment, the study was established in 2008 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 Ely chained. After the first pass with the chain, a seed mix of grass and forb species was aerially seeded over the project area. Following the second pass of the chain, the project area was again aerially seeded with browse species. The smaller treatment polygon totaling 110 acres was aerially seeded with forage kochia (*Kochia prostrata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and the larger treatment polygon totaling 237 acres was seeded with kochia only (Table - Seed Mix). The study site is located in the larger treatment area. An adjacent property to the project area had been chained in the past with successful results. 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 2012). In 2008, deer pellet groups were sampled in moderate abundance, while elk and cattle sign were sampled in low abundance. In 2011, deer and elk pellet groups were sampled in low abundance (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		lbs in mix	lbs/acre
G	Blue Grama	40	0.20	B	Forage Kochia	350	1.75
G	Bluebunch Wheatgrass 'Goldar'	200	1.00	Total Pounds:		350	1.75
G	Crested Wheatgrass 'Nordan'	200	1.00	PLS Pounds:			1.16
G	Indian Ricegrass 'Rimrock'	200	1.00				
G	Russian Wildrye 'Bozoisky'	200	1.00				
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*), basin big sagebrush (*A. tridentata* ssp. *tridentata*), green ephedra (*Ephedra viridis*), and forage kochia (*Kochia prostrata*). Forage kochia and black sagebrush are the dominant preferred browse species on the site. The black sagebrush is a small, lightly used population, with low decadence and good vigor within the population, though decadence was moderately high prior to the treatment. The basin big sagebrush is a small, lightly used population, with low decadence and good vigor within the population, though decadence and poor vigor were high prior to the treatment. The recruitment of young black sagebrush and basin big sagebrush plants was poor in 2008, but was good in 2011. The seeded species forage kochia was sampled in moderately low abundance on the site. Recruitment of young forage kochia plants to the population was good and seedling production was high. Other browse species sampled on the site include spiny hopsage (*Grayia spinosa*), stickyleaf low rabbitbrush

(*Chrysothamnus viscidiflorus*), black greasewood (*Sarcobatus vermiculatus*), and pricklypear cactus (*Opuntia sp*.) (Table - Browse Characteristics). Prior to the treatment, Utah juniper dominated the overstory vegetation, but following the treatment became rare on the site (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase II transitioning into Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Perennial grasses are abundant and diverse on the site, but prior to treatment grasses were not abundant or diverse, and were in poor condition on the site. The dominant perennial grass species are crested wheatgrass (*Agropyron cristatum*), thickspike wheatgrass (*A. dasystachyum*), and Indian ricegrass (*Oryzopsis hymenoides*). Prior to the treatment, perennial grass species were very rare on the site, and no perennial grass species were sampled in 2008. Seeded grass species sampled on the site include crested wheatgrass, thickspike wheatgrass, bluebunch wheatgrass (*A. spicatum*), Russian wildrye (*Elymus junceus*), and Indian ricegrass. The weedy annual grass species cheatgrass (*Bromus tectorum*) has been sample on the site in low abundance since the outset of the study. Other grass species sampled on the site include the native annual species sixweeks fescue (*Vulpia octoflora*). Forbs are moderately abundant and somewhat diverse on the site. The dominant perennial forb species is Douglas chaenactis (*Chaenactis douglasii*), which has provided the majority of the perennial forb cover over the sample years. Perennial forbs were not very common the site prior to the treatment. The seeded species blue flax (*Linum perenne*) was sampled in low abundance on the site following the treatment. Annual forbs have been moderately abundant over the sample years (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is high on the site, though there is a moderately high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008 and 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: The density of black sagebrush decreased 43% from 920 plants/acre to 520 plants/acre, and canopy cover decreased from 3% to 2%. The health of the black sagebrush population improved with decadence decreasing from 20% to 0%, and plants displaying poor vigor decreasing from 7% to 0%. The recruitment of young black sagebrush plants to the population improved from 2% to 12%. Basin big sagebrush decreased 20% in density from 700 plants/acre to 560 plants/acre, and canopy cover decreased from 3% to less than 1%. The health of the basin big sagebrush population improved with decadence decreasing from 43% to 0%, and plants displaying poor vigor decreasing from 23% to 4%. The recruitment of young basin big sagebrush plants to the population improved substantially from 0% to 75%. Forage kochia was sampled for the first time at a density of 900 plants/acre and provided 5% canopy cover. Utah juniper decreased in density from 77 trees/acre to 18 trees/acre and the average trunk diameter decreased from 14.1 inches to 4.3 inches. Canopy cover of juniper trees decreased from 16% to less than 1%.

Grasses: The sum of nested frequency of perennial grasses increased substantially, cover increased from 0% to 14%. Perennial grasses were very rare on the site prior to the treatment, and were not sampled on the study site in 2008. In 2011, the dominant grass species were thickspike wheatgrass, crested wheatgrass, and Indian ricegrass, which provided 3%, 5%, and 5% cover, respectively. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased to 1%.

Forbs: The sum of nested frequency increased two-fold, and cover increased from 2% to 4%. Diversity of forbs increased on the site with several new species being sampled for the first time in 2011. Annual forbs increased 54% in the sum of nested frequency, and cover increased from 3% to 5%.

HERBACEOUS TRENDS--
Management unit 09R, Study no: 18

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a-	b95	-	5.08
G	Agropyron dasystachyum	a-	b95	-	3.39
G	Agropyron spicatum	a-	b23	-	.14
G	Bromus tectorum (a)	a15	b90	.03	.60
G	Elymus junceus	a-	b13	-	.39
G	Oryzopsis hymenoides	a-	b87	-	5.03
G	Vulpia octoflora (a)	5	-	.01	-
Total for Annual Grasses		20	89	0.03	0.60
Total for Perennial Grasses		0	314	0	14.05
Total for Grasses		20	403	0.03	14.65
F	Abronia fragrans	-	7	-	.30
F	Arabis sp.	3	4	.03	.01
F	Astragalus convallarius	-	4	-	.03
F	Chaenactis douglasii	a78	b155	1.18	2.50
F	Chenopodium leptophyllum(a)	a42	b129	.42	1.84
F	Cryptantha sp.(a)	a-	b21	-	.20
F	Descurainia pinnata (a)	b70	a16	1.18	.07
F	Eriogonum cernuum (a)	93	90	1.27	.52
F	Gilia sp. (a)	b18	a-	.07	-
F	Halogeton glomeratus (a)	-	3	-	.01
F	Lappula occidentalis (a)	7	-	.04	-
F	Linum perenne	-	6	-	.04
F	Microsteris gracilis (a)	-	2	-	.00
F	Polygonum douglasii (a)	-	7	-	.01
F	Salsola iberica (a)	a-	b88	-	2.06
F	Schoencrambe linifolia	a7	b31	`.24	1.22
F	Sisymbrium altissimum (a)	4	4	.00	.15
Total for Annual Forbs		234	360	3.00	4.89
Total for Perennial Forbs		88	207	1.46	4.12
Total for Forbs		322	567	4.47	9.01

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

BROWSE TRENDS--
Management unit 09R, Study no: 18

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia nova	19	12	2.48	.60
B	Artemisia tridentata tridentata	24	17	1.62	.08
B	Grayia spinosa	8	2	.60	.78
B	Juniperus osteosperma	8	1	6.42	-
B	Kochia prostrata	-	24	-	2.30
B	Opuntia sp.	66	67	10.94	1.80
Total for Browse		125	123	22.07	5.57

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

Species	Percent Cover '08	Percent Cover '11
Artemisia nova	2.51	2.16
Artemisia tridentata tridentata	2.78	.35
Grayia spinosa	.75	.28
Juniperus osteosperma	15.83	.05
Kochia prostrata	-	4.76
Opuntia sp.	7.96	1.73

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

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia nova	0.5	0.9
Artemisia tridentata tridentata	2.6	2.8

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

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	77	18	14.1	4.3

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

Cover Type	Average Cover % '08	Average Cover % '11
Vegetation	27.33	29.63
Pavement	.93	0
Litter	39.40	32.57
Cryptogams	2.47	0
Bare Ground	45.99	43.26

SOIL ANALYSIS DATA --

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

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	'11	'08	'11
Rabbit	54	15	-	-
Elk	-	1	3 (8)	3 (7)
Deer	5	1	38 (93)	1 (2)
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)
Artemisia nova									
08	**920**	2	78	20	80	0	0	7	9/19
11	**520**	12	88	0	140	0	0	0	9/18
Artemisia tridentata tridentata									
08	**700**	0	57	43	-	9	0	23	24/36
11	**560**	75	25	0	1240	0	0	4	12/19
Chrysothamnus viscidiflorus									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	15/26
Ephedra viridis									
08	**0**	0	0	-	-	0	0	0	21/29
11	**0**	0	0	-	-	0	0	0	18/27
Grayia spinosa									
08	**160**	0	50	50	-	25	13	13	22/29
11	**40**	0	100	0	-	0	0	0	17/34
Juniperus osteosperma									
08	**160**	13	88	-	-	0	0	0	-/-
11	**20**	100	0	-	20	0	0	0	-/-
Kochia prostrata									
08	**0**	0	0	-	-	0	0	0	-/-
11	**900**	9	91	-	1940	0	0	0	16/22
Opuntia sp.									
08	**3740**	9	79	10	20	0	0	4	4/27
11	**4160**	5	94	0	180	0	0	0	2/8

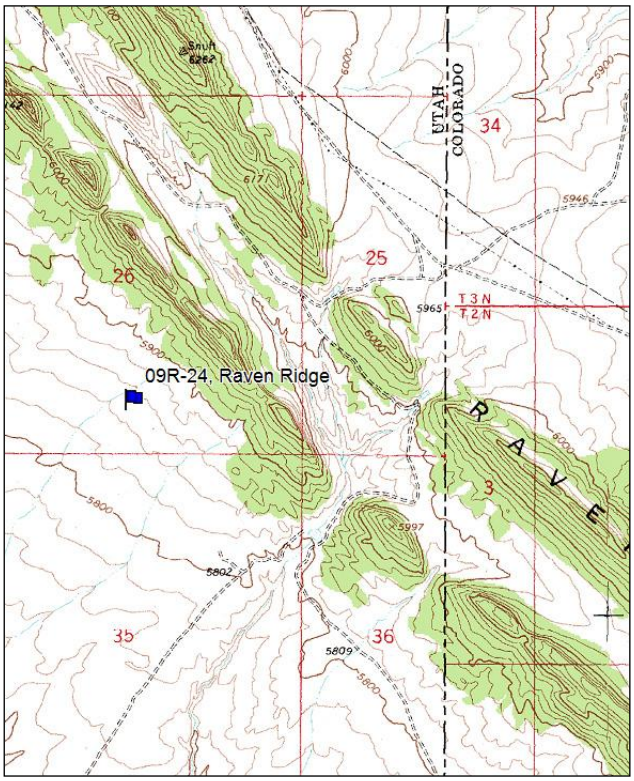
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Sarcobatus vermiculatus									
08	**0**	0	0	-	-	0	0	0	59/64
11	**0**	0	0	-	-	0	0	0	24/35

RAVEN RIDGE - WRI STUDY 9R-24-11
Project #1989

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Antelope Year-long (Fawning habitat)
NRCS Ecological Site Description: Semidesert Loam (Wyoming big sagebrush), R034XY212UT
Land Ownership: BLM
Elevation: 5,790 ft (1,765 m)
Aspect: South
Slope: 5%
Transect bearing: 210° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the intersection of state road 45 and US 40 drive south on state road 45 for 13.5 miles. Turn right heading east and go .2 miles to a railroad crossing. Cross the railroad staying left and follow the railroad tracks for 3.7 miles. Cross the railroad track heading north and go 3 miles. Turn left heading west and go 0.9 miles to a wildlife guzzler. The transect is 15 paces from the guzzler at 215 degrees metric. The browse tag is #181.

Map Name: Dinosaur



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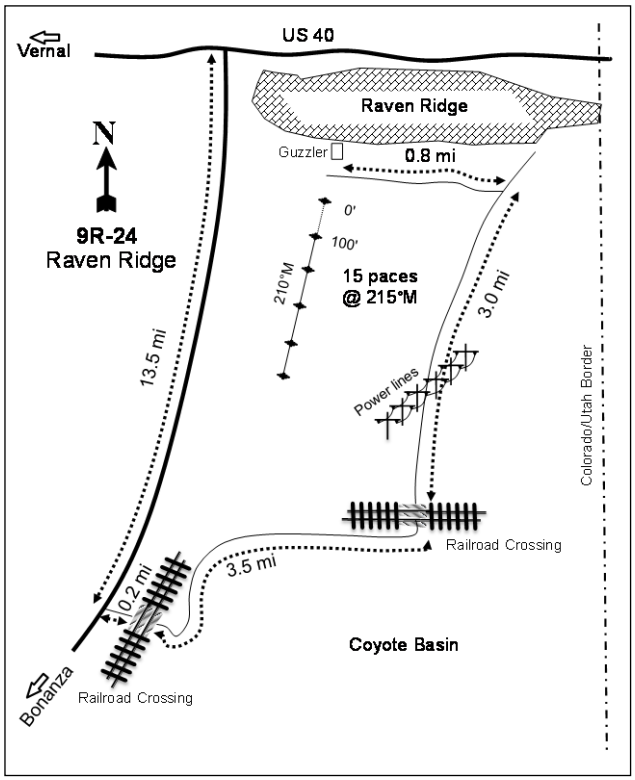


Township: 7S Range: 25E Section: 26

GPS: NAD 83, UTM 12S 664514 E 4448961 N

RAVEN RIDGE - WRI STUDY 9R-24
Project #1989

Site Description

Site Information: The study is located approximately twenty miles southeast of Jensen, within a Wyoming big sagebrush flat, on the north end of Coyote basin south of Raven Ridge. The area is administrated by the Bureau of Land Management (BLM) as part of the Raven Ridge. Prior to treatment, the study was established in 2011 to monitor a one-way chain harrow and Plateau (Imazapic) herbicide treatment. In September of 2011, Plateau herbicide was aerially applied over the project area. Following the Plateau herbicide treatment, the area was one-way chain harrowed and a seed mix of grass, forb, and browse species was broadcast seeded in front of the harrow (Table - Seed Mix). The area will be rested from grazing for a minimum of two growing seasons to allow seed to establish. A follow-up herbicide treatment may be considered in the future to further combat cheatgrass (*Bromus tectorum*). The objectives of the project are to improve habitat quality for sage-grouse and big game, control the spread of cheatgrass, and decrease the density of the sagebrush community (WRI Database 2012). Deer/pronghorn pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 9R, Study no: 24

Project Name: Raven Ridge WRI Database #: 1989			
Application: Broadcast Seed		Acres:	500
Seed Type		lbs in mix	lbs/acre
G	Bottlebrush Squirreltail	250	0.50
G	Canby Bluegrass 'Canbar'	125	0.25
G	Crested Wheatgrass 'Ephraim'	750	1.50
G	Indian Ricegrass	387	0.77
G	Russian Wildrye 'Bozoisky'	750	1.50
G	Siberian Wheatgrass 'Vavilov' NC	500	1.00
G	Snake River Wheatgrass 'Secar'	750	1.50
G	Western Wheatgrass 'Arriba'	1000	2.00
F	Blue Flax 'Appar'	250	0.50
F	Rocky Mountain Beeplant	250	0.50
F	Scarlet Globemallow	100	0.20
F	Western Yarrow 'Eagle Mountain'	50	0.10
B	Fourwing Saltbush	750	1.50
Total Pounds:		5912	11.82
PLS Pounds:			9.29

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a moderately dense population with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was poor. Utilization of sagebrush was mostly moderate. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Trends: Grass community is in poor condition, and is dominated by the weedy annual grass species cheatgrass. Perennial grass species were rare on the site in 2011 with only two species sampled, western wheatgrass (*Agropyron smithii*) and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are not overly abundant or particularly diverse on the site. Perennial forbs were rare on the site in 2011, and forb composition is dominated by annual species (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Solirec-Abracon-Begay complex, which is found on fan remnants. The parent material consists of eolian deposits over slope alluvium derived from sandstone and shale and/or slope alluvium derived from sandstone, limestone, shale, and quartzite and/or eolian deposits over alluvium derived from sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately to highly permeable restrictive layer. The soil surface texture is a fine sandy loam (Soil Survey Staff 2011). Bare ground is high on the site, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2011.

HERBACEOUS TRENDS--
Management unit 09R, Study no: 24

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron smithii	47	.63
G	Bromus tectorum (a)	375	8.96
G	Sitanion hystrix	10	.09
Total for Annual Grasses		375	8.96
Total for Perennial Grasses		57	0.72
Total for Grasses		432	9.69
F	Alyssum alyssoides (a)	8	.01
F	Descurainia pinnata (a)	1	.00
F	Eriastrum diffusum (a)	18	.34
F	Erysimum sp.	20	.32
F	Lappula occidentalis (a)	4	.01
F	Machaeranthera canescens	10	.10
F	Sisymbrium altissimum (a)	22	1.39
F	Sphaeralcea grossulariifolia	1	.00
Total for Annual Forbs		53	1.76
Total for Perennial Forbs		31	0.42
Total for Forbs		84	2.19

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

BROWSE TRENDS--
Management unit 09R, Study no: 24

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata wyomingensis	85	18.11
B	Gutierrezia sarothrae	4	.15
B	Opuntia sp.	3	.03
Total for Browse		92	18.29

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 24

Species	Percent Cover '11
Artemisia tridentata wyomingensis	23.38
Opuntia sp.	.21

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 09R, Study no: 24

Species	Average leader growth (in) '11
Artemisia tridentata wyomingensis	1.6

POINT-QUARTER TREE DATA--
Management unit 09R, Study no: 24

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	5	2.8

BASIC COVER--
Management unit 09R, Study no: 24

Cover Type	Average Cover % '11
Vegetation	30.02
Rock	.02
Pavement	.34
Litter	32.49
Cryptogams	2.12
Bare Ground	40.24

PELLET GROUP DATA--
Management unit 09R, Study no: 24

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	7	-
Elk	2	-
Deer/Pronghorn	6	11 (26)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 24

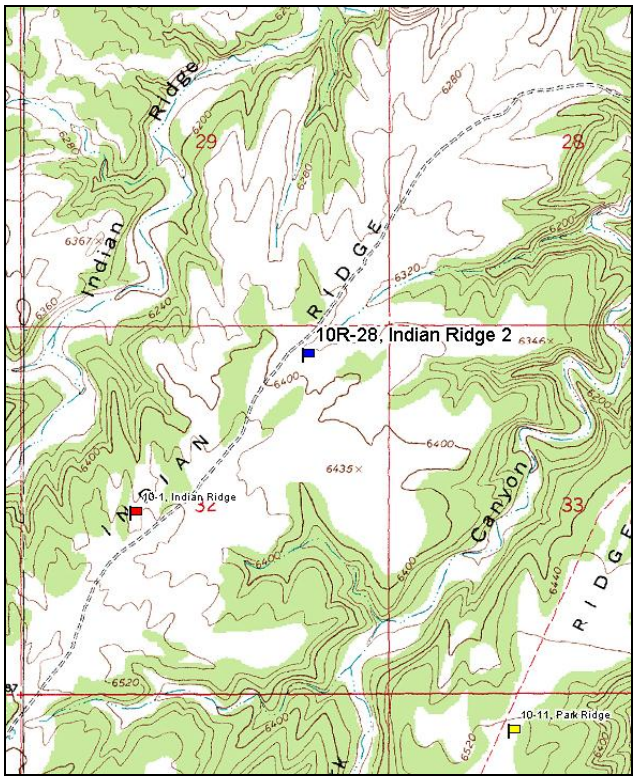
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
11	**4120**	2	67	32	2060	62	13	29	21/31
Gutierrezia sarothrae									
11	**120**	0	100	-	-	0	0	0	11/21
Opuntia sp.									
11	**60**	0	100	-	-	0	0	0	4/14

INDIAN RIDGE 2 - WRI STUDY 10R-28-11
Project #1952

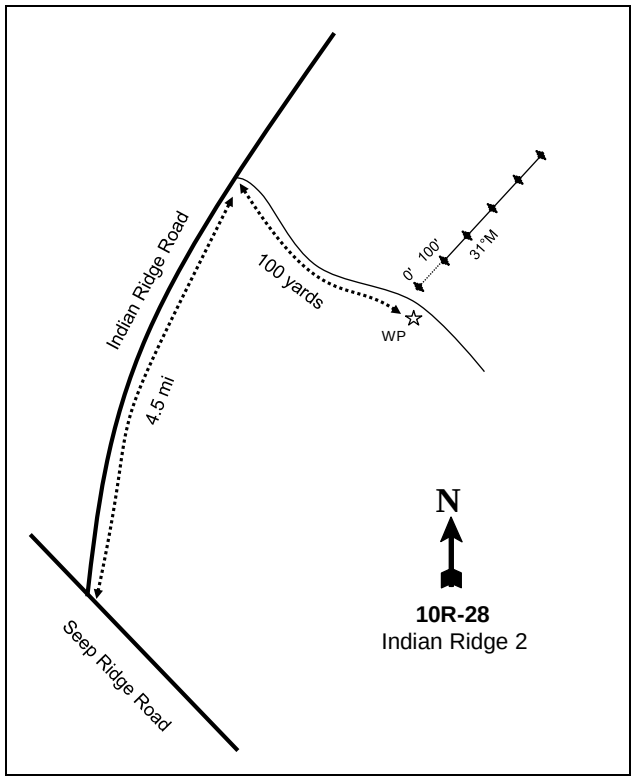
Vegetation Type: Fourwing Saltbush and Winterfat
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Silt Loam (Fourwing Saltbush-Winterfat), R034XY329UT
Land Ownership: SITLA
Elevation: 6,317 ft (1,925 m)
Aspect: Northeast
Slope: 6%
Transect bearing: 31° magnetic
Belt placement: line 1 (11ft), line 2 (34ft) is only 75 foot long, line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the intersection of Seep Ridge Road and Indian Ridge Road, follow Indian Ridge Road 4.5 miles to where a road breaks off to the right. Take this road for 100 yards to a witness post on the left side of the road. From the witness post the 0-foot stake is 6 paces at 31°M and is marked with browse tag #402.

Map Name: Cooper Canyon



Diagrammatic Sketch:



Township: 13S Range: 23E Section: 32

GPS: NAD 83, UTM 12S 640612 E 4390112 N

INDIAN RIDGE 2 - WRI STUDY 10R-28
Project #1952

Site Description

Site Information: The study is located approximately six miles northeast of the pine springs cabin, within a fourwing saltbush (*Atriplex canescens*) and winterfat (*Ceratoides lanata*) flat, on the north end of Indian Ridge near Sweet Water Canyon, on Utah State Institutional Trust Land (SITLA). The study was originally established in 1999 to monitor elk use. In 2011, the study was reread, prior to treatment, to monitor the effects of a rangeland drill seeding and Plateau (Imazapic) herbicide treatment. It was observed in 1999 that the area appeared to have been burned 10 to 20 years prior to the establishment of the study. It was also noted at that time that remnant unburned areas near the study site had little herbaceous vegetation and small stands of black sagebrush (*Artemisia nova*). In September of 2011, a total of 224 acres were seeded with a seed mix of grass, forb, and browse species using a rangeland drill (Table - Seed Mix). In October of 2011, the treatment area was sprayed with Plateau (Imazapic) herbicide. The objectives of the project are to improve crucial mule deer winter habitat, decrease the abundance of cheatgrass (*Bromus tectorum*), and establish desirable seeded species (WRI Database 2012). In 1999, cattle sign was sampled in very high abundance, while deer and elk pellet groups were sampled in low abundance. In 2011, cattle sign was sampled in moderate abundance, while deer and elk pellet groups were sampled in low abundance (Table - Pellet Group).

SEED MIX--
Management unit 10R, Study no: 28

Project Name: Indian Ridge Sagebrush WRI Database #: 1952			
Application: Rangeland Drill		Acres:	218
Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone	250	1.15
G	Bottlebrush Squirreltail	100	0.46
G	Canby Bluegrass 'Canbar'	50	0.23
G	Crested Wheatgrass 'Nordan'	300	1.38
G	Indian Ricegrass	250	1.15
G	Russian Wildrye	200	0.92
G	Sandberg Bluegrass	50	0.23
G	Snake River Wheatgrass 'Secar'	200	0.92
G	Thickspike Wheatgrass 'Critana'	250	1.15
F	Alfalfa 'Nomad'	200	0.92
F	Alfalfa 'Ranger'	150	0.69
F	Blue Flax 'Appar'	100	0.46
B	Fourwing Saltbush	250	1.15
Total Pounds:		2350	10.78
PLS Pounds:			8.38

Project Name: Indian Ridge Sagebrush - Fluffy Mix WRI Database #: 1952			
Application: Rangeland Drill		Acres:	218
Seed Type		lbs in mix	lbs/acre
B	Forage Kochia	250	1.15
B	Sagebrush, Wyoming	250	1.15
B	Winterfat	40	0.18
Total Pounds:		540	2.48
PLS Pounds:			0.81

Browse: The preferred browse species on the site are fringed sagebrush (*Artemisia frigida*), black sagebrush (*A. nova*), fourwing saltbush (*Atriplex canescens*), and winterfat (*Ceratoides lanata*). Winterfat and fourwing saltbush are the dominant browse species on the site. Winterfat is a dense, lightly used population, with low decadence and good vigor. The fourwing saltbush is a moderately abundant population, with low decadence and good vigor. Utilization of fourwing saltbush was light in 2011, but was moderate at the outset of the study. The recruitment of young winterfat and fourwing saltbush plants to the respective populations has been good over the sample years. A small number of black sagebrush plants were sampled in 1999, but in 2011, black sagebrush was only sampled in height/crown measurements. A small population of fringed sagebrush was sampled for the first time in 2011. Other browse species sampled on the site include bud sagebrush

(*Artemisia spinescens*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Trends: Perennial grasses are abundant and moderately diverse on the site. The dominant perennial grass species are thickspike wheatgrass (*Agropyron dasystachyum*) and sand dropseed (*Sporobolus cryptandrus*), which provides the majority of the grass cover on the site. Other less common grass species sampled on the site include blue grama (*Bouteloua gracilis*), galleta (*Hilaria jamesii*), prairie junegrass (*Koeleria cristata*), Indian ricegrass (*Oryzopsis hymenoides*), and Sandberg bluegrass (*Poa secunda*). The weedy annual grass species cheatgrass has been sampled on the site in high abundance and cover over the sample years. Forbs are moderately abundant, but are not overly diverse on the site. The dominant forb species is scarlet globemallow (*Sphaeralcea coccinea*), which has provided the majority of forb cover over the sample years (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Whitesage-Cedarknoll complex, likely as part of the Whitesage component, which is found on fan remnants. The parent material consists of slope alluvium derived from sandstone, limestone, shale, and quartzite. The soils within this classification are characterized as deep and well drained, with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil is a clay loam with a slightly alkaline soil reaction (pH 7.8). Bare ground cover is moderate on the site, though there is a high amount of vegetation and litter providing protective ground cover. In 1999, combined with the abundant vegetation and litter cover and the evenness of terrain there was no significant erosion occurring on the site. The soil erosion condition was classified as stable in 2011.

Trend Assessments

Browse

- **1999 to 2011 - stable (0):** The density of winterfat decreased 28% from 10,260 plants/acre to 7,400 plants/acre, but browse cover increased from 3% to 10%. Fourwing saltbush slightly decreased 10% in density from 1,240 plants/acre to 1,120 plants/acre, but browse cover remained similar at 7%. The health of the winterfat and fourwing saltbush populations remained in good condition with decadence and plants displaying poor vigor remaining near 0%. The recruitment of young winterfat and fourwing saltbush plants to their respective populations remained good at 15% and 27%, respectively. Fringed sagebrush was sampled for the first time in 2011 at a density of 540 plants/acre and provided 1% cover.

Grass

- **2006 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased two-fold, and cover increased from 11% to 38%. Thickspike, blue grama, and sand dropseed increased significantly in nested frequency, and cover increased from 10% to 20%, less than 1% to 3%, and less than 1% to 13%. Cheatgrass remained similar in nested frequency and had cover at 25%.

Forb

- **2006 to 2011 - up (+2)**: Scarlet globemallow was the only perennial forb species sampled in either sample year. Scarlet globemallow remained similar in nested frequency, but cover increased from 1% to 4%. Annual forbs remained rare on the site.

HERBACEOUS TRENDS--
Management unit 10R, Study no: 28

Type	Species	Nested Frequency '99	Nested Frequency '11	Average Cover % '99	Average Cover % '11
G	Agropyron dasystachyum	$_{a}$201	$_{b}$254	10.38	20.21
G	Bouteloua gracilis	$_{a}$11	$_{b}$46	.07	3.42
G	Bromus tectorum (a)	387	364	24.73	25.24
G	Hilaria jamesii	4	-	.03	-
G	Koeleria cristata	-	10	-	.68
G	Oryzopsis hymenoides	-	1	-	.03
G	Poa secunda	5	6	.03	.03
G	Sporobolus cryptandrus	$_{a}$21	$_{b}$173	.28	13.28
Total for Annual Grasses		387	364	24.73	25.24
Total for Perennial Grasses		242	490	10.79	37.68
Total for Grasses		629	854	35.52	62.92
F	Chenopodium leptophyllum(a)	$_{a}$-	$_{b}$10	-	.21
F	Descurainia pinnata (a)	7	9	.04	.08
F	Kochia scoparia (a)	-	7	-	.06
F	Lactuca serriola (a)	3	-	.00	-
F	Lappula occidentalis (a)	-	1	-	.00
F	Sphaeralcea coccinea	55	74	.62	3.90
Total for Annual Forbs		10	27	0.04	0.36
Total for Perennial Forbs		55	74	0.62	3.90
Total for Forbs		65	101	0.67	4.26

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

BROWSE TRENDS--
Management unit 10R, Study no: 28

Type	Species	Strip Frequency '99	Strip Frequency '11	Average Cover % '99	Average Cover % '11
B	Artemisia frigida	-	11	-	1.03
B	Artemisia nova	2	-	.15	-
B	Artemisia spinescens	13	-	.07	-
B	Atriplex canescens	37	34	6.63	7.23
B	Ceratoides lanata	93	91	2.78	9.59
B	Gutierrezia sarothrae	6	2	.18	.03
B	Opuntia sp.	1	-	.00	-
Total for Browse		152	138	9.82	17.89

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 28

Species	Percent Cover '99	'11
Artemisia frigida	-	.46
Atriplex canescens	-	12.73
Ceratoides lanata	-	10.21
Gutierrezia sarothrae	-	.28

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10R, Study no: 28

Species	Average leader growth (in) '11
Atriplex canescens	15.6
Ceratoides lanata	8.1

BASIC COVER--
Management unit 10R, Study no: 28

Cover Type	Average Cover % '99	'11
Vegetation	48.66	65.61
Rock	.03	.08
Pavement	1.44	3.87
Litter	63.68	37.95
Cryptogams	.01	.18
Bare Ground	9.13	21.95

SOIL ANALYSIS DATA --
Management unit 10R, Study no: 28, Study Name: Indian Ridge 2

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
16.7	7.9	34.9	26.6	28.6	2.7	12.0	256.0	0.6

PELLET GROUP DATA--
Management unit 10R, Study no: 28

Type	Quadrat Frequency '99	'11	Days use per acre (ha) '99	'11
Rabbit	4	3	-	-
Elk	13	-	11 (27)	3 (8)
Deer	2	12	13 (32)	10 (26)
Cattle	9	6	74 (183)	23 (57)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 28

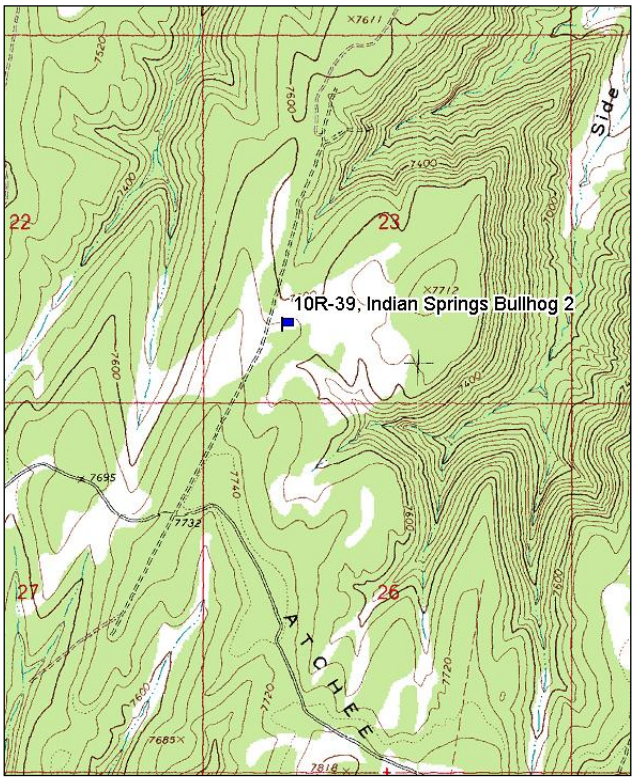
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia frigida									
99	**0**	0	0	-	-	0	0	0	-/-
11	**540**	11	89	-	40	0	0	0	17/15
Artemisia nova									
99	**40**	0	100	-	-	0	100	0	14/27
11	**0**	0	0	-	-	0	0	0	13/22
Artemisia spinescens									
99	**660**	0	82	18	-	36	55	18	4/4
11	**0**	0	0	0	-	0	0	0	-/-
Atriplex canescens									
99	**1240**	27	68	5	-	40	11	2	31/44
11	**1120**	27	70	4	40	7	0	0	33/45
Ceratoides lanata									
99	**10260**	9	90	1	-	35	20	.58	9/8
11	**7400**	15	85	0	-	.54	1	0	18/18
Gutierrezia sarothrae									
99	**460**	0	100	-	-	0	0	4	8/10
11	**40**	0	100	-	-	0	0	0	12/14
Opuntia sp.									
99	**20**	0	100	-	-	0	0	0	3/3
11	**0**	0	0	-	-	0	0	0	-/-

INDIAN SPRINGS BULLHOG 2 - WRI STUDY 10R-39-11
Project #1885 and Project #362

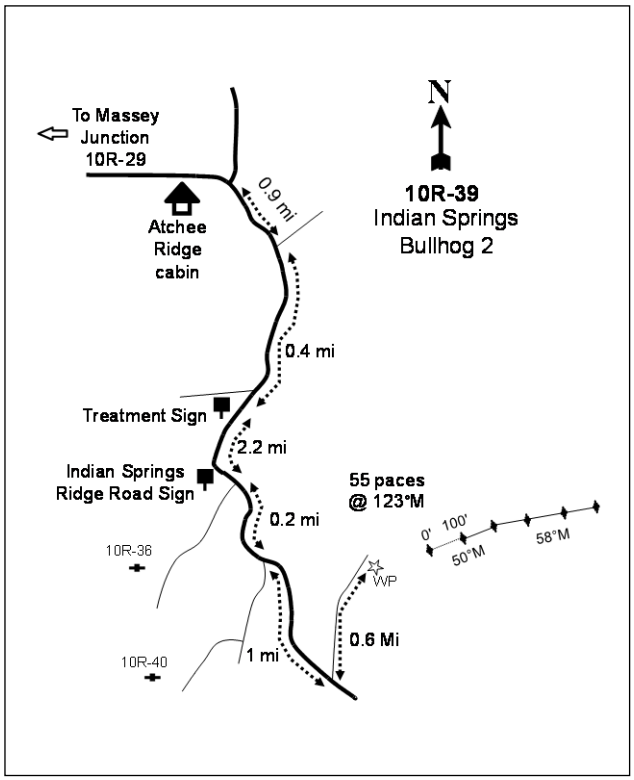
Vegetation Type: Pinyon and Juniper
Range Type: Crucial Deer Summer (fawning habitat), Crucial Elk Summer (calving habitat)
NRCS Ecological Site Description: Upland Shallow Loam (Pinyon-Utah Juniper), R034XY322UT
Land Ownership: BLM
Elevation: 7,611 ft (2,319 m)
Aspect: North
Slope: 8%
Transect bearing: Lines 1 and 2 are at 50° magnetic and Lines 3, 4, and 5 are at 58° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From Seep Ridge Road, about 10 miles north of Pine Spring, turn onto the Bitter Creek Road near McCoy Reservoir. Drive east on this road for 10.9 miles to where the road tops out, and turn right off the main road. Go 7.65 miles, staying on the main road to a fork. Turn left (west) at the fork and drive 0.9 miles to another junction, staying right for another 0.4 miles to a fork and a treatment sign. From there, go right for 2.2 miles to a junction with a sign reading "Indian Springs Ridge Road". Stay left and continue on for 0.2 miles to another fork, stay left here also and go 1 mile to a road coming in from the left (north) side of the road. Turn here and drive 0.6 miles to a witness post on the right side of the road. From the witness post, the 0-foot stake is 55 paces at 123 degrees magnetic and is marked with browse tag #200.

Map Name: Davis Canyon



Diagrammatic Sketch:



Township: 13S Range: 25E Section: 23

GPS: NAD 83, UTM 12S 663761 E 4392637 N

INDIAN SPRINGS BULLHOG 2 - WRI STUDY 10R-39
Project #1885 and Project #362

Site Description

Study Information: The study is located approximately four miles southeast of the Atchee Ridge cabin, within a burned mountain brush community, on Atchee Ridge, east of Side Canyon. The area is administrated by the Bureau of Land Management (BLM) as part of the Atchee Ridge AMP allotment. Prior to treatment, the study was originally established in 2007 to monitor the effects of a bullhog project. Following the bullhog project in September of 2010, the study site was burned in the Augusi fire which burned approximately 955 acres. As a result of the fire, in November 2010, the area was aerially seeded with a seed mix of grass and forb species (Table - Seed Mix). The objectives of the fire restoration seeding are to improve forage for elk and mule deer, stabilize the soil and watershed by establishing ground cover to prevent erosion and soil loss, and establish perennial vegetation to minimize invasion by cheatgrass and other weedy species (WRI Database 2012). In 2007, elk pellet groups were sampled in high abundance, while deer and cattle pellet groups were low in abundance. In 2011, deer and elk pellet groups were sampled in low abundance (Table - Pellet Group Data).

SEED MIX--
Management unit 10R, Study no: 39

Project Name: Augusi Canyon Fire Rehabilitation WRI Database #: 1885			
Application: Aerial Seed		Acres:	955
Seed Type		lbs in mix	lbs/acre
G	Big Bluegrass 'Sherman'	500	0.52
G	Bluebunch Wheatgrass 'Anatone	950	0.99
G	Canby Bluegrass 'Canbar'	500	0.52
G	Crested Wheatgrass 'Nordan'	950	0.99
G	Green Needlegrass 'Lodorm'	390	0.41
G	Orchardgrass 'Paiute'	500	0.52
G	Russian Wildrye 'Bozoisky'	950	0.99
G	Slender Wheatgrass 'San Luis'	700	0.73
G	Thickspike Wheatgrass 'Critana'	950	0.99
F	Alfalfa 'Ladak Plus'	950	0.99
F	Alfalfa 'Spreador 4'	950	0.99
F	Blue Flax 'Appar'	500	0.52
F	Sainfoin 'Eski'	1900	1.99
F	Small Burnet 'Delar'	1900	1.99
Total Pounds:		12590	13.18
PLS Pounds:			11.56

Browse: The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), true mountain mahogany (*Cercocarpus montanus*), white stem rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), antelope bitterbrush (*Purshia tridentata*), and Gambel oak (*Quercus gambelii*). The dominant preferred browse species are Utah serviceberry and Gambel oak. Prior to the wildfire; mountain big sagebrush, true mountain mahogany, and antelope bitterbrush were fairly common, but following the fire these species have been rare on the site. The fire substantially decreased the abundance of browse species on the study site. The serviceberry is a relatively small, young population with low decadence and good vigor within the population. Utilization of serviceberry plants has mostly been moderately light since the establishment of the study. The recruitment of young serviceberry plants to the population has been good over the sample years. The Gambel oak population is moderately utilized and is mostly comprised by small plants. The health of the oak population is in good condition with low decadence

and good vigor within the population. The recruitment of young oak plants to the population has been good since the outset of the study (Table - Browse Characteristics). Prior to the fire, nearly half of the study transect was treated by bullhog machinery. In addition, nearly all the pinyon pine and Utah juniper trees within the fire perimeter near the study site were killed due to the wildfire. From the outset of the study pinyon pine trees have been fairly dense on the site (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase II transitioning into Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Trends: Collectively, grasses are abundant and diverse on the site. The dominant grass species is thickspike wheatgrass (*Agropyron dasystachyum*), which provides the majority of the grass cover. Seeded grass species sampled on the site include crested wheatgrass (*A. cristatum*), thickspike wheatgrass, and Canby bluegrass (*Poa canbyi*), though thickspike wheatgrass was present on the site prior to the seeding. Several grass species decreased in abundance on the site following the fire which included Ross sedge (*Carex rossii*), mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*P. secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). The weedy annual grass species cheatgrass (*Bromus tectorum*) has been sampled in low abundance on the site since the outset of the study. Perennial forb species are moderately abundant and highly diverse on the site. The dominant forb species are rose pussytoes (*Antennaria rosea*) and penstemon (*Penstemon sp.*). Three of the seeded forb species were sampled on the site following the fire, which include blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Moonset-Whetrock association, which is found on hills. The parent material consists of slope alluvium and colluvium derived from sandstone and shale. The soils within this classification are characterized as shallow and well drained with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil is a loam with a neutral soil reaction (pH 6.8). Bare ground cover is high, though there is a moderate amount of vegetation providing protective ground cover. Prior to the fire, bare ground cover was moderately low on the site (Table - Basic Cover). The soil erosion condition was classified as slight in 2007 and 2011.

Pre vs. One Year Post Treatment, 2007 vs. 2011

Browse: The density of Utah serviceberry decreased 31% from 1,160 plants/acre to 800 plants/acre, and canopy cover decreased from 8% to 3%. The health of the serviceberry population remained good with low decadence and good vigor. The recruitment of young serviceberry plants to the population remained good. The density of Gambel oak decreased 48% from 660plants/acre to 340 plants/acre, but cover remained similar at 1%. Mountain big sagebrush became rare on the site following the fire with density decreasing from 1,920 plants/acre to less than 20 plants/acre. Pinyon pine decreased in density from 152 trees/acre to 6 trees/acre, with average trunk diameter decreasing from 4.6 inches to 3.9 inches. Utah juniper decreased in density from 34 trees/acre to 5 trees/acre, with average trunk diameter decreasing from 3.4 inches to 1.2 inches. Canopy cover of pinyon and juniper trees decreased from 22% to less than 1% and 1% to less than 1% cover, respectively.

Grasses: The sum of nested frequency of perennial grasses decreased 49%, but cover increased from 8% to 10%. The increase in cover can solely be attributed to thickspike wheatgrass, which increased significantly in nested frequency, and cover increased from 1% to 7%. Several species (Ross sedge, mutton bluegrass, Sandberg bluegrass, bottlebrush squirreltail, and needle-and-thread) significantly decreased in nested frequency following the fire. Sandberg and mutton bluegrass each decreased in cover from 2% to 1%. Ross sedge remained similar in cover, and bottlebrush squirreltail was not sampled in 2011. Cheatgrass remained similar in nested frequency and cover remained similar at 1%.

Forbs: The sum of nested frequency of perennial forbs decreased 42%, though cover remained similar at 7%. Diversity of forbs increased on the site with several new species, including several seeded species, being sampled for the first time in 2011.

HERBACEOUS TRENDS--
Management unit 10R, Study no: 39

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
G	Agropyron cristatum	-	8	-	.37
G	Agropyron dasystachyum	a80	b128	1.11	6.85
G	Agropyron spicatum	2	-	.00	-
G	Bouteloua gracilis	23	10	.54	.36
G	Bromus tectorum (a)	40	41	.52	1.31
G	Carex rossii	b66	a30	1.11	.59
G	Koeleria cristata	21	8	.76	.15
G	Oryzopsis hymenoides	4	-	.06	.15
G	Poa canbyi	-	5	-	.30
G	Poa fendleriana	b71	a5	1.92	.53
G	Poa pratensis	-	1	-	.03
G	Poa secunda	b38	a5	.28	.18
G	Sitanion hystrix	b22	a-	.21	.00
G	Stipa comata	b36	a12	1.62	.75
Total for Annual Grasses		40	41	0.52	1.31
Total for Perennial Grasses		363	212	7.64	10.28
Total for Grasses		403	253	8.17	11.60
F	Agoseris glauca	2	-	.00	.00
F	Androsace septentrionalis (a)	-	1	-	.00
F	Antennaria rosea	b44	a27	1.16	1.02
F	Arabis sp.	b20	a-	.04	-
F	Artemisia ludoviciana	4	-	.03	-
F	Astragalus sp.	8	7	.04	.48
F	Astragalus utahensis	-	10	-	.07
F	Balsamorhiza sagittata	1	-	.15	-
F	Calochortus nuttallii	-	1	-	.03
F	Castilleja flava	-	1	-	.03
F	Castilleja linariaefolia	8	-	.05	-
F	Chaenactis douglasii	-	2	-	.00
F	Chenopodium fremontii (a)	-	2	-	.03
F	Chenopodium leptophyllum(a)	a-	b15	-	1.28
F	Collinsia parviflora (a)	2	1	.00	.00
F	Comandra pallida	11	16	.31	.10
F	Crepis acuminata	10	16	.18	.18
F	Cryptantha sp.	4	-	.06	-
F	Delphinium bicolor	6	-	.02	-
F	Erigeron eatonii	-	1	-	.00
F	Erigeron pumilus	5	-	.03	-
F	Erigeron sp.	23	1	.21	.03
F	Eriogonum alatum	b15	a-	.20	-
F	Eriogonum umbellatum	-	2	-	.00
F	Gayophytum ramosissimum(a)	a7	b26	.01	.70
F	Gilia sp. (a)	b19	a-	.06	-

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
F	Grindelia squarrosa	-	-	-	.15
F	Haplopappus acaulis	2	-	.00	-
F	Hedysarum boreale	a-	b21	-	.27
F	Heterotheca villosa	-	-	.03	-
F	Ipomopsis aggregata	b45	a-	.17	-
F	Linum perenne	a-	b13	-	.29
F	Lupinus argenteus	-	2	-	.00
F	Machaeranthera canescens	4	-	.01	-
F	Medicago sativa	a-	b10	-	.14
F	Microsteris gracilis (a)	5	-	.01	-
F	Penstemon sp.	11	10	.24	.96
F	Penstemon sp.	b83	a45	2.24	2.42
F	Phlox austromontana	b64	a11	1.50	.12
F	Phlox longifolia	65	46	.48	.52
F	Polygonum douglasii (a)	23	33	.05	.53
F	Sanguisorba minor	a-	b10	-	.14
F	Schoencrambe linifolia	3	-	.03	-
F	Sedum lanceolatum	5	-	.03	-
F	Senecio integerrimus	12	-	.04	-
F	Senecio multilobatus	1	10	.03	.07
F	Sphaeralcea coccinea	11	8	.07	.04
F	Taraxacum officinale	-	3	-	.03
F	Zigadenus paniculatus	2	1	.04	.03
Total for Annual Forbs		56	78	0.15	2.56
Total for Perennial Forbs		469	274	7.48	7.19
Total for Forbs		525	352	7.63	9.76

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

BROWSE TRENDS--
Management unit 10R, Study no: 39

Type	Species	Strip Frequency '07	Strip Frequency '11	Average Cover % '07	Average Cover % '11
B	Amelanchier utahensis	30	15	4.25	1.81
B	Artemisia tridentata vaseyana	45	0	4.13	.01
B	Cercocarpus montanus	15	3	.86	-
B	Chrysothamnus depressus	9	0	.09	-
B	Chrysothamnus nauseosus albicaulis	4	0	.15	-
B	Chrysothamnus viscidiflorus viscidiflorus	4	4	-	.38
B	Gutierrezia sarothrae	2	0	.18	-
B	Juniperus osteosperma	4	0	.38	-
B	Opuntia fragilis	4	0	-	-
B	Opuntia sp.	0	1	-	-
B	Pediocactus simpsonii	1	0	-	-
B	Pinus edulis	21	0	7.97	-
B	Purshia tridentata	21	3	2.14	.16
B	Quercus gambelii	5	4	.21	1.28
B	Symphoricarpos oreophilus	29	3	.80	.06
B	Tetradymia canescens	1	1	.03	-
Total for Browse		195	34	21.23	3.71

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 39

Species	Percent Cover '07	Percent Cover '11
Amelanchier utahensis	8.05	2.66
Artemisia tridentata vaseyana	5.63	-
Cercocarpus montanus	1.41	-
Chrysothamnus depressus	.13	-
Chrysothamnus nauseosus albicaulis	-	-
Chrysothamnus viscidiflorus viscidiflorus	.20	.56
Gutierrezia sarothrae	.06	-
Juniperus osteosperma	.56	-
Opuntia fragilis	.05	-
Pediocactus simpsonii	.03	-
Pinus edulis	21.91	-
Purshia tridentata	2.91	.21
Quercus gambelii	.68	1.20
Symphoricarpos oreophilus	1.75	1.21

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10R, Study no: 39

Species	Average leader growth (in)	
	'07	'11
Amelanchier utahensis	1.4	8.2
Artemisia tridentata vaseyana	1.7	4.2
Cercocarpus montanus	3.3	9.1
Purshia tridentata	4.1	6.4

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 39

Species	Trees per Acre		Average diameter (in)	
	'07	'11	'07	'11
Juniperus osteosperma	34	5	3.4	1.2
Pinus edulis	152	6	4.6	3.9

BASIC COVER--
Management unit 10R, Study no: 39

Cover Type	Average Cover %	
	'07	'11
Vegetation	38.42	27.58
Rock	1.85	2.75
Pavement	1.71	12.17
Litter	52.82	9.85
Cryptogams	2.29	0
Bare Ground	21.35	59.47

SOIL ANALYSIS DATA --
Management unit 10R, Study no: 39, Study Name: Indian Springs Bullhog 2

pH	loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.8	45.2	34.4	20.4	5.5	11.1	86.4	0.8

PELLET GROUP DATA--
Management unit 10R, Study no: 39

Type	Quadrat Frequency		Days use per acre (ha)	
	'07	'11	'07	'11
Rabbit	24	-	-	-
Elk	21	9	84 (208)	2 (5)
Deer	9	-	8 (20)	16 (40)
Cattle	1	-	2 (4)	-

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 39

		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									
07	**1160**	29	69	2	140	28	0	3	41/39
11	**800**	80	20	0	400	3	10	3	19/30
Artemisia tridentata vaseyana									
07	**1920**	2	52	46	320	33	4	20	20/26
11	**0**	0	0	0	160	0	0	0	11/25
Cercocarpus montanus									
07	**440**	45	45	9	-	27	5	5	48/41
11	**60**	67	33	0	20	33	33	0	18/22
Chrysothamnus depressus									
07	**280**	0	93	7	20	29	29	7	6/9
11	**0**	0	0	0	-	0	0	0	6/12
Chrysothamnus nauseosus albicaulis									
07	**100**	0	100	-	-	0	0	0	17/24
11	**0**	0	0	-	-	0	0	0	-/-
Chrysothamnus viscidiflorus viscidiflorus									
07	**100**	0	100	-	-	0	0	0	15/13
11	**100**	0	100	-	-	0	0	0	14/19
Gutierrezia sarothrae									
07	**60**	0	67	33	-	0	0	33	6/7
11	**0**	0	0	0	-	0	0	0	9/11
Juniperus osteosperma									
07	**80**	75	25	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Opuntia fragilis									
07	**80**	0	100	-	-	0	0	0	3/7
11	**0**	0	0	-	-	0	0	0	-/-
Opuntia sp.									
07	**0**	0	0	-	-	0	0	0	-/-
11	**40**	100	0	-	-	0	0	0	-/-
Pediocactus simpsonii									
07	**20**	0	100	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	2/3
Pinus edulis									
07	**480**	63	33	4	100	0	4	4	-/-
11	**0**	0	0	0	-	0	0	0	-/-
Purshia tridentata									
07	**560**	7	89	4	-	54	7	0	19/36
11	**60**	33	67	0	140	0	0	67	13/24

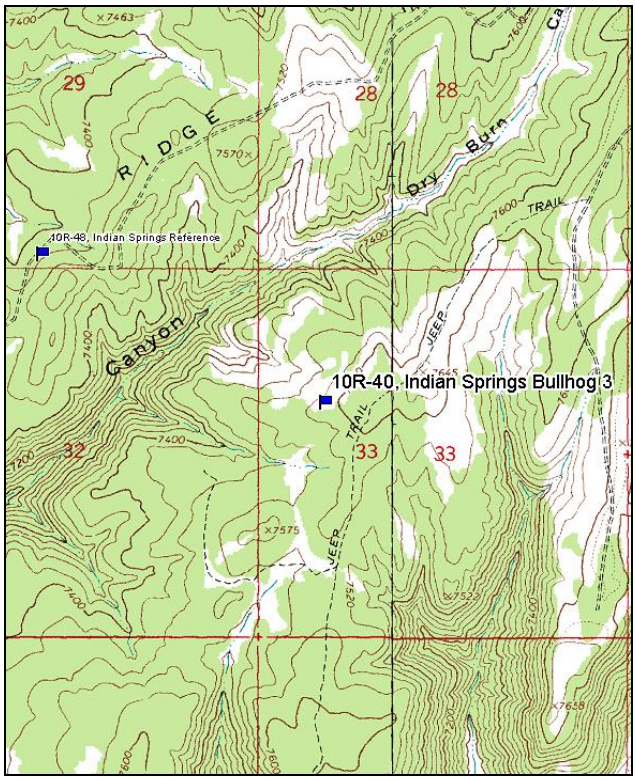
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Quercus gambelii									
07	**660**	94	6	-	-	0	0	0	52/22
11	**340**	100	0	-	-	100	0	0	13/17
Symphoricarpos oreophilus									
07	**2040**	36	64	-	40	0	0	0	13/23
11	**60**	0	100	-	-	0	0	0	12/27
Tetradymia canescens									
07	**20**	0	100	-	-	0	0	0	6/7
11	**20**	100	0	-	-	0	0	0	6/9

INDIAN SPRINGS BULLHOG 3 - WRI STUDY 10R-40-11
Project #677

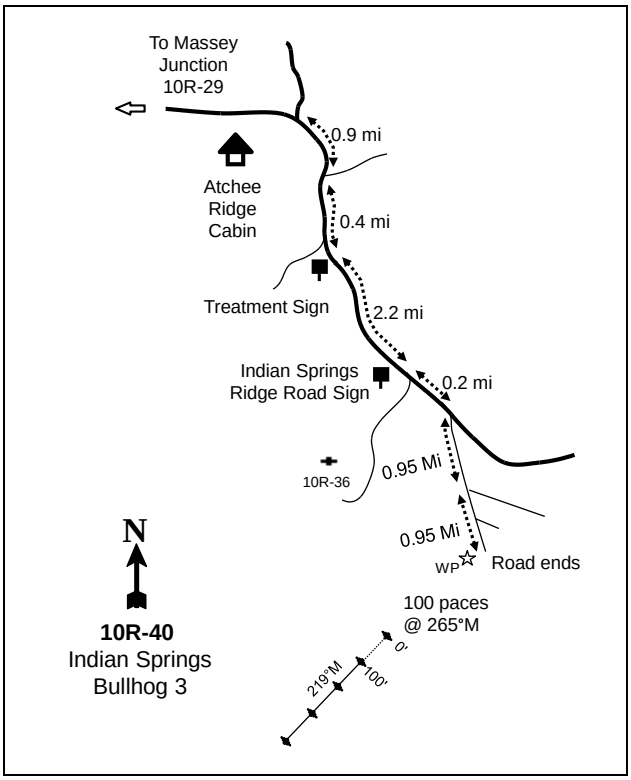
Vegetation Type: Pinyon and Juniper
Range Type: Substantial Deer Summer, Crucial Elk Summer (Calving habitat)
NRCS Ecological Site Description: Upland Shallow Loam (Pinyon-Utah Juniper), R034XY322UT
Land Ownership: BLM
Elevation: 7,580 ft (2,310 m)
Aspect: Southwest
Slope: 3%
Transect bearing: 219° magnetic
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: From the Seep Ridge Road, about 10 miles north of Pine Spring, turn onto the Bitter Creek Road near McCoy Reservoir. Drive east on this road for 10.9 miles to where the road tops out, turn right off the main road. Go 7.65 miles staying on the main road to a fork. Turn left (west) at the fork and drive 0.9 miles to another junction staying right for another 0.4 miles to a fork and a treatment sign. From there go right for 2.2 miles to a junction with a sign reading "Indian Springs Ridge Road". Stay left and continue on for 0.2 miles to another fork, take a right here and go 0.95 miles to a fork, staying right continue on for another 0.95 miles to where the road dead ends, and there is a witness post on the left side of the road. From the witness post the 0-foot stake is 100 paces at 265 degrees magnetic.

Map Name: Burnt Timber Canyon



Diagrammatic Sketch:



Township: 13S Range: 25E Section: 33

GPS: NAD 83, UTM 12S 660515 E 390037 N

INDIAN SPRINGS BULLHOG 3 - WRI STUDY 10R-40
Project #677

Site Description

Site Information: The study is located approximately four miles south of Atchee Ridge cabin, within a treated pinyon pine (*Pinyon pine*) and Utah juniper (*Juniperus osteosperma*) woodland, on a ridge south of Dry Burn Canyon. The area is administrated by Bureau of Land Management (BLM) as part of the Atchee Ridge AMP allotment. Prior to treatment, the study was established in 2007 to monitor a bullhog project. In the fall of 2009, a total of 351 acres of pinyon and juniper trees were removed using a bullhog implement. The project area was not seeded due to the amount of herbaceous understory present in the project area. Livestock grazing was not rested following the treatment. The objectives of the project are to remove pinyon and juniper trees from sagebrush and mountain browse communities, improve habitat for mule deer and elk, and reduce hazardous fuels and create fire breaks (WRI Database 2012). The last 100 feet of the transect was not treated, and as a result, belt five was moved to line one following the treatment. Deer and elk pellet groups were sampled in low abundance in 2007 and 2011 (Table - Pellet Group Data).

Browse: Browse species are limited on the site, though there is high diversity of desirable species. The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*), true mountain mahogany (*Cercocarpus montanus*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), black sagebrush (*Artemisia* nova), elderberry (*Sambucus sp.*), and antelope bitterbrush (*Purshia tridentata*). Utah serviceberry is the dominant preferred browse species on the site. Prior to the treatment, true mountain mahogany provided the majority of the palatable browse cover (Table - Canopy Cover). The Utah serviceberry is a small, relatively young population, with good vigor and low decadence. The recruitment of young plants was high following the treatment, with the majority of the sampled plants being young (Table - Browse Characteristics). Prior to the treatment, the study site was dominated by dense stand of pinyon pine (*Pinus* edulis) and Utah juniper (*Juniperus osteosperma*) trees, but following the treatment pinyon and juniper trees became rare within the treatment area (Table - Point Quarter Tree Data). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Trends: Grasses are moderately abundant and diverse on the site. The dominant grass species are Ross sedge (*Carex rossii*), Indian ricegrass (*Oryzopsis hymenoides*), and mutton bluegrass (*Poa fendleriana*). Prior to the treatment grasses were not very abundant or diverse with only Ross sedge and mutton bluegrass being sampled. Following the treatment, other grass species sampled on the site included Indian ricegrass, blue grama (*Bouteloua gracilis*), prairie junegrass (*Koeleria cristata*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and -thread (*Stipa comata*). The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled for the first time in 2011 in low abundance on the site. Forbs are not overly abundant, but are somewhat diverse on the site. The perennial forb species desert phlox (*Phlox austromontana*) was the dominant forb species in both sampled years (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Moonset-Whetrock association, which is found on hills. The parent material consists of slope alluvium and colluvium derived from sandstone and shale. The soils within this classification are characterized as shallow and well drained, with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil is a loam with a neutral soil reaction (pH 6.8). Bare ground cover is low on the site, though there is a high amount litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). Due to pedestalling around plants and the presence of flow patterns the soil erosion condition was classified as slight in 2007. In 2011, the soil erosion condition was classified as stable.

Pre vs. Two Years Post Treatment, 2007 vs. 2011

Browse: The density of Utah serviceberry increased from 80 plants/acre to 320 plants/acre, though canopy cover remained similar at 1%. Nearly all the serviceberry population was made up of young plants at 94%.

The density of true mountain mahogany decreased 52% from 460 plants/acre to 220 plants/acre, and cover decreased from 5% to less than 1%. The density of antelope bitterbrush decreased from 380 plants/acre to 160 plants/acre, and cover remained similar at 1% cover. Pinyon pine decreased in density from 403 trees/acre to 10 trees/acre with average trunk diameter decreasing from 9.6 inches to 3.0 inches Utah juniper decreased in density from 93 trees/acre to 18 trees/acre with average trunk diameter decreasing from 9.9 inches to 0.9 inches. Canopy cover of pinyon and juniper trees decreased from 26% to less than 1% and 7% to less than 1% cover, respectively.

Grasses: The sum of nested frequency of perennial grasses increased 35%, and cover increased from 2% to 8%. Ross sedge and mutton blue grass remained similar in nested frequency, though cover increased from 1% to 2% cover. A number of other species including Indian ricegrass were sampled for the first time in 2011. Indian ricegrass had 2% cover.

Forbs: The sum of nested frequency of perennial forbs increased 15%, and cover increased from 2% to 4%. Desert phlox decreased significantly in nested frequency, though cover remained similar at 1%. Diversity of forbs species increased with several new species being sampled following the treatment, though the new species occurred in low abundance on the site. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 10R, Study no: 40

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
G	Bouteloua gracilis	-	14	-	.71
G	Bromus tectorum (a)	-	10	-	.36
G	Carex rossii	44	39	.99	2.25
G	Koeleria cristata	[a]-	[b]13	-	.80
G	Oryzopsis hymenoides	-	4	-	1.88
G	Poa fendleriana	41	30	1.14	1.46
G	Sitanion hystrix	[a]-	[b]12	-	.50
G	Stipa comata	-	3	-	.03
Total for Annual Grasses		0	10	0	0.35
Total for Perennial Grasses		85	115	2.13	7.63
Total for Grasses		85	125	2.13	7.99
F	Antennaria rosea	2	2	.03	.03
F	Arabis holboellii	5	14	.02	.31
F	Aster sp.	-	1	-	.03
F	Chaenactis douglasii	7	27	.07	.40
F	Chenopodium fremontii (a)	-	3	-	.03
F	Erigeron sp.	17	7	.09	.01
F	Hymenoxys acaulis	-	2	-	.03
F	Lesquerella sp.	6	17	.01	.25
F	Machaeranthera grindelioides	1	-	.00	-
F	Nicotiana attenuata (a)	-	-	-	.00
F	Penstemon caespitosus	5	5	.03	.18
F	Penstemon pachyphyllus	9	9	.02	.48
F	Penstemon sp.	[a]3	[b]19	.01	.55
F	Petradoria pumila	[b]14	[a]-	.39	-
F	Phlox austromontana	[b]62	[a]28	.99	.79

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
F	Senecio multilobatus	-	5	-	.06
F	Senecio spartioides	-	9	-	.68
F	Sisymbrium altissimum (a)	-	3	-	.21
Total for Annual Forbs		0	6	0	0.24
Total for Perennial Forbs		131	145	1.67	3.82
Total for Forbs		131	151	1.67	4.07

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

BROWSE TRENDS--
Management unit 10R, Study no: 40

Type	Species	Strip Frequency '07	Strip Frequency '11	Average Cover % '07	Average Cover % '11
B	Amelanchier utahensis	4	6	.30	1.23
B	Artemisia tridentata vaseyana	1	1	.01	-
B	Cercocarpus montanus	20	8	2.42	.36
B	Chrysothamnus nauseosus	-	1	-	-
B	Juniperus osteosperma	11	-	1.87	-
B	Pinus edulis	15	-	5.55	-
B	Purshia tridentata	13	8	.67	.51
B	Symphoricarpos oreophilus	10	4	.45	1.02
Total for Browse		49	12	11.30	3.13

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 40

Species	Percent Cover '07	Percent Cover '11
Amelanchier utahensis	1.46	1.00
Artemisia tridentata vaseyana	-	.06
Cercocarpus montanus	4.83	.18
Juniperus osteosperma	6.86	-
Pinus edulis	26.43	-
Purshia tridentata	.88	.55
Symphoricarpos oreophilus	.81	.83

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10R, Study no: 40

Species	Average leader growth (in) '07	Average leader growth (in) '11
Amelanchier utahensis	1.9	10.0
Artemisia tridentata vaseyana	1.8	8.2
Cercocarpus montanus	3.7	6.5
Purshia tridentata	4.5	6.5

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 40

Species	Trees per Acre		Average diameter (in)	
	'07	'11	'07	'11
Juniperus osteosperma	93	18	9.9	0.9
Pinus edulis	403	10	9.6	3.0
Pseudotsuga menziesii	-	5	-	8.9

BASIC COVER--
Management unit 10R, Study no: 40

Cover Type	Average Cover %	
	'07	'11
Vegetation	15.43	15.32
Rock	2.05	.06
Pavement	17.76	5.69
Litter	63.15	76.70
Cryptogams	.38	0
Bare Ground	12.95	5.77

SOIL ANALYSIS DATA --
Management unit 10R, Study no: 40, Study Name: Indian Springs Bullhog 3

pH	loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.8	42.2	35.4	22.4	6.3	27.8	185.6	1.2

PELLET GROUP DATA--
Management unit 10R, Study no: 40

Type	Quadrat Frequency		Days use per acre (ha)	
	'07	'11	'07	'11
Rabbit	18	-	-	-
Elk	6	6	15 (38)	3 (7)
Deer	6	5	11 (28)	9 (22)
Cattle	-	1	-	-

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 40

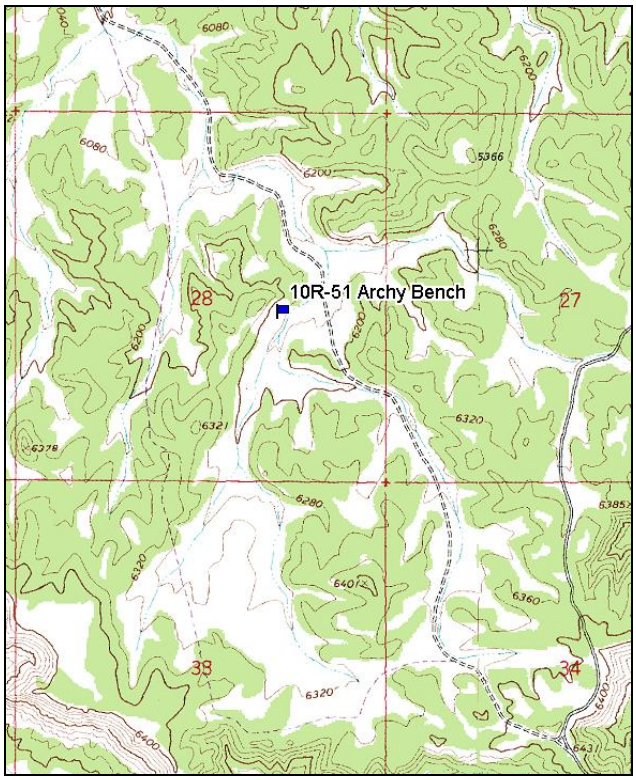
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
07	**80**	50	50	-	-	0	25	0	59/53
11	**320**	94	6	-	-	0	0	0	25/30
Artemisia nova									
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	14/22
Artemisia tridentata vaseyana									
07	**40**	0	0	100	20	0	0	0	18/23
11	**20**	0	100	0	-	0	0	0	20/27
Cercocarpus montanus									
07	**460**	17	74	9	160	48	17	4	50/50
11	**220**	91	9	0	-	55	9	9	33/39
Chrysothamnus nauseosus									
07	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	20/26
Juniperus osteosperma									
07	**220**	27	64	9	60	0	0	9	-/-
11	**0**	0	0	0	-	0	0	0	-/-
Pinus edulis									
07	**420**	48	48	5	540	0	0	0	-/-
11	**0**	0	0	0	-	0	0	0	-/-
Purshia tridentata									
07	**380**	5	74	21	-	16	0	5	20/30
11	**160**	88	13	0	-	38	0	0	13/32
Sambucus sp.									
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	7/10
Symphoricarpos oreophilus									
07	**500**	44	56	-	20	0	0	0	10/20
11	**100**	0	100	-	-	20	0	0	17/47

ARCHY BENCH - WRI STUDY 10R-51-11
Project #2050

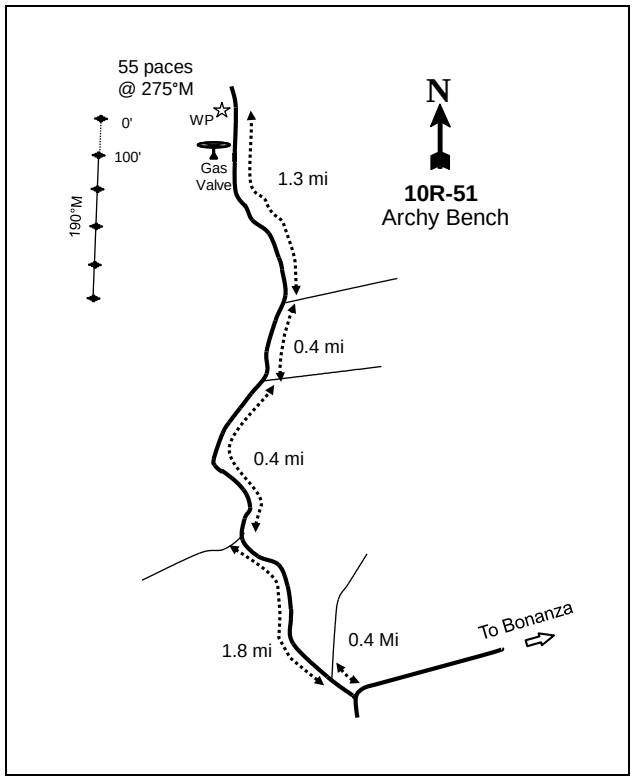
Vegetation Type: Wyoming Big Sagebrush
Range Type: Substantial Deer Winter, Substantial Elk winter
NRCS Ecological Site Description: Semidesert Shallow Loam (Utah Juniper-Pinyon), R034XY233UT
Land Ownership: BLM
Elevation: 6,107 ft (1,861 m)
Aspect: Northeast
Slope: 4%
Transect bearing: 190° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the main road graveled road from Bonanza, at the intersection in West Fork Asphalt Wash, take the road heading north towards Archy Bench. Drive 0.4 miles to an intersection stay left and continue for another 1.8 miles stay right and head another 0.4 miles stay left for another 0.4 miles and stay left again and go another 1.3 miles. The 0-foot stake is located approximately 55 paces to the west at 275 degrees magnetic with browse tag #186. The witness post is next to a gas valve on the gas line.

Map Name: Archy Bench SE



Diagrammatic Sketch:



Township: 11S Range: 23E Section: 28

GPS: NAD 83, UTM 12S 641689 E 4410270 N

ARCHY BENCH - WRI STUDY 10R-51
Project #2050

Site Description

Site Information: The study is located approximately sixteen miles southwest of Bonanza, within a Wyoming big sagebrush flat (*Artemisia tridentata* ssp. *wyomingensis*) on Archy Bench. The area is administrated by the Bureau of Land Management (BLM) as part of the Olsen AMP allotment. Prior to treatment, the study was established in 2011 to monitor a Plateau (Imazapic) herbicide and one-way Ely chaining treatment. Prior to the establishment of the study, the project area was lopped and scattered to remove pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) trees. In the fall of 2011, a seed mix of grass, forb, and browse species was aerially applied to the project area, and then the project area was one-chained with an Ely chain (Table - Seed Mix). Following the chaining and seeding treatment, the project area was aerially sprayed with Plateau herbicide. The grazing operator has agreed to defer grazing on the project area for a minimum of two growing seasons (WRI Database 2012). The objective of the project is to restore the Wyoming big sagebrush community that has dramatically declined over the last few years. Deer pellet groups were sampled in moderate abundance, while elk pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 10R, Study no: 51

Project Name: Archy Bench Sagebrush Restoration WRI Database #: 2050			
Application: Aerial Seed		Acres:	600
Seed Type		lbs in mix	lbs/acre
G	Bottlebrush Squirreltail	600	1.00
G	Canby Bluegrass 'Canbar'	150	0.25
G	Crested Wheatgrass 'Ephraim'	900	1.50
G	Indian Ricegrass	600	1.00
G	Russian Wildrye 'Bozoisky'	900	1.50
G	Siberian Wheatgrass 'Vavilov'	600	1.00
G	Snake River Wheatgrass 'Secar'	900	1.50
G	Western Wheatgrass 'Arriba'	1200	2.00
F	Blue Flax 'Appar'	600	1.00
F	Rocky Mountain Beeplant	598	1.00
F	Western Yarrow 'Eagle Mountain'	75	0.13
B	Forage Kochia	150	0.25
B	Fourwing Saltbush	900	1.50
B	Winterfat	600	1.00
Total Pounds:		8773	14.62
PLS Pounds:			10.92

Browse: The preferred browse species on the site is Wyoming big sagebrush, which provides the majority of the browse cover. The Wyoming big sagebrush is a moderately dense population with high decadence, and high amount of plants displaying poor vigor within the population. The recruitment of young sagebrush plants to the population was poor. Utilization of sagebrush was mostly moderate. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), stickyleaf low rabbitbrush (*C. viscidiflorus*), spiny hopsage (*Grayia spinosa*), broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia sp.*), and black greasewood (*Sarcobatus vermiculatus*). Pinyon pine and Utah juniper trees were removed from the site prior to the establishment of the study site (Table - Browse characteristics). The stage of woodland succession was considered to be within Phase I (Tausch et al. 2009).

Herbaceous Trends: The grass community is not overly abundant or diverse, and is dominated by the weedy annual grass species cheatgrass (*Bromus tectorum*). Perennial species are rare. Thickspike wheatgrass (*Agropyron dasystachyum*) and bottlebrush squirreltail (*Sitanion hystrix*) were the most abundant perennial grass species sampled on the site. Other grass species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*) and needle-and-thread (*Stipa comata*). Forbs are moderately diverse, but are dominated by annual species. The weedy annual species Russian thistle (*Salsola iberica*) was the dominant forb sampled on the site in frequency and cover (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Walknolls-Gilston association, most likely as part of the Gilston component, which is found on drainage ways. The parent material consists of alluvium derived from sandstone. The soils within this classification are characterized as deep, well drained, and with a highly permeable restrictive layer. The soil surface texture is an extremely channery sandy loam (Soil Survey Staff 2011). Bare ground is low on the site, though there is a high amount of vegetation, and a moderate amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2011.

HERBACEOUS TRENDS--
Management unit 10R, Study no: 51

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron dasystachyum	41	1.55
G	Bromus tectorum (a)	317	16.86
G	Oryzopsis hymenoides	5	.18
G	Sitanion hystrix	28	1.12
G	Stipa comata	3	.00
Total for Annual Grasses		317	16.86
Total for Perennial Grasses		77	2.86
Total for Grasses		394	19.73
F	Astragalus convallarius	5	.03
F	Astragalus sp.	8	.06
F	Chenopodium fremontii (a)	8	.07
F	Cryptantha sp.	6	.03
F	Descurainia pinnata (a)	6	.06
F	Eriogonum cernuum (a)	7	.16
F	Euphorbia albomarginata	24	.33
F	Halogeton glomeratus (a)	2	.15
F	Lappula occidentalis (a)	1	.03
F	Machaeranthera canescens	8	.07
F	Phlox austromontana	5	.16
F	Phlox longifolia	12	.03
F	Salsola iberica (a)	55	3.54
F	Sisymbrium altissimum (a)	17	.63
Total for Annual Forbs		96	4.65
Total for Perennial Forbs		68	0.73
Total for Forbs		164	5.38

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

BROWSE TRENDS--
Management unit 10R, Study no: 51

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata wyomingensis	75	18.58
B	Chrysothamnus viscidiflorus	1	-
B	Grayia spinosa	1	.98
B	Gutierrezia sarothrae	20	2.33
B	Opuntia sp.	1	.03
B	Sarcobatus vermiculatus	5	1.32
Total for Browse		103	23.26

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 51

Species	Percent Cover '11
Artemisia tridentata wyomingensis	22.20
Grayia spinosa	.83
Gutierrezia sarothrae	1.73
Sarcobatus vermiculatus	3.46

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10R, Study no: 51

Species	Average leader growth (in) '11
Artemisia tridentata wyomingensis	0.9

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 51

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	7	2.5
Pinus edulis	5	0.8

BASIC COVER--
Management unit 10R, Study no: 51

Cover Type	Average Cover % '11
Vegetation	45.07
Rock	1.44
Pavement	35.29
Litter	27.35
Cryptogams	2.00
Bare Ground	7.87

PELLET GROUP DATA--
Management unit 10R, Study no: 51

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	2	-
Elk	8	7 (18)
Deer	6	24 (60)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 51

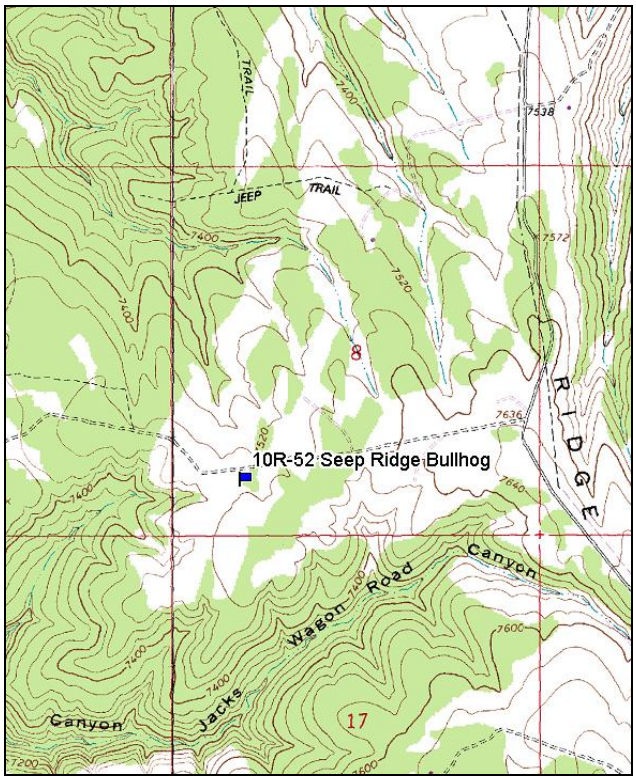
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
11	**3460**	3	71	25	40	60	18	18	28/38
Chrysothamnus nauseosus									
11	**0**	0	0	-	-	0	0	0	23/21
Chrysothamnus viscidiflorus									
11	**20**	0	100	-	-	0	0	0	18/31
Grayia spinosa									
11	**40**	50	50	-	-	100	0	0	28/42
Gutierrezia sarothrae									
11	**1140**	35	65	-	240	0	0	0	14/30
Juniperus osteosperma									
11	**0**	0	0	-	20	0	0	0	-/-
Opuntia sp.									
11	**20**	0	100	-	-	0	0	0	4/12
Sarcobatus vermiculatus									
11	**180**	11	89	-	20	22	44	0	44/65

SEEP RIDGE BULLHOG - WRI STUDY 10R-52-11
Project #1950

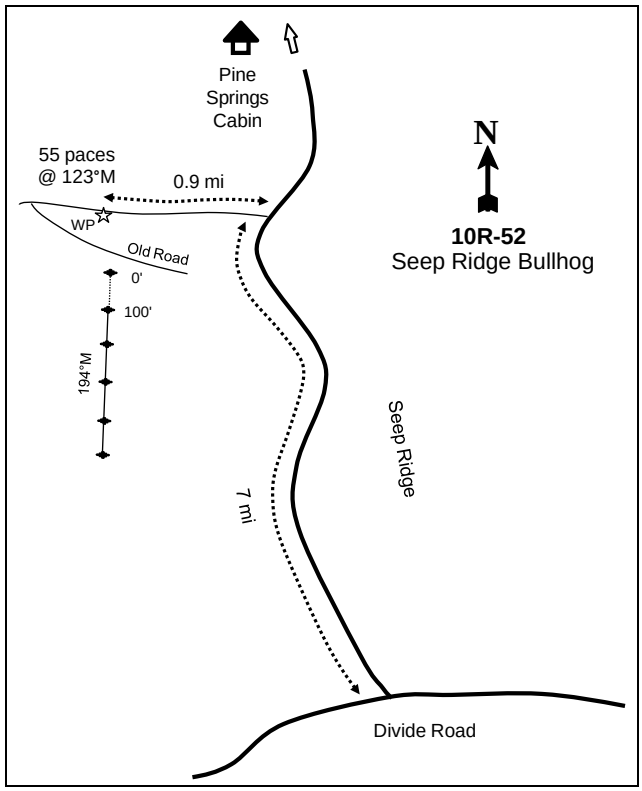
Vegetation Type: Pinyon and Juniper
Range Type: Substantial Deer Winter, Crucial Elk Summer
NRCS Ecological Site Description: Upland Shallow Loam (Pinyon-Utah Juniper), R034XY322UT
Land Ownership: BLM
Elevation: 7,550 ft (2,301 m)
Aspect: Northwest
Slope: 1%
Transect bearing: 194° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the intersect of the Divide road and Seep Ridge road drive north on the seep ridge road 7 miles and turn left heading west. Drive 0.9 miles to the witness post on the left side of the road. The o-foot stake is 24 paces at 170 degrees magnetic. The browse tag is #183.

Map Name: Seep Canyon



Diagrammatic Sketch:



Township: 15S Range: 23E Section: 8

GPS: NAD 83, UTM 12S 639911 E 4375992 N

SEEP RIDGE BULLHOG - WRI STUDY 10R-52
Project #1950

Site Description

Site Information: The study is located approximately four miles southeast of the Pine Springs cabin, within a pinyon pine (*Pinus edulis*) and juniper (*Juniperus sp.*) woodland, on Seep Ridge north of Jacks Wagon Road Canyon. The area is administrated by the Bureau of Land Management (BLM) as part of the Sweet Water allotment. Prior to treatment, the study was established in 2011 to monitor a pinyon and juniper tree removal project using bullhog machinery. In the fall of 2011, a seed mix of grass, forb, and browse species was aerially seeded over the project area prior to the start of bullhog work. An estimated 475 acres were bullhogged in the winter of 2011/12. In the latter end of December of 2011 during the bullhog treatment, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) was aerially seeded over the project area (Table - Seed Mix). The treatment area will be rested from grazing for two growing seasons to allow seed establishment. The objectives of the project are to increase cover of grasses, forbs, and browse species through seeding, and reduced competition from conifers (WRI Database 2012). Elk pellet groups were sampled in moderate abundance, while deer and cattle sign were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 10R, Study no: 52

Project Name: Seep Ridge Bullhog Phase II WRI Database #: 1950			
Application: Aerial Seed		Acres:	475
Seed Type		lbs in mix	lbs/acre
G	Big Bluegrass 'Sherman'	100	0.74
G	Bluebunch Wheatgrass 'P-7'	600	0.21
G	Canby Bluegrass 'Canbar'	100	1.26
G	Great Basin Wildrye 'Trailhead'	350	0.21
G	Green Needlegrass 'Lodorm'	350	0.74
G	Indian Ricegrass	500	0.74
G	Sandberg Bluegrass	100	1.05
G	Slender Wheatgrass 'San Luis'	700	0.21
F	Alfalfa 'Nomad'	350	1.47
G	Thickspike Wheatgrass 'Bannock'	600	1.26
F	Alfalfa 'Spreador 4'	350	0.74
F	Blue Flax 'Appar'	200	0.42
F	Sainfoin 'Eski'	950	2.00
F	Small Burnet 'Delar'	950	2.00
B	Bitterbrush	200	0.42
B	True Mountain Mahogany	100	0.21
Total Pounds:		6500	13.68
PLS Pounds:			12.07

Project Name: Seep Ridge Bullhog Phase II - Browse WRI Database #: 1950			
Application: Aerial Seed		Acres:	400
Seed Type		lbs in mix	lbs/acre
B	Sagebrush, Wyoming	400	1.00
Total Pounds:		400	1.00
PLS Pounds:			0.16

Browse: The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), and antelope bitterbrush (*Purshia tridentata*). Mountain big sagebrush and antelope bitterbrush are the dominant preferred browse species on the site. The mountain big sagebrush is a sparse population, with high decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was good. Utilization of sagebrush plants was light to moderate. Antelope bitterbrush is a moderately dense population, with low decadence and good vigor within the population. The recruitment of young bitterbrush plants to the population was good. Utilization of bitterbrush plants was mostly light with a few plants that were heavily grazed. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia sp.*), mountain ball cactus (*Pediocactus simpsonii*), and snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics). The study site was dominated by a dense stand of pinyon pine, Utah juniper (*Juniperus osteosperma*), and Rocky Mountain juniper (*Juniperus scopulorum*) (Table - Point Quarter Tree Data), which provided the majority of the canopy cover on the site in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009).

Herbaceous Trends: Grasses are not overly abundant or diverse on the site. The dominant grass species is mutton bluegrass (*Poa fendleriana*), which provides the majority of the grass cover on the site. Other grass species sampled on the site include blue grama (*Bouteloua gracilis*), sedge (*Carex sp.*), prairie junegrass (*Koeleria cristata*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are neither abundant or diverse on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Jagon-Rock outcrop complex, and is part of the Jagon component, which is found on plateaus. The parent material consists of eolian deposits and slope alluvium derived from sandstone. The soils within this classification are characterized as shallow and well drained with a moderately permeable restrictive layer. The soil surface texture is a very gravelly loam (Soil Survey Staff 2011). Bare ground is moderate on the site, though there is a high amount of litter, and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 10R, Study no: 52

Type	Species	Nested Frequency '11	Average Cover % '11
G	Bouteloua gracilis	20	.26
G	Carex sp.	3	.03
G	Koeleria cristata	11	.16
G	Poa fendleriana	102	3.25
G	Sitanion hystrix	25	.20
Total for Annual Grasses		0	0
Total for Perennial Grasses		161	3.90
Total for Grasses		161	3.90
F	Antennaria rosea	4	.01
F	Arabis holboellii	17	.04
F	Chenopodium leptophyllum(a)	5	.18
F	Cryptantha sp.	3	.00
F	Descurainia pinnata (a)	1	.00
F	Lesquerella sp.	4	.01
F	Linum lewisii	2	.00
F	Penstemon caespitosus	1	.00

Type	Species	Nested Frequency '11	Average Cover % '11
F	Penstemon pachyphyllus	2	.03
F	Phlox longifolia	3	.00
F	Polygonum douglasii (a)	21	.05
Total for Annual Forbs		27	0.23
Total for Perennial Forbs		36	0.12
Total for Forbs		63	0.35

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

BROWSE TRENDS--
Management unit 10R, Study no: 52

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	40	3.84
B	Cercocarpus montanus	3	1.23
B	Gutierrezia sarothrae	1	.15
B	Juniperus osteosperma	11	5.37
B	Juniperus scopulorum	2	.18
B	Opuntia sp.	5	-
B	Pinus edulis	26	12.04
B	Purshia tridentata	43	9.00
B	Symphoricarpos oreophilus	14	.44
Total for Browse		145	32.28

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 52

Species	Percent Cover '11
Artemisia tridentata vaseyana	5.05
Cercocarpus montanus	.80
Juniperus osteosperma	20.31
Juniperus scopulorum	.18
Opuntia sp.	.01
Pinus edulis	34.08
Purshia tridentata	6.84
Symphoricarpos oreophilus	.50

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10R, Study no: 52

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.2
Cercocarpus montanus	9.3
Purshia tridentata	4.8

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 52

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	285	3.7
Juniperus scopulorum	34	3.1
Pinus edulis	811	2.4
Pseudotsuga menziesii	21	1.4

BASIC COVER--
Management unit 10R, Study no: 52

Cover Type	Average Cover % '11
Vegetation	30.91
Rock	2.23
Pavement	8.06
Litter	51.68
Cryptogams	4.67
Bare Ground	23.19

PELLET GROUP DATA--
Management unit 10R, Study no: 52

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Elk	6	20 (50)
Deer	4	13 (33)
Cattle	-	3 (7)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 52

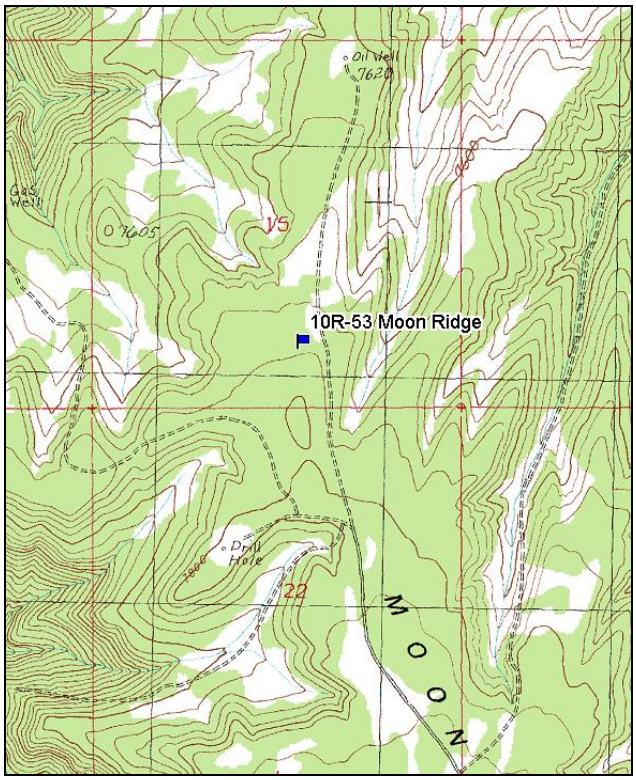
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
11	**0**	0	0	-	-	0	0	0	3/10
Artemisia tridentata vaseyana									
11	**1060**	15	53	32	20	19	2	23	26/32
Cercocarpus montanus									
11	**60**	33	67	-	-	0	0	0	41/53
Gutierrezia sarothrae									
11	**20**	0	100	-	-	0	0	0	-/-
Juniperus osteosperma									
11	**220**	55	45	-	80	0	0	0	-/-
Juniperus scopulorum									
11	**40**	100	0	-	20	0	0	0	-/-
Opuntia sp.									
11	**100**	0	100	-	-	0	0	0	4/11
Pediocactus simpsonii									
11	**0**	0	0	-	-	0	0	0	2/2
Pinus edulis									
11	**580**	55	45	-	480	0	0	0	-/-
Purshia tridentata									
11	**1440**	31	67	3	80	11	10	3	19/27
Symphoricarpos oreophilus									
11	**560**	71	29	-	-	0	0	4	11/20

MOON RIDGE - WRI STUDY 10R-53-11
Project #1973 and Project #2218

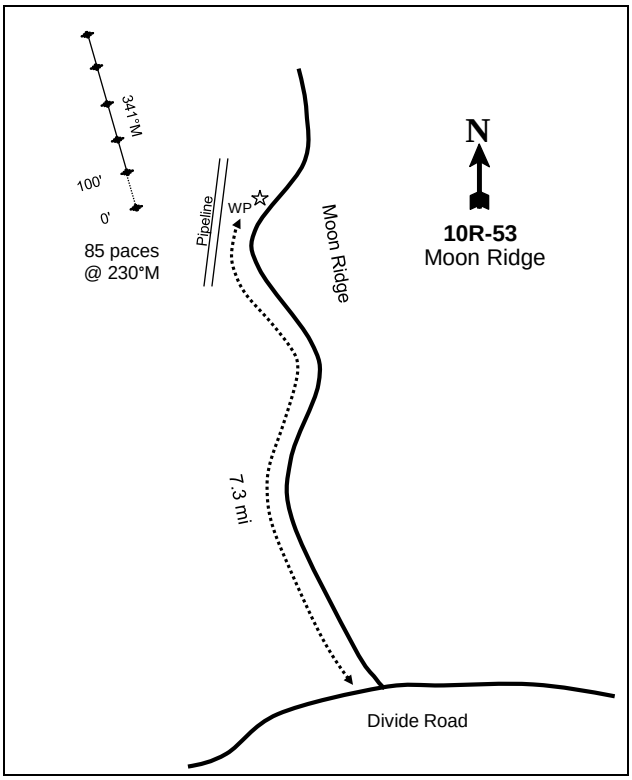
Vegetation Type: Pinyon and Juniper
Range Type: Substantial Deer Summer, Crucial Elk Winter
NRCS Ecological Site Description: Upland Loam (Wyoming Big Sagebrush), R034XY306UT
Land Ownership: BLM
Elevation: 7,754 ft (2,357 m)
Aspect: North
Slope: 5%
Transect bearing: 341° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the intersect of the Divide road and Moon Ridge road drive north on the Moon Ridge road 7.3 miles to the witness post. The 0-foot stake is 85 paces at 230 degrees magnetic. The browse tag is #182.

Map Name: Tenmile Canyon North



Diagrammatic Sketch:



Township: 16S Range: 21E Section: 15

GPS: NAD 83, UTM 12S 621556 E 4363326 N

MOON RIDGE - WRI STUDY 10R-53
Project #1973 and Project #2218

Site Description

Site Information: The study is located approximately four miles north of Steer Ridge cabin, within a pinyon pine (*Pinus edulis*) and juniper (*Juniperus sp.*) woodland on Moon Ridge. The area is administrated by the Bureau of Land Management (BLM) as part of the McClelland allotment. Originally, the study was established in 2011, prior to treatment, to monitor a pinyon and juniper tree removal project using bullhog machinery, but the project was cancelled. In 2012, the project area is planned to be included in a chaining project. Updated information on the project will be available in the next report (WRI Database 2012). Deer, elk, and horse pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), dwarf rabbitbrush (*Chrysothamnus depressus*), and antelope bitterbrush (*Purshia tridentata*). Mountain big sagebrush is the dominant preferred browse species on the site. The mountain big sagebrush is a sparse population with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was good. Utilization of sagebrush plants was light. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*), pricklypear cactus (*Opuntia sp.*), and snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics). The study site was dominated by a dense stand of pinyon pine, Utah juniper (*Juniperus osteosperma*), and Rocky Mountain juniper (*Juniperus scopulorum*) trees (Table - Point Quarter Tree Data), which provided the majority of the canopy cover on the study site in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009).

Herbaceous Trends: Grasses are moderately abundant and diverse on the site. The dominant grass species are mutton bluegrass (*Poa fendleriana*) and Sandberg bluegrass (*P. secunda*), which provides the majority of the grass cover on the site. Other grass species sampled on the site include thickspike wheatgrass (*Agropyron dasystachyum*), blue grama (*Bouteloua gracilis*), sedge (*Carex sp.*), prairie junegrass (*Koeleria cristata*), needle-and-thread (*Stipa comata*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are moderately abundant and diverse on the site. The dominant forb species were rose pussytoes (*Antennaria rosea*) and penstemon (*Penstemon sp.*), which provided the majority of the forb cover on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Winteridge-Moonset association and is most likely part of the Moonset component, which is found on hills. The parent material consists of slope alluvium derived from sandstone and shale. The soils within this classification are characterized as shallow, well drained, and with a moderately permeable restrictive layer. The soil surface texture is a loam (Soil Survey Staff 2011). Bare ground is low on the site, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2011.

HERBACEOUS TRENDS--
Management unit 10R, Study no: 53

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron dasystachyum	9	.04
G	Carex sp.	33	.65
G	Koeleria cristata	41	.97
G	Poa fendleriana	87	3.79
G	Poa secunda	41	2.03
G	Sitanion hystrix	16	.14
G	Stipa comata	1	.00
Total for Annual Grasses		0	0
Total for Perennial Grasses		228	7.64
Total for Grasses		228	7.64
F	Agoseris glauca	9	.05
F	Antennaria rosea	46	1.52
F	Arabis holboellii	4	.00
F	Astragalus tenellus	2	.03
F	Astragalus utahensis	4	.06
F	Crepis acuminata	1	.00
F	Erigeron eatonii	19	.15
F	Lupinus argenteus	6	.71
F	Penstemon comarrhenus	3	.00
F	Penstemon sp.	94	3.20
F	Phlox austromontana	9	.45
F	Phlox longifolia	2	.03
F	Polygonum douglasii (a)	8	.01
Total for Annual Forbs		8	0.01
Total for Perennial Forbs		199	6.24
Total for Forbs		207	6.25

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

BROWSE TRENDS--
Management unit 10R, Study no: 53

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	9	1.56
B	Cercocarpus montanus	0	.15
B	Chrysothamnus depressus	3	.00
B	Chrysothamnus viscidiflorus viscidiflorus	2	-
B	Juniperus osteosperma	8	1.72
B	Juniperus scopulorum	0	.15
B	Opuntia sp.	2	.15
B	Pinus edulis	21	13.96
Total for Browse		45	17.71

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 53

Species	Percent Cover '11
Amelanchier utahensis	-
Artemisia tridentata vaseyana	1.89
Cercocarpus montanus	-
Juniperus osteosperma	19.98
Juniperus scopulorum	1.18
Pinus edulis	42.79

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10R, Study no: 53

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	2.1
Cercocarpus montanus	6.0

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 53

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	442	9.5
Pinus edulis	793	2.2

BASIC COVER--
Management unit 10R, Study no: 53

Cover Type	Average Cover % '11
Vegetation	26.47
Pavement	.31
Litter	63.65
Cryptogams	7.89
Bare Ground	16.59

PELLET GROUP DATA--
Management unit 10R, Study no: 53

Type	Quadrat Frequency '11	Days use per acre (ha) 11
Elk	-	5 (12)
Deer	-	7 (17)
Horse	-	1 (1)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 53

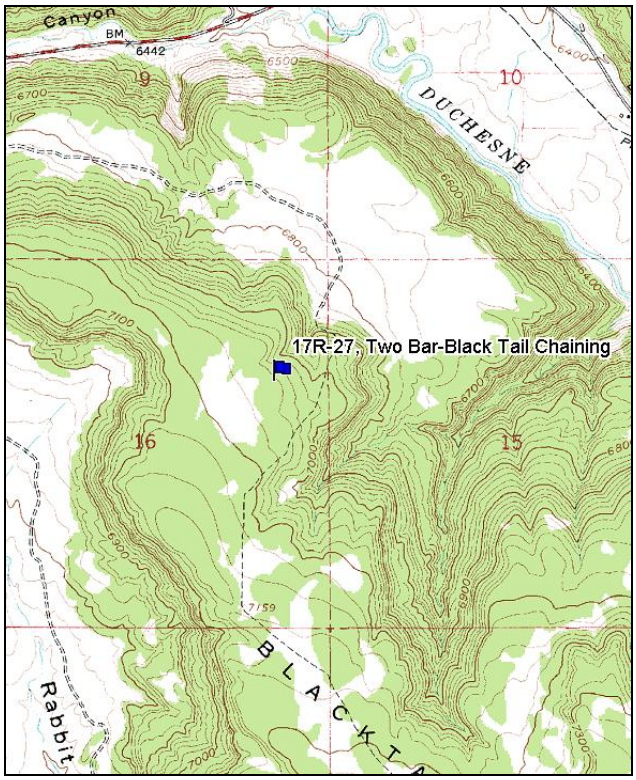
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
11	**0**	0	0	-	-	0	0	0	6/11
Artemisia tridentata vaseyana									
11	**280**	29	64	7	-	0	0	7	23/26
Cercocarpus montanus									
11	**0**	0	0	-	-	0	0	0	33/33
Chrysothamnus depressus									
11	**60**	0	100	-	20	0	0	0	5/7
Chrysothamnus viscidiflorus viscidiflorus									
11	**40**	50	50	-	-	0	0	0	25/24
Juniperus osteosperma									
11	**160**	63	38	-	100	0	0	13	-/-
Opuntia sp.									
11	**60**	33	67	-	-	0	0	0	5/19
Pinus edulis									
11	**500**	36	64	-	480	0	0	0	-/-
Purshia tridentata									
11	**0**	0	0	-	-	0	0	0	14/26
Symphoricarpos oreophilus									
11	**0**	0	0	-	-	0	0	0	16/33

TWO BAR-BLACKTAIL CHAINING - WRI STUDY 17R-27-11
Project #368

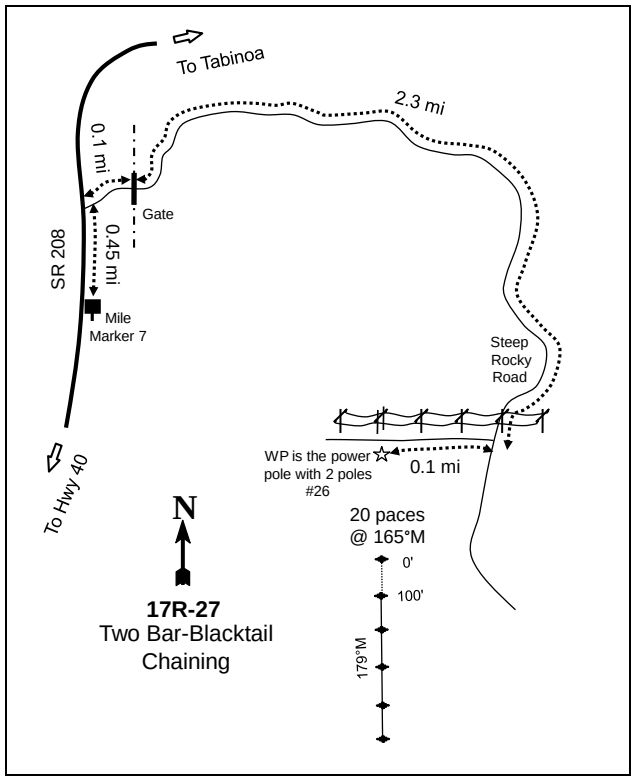
Vegetation Type: Perennial Grass
Range Type: Substantial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Not available
Land Ownership: UDWR
Elevation: 7,012 ft (2,137 m)
Aspect: Southeast
Slope: 4%
Transect bearing: 179° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From Highway 40 drive north on the SR 208 and travel to mile marker 7. Travel north from mile marker 7 and go 0.65 miles to a road coming in from the right (east). Turn right and travel 0.1 miles to a gate and proceed another 2.3 miles to a power line. Park at the power line service road (In past readings of the study the road up the steep rocky hill was impassable, so be cautious, you may have to park at bottom). From the service road walk 0.1 miles to the double power pole marked with pole #26. The 0-foot stake is 20 paces at 165 degrees magnetic. The 0-foot stake is marked with browse tag #137.

Map Name: Tabiona



Diagrammatic Sketch:



Township: 6S Range: 11E Section: 11

GPS: NAD 83, UTM 12S 527706 E 4462075 N

TWO BAR-BLACKTAIL CHAINING - WRI STUDY 17R-27
Project #368

Site Description

Site Information: The study is located approximately four miles southeast of Tabiona, within a perennial grass dominated flat, on top of Black Ridge near Golden Stair Canyon, on the Tabby Mountain Wildlife Management Area (WMA). Prior to treatment, the study was established in 2007 to monitor a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) thinning project. In the fall of 2007, approximately 978 acres were two-way Ely chained, and a seed mix of browse species was seeded with a dribbler during the second pass of the chain. A seed mix of grass and forb species was aerially applied to the project area following the first pass of the chain. In January of 2008, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) was aerially seeded over the project after the completion of the chaining treatment (Table - Seed Mix). The objective of the project is to improve crucial winter habitat for mule deer and elk by removing pinyon and juniper from important browse and sagebrush communities. The project area was rested from livestock grazing for two growing seasons following the treatment (WRI Database 2012). Deer pellet groups were sampled in moderate abundance in 2007, but in low abundance in 2009 and 2011. Elk pellet groups were sampled in high abundance in 2007, moderate abundance in 2009, and low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 17R, Study no: 27

Project Name: 2-Bar PJ Thinning - Black Tail WRI Database #: 368			
Application: Aerial Seed		Acres:	600
Seed Type		lbs in mix	lbs/acre
G	Blue Grama	300	0.50
G	Canby Bluegrass 'Canbar'	150	0.25
G	Crested Wheatgrass 'Douglas'	300	0.50
G	Crested Wheatgrass 'Ephraim'	300	0.50
G	Great Basin Wildrye 'Trailhead'	300	0.50
G	Orchardgrass 'Paiute'	300	0.50
G	Russian Wildrye	450	0.75
G	Sandberg Bluegrass	150	0.25
G	Snake River Wheatgrass 'Secar'	300	0.50
G	Thickspike Wheatgrass 'Bannock'	600	1.00
F	Blue Flax ' Appar	150	0.25
F	Sainfoin 'Eski'	1500	2.50
F	Small Burnet 'Delar'	1200	2.00
Total Pounds:		6000	10.00
PLS Pounds:			8.85

Project Name: 2-Bar PJ Thinning - Sagebrush WRI Database #: 368			
Application: Aerial Seed		Acres:	925
Seed Type		lbs in mix	lbs/acre
B	Sagebrush, Wyoming	960	1.04
Total Pounds:		960	1.04
PLS Pounds:			0.22

Project Name: 2-Bar PJ Thinning - Dribbler WRI Database #: 368			
Application: Dribbler		Acres:	1000
Seed Type		lbs in mix	lbs/acre
B	Bitterbrush	150	0.15
B	Fourwing Saltbush	200	0.20
B	True Mountain Mahogany	50	0.05
Total Pounds:		400	0.40
PLS Pounds:			0.26

Browse: The preferred browse species on this site are black sagebrush (*Artemisia nova*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), true mountain mahogany (*Cercocarpus montanus*), and dwarf rabbitbrush (*Chrysothamnus depressus*). Black sagebrush is the dominant preferred browse species and has provided the majority of the preferred browse canopy cover on the site over the sample years (Table - Canopy Cover). The black sagebrush is a sparse, lightly used population, with low decadence and good vigor within the population, though prior to treatment, decadence and plants displaying poor vigor were high. The recruitment of young black sagebrush plants to the population has been good over the sample years. The seeded species Wyoming big sagebrush and true mountain mahogany were sampled on the site following the

treatment, though each of these species was present on the site prior to treatment. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), prickly phlox (*Leptodactylon pungens*), pricklypear cactus (*Opuntia sp.* and *O. fragilis*), and mountain ball cactus (*Pediocactus simpsonii*) (Table - Browse Characteristics). Prior to treatment, pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) dominated the site providing the majority of the canopy cover, but following the treatment canopy cover decreased substantially and has remained minimal on the site (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species are crested wheatgrass (*Agropyron cristatum*), thickspike wheatgrass (*A. dasystachyum*), and bluebunch wheatgrass (*A. spicatum*). The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled following the treatment and has increased in abundance on the site. Several seeded grass species were sampled on the site which include crested wheatgrass, thickspike wheatgrass, orchardgrass (*Dactylis glomerata*), Great Basin wildrye (*Elymus cinereus*), Russian wildrye (*E. junceus*), and Sandberg bluegrass (*Poa secunda*), though Sandberg bluegrass was present on the site prior to the treatment. Other grass species sampled on the site include western wheatgrass (*Agropyron smithii*), sedge (*Carex sp.*), Indian ricegrass (*Oryzopsis hymenoides*), mutton bluegrass (*Poa fendleriana*), bottlebrush squirreltail (*Sitanion hystrix*), sand dropseed (*Sporobolus cryptandrus*), and needle-and-thread (*Stipa comata*). Forbs are moderately abundant and fairly diverse, though prior to treatment, forbs were rare on the site. The dominant forb species on the site are Hoods phlox (*Phlox hoodii*) and blue flax (*Linum perenne*). Seeded forb species sampled on the site include blue flax, alfalfa (*Medicago sativa*), small burnet (*Sanguisorba minor*), and sainfoin (*Onobrychis viciaefolia*) (Table - Herbaceous Trends).

Soils: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as moderate to critical in 2007 due to surface litter and soil movement, pedestalling around plants, flow patterns, and the formation of rills and gullies. Following the treatment the soil erosion improved and was classified as slight in 2009, and stable in 2011. It was noted in the 2009 study year that much of the contributing factors to erosion were still present on the site, but in a lesser degree. It was also noted that areas where gullies had or were forming were now filled in with organic material and bars were mechanically constructed to prevent water from running back into the gullies.

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

Browse: Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Black sagebrush canopy cover decreased slightly from 2% to 1%. Although preferred browse cover did not increase, the removal of the pinyon and juniper overstory releases the potential for recruitment and sagebrush development. The density of pinyon pine trees decreased from 185 trees/acre with an average diameter of 5.3 inches to 32 trees/acre with an average diameter of 3.0 inches. The density of Utah juniper trees decreased from 34 trees/acre with an average diameter of 11.6 inches to 23 trees/acre with an average diameter of 6.0 inches. Canopy cover of pinyon and juniper trees decreased from 21% to 1% and 3% to 2%, respectively. Most of the trees sampled from both species were less than 4 feet tall in 2009 with many being knocked over by the chaining, but remained alive.

Grass: The sum of nested frequency of perennial grasses remained similar, though cover increased from 5% to 12%, and most species exhibited good seed production. Bluebunch wheatgrass remained similar in nested frequency, though cover increased from 3% to 7%. Sandberg bluegrass decreased in nested frequency and cover remained at 1%. Diversity also increased with the introduction of many of the seeded species. Crested wheatgrass and orchardgrass were the most common seeded grass species sampled on the site following the treatment and provided 2% and 1% cover, respectively.

Forb: The sum of nested frequency of perennial forbs increased 60%, and cover increased from 1% to 4%. Annual forbs also had a substantial increase in the sum of nested frequency, and cover increased from near 0% to 6%. The seeded species blue flax, small burnet, and sainfoin each provided 1% cover following the treatment.

Trend Assessments

Browse:

- **2009 to 2011 - up (+2):** Density of browse species was not sampled in 2009; therefore comparisons are based on line intercept canopy cover. Black sagebrush increased in cover to 5%. The seeded species Wyoming big sagebrush and true mountain mahogany each increased in cover from less than 1% to 1%. In comparing the density of browse species prior to treatment in 2007 to the 2011 sample years, the density of black sagebrush increased 23% from 1,400 plants/acre to 1,720 plants/acre. Also, the health of the black sagebrush community improved with decadence decreasing from 40% to 3%, and plants displaying poor vigor decreased from 21% to 5%.

Grass:

- **2009 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased 64%, and cover increased to 17%. Thickspike wheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 5%. Bluebunch wheatgrass remained similar in nested frequency, but cover decreased to 5%.

Forb:

- **2009 to 2011 - up (+2):** The sum of nested frequency of perennial forbs increased two-fold, and cover increased from 4% to 7%. Blue flax increased significantly in nested frequency and cover increased to 3%. The mat forming perennial forb species Hoods phlox remained similar in nested frequency, but cover increased to 1% cover.

HERBACEOUS TRENDS--
Management unit 17R, Study no: 27

Type	Species	Nested Frequency			Average Cover %		
		'07	'09	'11	'07	'09	'11
G	Agropyron cristatum	a-	b30	b55	-	1.66	2.01
G	Agropyron dasystachyum	a-	a8	b105	-	.07	4.60
G	Agropyron smithii	ab19	a2	b23	.09	.03	1.13
G	Agropyron spicatum	101	96	105	3.00	6.53	4.87
G	Bromus tectorum (a)	a-	b19	c128	-	.24	1.44
G	Carex sp.	5	-	1	.03	-	.00
G	Dactylis glomerata	a-	ab28	ab17	-	.83	.99
G	Elymus cinereus	-	10	11	-	.07	.84
G	Elymus junceus	-	1	-	-	.00	.00
G	Oryzopsis hymenoides	b23	a2	ab12	.36	.03	.42
G	Poa fendleriana	a4	b30	a10	.38	.70	.33
G	Poa secunda	b115	b56	a49	1.18	.62	.52
G	Sitanion hystrix	ab4	a2	b16	.04	.06	.58
G	Sporobolus cryptandrus	-	-	1	-	-	.03
G	Stipa comata	a5	a2	b32	.03	.90	1.00
Total for Annual Grasses		0	19	128	0	0.24	1.44
Total for Perennial Grasses		276	267	437	5.13	11.54	17.36

Type	Species	Nested Frequency			Average Cover %		
		'07	'09	'11	'07	'09	'11
Total for Grasses		276	286	565	5.13	11.78	18.80
F	Antennaria rosea	-	-	4	-	-	.03
F	Arabis sp.	$_{b}$9	$_{a}$-	$_{a}$2	.03	-	.00
F	Astragalus convallarius	-	3	-	-	.18	-
F	Astragalus sp.	-	1	4	-	.00	.01
F	Chaenactis douglasii	$_{a}$3	$_{a}$-	$_{b}$20	.00	-	.38
F	Chenopodium album (a)	-	1	2	-	.00	.06
F	Chenopodium fremontii (a)	$_{a}$3	$_{c}$77	$_{b}$32	.00	1.99	.68
F	Chenopodium leptophyllum(a)	-	2	11	-	.01	.05
F	Crepis acuminata	-	3	-	-	.03	-
F	Cryptantha sp.	-	1	10	-	.00	.10
F	Cymopterus sp.	15	10	-	.03	.09	-
F	Descurainia pinnata (a)	1	5	11	.00	.19	.09
F	Eriogonum sp.	-	10	3	-	.34	.03
F	Gayophytum ramosissimum(a)	$_{a}$-	$_{b}$29	$_{b}$17	-	.71	.10
F	Holosteum umbellatum (a)	-	-	2	-	-	.00
F	Hymenoxys acaulis	-	3	-	-	.00	-
F	Ipomopsis aggregata	-	3	8	-	.15	.06
F	Lactuca serriola (a)	-	-	12	-	-	.19
F	Lappula occidentalis (a)	31	42	37	.09	2.92	.07
F	Linum perenne	$_{a}$-	$_{b}$18	$_{c}$56	-	1.10	2.75
F	Machaeranthera canescens	$_{a}$-	$_{a}$5	$_{b}$47	-	.21	.48
F	Medicago sativa	-	-	4	-	-	.01
F	Onobrychis viciaefolia	-	9	12	-	.69	.52
F	Penstemon humilis	23	19	26	.18	.20	.24
F	Phlox hoodii	24	20	25	.58	.32	1.39
F	Phlox longifolia	-	4	1	-	.01	.03
F	Polygonum douglasii (a)	-	2	48	-	.15	.35
F	Sanguisorba minor	-	9	10	-	.54	.51
F	Tragopogon dubius (a)	-	-	1	-	-	.03
Total for Annual Forbs		35	158	173	0.09	5.99	1.64
Total for Perennial Forbs		74	118	232	0.83	3.88	6.57
Total for Forbs		109	276	405	0.93	9.88	8.22

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

BROWSE TRENDS--
Management unit 17R, Study no: 27

Type	Species	Strip Frequency			Average Cover %		
		'07	'09	'11	'07	'09	'11
B	Artemisia nova	38	0	34	1.49	1.42	3.10
B	Artemisia tridentata wyomingensis	7	0	9	.18	.18	.36
B	Cercocarpus montanus	1	0	2	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	19	0	15	-	-	-
B	Chrysothamnus depressus	0	0	2	.38	.98	1.41
B	Juniperus osteosperma	0	0	1	-	1.08	.98
B	Leptodactylon pungens	3	0	3	-	-	.03
B	Opuntia fragilis	13	0	0	.01	.04	-
B	Opuntia sp.	8	0	9	.03	.09	.06
B	Pediocactus simpsonii	1	0	0	-	-	-
B	Pinus edulis	7	0	2	4.91	2.45	1.04
Total for Browse		97	0	77	7.02	6.27	7.00

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 27

Species	Percent Cover		
	'07	'09	'11
Artemisia nova	2.26	1.38	4.80
Artemisia tridentata wyomingensis	.05	.18	.55
Cercocarpus montanus	-	-	.78
Chrysothamnus depressus	.18	-	.21
Juniperus osteosperma	3.29	2.36	1.26
Leptodactylon pungens	-	.50	-
Opuntia sp.	.01	.01	.10
Pinus edulis	21.41	1.25	1.31

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 27

Species	Average leader growth (in)		
	'07	'09	'11
Artemisia nova	0.7	-	1.5
Artemisia tridentata vaseyana	-	-	3.8

POINT-QUARTER TREE DATA--
Management unit 17R, Study no: 27

Species	Trees per Acre			Average diameter (in)		
	'07	'09	'11	'07	'09	'11
Juniperus osteosperma	34	23	22	11.6	6.0	5
Pinus edulis	185	32	38	5.3	3.0	2.2

BASIC COVER--
Management unit 17R, Study no: 27

Cover Type	Average Cover %		
	'07	'09	'11
Vegetation	12.70	28.27	31.73
Rock	3.20	3.05	3.35
Pavement	1.17	.06	.31
Litter	58.04	65.05	55.79
Cryptogams	10.44	.58	.22
Bare Ground	23.95	19.63	16.77

SOIL ANALYSIS DATA --
Management unit 17R, Study no: 27, Study Name: Two Bar-Black Tail Chaining

pH	loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
7.0	41.4	44.0	14.6	1.6	9.1	67.2	0.6

PELLET GROUP DATA--
Management unit 17R, Study no: 27

Type	Quadrat Frequency		
	'07	'09	'11
Rabbit	38	4	8
Elk	31	6	9
Deer	35	14	9

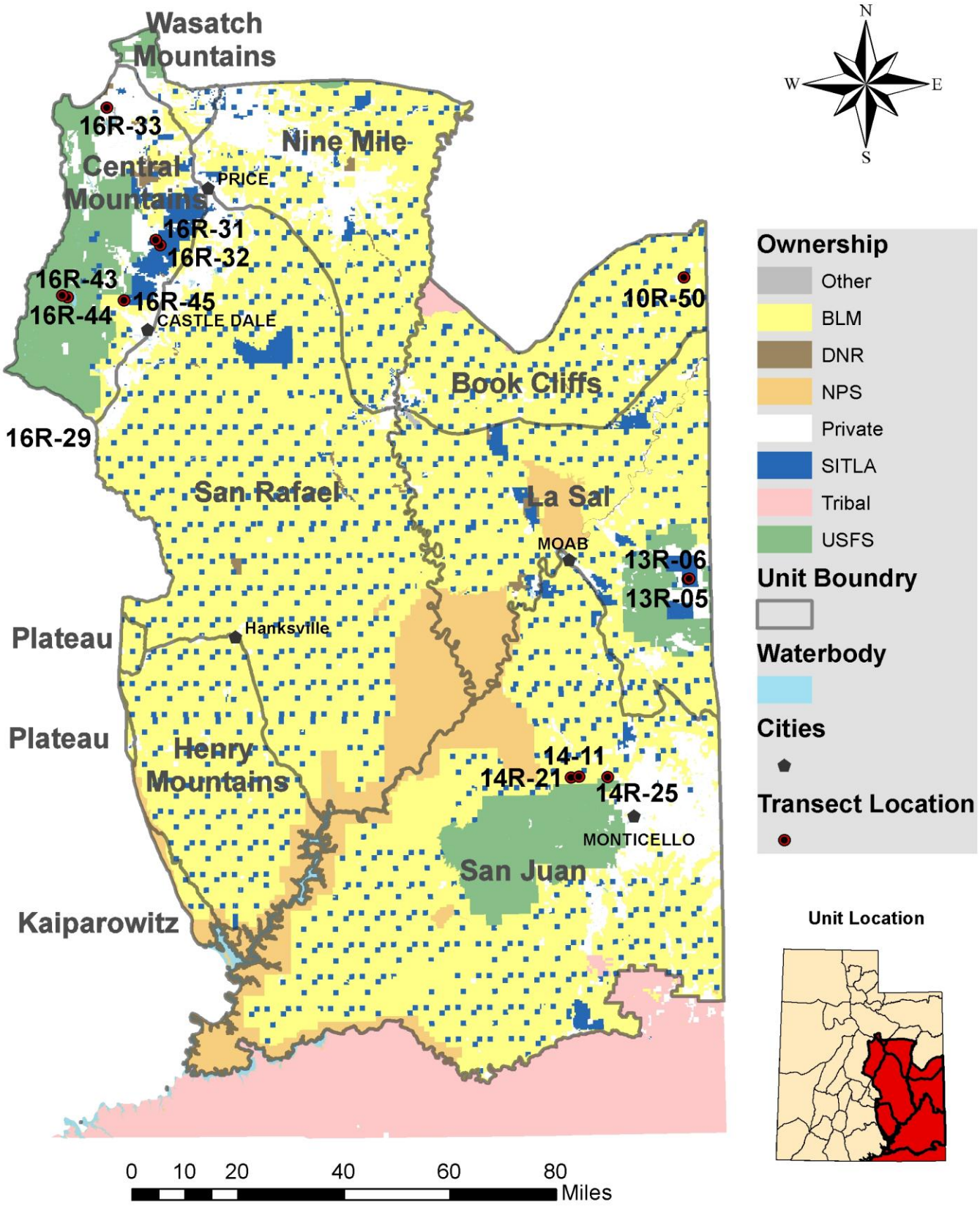
Days use per acre (ha)		
'07	'09	'11
-	-	-
42 (104)	31 (76)	13 (33)
25 (63)	16 (40)	17 (43)

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 27

		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									
07	**1400**	21	39	40	220	9	39	21	10/19
09	**0**	0	0	0	-	0	0	0	14/22
11	**1720**	42	55	3	4020	8	0	5	8/17
Artemisia tridentata wyomingensis									
07	**180**	0	33	67	-	0	56	56	17/26
09	**0**	0	0	0	-	0	0	0	17/24
11	**280**	29	71	0	420	0	0	0	15/22
Cercocarpus montanus									
07	**20**	0	0	100	-	0	100	100	19/22
09	**0**	0	0	0	-	0	0	0	22/27
11	**40**	0	100	0	-	50	0	0	21/26
Chrysothamnus depressus									
07	**900**	0	84	16	440	40	49	7	3/9
09	**0**	0	0	0	-	0	0	0	7/15
11	**680**	9	91	0	80	3	0	0	5/13

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus									
07	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	19/19
Chrysothamnus viscidiflorus viscidiflorus									
07	**0**	0	0	-	-	0	0	0	8/10
09	**0**	0	0	-	-	0	0	0	15/17
11	**40**	0	100	-	-	0	0	0	9/18
Juniperus osteosperma									
07	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	20	0	0	0	-/-
Leptodactylon pungens									
07	**100**	0	0	100	-	0	0	100	-/-
09	**0**	0	0	0	-	0	0	0	5/9
11	**180**	0	100	0	-	0	0	0	4/7
Opuntia fragilis									
07	**320**	19	81	-	-	0	0	0	2/6
09	**0**	0	0	-	-	0	0	0	2/9
11	**0**	0	0	-	-	0	0	0	-/-
Opuntia sp.									
07	**260**	8	62	31	-	0	0	8	5/13
09	**0**	0	0	0	-	0	0	0	4/13
11	**220**	0	91	9	20	0	0	9	3/8
Pediocactus simpsonii									
07	**20**	0	100	-	-	0	0	0	1/2
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Pinus edulis									
07	**140**	43	57	-	20	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**40**	100	0	-	20	0	0	0	-/-

Southeastern Region
WRI Studies 2011

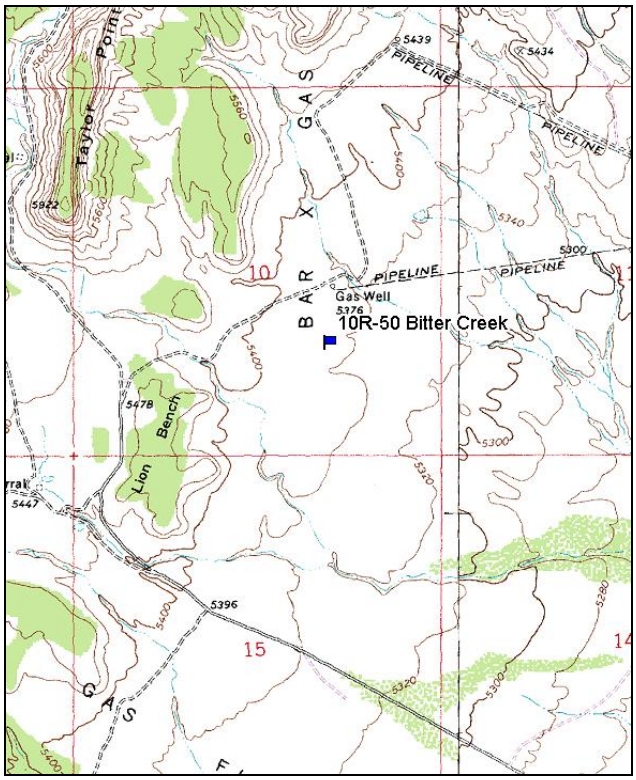


BITTER CREEK - WRI STUDY 10R-50-11
Project #1606

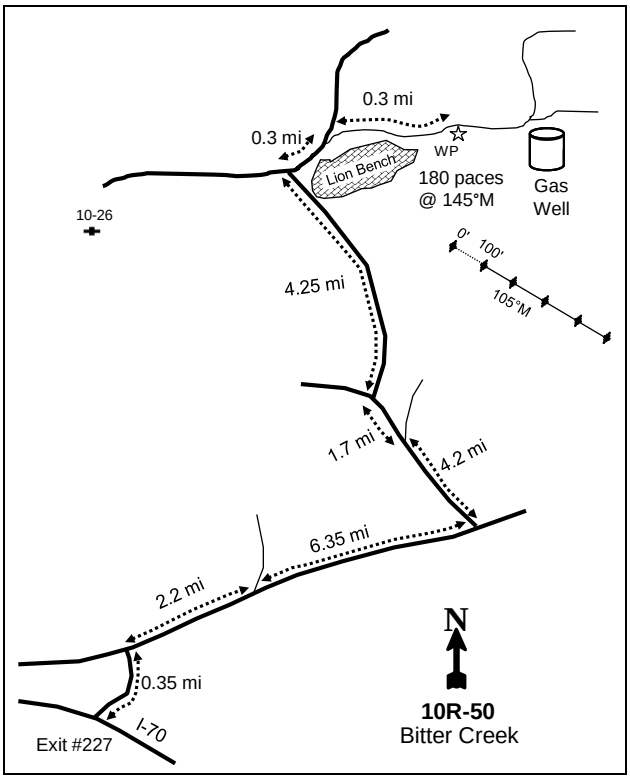
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT
Land Ownership: BLM
Elevation: 5,315 ft (1,620 m)
Aspect: East
Slope: 1%
Transect bearing: 105° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: Take I-70 exit #227 Westwater and turn left to the Book Cliff area. Travel 0.35 miles to a "T" intersection and turn right (northeast). Proceed 2.2 miles to a fork and keep right. Stay on the main road for 6.35 miles to a dirt road on the left. Turn left traveling north-northwest. Proceed 4.2 miles and stay left on the main road. Continue and turn right. Travel another 4.25 miles to a fork. Turn right and continue for 0.3 miles and to a fork and turn right. Travel another 0.3 miles to the WP on the right side of the road (south). The study is a80 paces at 145 degrees magnetic. The browse tag is #187.

Map Name: Bryson Canyon



Diagrammatic Sketch:



Township: 7S Range: 25E Section: 10

GPS: NAD 83, UTM 12S 660944 E 4356145 N

BITTER CREEK - WRI STUDY 10R-50
Project #1606

Site Description

Site Information: The study is located approximately eleven miles north of Harley Dome, within a cheatgrass (*Bromus tectorum*) dominated flat, on the northeast side of Lion Bench. The area is administrated by the Bureau of Land Management (BLM) as part of the San Arroyo allotment. Prior to treatment, the study was established in 2011 to monitor a prescribed fire, herbicide, and seeding treatment. Due to limited fire conditions and cheatgrass green up in the fall of 2011, the prescribed fire was not used on the project area. In the fall of 2011, a total of 1,100 acres were aerially sprayed with Plateau (Imazapic) herbicide. A seed mix of grass, forb, and browse species was drill seeded following the herbicide treatment (Table - Seed Mix). In December of 2011, a pasture fence was constructed to reduce grazing pressure on the project site. The objectives of the project are to develop a mosaic native plant community, reduce cheatgrass and other noxious weeds, improve wildlife habitat and forage, increase grazing opportunities, and support a functional watershed (WRI Database 2012). In 2011, cattle sign was sampled in moderate abundance, while deer and elk pellet groups were sampled in low abundance (Table - Pellet Group Data).

SEED MIX--
Management unit 10R, Study no: 50

Project Name: Bitter Creek Restoration WRI Database #: 1606			
Application: Rangeland Drill		Acres:	1100
Seed Type		lbs in mix	lbs/acre
G	Blue Grama 'Alma'	350	0.32
G	Bluebunch Wheatgrass 'Anatone	1640	1.49
G	Crested Wheatgrass 'Ephraim'	2750	2.50
G	Galleta	822	0.75
G	Indian Ricegrass	1650	1.50
G	Pubescent Wheatgrass 'Luna'	2200	2.00
G	Russian Wildrye 'Bozoisky'	1100	1.00
G	Sand Dropseed	100	0.09
G	Western Wheatgrass 'Arriba'	1650	1.50
F	Blue Flax 'Appar'	550	0.50
F	Palmer Penstemon	548	0.50
F	Small Burnet 'Delar'	1950	1.77
B	Fourwing Saltbush	2201	2.00
B	Winterfat	1100	1.00
Total Pounds:		18611	16.92
PLS Pounds:			12.88

Project Name: Bitter Creek Restoration - Browse Mix WRI Database #: 1606			
Application: Rangeland Drill		Acres:	1100
Seed Type		lbs in mix	lbs/acre
B	Forage Kochia	550	0.50
B	Sagebrush, Wyoming	653	0.59
Total Pounds:		1203	1.09
PLS Pounds:			0.33

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 low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was poor in 2011, with no young plants sampled. Utilization of sagebrush plants was mostly moderate. No other browse species were sampled on the site in 2011 (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and moderately diverse, but are in poor condition on the site. The weedy annual grass species cheatgrass dominates the site and provides the majority of herbaceous cover. Crested wheatgrass (*Agropyron cristatum*), Blue grama (*Bouteloua gracilis*), and sand dropseed (*Sporobolus*

cryptandrus) were the most common perennial grass species sampled on the site prior to the treatment. Forbs are rare on the site. Scarlet globemallow (*Sphaeralcea coccinea*) was the only perennial forb species sampled on the site in 2011 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Barx component, which is found on alluvial fans and fan terraces. The parent material consists of alluvium derived from sandstone. The soils within this classification are characterized as deep and well drained with a moderately permeable restrictive layer. According to the Natural Resources Conservation Service (NRCS) soil maps the soil surface texture is a fine sandy loam (Soil Survey Staff 2011). Bare ground is high on the site, though there is 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 2011.

HERBACEOUS TRENDS--
Management unit 10R, Study no: 50

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron cristatum	112	6.75
G	Bouteloua gracilis	62	3.77
G	Bromus tectorum (a)	413	26.97
G	Hilaria jamesii	10	.36
G	Sporobolus cryptandrus	33	1.89
G	Vulpia octoflora (a)	12	.10
Total for Annual Grasses		425	27.07
Total for Perennial Grasses		217	12.80
Total for Grasses		642	39.87
F	Chorispora tenella (a)	1	.00
F	Descurainia pinnata (a)	1	.00
F	Erodium cicutarium (a)	2	.03
F	Lappula occidentalis (a)	17	.08
F	Ranunculus testiculatus (a)	9	.01
F	Sisymbrium altissimum (a)	11	.21
F	Sphaeralcea coccinea	56	.77
Total for Annual Forbs		41	0.35
Total for Perennial Forbs		56	0.77
Total for Forbs		97	1.12

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

BROWSE TRENDS--
Management unit 10R, Study no: 50

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata wyomingensis	12	2.19
Total for Browse		12	2.19

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 50

Species	Percent Cover '11
Artemisia tridentata wyomingensis	4.09

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10R, Study no: 50

Species	Average leader growth (in) '11
Artemisia tridentata wyomingensis	2.2

BASIC COVER--
Management unit 10R, Study no: 50

Cover Type	Average Cover % '11
Vegetation	44.55
Rock	.09
Pavement	.30
Litter	22.48
Cryptogams	.18
Bare Ground	35.09

PELLET GROUP DATA--
Management unit 10R, Study no: 50

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	24	-
Elk	4	3 (7)
Deer	15	9 (22)
Cattle	4	20 (48)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 50

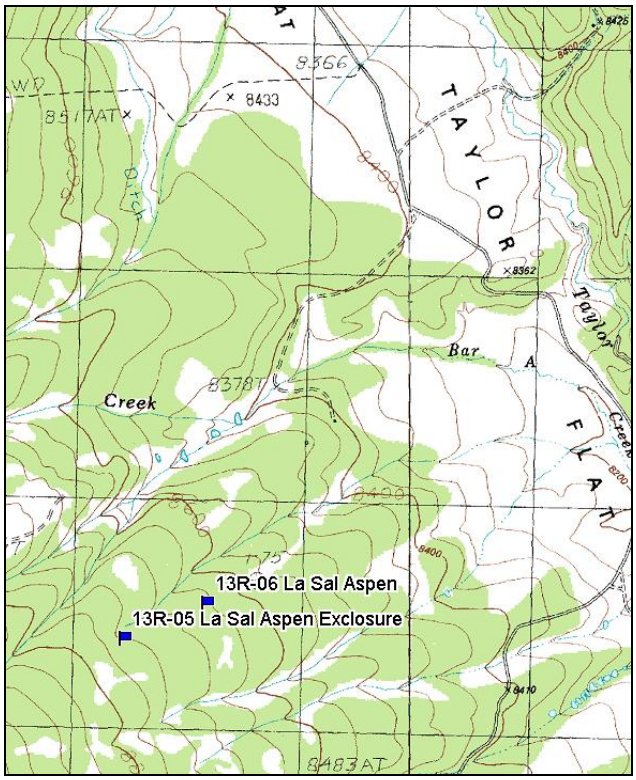
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
11	**260**	0	100	-	-	38	0	8	20/31

LA SAL ASPEN EXCLOSURE - WRI STUDY 13R-5-11
Project #1990

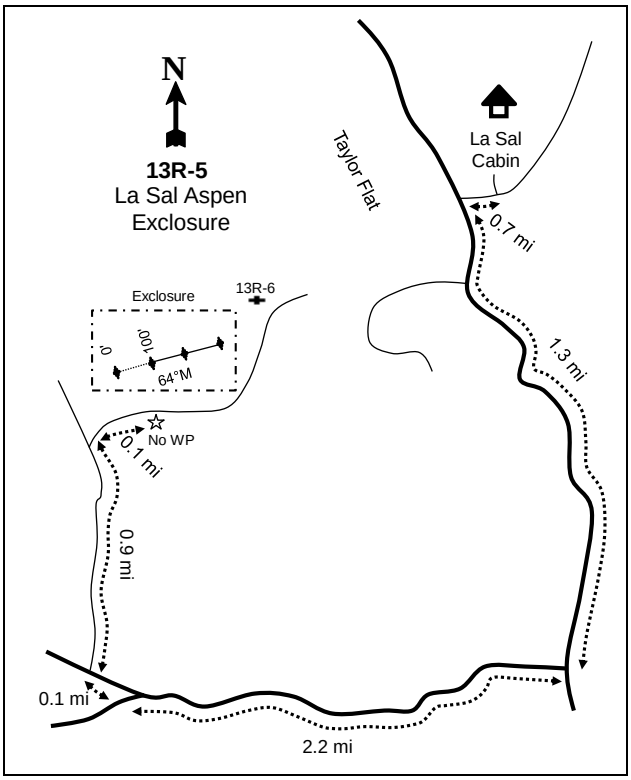
Vegetation Type: Aspen
Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Summer
NRCS Ecological Site Description: High Mountain Loam (Aspen), R048AY506UT
Land Ownership: SITLA
Elevation: 8,682 ft (2,650 m)
Aspect: Northeast
Slope: 9%
Transect bearing: 64° magnetic
Belt placement: line 1 (11ft & 95ft), line 2 (34ft & 71ft), line 3 (59ft)
No rebar

Directions: From the La Sal cabin drive down the canyon to the southwest 0.7 miles. Turn left heading south in Taylors Flat. Drive 1.3 miles turn right and drive another 2.2 miles. At the intersection drive a short 0.1 miles and turn right and drive another 0.9 miles and turn right. Drive 0.1 mile to the exclosure. The study is on the north side of the road inside the exclosure. The 0-foot stake is approximately 12 paces from the road heading north. The 0-foot stake is marked with browse tag #189.

Map Name: Mount Waas



Diagrammatic Sketch:



Township: 26S Range: 25E Section: 26

GPS: NAD 83, UTM 12S 662148 E 4264560 N

LA SAL ASPEN EXCLOSURE - WRI STUDY 13R-5
Project #1990

Site Description

Site Information: The study is located approximately two miles southwest of La Sal cabin, within a quaking aspen (*Populus tremuloides*) stand, on a mountain slope west of Taylor Flat, on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). Prior to treatment, the study was established in 2011 to monitor an aspen regeneration project. In the fall of 2011, aspen trees were cut and removed by logging methods. Following the logging treatment, mountain snowberry (*Symphoricarpos oreophilus*) was planned to be thinned by a dozer or a skidsteer equipped with a brush rake, however, due to timing and limited access from winter storms, the snowberry was not thinned. Three temporary fences were constructed in areas known to experience heavy browsing within the project. Exclosure size ranged from three to eight acres. The study is located within an exclosure portion of the project. Livestock grazing occurs from June 15 to Oct 20. Management efforts will address current grazing practices and find ways to develop pastures for extended resting. The objectives of the project are to decrease the density of snowberry following aspen clearfell-coppice harvest and protect aspen suckers in known heavily browsed areas with temporary fences (WRI Database 2012). Deer and elk pellet groups were sampled in low abundance in 2011. It was noted that pellet groups were hard to see due to thick vegetation on the site. Also, cattle were on the site at the time of sampling, but no cattle pellet groups were sampled on the study site in 2011 (Table - Pellet Group Data).

Browse: The study site is dominated by mountain snowberry and quaking aspen. Quaking aspen is a moderately dense population. Methods for classifying the age class of aspen was different than the other browse species sampled. The age class of aspen trees were split into four different size classes; size class I = less than or equal to 1.5 feet; size class II = greater than 1.5 feet to 5 feet; size class III = greater than 5 feet and up to 1 inch diameter at breast height; and size class IV = greater than 1 inch diameter at breast height (Jones 2005). The aspen population consisted of an over-story of size class IV trees with an understory of intermixed size class I-III trees. Utilization of aspen was moderately light (Table - Aspen Characteristics). Point-quarter tree data was only collected on mature aspen trees at a density of 67 trees/acre with an average diameter of 15.4 inches (Table - Point Quarter Data). The snowberry was a very dense population. Only cover measurement for snowberry was collected due to the high density of the population (Table - Canopy Cover). Other browse species sampled on the site include mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), Gambel oak (*Quercus gambelii*), and Woods rose (*Rosa woodsii*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and moderately diverse on the site. The dominant grass species on the site are thickspike wheatgrass (*Agropyron trachycaulum*), sedge (*Carex sp.*), and Kentucky bluegrass (*Poa pratensis*). Other grass species sampled on the site include nodding brome (*Bromus anomalus*), mountain brome (*B. carinatus*), Thurber fescue (*Festuca thurberi*), and subalpine needlegrass (*Stipa columbiana*). Forbs are abundant and moderately diverse on the site. The dominant forb species are thickleaf peavine (*Lathyrus lanszwertii*), Fendler meadowrue (*Thalictrum fendleri*), and American vetch (*Vicia americana*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Toone component, which is found on valley trains and outwash fans. The parent material consists of alluvium derived from diorite. The soils within this classification are characterized as deep, well drained, and with a slightly permeable restrictive layer. The soil surface texture is a loam (Soil Survey Staff 2011). Bare ground is low on the site, with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 13R, Study no: 5

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron trachycaulum	129	3.75
G	Bromus anomalus	23	.19
G	Bromus carinatus	18	.66
G	Carex sp.	84	4.30
G	Festuca thurberi	8	.36
G	Poa pratensis	391	23.65
G	Stipa columbiana	45	1.37
Total for Annual Grasses		0	0
Total for Perennial Grasses		698	34.30
Total for Grasses		698	34.30
F	Achillea millefolium	71	1.99
F	Artemisia ludoviciana	3	.00
F	Aster sp.	17	.31
F	Calochortus gunnisoni	2	.00
F	Cymopterus lemmonii	14	.34
F	Galium sp.	58	1.50
F	Gilia sp. (a)	3	.03
F	Heracleum lanatum	24	1.67
F	Lathyrus lanszwertii	206	6.95
F	Lupinus sericeus	6	.23
F	Potentilla gracilis	1	.00
F	Stellaria jamesiana	10	.07
F	Taraxacum officinale	33	.50
F	Thalictrum fendleri	301	26.61
F	Vicia americana	204	9.58
Total for Annual Forbs		3	0.03
Total for Perennial Forbs		950	49.82
Total for Forbs		953	49.85

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

BROWSE TRENDS--
Management unit 13R, Study no: 5

Type	Species	Strip Frequency '11	Average Cover % '11
B	Populus tremuloides	64	3.28
B	Quercus gambelii	1	-
B	Rosa woodsii	6	.15
B	Symphoricarpos oreophilus	-	25.27
Total for Browse		71	28.71

CANOPY COVER, LINE INTERCEPT--
Management unit 13R, Study no: 5

Species	Percent Cover '11
Populus tremuloides	29.18
Rosa woodsii	.40
Symphoricarpos oreophilus	38.68

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 13R, Study no: 5

Species	Average leader growth (in) '11
Populus tremuloides	13.1

POINT-QUARTER TREE DATA--
Management unit 13R, Study no: 5

Species	Trees per Acre '11	Average diameter (in) '11
Populus tremuloides	67	15.4

BASIC COVER--
Management unit 13R, Study no: 5

Cover Type	Average Cover % '11
Vegetation	86.97
Litter	56.17
Cryptogams	.15
Bare Ground	.04

PELLET GROUP DATA--
Management unit 13R, Study no: 5

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Elk	-	1 (3)
Deer	-	11 (26)
Cattle	1	-

BROWSE CHARACTERISTICS--
Management unit 13R, Study no: 5

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
11	**0**	0	0	-	60	0	0	0	-/-
Quercus gambelii									
11	**40**	0	100	-	-	0	0	0	-/-
Rosa woodsii									
11	**180**	33	67	-	-	0	0	0	19/12

ASPEN CHARACTERISTICS--
Management unit 13R, Study no: 5

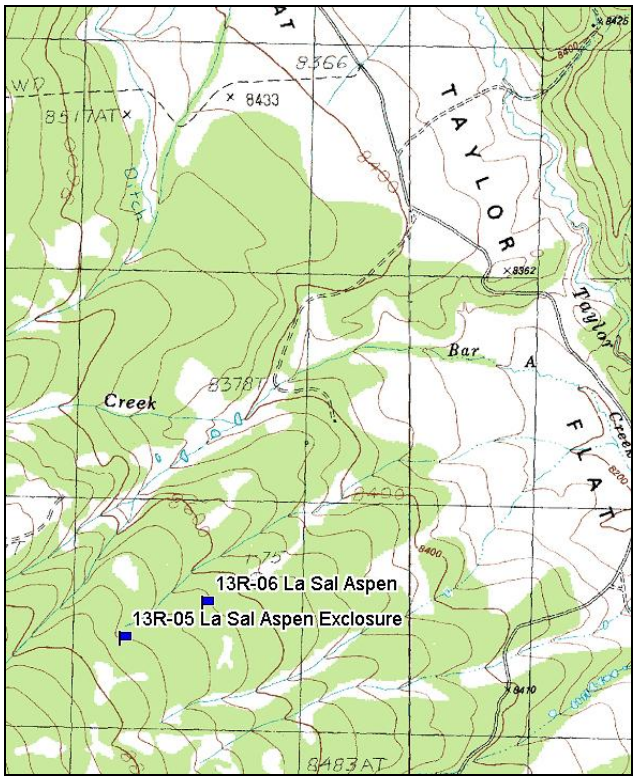
		Age class distribution				Utilization			
Year	Plants per Acre	Size Class I	Size Class II	Size Class III	Size Class IV	% moderate	% heavy	% poor vigor	Average Height Crown (in)
		Density (Plants/acre)							
Populus tremuloides									
11	**4740**	1000	3640	100	160	24	11	.53	-/-

LA SAL ASPEN - WRI STUDY 13R-6-11
Project #1990

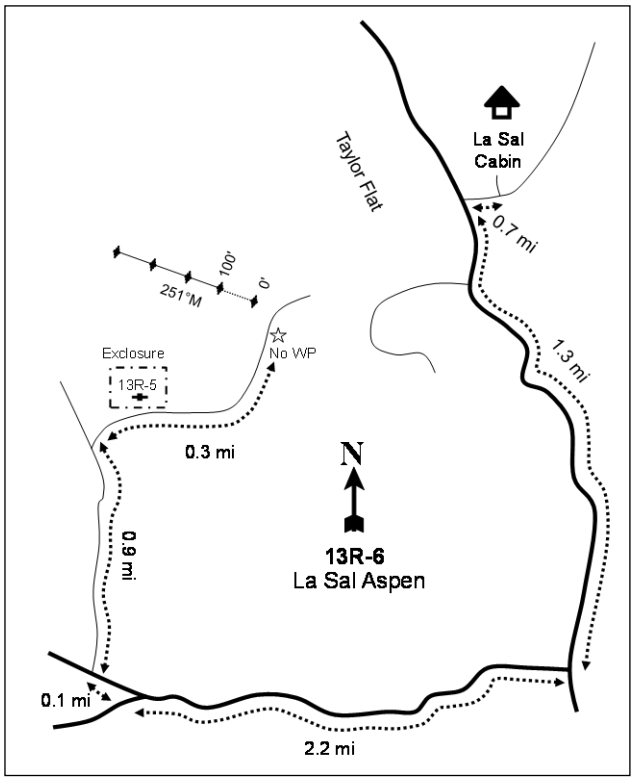
Vegetation Type: Aspen
Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Summer
NRCS Ecological Site Description: High Mountain Loam (Aspen), R048AY506UT
Land Ownership: SITLA
Elevation: 8,593 ft (2,618 m)
Aspect: East
Slope: 10%
Transect bearing: 251° magnetic
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)
No rebar

Directions: From the La Sal cabin drive down the canyon to the southwest 0.7 miles. Turn left heading south in Taylors Flat. Drive 1.3 miles turn right and drive another 2.2 miles. At the intersection drive a short 0.1 miles and turn right and drive another 0.9 miles and turn right. Drive 0.3 miles. The study is on the west side of the road. The 0-foot stake is approximately 12 paces from the road heading west. The 0-foot stake is marked with browse tag #188.

Map Name: Mount Waas



Diagrammatic Sketch:



Township: 26S Range: 25E Section: 26

GPS: NAD 83, UTM 12S 662507 E 4264773 N

LA SAL ASPEN - WRI STUDY 13R-6
Project #1990

Site Description

Site Information: The study is located approximately two miles southwest of La Sal cabin, within a quaking aspen (*Populus tremuloides*) stand, on a mountain slope west of Taylor Flat, on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). Prior to treatment, the study was established in 2011 to monitor an aspen regeneration project. In the fall of 2011, aspen trees were cut and removed by logging methods. Following the logging treatment, mountain snowberry (*Symphoricarpos oreophilus*) was planned to be thinned by a dozer or a skidsteer equipped with a brush rake; however, due to timing and limited access from winter storms, the snowberry was not thinned. Three temporary fences were constructed in areas known to experience heavy browsing within the project. Exclosure size ranged from three to eight acres. The study is located outside of the exclosure portion of the project. Livestock grazing occurs from June 15 to Oct 20. Management efforts will address current grazing practices and find ways to develop pastures for extended resting. The objectives of the project are to decrease the density of snowberry following aspen clearfell-coppice harvest and protect aspen suckers in known heavily browsed areas with temporary fences (WRI Database 2012). Cattle, deer, and elk pellet groups were sampled in low abundance in 2011. Cattle were present on the site at the time of sampling. It was noted that pellet groups were hard to see due to thick vegetation on the site (Table - Pellet Group Data).

Browse: The study site is dominated by mountain snowberry and quaking aspen. Quaking aspen is a moderately dense population. Methods for classifying the age class of aspen was different than the other browse species sampled. The age class of aspen trees were split into four different size classes; size class I = less than or equal to 1.5 feet; size class II = greater than 1.5 feet to 5 feet; size class III = greater than 5 feet and up to 1 inch diameter at breast height; and size class IV = greater than 1 inch diameter at breast height (Jones 2005). The aspen population consisted of an over-story of size class IV trees with an understory of intermixed size class I-III trees. Utilization of aspen was moderately heavy (Table - Aspen Characteristics). Point-quarter tree data was only collected on mature aspen trees at a density of 39 trees/acre, and with an average diameter of 14.8 incher (Table - Point Quarter Data). The snowberry was a very dense population. Only cover measurements of snowberry were collected due to the high density of the population (Table - Canopy Cover). Other browse species sampled on the site include Gambel oak (*Quercus gambelii*) and Woods rose (*Rosa woodsii*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and diverse on the site. The dominant grass species on the site are thickspike wheatgrass (*Agropyron trachycaulum*), subalpine needlegrass (*Stipa columbiana*), and Kentucky bluegrass (*Poa pratensis*). Other grass species sampled on the site include nodding brome (*Bromus anomalus*), mountain brome (*B. carinatus*), smooth brome (*B.* inermis), Thurber fescue (*Festuca thurberi*), sheep fescue (*Festuca ovina*), and sedge (*Carex sp.*). Forbs are abundant and moderately diverse on the site. The dominant forb species are western yarrow (*Achillea millefolium*), thickleaf peavine (*Lathyrus lanszwertii*), Fendler meadowrue (*Thalictrum fendleri*), and American vetch (*Vicia americana*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Toone component, which is found on valley trains and outwash fans. The parent material consists of alluvium derived from diorite. The soils within this classification are characterized as deep, well drained, and with a slightly permeable restrictive layer. The soil surface texture is a loam (Soil Survey Staff 2011). Bare ground is low on the site, with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 13R, Study no: 6

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron trachycaulum	94	3.70
G	Bromus anomalus	35	.48
G	Bromus carinatus	24	1.24
G	Bromus inermis	6	.06
G	Carex sp.	11	.21
G	Festuca ovina	7	.21
G	Festuca thurberi	28	1.93
G	Poa pratensis	374	25.07
G	Stipa columbiana	82	3.01
Total for Annual Grasses		0	0
Total for Perennial Grasses		661	35.94
Total for Grasses		661	35.94
F	Achillea millefolium	204	9.62
F	Androsace septentrionalis (a)	3	.00
F	Aster sp.	12	.07
F	Chenopodium fremontii (a)	8	.07
F	Cirsium sp.	1	.03
F	Cymopterus lemmonii	3	.03
F	Erigeron flagellaris	2	.03
F	Galium sp.	12	.22
F	Heracleum lanatum	10	.30
F	Lathyrus lanszwertii	232	9.82
F	Lupinus sericeus	15	.90
F	Taraxacum officinale	34	.70
F	Thalictrum fendleri	257	20.85
F	Vicia americana	138	4.84
Total for Annual Forbs		11	0.07
Total for Perennial Forbs		920	47.43
Total for Forbs		931	47.51

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

BROWSE TRENDS--
Management unit 13R, Study no: 6

Type	Species	Strip Frequency '11	Average Cover % '11
B	Populus tremuloides	28	2.44
B	Quercus gambelii	5	.30
B	Rosa woodsii	3	-
B	Symphoricarpos oreophilus	-	24.65
Total for Browse		36	27.40

CANOPY COVER, LINE INTERCEPT--
Management unit 13R, Study no: 6

Species	Percent Cover '11
Populus tremuloides	17.50
Quercus gambelii	7.61
Rosa woodsii	.11
Symphoricarpos oreophilus	30.68

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 13R, Study no: 6

Species	Average leader growth (in) '11
Populus tremuloides	5.0

POINT-QUARTER TREE DATA--
Management unit 13R, Study no: 6

Species	Trees per Acre '11	Average diameter (in) '11
Populus tremuloides	39	14.5

BASIC COVER--
Management unit 13R, Study no: 6

Cover Type	Average Cover % '11
Vegetation	82.77
Litter	50.04
Cryptogams	.06
Bare Ground	.84

PELLET GROUP DATA--
Management unit 13R, Study no: 6

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Elk	-	2 (5)
Deer	-	1 (2)
Cattle	1	9 (22)

BROWSE CHARACTERISTICS--
Management unit 13R, 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)
Quercus gambelii									
11	**620**	90	10	-	-	52	0	0	-/-
Rosa woodsii									
11	**60**	0	100	-	-	0	0	0	25/19

ASPEN CHARACTERISTICS--
Management unit 13R, Study no: 6

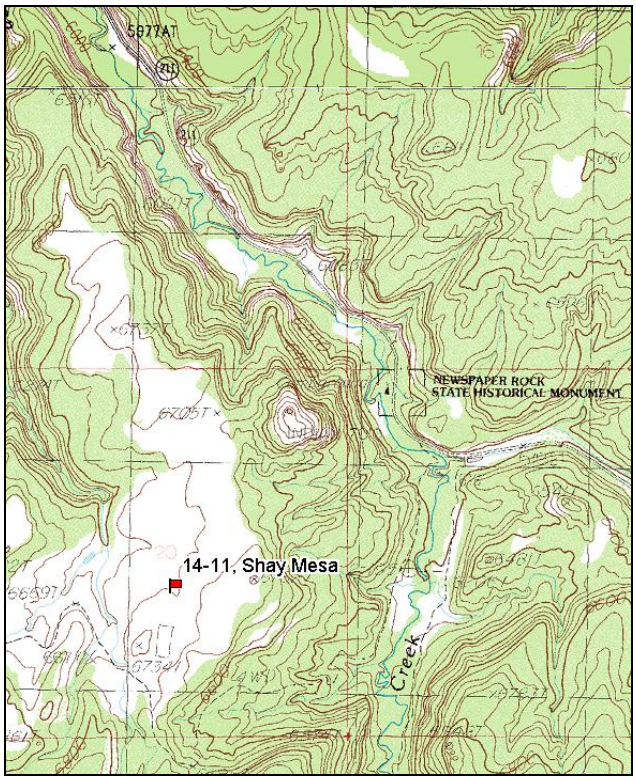
		Age class distribution				Utilization			
Year	Plants per Acre	Size Class I	Size Class II	Size Class III	Size Class IV	% moderate	% heavy	% poor vigor	Average Height Crown (in)
		Density (Plants/acre)							
Populus tremuloides									
11	**4380**	640	1220	40	20	24	11	.53	-/-

SHAY MESA - TREND STUDY NO. 14-11-11
Project #1091

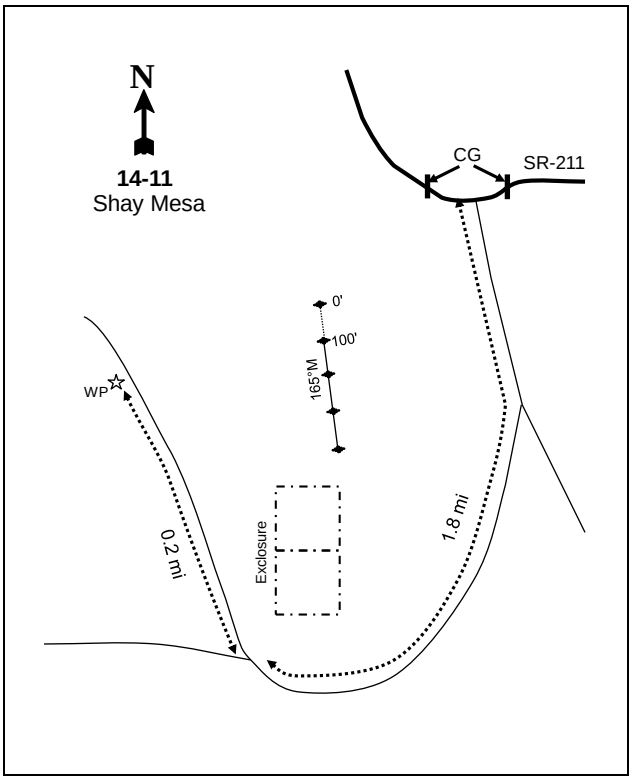
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R035XY306UT
Land Ownership: BLM
Elevation: 6,624 ft (2,019 m)
Aspect: North West
Slope: 4%
Transect bearing: 165° magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: From the junction of SR-l91 and 211 (about 14 miles north of Monticello), turn west on the road towards Canyonlands National Park and Newspaper Rock. Go approximately 13 miles on this paved road, the last two miles dropping into the canyon of a tributary to Indian Creek. Cross a cattleguard and turn left just before another cattleguard and 0.1 miles east of Newspaper Rock. Turn left on this road, cross Indian Creek and go 1.8 miles up onto the mesa. Look for a faint road going up to the right through an old pinyon-juniper chaining to an exclosure. Follow this road 0.2 miles to the north end of the exclosure. The end of the baseline is located 100 feet north of the northeast corner of the exclosure. The 0 foot end of the baseline is 400 feet north and the stake is tagged #7877.

Map Name: Shay Mountain



Diagrammatic Sketch:



Township: 32S Range: 22E Section: 20

GPS: NAD 83, UTM 12S 629121 E 4204634 N

SHAY MESA - TREND STUDY NO. 14-11
Project #1091

Site Information

Site Description: The study is located on Shay Mesa and samples a former mixed pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The study transect was placed just outside a 1958 BLM two-way exclosure and is 700 feet above Indian Creek, which is a perennial stream. A large chaining and seeding project was done in the mid-1960 on these high mesa foothills north of the Abajo Mountains. The area was part of the Shay Mesa Phase II Watershed Restoration Initiative project (project# 1091) done in the early summer of 2009 that treated over 1,300 acres in the area. The study was within a bullhog section of the project that was done in conjunction with several other treatment types in the area. The study site was not seeded. The treatments were designed to reduce pinyon pine and Utah juniper cover, and increase shrub and herbaceous production and diversity. The bullhog treatment removed nearly all the pinyon and juniper on the study site. The bullhog project was done just prior to the sampling in 2009 with many fresh tire tracks throughout the site and the cut trees were still green. The objectives of the project are to reduce hazardous fuel loads, improve wildlife habitat by removing encroaching pinyon and juniper trees, and to increase browse and herbaceous production and diversity (WRI Database 2012). Deer pellet groups were sampled in low abundance in 1999 and 2004, moderate abundance in 2009, and low abundance in 2011. Elk pellet groups have been sampled in low abundance since 2004. Sampled cattle sign was moderate in 1999, but has been low in abundance since 2004 (Table - Pellet Group Data).

Browse: The key browse species is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), which provides nearly all of the preferred browse forage on the site. Prior to the treatment, the dominant overstory was pinyon pine with a few Utah juniper trees scattered throughout the site. The bullhog treatment reduced sagebrush cover, but with the reduction in pinyon and juniper, sagebrush is now the dominant browse species on the site (Table - Browse Trends). Prior to the treatment pinyon pine and Utah juniper density was moderately high. Following the treatment, very few trees were left on the site, and those sampled were mostly young (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009). The bullhog treatment reduced the density of sagebrush and initially increased decadence, but decadence has since decreased to a low amount within the population. Utilization of sagebrush has been mostly moderate over the sample years. Other palatable browse species in the area include fourwing saltbush, slender buckwheat (*Eriogonum microthecum*), and winterfat (*Ceratoides lanata*). Broom snakeweed (*Gutierrezia sarothrae*), a weedy increaser, is also common (Table - Browse Characteristics).

Herbaceous Understory: Grasses are fairly abundant with much of the cover provided by native perennial species. Blue grama (*Bouteloua gracilis*) is the dominant grass species, but the weedy annual grass species cheatgrass (*Bromus tectorum*) provided similar cover in 1999. Cheatgrass abundance has been related to precipitation patterns over the sample years. Other grass species found less frequently include needle-and-thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), and bottlebrush squirreltail (*Sitanion hystrix*). Several typical pinyon and juniper associated forb species are present, although overall density and usefulness is limited. The total cover for forbs has averaged slightly over 1% since 1994. The most common perennial species is scarlet globemallow (*Sphaeralcea coccinea*).

Soil: The soil is classified as part of the Begay component, which is found on cuestas and structural benches. The parent material consists of eolian deposits derived from sandstone. The soils within this classification are characterized as deep and well drained with a highly permeable restrictive layer (Soil Survey Staff 2011). The soil is a light red, sandy clay loam with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). There is one large gully about 20 yards northeast of the baseline which was active in 1986, but appeared to be healing as of 1999. Bare ground cover is moderate on the site, though there is high amount of litter and a moderate amount of vegetation providing protective ground cover. Bare ground cover has been high in the past, but decreased slightly after the treatment with an increase in litter cover and vegetation (Table - Basic Cover).

The soil erosion condition was classified as slight in 2004 and 2011, but was stable in 2009.

Trend Assessments

Browse:

- **1986 to 1994 - stable (0):** Differences in density may be related to the larger sample area used in 1994; therefore, trend was determined using other parameters. There was little change in the sagebrush population, though poor vigor increased from 6% to 18% and recruitment of young sagebrush plants decreased from 77% to 20%.
- **1994 to 1999 - stable (0):** There was little change in the density of mountain big sagebrush, though cover increased slightly. Sagebrush plants displaying poor vigor decreased to less than 1%, though recruitment of young sagebrush plants continued to decrease to 8%.
- **1999 to 2004 - slightly up (+1):** The density of mountain big sagebrush increased by 43% from 2,060 plants/acre to 2,960 plants/acre, and cover increased from 6% to 10%. However, decadence increased from 6% to 27% and plants displaying poor vigor increased to 18%. Recruitment of young sagebrush plants continued to decrease and represented only 4% of the population.

Grass:

- **1986 to 1994 - down (-2):** The sum of nested frequency of perennial grasses decreased by 41%, with a significant decrease in the nested frequency for western wheatgrass and needle-and-thread.
- **1994 to 1999 - slightly down (-1):** There was an 8% decrease in the sum of nested frequency for perennial grasses, though cover increased slightly. There was a significant increase in the nested frequency of cheatgrass, and cover increased to 5%, making cheatgrass the dominant grass species in 1999. There was a significant decrease in the nested frequency for needle-and-thread.
- **1999 to 2004 - down (-2):** The sum of nested frequency of perennial grasses decreased by 30%, though cover remained similar. There was a significant decrease in the nested frequency for western wheatgrass and needle-and-thread. A positive trend was the significant decrease in the nested frequency for cheatgrass, and a decrease in cover to less than 1%.

Forb:

- **1986 to 1994 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, though there was a significant decrease in the nested frequency of low fleabane (*Erigeron pumilus*).
- **1994 to 1999 - slightly up (+1):** The sum of nested frequency for the perennial forbs increased by 11%, and cover increased slightly.
- **1999 to 2004 - down (-2):** There was a 36% decrease in the sum of nested frequency for the perennial forb community, and cover decreased to less than 1%. There was a significant decrease in the nested frequency for the dominant forb scarlet globemallow.

Pre vs. One Year Post Treatment, 2004 vs. 2009

Browse: After the bullhog treatment, density of sagebrush decreased by 51% to 1,440 plants/acre and cover decreased to 6%. Decadence and poor vigor both increased slightly, and recruitment of young sagebrush plants was minimal at 1%. The density of pinyon pine and Utah juniper trees decreased from 79 trees/acre to 8 trees/acre and 34 trees/acre to 5 trees/acre, respectively. The average size of pinyon and juniper trees decreased from an average diameter of 5.1 inches to 0.9 inches and 8.5 inches to 1.0 inches, respectively. Approximately 61% of the pinyon and 50% of the juniper trees were greater than 12 feet in height in 2004. There were few trees sampled in 2009 and all of the sampled trees were less than 4 feet tall.

Grasses: There was little change in the sum of nested frequency for perennial grasses, though cover decreased slightly. There was a significant increase in the nested frequency of cheatgrass, and cover increased to 2%.

Forbs: The sum of nested frequency for perennial forbs decreased by 15%, though cover remained similar.

Post Treatment Trend Assessments

Browse:

- **2009 to 2011 - slightly up (+1):** The density of mountain big sagebrush remained similar at 1,320 plants/acre, though cover increased to 8%. However, decadence decreased from 32% to 9%, and plants displaying poor vigor decreased from 28% to 9%. Recruitment of young sagebrush plants improved with recruitment increasing from 1% to 17% of the population.

Grass:

- **2009 to 2011 - up (+2):** The sum of nested frequency for perennial grasses increased 54%, and cover increased from 7% to 16%. Cheatgrass increased significantly in nested frequency, and cover increased to 3%. Blue grama remained similar in nested frequency, though cover increased from 5% to 10%. Western wheatgrass and needle-and-thread both increased significantly in nested frequency, and increased in cover from less than 1% to 2% and 1% to 3%, respectively.

Forb:

- **2009 to 2011 - up (+2):** The sum of nested frequency for perennial forbs increased 51%, and cover increased from 1% to 3%. The increase in forb cover can be attributed to the increase in cover of scarlet globemallow, which increased in cover from less than 1% to 2%.

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

Type	Species	Nested Frequency						Average Cover %				
		'86	'94	'99	'04	'09	'11	'94	'99	'04	'09	'11
G	Agropyron smithii	$_{d}$204	$_{bcd}$69	$_{cd}$72	$_{b}$38	$_{a}$25	$_{bc}$60	.42	.46	.21	.12	1.67
G	Agropyron spicatum	-	-	-	-	-	1	-	-	-	-	.00
G	Bouteloua gracilis	168	154	163	150	150	161	3.05	5.13	5.67	5.36	9.66
G	Bromus tectorum (a)	$_{a}$-	$_{b}$49	$_{d}$222	$_{a}$2	$_{c}$104	$_{d}$185	.18	5.43	.03	1.79	3.39
G	Hilaria jamesii	-	-	-	-	3	-	-	-	-	.03	-
G	Oryzopsis hymenoides	-	4	10	3	9	7	.03	.02	.03	.07	.30
G	Poa fendleriana	1	1	-	-	1	3	.00	-	-	.00	.15
G	Poa secunda	-	-	-	-	-	3	-	-	-	-	.01
G	Sitanion hystrix	$_{a}$2	$_{b}$12	$_{b}$19	$_{b}$12	$_{b}$17	$_{b}$48	.03	.09	.16	.18	1.50
G	Sporobolus cryptandrus	$_{b}$53	$_{a}$3	$_{a}$7	$_{a}$9	$_{a}$7	$_{a}$3	.00	.01	.07	.04	.18
G	Stipa comata	$_{d}$280	$_{d}$178	$_{c}$117	$_{b}$60	$_{a}$47	$_{c}$113	3.65	2.50	1.19	.96	2.84
G	Vulpia octoflora (a)	$_{a}$-	$_{b}$121	$_{a}$39	$_{a}$12	$_{a}$20	$_{a}$29	.40	.17	.03	.06	.07
Total for Annual Grasses		0	170	261	14	124	214	0.58	5.60	0.06	1.85	3.46
Total for Perennial Grasses		708	421	388	272	259	399	7.20	8.24	7.35	6.79	16.34
Total for Grasses		708	591	649	286	383	613	7.79	13.85	7.41	8.65	19.80
F	Aster sp.	-	-	-	-	-	1	-	-	-	-	.15
F	Astragalus mollissimus	$_{ab}$11	$_{b}$15	$_{a}$1	$_{a}$-	$_{ab}$11	$_{b}$16	.09	.03	-	.08	.14
F	Calochortus nuttallii	2	-	4	-	2	-	-	.03	-	.00	-
F	Chaenactis douglasii	-	3	-	-	-	-	.01	-	-	-	-
F	Descurainia pinnata (a)	$_{a}$-	$_{ab}$16	$_{b}$16	$_{ab}$6	$_{a}$-	$_{a}$1	.04	.04	.01	-	.00
F	Draba sp. (a)	$_{a}$-	$_{b}$65	$_{a}$-	$_{a}$-	$_{a}$1	$_{a}$3	.14	-	-	.00	.00
F	Erigeron pumilus	$_{b}$44	$_{a}$-	$_{a}$9	$_{a}$-	$_{a}$2	$_{a}$5	-	.02	-	.03	.21
F	Eriogonum cernuum (a)	3	5	4	-	3	-	.01	.01	-	.00	-
F	Gilia sp. (a)	-	4	-	4	1	3	.01	-	.01	.00	.00

Type	Species	Nested Frequency						Average Cover %				
		'86	'94	'99	'04	'09	'11	'94	'99	'04	'09	'11
F	Holosteum umbellatum (a)	-	3	1	-	-	-	.01	.00	-	-	-
F	Lappula occidentalis (a)	a-	b18	a4	a4	a2	a3	.05	.01	.15	.01	.03
F	Lepidium sp. (a)	-	-	-	-	-	4	-	-	-	-	.15
F	Machaeranthera canescens	-	-	-	-	-	3	-	-	-	-	.07
F	Penstemon sp.	-	3	3	-	3	-	.03	.00	-	.03	-
F	Phlox hoodii	-	19	22	16	13	19	.26	.27	.06	.15	.31
F	Phlox longifolia	-	8	16	10	3	18	.02	.06	.09	.03	.09
F	Plantago patagonica (a)	a-	b99	ab74	b100	a55	ab87	.25	.24	.31	.19	.74
F	Ranunculus testiculatus (a)	a-	ab16	b36	a-	b24	a2	.03	.14	-	.07	.00
F	Senecio multilobatus	3	-	1	-	-	1	-	.03	-	-	.00
F	Solanum sp.	-	-	-	-	-	3	-	-	-	-	.38
F	Sphaeralcea coccinea	bc118	bc126	c139	ab98	a72	ab94	.60	1.16	.56	.42	1.99
F	Tragopogon dubius (a)	-	1	-	-	-	-	.00	-	-	-	-
Total for Annual Forbs		3	227	135	114	86	103	0.56	0.45	0.48	0.29	0.94
Total for Perennial Forbs		178	174	195	124	106	160	1.03	1.62	0.71	0.77	3.35
Total for Forbs		181	401	330	238	192	263	1.59	2.07	1.20	1.06	4.30

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

BROWSE TRENDS--
Management unit 14, Study no: 11

Type	Species	Strip Frequency					Average Cover %				
		'94	'99	'04	'09	'11	'94	'99	'04	'09	'11
B	Artemisia frigida	0	0	0	0	1	-	-	-	-	-
B	Artemisia tridentata vaseyana	44	40	56	30	30	3.49	5.55	10.04	5.75	6.56
B	Atriplex canescens	3	2	2	2	3	.03	.03	.30	.03	.15
B	Ceratoides lanata	0	1	1	1	0	-	-	-	-	-
B	Chrysothamnus nauseosus	0	0	4	0	0	-	-	-	-	-
B	Echinocereus sp.	0	5	2	0	2	.00	.01	.01	-	.00
B	Ephedra viridis	0	0	0	0	0	-	-	-	-	-
B	Eriogonum microthecum	14	18	19	17	19	.12	.15	.10	.44	.62
B	Gutierrezia sarothrae	18	62	19	27	31	.11	1.12	.03	.13	.57
B	Juniperus osteosperma	-	-	-	-	-	.76	1.88	-	-	-
B	Leptodactylon pungens	0	1	0	0	4	-	-	-	-	.06
B	Opuntia sp.	21	26	30	34	42	.16	.55	.41	.81	.98
B	Pediocactus simpsonii	0	0	1	0	0	-	-	-	-	-
B	Pinus edulis	0	8	3	0	1	9.51	9.40	9.44	.15	-
B	Yucca sp.	0	0	0	0	0	-	.03	-	.03	-
Total for Browse		21	35	34	34	47	14.20	18.76	20.34	7.34	8.95

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

Species	Percent Cover			
	'99	'04	'09	'11
Artemisia tridentata vaseyana	-	13.81	5.66	7.50
Eriogonum microthecum	-	.05	.08	.45
Gutierrezia sarothrae	-	.08	.26	.50
Juniperus osteosperma	3.59	-	-	-
Leptodactylon pungens	-	-	-	.11
Opuntia sp.	-	3.56	2.25	1.39
Pinus edulis	12.80	12.93	-	-

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

Species	Average leader growth (in)		
	'04	'09	'11
Artemisia tridentata vaseyana	1.6	1.3	1.6

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

Species	Trees per Acre			
	'99	'04	'09	'11
Juniperus osteosperma	30	34	5	7
Pinus edulis	86	79	8	8

Average diameter (in)			
'99	'04	'09	'11
5.4	8.5	1.0	0.8
4.8	5.1	0.9	0.7

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

Cover Type	Average Cover %					
	'86	'94	'99	'04	'09	'11
Vegetation	14.00	23.29	33.92	27.69	16.04	33.37
Rock	0	.01	0	0	0	0
Pavement	0	.01	.00	.01	0	0
Litter	61.25	36.06	40.02	29.13	58.26	45.52
Cryptogams	4.25	1.69	5.40	3.53	.84	.98
Bare Ground	20.50	39.61	41.13	59.37	30.24	29.23

SOIL ANALYSIS DATA --
Management unit 14, Study no: 11, Study Name: Shay Mesa

Effective rooting depth (in)	pH	sandy clay loam			%0M	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.8	7.3	58.9	18.6	22.6	1.5	7.9	83.2	0.6

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

Type	Quadrat Frequency				
	'94	'99	'04	'09	'11
Rabbit	62	60	56	43	5
Elk	-	-	20	4	4
Deer	9	3	1	12	13
Cattle	3	11	3	-	1

Days use per acre (ha)			
'99	'04	'09	'11
-	-	-	-
-	13 (31)	11 (28)	11 (26)
1 (2)	2 (5)	25 (63)	14 (35)
26 (64)	8 (20)	7 (16)	16 (39)

BROWSE CHARACTERISTICS--
Management unit 14, 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)
Artemisia frigida									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	3/11
11	**20**	0	100	-	-	0	0	0	26/34
Artemisia tridentata vaseyana									
86	**2265**	77	21	3	-	76	9	6	23/25
94	**2100**	20	76	4	20	0	0	18	18/22
99	**2060**	8	86	6	20	49	17	.97	22/30
04	**2960**	4	69	27	-	52	16	18	16/25
09	**1440**	1	67	32	-	35	21	28	19/29
11	**1320**	17	74	9	40	32	3	9	21/28
Atriplex canescens									
86	**199**	0	100	0	-	67	33	0	5/3
94	**120**	50	17	33	20	0	0	33	20/30
99	**40**	0	50	50	-	0	50	50	23/21
04	**40**	0	100	0	-	0	0	0	16/19
09	**60**	67	33	0	-	0	0	0	22/20
11	**60**	67	33	0	-	33	0	0	21/35
Ceratoides lanata									
86	**0**	0	0	0	-	0	0	0	-/-
94	**0**	0	0	0	-	0	0	0	11/11
99	**20**	0	100	0	-	0	100	0	11/12
04	**20**	0	100	0	-	0	100	0	12/14
09	**20**	0	0	100	-	0	0	100	7/8
11	**0**	0	0	0	-	0	0	0	-/-
Chrysothamnus nauseosus									
86	**3199**	23	77	-	-	4	96	0	15/16
94	**0**	0	0	-	-	0	0	0	9/39
99	**0**	0	0	-	-	0	0	0	-/-
04	**80**	0	100	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Echinocereus sp.									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**100**	60	40	-	-	0	0	0	3/6
04	**80**	100	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	2/17
11	**40**	50	50	-	-	0	0	0	3/6
Ephedra viridis									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	26/28
99	**0**	0	0	-	-	0	0	0	20/30
04	**0**	0	0	-	-	0	0	0	15/24
09	**0**	0	0	-	-	0	0	0	25/39
11	**0**	0	0	-	-	0	0	0	9/17
Eriogonum microthecum									
86	**532**	37	63	0	-	0	0	0	11/6
94	**560**	46	43	11	60	0	0	0	3/4
99	**1020**	24	73	4	40	18	51	0	6/5
04	**620**	3	97	0	-	0	0	0	4/3
09	**620**	13	77	10	40	6	0	0	8/7
11	**540**	15	85	0	-	26	0	0	11/11
Gutierrezia sarothrae									
86	**8264**	17	80	3	-	0	0	0	7/5
94	**640**	19	72	9	-	0	0	0	6/6
99	**4120**	15	83	2	60	0	0	.97	7/7
04	**700**	3	97	0	40	0	0	0	6/7
09	**1100**	11	78	11	-	0	7	4	6/7
11	**1060**	13	87	0	20	2	0	2	7/9
Leptodactylon pungens									
86	**999**	0	93	7	-	0	0	0	1/3
94	**0**	0	0	0	-	0	0	0	-/-
99	**20**	0	100	0	-	0	0	0	-/-
04	**0**	0	0	0	-	0	0	0	-/-
09	**0**	0	0	0	-	0	0	0	-/-
11	**220**	9	91	0	20	0	0	0	2/3
Opuntia sp.									
86	**265**	25	75	0	-	0	0	0	3/4
94	**580**	10	66	24	-	0	0	3	3/11
99	**760**	18	79	3	60	0	0	0	6/13
04	**1240**	2	95	3	-	0	0	3	5/14
09	**960**	6	88	6	-	0	4	19	3/13
11	**1120**	13	71	16	-	2	0	11	3/14

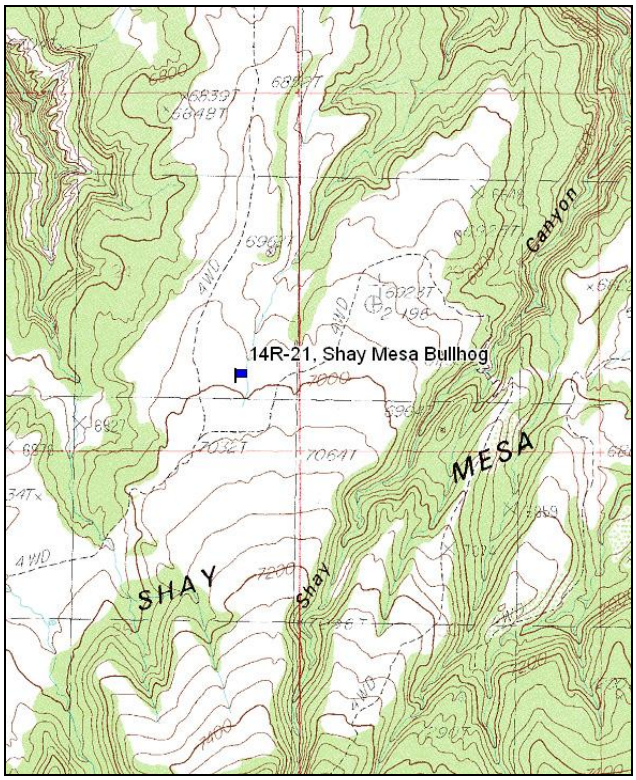
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Pediocactus simpsonii									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**40**	0	100	-	-	0	0	0	2/2
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Pinus edulis									
86	**199**	33	67	-	-	0	0	0	114/45
94	**0**	0	0	-	-	0	0	0	-/-
99	**160**	25	75	-	20	0	0	0	-/-
04	**60**	0	100	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	100	0	0	-/-
Symphoricarpos oreophilus									
86	**199**	0	100	-	-	67	33	33	15/22
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Yucca sp.									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	33/38
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	7/19
11	**0**	0	0	-	-	0	0	0	-/-

SHAY MESA BULLHOG - TREND STUDY NO. 14R-21-11
Project #1091

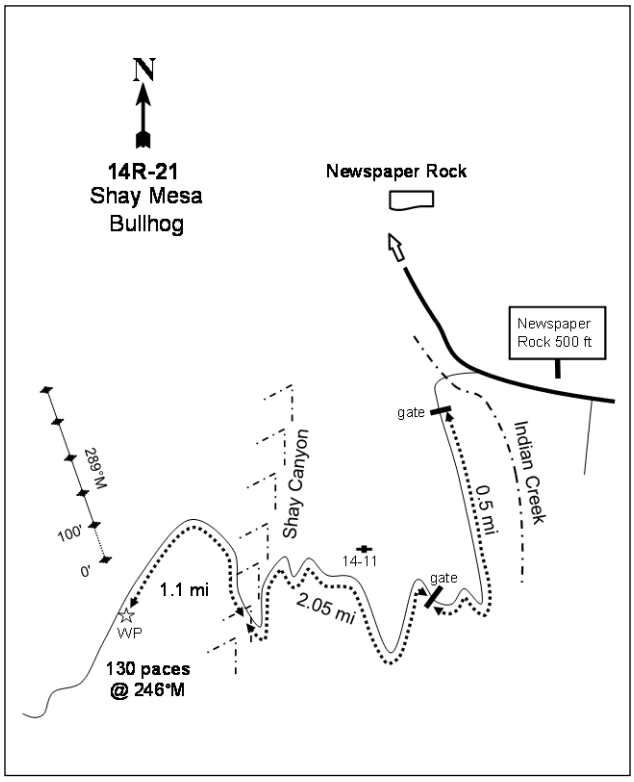
Vegetation Type: Pinyon-Juniper, Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R035XY306UT
Land Ownership: BLM
Elevation: 6,997 ft. (2,133 m)
Aspect: Northwest
Slope: 6%
Transect bearing: 289° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)
No rebar

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



Diagrammatic Sketch:



Township: 32S Range: 21E Section: 24

GPS: NAD 83, UTM 12T 626684 E 4204320 N

SHAY MESA BULLHOG - WRI STUDY 14R-21-11
Project #1091

Site Description

Site Information: The study is located on the north side of Shay Mountain, in a treated pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland on Shay Mesa, west of Shay Canyon. Prior to treatment, the study was established in 2008 to monitor a bullhog project to remove pinyon and juniper trees. Large areas of Shay Mesa were chained and seeded in 1959. The lack of maintenance has resulted in a regenerated 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 were to reduce hazardous fuel loads, improve wildlife habitat by removing encroaching pinyon and juniper trees, and to increase browse and herbaceous production and diversity (WRI Database 2012). Following the treatment, the study stakes were not found. Consequently new stakes were placed as close to the previous location of the pretreatment transect as possible. In 2008, elk pellet groups were sampled in moderate abundance. Deer, cattle, and horse sign was sampled in low abundance in 2008. In 2011, elk pellet groups were sampled in moderate abundance, while deer and cattle sign were sampled in low abundance (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*), green ephedra (*Ephedra viridis*), and slender eriogonum (*Eriogonum microthecum*). The dominant preferred browse species is mountain big sagebrush. The mountain big sagebrush is a moderately dense, lightly used population, with moderately low decadence and good vigor within the population. Prior to treatment, the recruitment of young sagebrush plants to the population was good but was poor following the treatment. The slender eriogonum is a sparse, moderately used population, with low decadence and good vigor within the population. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*) prickly phlox (*Leptodactylon* pungens), pricklypear cactus (*Opuntia sp.*), and broom snakeweed (*Gutierrezia sarothrae*) (Table - Browse Characteristics). Prior to the

bullhog treatment, pinyon pine and Utah juniper trees were abundant on the site, but density decreased following the treatment (Table - Point-Quarter Tree Data). Prior to the treatment, pinyon pine provided the majority of the cover, but cover was reduced substantially following the treatment (Table - Canopy Cover). The stage of woodland succession was in Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and somewhat diverse on the site. Prior to the treatment, the invasive annual grass species cheatgrass (*Bromus tectorum*) dominated the grass component and provided the majority of the grass cover. Following the treatment, cheatgrass was less common. Crested wheatgrass (*Agropyron cristatum*) was the dominant grass species sampled on the site following the treatment. Seeded species sampled on the site include crested wheatgrass, Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass, (*Poa secunda*), and needle-and-thread (*Stipa comata*), though each of these species was present on the site prior to the treatment except for Sandberg bluegrass. Other perennial grass species sampled include galleta (*Hilaria jamesii*), Indian ricegrass, bottlebrush squirreltail (*Sitanion hystrix*), needle-and-thread (*Stipa comata*), and blue grama (*Bouteloua gracilis*), though each species is rare on the site with the exception of bottlebrush squirreltail. Forbs are not overly abundant and are somewhat diverse on the site. Seeded species sampled on the site include cicer milkvetch (*Astragalus cicer*), blue flax (*Linum perenne*), and yellow sweetclover (*Melilotus officinalis*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Cahona component, which is found on cuestas and structural benches. The parent material consists of eolian deposits derived from sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Phosphorus may have limited availability for plant growth and development at 4.2 ppm (Tiedemann and Lopez 2004). Bare ground cover is high on the site, though there is a moderate amount of litter, vegetation, and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008, but stable in 2011.

Pre vs. two Years Post Treatment, 2008 vs. 2011

Browse: The density of mountain big sagebrush increased 48% from 2,400 plants/acre to 3,560 plants/acre, and canopy cover increased from 7% to 18%. The health of the sagebrush population decreased with decadence increasing from 12% to 32%, and plants displaying poor vigor increasing from 3% to 21% of the population. The recruitment of young sagebrush plants decreased from 16% to 4% of the population. The density of pinyon pine and Utah juniper trees decreased from 67 trees/acre to 25 trees/acre and 50 trees/acre to 20 trees/acre, respectively. The average size of pinyon trees decreased from an average diameter of 6.6 inches to 3.7 inches, but juniper trees average diameter increased from 8.5 inches to 9.9 inches.

Grasses: The sum of nested frequency of perennial grasses increased more than two-fold, and cover increased from less than 1% to 6%. Crested wheatgrass decreased significantly in nested frequency, but cover increased from 1% to 3%.

Forbs: Forbs are fairly rare on the site. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 14R, Study no: 21

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	$_{b}$78	$_{a}$58	.49	3.00
G	Bouteloua gracilis	$_{a}$-	$_{b}$39	-	.38
G	Bromus tectorum (a)	$_{b}$141	$_{a}$60	2.31	.34
G	Hilaria jamesii	3	-	.00	-
G	Oryzopsis hymenoides	1	10	.00	.13
G	Poa secunda	$_{a}$-	$_{b}$32	-	.64
G	Sitanion hystrix	$_{a}$10	$_{b}$35	.13	1.17
G	Stipa comata	$_{a}$12	$_{b}$47	.06	.82
G	Vulpia octoflora (a)	-	2	-	.00
Total for Annual Grasses		141	62	2.31	0.34
Total for Perennial Grasses		104	221	0.69	6.16
Total for Grasses		245	283	3.01	6.51
F	Agoseris glauca	5	-	.00	-
F	Astragalus cicer	-	8	-	.01
F	Astragalus mollissimus	14	9	.09	.07
F	Chenopodium leptophyllum(a)	3	-	.00	-
F	Cryptantha sp.	-	5	-	.03
F	Descurainia pinnata (a)	$_{b}$11	$_{a}$-	.08	-
F	Erigeron pumilus	-	6	-	.01
F	Lappula occidentalis (a)	$_{b}$20	$_{a}$-	.06	-
F	Linum perenne	$_{a}$-	$_{b}$11	-	.64
F	Machaeranthera canescens	-	2	-	.18
F	Melilotus officinalis	-	-	-	.00
F	Phlox austromontana	7	3	.04	.15
F	Phlox longifolia	$_{a}$-	$_{b}$15	-	.08
F	Ranunculus testiculatus (a)	$_{b}$32	$_{a}$-	.10	-
F	Sphaeralcea coccinea	$_{a}$-	$_{b}$11	-	.13
F	Trifolium sp.	-	1	-	.00
Total for Annual Forbs		66	0	0.25	0
Total for Perennial Forbs		26	71	0.13	1.34
Total for Forbs		92	71	0.39	1.34

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

BROWSE TRENDS--
Management unit 14R, Study no: 21

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia tridentata vaseyana	46	74	5.84	11.33
B	Chrysothamnus depressus	3	0	.01	-
B	Chrysothamnus nauseosus	1	0	.15	-
B	Ephedra viridis	0	3	-	.38
B	Eriogonum microthecum	8	15	.03	.24
B	Gutierrezia sarothrae	77	52	5.17	1.42
B	Juniperus osteosperma	1	0	1.52	-
B	Leptodactylon pungens	0	8	-	.07
B	Opuntia sp	0	1	-	-
B	Pinus edulis	9	4	11.06	1.15
Total for Browse		145	157	23.80	14.61

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 21

Species	Percent Cover '08	Percent Cover '11
Artemisia tridentata vaseyana	6.76	17.61
Ephedra viridis	-	.11
Eriogonum microthecum	.05	.13
Gutierrezia sarothrae	6.61	1.14
Juniperus osteosperma	1.58	-
Leptodactylon pungens	-	.16
Pinus edulis	21.21	3.31

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14R, Study no: 21

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.6	1.3

POINT-QUARTER TREE DATA--
Management unit 14R, Study no: 21

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	50	20	9.9	4.4
Pinus edulis	67	25	6.6	3.7

BASIC COVER--
Management unit 14R, Study no: 21

Cover Type	Average Cover % '08	'11
Vegetation	26.22	22.36
Rock	.11	.04
Pavement	5.65	.33
Litter	46.15	32.44
Cryptogams	.39	.74
Bare Ground	40.77	46.70

SOIL ANALYSIS DATA --
Management unit 14R, Study no: 21, Study Name: Shay Mesa Bullhog

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	'11	Days use per acre (ha) '08	'11
Rabbit	43	-	-	-
Horse	-	-	1 (1)	-
Elk	12	12	25 (63)	21 (51)
Deer	2	1	5 (12)	9 (23)
Cattle	3	-	5 (13)	1 (2)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 21

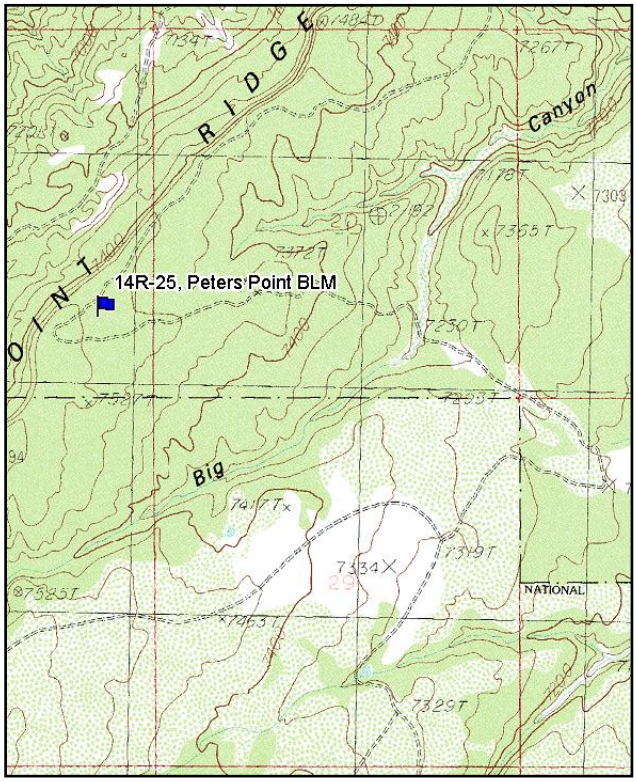
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
08	**2400**	16	73	12	3380	14	7	3	24/30
11	**3560**	4	63	32	60	33	15	21	16/27
Chrysothamnus depressus									
08	**60**	0	33	67	-	0	100	67	3/4
11	**0**	0	0	0	-	0	0	0	-/-
Chrysothamnus nauseosus									
08	**20**	0	100	-	-	0	0	0	17/16
11	**0**	0	0	-	-	0	0	0	-/-
Ephedra viridis									
08	**0**	0	0	-	-	0	0	0	15/11
11	**180**	0	100	-	-	0	100	0	9/10

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Eriogonum microthecum									
08	**240**	42	58	-	20	17	0	0	7/5
11	**460**	4	96	-	-	74	9	0	6/9
Gutierrezia sarothrae									
08	**9400**	24	73	4	920	0	0	.42	9/12
11	**2700**	8	87	5	20	.74	0	7	6/8
Juniperus osteosperma									
08	**20**	0	100	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Leptodactylon pungens									
08	**0**	0	0	-	-	0	0	0	-/-
11	**760**	0	71	-	-	0	0	0	2/5
Opuntia sp.									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	0	100	-	-	0	0	0	2/4
Pinus edulis									
08	**180**	0	100	-	-	0	0	0	-/-
11	**80**	75	25	-	-	0	0	0	-/-

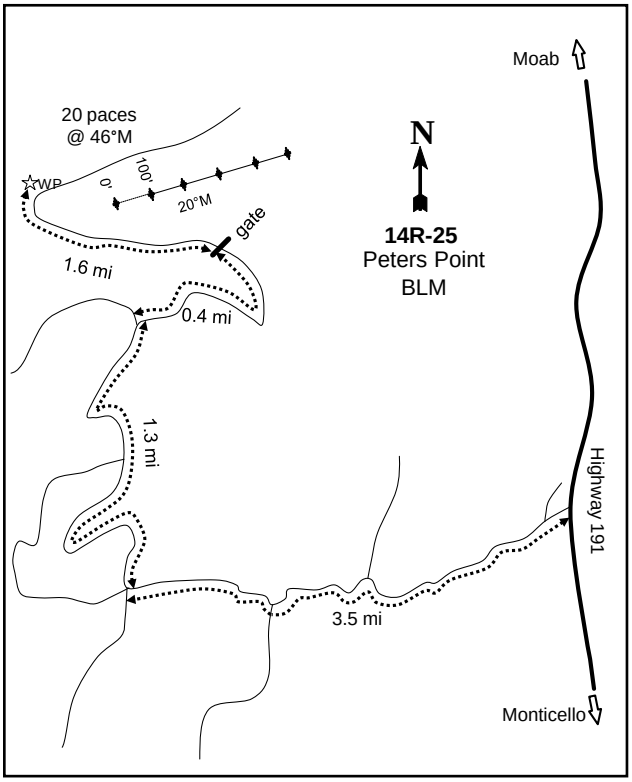
PETERS POINT BLM - WRI STUDY 14R-25-11
Project #1944

Vegetation Type: Pinyon and Juniper
Range Type: Crucial Deer Spring/Fall, Crucial Elk Year-long
NRCS Ecological Site Description: Upland Shallow Hardpan (Pinyon-Utah Juniper), R035XY316UT
Land Ownership: BLM
Elevation: 7,456 ft (2,274 m)
Aspect: East
Slope: 5%
Transect bearing: 20° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
No rebar
Directions: From highway 191 head west on a gravel road 3.5 miles stay on main road until intersect. Turn right heading north another 1.3 miles staying right. Turn right heading to the northeast and go 2.0 miles. The study is 20 paces from the witness post at 43 degrees magnetic.

Map Name: Monticello Lake



Diagrammatic Sketch:



Township: 32S Range: 23E Section: 19

GPS: NAD 83, UTM 12S 637776 E 4204486 N

PETERS POINT BLM - WRI STUDY 14R-25
Project #1944

Site Description

Site Information: The study is located approximately nine miles northwest of Monticello, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland on Peters Point Ridge, west of big canyon. The area is administrated by the Bureau of Land Management (BLM) as part of the Peters Point allotment. Prior to treatment, the study was established in 2011 to monitor a pinyon and juniper tree removal project using a bullhog implement. Approximately 1,300 acres were treated in the fall of 2011 and the spring of 2012. Treatment methodology consisted of thinning dense stands of pinyon and juniper overstory with bullhog equipment. Treatment units of the Peters Point Phase I project were focused in areas that still had a diverse and productive understory of grass and forb species; therefore, no seeding was used on the treatment units and no impacts to grazing were anticipated. The project objectives are to prevent high intensity fire events and improve wildlife habitat (WRI Database 2012). Elk pellet groups were sampled in moderate abundance, while deer and cattle were sampled in low abundance in 2011 (Table - Pellet Group Data).

Browse: Palatable browse species are limited on the site, and the browse component is dominated by pinyon pine and Utah juniper (Table - Canopy Cover). Pinyon pine and Utah juniper density is high on the site (Table - Point Quarter Tree Data). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009). The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and true mountain mahogany (*Cercocarpus montanus*). Mountain big sagebrush is a sparse population, with high decadence and poor vigor within the population. Utilization of sagebrush plants was mostly high. Recruitment of young sagebrush plants to the population was poor. True mountain mahogany was only sampled in height/crown measurements. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia sp.*), mountain ball cactus (*Pediocactus simpsonii*), and yucca (*Yucca sp.*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are somewhat limited on the site. Mutton bluegrass (*Poa fendleriana*) dominates the site and provides the majority of the grass cover on the site. Other grass species are rare on the site, but sampled species include Indian ricegrass (*Oryzopsis hymenoides*) and blue grama (*Bouteloua gracilis*). Forbs are rare on the site.

Soil: The soil is classified as part of the Bond-Rizno association, which is found on cuestas and structural benches. The parent material consists of eolian deposits derived from sandstone and eolian deposits over residuum weathered from sandstone and shale. The soils within this classification are characterized as shallow and well drained with a moderately to highly permeable restrictive layer. The soil surface texture is a fine sandy loam (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2011.

HERBACEOUS TRENDS--
Management unit 14R, Study no: 25

Type	Species	Nested Frequency '11	Average Cover % '11
G	Bouteloua gracilis	6	.12
G	Oryzopsis hymenoides	10	.10
G	Poa fendleriana	233	9.32
Total for Annual Grasses		0	0
Total for Perennial Grasses		249	9.54

Type	Species	Nested Frequency '11	Average Cover % '11
Total for Grasses		249	9.54
F	Arabis holboellii	13	.07
F	Lesquerella rectipes	13	.03
F	Pedicularis centranthera	5	.01
F	Penstemon pachyphyllus	3	.01
F	Petradoria pumila	43	.85
Total for Annual Forbs		0	0
Total for Perennial Forbs		77	0.97
Total for Forbs		77	0.97

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

BROWSE TRENDS--
Management unit 14R, Study no: 25

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	2	.18
B	Gutierrezia sarothrae	2	-
B	Juniperus osteosperma	5	.41
B	Opuntia sp.	11	.07
B	Pinus edulis	9	2.40
Total for Browse		29	3.06

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 25

Species	Percent Cover '11
Artemisia tridentata vaseyana	.10
Gutierrezia sarothrae	.05
Juniperus osteosperma	21.46
Opuntia sp.	.21
Pinus edulis	20.63

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14R, Study no: 25

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.9

POINT-QUARTER TREE DATA--
Management unit 14R, Study no: 25

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	64	14
Pinus edulis	133	9

BASIC COVER--
Management unit 14R, Study no: 25

Cover Type	Average Cover % '11
Vegetation	15.40
Rock	4.93
Pavement	1.48
Litter	56.00
Cryptogams	4.64
Bare Ground	20.78

PELLET GROUP DATA--
Management unit 14R, Study no: 25

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	10	-
Elk	13	22 (55)
Deer	5	11 (28)
Cow	-	6 (14)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 25

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
11	**60**	0	33	67	-	0	67	33	12/25
Cercocarpus montanus									
11	**0**	0	0	-	-	0	0	0	31/34
Gutierrezia sarothrae									
11	**40**	0	100	-	-	0	0	0	6/6
Juniperus osteosperma									
11	**100**	0	0	100	-	0	0	60	-/-
Opuntia sp.									
11	**320**	31	69	-	-	0	0	0	3/12

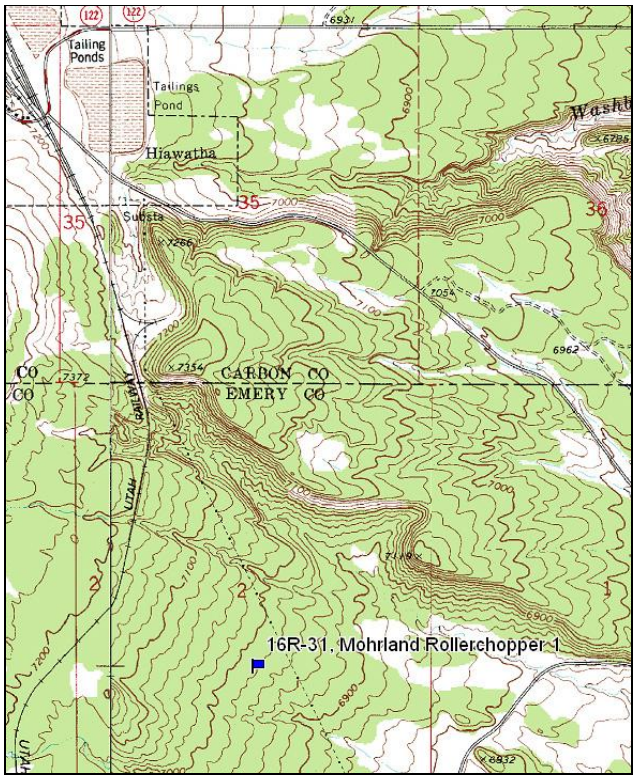
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Pediocactus simpsonii									
11	**0**	0	0	-	-	0	0	0	3/12
Pinus edulis									
11	**180**	22	22	56	20	11	0	11	-/-
Yucca sp.									
11	**0**	0	0	-	-	0	0	0	7/11

MOHRLAND ROLLER CHOPPER 1 - TREND STUDY NO. 16R-31-11
Project #1083

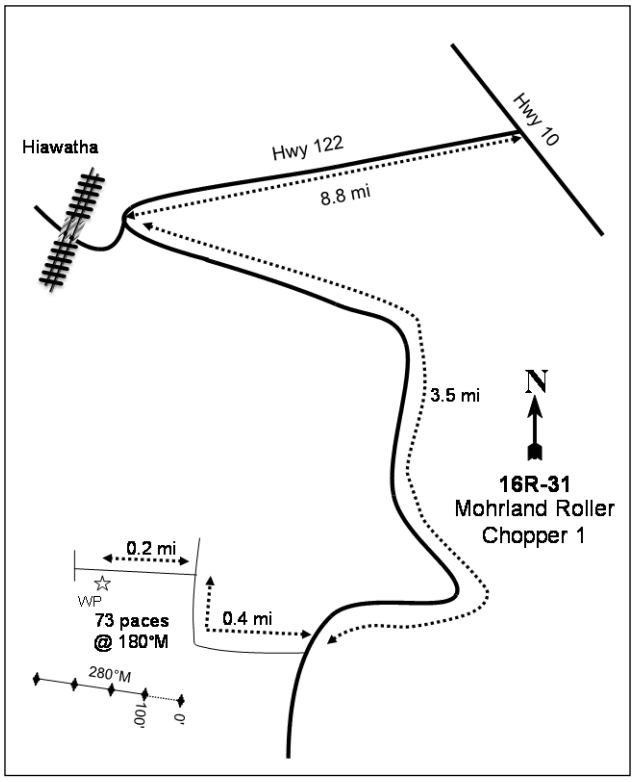
Vegetation Type: Pinyon and Juniper, Black Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Very Steep Shallow Clay Loam (Utah Juniper-Pinyon), R034XY330UT
Land Ownership: SITLA
Elevation: 6,979 ft. (2,127 m)
Aspect: Southeast
Slope: 6%
Transect bearing: 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. The study is on land administered by the Utah State Institutional Trust Land Administration (SITLA). Prior to treatment, the study was established in 2008 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, which removed the majority of the pinyon and juniper trees, but over time the pinyon and 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. A seed mix of grass, forb, and browse species was aerially seeded in October prior to the roller chopper treatment (Table - Seed Mix). The treatment area was rested from livestock grazing for two years. The objectives of the project are to improve wildlife habitat by removing pinyon and juniper trees, and increasing the browse and herbaceous production and diversity (WRI Database 2012). Deer pellet groups were sampled in moderate abundance in 2008 and 2011. Elk and cattle sign were sampled in low abundance in 2008, but elk pellet groups were sampled in moderate abundance in 2011 (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		lbs in mix	lbs/acre
G	Bottlebrush Squirreltail 'Toe Jam'	250	0.30	B	Fourwing Saltbush	350	0.41
G	Bottlebrush Squirreltail	150	0.18	B	True Mountain Mahogany	25	0.03
G	Canby Bluegrass 'Canbar'	400	0.47	Total Pounds:		375	0.44
G	Crested Wheatgrass 'Hycrest'	650	0.77	PLS Pounds:			0.20
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*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and true mountain mahogany (*Cercocarpus montanus*), though true mountain mahogany and mountain big sagebrush were rare on the site and mahogany was mostly found in the drainages. The black sagebrush is a moderately dense population with low decadence and good vigor, though decadence was high prior to the treatment. The recruitment of young sagebrush plants to the population has been good over the sample years. Utilization of black sagebrush plants has been mostly moderate and

utilization of the true mountain mahogany plants sampled on the site has been heavy over the sample years. 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*.), though each 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, but density was reduced markedly following the treatment (Table - Point-Quarter Tree Data). The stage of woodland succession was in the early part of Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site, though prior to treatment, grasses were very rare. The dominant grass species on the site are crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*), which provide the majority of the grass cover. The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site in low abundance following the treatment. Several seeded grass species were sampled on the site following the treatment including crested wheatgrass, intermediate wheatgrass, western wheatgrass (*A. smithii*), Snake River wheatgrass (*Elymus wawawaiensis*), Indian ricegrass (*Oryzopsis hymenoides*), Canby bluegrass (*Poa canbyi*), and bottlebrush squirreltail (*Sitanion hystrix*), though crested wheatgrass was sampled on the site prior to the treatment. Forbs are not very abundant or diverse. The dominant perennial forb species sampled on the site is whitemargin euphorbia (*Euphorbia albomarginata*). The seeded species blue flax (*Linum perenne*) was sampled on the site following the treatment in low abundance. The weedy annual forb species Russian thistle (*Salsola iberica*) provided the majority of the forb cover following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Strych component, which is found on benches and outwash plains. The parent material consists of colluvium, outwash and/or slope alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is a moderate amount of vegetation, litter, rock, and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008, but stable in 2011.

Pre vs. Three Year Post Treatment, 2008 vs. 2011

Browse: The density of black sagebrush decreased 48% from 8,620 plants/acre to 4,440 plants/acre, and canopy cover decreased from 14% to 9%. The health of the black sagebrush population improved with decadence decreasing from 35% to 3% of the population. The recruitment of young sagebrush plants to the population remained good at 25% of the population. The density of Utah juniper and pinyon pine decreased from 107 tree/acre to 31 trees/acre and 51 trees/acre to 5 trees/acre, respectively. The average size of juniper and pinyon trees decreased from an average diameter of 4.7 to 2 and 6.5 to 1.4 inches, respectively.

Grasses: The sum of nested frequency of perennial grasses increased nearly five-fold, and cover increased from less than 1% cover to 10% cover. Crested wheatgrass was the only grass species sampled on the site prior to the treatment. Following the treatment crested wheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 5%. The seeded species intermediate wheatgrass and western wheatgrass provided 4% and 1% cover, respectively, following the treatment.

Forbs: Perennial forbs remained rare on the site. The weedy annual forb species Russian thistle increased significantly in nested frequency, and cover increased from less than 1% to 2% cover. Whitemargin euphorbia has been the dominant perennial forb species and provided 1% cover in both sample years.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 31

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	$_{a}$71	$_{b}$146	.26	4.62
G	Agropyron intermedium	$_{a}$-	$_{b}$143	-	3.64
G	Agropyron smithii	$_{a}$-	$_{b}$29	-	1.06
G	Bromus japonicus (a)	-	7	-	.16
G	Bromus tectorum (a)	-	4	-	.03
G	Elymus wawawaiensis	-	4	-	.01
G	Oryzopsis hymenoides	$_{a}$-	$_{b}$14	-	.22
G	Poa canbyi	-	1	-	.00
G	Sitanion hystrix	$_{a}$-	$_{b}$12	-	.19
Total for Annual Grasses		0	11	0	0.19
Total for Perennial Grasses		71	349	0.26	9.76
Total for Grasses		71	360	0.26	9.96
F	Arabis sp.	1	-	.03	-
F	Astragalus convallarius	5	7	.07	.21
F	Descurainia pinnata (a)	$_{a}$-	$_{b}$12	-	.37
F	Eriogonum cernuum (a)	17	17	.08	.23
F	Euphorbia albomarginata	38	23	1.27	.70
F	Ipomopsis aggregata	1	-	.03	-
F	Lactuca serriola (a)	-	5	-	.01
F	Linum perenne	-	2	-	.00
F	Machaeranthera canescens	-	2	-	.00
F	Penstemon sp.	3	-	.03	-
F	Salsola iberica (a)	$_{a}$2	$_{b}$109	.00	2.03
F	Senecio multilobatus	1	-	.03	-
F	Sisymbrium altissimum (a)	-	6	-	.03
Total for Annual Forbs		19	149	0.08	2.70
Total for Perennial Forbs		49	34	1.46	0.91
Total for Forbs		68	183	1.55	3.61

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

BROWSE TRENDS--
Management unit 16R, Study no: 31

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia nova	75	67	12.77	10.20
B	Artemisia tridentata vaseyana	0	1	-	-
B	Cercocarpus montanus	2	1	.15	-
B	Chrysothamnus nauseosus	7	11	1.63	1.06
B	Gutierrezia sarothrae	20	13	.03	.77
B	Juniperus osteosperma	8	1	5.88	.68
B	Leptodactylon pungens	4	1	.03	.15
B	Opuntia sp.	2	1	.00	-
B	Pinus edulis	1	0	3.04	.00
Total for Browse		119	96	23.54	12.87

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 31

Species	Percent Cover '08	Percent Cover '11
Artemisia nova	13.76	8.81
Artemisia tridentata vaseyana	-	.03
Cercocarpus montanus	.56	.15
Chrysothamnus nauseosus	1.89	2.09
Gutierrezia sarothrae	-	.45
Juniperus osteosperma	7.11	.65
Opuntia sp.	.21	.28
Pinus edulis	6.15	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 31

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia nova	0.6	0.2
Cercocarpus montanus	4.4	0.6

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 31

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	107	31	4.7	2
Pinus edulis	51	5	6.5	1.4

BASIC COVER--
Management unit 16R, Study no: 31

Cover Type	Average Cover % '08	'11
Vegetation	26.13	29.14
Rock	7.36	8.14
Pavement	7.96	6.98
Litter	37.48	32.23
Cryptogams	.09	.09
Bare Ground	40.54	26.29

SOIL ANALYSIS DATA --
Management unit 16R, Study no: 31, Study Name: Mohrland Roller Chopper 1

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	'11	Days use per acre (ha) '08	'11
Rabbit	54	8	-	-
Elk	1	4	3 (7)	21 (52)
Deer	41	15	34 (84)	34 (84)
Cattle	3	2	2 (5)	-

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 31

		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	**8620**	23	42	35	2940	32	12	6	9/22
11	**4440**	25	72	3	1340	68	9	5	9/17
Artemisia tridentata vaseyana									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	0	100	-	-	0	0	0	9/9
Cercocarpus montanus									
08	**40**	0	100	-	-	100	0	0	48/56
11	**20**	100	0	-	-	100	0	0	33/47
Chrysothamnus nauseosus									
08	**200**	10	90	0	-	0	0	10	27/40
11	**240**	33	58	8	-	25	0	8	12/16

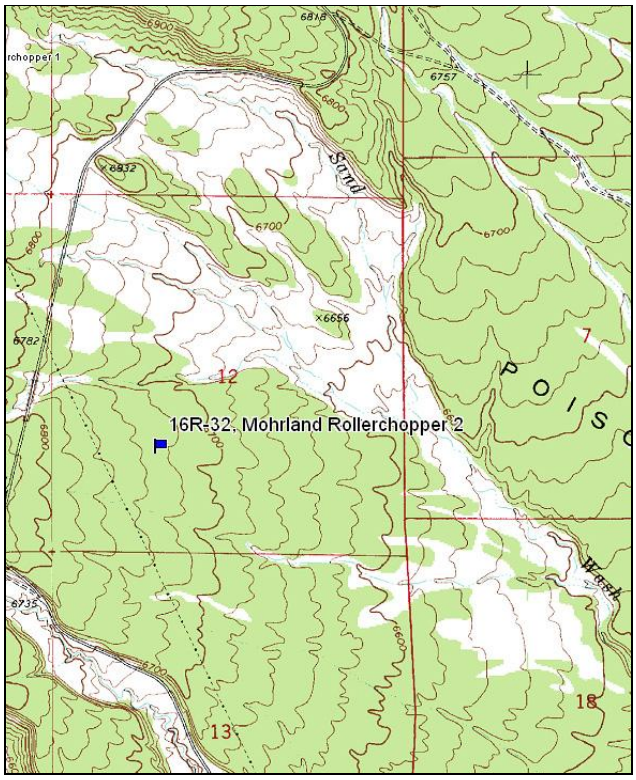
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae									
08	**800**	10	83	8	20	0	5	8	6/6
11	**280**	43	50	7	-	0	0	7	9/12
Juniperus osteosperma									
08	**180**	22	78	-	-	0	0	0	-/-
11	**20**	0	100	-	20	0	0	0	-/-
Leptodactylon pungens									
08	**120**	50	33	17	-	0	0	0	2/4
11	**40**	0	100	0	20	0	0	0	3/8
Opuntia sp.									
08	**40**	0	100	-	-	0	0	0	3/15
11	**20**	0	100	-	-	0	0	0	3/8
Pinus edulis									
08	**20**	0	100	-	-	0	0	0	-/-
11	**0**	0	0	-	20	0	0	0	-/-

MOHRLAND ROLLER CHOPPER 2 - TREND STUDY NO. 16R-32-11
Project #1083

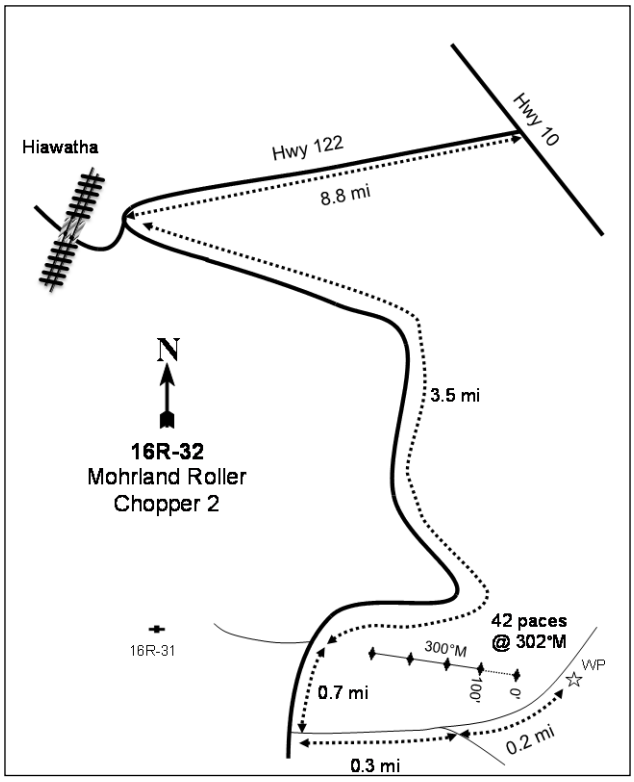
Vegetation Type: Pinyon and Juniper, Black Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Very Steep Shallow Clay Loam (Utah Juniper-Pinyon), R034XY330UT
Land Ownership: SITLA
Elevation: 6,732 ft. (2,052 m)
Aspect: East
Slope: 7-9%
Transect bearing: 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



Diagrammatic Sketch:



Township: 16S Range: 8E Section: 12

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, within an old pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining, on the southwest portion of Poison Spring bench north of Cedar Creek. The study is on land administered by the Utah State Institutional Trust Land Administration (SITLA). Prior to treatment, the study was established in 2008 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, which removed the majority of the pinyon and juniper trees, but over time the pinyon and 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 the dozer. A seed mix of grass, forb, and browse species was aerially seeded in October prior to the roller chopper treatment (Table - Seed Mix). The treatment area was rested from livestock grazing for two years. The objectives of the project are to improve wildlife habitat by removing pinyon and juniper trees, and increase the browse and herbaceous production and diversity (WRI Database 2012). Pellet groups were sampled in moderate abundance for deer and low abundance for elk and cattle in 2008. In 2011, deer, elk, and cattle pellet groups were sampled in low abundance (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		lbs in mix	lbs/acre
G	Bottlebrush Squirreltail 'Toe Jam'	250	0.30	B	Fourwing Saltbush	350	0.41
G	Bottlebrush Squirreltail	150	0.18	B	True Mountain Mahogany	25	0.03
G	Canby Bluegrass 'Canbar'	400	0.47	Total Pounds:		375	0.44
G	Crested Wheatgrass 'Hycrest'	650	0.77	PLS Pounds:			0.20
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 mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), though mountain big sagebrush was rare on the site. The black sagebrush is a moderately used, somewhat dense population with high decadence and good vigor within the population. Prior to treatment, recruitment of young sagebrush was fairly poor; however, recruitment of young sagebrush plants to the population was good following the treatment. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp*.), though each

species was sampled in low abundance (Table - Browse Characteristics). Prior to the treatment in 2008, pinyon pine and Utah juniper trees were common on the site, but following the treatment have become less common on the site (Table - Point-Quarter Tree Data). The stage of woodland succession was in early part of Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site, though prior to treatment grasses were very limited on the site. The dominant grass species are crested wheatgrass (*Agropyron* cristatum) and intermediate wheatgrass (*A.* intermedium). Several seeded grass species were sampled on the site following the treatment, which included crested wheatgrass, intermediate wheatgrass, western wheatgrass (*A. smithii*), Snake River wheatgrass (*Elymus wawawaiensis*), Indian ricegrass (*Oryzopsis hymenoides*), needle-and-thread (*Stipa comata*), and bottlebrush squirreltail (*Sitanion hystrix*), though crested wheatgrass was sampled on the site prior to the treatment. The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled following the treatment in low abundance on the site. Forbs are not very abundant or diverse, but are very limited on the site. The seeded species blue flax (*Linum perenne*) was sampled on the site following the treatment in low abundance. The weedy annual forb species Russian thistle (*Salsola iberica*) provided the majority of the forb cover following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Strych component, which is found on benches and outwash plains. The parent material consists of colluvium, outwash and/or slope alluvium derived from sandstone and shale. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is moderately high on the site, though there is a moderate amount of litter, pavement, and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Year Post Treatment, 2008 vs. 2011

Browse: The density of black sagebrush decreased 36% from 7,180 plants/acre to 4,580 plants/acre, and canopy cover decreased from 20% to 9%. The health of the black sagebrush population improved with decadence decreasing from 36% to 10% of the population. The recruitment of young sagebrush plants to the population increased from 7% to 21% of the population. The density of Utah juniper and pinyon pine decreased from 122 tree/acre to 65 trees/acre and 156 trees/acre to 26 trees/acre, respectively. The average size of juniper and pinyon trees decreased from an average diameter of 2.5 to and 2.1 and 4.4 to 1.6 inches, respectively.

Grasses: The sum of nested frequency of perennial grasses increased nearly five-fold, and cover increased from less than 1% cover to 12% cover. Crested wheatgrass was the only grass species sampled on the site prior to the treatment. Following the treatment, crested wheatgrass increased significantly in nested frequency, and cover increased from 1% to 7%. The seeded species intermediate wheatgrass provided 4% cover.

Forbs: Perennial forbs remained rare on the site. No single forb species provided more than 1% cover in either sampled year.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 32

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	$_{a}$77	$_{b}$167	.73	7.30
G	Agropyron intermedium	$_{a}$-	$_{b}$114	-	3.45
G	Agropyron smithii	-	11	-	.07
G	Bromus japonicus (a)	-	-	-	.00
G	Bromus tectorum (a)	-	3	-	.00
G	Elymus junceus	-	2	-	.15
G	Elymus wawawaiensis	-	7	-	.09
G	Oryzopsis hymenoides	$_{a}$-	$_{b}$33	-	.75
G	Sitanion hystrix	$_{a}$-	$_{b}$18	-	.29
G	Stipa comata	-	1	-	.03
Total for Annual Grasses		0	3	0	0.00
Total for Perennial Grasses		77	353	0.73	12.15
Total for Grasses		77	356	0.73	12.16
F	Chenopodium fremontii (a)	-	2	-	.00
F	Cryptantha sp.	2	-	.00	-
F	Descurainia pinnata (a)	$_{a}$-	$_{b}$26	-	.85
F	Eriogonum cernuum (a)	14	6	.07	.04
F	Erodium cicutarium (a)	-	2	-	.00
F	Euphorbia albomarginata	16	26	.12	.35
F	Lactuca serriola (a)	-	1	-	.00
F	Linum perenne	-	7	-	.01
F	Lithospermum incisum	-	4	-	.01
F	Penstemon palmeri	-	1	-	.00
F	Penstemon sp.	-	2	-	.15
F	Salsola iberica (a)	$_{a}$4	$_{b}$78	.01	.70
F	Sisymbrium altissimum (a)	-	3	-	.15
Total for Annual Forbs		18	118	0.08	1.75
Total for Perennial Forbs		18	40	0.12	0.52
Total for Forbs		36	158	0.21	2.28

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

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

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia nova	81	81	14.13	6.05
B	Gutierrezia sarothrae	5	0	-	-
B	Juniperus osteosperma	8	1	.68	.00
B	Pinus edulis	7	1	2.76	-
Total for Browse		101	83	17.57	6.05

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 32

Species	Percent Cover	
	'08	'11
Artemisia nova	20.11	9.06
Juniperus osteosperma	.66	.48
Pinus edulis	8.81	.03

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

Species	Average leader growth (in)	
	'08	'11
Artemisia nova	.05	1.1

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

Species	Trees per Acre		Average diameter (in)	
	'08	'11	'08	'11
Juniperus osteosperma	122	65	2.5	2.1
Pinus edulis	156	26	4.4	1.6

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

Cover Type	Average Cover %	
	'08	'11
Vegetation	19.01	23.70
Rock	2.71	4.39
Pavement	21.88	15.51
Litter	22.14	29.40
Cryptogams	.17	0
Bare Ground	34.17	30.12

SOIL ANALYSIS DATA --
Management unit 16R, Study no: 32, Study Name: Mohrland Roller Chopper 2

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		Days use per acre (ha)	
	'08	'11	'08	'11
Rabbit	44	3	-	-
Elk	1	3	1 (3)	8 (20)
Deer	41	6	30 (74)	17 (41)
Cattle	-	6	5 (13)	2 (5)

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

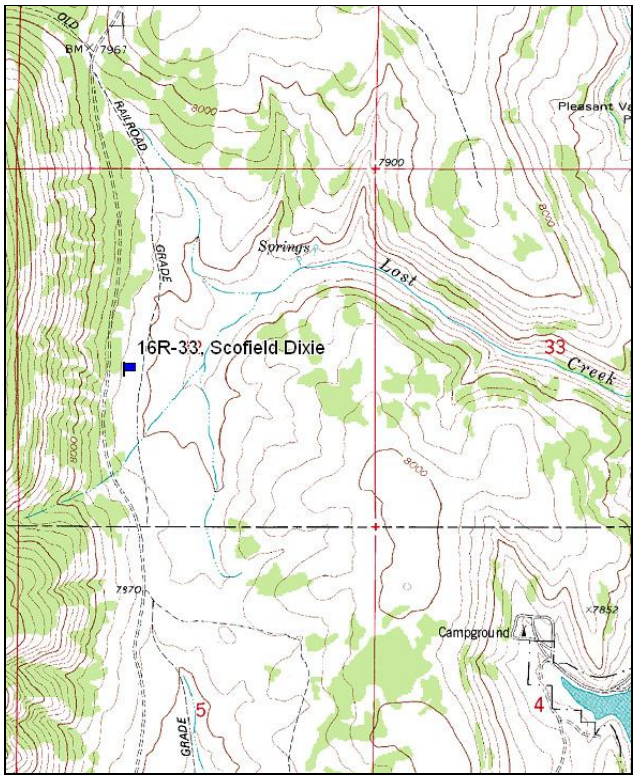
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
08	**7180**	7	57	36	3460	33	8	8	8/22
11	**4580**	21	68	10	220	51	7	9	9/17
Artemisia tridentata vaseyana									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	15/15
Gutierrezia sarothrae									
08	**160**	0	100	-	-	0	0	0	5/5
11	**0**	0	0	-	-	0	0	0	8/9
Juniperus osteosperma									
08	**160**	100	0	-	-	0	0	0	-/-
11	**20**	0	100	-	20	0	0	0	-/-
Opuntia sp.									
08	**0**	0	0	-	-	0	0	0	3/17
11	**0**	0	0	-	-	0	0	0	-/-
Pinus edulis									
08	**140**	29	71	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	-/-

SCOFIELD DIXIE - TREND STUDY NO. 16R-33-11
Project #1085

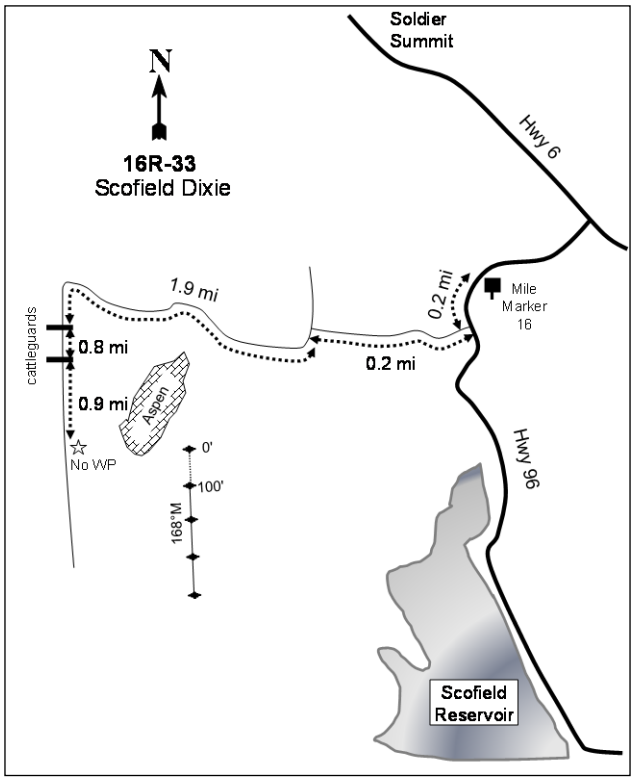
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Year-Long
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 7,822 ft. (2,384 m)
Aspect: Northeast
Slope: 10%
Transect bearing: 168° magnetic
Belt placement: line 1 (11ft 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 on private land approximately one and a half miles northwest of Scofield Reservoir, within a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat, near the headwaters of Lost Creek. Prior to treatment, the study was established in 2008 to monitor a Dixie harrow project to reduce the density and cover of mountain big sagebrush. The Scofield area provides wintering and brood rearing habitat for 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, a total of 150 acres were 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 2012). Cattle pellet groups were sampled in moderate abundance, while deer and elk pellet groups were sampled in low abundance in 2008. Deer and cattle sign were sampled in low abundance in 2011 (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 Wheatgrass '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 mountain big sagebrush is a lightly used, somewhat dense population, with low decadence and good vigor within the population, though prior to treatment decadence was high. The recruitment of young sagebrush plants to the population was good following the treatment. The antelope bitterbrush is a relatively small population of mostly mature plants, with heavy use within the population. Other browse species sampled on the site include silver sagebrush (*Artemisia cana*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), creeping barberry (*Mahonia repens*), and mountain snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are 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 grass species sampled on the site include prairie junegrass (*Koeleria cristata*), needle-and-thread (*Stipa comata*), and nodding brome (*Bromus anomalus*). Prairie junegrass was the only seeded grass species sampled on the site following the treatment, though junegrass was present on the site prior to the treatment. Forbs are abundant and fairly diverse on the site. The dominant perennial forbs species on the site are silvery lupine (*Lupinus argenteus*) and Bonneville pea (*Lathyrus brachycalyx*), which provide the majority of the forb cover. Other common perennial forb species sampled on the site include rose pussytoes (*Antennaria rosea*), western aster (*Aster ascendant*), houndstounge (*Cynoglossum officinale*), sulfur eriogonum (*Eriogonum umbellatum*), hoary aster (*Machaeranthera canescens*), and Utah lupine (*Lupinus caespitosus* ssp. *utahensis*). Houndstounge is on Utah's noxious weed list. Several seeded species have been sampled on the site following the treatment including western yarrow (*Achillea millefolium*), arrowleaf balsamroot (*Balsamorhiza sagittata*), blue flax (*Linum Perenne*), silvery lupine, small burnet (*Sanguisorba minor*), and American vetch (*Vicia americana*), though western yarrow, silvery lupine, and American vetch were present on the site prior to treatment. The annual forb species blue-eyed Mary (*Collinsia parviflora*), pinyon groundsmoke (*Gayophytum ramosissimum*), and Douglas knotweed (*Polygonum douglasii*) were fairly abundant on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a moderately acidic soil reaction (pH 5.7) (Table - Soil Analysis Data). Bare ground cover is low, though a moderate amount of litter and a high amount of vegetation provide protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. three Years Post Treatment, 2008 vs. 2011

Browse: The density of mountain big sagebrush decreased 42% from 10,680 plants/acre to 6,220 plants/acre, and canopy cover decreased from 45% to 15%. The health of the sagebrush population improved with decadence decreasing from 42% to 5%, and plants displaying poor vigor decreasing from 13% to 6%. The recruitment of young sagebrush plants to the population increased from 4% to 45%. The density of antelope bitterbrush decreased slightly from 200 plants/acre to 180 plants/acre, though cover remained similar at 1%.

Grasses: The sum of nested frequency of perennial grasses increased by 14%, and cover increased from 12% to 28%. Kentucky bluegrass increased significantly in nested frequency, and cover increased from 7% to 19%. Letterman needlegrass decreased significantly in nested frequency, though cover remained similar at 3%.

Forbs: The sum of nested frequency of perennial forbs increased 49%, and cover increased from 14% to 17%. Silvery lupine increased significantly in nested frequency, though cover decreased from 8% to 6%. The noxious weed houndstounge was sampled for the first time following the treatment at1% cover.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 33

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron smithii	$_a$26	$_b$51	.16	.54
G	Bromus anomalus	$_a$-	$_b$94	-	1.27
G	Bromus carinatus	7	1	.21	.00
G	Carex rossii	20	16	.14	.27
G	Juncus sp.	8	16	.04	.19
G	Koeleria cristata	42	59	.52	1.15
G	Muhlenbergia richardsonis	-	3	-	.00

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Poa canbyi	a-	b28	-	.38
G	Poa fendleriana	a8	b35	.07	.68
G	Poa pratensis	a284	b371	6.58	19.40
G	Sitanion hystrix	b54	a15	.65	.45
G	Sporobolus sp.	b23	a-	.27	-
G	Stipa comata	36	42	.81	1.20
G	Stipa lettermani	b185	a61	2.41	2.51
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		693	792	11.89	28.09
Total for Grasses		693	792	11.89	28.09
F	Achillea millefolium	9	19	.44	.42
F	Agoseris glauca	7	2	.01	.00
F	Androsace septentrionalis (a)	5	14	.01	.05
F	Antennaria rosea	b29	a18	.78	.93
F	Arabis drummondi	3	4	.00	.01
F	Aster ascendens	a9	b17	.09	.65
F	Balsamorhiza sagittata	-	4	-	.01
F	Camissonia subacaulis	-	11	-	.09
F	Castilleja chromosa	4	-	.03	-
F	Chaenactis douglasii	7	13	.07	.40
F	Cirsium sp.	a-	b11	-	.53
F	Collinsia parviflora (a)	a98	b194	.23	3.88
F	Collomia linearis (a)	4	15	.01	.08
F	Comandra pallida	-	5	-	.15
F	Cordylanthus sp. (a)	b52	a12	.89	.56
F	Cynoglossum officinale	a-	b40	-	.77
F	Epilobium brachycarpum (a)	a-	b88	-	.89
F	Erigeron pumilus	3	-	.03	-
F	Eriogonum umbellatum	12	18	.33	.86
F	Gayophytum ramosissimum(a)	a-	b169	-	1.62
F	Helianthus annuus (a)	1	-	.03	-
F	Heracleum lanatum	2	-	.00	-
F	Holosteum umbellatum (a)	-	7	-	.01
F	Lactuca serriola (a)	-	1	-	.00
F	Lappula occidentalis (a)	-	5	-	.01
F	Lathyrus brachycalyx	a21	b31	1.39	2.44
F	Linum perenne	a-	b45	-	.42
F	Lupinus argenteus	a105	b162	8.10	6.23
F	Lupinus caespitosus utahensis	49	59	1.03	.79
F	Machaeranthera canescens	a54	a23	.97	.99
F	Microsteris gracilis (a)	a-	b17	-	.06
F	Orobanche sp.	2	-	.03	-
F	Phlox hoodii	b13	a6	.25	.24
F	Polygonum douglasii (a)	a161	b222	.57	2.16
F	Sanguisorba minor	-	1	-	.03

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
F	Senecio integerrimus	-	6	-	.18
F	Taraxacum officinale	22	26	.21	.42
F	Tragopogon dubius (a)	-	7	.00	.01
F	Verbascum thapsus	2	-	.00	-
F	Vicia americana	2	8	.03	.05
F	Viguiera multiflora	2	-	.00	-
F	Viola sp.	-	3	-	.03
Total for Annual Forbs		321	751	1.76	9.36
Total for Perennial Forbs		357	532	13.84	16.69
Total for Forbs		678	1283	15.60	26.06

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

BROWSE TRENDS--
Management unit 16R, Study no: 33

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia cana	2	2	-	.15
B	Artemisia tridentata vaseyana	100	91	28.14	10.30
B	Chrysothamnus viscidiflorus viscidiflorus	23	33	.65	2.26
B	Mahonia repens	3	3	.15	.30
B	Purshia tridentata	9	5	.91	.53
B	Symphoricarpos oreophilus	1	0	.15	.15
Total for Browse		138	134	30.02	13.71

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 33

Species	Percent Cover '08	Percent Cover '11
Artemisia tridentata vaseyana	45.25	14.91
Chrysothamnus viscidiflorus viscidiflorus	.60	3.01
Purshia tridentata	1.26	.45

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 33

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia tridentata vaseyana	0.9	2.3
Purshia tridentata	3.0	1.4

BASIC COVER--
Management unit 16R, Study no: 33

Cover Type	Average Cover % '08	'11
Vegetation	60.32	66.44
Rock	.63	1.03
Pavement	.96	.06
Litter	44.31	30.82
Cryptogams	0	.03
Bare Ground	17.24	8.51

SOIL ANALYSIS DATA --
Management unit 16R, Study no: 33, Study Name: Scofield Dixie

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	'11	Days use per acre (ha) '08	'11
Rabbit	2	-	-	-
Elk	-	-	1 (3)	-
Deer	10	1	1 (3)	1 (3)
Cattle	6	1	23 (56)	3 (7)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 33

		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 cana									
08	**40**	50	50	-	-	0	0	0	6/16
11	**60**	33	67	-	-	0	0	0	10/17
Artemisia tridentata vaseyana									
08	**10680**	4	54	42	300	27	8	13	21/29
11	**6220**	45	50	5	2140	0	0	6	17/22
Chrysothamnus viscidiflorus viscidiflorus									
08	**900**	18	67	16	-	0	0	7	11/12
11	**2160**	4	96	0	-	0	0	0	9/12
Mahonia repens									
08	**440**	0	100	-	-	0	0	0	4/3
11	**260**	0	100	-	-	0	0	0	3/4

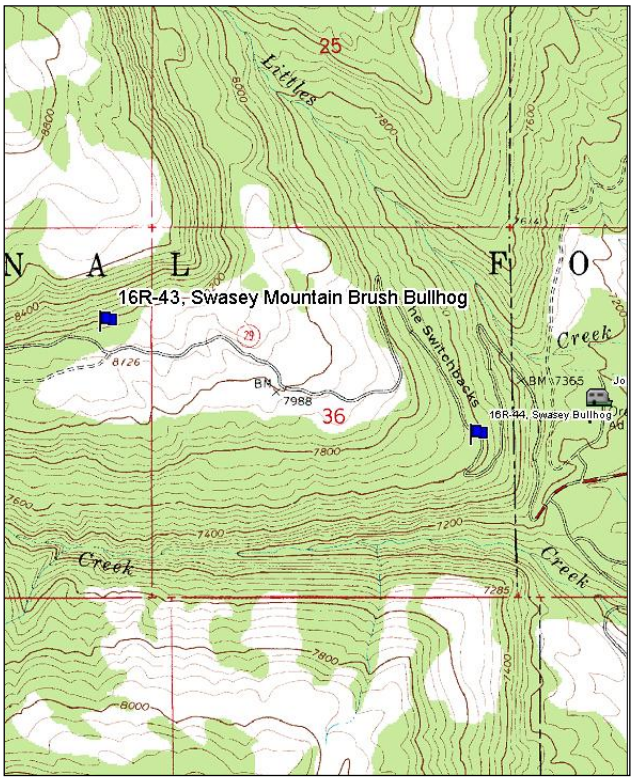
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Purshia tridentata									
08	**200**	0	90	10	-	40	60	10	14/33
11	**180**	0	100	0	-	0	89	0	5/16
Symphoricarpos oreophilus									
08	**20**	0	100	-	-	0	0	0	14/18
11	**0**	0	0	-	-	0	0	0	20/24

SWASEY MOUNTAIN BRUSH BULLHOG - WRI STUDY 16R-43-11
Project #2091

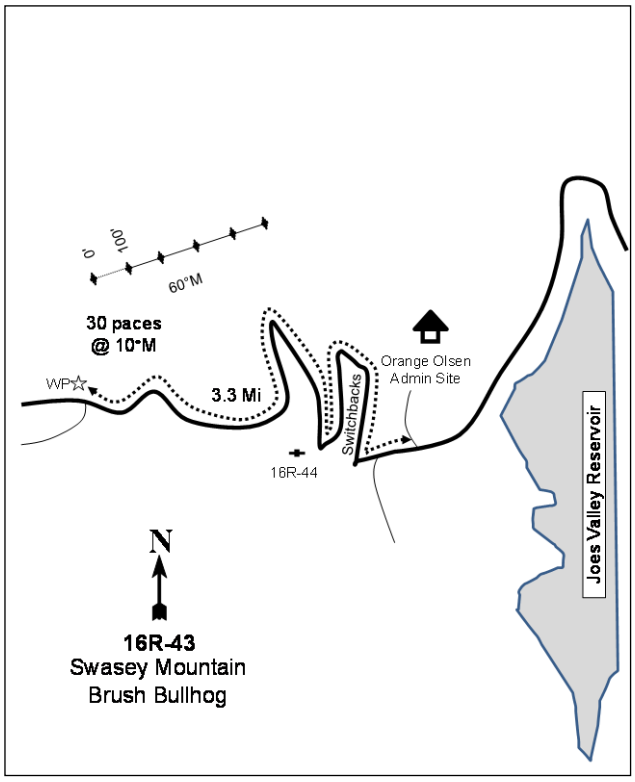
Vegetation Type: Mountain Brush
Range Type: Crucial Deer Summer (Fawning habitat), Substantial Elk Winter
NRCS Ecological Site Description: Not available
Land Ownership: Forest Service
Elevation: 8,080 ft (2,463 m)
Aspect: Southeast
Slope: 7%
Transect bearing: 60° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the turnoff to the Orange Olsen Administration Site near Joes Valley Reservoir drive 3.3 miles up the switchbacks to the west. The witness post is on the north side of the road. The 0-foot stake is approximately 30 paces from the witness post at 10 degrees magnetic. The 0-foot stake is marked with browse tag #9162.

Map Name: Joes Valley Reservoir



Diagrammatic Sketch:



Township: 17S Range: 5E Section: 35

GPS: NAD 83, UTM 12S 472230 E 4350656 N

SWASEY MOUNTAIN BRUSH BULLHOG - WRI STUDY 16R-43
Project #2091

Site Description

Site Information: The study is located approximately two miles west of Joes Valley Reservoir, within a mountain brush community, on a bench north of Seely Creek, in the Manti-La Sal National Forest. Prior to treatment, the study was established in 2011 to monitor a pinyon and juniper tree removal project using bullhog machinery. Treatment methodology will consist of thinning dense stands of pinyon and juniper overstory with bullhog equipment. The project area is not planned to be seeded due to the good herbaceous understory present on the study site. The objectives of the project are to increase the herbaceous understory, and improve winter and transition range for mule deer and elk (WRI Database 2012). Elk pellet groups were sampled in low abundance, while deer sign were low in abundance in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*) mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), dwarf rabbitbrush (*Chrysothamnus depressus*), chokecherry (*Prunus virginiana*), antelope bitterbrush (*Purshia tridentata*), Woods rose (*Rosa woodsii*), and elderberry (*Sambucus sp.*). The dominant preferred browse species on the site is mountain big sagebrush. The mountain big sagebrush is a relatively dense population, with high decadence and poor vigor within the population. The recruitment of young sagebrush plants was good in 2011. The utilization of sagebrush was moderate to light (Table - Browse Characteristics). The majority of the preferred browse species was rare on the site, and provided little cover (Table - Canopy Cover). The Rocky Mountain juniper (*Juniperus scopulorum*) population was a fairly dense population (Table - Point-Quarter Tree Data), and provided a large portion of the canopy cover in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase II prior to treatment (Tausch et al. 2009).

Herbaceous Trends: Grasses are moderately abundant and fairly diverse on the site. The dominant grass species are bluebunch wheatgrass (*Agropyron spicatum*), thickspike wheatgrass (*A. dasystachyum*), and sedge (*Carex sp.*). Other grass species sampled on the site include smooth brome (*Bromus inermis*), prairie junegrass (*Koeleria cristata*), Indian ricegrass (*Oryzopsis hymenoides*), mutton bluegrass (*Poa fendleriana*), Kentucky bluegrass (*P. pratensis*), Sandberg bluegrass (*P. secunda*), and letterman needlegrass (*Stipa lettermani*), though each of these species occurred in low abundance on the site. Forbs are moderately abundant and diverse on the site, though most of the cover is from two species, penstemon (*Penstemon sp.*) and desert phlox (*Phlox austromontana*) (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is moderate on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2011.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 43

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron dasystachyum	55	1.20
G	Agropyron spicatum	154	4.79
G	Bromus inermis	2	.00
G	Carex sp.	87	1.11
G	Koeleria cristata	11	.02
G	Oryzopsis hymenoides	25	.27
G	Poa fendleriana	11	.19
G	Poa pratensis	-	.00
G	Poa secunda	12	.07
G	Stipa lettermani	6	.07
Total for Annual Grasses		0	0
Total for Perennial Grasses		363	7.75
Total for Grasses		363	7.75
F	Achillea millefolium	11	.12
F	Agoseris glauca	-	.00
F	Arabis sp.	3	.00
F	Artemisia ludoviciana	1	.03
F	Astragalus convallarius	13	.26
F	Astragalus utahensis	1	.00
F	Calochortus nuttallii	1	.00
F	Descurainia pinnata (a)	3	.03
F	Erigeron eatonii	19	.09
F	Hackelia patens	3	.00
F	Hymenoxys richardsonii	2	.03
F	Ipomopsis aggregata	10	.05
F	Lactuca serriola (a)	2	.00
F	Machaeranthera canescens	6	.04
F	Penstemon caespitosus	11	.07
F	Penstemon sp.	145	4.82
F	Phlox austromontana	85	2.44
F	Polygonum douglasii (a)	1	.00
F	Schoencrambe linifolia	5	.03
F	Senecio multilobatus	14	.10
F	Taraxacum officinale	1	.00
Total for Annual Forbs		6	0.03
Total for Perennial Forbs		331	8.14
Total for Forbs		337	8.18

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

BROWSE TRENDS--
Management unit 16R, Study no: 43

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	76	7.91
B	Chrysothamnus depressus	2	.00
B	Chrysothamnus nauseosus	33	1.08
B	Chrysothamnus viscidiflorus viscidiflorus	1	.00
B	Gutierrezia sarothrae	8	.10
B	Juniperus scopulorum	5	5.65
B	Mahonia repens	55	1.70
B	Prunus virginiana	1	.03
B	Purshia tridentata	10	1.04
B	Symphoricarpos oreophilus	91	11.39
B	Tetradymia canescens	5	.04
Total for Browse		287	28.97

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 43

Species	Percent Cover '11
Artemisia tridentata vaseyana	12.11
Chrysothamnus nauseosus	1.96
Gutierrezia sarothrae	.20
Juniperus scopulorum	13.18
Mahonia repens	1.54
Prunus virginiana	.30
Purshia tridentata	1.28
Symphoricarpos oreophilus	14.33

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 43

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.6
Amelanchier utahensis	1.0
Purshia tridentata	5.4

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 43

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus scopulorum	154	5.7

BASIC COVER--
Management unit 16R, Study no: 43

Cover Type	Average Cover % '11
Vegetation	39.68
Rock	3.04
Pavement	4.50
Litter	40.56
Cryptogams	.79
Bare Ground	25.06

PELLET GROUP DATA--
Management unit 16R, Study no: 43

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	25	-
Elk	2	4 (10)
Deer	7	24 (60)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 43

		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									
11	**0**	0	0	-	-	0	0	0	75/81
Artemisia tridentata vaseyana									
11	**3080**	18	60	22	80	32	0	23	27/33
Cercocarpus montanus									
11	**0**	0	0	-	-	0	0	0	57/63
Chrysothamnus depressus									
11	**60**	0	100	-	-	0	0	0	6/6
Chrysothamnus nauseosus									
11	**1000**	20	62	18	20	0	0	22	19/13
Chrysothamnus viscidiflorus									
11	**0**	0	0	-	-	0	0	0	17/5
Chrysothamnus viscidiflorus viscidiflorus									
11	**20**	100	0	-	-	0	0	0	7/7
Gutierrezia sarothrae									
11	**260**	0	100	-	-	0	0	0	8/8
Juniperus scopulorum									
11	**100**	60	40	-	60	0	0	0	-/-
Mahonia repens									
11	**15860**	5	95	-	40	0	0	0	3/4

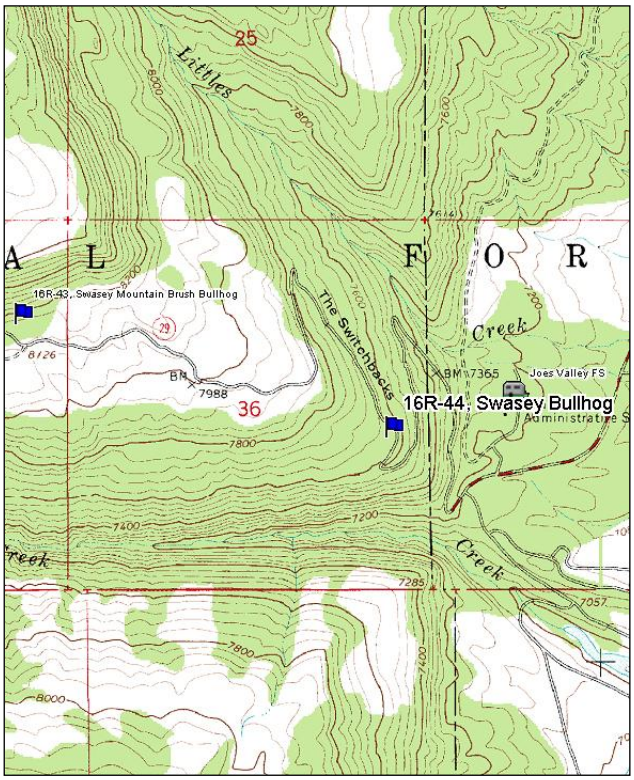
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Prunus virginiana									
11	**20**	0	100	-	-	0	0	0	32/37
Purshia tridentata									
11	**240**	8	92	-	-	25	25	0	15/32
Rosa woodsii									
11	**40**	0	100	-	-	0	0	0	5/6
Sambucus sp.									
11	**0**	0	0	-	-	0	0	0	7/13
Symphoricarpos oreophilus									
11	**5960**	8	91	1	20	12	2	4	14/25
Tetradymia canescens									
11	**320**	56	44	-	-	0	0	0	13/14

SWASEY BULLHOG - WRI STUDY 16R-44-11
Project #2091

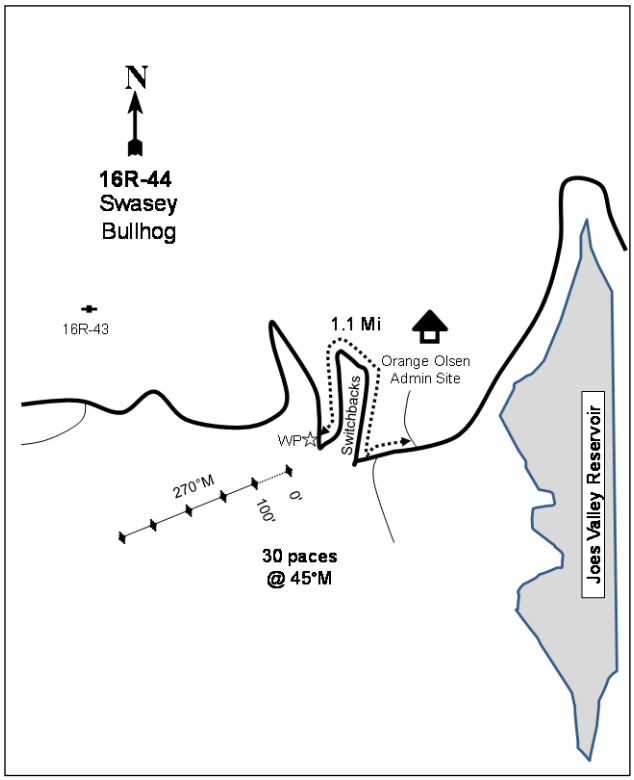
Vegetation Type: Pinyon and Juniper
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Not available
Land Ownership: Forest Service
Elevation: 7,565 ft (2,306 m)
Aspect: Southeast
Slope: 10%
Transect bearing: 270° magnetic
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)
No rebar

Directions: From the turnoff to the Orange Olsen Administration Site near Joes Valley Reservoir drive 1.1 miles up the switchbacks to the west. The witness post is on the east side of the road. The 0-foot stake is approximately 30 paces from the witness post at 45 degrees magnetic. The 0-foot stake is marked with browse tag #9161.

Map Name: Joes Valley Reservoir



Diagrammatic Sketch:



Township: 17S Range: 5E Section: 36

GPS: NAD 83, UTM 12S 473854 E 4350161 N

SWASEY BULLHOG - WRI STUDY 16R-44
Project #2091

Site Description

Site Information: The study is located approximately one miles west of Joes Valley Reservoir, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus Osteosperma*) woodland, on a bench north of Seely Creek, in the Manti-La Sal National Forest. Prior to treatment, the study was established in 2011 to monitor a pinyon and juniper tree removal project using bullhog machinery. Treatment methodology will consist of thinning dense stands of pinyon and juniper overstory with bullhog equipment. The project area is not planned to be seeded due to the good herbaceous understory present on the study site. The objectives of the project are to increase the herbaceous understory, and improve winter and transition range for mule deer and elk (WRI Database 2012). Elk and deer pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

Browse: The site was dominated by Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*), which provided the majority of the canopy cover on the site (Table - Canopy Cover). The stage of woodland succession was Phase III prior to treatment (Tausch et al. 2009). The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), black sagebrush (*Artemisia nova*), true mountain mahogany (*Cercocarpus montanus*), dwarf rabbitbrush (*Chrysothamnus depressus*), antelope bitterbrush (*Purshia tridentata*), and Gambel oak (*Quercus gambelii*). The dominant preferred browse species on the site are antelope bitterbrush and mountain big sagebrush. The mountain big sagebrush population is a sparse population, with low decadence and poor vigor within the population. The recruitment of young sagebrush plants to the population was high in 2011, with the majority of the population classified as young plants. Utilization of sagebrush plants was mostly light. The antelope bitterbrush is a small population, with low decadence and good vigor within the population. The recruitment of young bitterbrush plants to the population was poor, and utilization was light. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), pricklypear cactus (*Opuntia sp.*), and snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are not overly abundant, but are diverse on the site. The dominant grass species are thickspike wheatgrass (*Agropyron dasystachyum*) and bluebunch wheatgrass (*A. spicatum*). No annual grass species were sampled on the site in 2011. Other grass species sampled on the site include western wheatgrass (*A. smithii*), rush (*Junceus sp.*), prairie junegrass (*Koeleria cristata*), Indian ricegrass (*Oryzopsis hymenoides*), mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*P. secunda*), and letterman needlegrass (*Stipa lettermani*), though each of these species occurred in low abundance on the site. Forbs are fairly abundant and diverse on the site, though most of the abundance is from two species, mat penstemon (*Penstemon caespitosus*) and desert phlox (*Phlox austromontana*) (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is high on the site, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). Due to surface litter, rock, and soil movement; pedestalling, and flow patterns, the soil erosion condition was classified as moderate in 2011.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 44

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron dasystachyum	80	1.63
G	Agropyron smithii	5	.04
G	Agropyron spicatum	53	1.73
G	Carex rossii	6	.10
G	Juncus sp.	3	.03
G	Koeleria cristata	1	.03
G	Oryzopsis hymenoides	9	.37
G	Poa fendleriana	38	.49
G	Poa secunda	1	.00
G	Stipa lettermani	4	.03
Total for Annual Grasses		0	0
Total for Perennial Grasses		200	4.48
Total for Grasses		200	4.48
F	Achillea millefolium	3	.03
F	Arabis sp.	4	.03
F	Aster sp.	15	.03
F	Astragalus convallarius	6	.08
F	Astragalus sp.	9	.04
F	Astragalus tenellus	3	.03
F	Calochortus nuttallii	2	.00
F	Chaenactis douglasii	8	.02
F	Erigeron eatonii	18	.03
F	Eriogonum umbellatum	3	.15
F	Hymenoxys richardsonii	-	.00
F	Machaeranthera canescens	5	.03
F	Penstemon caespitosus	119	2.64
F	Phlox austromontana	85	2.23
Total for Annual Forbs		0	0
Total for Perennial Forbs		280	5.38
Total for Forbs		280	5.38

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

BROWSE TRENDS--
Management unit 16R, Study no: 44

Type	Species	Strip Frequency '11	Average Cover % '11
B	Abies concolor	-	.03
B	Amelanchier utahensis	0	.38
B	Artemisia nova	1	-
B	Artemisia tridentata vaseyana	17	.10
B	Cercocarpus montanus	1	-
B	Chrysothamnus depressus	8	.06
B	Chrysothamnus viscidiflorus viscidiflorus	1	-
B	Juniperus osteosperma	10	4.69
B	Opuntia sp.	9	.68
B	Pinus edulis	4	9.38
B	Purshia tridentata	17	1.65
B	Symphoricarpos oreophilus	11	.12
Total for Browse		79	17.11

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 44

Species	Percent Cover '11
Abies concolor	.20
Artemisia tridentata vaseyana	.40
Chrysothamnus depressus	.08
Juniperus osteosperma	18.18
Opuntia sp.	.83
Pinus edulis	22.79
Purshia tridentata	3.03
Symphoricarpos oreophilus	.08

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 44

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.9
Purshia tridentata	8.1

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 44

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	127	8.3
Pinus edulis	98	4.3

BASIC COVER--
Management unit 16R, Study no: 44

Cover Type	Average Cover % '11
Vegetation	25.36
Rock	9.38
Pavement	2.71
Litter	34.97
Cryptogams	.56
Bare Ground	39.59

PELLET GROUP DATA--
Management unit 16R, Study no: 44

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	21	-
Elk	5	15 (36)
Deer	10	17 (43)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 44

		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									
11	**0**	0	0	-	-	0	0	0	8/9
Artemisia nova									
11	**9220**	0	100	-	-	0	100	0	7/21
Artemisia tridentata vaseyana									
11	**1020**	63	29	8	300	18	12	6	17/23
Cercocarpus montanus									
11	**20**	0	100	-	-	0	100	0	12/16
Chrysothamnus depressus									
11	**420**	0	100	-	-	38	0	0	4/10
Chrysothamnus nauseosus									
11	**0**	0	0	-	-	0	0	0	23/14
Chrysothamnus viscidiflorus viscidiflorus									
11	**20**	0	100	-	-	0	0	0	4/7
Juniperus osteosperma									
11	**240**	42	42	17	-	0	0	17	-/-
Opuntia sp.									
11	**440**	18	82	-	-	0	0	0	4/15
Pinus edulis									
11	**80**	75	25	-	220	0	0	0	-/-

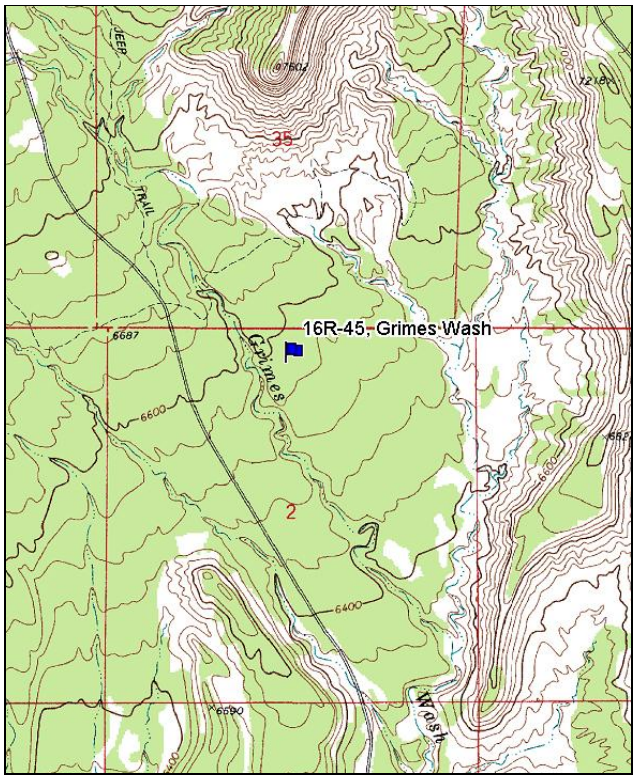
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Purshia tridentata									
11	**620**	3	90	6	20	23	10	6	13/45
Quercus gambelii									
11	**0**	0	0	-	-	0	0	0	21/19
Symphoricarpos oreophilus									
11	**260**	46	46	8	-	15	15	8	5/9

GRIMES WASH - WRI STUDY 16R-45-11
Project #1946

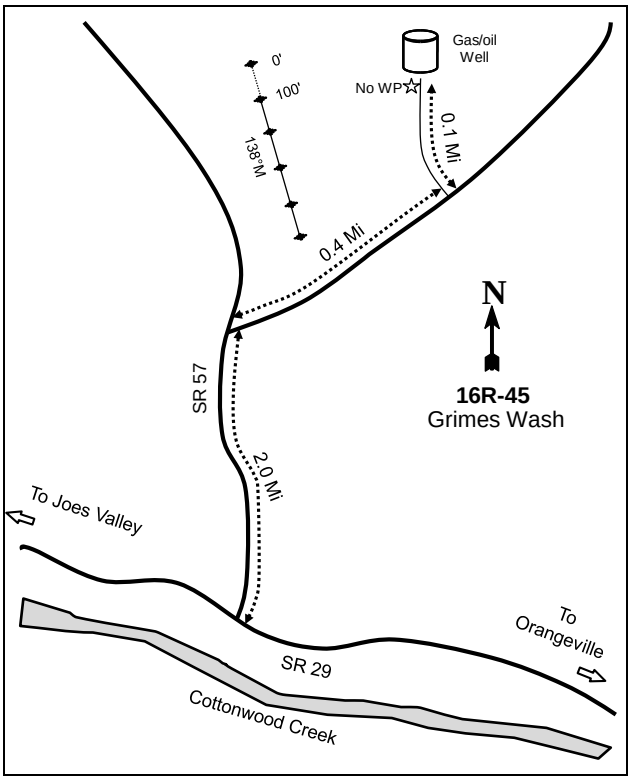
Vegetation Type: Pinyon and Juniper
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Semi Desert Bouldery Loam (Shadscale), R034XY202UT
Land Ownership: SITLA
Elevation: 6,506 ft (1,983 m)
Aspect: Southeast
Slope: 6%
Transect bearing: 138° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the intersection of SR 29 and SR 57, drive 2.0 miles north on SR 57. Turn right heading north east and go 0.4 miles. Turn right heading northwest and go 0.1 mile. There is a gas/oil well, park near it and walk 65 paces to the west. The 0-foot stake is marked with browse tag #184.

Map Name: Red Point



Diagrammatic Sketch:



Township: 18S Range: 7E Section: 2

GPS: NAD 83, UTM 12S 490949 E 4349143 N

GRIMES WASH - WRI STUDY 16R-45
Project #1946

Site Description

Site Information: The study is located approximately four and half miles northwest of Orangeville, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, on a bench east of Grimes Wash. The study is on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). Prior to treatment, the study was established in 2011 to monitor the effects of a two-way chaining. Prior to the chaining, the project area was aerially seeded with a seed mix of grass, forb, and browse species. Due to ruggedness of terrain and large boulders present within the project area, only a portion of the proposed treatment area was chained in the treatment. As a result the study site was not chained, but was seeded. The untreated portions of the project are planned to be treated in the future, but the study transect will be repositioned into the current treatment area during the next sample. The project area will be rested from livestock grazing for two growing seasons following the treatment. The objectives of the project are to improve wildlife habitat by removing encroaching pinyon and juniper trees, and increase shrub and herbaceous production and diversity (WRI Database 2012). Deer pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 16R, Study no: 45

Project Name: Grimes Wash WRI Database #: 1946			
Application: Aerial Seed		Acres:	272
Seed Type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	150	0.55
G	Indian Ricegrass	550	2.02
G	Siberian Wheatgrass 'Vavilov' NC	400	1.47
G	Thickspike Wheatgrass 'Bannock'	400	1.47
F	Alfalfa 'Ladak+'	100	0.37
F	Blue Flax 'Appar'	150	0.55
F	Gooseberryleaf Globemallow	50	0.18
F	Western Yarrow 'Eagle Mountain'	25	0.09
F	Yellow Sweetclover	100	0.37
B	Fourwing Saltbush	150	0.55
B	Winterfat	120	0.44
Total Pounds:		2195	8.07
PLS Pounds:			5.91

Browse: The site was dominated by a moderately dense, mature population of Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*), which provided the majority of the canopy cover in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009). The preferred browse species on the site are slenderbush eriogonum (*Eriogonum microthecum*) true mountain mahogany (*Cercocarpus montanus*), and green ephedra (*Ephedra viridis*), though each of these species provides little cover on the site (Table - Canopy Cover). The green ephedra is a sparse, moderately used population with high decadence and good vigor within the population. The slenderbush eriogonum is a small population of mostly lightly used plants with good vigor and low decadence within the population. Mountain mahogany was very rare on the site and was only sampled in height/crown measurements. Both, ephedra and eriogonum populations had good recruitment within their respective populations in 2011. Other browse species sampled on the site include pricklypear cactus (*Opuntia sp.*), sclerocactus (*Sclerocactus sp.*), and yucca (*Yucca sp.*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are rare on the site. No grass species were sampled within the quadrats in 2011. Forbs are moderately diverse, but rare on the site (Table - Herbaceous Trends).

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

HERBACEOUS TRENDS--
Management unit 16R, Study no: 45

Type	Species	Nested Frequency '11	Average Cover % '11
F	Arabis holboellii	1	.00
F	Caulanthus crassicaulis	2	.00
F	Chenopodium fremontii (a)	12	.21
F	Cryptantha sp.	8	.07
F	Descurainia pinnata (a)	38	.12
F	Draba sp. (a)	4	.04
F	Eriastrum sparsiflorum (a)	2	.00
F	Eriogonum sp.	8	.05
F	Euphorbia albomarginata	3	.04
F	Lactuca serriola (a)	2	.03
F	Lepidium sp. (a)	17	.18
F	Penstemon sp.	8	.09
F	Salsola iberica (a)	3	.00
F	Stanleya viridiflora	3	.01
Total for Annual Forbs		78	0.59
Total for Perennial Forbs		33	0.27
Total for Forbs		111	0.87

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

BROWSE TRENDS--
Management unit 16R, Study no: 45

Type	Species	Strip Frequency '11	Average Cover % '11
B	Ephedra viridis	6	1.38
B	Eriogonum microthecum	32	.04
B	Juniperus osteosperma	4	5.34
B	Opuntia sp.	4	.03
B	Pinus edulis	13	5.36
Total for Browse		59	12.17

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 45

Species	Percent Cover '11
Ephedra viridis	2.03
Eriogonum microthecum	.15
Juniperus osteosperma	13.11
Pinus edulis	13.78

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 45

Species	Average leader growth (in) '11
Cercocarpus montanus	4.5

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 45

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	159	11.6
Pinus edulis	223	2.9

BASIC COVER--
Management unit 16R, Study no: 45

Cover Type	Average Cover % '11
Vegetation	12.55
Rock	12.89
Pavement	15.36
Litter	34.25
Cryptogams	1.80
Bare Ground	41.84

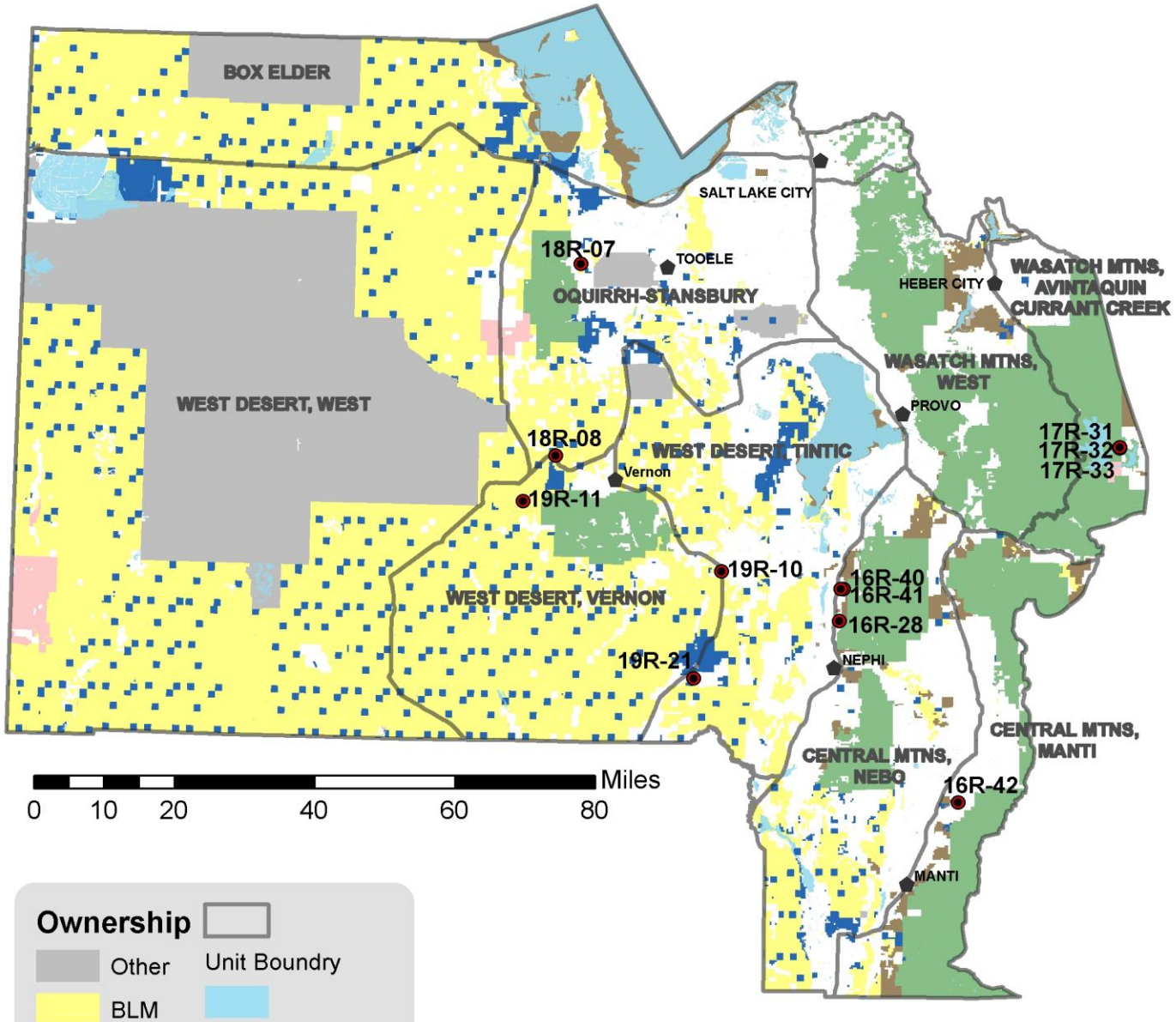
PELLET GROUP DATA--
Management unit 16R, Study no: 45

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	2	-
Elk	5	-
Deer	13	15 (36)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 45

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Cercocarpus montanus									
11	**0**	0	0	-	20	0	0	0	35/49
Ephedra viridis									
11	**160**	13	63	25	-	25	25	0	27/37
Eriogonum microthecum									
11	**1440**	46	54	-	260	3	6	0	3/3
Juniperus osteosperma									
11	**80**	0	100	-	20	0	0	0	-/-
Opuntia sp.									
11	**80**	25	75	-	-	0	0	0	3/8
Pinus edulis									
11	**300**	73	27	-	40	0	0	7	-/-
Sclerocactus sp.									
11	**0**	0	0	-	-	0	0	0	6/7
Yucca sp.									
11	**0**	0	0	-	-	0	0	0	8/12

Central Region
WRI Studies 2011

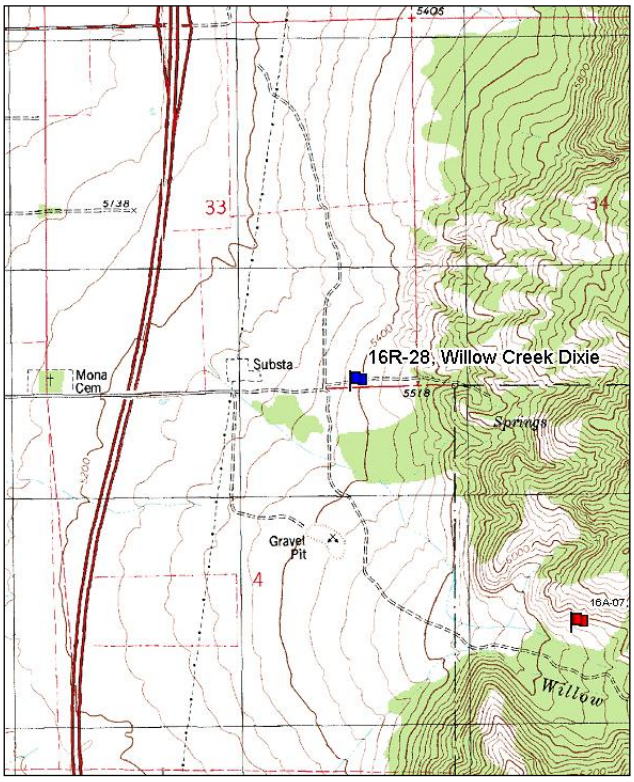


WILLOW CREEK DIXIE - TREND STUDY NO. 16R-28-11
Project #1101

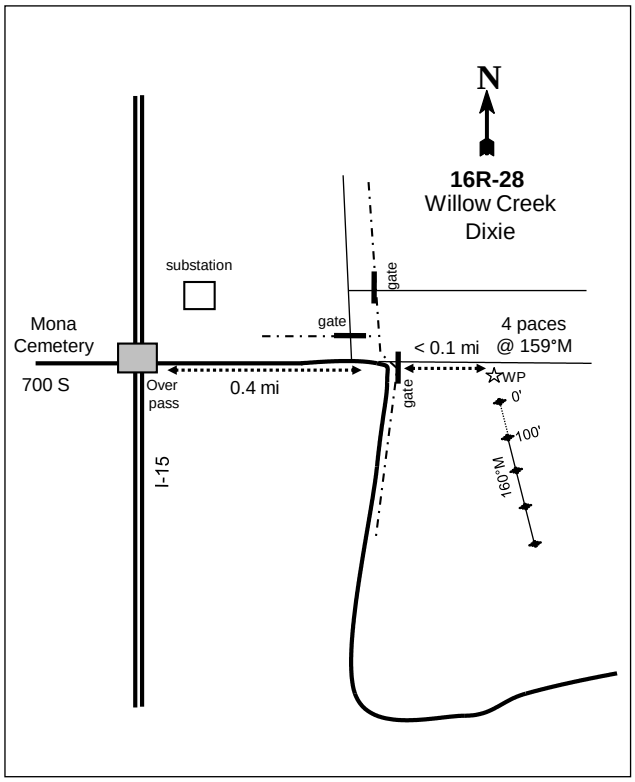
Vegetation Type: Grass, Annual Forb
Range Type: Crucial Elk Winter
NRCS Ecological Site Description: Mountain Gravelly Loam (Oak), R047XA410UT
Land Ownership: Private
Elevation: 5,385 ft. (1,641 m)
Aspect: West
Slope: 12%
Transect bearing: 160° magnetic
Belt placement: line 1 (11ft and 71ft), line 2 (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



Diagrammatic Sketch:



Township: 12S Range: 1E Section: 4

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

WILLLOW CREEK DIXIE - WRI STUDY 16R-28
Project #1101

Site Description

Site Information: The study is located approximately one and half miles east of Mona, within an annual dominated flat at the base of Cedar Ridge, on private land. Prior to the treatment, the study was originally established in 2008 to monitor a Plateau (Imazapic) herbicide treatment and seeding with a rangeland drill. However, due to scheduling conflicts the Plateau was not used on the project area 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 objectives of the project are to reduce the prevalence of cheatgrass (*Bromus tectorum*) and annual weeds, establish desirable perennial grass, forb, and browse species, and reduce the risk of wildfire (WRI Database 2012). Cattle sign was sampled in moderate abundance in 2008, and deer pellet groups were sampled in low abundance in 2011 (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 Wheatgrass '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, but include very small populations of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), rubber rabbitbrush (*Chrysothamnus nauseous*), and broom snakeweed (*Gutierrezia sarothrae*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and moderately diverse on the site. The invasive annual grass species cheatgrass is the dominant grass species and has provided the majority of the grass cover over the sample years. The dominant perennial grass species are purple three-awn (*Aristida purpurea*) and the weedy species bulbous bluegrass (*Poa bulbosa*). In 2011, the invasive annual weedy species jointed goatgrass (*Aegilops cylindrica*) was sampled for the first time on the site in low abundance. Seeded species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), Indian wheatgrass (*Oryzopsis hymenoides*), and Sandberg bluegrass (*Poa secunda*). The annual species rattail fescue (*Festuca myuros*) has occurred in low abundance on the site over the sample years. Forbs are abundant, but are not particularly diverse and are in poor condition. Prior to treatment, the annual species storksbill dominated the site, but following treatment has become rare on the site. The noxious weed field bindweed (*Convolvulus arvensis*) has become the

dominant perennial forb species on the site following the treatment. Alfalfa (*Medicago sativa*) was the only seeded forb species sampled on the site following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Lizzant component, which is found on alluvial fans and mountain slopes. The parent material consists of alluvium derived from limestone and/or colluvium derived from limestone. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of litter and pavement, and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Year Post Treatment, 2008 vs. 20011

Browse: Browse species are rare on the site. Mountain big sagebrush was sampled for the first time in 2011.

Grasses: The sum of nested frequency of perennial grasses increased two-fold, and cover increased from 4% to 36%. The change in perennial frequency and cover can be mostly attributed to the weedy species bulbous bluegrass. Bulbous bluegrass increased significantly in nested frequency, and cover increased from less than 1% to 25%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from 5% to 33%.

Forbs: The sum of perennial forbs remained similar in nested frequency, though cover increased from 1% to 11%. The increase in perennial forb cover was mostly due to the increase of cover of the noxious weed field bindweed, which increased from 1% to 9% cover. The palatable annual forb species prickly lettuce (*Lactuca serriola*) increased significantly in nested frequency, and cover increased from less than 1% cover to 11%. The seeded forb species alfalfa was sampled for the first time at 1% cover.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 28

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Aegilops cylindrica (a)	-	6	-	.24
G	Agropyron cristatum	a1	b14	.00	.52
G	Agropyron intermedium	a4	b46	.18	1.24
G	Agropyron smithii	-	4	-	.15
G	Agropyron spicatum	-	3	-	.03
G	Aristida purpurea	b206	a118	3.71	9.61
G	Bromus tectorum (a)	a412	b434	4.67	32.54
G	Festuca myuros (a)	a8	b40	.18	1.90
G	Oryzopsis hymenoides	-	2	-	.03
G	Poa bulbosa	a19	b348	.29	24.48
G	Poa secunda	-	4	-	.09
Total for Annual Grasses		420	480	4.86	34.68
Total for Perennial Grasses		230	539	4.20	36.18
Total for Grasses		650	1019	9.06	70.86
F	Alyssum alyssoides (a)	4	4	.01	.01
F	Artemisia ludoviciana	-	2	-	.06
F	Calochortus nuttallii	a-	b16	-	.06
F	Convolvulus arvensis	117	100	1.13	8.93

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Erodium cicutarium (a)	$_{b}$414	$_{a}$58	14.70	.42
F	Euphorbia sp.	5	-	.03	-
F	Grindelia squarrosa	-	7	-	.33
F	Helianthus annuus (a)	$_{a}$-	$_{b}$25	-	.07
F	Holosteum umbellatum (a)	-	3	-	.00
F	Lactuca serriola (a)	$_{a}$38	$_{b}$316	.16	10.54
F	Leucelene ericoides	10	-	.04	-
F	Lygodesmia grandiflora	-	1	-	.00
F	Medicago sativa	-	4	-	.68
F	Phlox longifolia	-	2	-	.00
F	Salsola iberica (a)	-	1	-	.00
F	Sisymbrium altissimum (a)	2	-	.01	.00
F	Sphaeralcea coccinea	6	6	.04	.41
F	Tragopogon dubius (a)	$_{b}$21	$_{a}$7	.07	.10
Total for Annual Forbs		479	414	14.96	11.16
Total for Perennial Forbs		138	138	1.26	10.48
Total for Forbs		617	552	16.22	21.65

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

BROWSE TRENDS--
Management unit 16R, Study no: 28

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia tridentata vaseyana	0	1	-	.03
B	Gutierrezia sarothrae	0	1	-	-
Total for Browse		0	2	0	0.03

BASIC COVER--
Management unit 16R, Study no: 28

Cover Type	Average Cover % '08	'11
Vegetation	29.25	76.41
Rock	3.31	5.32
Pavement	9.10	14.23
Litter	59.23	17.59
Cryptogams	.01	0
Bare Ground	8.30	3.74

SOIL ANALYSIS DATA --

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

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		Days use per acre (ha)	
	'08	'11	'08	'11
Rabbit	4	-	-	-
Elk	1	-	-	-
Deer	1	-	-	1 (3)
Cattle	16	1	25 (63)	-

BROWSE CHARACTERISTICS--

Management unit 16R, Study no: 28

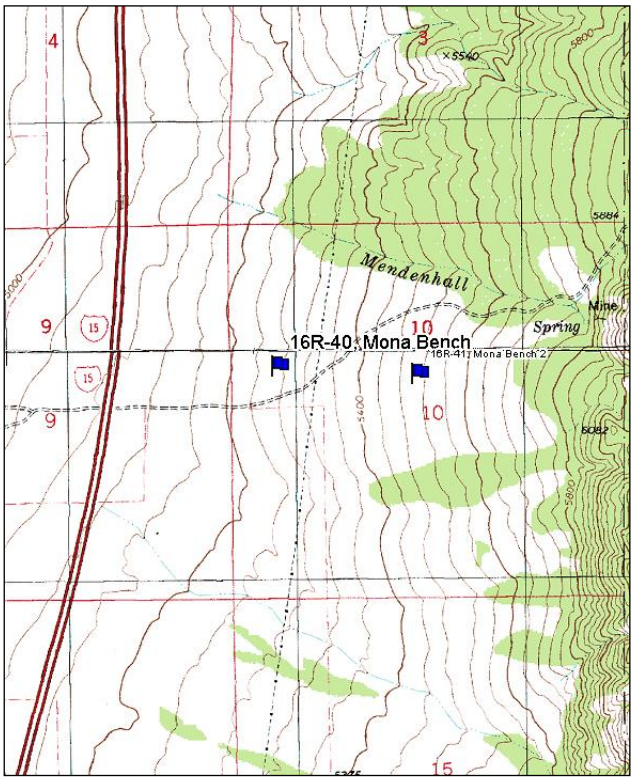
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	4/3
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	15/19
Gutierrezia sarothrae									
08	**0**	0	0	-	-	0	0	0	10/10
11	**20**	0	100	-	-	0	0	0	16/17

MONA BENCH - WRI STUDY 16R-40-11
Project #1934

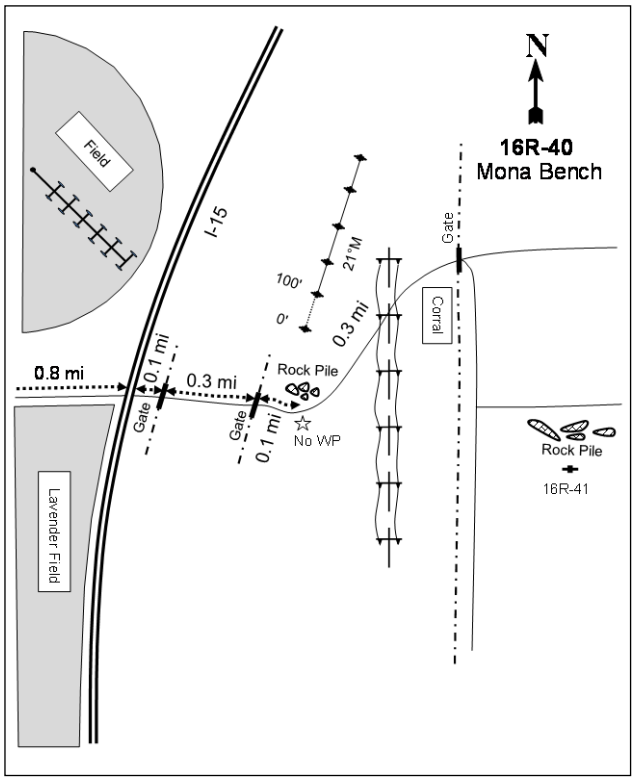
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R028AY334UT
Land Ownership: Private
Elevation: 5,181 ft (1,578 m)
Aspect: West
Slope: 8%
Transect bearing: 21° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
No rebar

Directions: From Mona drive 3 miles heading north. Turn right on road to the east by the lavender farms. Go 0.8 miles and drive under the freeway. Go another 0.1 miles to panel gate. Proceed through gate and go another 0.3 miles to a wire gate. Go another 0.1 miles to a rock pile on the north side of the road. There is no witness post. The 0-foot stake is 18 paces to the north of the road. The browse tag is #194.

Map Name: Mona



Diagrammatic Sketch:



Township: 11S Range: 1E Section: 10

GPS: NAD 83, UTM 12S 429839 E 4414083 N

MONA BENCH - WRI STUDY 16R-40
Project #1934

Site Description

Site Information: The study is located approximately four miles north of Mona, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, east of Mendenhall Spring, on private land. Prior to treatment, the study was established in 2011 to monitor an herbicide, chain-harrow, and seeding treatment. Prior to the placement of the study in May of 2011, approximately 62 acres of the lower section was sprayed with Milestone (aminopyralid) herbicide to control squarrose knapweed (*Centaurea virgata*). In October of 2011, the entire project area was chain harrowed once, then back harrowed while broadcasting seed through a head seeder (Table - Seed Mix). In November of 2011, the entire project area, approximately 190 acres, was sprayed with Plateau (Imazapic) herbicide. In February of 2012, an aerial seeding of forage kochia (*Kochia prostrata*), alfalfa (*Medicago sativa*), and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) was seeded over the entire project area (Table - Seed Mix). In May of 2012, the lower portion of the project and portions of north east sections will be spot sprayed for knapweed with Milestone herbicide. The study is located in the lower portion of the treatment that was chain harrowed and sprayed with Plateau and Milestone herbicide. Livestock grazing will be rested until grass and forb species reestablish within the treatment area. The objectives of the project are control the noxious weeds, establish grass and forb species, and improve wildlife habitat (WRI Database 2012). Deer pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 16R, Study no: 40

Project Name: Mona Bench - Grass Mix WRI Database #: 1934				Project Name: Mona Bench - Browse Mix WRI Database #: 1934			
Application: Broadcast Seed		Acres:	62	Application: Aerial Seed		Acres:	129
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone'	100	1.61	F	Alfalfa 'Nomad'	65	0.50
G	Canby Bluegrass 'Canbar'	25	0.40	B	Forage Kochia	130	1.01
G	Crested Wheatgrass 'Hycrest'	100	1.61	B	Sagebrush, Wyoming	40	0.31
G	Great Basin Wildrye 'Trailhead'	100	1.61	Total Pounds:		235	1.82
G	Indian Ricegrass 'Rimrock'	100	1.61	PLS Pounds:			1.09
G	Russian Wildrye	100	1.61				
G	Sandberg Bluegrass	25	0.40				
G	Thickspike Wheatgrass 'Bannock'	100	1.61				
G	Western Wheatgrass 'Arriba'	100	1.61				
Total Pounds:		750	12.10				
PLS Pounds:			10.54				

Browse: The preferred browse species on the site are Wyoming big sagebrush and black sagebrush (*Artemisia nova*). The Wyoming big sagebrush is a moderately dense population with low decadence and good vigor within the population. The black sagebrush is a relatively small population with low decadence and good vigor within the population. The recruitment of young black and big sagebrush plants to the population was good in 2011. Utilization of Wyoming big sagebrush was mostly moderate and use of black sagebrush was mostly light. A moderately dense population of broom snakeweed (*Gutierrezia* sarothrae) was sampled on the site in 2011. Pricklypear cactus (*Opuntia sp.*) was also sampled on the site, though was only sampled in height/crown measurements (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and diverse on the site, but are dominated by the weedy annual grass species, cheatgrass (*Bromus tectorum*) and Japanese chess (*B. japonicus*). The invasive weedy species jointed

goatgrass (*Aegilops cylindrica*) was sampled on the site in patches, but provided little cover on the site. Purple three-awn (*Aristida purpurea*) was the most common perennial grass species. Other perennial grass species were rare on the site and provided little cover, but include intermediate wheatgrass (*Agropyron intermedium*), the weedy species bulbous bluegrass (*Poa bulbosa*), mutton bluegrass (*P. fendleriana*), Sandberg bluegrass (*P. secunda*), and sand dropseed (*Sporobolus cryptandrus*). Forbs are diverse, but not overly abundant on the site. The dominant forbs species were pale alyssum (*Alyssum alyssoides*) and draba (*Draba sp.*). A small population of the noxious weed squarrose knapweed was sampled on the site in 2011. Other forb species were rare on the site and provided little cover (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Donnardo component, which is found on alluvial fans. The parent material consists of alluvium derived from quartzite and/or alluvium derived from limestone and sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer. The soil surface texture is a stony loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is 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 2011.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 40

Type	Species	Nested Frequency '11	Average Cover % '11
G	Aegilops cylindrica (a)	8	.36
G	Agropyron intermedium	12	.11
G	Aristida purpurea	67	3.60
G	Bromus japonicus (a)	234	16.18
G	Bromus tectorum (a)	311	21.78
G	Festuca myuros (a)	7	.02
G	Poa bulbosa	45	.49
G	Poa fendleriana	1	.00
G	Poa secunda	45	.29
G	Sporobolus cryptandrus	8	.51
Total for Annual Grasses		560	38.35
Total for Perennial Grasses		178	5.02
Total for Grasses		738	43.37
F	Alyssum alyssoides (a)	197	1.23
F	Artemisia ludoviciana	1	.00
F	Asclepias subverticillata	-	.00
F	Astragalus utahensis	-	.00
F	Calochortus nuttallii	25	.07
F	Castilleja chromosa	1	.00
F	Centaurea virgata	15	.47
F	Cirsium sp.	4	.18
F	Crepis acuminata	3	.00
F	Draba sp. (a)	98	1.00
F	Erigeron flagellaris	3	.03
F	Erodium cicutarium (a)	17	.35
F	Helianthus annuus (a)	9	.03
F	Holosteum umbellatum (a)	128	.69
F	Lactuca serriola (a)	29	.08

Type	Species	Nested Frequency '11	Average Cover % '11
F	Phlox longifolia	8	.04
F	Ranunculus testiculatus (a)	26	.15
F	Sphaeralcea coccinea	19	.24
F	Tragopogon dubius (a)	2	.03
F	Zigadenus paniculatus	14	.13
Total for Annual Forbs		506	3.58
Total for Perennial Forbs		93	1.20
Total for Forbs		599	4.78

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

BROWSE TRENDS--
Management unit 16R, Study no: 40

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia nova	5	1.77
B	Artemisia tridentata wyomingensis	56	6.86
B	Gutierrezia sarothrae	90	9.81
Total for Browse		151	18.45

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 40

Species	Percent Cover '11
Artemisia nova	2.53
Artemisia tridentata wyomingensis	9.26
Gutierrezia sarothrae	10.14

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 40

Species	Average leader growth (in) '11
Artemisia tridentata wyomingensis	2.0

BASIC COVER--
Management unit 16R, Study no: 40

Cover Type	Average Cover % '11
Vegetation	57.56
Rock	4.44
Pavement	15.45
Litter	29.72
Cryptogams	.13
Bare Ground	14.75

PELLET GROUP DATA--
Management unit 16R, Study no: 40

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	3	-
Horse	1	-
Deer	16	7 (18)
Cattle	1	-

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 40

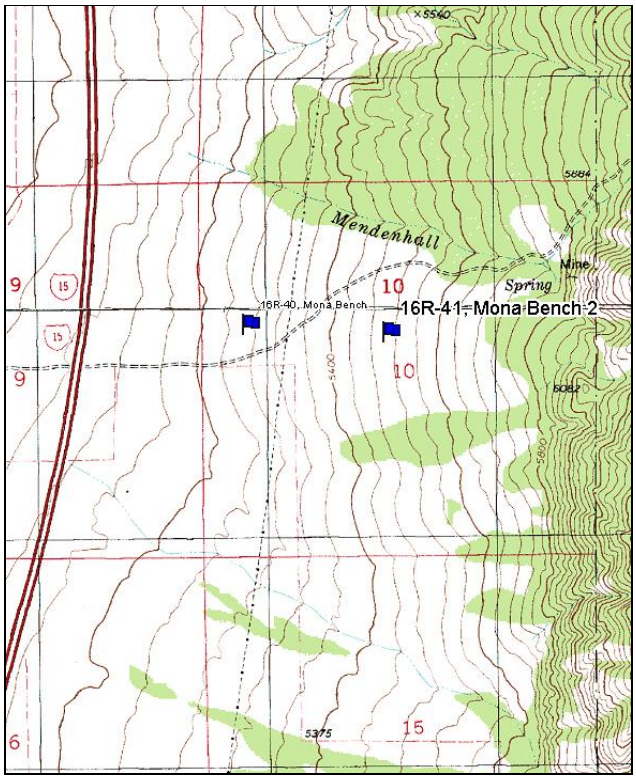
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
11	**140**	0	100	-	-	0	0	0	17/27
Artemisia tridentata wyomingensis									
11	**1480**	22	73	5	60	45	8	1	21/31
Gutierrezia sarothrae									
11	**8160**	15	80	4	980	3	0	4	9/12
Opuntia sp.									
11	**0**	0	0	-	-	0	0	0	2/5

MONA BENCH 2 - WRI STUDY 16R-41-11
Project #1934

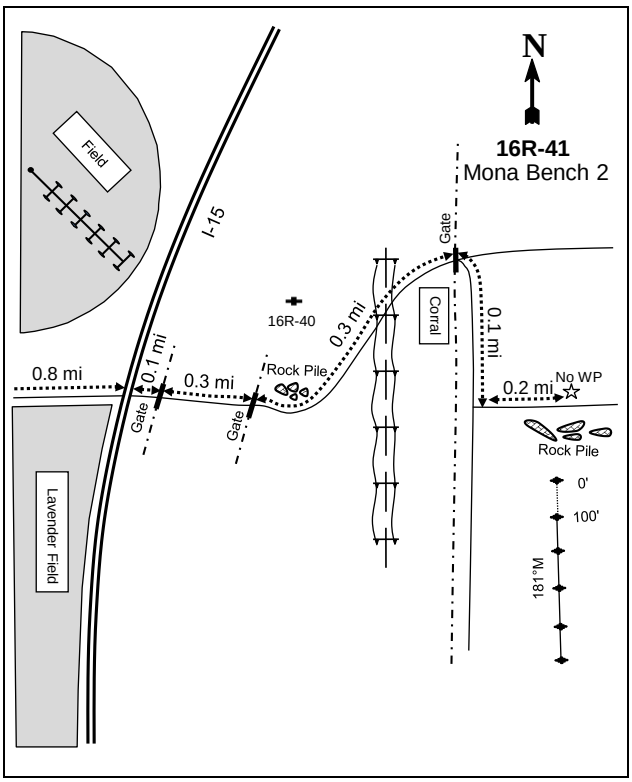
Vegetation Type: Annual Grassland
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R028AY334UT
Land Ownership: Private
Elevation: 5,432 ft (1,656 m)
Aspect: West
Slope: 11%
Transect bearing: 181° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
No rebar

Directions: From Mona drive 3 miles heading north. Turn right on road to the east by the lavender farms. Go 0.8 miles and drive under the freeway. Go another 0.1 miles to panel gate. Proceed through gate and go another 0.3 miles to a wire gate. Go another 0.3 miles to a gate and corrals on the right. Turn right and head south after passing through the gate. Go 0.1 mile and turn left and head east. Go 0.2 miles. There is no witness post, but there is a pile of larger rocks on the south side of the road the 0-foot stake is 18 paces to the south of the road. The browse tag is #195.

Map Name: Mona



Diagrammatic Sketch:



Township: 11S Range: 1E Section: 10

GPS: NAD 83, UTM 12S 430450 E 4414044 N

MONA BENCH 2 - WRI STUDY 16R-41
Project #1934

Site Description

Site Information: The study is located approximately four miles north of Mona, within an annual grass species dominated flat, east of Mendenhall Spring, on private land. Prior to treatment, the study was established in 2011 to monitor an herbicide, chain-harrow, and seeding treatment. Prior to the placement of the study in May of 2011, approximately 62 acres of the lower section was sprayed with Milestone (aminopyralid) herbicide to control squarrose knapweed (*Centaurea virgata*). In October of 2011, the entire project area was chained harrowed once, then back harrowed while broadcasting seed through a head seeder (Table - Seed Mix). In November of 2011, the entire project area, approximately 190 acres, was sprayed with Plateau (Imazapic) herbicide. In February of 2012, an aerial seeding of forage kochia (*Kochia prostrata*), alfalfa (*Medicago sativa*), and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) was seeded over the entire project area (Table - Seed Mix). In May of 2012, the lower portion of the project and portions of northeast sections will be spot sprayed for knapweed with Milestone herbicide. The study is located in the portion of the treatment that was chain harrowed and sprayed with Plateau herbicide. Livestock grazing will be rested until grass and forb species reestablish within the treatment area. The objectives of the project are to control the noxious weeds, establish grass and forb species, and improve wildlife habitat (WRI Database 2012). In 2011, livestock or wildlife sign was nearly absent (Table - Pellet Group Data).

SEED MIX--
Management unit 16R, Study no: 41

Project Name: Mona Bench - Forb/Grass Mix WRI Database #: 1934				Project Name: Mona Bench - Browse Mix WRI Database #: 1934			
Application: Broadcast Seed		Acres:	129	Application: Aerial Seed		Acres:	129
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone'	150	1.16	F	Alfalfa 'Nomad'	65	0.50
G	Crested Wheatgrass 'Hycrest'	200	1.55	B	Forage Kochia	130	1.01
G	Great Basin Wildrye 'Trailhead'	150	1.16	B	Sagebrush, Wyoming	40	0.31
G	Indian Ricegrass 'Rimrock'	150	1.16	Total Pounds:		235	1.82
G	Russian Wildrye	200	1.55	PLS Pounds:			1.09
G	Thickspike Wheatgrass 'Bannock'	200	1.55				
G	Western Wheatgrass 'Arriba'	250	1.94				
F	Alfalfa 'Nomad'	100	0.78				
F	Blue Flax 'Appar'	35	0.27				
F	Sainfoin 'Eski'	200	1.55				
F	Small Burnet 'Delar'	150	1.16				
Total Pounds:		1785	13.84				
PLS Pounds:			12.34				

Browse: Preferred browse species are rare on the site. A small population of Wyoming big sagebrush was sampled on the site in height/crown measurements only. A sparse population of broom snakeweed (*Gutierrezia sarothrae*) was sampled throughout the site. Other browse species sampled on the site include mountain ball cactus (*Pediocactus simpsonii*) and rubber rabbitbrush (*Chrysothamnus nauseosus*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and diverse, though the site is dominated by the weedy annual grass species cheatgrass (*Bromus tectorum*) and jointed goatgrass (*Aegilops cylindrica*). The perennial grass species purple three-awn (*Aristida purpurea*) was abundant and provided a high amount of cover on the site. A small population of sand dropseed (*Sporobolus cryptandrus*) was sampled in low abundance on the site. Other grass

species sampled on the site include Japanese chess (*Bromus tectorum*), bulbous bluegrass (*Poa bulbosa*), and Sandberg bluegrass (*P. secunda*). Forbs are diverse, but are not overly abundant and are dominated by the weedy annual forb species storksbill (*Erodium cicutarium*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Donnardo component, which is found on alluvial fans. The parent material consists of alluvium derived from quartzite and/or alluvium derived from limestone and sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer. The soil surface texture is a stony loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of vegetation, and moderate amount of pavement and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 41

Type	Species	Nested Frequency '11	Average Cover % '11
G	Aegilops cylindrica (a)	76	7.08
G	Aristida purpurea	273	20.03
G	Bromus japonicus (a)	1	.00
G	Bromus tectorum (a)	456	22.52
G	Festuca myuros (a)	75	.65
G	Poa bulbosa	10	.07
G	Poa secunda	29	.06
G	Sporobolus cryptandrus	39	1.13
Total for Annual Grasses		608	30.26
Total for Perennial Grasses		351	21.31
Total for Grasses		959	51.57
F	Alyssum alyssoides (a)	118	.46
F	Artemisia ludoviciana	13	.40
F	Astragalus utahensis	1	.00
F	Calochortus nuttallii	7	.05
F	Descurainia pinnata (a)	3	.00
F	Draba sp. (a)	26	.06
F	Epilobium brachycarpum (a)	1	.00
F	Eriogonum racemosum	38	.26
F	Erodium cicutarium (a)	230	3.54
F	Euphorbia albomarginata	1	.00
F	Helianthus annuus (a)	23	.08
F	Holosteum umbellatum (a)	133	.93
F	Lactuca serriola (a)	26	.10
F	Leucelene ericoides	21	.06
F	Lomatium sp.	1	.00
F	Sphaeralcea coccinea	28	.47
F	Tragopogon dubius (a)	4	.03
F	Zigadenus paniculatus	16	.11
Total for Annual Forbs		564	5.23
Total for Perennial Forbs		126	1.38
Total for Forbs		690	6.61

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

BROWSE TRENDS--
Management unit 16R, Study no: 41

Type	Species	Strip Frequency '11	Average Cover % '11
B	Gutierrezia sarothrae	53	3.67
B	Pediocactus simpsonii	1	.00
Total for Browse		54	3.67

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 41

Species	Percent Cover '11
Gutierrezia sarothrae	3.41

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 41

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	2.7

BASIC COVER--
Management unit 16R, Study no: 41

Cover Type	Average Cover % '11
Vegetation	53.77
Rock	11.30
Pavement	27.25
Litter	24.27
Cryptogams	.48
Bare Ground	1.12

PELLET GROUP DATA--
Management unit 16R, Study no: 41

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Deer	1	-
Cattle	10	-

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 41

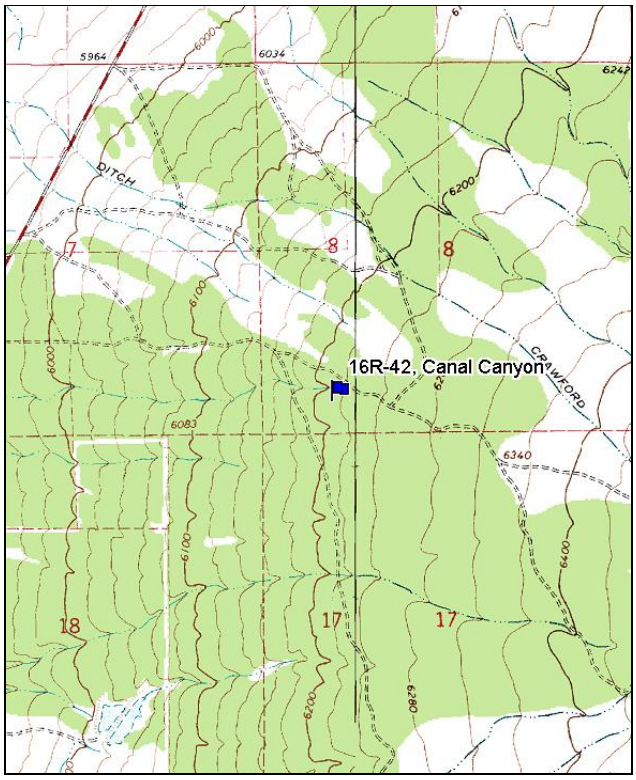
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
11	**0**	0	0	-	-	0	0	0	17/23
Chrysothamnus nauseosus									
11	**0**	0	0	-	-	0	0	0	19/21
Gutierrezia sarothrae									
11	**3760**	22	76	2	740	.53	0	5	9/12
Pediocactus simpsonii									
11	**20**	0	100	-	-	0	0	0	3/3

CANAL CANYON - WRI STUDY 16R-42-11
Project #1921

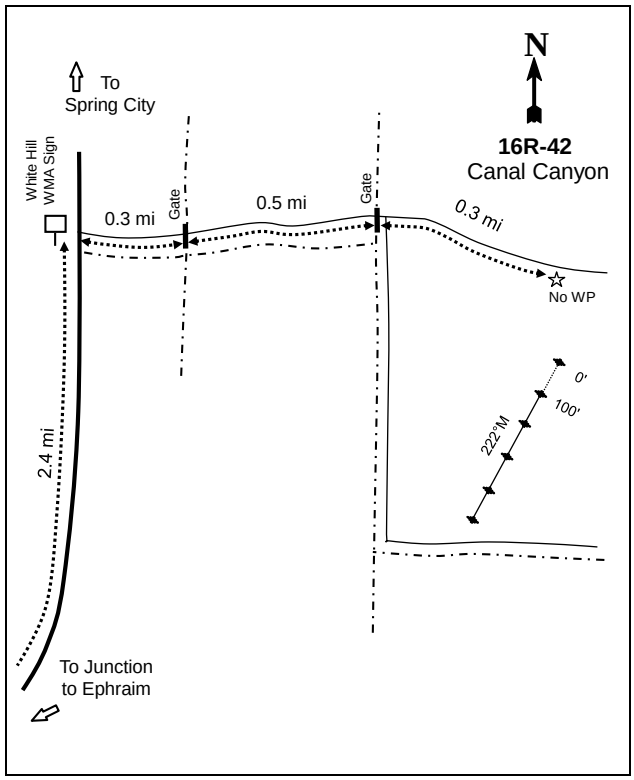
Vegetation Type: Utah Juniper
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 6,137 ft (1,870 m)
Aspect: West
Slope: 5%
Transect bearing: 222° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the Pigeon Hollow Junction head east towards Spring City. Travel 2.4 miles until the White Hill WMA sign on the left side of the road (west). Turn right and head east. Go 0.3 miles to a gate. Proceed another 0.5 miles to another gate. Travel 0.3 miles. There is no witness post. The study transect is approximately 75 paces to the south. The 0-foot stake is marked with browse tag#185.

Map Name: Chester



Diagrammatic Sketch:



Township: 16S Range: 4E Section: 8

GPS: NAD 83, UTM 12S 456805 E 4365063 N

CANAL CANYON - WRI STUDY 16R-42
Project #1921

Site Description

Site Information: The study is located approximately two and half miles south of Spring City, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, east of the White Hills Wildlife Management Area (WMA), on private land. Prior to treatment, the study was established in 2011 to monitor two-way chaining project. In October of 2011, approximately 314 acres were two-way chained with an Ely chain on the first pass and a smooth chain on the second pass. A seed mix of grass and forb species was aerially seeded over the project area in between the Ely and smooth chain treatments. Seed dribblers were used during the pass with the smooth chain to seed browse species. In the February of 2012, a seed mix of forb and browse species was aerially applied to the project area (Table - Seed Mix). An aerial application of Plateau (Imazapic) herbicide will be applied to the project area in the summer of 2012 or following year. The project area will be rested from livestock grazing for two growing seasons. The objectives of the project are to remove encroaching pinyon and juniper trees, improve the herbaceous understory, and improve habitat for wildlife (WRI Database 2012). Deer and elk pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 16R, Study no: 42

Project Name: Canal Canyon Project WRI Database #: 1921				Project Name: Canal Canyon Project WRI Database #: 1921			
Application: Aerial Seed		Acres:	402	Application: Aerial Seed		Acres:	402
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone'	603	1.50	F	Alfalfa 'Ladak'	201	0.50
G	Crested Wheatgrass 'Hycrest'	804	2.00	B	Forage Kochia 'Immigrant'	402	1.00
G	Great Basin Wildrye 'Trailhead'	201	0.50	B	Sagebrush, Wyoming	10	0.03
G	Indian Ricegrass 'Rimrock'	402	1.00	Total Pounds:		613	1.53
G	Orchardgrass 'Paiute'	402	1.00	PLS Pounds:			1.16
G	Pubescent wheatgrass 'Luna'	402	1.00	Project Name: Canal Canyon Project WRI Database #: 1921			
F	Alfalfa 'Ladak'	402	1.00				
F	Blue Flax ' Appar	201	0.50	Application: Dribbler		Acres:	402
F	Sainfoin 'Eski'	804	2.00	Seed Type		lbs in mix	lbs/acre
F	Small Burnet 'Delar'	804	2.00	B	Bitterbrush	26	0.07
F	Western Yarrow	10	0.03	B	Fourwing Saltbush	60	0.15
Total Pounds:		5035	12.53	Total Pounds:		86	0.22
PLS Pounds:			11.02	PLS Pounds:			0.11

Browse: Browse species are rare on the site, and the browse composition is dominated by Utah juniper (*Juniperus osteosperma*). The Utah juniper population was a highly dense population with mostly mature trees of eight feet or taller (Table - Point-Quarter Tree Data), and provided all of the canopy cover in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009).

Herbaceous Trends: Grasses are in poor condition and are dominated by the weedy annual grass species cheatgrass (*Bromus tectorum*). Other less common grass species sampled on the site included crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Agropyron intermedium*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are not abundant or diverse on the site. The annual species pale alyssum (*Alyssum alyssoides*) provided the majority of the forb cover in 2011 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Borvant-Doyce complex, which is found on alluvial fans, ridges, fans, and swales. The parent material consists of alluvium and colluvium derived from limestone and shale and/or alluvium derived from limestone, sandstone, and shale. The soils within this classification are characterized as deep, well drained, and with a slightly to moderately permeable restrictive layer. The soil surface texture is a very stony loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 42

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron cristatum	12	.31
G	Agropyron intermedium	2	.00
G	Bromus tectorum (a)	174	3.49
G	Poa secunda	10	.10
G	Sitanion hystrix	16	.09
Total for Annual Grasses		174	3.49
Total for Perennial Grasses		40	0.50
Total for Grasses		214	4.00
F	Alyssum alyssoides (a)	295	4.60
F	Arabis holboellii	2	.15
F	Descurainia pinnata (a)	4	.01
F	Lactuca serriola (a)	5	.01
F	Ranunculus testiculatus (a)	121	.25
Total for Annual Forbs		425	4.88
Total for Perennial Forbs		2	0.15
Total for Forbs		427	5.03

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

BROWSE TRENDS--
Management unit 16R, Study no: 42

Type	Species	Strip Frequency '11	Average Cover % '11
B	Juniperus osteosperma	8	20.17
Total for Browse		8	20.17

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 42

Species	Percent Cover '11
Juniperus osteosperma	35.31

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 42

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	236	7.6

BASIC COVER--
Management unit 16R, Study no: 42

Cover Type	Average Cover % '11
Vegetation	26.87
Rock	3.03
Pavement	11.98
Litter	36.44
Cryptogams	9.01
Bare Ground	41.79

PELLET GROUP DATA--
Management unit 16R, Study no: 42

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	19	-
Elk	12	15 (38)
Deer	5	8 (20)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 42

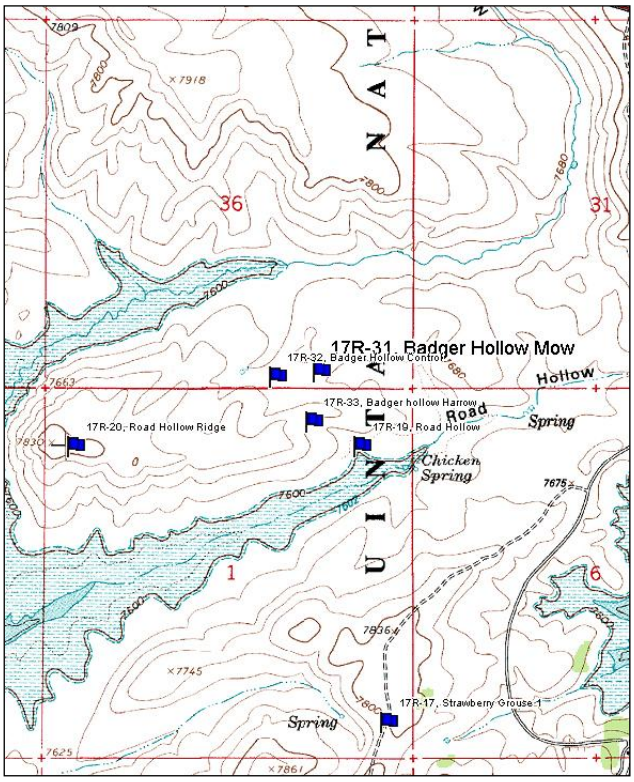
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Juniperus osteosperma									
11	**180**	0	100	-	-	0	0	0	-/-

BADGER HOLLOW MOW - WRI STUDY 17R-31-11
Project #1816

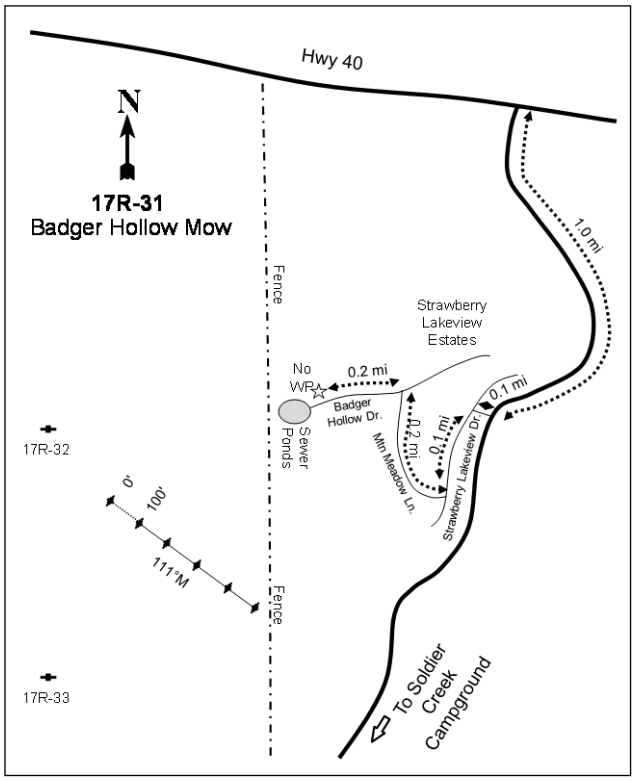
Vegetation Type: Mountain Big Sagebrush
Range Type: Substantial Deer Summer/Fall, Crucial Elk Summer
NRCS Ecological Site Description: Not available
Land Ownership: Forest Service
Elevation: 7,680 ft (2,340 m)
Aspect: Northwest
Slope: 5-10%
Transect bearing: 111° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
No rebar or stakes. Install stake and rebar during next sampling

Directions: From Hwy 40 and the Soldier Creek campground intersection head south towards the Soldier Creek campground. Travel 1 mile to the Strawberry Lakeview Estates and turn right heading west. Drive 0.1 miles to the Strawberry Lakeview Dr. and turn left (south). Go 0.1 miles to Mtn Meadow Ln. on the right side of the road (west). Drive on Mtn Meadow Ln. for 0.2 miles to Badger Hollow Dr. and turn left and head west. Drive 0.2 miles to the Sewer ponds. Park at the sewer ponds and walk about a half mile heading south west.

Map Name: Strawberry Reservoir NE



Diagrammatic Sketch:



Township: 3S Range: 11W Section: 36

GPS: NAD 83, UTM 12S 493929 E 4446517 N

BADGER HOLLOW MOW - WRI STUDY 17R-31
Project #1816

Site Description

Site Information: The study is located approximately one mile northwest of the Soldier Creek Recreation Area near Strawberry reservoir, within a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community, on the Uinta-Wasatch-Cache National Forest. Prior to treatment, the study was established in 2011 to monitor the effects of a two-way chain harrow and brush mower treatment project to decrease the density of mountain big sagebrush. The project consisted of two types of treatments, two-way chain harrow and brush mower. The project area was divided into several small polygons. Each of these polygons was either chain harrowed or brush mowed. The two-way chain harrow polygons were one-way chain harrowed on the outer edge of each polygon. The study site was located within one of the brush mowed polygon treatments. In august of 2011, a total of 438 acres were chain harrowed (384 acres) or brush mowed (60 acres). The project area was not seeded due to the good herbaceous understory. The objectives of the project are to reduce sagebrush canopy cover to 10%-15%, improve brood rearing habitat by increasing cover and abundance of grasses and forbs, and increase aerial cover of perennial grasses to 30% and forb cover to 20% (WRI Database 2012). Deer and elk pellet groups were sampled in low abundance, and 17 sage-grouse pellet groups/acre were sampled in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is mountain big sagebrush, which provides the majority of the browse canopy cover on the site (Table - Canopy Cover). The mountain big sagebrush is a highly dense, moderately used population, with relatively low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was poor prior to the treatment. A small population of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) was sampled on the site (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and diverse on the site. The dominant grass species are prairie junegrass (*Koeleria cristata*), Kentucky bluegrass (*Poa pratensis*), needle-and-thread (*Stipa comata*), and Letterman needlegrass (*Stipa lettermani*). Other common grass species sampled on the site include Sandberg bluegrass (*Poa secunda*), mutton bluegrass (*P. fendleriana*), bottlebrush squirreltail (*Sitanion hystrix*), nodding brome (*Bromus anomalus*), and sedge (*Carex sp.*). Forbs are abundant and moderately diverse on the site. The dominant forb species are Fendler sandwort (*Arenaria fendleri*), sulfur eriogonum (*Eriogonum umbellatum*), silvery lupine (*Lupinus argenteus*), and the annual species yellow owlclover (*Orthocarpus luteus*) (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 17R, Study no: 31

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron dasystachyum	10	.09
G	Bromus anomalus	42	.94
G	Carex sp.	58	.90
G	Dactylis glomerata	1	.00
G	Deschampsia caespitosa	1	.00
G	Festuca ovina	9	.07

Type	Species	Nested Frequency '11	Average Cover % '11
G	Juncus balticus	4	.03
G	Koeleria cristata	198	8.92
G	Poa fendleriana	20	.72
G	Poa pratensis	118	5.40
G	Poa secunda	39	1.94
G	Sitanion hystrix	81	1.79
G	Stipa comata	248	13.85
G	Stipa lettermani	58	4.89
Total for Annual Grasses		0	0
Total for Perennial Grasses		887	39.60
Total for Grasses		887	39.60
F	Achillea millefolium	3	.00
F	Androsace septentrionalis (a)	8	.08
F	Antennaria rosea	1	.00
F	Arabis drummondi	1	.00
F	Arenaria fendleri	251	10.94
F	Draba rectifructa (a)	14	.02
F	Eriogonum umbellatum	144	9.06
F	Lupinus argenteus	295	25.44
F	Machaeranthera canescens	3	.00
F	Mertensia sp.	25	.16
F	Orthocarpus luteus (a)	138	4.58
F	Penstemon procerus	3	.03
F	Polygonum douglasii (a)	4	.01
F	Senecio multilobatus	12	.26
Total for Annual Forbs		164	4.70
Total for Perennial Forbs		738	45.93
Total for Forbs		902	50.63

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

BROWSE TRENDS--
Management unit 17R, Study no: 31

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	92	33.98
B	Chrysothamnus viscidiflorus viscidiflorus	11	1.22
Total for Browse		103	35.20

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 31

Species	Percent Cover '11
Artemisia tridentata vaseyana	40.90
Chrysothamnus viscidiflorus viscidiflorus	1.28

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 31

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.5

BASIC COVER--
Management unit 17R, Study no: 31

Cover Type	Average Cover % '11
Vegetation	81.65
Rock	.03
Pavement	.19
Litter	44.88
Cryptogams	.09
Bare Ground	5.00

PELLET GROUP DATA--
Management unit 17R, Study no: 31

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	8	-
Elk	1	7 (17)
Deer	1	11 (26)
Sage-grouse	-	17 groups/acre

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 31

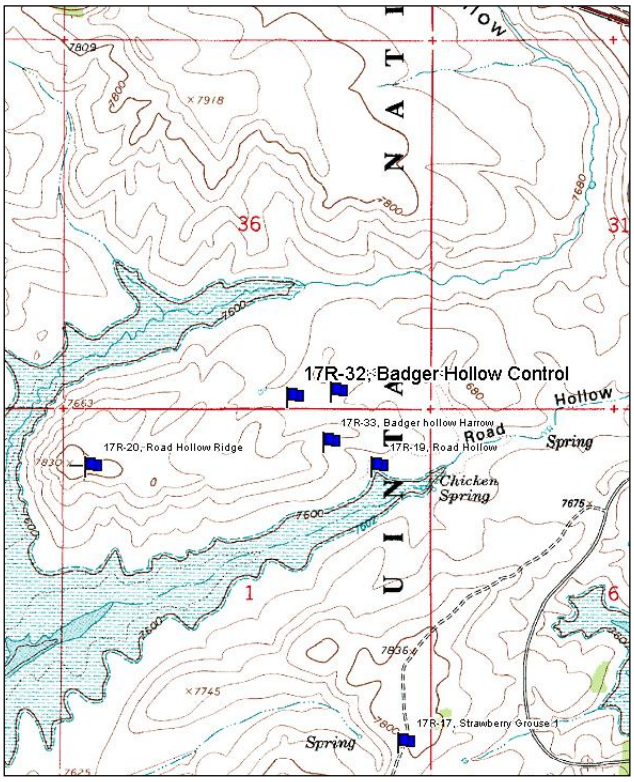
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
11	**4820**	2	89	10	40	41	1	8	24/38
Chrysothamnus viscidiflorus viscidiflorus									
11	**780**	100	0	-	340	0	0	0	8/10

BADGER HOLLOW CONTROL - WRI STUDY 17R-32-11
Project #1816

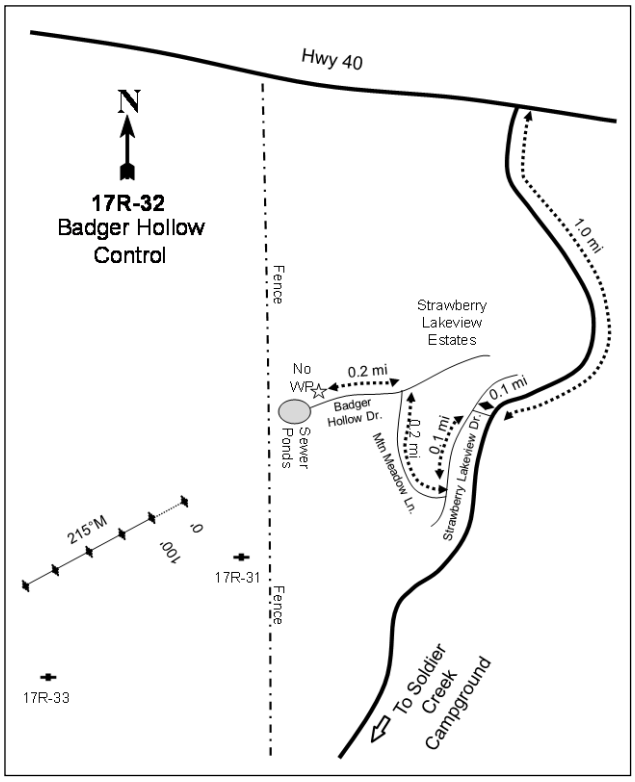
Vegetation Type: Mountain Big Sagebrush
Range Type: Substantial Deer Summer/Fall, Crucial Elk Summer
NRCS Ecological Site Description: Not available
Land Ownership: Forest Service
Elevation: 7,636 ft (2,327 m)
Aspect: East
Slope: 3%
Transect bearing: 215° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
No rebar or stakes. Install stake and rebar during next sampling

Directions: From Hwy 40 and the Soldier Creek campground intersection head south towards the Soldier Creek campground. Travel 1 mile to the Strawberry Lakeview Estates and turn right heading west. Drive 0.1 miles to the Strawberry Lakeview Dr. and turn left (south). Go 0.1 miles to Mtn Meadow Ln. on the right side of the road (west). Drive on Mtn Meadow Ln. for 0.2 miles to Badger Hollow Dr. and turn left and head west. Drive 0.2 miles to the Sewer ponds. Park at the sewer ponds and walk about a half mile heading south west.

Map Name: Strawberry Reservoir NE



Diagrammatic Sketch:



Township: 3S Range: 11W Section: 36

GPS: NAD 83, UTM 12S 493737 E 4446499 N

BADGER HOLLOW CONTROL - WRI STUDY 17R-32
Project #1816

Site Description

Site Information: The study is located approximately one mile northwest of the Soldier Creek Recreation Area near Strawberry reservoir, within a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community, on the Uinta-Wasatch-Cache National Forest. Prior to treatment, the study was established in 2011 to monitor the effects of a two-way chain harrow and brush mower treatment project to decrease the density of mountain big sagebrush. The project consisted of two treatment methodologies, a two-way chain harrow and brush mower. The project area was divided into several small polygons. Each of these polygons was either chain harrowed or brush mowed. The two-way chain harrow polygons were one-way chain harrowed on the outer edge of each polygon. The study site was placed between the polygon treatment areas as a control study and was not treated. In August of 2011, a total of 438 acres were chain harrowed (384 acres) or brush mowed (60 acres). The project area was not seeded due to the good herbaceous understory. The objectives of the project are to reduce sagebrush canopy cover to 10%-15%, improve brood rearing habitat by increasing cover and abundance of grasses and forbs, and increase aerial cover of perennial grasses to 30% and forb cover to 20% (WRI Database 2012). Deer pellet groups were sampled in low abundance and nine sage-grouse pellet groups/acre were sampled in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is mountain big sagebrush, which provides the majority of the browse canopy cover on the site (Table - Canopy Cover). The mountain big sagebrush is a highly dense, lightly used population, with relatively low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was poor prior to the treatment. A small population of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and rubber rabbitbrush (*C. nauseosus*) was sampled on the site (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and diverse on the site. The dominant grass species are prairie junegrass (*Koeleria cristata*), Kentucky bluegrass (*Poa pratensis*), and needle-and-thread (*Stipa comata*). Other common grass species sampled on the site include thickspike wheatgrass (*Agropyron dasystachyum*), bottlebrush squirreltail (*Sitanion hystrix*), nodding brome (*Bromus anomalus*), Letterman needlegrass (*Stipa lettermani*), and sedge (*Carex sp.*). Forbs are abundant and moderately diverse on the site. The dominant forb species are Fendler sandwort (*Arenaria fendleri*), sulfur eriogonum (*Eriogonum umbellatum*), silvery lupine (*Lupinus argenteus*), and the annual species yellow owlclover (*Orthocarpus luteus*) (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 17R, Study no: 32

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron dasystachyum	33	.98
G	Bromus anomalus	4	.21
G	Carex sp.	70	2.14
G	Juncus balticus	5	.16
G	Koeleria cristata	145	6.91
G	Poa fendleriana	3	.38

Type	Species	Nested Frequency '11	Average Cover % '11
G	Poa pratensis	222	18.21
G	Poa secunda	6	.30
G	Sitanion hystrix	62	1.00
G	Stipa comata	192	11.00
G	Stipa lettermani	31	3.09
Total for Annual Grasses		0	0
Total for Perennial Grasses		773	44.41
Total for Grasses		773	44.41
F	Achillea millefolium	13	.22
F	Antennaria rosea	3	.18
F	Arenaria fendleri	86	4.05
F	Aster ascendens	17	.35
F	Eriogonum umbellatum	36	2.02
F	Hackelia patens	6	.06
F	Lupinus argenteus	252	22.42
F	Mertensia sp.	18	.06
F	Orthocarpus luteus (a)	98	2.65
F	Penstemon procerus	1	.03
F	Polygonum douglasii (a)	8	.04
F	Senecio multilobatus	1	.03
Total for Annual Forbs		106	2.69
Total for Perennial Forbs		433	29.44
Total for Forbs		539	32.13

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

BROWSE TRENDS--
Management unit 17R, Study no: 32

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	94	45.28
B	Chrysothamnus nauseosus	1	-
B	Chrysothamnus viscidiflorus viscidiflorus	10	1.14
Total for Browse		105	46.42

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 32

Species	Percent Cover '11
Artemisia tridentata vaseyana	52.53
Chrysothamnus viscidiflorus viscidiflorus	.28

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 32

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.9

BASIC COVER--
Management unit 17R, Study no: 32

Cover Type	Average Cover % '11
Vegetation	84.30
Pavement	.00
Litter	50.29
Bare Ground	2.49

PELLET GROUP DATA--
Management unit 17R, Study no: 32

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	1	-
Elk	1	-
Deer	3	1 (3)
Sage-grouse	-	9 groups/acre

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 32

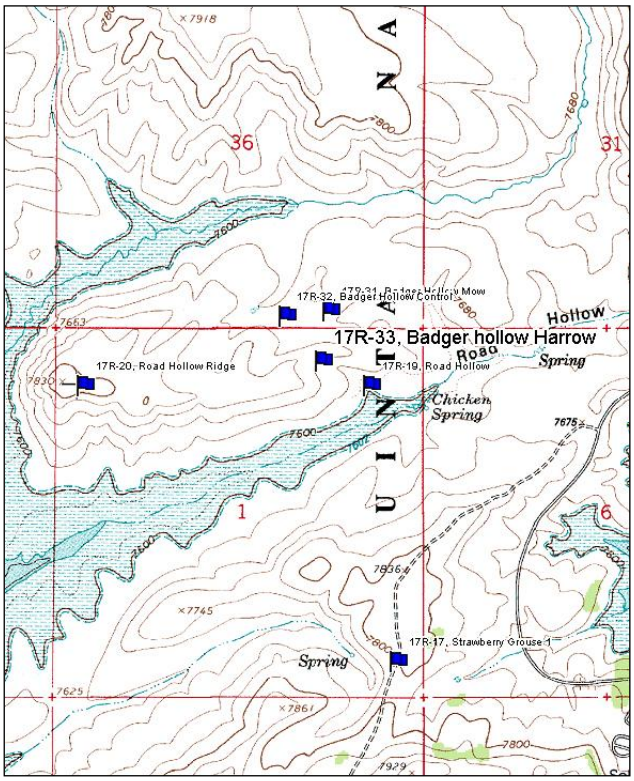
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
11	**5400**	3	93	4	100	4	0	2	27/44
Chrysothamnus nauseosus									
11	**20**	0	100	-	-	0	0	0	17/31
Chrysothamnus viscidiflorus viscidiflorus									
11	**280**	43	50	7	-	0	0	7	12/15

BADGER HOLLOW HARROW - WRI STUDY 17R-33-11
Project #1816

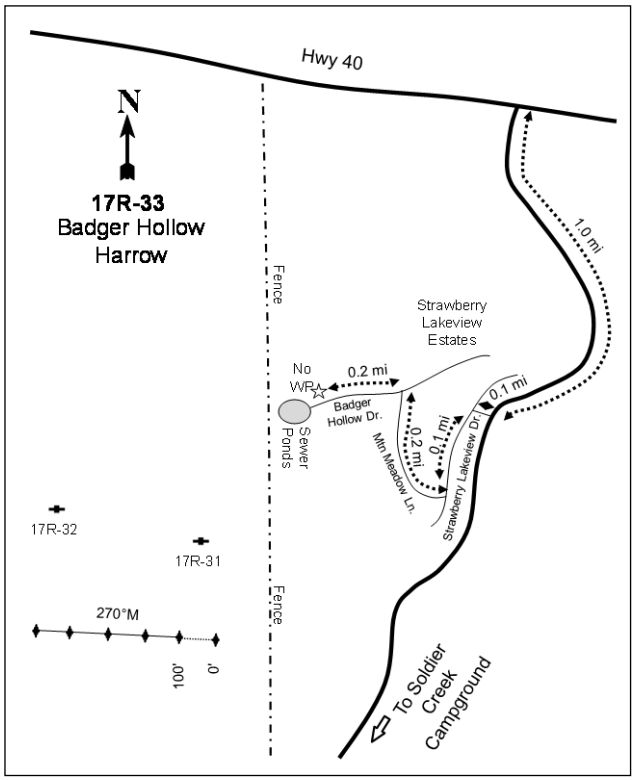
Vegetation Type: Mountain Big Sagebrush
Range Type: Substantial Deer Summer/Fall, Crucial Elk Summer
NRCS Ecological Site Description: Not available
Land Ownership: Forest Service
Elevation: 7,641 ft (2,329 m)
Aspect: East
Slope: 4%
Transect bearing: 270° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
No rebar or stakes. Install stake and rebar during next sampling

Directions: From Hwy 40 and the Soldier Creek campground intersection head south towards the Soldier Creek campground. Travel 1 mile to the Strawberry Lakeview Estates and turn right heading west. Drive 0.1 miles to the Strawberry Lakeview Dr. and turn left (south). Go 0.1 miles to Mtn Meadow Ln. on the right side of the road (west). Drive on Mtn Meadow Ln. for 0.2 miles to Badger Hollow Dr. and turn left and head west. Drive 0.2 miles to the Sewer ponds. Park at the sewer ponds and walk about a half mile heading southwest.

Map Name: Strawberry Reservoir NE



Diagrammatic Sketch:



Township: 4S Range: 11W Section: 1

GPS: NAD 83, UTM 12S 493893 E 4446299 N

BADGER HOLLOW HARROW - WRI STUDY 17R-33
Project #1816

Site Description

Site Information: The study is located approximately one mile northwest of the Soldier Creek Recreation Area near Strawberry reservoir, within a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community, on the Uinta-Wasatch-Cache National Forest. Prior to treatment, the study was established in 2011 to monitor the effects of a two-way chain harrow and brush mower treatment project to decrease the density of mountain big sagebrush. The project consisted of two treatment methodologies, a two-way chain harrow and brush mower. The project area was divided into several small polygons. Each of these polygons was either chain harrowed or brush mowed. The two-way chain harrow polygons were one-way chain harrowed on the outer edge of each polygon. The study site is located within one of the two-way chain harrowed polygon treatments. In august of 2011, a total of 438 acres were chain harrowed (384 acres) or brush mowed (60 acres). The project area was not seeded due to the good herbaceous understory. The objectives of the project are to reduce sagebrush canopy cover to 10%-15%, improve brood rearing habitat by increasing cover and abundance of grasses and forbs, and increase aerial cover of perennial grasses to 30% and forb cover to 20% (WRI Database 2012). Deer and elk pellet groups were sampled in low abundance, and 148 sage-grouse pellet groups/acre were sampled in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is mountain big sagebrush, which provides the majority of the browse canopy cover on the site (Table - Canopy Cover). The mountain big sagebrush is a highly dense, moderately used population, with relatively low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population was poor prior to the treatment. A small population of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and rubber rabbitbrush (*C. nauseosus*) was sampled on the site (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and diverse on the site. The dominant grass species are prairie junegrass (*Koeleria cristata*), Kentucky bluegrass (*Poa pratensis*), needle-and-thread (*Stipa comata*), and Letterman needlegrass (*Stipa lettermani*). Other common grass species sampled on the site include Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), nodding brome (*Bromus anomalus*), and sedge (*Carex sp.*). Forbs are abundant and moderately diverse on the site. The dominant forb species are rose pussytoes (*Antennaria rosea*), sulfur eriogonum (*Eriogonum umbellatum*), silvery lupine (*Lupinus argenteus*), and the annual species yellow owlclover (*Orthocarpus luteus*) (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 17R, Study no: 33

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron dasystachyum	1	.00
G	Bromus anomalus	48	2.40
G	Carex sp.	50	.74
G	Deschampsia caespitosa	1	.03
G	Festuca ovina	15	.09
G	Koeleria cristata	124	8.98
G	Poa fendleriana	5	.41

Type	Species	Nested Frequency '11	Average Cover % '11
G	Poa pratensis	234	13.71
G	Poa secunda	13	.84
G	Sitanion hystrix	45	.91
G	Stipa comata	151	7.68
G	Stipa lettermani	84	6.35
Total for Annual Grasses		0	0
Total for Perennial Grasses		771	42.18
Total for Grasses		771	42.18
F	Achillea millefolium	10	.56
F	Androsace septentrionalis (a)	12	.07
F	Antennaria rosea	10	1.62
F	Arabis drummondi	1	.00
F	Arenaria fendleri	15	.63
F	Aster ascendens	6	.04
F	Collinsia parviflora (a)	3	.03
F	Draba rectifructa (a)	19	.32
F	Eriogonum umbellatum	48	3.82
F	Gayophytum ramosissimum(a)	5	.03
F	Hackelia patens	1	.03
F	Hydrophyllum capitatum	10	.24
F	Lappula occidentalis (a)	5	.00
F	Lupinus argenteus	276	22.75
F	Melilotus officinalis	1	.15
F	Mertensia sp.	1	.00
F	Orthocarpus luteus (a)	77	2.13
F	Phacelia hastata	6	.18
F	Polygonum douglasii (a)	26	.11
F	Taraxacum officinale	2	.00
Total for Annual Forbs		147	2.70
Total for Perennial Forbs		387	30.06
Total for Forbs		534	32.76

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

BROWSE TRENDS--
Management unit 17R, Study no: 33

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	98	41.97
B	Chrysothamnus viscidiflorus viscidiflorus	4	.45
Total for Browse		102	42.43

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 33

Species	Percent Cover '11
Artemisia tridentata vaseyana	56.28
Chrysothamnus viscidiflorus viscidiflorus	.43

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 33

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.6

BASIC COVER--
Management unit 17R, Study no: 33

Cover Type	Average Cover % '11
Vegetation	83.75
Rock	.04
Litter	49.76
Cryptogams	.06
Bare Ground	4.15

PELLET GROUP DATA--
Management unit 17R, Study no: 33

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	5	-
Elk	1	2 (5)
Deer	3	4 (10)
Sage-grouse	-	148 groups/acre

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 33

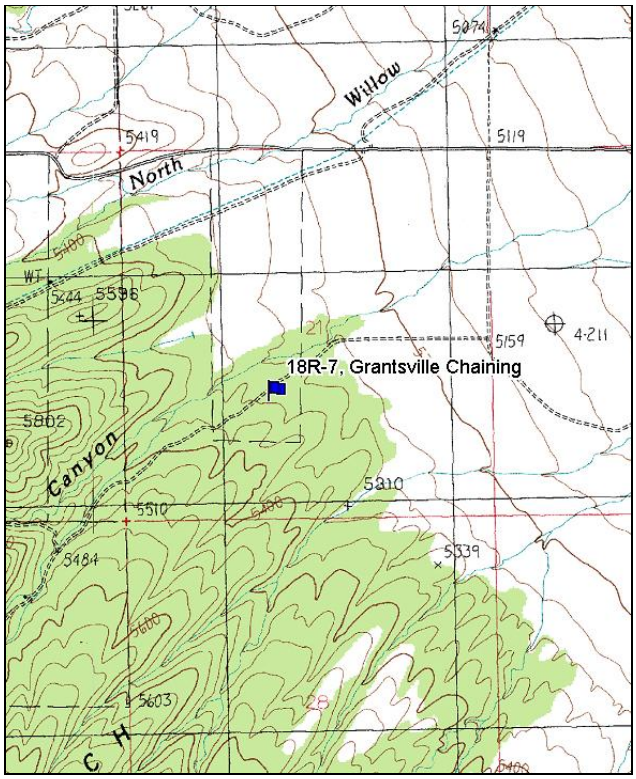
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
11	**6160**	0	91	9	100	1	0	4	25/40
Chrysothamnus nauseosus									
11	**0**	0	0	-	-	0	0	0	20/25
Chrysothamnus viscidiflorus viscidiflorus									
11	**160**	63	38	-	-	0	0	0	11/14

GRANTSVILLE CHAINING - WRI STUDY 18R-7-11
Project #1117

Vegetation Type: Pinyon and 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 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (11ft)
Belt 4 was moved to the 11ft mark on line 4 due to large gully that cut 10ft deep at the end of line 4 following chaining

Directions: From Center Street in Grantsville, drive west and turn south on Cooley Street. Follow this road until 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



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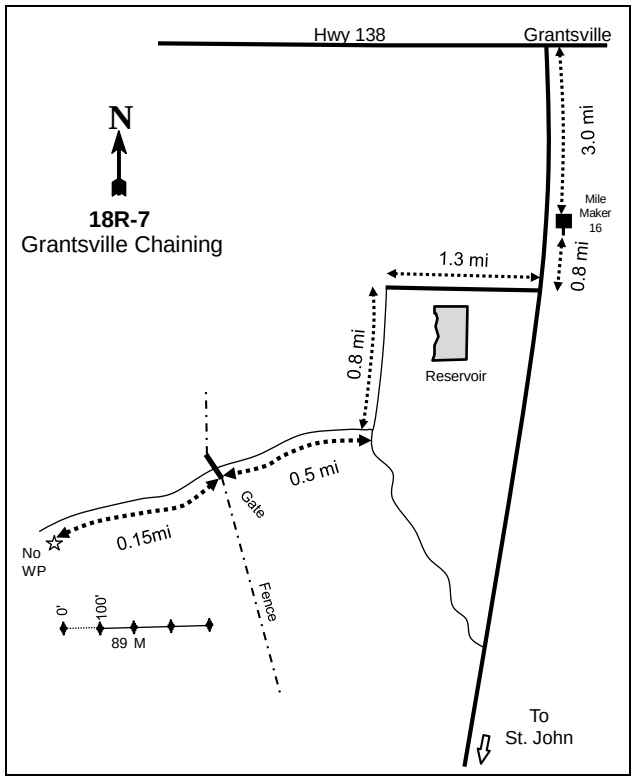


Township: 3S Range: 6W Section: 21

GPS: NAD 83, UTM 12S 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, within a Utah juniper (*Juniperus osteosperma*) woodland, near the mouth of Coal Pit Canyon. Prior to treatment, the study was established in 2008 to monitor the effects of a two-way chaining project designed to remove pinyon pine (*Pinus edulis*) and Utah 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 and juniper has decreased the mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) canopy and herbaceous understory components. 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 mountain big sagebrush (WRI Database 2012). Sheep and cattle pellet groups were sampled in low abundance in 2008; and pellet groups were sampled in low abundance for deer and cattle in 2011 (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 has provided minimal cover on the site since the outset of the study (Table - Canopy Cover). The mountain big sagebrush is a relatively small population, with low decadence and good vigor within the population, though decadence and poor vigor were high within the population prior to treatment. 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 and provided nearly all the canopy cover on the site in 2008. Following the treatment, density (Table - Point Quarter Tree Data) and cover of juniper decreased on the site, though many of the trees sampled had been chained, but were still alive (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment and is now considered to be within Phase I, but due to the high density and survival of young and mature trees, it is likely the site will transition into Phase II quickly (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and diverse on the site. The dominant perennial grass species sampled on the site are Sandberg bluegrass (*Poa secunda*), crested wheatgrass (*Agropyron cristatum*), and bluebunch wheatgrass (*A. spicatum*). Seeded grass species sampled on the site include crested wheatgrass, pubescent wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass, orchardgrass (*Dactylis glomerata*), and Snake River wheatgrass (*Elymus wawawaiensis*). Other perennial 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 on the site prior to treatment, but has become more common the site following the treatment. Forbs are moderately abundant and fairly diverse on the site, though prior to treatment perennial forbs were rare. Seeded forb species sampled on the site include western yarrow (*Achillea millefolium*), blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*). The weedy annual forb species bur buttercup (*Ranunculus testiculatus*) has been fairly common the site since the outset of the study (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Kapod component, which is found on fan remnants. The parent material consists of alluvium derived from limestone and sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a moderately high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008, but stable in 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: The density of Utah juniper decreased from 547 trees/acre with an average diameter of 8.4 inches to 305 trees/acre with an average diameter of 3.9 inches. The majority of the trees sampled following the treatment were trees which were chained over, or young trees that were not affected by the chaining treatment. The canopy cover of juniper decreased substantially from 31% to 8%. Palatable browse species remained rare on the site following the treatment. Mountain big sagebrush remained similar in density at 60 plant/acre, though decadence and plants displaying poor vigor decreased on the site. Prior to the treatment, the majority of the plants sampled on the site were dead (740 plants/acre).

Grasses: The sum of nested frequency of perennial grasses increased more than two-fold, and cover increased from 3% to 13%. The increase in cover and density can be attributed to seeded grass species crested wheatgrass, western wheatgrass, and bluebunch wheatgrass, which provided 6%, 1%, and 2% cover, respectively. Sandberg bluegrass decreased significantly in nested frequency, though cover increased slightly from 3% to 4%. The weedy annual grass species cheatgrass increased significantly in nested frequency and cover increased from less than 1% to 3%.

Forbs: The sum of nested frequency of perennial forbs increased more than ten-fold, and cover increased from less than 1% to 7%. The seeded species blue flax and small burnet provided 1% and 2% cover, respectively. The palatable annual forb species prickly lettuce (*Lactuca serriola*) was sampled on the site for the first time following the treatment at 2% cover. The weedy annual forb species bur buttercup (*Ranunculus testiculatus*) decreased significantly in nested frequency, though cover increased from 1% to 3% cover.

HERBACEOUS TRENDS--
Management unit 18R, Study no: 7

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a-	b198	-	5.96
G	Agropyron intermedium	-	8	-	.20
G	Agropyron smithii	a-	b59	-	.63
G	Agropyron spicatum	a-	b95	-	2.13
G	Bromus tectorum (a)	a45	b220	.27	2.46
G	Dactylis glomerata	a-	b19	-	.42
G	Elymus wawawaiensis	a-	b8	-	.13
G	Oryzopsis hymenoides	2	-	.04	-
G	Poa secunda	b255	a179	3.19	3.80
G	Sitanion hystrix	14	4	.10	.08
G	Stipa comata	1	-	.00	-
G	Vulpia octoflora (a)	-	3	-	.00
Total for Annual Grasses		45	223	0.27	2.46
Total for Perennial Grasses		272	570	3.34	13.39
Total for Grasses		317	793	3.61	15.86
F	Achillea millefolium	-	9	-	.05
F	Allium sp.	a2	b54	.00	.21
F	Alyssum alyssoides (a)	-	1	-	.00
F	Antennaria rosea	a4	b25	.01	.62
F	Astragalus sp.	a1	b36	.00	1.59
F	Calochortus nuttallii	a-	b30	-	.07
F	Crepis acuminata	2	8	.03	.19
F	Cryptantha sp.	4	8	.01	.15
F	Descurainia pinnata (a)	a2	b32	.00	.54
F	Epilobium brachycarpum (a)	a-	b32	-	.11
F	Lactuca serriola (a)	a-	b164	-	2.02
F	Lappula occidentalis (a)	6	1	.01	.00
F	Linum perenne	a-	b95	-	1.28
F	Machaeranthera grindelioides	-	10	-	.02
F	Medicago sativa	-	14	-	.25
F	Microsteris gracilis (a)	1	9	.00	.02
F	Onobrychis viciaefolia	-	11	-	.22
F	Phlox longifolia	24	22	.05	.07
F	Ranunculus testiculatus (a)	b269	a190	.86	2.65
F	Sanguisorba minor	a-	b66	-	2.24
F	Sphaeralcea coccinea	-	2	-	.03
Total for Annual Forbs		278	429	0.89	5.37
Total for Perennial Forbs		37	390	0.11	7.02
Total for Forbs		315	819	1.00	12.39

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	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia tridentata vaseyana	3	3	-	.00
B	Gutierrezia sarothrae	1	0	-	-
B	Juniperus osteosperma	18	9	16.98	4.66
B	Opuntia sp.	0	2	-	.03
Total for Browse		22	14	16.98	4.70

CANOPY COVER, LINE INTERCEPT--
Management unit 18R, Study no: 7

Species	Percent Cover '08	Percent Cover '11
Artemisia tridentata vaseyana	.15	-
Gutierrezia sarothrae	.10	-
Juniperus osteosperma	31.25	8.38

POINT-QUARTER TREE DATA--
Management unit 18R, Study no: 7

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	547	305	8.4	3.9

BASIC COVER--
Management unit 18R, Study no: 7

Cover Type	Average Cover % '08	Average Cover % '11
Vegetation	23.39	34.90
Rock	1.87	.64
Pavement	21.56	5.43
Litter	42.62	38.83
Cryptogams	1.49	.63
Bare Ground	29.63	14.88

SOIL ANALYSIS DATA --
Management unit 18R, Study no: 7, Study Name: Grantsville Chaining

pH	clay loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.9	36.0	32.4	31.6	2.3	1.9	249.6	0.8

PELLET GROUP DATA--
Management unit 18R, Study no: 7

Type	Quadrat Frequency '08	'11	Days use per acre (ha) '08	'11
Rabbit	79	12	-	-
Sheep	-	-	1 (3)	-
Elk	1	-	-	4 (10)
Deer	2	2	-	1 (3)
Cattle	-	-	1 (2)	-

BROWSE CHARACTERISTICS--
Management unit 18R, Study no: 7

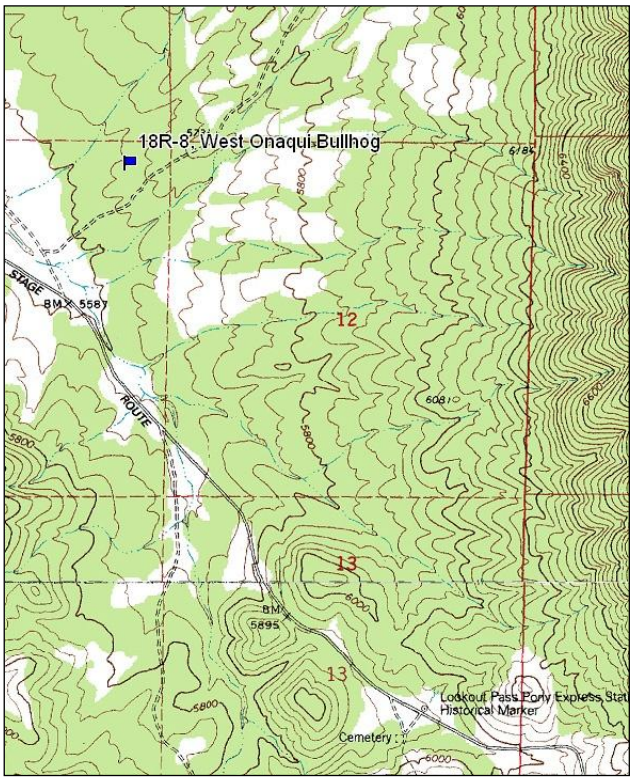
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
08	**80**	0	0	100	-	0	0	25	10/18
11	**60**	33	67	0	-	0	0	0	13/14
Gutierrezia sarothrae									
08	**20**	0	100	-	-	0	0	0	5/4
11	**0**	0	0	-	-	0	0	0	-/-
Juniperus osteosperma									
08	**400**	20	80	0	40	0	0	5	-/-
11	**200**	30	50	20	40	0	0	20	5/7
Opuntia sp.									
08	**0**	0	0	-	-	0	0	0	6/12
11	**40**	0	100	-	-	0	0	0	6/9

WEST ONAQUI BULLHOG - TREND STUDY NO. 18R-8-11
Project #1133

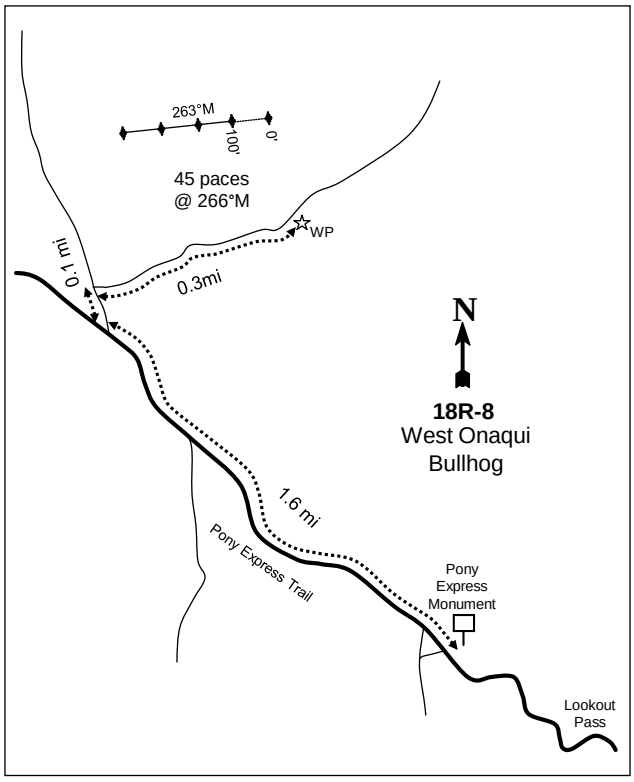
Vegetation Type: Pinyon and Juniper
Range Type: Crucial Deer Winter/Spring
NRCS Ecological Site Description: Not available
Land Ownership: BLM
Elevation: 5,659 ft. (1,725 m)
Aspect: Northwest
Slope: 7%
Transect bearing: 263° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), 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, walk 45 paces at 266°M to the 0` stake.

Map Name: Onaqui Mountains South



Diagrammatic Sketch:



Township: 8S Range: 7W Section: 11

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. The area is administrated by the Bureau of Land Management (BLM) as part of the Pony Express Trail allotment. Prior to treatment, the study was established in 2008 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 trees. 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 2012). Wildlife and livestock pellet groups were nearly absent in 2008 along the pellet group transects; however, quadrat frequency was high for rabbits. In 2011, deer/pronghorn and sheep pellet groups were sampled in low abundance (Table - Pellet Group Data).

Browse: The preferred browse species is black sagebrush (*Artemisia nova*). The black sagebrush is a sparse, 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 in 2008 (Table - Browse Characteristics). Utah juniper was the dominant browse species prior to the treatment in 2008 with a very high estimated density (Table - Point-Quarter Data) and provided nearly all of the canopy cover on the study site(Table - Canopy Cover). Following the treatment, juniper density (Table - Point-Quarter Data) and cover decreased substantially (Table - Canopy Cover). Nearly all the juniper trees sampled in 2011 were treated, but still had vegetative regrowth from the trunk of tree. The stage of woodland succession was in Phase III prior to treatment and is now considered to be within Phase I, but due to the high density and survival of young trees, it is likely the site will transition into Phase II quickly (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and fairly diverse on the site. The dominant grass species on the site is Sandberg bluegrass (*Poa secunda*), which has provided the majority of the cover over the sample years. Other perennial grass species sampled on the site include western wheatgrass (*Agropyron smithii*), bluebunch wheatgrass (*A. spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), the weedy species bulbous bluegrass (*Poa bulbosa*), and bottlebrush squirreltail (*Sitanion hystrix*). The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in low abundance and has provided little cover on the site since the outset of the study. Forbs are abundant and diverse on the site, though annual forbs have provided the majority of the forb cover over the sampled years. Following the treatment, perennial forbs increased in abundance and diversity. American vetch (*Vicia americana*) has been the dominant perennial forb species and has provided nearly all the perennial forb cover on the site since the outset of the study. The weedy annual forb species bur buttercup (*Ranunculus testiculatus*) and pale alyssum (*Alyssum alyssoides*) are the dominant annual forb species on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Borvant component, which is found on fan remnants. The parent material consists of alluvium derived from limestone. The soils within this classification are characterized as shallow and well drained with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of litter and moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008, but stable in 2011.

Pre vs. Two Years Post Treatment, 2008 vs. 2011

Browse: Palatable browse species remained rare on the site. The density of black sagebrush decreased 71% from 340 plants/acre to 100 plants/acre. Prior to the treatment, the majority of black sagebrush plants sampled were dead at a density of 1,500 plants/acre. The remaining live plants also had a high amount of decadence at 82% of the population, and 82% of the plants displayed poor vigor within the populations. Following the treatment, decadence and plants displaying poor vigor decreased to 20%, respectively. The density of Utah juniper substantially decreased from 1, 426 trees/acre with an average trunk diameter of 4.3 inches to 387 trees/acre with an average trunk diameter of 2.4 inches, and canopy cover decreased from 31% to 1%.

Grasses: The sum of nested frequency of perennial grasses increased 15%, and cover increased from 3% to 14%. Sandberg bluegrass remained similar in nested frequency, though cover increased from 2% to 11%. The annual grass species cheatgrass increased significantly in nested frequency, but cover remained minimal.

Forbs: The sum of nested frequency of perennial forbs increased nearly three-fold, and cover increased from less than 1% to 6% cover. Most of the change in nested frequency and cover for perennial forbs can be attributed to American vetch, which increased significantly in nested frequency, and cover increased from less than 1% to 5%. The sum of nested frequency of annual forbs increased substantially, and cover increased from 1% to 9%. The weedy annual species bur buttercup and pale alyssum increased in cover from 1% to 4% and less than 1% to 3%, respectively.

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

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron smithii	a5	b26	.04	.04
G	Agropyron spicatum	a14	b32	.23	1.22
G	Bromus tectorum (a)	a6	b109	.02	.51
G	Oryzopsis hymenoides	-	3	-	.00
G	Poa bulbosa	-	6	-	.16
G	Poa secunda	229	219	2.44	10.72
G	Sitanion hystrix	36	40	.49	1.97
Total for Annual Grasses		6	109	0.01	0.51
Total for Perennial Grasses		284	326	3.20	14.14
Total for Grasses		290	435	3.22	14.65
F	Alyssum alyssoides (a)	a89	b189	.18	2.79
F	Antennaria rosea	a4	b22	.06	.25
F	Calochortus nuttallii	-	8	-	.04
F	Chaenactis douglasii	1	-	.00	-
F	Collinsia parviflora (a)	4	-	.00	-
F	Cryptantha sp.	-	2	-	.04
F	Descurainia pinnata (a)	a-	b24	-	.14
F	Gilia sp. (a)	-	3	-	.00
F	Helianthus annuus (a)	-	10	-	.01
F	Lactuca serriola (a)	a-	b179	-	1.38
F	Phlox austromontana	5	-	.07	-
F	Phlox hoodii	-	7	-	.16
F	Phlox longifolia	-	6	-	.07
F	Ranunculus testiculatus (a)	b272	b210	.48	4.44

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Sisymbrium altissimum (a)	$_{a}$-	$_{b}$27	-	.58
F	Taraxacum officinale	-	3	-	.03
F	Vicia americana	$_{a}$42	$_{b}$98	.29	5.11
F	Zigadenus paniculatus	$_{a}$1	$_{b}$6	.00	.02
Total for Annual Forbs		365	642	0.66	9.39
Total for Perennial Forbs		53	152	0.43	5.73
Total for Forbs		418	794	1.10	15.12

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

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

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia nova	12	5	.28	.18
B	Juniperus osteosperma	40	14	11.39	1.44
Total for Browse		52	19	11.67	1.62

CANOPY COVER, LINE INTERCEPT--
Management unit 18R, Study no: 8

Species	Percent Cover '08	'11
Juniperus osteosperma	31.03	1.08

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 18R, Study no: 8

Species	Average leader growth (in) '08	'11
Artemisia nova	1.1	2.8

POINT-QUARTER TREE DATA--
Management unit 18R, Study no: 8

Species	Trees per Acre '08	'11	Average diameter (in) '08	'11
Juniperus osteosperma	1426	387	4.3	2.4

BASIC COVER--
Management unit 18R, Study no: 8

Cover Type	Average Cover % '08	'11
Vegetation	17.59	29.33
Rock	1.95	.85
Pavement	22.40	3.60
Litter	41.47	52.58
Cryptogams	20.73	1.84
Bare Ground	14.44	10.31

SOIL ANALYSIS DATA --
Management unit 18R, Study no: 8, Study Name: West Onaqui Bullhog

pH	clay loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.8	30.0	35.4	34.6	2.5	1.9	192.0	0.7

PELLET GROUP DATA--
Management unit 18R, Study no: 8

Type	Quadrat Frequency '08	'11	Days use per acre (ha) '08	'11
Rabbit	84	6	-	-
Deer/Pronghorn	4	4	-	5 (13)
Sheep	-	-	-	1 (3)

BROWSE CHARACTERISTICS--
Management unit 18R, Study no: 8

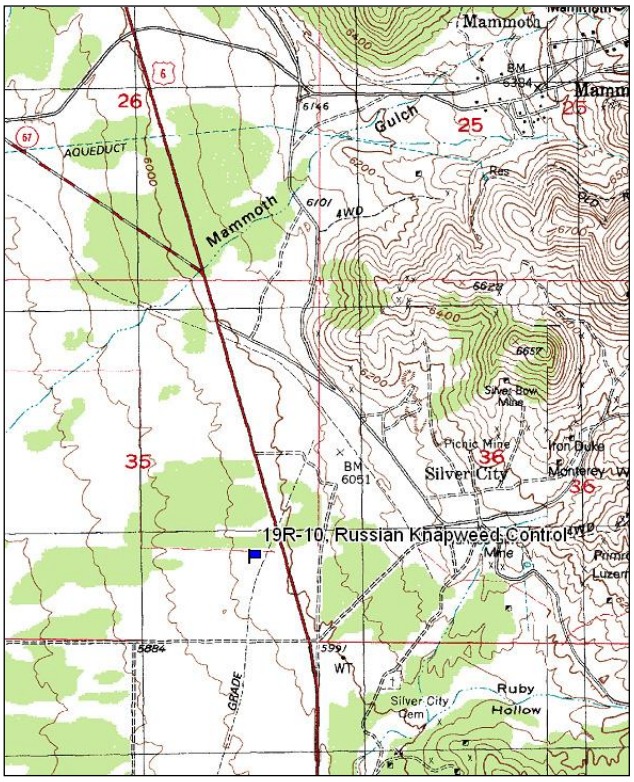
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
08	**340**	6	12	82	-	0	53	82	9/16
11	**100**	20	60	20	40	0	0	20	10/15
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	4/10
Gutierrezia sarothrae									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	8/9
Juniperus osteosperma									
08	**1000**	42	48	10	100	2	2	4	-/-
11	**320**	81	13	6	60	0	0	6	-/-

RUSSIAN KNAPWEED CONTROL - TREND STUDY NO. 19R-10-11
Project #1102

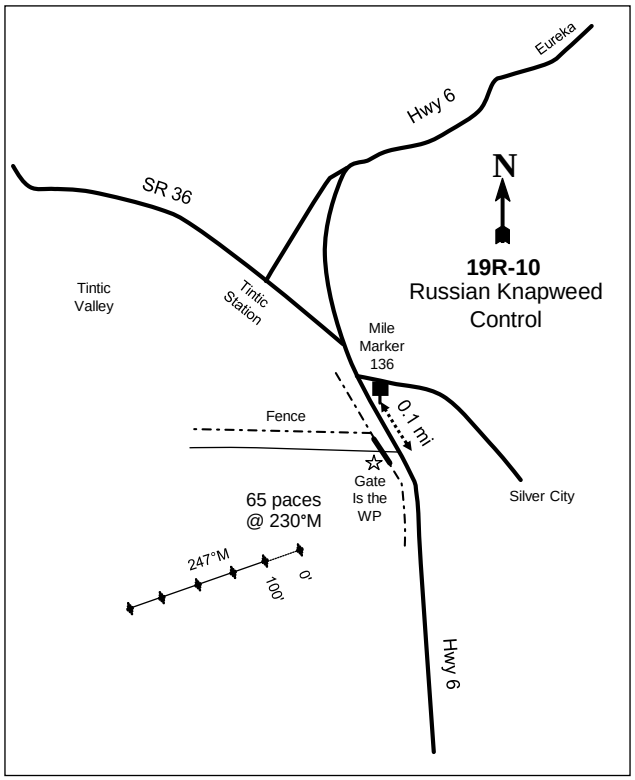
Vegetation Type: Perennial Grass
Range Type: Deer Winter/Spring
NRCS Ecological Site Description: Upland Loam (Mountain Big Sagebrush), R028AY310UT
Land Ownership: Private
Elevation: 5,900 ft. (1,798 m)
Aspect: West
Slope: 4%
Transect bearing: 247° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:
From Eureka, follow Hwy 6 to 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



Diagrammatic Sketch:



Township: 10S Range: 3W Section: 35

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. Prior to treatment, the study was established in 2008 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 of 310 acres were unsuccessful and only a portion of the project area was treated. As a result, the project area was decreased to the 55 acre portion that was 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 2012). Wildlife and livestock pellet groups have been nearly absent since 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 has been poor since the outset of the study. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*) and stickyleaf low rabbitbrush (*C. viscidiflorus*), though each of these species occurred in low abundance (Table - Browse Characteristics).

Herbaceous Understory: Grasses are moderately abundant and somewhat diverse following the treatment. The dominant perennial grass species on the site are intermediate wheatgrass (*Agropyron intermedium*) and smooth brome (*Bromus inermis*). Perennial grass species were not very abundant prior to the treatment in 2008. Seeded species sampled on the site include crested wheatgrass (*Agropyron cristatum*), pubescent wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), and Sandberg bluegrass (*Poa secunda*), though crested wheatgrass was present on the site prior to treatment. Bottlebrush

squirreltail (*Sitanion hystrix*) was also sampled on the site in low abundance. The invasive annual grass species cheatgrass (*Bromus tectorum*) has been a major component of the grass composition over the sample years. Forbs are not abundant or diverse, and are in poor condition. Two noxious weed forb species, hoary cress (*Cardaria draba*) and Russian knapweed, have been sampled on the study site since the outset of the study. Russian knapweed provided the majority of the forb cover prior to treatment and was rare following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Doyce component, which is found on alluvial fans. The parent material consists of alluvium derived from quartzite and/or alluvium derived from limestone and sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: The density of Wyoming big sagebrush increased 36% from 220 plants/acre to 300 plants/acre, and canopy cover increased from 1% to 2%. The health of the sagebrush population remained in good condition, with low decadence and good vigor within the population. The recruitment of young sagebrush plants remained poor. Stickyleaf low rabbitbrush increased in cover from 1% to 2%, and rubber rabbitbrush provided minimal cover on the site.

Grasses: The sum of nested frequency of perennial grasses increased more than six-fold, and cover increased from 2% to 23%. The dominant perennial grass species intermediate wheatgrass and smooth brome increased in cover from 1% to 12% and 1% to 10%, respectively. The weedy annual grass species cheatgrass increased in cover from 7% to 13%.

Forbs: Forbs remained rare on the site. The noxious weeds, Russian knapweed and hoary cress, both decreased in abundance on the site following the treatment. Russian knapweed decreased significantly in nested frequency, and cover decreased from 3% to less than 1% cover. Hoary cress provided little to no cover in either sample year.

HERBACEOUS TRENDS--
Management unit 19R, Study no: 10

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a4	b19	.06	.90
G	Agropyron intermedium	a19	b174	1.11	12.22
G	Agropyron smithii	-	-	-	.03
G	Agropyron spicatum	-	1	-	.15
G	Bromus inermis	a37	b174	.66	9.63
G	Bromus tectorum (a)	a203	b372	7.07	12.99
G	Poa secunda	-	6	-	.39
G	Sitanion hystrix	1	-	.00	-
Total for Annual Grasses		203	372	7.07	12.99
Total for Perennial Grasses		61	374	1.84	23.32
Total for Grasses		264	746	8.91	36.32
F	Alyssum desertorum (a)	68	39	.79	.30

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Calochortus nuttallii	1	-	.03	-
F	Cardaria draba	7	2	.18	.00
F	Centaurea repens	$_{b}$16	$_{a}$3	2.59	.03
F	Lactuca serriola (a)	$_{a}$-	$_{b}$36	-	.63
F	Ranunculus testiculatus (a)	$_{a}$38	$_{b}$68	.11	.31
F	Tragopogon dubius (a)	-	1	-	.03
Total for Annual Forbs		106	144	0.90	1.28
Total for Perennial Forbs		24	5	2.80	0.03
Total for Forbs		130	149	3.70	1.31

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

BROWSE TRENDS--
Management unit 19R, Study no: 10

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia tridentata wyomingensis	10	11	.63	.92
B	Chrysothamnus nauseosus	2	2	.00	.15
B	Chrysothamnus viscidiflorus	20	17	1.11	2.30
Total for Browse		32	30	1.75	3.37

CANOPY COVER, LINE INTERCEPT--
Management unit 19R, Study no: 10

Species	Percent Cover '08	'11
Artemisia tridentata wyomingensis	1.33	1.70
Chrysothamnus nauseosus	-	.48
Chrysothamnus viscidiflorus	.46	1.91

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 19R, Study no: 10

Species	Average leader growth (in) '08	'11
Artemisia tridentata wyomingensis	1.8	4.1

BASIC COVER--
Management unit 19R, Study no: 10

Cover Type	Average Cover % '08	'11
Vegetation	14.25	38.85
Rock	.01	.03
Pavement	.14	.04
Litter	60.72	46.56
Cryptogams	.04	0
Bare Ground	36.51	26.81

SOIL ANALYSIS DATA --
Management unit 19R, Study no: 10, Study Name: Russian Knapweed Control

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	'11	Days use per acre (ha) '08	'11
Rabbit	40	1	-	-
Horse	1	-	-	-
Elk	1	-	-	-
Deer	1	1	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 19R, Study no: 10

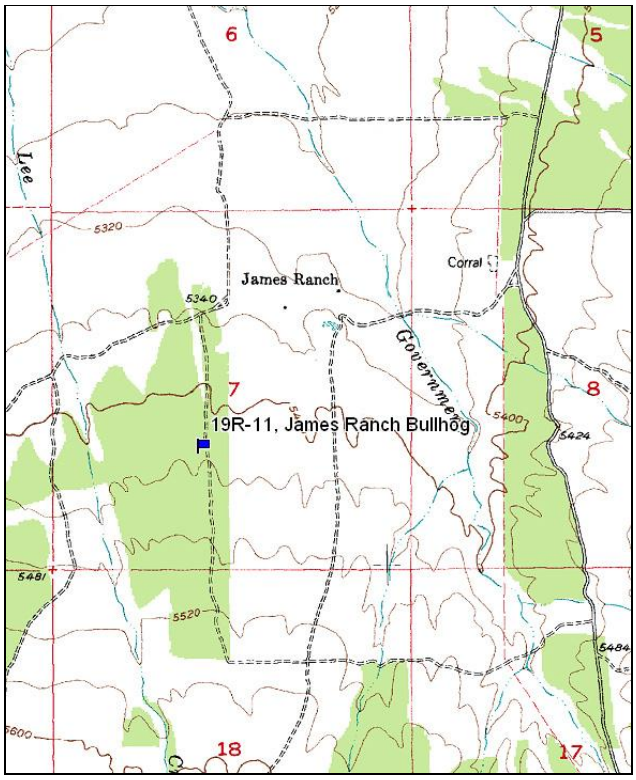
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
08	**220**	9	82	9	-	18	0	9	22/32
11	**300**	0	100	0	-	0	0	0	27/45
Chrysothamnus nauseosus									
08	**40**	0	50	50	-	0	100	50	19/23
11	**40**	0	100	0	-	0	0	0	29/40
Chrysothamnus viscidiflorus									
08	**720**	0	92	8	-	19	0	6	14/21
11	**560**	0	100	0	-	0	0	0	21/35

JAMES RANCH BULLHOG - TREND STUDY NO. 19R-11-11
Project #1131

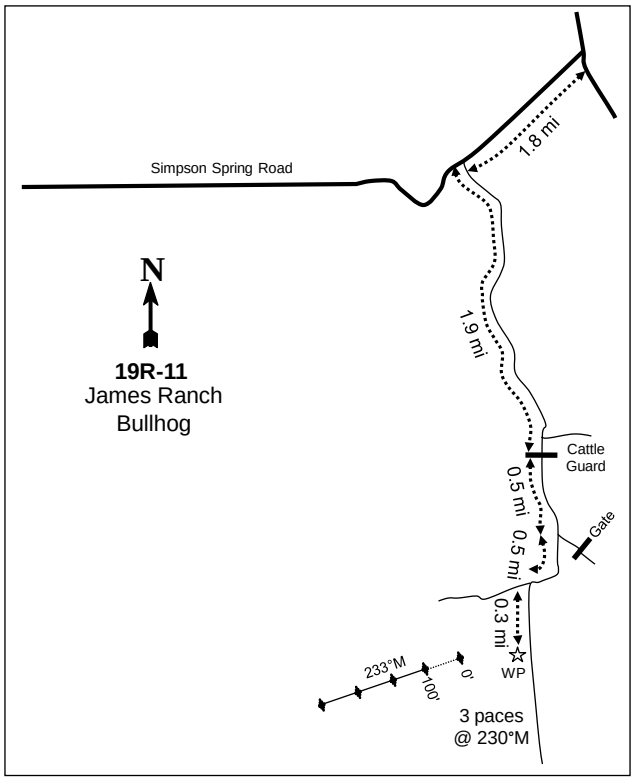
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter/Spring
NRCS Ecological Site Description: Not available
Land Ownership: BLM
Elevation: 5,456 ft. (1,663 m)
Aspect: North
Slope: 3%
Transect bearing: 233° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), 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



Diagrammatic Sketch:



Township: 9S Range: 7W Section: 7

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. The area is administrated by the Bureau Land Management (BLM) as part of the Government Creek allotment. Prior to the treatment, the study was established in 2008 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 2012). Cattle and deer pellet groups were sampled in low abundance in 2008 and 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site is Wyoming big sagebrush. The Wyoming big sagebrush is a sparse population, with moderate decadence and a moderate amount of plants displaying poor vigor within the population. Utilization of sagebrush plants has been mostly light, though in 2008 use was more moderate. In 2008, a large portion of the sagebrush plants sampled were dead, and the recruitment of young sagebrush plants to the population was poor, but following the treatment recruitment of young sagebrush plants was good. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*) and prickly phlox (*Leptodactylon pungens*) (Table - Browse Characteristics). Prior to the bullhog treatment, Utah juniper was the dominant browse species and provided the majority of the canopy cover, but following the treatment has become fairly rare on the site (Table - Canopy Cover). The stage of woodland succession was in Phase II prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are fairly abundant, but are not particularly diverse on the site. The dominant grass species sampled on the site is Sandberg bluegrass (*Poa secunda*), which has provided the majority of the grass cover since the outset of the study. 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 on the site and has increased in abundance following the treatment. Forbs are not abundant, but are moderately diverse. Perennial forbs are rare on the site. The most common forb species is the weedy annual forb species bur buttercup (*Ranunculus testiculatus*), which has provided the majority of the forb cover on the site since the outset of the study (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Abela component, which is found on fan remnants. The parent material consists of alluvium derived from limestone and/or alluvium derived from quartzite. The soils within this classification are characterized as deep, well drained, and with a highly permeable restrictive layer (Soil Survey Staff 2011). 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 on the site, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008, but stable in 2011.

Pre vs. Two Years Post Treatment, 2008 vs. 2011

Browse: The density of Wyoming big sagebrush increased two-fold from 860 plants/acre to 1,720 plants/acre, and canopy cover increased from 4% to 6%. The health of the sagebrush improved with decadence decreasing from 74% to 19% of the population, and plants displaying poor vigor decreasing from 63% to 17%. The

recruitment of young sagebrush plants to the population improved from 7% to 45% of the population. The density of Utah juniper decreased from 107 trees/acre with an average trunk diameter of 10.9 inches to 26 trees/acre with an average trunk diameter of 1.4 inches. Also, juniper canopy cover decreased from 24% to near 0%.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover increased from 9% to 16%. Sandberg bluegrass remained similar in nested frequency, but cover increased from 5% to 11%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 2%.

Forbs: Perennial forbs remained rare on the site and provided minimal cover. The sum of nested frequency of annual forbs increased 33%, and cover increased from 1% to 5%. The weedy annual forb species bur buttercup remained similar in nested frequency, but cover increased from less than 1% cover to 4%.

HERBACEOUS TRENDS--
Management unit 19R, Study no: 11

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron spicatum	18	28	.64	.48
G	Bromus tectorum (a)	$_{a}$58	$_{b}$143	.28	1.68
G	Oryzopsis hymenoides	11	4	.37	.15
G	Poa secunda	248	227	5.33	11.19
G	Sitanion hystrix	$_{a}$68	$_{b}$106	2.15	3.80
Total for Annual Grasses		58	143	0.28	1.68
Total for Perennial Grasses		345	365	8.50	15.63
Total for Grasses		403	508	8.78	17.31
F	Alyssum desertorum (a)	$_{a}$33	$_{b}$106	.15	.48
F	Antennaria rosea	6	4	.01	.04
F	Astragalus sp.	1	1	.00	.00
F	Calochortus nuttallii	3	6	.00	.01
F	Cirsium sp.	-	1	-	.15
F	Descurainia pinnata (a)	1	1	.00	.00
F	Erigeron sp.	-	-	-	.00
F	Eriogonum ovalifolium	3	2	.03	.00
F	Gilia sp. (a)	4	-	.00	-
F	Lactuca serriola (a)	$_{a}$-	$_{b}$7	-	.05
F	Petradoria pumila	1	3	.15	.06
F	Phlox hoodii	7	8	.07	.10
F	Phlox longifolia	3	-	.00	-
F	Ranunculus testiculatus (a)	206	210	.40	3.98
F	Zigadenus paniculatus	4	-	.01	-
Total for Annual Forbs		244	324	0.56	4.51
Total for Perennial Forbs		28	25	0.29	0.38
Total for Forbs		272	349	0.86	4.90

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

BROWSE TRENDS--
Management unit 19R, Study no: 11

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia tridentata wyomingensis	35	42	3.41	3.47
B	Chrysothamnus viscidiflorus	5	18	.00	.14
B	Juniperus osteosperma	6	0	11.55	-
Total for Browse		46	60	14.97	3.61

CANOPY COVER, LINE INTERCEPT--
Management unit 19R, Study no: 11

Species	Percent Cover '08	Percent Cover '11
Artemisia tridentata wyomingensis	4.38	5.90
Chrysothamnus viscidiflorus	.23	1.13
Juniperus osteosperma	24.13	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 19R, Study no: 11

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia tridentata wyomingensis	1.4	2.9

POINT-QUARTER TREE DATA--
Management unit 19R, Study no: 11

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	107	26	10.9	1.4

BASIC COVER--
Management unit 19R, Study no: 11

Cover Type	Average Cover % '08	Average Cover % '11
Vegetation	24.40	25.90
Rock	1.10	.26
Pavement	12.67	3.79
Litter	44.70	43.63
Cryptogams	6.34	1.88
Bare Ground	31.07	27.31

SOIL ANALYSIS DATA --
Management unit 19R, Study no: 11, Study Name: James Ranch Bullhog

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 '08	'11	Days use per acre (ha) '08	'11
Rabbit	86	13	-	-
Deer	2	1	7 (18)	2 (5)
Cattle	4	2	4 (11)	9 (22)

BROWSE CHARACTERISTICS--
Management unit 19R, Study no: 11

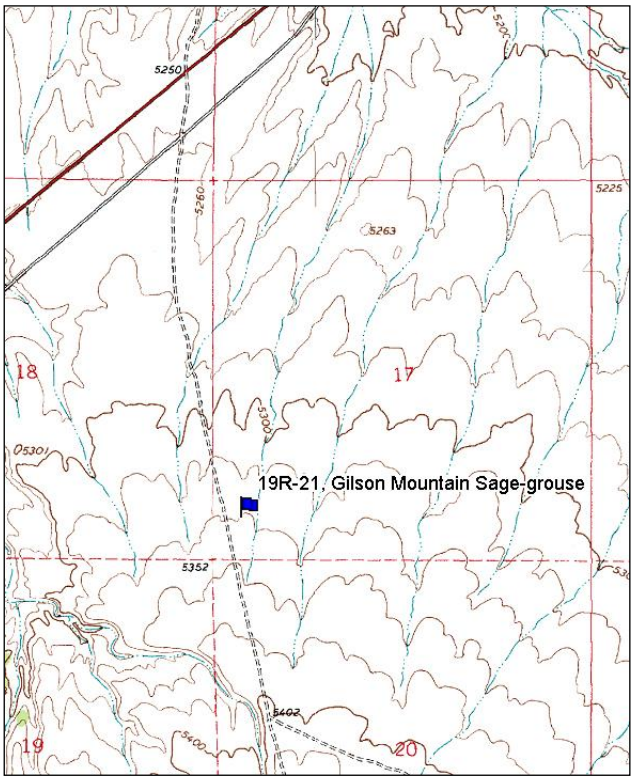
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
08	**860**	7	19	74	60	16	23	63	18/25
11	**1720**	45	36	19	1260	3	0	17	22/30
Chrysothamnus viscidiflorus									
08	**140**	0	57	43	-	0	29	14	8/9
11	**640**	38	63	0	560	0	0	0	12/16
Juniperus osteosperma									
08	**120**	0	50	50	-	0	0	17	-/-
11	**0**	0	0	0	-	0	0	0	-/-
Leptodactylon pungens									
08	**0**	0	0	-	-	0	0	0	10/11
11	**0**	0	0	-	-	0	0	0	-/-

GILSON MOUNTAIN SAGE-GROUSE - TREND STUDY NO. 19R-21-11
Project #1103

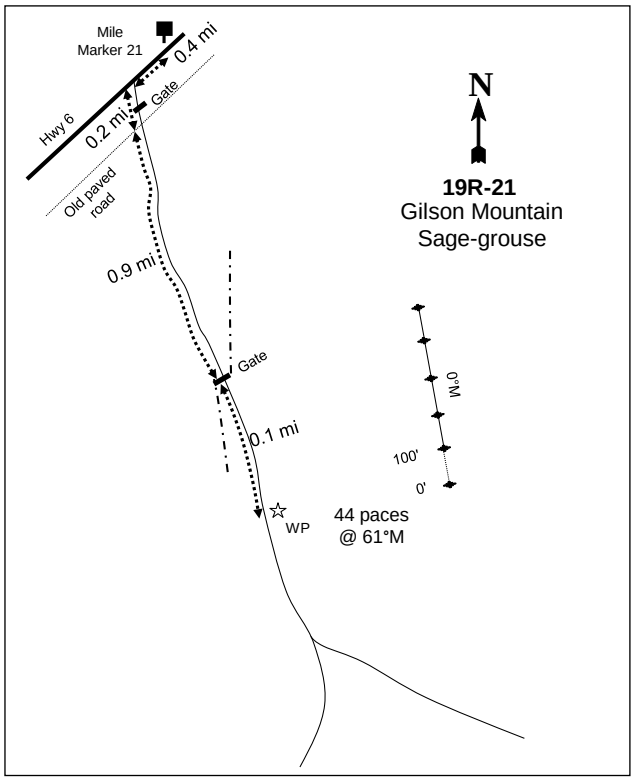
Vegetation Type: Annual Grass
Range Type: Deer Winter/Spring
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R028AY220UT
Land Ownership: Private
Elevation: 5,350 ft. (1,631 m)
Aspect: Northwest
Slope: 2%
Transect bearing: 0° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:
Drive south on Hwy 6 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



Diagrammatic Sketch:



Township: 13S Range: 3W Section: 17

GPS: NAD 83, UTM 12T 395994 E 4393581 N

GILSON MOUNTAIN SAGE-GROUSE - WRI STUDY 19R-21
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. Prior to treatment, the study was established in 2008 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 project area was rested from livestock grazing for two growing seasons following the treatment. The objectives of the project are to improve sage-grouse habitat, mule deer winter range, and livestock grazing and distribution (WRI Database 2012). Deer and cattle pellet groups were sampled in low abundance in 2008. Cattle sign was sampled in low abundance in 2011 (Table- Pellet Group Data).

SEED MIX--
Management unit 19R, Study no: 21

Project Name: Gilson Mountain WRI Database #: 1103			
Application: Drill Seed		Acres:	640
Seed type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass '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. The preferred browse species are forage kochia (*Kochia prostrata*) and Wyoming big sagebrush, though each of these species has not been very common on the site. The forage kochia was seeded and has been sampled in low abundance on the site. Wyoming big sagebrush has been sampled only in the height/crown measurements. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), stickyleaf low rabbitbrush (*C. viscidiflorus*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is in poor condition. Grasses are abundant, but not overly diverse on the site. The invasive annual grass species cheatgrass is the dominant grass species and has

provided the majority of the grass cover on the site since the outset of the study. Perennial grass species are not very common on the site. The most common perennial grass specie on the site are pubescent wheatgrass (*Agropyron intermedium),* crested wheatgrass (*A. cristatum*), and bottlebrush squirreltail (*Sitanion hystrix*). Seeded grass species sampled on the site include crested wheatgrass, pubescent wheatgrass, western wheatgrass (*Agropyron smithii*), and Great Basin wildrye (*Elymus cinereus*), though crested wheatgrass and western wheatgrass were present on the site prior to the treatment. Forbs are abundant and marginally diverse, but are dominated by annual species. Perennial forbs are rare on the site. The dominant forb species on the site is Russian thistle (*Salsola iberica*), which has provided the majority of the forb cover on the site since the outset of the study. Desert madwort (*Alyssum desertorum*) and tumblemustard (*Sisymbrium altissimum*) have also been common the site (Table - Herbaceous trends).

Soil: The soil is classified as part of the Truesdale component, which is found on alluvial fans. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as moderately deep, well drained, and with a slightly permeable restrictive layer (Soil Survey Staff 2011). 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 on the site, though there is moderate amount of litter and high amount vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Year Post Treatment, 2008 vs. 2011

Browse: Browse species remained rare on the site. The seeded browse species forage kochia was sampled at a density of 340 plants/acre with 65% of the plants sampled as young, and forage kochia provided 1% canopy cover.

Grasses: The sum of nested frequency of perennial grasses increased more than two-fold, and cover increased from 2% to 4%. The weedy annual grass species cheatgrass remained similar in nested frequency, though cover increased from 7% to 13%.

Forbs: Perennial forbs remained rare on the site and provided less than 1% cover in both sample years. The sum of nested frequency of annual forbs decreased 12%, and cover decreased from 25% to 22%. Russian thistle decreased significantly in nested frequency, and cover decreased from 18% to 13%. The palatable annual forb species prickly lettuce (*Lactuca serriola*) increased significantly in nested frequency, and cover increased to 1%.

HERBACEOUS TRENDS--
Management unit 19R, Study no: 21

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a4	b47	.15	.98
G	Agropyron intermedium	a-	b18	-	1.92
G	Agropyron smithii	23	9	1.33	.19
G	Bromus tectorum (a)	344	383	6.50	13.14
G	Elymus cinereus	-	1	-	.00
G	Sitanion hystrix	13	16	.13	.78
Total for Annual Grasses		344	383	6.50	13.14
Total for Perennial Grasses		40	91	1.61	3.89
Total for Grasses		384	474	8.11	17.03
F	Alyssum desertorum (a)	336	422	4.30	6.45

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Chenopodium fremontii (a)	2	-	.00	-
F	Cryptantha sp.	2	10	.00	.30
F	Erodium cicutarium (a)	$_{b}$47	$_{a}$-	1.21	-
F	Kochia scoparia (a)	-	8	-	.18
F	Lactuca serriola (a)	$_{a}$3	$_{b}$42	.01	1.24
F	Oenothera sp.	-	2	-	.03
F	Phlox longifolia	5	-	.03	-
F	Plantago patagonica (a)	1	-	.00	-
F	Ranunculus testiculatus (a)	$_{a}$-	26	-	.04
F	Salsola iberica (a)	$_{b}$452	$_{a}$302	17.84	12.98
F	Sisymbrium altissimum (a)	$_{b}$90	$_{a}$32	.98	.61
F	Sphaeralcea munroana	$_{b}$9	$_{a}$1	.11	.00
F	Tragopogon dubius (a)	$_{b}$28	$_{a}$8	.50	.25
Total for Annual Forbs		959	840	24.85	21.78
Total for Perennial Forbs		16	13	0.14	0.34
Total for Forbs		975	853	25.00	22.12

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

BROWSE TRENDS--
Management unit 19R, Study no: 21

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Chrysothamnus nauseosus	1	2	-	.15
B	Kochia prostrata	0	2	-	.66
B	Opuntia sp.	2	4	-	.03
Total for Browse		3	8	0	0.83

CANOPY COVER, LINE INTERCEPT--
Management unit 19R, Study no: 21

Species	Percent Cover '08	'11
Kochia prostrata	-	.50
Opuntia sp.	-	.55

BASIC COVER--
Management unit 19R, Study no: 21

Cover Type	Average Cover % '08	'11
Vegetation	36.70	40.51
Rock	.33	1.36
Pavement	10.52	11.32
Litter	31.39	27.46
Cryptogams	1.07	.63
Bare Ground	31.47	22.70

SOIL ANALYSIS DATA --
Management unit 19R, Study no: 21, Study Name: Gilson Mountain Sage-Grouse

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

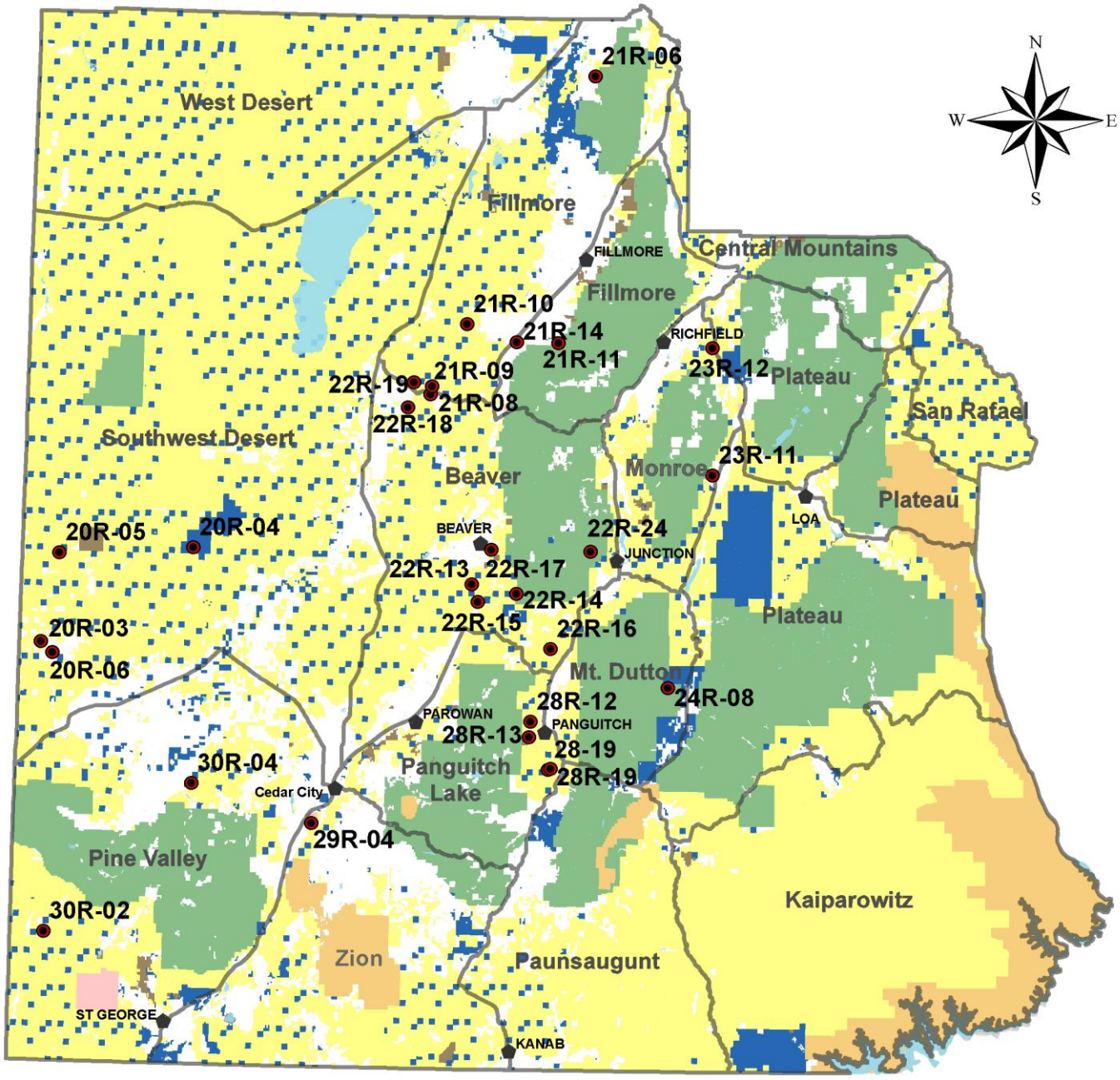
PELLET GROUP DATA--
Management unit 19R, Study no: 21

Type	Quadrat Frequency '08	'11	Days use per acre (ha) '08	'11
Rabbit	3	-	-	-
Elk	-	1	-	-
Deer	3	-	4 (10)	-
Cattle	11	2	5 (13)	3 (7)

BROWSE CHARACTERISTICS--
Management unit 19R, 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)
Artemisia tridentata wyomingensis									
08	**0**	0	0	-	-	0	0	0	15/18
11	**0**	0	0	-	-	0	0	0	7/5
Chrysothamnus nauseosus									
08	**20**	0	100	-	-	0	0	100	15/21
11	**40**	0	100	-	-	0	0	0	25/37
Chrysothamnus viscidiflorus									
08	**0**	0	0	-	-	0	0	0	7/8
11	**0**	0	0	-	-	0	0	0	-/-
Kochia prostrata									
08	**0**	0	0	-	-	0	0	0	-/-
11	**340**	65	35	-	-	0	0	0	14/25
Opuntia sp.									
08	**40**	50	50	-	-	0	0	0	7/17
11	**260**	0	100	-	-	0	0	0	6/17

Southern Region
WRI Studies 2011

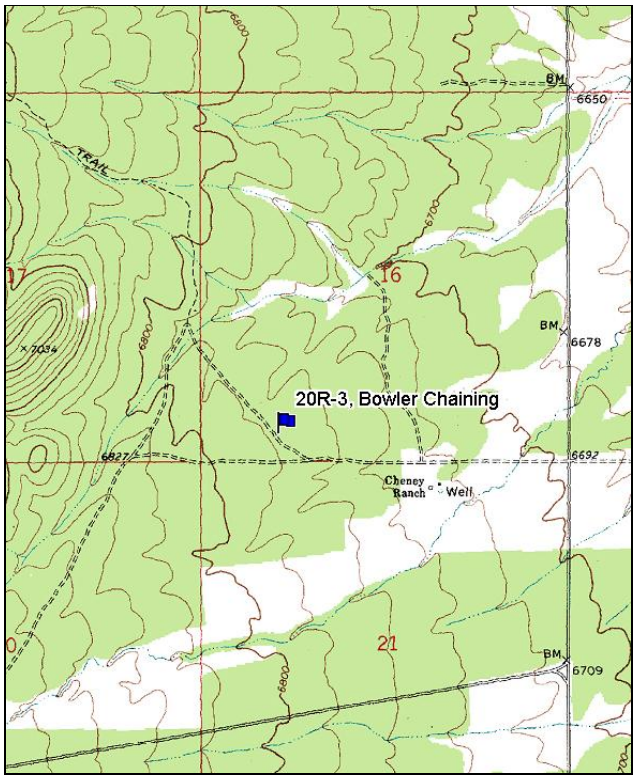


BOWLER CHAINING - WRI STUDY 20R-3-11
Project #563

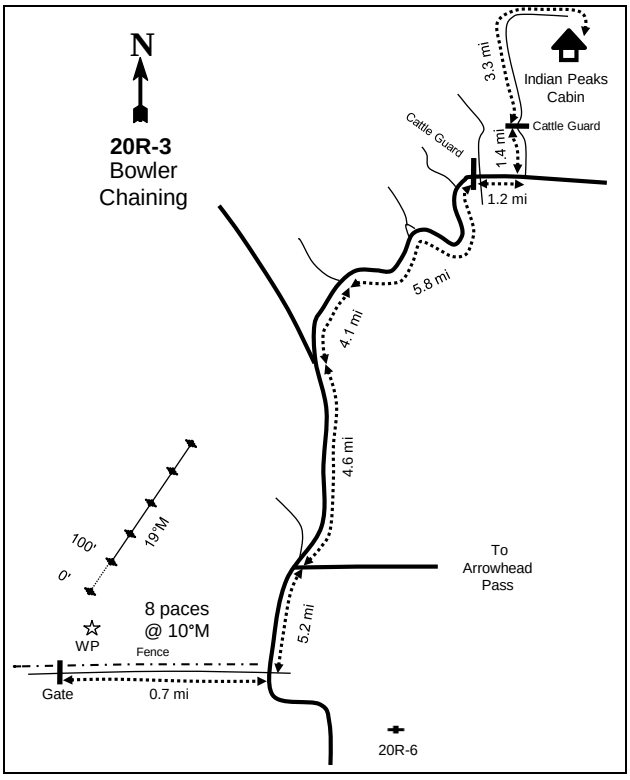
Vegetation Type: Wyoming Big Sagebrush
Range Type: Substantial Deer Summer, Substantial Elk Year-long
NRCS Ecological Site Description: Upland Stony Loam (Pinyon-Utah Juniper), R047XB333UT
Land Ownership: Private
Elevation: 6,800 ft (2,073 m)
Aspect: East
Slope: 3%
Transect bearing: 19° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: Drive west from Indian Peaks cabin 0.3 miles to a fork and take a left then 0.1 miles to another fork again stay left. From there drive 2.9 miles to a cattle guard. From the cattle guard drive 1.4 miles to a junction. Take a right and drive 1.2 miles to an intersection. Go straight crossing a cattle guard. From the cattle guard drive 5.8 miles staying on the main road to a fork. Take the left and drive 4.1 miles to another fork. Go left again for 4.6 miles to a fork leading to Arrowhead Pass. Stay right for another 5.2 miles to an intersection and take a right. Drive 0.7 miles to a fork and go right. There was an old two track road prior to the treatment but it no longer exists. The witness post is to the north of the road by to old two-track in the treatment. From the witness post walk 8 paces at 10 degrees magnetic to the 0-foot stake marked with browse tag #160.

Map Name: Steamboat Mountain SW



Diagrammatic Sketch:



Township: 32S Range: 19W Section: 16

GPS: NAD 83, UTM 12S 238018 E 4211556 N

BOWLER CHAINING - WRI STUDY 20R-3
Project #563

Site Description

Site Information: The study is located approximately fifteen miles north of Modena, within a singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) woodland, in Hamblin Valley, on private land. Prior to treatment, the study was established in 2006 to monitor the effects of a pinyon and juniper two-way chaining treatment. In the fall of 2006, approximately 854 acres were two-way Ely chained. Prior to the second pass of the chain, a seed mix of grass, forb, and browse species was aerially seeded over the treatment area (Table - Seed Mix). Livestock grazing was rested for two years following the treatment. The objectives of the project are to increase wildlife forage, and improve habitat for elk and greater sage-grouse (WRI Database 2012). Deer pellet groups were sampled in low abundance in 2006 and 2011. Pellet groups were sampled in low abundance for cattle and elk in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 20R, Study no: 3

Project Name: Bowler Chaining WRI Database #: 563			
Application: Aerial Seed		Acres:	700
Seed Type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	140	0.20
G	Crested Wheatgrass 'Douglas'	350	0.50
G	Crested Wheatgrass 'Hycrest'	350	0.50
G	Hard Fescue 'Durar'	140	0.20
G	Indian Ricegrass 'Rimrock'	700	1.00
G	Pubescent Wheatgrass	700	1.00
G	Sandberg Bluegrass 'Toole MT'	140	0.20
G	Snake River Wheatgrass 'Secar'	700	1.00
F	Alfalfa 'Ladak'	250	0.36
F	Alfalfa 'Nomad'	250	0.36
F	Alfalfa 'Ranger'	250	0.36
F	Blue Flax	175	0.25
F	Cicer Milkvetch 'Lutana'	350	0.50
F	Sainfoin 'Eski'	1400	2.00
F	Small Burnet 'Delar'	1050	1.50
F	Yellow Sweetclover	140	0.20
B	Forage Kochia 'Immigrant'	700	1.00
B	Sagebrush, Wyoming	700	1.00
Total Pounds:		8485	12.12
PLS Pounds:			9.93

Browse: The preferred browse species on the site are black sagebrush (*Artemisia nova*), Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*), and forage kochia (*kochia prostrata*). The dominant preferred browse species is Wyoming big sagebrush, which has provided the majority of the preferred browse canopy cover on the site since the outset of the study (Table - Canopy Cover). The Wyoming big sagebrush is a sparse, lightly used population, with low decadence and good vigor within the population; though decadence and plants displaying poor vigor were moderately high prior to the treatment. The recruitment of young sagebrush plants to the population has been good over the sample years (Table - Browse Characteristics). Prior to the treatment, pinyon and juniper trees dominated the site and provided the majority of the canopy cover, but following the treatment pinyon and juniper trees substantially decreased in abundance on the site

(Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant grass species are crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. smithii*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). Seeded grass species sampled on the site include crested wheatgrass, pubescent wheatgrass (*Agropyron intermedium*), Snake River wheatgrass (*Elymus wawawaiensis*), hard fescue (*Festuca ovina* ssp. *duriuscula*), Indian ricegrass, and Sandberg bluegrass (*Poa secunda*), though Indian ricegrass and Sandberg blue grass were present on the site prior to treatment. Other perennial grass species sampled on the site include western wheatgrass, Great Basin wildrye (*Elymus cinereus*), Russian wildrye (*E. junceus*), mutton bluegrass (*Poa fendleriana*), and pinewoods needlegrass (*Stipa pinetorum*). The weedy annual grass species cheatgrass (*Bromus tectorum*) has been sampled on the site in low abundance over the sampled years. Forbs are moderately abundant and highly diverse on the site. The dominant perennial forb species are mat eriogonum (*Eriogonum caespitosum*) and blue flax (*Linum perenne*). Seeded forb species sampled on the site include blue flax, alfalfa (*Medicago sativa*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Red Butte component. The parent material consists of alluvium derived from basic and intermediate igneous rock and/or colluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and moderately permeable soils (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly acidic soil reaction (pH 6.4) (Table - Soil Analysis Data). Bare ground cover is low on the study site, though there is 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 2006, but stable in 2011.

Pre vs. Five Years Post Treatment, 2006 vs. 2011

Browse: The density of Wyoming big sagebrush remained similar at 760 plants/acre, though canopy cover increased from 1% to 4%. The health of the sagebrush plants improved with decadence decreasing from 26% to 0%, and plants displaying poor vigor decreased from 11% to 0%. The recruitment of young sagebrush plants remained similar at 13% of the population. Following the treatment, a high amount of seedlings were sampled at 1,020 plants/acre. The seeded species forage kochia was sampled following the treatment at a density of 140 plants/acre. The density of pinyon pine trees decreased from 411 trees/acre with an average diameter of 1.5 inches to 84 trees/acre with an average diameter of 1.5 inches. The density of Utah juniper trees decreased from 212 trees/acre with an average diameter of 8.9 inches to 79 trees/acre with an average diameter of 2.9 inches. Canopy cover of pinyon and juniper trees decreased from 7% to 1% and 18% to 1%, respectively.

Grasses: The sum of nested frequency of perennial grasses increased more than two-fold, and cover increased from 3% to 13%. Bottlebrush squirreltail remained similar in nested frequency, but cover increased from 2% to 5%. The seeded grass species crested wheatgrass provided 4% cover following the treatment. The weedy annual grass species cheatgrass remained minimal on the site following the treatment.

Forbs: The sum of nested frequency of perennial forbs remained similar in nested frequency, though cover increased from 6% to 7%. Mat eriogonum decreased significantly in nested frequency, and cover decreased from 4% to 3%. The seeded species blue flax provided 1% cover following the treatment.

HERBACEOUS TRENDS--
Management unit 20R, Study no: 3

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	a-	b100	-	3.63
G	Agropyron intermedium	-	4	-	.06
G	Agropyron smithii	a2	b57	.04	1.07
G	Bromus tectorum (a)	a1	b17	.03	.09
G	Elymus cinereus	-	8	-	.16
G	Elymus junceus	-	4	-	.18
G	Elymus wawawaiensis	a-	b12	-	.02
G	Festuca ovina duriuscula	a-	b29	-	.52
G	Oryzopsis hymenoides	21	36	.39	1.36
G	Poa fendleriana	3	14	.06	.08
G	Poa secunda	31	17	.70	.35
G	Sitanion hystrix	124	144	1.86	5.10
G	Stipa pinetorum	7	7	.24	.56
Total for Annual Grasses		1	17	0.03	0.09
Total for Perennial Grasses		188	432	3.30	13.13
Total for Grasses		189	449	3.33	13.22
F	Arabis sp.	10	-	.03	-
F	Astragalus convallarius	13	7	.07	.04
F	Astragalus lentiginosus	-	4	-	.30
F	Astragalus utahensis	6	10	.04	.01
F	Chaenactis douglasii	22	14	.10	.05
F	Cryptantha sp.	5	4	.01	.01
F	Cymopterus sp.	-	7	-	.18
F	Descurainia pinnata (a)	-	91	-	1.27
F	Erigeron pumilus	-	1	-	.03
F	Eriogonum caespitosum	b150	a106	4.11	3.42
F	Eriogonum ovalifolium	-	3	-	.00
F	Eriogonum umbellatum	2	-	.06	.00
F	Gayophytum ramosissimum(a)	a-	b39	-	.14
F	Gilia sp. (a)	-	2	-	.01
F	Hedysarum boreale	14	13	.13	.41
F	Holosteum umbellatum (a)	11	5	.02	.15
F	Ipomopsis congesta	b90	a15	.69	.04
F	Lactuca serriola (a)	-	78	-	.66
F	Lappula occidentalis (a)	b28	a2	.06	.01
F	Lesquerella sp.	b38	a-	.21	-
F	Leucelene ericoides	-	-	.00	-
F	Linum perenne	a-	b107	-	1.36
F	Lupinus argenteus	a7	b46	.19	.49
F	Lupinus kingii (a)	b24	a-	.07	-
F	Machaeranthera canescens	-	2	-	.00
F	Medicago sativa	-	5	-	.04
F	Microsteris gracilis (a)	3	5	.00	.01

Type	Species	Nested Frequency '06	'11	Average Cover % '06	'11
F	Penstemon caespitosus	a-	b13	-	.18
F	Penstemon sp.	8	-	.04	-
F	Phlox austromontana	7	8	.07	.06
F	Phlox longifolia	8	10	.03	.02
F	Polygonum douglasii (a)	67	55	.14	.11
F	Sanguisorba minor	a-	b7	-	.24
F	Senecio multilobatus	8	1	.02	.00
F	Sisymbrium altissimum (a)	-	2	-	.03
F	Sphaeralcea grossulariifolia	a-	b16	-	.12
F	Trifolium sp.	32	17	.08	.05
Total for Annual Forbs		133	279	0.30	2.41
Total for Perennial Forbs		420	416	5.92	7.13
Total for Forbs		553	695	6.22	9.55

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

BROWSE TRENDS--
Management unit 20R, Study no: 3

Type	Species	Strip Frequency '06	'11	Average Cover % '06	'11
B	Artemisia nova	4	3	.03	-
B	Artemisia tridentata wyomingensis	27	25	1.25	4.17
B	Gutierrezia sarothrae	15	15	.09	.28
B	Juniperus osteosperma	16	4	8.85	.93
B	Kochia prostrata	0	7	-	.30
B	Leptodactylon pungens	1	1	-	-
B	Pinus monophylla	17	10	5.48	.18
Total for Browse		80	65	15.71	5.87

CANOPY COVER, LINE INTERCEPT--
Management unit 20R, Study no: 3

Species	Percent Cover '06	'11
Artemisia nova	.03	.36
Artemisia tridentata wyomingensis	1.20	3.86
Gutierrezia sarothrae	.11	.48
Juniperus osteosperma	17.89	1.26
Pinus monophylla	6.61	.91

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 20R, Study no: 3

Species	Average leader growth (in) '06	'11
Artemisia nova	0.6	1.1
Artemisia tridentata wyomingensis	1.2	1.9

POINT-QUARTER TREE DATA--
Management unit 20R, Study no: 3

Species	Trees per Acre '06	'11	Average diameter (in) '06	'11
Juniperus osteosperma	212	79	8.9	2.9
Pinus monophylla	411	84	1.5	1.5

BASIC COVER--
Management unit 20R, Study no: 3

Cover Type	Average Cover % '06	'11
Vegetation	21.79	32.20
Rock	5.63	1.23
Pavement	27.65	5.04
Litter	38.63	42.96
Cryptogams	1.82	.06
Bare Ground	21.53	16.61

SOIL ANALYSIS DATA --
Management unit 20R, Study no: 3, Study Name: Bowler Chaining

Effective rooting depth (in)	pH	clay loam %sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
13.5	6.4	30.0	33.1	36.9	1.7	10.1	188.8	0.5

PELLET GROUP DATA--
Management unit 20R, Study no: 3

Type	Quadrat Frequency '06	'11	Days use per acre (ha) '06	'11
Rabbit	46	-	-	-
Elk	-	4	-	7 (18)
Deer	3	3	2 (5)	3 (7)
Cattle	-	-	-	8 (20)

BROWSE CHARACTERISTICS--
Management unit 20R, Study no: 3

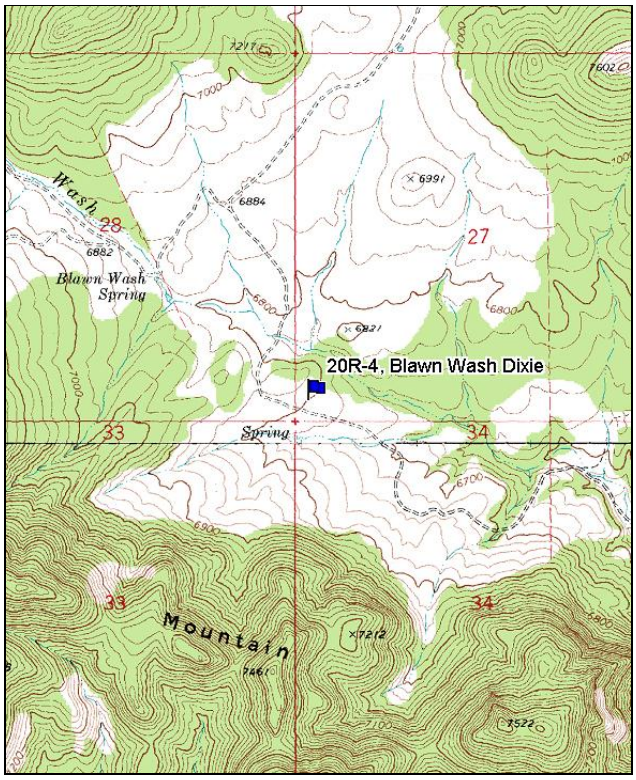
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
06	**100**	20	0	80	-	0	0	80	11/20
11	**80**	100	0	0	60	0	0	0	8/13
Artemisia tridentata wyomingensis									
06	**700**	11	63	26	160	0	0	11	18/25
11	**760**	13	87	0	1020	3	3	0	17/23
Chrysothamnus nauseosus									
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	20/20
Chrysothamnus viscidiflorus viscidiflorus									
06	**0**	0	0	-	-	0	0	0	6/7
11	**0**	0	0	-	-	0	0	0	13/15
Gutierrezia sarothrae									
06	**540**	26	74	0	220	0	0	0	8/8
11	**520**	35	58	8	40	0	0	8	6/9
Juniperus osteosperma									
06	**320**	0	81	19	40	0	0	0	-/-
11	**140**	100	0	0	-	0	0	14	-/-
Kochia prostrata									
06	**0**	0	0	-	-	0	0	0	-/-
11	**140**	0	100	-	-	29	0	0	3/7
Leptodactylon pungens									
06	**20**	0	100	-	-	0	0	0	2/7
11	**20**	100	0	-	-	0	0	0	1/2
Opuntia sp.									
06	**0**	0	0	-	-	0	0	0	6/20
11	**0**	0	0	-	-	0	0	0	4/17
Pinus monophylla									
06	**520**	81	19	-	720	0	0	0	-/-
11	**220**	100	0	-	100	0	0	0	-/-

BLAWN WASH DIXIE - WRI STUDY 20R-4-11
Project #391

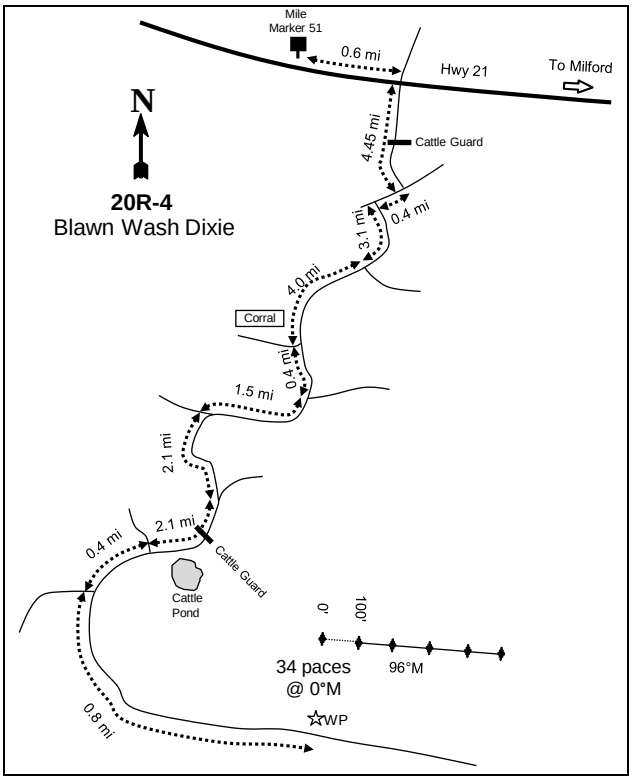
Vegetation Type: Mountain Big Sagebrush
Range Type: Substantial Deer Summer, Substantial Elk Year-long
NRCS Ecological Site Description: Not Available
Land Ownership: SITLA
Elevation: 6,676 ft (2,034 m)
Aspect: Southeast
Slope: 9%
Transect bearing: 96° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)
Rebar on line 3 is on the 2 foot mark

Directions: From mile marker #51 on highway 21 drive east 0.6 miles to an intersection. Turn right and drive 4.45 miles crossing a cattle guard to a junction. Take a right and drive 0.4 miles to another junction and take a left. Drive 3.1 miles to a fork and stay right for 4.0 miles passing a fence and corral to a fork. At the fork go left for 0.4 miles to another fork staying right for 1.5 miles to a junction. From there turn and drive 2.1 miles to a fork and to right. Drive 2.1 miles crossing one cattle guard to another fork. Stay left for 0.4 miles to a fork again staying right for 0.8 miles to a witness post on the left. Walk 34 paces at 0 degrees magnetic to the 0-foot stake marked with browse tag#173.

Map Name: Lamerdorf Peak



Diagrammatic Sketch:



Township: 29S Range: 15W Section: 27

GPS: NAD 83, UTM 12S 278974 E 4236756 N

BLAWN WASH DIXIE - WRI STUDY 20R-4
Project #391

Site Description

Site Information: The study is located approximately 33 miles west of Minersville, within a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat, south of Blawn Wash on the south end of the Wah Wah Mountain range. The study is on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). Prior to treatment, the study was established in 2006 to monitor the effects of a one-way Dixie harrow project. The project area was originally treated in the mid 1960's by chaining the singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) trees and seeding forage species. Over time forage production decreased dramatically, due to the age of the seedings, sustained heavy use by horses, drought, and encroachment of pinyon and juniper trees. In the fall of 2006, a total of 1,067 acres were one-way harrowed to remove pinyon and juniper trees, which were encroaching back into the old seedings. A seed mix of grass, forb, and browse species was broadcast seeded during the harrow treatment (Table - Seed Mix). The livestock operator agreed to rest the seeded area from grazing for a period of two growing seasons. In addition, the Bureau of Land management (BLM) agreed to remove all wild horses from the area. The objective of the project is to increase forage production within the Blawn Wash seedings (WRI Database 2012). Deer, elk, cattle, and horse pellet groups were sampled in low abundance in 2006. In 2011, pellet group abundance was low for deer, cattle, and horse (Table - Pellet Group Data).

SEED MIX--
Management unit 20R, Study no: 4

Project Name: Blawn Wash WRI Database #: 319			
Application: Broadcast Seed		Acres:	1800
Seed Type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	350	0.19
G	Crested Wheatgrass 'Hycrest'	3600	2.00
G	Great Basin Wildrye 'Trailhead'	600	0.33
G	Indian Ricegrass 'Rimrock'	834	0.46
G	Intermediate Wheatgrass	1800	1.00
G	Pubescent Wheatgrass	1800	1.00
G	Russian Wildrye	900	0.50
G	Sheep Fescue	208	0.12
G	Western Yarrow 'SID Columbia'	90	0.05
F	Alfalfa 'Nomad'	600	0.33
F	Alfalfa 'Ranger'	600	0.33
F	Alfalfa 'Spredor 4'	600	0.33
F	Sainfoin 'Eski'	900	0.50
F	Small Burnet 'Delar'	1800	1.00
B	Forage Kochia	900	0.50
Total Pounds:		15582	8.66
PLS Pounds:			7.62

Browse: The preferred browse species on the site are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush, dwarf rabbitbrush (*Chrysothamnus depressus*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), Nevada ephedra (*Ephedra nevadensis*), forage kochia (*Kochia prostrata*), and antelope bitterbrush (*Purshia tridentata*). The dominant preferred browse species is mountain big sagebrush, which has provided the majority of the canopy cover on the site over the sampled years (Table - Canopy Cover). The mountain big sagebrush is a moderately dense population, with low decadence and good vigor within the

population, though prior to the treatment decadence and poor vigor were high. The recruitment of young sagebrush plants to the population was good following the treatment. Utilization of sagebrush plants has been mostly light to moderate since the outset of the study. The antelope bitterbrush has been the only other preferred browse species to provide measureable abundance on the site. The antelope bitterbrush is a moderately used population, with good vigor and low decadence within the population. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous* ssp. *hololeucus*), stickyleaf low rabbitbrush (*C. viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). Pinyon and juniper trees are scattered across the site in low abundance. Following the treatment, pinyon and juniper densities decreased. Some of the treated juniper trees were knocked over, but still had live growth (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase I transitioning into Phase II prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are somewhat abundant and fairly diverse on the site. The dominant perennial grass species is crested wheatgrass (*Agropyron cristatum*), which has provided the majority of the perennial grass cover on site since the outset of the study. The weedy annual grass species cheatgrass (*Bromus tectorum*) has increased in abundance on the site over the sample years. Seeded grass species sampled on the site include crested wheatgrass, intermediate wheatgrass (*Agropyron intermedium*), and Indian ricegrass (*Oryzopsis hymenoides*), though each of these species were present on the site prior to treatment. Other grass species sampled on the site include western wheatgrass (*Agropyron smithii*), mutton bluegrass (*Poa fendleriana*), bottlebrush squirreltail (*Sitanion hystrix*), and the annual grass species Japanese chess (*Bromus japonicus*). Forbs are not overly abundant, but are fairly diverse on the site. No single forb species has been dominant on the site since the outset of the study. Seeded forb species sampled on the site include alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*) and small burnet (*Sanguisorba minor*) (Table - Herbaceous trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is moderate amount of vegetation and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2006, but stable in 2011.

Pre vs. Five Years Post Treatment, 2006 vs. 2011

Browse: The density of mountain big sagebrush decreased 46% from 8,920 plants/acre to 4,860 plants/acre, and canopy cover decreased from 24% to 21%. The health of the sagebrush population improved with decadence decreasing from 35% to 3%, and plants displaying poor vigor decreasing from 17% to 9%. The recruitment of young sagebrush increased from 1% to 11% of the population. The density of antelope bitterbrush remained similar at 240 plants/acre, though canopy cover decreased from 4% to 2%. The density of pinyon pine increased from 18 trees/acre with an average diameter of 0.5 inches to 34 trees/acre with an average diameter of 1.1 inches. Utah juniper density decreased from 61 trees/acre with an average diameter of 7.5 inches to 8 trees/acre with an average diameter of 5.4 inches.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover decreased from 10% to 5%. Crested wheatgrass decreased significantly in nested frequency, and cover decreased from 9% to 3%. The nested frequency of the annual grass species cheatgrass increased significantly, and cover increased from 4% to 10%.

Forbs: The sum of nested frequency of perennial forbs increased nearly six-fold, and cover increased to 1%. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 20R, Study no: 4

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	$_{b}$131	$_{a}$100	8.71	3.12
G	Agropyron intermedium	23	29	.58	.34
G	Agropyron smithii	$_{a}$-	$_{b}$19	-	.50
G	Bromus japonicus (a)	-	2	-	.00
G	Bromus tectorum (a)	198	305	3.57	9.96
G	Oryzopsis hymenoides	1	5	.15	.04
G	Poa fendleriana	3	4	.03	.15
G	Sitanion hystrix	14	28	.31	.28
Total for Annual Grasses		198	307	3.57	9.96
Total for Perennial Grasses		172	185	9.78	4.45
Total for Grasses		370	492	13.36	14.42
F	Allium sp.	-	1	-	.00
F	Astragalus lentiginosus	$_{a}$-	$_{b}$7	.03	.07
F	Calochortus nuttallii	-	5	-	.01
F	Castilleja chromosa	$_{a}$-	$_{b}$14	-	.11
F	Chaenactis douglasii	$_{a}$10	$_{b}$60	.02	.33
F	Collinsia parviflora (a)	6	7	.04	.01
F	Comandra pallida	-	3	-	.00
F	Crepis acuminata	-	3	-	.01
F	Cryptantha sp.	-	4	-	.03
F	Cymopterus sp.	$_{a}$-	$_{b}$10	-	.02
F	Gilia sp. (a)	$_{a}$-	$_{b}$25	-	.22
F	Heterotheca villosa	-	3	-	.00
F	Lesquerella sp.	1	-	.00	-
F	Leucelene ericoides	$_{a}$8	$_{a}$2	.01	.00
F	Lupinus argenteus	$_{a}$-	$_{b}$9	.03	.17
F	Machaeranthera canescens	-	4	-	.03
F	Medicago sativa	-	6	-	.19
F	Microsteris gracilis (a)	$_{a}$2	$_{b}$62	.00	.65
F	Onobrychis viciaefolia	-	5	-	.07
F	Penstemon palmeri	-	3	-	.15
F	Penstemon sp.	1	-	.03	-
F	Phlox longifolia	-	4	-	.00
F	Sanguisorba minor	-	3	-	.00
F	Senecio multilobatus	6	4	.01	.01
F	Sphaeralcea coccinea	-	1	-	.03
F	Tragopogon dubius (a)	1	-	.00	-
Total for Annual Forbs		9	94	0.04	0.88
Total for Perennial Forbs		26	151	0.14	1.28
Total for Forbs		35	245	0.19	2.16

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

BROWSE TRENDS--
Management unit 20R, Study no: 4

Type	Species	Strip Frequency '06	Strip Frequency '11	Average Cover % '06	Average Cover % '11
B	Artemisia tridentata vaseyana	96	90	20.73	17.59
B	Chrysothamnus nauseosus hololeucus	5	3	.00	-
B	Chrysothamnus viscidiflorus	1	1	-	.15
B	Gutierrezia sarothrae	42	9	1.56	.06
B	Opuntia sp.	0	0	-	.03
B	Pinus monophylla	2	2	.03	.41
B	Purshia tridentata	12	11	2.16	.96
Total for Browse		158	116	24.50	19.21

CANOPY COVER, LINE INTERCEPT--
Management unit 20R, Study no: 4

Species	Percent Cover '06	Percent Cover '11
Artemisia tridentata vaseyana	24.31	20.54
Chrysothamnus nauseosus hololeucus	.83	.51
Chrysothamnus viscidiflorus	-	.11
Gutierrezia sarothrae	.98	.05
Pinus monophylla	.68	.80
Purshia tridentata	4.18	1.95

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 20R, Study no: 4

Species	Average leader growth (in) '06	Average leader growth (in) '11
Artemisia tridentata vaseyana	0.9	2.5
Purshia tridentata	1.8	2.2

POINT-QUARTER TREE DATA--
Management unit 20R, Study no: 4

Species	Trees per Acre '06	Trees per Acre '11	Average diameter (in) '06	Average diameter (in) '11
Juniperus osteosperma	61	8	7.5	5.4
Pinus monophylla	18	34	0.5	1.1

BASIC COVER--
Management unit 20R, Study no: 4

Cover Type	Average Cover % '06	'11
Vegetation	32.26	34.12
Rock	15.81	12.81
Pavement	28.80	12.47
Litter	24.12	18.63
Cryptogams	.29	.04
Bare Ground	13.24	26.69

SOIL ANALYSIS DATA --
Management unit 20R, Study no: 4, Study Name: Blawn Wash Dixie

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.2	6.8	56.0	18.4	25.6	2.1	12.6	240.0	0.7

PELLET GROUP DATA--
Management unit 20R, Study no: 4

Type	Quadrat Frequency '06	'11	Days use per acre (ha) '06	'11
Rabbit	55	1	-	-
Horse	5	-	7 (17)	3(7)
Elk	1	-	5 (12)	-
Deer	8	3	5 (13)	2 (5)
Cattle	-	-	-	3 (7)

BROWSE CHARACTERISTICS--
Management unit 20R, Study no: 4

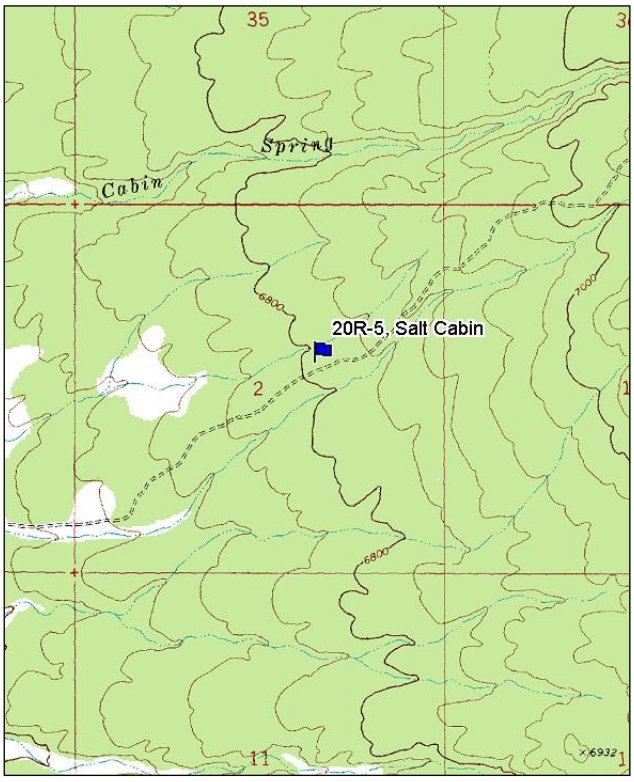
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	19/27
Artemisia tridentata vaseyana									
06	**8920**	1	64	35	-	34	3	17	15/27
11	**4860**	11	86	3	-	1	0	9	13/23
Chrysothamnus depressus									
06	**0**	0	0	-	-	0	0	0	4/7
11	**0**	0	0	-	-	0	0	0	-/-
Chrysothamnus nauseosus hololeucus									
06	**120**	0	50	50	-	0	50	33	23/27
11	**60**	0	100	0	-	0	0	0	22/28
Chrysothamnus viscidiflorus									
06	**20**	0	100	-	-	0	0	0	5/7
11	**20**	100	0	-	-	0	0	0	4/5
Cowania mexicana stansburiana									
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	22/27
Ephedra nevadensis									
06	**0**	0	0	-	-	0	0	0	10/12
11	**0**	0	0	-	-	0	0	0	-/-
Gutierrezia sarothrae									
06	**1560**	9	79	12	320	0	0	9	8/10
11	**420**	43	57	0	-	0	0	0	6/7
Juniperus osteosperma									
06	**0**	0	0	-	20	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Kochia prostrata									
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	3/6
Opuntia sp.									
06	**0**	0	0	-	-	0	0	0	3/5
11	**0**	0	0	-	-	0	0	0	3/6
Pinus monophylla									
06	**40**	100	0	-	100	0	0	0	-/-
11	**40**	50	50	-	20	0	0	0	11/11
Purshia tridentata									
06	**260**	8	85	8	-	62	0	8	17/40
11	**240**	8	92	0	-	42	0	0	13/31

SALT CABIN - WRI STUDY 20R-5-11
Project #479

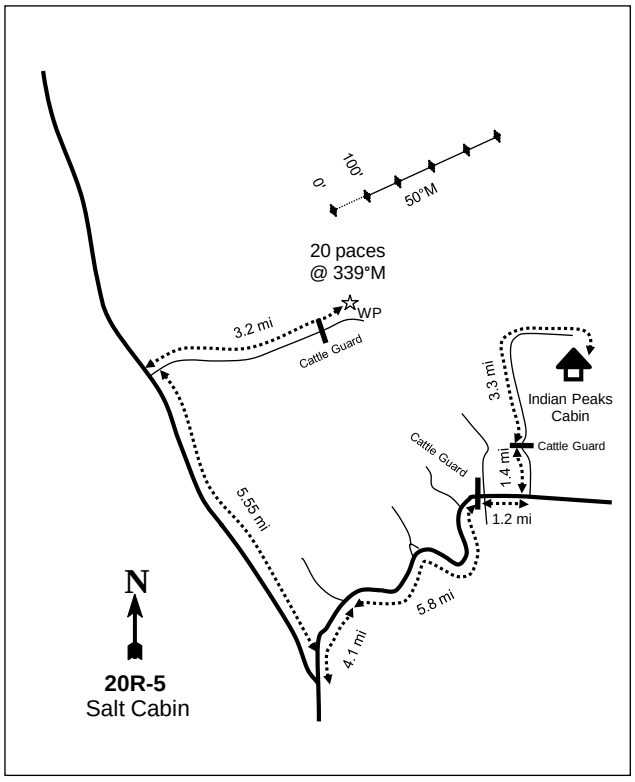
Vegetation Type: Wyoming Big Sagebrush
Range Type: Substantial Deer Summer, Substantial Elk Year-long
NRCS Ecological Site Description: Not available
Land Ownership: SITLA
Elevation: 6,800 ft (2,073 m)
Aspect: West
Slope: 4%
Transect bearing: 50° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: Drive west from Indian Peaks cabin 0.3 miles to a fork and take a left then 0.1 miles to another fork again stay left. From there drive 2.9 miles to a cattle guard. From the cattle guard drive 1.4 miles to a junction. Take a right and drive 1.2 miles to an intersection. Go straight crossing a cattle guard. From the cattle guard drive 5.8 miles staying on the main road to a fork. Take the left and drive 4.1 miles to another fork. Turn right (north) and drive 5.55 miles to a junction. Turn right and proceed 3.2 miles to a witness post on the left. Walk 20 paces at 339 degrees magnetic to the 0-foot stake marked with browse tag #172.

Map Name: Atchison Creek



Diagrammatic Sketch:



Township: 30S Range: 19W Section: 2

GPS: NAD 83, UTM 12S 242924 E 4235346 N

SALT CABIN - WRI STUDY 20R-5
Project #479

Site Description

Site Information: The study is located approximately seven and half miles southwest of the Indian Peaks Cabin, on the west slope of the Indian Peaks Mountain range east of Hamblin Valley. The study is on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). Prior to treatment, the study was established in 2006 to monitor the effects of a pinyon and juniper two-way chaining treatment. In fall of 2006, approximately 733 acres were two-way Ely chained. Prior to the second pass of the chain, a seed mix of grass, forb, and browse species was aerially seeded over the treatment area (Table - Seed Mix). Livestock grazing was rested for two years following the treatment. The objectives of the project are to increase wildlife forage, and improve habitat for elk and greater sage-grouse (WRI Database 2012). Pellet groups were sampled in low abundance for deer and cattle in 2006 and 2011, moderate abundance for horse in 2006, and high abundance for elk and horse in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 20R, Study no: 5

Project Name: Salt Cabin Reseed WRI Database #: 479			
Application: Aerial Seed		Acres:	800
Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Goldar'	800	1.00
G	Canby Bluegrass 'Canbar'	161	0.20
G	Crested Wheatgrass 'Douglas'	800	1.00
G	Intermediate Wheatgrass	796	1.00
G	Orchardgrass 'Paiute'	200	0.25
G	Russian Wildrye	800	1.00
G	Snake River Wheatgrass 'Secar'	800	1.00
G	Western Wheatgrass 'Arriba'	800	1.00
F	Alfalfa 'Ladak'	400	0.50
F	Alfalfa 'Nomad'	400	0.50
F	Alfalfa 'Ranger'	400	0.50
F	Blue Flax	160	0.20
F	Sainfoin 'Eski'	2400	3.00
F	Small Burnet 'Delar'	1600	2.00
B	Forage Kochia	800	1.00
Total Pounds:		11317	14.15
PLS Pounds:			12.53

Browse: The preferred browse species on the site are black sagebrush (*Artemisia nova*), Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*), dwarf rabbitbrush (*Chrysothamnus depressus*), and antelope bitterbrush (*Purshia tridentata*). The dominant preferred browse species are black sagebrush and Wyoming big sagebrush. The black sagebrush and Wyoming big sagebrush are sparse, lightly used populations, with low decadence and good vigor within each population; though prior to the study, use of Wyoming big sagebrush was mostly moderate. The recruitment of young sagebrush plants has been good since the treatment; however, prior to the treatment recruitment of young Wyoming big sagebrush plants was poor. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous* ssp. *hololeucus*), stickyleaf low rabbitbrush (*C. viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). Pinyon and juniper trees are scattered across the site in low abundance. Following the treatment, pinyon and juniper densities decreased. Some of

the treated juniper trees were knocked over, but still had live growth (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase II prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and fairly diverse on the site. The dominant grass species are crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromus inermis*), which have provided the majority of the grass cover on the site. Seeded grass species sampled on the site include crested wheatgrass, intermediate wheatgrass (*Agropyron intermedium*), western wheatgrass (*Agropyron smithii*), and Russian wildrye (*Elymus junceus*). Other grass species sampled on the site include purple three-awn (*Aristida purpurea*), Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), needle-and-thread (*Stipa comata*), and Letterman needlegrass (*S. lettermani*). The weedy annual grass species cheatgrass (*Bromus tectorum*) has increased in abundance on the site since the treatment. Forbs are not overly abundant, but are fairly diverse on the site. No single forb species has been dominant on the site since the outset of the study. Blue flax (*Linum perenne*) was the only seeded species sampled on the site (Table - Herbaceous trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2006 and 2011 due to the abundance of rhizomatous grasses.

Pre vs. Five Years Post Treatment, 2006 vs. 2011

Browse: The density of black sagebrush remained similar at 480 plants/acre, and canopy cover remained at 1%. The density of Wyoming big sagebrush increased from 80 plants/acre to 220 plants/acre, and canopy cover remained less than 1%. The density of pinyon pine trees decreased from 48 trees/acre with an average diameter of 2.7 inches to 13 trees/acre with an average diameter of 2.5 inches. Utah juniper trees decreased from 91 trees/acre with an average diameter of 4.7 inches to 41 trees/acre with an average diameter of 4.0 inches. Canopy cover of pinyon and juniper trees decreased from 2% to 0% and 5% to 1%, respectively.

Grasses: The sum of nested frequency of perennial grasses increased 12%, and cover increased from 17% to 18%. The rhizomatous grass species smooth brome increased significantly in nested frequency, and cover increased from 10% to 11%. Crested wheatgrass remained similar in nested frequency and cover at 5%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased to 1%.

Forbs: The sum of nested frequency of perennial forbs decreased 27%, and cover remained similar at 2%. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 20R, Study no: 5

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	159	145	5.33	4.57
G	Agropyron intermedium	$_{b}$48	$_{a}$4	.63	.38
G	Agropyron smithii	$_{a}$-	$_{b}$28	-	1.01
G	Aristida purpurea	-	-	.00	-
G	Bromus inermis	$_{a}$212	$_{b}$271	9.64	10.86
G	Bromus tectorum (a)	$_{a}$18	$_{b}$45	.11	.70
G	Elymus junceus	-	10	-	.33
G	Oryzopsis hymenoides	18	13	.53	.17
G	Sitanion hystrix	$_{a}$3	$_{b}$17	.07	.28
G	Stipa comata	15	21	.40	.34
G	Stipa lettermani	-	2	-	.03
Total for Annual Grasses		18	45	0.10	0.70
Total for Perennial Grasses		455	511	16.62	18.00
Total for Grasses		473	556	16.73	18.70
F	Astragalus sp.	11	8	.23	.18
F	Astragalus utahensis	3	-	.00	-
F	Caulanthus crassicaulis	-	2	-	.00
F	Chaenactis douglasii	-	-	-	.00
F	Collinsia parviflora (a)	-	11	-	.01
F	Cryptantha sp.	8	11	.08	.34
F	Cymopterus sp.	-	3	-	.01
F	Dalea searlsiae	$_{a}$-	11	-	.13
F	Descurainia pinnata (a)	$_{a}$-	24	-	.05
F	Eriogonum cernuum (a)	2	3	.00	.00
F	Gilia sp. (a)	$_{a}$6	$_{b}$59	.01	.18
F	Ipomopsis congesta	8	11	.06	.31
F	Lappula occidentalis (a)	$_{a}$2	$_{b}$39	.01	.17
F	Linum perenne	-	2	-	.00
F	Lupinus argenteus	$_{a}$-	$_{b}$10	-	.31
F	Lygodesmia spinosa	1	-	.00	-
F	Machaeranthera canescens	6	3	.04	.00
F	Penstemon confusus	$_{b}$36	$_{a}$12	.35	.42
F	Penstemon sp.	1	-	.03	-
F	Phlox longifolia	-	2	-	.00
F	Salsola iberica (a)	-	1	-	.00
F	Senecio multilobatus	12	5	.12	.03
F	Sphaeralcea coccinea	$_{b}$41	$_{a}$13	.55	.33
F	Tragopogon dubius (a)	3	-	.03	-
Total for Annual Forbs		13	137	0.06	0.43
Total for Perennial Forbs		127	93	1.49	2.12
Total for Forbs		140	230	1.54	2.56

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

BROWSE TRENDS--
Management unit 20R, Study no: 5

Type	Species	Strip Frequency '06	Strip Frequency '11	Average Cover % '06	Average Cover % '11
B	Artemisia nova	8	10	1.22	1.08
B	Artemisia tridentata wyomingensis	4	5	.76	.09
B	Chrysothamnus depressus	1	2	.03	.01
B	Chrysothamnus nauseosus hololeucus	27	39	1.80	3.25
B	Chrysothamnus viscidiflorus	5	8	.45	.79
B	Gutierrezia sarothrae	9	7	.16	.06
B	Juniperus osteosperma	7	2	3.74	.06
B	Opuntia sp.	3	2	.03	.03
B	Pinus monophylla	3	1	1.41	-
B	Purshia tridentata	5	5	1.71	.58
Total for Browse		72	81	11.34	5.97

CANOPY COVER, LINE INTERCEPT--
Management unit 20R, Study no: 5

Species	Percent Cover '06	Percent Cover '11
Artemisia nova	1.21	.91
Artemisia tridentata wyomingensis	.23	.41
Chrysothamnus depressus	.05	.10
Chrysothamnus nauseosus hololeucus	2.41	2.54
Chrysothamnus viscidiflorus	.30	.51
Gutierrezia sarothrae	.20	.03
Juniperus osteosperma	4.78	1.35
Pinus monophylla	2.31	-
Purshia tridentata	1.50	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 20R, Study no: 5

Species	Average leader growth (in) '06	Average leader growth (in) '11
Artemisia nova	0.8	1.1
Artemisia tridentata wyomingensis	-	1.5
Purshia tridentata	2.0	1.5

POINT-QUARTER TREE DATA--
Management unit 20R, Study no: 5

Species	Trees per Acre '06	Trees per Acre '11	Average diameter (in) '06	Average diameter (in) '11
Juniperus osteosperma	91	41	4.7	4.0
Pinus monophylla	48	13	2.7	2.5

BASIC COVER--
Management unit 20R, Study no: 5

Cover Type	Average Cover % '06	'11
Vegetation	27.63	32.26
Rock	1.84	1.68
Pavement	28.37	1.32
Litter	33.91	30.05
Cryptogams	.18	.81
Bare Ground	23.90	31.97

SOIL ANALYSIS DATA --
Management unit 20R, Study no: 5, Study Name: Salt Cabin

Effective rooting depth (in)	pH	sandy loan			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.9	7.1	61.0	19.1	19.9	2.8	19.6	188.8	0.7

PELLET GROUP DATA--
Management unit 20R, Study no: 5

Type	Quadrat Frequency '06	'11	Days use per acre (ha) '06	'11
Rabbit	55	-	-	-
Horse	17	11	27 (66)	19 (46)
Elk	11	11	17 (41)	27 (66)
Deer	10	5	7 (17)	8 (7)
Cattle	4	-	8 (20)	2 (5)

BROWSE CHARACTERISTICS--
Management unit 20R, Study no: 5

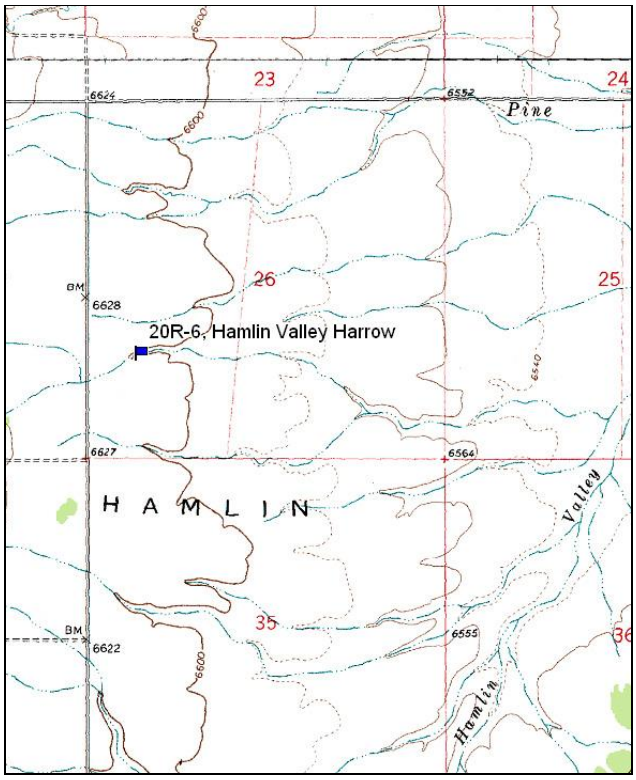
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
06	**480**	25	71	4	240	0	0	0	14/26
11	**480**	17	83	0	100	0	0	0	9/17
Artemisia tridentata wyomingensis									
06	**80**	0	100	-	140	75	0	0	24/30
11	**220**	64	36	-	-	0	0	0	15/19
Chrysothamnus depressus									
06	**20**	100	0	-	-	0	0	0	3/6
11	**40**	100	0	-	-	0	0	0	5/6
Chrysothamnus nauseosus hololeucus									
06	**1120**	64	36	0	460	7	2	29	25/40
11	**1480**	30	69	1	-	11	3	3	14/19
Chrysothamnus viscidiflorus									
06	**220**	45	55	-	80	0	18	0	14/26
11	**360**	6	94	-	-	0	0	0	23/18
Gutierrezia sarothrae									
06	**480**	4	67	29	140	0	0	29	9/11
11	**280**	21	71	7	-	0	0	7	7/8
Juniperus osteosperma									
06	**140**	29	43	29	-	0	0	0	-/-
11	**40**	100	0	0	-	0	0	0	-/-
Opuntia sp.									
06	**60**	0	100	-	60	0	0	0	4/8
11	**40**	0	100	-	-	0	0	0	3/6
Pinus monophylla									
06	**60**	67	33	-	20	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	-/-
Purshia tridentata									
06	**100**	0	80	20	40	60	40	20	28/67
11	**120**	17	83	0	-	33	17	0	14/29

HAMLIN VALLEY HARROW - TREND STUDY NO. 20R-6-11
Project #1185

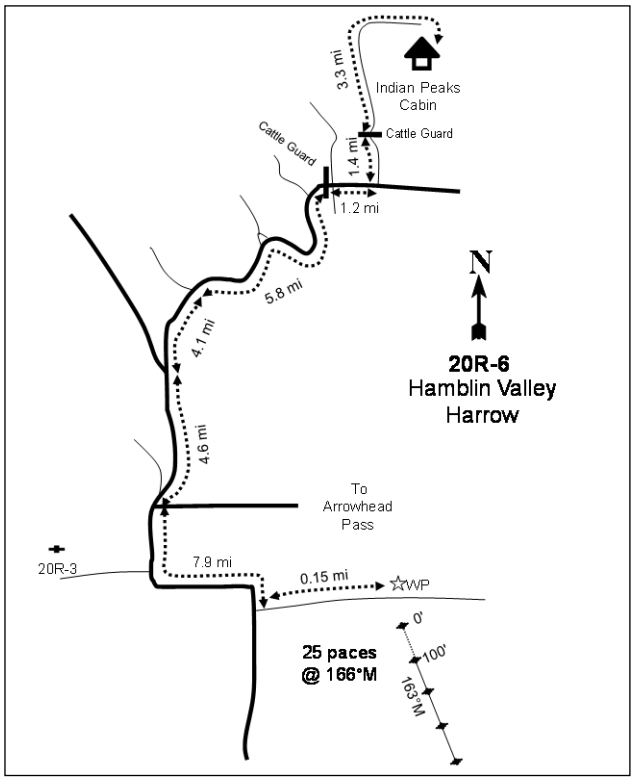
Vegetation Type: Wyoming Big Sagebrush
Range Type: Substantial Deer Summer, Substantial Elk Year-Long
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R028AY220UT
Land Ownership: Private
Elevation: 6,627 ft. (2,020 m)
Aspect: East
Slope: 0-1%
Transect bearing: 163° magnetic
Belt placement: line 1 (34ft), line 2 (59ft), line 3 (71ft), line 4(11ft & 95ft)
Original line 1 was not treated so belt one was moved to original line 5

Directions: Drive west from Indian Peaks cabin 0.3 miles to a fork and take a left then 0.1 miles to another fork again stay left. From there drive 2.9 miles to a cattle guard. From the cattle guard drive 1.4 miles to a junction. Take a right and drive 1.2 miles to an intersection. Go straight crossing a cattle guard. From the cattle guard drive 5.8 miles staying on the main road to a fork. Take the left and drive 4.1 miles to another fork. Go left again for 4.6 miles to a fork leading to Arrowhead Pass. Stay on main road for another 7.9 miles to a faint old road and take a right. Drive 0.15 miles on this road to the witness post. The 0' stake is 25 paces from the witness post at 166 degrees magnetic. The 0-foot stake is marked with browse tag# 101.

Map Name: Eightmile Spring



Diagrammatic Sketch:



Township: 32S Range: 19W Section: 26

GPS: NAD 83, UTM 12T 241036 E 4208531 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. Prior to treatment, the study was established in 2008, 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 treatment area was rested from livestock grazing for two growing seasons following the treatment. The objectives of the project are to reduce sagebrush cover, increase soil stability, and increase the diversity of the herbaceous understory (WRI Database 2012). The first fifty feet of the study transect was not treated, and as a result belt one was moved to line four to be within the treatment area in 2011. Cattle pellet groups were sampled in low abundance in 2008, and deer pellet groups were sampled in low abundance in 2011 (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 are Wyoming big sagebrush and antelope bitterbrush (*Purshia tridentata*). The Wyoming big sagebrush is the dominant preferred browse species on the site. The Wyoming big sagebrush is a mostly young population of scattered mature plants, with a high density of young plants within the population. Also, the sagebrush is a lightly used population, with low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population has been excellent since the outset of the study. The overall age-class diversity of the sagebrush plants was good with a fairly even distribution 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 density of broom snakeweed increased substantially following the treatment with a high amount of young recruitment sampled in 2011. The stickyleaf low rabbitbrush exhibited moderate utilization in 2008. Other less common browse species sampled on the site include Parry rabbitbrush (*Chrysothamnus parryi*), rubber rabbitbrush (*C. nauseosus*), 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 diverse on the site. The dominant grass species is crested wheatgrass (*Agropyron cristatum*), which has provided the majority of the grass cover on the site since the outset of the study. Sandberg bluegrass (*Poa secunda*) and intermediate wheatgrass (*Agropyron intermedium*) are also fairly common on the site. Seeded grass species sampled on the site include crested wheatgrass, intermediate wheatgrass, western wheatgrass (*A. smithii*), Indian ricegrass (*Oryzopsis hymenoides*), and Sandberg bluegrass, though crested wheatgrass and Sandberg bluegrass were present on the site prior to the treatment. Other perennial grass species sampled on the site included blue grama (*Bouteloua gracilis*), bluebunch wheatgrass (*Agropyron spicatum*), nodding brome (*Bromus anomalus*), bottlebrush squirreltail (*Sitanion hystrix*), 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*) has been sampled in low abundance and has provided little cover on the site over the sample years. Forbs are not particularly abundant, but are fairly diverse. The most common forb species sampled on the site was longleaf phlox (*Phlox longifolia*). Seeded forb species sampled on the site include blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Ripgut component. The parent material consists of alluvium derived from igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is high amount of vegetation and moderate amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008, but stable in 2011.

Pre vs. Two Year Post Treatment, 2008 vs. 2011

Browse: The density of Wyoming big sagebrush remained similar at 4,840 plants/acre, though cover decreased from 12% to 2%. The size of mature sagebrush plants decreased from an average height of 25 inches with an average crown of 37 inches to an average height of 10 inches with an average crown of 13 inches. The recruitment of young sagebrush plants to the population increased following the treatment from 41% to 66% of the population. The density of broom snakeweed increased substantially from 9,640 plants/acre to 19,000 plants/acre. The majority of the increase in broom snakeweed was from an increase in recruitment of young plants to the population, which increased from 4% to 44% of the population.

Grasses: The sum of nested frequency of perennial grasses increased 71%, and cover increased from 12% to 19%. Crested wheatgrass increased significantly in nested frequency, and increased in cover from 8% to 13%. Sandberg bluegrass remained similar in nested frequency and cover at 2%. Intermediate wheatgrass was sampled for the first time following the treatment at 1% cover.

Forbs: The sum of nested frequency of perennial forbs increased more than two-fold, and cover increased from 2% to 8%. Longleaf phlox remained similar in nested frequency, but increased in cover from 1% to 2%. The seeded forb species sainfoin, blue flax, and small burnet each provided 1% cover following the treatment.

HERBACEOUS TRENDS--
Management unit 20R, Study no: 6

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a219	b284	8.36	13.42
G	Agropyron intermedium	a-	b58	-	1.29
G	Agropyron smithii	a-	b17	-	.26
G	Agropyron spicatum	a-	b29	-	.23
G	Bouteloua gracilis	a9	b29	.19	.82
G	Bromus anomalus	-	2	-	.15
G	Bromus tectorum (a)	5	10	.01	.06
G	Koeleria cristata	14	21	.72	.09
G	Oryzopsis hymenoides	a-	b9	-	.05
G	Poa secunda	109	143	2.01	2.20
G	Sitanion hystrix	-	3	-	.00
G	Stipa lettermani	6	15	.21	.34
G	Vulpia octoflora (a)	a-	b29	-	.06
Total for Annual Grasses		5	39	0.01	0.13
Total for Perennial Grasses		357	610	11.51	18.88
Total for Grasses		362	649	11.53	19.01
F	Astragalus convallarius	1	-	.03	-
F	Astragalus utahensis	4	5	.01	.04
F	Calochortus nuttallii	-	3	-	.01
F	Crepis acuminata	1	-	.00	-
F	Cryptantha sp.	a7	b42	.03	.53
F	Cymopterus sp.	a12	b49	.04	.35
F	Erigeron pumilus	16	61	.09	.80
F	Eriogonum sp.	1	-	.00	-
F	Gayophytum ramosissimum(a)	a-	b106	-	.27
F	Grindelia squarrosa	-	5	-	.03
F	Ipomopsis congesta	-	-	-	.00
F	Lactuca serriola (a)	-	2	-	.00
F	Linum perenne	a-	b28	-	.69
F	Lupinus argenteus	-	7	.15	.01
F	Lygodesmia spinosa	5	7	.04	.06
F	Machaeranthera canescens	-	4	-	.01
F	Medicago sativa	a-	b28	-	.08
F	Microsteris gracilis (a)	1	1	.00	.00
F	Oenothera sp.	3	1	.00	.03
F	Onobrychis viciaefolia	a-	b69	-	1.41
F	Penstemon caespitosus	8	3	.02	.01
F	Phlox austromontana	33	31	.65	.91
F	Phlox longifolia	130	159	.45	2.22
F	Polygonum douglasii (a)	a-	b19	-	.02
F	Ranunculus testiculatus (a)	2	-	.00	-
F	Sanguisorba minor	a-	b51	-	.95
F	Sphaeralcea coccinea	2	1	.00	.00

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
F	Townsendia sp.	-	1	-	.03
F	Trifolium sp.	14	15	.04	.06
F	Zigadenus paniculatus	-	1	-	.00
Total for Annual Forbs		3	128	0.00	0.31
Total for Perennial Forbs		237	571	1.60	8.29
Total for Forbs		240	699	1.61	8.60

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

BROWSE TRENDS--
Management unit 20R, Study no: 6

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia tridentata wyomingensis	82	74	14.88	3.00
B	Chrysothamnus parryi	11	0	.33	-
B	Chrysothamnus viscidiflorus	36	5	1.53	.03
B	Gutierrezia sarothrae	81	97	2.77	5.95
B	Leptodactylon pungens	6	6	.18	.02
B	Opuntia sp.	0	1	-	-
B	Purshia tridentata	0	1	-	-
B	Tetradymia canescens	1	0	-	-
Total for Browse		217	184	19.71	9.02

CANOPY COVER, LINE INTERCEPT--
Management unit 20R, Study no: 6

Species	Percent Cover '08	Percent Cover '11
Artemisia tridentata wyomingensis	11.85	2.28
Chrysothamnus viscidiflorus	.40	.21
Gutierrezia sarothrae	1.53	4.91
Leptodactylon pungens	.06	.10

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 20R, Study no: 6

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia tridentata wyomingensis	0.8	1.8

BASIC COVER--
Management unit 20R, Study no: 6

Cover Type	Average Cover % '08	'11
Vegetation	30.75	41.60
Rock	.36	.60
Pavement	23.79	10.40
Litter	23.32	20.63
Cryptogams	.40	.15
Bare Ground	38.62	22.09

SOIL ANALYSIS DATA --
Management unit 20R, Study no: 6, Study Name: Hamblin Valley Harrow

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 '08	'11	Days use per acre (ha) '08	'11
Rabbit	60	3	-	-
Deer	-	-	-	3 (7)
Cattle	3	1	14 (34)	-

BROWSE CHARACTERISTICS--
Management unit 20R, Study no: 6

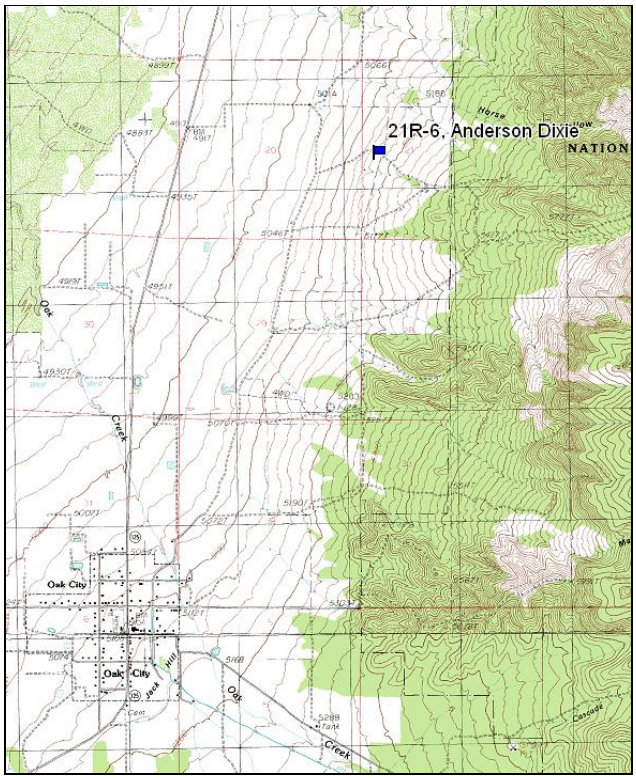
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
08	**5040**	41	46	13	3600	8	.79	8	25/37
11	**4840**	65	33	2	5900	4	0	.82	10/13
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	7/6
Chrysothamnus parryi									
08	**520**	15	85	-	-	0	0	0	4/12
11	**0**	0	0	-	-	0	0	0	-/-
Chrysothamnus viscidiflorus									
08	**1280**	5	91	5	20	30	28	3	6/12
11	**120**	17	83	0	-	0	0	17	5/9
Gutierrezia sarothrae									
08	**9640**	4	91	5	42780	1	1	3	6/6
11	**19000**	44	56	0	2380	0	.42	.10	5/7
Leptodactylon pungens									
08	**220**	0	91	9	-	9	0	0	4/9
11	**120**	33	67	0	60	0	0	0	3/6
Opuntia sp.									
08	**0**	0	0	-	-	0	0	0	4/4
11	**20**	100	0	-	-	0	0	0	2/2
Pediocactus simpsonii									
08	**0**	0	0	-	20	0	0	0	1/3
11	**0**	0	0	-	-	0	0	0	-/-
Purshia tridentata									
08	**0**	0	0	-	-	0	0	0	-/-
11	**40**	100	0	-	-	0	0	0	-/-
Tetradymia canescens									
08	**20**	0	100	-	-	0	0	0	6/7
11	**0**	0	0	-	-	0	0	0	-/-

ANDERSON DIXIE - TREND STUDY NO. 21R-6-11
Project #797

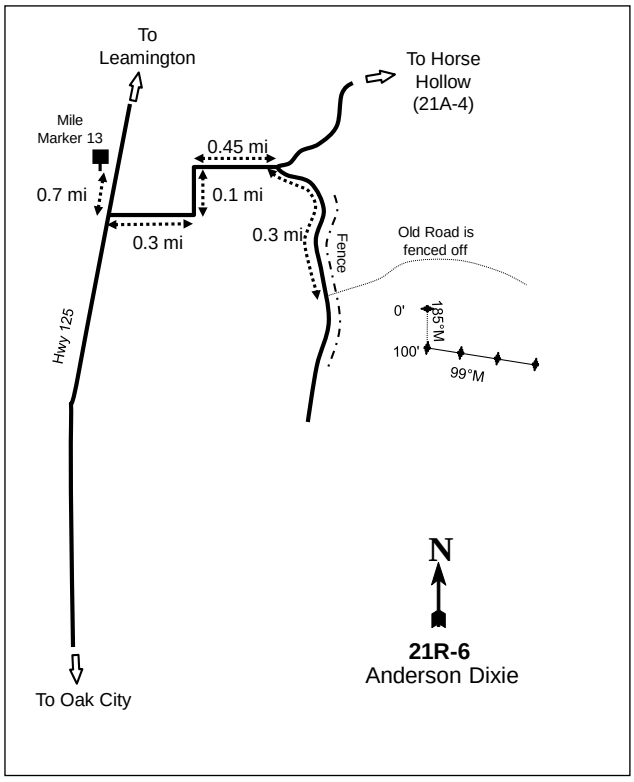
Vegetation Type: Wyoming Big Sagebrush, Utah Juniper
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Semidesert Stony Loam (Black Sagebrush), R028AY252UT
Land Ownership: Private
Elevation: 5,170 ft. (1,576 m)
Aspect: West
Slope: 5%
Transect bearing: 185° magnetic (0ft to 100ft) 99° magnetic (100ft to 500ft)
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions:
Heading south on Highway 125 between Leamington and Oak City go to mile marker 13, continue south 0.7 miles to a road coming in from the left (east). Turn left (east) and go 0.3 miles where the road will turn left, (north) for 0.1 miles then right (east) again for 0.45 miles to a T-intersection in the road. (The left heads to the Horse Hollow (21A-4) study. Go right 0.3 miles. Here there is a faint dirt road to the left that is now fenced off. Park here, and walk up the road (east) to another fence. From the end fence post on the south side of the road the 0-foot stake is 51 paces at 220 degrees magnetic with browse tag #139 (The fence may not be there anymore following the treatment).

Map Name: Oak City North



Diagrammatic Sketch:



Township: 16S Range: 4W Section: 21

GPS: NAD 83, UTM 12S 387222 E 4363473 N

ANDERSON DIXIE - WRI STUDY 21R-6
Project #797

Site Description

Site Information: The study is located approximately two and half miles northeast of Oak City, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, near the mouth of Horse Hollow, on private land. Prior to treatment, the study was established in 2007 to monitor a one-way Dixie harrow project. In the summer of 2006, the Devils Den and Oak City fires burned a large portion (nearly 25,000 acres) of deer winter and transitional rangeland in the Oak City area. The treatment area was located outside of the fire parameter within a decadent Wyoming big sagebrush stand. In the fall of 2007, A one-way Dixie harrow project was used to treat 166 acres of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat. A seed mix of grass, forb, and browse species was broadcast seeded during the harrow pass (Table - Seed Mix). Seeded areas were excluded from cattle grazing for two growing seasons following the treatment. The project objectives were to increase winter forage for deer and also forage for livestock. Part of the study transect was not treated and was moved within the treated portion of the project area in 2011 (WRI Database 2012). Deer pellet groups were sampled in moderate abundance in 2007, but low in abundance in 2011. Elk and cattle were low in abundance in 2007. Cattle sign was low in abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 21R, Study no: 6

Project Name: D. Anderson Dixie Harrow WRI Database #: 797			
Application: Broadcast Seeder		Acres:	250
Seed type		lbs in mix	lbs/acre
G	Canby Bluegrass 'Canbar'	50	0.20
G	Crested Wheatgrass 'Douglas'	100	0.40
G	Crested Wheatgrass 'Ephraim'	72	0.29
G	Crested Wheatgrass 'Hycrest'	100	0.40
G	Intermediate Wheatgrass	250	1.00
G	Snake River Wheatgrass 'Secar'	300	1.20
F	Alfalfa 'Ladak'	100	0.40
F	Alfalfa 'Ranger'	100	0.40
F	Alfalfa 'Spredor 4'	50	0.20
F	Sainfoin 'Eski'	550	2.20
F	Small Burnet 'Delar'	750	3.00
F	Western Yarrow	13	0.05
B	Forage Kochia	125	0.50
B	Sagebrush, Wyoming	100	0.40
Total Pounds:		2660	10.64
PLS Pounds:			9.26

Browse: The preferred browse species on the site is Wyoming big sagebrush, Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), forage kochia (*Kochia prostrata*), and antelope bitterbrush (*Purshia tridentata*). The dominant preferred browse species is Wyoming big sagebrush, which has provided the majority of the browse cover on the site over the sample years (Table - Canopy Cover). The Wyoming big sagebrush is a moderately dense population, with low decadence and good vigor within the population; though prior to the treatment decadence and poor vigor were high. Utilization of sagebrush has been mostly light over the sample years. The recruitment of young sagebrush plants to the population was poor prior to the treatment but has since been good. Other browse species sampled on the site include narrowleaf low rabbitbrush

(*Chrysothamnus viscidiflorus ssp. stenophyllus*) and broom snakeweed (*Gutierrezia sarothrae*) (Table - Browse Characteristics). Utah juniper (*Juniperus osteosperma*) trees are sparsely scattered throughout the site (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase I prior to, and following, the treatment (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and diverse on the site. The dominant perennial grass species are crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*). The weedy annual grass species cheatgrass (*Bromus tectorum*) has provided the majority of grass cover on the site since the outset of the study. Seeded grass species sampled on the site include crested wheatgrass, intermediate wheatgrass (*Agropyron intermedium*), and Snake River wheatgrass (*Elymus wawawaiensis*). Other perennial grass species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*), western wheatgrass (*Agropyron smithii*), and bottlebrush squirreltail (*Sitanion hystrix*). Perennial forbs are rare on the site and provide little cover. The weedy annual species bur buttercup (*Ranunculus testiculatus*) is the dominant forb species and has provided the majority of the forb cover on the site. Seeded forb species sampled on the site following the treatment include Alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*), but each occurred in low frequency and cover (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Pober component, which is found on fan remnants. The parent material consists of alluvium from limestone, sandstone, and quartzite. The soils within this classification are characterized as moderately deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a slightly alkaline soil reaction (pH 7.4) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is moderate amount of litter and high amount 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 Assessment, 2007 vs. 2011

Browse: The density of Wyoming big sagebrush decreased 17% from 2,380 plants/acre to 1,980 plants/acre, and canopy cover decreased 15% to 8%. The health of sagebrush improved with decadence decreasing from 39% to 6%, and poor vigor decreasing from 22% to 4%. The recruitment of young sagebrush plants to the population increased from 0% to 44%. The density of Utah juniper remained low at 26 trees/acre.

Grasses: The sum of nested frequency of perennial grasses increased 52%, and cover increased from 8% to 15%. Sandberg bluegrass decreased significantly in nested frequency, and cover decreased from 8% to 7%. The seeded grass species crested wheatgrass was sampled at 6% cover following the treatment. The weedy annual species cheatgrass remained similar in nested frequency, though cover increased from 16% to 19%.

Forbs: Perennial forbs are rare on the site despite increasing nearly three-fold. No single forb species provided more than 1% cover in either sample year, with the exception of bur buttercup. Bur buttercup increased significantly in nested frequency, and cover increased from 1% to 2%.

HERBACEOUS TRENDS--
Management unit 21R, Study no: 6

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
G	Agropyron cristatum	[a]-	[b]147	-	5.68
G	Agropyron intermedium	[a]-	[b]19	-	.88
G	Agropyron smithii	[a]-	[b]39	-	1.08
G	Bromus tectorum (a)	423	405	15.80	18.59
G	Elymus wawawaiensis	[a]-	[b]10	-	.28
G	Oryzopsis hymenoides	-	1	-	.00

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
G	Poa secunda	$_{b}$260	$_{a}$184	7.93	6.58
G	Secale cereale (a)	-	5	-	.01
G	Sitanion hystrix	10	11	.09	.66
Total for Annual Grasses		423	410	15.80	18.60
Total for Perennial Grasses		270	411	8.03	15.19
Total for Grasses		693	821	23.83	33.79
F	Alyssum alyssoides (a)	$_{a}$-	$_{b}$34	-	.10
F	Astragalus utahensis	-	1	-	.00
F	Calochortus nuttallii	-	-	.00	-
F	Descurainia pinnata (a)	17	10	.06	.02
F	Draba sp. (a)	$_{b}$21	$_{a}$-	.03	-
F	Erodium cicutarium (a)	3	-	.00	-
F	Gilia sp. (a)	6	5	.01	.01
F	Lactuca serriola (a)	-	3	-	.00
F	Lomatium sp.	$_{a}$2	$_{b}$17	.03	.07
F	Medicago sativa	-	4	-	.01
F	Onobrychis viciaefolia	-	1	-	.00
F	Phlox longifolia	$_{a}$22	$_{b}$41	.08	.57
F	Ranunculus testiculatus (a)	$_{a}$138	$_{b}$235	.58	2.18
F	Sanguisorba minor	-	4	-	.18
F	Sisymbrium altissimum (a)	-	1	-	.00
F	Zigadenus paniculatus	1	3	.03	.01
Total for Annual Forbs		185	288	0.70	2.33
Total for Perennial Forbs		25	71	0.15	0.85
Total for Forbs		210	359	0.86	3.18

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

BROWSE TRENDS--
Management unit 21R, Study no: 6

Type	Species	Strip Frequency '07	Strip Frequency '11	Average Cover % '07	Average Cover % '11
B	Artemisia tridentata wyomingensis	65	48	11.78	3.51
B	Chrysothamnus viscidiflorus stenophyllus	8	8	.22	.57
B	Cowania mexicana stansburiana	0	0	.01	-
B	Gutierrezia sarothrae	14	24	.25	.96
B	Juniperus osteosperma	1	2	.81	.15
B	Kochia prostrata	0	4	-	.12
B	Purshia tridentata	1	0	-	-
Total for Browse		89	86	13.07	5.32

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 6

Species	Percent Cover '07	'11
Artemisia tridentata wyomingensis	14.88	7.56
Chrysothamnus viscidiflorus stenophyllus	.40	.95
Gutierrezia sarothrae	.08	1.95
Juniperus osteosperma	1.60	-
Kochia prostrata	-	.03
Purshia tridentata	.40	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 21R, Study no: 6

Species	Average leader growth (in) '07	'11
Artemisia tridentata wyomingensis	1.4	2.2

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 6

Species	Trees per Acre '07	'11	Average diameter (in) '07	'11
Juniperus osteosperma	26	26	5.9	6.8

BASIC COVER--
Management unit 21R, Study no: 6

Cover Type	Average Cover % '07	'11
Vegetation	38.81	43.54
Rock	6.66	2.79
Pavement	6.64	4.49
Litter	33.65	27.99
Cryptogams	5.59	.87
Bare Ground	22.38	30.65

SOIL ANALYSIS DATA --
Management unit 21R, Study no: 6, Study Name: Anderson Dixie

pH	loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
7.4	45.4	34.0	20.6	2.0	3.3	182.4	0.5

PELLET GROUP DATA--
Management unit 21R, Study no: 6

Type	Quadrat Frequency '07	'11	Days use per acre (ha) '07	'11
Rabbit	59	15	-	-
Elk			2(5)	
Deer	5	5	23(56)	5 (12)
Cattle	5	1	6(14)	15 (38)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 6

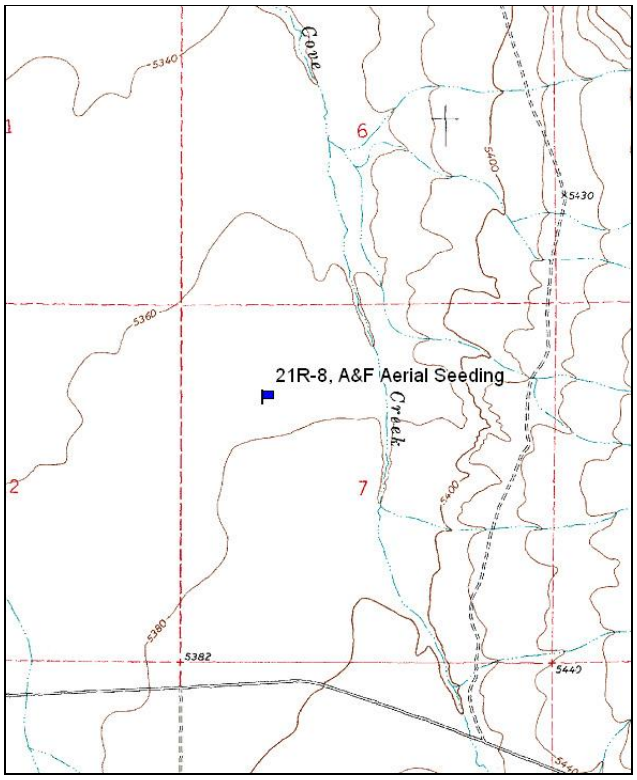
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
07	**2380**	0	61	39	-	11	5	22	31/40
11	**1980**	44	49	6	40	5	0	4	21/29
Chrysothamnus viscidiflorus stenophyllus									
07	**220**	0	91	9	-	0	27	0	12/15
11	**280**	14	64	21	20	0	0	7	14/23
Cowania mexicana stansburiana									
07	**0**	0	0	-	-	0	0	0	72/73
11	**0**	0	0	-	-	0	0	0	26/28
Gutierrezia sarothrae									
07	**680**	3	94	3	80	0	0	12	8/10
11	**1300**	34	63	3	-	2	0	3	10/14
Juniperus osteosperma									
07	**20**	0	100	-	-	0	0	0	-/-
11	**40**	50	50	-	-	50	0	0	-/-
Kochia prostrata									
07	**0**	0	0	-	-	0	0	0	-/-
11	**80**	75	25	-	-	0	0	0	9/8
Purshia tridentata									
07	**20**	0	100	-	-	0	0	0	49/59
11	**0**	0	0	-	-	0	0	0	-/-

A&F AERIAL SEEDING (GIP) - TREND STUDY NO. 21R-8-11
Project #1007

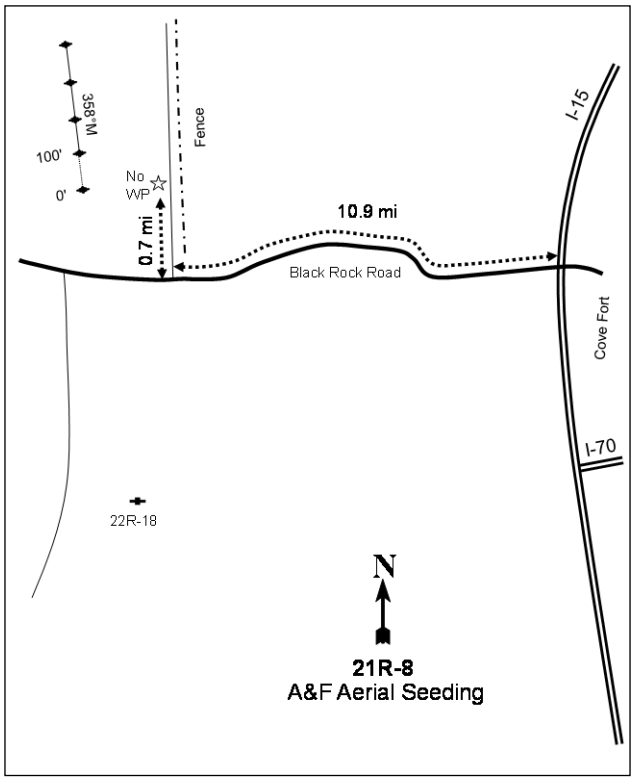
Vegetation Type: Annual Grass
Range Type: Deer Winter
NRCS Ecological Site Description: Semidesert Stony Loam (Black Sagebrush), R028AY252UT
Land Ownership: Private
Elevation: 5,381 ft. (1,640 m)
Aspect: Flat
Slope: 0%
Transect bearing: 358° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
Take the Cove Fort exit on I-15 and proceed west on Black Rock Road 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 (10.9miles in total). From here, drive 1.3 miles to a fence line on the right. Take the faint 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, within a grassy flat, north of Antelope Mountain, near Cove Creek, on private land. Following treatment, 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 occurred in areas were drills could not be used. Also aerial seeding was used in an area were 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 seeded polygon. The seeded area was rested from livestock grazing for two growing seasons following the treatment. 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 2012). Wildlife and livestock pellet groups were not observed within the pellet group transect in 2008 or 2011 (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: Browse species are limited on the site. The seeded browse species fourwing saltbush (*Atriplex canescens*) has been the only preferred browse species sampled on the site since the outset of the study; though fourwing saltbush was only sampled in height/crown measurements. No browse species were sampled on the study site in 2008. A small population of broom snakeweed (*Gutierrezia sarothrae*) and rubber rabbitbrush (*Chrysothamnus nauseous*) were sampled in 2011 (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and moderately diverse on the site. The weedy annual grass species cheatgrass (*Bromus tectorum*) is abundant and provides the majority of the cover; though at the outset of the study cheatgrass was rare on the site. The dominant perennial grass species on the site are galleta (*Hilaria Jamesii*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). Seeded grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), Russian wildrye (*Elymus junceus*), and Indian ricegrass, though Indian ricegrass was present on the site prior to the treatment. Other perennial grass species sampled on the site include purple three-awn (*Aristida purpurea*) and needle-and-thread (*Stipa comata*). Forbs are moderately abundant, but are

not overly diverse on the site. The dominant forb species is specklepod locoweed (*Astragalus lentiginosus*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Decca component, which is found on fan terraces. The parent material consists of alluvium derived from igneous rock and quartzite. The soils within this classification are characterized as deep, excessively drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). 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 on the site, though there is 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, but stable in 2011.

Trend Assessments

Browse

- **2008 to 2011 - stable (0):** Browse species remained limited on the site. Broom snakeweed was sampled for the first time in 2011 at a density of 2,740 plants/acre, and provided 5% canopy cover.

Grasses

- **2008 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased more than three-fold, and cover increased from 2% to 9%. Galleta increased significantly in nested frequency, and cover increased from 2% to 4%. Indian ricegrass remained similar in nested frequency, though cover increased from less than 1% to 3%. Bottlebrush squirreltail was sampled for the first time in 2011 and provided 1% cover. The invasive annual grass species cheatgrass increased significantly in nested frequency, and cover increased from less than 1% cover to 12%.

Forbs

- **2008 to 2011 - up (+2):** The sum of nested frequency of perennial forbs increased 69%, and cover increased from less than 1% to 4%. Specklepod locoweed was sampled for the first time in 2011 at 3% cover. The weedy annual forb species Russian thistle was also sampled for the first time in 2011 at 2% cover.

HERBACEOUS TRENDS--
Management unit 21R, Study no: 8

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a-	b13	-	.36
G	Agropyron intermedium	-	-	-	.03
G	Aristida purpurea	1	-	.03	-
G	Bromus tectorum (a)	a4	b421	.01	11.51
G	Elymus junceus	-	1	-	.15
G	Hilaria jamesii	a35	b61	1.79	4.19
G	Oryzopsis hymenoides	5	17	.25	2.73
G	Sitanion hystrix	a-	b44	-	1.12
G	Stipa comata	-	1	-	.00
Total for Annual Grasses		4	421	0.01	11.51
Total for Perennial Grasses		41	137	2.07	8.60
Total for Grasses		45	558	2.09	20.11
F	Alyssum desertorum (a)	a-	b212	-	.46

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
F	Astragalus lentiginosus	a-	b62	-	2.83
F	Astragalus utahensis	-	5	-	.01
F	Descurainia pinnata (a)	-	7	-	.01
F	Erodium cicutarium (a)	a1	b26	.00	.06
F	Lactuca serriola (a)	a-	b9	-	.02
F	Leucelene ericoides	7	7	.02	.42
F	Machaeranthera canescens	-	2	-	.03
F	Phlox longifolia	84	78	.22	.43
F	Salsola iberica (a)	a-	b301	-	2.15
F	Sisymbrium altissimum (a)	a-	b21	-	.12
F	Sphaeralcea grossulariifolia	3	5	.15	.53
Total for Annual Forbs		1	576	0.00	2.84
Total for Perennial Forbs		94	159	0.39	4.26
Total for Forbs		95	735	0.40	7.10

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

BROWSE TRENDS--
Management unit 21R, Study no: 8

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Chrysothamnus nauseosus	0	1	-	-
B	Gutierrezia sarothrae	0	59	-	3.29
Total for Browse		0	60	0	3.29

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 8

Species	Percent Cover '08	Percent Cover '11
Chrysothamnus nauseosus	-	.25
Gutierrezia sarothrae	-	5.16

BASIC COVER--
Management unit 21R, Study no: 8

Cover Type	Average Cover % '08	Average Cover % '11
Vegetation	2.92	32.37
Rock	.55	1.45
Pavement	94.58	45.04
Litter	.78	19.60
Cryptogams	.98	.01
Bare Ground	3.25	9.15

SOIL ANALYSIS DATA --

Management unit 21R, Study no: 8, Study Name: A&F Aerial Seeding

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

PELLET GROUP DATA--

Management unit 21R, Study no: 8

Type	Quadrat Frequency	
	'08	'11
Cattle	-	1

Days use per acre (ha)	
'08	'11
-	-

BROWSE CHARACTERISTICS--

Management unit 21R, Study no: 8

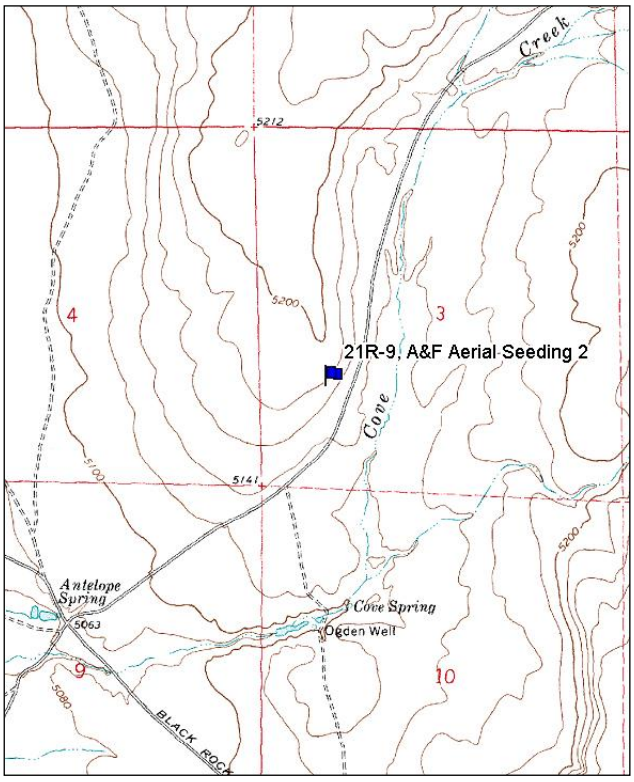
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Atriplex canescens									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	18/19
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	13/18
Gutierrezia sarothrae									
08	**0**	0	0	0	-	0	0	0	-/-
11	**2740**	24	75	1	20	.72	0	0	9/15

A&F AERIAL SEEDING 2 (GIP) - TREND STUDY NO. 21R-9-11
Project #1010

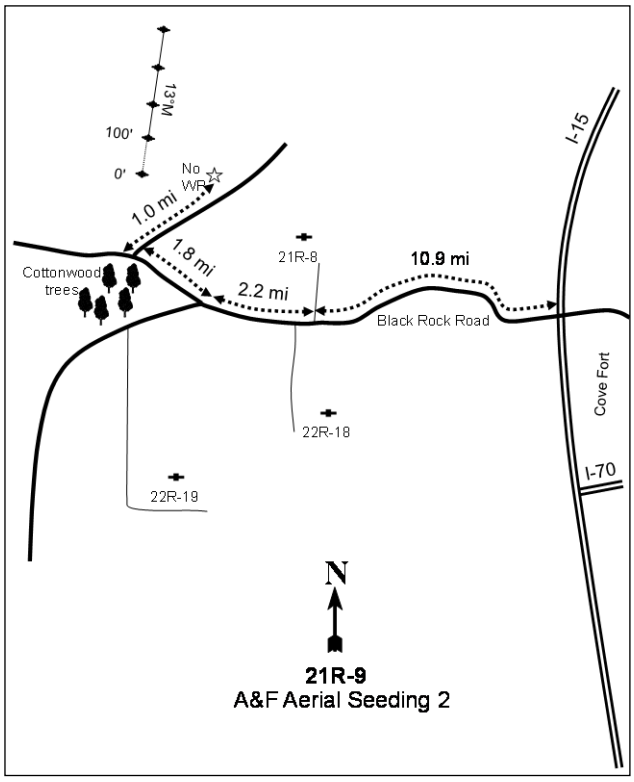
Vegetation Type: Grassland
Range Type: Deer Winter
NRCS Ecological Site Description: Desert Loam (Shadscale), R028AY124UT
Land Ownership: Private
Elevation: 5,172 ft. (1,576 m)
Aspect: East
Slope: 9%
Transect bearing: 13° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
Take the Cove Fort exit on I-15 and proceed west on Black Rock Road 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) (10.9 miles total from Cove Fort). 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



Diagrammatic Sketch:



Township: 25S Range: 9W Section: 3

GPS: NAD 83, UTM 12T 338402 E 4281119 N

A&F AERIAL SEEDING 2 (GIP) - WRI STUDY 21R-9
Project #1010

Site Description

Site Information: The study is located approximately seven miles southeast of Black Rock, in a grassy flat, north of Antelope Mountain, north of Cove Spring, on private land. Following treatment, 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 aerial seeded portion of the project. The seeded area was rested from livestock grazing for two growing seasons following the treatment. The objectives of the project are to reestablish vegetation through reseeding efforts following the wildfire of 2007, and rehabilitate crucial wildlife and livestock habitat (WRI Database 2012). Wildlife or livestock pellet groups were nearly absent in 2008, though quadrat frequency of rabbit pellets was high. In 2011, deer/pronghorn pellet groups were sampled in low abundance (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*), pricklypear cactus (*Opuntia sp.*), and Nevada ephedra (*Ephedra nevadensis*) occurred in low abundance on the site. Winterfat (*Ceratoides lanata*) and broom snakeweed (*Gutierrezia sarothrae*) were also sampled, but only in the height/crown measurements (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and diverse on the site. The invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species and provides the majority of the cover on the site. The most common perennial grass species on the site are needle-and-thread (*Stipa comata*) and Indian ricegrass (*Oryzopsis hymenoides*). Crested wheatgrass (*Agropyron cristatum*) was the only seeded grass species sampled on the site following the seeding treatment. Other less common perennial grass species sampled on the site include purple three-awn (*Aristida purpurea*), Sandberg bluegrass (*Poa secunda*), sand dropseed (*Sporobolus cryptandrus*), and galleta (*Hilaria jamesii*). Perennial forbs are uncommon on the site. Scarlet globemallow (*Sphaeralcea grossulariifolia*) is the most common perennial forb sampled on the site. Weedy annual forb species comprise the majority of the forb species sampled on the site and include desert

madwort (*Alyssum desertorum*), tumblemustard (*Sisymbrium altissimum*), bur buttercup (*Ranunculus testiculatus*), and Russian thistle (*Salsola iberica*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Penoyer component, which is found on valley floors and alluvial fans. The parent material consists of alluvium derived from basic igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is moderate amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Trend Assessments

Browse

- **2008 to 2011 - stable (0):** Browse species remained limited on the site. Green ephedra decreased in density 71% from 480 plants/acre to 140 plants/acre, though cover remained similar at 1%.

Grasses

- **2008 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased more than two-fold, and cover increased from 2% to 7%. Needle-and-thread remained similar in nested frequency, though cover increased from 1% to 3%. Indian ricegrass, purple three-awn, and bottlebrush squirreltail increased significantly in nested frequency, and cover increased to 1%. The invasive annual grass species cheatgrass increased significantly in nested frequency, and cover increased from less than 2% cover to 12%.

Forbs

- **2008 to 2011 - slightly down (-1):** Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs increased more than three-fold, and cover increased from 6% to 12%. Tumble mustard increased significantly in nested frequency, and cover increased from less than 1% to 6%. Bur buttercup and Russian thistle increased significantly in nested frequency, though each species remained similar in cover at 1%. Scarlet globemallow remained similar in nested frequency, but cover increased to 1%.

HERBACEOUS TRENDS--
Management unit 21R, Study no: 9

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	-	2	-	.15
G	Aristida purpurea	a4	b10	.03	.51
G	Bromus tectorum (a)	a275	b371	1.52	12.19
G	Hilaria jamesii	16	34	.51	.91
G	Oryzopsis hymenoides	a8	b36	.21	1.20
G	Poa secunda	-	3	-	.00
G	Sitanion hystrix	a13	b52	.05	.67
G	Sporobolus cryptandrus	-	14	-	.60
G	Stipa comata	43	41	1.32	3.11
G	Unknown grass - perennial	1	-	.00	-
Total for Annual Grasses		275	371	1.52	12.19
Total for Perennial Grasses		85	192	2.15	7.19

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
Total for Grasses		360	563	3.67	19.38
F	Alyssum desertorum (a)	$_{a}$8	$_{b}$174	.05	1.10
F	Astragalus lentiginosus	-	2	-	.03
F	Cryptantha gracilis (a)	$_{a}$-	$_{b}$19	-	.25
F	Eriogonum cernuum (a)	$_{a}$23	$_{b}$134	.46	.64
F	Erodium cicutarium (a)	$_{b}$127	$_{a}$33	1.72	.48
F	Gilia sp. (a)	$_{a}$-	$_{b}$76	-	.27
F	Halogeton glomeratus (a)	3	-	.00	-
F	Lactuca serriola (a)	-	1	-	.00
F	Lappula occidentalis (a)	$_{a}$4	$_{b}$76	.01	.44
F	Lygodesmia sp.	1	6	.03	.07
F	Mentzelia albicaulis (a)	$_{b}$125	$_{a}$76	2.09	.31
F	Phlox longifolia	-	7	-	.02
F	Ranunculus testiculatus (a)	$_{a}$3	$_{b}$122	.01	1.13
F	Salsola iberica (a)	$_{a}$24	$_{b}$274	1.66	1.24
F	Sisymbrium altissimum (a)	$_{a}$28	$_{b}$201	.35	5.92
F	Sphaeralcea grossulariifolia	8	14	.22	1.30
Total for Annual Forbs		345	1186	6.38	11.82
Total for Perennial Forbs		9	29	0.25	1.43
Total for Forbs		354	1215	6.64	13.26

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

BROWSE TRENDS--
Management unit 21R, Study no: 9

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Chrysothamnus viscidiflorus	1	0	.03	-
B	Ephedra nevadensis	3	3	.15	.18
B	Opuntia sp.	0	1	-	-
Total for Browse		4	4	0.18	0.17

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 9

Species	Percent Cover '08	Percent Cover '11
Ephedra nevadensis	.43	.51

BASIC COVER--
Management unit 21R, Study no: 9

Cover Type	Average Cover % '08	'11
Vegetation	12.82	34.97
Rock	5.80	10.24
Pavement	48.83	16.44
Litter	10.76	21.95
Cryptogams	0	.39
Bare Ground	35.24	22.14

SOIL ANALYSIS DATA --
Management unit 21R, Study no: 9, Study Name: A&F Aerial Seeding 2

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	'11	Days use per acre (ha) '08	'11
Rabbit	68	7	-	-
Cattle	-	1	-	-
Deer/pronghorn	-	-	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 9

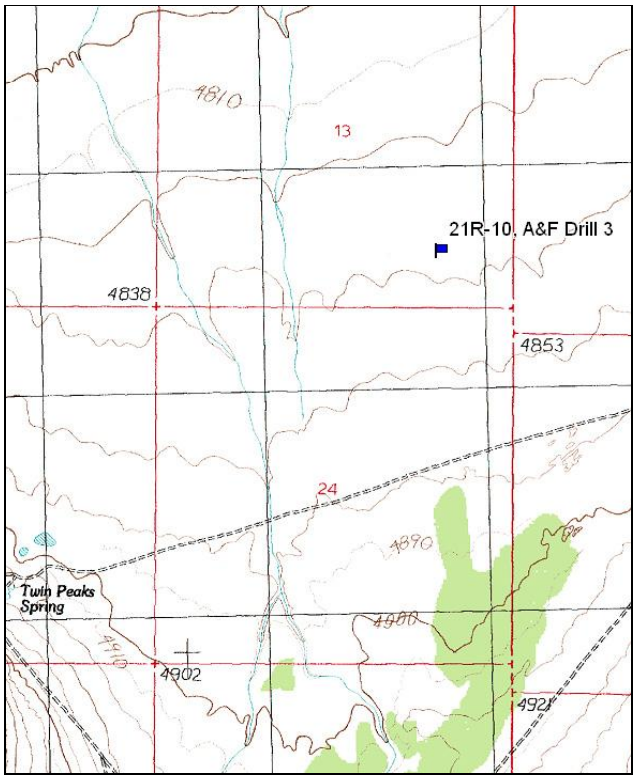
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Ceratoides lanata									
08	**0**	0	0	-	-	0	0	0	9/16
11	**0**	0	0	-	-	0	0	0	-/-
Chrysothamnus viscidiflorus									
08	**40**	100	0	-	-	0	0	100	-/-
11	**0**	0	0	-	-	0	0	0	9/13
Ephedra nevadensis									
08	**480**	0	100	-	-	0	0	75	10/19
11	**140**	0	100	-	-	100	0	0	19/29
Gutierrezia sarothrae									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	11/17
Opuntia sp.									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	0	100	-	-	0	0	0	6/11

A&F DRILL 3 (GIP) - TREND STUDY NO. 21R-10-11
Project #1006

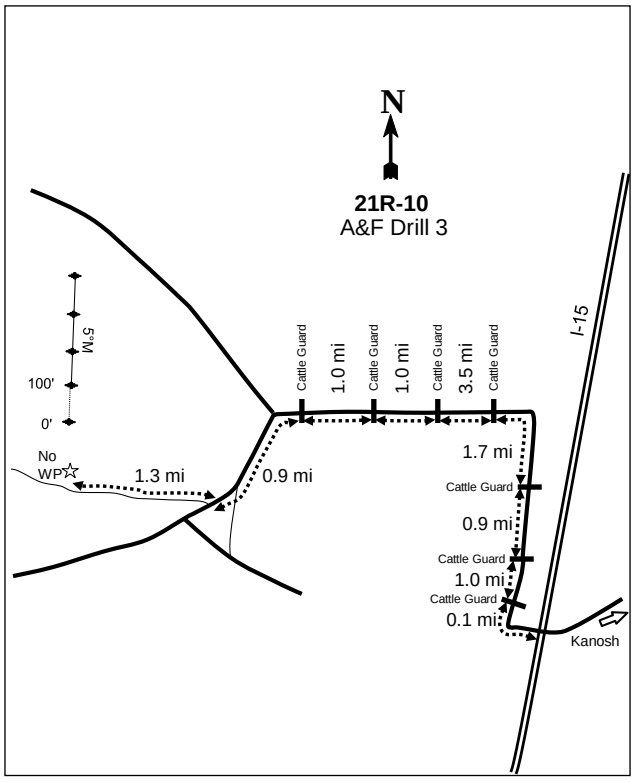
Vegetation Type: Annual forb and annual grass
Range Type: Deer Winter
NRCS Ecological Site Description: Desert Loam (Shadscale), R028AY124UT
Land Ownership: Private
Elevation: 4,842 ft. (1,476 m)
Aspect: Flat
Slope: 0%
Transect bearing: 5° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), 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 mile 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



Diagrammatic Sketch:



Township: 23S Range: 8W Section: 13

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, within a flat dominated by weedy annual species, northwest of Lava Ridge, on private land. Following treatment, 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 seeded area was rested from livestock grazing for two growing seasons following the treatment. 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 2012). Pellet group data estimated little to no use by wildlife or livestock in 2008. In 2011, use was estimated to be light for cattle (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. In 2011, a high number of forage kochia seedlings were sampled on the site. Shadscale (*Atriplex confertifolia*) was sampled on the site in 2011 in height/crown measurements (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is in poor condition. Perennial grass species are rare on the site. Needle-and-thread (*Stipa comata*) and an unidentified perennial species of grass were the only perennial grass specie sampled on the site in 2008, though each species was very rare. In 2011, crested wheatgrass (*Agropyron cristatum*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*) were the only perennial grasses sampled, and each species provided little cover on the site. Seeded species sampled on the site include crested wheatgrass and Indian ricegrass. The invasive annual grass species cheatgrass (*Bromus tectorum*) increased in abundance on the site, and provided the majority of the cover in 2011. Forbs are abundant, but are not overly diverse, and are dominated by weedy annual forb species. Perennial forb species are rare on the site. The weedy annual forb species Russian thistle (*Salsola iberica*), tumble mustard (*Sisymbrium altissimum*), pinnate tansymustard (*Descurainia pinnata*), desert

madwort (*Alyssum desertorum*), and bur buttercup (*Ranunculus testiculatus*) are the dominant forb species on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Thiokol component, which is found on lake terraces. The parent material consists of lacustrine deposits. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer. The soil surface texture is a silt loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is moderate amount of litter and high amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011, but it was noted in 2008 that wind had eroded up to two and half inches of soil from the site after the burn.

Trend Assessments

Browse

- **2008 to 2011 - slightly up (+1):** Browse species remained limited on the site. Forage kochia increased in density from 60 plants/acre to 720 plants/acre, though cover remained minimal on the site.

Grasses

- **2008 to 2011 - slightly down (-1):** Perennial grasses remained rare on the site. The invasive annual grass species cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 8%.

Forbs

- **2008 to 2011 - slightly down (-1):** Perennial forbs remained rare on the site. The sum of nested frequency of annual forbs increased more than eight-fold, and cover increased from 16% to 34%. Tumble mustard, pinnate tansymustard, and bur buttercup were sampled for the first time in 2011 and provided 10%, 3%, and 2% cover, respectively. Russian thistle increased significantly in nested frequency, though cover decreased from 15% to 3%. Desert madwort increased in nested frequency, and cover increased from less than 1% to 15%.

HERBACEOUS TRENDS--
Management unit 21R, Study no: 10

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	-	7	-	.73
G	Bromus tectorum (a)	a11	b253	.02	7.70
G	Oryzopsis hymenoides	-	4	-	.18
G	Sitanion hystrix	-	8	-	.01
G	Stipa comata	1	-	.00	-
G	Unknown grass - perennial	b12	a-	.03	-
Total for Annual Grasses		11	253	0.02	7.70
Total for Perennial Grasses		13	19	0.03	0.93
Total for Grasses		24	272	0.06	8.64
F	Alyssum desertorum (a)	a75	b370	.34	15.04
F	Amaranthus albus	2	-	.03	-
F	Descurainia pinnata (a)	a-	b149	-	2.89
F	Erodium cicutarium (a)	-	5	-	.01
F	Halogeton glomeratus (a)	18	15	.35	.06

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Malcolmia africana	$_{a}$-	$_{b}$17	-	.14
F	Mentzelia albicaulis (a)	$_{a}$-	$_{b}$65	-	.71
F	Ranunculus testiculatus (a)	$_{a}$-	$_{b}$161	-	1.92
F	Salsola iberica (a)	$_{a}$62	$_{b}$313	14.85	3.30
F	Sisymbrium altissimum (a)	$_{a}$-	$_{b}$238	-	10.23
Total for Annual Forbs		155	1316	15.55	34.20
Total for Perennial Forbs		2	17	0.02	0.13
Total for Forbs		157	1333	15.58	34.34

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	'11	Average Cover % '08	'11
B	Kochia prostrata	3	11	-	.27
Total for Browse		3	11	0	0.27

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 10

Species	Percent Cover '08	'11
Kochia prostrata	-	.18

BASIC COVER--
Management unit 21R, Study no: 10

Cover Type	Average Cover % '08	'11
Vegetation	17.20	40.46
Pavement	.87	.01
Litter	2.11	19.09
Cryptogams	0	.03
Bare Ground	89.47	46.79

PELLET GROUP DATA--
Management unit 21R, Study no: 10

Type	Quadrat Frequency '08	'11
Rabbit	-	1
Cattle	-	-

Days use per acre (ha) '08	'11
-	-
-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 10

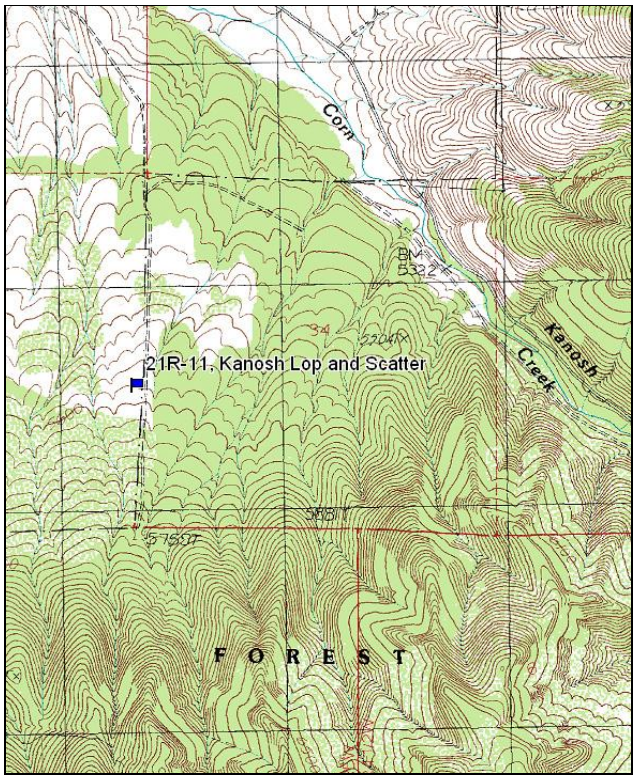
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Atriplex confertifolia									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	3/6
Kochia prostrata									
08	**60**	67	33	-	-	0	0	0	5/11
11	**720**	64	36	-	5620	3	0	0	12/16

KANOSH LOP AND SCATTER - TREND STUDY NO. 21R-11-11
Project #408

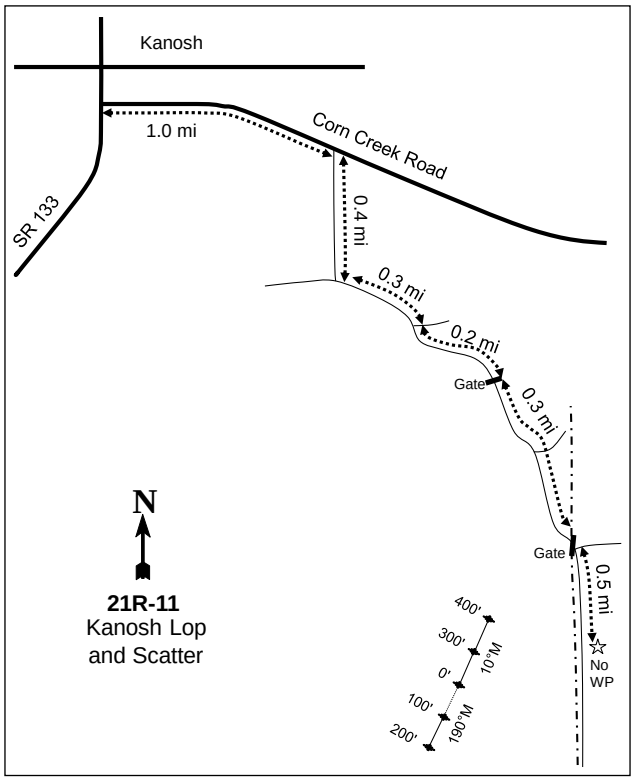
Vegetation Type: Mountain Brush
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R028AY334UT
Land Ownership: UDWR
Elevation: 5,598 ft. (1,706 m)
Aspect: Northwest
Slope: 13%
Transect bearing: 190° magnetic (0ft to 200ft) 10° magnetic (0ft to 400ft)
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

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



Diagrammatic Sketch:



Township: 23S Range: 5W Section: 33

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*) trees south of Corn Creek. Prior to the treatment, the study was established in 2008 to monitor a lop and scatter treatment on the Kanosh (Corn Creek) Unit within 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 have been 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 productive 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 2012). Part of the study transect was not treated, and untreated sample transects were moved within the treated portion of the project area in 2011. Pellet groups were sampled in very high abundance for deer in 2008 and 2011, low abundance for elk in 2008, moderate abundance for elk in 2011, and low abundance for cattle in 2011 (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*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), Gambel oak (*Quercus gambelii*), skunk bush (*Rhus trilobata*), and current (*Ribes sp*.). The key browse species are mountain big sagebrush and antelope bitterbrush. The mountain big sagebrush is a moderately used population, with moderate decadence and good vigor within the population; though prior to treatment decadence and poor vigor were high. The recruitment of young sagebrush plants to the population has been poor since the outset of the study. The antelope bitterbrush is a moderately used population, with moderate decadence and good vigor within the population; though prior to treatment decadence and poor vigor were high. The utilization of Gambel oak, skunk bush, and current has been mostly light over the sampled years (Table - Browse Characteristics). Prior to the lop and scatter treatment, Utah juniper were common on the site; however, following the treatment juniper trees were not common within the treatment area (Table - Point-Quarter Data). The stage of woodland succession was in Phase II prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are abundant and moderately diverse; however, the invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species on the site. Sandberg bluegrass (*Poa secunda*), crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), bluebunch wheatgrass (*A. spicatum*), and bottle brush squirreltail (*Sitanion hystrix*) were common perennial grass species sampled on the site. Other grass species sampled on the site include western wheatgrass (*Agropyron smithii*), smooth brome (*Bromus inermis*), the weedy annual species Japanese chess (*B. japonicus*), sheep fescue (*Festuca ovina*), and the weedy perennial species bulbous bluegrass (*Poa bulbosa*). Forbs are moderately abundant and diverse on the site. Perennial forbs are rare on the site. The annual forb species pale alyssum (*Alyssum alyssoides*) has increased in abundance on the site since the outset of the study and provided the majority of the forb cover in 2011 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Current Spring-Maple Hollow complex. The parent material consists of alluvium and colluvium from limestone, sandstone, and quartzite. The soils within this classification are characterized as deep, well drained, and with a slightly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 6.6) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Two Year Post Treatment, 2008 vs. 2011

Browse: The density of Wyoming big sagebrush increased 42% from 1,580 plants/acre to 2,240 plants/acre, and canopy cover increased from 11% to 20%. The health of the sagebrush population improved with decadence decreasing from 66% to 22% of the population, and plants displaying poor vigor decreasing from 49% to 2%. The density of antelope bitterbrush increased 32% from 560 plants/acre to 740 plants/acre, and canopy cover increased from 11% to 22%. The health of the bitterbrush population improved with decadence decreasing from 57% to 19% of the population, and plants displaying poor vigor decreasing from 54% to 5%. Skunk bush increased in canopy cover from 1% to 3%. The density of Utah juniper trees decreased from 220 trees/acre with an average diameter of 5.3 inches to 27 trees/acre with an average diameter of 3.7 inches. Canopy cover of juniper trees decreased from 19% to 0%.

Grasses: The sum of nested frequency of perennial grasses increased 52%, and cover increased from 7% to 17%. Sandberg bluegrass and bottlebrush squirreltail remained similar in nested frequency, though cover increased from 3% to 4% and 1% to 4%, respectively. Crested wheatgrass and bluebunch wheatgrass increased significantly in nested frequency, and cover increased from 1% to 4% and 1% to 3%, respectively. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increase from 4% to 14%.

Forbs: The sum of nested frequency of perennial forbs increased 32%, though cover decreased from 2% to 1%. The sum of nested frequency for annual forbs increased four-fold, and cover increased from less than 1% to 7%. Pale alyssum increased significantly in nested frequency, cover increased from less than 1% to 4% cover.

HERBACEOUS TRENDS--
Management unit 21R, Study no: 11

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a24	b57	1.00	3.75
G	Agropyron intermedium	22	20	1.39	1.06
G	Agropyron smithii	-	5	-	.15
G	Agropyron spicatum	a14	b81	.91	3.43
G	Bromus inermis	-	3	-	.03
G	Bromus japonicus (a)	a-	b57	-	2.02
G	Bromus tectorum (a)	a310	b365	4.23	13.64
G	Festuca ovina	b22	-	.06	-
G	Poa bulbosa	a-	b22	-	.33
G	Poa secunda	157	201	2.47	4.27
G	Sitanion hystrix	77	92	1.33	3.78
Total for Annual Grasses		310	422	4.23	15.67
Total for Perennial Grasses		316	481	7.18	16.84
Total for Grasses		626	903	11.41	32.51
F	Agoseris glauca	-	2	-	.00
F	Allium sp.	-	1	-	.00
F	Alyssum alyssoides (a)	a104	b264	.32	4.38
F	Antennaria rosea	-	1	-	.00
F	Arenaria sp.	b20	a-	1.62	-
F	Astragalus sp.	10	5	.16	.04
F	Calochortus nuttallii	a-	b27	-	.12
F	Collinsia parviflora (a)	a12	b79	.02	.93

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Draba sp. (a)	-	9	-	.01
F	Epilobium brachycarpum (a)	-	8	-	.01
F	Eriogonum racemosum	1	3	.00	.03
F	Eriogonum umbellatum	5	1	.04	.03
F	Erodium cicutarium (a)	$_{a}$-	$_{b}$15	-	.10
F	Galium aparine (a)	$_{a}$-	$_{b}$33	-	.89
F	Holosteum umbellatum (a)	$_{a}$-	$_{b}$82	-	.35
F	Lactuca serriola (a)	$_{a}$-	$_{b}$50	-	.32
F	Linum lewisii	$_{a}$-	$_{b}$22	-	.21
F	Lithospermum ruderale	2	1	.03	.38
F	Microsteris gracilis (a)	5	1	.03	.00
F	Montia perfoliata (a)	-	10	-	.09
F	Orogenia linearifolia	-	6	-	.01
F	Phlox longifolia	15	14	.08	.17
F	Polygonum douglasii (a)	8	-	.02	-
F	Ranunculus testiculatus (a)	$_{b}$10	$_{a}$5	.04	.01
F	Unknown forb-annual (a)	-	3	-	.03
F	Zigadenus paniculatus	16	8	.21	.27
Total for Annual Forbs		139	559	0.43	7.15
Total for Perennial Forbs		69	91	2.15	1.29
Total for Forbs		208	650	2.59	8.44

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

BROWSE TRENDS--
Management unit 21R, Study no: 11

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia tridentata vaseyana	57	66	8.42	15.10
B	Gutierrezia sarothrae	6	8	.33	.41
B	Juniperus osteosperma	9	0	7.98	-
B	Purshia tridentata	19	27	6.57	9.57
B	Quercus gambelii	5	0	.49	-
B	Rhus trilobata	1	1	1.00	1.36
B	Ribes sp.	1	0	.38	-
Total for Browse		98	102	25.19	26.45

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 11

Species	Percent Cover	
	'08	'11
Artemisia tridentata vaseyana	10.50	19.96
Gutierrezia sarothrae	.11	.10
Juniperus osteosperma	19.29	-
Purshia tridentata	10.39	22.20
Quercus gambelii	2.20	-
Rhus trilobata	1.08	3.03
Ribes sp.	.48	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 21R, Study no: 11

Species	Average leader growth (in)	
	'08	'11
Artemisia tridentata vaseyana	0.9	2.0
Purshia tridentata	6.4	2.1

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 11

Species	Trees per Acre		Average diameter (in)	
	'08	'11	'08	'11
Juniperus osteosperma	220	27	5.3	3.7

BASIC COVER--
Management unit 21R, Study no: 11

Cover Type	Nested Frequency		Average Cover %	
	'08	'11	'08	'11
Vegetation	413	481	42.48	60.97
Rock	100	88	3.92	2.97
Pavement	147	75	6.14	2.32
Litter	453	457	58.27	52.18
Cryptogams	85	53	1.16	1.12
Bare Ground	168	85	11.80	4.91

SOIL ANALYSIS DATA --
Management unit 21R, Study no: 11, Study Name: Kanosh L&S

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 '08	'11	Days use per acre (ha) '08	'11
Rabbit	30	4	-	-
Elk	1	7	1 (2)	23 (58)
Deer	44	31	203 (501)	141 (349)
Cattle	-	-	-	2 (5)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 11

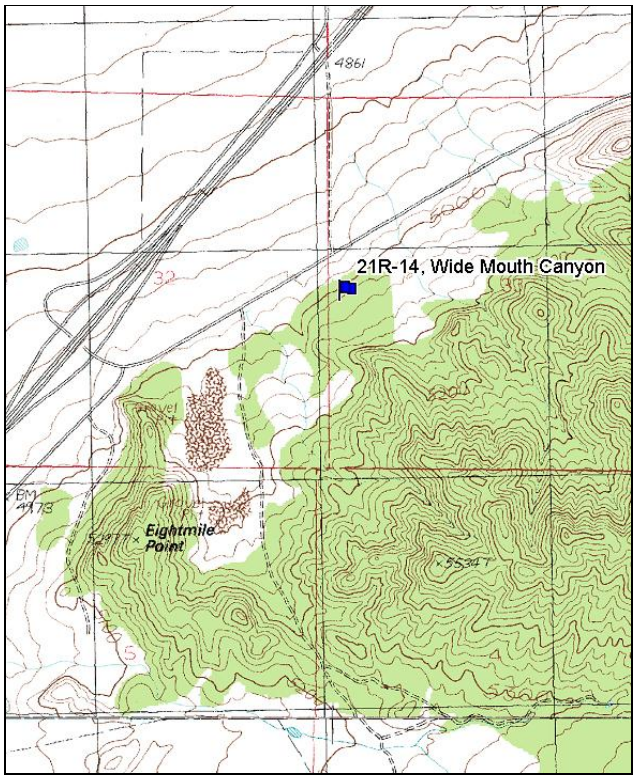
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
08	**1580**	0	34	66	-	13	4	49	23/34
11	**2240**	3	75	22	80	49	4	2	36/42
Chrysothamnus viscidiflorus									
08	**0**	0	0	-	-	0	0	0	11/23
11	**0**	0	0	-	-	0	0	0	11/23
Cowania mexicana stansburiana									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	81/87
Gutierrezia sarothrae									
08	**160**	0	75	25	-	0	0	13	9/12
11	**220**	36	64	0	120	0	0	0	10/13
Juniperus osteosperma									
08	**180**	0	100	-	20	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Purshia tridentata									
08	**560**	0	43	57	-	79	7	54	37/66
11	**740**	3	78	19	-	76	3	5	41/68
Quercus gambelii									
08	**280**	7	93	-	-	0	0	0	35/25
11	**0**	0	0	-	-	0	0	0	-/-
Rhus trilobata									
08	**40**	0	50	50	-	0	0	50	35/51
11	**20**	0	100	0	-	0	0	0	46/90
Ribes sp.									
08	**20**	0	0	100	-	0	0	0	37/118
11	**0**	0	0	0	-	0	0	0	-/-
Tetradymia canescens									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	19/52

WIDEMOUTH CANYON - WRI STUDY 21R-14-11
Project #1972

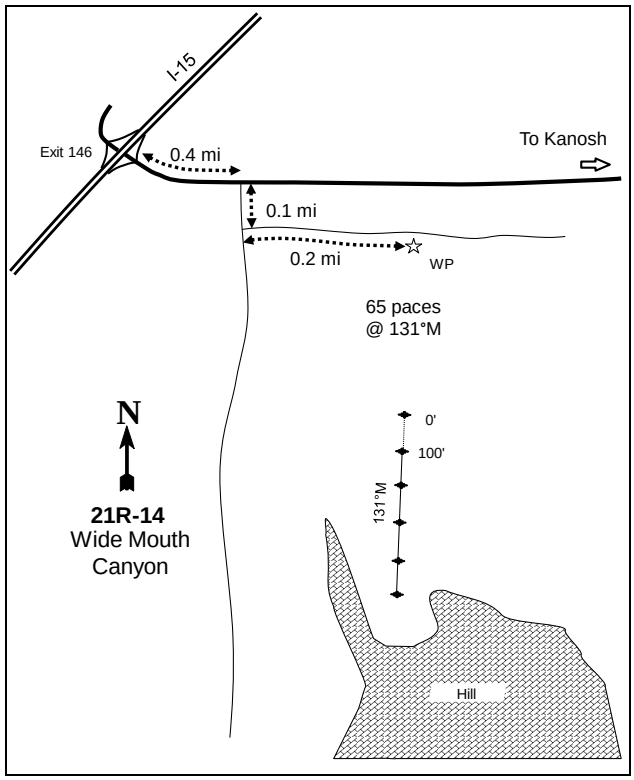
Vegetation Type: Pinyon and Juniper Woodland
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R028AY334UT
Land Ownership: Private
Elevation: 4,953 ft (1,509 m)
Aspect: Northwest
Slope: 6%
Transect bearing: 131° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: Take exit 146 on from I-15 and travel east towards Kanosh. Drive 0.4 miles to a gravel road on the right side of the road (south). Turn right and travel south on gravel road for 0.1 miles to a two track road on the left side of the road (east). Turn left and travel 0.2 miles to the witness post. The 0-foot stake is 65 paces at a bearing of 131 degrees magnetic and is marked with browse tag #146.

Map Name: Sixmile Point



Diagrammatic Sketch:



Township: 23S Range: 6W Section: 33

GPS: NAD 83, UTM 12S 366025 E 4291977 N

WIDEMOUTH CANYON - WRI STUDY 21R-14
Project #1972

Site Description

Site Information: The study is located approximately eleven and half miles southwest of Meadow, within a pinyon pine (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*) woodland, northeast of Eightmile Point, on private land. Prior to treatment, the study was established in 2011 to monitor the effects of a two-way chaining project. In the fall of 2011, approximately 500 acres were one-way Ely chained and back chained with a smooth chain. Seed dribblers were used during the back chaining to seed browse species. In between chaining passes, a seed mix of grass and forb species was aerially seeded over the project area (Table - Seed Mix). An aerial application of plateau (Imazapic) herbicide was applied to the project area to control the growth of cheatgrass (*Bromus tectorum*). In February of 2012, a seed mix of forb and browse species was aerially applied to the project area (Table - Seed Mix). Following the treatment, livestock grazing will be suspended for two growing seasons to allow grass and forb species to establish. The objectives of the project are to increase habitat quality and quantity for wintering big game and livestock, increase forage value and improved range utilization for wildlife and livestock, and decrease invasive plant species such as cheatgrass through chemical treatment (WRI Database 2012). Deer, elk, and cattle pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 21R, Study no: 14

Project Name: Widemouth Canyon Chaining Phase III
WRI Database #: 1972

Application: Aerial Seed		Acres:	240	Application: Dribbler		Acres:	240
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Bluebunch Wheatgrass 'Anatone'	500	2.08	B	Bitterbrush	30	0.13
G	Bottlebrush Squirreltail	250	1.04	B	Fourwing Saltbush	60	0.25
G	Canby Bluegrass 'Canbar'	100	0.42	B	Stansbury Cliffrose	30	0.13
G	Crested Wheatgrass 'Hycrest II'	500	2.08	Total Pounds:		120	0.50
G	Indian Ricegrass 'Nezpar'	350	1.46	PLS Pounds:			0.27
G	Sandberg Bluegrass	150	0.63				
G	Thickspike Wheatgrass 'Critana'	450	1.88				
F	Alfalfa 'Nomad'	250	1.04				
F	Blue Flax 'Appar'	50	0.21				
F	Small Burnet 'Delar'	500	2.08				
F	Western Yarrow 'Eagle Mountain'	25	0.10				
Total Pounds:		3125	13.02				
PLS Pounds:			11.51				

Browse: Prior to the treatment, a moderately dense, mature population of Utah juniper was the dominant browse species and provided the majority of canopy cover on the site (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009). The preferred browse species on the site are Wyoming big sagebrush (*Artemisia tridentata*) and green ephedra (*Ephedra viridis*). Wyoming big sagebrush is the dominant preferred browse species, which provides the majority of the shrub cover on the site. The Wyoming big sagebrush is a relatively small population, with high decadence and moderate vigor within the population. Utilization of sagebrush plants was mostly moderate. The recruitment of young sagebrush plants to the population was poor in 2011. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), prickly phlox (*Leptodactylon pungens*), pricklypear cactus (*Opuntia sp.*), and littleleaf horsebrush (*Tetradymia glabrata*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and fairly diverse on the site. Cheatgrass is the dominant grass species on the site and provides the majority of the grass cover. The most common perennial grass species are purple three-awn (*Aristida purpurea*), galleta (*Hilaria jamesii*), and Sandberg bluegrass (*Poa secunda*). Other grass species sampled on the site include the weedy species bulbous bluegrass (*Poa bulbosa*), mutton blue grass (*P. fendleriana*), needle-and-thread (*Stipa comata*), and sixweeks fescue (*Festuca octoflora*). Forbs are moderately diverse, but not overly abundant on the site. Perennial forbs are rare on the site. Annual forb species comprise the majority of the forb component. No single forb species dominants the forb understory (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Donnardo component, which is found on fan remnants. The parent material consists of alluvium from limestone and sandstone. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer. The soil surface texture is a very stony loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a high amount of vegetation and a moderate amount of pavement and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 21R, Study no: 14

Type	Species	Nested Frequency '11	Average Cover % '11
G	Aristida purpurea	111	4.17
G	Bromus tectorum (a)	460	28.56
G	Hilaria jamesii	56	1.30
G	Poa bulbosa	1	.00
G	Poa fendleriana	1	.00
G	Poa secunda	215	3.76
G	Stipa comata	12	.26
G	Vulpia octoflora (a)	158	.52
Total for Annual Grasses		618	29.08
Total for Perennial Grasses		396	9.52
Total for Grasses		1014	38.60
F	Allium acuminatum	13	.03
F	Alyssum desertorum (a)	26	.14
F	Calochortus nuttallii	3	.00
F	Collinsia parviflora (a)	21	.18
F	Eriastrum sparsiflorum (a)	3	.03
F	Eriogonum cernuum (a)	1	.00
F	Erodium cicutarium (a)	60	.61
F	Holosteum umbellatum (a)	77	.25
F	Lactuca serriola (a)	9	.02
F	Lygodesmia grandiflora	2	.00
F	Phlox longifolia	8	.16
F	Plantago patagonica (a)	122	.52
F	Ranunculus testiculatus (a)	12	.39
Total for Annual Forbs		331	2.16
Total for Perennial Forbs		26	0.20
Total for Forbs		357	2.37

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

BROWSE TRENDS--
Management unit 21R, Study no: 14

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata wyomingensis	33	3.67
B	Ephedra nevadensis	1	-
B	Gutierrezia sarothrae	1	-
B	Juniperus osteosperma	2	5.44
B	Leptodactylon pungens	11	.30
B	Opuntia sp.	4	.03
Total for Browse		52	9.46

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 14

Species	Percent Cover '11
Artemisia tridentata wyomingensis	7.51
Gutierrezia sarothrae	.10
Juniperus osteosperma	13.66
Leptodactylon pungens	.13

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 21R, Study no: 14

Species	Average leader growth (in) '11
Artemisia tridentata wyomingensis	1.5

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 14

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	35	14.3

BASIC COVER--
Management unit 21R, Study no: 14

Cover Type	Average Cover % '11
Vegetation	50.70
Rock	.19
Pavement	20.64
Litter	30.73
Cryptogams	5.56
Bare Ground	2.41

PELLET GROUP DATA--
Management unit 21R, Study no: 14

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	9	-
Elk	1	1 (3)
Deer	20	13 (33)
Cattle	4	1 (2)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 14

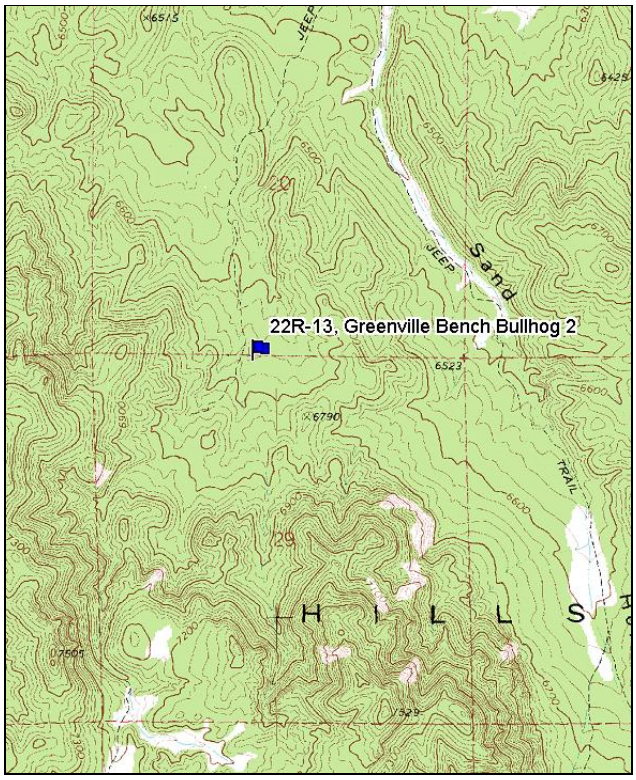
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
11	**840**	2	64	33	-	50	5	10	24/38
Chrysothamnus viscidiflorus									
11	**0**	0	0	-	-	0	0	0	14/20
Ephedra nevadensis									
11	**20**	0	0	100	-	0	0	0	21/47
Gutierrezia sarothrae									
11	**20**	0	100	-	-	0	0	0	9/11
Juniperus osteosperma									
11	**40**	0	100	-	20	0	0	0	-/-
Leptodactylon pungens									
11	**240**	0	50	50	20	0	0	0	8/14
Opuntia sp.									
11	**80**	0	75	25	-	0	0	0	7/13
Tetradymia glabrata									
11	**0**	0	0	-	-	0	0	0	18/31

GREENVILLE BENCH BULLHOG 2 - WRI STUDY 22R-13-11
Project #993

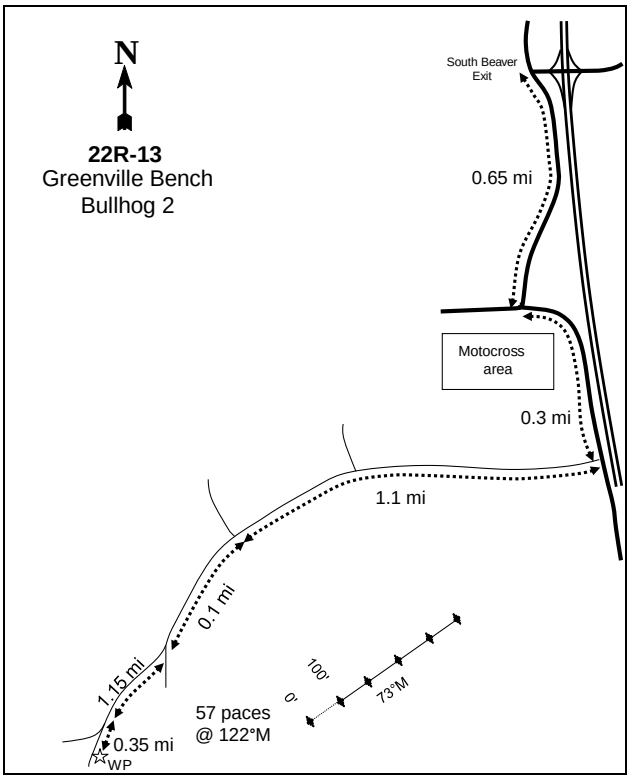
Vegetation Type: Grass and Forb
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Not available
Land Ownership: BLM
Elevation: 6,600 ft (2,011 m)
Aspect: North
Slope: 6%
Transect bearing: 73° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: Take Exit 109 off of I-15 and go west on the overpass toward a Chevron Station. From the Chevron Station, head south on 600 West for 0.7 miles. Turn left before the motocross area. Stay on the most road to where the road turns more south. From here travel 2.0 miles to a road coming in on the right. Turn onto this road and travel 1.1 miles to a fork. Stay left and travel 0.1 miles to another fork. Go right 1.15 miles to another fork. Go left 0.5 miles on a small two-track in the bottom of a drainage to a witness post. The 0-foot stake is 57 paces from the witness post at 122 degrees magnetic, and is marked with browse tag #112.

Map Name: Greenville Bench



Diagrammatic Sketch:



Township: 30S Range: 7W Section: 29

GPS: NAD 83, UTM 12S 353847 E 4226732 N

GREENVILLE BENCH BULLHOG 2 - WRI STUDY 22R-13
Project #993

Site Description

Site Information: The study is located approximately five miles south of Beaver, within a treated pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, on the north end of the South Hills. The area is administrated by the Bureau of Land Management (BLM) as part of the Bald Hills allotment. Prior to treatment, the study was established in 2007 to monitor the effects of a bullhog treatment project. The study area appears to be bullhogged in 2008 or 2009. The bullhog project was a BLM project. In July of 2007, the Greenville fire burned 14,716 acres. In the fall of 2007, approximately 11,065 acres were aerially seeded within the burned regions of the Greenville fire and a small portion of unburned area. The study is located within the unburned area which was seeded (Table - Seed Mix). The objectives of the project were to increase shrubs and forage for wildlife (WRI Database 2012). Elk pellet groups were sampled in low abundance in 2007. Deer pellet groups have been sampled in low abundance since 2007 (Table - Pellet Group Data).

SEED MIX--
Management unit 22R, Study no: 13

Project Name: Greenville Bench Mix #1 WRI Database #: 993				Project Name: Greenville Bench Mix #2 WRI Database #: 993			
Application: Aerial Seed		Acres:	10860	Application: Aerial Seed		Acres:	4030
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	*†Bluebunch Wheatgrass 'P-7'	6750	0.62	G	†Bluebunch Wheatgrass 'P-7'	3250	0.81
G	*Bottlebrush Squirreltail	200	0.02	G	*†Bottlebrush Squirreltail 'Toe Jam'	1300	0.32
G	†Canby Bluegrass 'Canbar'	1100	0.10	G	†Canby Bluegrass 'Canbar'	1750	0.43
G	†Crested Wheatgrass 'Nordan'	11000	1.01	G	†Crested Wheatgrass 'Hycrest'	4050	1.00
G	*Indian Ricegrass 'Rimrock'	5750	0.53	G	*Indian Ricegrass	1250	0.31
G	*Intermediate Wheatgrass 'Rush'	4200	0.39	G	*Intermediate Wheatgrass 'Rush'	1050	0.26
G	†Orchardgrass 'Paiute'	2100	0.19	G	†Orchardgrass 'Paiute'	3900	0.97
G	*†Pubescent Wheatgrass 'Luna'	14150	1.30	G	*†Pubescent Wheatgrass 'Luna'	5050	1.25
G	*Russian Wildrye	450	0.04	G	*Russian Wildrye	150	0.04
G	*Sand Dropseed	150	0.01	G	*Sand Dropseed	150	0.04
G	*Thickspike Wheatgrass 'Bannock'	6750	0.62	G	*Thickspike Wheatgrass 'Bannock'	850	0.21
G	*†Western Wheatgrass 'Arriba'	10750	0.99	G	*†Western Wheatgrass 'Arriba'	3850	0.96
F	†Alfalfa 'Ladak'	10850	1.00	F	*†Alfalfa 'Ladak'	3650	0.91
F	*Blue Flax	250	0.02	F	†Blue Flax 'Maple Grove'	824	0.20
F	*Gooseberryleaf Globemallow	100	0.01	F	*Blue Flax	100	0.02
F	*Ladak Alfalfa	1450	0.13	F	*Gooseberryleaf Globemallow	40	0.01
F	*Palmer Penstemon	390	0.04	F	*†Palmer Penstemon	287	0.07
F	*Small Burnet	3450	0.32	F	†Sainfoin 'Eski'	8100	2.01
F	*Western Yarrow	300	0.03	F	*†Small Burnet 'Delar'	10500	2.61
F	*†Yellow Sweetclover	15150	1.40	F	*Western Yarrow	100	0.02
B	*Antelope Bitterbrush	450	0.04	F	*†Yellow Sweetclover	4000	0.99
B	*Fourwing Saltbush	600	0.06	B	*Fourwing Saltbush	150	0.04
	**SITLA MIX	1600	0.15		**SITLA MIX	540	0.13
Total Pounds:		97940	9.02	Total Pounds:		54891	13.62

* Seed provided by BLM and mixed by GBRC
** Seed provided by SITLA and mixed by GBRC
† Seed provided by UDWR to augment BLM/SITLA seed mix

Browse: The preferred browse species sampled on the site include fringe sagebrush (*Artemisia frigida*), Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*), winterfat (*Ceratoides lanata*), curlleaf mountain mahogany (*Cercocarpus ledifolius*), squaw-apple (*Peraphyllum ramosissimum*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), and elderberry (*Sambucus sp.*). Antelope bitterbrush and Gambel oak provided the majority of the canopy cover on the site following the treatment (Table - Canopy Cover). The antelope bitterbrush is a scattered population with low decadence and good vigor within the population. Utilization of bitterbrush plants has been mostly moderate over the sample years. The recruitment of young bitterbrush plants to the population has been good since the outset of the study. Gambel oak is found in patches across the site. Several other less palatable browse species that have been sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous*), broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia sp.*), and brittle pricklypear (*Opuntia fragilis*) (Table - Browse Characteristics). Prior to the treatment, a dense population of pinyon pine and Utah juniper, but density was greatly reduced following the treatment (Table - Point-Quarter Data). Prior to the treatment, pinyon pine and Utah juniper provided the majority of the canopy cover, but cover was greatly reduced following the treatment (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment and is now considered to be within Phase I (Tausch et al 2009)

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The weedy annual grass species cheatgrass is the dominant grass species and provides the majority of the grass cover on the site. Bottlebrush squirreltail (*Sitanion hystrix*) has been the most common perennial grass species sampled on the site since the outset of the study. Seeded grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*), though each of these species were not very abundant on the site. Forbs are fairly abundant and diverse on the site, but are dominated by annual species. The palatable annual species prickly lettuce (*Lactuca serriola*) was the dominate forb species and provided the majority of the forb cover on the site following the treatment. Seeded forb species sampled on the site following the treatment include Lewis flax (*Linum lewisii*), alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), Palmer penstemon (*Penstemon palmeri*), small burnet (*Sanguisorba minor*), and gooseberryleaf globemallow (*Sphaeralcea grossulariifolia*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Red Butte component, which is found on hills and mountain slopes. The parent material consists of alluvium and colluvium derived from intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). The soil erosion condition was classified as slight due to pedestalling around plants and the presence of flow patterns in 2007 and was classified as stable in 2011.

Pre vs. Three Year Post Treatment, 2007 vs. 2011

Browse: Antelope bitterbrush decreased in density by 11% from 180 plants/acre to 160 plants/acre, though canopy cover increased from less than 1% to 2%. The health of the bitterbrush population improved with decadence decreasing from 11% to 0%, and plants displaying poor vigor decreased from 11% to 0%. Recruitment of young bitterbrush plants remained good within the population at 38%. The density of pinyon pine trees decreased from 245 trees/acre with an average diameter of 2.1 inches to 5 trees/acre with an average diameter of 11.7 inches. The density of Utah juniper trees decreased from 143 trees/acre with an average diameter of 7.6 inches to 12 trees/acre with an average diameter of 7.4 inches. Canopy cover of pinyon and juniper trees decreased from 35% to 0% and 9% to 0%, respectively.

Grasses: The sum of nested frequency of perennial grasses increased substantially, and cover increased from less than 1% to 7%. The majority of the increase in frequency and cover was from bottlebrush squirreltail. Bottlebrush squirreltail increased significantly in frequency and cover increased from less than 0% to 6%. The

weedy annual species cheatgrass increased significantly in nested frequency on the site, and cover increased from less than 1% to 8%.

Forbs: The sum of nested frequency of perennial forbs increased over three fold, and cover increased from less than 1% to 2%. The sum of nested frequency of annual forbs increased substantially, and cover increased from 1% to 21%. The majority of the increase in annual forb frequency and cover was from prickly lettuce, which was sampled for the first time following the treatment at 16% cover.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 13

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
G	Agropyron cristatum	a-	b11	-	.87
G	Agropyron intermedium	-	4	-	.17
G	Agropyron smithii	-	6	-	.12
G	Agropyron spicatum	-	3	-	.06
G	Bromus japonicus (a)	-	4	-	.01
G	Bromus tectorum (a)	a8	b213	.04	7.74
G	Oryzopsis hymenoides	1	3	.03	.03
G	Poa secunda	-	1	-	.00
G	Sitanion hystrix	a13	b170	.06	6.03
G	Vulpia octoflora (a)	-	10	-	.01
Total for Annual Grasses		8	227	0.04	7.77
Total for Perennial Grasses		14	198	0.09	7.30
Total for Grasses		22	425	0.13	15.07
F	Arabis holboellii	4	5	.00	.02
F	Astragalus argophyllus	-	1	-	.03
F	Calochortus nuttallii	-	3	-	.01
F	Chaenactis douglasii	a-	b43	-	.24
F	Cirsium sp.	-	1	-	.03
F	Collinsia parviflora (a)	a-	b21	-	.07
F	Descurainia pinnata (a)	27	41	.07	.17
F	Draba sp. (a)	-	7	-	.01
F	Eriogonum caespitosum	3	5	.06	.18
F	Eriogonum cernuum (a)	b32	a10	.29	.30
F	Eriogonum racemosum	-	-	-	.00
F	Gayophytum ramosissimum(a)	1	12	.00	.02
F	Gilia sp. (a)	a-	b32	-	.06
F	Hackelia patens	-	2	-	.00
F	Lactuca serriola (a)	a-	b329	-	15.69
F	Linum lewisii	-	6	-	.05
F	Lygodesmia sp.	-	1	-	.00
F	Medicago sativa	-	3	-	.18
F	Microsteris gracilis (a)	a24	b284	.06	4.28
F	Onobrychis viciaefolia	-	4	-	.15
F	Penstemon palmeri	-	-	-	.00
F	Penstemon sp.	3	-	.00	-
F	Phlox longifolia	1	-	.00	-

Type	Species	Nested Frequency '07	'11	Average Cover % '07	'11
F	Polygonum douglasii (a)	$_{b}$41	$_{a}$11	.19	.02
F	Sanguisorba minor	-	9	-	.66
F	Senecio multilobatus	8	-	.02	-
F	Sisymbrium altissimum (a)	$_{a}$-	$_{b}$16	-	.06
F	Sphaeralcea grossulariifolia	-	1	-	.00
F	Streptanthus cordatus	6	-	.01	-
F	Taraxacum officinale	-	3	-	.03
F	Tragopogon dubius (a)	$_{a}$-	$_{b}$17	-	.26
Total for Annual Forbs		125	780	0.62	20.98
Total for Perennial Forbs		25	87	0.10	1.62
Total for Forbs		150	867	0.73	22.61

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

BROWSE TRENDS--
Management unit 22R, Study no: 13

Type	Species	Strip Frequency '07	'11	Average Cover % '07	'11
B	Artemisia tridentata wyomingensis	2	1	-	.38
B	Cercocarpus ledifolius	1	0	-	-
B	Chrysothamnus nauseosus	0	2	-	.15
B	Gutierrezia sarothrae	2	3	.03	.00
B	Juniperus osteosperma	6	0	.89	-
B	Peraphyllum ramosissimum	5	2	.15	-
B	Pinus edulis	13	0	7.31	-
B	Purshia tridentata	8	6	.75	2.04
B	Quercus gambelii	2	5	.77	1.48
Total for Browse		39	19	9.90	4.06

CANOPY COVER, LINE INTERCEPT--
Management unit 22R, Study no: 13

Species	Percent Cover '07	'11
Chrysothamnus nauseosus	-	.25
Gutierrezia sarothrae	.05	.21
Juniperus osteosperma	8.83	.05
Peraphyllum ramosissimum	.91	.13
Pinus edulis	34.54	-
Purshia tridentata	.76	2.13
Quercus gambelii	2.45	2.15

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 22R, Study no: 13

Species	Average leader growth (in)	
	'07	'11
Purshia tridentata	2.7	2.7

POINT-QUARTER TREE DATA--
Management unit 22R, Study no: 13

Species	Trees per Acre		Average diameter (in)	
	'07	'11	'07	'11
Juniperus osteosperma	143	12	7.6	7.4
Pinus edulis	245	5	2.1	11.7

BASIC COVER--
Management unit 22R, Study no: 13

Cover Type	Nested Frequency		Average Cover %	
	'07	'11	'07	'11
Vegetation	145	442	10.39	39.18
Rock	113	63	3.84	3.32
Pavement	289	52	24.20	1.95
Litter	450	460	56.94	60.52
Cryptogams	21	-	1.61	0
Bare Ground	214	150	15.89	7.66

SOIL ANALYSIS DATA --
Management unit 22R, Study no: 13, Study Name: Greenville Bench Bullhog 2

pH	sandy loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.8	63.4	20.0	16.6	1.6	6.6	124.8	0.5

PELLET GROUP DATA--
Management unit 22R, Study no: 13

Type	Quadrat Frequency		Days use per acre (ha)	
	'07	'11	'07	'11
Rabbit	43	7	-	-
Elk	1	-	1 (3)	-
Deer	13	6	11 (28)	11 (26)

BROWSE CHARACTERISTICS--
Management unit 22R, 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 frigida									
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	12/15
Artemisia tridentata wyomingensis									
07	**40**	0	0	100	-	0	50	100	-/-
11	**20**	0	100	0	-	0	100	0	17/13
Ceratoides lanata									
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	26/36
Cercocarpus ledifolius									
07	**20**	0	100	-	-	0	100	0	24/29
11	**0**	0	0	-	-	0	0	0	30/32
Chrysothamnus nauseosus									
07	**0**	0	0	-	-	0	0	0	-/-
11	**40**	50	50	-	-	0	0	0	13/20
Gutierrezia sarothrae									
07	**80**	0	100	-	-	0	0	0	9/8
11	**60**	0	100	-	-	0	0	0	9/12
Juniperus osteosperma									
07	**120**	33	67	-	-	0	0	0	-/-
11	**0**	0	0	-	40	0	0	0	-/-
Opuntia fragilis									
07	**0**	0	0	-	80	0	0	0	4/8
11	**0**	0	0	-	-	0	0	0	-/-
Opuntia sp.									
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	4/9
Peraphyllum ramosissimum									
07	**120**	17	33	50	-	17	33	50	42/53
11	**40**	0	100	0	-	50	0	0	20/28
Pinus edulis									
07	**300**	53	47	-	160	0	0	0	-/-
11	**0**	0	0	-	20	0	0	0	-/-
Purshia tridentata									
07	**180**	11	78	11	20	22	44	11	26/45
11	**160**	38	63	0	20	38	13	0	17/32
Quercus gambelii									
07	**460**	13	83	4	40	0	0	0	52/39
11	**1080**	0	100	0	-	0	0	0	-/-

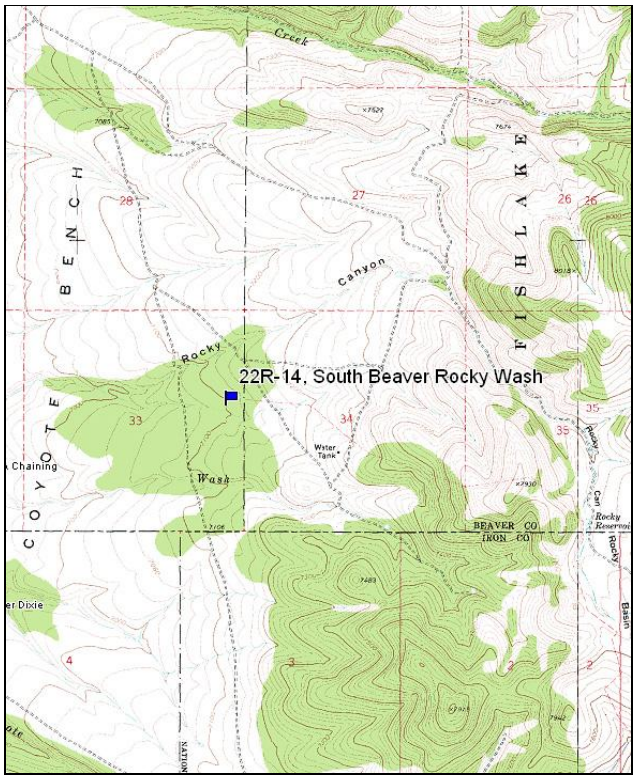
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Sambucus sp.									
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	37/63

SOUTH BEAVER ROCKY WASH - TREND STUDY NO. 22R-14-11
Project #1224

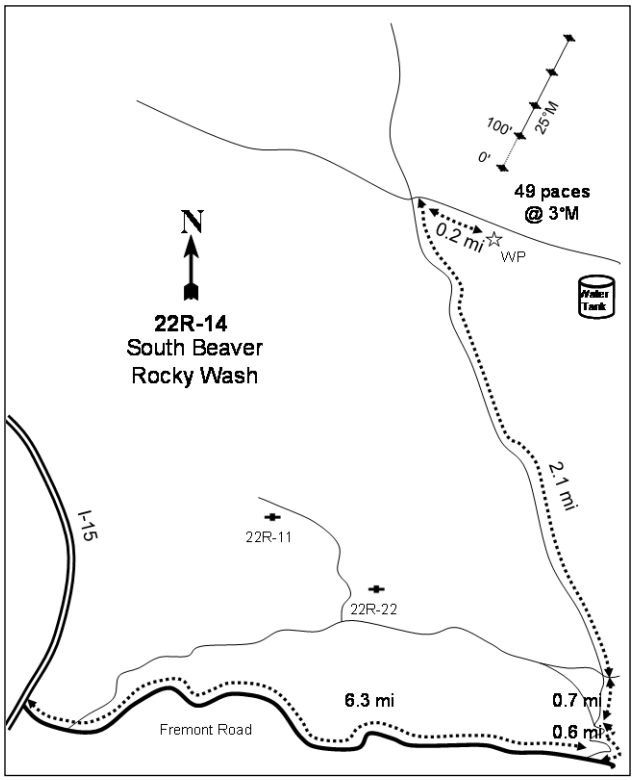
Vegetation Type: Mountain Big Sagebrush and Antelope Bitterbrush
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Unspecified Ecological Site, F028AY320UT
Land Ownership: BLM
Elevation: 7,104 ft. (2,165 m)
Aspect: Southwest
Slope: 4%
Transect bearing: 25° magnetic
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 to 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. The area is managed by Bureau of Land Management (BLM) as part of the South Creek allotment, near the Fishlake National Forest boundary line. Prior to the treatment, the study was established in 2008, to monitor the effects of a bullhog treatment to remove pinyon and juniper trees. The pinyon and juniper woodlands have increased their range and have 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 seeded 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 reestablishment. The study site was within the seeded portion of the project. 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 2012). Pellet groups were sampled in moderate abundance for deer, and low abundance for cattle and elk in 2008. Deer, elk, and cattle pellet groups were sampled in low abundance in 2011. Quadrat frequency of rabbit pellets was very high 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 Wheatgrass 'Anatone'	1430	0.97
G	Bluebunch Wheatgrass '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*), Utah serviceberry (*Amelanchier utahensis*), and antelope bitterbrush (*Purshia tridentata*), though Utah serviceberry is rare on the site. The mountain big sagebrush is a moderately dense population, with moderate decadence and poor vigor within the population; though prior to treatment, decadence and poor vigor were high. Utilization of sagebrush plants was moderately light following the treatment, but prior to treatment use was heavy. The recruitment of young sagebrush plants to the population was good following the treatment, though prior to treatment recruitment of young sagebrush plants was poor. A good portion of the sagebrush plants sampled in 2008 were dead or decadent. The antelope bitterbrush is a relatively small population, with low decadence and good vigor within the population. Utilization of bitterbrush plants was mostly heavy prior to treatment, but use was more moderate in 2011. The recruitment of young bitterbrush plants to the population has been poor since the outset of the study (Table - Browse Characteristics). Pinyon pine and Utah juniper were fairly common on the study site in 2008, but decreased substantially in density following the treatment (Table - Point-Quarter Tree Data). Prior to the treatment, Utah juniper also provided the majority of the canopy on the site, but cover was minimal following the treatment (Table - Canopy Cover). The stage of woodland succession was in Phase II transitioning into Phase III prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are fairly abundant and diverse on the site. The dominant perennial grass species are bluebunch wheatgrass (*Agropyron spicatum*) and bottle brush squirreltail (*Sitanion hystrix*). Seeded grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), Intermediate wheatgrass (*A. intermedium*), bluebunch wheatgrass, Indian ricegrass (*Oryzopsis hymenoides*), and Sandberg bluegrass (*Poa Secunda*), though each of these species were sampled on the site prior to the treatment with the exception of intermediate wheatgrass. Other perennial grass species sampled on the site include western wheatgrass (*Agropyron smithii*) and mutton bluegrass (*Poa fendleriana*). The invasive annual grass species cheatgrass (*Bromus tectorum*) increased in abundance on the site following the treatment. Forbs are not particularly abundant, but are fairly diverse. Seeded forb species sampled on the site following the treatment include blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), yellow sweetclover (*Melilotus officinalis*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*). Annual forb species increased in abundance on the site following the treatment (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Pavant component, which is found on fans and terraces. The parent material consists of alluvium derived from intermediate igneous rock. The soils within this classification are characterized as shallow, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). Bare ground cover is low, though there is a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: The density of mountain big sagebrush decreased 66% from 3,440 plants/acre to 1,180 plants/acre, and canopy cover decreased from 9% to 5%. The health of the of the sagebrush population improved with decadence decreasing from 77% to 17%, and plants displaying poor vigor decreasing from 54% to 15%. The recruitment of young sagebrush plants to the population improved, with recruitment of young sagebrush plants increasing from 3% to 24% of the population. The density of antelope bitterbrush decreased 10% from 420 plants/acre to 380 plants/acre, though canopy cover increased from 4% to 5%. The density of Utah juniper trees decreased from 128 trees/acre with an average diameter of 9.3 inches to 40 trees/acre with an average diameter of 1.1 inches. The density of pinyon pine trees decreased from 27 trees/acre with an average diameter of 3.1 inches to less than 4 trees/acre with an average diameter of less than 1 inch. Canopy cover of pinyon and juniper trees decreased from 2% to 0% and 18% to 0%, respectively.

Grasses: The sum of nested frequency of perennial grasses increased 67%, and cover increased from 6% to 20%. Bluebunch wheatgrass remained similar in nested frequency, though cover increased from 3% to 6%.

Bottlebrush squirreltail increased significantly in nested frequency, and cover increased from 2% to 5%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 7%.

Forbs: The sum of nested frequency of perennial forbs remained similar, but cover increased from 1% to 3%. The seeded species blue flax provided 1% cover following the treatment. The palatable annual species prickly lettuce (*Lactuca serriola*) was sampled for the first time following the treatment at 1% cover. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 14

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a13	b50	.37	2.30
G	Agropyron intermedium	a-	b66	-	2.55
G	Agropyron smithii	20	20	.24	1.13
G	Agropyron spicatum	88	91	3.13	6.30
G	Bromus japonicus (a)	-	6	-	.03
G	Bromus tectorum (a)	a36	b236	.25	7.01
G	Oryzopsis hymenoides	a5	b22	.04	.52
G	Poa fendleriana	37	29	.81	1.13
G	Poa secunda	23	22	.28	.34
G	Sitanion hystrix	a58	b108	1.47	5.24
Total for Annual Grasses		36	242	0.25	7.05
Total for Perennial Grasses		244	408	6.36	19.55
Total for Grasses		280	650	6.61	26.60
F	Agoseris glauca	10	17	.05	.13
F	Alyssum alyssoides (a)	a-	b12	-	.07
F	Antennaria rosea	2	-	.01	-
F	Arabis sp.	3	1	.01	.03
F	Astragalus convallarius	2	3	.00	.00
F	Astragalus megacarpus	1	9	.03	.16
F	Calochortus nuttallii	3	1	.01	.00
F	Chaenactis douglasii	a-	b22	-	.15
F	Collinsia parviflora (a)	4	10	.00	.07
F	Crepis acuminata	-	4	-	.06
F	Cymopterus sp.	9	13	.05	.12
F	Delphinium nuttallianum	7	2	.02	.15
F	Erigeron aphanactis	3	3	.01	.03
F	Gayophytum ramosissimum(a)	29	a11	.06	.05
F	Lactuca serriola (a)	a-	b80	-	1.15
F	Linum perenne	a-	b27	-	.86
F	Lithospermum incisum	-	4	-	.00
F	Lomatium sp.	b43	a25	.21	.08
F	Lupinus argenteus	a3	b15	.00	.37
F	Machaeranthera canescens	-	6	-	.01
F	Medicago sativa	-	6	-	.33
F	Melilotus officinalis	-	1	-	.15

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Microsteris gracilis (a)	$_{a}$51	$_{b}$125	.10	1.18
F	Onobrychis viciaefolia	-	3	-	.03
F	Penstemon comarrhenus	-	-	-	.00
F	Phlox longifolia	$_{b}$96	$_{a}$15	.52	.08
F	Polygonum douglasii (a)	11	12	.04	.02
F	Ranunculus testiculatus (a)	$_{a}$16	$_{b}$84	.03	.65
F	Sanguisorba minor	-	4	-	.01
F	Senecio multilobatus	6	4	.04	.18
F	Zigadenus paniculatus	4	3	.05	.03
Total for Annual Forbs		111	334	0.25	3.21
Total for Perennial Forbs		192	188	1.04	3.01
Total for Forbs		303	522	1.29	6.23

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

BROWSE TRENDS--
Management unit 22R, Study no: 14

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia tridentata vaseyana	81	37	7.03	2.89
B	Juniperus osteosperma	5	2	11.55	.18
B	Pinus edulis	1	0	1.23	-
B	Purshia tridentata	18	15	3.73	2.62
Total for Browse		105	54	23.55	5.69

CANOPY COVER, LINE INTERCEPT--
Management unit 22R, Study no: 14

Species	Percent Cover '08	'11
Artemisia tridentata vaseyana	8.56	4.68
Juniperus osteosperma	17.61	-
Pinus edulis	1.96	-
Purshia tridentata	3.48	4.66

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 22R, Study no: 14

Species	Average leader growth (in) '08	'11
Artemisia tridentata vaseyana	0.9	0.5
Purshia tridentata	0.6	0.4

POINT-QUARTER TREE DATA--
Management unit 22R, Study no: 14

Species	Trees per Acre		Average diameter (in)	
	'08	'11	'08	'11
Juniperus osteosperma	128	40	9.3	1.1

BASIC COVER--
Management unit 22R, Study no: 14

Cover Type	Average Cover %	
	'08	'11
Vegetation	27.11	41.11
Rock	11.03	6.28
Pavement	10.92	3.00
Litter	39.56	45.63
Cryptogams	.04	0
Bare Ground	32.01	14.61

SOIL ANALYSIS DATA --
Management unit 22R, Study no: 14, Study Name: South Beaver Rocky Wash

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		Days use per acre (ha)	
	'08	'11	'08	'11
Rabbit	90	6	-	-
Elk	7	4	13 (31)	18 (45)
Deer	14	8	29 (73)	11 (26)
Cattle	1	4	1 (2)	4 (9)

BROWSE CHARACTERISTICS--
Management unit 22R, Study no: 14

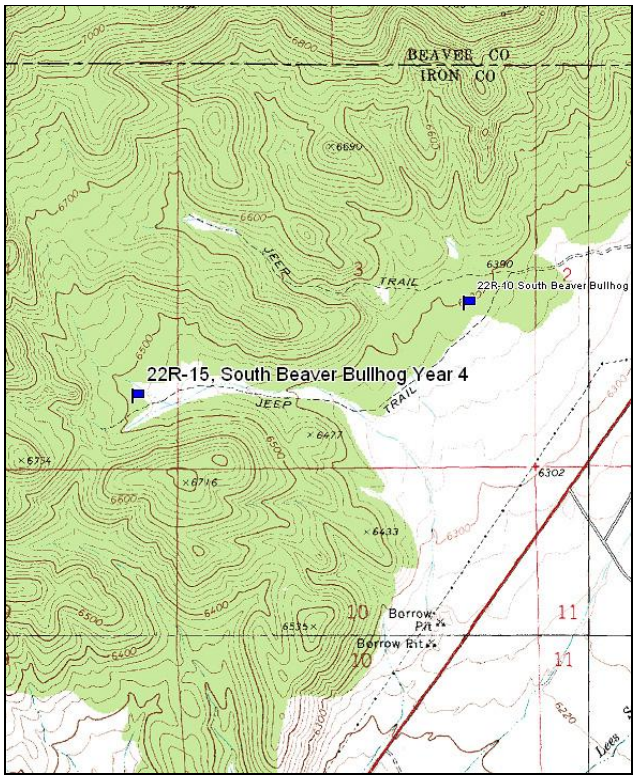
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
08	**0**	0	0	-	20	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Artemisia tridentata vaseyana									
08	**3440**	3	19	77	240	19	49	54	17/21
11	**1180**	24	59	17	160	17	0	15	18/22
Juniperus osteosperma									
08	**100**	40	60	-	100	0	0	0	-/-
11	**40**	100	0	-	60	0	0	0	-/-
Pinus edulis									
08	**20**	0	100	-	40	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Purshia tridentata									
08	**420**	5	76	19	120	24	71	10	31/47
11	**380**	11	89	0	-	26	5	5	15/30

SOUTH BEAVER BULLHOG YEAR 4 - TREND STUDY NO. 22R-15-11
Project #1224

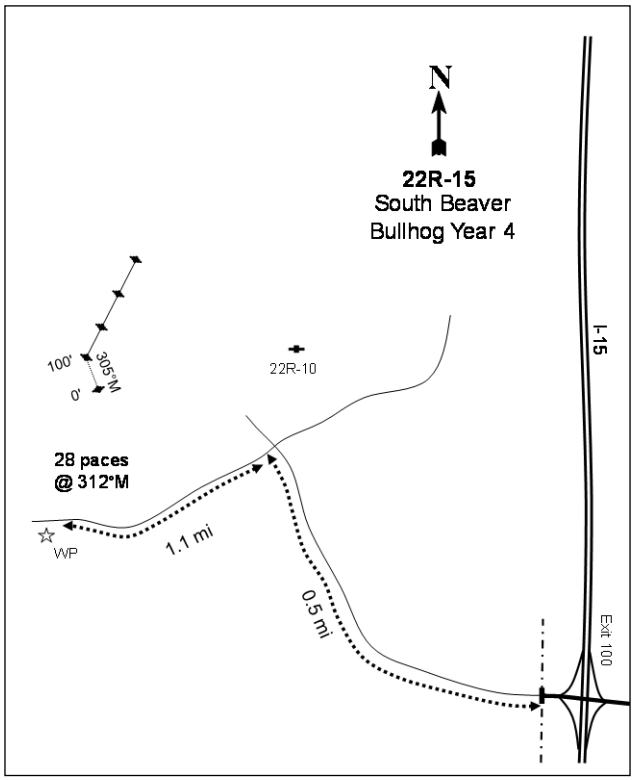
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Upland Stony Loam (Pinyon-Utah Juniper), R047XB333UT
Land Ownership: BLM
Elevation: 6,494 ft. (1,979 m)
Aspect: East
Slope: 5%
Transect bearing: 305° magnetic
Belt placement: line 1 (11ft, 95ft), 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



Diagrammatic Sketch:



Township: 31S Range: 7W Section: 4

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 treated pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, west of I-15. The area is managed by the Bureau of Land Management (BLM) as part of the Fremont allotment. Prior to the treatment, the study was established in 2008 to monitor the effects of a bullhog treatment to remove pinyon and juniper trees. The pinyon and juniper woodland has increased its range and has 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 machinery. 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 reestablishment. The study was located within the seeded portion of the project. 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 2012). Wildlife and livestock pellet groups were nearly absent in 2008, though quadrat frequency of rabbit pellets was very high. In 2011, deer and cattle pellet groups were sampled in low abundance (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 are Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and fringed sagebrush (*A. frigida*), though Wyoming big sagebrush provides the majority of the

canopy cover on the site (Table - Canopy Cover). The Wyoming big sagebrush is a scattered, lightly used population, with low decadence and good vigor within the population; though decadence and plants displaying poor vigor were high prior to treatment. The recruitment of young sagebrush plants to the population was poor prior to treatment, but following treatment recruitment of young sagebrush plants to the population was good. A relatively small population of broom snakeweed (*Gutierrezia sarothrae*) has been sampled on the site since the outset of the study. 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, a moderately dense population of pinyon pine and Utah juniper were common on the site in 2008, but trees were rare following the treatment (Table - Point Quarter Tree Data). Also, these two tree species provided the majority of the canopy cover sampled on the site in 2008, but cover was minimal following the treatment (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The dominant perennial grass species sampled on the site are bottlebrush squirreltail (*Sitanion hystrix*) and Siberian wheatgrass (*Agropyron fragile*). The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site following the treatment in low abundance. Seeded species sampled on the site include crested wheatgrass (*Agropyron cristatum*), Siberian wheatgrass, intermediate wheatgrass (*A. intermedium*), bluebunch wheatgrass (*A. spicatum*), Snake River wheatgrass (*Elymus wawawaiensis*), Indian ricegrass (*Oryzopsis hymenoides*), and Sandberg bluegrass (*Poa secunda*), though Indian ricegrass was present on the site prior to treatment. Other grass species sampled on the site include blue grama (*Bouteloua gracilis*), bottlebrush squirreltail (*Sitanion hystrix*), the weedy annual species Japanese chess (*Bromus japonicus*), and sixweeks fescue (*Vulpia octoflora*). Forbs are moderately abundant and diverse on the site. The dominant perennial forb species are silvery lupine (*Lupinus argenteus*) and Utah deervetch (*Lotus utahensis*). The palatable annual forb species prickly lettuce (*Lactuca serriola*) provided the majority of the forb cover in 2011. Seeded forb species sampled on the site include blue flax (*Linum perenne*), Palmer penstemon (*Penstemon palmeri*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Ocambee component. The parent material consists of colluviums derived from basic and intermediate igneous rock and/or residuum weathered from basic and intermediate igneous rock. The soils within this classification are characterized as moderately deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a slightly acidic soil reaction (pH 6.5) (Table - Soil Analysis Data). Bare ground cover is low, though there is a high amount of litter and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: The density of Wyoming big sagebrush decreased 64% from 3,600 plants/acre to 1,300 plants/acre, and canopy cover decreased from 9% to 6%. The health of the sagebrush population improved with decadence decreasing from 74% to 6%, and plants displaying poor vigor decreasing from 31% to 5% of the population. The density of pinyon pine trees decreased from 260 trees/acre with an average diameter of 2.6 inches to 6 trees/acre with an average diameter of 1.1 inches. The density of Utah juniper trees decreased from 57 trees/acre with an average diameter of 9.0 inches to 5 trees/acre with an average diameter of 10.6 inches. Canopy cover of pinyon and juniper trees decreased from 13% to less than 1%, and 15% to less than 1%, respectively.

Grasses: The sum of nested frequency of perennial grasses increased more than five-fold, and cover increased from less than 1% to 7%. The increase in frequency and cover can be mostly attributed the establishment of seeded species within the treatment area. The seeded species crested wheatgrass, intermediate wheatgrass, and Snake River wheatgrass each provided 1% cover, and Siberian wheatgrass provided 2% cover following the treatment. Bottlebrush squirreltail increased significantly in nested frequency, and cover increased from less

than 1% to 2%. The weedy annual grass species cheatgrass was sampled for the first time following the treatment at 1% cover.

Forbs: The sum of nested frequency of perennial forbs increased more than three-fold, and cover increased from 1% to 5%. Silvery lupine increased significantly in nested frequency, cover increased from 1% to 2%. Utah deervetch and prickly lettuce were sampled for the first time following the treatment at 2% and 13% cover, respectively.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 15

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a-	b26	-	.86
G	Agropyron fragile	a-	b42	-	1.45
G	Agropyron intermedium	a-	b28	-	1.12
G	Agropyron spicatum	a-	b19	-	.41
G	Bouteloua gracilis	3	2	.03	.00
G	Bromus japonicus (a)	a-	b12	-	.03
G	Bromus tectorum (a)	a-	b91	-	.76
G	Elymus wawawaiensis	a-	b25	-	.89
G	Oryzopsis hymenoides	a1	b15	.03	.22
G	Poa secunda	-	5	-	.01
G	Sitanion hystrix	a34	b53	.07	2.06
G	Vulpia octoflora (a)	-	3	-	.00
Total for Annual Grasses		0	106	0	0.79
Total for Perennial Grasses		38	215	0.14	7.04
Total for Grasses		38	321	0.14	7.84
F	Agoseris glauca	-	6	.00	.38
F	Chaenactis douglasii	6	5	.01	.18
F	Collinsia parviflora (a)	-	4	-	.01
F	Crepis acuminata	-	4	-	.03
F	Cryptantha sp.	3	-	.03	-
F	Cymopterus sp.	a4	b9	.01	.36
F	Descurainia pinnata (a)	a-	b42	-	.17
F	Eriogonum umbellatum	a1	b31	.00	.26
F	Erysimum sp.	-	2	-	.00
F	Gayophytum ramosissimum(a)	a-	b82	-	.31
F	Gilia sp. (a)	a-	b86	-	.34
F	Ipomopsis aggregata	2	2	.03	.04
F	Lactuca serriola (a)	a-	b344	-	12.99
F	Lappula occidentalis (a)	-	9	-	.04
F	Lepidium densiflorum (a)	-	7	-	.04
F	Linum perenne	a-	b14	-	.16
F	Lonicera utahensis	10	-	.04	-
F	Lotus utahensis	a-	b23	-	1.62
F	Lupinus argenteus	a5	b22	.59	1.86
F	Machaeranthera canescens	-	2	-	.00
F	Mentzelia albicaulis (a)	-	9	-	.15

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Microsteris gracilis (a)	a-	b128	-	1.62
F	Penstemon eatoni	-	2	-	.01
F	Penstemon palmeri	-	7	-	.01
F	Penstemon sp.	b9	a-	.03	-
F	Ranunculus testiculatus (a)	-	1	-	.00
F	Salsola iberica (a)	1	-	.00	-
F	Sanguisorba minor	-	3	-	.01
F	Senecio multilobatus	-	6	-	.06
Total for Annual Forbs		1	712	0.00	15.70
Total for Perennial Forbs		40	138	0.78	5.00
Total for Forbs		41	850	0.78	20.70

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

BROWSE TRENDS--
Management unit 22R, Study no: 15

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia frigida	1	4	-	.15
B	Artemisia tridentata wyomingensis	72	34	9.88	4.17
B	Gutierrezia sarothrae	21	7	.28	.36
B	Juniperus osteosperma	2	0	6.05	-
B	Leptodactylon pungens	2	1	-	.15
B	Opuntia sp.	1	1	-	-
B	Pinus edulis	7	3	4.61	-
Total for Browse		106	50	20.83	4.84

CANOPY COVER, LINE INTERCEPT--
Management unit 22R, Study no: 15

Species	Percent Cover '08	'11
Artemisia frigida	-	.78
Artemisia tridentata wyomingensis	8.61	6.01
Gutierrezia sarothrae	.06	.40
Juniperus osteosperma	14.60	-
Pinus edulis	12.86	.03

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 22R, Study no: 15

Species	Average leader growth (in) '08	'11
Artemisia tridentata wyomingensis	1.0	3.1

POINT-QUARTER TREE DATA--
Management unit 22R, Study no: 15

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	57	5	9.0	10.6
Pinus edulis	260	6	2.6	1.1

BASIC COVER--
Management unit 22R, Study no: 15

Cover Type	Average Cover % '08	Average Cover % '11
Vegetation	20.32	34.76
Rock	5.94	2.13
Pavement	30.22	8.94
Litter	44.09	53.24
Cryptogams	.21	.15
Bare Ground	20.28	9.19

SOIL ANALYSIS DATA --
Management unit 22R, Study no: 15, Study Name: South Beaver Bullhog Year 4

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	Quadrat Frequency '11	Days use per acre (ha) '08	Days use per acre (ha) '11
Rabbit	80	1	-	-
Deer	-	2	-	3 (8)
Cattle	-	-	-	2 (4)

BROWSE CHARACTERISTICS--
Management unit 22R, Study no: 15

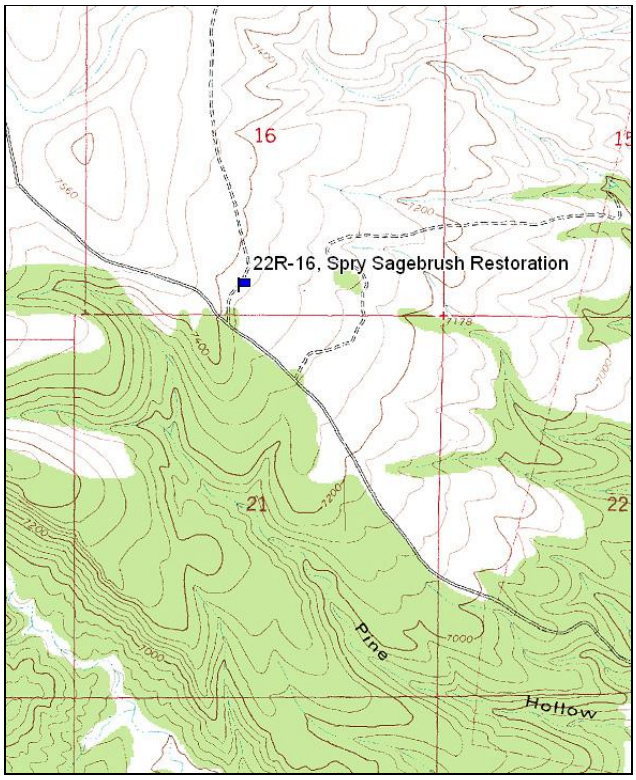
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia frigida									
08	**20**	0	0	100	-	0	0	100	-/-
11	**80**	0	100	0	-	0	0	0	15/17
Artemisia tridentata wyomingensis									
08	**3600**	4	22	74	60	9	3	31	19/24
11	**1300**	17	77	6	-	5	0	5	17/24
Chrysothamnus viscidiflorus									
08	**0**	0	0	-	20	0	0	0	8/10
11	**0**	0	0	-	-	0	0	0	16/27
Gutierrezia sarothrae									
08	**960**	10	69	16	120	27	17	0	6/5
11	**200**	30	70	0	-	0	0	0	9/11
Juniperus osteosperma									
08	**40**	0	100	-	40	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Leptodactylon pungens									
08	**40**	0	50	50	-	0	50	50	6/8
11	**20**	0	100	0	-	0	0	0	8/12
Opuntia sp.									
08	**20**	0	100	-	-	0	0	0	4/11
11	**20**	0	100	-	-	0	0	0	5/7
Pinus edulis									
08	**200**	80	20	-	180	0	0	0	-/-
11	**60**	100	0	-	20	0	0	0	-/-

SPRY SAGEBRUSH RESTORATION - TREND STUDY NO. 22R-16-11
Project #1173

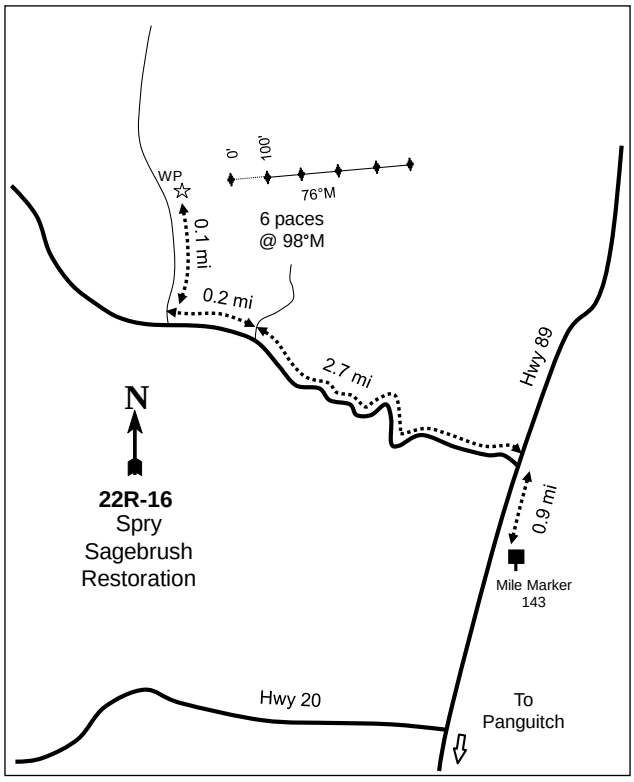
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Upland Shallow Hardpan (Black Sagebrush), R047XB316UT
Land Ownership: SITLA
Elevation: 7,300 ft. (2,225 m)
Aspect: East
Slope: 2%
Transect bearing: 76° magnetic
Belt placement: 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 to mile marker 143 and drive 0.9 miles 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



Diagrammatic Sketch:



Township: 32S Range: 5W Section: 16

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, within a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) flat, near the head of Pine Hollow. The study is on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). Prior to the treatment, the study was established in 2008 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 2012). Deer, elk, and cattle pellet groups were sampled in low abundance in 2008 and 2011 (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 moderately dense population, with low decadence and good vigor within the population; though decadence was high prior to the treatment. The recruitment of young sagebrush to the population was good following the treatment; however, prior to the treatment recruitment of young sagebrush plants was poor. The antelope bitterbrush is a heavily used, small population, with low decadence and good vigor within the population; though prior to treatment decadence was high and vigor was moderate. The recruitment of young bitterbrush plants to the population has been poor over the sample years. Broom snakeweed (*Gutierrezia sarothrae*) has been fairly common on the site, though density decreased following treatment (Table - Browse Characteristics). Prior to the lop and scatter treatment, pinyon pine and Utah juniper were fairly common, but following the treatment pinyon and juniper had minimal presence on the site (Table - Point-Quarter Tree Data). The stage of woodland succession was in the early stages of Phase II prior to treatment and is now considered to be within Phase I (Tausch et al. 2009).

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, occur in low abundance, and include western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), blue grama (*Bouteloua gracilis*), sedge (*Carex sp*.), Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). The weedy annual grass species cheatgrass (*Bromus tectorum*) has been sampled on the site since the outset of the study, but has been minimal on the site. Forbs are not abundant, but are moderately diverse. No single forb species has been dominant on the site (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Venture component, which is found on ridges and mountain slopes. The parent material consists of alluvium derived from basic and intermediate volcanic rock, and/or colluvium derived from intermediate and basic volcanic rock, and/or residuum weathered from intermediate and basic volcanic rock. The soils within this classification are characterized as shallow, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). 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 on the site, though there is a moderate amount pavement, vegetation, and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 in 2011.

Pre vs. Two Years Post Treatment, 2008 vs. 2011

Browse: The density of mountain big sagebrush increased 22% from 1,640 plants/acre to 2,000 plants/acre, and canopy cover increased from 9% to 15%. The health of the sagebrush population improved with decadence decreasing from 37% to 2%, and plants displaying poor vigor decreasing from 15% to 4%. The recruitment of young sagebrush plants to the population increased from 1% to 36% of the population. The density of pinyon pine trees decreased from 76 trees/acre with an average diameter of 5.8 inches to 22 trees/acre with an average diameter of 1.1 inches. The density of Utah juniper trees decreased from 27 trees/acre with an average diameter of 6.9 inches to 7 trees/acre with an average diameter of 1.7 inches. Canopy cover of pinyon pine decreased from 1% to less than 1%, but Utah juniper remained similar in cover at 1%.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover increased from 14% to 21%. Crested wheatgrass remained similar in nested frequency, but cover increased from 13% to 20%.

Forbs: Forb species remained rare on the site, although species diversity increased following the treatment. No single forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 16

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	332	309	12.99	20.40
G	Agropyron smithii	6	8	.06	.01
G	Agropyron spicatum	-	1	-	.00
G	Bouteloua gracilis	10	-	.56	-
G	Bromus tectorum (a)	2	6	.00	.01
G	Carex obtusata	7	5	.04	.06
G	Oryzopsis hymenoides	3	9	.03	.04
G	Sitanion hystrix	3	3	.00	.00
G	Stipa comata	9	7	.07	.16
Total for Annual Grasses		2	6	0.00	0.01
Total for Perennial Grasses		370	342	13.77	20.69
Total for Grasses		372	348	13.77	20.70
F	Agoseris glauca	9	2	.05	.01
F	Astragalus argophyllus	-	1	-	.03
F	Astragalus calycosus	4	10	.01	.19
F	Astragalus lentiginosus	7	9	.09	.27
F	Calochortus nuttallii	1	5	.00	.00
F	Cryptantha sp.	8	2	.02	.15
F	Descurainia pinnata (a)	[a]-	[b]38	-	.07
F	Erigeron aphanactis	-	7	-	.01
F	Erigeron eatonii	-	3	-	.00
F	Erigeron pumilus	-	3	-	.04
F	Erigeron sp.	2	-	.00	-
F	Gayophytum ramosissimum(a)	[a]2	[b]48	.01	.26
F	Lactuca serriola (a)	-	3	-	.00
F	Lappula occidentalis (a)	2	2	.00	.00

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Lomatium sp.	2	-	.01	-
F	Lygodesmia spinosa	2	4	.03	.15
F	Microsteris gracilis (a)	-	2	-	.00
F	Phlox austromontana	1	1	.00	.03
F	Phlox longifolia	4	4	.03	.06
F	Ranunculus testiculatus (a)	-	2	-	.00
F	Sphaeralcea coccinea	2	-	.01	-
F	Trifolium sp.	10	7	.18	.02
F	Zigadenus paniculatus	$_{b}$7	$_{a}$2	.04	.00
Total for Annual Forbs		4	95	0.01	0.35
Total for Perennial Forbs		59	60	0.50	0.97
Total for Forbs		63	155	0.51	1.33

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

BROWSE TRENDS--
Management unit 22R, Study no: 16

Type	Species	Strip Frequency '08	'11	Average Cover % '08	'11
B	Artemisia tridentata vaseyana	50	58	6.42	13.89
B	Gutierrezia sarothrae	27	16	.34	.19
B	Juniperus osteosperma	1	0	1.48	.30
B	Opuntia sp.	2	2	.04	.01
B	Pinus edulis	3	3	1.58	.15
B	Purshia tridentata	6	5	.93	1.31
Total for Browse		89	84	10.81	15.86

CANOPY COVER, LINE INTERCEPT--
Management unit 22R, Study no: 16

Species	Percent Cover '08	'11
Artemisia tridentata vaseyana	9.06	15.13
Gutierrezia sarothrae	.20	.16
Juniperus osteosperma	1.20	.73
Pinus edulis	.71	-
Purshia tridentata	.56	1.16

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 22R, Study no: 16

Species	Average leader growth (in) '08	'11
Artemisia tridentata vaseyana	1.3	2.0
Purshia tridentata	0.8	1.8

POINT-QUARTER TREE DATA--
Management unit 22R, Study no: 16

Species	Trees per Acre		Average diameter (in)	
	'08	'11	'08	'11
Juniperus osteosperma	27	7	6.9	1.7
Pinus edulis	76	22	5.8	1.1

BASIC COVER--
Management unit 22R, Study no: 16

Cover Type	Average Cover %	
	'08	'11
Vegetation	23.52	34.17
Rock	9.94	6.34
Pavement	19.85	17.59
Litter	30.97	24.87
Cryptogams	.86	.18
Bare Ground	27.67	22.81

SOIL ANALYSIS DATA --
Management unit 22R, Study no: 16, Study Name: Spry Sagebrush Restoration

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	'11	'08	'11
Rabbit	95	16	-	-
Elk	-	1	1 (3)	2 (5)
Deer	18	3	5 (12)	15 (36)
Cattle	11	3	14 (34)	6 (14)

BROWSE CHARACTERISTICS--
Management unit 22R, Study no: 16

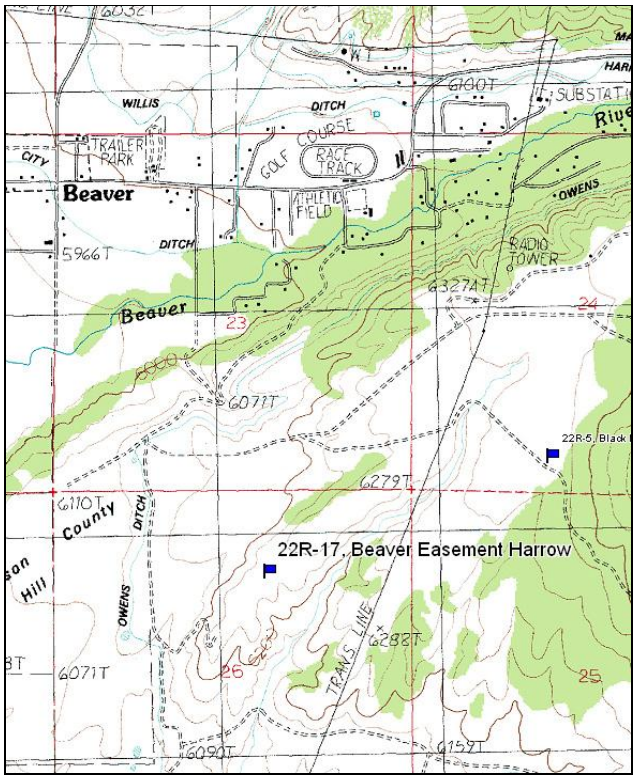
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
08	**1640**	1	62	37	300	16	13	15	28/33
11	**2000**	36	62	2	2380	9	0	4	29/36
Gutierrezia sarothrae									
08	**1660**	2	87	11	280	8	0	5	6/5
11	**840**	57	43	0	80	0	0	2	9/11
Juniperus osteosperma									
08	**20**	0	100	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Opuntia sp.									
08	**40**	0	100	-	40	0	0	0	5/13
11	**40**	0	100	-	-	0	0	0	4/11
Pinus edulis									
08	**60**	100	0	-	40	0	0	0	-/-
11	**60**	67	33	-	-	0	0	33	-/-
Purshia tridentata									
08	**120**	0	67	33	-	0	100	17	18/41
11	**100**	0	100	0	-	60	40	0	23/45

BEAVER EASEMENT HARROW - TREND STUDY NO. 22R-17-11
Project #1294

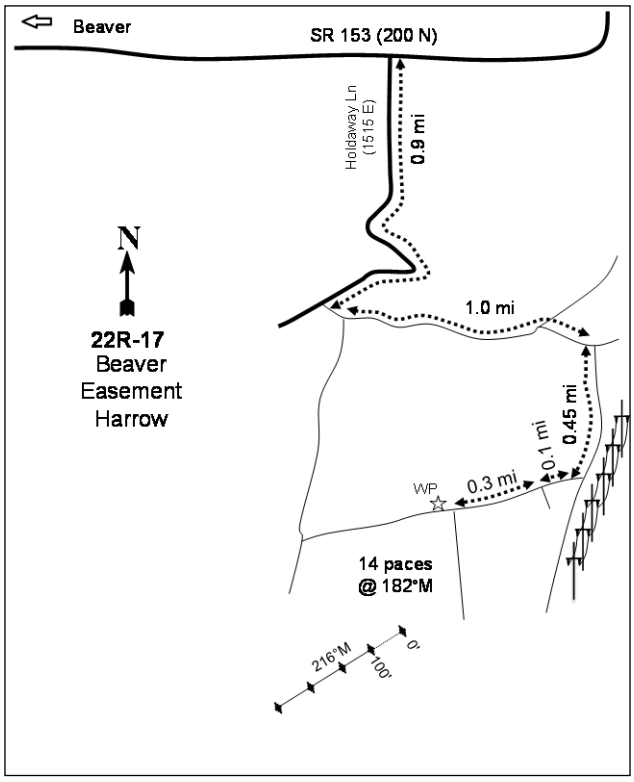
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 6,256 ft. (1,907 m)
Aspect: South
Slope: 1%
Transect bearing: 198° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 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. Prior to the treatment, the study was established in 2008 to monitor the effects of a two-way Dixie harrow project. The Beaver Easement property was purchased several years ago and is managed as part of the Beaver Wildlife Management Area (WMA). Following the purchase of the property, an aerial seeding treatment was conducted in an effort to increase big game forage productivity, but 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) was aerially applied on top of snow over the project area. Livestock grazing has been suspended indefinitely from the easement property. The objective of the project is to increase big game forage productivity (WRI Database 2012). Pellet groups were sampled in high abundance for deer and low abundance for elk and cattle in 2008. Deer, elk, and cattle pellet groups were sampled in low abundance in 2011 (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		lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'	300	1.43	F	Alfalfa 'Ladak 65'	200	1.00
G	Indian Ricegrass 'Rimrock'	450	2.14	B	Forage Kochia	200	1.00
G	Intermediate Wheatgrass 'Oahe'	450	2.14	Total Pounds:		400	2.00
F	Alfalfa 'Ladak'	300	1.43	PLS Pounds:			1.55
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 low decadence and good vigor within the population. The recruitment of young sagebrush plants to the population has been good since the outset of the study. Sagebrush seedlings were abundant on the site in 2008. Other browse species sampled on site include stickyleaf low 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 on the site. Following the treatment, the annual grass species cheatgrass (*Bromus tectorum*) increased substantially in abundance and provided the majority of the grass cover on the site. The dominant perennial grass species is needle-and-thread (*Stipa comata*). Other less common grass species sampled on the site include blue grama (*Bouteloua gracilis*), galleta (*Hilaria jamesii*), sand dropseed (*Sporobolus cryptandrus*), Indian ricegrass (*Oryzopsis hymenoides),

bottlebrush squirreltail (*Sitanion hystrix*), and sixweeks fescue (*Vulpia octoflora*). Indian ricegrass has been the only seeded species sampled on the site, though being present on the site prior to treatment. 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*), which provides the majority of the perennial forb cover on the site. Annual forbs are abundant on the site with annual stickseed (*Lappula occidentalis*), pale alyssum (*Alyssum alyssoides*), and bur buttercup (*Ranunculus testiculatus*) being dominant (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Red Butte-Phage association, which is found on ridges and hills. The parent material consists of alluvium and colluvium derived from igneous, intermediate igneous, and sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). 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 on the site, though there is high amount of vegetation, and moderate amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 in 2011.

Pre vs. Three Years Post Treatment, 2008 vs. 2011

Browse: The density of Wyoming big sagebrush decreased 24% from 4,980 plants/acre to 3,800 plants/acres, and cover decreased from 15% to 5%. The health of the sagebrush population improved with decadence decreasing from 22% to 6%, and plants displaying poor vigor decreasing from 12% to 5% of the population. The recruitment of young sagebrush plants to the population was good in both sample years at 39% in 2008 and 53% in 2011.

Grasses: The sum of nested frequency of perennial grasses decreased 25%, though cover remained similar at 12%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from 3% to 48%. Needle-and-thread increased significantly in nested frequency, and cover increased from 7% to 9%.

Forbs: The sum of nested frequency of perennial forbs increased 48%, and cover increased from 4% to 6%. Scarlet globemallow increased significantly in nested frequency, and cover increased from 4% to 5%.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 17

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Bouteloua gracilis	$_{b}$42	$_{a}$31	.31	.87
G	Bromus tectorum (a)	$_{a}$359	$_{b}$488	3.38	47.83
G	Hilaria jamesii	$_{b}$193	$_{a}$3	3.37	.01
G	Oryzopsis hymenoides	9	11	.60	.09
G	Sitanion hystrix	21	4	.32	.04
G	Sporobolus cryptandrus	$_{a}$-	$_{b}$96	-	2.32
G	Stipa comata	$_{a}$177	$_{b}$188	7.14	8.57
G	Vulpia octoflora (a)	$_{a}$7	$_{b}$67	.01	.45
Total for Annual Grasses		366	555	3.39	48.28
Total for Perennial Grasses		442	333	11.75	11.91
Total for Grasses		808	888	15.15	60.20
F	Alyssum alyssoides (a)	$_{a}$97	$_{b}$164	.26	1.43

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
F	Astragalus argophyllus	-	3	-	.03
F	Astragalus lentiginosus	$_{a}$7	$_{b}$18	.04	.66
F	Chenopodium fremontii (a)	3	-	.00	-
F	Collinsia parviflora (a)	2	-	.00	-
F	Descurainia pinnata (a)	4	-	.01	-
F	Draba sp. (a)	$_{a}$3	$_{b}$63	.00	.32
F	Gilia sp. (a)	$_{b}$49	$_{a}$7	.29	.04
F	Lactuca serriola (a)	-	8	-	.04
F	Lappula occidentalis (a)	$_{b}$102	$_{a}$67	2.73	1.52
F	Leucelene ericoides	3	2	.15	.15
F	Lupinus brevicaulis (a)	$_{b}$19	$_{a}$-	.15	-
F	Phlox hoodii	-	1	-	.00
F	Phlox longifolia	12	3	.05	.03
F	Ranunculus testiculatus (a)	$_{b}$357	$_{a}$206	2.76	3.41
F	Sisymbrium altissimum (a)	$_{a}$-	$_{b}$8	-	.05
F	Sphaeralcea coccinea	$_{a}$72	$_{b}$112	3.81	5.05
Total for Annual Forbs		636	523	6.23	6.84
Total for Perennial Forbs		94	139	4.05	5.92
Total for Forbs		730	662	10.29	12.77

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

BROWSE TRENDS--
Management unit 22R, Study no: 17

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia tridentata wyomingensis	76	64	11.62	5.82
	Chrysothamnus viscidiflorus	1	0	-	-
	Pediocactus simpsonii	1	0	-	-
Total for Browse		78	64	11.62	5.82

CANOPY COVER, LINE INTERCEPT--
Management unit 22R, Study no: 17

Species	Percent Cover '08	Percent Cover '11
Artemisia tridentata wyomingensis	15.26	5.40

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 22R, Study no: 17

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia tridentata wyomingensis	1.7	1.9

POINT-QUARTER TREE DATA--
Management unit 22R, Study no: 17

Species	Trees per Acre		Average diameter (in)	
	'08	'11	'08	'11
Juniperus osteosperma	-	5	-	7.2

BASIC COVER--
Management unit 22R, Study no: 17

Cover Type	Average Cover %	
	'08	'11
Vegetation	33.69	74.09
Rock	2.53	4.48
Pavement	21.73	14.96
Litter	50.02	20.14
Cryptogams	.08	.06
Bare Ground	8.96	.91

SOIL ANALYSIS DATA --
Management unit 22R, Study no: 17, Study Name: Beaver Easement Harrow

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	'11	'08	'11
Rabbit	89	7	-	-
Elk	1	-	1 (2)	1 (2)
Deer	30	8	59 (146)	5 (13)
Cattle	14	3	13 (32)	9 (23)

BROWSE CHARACTERISTICS--
Management unit 22R, Study no: 17

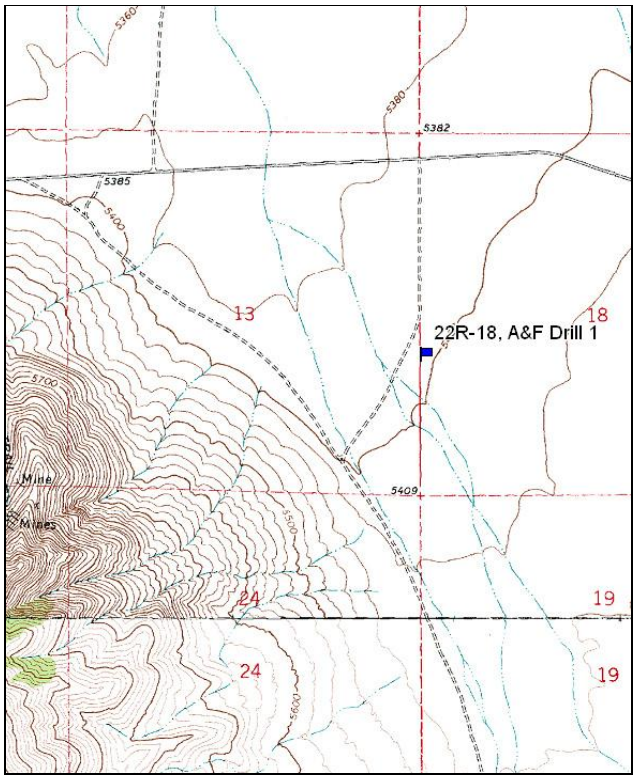
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
08	**4980**	39	39	22	21360	11	16	12	22/34
11	**3800**	53	41	6	1320	10	0	5	13/19
Chrysothamnus viscidiflorus									
08	**20**	0	100	-	-	0	100	0	-/-
11	**0**	0	0	-	-	0	0	0	11/12
Pediocactus simpsonii									
08	**20**	0	100	-	-	0	0	0	3/3
11	**0**	0	0	-	-	0	0	0	-/-

A&F DRILL 1 (GIP) - TREND STUDY NO. 22R-18-11
Project #1007

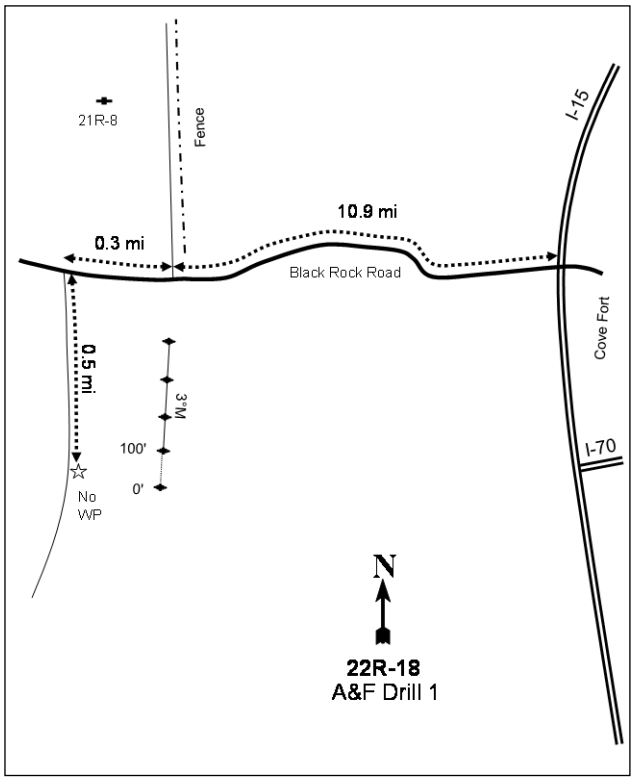
Vegetation Type: Grassland
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Semidesert Stony Loam (Black Sagebrush), R028AY252UT
Land Ownership: Private
Elevation: 5,330 ft. (1,625 m)
Aspect: South
Slope: 2%
Transect bearing: 3° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), 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) (For a total of 10.9Miles from I-15). 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, within 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 2012). Wildlife and livestock pellet groups were nearly absent in 2008. Sampled cattle sign was minimal in 2011 (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: The preferred browse species are forage kochia (*Kochia prostrata*) and fourwing saltbush (*Atriplex canescens*), which were seeded following the fire. Forage kochia is a mostly young population, with good vigor and low decadence within the population. Utilization of kochia plants has been light over the sample years. Recruitment of young kochia plants to the population was poor in 2008, but in 2011, a high number of seedlings were sampled as well as young plants. The fourwing saltbush is a very small population. Broom snakeweed (*Gutierrezia sarothrae*) has been the only other browse species sampled on the site since the outset of the study (Table - Browse Characteristics). An isolated patch of unburned Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is located to the southwest of the study site.

Herbaceous Understory: Grasses are abundant and fairly diverse on the site. The dominant grass species are crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*), which provide the majority of the grass cover on the site. In 2008, an unidentified grass species provided the majority of the cover. Seeded species sampled on the site include crested wheatgrass, Siberian wheatgrass (*Agropyron fragile*), intermediate wheatgrass, Russian wildrye (*Elymus junceus*), and Indian ricegrass (*Oryzopsis*

hymenoides). Other grass species sampled on the site include bottlebrush squirreltail (*Sitanion hystrix*), western wheatgrass (*Agropyron smithii*), Great Basin wildrye (*Elymus cinereus*), and sand dropseed (*Sporobolus cryptandrus*). The invasive annual grass species cheatgrass (*Bromus tectorum*) has been sampled in moderate abundance and cover on the site since the outset of the study. Forbs are not abundant or diverse, and perennial forbs are rare on the site. The annual species desert madwort (*Alyssum desertorum*) has been the dominant forb species and has provided the majority of the forb cover on the site since the outset of the study (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Decca component, which is found on fan terraces. The parent material consists of alluvium derived from igneous rock and quartzite. The soils within this classification are characterized as deep, excessively drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of pavement, and a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011, though there was evidence of wind erosion following the fire.

Trend Assessments

Browse

- **2008 to 2011 - up (+2):** The density of forage kochia increased substantially from 440 plants/acre to 15,860 plants/acre, and canopy cover increased from 1% to 10%. The majority of the increase in density was from an increase in recruitment of young plants to the population, which increased from 0 plants/acre to 14,980 plants/acre. A high density of seedlings was sampled in 2011 at 298,760 seedlings/acre. The density of fourwing saltbush increased from 20 plants/acre to 60 plants/acre.

Grass

- **2008 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased more than two-fold, and cover increased from 4% to 24%. In 2008, due to the size and indistinguishable characteristics, grasses were identified as an unknown perennial grass species, which provided 4% cover. In 2011, the seeded species crested wheatgrass, intermediate wheatgrass, Russian wildrye, and Indian ricegrass provided 11%, 7%, 2%, and 2% cover, respectively. The invasive annual grass species cheatgrass increased significantly in nested frequency, and cover increased from 1% to 6%.

Forb:

- **2008 to 2011 - stable (0):** Perennial forbs remained rare on the site. The annual species desert madwort increased significantly in nested frequency, though cover remained at 1%.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 18

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a11	b200	.06	10.76
G	Agropyron fragile	-	4	-	.18
G	Agropyron intermedium	a-	b141	-	7.07
G	Agropyron smithii	a-	b40	-	1.63
G	Bromus tectorum (a)	a109	b402	1.02	6.26
G	Elymus cinereus	a-	b26	-	.99
G	Elymus junceus	a-	b43	-	1.62
G	Oryzopsis hymenoides	a3	b32	.15	1.95

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Sitanion hystrix	3	1	.03	.03
G	Sporobolus cryptandrus	-	-	-	.00
G	Unknown grass - perennial	$_{b}$187	$_{a}$-	4.15	-
Total for Annual Grasses		109	402	1.02	6.26
Total for Perennial Grasses		204	487	4.39	24.25
Total for Grasses		313	889	5.42	30.52
F	Alyssum desertorum (a)	$_{a}$52	$_{b}$379	1.11	1.36
F	Amaranthus albus	-	-	.41	-
F	Astragalus lentiginosus	3	7	.04	.19
F	Draba sp. (a)	-	5	-	.00
F	Erodium cicutarium (a)	-	7	-	.04
F	Melilotus officinalis	-	-	.00	-
F	Phlox hoodii	-	1	-	.00
F	Phlox longifolia	$_{a}$10	$_{b}$37	.03	.28
F	Solanum triflorum (a)	1	-	.41	-
F	Sphaeralcea grossulariifolia	-	3	-	.03
F	Verbena bracteata	2	-	.15	-
Total for Annual Forbs		53	391	1.52	1.41
Total for Perennial Forbs		15	48	0.64	0.50
Total for Forbs		68	439	2.17	1.92

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

BROWSE TRENDS--
Management unit 22R, Study no: 18

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Atriplex canescens	1	3	-	.00
B	Kochia prostrata	19	40	.05	2.38
Total for Browse		20	43	0.05	2.39

CANOPY COVER, LINE INTERCEPT--
Management unit 22R, Study no: 18

Species	Percent Cover '08	Percent Cover '11
Atriplex canescens	-	.40
Kochia prostrata	.76	10.05

BASIC COVER--
Management unit 22R, Study no: 18

Cover Type	Average Cover % '08	'11
Vegetation	7.59	34.81
Rock	2.85	1.82
Pavement	86.88	40.98
Litter	.76	21.03
Cryptogams	0	.15
Bare Ground	10.00	4.11

SOIL ANALYSIS DATA --
Management unit 22R, Study no: 18, Study Name: A&F Drill 1

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	'11
Rabbit	5	1
Cattle	-	7

Days use per acre (ha) '08	'11
-	-
-	10 (25)

BROWSE CHARACTERISTICS--
Management unit 22R, Study no: 18

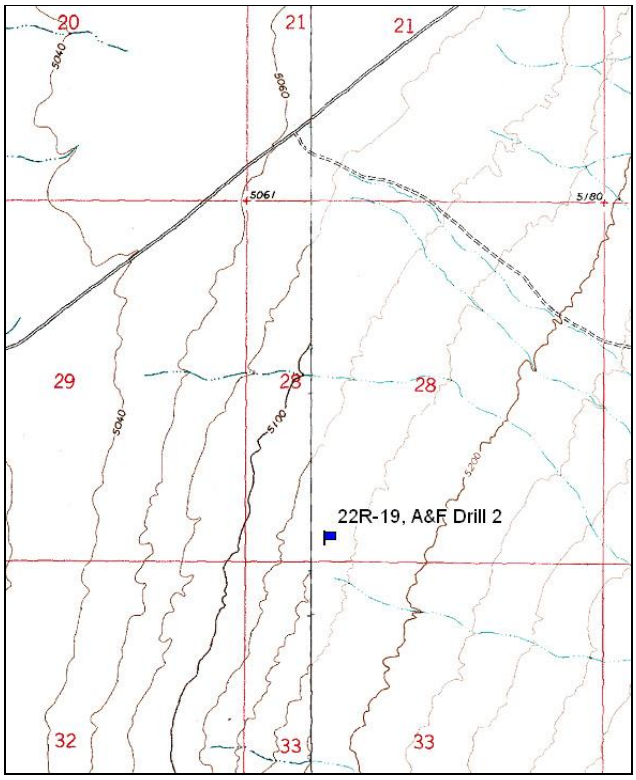
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Atriplex canescens									
08	**20**	100	0	0	20	0	0	0	-/-
11	**60**	33	33	33	-	33	0	0	24/33
Gutierrezia sarothrae									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	8/12
Kochia prostrata									
08	**440**	0	100	0	-	5	0	0	9/18
11	**15860**	94	5	0	298760	.25	0	0	13/30

A&F DRILL 2 - TREND STUDY NO. 22R-19-11
Project #1007

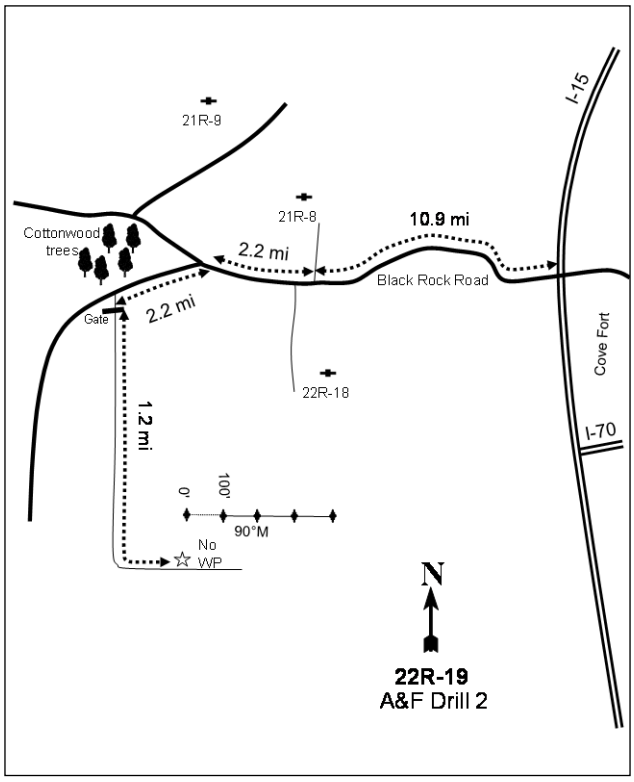
Vegetation Type: Annual Grass and Annual Forb
Range Type: Deer Winter
NRCS Ecological Site Description: Not available
Land Ownership: Private
Elevation: 5,146 ft. (1,569 m)
Aspect: West
Slope: 3%
Transect bearing: 90° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (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) (10.9 miles from I-15). 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



Diagrammatic Sketch:



Township: 25S Range: 9W Section: 28

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, within a grass flat, west of Antelope Mountain, on private land. Following the treatment, 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 2012). Wildlife and livestock pellet groups were nearly absent in 2008. Sampled cattle sign was minimal in 2011 (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: Browse species are limited on the site. Broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp.*) were the only browse species sampled, though each species was only sampled in height/crown measurements in 2011. No browse species were sampled on the study site in 2008 (Table - Browse Characteristics).

Herbaceous Understory: Grasses are moderately abundant, but are not diverse and are in poor condition. The invasive annual grass species cheatgrass (*Bromus tectorum*) is the dominant grass species, and provides the majority of the grass cover. Perennial grass species are rare on the site. Seeded grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), Siberian wheatgrass (*A. fragile*) and Indian ricegrass (*Oryzopsis hymenoides*). Other grass species sampled on the site include purple three-awn (*Aristida purpurea*), galleta (*Hilaria jamesii*), Sandberg bluegrass (*Poa secunda*), and needle-and-thread (*Stipa comata*). Forbs are moderately abundant, but are not particularly diverse and are dominated by weedy annual species. Perennial forbs are not very common on the site. Specklepod locoweed (*Astragalus lentiginosus*) has been the most common perennial forb species on the site since the outset of the study. The weedy annual forb species storksbill (*Erodium cicutarium*), Russian thistle (*Salsola iberica*), and tumblemustard (*Sisymbrium altissimum*)

are common on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy loam with a slightly alkaline soil reaction (pH 7.7) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of vegetation, and a moderate amount of litter and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Trend Assessments

Browse

- **2008 to 2011 - stable (0):** Browse species remained rare on the site.

Grass

- **2008 to 2011 - up (+2):** The sum of nested frequency of perennial grasses increased two-fold, and cover increased to 1%. Indian ricegrass was sampled for the first time in 2011 at 1% cover. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from 6% to 29%.

Forb:

- **2008 to 2011 - up (+2):** The sum of nested frequency of perennial forbs increased three-fold, and cover increased from 1% to 9%. The majority of the increase in nested frequency and cover can be attributed to specklepod locoweed, which increased significantly in nested frequency, and cover increased from less than 1% to 8%. The sum of nested frequency of annual forbs increased six-fold, and cover increased from 7% to 19%. Storksbill increased significantly in nested frequency, and cover increased from 3% to 12%.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 19

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	-	1	-	.03
G	Agropyron fragile	-	-	-	.00
G	Aristida purpurea	5	5	.18	.03
G	Bromus tectorum (a)	242	471	5.60	28.85
G	Hilaria jamesii	4	5	.15	.15
G	Oryzopsis hymenoides	-	10	-	.87
G	Poa secunda	-	1	-	.00
G	Stipa comata	2	-	.00	-
Total for Annual Grasses		242	471	5.60	28.85
Total for Perennial Grasses		11	22	0.33	1.09
Total for Grasses		253	493	5.94	29.94
F	Alyssum desertorum (a)	3	25	.00	.04
F	Argemone munita	5	-	.15	.00
F	Astragalus lentiginosus	11	66	.05	8.14
F	Eriogonum cernuum (a)	46	36	3.64	.13
F	Erodium cicutarium (a)	77	402	2.79	11.83
F	Lactuca serriola (a)	-	2	-	.00
F	Lappula occidentalis (a)	3	-	.03	-

Type	Species	Nested Frequency '08	'11	Average Cover % '08	'11
F	Lygodesmia sp.	1	-	.15	-
F	Mentzelia albicaulis (a)	3	-	.03	-
F	Oenothera sp.	3	2	.15	.15
F	Penstemon sp.	-	1	-	.00
F	Salsola iberica (a)	3	336	.00	4.06
F	Sisymbrium altissimum (a)	11	96	.06	2.43
F	Sphaeralcea grossulariifolia	3	2	.19	.36
Total for Annual Forbs		146	897	6.56	18.51
Total for Perennial Forbs		23	71	0.70	8.66
Total for Forbs		169	968	7.26	27.17

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	'11
Vegetation	15.45	51.71
Rock	.36	.28
Pavement	74.23	24.96
Litter	2.78	18.88
Bare Ground	15.80	8.04

SOIL ANALYSIS DATA --
Management unit 22R, Study no: 19, Study Name: A&F Drill Seed

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	'11	Days use per acre (ha) '08	'11
Rabbit	9	2	-	-
Deer	4	-	-	-
Cattle	1	-	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 22R, Study no: 19

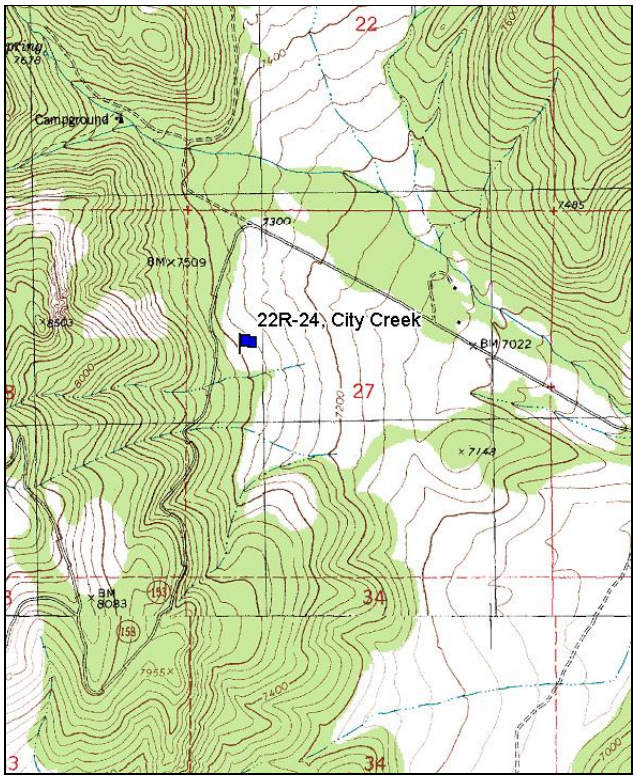
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae									
08	**0**	0	0	-	-	0	0	0	-/-
11	**20**	0	100	-	-	0	0	0	14/15
Opuntia sp.									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	6/13

CITY CREEK - WRI STUDY 22R-24-11
Project #1995

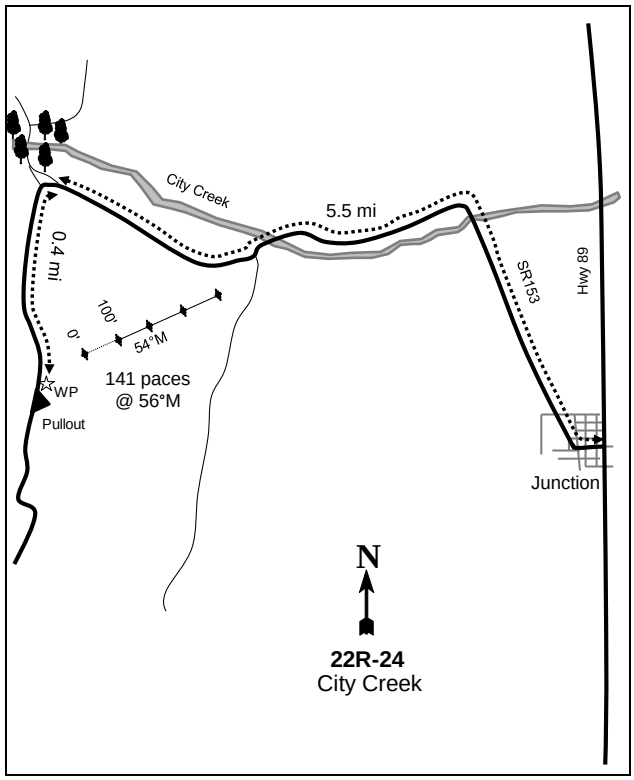
Vegetation Type: Pinyon and Juniper Woodland
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Not available
Land Ownership: Forest Service
Elevation: 7,341 ft (2,237 m)
Aspect: Northeast
Slope: 10%
Transect bearing: 54° magnetic
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)
No rebar

Directions: From the town of Junction turn on to SR153 (Center St) head west 5.5 miles stay left heading towards Puffer lake and go another 0.4 miles to a pullout on the east side of the road. From the pullout, the transect is on the east side of the road, the 0-foot stake is 141 paces at 56 degrees magnetic and is marked with browse tag #192.

Map Name: Delano Peak



Diagrammatic Sketch:



Township: 29S Range: 4W Section: 27S

GPS: NAD 83, UTM 12S 385840 E 4235499 N

CITY CREEK - WRI STUDY 22R-24
Project #1995

Site Description

Site Information: The study is located approximately four and half miles west of Junction, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, west of City Creek Wildlife Management Area (WMA), within the Fishlake National Forest. Prior to treatment, the study was established in 2011 to monitor the effects of a bullhog project to remove encroaching pinyon and juniper trees from an old chaining treatment. The original chaining was done several decades ago, and over time pinyon and juniper trees reestablished within the treatment area. A total of 2,129 acres have been or will be treated in 2011 and 2012. Treatments will occur with the use of a track-type skid-steer loader (Bobcat) using a brushsaw or bullhog attachment. Future Management in this area includes a 60% reduction in livestock numbers from 200 - 80, and reduced utilization from 60% to 30%. Follow up steps after this treatment include prescribed fire in specific areas, which will be followed by re-seeding, and total rest from livestock grazing for a minimum of two growing seasons. The objectives of the project are to remove pinyon and juniper trees, and increase desirable and palatable forbs, shrubs, and grasses (WRI Database 2012). Pellet groups were sampled in high abundance for deer and low abundance for elk and cattle in 2011 (Table - Pellet Group Data).

Browse: A dense population of pinyon pine and Utah juniper trees dominated the site (Table - Point-Quarter Tree Data) and provided the majority of the canopy cover on the site in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009). The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), curlleaf mountain mahogany (*Cercocarpus ledifolius*), true mountain mahogany (*C. montanus*), antelope bitterbrush (*Purshia tridentata*), and Gambel oak (*Quercus gambelii*). The dominant preferred browse species are mountain big sagebrush, antelope bitterbrush, and Gambel oak. The mountain big sagebrush is a moderately dense population, with high decadence and poor vigor within the population. The antelope bitterbrush is a scattered population, with high decadence and moderately poor vigor within the population. The Gambel oak is a scattered population, with low decadence and good vigor within the population. Utilization was mostly moderate for oak and sagebrush, but heavier for bitterbrush. The recruitment of young sagebrush and bitterbrush plants to their populations was poor, but recruitment of young oak plants was good. Other browse species sampled on the site include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus*), pricklypear cactus (*Opuntia sp.*), and mountain ball cactus (*Pediocactus simpsonii*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are moderately abundant and somewhat diverse on the site. The dominant grass species are mutton bluegrass (*Poa fendleriana*) and Ross sedge (*Carex rossii*), which provided the majority of the grass cover on the site. Other grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), bluebunch wheatgrass (*A. spicatum*), bottlebrush squirreltail (*Sitanion hystrix*), and Letterman needlegrass (*Stipa lettermani*). The weedy annual grass species cheatgrass was sampled on the site in low abundance. Forbs are not overly abundant, but are fairly diverse on the site. No single forb species was dominant on the site (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Bare ground cover is low on the site, though there is a high amount of vegetation, rock, and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2011.

HERBACEOUS TRENDS--
Management unit 22R, Study no: 24

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron cristatum	3	.15
G	Agropyron intermedium	19	.43
G	Agropyron spicatum	3	.03
G	Bromus tectorum (a)	21	.06
G	Carex rossii	48	1.55
G	Poa fendleriana	109	2.96
G	Sitanion hystrix	30	.23
G	Stipa lettermani	13	.11
Total for Annual Grasses		21	0.06
Total for Perennial Grasses		225	5.48
Total for Grasses		246	5.54
F	Agoseris glauca	3	.06
F	Arabis holboellii	15	.08
F	Astragalus convallarius	-	.01
F	Astragalus sp.	3	.03
F	Calochortus nuttallii	6	.01
F	Castilleja chromosa	3	.00
F	Chaenactis douglasii	4	.01
F	Chenopodium fremontii (a)	3	.00
F	Collinsia parviflora (a)	14	.02
F	Erigeron pumilus	1	.00
F	Eriogonum racemosum	6	.06
F	Gayophytum ramosissimum(a)	90	.24
F	Hymenopappus filifolius	2	.03
F	Lactuca serriola (a)	1	.00
F	Lomatium sp.	20	.04
F	Lotus utahensis	30	.18
F	Penstemon comarrhenus	1	.00
F	Phlox longifolia	6	.04
F	Polygonum douglasii (a)	6	.03
F	Senecio multilobatus	4	.01
F	Trifolium gymnocarpon	4	.03
F	Zigadenus paniculatus	18	.15
Total for Annual Forbs		114	0.30
Total for Perennial Forbs		126	0.79
Total for Forbs		240	1.09

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

BROWSE TRENDS--
Management unit 22R, Study no: 24

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	81	11.67
B	Cercocarpus ledifolius	2	-
B	Cercocarpus montanus	4	.76
B	Chrysothamnus viscidiflorus viscidiflorus	4	.03
B	Juniperus osteosperma	9	7.92
B	Opuntia sp.	8	.00
B	Pediocactus simpsonii	1	-
B	Pinus edulis	12	5.82
B	Purshia tridentata	18	3.48
B	Quercus gambelii	20	6.25
Total for Browse		159	35.94

CANOPY COVER, LINE INTERCEPT--
Management unit 22R, Study no: 24

Species	Percent Cover '11
Artemisia tridentata vaseyana	11.14
Cercocarpus ledifolius	.10
Cercocarpus montanus	.53
Chrysothamnus viscidiflorus viscidiflorus	.20
Juniperus osteosperma	11.50
Opuntia sp.	.11
Pinus edulis	17.89
Purshia tridentata	4.51
Quercus gambelii	9.46

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 22R, Study no: 24

Species	Average leader growth (in) '11
Artemisia tridentata vaseyana	1.8
Purshia tridentata	4.5
Cercocarpus montanus	5.8
Cercocarpus ledifolius	3.6

POINT-QUARTER TREE DATA--
Management unit 22R, Study no: 24

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	131	6.7
Pinus edulis	229	3.9

BASIC COVER--
Management unit 22R, Study no: 24

Cover Type	Average Cover % '11
Vegetation	38.15
Rock	26.75
Pavement	3.69
Litter	45.28
Cryptogams	.66
Bare Ground	13.03

PELLET GROUP DATA--
Management unit 22R, Study no: 24

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	2	-
Elk	-	2 (5)
Deer	20	46 (112)
Cattle	1	1 (2)

BROWSE CHARACTERISTICS--
Management unit 22R, 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)
Artemisia tridentata vaseyana									
11	**3880**	6	39	55	40	37	5	30	22/30
Cercocarpus ledifolius									
11	**40**	0	100	-	-	0	50	0	20/22
Cercocarpus montanus									
11	**80**	0	100	-	-	25	50	0	36/39
Chrysothamnus viscidiflorus viscidiflorus									
11	**120**	0	100	-	-	0	0	0	7/11
Juniperus osteosperma									
11	**180**	0	100	-	-	0	0	0	-/-

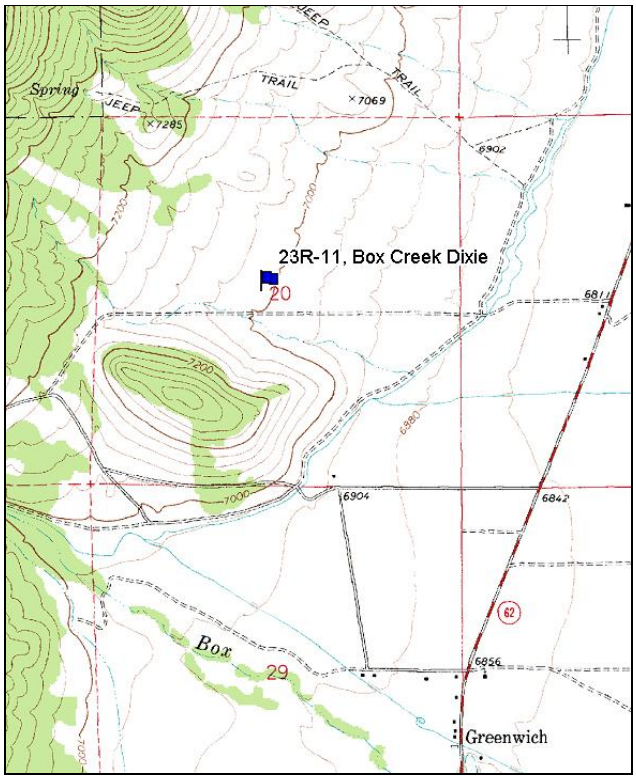
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Opuntia sp.									
11	**200**	0	80	20	-	0	0	20	5/13
Pediocactus simpsonii									
11	**20**	0	100	-	-	0	0	0	3/3
Pinus edulis									
11	**240**	50	33	17	60	0	0	0	-/-
Purshia tridentata									
11	**420**	0	76	24	-	43	48	14	24/42
Quercus gambelii									
11	**1340**	24	70	6	-	24	1	6	34/34

BOX CREEK DIXIE - WRI STUDY 23R-11-11

Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Not available
Land Ownership: BLM
Elevation: 6,940 ft (2,115 m)
Aspect: East
Slope: 6%
Transect bearing: 21° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From mile marker 32 on SR 62, drive north 0.4 miles to a turnoff on the left with a sign showing "To Box Creek". Turn here and drive 0.6 miles to a crossroads. Continue straight for 0.5 miles to a fork. Turn right and drive0.2 miles to another fork and turn right. Drive 0.3 miles to an intersection, continue straight (northwest) for 0.3 miles to a fork and turn right. Go 0.2 miles to a witness post on the left. From the witness post walk 18 paces at 26 degrees magnetic to the 0-foot stake marked with browse tag #169.

Map Name: Greenwich



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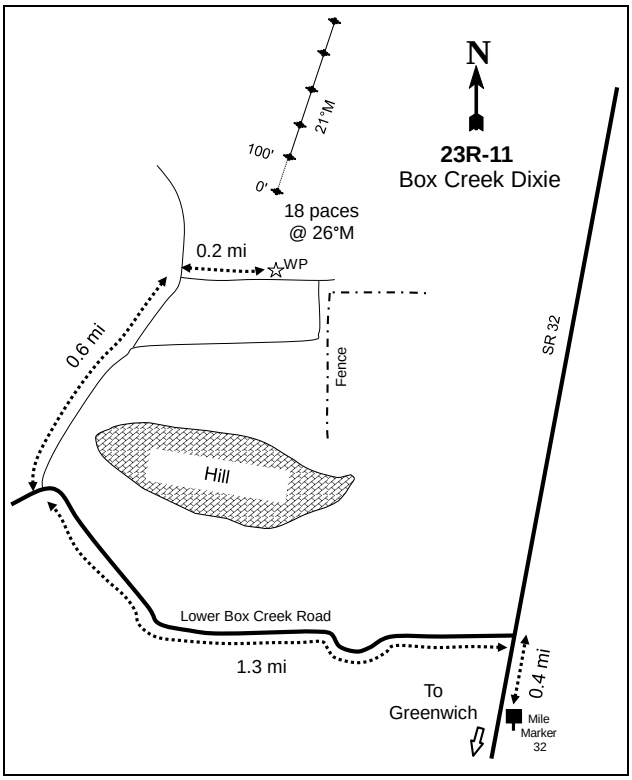


Township: 27S Range: 1W Section: 3

GPS: NAD 83, UTM 12S 418610 E 4255979 N

BOX CREEK DIXIE - WRI STUDY 23R-11

Site Description

Site Information: The study is located approximately one mile northwest of Greenwich, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) flat, north of Box Creek. The area is administrated by the Bureau of Land Management (BLM) as part of the Box Creek allotment. Prior to treatment, the study was established in 2006 to monitor a two-way Dixie harrow project. In the fall of 2006, the study site was two-way Dixie harrowed and a seed mix of grass, forb, and browse species was seeded on the project area between passes of the harrow. Forage Kochia (*Kochia prostrata*) was aerially seeded on the project area after the completion of the harrow project (Table - Seed Mix). In 2011, following the treatment, none of the transect stakes were located and new stakes were placed as close to the original locations as possible. Pellet groups were sampled in low abundance for cattle in 2011, and low abundance for deer in 2006 and 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 23R, Study no: 11

Project Name: Box Creek Dixie WRI Database #: PDB	
Application: Broadcast Seed	
Seed Type	
G	Big Bluegrass 'Sherman'
G	Bluebunch Wheatgrass 'Anatone'
G	Crested Wheatgrass 'Hycrest'
G	Great Basin Wildrye 'Magnar'
G	Pubescent Wheatgrass 'Luna'
G	Russian wildrye 'Bozoisky'
G	Sandberg's Bluegrass
G	Sheep Fescue 'Covar'
G	Snake River Wheatgrass 'Secar'
F	Alfalfa 'Ladak'
F	Blue Flax 'Appar'
F	Sainfoin 'Eski'
F	Small Burnet 'Delar'
F	Yellow Sweetclover 'Madrid'
B	*Forage Kochia
B	Fourwing Saltbush

*Forage kochia was aerially seeded over the project following the completion of the two-way harrow.

Browse: The preferred browse species on the site is Wyoming big sagebrush, which has provided the majority of the browse canopy cover on the site since the outset of the study (Table - Canopy Cover). The Wyoming big sagebrush is a moderately dense population, with low decadence and good vigor within the population; though prior to treatment decadence was high and vigor was poor. Utilization of sagebrush plants has been mostly light over the sample years. The recruitment of young sagebrush plants to the population has been good since the outset of the study. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are not overly abundant, but are fairly diverse on the site. The dominant grass species are Russian wildrye (*Elymus junceus*) and bottlebrush squirreltail (*Sitanion hystrix*). Prior to treatment, only two grass species were sampled, Indian rice grass (*Oryzopsis hymenoides*) and bottlebrush squirreltail, though both species were limited on the site. Seeded grass species sampled on the site included crested wheatgrass (*Agropyron cristatum*), pubescent wheatgrass (*Agropyron intermedium*), Great Basin

wildrye (*Elymus cinereus*), sheep fescue (*Festuca ovina*), and Russian wildrye, though each species was fairly rare on the site. Other grass species sampled on the site included galleta (*Hilaria jamesii*), and needle-and-thread (*Stipa comata*). The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site following the treatment in low abundance. Forbs are moderately abundant and fairly diverse on the site. Perennial forb species are rare on the site. The site is dominated by the annual forb species tumblemustard (*Sisymbrium altissimum*), Russian thistle (*Salsola iberica*), annual stickseed (*Lappula occidentalis*), and pinnate tansymustard (*Descurainia pinnata*) (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a loam with a mildly alkaline soil reaction (pH 7.4). Bare ground cover is moderately high on the site, though there is a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as critical in 2006 due to moderately high surface litter movement, a high amount of pedestaling around perennial plants, flow patterns, rills, gullies, and a high rate of soil movement. The soil erosion condition was classified as stable in 2011.

Pre vs. Five Year Post Treatment, 2006 vs. 2011

Browse: The density of Wyoming big sagebrush increased two-fold from 3,440 plants/acre to 6,900 plants/acre. Most of the change in density can be attributed to the increase in recruitment of young plants to the population, which increased from 24% to 75% of the population. The health of the sagebrush population improved with decadence decreasing from 33% to less than 1%, and plants displaying poor vigor decreasing from 19% to less than 1% of the population.

Grasses: Grasses remained limited on the site. The sum of nested frequency of perennial grasses increased 59%, and cover increased to 1%.

Forbs: Perennial forbs remained limited on the site. The sum of nested frequency of annual forbs increased substantially, and cover increased from 1% to 20%. Prior to treatment, only four forb species were sampled. Following the treatment, species diversity increased, though much of the increase was due to the increase of annual forbs. The weedy annual forb species tumblemustard, Russian thistle, annual stickseed, and pinnate tansymustard provided 11%, 4%, 3%, and 1% cover, respectively.

HERBACEOUS TRENDS--
Management unit 23R, Study no: 11

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	-	2	-	.03
G	Agropyron intermedium	-	1	-	.03
G	Bromus tectorum (a)	-	3	-	.00
G	Elymus cinereus	-	2	-	.00
G	Elymus junceus	[a]-	[b]12	-	.51
G	Festuca ovina	-	5	-	.03
G	Hilaria jamesii	-	3	-	.03
G	Oryzopsis hymenoides	7	4	.04	.09
G	Sitanion hystrix	22	17	.31	.38
G	Stipa comata	-	-	-	.03
Total for Annual Grasses		0	3	0	0.00
Total for Perennial Grasses		29	46	0.35	1.14
Total for Grasses		29	49	0.35	1.14

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
F	Astragalus calycosus	$_{a}$-	$_{b}$13	-	.05
F	Astragalus lentiginosus	3	6	.03	.04
F	Caulanthus crassicaulis	2	-	.01	.03
F	Collinsia parviflora (a)	-	10	-	.01
F	Cryptantha sp.	-	2	-	.01
F	Descurainia pinnata (a)	$_{a}$36	$_{b}$119	.51	1.25
F	Eriogonum cernuum (a)	$_{a}$-	$_{b}$21	-	.06
F	Erodium cicutarium (a)	-	5	-	.01
F	Gayophytum ramosissimum(a)	$_{a}$-	$_{b}$25	-	.08
F	Helianthus annuus (a)	-	2	-	.03
F	Ipomopsis aggregata	3	4	.02	.30
F	Lactuca serriola (a)	$_{a}$-	$_{b}$69	-	.49
F	Lappula occidentalis (a)	$_{a}$-	$_{b}$142	-	2.58
F	Lupinus brevicaulis (a)	-	1	-	.00
F	Marrubium vulgare	$_{a}$-	$_{b}$28	-	.44
F	Mentzelia albicaulis (a)	-	10	-	.04
F	Phlox longifolia	-	2	-	.03
F	Ranunculus testiculatus (a)	-	3	-	.00
F	Salsola iberica (a)	$_{a}$-	$_{b}$341	-	4.32
F	Sisymbrium altissimum (a)	$_{a}$-	$_{b}$331	-	11.03
F	Sphaeralcea coccinea	-	4	-	.18
F	Tragopogon dubius (a)	-	3	-	.03
Total for Annual Forbs		36	1082	0.50	19.97
Total for Perennial Forbs		8	59	0.06	1.09
Total for Forbs		44	1141	0.56	21.06

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

BROWSE TRENDS--
Management unit 23R, Study no: 11

Type	Species	Strip Frequency '06	Strip Frequency '11	Average Cover % '06	Average Cover % '11
B	Artemisia tridentata wyomingensis	82	62	19.25	8.35
B	Opuntia sp.	0	0	.03	-
Total for Browse		82	62	19.28	8.35

CANOPY COVER, LINE INTERCEPT--
Management unit 23R, Study no: 11

Species	Percent Cover '06	Percent Cover '11
Artemisia tridentata wyomingensis	21.73	11.14
Opuntia sp.	.16	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 23R, Study no: 11

Species	Average leader growth (in)	
	'06	'11
Artemisia tridentata wyomingensis	1.6	2.4

BASIC COVER--
Management unit 23R, Study no: 11

Cover Type	Average Cover %	
	'06	'11
Vegetation	19.60	29.12
Rock	5.97	6.56
Pavement	26.96	7.14
Litter	23.73	26.97
Cryptogams	1.20	.16
Bare Ground	34.43	34.09

SOIL ANALYSIS DATA --
Management unit 23R, Study no: 11, Study Name: Box Creek Dixie

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
13.4	7.4	46.0	29.1	24.9	1.6	15.7	163.2	0.6

PELLET GROUP DATA--
Management unit 23R, Study no: 11

Type	Quadrat Frequency		Days use per acre (ha)	
	'06	'11	'06	'11
Rabbit	65	2	-	-
Elk	-	1	-	1 (2)
Deer	12	5	12 (30)	9 (22)

BROWSE CHARACTERISTICS--
Management unit 23R, Study no: 11

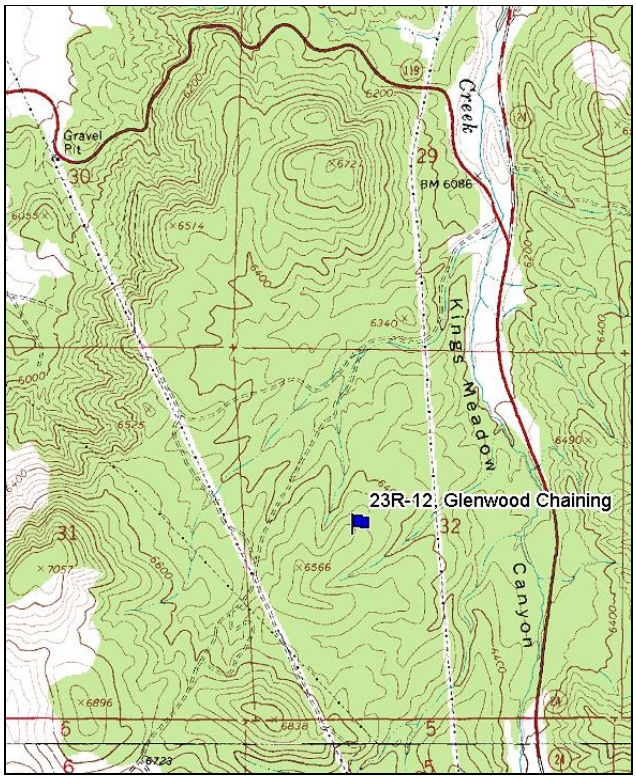
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
06	**3440**	24	43	33	800	3	2	19	25/38
11	**6900**	75	25	0	23380	2	0	0	21/28
Gutierrezia sarothrae									
06	**0**	0	0	-	-	0	0	0	5/9
11	**0**	0	0	-	-	0	0	0	-/-
Opuntia sp.									
06	**0**	0	0	-	20	0	0	0	4/9
11	**0**	0	0	-	-	0	0	0	-/-

GLENWOOD CHAINING - WRI STUDY 23R-12-11
Project #1941

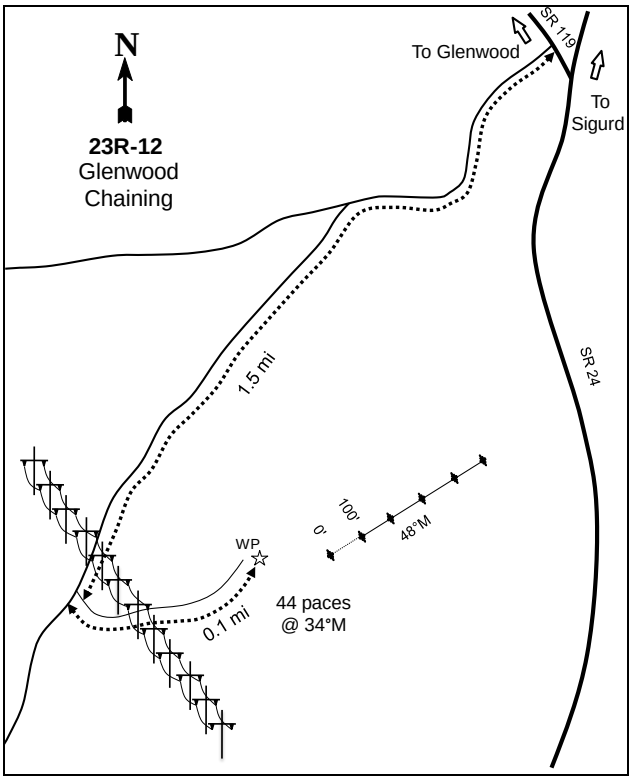
Vegetation Type: Pinyon and Juniper Woodland
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Upland Shallow Loam (Utah Juniper - Pinyon), R028AY324UT
Land Ownership: SITLA
Elevation: 6,449 ft (1,964 m)
Aspect: Northeast
Slope: 15%
Transect bearing: 48° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the junction of SR 24 and SR 119 turn onto the dirt road heading southwest and go 1.5 miles. Just past the power poles turn left heading east up to the top of a hill go 0.1 miles and park on the top of the hill. The 0-foot stake is 44 paces at 35 degrees magnetic and is marked with browse tag #190.

Map Name: Sigurd



Diagrammatic Sketch:



Township: 23S Range: 1W Section: 32

GPS: NAD 83, UTM 12S 418699 E 4290352 N

GLENWOOD CHAINING - WRI STUDY 23R-12
Project #1941

Site Description

Site Information: The study is located approximately two and half miles east of Glenwood, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland, west of Kings Meadow Canyon. The study is on land administrated by the Utah School and Institutional Trust Lands Administration (SITLA). Prior to treatment, the study was established in 2011 to monitor the effects of a two-way Ely chaining project. In the fall of 2011, a total of 305 acres was two-way chained with an Ely chain on the first pass and a smooth chain on the second pass. A seed mix of grass and forb species was aerially seeded over the project area following the first pass of the chain. Seed dribblers were used during the second pass of the chain to distribute antelope bitterbrush (*Purshia tridentata*) and small burnet (*Sanguisorba minor*) seed over the project area (Table - Seed Mix). The objectives of the project are to decrease encroaching pinyon and juniper trees within defined polygons by at least 80% thereby releasing the existing shrub steppe understory, and increase diversity through seeding (Table - WRI Database). Deer and elk pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 23R, Study no: 12

Project Name: Glenwood Habitat Enhancement - Chaining
WRI Database #: 1941

Application: Aerial Seed		Acres:	317	Application: Dribbler		Acres:	210
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Bluebunch WG 'P-7'	400	1.26	F	Small Burnet 'Delar'	100	0.48
G	Crested Wheatgrass 'Ephraim'	550	1.74	B	Bitterbrush	75	0.36
G	Indian Ricegrass 'Rimrock'	400	1.26	Total Pounds:		175	0.83
G	Needle and Threadgrass	150	0.47	PLS Pounds:			0.74
G	Pubescent Wheatgrass 'Luna'	300	0.95				
G	Russian Wildrye	300	0.95				
G	Sandberg Bluegrass	150	0.47				
F	Alfalfa 'Nomad'	300	0.95				
F	Annual Sunflower	310	0.98				
F	Blue Flax 'Appar'	300	0.95				
F	Palmer Penstemon	75	0.24				
F	Small Burnet 'Delar'	700	2.21				
F	Yellow Sweetclover	300	0.95				
Total Pounds:		4235	13.36				
PLS Pounds:			12.02				

Browse: A dense population of pinyon pine and Utah juniper trees dominated the site at (Table - Point-Quarter Tree Data), and provided the majority of the canopy cover on the site in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009). The preferred browse species on the site are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush, though both species were rare on the site. A small population of pricklypear cactus (*Opuntia sp.*) was the only other browse species sampled on the site (Table - Browse Characteristics).

Herbaceous Trends: Grasses are not very common on the site and are dominated by the weedy annual grass species cheatgrass (*Bromus tectorum*). Perennial grasses are rare, which include Indian ricegrass (*Oryzopsis hymenoides*), mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*P. secunda*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are rare on the site (Table - Herbaceous Trends)

Soil: The soil is classified as part of the Pass Canyon-Red Butte complex, which is found on hills and foothills. The parent material consists of colluvium and/or slope alluvium derived from igneous rock and/or colluvium over residuum weathered from igneous rock. The soils within this classification are characterized as shallow to deep, well drained, and with a moderately permeable restrictive layer. The soil surface texture is a very gravelly sandy loam (Soil Survey Staff 2011). Bare ground cover is low on the site, though there is a moderate amount of litter and high amount of pavement and rock providing protective ground cover (Table - Basic Cover). Due to surface litter movement and pedestaling, the soil erosion condition was classified as slight in 2011.

HERBACEOUS TRENDS--
Management unit 23R, Study no: 12

Type	Species	Nested Frequency '11	Average Cover % '11
G	Bromus tectorum (a)	150	1.22
G	Oryzopsis hymenoides	1	.00
G	Poa fendleriana	5	.03
G	Poa secunda	1	.00
G	Sitanion hystrix	34	.18
Total for Annual Grasses		150	1.22
Total for Perennial Grasses		41	0.22
Total for Grasses		191	1.44
F	Arabis holboellii	5	.03
F	Astragalus calycosus	3	.03
F	Calochortus nuttallii	2	.00
F	Chaenactis douglasii	1	.00
F	Cryptantha sp.	4	.03
F	Eriogonum cernuum (a)	5	.03
F	Gayophytum ramosissimum(a)	1	.00
F	Gilia sp. (a)	117	.71
F	Lactuca serriola (a)	5	.01
F	Ranunculus testiculatus (a)	14	.05
F	Streptanthus cordatus	3	.04
Total for Annual Forbs		142	0.81
Total for Perennial Forbs		18	0.14
Total for Forbs		160	0.96

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

BROWSE TRENDS--
Management unit 23R, Study no: 12

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia tridentata vaseyana	2	-
B	Juniperus osteosperma	7	7.18
B	Opuntia sp.	2	.15
B	Pinus edulis	2	3.36
B	Purshia tridentata	1	.38
Total for Browse		14	11.07

CANOPY COVER, LINE INTERCEPT--
Management unit 23R, Study no: 12

Species	Percent Cover '11
Artemisia tridentata vaseyana	.03
Juniperus osteosperma	14.14
Pinus edulis	12.60

POINT-QUARTER TREE DATA--
Management unit 23R, Study no: 12

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	212	6.7
Pinus edulis	56	5.6

BASIC COVER--
Management unit 23R, Study no: 12

Cover Type	Average Cover % '11
Vegetation	12.71
Rock	19.27
Pavement	41.89
Litter	24.54
Cryptogams	.44
Bare Ground	12.87

PELLET GROUP DATA--
Management unit 23R, Study no: 12

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	11	-
Elk	1	2 (5)
Deer	3	3 (7)
Cattle	1	-

BROWSE CHARACTERISTICS--
Management unit 23R, Study no: 12

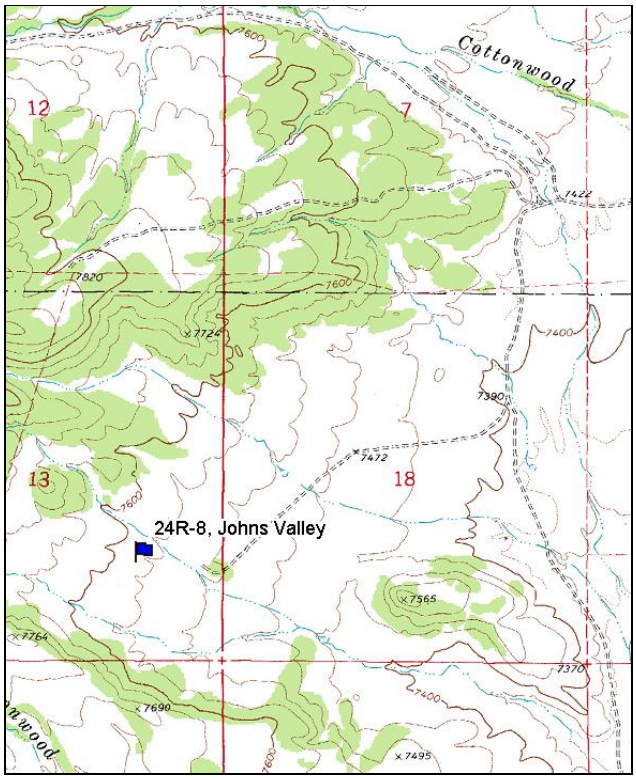
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
11	**40**	0	0	100	-	0	0	100	25/16
Juniperus osteosperma									
11	**140**	29	43	29	80	0	0	0	-/-
Opuntia sp.									
11	**40**	0	100	-	-	0	0	0	5/17
Pinus edulis									
11	**40**	0	100	-	40	0	0	0	-/-
Purshia tridentata									
11	**20**	0	0	100	-	0	100	0	40/65

JOHNS VALLEY - WRI STUDY 24R-8-11
Project #2055

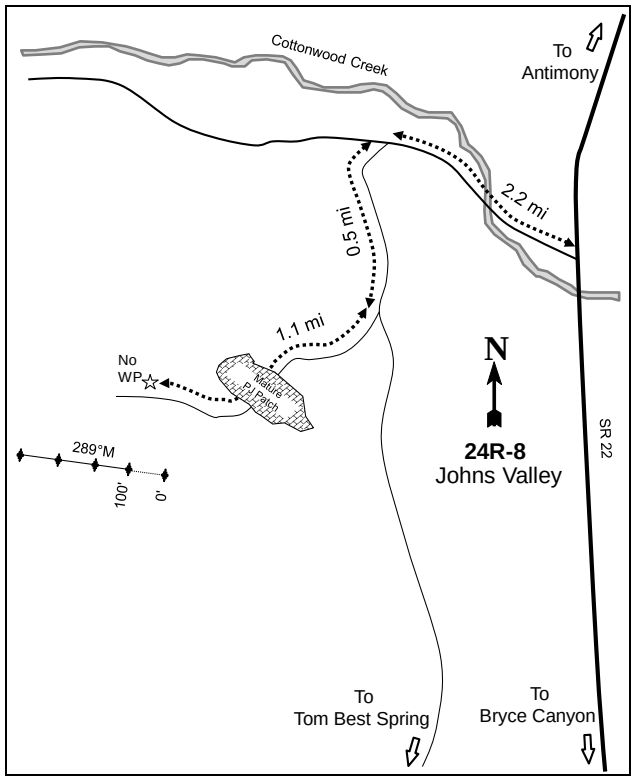
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R047XB336UT
Land Ownership: Forest Service
Elevation: 7,493 ft (2,283 m)
Aspect: East
Slope: 4%
Transect bearing: 289° magnetic
Belt placement: line 1 (11ft & 95 ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: From SR 22 turn west onto the Cottonwood road. Head west 2.2 miles and turn right heading south towards Tom Best Spring. Turn right on a two track road and head south 0.5 miles. The 0-foot stake is 100 paces south of the road and is marked with browse tag #191.

Map Name: Cow Creek



Diagrammatic Sketch:



Township: 33S Range: 3W Section: 13

GPS: NAD 83, UTM 12S 406657 E 4198823 N

JOHNS VALLEY - WRI STUDY 24R-8
Project #2055

Site Description

Site Information: The study is located approximately seven and half miles north of Widtsoe Junction, within a pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) woodland, on the northwest end of Johns Valley near Cottonwood Creek, within the Dixie National Forest. Prior to treatment, the study was established in 2011 to monitor the effects of a bullhog project to remove pinyon and juniper trees. Approximately, 1,236 acres will be treated with a bull hog, Dixie harrow, seeding, and hand thinning of pinyon and juniper in riparian areas. In addition, some prescribed burning on steeper sloped pinyon and juniper woodland areas could occur. The objectives of the project are to enhance sage-steppe habitat, restore function to sagebrush ecosystems, and riparian areas (WRI Database 2012). Deer, elk, and cattle pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

Browse: Prior to the treatment, pinyon pine and Rocky Mountain juniper provided the majority of the canopy cover on the site (Table - Canopy Cover). The stage of woodland succession was in Phase II prior to treatment (Tausch et al. 2009). The preferred browse species on the site are black sagebrush (*Artemisia nova*), mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), curlleaf mountain mahogany (*Cercocarpus ledifolius*), and antelope bitterbrush (*Purshia tridentata*). The dominant preferred browse species are black sagebrush and mountain big sagebrush. The mountain big sagebrush and black sagebrush are moderately dense populations, with high decadence and moderate vigor within their respective populations. Utilization of sagebrush plants was mostly moderate for mountain big sagebrush, and light for black sagebrush. The recruitment of young sagebrush plants to the population has been good for black sagebrush, but poor for mountain big sagebrush. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous*), stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), prickly phlox (*Leptodactylon pungens*), pricklypear cactus (*Opuntia sp.*), and mountain ball cactus (*Pediocactus simpsonii*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are abundant and fairly diverse on the site. The dominant grass species are crested wheatgrass (*Agropyron cristatum*), blue grama (*Bouteloua gracilis*), obtuse sedge (*Carex obtusata*), and needle-and-thread (*Stipa comata*). Forbs are not overly abundant, but are fairly diverse on the site. No single forb species were dominant on the site. The forb composition consisted mostly of perennial forbs (Table - Herbaceous Trends)

Soil: The soil is classified as part of the Guben-Showalter complex, which is found on pediments. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer. The soil surface texture is a gravelly loam (Soil Survey Staff 2011). Bare ground cover is high on the site, though there is a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). Due to high amounts of surface litter and soil movement, rock movement, pedestalling, rills, and active gully formation the soil erosion condition was classified as moderate in 2011.

HERBACEOUS TRENDS--
Management unit 24R, Study no: 8

Type	Species	Nested Frequency '11	Average Cover % '11
G	Agropyron cristatum	102	3.22
G	Agropyron dasystachyum	7	.01
G	Bouteloua gracilis	85	1.51
G	Carex obtusata	201	5.93
G	Oryzopsis hymenoides	3	.18
G	Poa fendleriana	17	.34
G	Sitanion hystrix	29	.45
G	Stipa comata	85	1.57
G	Stipa lettermani	3	.03
Total for Annual Grasses		0	0
Total for Perennial Grasses		532	13.26
Total for Grasses		532	13.26
F	Chaenactis douglasii	1	.03
F	Cryptantha sp.	11	.12
F	Descurainia pinnata (a)	16	.04
F	Draba sp. (a)	3	.00
F	Erigeron divergens	3	.06
F	Erigeron pumilus	6	.02
F	Eriogonum alatum	3	.03
F	Eriogonum racemosum	21	.35
F	Gayophytum ramosissimum(a)	27	.07
F	Hymenopappus filifolius	6	.18
F	Lotus utahensis	30	.39
F	Machaeranthera canescens	2	.00
F	Penstemon comarrhenus	2	.30
F	Phlox longifolia	5	.01
F	Senecio multilobatus	1	.03
F	Sphaeralcea coccinea	4	.01
F	Tragopogon dubius (a)	-	.00
F	Trifolium gymnocarpon	32	.18
Total for Annual Forbs		46	0.12
Total for Perennial Forbs		127	1.74
Total for Forbs		173	1.86

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

BROWSE TRENDS--
Management unit 24R, Study no: 8

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia nova	38	4.98
B	Artemisia tridentata vaseyana	47	4.89
B	Cercocarpus ledifolius	1	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	-
B	Gutierrezia sarothrae	23	.39
B	Juniperus scopulorum	2	3.37
B	Leptodactylon pungens	8	.36
B	Opuntia sp	1	-
B	Pediocactus simpsonii	2	.00
B	Pinus edulis	8	3.17
B	Purshia tridentata	2	.41
Total for Browse		133	17.59

CANOPY COVER, LINE INTERCEPT--
Management unit 24R, Study no: 8

Species	Percent Cover '11
Artemisia nova	6.58
Artemisia tridentata vaseyana	7.83
Gutierrezia sarothrae	.95
Juniperus scopulorum	4.40
Leptodactylon pungens	.25
Pinus edulis	11.78
Purshia tridentata	1.23

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 24R, Study no: 8

Species	Average leader growth (in) '11
Artemisia nova	0.6
Artemisia tridentata vaseyana	1.0

POINT-QUARTER TREE DATA--
Management unit 24R, Study no: 8

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus osteosperma	20	4.7
Juniperus scopulorum	28	5.8
Pinus edulis	80	5.1

BASIC COVER--
Management unit 24R, Study no: 8

Cover Type	Average Cover % '11
Vegetation	30.39
Rock	6.81
Pavement	4.05
Litter	27.75
Cryptogams	2.08
Bare Ground	44.73

PELLET GROUP DATA--
Management unit 24R, Study no: 8

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	28	-
Elk	2	5 (12)
Deer	9	6 (15)
Cattle	1	2 (4)

BROWSE CHARACTERISTICS--
Management unit 24R, Study no: 8

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
11	**2600**	12	65	23	60	2	0	15	13/23
Artemisia tridentata vaseyana									
11	**1660**	0	58	42	40	42	1	16	24/39
Cercocarpus ledifolius									
11	**20**	0	100	-	-	0	100	0	26/33
Chrysothamnus nauseosus									
11	**0**	0	0	-	-	0	0	0	35/34
Chrysothamnus viscidiflorus viscidiflorus									
11	**20**	0	100	-	-	0	0	0	5/10
Gutierrezia sarothrae									
11	**1580**	1	99	-	-	0	0	0	8/9
Juniperus scopulorum									
11	**40**	0	100	-	-	0	0	0	-/-
Leptodactylon pungens									
11	**560**	4	82	14	-	0	0	0	7/9
Opuntia sp.									
11	**20**	0	100	-	-	0	0	0	6/17

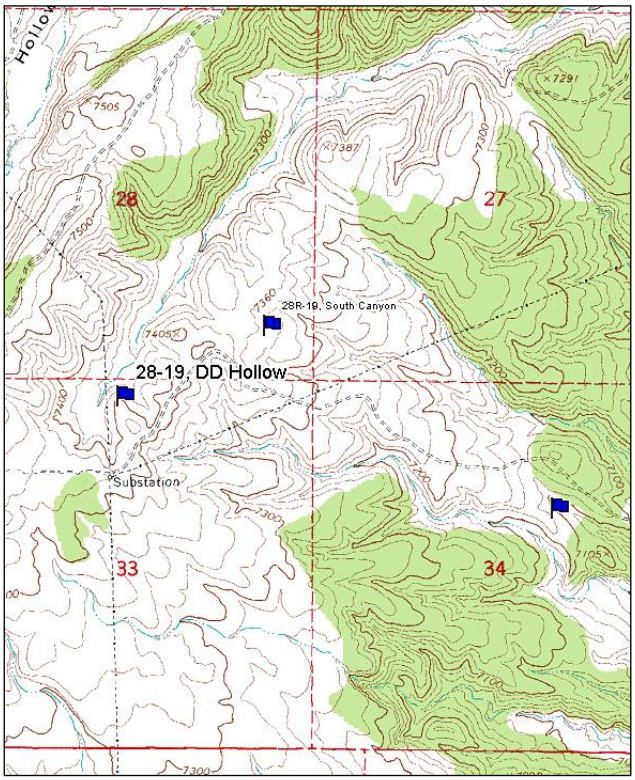
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Pediocactus simpsonii									
11	**40**	0	100	-	-	0	0	0	1/1
Pinus edulis									
11	**180**	33	67	-	-	0	0	0	-/-
Purshia tridentata									
11	**40**	0	100	-	-	100	0	0	21/35

DD HOLLOW - WRI STUDY 28-19-11

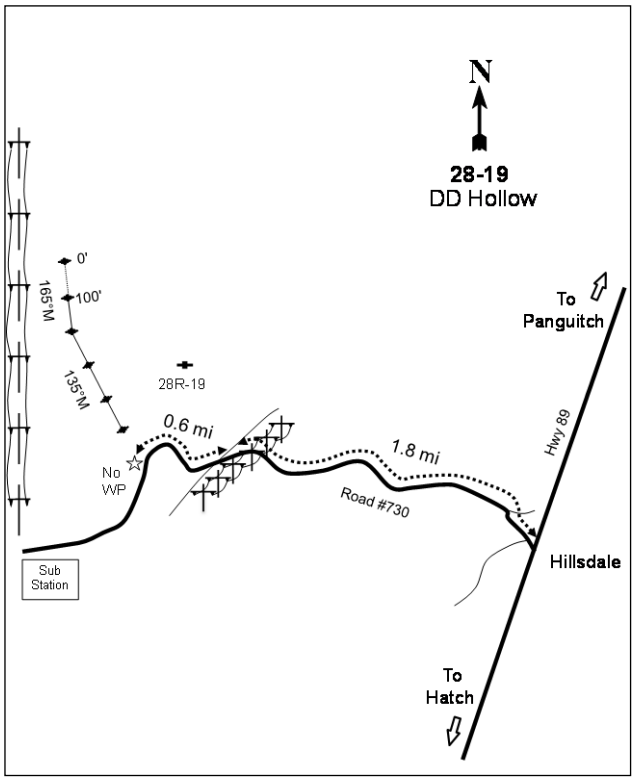
Vegetation Type: Black Sagebrush
Range Type: Substantial Deer Winter
NRCS Ecological Site Description: Upland Stony Loam (Pinyon - Utah Juniper), R047XB333UT
Land Ownership: BLM
Elevation: 7,402 ft (2,256 m)
Aspect: Southwest
Slope: 10%
Transect bearing: 165° magnetic (0ft - 200ft), 135° magnetic (200ft - 500ft)
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From the turnoff to Red Canyon drive 2 miles south towards Hatch. Turn right going west on road #730. Drive 1.8 miles to road and power lines. Continue on the same road another 0.6 miles. The 0-foot stake is on the northwest side of the road and is marked with browse tag #163.

Map Name: Hatch



Diagrammatic Sketch:



Township: 35S Range: 5W Section: 33

GPS: NAD 83, UTM 12S 374401 E 4176769 N

DD HOLLOW - WRI STUDY 28-19

Site Description

Site Information: The study is located approximately two miles west of Hillsdale, within a treated pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) woodland, east of DD Hollow. The area is administrated by the Bureau of Land Management (BLM) as part of the South Canyon allotment. Prior to treatment, the study was established in 2003 to monitor the effects of a prescribed fire project. In the fall of 2003, a total of 765 acres were bullhogged to protect the substation and other buildings around the project location, and to help facilitate the South Canyon burn. The bullhog project consisted of two separate treatment polygon units. The northern unit (601 acres) was seed while the southern unit (164 acres) was not seeded. The study transect was located within the southern unit, though the study site appears to have been seeded, based on the plant species sampled on the study site. The seed used on this project was surplus seed which the BLM contributed. It is unknown what exact seed mixture was used on the project site. The objectives of the project are to remove the pinyon and juniper trees, and improve the vegetation understory. The area is important winter range for deer, and to a lesser extent elk, and the surrounding open areas are used by pronghorn antelope year-round. Pellet groups were sampled in moderate abundance for deer/pronghorn in 2003. Deer/pronghorn and cattle pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are black sagebrush (*Artemisia nova*), mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and current (*Ribes sp.*). The black sagebrush and antelope bitterbrush are the dominant browse species and provides the majority of the canopy cover on the site (Table - Canopy Cover). The black sagebrush is a moderately dense population, with low decadence and good vigor within the population. The antelope bitterbrush is a small population, with low decadence and good vigor within the population. Utilization of black sagebrush has been mostly light over the sampled years, and use of bitterbrush plants has been mostly moderate over the sampled years. The recruitment of young sagebrush and bitterbrush plants has been good since the treatment, but prior to treatment recruitment of young plants was poor. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseous*), stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*). Prior to the treatment, a dense population of pinyon pine trees dominated the site (Table - Browse Characteristics) and provided the majority of the canopy cover on the site (Table - Canopy Cover). The stage of woodland succession was in Phase II transitioning into Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse, though prior to the treatment grass species were rare on the site. Species diversity increased following the treatment. The dominant grass species are blue grama (*Bouteloua gracilis*) and bottlebrush squirreltail (*Sitanion hystrix*). Other grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*A. smithii*), obtuse sedge (*Carex obtusata*), orchardgrass (*Dactylis glomerata*), Idaho fescue (*Festuca idahoensis*), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), and Letterman needlegrass (*Stipa lettermani*). The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled on the site following the treatment in low abundance. Forbs are not overly abundant, but are fairly diverse on the site. No single forb species dominated the site. The noxious weed species musk thistle (*Carduus nutans*) was sampled on the site in low abundance in 2011. Following the treatment, species diversity increased substantially (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Waltershow component, which is found on mountain slopes. The parent material consists of alluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a slightly acidic soil reaction (pH 6.2). Bare ground cover is low on the site, though there is a high amount of litter, and a moderate amount of vegetation

providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2003 and 2011.

Pre vs. Eight Year Post Treatment, 2003 vs. 2011

Browse: The density of black sagebrush increased nearly four-fold, and canopy cover increased from 5% to 13%. The health of the sagebrush population improved with decadence decreasing from 45% to 1%, and plants displaying poor vigor decreasing from 17% to 2%. The density of pinyon pine decreased from 337 trees/acre with an average tree diameter of 5.4 inches to 27 trees/acre with an average tree diameter of 5.6 inches.

Grasses: The sum of nested frequency of perennial grasses increased nearly five-fold, and cover increased from 1% to 6%. Blue grama remained similar in nested frequency, though cover increased from 1% to 2%. Bottlebrush squirreltail increased significantly in nested frequency, and cover increased from less than 1% to 2%.

Forbs: The sum of nested frequency of perennial forbs increased substantially, and cover increased to 1%. Annual forbs increased substantially in nested frequency, and cover increased from less than 1% to 2%.

HERBACEOUS TRENDS--
Management unit 28, Study no: 19

Type	Species	Nested Frequency '03	Nested Frequency '11	Average Cover % '03	Average Cover % '11
G	Agropyron cristatum	a-	b11	-	.36
G	Agropyron smithii	-	1	-	.03
G	Bouteloua gracilis	29	62	.46	1.98
G	Bromus tectorum (a)	-	4	-	.00
G	Carex obtusata	a-	b29	-	.29
G	Dactylis glomerata	-	1	-	.03
G	Festuca idahoensis	a-	b12	-	.42
G	Oryzopsis hymenoides	a-	b11	-	.58
G	Poa secunda	3	3	.03	.04
G	Sitanion hystrix	a10	b103	.05	2.23
G	Stipa lettermani	7	-	.01	-
Total for Annual Grasses		0	4	0	0.00
Total for Perennial Grasses		49	233	0.55	5.98
Total for Grasses		49	237	0.55	5.98
F	Achillea millefolium	-	3	-	.03
F	Arabis holboellii	4	4	.00	.03
F	Astragalus argophyllus	-	5	-	.03
F	Carduus nutans (a)	-	1	-	.00
F	Chenopodium fremontii (a)	a-	b62	-	.29
F	Chenopodium leptophyllum(a)	-	8	-	.02
F	Cirsium vulgare	-	4	-	.01
F	Cryptantha sp.	a-	b12	-	.03
F	Descurainia pinnata (a)	a15	b37	.09	.16
F	Eriogonum cernuum (a)	a-	b117	-	.33
F	Eriogonum racemosum	-	3	-	.00
F	Gayophytum ramosissimum(a)	a3	b160	.01	.70

Type	Species	Nested Frequency '03	Nested Frequency '11	Average Cover % '03	Average Cover % '11
F	Hymenopappus filifolius	-	3	-	.00
F	Lactuca serriola (a)	-	3	-	.03
F	Lappula occidentalis (a)	a1	b27	.00	.22
F	Linum lewisii	-	4	-	.01
F	Lotus utahensis	-	5	-	.15
F	Lygodesmia spinosa	-	5	-	.15
F	Machaeranthera canescens	-	1	-	.00
F	Medicago sativa	-	10	-	.42
F	Phlox longifolia	a-	b15	-	.05
F	Polygonum douglasii (a)	-	4	-	.01
F	Salsola iberica (a)	-	3	-	.00
F	Sanguisorba minor	-	2	-	.03
F	Sphaeralcea coccinea	-	5	-	.06
F	Verbascum thapsus	-	1	-	.15
Total for Annual Forbs		19	422	0.10	1.79
Total for Perennial Forbs		4	82	0.00	1.20
Total for Forbs		23	504	0.11	2.99

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

BROWSE TRENDS--
Management unit 28, Study no: 19

Type	Species	Strip Frequency '03	Strip Frequency '11	Average Cover % '03	Average Cover % '11
B	Artemisia nova	72	78	5.65	10.34
B	Artemisia tridentata vaseyana	0	3	-	1.25
B	Chrysothamnus nauseosus	0	30	-	1.76
B	Gutierrezia sarothrae	0	4	-	.02
B	Juniperus osteosperma	-	-	.03	-
B	Opuntia sp.	3	2	-	.03
B	Pinus edulis	29	3	23.40	1.37
B	Purshia tridentata	15	18	2.81	3.75
Total for Browse		47	23	31.91	18.55

CANOPY COVER, LINE INTERCEPT--
Management unit 28, Study no: 19

Species	Percent Cover '03	Percent Cover '11
Artemisia nova	4.46	12.85
Artemisia tridentata vaseyana	-	2.15
Chrysothamnus nauseosus	-	.46
Opuntia sp.	-	.10
Pinus edulis	38.48	5.63
Purshia tridentata	2.79	5.16

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 28, Study no: 19

Species	Average leader growth (in)	
	'03	'11
Artemisia nova	-	1.5
Purshia tridentata	2.5	4.4

POINT-QUARTER TREE DATA--
Management unit 28, Study no: 19

Species	Trees per Acre		Average diameter (in)	
	'03	'11	'03	'11
Juniperus scopulorum	-	7	-	2.5
Pinus edulis	337	27	5.4	5.6

BASIC COVER--
Management unit 28, Study no: 19

Cover Type	Average Cover %	
	'03	'11
Vegetation	31.90	24.97
Rock	8.42	7.19
Pavement	15.64	9.58
Litter	55.50	55.42
Cryptogams	.83	.00
Bare Ground	15.05	11.07

SOIL ANALYSIS DATA --
Management unit 28, Study no: 19, Study Name: DD Hollow

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.2	6.7	52.6	23.2	24.2	0.7	5.9	515.2	0.5

PELLET GROUP DATA--
Management unit 28, Study no: 19

Type	Quadrat Frequency		Days use per acre (ha)	
	'03	'11	'03	'11
Rabbit	20	10	-	-
Elk	1	-	-	-
Deer/Pronghorn	9	7	22 (53)	9 (22)
Cattle	2	3	-	4 (11)

BROWSE CHARACTERISTICS--
Management unit 28, Study no: 19

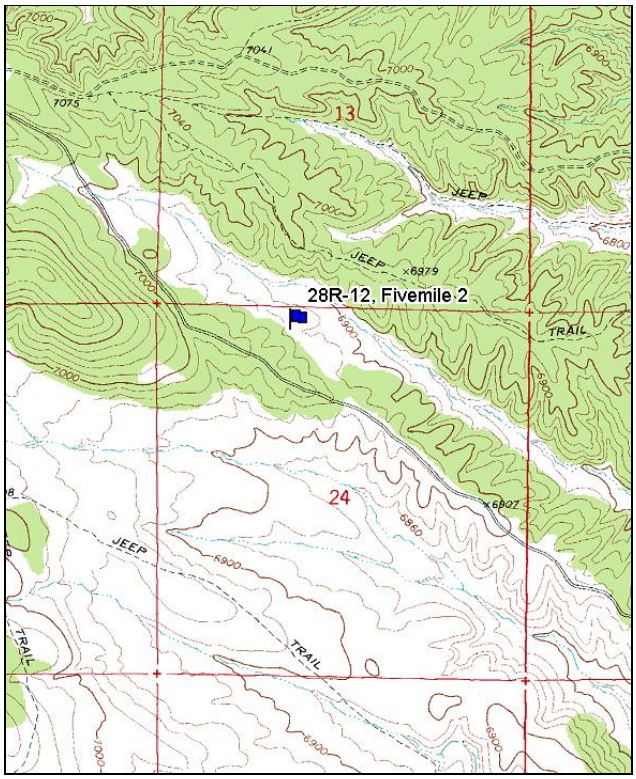
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
03	**3380**	9	46	45	-	22	1	17	14/22
11	**12460**	77	22	1	16240	2	0	2	14/24
Artemisia tridentata vaseyana									
03	**0**	0	0	0	-	0	0	0	-/-
11	**100**	0	80	20	60	0	0	20	23/36
Chrysothamnus nauseosus									
03	**0**	0	0	-	-	0	0	0	-/-
11	**1320**	68	32	-	1000	0	0	2	22/28
Chrysothamnus viscidiflorus viscidiflorus									
03	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	19/38
Gutierrezia sarothrae									
03	**0**	0	0	-	-	0	0	0	-/-
11	**80**	0	100	-	400	0	0	0	10/12
Juniperus scopulorum									
03	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	20	0	0	0	-/-
Opuntia sp.									
03	**60**	0	100	-	-	0	0	0	5/11
11	**40**	0	100	-	-	0	0	0	4/9
Pinus edulis									
03	**680**	24	76	0	-	3	0	0	-/-
11	**60**	67	0	33	80	0	0	0	-/-
Purshia tridentata									
03	**360**	6	61	33	-	61	22	6	30/51
11	**420**	14	81	5	-	33	24	0	20/45
Ribes sp.									
03	**0**	0	0	-	-	0	0	0	35/57
11	**0**	0	0	-	-	0	0	0	33/76

FIVE MILE 2 - WRI STUDY 28R-12-11
Project #901

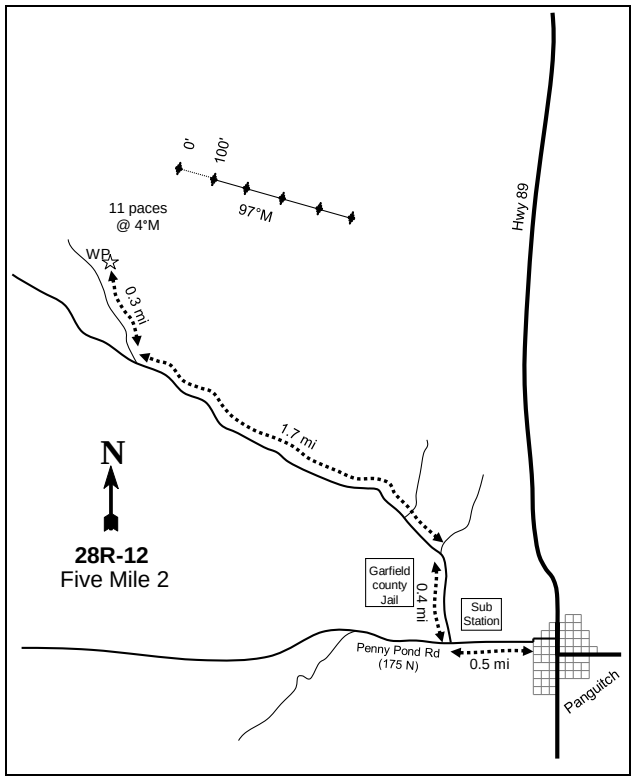
Vegetation Type: Black Sagebrush and Great Basin Sagebrush
Range Type: Crucial Deer Winter (Fawning habitat)
NRCS Ecological Site Description: Upland Stony Loam (Pinyon-Utah Juniper), R047XB333UT
Land Ownership: BLM
Elevation: 6,868 ft (2,092 m)
Aspect: Northeast
Slope: 4%
Transect bearing: 97° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From 200 north and Main St in Panguitch, drive east on 200 North to 300 West. Turn left, heading south to 175 North. Go right (east) 0.5 miles, passing a substation on the right. Go right (north) 0.4 miles, passing the Garfield County Jail, to a road to the left. Go left here for 1.7 miles to a fork. Take the right and drive 0.3 miles to a witness post. From the witness post the 0-foot stake is 11 paces at 4 degrees magnetic, and is marked with browse tag #186.

Map Name: Panguitch



Diagrammatic Sketch:



Township: 34S Range: 6W Section: 24

GPS: NAD 83, UTM 12S 369739 E 4189766 N

FIVE MILE 2 - WRI STUDY 28R-12
Project #901

Site Description

Site Information: The study is located approximately two and half miles northwest of Panguitch, within a treated pinyon pine (*Pinus edulis*) woodland. The area is administrated by the Bureau of Land Management (BLM) as part of the Shearing Corral allotment. Prior to treatment, the study was established in 2007 to monitor the effects of a lop and scatter treatment project. In 2008 and 2009, a total of 6,465 acres of pinyon pine and Utah juniper (*Juniperus osteosperma*) woodland was treated with a lop and scattered method. The treatment area was not seeded. The objectives of the project are to remove the pinyon and juniper trees, and improve the vegetation understory (WRI Database 2012). In 2007, deer pellet groups were sampled in moderate abundance, while elk pellet groups were sampled in low abundance. Deer pellet groups were sampled in high abundance in 2011 (Table - Pellet Group Data).

Browse: The preferred browse species on the site are black sagebrush (*Artemisia nova*) and basin big sagebrush (*A. tridentata* ssp. *tridentata*), which provide the majority of the canopy cover on the site. The basin big sagebrush is mostly located in the drainage bottoms, while the black sagebrush is located mostly on the benches and upper hillslopes above the drainages. The black sagebrush is a moderately dense population, with high decadence and moderately poor vigor within the population. The basin big sagebrush is a moderately dense population, with high decadence and good vigor within the population. Utilization of sagebrush plants has been mostly moderate over the sampled years for both sagebrush species. The recruitment of young sagebrush plants to both sagebrush populations has been good following the treatment; though prior to treatment recruitment of young plants was poor. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics). Prior to the treatment, a dense population of pinyon pine trees dominated the site, but density was greatly reduced following treatment (Table - Point-Quarter Tree Data). Prior to treatment, pinyon pine provided the majority of the canopy cover on the site, but cover was minimal following the treatment (Table - Canopy Cover). The stage of woodland succession was in Phase II transitioning into Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant, but are not overly diverse on the site. The dominant grass species on the site is blue grama (*Bouteloua gracilis*), which has provided the majority of the cover on the site since the outset of the study. Other grass species are rare on the site, which include galleta (*Hilaria jamesii*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are not overly abundant or diverse on the site. Perennial forbs are rare and are dominated by annual forb species (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Ipson component, which is found on hillslopes and fan terraces. The parent material consists of alluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a slightly acidic soil reaction (pH 6.2) (Table - Soil Analysis Data). Bare ground cover is moderately high on the site, though there is a high amount of litter, and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2007, but was stable in 2011.

Pre vs. Three Year Post Treatment, 2007 vs. 2011

Browse: The density of black sagebrush remained similar at 2,960 plants/acre, though canopy cover increased from 5% to 7%. The health of the black sagebrush population improved with decadence decreasing from 59% to 28%, and plants displaying poor vigor decreasing from 47% to 16%. The density of basin big sagebrush increased 41% from 540 plants/acre to 760 plants/acre, and canopy cover increased from 2% to 3%. The

health of the basin big sagebrush population remained similar with high decadence at 39%, but vigor was good at 3% of the population displaying poor vigor. The recruitment of young black sagebrush and basin big sagebrush plants to the population increased from 2% to 16% and 4% to 11% of the population, respectively.

Grasses: The sum of nested frequency of perennial grasses remained similar, though cover increased from 5% to 6%. Blue grama provided nearly all the cover in both sample years at 5% in 2007 and 6% in 2011.

Forbs: Perennial forb species remained rare on the site. The sum of nested frequency of annual forbs increased substantially, and cover increased from less than 1% to 4%.

HERBACEOUS TRENDS--
Management unit 28R, Study no: 12

Type	Species	Nested Frequency '07	Nested Frequency '11	Average Cover % '07	Average Cover % '11
G	Bouteloua gracilis	153	157	5.07	5.57
G	Hilaria jamesii	4	7	.00	.01
G	Oryzopsis hymenoides	7	-	.07	-
G	Sitanion hystrix	$_{a}$10	$_{b}$25	.02	.33
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		174	189	5.17	5.91
Total for Grasses		174	189	5.17	5.91
F	Astragalus lentiginosus	$_{a}$-	$_{b}$27	-	.19
F	Calochortus nuttallii	-	2	-	.03
F	Chenopodium fremontii (a)	$_{a}$-	$_{b}$50	-	1.18
F	Chenopodium leptophyllum(a)	$_{a}$-	$_{b}$79	-	.36
F	Descurainia pinnata (a)	$_{a}$16	$_{b}$127	.04	.98
F	Eriogonum cernuum (a)	9	17	.02	.05
F	Gayophytum ramosissimum(a)	$_{a}$5	$_{b}$83	.01	.54
F	Lactuca serriola (a)	$_{a}$2	$_{b}$12	.00	.19
F	Lappula occidentalis (a)	$_{a}$-	$_{b}$38	-	.22
F	Phlox longifolia	-	1	-	.00
Total for Annual Forbs		32	406	0.08	3.55
Total for Perennial Forbs		0	30	0	0.23
Total for Forbs		32	436	0.08	3.78

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

BROWSE TRENDS--
Management unit 28R, Study no: 12

Type	Species	Strip Frequency '07	Strip Frequency '11	Average Cover % '07	Average Cover % '11
B	Artemisia nova	67	55	4.70	6.19
B	Artemisia tridentata tridentata	20	26	1.75	2.33
B	Chrysothamnus nauseosus	0	0	-	-
B	Gutierrezia sarothrae	8	13	.04	.08
B	Juniperus osteosperma	1	0	-	-
B	Opuntia sp.	1	0	.00	-
B	Pinus edulis	9	1	7.99	.15
Total for Browse		106	95	14.49	8.76

CANOPY COVER, LINE INTERCEPT--
Management unit 28R, Study no: 12

Species	Percent Cover '07	Percent Cover '11
Artemisia nova	4.46	6.84
Artemisia tridentata tridentata	1.78	2.51
Gutierrezia sarothrae	.06	.15
Pinus edulis	17.29	.21

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 28R, Study no: 12

Species	Average leader growth (in) '07	Average leader growth (in) '11
Artemisia nova	2.7	1.5
Artemisia tridentata tridentata	2.4	1.8

POINT-QUARTER TREE DATA--
Management unit 28R, Study no: 12

Species	Trees per Acre '07	Trees per Acre '11	Average diameter (in) '07	Average diameter (in) '11
Pinus edulis	101	10	7.4	0.9

BASIC COVER--
Management unit 28R, Study no: 12

Cover Type	Average Cover % '07	Average Cover % '11
Vegetation	20.93	18.65
Rock	1.75	.75
Pavement	11.42	5.96
Litter	39.67	44.60
Cryptogams	5.34	.79
Bare Ground	36.38	36.51

SOIL ANALYSIS DATA --

Management unit 28R, Study no: 12, Study Name: Fivemile 2

pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
	%sand	%silt	%clay				
6.5	53.4	25.0	21.6	1.7	12.5	156.8	0.4

PELLET GROUP DATA--

Management unit 28R, Study no: 12

Type	Quadrat Frequency		Days use per acre (ha)	
	'07	'11	'07	'11
Rabbit	86	6	-	-
Deer	16	31	34 (84)	40 (99)

BROWSE CHARACTERISTICS--

Management unit 28R, Study no: 12

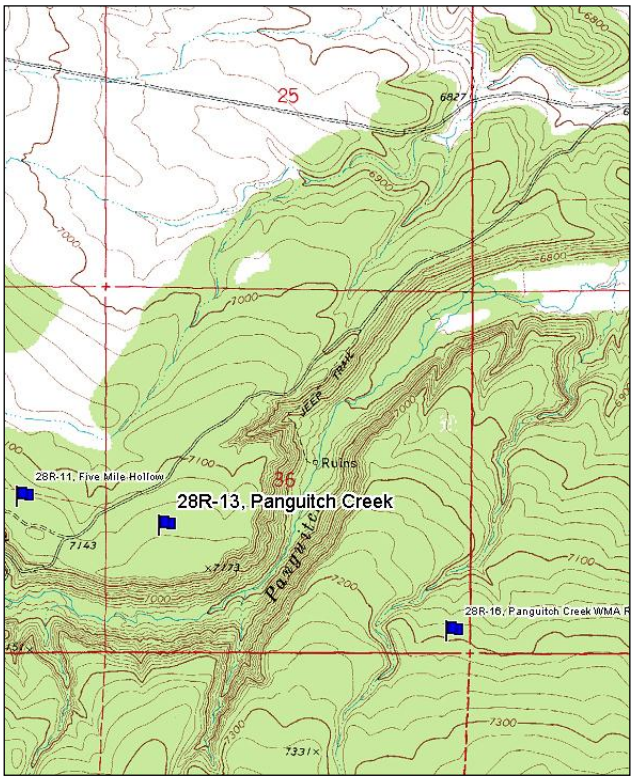
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
07	**2780**	2	39	59	500	22	26	47	12/19
11	**2960**	16	55	28	5540	24	4	16	13/21
Artemisia tridentata tridentata									
07	**540**	4	56	41	100	26	0	7	39/43
11	**760**	11	50	39	7940	29	8	3	35/36
Chrysothamnus nauseosus									
07	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	20	0	0	0	-/-
Gutierrezia sarothrae									
07	**360**	78	22	-	280	0	0	0	3/3
11	**500**	4	96	-	60	0	0	0	9/8
Juniperus osteosperma									
07	**20**	100	0	-	-	0	0	100	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Opuntia sp.									
07	**20**	100	0	-	20	0	0	0	4/10
11	**0**	0	0	-	-	0	0	0	5/13
Pinus edulis									
07	**180**	22	78	-	40	0	0	0	-/-
11	**40**	100	0	-	20	0	0	0	-/-

PANGUITCH CREEK - TREND STUDY NO. 28R-13-11
Project #1206

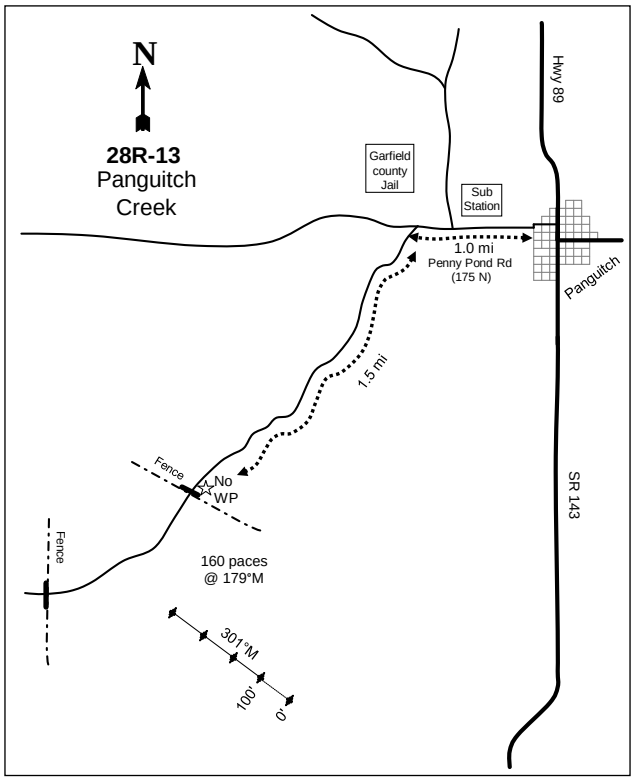
Vegetation Type: Pinyon and Juniper
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Upland Shallow Hardpan (Pinyon-Utah Juniper), R047XB318UT
Land Ownership: UDWR
Elevation: 7,100 ft. (2,164 m)
Aspect: North
Slope: 2%
Transect bearing: 301° magnetic
Belt placement: 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 and turn left (south) and make an immediate right (west) onto 175 north (Penny Pond 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



Diagrammatic Sketch:



Township: 34S Range: 6W Section: 36

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). Prior to the treatment, the study was established in 2008 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) was 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 2012). In 2011, the study transect was rotated on the zero foot stake to be within the treated portions of the project. Elk pellet groups were sampled in low abundance in 2011. Deer pellet groups were sampled in low abundance in 2008 and 2011 (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: The preferred browse species are black sagebrush (*Artemisia nova*), mountain big sagebrush (*A. tridentata* ssp. vaseyana), and skunk bush (*Rhus trilobata*). Black sagebrush is the dominant preferred browse species on the site. The black sagebrush is a moderately used population, with high decadence and good vigor within the population; though prior to the treatment vigor was poor. The recruitment of young sagebrush plants to the population was poor prior to the treatment, but was good following the treatment. Most of the black sagebrush population sampled in 2008 was either decadent or dead. Other browse species sampled on the site include broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia sp.*) and mountain ball cactus (*Pediocactus simpsonii*) (Table - Browse Characteristics). Prior to the treatment, a dense population of pinyon pine trees was the dominant browse species on the site, but density was greatly reduced following the treatment (Table - Point-Quarter Tree Data). Prior to the treatment, pinyon pine also provided the majority of

the canopy cover, but cover was low following the treatment (Table - Canopy Cover). Density of Utah juniper remained similar following the treatment (Table - Point-Quarter Tree Data), but canopy cover increased (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment, but is now considered to be within Phase II (Tausch et al. 2009).

Herbaceous Understory: Grasses are not overly abundant, but are somewhat diverse on the site. Prior to the treatment, grass and forb species were rare on the site and cryptantha (*Cryptantha sp*.) was the only herbaceous species sampled in 2008, though it occurred in low abundance and provided very little cover. No single grass species is dominant on the site. Seeded grass species sampled on the site include intermediate wheatgrass (*Agropyron intermedium*), Russian wildrye (*Elymus junceus*), Snake River wheatgrass (*E. wawawaiensis*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are moderately abundant and fairly diverse on the site. The dominant forb species is specklepod locoweed (*Astragalus lentiginosus*), which provides the majority of the forb cover on the site. Seeded forb species sampled on the site include blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), Palmer penstemon (*Penstemon palmeri*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Venture component, which is found on ridges and mountain slopes. The parent material consists of alluvium derived from basic and intermediate volcanic rock, and/or colluvium derived from intermediate and basic volcanic rock, and/or residuum weathered from intermediate and basic volcanic rock. The soils within this classification are characterized as shallow, well drained, and with a moderately permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 and 2011.

Pre vs. Two Year Post Treatment, 2008 vs. 2011

Browse: The density of black sagebrush increased nearly two-fold from 600 plants/acre to 1,180 plants/acre, and canopy cover increased from 1% to 2%. The health of the black sagebrush population improved with decadence decreasing from 87% to 24%, and plants displaying poor vigor decreasing from 73% to 10% of the population. The recruitment of young sagebrush plants to the population increased from 0% to 19%. The density of pinyon pine decreased from 483 trees/acre with an average tree diameter of 3.1 inches to 95 trees/acre with an average tree diameter of 5.1 inches. Canopy cover of pinyon pine decreased from 39% to less than 3%, but Utah juniper increased in canopy cover from less than 1% to 2%.

Grasses: The sum of nested frequency of perennial grasses increased on the site, and cover increased from 0% to 1%. Prior to treatment, grass species were not sampled on the site. Following the treatment, several seeded grass species were sampled on the site, though no single grass species was dominant on the site, and no single grass species provided more than 1% cover.

Forbs: The sum of perennial forbs increased substantially on the site, and cover increased from less than 1% to 8%. Prior to the treatment, cryptantha was the only species sampled on the site in low abundance. Following the treatment several species were sampled. Specklepod locoweed provided the majority of the cover following the treatment at 6%. No other forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 28R, Study no: 13

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	-	4	-	.04
G	Agropyron intermedium	$_a$-	$_b$17	-	.22
G	Bouteloua gracilis	-	5	-	.33
G	Elymus junceus	-	3	-	.03
G	Elymus wawawaiensis	-	1	-	.03
G	Oryzopsis hymenoides	-	3	-	.03
G	Sitanion hystrix	$_a$-	$_b$29	-	.32
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		0	62	0	1.01
Total for Grasses		0	62	0	1.01
F	Astragalus lentiginosus	$_a$-	$_b$102	-	5.66
F	Astragalus miser	-	1	-	.00
F	Cryptantha sp.	12	21	.09	.55
F	Descurainia pinnata (a)	$_a$-	$_b$43	-	.72
F	Eriogonum cernuum (a)	-	5	-	.06
F	Ipomopsis aggregata	$_a$-	$_b$25	-	.72
F	Lactuca serriola (a)	$_a$-	$_b$43	-	.83
F	Linum perenne	$_a$-	$_b$27	-	.57
F	Medicago sativa	-	2	-	.15
F	Penstemon palmeri	$_a$-	$_b$6	-	.05
F	Sanguisorba minor	-	-	-	.00
Total for Annual Forbs		0	91	0	1.61
Total for Perennial Forbs		12	184	0.09	7.73
Total for Forbs		12	275	0.09	9.34

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

BROWSE TRENDS--
Management unit 28R, Study no: 13

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia nova	19	35	.89	2.84
B	Artemisia tridentata vaseyana	0	3	-	.00
B	Gutierrezia sarothrae	15	45	.03	.99
B	Juniperus osteosperma	0	1	-	.76
B	Opuntia sp.	3	0	-	.00
B	Pinus edulis	30	3	16.34	.16
B	Rhus trilobata	0	1	-	.03
Total for Browse		67	88	17.27	4.80

CANOPY COVER, LINE INTERCEPT--
Management unit 28R, Study no: 13

Species	Percent Cover	
	'08	'11
Artemisia nova	.75	2.33
Artemisia tridentata vaseyana	-	.03
Gutierrezia sarothrae	-	1.06
Juniperus osteosperma	.03	2.33
Pinus edulis	39.09	3.33

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 28R, Study no: 13

Species	Average leader growth (in)	
	'08	'11
Artemisia nova	0.8	2.2

POINT-QUARTER TREE DATA--
Management unit 28R, Study no: 13

Species	Trees per Acre		Average diameter (in)	
	'08	'11	'08	'11
Pinus edulis	483	95	3.1	5.1
Juniperus osteosperma	24	26	3.5	6.5

BASIC COVER--
Management unit 28R, Study no: 13

Cover Type	Average Cover %	
	'08	'11
Vegetation	17.67	14.47
Rock	2.67	3.54
Pavement	17.22	8.49
Litter	59.86	62.37
Cryptogams	.28	.24
Bare Ground	22.34	15.33

SOIL ANALYSIS DATA --
Management unit 28R, Study no: 13, Study Name: Panguitch Creek

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		Days use per acre (ha)	
	'08	'11	'08	'11
Rabbit	67	5	-	-
Elk	-	1	-	1 (2)
Deer	14	15	16(40)	15 (38)

BROWSE CHARACTERISTICS--
Management unit 28R, Study no: 13

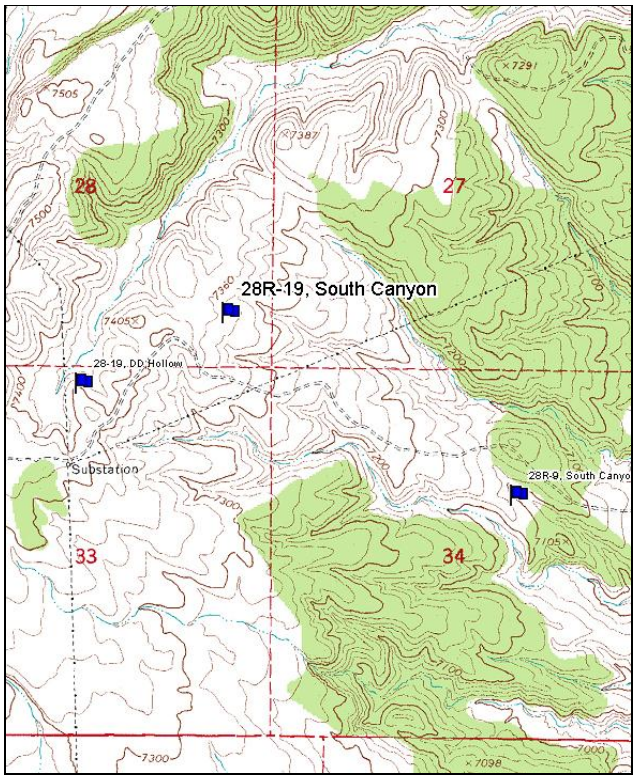
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
08	**600**	0	13	87	20	23	23	73	8/17
11	**1180**	19	58	24	1000	15	0	10	10/21
Artemisia tridentata vaseyana									
08	**0**	0	0	-	-	0	0	0	-/-
11	**80**	100	0	-	-	0	0	0	9/11
Gutierrezia sarothrae									
08	**740**	11	89	0	400	0	0	0	3/2
11	**2720**	26	73	1	660	0	0	.73	10/10
Juniperus osteosperma									
08	**0**	0	0	-	20	0	0	0	-/-
11	**20**	0	100	-	20	0	0	0	-/-
Opuntia sp.									
08	**80**	0	75	25	20	0	0	0	4/13
11	**0**	0	0	0	-	0	0	0	4/11
Pediocactus simpsonii									
08	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	1/3
Pinus edulis									
08	**1000**	46	52	2	80	0	0	0	-/-
11	**80**	50	50	0	180	0	0	0	-/-
Rhus trilobata									
08	**0**	0	0	-	-	0	0	0	20/22
11	**20**	100	0	-	-	100	0	0	11/11

SOUTH CANYON - WRI STUDY 28R-19-11
Project #2027

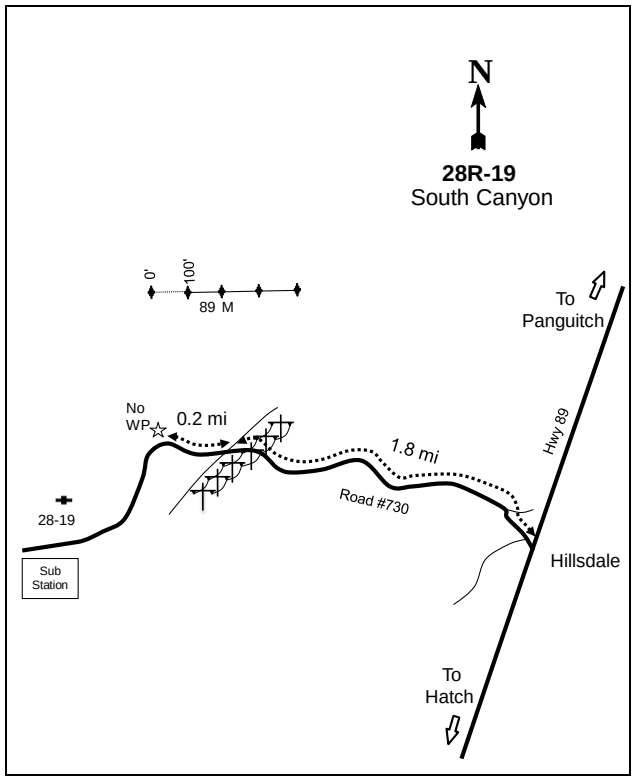
Vegetation Type: Pinyon and Juniper Woodland
Range Type: Substantial Deer Winter
NRCS Ecological Site Description: Upland Stony Loam (Pinyon - Utah Juniper), R047XB333UT
Land Ownership: BLM
Elevation: 7,278 ft (2,219 m)
Aspect: East
Slope: 5%
Transect bearing: 89° magnetic
Belt placement: line 1 (11ft & 95 ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: From the turnoff to Red Canyon drive 2 miles south towards Hatch. Turn right going west on road #730. Drive 1.8 miles to road and power lines. Continue on the same road another 0.2 miles. The 0-foot stake is on the north side of the road about 147 paces and is marked with browse tag #163.

Map Name: Hatch



Diagrammatic Sketch:



Township: 35S Range: 5W Section: 28

GPS: NAD 83, UTM 12S 375044 E 177068 N

SOUTH CANYON - WRI STUDY 28R-19
Project #2027

Site Description

Site Information: The study is located approximately two miles northwest of Hillsdale, within a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) woodland. The area is administrated by the Bureau of Land Management (BLM) as part of the South Canyon allotment. Prior to treatment, the study was established in 2011 to monitor the effects of a bullhog project to remove pinyon and juniper trees. Approximately 2,549 acres will be treated with a bull hog implement. Prior to the treatment, a seed mix of grass and forb species will be aerially seeded on the project area (Table - Seed Mix). Areas seeded within the South Canyon allotment will be rested from grazing for a minimum of two complete growing seasons in order to allow the seedlings to become established. The objectives of the project are to enhance sage-steppe habitat by increasing the herbaceous understory, decreasing density of pinyon and juniper trees, and decreasing sedimentation through erosion into the Sevier River (WRI Database 2012). Deer and elk pellet groups were sampled in low abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 28R, Study no: 19

Project Name: South Canyon Year 2 WRI Database #: 2027			
Application: Aerial Seed		Acres:	1900
Seed Type		lbs in mix	lbs/acre
G	Crested Wheatgrass 'Hycrest II'	4650	2.45
G	Great Basin Wildrye 'Trailhead'	2757	1.45
G	Indian Ricegrass 'Rimrock'	3700	1.95
G	Pubescent Wheatgrass	3000	1.58
G	Pubescent Wheatgrass 'Luna'	807	0.42
G	Snake River Wheatgrass 'Secar'	2849	1.50
F	Alfalfa 'Ladak+'	950	0.50
F	Alfalfa 'Nomad'	945	0.50
F	Blue Flax 'Appar'	1900	1.00
F	Sainfoin 'Eski'	1900	1.00
F	Small Burnet 'Delar'	2850	1.50
Total Pounds:		26308	13.85
PLS Pounds:			12.44

Browse: A dense population of pinyon pine and Utah juniper trees dominated the site (Table - Point-Quarter Tree Data), and provided the majority of the canopy cover on the site in 2011 (Table - Canopy Cover). The stage of woodland succession was in Phase III prior to treatment (Tausch et al. 2009). The preferred browse species on the site are fringe sagebrush (*Artemisia frigida*), black sagebrush (*A. nova*), mountain big sagebrush (*A. tridentata* ssp. *vaseyana*), and antelope bitterbrush (*Purshia tridentata*). The dominant preferred browse species are black sagebrush and antelope bitterbrush, which provides the majority of the preferred browse cover on the site (Table - Canopy Cover). The black sagebrush is a moderately dense population, with high decadence and moderately poor vigor within the population. The antelope bitterbrush is a relatively young, scattered population, with low decadence and good vigor within the population. The recruitment of young sagebrush and bitterbrush plants to their respective populations was good. Utilization of bitterbrush was mostly moderate and utilization of sagebrush was mostly light in 2011. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia sp.*) (Table - Browse Characteristics).

Herbaceous Trends: Grasses are not abundant or diverse on the site. The dominant grass species are blue grama (*Bouteloua gracilis*) and bottlebrush squirreltail (*Sitanion hystrix*). The weedy annual grass species cheatgrass (*Bromus tectorum*) was sampled in low abundance on the site. Mutton bluegrass (*Poa fendleriana*) was the only other grass species sampled on the site. Forbs are not very abundant, but are somewhat diverse on the site. The forb composition was dominated by annual forb species. No single forb species was dominant on the site in 2011 (Table - Herbaceous Trend).

Soil: The soil is classified as part of the Waltershow component, which is found on mountain slopes. The parent material consists of alluvium derived from basic and intermediate igneous rock. The soils within this classification are characterized as deep, well drained, and with a moderately permeable restrictive layer. The soil surface texture is an extremely cobbly loam (Soil Survey Staff 2011). Bare ground cover is moderate on the site, though there is a high amount of litter, and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as sight in 2011.

HERBACEOUS TRENDS--
Management unit 28R, Study no: 19

Type	Species	Nested Frequency '11	Average Cover % '11
G	Bouteloua gracilis	30	.62
G	Bromus tectorum (a)	1	.00
G	Poa fendleriana	3	.03
G	Sitanion hystrix	75	.75
Total for Annual Grasses		1	0.00
Total for Perennial Grasses		108	1.40
Total for Grasses		109	1.40
F	Astragalus lentiginosus	3	.03
F	Chenopodium fremontii (a)	2	.00
F	Cirsium sp.	6	.33
F	Cryptantha sp.	2	.06
F	Descurainia pinnata (a)	49	.16
F	Eriogonum cernuum (a)	7	.02
F	Gayophytum ramosissimum(a)	120	.30
F	Lappula occidentalis (a)	3	.00
F	Phlox longifolia	3	.01
F	Polygonum douglasii (a)	10	.02
F	Zigadenus paniculatus	1	.00
Total for Annual Forbs		191	0.51
Total for Perennial Forbs		15	0.43
Total for Forbs		206	0.95

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

BROWSE TRENDS--
Management unit 28R, Study no: 19

Type	Species	Strip Frequency '11	Average Cover % '11
B	Artemisia nova	67	5.51
	Artemisia tridentata vaseyana	1	-
B	Juniperus scopulorum	1	1.00
B	Opuntia sp.	3	.03
B	Pinus edulis	16	10.72
B	Purshia tridentata	15	1.62
Total for Browse		103	18.89

CANOPY COVER, LINE INTERCEPT--
Management unit 28R, Study no: 19

Species	Percent Cover '11
Artemisia nova	6.93
Juniperus scopulorum	2.38
Pinus edulis	29.60
Purshia tridentata	2.95

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 28R, Study no: 19

Species	Average leader growth (in) '11
Artemisia nova	1.1
Purshia tridentata	3.0

POINT-QUARTER TREE DATA--
Management unit 28R, Study no: 19

Species	Trees per Acre '11	Average diameter (in) '11
Juniperus scopulorum	19	6.7
Pinus edulis	283	5.7

BASIC COVER--
Management unit 28R, Study no: 19

Cover Type	Average Cover % '11
Vegetation	21.43
Rock	4.87
Pavement	16.48
Litter	53.07
Cryptogams	.62
Bare Ground	20.12

PELLET GROUP DATA--
Management unit 28R, Study no: 19

Type	Quadrat Frequency '11	Days use per acre (ha) '11
Rabbit	17	-
Elk	-	1 (2)
Deer	1	6 (15)
Cattle	1	-

BROWSE CHARACTERISTICS--
Management unit 28R, Study no: 19

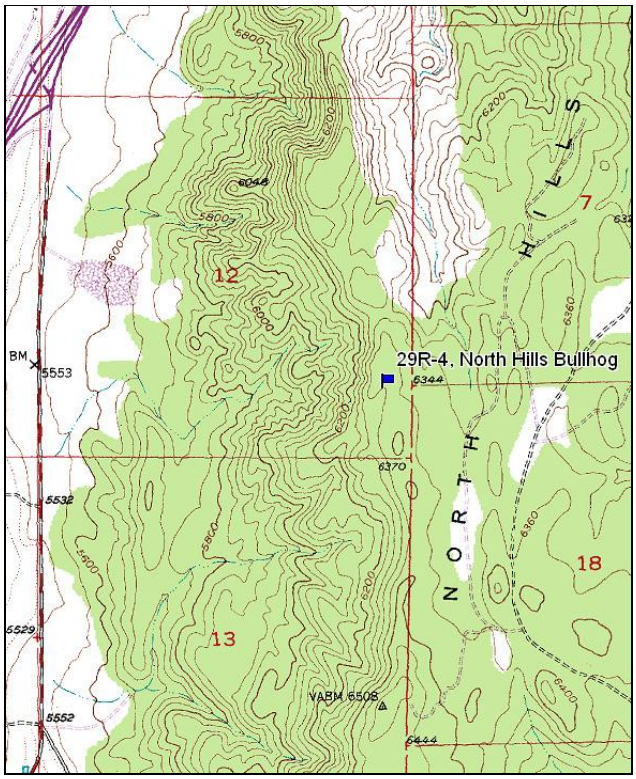
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia frigida									
11	**0**	0	0	-	-	0	0	0	6/9
Artemisia nova									
11	**3400**	22	49	29	1840	5	0	15	12/23
Artemisia tridentata vaseyana									
11	**20**	0	100	-	-	0	0	0	24/31
Chrysothamnus nauseosus									
11	**0**	0	0	-	-	0	0	0	29/39
Gutierrezia sarothrae									
11	**0**	0	0	-	-	0	0	0	8/10
Juniperus scopulorum									
11	**20**	0	100	-	-	0	0	0	-/-
Opuntia sp.									
11	**60**	0	100	-	-	0	0	0	5/10
Pinus edulis									
11	**400**	35	45	20	140	0	0	10	-/-
Purshia tridentata									
11	**420**	57	33	10	-	43	0	0	37/65

NORTH HILLS BULLHOG - TREND STUDY NO. 29R-4-11
Project #1190

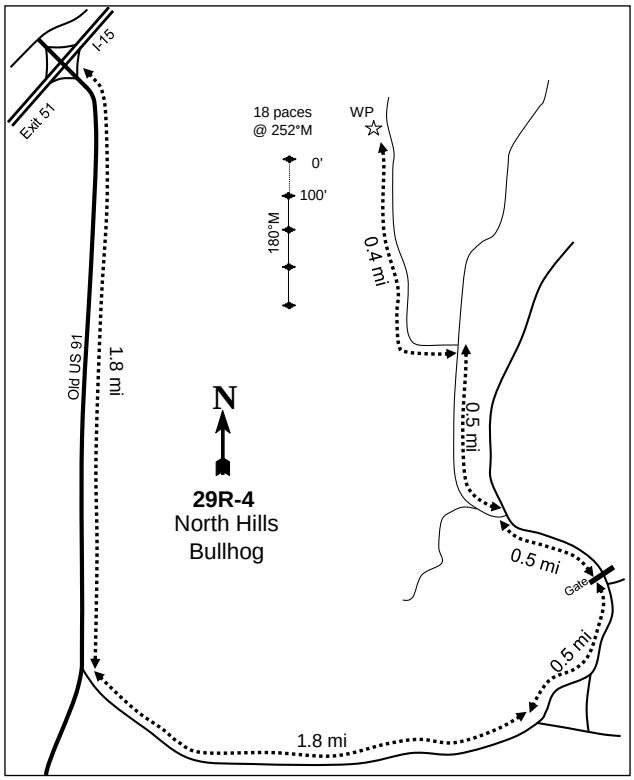
Vegetation Type: Black Sagebrush
Range Type: Substantial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Upland Shallow Hardpan (Pinyon-Utah Juniper), R028AY320UT
Land Ownership: Tribal
Elevation: 6,300 ft. (1,920 m)
Aspect: South
Slope: 4%
Transect bearing: 180° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
From Exit 51 (Hamilton Fort), 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



Diagrammatic Sketch:



Township: 37S Range: 12W Section: 12

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 Kanarraville, within an old chaining project encroached by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) trees, on top of the North Hills, within the Paiute Indian Reservation. Prior to the treatment, the study was established in 2008, 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 upon 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 bullhog machinery 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 soil stability, and increase forb diversity (WRI Database 2012). Deer pellet groups were sampled in moderate abundance in 2008 and 2011. Elk pellet groups were sampled in low abundance 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: 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 provide little cover (Table - Canopy Cover). The black sagebrush is a lightly used, moderately dense population of mature plants, with low decadence and good vigor within the population; though decadence and poor vigor were high prior to the treatment. The recruitment of young black sagebrush plants to the population was poor prior to treatment, but good following the treatment. 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 prior to treatment, but poor following the treatment. The weedy species broom snakeweed (*Gutierrezia sarothrae*) is fairly abundant on the site, with half of the population sampled being young plants in 2008;

though following the treatment, abundance decreased (Table - Browse Characteristics). Prior to the treatment, pinyon pine and Utah juniper provided the majority of the canopy cover on the site in 2008, but cover was greatly reduced following the treatment (Table - Canopy Cover). The stage of woodland succession was in Phase II transitioning into Phase III prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are moderately abundant and fairly diverse on the site. The dominant perennial grass species is crested wheatgrass (*Agropyron cristatum*), which provides the majority of the perennial grass cover. The invasive annual grass species cheatgrass (*Bromus tectorum*) increased in abundance on the site following the treatment and provided the majority of the grass cover on the site in 2011. Seeded grass species sampled on the site include crested wheatgrass, intermediate wheatgrass (*Agropyron intermedium*), western wheatgrass (*A. smithii*), and Indian ricegrass (*Oryzopsis hymenoides*), though crested wheatgrass and intermediate wheatgrass were sampled on the site prior to the treatment. Other less common grass species sampled on the site include mutton bluegrass (*Poa fendleriana*), sixweeks fescue (*Vulpia octoflora*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are moderately abundant and fairly diverse on the site, though prior to the treatment forbs were rare on the site. The dominant forb species is the palatable annual forb species prickly lettuce (*Lactuca serriola*), which provides the majority of the forb cover on the site. Seeded forb species sampled on the site include blue flax (*Linum perenne*), alfalfa (*Medicago sativa*), Palmer penstemon (*Penstemon palmeri*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Pavant-Abela complex. The parent material consists of alluvium derived from igneous and sedimentary rock. The soils within this classification are characterized as shallow to deep, well drained, and with a moderately to highly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is low on the site, though there is a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2008 in 2011.

Pre vs. Three Year Post Treatment, 2008 vs. 2011

Browse: The density of black sagebrush increased nearly 28% from 1,800 plants/acre to 2,300 plants/acre, and canopy cover increased from 5% to 8%. The health of the black sagebrush population improved with decadence decreasing from 32% to 0%, and plants displaying poor vigor decreasing from 14% to 0% of the population. The recruitment of young sagebrush plants to the population increased from 9% to 22%. The density of antelope bitterbrush increased nearly two-fold from 160 plants/acre to 300 plants/acre, though canopy cover decreased from 5% to 4%. The density of pinyon pine decreased from 102 trees/acre with an average tree diameter of 6.8 inches to 17 trees/acre with an average tree diameter of 1.6 inches. The density of Utah juniper decreased from 102 tree/acre with an average tree diameter of 6.7 to 25 trees/acre with an average tree diameter of 2.3 inches. Canopy cover of pinyon pine and Utah juniper trees decreased from 11% to 0% and 11% to 2%, respectively.

Grasses: The sum of nested frequency of perennial grasses increased 89%, and cover increased from 3% to 14%. Crested wheatgrass increased significantly in nested frequency, and cover increased from 3% to 12%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from 1% to 17%.

Forbs: The sum of perennial forbs increased more than three-fold, and cover increased to 1%. Annual forbs increased substantially in nested frequency, and cover increased from less than 1% to 5%. Prickly lettuce was sampled for the first time following the treatment at 4% cover. No other forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 29R, Study no: 4

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	a140	b206	2.85	12.02
G	Agropyron intermedium	a1	b25	.03	.70
G	Agropyron smithii	y-	b25	-	.72
G	Bromus tectorum (a)	a157	b381	.79	16.86
G	Oryzopsis hymenoides	-	2	-	.03
G	Poa fendleriana	a1	b8	.03	.36
G	Sitanion hystrix	3	8	.03	.33
G	Vulpia octoflora (a)	a-	b13	-	.06
Total for Annual Grasses		157	394	0.79	16.92
Total for Perennial Grasses		145	274	2.95	14.18
Total for Grasses		302	668	3.74	31.11
F	Astragalus sp.	3	4	.03	.00
F	Collinsia parviflora (a)	-	6	-	.01
F	Cryptantha sp.	-	9	-	.02
F	Cymopterus purpurascens	-	1	-	.00
F	Descurainia pinnata (a)	a-	b35	-	.37
F	Draba sp. (a)	a-	b43	-	.18
F	Euphorbia albomarginata	15	13	.06	.07
F	Gilia sp. (a)	a-	b23	-	.08
F	Lactuca serriola (a)	a-	b243	-	3.83
F	Lappula occidentalis (a)	a-	b27	-	.20
F	Linum perenne	a-	b31	-	.35
F	Medicago sativa	-	-	-	.00
F	Microsteris gracilis (a)	a-	b73	-	.31
F	Penstemon palmeri	-	5	-	.15
F	Ranunculus testiculatus (a)	a19	b56	.06	.39
F	Sanguisorba minor	-	1	-	.00
F	Sisymbrium altissimum (a)	-	3	-	.00
F	Sphaeralcea grossulariifolia	1	7	.00	.03
F	Streptanthus cordatus	3	5	.00	.15
F	Tragopogon dubius (a)	-	4	-	.00
Total for Annual Forbs		19	513	0.06	5.39
Total for Perennial Forbs		22	76	0.09	0.81
Total for Forbs		41	589	0.15	6.21

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

BROWSE TRENDS--
Management unit 29R, Study no: 4

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Amelanchier utahensis	2	7	1.36	1.34
B	Artemisia nova	34	44	4.32	5.82
B	Artemisia tridentata vaseyana	1	0	-	-
B	Cercocarpus montanus	1	0	1.16	-
B	Ephedra viridis	5	5	.93	.93
B	Gutierrezia sarothrae	40	27	.50	1.14
B	Juniperus osteosperma	5	0	6.01	1.70
B	Opuntia sp.	2	1	-	.03
B	Pinus edulis	6	2	8.48	.03
B	Purshia tridentata	8	12	3.40	2.15
Total for Browse		104	98	26.19	13.15

CANOPY COVER, LINE INTERCEPT--
Management unit 29R, Study no: 4

Species	Percent Cover '08	Percent Cover '11
Amelanchier utahensis	2.16	1.21
Artemisia nova	5.00	7.65
Artemisia tridentata vaseyana	.10	-
Cercocarpus montanus	.50	-
Ephedra viridis	.91	1.25
Gutierrezia sarothrae	.61	.80
Juniperus osteosperma	10.68	2.00
Opuntia sp.	-	.08
Pinus edulis	11.08	-
Purshia tridentata	4.94	3.61

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 29R, Study no: 4

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia nova	0.9	3.4
Artemisia tridentata vaseyana	1.4	-
Purshia tridentata	2.9	2.0
Amelanchier utahensis	-	3.2

POINT-QUARTER TREE DATA--
Management unit 29R, Study no: 4

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	102	25	6.7	2.3
Pinus edulis	102	17	6.8	1.6

BASIC COVER--
Management unit 29R, Study no: 4

Cover Type	Average Cover % '08	'11
Vegetation	28.82	51.36
Rock	4.57	2.01
Pavement	8.18	2.03
Litter	61.55	47.46
Cryptogams	.26	.06
Bare Ground	22.33	11.48

SOIL ANALYSIS DATA --
Management unit 29R, Study no: 4, Study Name: North Hills Bullhog

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	'11	Days use per acre (ha) '08	'11
Rabbit	71	3	-	-
Elk	1	-	1 (2)	1 (2)
Deer	41	21	37 (91)	34 (83)
Cattle	2	-	-	-

BROWSE CHARACTERISTICS--
Management unit 29R, 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)
Amelanchier utahensis									
08	**40**	0	100	-	-	0	0	0	83/89
11	**400**	55	45	-	80	20	25	0	34/27
Artemisia nova									
08	**1800**	9	59	32	100	29	28	14	11/23
11	**2300**	22	78	0	1000	2	0	0	9/18
Artemisia tridentata vaseyana									
08	**20**	0	100	-	-	100	0	0	17/32
11	**0**	0	0	-	-	0	0	0	21/33
Cercocarpus montanus									
08	**20**	0	100	-	-	100	0	0	46/43
11	**0**	0	0	-	-	0	0	0	18/65

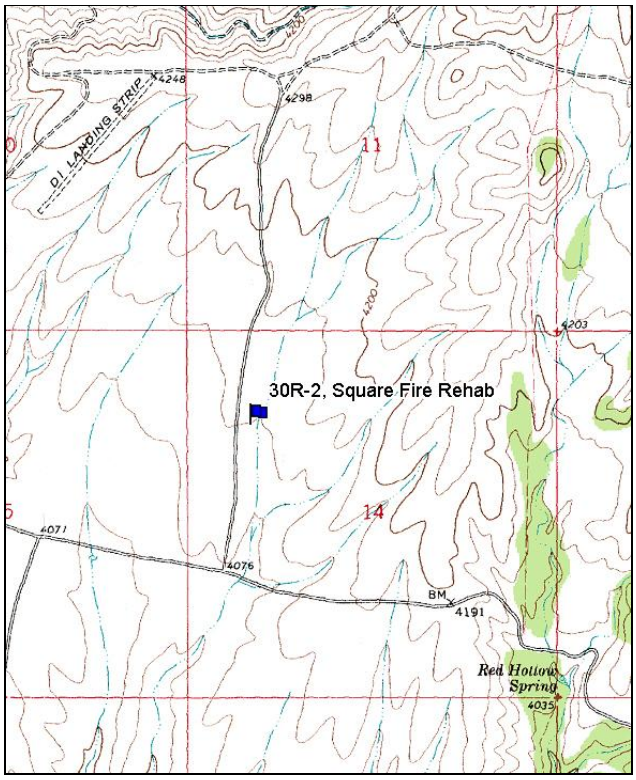
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus									
08	**0**	0	0	-	-	0	0	0	19/19
11	**0**	0	0	-	-	0	0	0	20/24
Ephedra viridis									
08	**120**	0	83	17	-	0	33	0	27/30
11	**160**	13	88	0	-	38	0	0	26/37
Gutierrezia sarothrae									
08	**6280**	47	50	3	440	8	1	2	7/7
11	**1020**	25	71	4	1880	0	4	6	6/10
Juniperus osteosperma									
08	**100**	40	60	-	-	0	0	0	-/-
11	**0**	0	0	-	20	0	0	0	-/-
Opuntia sp.									
08	**40**	0	100	-	-	0	0	0	5/12
11	**20**	0	100	-	-	0	0	0	4/10
Pinus edulis									
08	**120**	67	33	-	100	0	0	0	-/-
11	**40**	100	0	-	20	0	0	0	-/-
Purshia tridentata									
08	**160**	25	63	13	-	25	38	13	34/64
11	**300**	0	100	0	-	93	7	0	30/55

SQUARE FIRE REHAB - WRI STUDY 30R-2-11

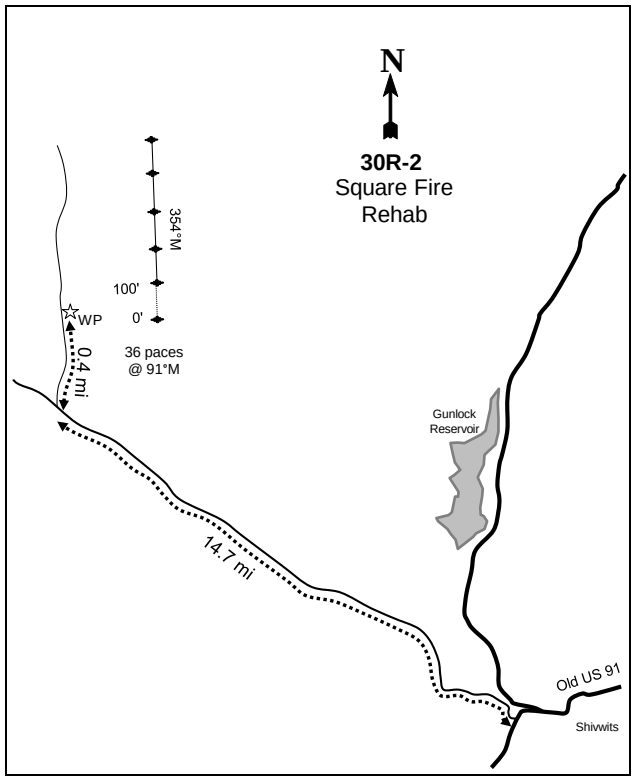
Vegetation Type: Blackbrush (burned)
Range Type: Substantial Deer Winter
NRCS Ecological Site Description: Semidesert Shallow Hardpan (Blackbrush), R030XY230UT
Land Ownership: BLM
Elevation: 4,121 ft (1,256 m)
Aspect: Southeast
Slope: 2%
Transect bearing: 354° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: From mile marker 20 on Old US 91 drive west 4.3 miles to a fork. Turn left and drive 0.9 miles to another fork. Take a right and drive 14.7 miles to a road on the right. Turn here and drive 0.4 miles to a witness post on the right. From the witness post walk 36 paces at 91 degrees magnetic to the 0-foot stake marked with browse tag #171.

Map Name: Motoqua



Diagrammatic Sketch:



Township: 40S Range: 19W Section: 14

GPS: NAD 83, UTM 12S 4133535 E 238660 N

SQUARE FIRE REHAB - WRI STUDY 30R-2

Site Description

Site Information: The study is located approximately fourteen miles northwest of Shivwits, within a burned blackbrush (*Coleogyne ramosissima*) flat, northwest of Red Hollow Spring. The area is administrated by the Bureau of Land Management (BLM) as part of the South Woodruff allotment. The study was established in 2006 following the Square fire that burned in 17,146 acres in 2004. The area around the study was chained and seeded with a diverse seed mix of grass, forb and browse species and a seed mix of forage kochia (*Kochia prostrata*) (Table - Seed Mix) following the fire. The study was established following the fire and revegetation project. Deer pellet groups were sampled in low abundance in 2006. Sampled cattle sign was low in abundance in 2011 (Table - Pellet Group Data).

SEED MIX--
Management unit 30R, Study no: 2

Project Name: Square Fire Rehab WRI Database #: PDB				Project Name: Square Fire WRI Database #: PDB			
Application: Aerial Seed 1*		Acres:	6,287	Application: Aerial Seed 2*		Acres:	3000
Seed Type		lbs in mix	lbs/acre	Seed Type		lbs in mix	lbs/acre
G	Blue Grama	3144	0.50	B	Forage Kochia	3000	1.00
G	Crested Wheatgrass 'Hycrest'	15718	2.50	Total Pounds:		3000	1.00
G	Galleta	3144	0.50	PLS Pounds:			0.74
G	Indian Ricegrass 'Rimrock'	3144	0.50				
G	Pubescent Wheatgrass	15718	2.50				
G	Sideoats Grama	3929	0.63				
G	Squirrel Tail	1572	0.25				
F	Alfalfa	3144	0.50				
F	Bee Plant	786	0.13				
F	Lewis Flax	3144	0.50				
F	Small Burnet	3144	0.50				
F	Yellow Sweetclover	3144	0.50				
F	Fourwing Saltbush	1572	0.25				
B	Winterfat	1572	0.25				
B	Forage Kochia	6287	1.00				
Total Pounds:		69157	11.00				

*Aerial Seed 1 was provided by the BLM and Aerial Seed 2 was provided by the UDWR.

Browse: The preferred browse species on the site are blackbrush, Nevada ephedra (*Ephedra nevadensis*), currant (*Ribes sp.*), and forage kochia. Forage kochia is the dominant preferred browse species on the site, and provides the majority of the canopy cover on the site (Table - Canopy cover). The forage kochia is a fairly dense population, with low decadence and good vigor within the population. The recruitment of young kochia plants to the population has been good over the sample years. Utilization of kochia plants has been mostly light since the outset of the study. Other browse species sampled on the site include rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia sp.*), desert almond (*Prunus fasciculata*), desert bitterbrush (*Purshia glandulosa*), and datil yucca (*Yucca baccata*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant and somewhat diverse, but are dominated by the weedy annual grass species cheatgrass (*Bromus tectorum*) and red brome (*B. rubens*). Perennial grass species are not very abundant on the site. Sideoats grama (*Bouteloua curtipendula*) has been the most common perennial grass species on the site. Other grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*),

western wheatgrass (*A. smithii*), galleta (*Hilaria jamesii*), sand dropseed (*Sporobolus cryptandrus*), and sixweeks fescue (*Vulpia octoflora*). Forbs are moderately abundant and fairly diverse on the site. The dominant forb species are locoweed (*Astragalus sp.*), storksbill (*Erodium cicutarium*), and wooly plantain (*Plantago patagonica*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Cave component, which is found on alluvial fans. The parent material consists of gravelly alluvium derived from gneiss, limestone, dolomite, quartzite, shale, and acid igneous rocks. The soils within this classification are characterized as shallow, well drained, and with a highly permeable restrictive layer (Soil Survey Staff 2011). The soil texture is a loam with a mildly alkaline soil reaction (pH 7.5) (Table - Soil Analysis Data). Bare ground cover is moderate on the site, though there is a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2006, but stable in 2011.

Trend Assessments

Browse

- **2006 to 2011 - stable (0):** The density of forage kochia decreased 52% from 60,680 plants/acre to 29,060 plants/acre, though cover remained similar at 12%. Most of the decrease in density was due to the change in young plants, which decreased from 49,420 plants/acre to 2,740 plants/acre. Broom snakeweed increased 10% in density from 1,680 plants/acre to 1,840 plants/acre, and canopy cover increased from 2% to 7%.

Grass

- **2006 to 2011 - stable (0):** Perennial grasses are rare on the site. Red brome increased significantly in nested frequency, and cover increased from less than 1% to 4%. Cheatgrass decreased significantly in nested frequency, and cover decreased from 7% to 1%.

Forb

- **2006 to 2011 - down (-2):** The sum of nested frequency of perennial forbs decreased 24%, though cover increased from 1% to 2%. The sum of nested frequency of annual forbs increased 23%, and cover increased slightly from 4% to 5%.

HERBACEOUS TRENDS--
Management unit 30R, Study no: 2

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
G	Agropyron cristatum	-	2	-	.03
G	Agropyron smithii	a-	b7	-	.14
G	Bouteloua curtipendula	b36	a8	.17	.53
G	Bromus rubens (a)	a113	b340	.36	3.64
G	Bromus tectorum (a)	b399	a133	7.00	1.11
G	Hilaria jamesii	-	3	-	.04
G	Sporobolus cryptandrus	3	-	.03	-
G	Vulpia octoflora (a)	a11	b75	.02	.27
Total for Annual Grasses		523	548	7.39	5.03
Total for Perennial Grasses		39	20	0.20	0.74
Total for Grasses		562	568	7.59	5.77
F	Alyssum alyssoides (a)	1	12	.00	.02
F	Astragalus oophorus	-	1	-	.00

Type	Species	Nested Frequency '06	Nested Frequency '11	Average Cover % '06	Average Cover % '11
F	Astragalus sp.	a3	b68	.01	1.04
F	Calochortus flexuosus	-	10	-	.02
F	Collinsia parviflora (a)	-	4	-	.00
F	Collomia linearis (a)	b50	a-	.14	-
F	Convolvulus arvensis	3	-	.03	-
F	Descurainia pinnata (a)	5	-	.01	-
F	Draba sp. (a)	a6	b49	.01	.09
F	Eriastrum sparsiflorum (a)	a-	b98	-	.42
F	Eriogonum cernuum (a)	3	-	.00	-
F	Eriophyllum wallacei (a)	-	5	-	.01
F	Erodium cicutarium (a)	a42	b304	.84	2.78
F	Euphorbia albomarginata	b29	a4	.08	.21
F	Lappula occidentalis (a)	1	-	.00	-
F	Layia glandulosa	-	1	-	.00
F	Lepidium sp. (a)	b78	a1	.20	.00
F	Linum lewisii	b60	a-	.28	-
F	Lupinus brevicaulis (a)	-	1	-	.00
F	Phlox sp.	-	1	-	.00
F	Plantago patagonica (a)	b372	a213	3.01	1.08
F	Ranunculus testiculatus (a)	2	-	.00	-
F	Salsola iberica (a)	4	9	.03	.02
F	Sanguisorba minor	b32	a-	.44	-
F	Sphaeralcea grossulariifolia	5	16	.22	.40
F	Unknown forb-annual (a)	3	-	.00	-
F	Verbena bracteata	-	-	.03	-
Total for Annual Forbs		567	696	4.28	4.45
Total for Perennial Forbs		132	101	1.09	1.69
Total for Forbs		699	797	5.38	6.14

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

BROWSE TRENDS--
Management unit 30R, Study no: 2

Type	Species	Strip Frequency '06	Strip Frequency '11	Average Cover % '06	Average Cover % '11
B	Coleogyne ramosissima	1	1	.01	.00
B	Ephedra nevadensis	3	2	.03	.38
B	Gutierrezia sarothrae	34	47	.87	5.97
B	Kochia prostrata	99	97	8.44	12.77
B	Prunus fasciculata	17	20	1.14	1.45
B	Ribes sp	1	0	-	-
B	Yucca baccata	1	1	-	.03
Total for Browse		156	168	10.51	20.62

CANOPY COVER, LINE INTERCEPT--
Management unit 30R, Study no: 2

Species	Percent Cover '06	'11
Coleogyne ramosissima	-	-
Ephedra nevadensis	.30	.38
Gutierrezia sarothrae	2.16	6.86
Kochia prostrata	12.25	12.01
Prunus fasciculata	2.75	2.75

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 30R, Study no: 2

Species	Average leader growth (in) '06	'11
Kochia prostrata	2.4	1.1

BASIC COVER--
Management unit 30R, Study no: 2

Cover Type	Nested Frequency '06	'11	Average Cover % '06	'11
Vegetation	458	446	22.92	34.97
Rock	206	161	4.61	3.94
Pavement	394	368	13.99	18.04
Litter	421	400	29.09	14.11
Cryptogams	1	-	.00	0
Bare Ground	424	338	40.68	23.38

SOIL ANALYSIS DATA --
Management unit 30R, Study no: 2, Study Name: Square Fire Rehab

Effective rooting depth (in)	pH	loam %sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
8.5	7.5	49.0	28.1	22.9	0.7	19.1	236.8	0.5

PELLET GROUP DATA--
Management unit 30R, Study no: 2

Type	Quadrat Frequency '06	'11	Days use per acre (ha) '06	'11
Rabbit	78	11	-	-
Deer	8	2	3 (8)	-
Cattle	1	-	-	2 (5)

BROWSE CHARACTERISTICS--
Management unit 30R, Study no: 2

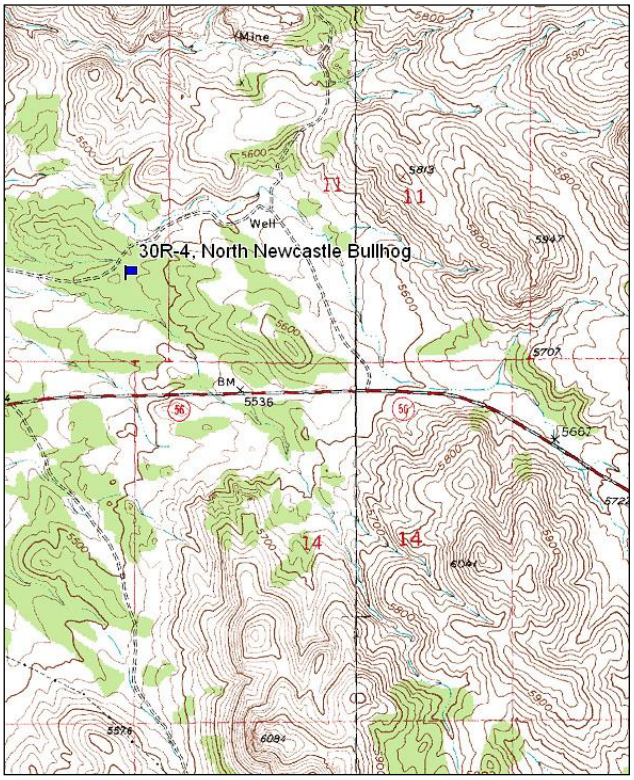
		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus									
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	20/30
Coleogyne ramosissima									
06	**20**	0	0	100	40	0	0	100	26/40
11	**20**	100	0	0	-	0	0	0	22/33
Ephedra nevadensis									
06	**140**	29	71	-	-	0	0	86	19/25
11	**60**	0	100	-	-	0	0	0	21/27
Gutierrezia sarothrae									
06	**1680**	7	93	-	100	4	0	0	10/12
11	**1840**	24	76	-	860	0	0	1	13/21
Kochia prostrata									
06	**60680**	81	19	0	6140	.03	0	0	7/10
11	**29060**	9	90	0	960	23	0	.06	5/8
Opuntia sp.									
06	**0**	0	0	-	-	0	0	0	9/25
11	**0**	0	0	-	-	0	0	0	9/25
Prunus fasciculata									
06	**380**	32	68	-	-	5	0	0	24/39
11	**500**	12	88	-	-	8	0	4	22/37
Purshia glandulosa									
06	**0**	0	0	-	-	0	0	0	12/22
11	**0**	0	0	-	-	0	0	0	26/56
Ribes sp.									
06	**60**	0	100	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Yucca baccata									
06	**20**	0	100	-	-	0	0	0	13/28
11	**20**	0	100	-	-	0	0	0	19/21

NORTH NEWCASTLE BULLHOG - TREND STUDY NO. 30R-4-11
Project #446

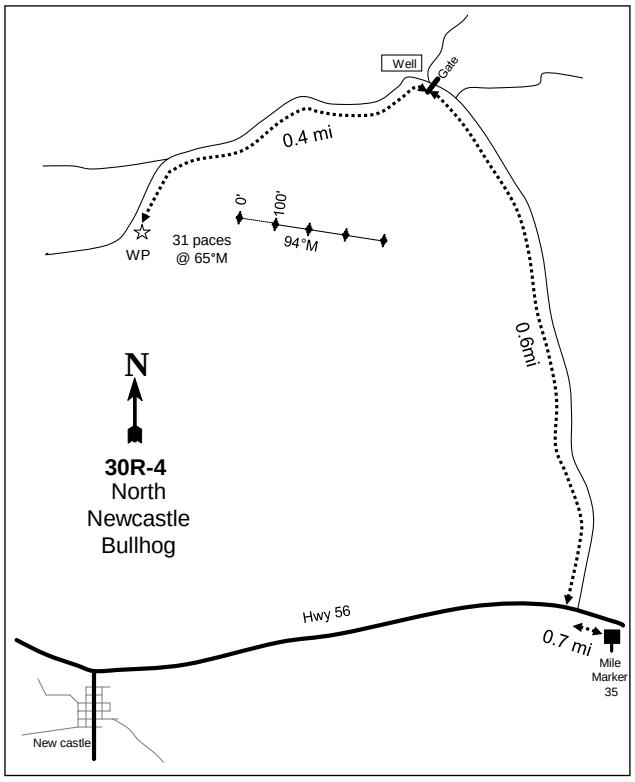
Vegetation Type: Pinyon and Juniper Woodland
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Semidesert Shallow Loam (Black Sagebrush), R028AY236UT
Land Ownership: BLM
Elevation: 5,478 ft. (1,670 m)
Aspect: Southeast
Slope: 4%
Transect bearing: 94° magnetic
Belt placement: line 1 (11ft, 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
From Cedar City, head west on Hwy 56 and turn right 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



Diagrammatic Sketch:



Township: 36S Range: 15W Section: 10

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. The area is administrated by the Bureau of Land Management (BLM) as part of the Silver Peak allotment. Prior to the treatment, the study was established in 2008 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 bullhog machinery. Prior to the bullhog work, a seed mix of grass and forb species were aerially applied to the project area (Table - Seed Mix). Following the treatment the seeded area was rested from livestock grazing for two growing seasons. The objectives of the project are to improve mule deer winter range habitat, and reduce hazardous fuel loads (WRI Database 2012). Deer and cattle pellet groups were sampled in low abundance in 2008 and 2011 (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 is moderately to lightly used populations, with low decadence and good vigor within the population; though decadence and vigor were high prior to the treatment. The mountain big sagebrush is a moderately to lightly used population, with low decadence and poor vigor within the population; though prior to treatment decadence was high. The recruitment of young sagebrush plants to the population was poor for both species of sagebrush prior to treatment, and following the treatment recruitment of young sagebrush plants was good for mountain big sagebrush, but remained poor for black sagebrush. The Nevada ephedra is a heavily to moderately used population, with low decadence and good vigor within the population; though prior to the treatment decadence and vigor were high. The slenderbush eriogonum is a mature, lightly used population, with low decadence and good vigor within the population; though prior to treatment use was mostly heavy. The recruitment of young ephedra and eriogonum plants to the population was poor prior to treatment, but following the treatment recruitment of young eriogonum plants was good, but ephedra remained poor. A fairly abundant population of stickyleaf low rabbitbrush

(*Chrysothamnus viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*) was 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, but density was reduced following the treatment (Table - Point-Quarter Tree Data). The stage of woodland succession was in Phase II prior to treatment, but is now considered to be within Phase I (Tausch et al. 2009).

Herbaceous Understory: Grasses are fairly abundant and moderately diverse on the site. The dominant perennial grass species is galleta (*Hilaria jamesii*), which provided the majority of the grass cover prior to treatment. The invasive grass species cheatgrass (*Bromus tectorum*) increased in abundance and provided the majority of the grass cover following the treatment. Seeded grass species sampled on the site include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), and western wheatgrass (*A. smithii*). Other less common grass species sampled on the site include Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), blue grama (*Bouteloua gracilis*), and needle-and-thread (*Stipa comata*). Forbs are not very abundant, but are moderately diverse. Perennial forbs are not very common on the site. Heath aster (*Leucelene ericoides*) has been the most common forb species on the site since the outset of the study (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Checkett component. The parent material consists of colluvium derived from igneous rock and/or residuum weathered from igneous rock. The soils within this classification are characterized as shallow, well drained, and with a highly permeable restrictive layer (Soil Survey Staff 2011). 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). Bare ground cover is high on the site, though there is a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2008, but stable in 2011.

Pre vs. Two Year Post Treatment, 2008 vs. 2011

Browse: The density of black sagebrush increased 58% from 480 plants/acre to 760 plants/acre, though canopy cover remained similar at 1%. The density of mountain big sagebrush increased two-fold from 200 plants/acre to 400 plants/acre, and cover increased from 1% to 2%. The health of the black sagebrush and mountain big sagebrush populations improved with decadence decreasing from 58% to 13% and 20% to 0%, respectively. Also, black sagebrush plants displaying poor vigor decreased from 54% to 11%, though mountain big sagebrush plants displaying poor vigor increased from 20% to 40%. The density of Utah juniper decreased from 69 trees/acre with an average tree diameter of 15.2 inches to 12 trees/acre with an average tree diameter of 14.9 inches. Canopy cover of Utah juniper trees decreased from 3% to 2%.

Grasses: the sum of nested frequency of perennial grasses increased 48%, and cover increased from 5% to 7%. Galleta remained similar in nested frequency, and cover remained similar at 4%. The weedy annual grass species cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 9%.

Forbs: The sum of nested frequency of perennial forbs increased 88%, and cover increased from 1% to 2%. Heath aster remained similar in nested frequency, though cover increased from less than 1% to 2%. No other forb species provided more than 1% cover in either sample year.

HERBACEOUS TRENDS--
Management unit 30R, Study no: 4

Type	Species	Nested Frequency '08	Nested Frequency '11	Average Cover % '08	Average Cover % '11
G	Agropyron cristatum	$_{a}$-	$_{b}$18	-	.09
G	Agropyron intermedium	-	3	-	.00
G	Agropyron smithii	$_{a}$-	$_{b}$11	-	.07
G	Bouteloua gracilis	-	6	-	.18
G	Bromus tectorum (a)	$_{a}$153	$_{b}$329	.39	8.79
G	Hilaria jamesii	148	171	4.07	3.83
G	Oryzopsis hymenoides	53	55	.73	1.10
G	Sitanion hystrix	$_{a}$20	$_{b}$69	.11	1.15
G	Stipa comata	6	2	.10	.01
Total for Annual Grasses		153	329	0.39	8.79
Total for Perennial Grasses		227	335	5.02	6.46
Total for Grasses		380	664	5.42	15.25
F	Astragalus beckwithii	-	2	-	.15
F	Astragalus calycosus	-	8	.00	.16
F	Astragalus lentiginosus	-	6	-	.03
F	Astragalus sp.	-	-	.03	-
F	Calochortus flexuosus	$_{a}$-	$_{b}$13	-	.03
F	Chaenactis douglasii	1	4	.00	.01
F	Chenopodium fremontii (a)	-	2	-	.03
F	Cordylanthus sp. (a)	$_{b}$68	$_{a}$15	.60	.02
F	Cryptantha gracilis (a)	-	2	-	.00
F	Cryptantha sp.	1	-	.00	-
F	Descurainia pinnata (a)	-	5	-	.00
F	Draba sp. (a)	-	8	-	.01
F	Eriogonum cernuum (a)	43	-	.15	-
F	Euphorbia albomarginata	16	18	.13	.12
F	Gilia sp. (a)	$_{a}$3	$_{b}$16	.00	.06
F	Ipomopsis congesta	1	3	.00	.00
F	Lepidium densiflorum (a)	-	5	-	.01
F	Leucelene ericoides	41	55	.42	1.38
F	Lygodesmia grandiflora	2	7	.03	.06
F	Microsteris gracilis (a)	-	11	-	.21
F	Penstemon confusus	2	2	.01	.03
F	Phlox longifolia	$_{a}$6	$_{b}$13	.02	.08
F	Sisymbrium altissimum (a)	-	-	-	.00
F	Streptanthus cordatus	3	6	.01	.04
Total for Annual Forbs		114	64	0.76	0.37
Total for Perennial Forbs		73	137	0.68	2.12
Total for Forbs		187	201	1.44	2.49

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

BROWSE TRENDS--
Management unit 30R, Study no: 4

Type	Species	Strip Frequency '08	Strip Frequency '11	Average Cover % '08	Average Cover % '11
B	Artemisia nova	18	20	.82	2.16
B	Artemisia tridentata vaseyana	9	14	1.94	.53
B	Chrysothamnus viscidiflorus	43	42	1.37	1.63
B	Ephedra nevadensis	22	20	.67	2.26
B	Eriogonum microthecum	30	26	.05	.37
B	Gutierrezia sarothrae	50	35	3.58	1.97
B	Juniperus osteosperma	1	1	1.86	.38
B	Pinus edulis	1	0	1.00	-
Total for Browse		174	158	11.32	9.33

CANOPY COVER, LINE INTERCEPT--
Management unit 30R, Study no: 4

Species	Percent Cover '08	Percent Cover '11
Artemisia nova	1.54	1.43
Artemisia tridentata vaseyana	1.18	1.95
Chrysothamnus viscidiflorus	.80	2.29
Ephedra nevadensis	1.56	2.90
Eriogonum microthecum	.20	.23
Gutierrezia sarothrae	3.11	1.83
Juniperus osteosperma	2.66	1.68
Pinus edulis	1.23	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 30R, Study no: 4

Species	Average leader growth (in) '08	Average leader growth (in) '11
Artemisia nova	1.1	0.9
Artemisia tridentata vaseyana	1.0	1.1

POINT-QUARTER TREE DATA--
Management unit 30R, Study no: 4

Species	Trees per Acre '08	Trees per Acre '11	Average diameter (in) '08	Average diameter (in) '11
Juniperus osteosperma	69	12	15.2	14.9
Pinus edulis	4.7	-	4.7	-

BASIC COVER--
Management unit 30R, Study no: 4

Cover Type	Nested Frequency		Average Cover %	
	'08	'11	'08	'11
Vegetation	308	410	18.29	33.96
Rock	120	73	2.00	1.22
Pavement	383	271	31.17	8.67
Litter	320	358	22.45	19.42
Cryptogams	4	-	.06	0
Bare Ground	415	378	39.39	35.90

SOIL ANALYSIS DATA --
Management unit 30R, Study no: 4, Study Name: North Newcastle Bullhog

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		Days use per acre (ha)	
	'08	'11	'08	'11
Rabbit	95	6	-	-
Elk	2	-	-	-
Deer	13	-	8 (20)	3 (8)
Cattle	5	6	1 (2)	11 (27)

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)
Artemisia nova									
08	**480**	4	38	58	40	25	13	54	15/28
11	**760**	3	84	13	40	3	0	11	9/20
Artemisia tridentata vaseyana									
08	**200**	0	80	20	-	30	0	20	18/29
11	**400**	35	65	0	60	10	5	40	15/24
Chrysothamnus viscidiflorus									
08	**1740**	1	69	30	60	26	44	24	7/10
11	**1740**	6	94	0	20	0	0	0	8/11
Ephedra nevadensis									
08	**860**	2	65	33	-	0	95	28	14/27
11	**860**	2	98	0	-	33	12	5	13/23
Eriogonum microthecum									
08	**1220**	3	97	-	-	13	72	0	5/6
11	**580**	17	83	-	40	7	0	0	5/9
Gutierrezia sarothrae									
08	**4460**	0	99	1	-	0	0	0	7/10
11	**1480**	15	84	1	-	0	1	1	7/11
Juniperus osteosperma									
08	**20**	100	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	-/-
Opuntia sp.									
08	**0**	0	0	-	-	0	0	0	6/15
11	**0**	0	0	-	-	0	0	0	-/-
Pinus edulis									
08	**20**	0	100	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Salvia dorrii									
08	**0**	0	0	-	-	0	0	0	9/22
11	**0**	0	0	-	-	0	0	0	6/26

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