2009 Watershed Restoration Initiative Vegetation Monitoring Report

PUBLICATION NUMBER 10-27
REPORT FOR FEDERAL AID PROJECT W-82-R-54

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

2009 Watershed Restoration Initiative Vegetation Monitoring Report

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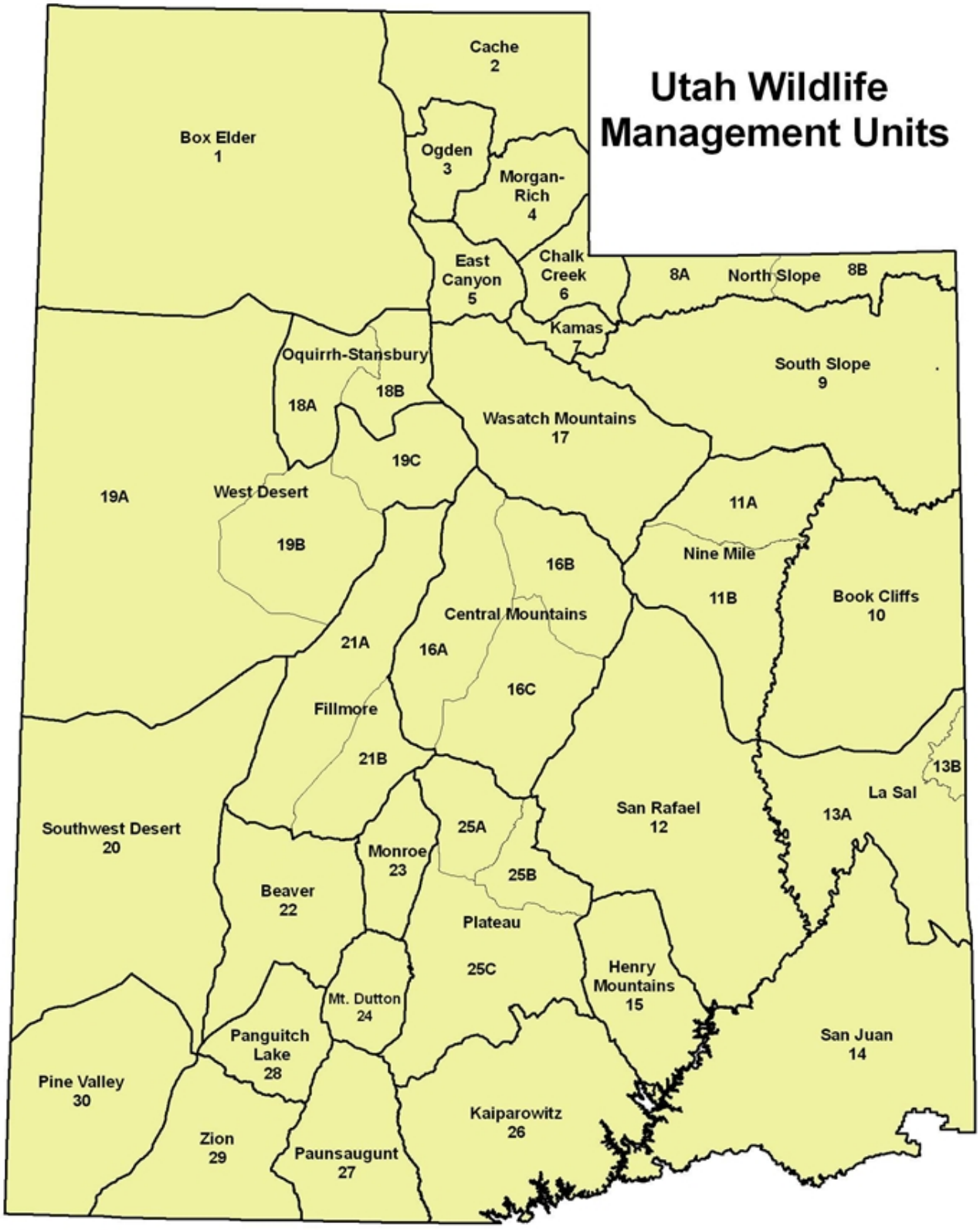
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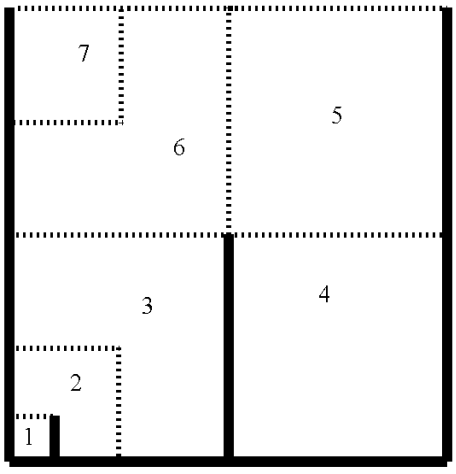
WATERSHED RESTORATION INITIATIVE STUDY METHODS

Watershed Restoration Initiative (WRI) studies have been established within watershed and habitat improvement projects to monitor vegetation changes. The data collected may be used to compare the goals of a treatment with the efficacy of the treatment. Most studies were established prior to treatment and each study has a companion reference site established in an untreated area nearby. Reference sites are placed in areas as similar to the study site prior to treatment as possible. Many of the studies were established in conjunction with the Wildlife Monitoring project. All sampling baselines are permanently marked by half-high steel fence posts.

Vegetative Composition

Determining vegetation characteristics for each treatment and reference is determined by setting up five consecutive 100 foot baseline transects in the area of interest. Two methods were used to read this baseline. The first method uses the 500 foot line as 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. The second method reads the 500 foot baseline and not the perpendicular belts. A 1/4 m^2 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.

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%. For example, to estimate vegetative 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.

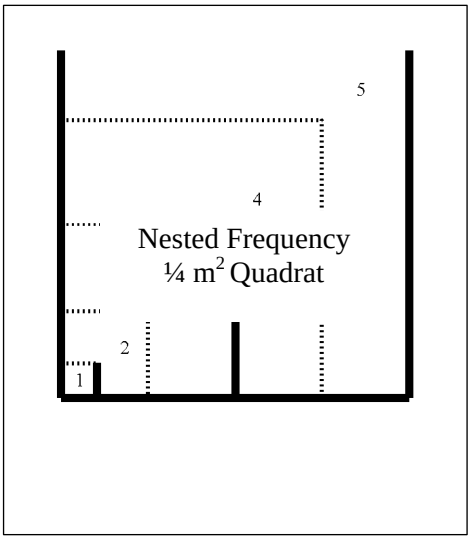


Cover Classes
1/4 m^2 Quadrat

Total canopy cover of shrubs or trees is estimated using the line intercept method. 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.

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.

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 by themselves 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. Nested frequency and average cover of vegetation, rock, pavement, litter, cryptogams, and bare ground are summarized in the "Basic Cover" table.

Shrub density was not estimated. Line intercept canopy cover, leader growth and height and crown was measured for shrubs.

Tree density is determined using the point-center quarter method at two hundred foot intervals along the baseline. Three hundred feet are 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.

TREND DETERMINATION

The methods described above rely on relative and absolute measurements of plant composition as determined from the frequency, cover, and line intercept data.

Trends in herbaceous plants as a group or as a single "key" species can be 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 (Friedman test which is analogous to analysis of variance) (Conover 1980) is conducted on nested frequencies of each species to determine significant changes at alpha = .10. Ground cover parameters are analyzed and compared in the discussions of the reread studies. Beginning in 2002, an erosion condition class assessment adapted from the Bureau of Land Management is also completed on each study site to provide additional qualitative information on soil condition. On newly established studies, a more subjective or apparent assessment is made from qualitative comparisons.

The following tables and partial tables are taken from study number 23-1 to help illustrate some basic comparisons that can be made with the data. The "Herbaceous Trends" table summarizes 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 23-1. 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, grasses had a combined total cover value of 11.39% in 1998 and 7.08% in 2003. In 1985 and 1991, bluebunch wheatgrass (*Agropyron spicatum*) had a nested frequency value of 227 out of a possible nested frequency score of 400. By 1998, nested frequency declined to 183. The subscript letters indicate that the nested frequency value for *A. spicatum* between 1991 and 1998 declined significantly. Nested frequency declined to 160 in 2003, but the subscript letters indicate that this was not a significant change.

Cover was estimated at 7.78% for *A. spicatum* in 1998 declining to 5.59% in 2003. Trend for this grass is down over the life of the transect due to a significant decline in sum of nested frequency since 1991.

HERBACEOUS TRENDS --
Management unit 23 , Study no: 1

Type	Species	Nested Frequency '85	'91	'98	'03	Average Cover % '98	'03
G	Agropyron spicatum	$_{b}$227	$_{b}$227	$_{a}$183	$_{a}$160	7.78	5.59
G	Bromus tectorum (a)	-	-	$_{b}$42	$_{a}$15	.43	.03
G	Oryzopsis hymenoides	4	12	12	5	.17	.04
G	Poa fendleriana	$_{a}$6	$_{bc}$36	$_{c}$49	$_{ab}$24	.98	.46
G	Poa secunda	$_{a}$3	$_{a}$18	$_{b}$94	$_{b}$80	2.00	.94
G	Sitanion hystrix	$_{c}$25	$_{bc}$20	$_{ab}$6	$_{a}$2	.01	.01
Total for Annual Grasses		0	0	42	15	0.43	0.03
Total for Perennial Grasses		265	313	344	271	10.95	7.05
Total for Grasses		265	313	386	286	11.39	7.08
F	Agoseris glauca	$_{a}$-	$_{a}$10	$_{ab}$1	$_{a}$-	.00	-
F	Arabis spp.	$_{a}$-	$_{b}$18	$_{a}$1	$_{a}$1	.00	.00
F	Astragalus convallarius	2	4	6	6	.15	.10
F	Calochortus nuttallii	4	8	-	-	-	-
F	Crepis acuminata	-	6	7	-	.06	-
F	Eriogonum racemosum	-	-	4	-	.03	-
F	Eriogonum umbellatum	$_{a}$-	$_{a}$1	$_{b}$9	$_{ab}$5	.16	.07
F	Phlox austromontana	-	6	4	6	.16	.15
F	Physaria chambersii	1	4	-	-	-	-
F	Phlox longifolia	$_{a}$8	$_{b}$27	$_{a}$16	$_{a}$6	.20	.02
Total for Annual Forbs		0	0	0	0	0.00	0
Total for Perennial Forbs		15	84	48	24	0.83	0.35
Total for Forbs		15	84	48	24	0.83	0.35

Values with different subscript letters are significantly different at alpha = .10

In 1985, perennial grasses had a sum of nested frequency value of 265. This value steadily increased to 313 in 1991 and 344 in 1998 before declining to 271 in 2003. These changes would indicate a slightly upward perennial grass trend from 1985 to 1998 and a stable trend overall for the life of the transect. The forb trend can be determined in a similar manner. The herbaceous understory trend is determined using both the grass and forb sum of nested frequency values. For example, total herbaceous cover was 12.23% in 1998 with grasses providing the bulk of the cover. Therefore, when determining herbaceous trend, the grass proportion should be weighted more heavily then the forb proportion in this example.

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 23-1 are listed. For example, mountain big sagebrush (*Artemisia tridentata vaseyana)* had a strip frequency of 40 out of a possible 100 in 1998, declining to 26 in 2003. 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 2.54% in 1998, declining to only 0.76% in 2003.

BROWSE TRENDS --
Management unit 23 , Study no: 1

Type	Species	Strip Frequency '98	Strip Frequency '03	Average Cover % '98	Average Cover % '03
B	Artemisia nova	35	26	2.24	2.41
B	Artemisia tridentata vaseyana	40	26	2.54	.76
B	Gutierrezia sarothrae	2	0	-	-
B	Juniperus osteosperma	4	5	5.51	9.29
B	Opuntia spp.	1	2	.15	-
B	Pinus edulis	4	6	5.99	8.81
B	Purshia tridentata	18	15	3.20	4.31
Total for Browse		104	80	19.63	25.58

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, Utah juniper (*Juniperus osteosperma*) had an estimated average cover of 23.31% in 2003. Prior to 2002, only trees species were sampled in the line-intercept transect. Beginning in 2002, all woody species are included in the line-intercept transect and a canopy cover value for each is determined. Live browse cover is measured along the belt transects and converted to percent cover. Gaps of six inches or more lacking live browse cover are excluded.

CANOPY COVER, LINE INTERCEPT --
Management unit 23 , Study no: 1

Species	Percent Cover '98	Percent Cover '03
Artemisia nova	-	1.85
Artemisia tridentata vaseyana	-	.55
Juniperus osteosperma	7.19	23.31

Beginning in 2002, annual leader growth of the key browse species is 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 bitterbrush (*Purshia tridentata*) averaged 4 inches in length while mountain big sagebrush leaders averaged only 1.1 inches in 2003.

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 23 , Study no: 1

Species	Average leader growth (in) '03
Artemisia tridentata vaseyana	1.1
Purshia tridentata	4.0

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. Data from 2003 estimated 197 juniper and 119 pinyon trees/acre with average basal diameters of 7.0 inches and 5.3 inches respectively.

POINT-QUARTER TREE DATA --
Management unit 23 , Study no: 1

Species	Trees per Acre		Average diameter (in)	
	'98	'03	'98	'03
Juniperus osteosperma	213	197	8.8	7.0
Pinus edulis	115	119	4.8	5.3

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 vegetative cover (2.0 and 5.75), while the new method estimates the vertical projection of the crown, or aerial cover (30.04 and 32.5%). Therefore, comparisons can be made for all cover measurements except for general vegetation cover.

BASIC COVER --
Management unit 23 , Study no: 1

Cover Type	Average Cover %			
	'85	'91	'98	'03
Vegetation	2.00	5.75	30.04	32.50
Rock	6.00	5.25	11.18	13.20
Pavement	30.50	24.25	26.32	19.74
Litter	46.50	46.50	42.49	37.44
Cryptogams	5.00	3.00	.93	3.45
Bare Ground	10.00	15.25	21.42	13.10

Occasionally a site may have data regarding soil characteristics. A summary of the soil data is found in the “Soil Analysis Data” table if available. 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. Average soil temperature is taken from the deepest probe, one at each of the 5 baseline starting stakes. The temperature is listed in the table as the top measurement (e.g., 62.3^{E}F), with the average depth (in inches) as the lower measurement (12.7). Average soil temperature is re-measured with each reading and the most current soil temperature and depth is listed in the soil analysis table. 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.

SOIL ANALYSIS DATA --
Management unit 23, Study no: 1, Study Name: Bear Ridge

Effective rooting depth (in)	pH	sandy loam			%0M	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.2	7.3	40	33.4	26.6	3.4	9	57.6	0.5

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

Ultra acid	< 3.5
Extremely acid	3.5-4.4
Very strongly acid	4.5-5.0
Strongly acid	5.1-5.5
Moderately acid	5.6-6.0
Slightly acid	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 10 ppm and 70 ppm respectively may be limiting to 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

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 1998, rabbit pellets were found in 25% of the quadrats placed on study 23-1, increasing to 32% in 2003. Quadrat frequency of rabbit or big game pellets indicate a relative amount of use by that particular animal. This data can help characterize changes in wildlife use patterns on the site.

PELLET GROUP DATA --
Management unit 23 , Study no: 1

Type	Quadrat Frequency '98	Quadrat Frequency '03	Days use/acre (ha) '98	Days use/acre (ha) '03
Rabbit	25	32	-	-
Elk	4	-	7 (17)	1 (3)
Deer	36	20	51 (125)	54 (134)

It was determined that additional information on pellet groups was necessary. Therefore, a pellet group transect is now sampled in conjunction with the vegetative 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 vegetative transect which runs 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. In the above example, deer days use/acre was estimated at 51 in 1998 increasing slightly to 54 in 2003. If a trend study needs to be read annually and more precision is required, the pellet group transect is

marked permanently (rebar) and the pellet groups within the circular plots are removed or marked after being counted.

In 2009 we did not characterize the age structure, growth form, or vigor of browse communities unless a site was part of the regular Range Trend rotation. Data from previous samplings is included in this report. The "Browse Characteristics" table summarizes characteristics of the shrub community on study 23-1. 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 1,400 in 1985, 1,065 in 1991, 1,100 in 1998, and 840 plants/acre in 2003. 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 (more than three times larger) is 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 of the population classified as dying, percent decadence, percent of the population displaying poor vigor, percent heavy hedging, young recruitment, etc. should be given more weight in determining shrub trend when comparing survey years where sample sizes are different.

BROWSE CHARACTERISTICS --
Management unit 23 , Study no: 1

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
85	**1400**	266	200	400	800	-	67	24	57	-	14	13/15
91	**1065**	333	333	66	666	-	19	6	63	11	38	12/13
98	**1100**	-	100	260	740	2300	56	2	67	27	40	15/23
03	**840**	-	120	140	580	1740	29	0	69	40	40	14/21

The data on mountain big sagebrush shows the proportion of decadent shrubs in the population has steadily increased from 57% in 1985 to 69% by 2003. Plants classified as dying had also increased to 40% by 2003. More seedlings were encountered in 1985 and 1991, with slight fluctuations in the number of young plants. Dead plants, included in sampling after 1992, are abundant at 2,300 plants/acre in 1998 and 1,740 in 2003, and outnumber live plants by a ratio of 2:1 in both years. The percentage of plants displaying poor vigor has increased from 14% in 1985 to 40% in 1998 and 2003. The proportion of shrubs displaying heavy hedging declined from 24% in 1985, to 6% in 1991, and 0% by 2003. The proportion of shrubs displaying moderate use has ranged from 67% in 1985 to 19% in 1991. The average height of mature sagebrush has remained similar in all readings and averaged 14 inches in 2003. Average crown diameter has fluctuated from 13 inches in 1991 to 23 inches in 1998.

Considering all these factors, trend for sagebrush in 2003 is slightly downward due to a decline in density, increased decadence, and an higher proportion of plants classified as dying. No seedlings were encountered in 1998 or 2003 and young plants are only moderately abundant.

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* and *Purshia*, the species names used by the Range Trend Study Plant Species List (Giunta 1983) and the Intermountain Flora (Cronquist et al. 1977) are retained to maintain continuity and alleviate confusion with earlier published reports.

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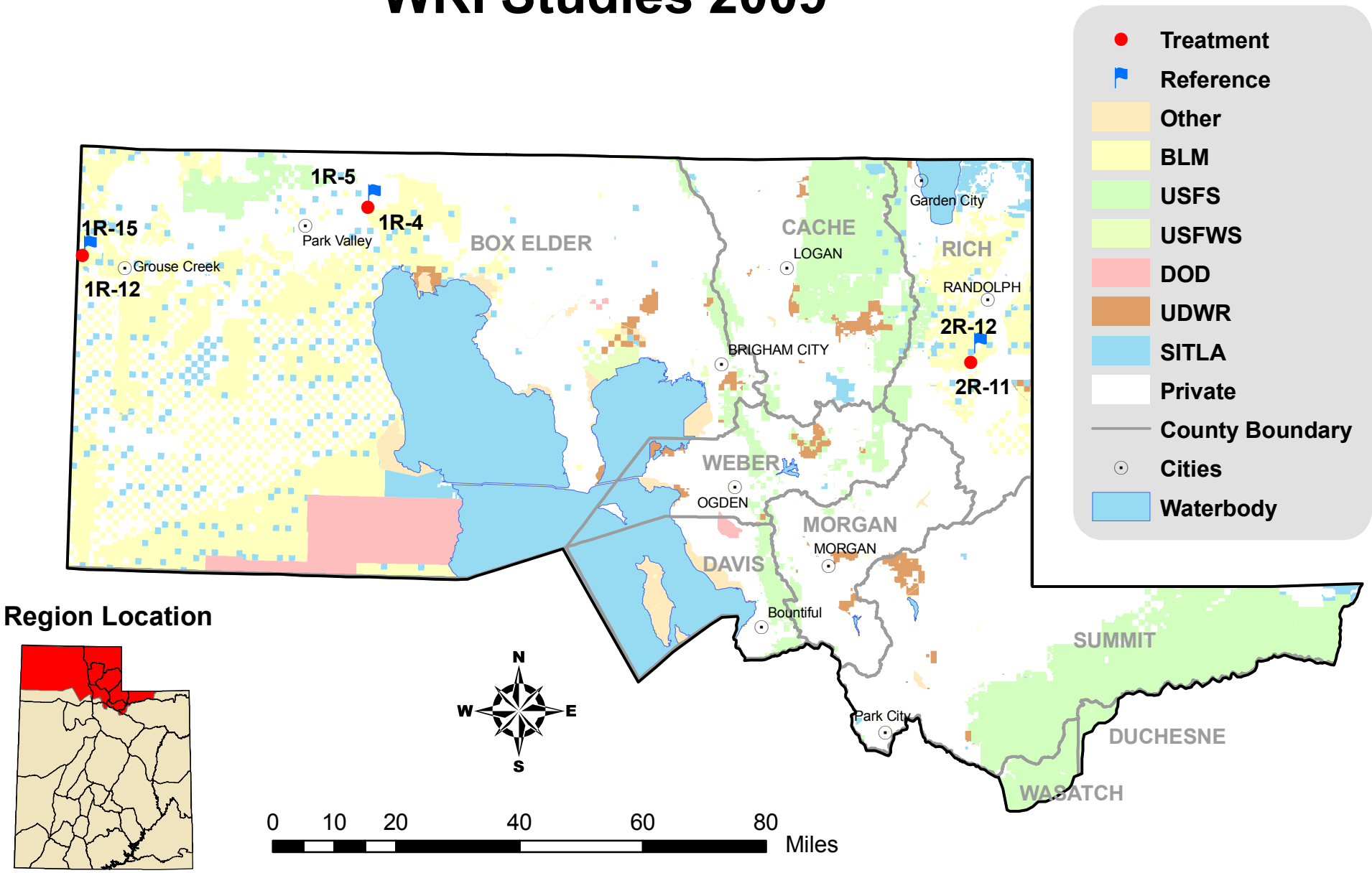
REPORT FORMAT

The name of the site and directions for locating the site are given on the location page. Also included on this page are the elevation, slope, vegetation type, 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 (NAD 83) 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 physical characteristics, soil, ground cover, vegetative community, and species composition as well as information on the treatment conducted. 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 years' data. Additional assessment is made by comparing photographs from year to year.

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

Northern Region
WRI Studies 2009



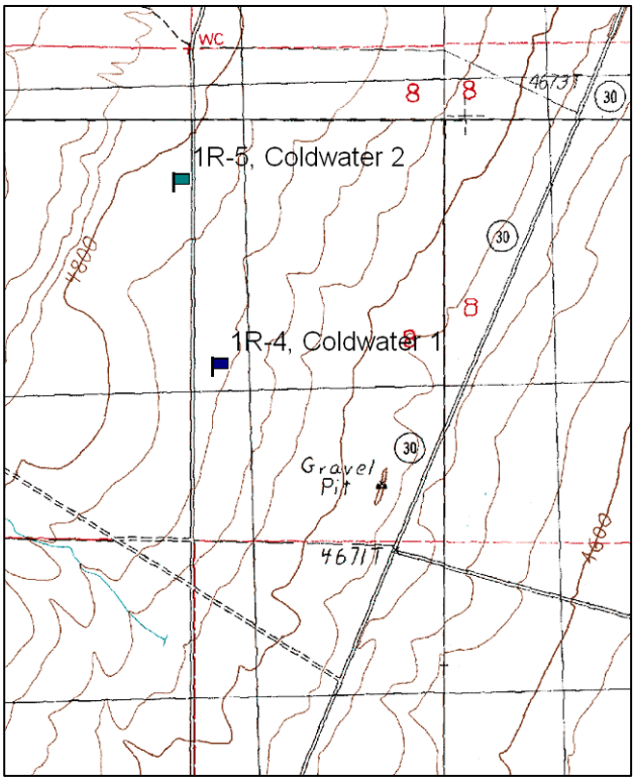
COLDWATER 1 WRI, 1R-4

Vegetation Type: Wyoming Big Sagebrush
Range Type: N/A
NRCS Ecological Site Description: Semidesert Gravelly Loam (Wyoming Big Sagebrush) North, R028AY215UT
Land Ownership: Private
Elevation: 4692 ft. (1430 m)
Aspect: northeast
Slope: 1%
Transect bearing: 73° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

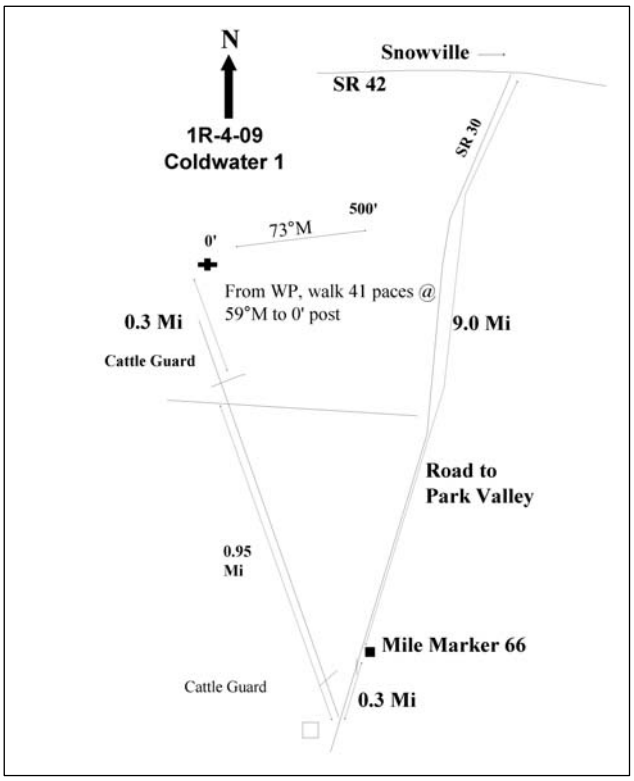
Directions:

Head west on SR-42 from Snowville, UT to Curlew Junction and turn south (left) onto SR-30 and drive toward Park Valley, UT. Drive to mile marker 66 and proceed another 0.3 miles and turn right. Drive north on this dirt road 0.95 miles to a cattle guard and continue another 0.3 miles to the witness post on the east (right) side of the road. From the witness post, walk 41 paces at 59°M to the 0' stake. The 0' stake is marked with browse tag #56.

Map Name: Black Butte



Diagrammatic Sketch:



Township: 13N, Range: 11W, Section: 57

GPS: NAD 83, UTM 12S 322707 E 4637863 N

COLDWATER 1 – WRI STUDY 1R-4
Project #163

Site Description

Site Information: This study was established in 2005 prior to a cheatgrass (*Bromus tectorum*) control study about 10 miles northeast of Park Valley, UT. In the fall of 2007, the entire project area was burned in a prescribed fire by FFSL. After the fire, the herbicide Plateau was aerially applied. In November and December the entire project area was drilled using two rangeland drills. Cattle use was low in 2005 and 2009, and deer/pronghorn use was low in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in both 2005 and 2009.

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the preferred browse species, but was greatly reduced years ago when it was sprayed and reseeded to improve the site for grazing. Unfortunately, cheatgrass took over the site. The purpose of the treatment is to improve the browse component.

Herbaceous Understory: Cheatgrass is the dominant grass species on the site. The treatment reduced cheatgrass significantly in nested frequency, but it is still common and provided the majority of grass cover on the site in 2009. Perennial grass species increased after the treatment with crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*) being the most common perennial grass species on the site. No other grass species provided more than 1% of cover in 2009. Forbs are fairly diverse, but are dominated by weedy annual species. Russian thistle (*Salsola iberica*) is the dominant species in cover on the site. The most common perennial forbs are yellow salsify (*Tragopogon dubius*) (a biennal) and gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*) (Table - Herbaceous Trends).

Pre vs. Two Years Post Treatment
Browse: No Wyoming big sagebrush canopy cover was measured in 2009 after providing less than 1% cover in 2005.

Grass: Perennial grasses have doubled in sum of nested frequency and cover has increased from 2% to 6%. Annual grasses have declined 72% in sum of nested frequency and cover has decreased from 48% to 11% since the treatment. There was a significant decrease in the nested frequency of cheatgrass and sixweeks fescue (*Vulpia octoflora*) and a significant increase in crested wheatgrass. The seeded species pubescent wheatgrass (*Agropyron intermedium*) and western wheatgrass (*A. smithii*) were sampled for the first time in 2009. Even with the decrease in cheatgrass, it is still the dominant grass on the site.

Forb: The sum of nested frequency for perennial forbs has declined 86% and cover decreased from 14% to 7% after the treatment. The sum of nested frequency of annual forbs decreased substantially, but cover increased from 15% to 24%. Much of this increase in cover is due to a large increase in cover of Russian thistle which may have been a result of the study being sampled later in the growing season in 2009. No seeded forb species were sampled.

Seed Mix

Project name: Coldwater Ranch

WRI Database #: 163 Size (acres): 2000

Mix lot #: nr-rg-cr-08

Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	293	0.15
Alfalfa 'Ranger'	600	0.30
Alfalfa 'Spredor 4'	700	0.35
Cicer Milkvetch 'Lutana'	150	0.08
Crested Wheatgrass 'Ephraim'	1000	0.50
Crested Wheatgrass 'Hycrest'	1081	0.54
Alfalfa 'Ladak'	350	0.18
Fourwing Saltbush--Juab/Millard UT	696	0.35
Great Basin Wildrye 'Trailhead'	2000	1.00
Pubescent Wheatgrass	1770	0.89
Pubescent Wheatgrass	250	0.13
Russian Wildrye	2000	1.00
Cicer Milkvetch 'Lutana'	824	0.41
Sainfoin 'Eski'	2000	1.00
Small Burnet 'Delar'	2000	1.00
Snake River Wheatgrass 'Secar'	1066	0.53
Snake River Wheatgrass 'Secar'	900	0.45
Western Wheatgrass 'Arriba'	2000	1.00
Canby Bluegrass 'Canbar'	400	0.20
BULK POUNDS PER ACRE:		10.04
PLS POUNDS PER ACRE:		8.68

Size (acres): 2000

Mix Lot #: nr-rg-crfb-08

Seed type	lbs in mix	lbs/acre
Forage Kochia--Humbolt NV	800	0.40
Sagebrush, Wyoming--Beaver UT	610	0.31
Western Yarrow	100	0.05
BULK POUNDS PER ACRE:		0.76
PLS POUNDS PER ACRE:		0.45

HERBACEOUS TRENDS--

Management unit 01R, Study no: 4

Type	Species	Nested Frequency '05	Nested Frequency '09	Average Cover % '05	Average Cover % '09
G	Agropyron cristatum	$_{a}$3	$_{b}$24	.10	2.15
G	Agropyron intermedium	-	$_{a}$9	-	.72
G	Agropyron smithii	-	3	-	.03
G	Agropyron spicatum	-	$_{b}$12	-	.75
G	Bromus tectorum (a)	$_{b}$488	$_{a}$178	45.69	10.76
G	Oryzopsis hymenoides	7	10	.33	.14
G	Poa secunda	42	57	1.11	1.68
G	Sitanion hystrix	5	4	.33	.82
G	Vulpia octoflora (a)	$_{b}$158	$_{a}$1	1.89	.00
Total for Annual Grasses		646	179	47.59	10.76
Total for Perennial Grasses		57	119	1.87	6.31
Total for Grasses		703	298	49.46	17.07
F	Allium sp.	-	3	-	.03
F	Astragalus sp.	5	-	.21	-
F	Descurainia pinnata (a)	13	3	.05	.18
F	Erigeron pumilus	1	-	.00	-
F	Erodium cicutarium (a)	13	-	.24	-
F	Ipomopsis congesta	-	1	-	.00

Type	Species	Nested Frequency '05	Nested Frequency '09	Average Cover % '05	Average Cover % '09
F	Lactuca serriola	$_{b}$403	-	11.85	-
F	Machaeranthera canescens	1	-	.03	-
F	Malcolmia africana	7	-	.06	-
F	Penstemon sp.	-	13	-	.56
F	Phlox longifolia	5	-	.04	-
F	Ranunculus testiculatus (a)	$_{b}$237	$_{a}$5	3.65	.01
F	Salsola iberica (a)	$_{b}$416	$_{a}$244	9.88	23.64
F	Senecio sp.	2	-	.03	-
F	Sisymbrium altissimum (a)	$_{b}$52	-	1.14	.15
F	Sphaeralcea coccinea	$_{b}$15	-	.48	-
F	Sphaeralcea grossulariifolia	-	$_{a}$11	-	1.99
F	Tragopogon dubius	$_{a}$27	$_{b}$38	1.05	4.40
F	Unknown cruciferae	5	-	.06	-
F	Unknown forb-annual (a)	-	6	-	.04
Total for Annual Forbs		731	258	14.98	24.02
Total for Perennial Forbs		471	66	13.84	6.99
Total for Forbs		1202	324	28.82	31.02

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

CANOPY COVER, LINE INTERCEPT--
Management unit 01R, Study no: 4

Species	Percent Cover '05	Percent Cover '09
Artemisia tridentata vaseyana	.15	-
Chrysothamnus nauseosus	.83	-

BASIC COVER--
Management unit 01R, Study no: 4

Cover Type	Average Cover % '05	Average Cover % '09
Vegetation	67.18	43.95
Rock	.98	.57
Pavement	5.35	19.32
Litter	16.92	12.73
Cryptogams	.28	0
Bare Ground	14.10	41.25

PELLET GROUP DATA--
Management unit 01R, Study no: 4

Type	Quadrat Frequency '05	'09	Days use per acre (ha) '05	'09
Rabbit	1	-	-	-
Cattle	4	-	12 (29)	2 (5)
Deer/Pronghorn	-	-	-	3 (7)

SOIL ANALYSIS DATA --
Management unit 1R, Study no: 4, Study Name: Cold Water 1

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
13.3	7.6	34.2	42	23.8	1	6.5	492.8	0.6

BROWSE CHARACTERISTICS--
Management unit 01R, Study no: 4

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
05	20/26
09	-/-
Atriplex canescens	
05	-/-
09	22/47
Chrysothamnus nauseosus	
05	19/25
09	-/-

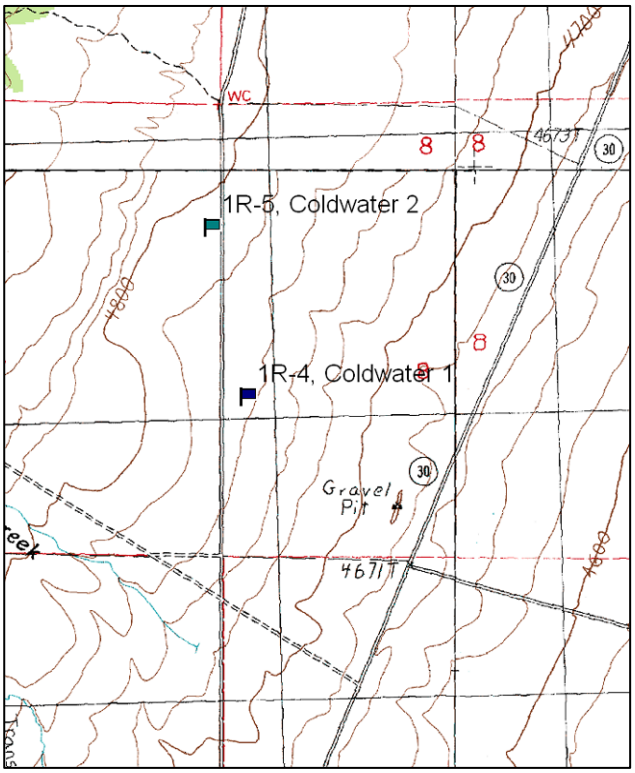
COLDWATER 2 WRI, 1R-5

Vegetation Type: Wyoming big sagebrush
Range Type: N/A
NRCS Ecological Site Description: Semidesert Gravelly Loam (Wyoming Big Sagebrush) North, R028AY215UT
Land Ownership: Private
Elevation: 4,741 ft. (1,445 m)
Aspect: northeast
Slope: 1%
Transect bearing: 243° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

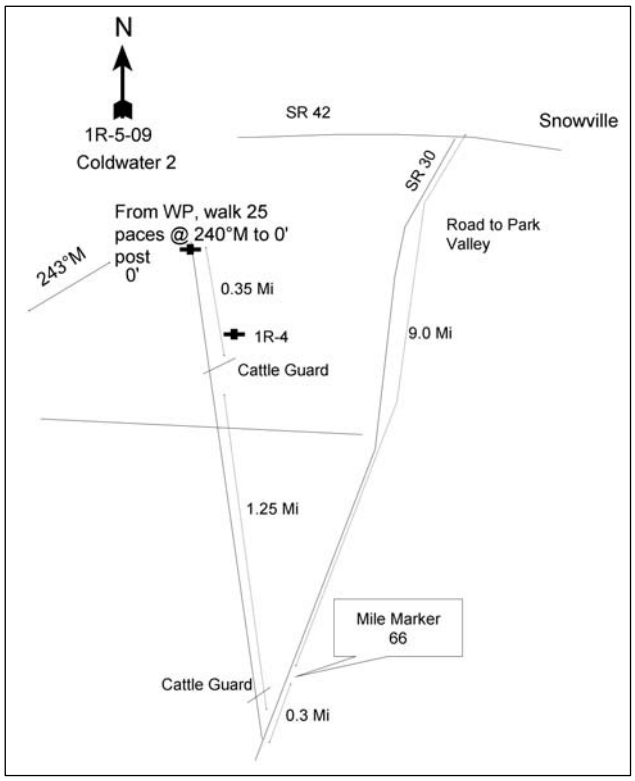
Directions:

Head west on SR-42 from Snowville UT to Curlew Junction and turn south (left) onto SR-30 and drive toward Park Valley, UT. Drive to mile marker 66 and proceed another 0.3 miles to a turn west. Drive north on this dirt road 1.25 miles to the witness post of 1R-4 on the east side of the road. Continue 035 miles to the witness post on the west of the road. From the witness post, walk 45 paces at 243° M to the 0' stake. The 0' stake is marked with browse tag #57.

Map Name: Black Butte



Diagrammatic Sketch:



Township: 13N, Range: 11W, Section: 57

GPS: NAD 83, UTM 12S 322707 E 4637863 N

COLDWATER 2 - WRI STUDY 1R-5
Project #163 Reference

Site Description

Site Information: The Coldwater 2 study was established as an untreated reference study in companion to the Coldwater 1 study and is located just to the west of the treatment site. The treatment area is located approximately 10 miles northeast of Park Valley, Utah. Pellet group data estimated moderate cattle use in 2005 and 2009. Due to difficulties distinguishing between species, deer and pronghorn pellets were counted together. Estimated deer/pronghorn use was low in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in both 2005 and 2009.

Browse: Browse species are very limited on the site. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant browse and increased in canopy cover from 2005 to 2009. Prostrate kochia (*Kochia prostrata*) occurs on the site, but in very low canopy cover (Table - Canopy Cover).

Herbaceous Understory: The annual grass, cheatgrass (*Bromus tectorum*), is the dominant grass species on the site and provides almost all of the grass cover on the site. There was a substantial decrease in the cover of cheatgrass from 2005 to 2009, but it still dominates the grasses. Three perennial grass species, crested wheatgrass (*Agropyron cristatum*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*), were sampled at low frequency and cover since 2005. The site is dominated by annual forbs. Russian thistle (*Salsola iberica*), halogeton (*Halogeton glomeratus*) and burr buttercup (*Ranunculus testiculatus*) provided the majority of forb cover in 2009. Perennial forb cover and sum of nested frequency decreased markedly from 2005 to 2009 (Table - Herbaceous Trends).

Trend Assessments

Browse

- **2005 to 2009 - slightly up (+1):** Wyoming big sagebrush canopy cover increased from less than 1% to 3%. Forage kochia has remained similar to past levels.

Grass

- **2005 to 2009 - slightly up (+1):** Perennial grasses were at similar cover and nested frequency levels. Cheatgrass declined significantly in nested frequency and cover decreased from 29% to 6%.

Forb

- **2005 to 2009 - down (-2):** The sum of nested frequency for perennial forbs decreased by 80% and cover decreased from 10%to 2%. Weedy annual species have increased in nested frequency and cover and provided 38% total cover in 2009.

HERBACEOUS TRENDS--
Management unit 01R, Study no: 5

Type	Species	Nested Frequency '05	Nested Frequency '09	Average Cover % '05	Average Cover % '09
G	Agropyron cristatum	$_{a}$1	$_{b}$10	.04	.51
G	Bromus tectorum (a)	$_{b}$450	$_{a}$190	29.08	6.34
G	Poa secunda	$_{b}$54	$_{a}$36	.76	.62
G	Sitanion hystrix	30	25	.95	.28
G	Vulpia octoflora (a)	$_{b}$31	-	.13	-
Total for Annual Grasses		481	190	29.21	6.34
Total for Perennial Grasses		85	71	1.75	1.41
Total for Grasses		566	261	30.96	7.75
F	Allium sp.	$_{b}$10	-	.05	-
F	Astragalus sp.	3	-	.03	-
F	Camelina microcarpa (a)	-	$_{b}$21	-	.27
F	Cardaria draba	$_{b}$34	-	.75	-
F	Descurainia pinnata (a)	13	-	.04	-
F	Erodium cicutarium (a)	-	4	-	.15
F	Halogeton glomeratus (a)	-	$_{b}$140	-	10.77
F	Iva axillaris	-	27	-	1.17
F	Lactuca serriola	$_{b}$269	$_{a}$3	8.35	.03
F	Lepidium perfoliatum (a)	$_{b}$107	-	8.00	-
F	Malcolmia africana	$_{a}$9	-	.21	-
F	Medicago sativa	-	-	.00	-
F	Penstemon sp.	-	1	-	.00
F	Phlox longifolia	5	10	.04	.09
F	Polygonum douglasii (a)	2	-	.01	-
F	Ranunculus testiculatus (a)	$_{b}$396	$_{a}$274	15.31	7.43
F	Salsola iberica (a)	$_{a}$126	$_{b}$263	1.04	19.80
F	Sisymbrium altissimum (a)	4	-	.03	-
F	Sphaeralcea coccinea	5	-	.16	-
F	Sphaeralcea grossulariifolia	-	2	-	.33
F	Thlaspi montanum	-	$_{b}$12	-	.20
F	Tragopogon dubius	19	17	.31	.58
Total for Annual Forbs		648	702	24.45	38.44
Total for Perennial Forbs		354	72	9.93	2.41
Total for Forbs		1002	774	34.38	40.86

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

CANOPY COVER, LINE INTERCEPT--
Management unit 01R, Study no: 5

Species	Percent Cover '05	Percent Cover '09
Artemisia tridentata wyomingensis	.15	2.83
Kochia prostrata	-	.51

BASIC COVER--
Management unit 01R, Study no: 5

Cover Type	Average Cover % '05	'09
Vegetation	56.84	46.40
Rock	1.08	.49
Pavement	2.57	3.81
Litter	27.95	41.73
Cryptogams	2.98	.03
Bare Ground	26.48	33.62

PELLET GROUP DATA--
Management unit 01R, Study no: 5

Type	Quadrat Frequency '05	'09	Days use per acre (ha) '05	'09
Rabbit	3	4	-	-
Deer	-	1	-	5 (12)
Cattle	13	3	46 (115)	33 (82)
Deer/Pronghorn	-	3	-	1 (3)

SOIL ANALYSIS DATA --
Management unit 1R, Study no: 5, Study Name: Cold Water 2

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
9.7	8.2	24.2	41	34.8	1.1	6.6	937.6	0.9

BROWSE CHARACTERISTICS--
Management unit 01R, Study no: 5

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
05	20/22
09	23/31
Chrysothamnus nauseosus	
05	-/-
09	18/28
Chrysothamnus viscidiflorus viscidiflorus	
05	13/17
09	18/30
Kochia prostrata	
05	-/-
09	25/37
Opuntia sp.	
05	5/8
09	6/10

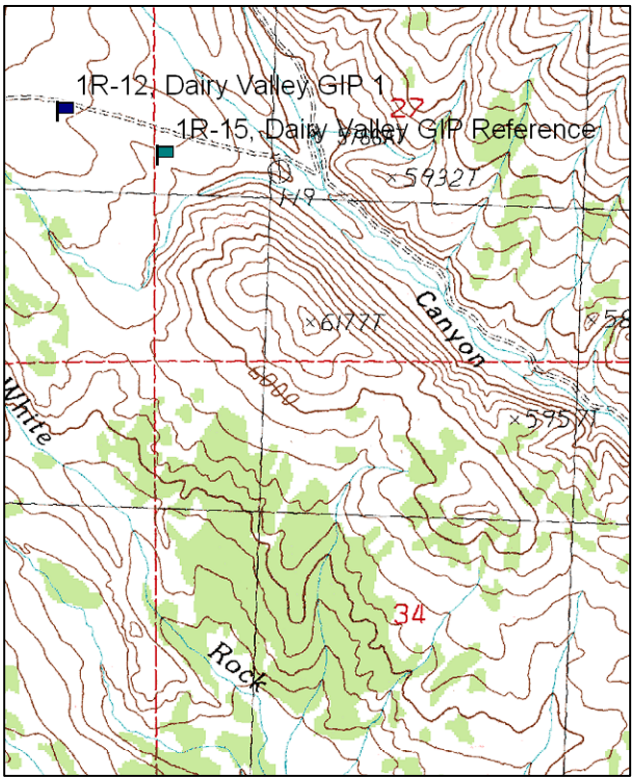
DAIRY VALLEY GIP 1 WRI, 1R-12

Vegetation Type: Mountain big sagebrush
Range Type: Substantial deer winter; crucial year-long elk
NRCS Ecological Site Description: Upland Juniper Savanna (Utah Juniper), R025XY322UT
Land Ownership: SITLA
Elevation: 5,883 ft. (1,793 m)
Aspect: southeast
Slope: 3-5%
Transect bearing: 355° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

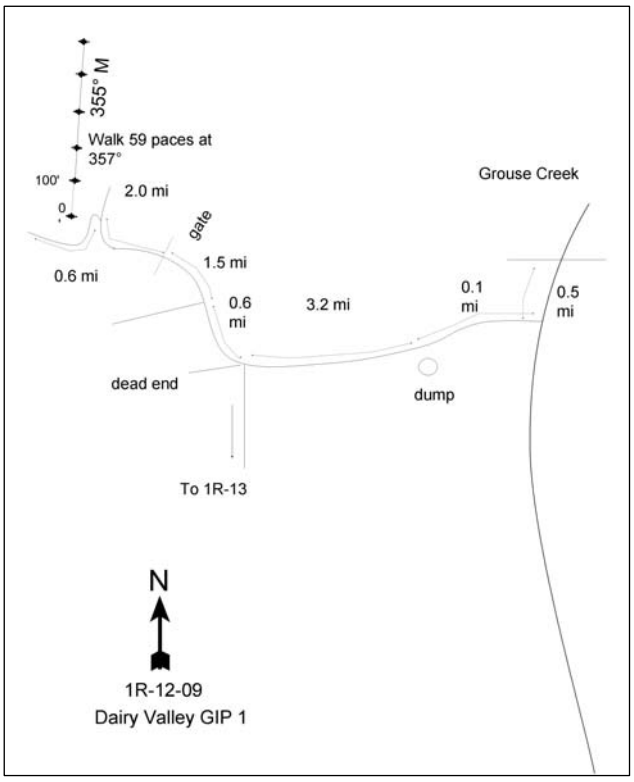
Directions:

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: Death Creek Reservoir



Diagrammatic Sketch:



Township: 12N, Range: 19W, Section: 28

GPS: NAD 83, UTM 11T 747227 E 4624581 N or
GPS: NAD 83, UTM 12S 248546 E 4624584 N

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

Site Description

Site Information: This study was established in 2008 to monitor effects of the post-fire chaining treatment after the Dairy Valley Fire, which burned in 2007. This study monitors a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) community. This area was aerially seeded and chained following the fire in the fall of 2007. A total of 6,900 acres of private and SITLA land were aerially seeded after the wildfire using a species diverse seed mix. This was done in December of 2007. In the spring of 2008, starting May 31st, 2,700 acres of private and SITLA lands were chained one way using an Ely chain. Pellet group data in 2008 estimated low deer and cattle use. Pellet group data in 2009 estimated low elk use and moderately low cattle use (Table - Pellet Group Data).

Browse: Mountain big sagebrush is the preferred browse species sampled on the site. Stickyleaf low rabbitbrush is the dominant browse species on the site providing the majority of canopy cover. Antelope bitterbrush (*Purshia tridentata*) has been sampled in low density on the site (Table - Browse Characteristics), but provides little cover (Table - Canopy Cover).

Herbaceous Understory: Nine grass species were sampled in 2009, cheatgrass (*Bromus tectorum*) being the only annual species. Sandberg bluegrass (*Poa secunda*) is the most common grass species providing the majority of the grass cover. Cheatgrass is common and was the second most abundant grass on the site in 2009, following the treatment. Forbs are diverse and abundant, but the low quality forage species longleaf phlox (*Phlox longifolia*) dominates the forb component (Table - Herbaceous Trends).

Pre vs. One Year Post Treatment

Browse: Mountain big sagebrush canopy cover increased from 4% to 10%, while stickyleaf low rabbitbrush canopy cover declined from 18% to 12%. Antelope bitterbrush canopy cover increased slightly, but is still low, and rubber rabbitbrush (*Chrysothamnus nauseosus*) was sampled for the first time at low cover.

Grass: The sum of nested frequency of perennial grasses remained similar to 2008, while cover increased from 8% to 17%. There was a significant increase in the nested frequency of cheatgrass and cover increased from less than 1% to 2%. The seeded species crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) were sampled for the first time in 2009. Bluebunch wheatgrass (*Agropyron spicatum*) was present on the site before it was seeded with the treatment, but increased significantly in nested frequency after the treatment.

Forb: The sum of nested frequency of perennial forbs stayed similar while cover nearly doubled from 8% to 14%. No seeded species were sampled in 2009, following the treatment. The forb community is still dominated by longleaf phlox. Annual forbs remain a minor part of the community.

Seed Mix

Project name: Dairy Valley
WRI Database #: 992

Mix lot #: nr-rg-dv-08	Size (acre):	6300
Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	7100	1.13
Alfalfa 'Ranger'	2350	0.37
Bluebunch WG 'P-7'	6300	1.00
Canby Bluegrass 'Canbar'	2239	0.36
Crested Wheatgrass 'Hycrest'	5500	0.87
Crested Wheatgrass 'Nordan'	5500	0.87
Forage Kochia 'Immigrant'	2300	0.37
Great Basin Wildrye 'Trailhead'	3400	0.54
Intermediate Wheatgrass 'Oahe'	6300	1.00
Orchardgrass 'Paiute'	3200	0.51
Pubescent Wheatgrass	6300	1.00
Sainfoin 'Eski'	6301	1.00
Small Burnet 'Delar'	6296	1.00
Snake River Wheatgrass 'Secar'	6300	1.00
Yellow Sweetclover	3200	0.51
BULK POUNDS PER ACRE:		11.52
PLS POUNDS PER ACRE:		10.30

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

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
G	Agropyron cristatum	-	3	-	.30
G	Agropyron intermedium	-	$_{b}$53	-	1.94
G	Agropyron smithii	$_{b}$77	$_{a}$23	1.26	.65
G	Agropyron spicatum	$_{a}$5	$_{b}$18	.01	.17
G	Bromus tectorum (a)	$_{a}$60	$_{b}$137	.29	2.24
G	Koeleria cristata	$_{a}$5	$_{b}$19	.04	.45
G	Oryzopsis hymenoides	4	1	.01	.03
G	Poa fendleriana	3	-	.15	-
G	Poa secunda	232	239	5.59	12.57
G	Sitanion hystrix	39	25	.48	1.06
Total for Annual Grasses		60	137	0.28	2.24
Total for Perennial Grasses		365	381	7.56	17.19
Total for Grasses		425	518	7.85	19.43
F	Achillea millefolium	3	-	.00	-
F	Agoseris glauca	$_{b}$96	$_{a}$22	.99	.04
F	Allium sp.	$_{a}$40	$_{b}$133	.10	1.96
F	Aster sp.	9	-	.02	-
F	Astragalus convallarius	4	10	.05	.06
F	Astragalus sp.	$_{b}$14	$_{a}$3	.10	.06
F	Camelina microcarpa (a)	$_{a}$4	$_{b}$15	.00	.11
F	Chaenactis douglasii	$_{a}$3	$_{b}$23	.04	.14
F	Chenopodium leptophyllum(a)	5	-	.01	-

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
F	Cirsium sp.	1	2	.00	.04
F	Comandra pallida	18	21	.14	.25
F	Cordylanthus sp. (a)	-	$_{b}$9	-	.26
F	Crepis acuminata	5	7	.04	.06
F	Descurainia pinnata (a)	-	$_{b}$13	-	.52
F	Gayophytum ramosissimum(a)	$_{a}$3	$_{b}$11	.00	.05
F	Lactuca serriola	$_{a}$8	$_{b}$80	.05	1.10
F	Lappula occidentalis (a)	$_{a}$5	$_{b}$12	.00	.22
F	Penstemon sp.	16	14	.12	.13
F	Phlox longifolia	$_{b}$356	$_{a}$288	5.78	9.81
F	Polygonum douglasii (a)	18	20	.04	.12
F	Ranunculus testiculatus (a)	1	-	.00	-
F	Taraxacum officinale	7	1	.01	.03
F	Tragopogon dubius	$_{b}$25	$_{a}$5	.32	.09
F	Veronica biloba (a)	$_{b}$25	-	.12	-
Total for Annual Forbs		61	80	0.20	1.31
Total for Perennial Forbs		605	609	7.81	13.81
Total for Forbs		666	689	8.01	15.13

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

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

Species	Percent Cover '08	Percent Cover '09
Artemisia tridentata vaseyana	3.93	10.18
Chrysothamnus nauseosus	-	.81
Chrysothamnus viscidiflorus viscidiflorus	17.81	11.71
Purshia tridentata	.36	.63

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

Species	Trees per Acre '08	Trees per Acre '09	Average diameter (in) '08	Average diameter (in) '09
Juniperus osteosperma	<18	<18	15	2.4

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

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

PELLET GROUP DATA--
Management unit 01R, Study no: 12

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

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

Yr	Average Height Crown (in)
Amelanchier utahensis	
08	22/24
09	31/34
Artemisia tridentata vaseyana	
08	13/19
09	13/19
Chrysothamnus nauseosus	
08	28/35
09	20/27
Chrysothamnus viscidiflorus viscidiflorus	
08	11/18
09	11/19
Eriogonum corymbosum	
08	8/13
09	-/-
Opuntia sp.	
08	4/11
09	5/13
Purshia tridentata	
08	14/38
09	15/31

Yr	Average Height Crown (in)
Symphoricarpos oreophilus	
08	6/15
09	-/-

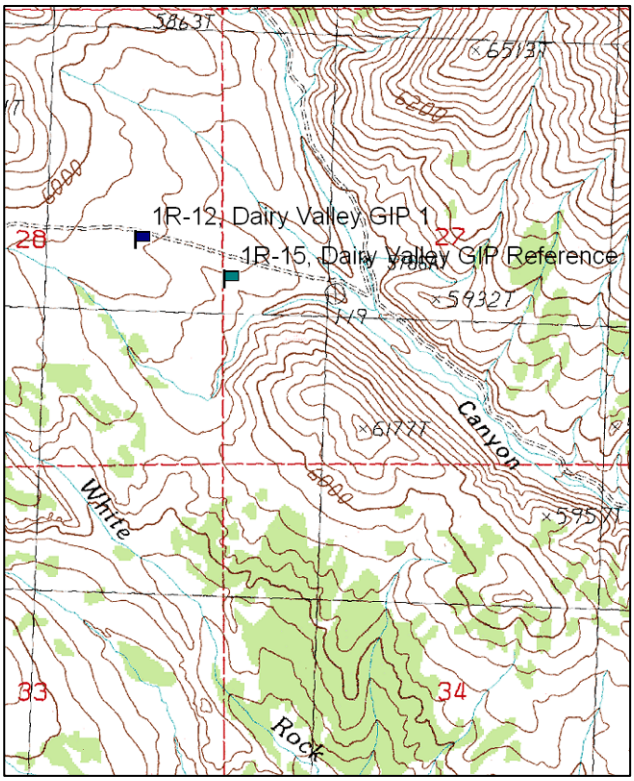
DAIRY GIP 1 REFERENCE WRI, 1R-15

Vegetation Type: Burned mountain big sagebrush
Range Type: Substantial deer winter; crucial year-long elk
NRCS Ecological Site Description: Upland Juniper Savanna (Utah Juniper), R025XY322UT
Land Ownership: BLM
Elevation: 5,833 ft. (1,778 m)
Aspect: east
Slope: 3%
Transect bearing: 93° 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 0.55 miles to a witness post on the right side of the road. From witness post go 10 paces at 8° to 0' stake.

Map Name: Death Creek Reservoir



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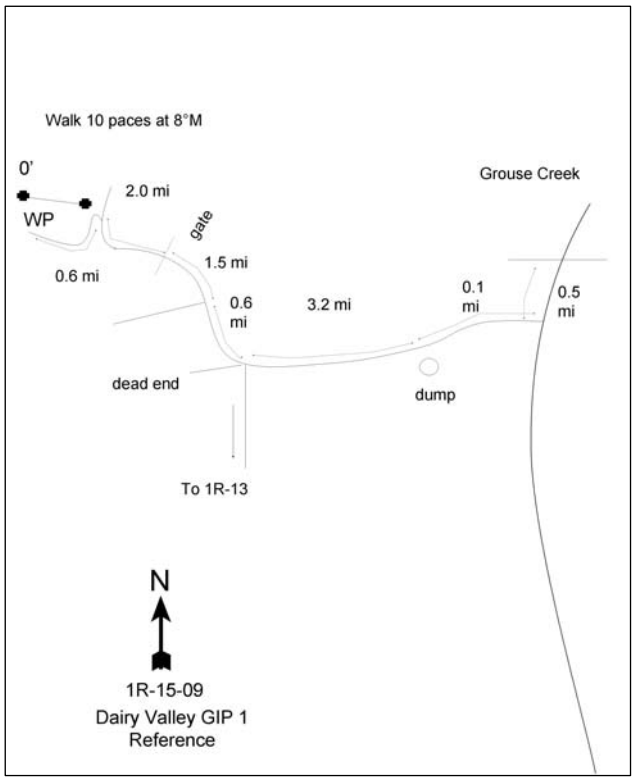


Township: 12N, Range: 19W, Section: 28

GPS: NAD 83, UTM 11T 747227 E 4624581 N or
GPS: NAD 83, UTM 12S 248235 E 4624738 N

DAIRY VALLEY GIP 1 REFERENCE - WRI STUDY 1R-15
Project #992 Reference

Site Description

Site Information: This study was established in 2009 as a reference study to the Dairy Valley GIP 1 study, 1R-12, in a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and sticklyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) community adjacent to the treated site. This area burned in the Dairy Valley Fire of 2007 and was seeded aerially, but not chained. Pellet group data estimated low cattle use in 2009 (Table - Pellet Group Data).

Browse: Stickyleaf low rabbitbrush is the dominant browse species on this site providing all of the notable canopy cover. The only other species that provided any cover was antelope bitterbrush (*Purshia tridentata*), but cover was negligible in 2009 (Table - Canopy Cover). This area was not chained following a burn leaving 67 standing dead juniper (*Juniperus osteosperma*) trees/acre.

Herbaceous Understory: Eight grass species were sampled on this study, with cheatgrass (*Bromus tectorum*) being the only annual. Sandberg bluegrass (*Poa secunda*) was the most common grass on site and provided most of the perennial grass cover. Cheatgrass is common and provides nearly as much cover as Sandberg bluegrass. Forbs are fairly diverse, but longleaf phlox (*Phlox longifolia*) was the most common forb and provided over 75% of the perennial forb cover (Table - Herbaceous Trends).

Seed Mix

Project name: Dairy Valley
WRI Database #: 992

Mix lot #: nr-rg-dv-08	Size (acre):	6300
Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	7100	1.13
Alfalfa 'Ranger'	2350	0.37
Bluebunch WG 'P-7'	6300	1.00
Canby Bluegrass 'Canbar'	2239	0.36
Crested Wheatgrass 'Hycrest'	5500	0.87
Crested Wheatgrass 'Nordan'	5500	0.87
Forage Kochia 'Immigrant'	2300	0.37
Great Basin Wildrye 'Trailhead'	3400	0.54
Intermediate Wheatgrass 'Oahe'	6300	1.00
Orchardgrass 'Paiute'	3200	0.51
Pubescent Wheatgrass	6300	1.00
Sainfoin 'Eski'	6301	1.00
Small Burnet 'Delar'	6296	1.00
Snake River Wheatgrass 'Secar'	6300	1.00
Yellow Sweetclover	3200	0.51
BULK POUNDS PER ACRE:		11.52
PLS POUNDS PER ACRE:		10.30

HERBACEOUS TRENDS--
Management unit 01R, Study no: 15

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	3	.16
G	Agropyron smithii	21	.91
G	Agropyron spicatum	21	.66
G	Bromus tectorum (a)	145	4.08
G	Koeleria cristata	11	.48
G	Oryzopsis hymenoides	3	.09
G	Poa secunda	154	5.99
G	Sitanion hystrix	21	.58
Total for Annual Grasses		145	4.08
Total for Perennial Grasses		234	8.88
Total for Grasses		379	12.96
F	Agoseris glauca	11	.16
F	Allium sp.	74	.72
F	Astragalus convallarius	11	.09
F	Astragalus utahensis	1	.00
F	Camelina microcarpa (a)	22	.87
F	Chaenactis douglasii	7	.54
F	Cirsium sp.	1	.00
F	Comandra pallida	13	.33
F	Cordylanthus sp. (a)	8	.09
F	Crepis acuminata	6	.18
F	Descurainia pinnata (a)	10	1.11
F	Gayophytum ramosissimum(a)	11	.12
F	Lactuca serriola	1	.03
F	Lappula occidentalis (a)	5	.10
F	Linum lewisii	-	.03
F	Lupinus sp.	1	.03
F	Microsteris gracilis (a)	13	.05
F	Phlox longifolia	303	10.47
F	Polygonum douglasii (a)	45	.53
F	Ranunculus testiculatus (a)	3	.00
F	Stellaria jamesiana	2	.00
F	Taraxacum officinale	3	.03
F	Thlaspi montanum	13	.25
F	Tragopogon dubius	3	.06
F	Unknown forb-annual (a)	36	.67
F	Unknown forb-perennial	4	.15
F	Zigadenus paniculatus	3	.01
Total for Annual Forbs		153	3.56
Total for Perennial Forbs		457	13.12
Total for Forbs		610	16.69

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

CANOPY COVER, LINE INTERCEPT--
Management unit 01R, Study no: 15

Species	Percent Cover '09
Chrysothamnus viscidiflorus viscidiflorus	16.39
Purshia tridentata	-

POINT-QUARTER TREE DATA--
Management unit 01R, Study no: 15

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	67 (Dead)	-

BASIC COVER--
Management unit 01R, Study no: 15

Cover Type	Average Cover % '09
Vegetation	35.95
Rock	1.01
Pavement	16.13
Litter	14.63
Bare Ground	42.73

PELLET GROUP DATA--
Management unit 01R, Study no: 15

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Deer	1	-
Cattle	3	9 (22)

BROWSE CHARACTERISTICS--
Management unit 01R, Study no: 15

Yr	Average Height Crown (in)
Amelanchier utahensis	
09	31/48
Artemisia tridentata vaseyana	
09	4/7
Chrysothamnus viscidiflorus viscidiflorus	
09	10/17
Opuntia sp.	
09	5/14
Purshia tridentata	
09	6/9

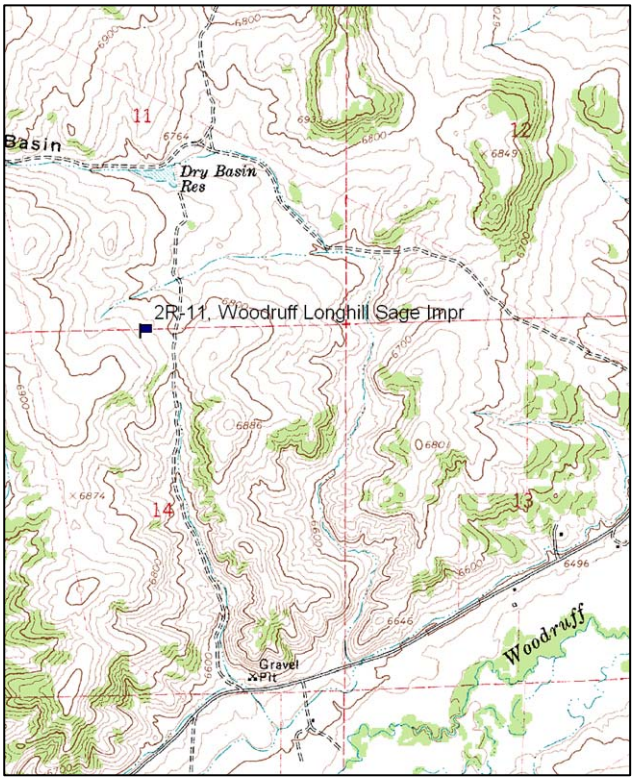
WOODRUFF LONGHILL SAGEBRUSH IMPROVEMENT WRI, 2R-11

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Upland Stony Loam (Wyoming Big Sagebrush), R047XA338UT
Land Ownership: BLM
Elevation: 6,807 ft. (2,075 m)
Aspect: Northeast
Slope: 3%-4%
Transect bearing: 44° magnetic
Belt placement: Read Baseline, No Belts

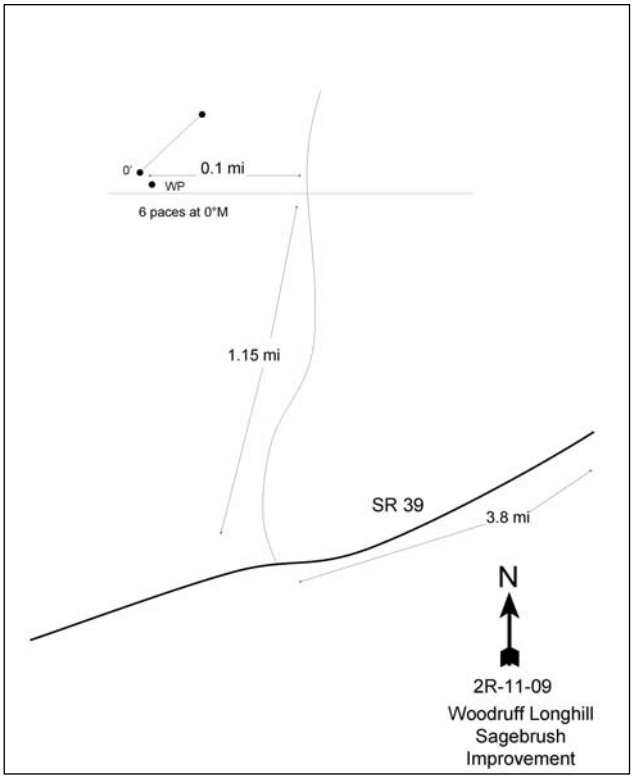
Directions:

From SR-16 (Woodruff Mainstreet) turn left onto SR-39 (towards Monte Cristo) and follow for 3.8 miles. Turn right (north) onto a dirt road and continue for 1.15 miles to an intersecting dirt road just north of a saddle. Turn left (west) for 0.1 miles. Witness post is on the right. 0' stake is 6 paces at 0°.

Map Name: Woodruff



Diagrammatic Sketch:



Township: 9N Range: 6E Section: 11

GPS: NAD 83, UTM 12S 480154 E 4596846 N

WOODRUFF LONGHILL SAGEBRUSH IMPROVEMENT - WRI STUDY 2R-11
Project #1477

Site Description

Site Information: This site was established in 2009 in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community prior to a Spike® treated sagebrush thinning scheduled for the fall of 2009. Treatment has been delayed due to the possible presence of pygmy rabbits on the site. Pellet group data in 2009 indicated moderately high deer use, low elk use, and moderately low cattle use (Table - Pellet Group Data). Soil erosion condition was classified as slight in 2009 due to surface litter movement and the presence of flow patterns.

Browse: The dominant browse species on the site is Wyoming big sagebrush which provides a high amount of canopy cover on the site. The only other browse sampled with notable cover was stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) (Table - Canopy Cover).

Herbaceous Understory: Crested wheatgrass (*Agropyron cristatum*) dominates the herbaceous understory providing over 80% of the grass cover in 2009. Sandberg bluegrass (*Poa secunda*) is the only other grass of consequence. Forbs are fairly diverse, but are not abundant in this community. The total forb cover was less than 1% in 2009 (Table - Herbaceous Trends).

Seed Mix

Project name: Woodruff Longhill Sagebrush Improvement
WRI Database #: 1477

Mix lot #: nr-rg-wlsi-10	Size (acre):	10
Seed type	lbs in mix	lbs/acre
Bluebunch WG 'Anatone'	30	3.00
Great Basin Wildrye 'Trailhead'	10	1.00
Western Wheatgrass 'Arriba'	20	2.00
Blue Flax 'Appar'	5	0.50
Canby Bluegrass 'Canbar'	5	0.50
Fourwing Saltbush--Beaver UT	10	1.00
Sainfoin 'Eski'	20	2.00
Small Burnet 'Delar'	20	2.00
Western Yarrow 'Eagle Mountain'	2	0.20
BULK POUNDS PER ACRE:	122	12.20
PLS POUNDS PER ACRE:		10.29

Mix Lot #: nr-rg-wlsis-10	Size (acre):	10
Seed type	lbs in mix	lbs/acre
Sagebrush, Wyoming--Beaver UT	3	0.30
Rice Hulls	5	0.50
BULK POUNDS PER ACRE:	8	0.80
PLS POUNDS PER ACRE:		

HERBACEOUS TRENDS--
Management unit 02R, Study no: 11

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	284	12.88
G	Elymus junceus	1	.03
G	Poa fendleriana	4	.07
G	Poa secunda	131	2.50
Total for Annual Grasses		0	0
Total for Perennial Grasses		420	15.47
Total for Grasses		420	15.47
F	Alyssum alyssoides (a)	20	.08

Type	Species	Nested Frequency '09	Average Cover % '09
F	Antennaria rosea	3	.00
F	Astragalus convallarius	1	.00
F	Comandra pallida	3	.03
F	Cordylanthus sp. (a)	9	.10
F	Erigeron pumilus	3	.03
F	Eriogonum racemosum	-	.00
F	Eriogonum umbellatum	6	.22
F	Penstemon humilis	6	.01
F	Penstemon sp.	8	.02
F	Phlox austromontana	4	.03
F	Phlox hoodii	18	.09
F	Phlox longifolia	8	.04
F	Ranunculus testiculatus (a)	35	.29
Total for Annual Forbs		64	0.46
Total for Perennial Forbs		60	0.49
Total for Forbs		124	0.96

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

CANOPY COVER, LINE INTERCEPT--
Management unit 02R, Study no: 11

Species	Percent Cover '09
Artemisia tridentata wyomingensis	23.83
Chrysothamnus viscidiflorus viscidiflorus	2.38

POINT-QUARTER TREE DATA--
Management unit 02R, Study no: 11

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	20	4

BASIC COVER--
Management unit 02R, Study no: 11

Cover Type	Average Cover % '09
Vegetation	41.25
Rock	.13
Pavement	1.60
Litter	39.90
Cryptogams	2.53
Bare Ground	27.43

PELLET GROUP DATA--
Management unit 02R, Study no: 11

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	21	-
Deer	33	82 (202)
Cattle	4	20 (50)
Elk	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 02R, Study no: 11

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	15/23
Chrysothamnus viscidiflorus viscidiflorus	
09	9/14
Tetradymia canescens	
09	4/13

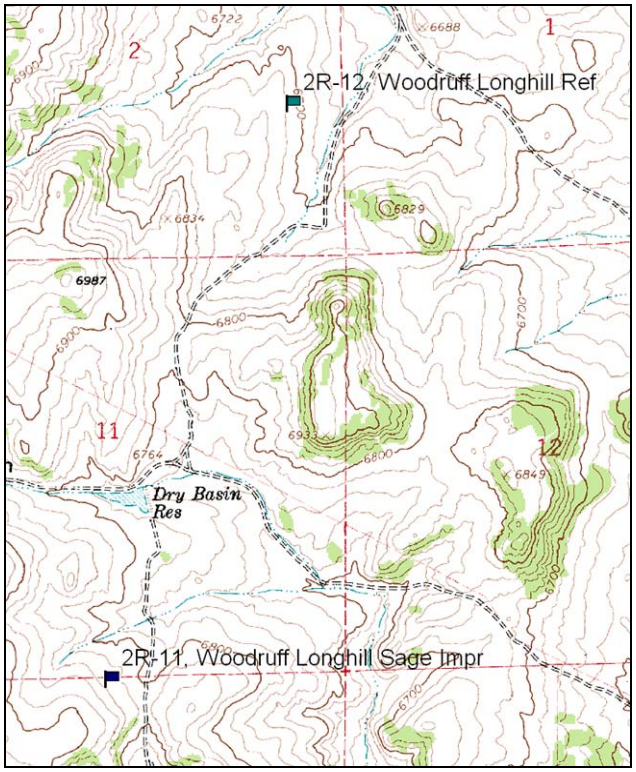
WOODRUFF LONGHILL SAGEBRUSH REFERENCE WRI, 2R-12

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT
Land Ownership: SITLA
Elevation: 6,653 ft. (2,028 m)
Aspect: East
Slope: 8%-10%
Transect bearing: 279° magnetic
Belt placement: Read Baseline, No Belts

Directions:

From SR-16 (Woodruff Main street) turn left onto SR-39 (towards Monte Cristo) and follow for 3.8 miles. Turn right (north) onto a dirt road and continue for 1.6 miles staying on the main road until passing a stock pond. Turn right (northeast) and continue for 1.3 miles. Witness post is on the west side of the road. 0' stake is 82 paces at 290°.

Map Name: Woodruff



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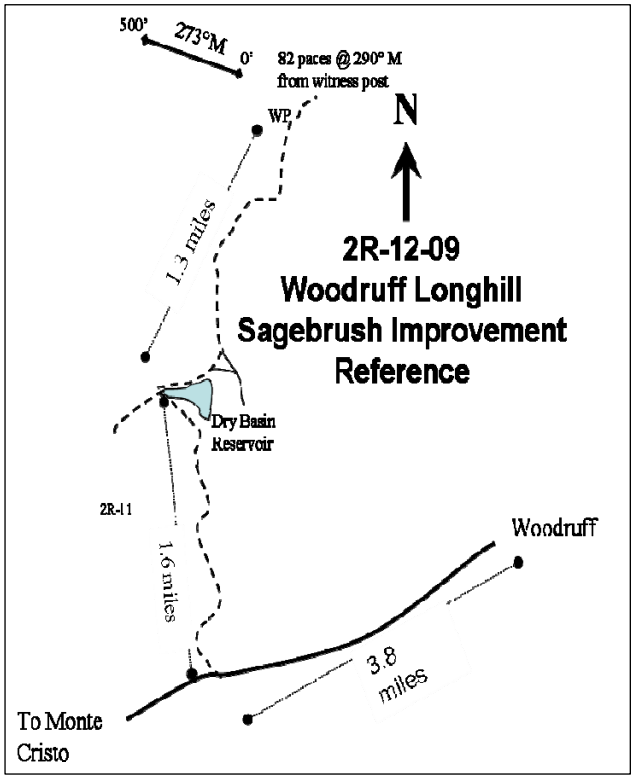


Township: 9N Range: 6E Section: 2

GPS: NAD 83, UTM 12S 4800855 E 4599058 N

WOODRUFF LONHILL SAGEBRUSH REFERENCE - WRI STUDY 2R-12
Project #1477 Reference

Site Description

Site Information: This site was established in 2009 as an untreated reference site for the Spike® treatment to take place at the Woodruff Longhill study, 2R-11, in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and black sagebrush (*Artemisia nova*) community about a mile and a half to the north of the treatment study. Pellet group data estimated moderately low deer and cattle use, and low sheep use in 2009 (Table - Pellet Group Data).

Browse: Wyoming big sagebrush is the dominant browse species on the site providing the majority of the canopy cover. There is a good component of black sagebrush canopy cover, as well. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) is also prevalent on the site (Table - Canopy Cover).

Herbaceous Understory: Crested wheatgrass (*Agropyron cristatum*) is the dominant grass species providing nearly all of the grass cover. Sandberg bluegrass (*Poa secunda*) is common, but provides little cover. Forbs are not diverse or abundant. Desert phlox (*Phlox austromontana*) was the most common forb, but provided only 1% cover (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 02R, Study no: 12

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	358	20.77
G	Poa secunda	102	1.25
G	Sitanion hystrix	3	.03
Total for Annual Grasses		0	0
Total for Perennial Grasses		463	22.06
Total for Grasses		463	22.06
F	Alyssum alyssoides (a)	24	.09
F	Chaenactis douglasii	7	.01
F	Comandra pallida	3	.01
F	Cordylanthus sp. (a)	7	.07
F	Eriogonum racemosum	5	.03
F	Phlox austromontana	60	1.37
F	Phlox hoodii	12	.15
F	Phlox longifolia	2	.00
Total for Annual Forbs		31	0.16
Total for Perennial Forbs		89	1.58
Total for Forbs		120	1.75

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

CANOPY COVER, LINE INTERCEPT--
Management unit 02R, Study no: 12

Species	Percent Cover '09
Artemisia nova	1.36
Artemisia tridentata wyomingensis	11.33
Chrysothamnus viscidiflorus viscidiflorus	2.00
Leptodactylon pungens	.06
Symphoricarpos oreophilus	.11

POINT-QUARTER TREE DATA--
Management unit 02R, Study no: 12

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	19	15

BASIC COVER--
Management unit 02R, Study no: 12

Cover Type	Average Cover % '09
Vegetation	37.71
Rock	.45
Pavement	2.44
Litter	41.81
Cryptogams	2.14
Bare Ground	29.34

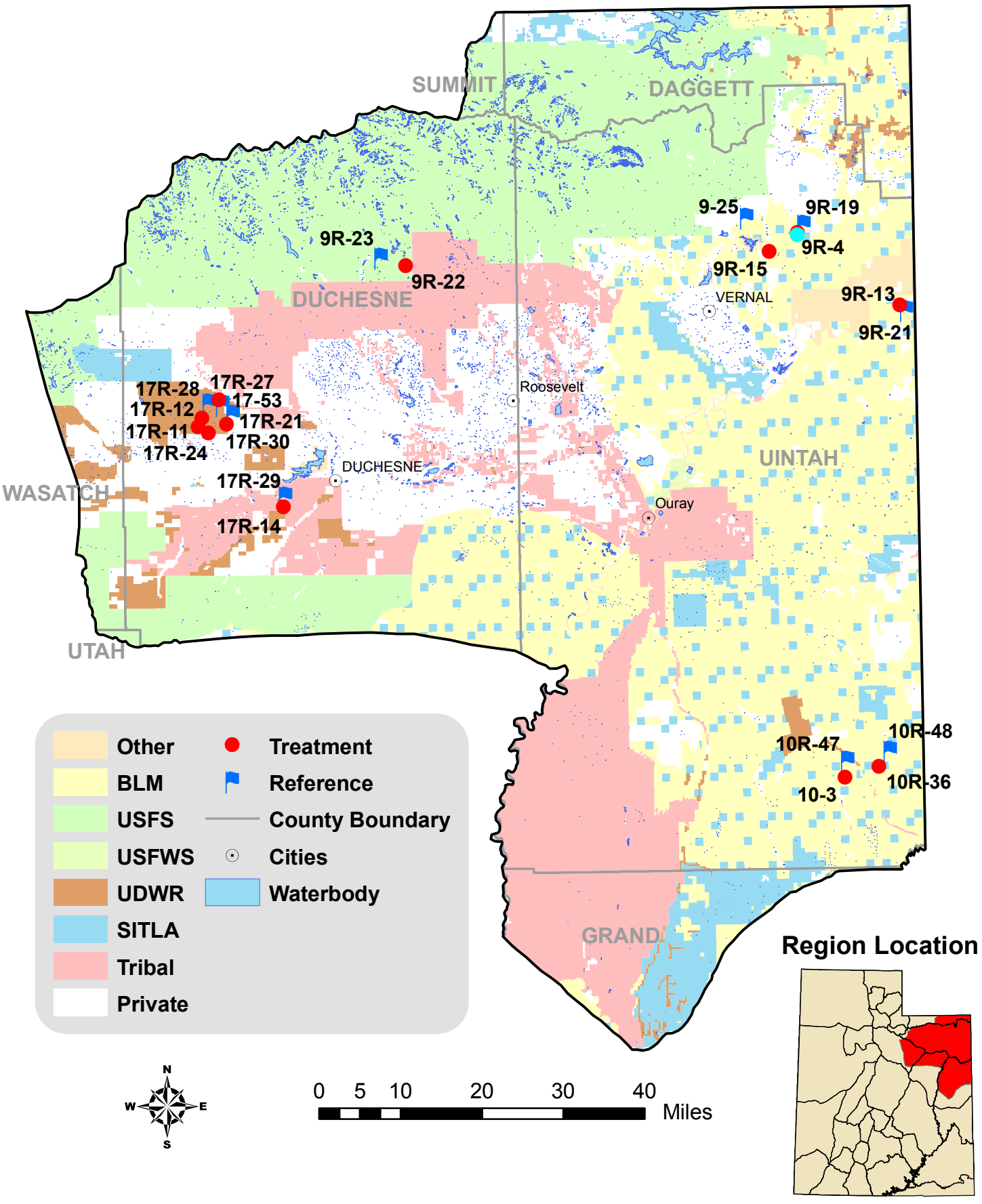
PELLET GROUP DATA--
Management unit 02R, Study no: 12

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	33	-
Elk	1	-
Deer	10	21 (51)
Cattle	8	1 (3)

BROWSE CHARACTERISTICS--
Management unit 02R, Study no: 12

Yr	Average Height Crown (in)
Amelanchier utahensis	
09	22/24
Artemisia nova	
09	11/24
Artemisia tridentata wyomingensis	
09	17/26
Chrysothamnus viscidiflorus viscidiflorus	
09	8/13
Gutierrezia sarothrae	
09	7/10
Leptodactylon pungens	
09	3/7
Opuntia sp.	
09	4/22
Symphoricarpos oreophilus	
09	7/19

Northeastern Region
WRI Studies 2009



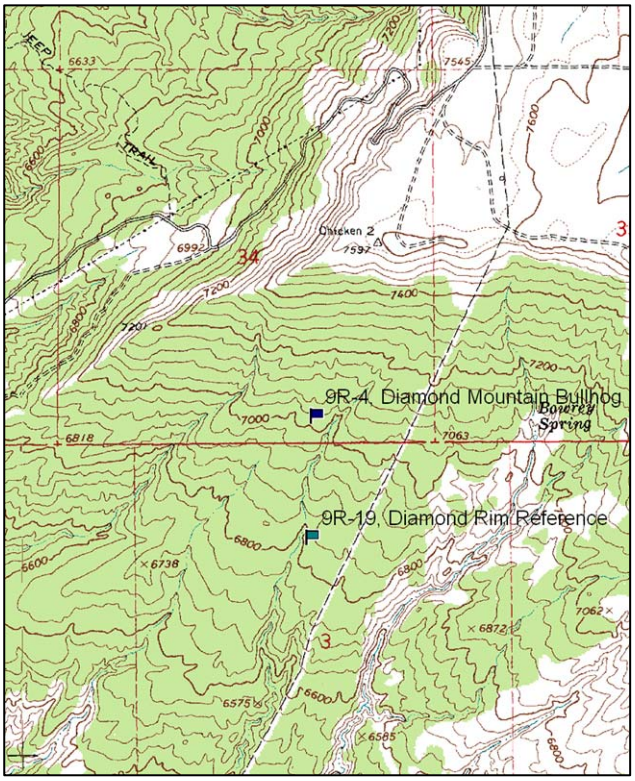
DIAMOND MOUNTAIN BULLHOG WRI, 9R-4

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter/crucial elk winter
NRCS Ecological Site Description: Semidesert Stony Loam (Utah Juniper-Pinyon), R034XY247UT
Land Ownership: Private/BLM
Elevation: 6,945 ft. (2,117 m)
Aspect: South
Slope: 12%-14%
Transect bearing: 209° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

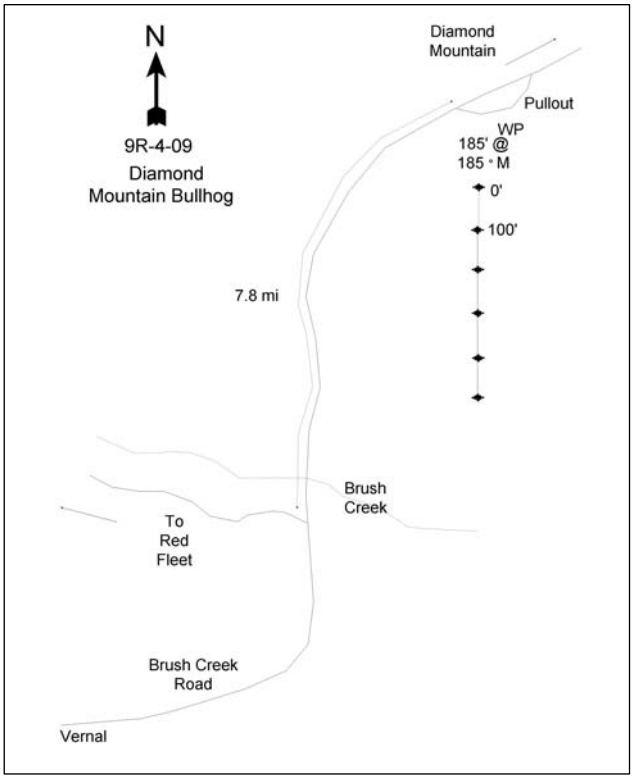
Directions:

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

Map Name: Jensen Ridge



Diagrammatic Sketch:



Township: 23E Range: 2S Section: 34

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

DIAMOND MOUNTAIN BULLHOG - WRI STUDY 9R-4

Site Description

Site Information: The Diamond Mountain Bullhog study was established in June of 2004 prior to treatment later that September. The BLM treated 320 acres of mature Utah juniper (*Juniperus osteosperma*) woodland in a fuels reduction project near the Diamond Mountain rim northeast of Vernal. The DWR provided a seed mix of grasses, forbs, and shrubs for the project. Grasses, forbs, and fourwing saltbush (*Atriplex canescens*) seed was flown on prior to the bullhog treatment. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) seed was applied following treatment (late November). Pellet group data estimated low deer and cow use in all sample years. Elk use was light in 2004, and moderate in 2007 and 2009 (Table - Pellet Group Data). The soil erosion condition was classified as stable in all sample years.

Browse: Black sagebrush (*Artemisia nova*) is the most abundant preferred browse species and has steadily increased in canopy cover, with a large increase from 2007 to 2009. Wyoming big sagebrush was first sampled in 2007, after seeding, and has increased each year to near the same amount of cover as black sagebrush in 2009. Black sagebrush and Wyoming big sagebrush combined to provide 93% of browse cover in 2009. Utah juniper was the dominant species prior to the bullhog treatment, but following the treatment, juniper provided no measurable canopy cover (Table - Canopy Cover) and occurred so infrequently as to not provide for a density estimate in 2009 (Table - Point-Quarter Tree Data).

Herbaceous Understory: In 2004, prior to treatment, the herbaceous understory was sparse, but increased in 2007 following the treatment. Cheatgrass (*Bromus tectorum*), the most abundant grass, has fluctuated in cover and frequency over the sample years. Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), letterman needlegrass (*Stipa lettermani*) were also sampled, but were not abundant. Bottlebrush squirreltail (*Sitanion hystrix*) is the dominant perennial species and increased substantially in frequency and cover following the treatment. Forbs were diverse, but not overly abundant prior to treatment. Following the treatment, diversity and abundance of forbs increased. Timber poisonvetch (*Astragalus convallarius*) was the most common forb in 2007. In 2009, no one forb species represented more than 1% cover (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Post treatment the preferred browse component improved with the introduction and establishment of Wyoming big sagebrush and the removal of Utah juniper. Utah juniper dominated the site in 2004, prior to treatment, with canopy cover at 39%. Juniper density was also very high at 444 trees/acre. Juniper cover was reduced to 0% after treatment and density decreased to less than 18 trees/acre. Wyoming big sagebrush provided 2% canopy cover, and black sagebrush canopy cover increased from 2% to near 3%.

Grass: The sum of nested frequency of perennial grasses increased 88% while cover increased to 9% from less than 1%. Western wheatgrass (*Agropyron smithii*) and orchardgrass (*Dactylis glomerata*) were species that appeared following seeding. Bottlebrush squirreltail (*Sitanion hystrix*) increased significantly in nested frequency and increased from less than 1% cover prior to treatment to 7% cover afterwards. Cheatgrass followed a similar pattern with a significant increase in nested frequency and increased from 1% cover to 14%.

Forb: The sum of nested frequency of perennial forbs increased 64% and cover increased from 1% to 6%. Seeded species present included blue flax (*Linum lewisii*), alflalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*). Only blue flax provided close to 1% cover. With an overall increase in vegetation and a large increase in litter cover, bare ground has been reduced from 15% pretreatment to less than 4% in subsequent samples (Table - Basic Cover).

Trend Assessments

Browse

- **2007 to 2009 - up (+2):** Preferred browse species, black sagebrush and Wyoming big sagebrush, continued to increase in canopy cover from 3% to 6% and from 2% to 4%, respectively.

Grass

- **2007 to 2009 - up (+2):** The nested frequency of perennial grasses increased 28% and cover remained similar at 7%. Cheatgrass declined significantly in nested frequency and decreased from 14% to 5% cover. Western wheatgrass and crested wheatgrass (*Agropyron cristatum*) increased significantly in nested frequency. None of the seeded species provide more than 1% cover, and bottlebrush squirreltail decreased to 4% cover.

Forb

- **2007 to 2009 - stable (0):** No substantial changes occurred in the forb community. Lewis flax continues to be the most predominant seeded species with 1% cover.

Seed Mix

Project name: Diamond Rim Bullhog

WRI Database #: PDB	Size (acre):	320		Size (acre):	320
Mix lot #: m-ner-mh-dr-05			Mix Lot #: m-ner-mh-drS-05		
Seed type	lbs in mix	lbs/acre	Seed type	lbs in mix	lbs/acre
Orchardgrass 'Paiute'	650	2.03	Sagebrush, Wyoming- Sanpete	320	1.00
Western Wheatgrass 'Arriba'	650	2.03	Rice Hulls	320	1.00
Sandberg Bluegrass- Toole MT	150	0.47	BULK POUNDS PER ACRE:	640	2.00
Yellow Sweetclover	300	0.94	PLS POUNDS PER ACRE:		0.28
Alfalfa 'Ladak+'	650	2.03			
Sainfoin	350	1.09			
Blue Flax 'Appar'	300	0.94			
Small Burnet 'Delar'	650	2.03			
Fourwing Saltbush	150	0.47			
BULK POUNDS PER ACRE:		12.03			
PLS POUNDS PER ACRE:		10.74			

HERBACEOUS TRENDS--
Management unit 09R, Study no: 4

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'09	'04	'07	'09
G	Agropyron cristatum	-	$_{a}$3	$_{b}$23	-	.22	.42
G	Agropyron smithii	-	$_{a}$10	$_{b}$37	-	.18	.95
G	Agropyron spicatum	-	-	3	-	-	.03
G	Bromus tectorum (a)	$_{a}$132	$_{c}$344	$_{b}$302	.81	14.07	5.41
G	Carex sp.	-	4	-	-	.06	-
G	Dactylis glomerata	-	$_{a}$17	$_{a}$23	-	.45	.73
G	Oryzopsis hymenoides	$_{b}$50	$_{a}$9	$_{a}$17	.22	.52	.58
G	Poa secunda	27	35	27	.14	.44	.28
G	Sitanion hystrix	$_{a}$22	$_{b}$133	$_{b}$144	.16	6.75	4.25
G	Stipa lettermani	$_{b}$14	$_{a}$2	-	.10	.03	.03
Total for Annual Grasses		132	344	302	0.81	14.07	5.41

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'09	'04	'07	'09
Total for Perennial Grasses		113	213	274	0.63	8.66	7.27
Total for Grasses		245	557	576	1.44	22.73	12.69
F	Alyssum alyssoides (a)	-	-	1	-	-	.00
F	Arabis sp.	$_{b}$27	$_{a}$2	-	.06	.00	-
F	Arenaria sp.	-	6	7	-	.03	.04
F	Astragalus convallarius	$_{a}$5	$_{b}$45	$_{a}$18	.01	2.05	.67
F	Cryptantha sp.	9	2	-	.02	.00	-
F	Cymopterus sp.	$_{a}$1	$_{b}$35	$_{a}$2	.00	.19	.00
F	Descurainia pinnata (a)	-	3	-	-	.07	-
F	Gilia sp. (a)	-	$_{a}$16	-	-	.03	-
F	Ipomopsis aggregata	-	1	-	-	.15	-
F	Lactuca serriola	-	-	$_{a}$38	-	-	.43
F	Linum lewisii	-	$_{a}$20	$_{a}$23	-	.95	1.18
F	Medicago sativa	-	$_{a}$14	$_{a}$16	-	.43	.27
F	Onobrychis viciaefolia	-	1	-	-	.03	.03
F	Penstemon humilis	3	4	-	.00	.04	-
F	Petradoria pumila	$_{b}$56	$_{a}$33	$_{ab}$42	1.01	1.66	1.49
F	Phlox austromontana	1	6	10	.00	.01	.19
F	Phlox longifolia	2	-	10	.01	-	.05
F	Salsola iberica (a)	$_{b}$3	$_{a}$11	$_{ab}$27	.00	.08	.91
F	Sanguisorba minor	-	6	1	-	.18	.03
F	Townsendia sp.	-	5	-	-	.03	-
F	Tragopogon dubius	-	-	2	-	-	.03
F	Trifolium sp.	6	-	5	.02	-	.00
F	Unkown Forb - annual (a)	-	-	9	-	-	-
Total for Annual Forbs		3	30	28	0.00	0.18	0.92
Total for Perennial Forbs		110	180	183	1.15	5.79	4.43
Total for Forbs		113	210	211	1.15	5.97	5.36

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

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 4

Species	Percent Cover		
	'04	'07	'09
Artemisia nova	2.29	2.59	6.28
Artemisia tridentata wyomingensis	-	1.61	4.26
Atriplex canescens	-	.36	.61
Chrysothamnus nauseosus	-	-	.53
Juniperus osteosperma	39.00	-	-
Purshia tridentata	.03	-	.15

POINT-QUARTER TREE DATA--
Management unit 09R, Study no: 4

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

Average diameter (in)		
'04	'07	'09
13.3	5.1	2.2

BASIC COVER--
Management unit 09R, Study no: 4

Cover Type	Average Cover %		
	'04	'07	'09
Vegetation	21.13	32.40	26.40
Rock	23.10	8.66	11.42
Pavement	9.55	2.20	2.63
Litter	46.48	62.60	65.34
Cryptogams	2.37	.00	.03
Bare Ground	15.22	3.80	2.54

SOIL ANALYSIS DATA --
Management unit 9R, Study no: 4, Study Name: Diamond Mountain Bullhog

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
8	6.6	61.4	19.2	19.5	2	7	153.6	0.6

PELLET GROUP DATA--
Management unit 09R, Study no: 4

Type	Quadrat Frequency		
	'04	'07	'09
Rabbit	65	23	3
Elk	7	19	10
Deer	1	1	12
Cattle	-	-	6

Days use per acre (ha)		
'04	'07	'09
-	-	-
9 (21)	25 (63)	20 (50)
5 (13)	7 (18)	6 (15)
-	2 (5)	11 (27)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 4

Yr	Average Height Crown (in)
Artemisia nova	
04	9/16
07	10/18
09	11/19
Artemisia tridentata wyomingensis	
04	-/-
07	18/21
09	20/25
Atriplex canescens	
04	-/-
07	30/49
09	21/26

Yr	Average Height Crown (in)
Chrysothamnus nauseosus	
04	-/-
07	24/43
09	29/42
Chrysothamnus nauseosus albicaulis	
04	-/-
07	17/17
09	19/23
Eriogonum microthecum	
04	1/1
07	7/6
09	-/-
Gutierrezia sarothrae	
04	-/-
07	11/15
09	10/15
Juniperus osteosperma	
04	-/-
07	-/-
09	-/-
Opuntia sp.	
04	3/16
07	-/-
09	4/11
Purshia tridentata	
04	7/46
07	8/55
09	11/45

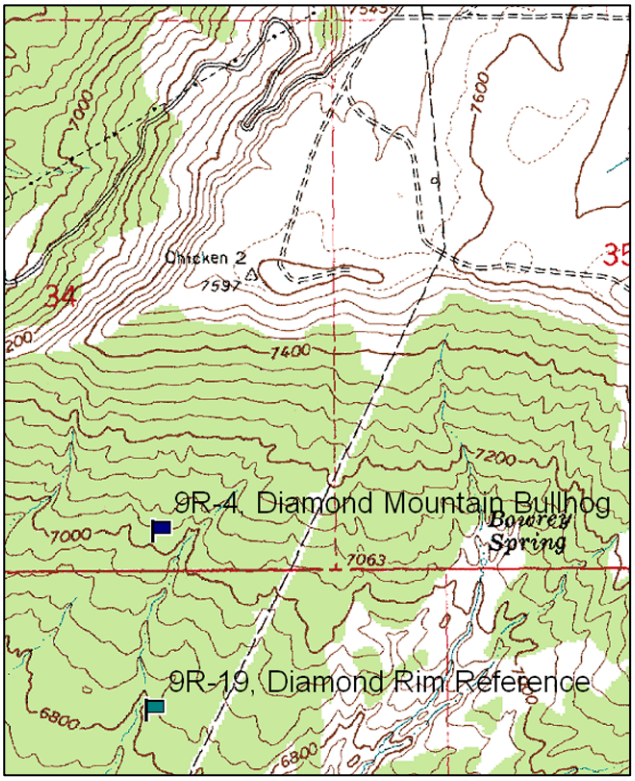
DIAMOND RIM REFERENCE WRI, 9R-19

Vegetation Type: Pinyon/Juniper
Range Type: Crucial deer winter/crucial elk winter
NRCS Ecological Site Description: Semidesert Stony Loam (Utah Juniper-Pinyon), R034XY247UT
Land Ownership: BLM
Elevation: 6,778 ft. (2,066 m)
Aspect: Southeast
Slope: 5%-7%
Transect bearing: 181° magnetic
Belt placement: Read Baseline, No Belts

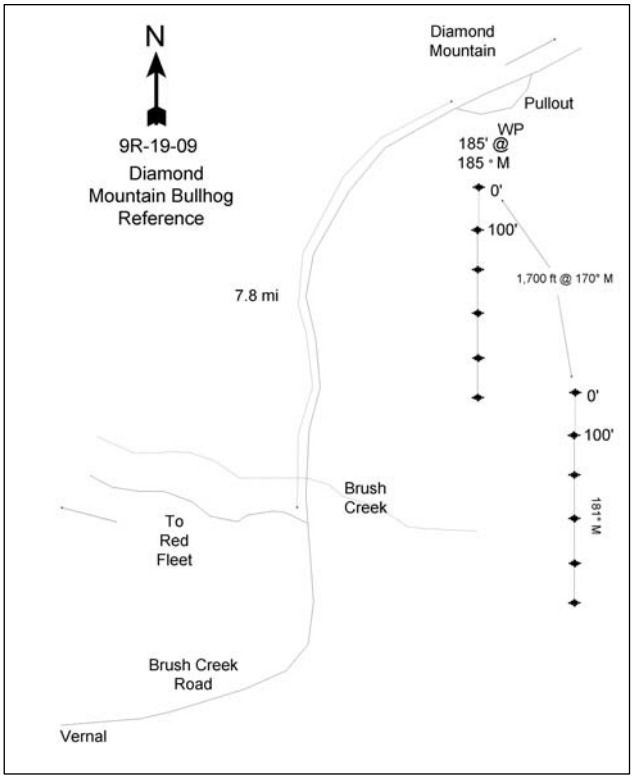
Directions:

From Vernal travel northeast on Brush Creek Road heading toward Diamond Mountain for 7.8 miles to a pull off on the right. Turn here. There is a witness post on the south side of the pull off. The 0-foot stake is 185 feet from the witness post at 185°M and is marked with browse tag # 133. From the 0' stake of 9R-4 proceed 1,706 feet at 170°M to the 0' stake of 9R-19.
A pipeline maintenance road falls to the east of this site but is very steep and impassable except in the very best of weather conditions.

Map Name: Jensen Ridge



Diagrammatic Sketch:



Township: 23E Range: 3S Section: 3

GPS: NAD 83, UTM 12S 642200 E 4494765 N

DIAMOND RIM REFERENCE - WRI STUDY 9R-19

Site Description

Site Information: This site was established in 2009 as an untreated reference site in companion to the Diamond Mountain Bullhog study, 9R-4. The study is located one third of a mile south of 9R-4 and northeast of Vernal eight miles on the Brush Creek Road. This is a site dominated by Utah juniper (*Juniperus osteosperma*). Pellet group data from 2009 estimated low deer use and moderate elk use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009. Litter cover was high at 44%, limiting bare ground cover to 23% (Table - Basic Cover).

Browse: Juniper is the predominant woody species on the site at 38% canopy cover (Table - Canopy Cover) and an estimated density of 393 trees/acre (Table - Point-Quarter Tree Data) in 2009, which is similar to the juniper density on 9R-4 prior to treatment. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) plants are present, but rare.

Herbaceous Understory: The herbaceous understory is very limited. Perennial grasses and forbs combined provide 1% cover (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 09R, Study no: 19

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	10	.05
G	Bromus tectorum (a)	83	.36
G	Poa secunda	6	.01
G	Secale cereale (a)	4	.01
G	Sitanion hystrix	17	.49
Total for Annual Grasses		87	0.37
Total for Perennial Grasses		33	0.55
Total for Grasses		120	0.93
F	Arabis sp.	27	.15
F	Arenaria sp.	3	.03
F	Cryptantha sp.	18	.15
F	Descurainia pinnata (a)	90	.39
F	Lactuca serriola	2	.00
F	Lappula occidentalis (a)	3	.00
F	Lesquerella sp.	27	.05
F	Microsteris gracilis (a)	11	.02
F	Phlox austromontana	2	.03
F	Phlox longifolia	3	.03
F	Unknown forb-annual (a)	13	.15
F	Unknown forb-perennial	7	.01
Total for Annual Forbs		117	0.58
Total for Perennial Forbs		89	0.48
Total for Forbs		206	1.06

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

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 19

Species	Percent Cover '09
Juniperus osteosperma	37.81

POINT-QUARTER TREE DATA--
Management unit 09R, Study no: 19

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	393	12.5

BASIC COVER--
Management unit 09R, Study no: 19

Cover Type	Average Cover % '09
Vegetation	14.16
Rock	10.93
Pavement	13.83
Litter	43.70
Cryptogams	.71
Bare Ground	23.14

PELLET GROUP DATA--
Management unit 09R, Study no: 19

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	5	-
Elk	4	25 (63)
Deer	6	1 (3)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 19

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	6/4

CHEW DIXIE WRI, 9R-13

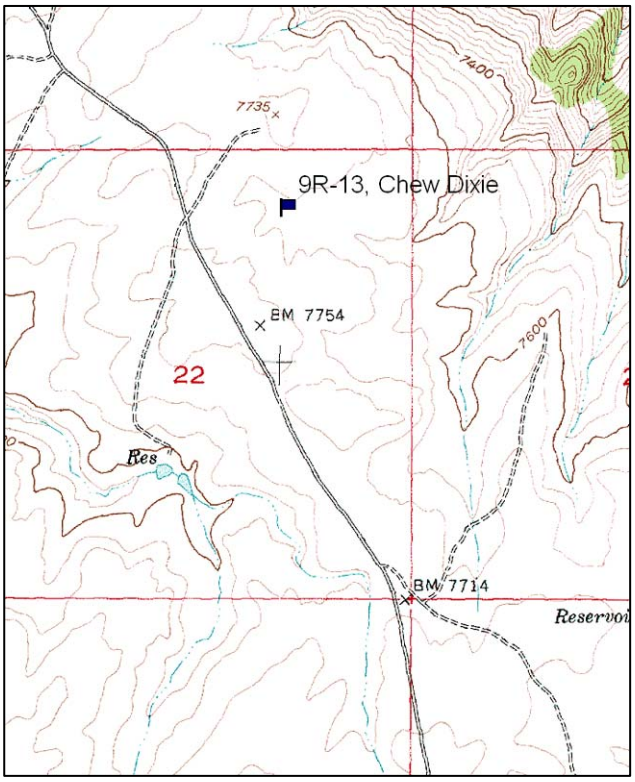
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial deer summer/substantial elk summer
NRCS Ecological Site Description: Mountain Loam (Mountain Big Sagebrush), R047XC430UT
Land Ownership: BLM and Private
Elevation: 7,608 ft. (2,319 m)
Aspect: North
Slope: 4%
Transect bearing: 125° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:

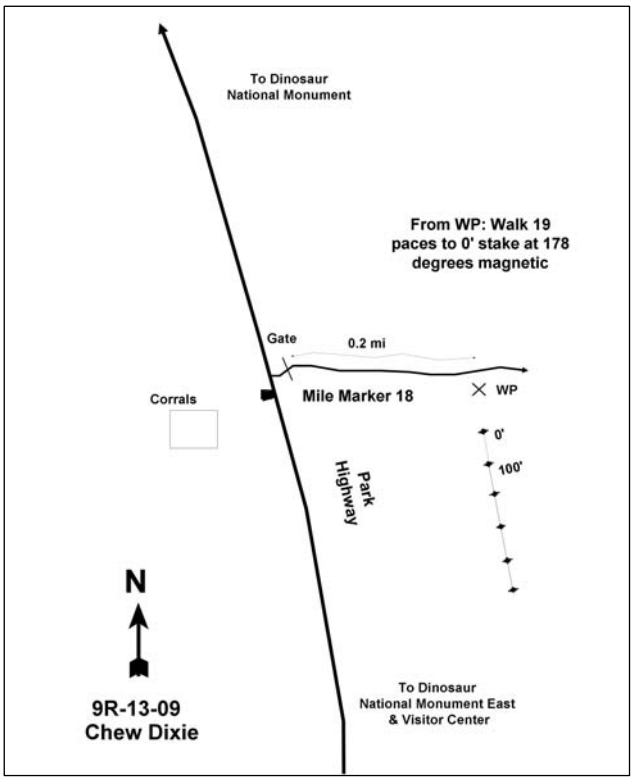
Contact the landowner prior to entering private land.

Driving north on Park Highway in Dinosaur National Monument from the east drive to mile marker 18. From mile marker 18 take the road to the right (east) immediately after the mile marker to a gate. From the gate drive 0.2 miles to a witness post on the left. The 0 foot stake is 19 paces from the witness post at 178 degrees magnetic with browse tag #149.

Map Name: Stuntz Reservoir



Diagrammatic Sketch:



Township: 4S Range: 25E Section: 22

GPS: NAD 83, UTM 12S 662450 E 4480913 N

CHEW DIXIE - WRI STUDY 9R-13
Project #316

Site Description

Site Information: The study was established in 2006 to monitor a mechanical sagebrush thinning treatment in sage grouse brooding habitat above Dinosaur National Monument. This treatment occurred in a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community. Pellet group data estimated moderate deer use in 2006 and high use in 2009. Elk, cow, sheep and horse use was low in all sample years. Pellet group sampling found 78 sage grouse pellet groups/acre in 2006 and 1 pellet group/acre in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2006 and 2009. Bare ground is high and averaged 31% over all sample years (Table - Basic Cover).

Browse: Mountain big sagebrush provides all of the canopy cover on the site. There was little reduction in canopy cover of mountain big sagebrush in 2009, following the treatment (Table - Canopy Cover), although it appears that a significant portion of the study transect was not treated. A strip of untreated sagebrush was left along the study transect baseline.

Herbaceous Understory: In 2006, six perennial grass species were sampled predominantly represented by Sandberg bluegrass (*Poa secunda*) and Letterman needlegrass (*Stipa lettermani*), which combined accounted for 70% of grass cover. Perennial grass cover increased in 2009, and 12 grass species were sampled. Cheatgrass (*Bromus tectorum*) was present in all sample years. Seeded grass species provided 34% of perennial grass cover in 2009, but much of that is due to Sandberg bluegrass which was common before the seeding (Table - Herbaceous Trends).

Forbs are diverse and abundant n the site. Longleaf phlox (*Phlox longifolia*) was the most common forb in 2007, prior to the treatment. Following the treatment cover of forbs increased in 2009 and the predominant forb species was silvery lupine (*Lupinus argenteus*). Douglas knotweed (*Polygonum douglasii*), which is an annual, was also very abundant in 2009. Seeded forbs provided 20% of perennial forb cover in 2009. Blue flax (*Linum lewisii*) was the most abundant seeded forb (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Mountain big sagebrush cover decreased from 36% cover prior to treatment to 25% after treatment in 2009. The average height and crown was reduced from two feet by three feet to a foot and a half by two feet. Some portions of the transect remained untreated.

Grass: Perennial grass nested frequency remained similar and cover increased from 8% to 9%. Sandberg bluegrass provided 40% of perennial grass cover prior to treatment, and 25% after. Cheatgrass cover increased from less than 1% prior to treatment to 4% following. Seeded species sampled for the first time following the treatment included thickspike wheatgrass (*Agropyron dasystachyum*), bluebunch wheatgrass (*A. spicatum*), and orchardgrass (*Dactylis glomerata*). No seeded species that was not on the site prior to treatment provided more than 1% cover.

Forb: The sum of nested frequency of perennial forbs decreased 22% while the cover increased from 7% to 12%. Silvery lupine has become the predominant species at 9% cover and accounts for 73% of perennial forb cover. Of the seeded species only blue flax provided more than 1% cover. Following treatment annual forbs occurred as frequently as perennials and provided 8% cover. Douglas knotweed (*Polygonum douglasii*) was the most common annual and provided 6% cover following treatment.

Seed Mix

Project name: Chew Blue Mountain Dixie

WRI Database #: 316 Size (acre): 260

Mix lot #: ner-mh-cbm-07

Seed type	lbs in mix	lbs/acre
Thickspike Wheatgrass 'Bannock'	250	0.96
Big Bluegrass 'Sherman'	125	0.48
Canby Bluegrass 'Canbar'	125	0.48
Sandberg Bluegrass 'Toole MT'	125	0.48
Bluebunch WG 'Goldar'	300	1.15
Orchardgrass 'Paiute'	50	0.19
Green Needlegrass 'Lodorm'	250	0.96
Blue Flax	50	0.19
Small Burnet 'Delar'	500	1.92
Alfalfa 'Ladak'	350	1.35
Sainfoin 'Eski'	985	3.79
Western Yarrow 'SID Columbia'	10	0.04
Bitterbrush--Millard UT	25	0.10
BULK POUNDS PER ACRE:		12.10
PLS POUNDS PER ACRE:		10.87

HERBACEOUS TRENDS--

Management unit 09R, Study no: 13

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
G	Agropyron dasystachyum	-	b5	-	.07
G	Agropyron intermedium	-	b26	-	.34
G	Agropyron smithii	101	99	.76	1.75
G	Agropyron spicatum	-	b28	-	.69
G	Bromus tectorum (a)	a1	b31	.00	1.76
G	Dactylis glomerata	-	2	-	.03
G	Koeleria cristata	b43	-	.58	-
G	Poa fendleriana	a4	b82	.07	2.53
G	Poa secunda	116	91	3.07	2.14
G	Sitanion hystrix	b24	a15	.51	.70
G	Stipa lettermani	b103	a11	2.40	.09
G	Stipa pinetorum	11	7	.33	.18
Total for Annual Grasses		1	31	0.00	1.76
Total for Perennial Grasses		402	366	7.74	8.55
Total for Grasses		403	397	7.75	10.32
F	Achillea millefolium	-	b10	-	.10
F	Agoseris glauca	b84	a20	.54	.29
F	Allium acuminatum	3	-	.01	-
F	Alyssum sp. (a)	-	1	-	.00
F	Antennaria rosea	a32	-	1.66	-
F	Arabis sp.	1	-	.00	-
F	Artemesia biennis	4	-	.03	-
F	Aster sp.	3	2	.15	.00

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
F	Astragalus convallarius	3	-	.00	-
F	Chenopodium leptophyllum(a)	3	7	.00	.04
F	Collinsia parviflora (a)	$_{b}$156	$_{a}$16	.57	.05
F	Cordylanthus ramosus (a)	$_{a}$3	$_{b}$17	.03	.47
F	Cordylanthus sp. (a)	-	2	-	.15
F	Crepis acuminata	7	6	.04	.01
F	Descurainia pinnata (a)	-	4	-	.18
F	Erigeron eatonii	5	8	.02	.02
F	Gayophytum ramosissimum(a)	$_{a}$15	$_{b}$33	.02	.87
F	Lactuca serriola	-	5	-	.00
F	Lappula occidentalis (a)	14	7	.03	.03
F	Linum lewisii	$_{a}$1	$_{b}$74	.00	1.45
F	Lupinus argenteus	$_{a}$39	$_{b}$106	.40	8.73
F	Machaeranthera grindelioides	1	-	.00	-
F	Medicago sativa	-	9	-	.10
F	Mertensia sp.	1	-	.03	-
F	Microsteris gracilis (a)	$_{b}$114	$_{a}$5	.31	.01
F	Onobrychis viciaefolia	-	$_{a}$22	-	.35
F	Phlox longifolia	$_{b}$205	$_{a}$50	3.52	.26
F	Polygonum douglasii (a)	$_{a}$81	$_{b}$285	.13	6.06
F	Ranunculus jovis	$_{b}$28	$_{a}$8	.37	.01
F	Ranunculus testiculatus (a)	$_{a}$28	-	.33	-
F	Sanguisorba minor	-	$_{a}$32	-	.45
F	Senecio integerrimus	11	3	.04	.00
F	Senecio multilobatus	-	5	-	.01
F	Taraxacum officinale	$_{a}$16	-	.08	-
F	Trifolium sp.	$_{b}$24	12	.22	.19
F	Zigadenus paniculatus	8	1	.04	.03
Total for Annual Forbs		414	377	1.44	7.89
Total for Perennial Forbs		476	373	7.21	12.04
Total for Forbs		890	750	8.65	19.94

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

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 13

Species	Percent Cover '06	Percent Cover '09
Artemisia tridentata vaseyana	35.96	24.85

BASIC COVER--
Management unit 09R, Study no: 13

Cover Type	Average Cover % '06	'09
Vegetation	43.69	44.84
Rock	1.24	.72
Pavement	.80	.41
Litter	38.40	37.48
Cryptogams	.10	.15
Bare Ground	30.97	31.69

SOIL ANALYSIS DATA --
Management unit 9R, Study no: 13, Study Name: Chew Dixie

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
11.1	6.3	32.3	40.4	27.3	3.5	28.6	243.2	0.5

PELLET GROUP DATA--
Management unit 09R, Study no: 13

Type	Quadrat Frequency '06	'09	Days use per acre (ha) '06	'09
Rabbit	48	3	-	-
Horse	1	1	8 (9)	2 (6)
Grouse	3	-	78 pellets/acre	9 pellets/acre
Elk	3	4	3 (7)	1 (2)
Deer	16	15	10 (25)	46 (112)
Cattle	6	2	20 (48)	3 (7)
Sheep	-	-	-	11 (26)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 13

Yr	Average Height Crown (in)
Amelanchier alnifolia	
06	-/-
09	7/9
Artemisia tridentata vaseyana	
06	27/34
09	17/24
Mahonia repens	
06	3/6
09	-/-

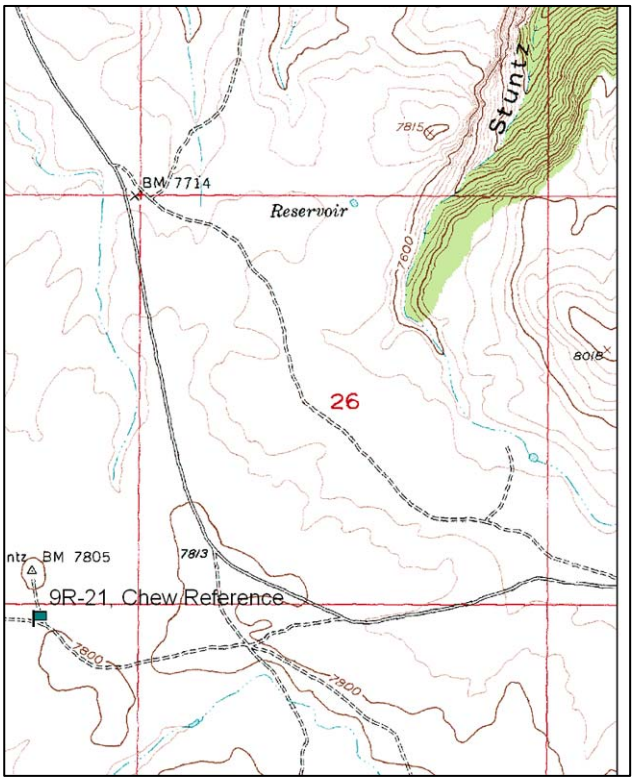
CHEW DIXIE REFERENCE WRI, 9R-21

Vegetation Type: Mountain Big Sagebrush
Range Type: Substantial deer summer/crucial elk summer
NRCS Ecological Site Description: Mountain Loam (Mountain Big Sagebrush), R047XC430UT
Land Ownership: BLM
Elevation: 7,749 ft. (2,362 m)
Aspect: East
Slope: 3%
Transect bearing: 59° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:

From the Utah state line go 0.5 miles west and turn left at the Cliff Ridge Launch site, proceed another 0.2 miles and turn right for 1.0 miles. The witness post is on the north side of the road. The 0' stake is 19 paces from the witness post at 43°M.

Map Name: Stuntz Reservoir



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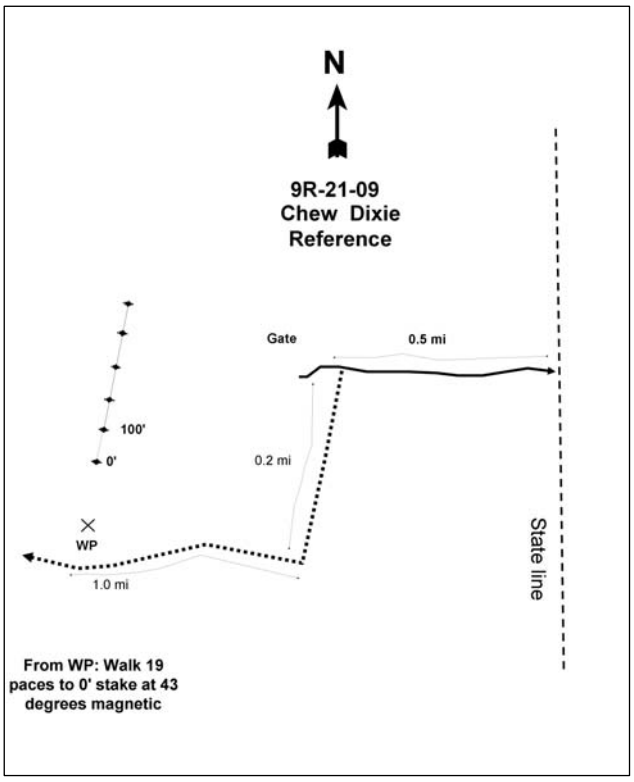


Township: 4S Range: 25E Section: 34

GPS: NAD 83, UTM 12S 662564 E 4477845 N

CHEW DIXIE REFERENCE - WRI STUDY 9R-21
Project #316 Reference

Site Description

Site Information: This site was established in 2009 as an untreated reference in companion to the Chew Dixie study, 9R-13. The study is located almost two miles south of 9R-13 in a robust mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Sandberg bluegrass (*Poa secunda*) community on the highlands north of Jensen, UT. Pellet group data from 2009 estimated low deer, elk, sheep and horse use, and high cow use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: Mountain big sagebrush was the dominant browse on the site providing the only notable canopy cover in 2009 (Table - Canopy Cover).

Herbaceous Understory: The grasses are diverse and abundant with nine different perennial grass species sampled in 2009. Cheatgrass (*Bromus tectorum*) was present, but infrequent. Sandberg bluegrass was the most common perennial species with other common species including mutton bluegrass (*Poa fendleriana*) and prairie junegrass (*Koeleria cristata*), western wheatgrass (*Agropyron smithii*), and pinewood needlegrass (*Stipa pinetorum*). Perennial forbs are also diverse and abundant with three species, a lupine (*Lupinus sp.*), a buckwheat (*Eriogonum sp.*), and a fleabane (*Erigeron sp.*) representing most of the perennial forb cover. Twenty forb species were sampled in 2009, only four of which were annual species (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 09R, Study no: 21

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron smithii	114	1.33
G	Agropyron spicatum	14	.10
G	Bromus tectorum (a)	6	.01
G	Dactylis glomerata	7	.04
G	Koeleria cristata	95	2.79
G	Poa fendleriana	92	2.57
G	Poa secunda	252	7.71
G	Sitanion hystrix	1	.00
G	Stipa comata	8	.04
G	Stipa pinetorum	42	1.36
Total for Annual Grasses		6	0.00
Total for Perennial Grasses		625	15.96
Total for Grasses		631	15.97
F	Agoseris glauca	1	.00
F	Alyssum alyssoides (a)	3	.03
F	Antennaria rosea	18	.55
F	Arenaria sp.	2	.03
F	Aster sp.	2	.00
F	Collinsia parviflora (a)	6	.01
F	Erigeron eatonii	4	.06
F	Erigeron sp.	40	1.08
F	Eriogonum alatum	2	.00

Type	Species	Nested Frequency '09	Average Cover % '09
F	Eriogonum sp.	64	2.57
F	Lupinus sp.	153	4.02
F	Machaeranthera canescens	1	.00
F	Phlox austromontana	18	.75
F	Phlox longifolia	64	.48
F	Polygonum douglasii (a)	22	.21
F	Potentilla sp.	6	.21
F	Sphaeralcea coccinea	17	.08
F	Trifolium sp.	21	.14
F	Unknown forb-annual (a)	-	.03
Total for Annual Forbs		31	0.28
Total for Perennial Forbs		413	10.02
Total for Forbs		444	10.31

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

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 21

Species	Percent Cover '09
Artemisia tridentata vaseyana	45.79

BASIC COVER--
Management unit 09R, Study no: 21

Cover Type	Average Cover % '09
Vegetation	51.31
Rock	.06
Pavement	.25
Litter	38.16
Cryptogams	.02
Bare Ground	18.59

PELLET GROUP DATA--
Management unit 09R, Study no: 21

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	11	-
Deer	6	4 (10)
Elk	-	1 (3)
Cattle	22	40 (99)
Sheep	-	9 (22)
Horse	-	1 (1)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 21

Yr	Average Height Crown (in)
Artemisia tridentata vaseyana	
09	21/24
Artemisia tridentata wyomingensis	
09	9/13
Eriogonum microthecum	
09	5/11

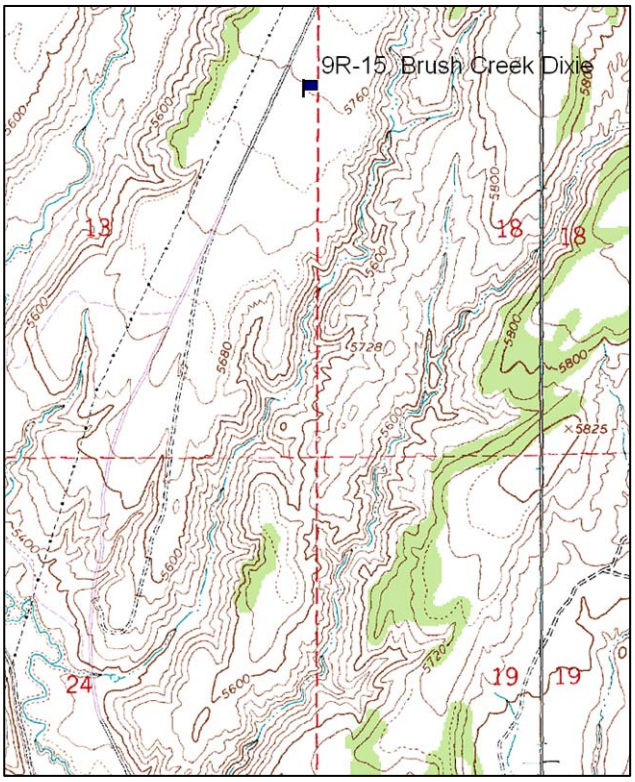
BRUSH CREEK DIXIE WRI, 9R-15

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: 5,708 ft. (1,740 m)
Aspect: North
Slope: 2%
Transect bearing: 22° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

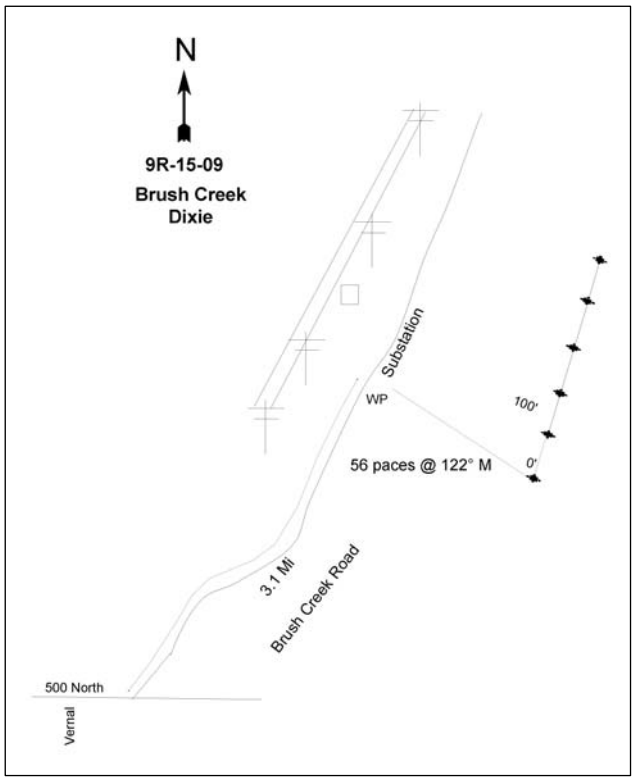
Directions:

From 500 north in Vernal, travel north on Brush Creek Road 3.1 miles to the witness post on the right side of the road. From the witness post the 0-foot stake is 56 paces at 122 degrees magnetic and is marked with browse tag # 134.

Map Name: Donkey Flat



Diagrammatic Sketch:



Township: 3S Range: 22E Section: 13

GPS: NAD 83, UTM 12S 636649 E 4491525 N

BRUSH CREEK DIXIE - WRI STUDY 9R-15
Project #315

Site Description

Site Information: This study was established in 2007 on Brush Creek Bench to monitor a sagebrush restoration project north of Vernal, Utah. The project treated 300 acres in the fall of 2008 with Plateau™ and a one-way Dixie harrow with an objective to improve and enhance crucial winter range for mule deer, elk, and sage grouse by establishing new sagebrush into sagebrush die-off areas. Pellet group data estimated high and very high deer use in 2007 and 2009, respectively. Elk and cattle use was low in 2007 and moderate in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2007 and 2009. Bare ground cover increased slightly after treatment, but remained moderate (Table - Basic Cover).

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the major browse species on the site providing almost all of the canopy cover. There is also a small component of broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia sp.*) on the site (Table - Canopy Cover).

Herbaceous Understory: Perennial grasses are rare on the site. Cheatgrass (*Bromus tectorum*) is the dominant species in cover on the site, though it decreased significantly in 2009 following the treatment. Cheatgrass was still abundant in 2009 as it was sampled in 97% of quadrats. Forbs are also rare on the site and decreased in cover and frequency in 2009, after the treatment scarlet globemallow (*Sphaeralcea coccinea*) was the most common forb species (Table - Herbaceous Trends).

Pre vs. One Year Post Treatment

Browse: One year after treatment, the canopy cover of Wyoming big sagebrush declined slightly from 7% to 6%.

Grass: Perennial grass sum of nested frequency remained similar to pretreatment, as did cover. Perennial grasses remain rare and still provide only 1% cover. Sandberg bluegrass (*Poa secunda*) was the only seeded species sampled in 2009, but was present prior to treatment. Cheatgrass, probably due to the Plateau ™ treatment, saw a 25% decrease in nested frequency and decreased from 32% cover to 9%.

Forb: The sum of nested frequency of perennial forbs declined 81% and cover declined from 2% to less than 1%. There was a significant decrease in the nested frequency of the most common forb, scarlet globemallow, and cover decreased from 2% to less than 1%.

Seed Mix

Project name: Brush Creek Bench Sage Restoration		
WRI Database #: 315	Size (acre):	300
Mix Lot #: ner-aw-bcbsr-09		
Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	600	2.00
Crested Wheatgrass 'Douglas'	450	1.50
Crested Wheatgrass 'Hycrest'	300	1.00
Russian Wildrye 'Bozoisky'	300	1.00
Sandberg Bluegrass--Toole MT	150	0.50
Snake River Wheatgrass 'Secar'	300	1.00
Thickspike Wheatgrass 'Critana'	300	1.00
BULK POUNDS PER ACRE:		8.00
PLS POUNDS PER ACRE:		6.86

Project name: Brush Creek Dixie		
WRI Database #: 315	Size (acre):	300
Mix lot #: ner-tm-bcbsk		
Seed type	lbs in mix	lbs/acre
Forage Kochia--Lander NV	300	1.00
Sagebrush, Wyoming--Sanpete UT	300	1.00
BULK POUNDS PER ACRE:	600	2.00
PLS POUNDS PER ACRE:		0.85

HERBACEOUS TRENDS--
Management unit 09R, Study no: 15

Type	Species	Nested Frequency '07	Nested Frequency '09	Average Cover % '07	Average Cover % '09
G	Agropyron intermedium	-	6	-	.41
G	Agropyron smithii	10	-	.09	-
G	Bromus tectorum (a)	$_{b}$480	$_{a}$360	30.54	9.37
G	Oryzopsis hymenoides	5	-	.04	-
G	Poa bulbosa	-	-	-	.03
G	Poa secunda	4	8	.04	.06
G	Sitanion hystrix	13	18	.25	.16
G	Stipa columbiana	-	2	-	.15
G	Stipa comata	19	24	.43	.49
G	Vulpia octoflora (a)	$_{b}$108	-	1.24	-
Total for Annual Grasses		588	360	31.78	9.37
Total for Perennial Grasses		51	58	0.86	1.31
Total for Grasses		639	418	32.64	10.69
F	Allium sp.	$_{b}$7	-	.02	-
F	Astragalus convallarius	1	-	.03	.03
F	Descurainia pinnata (a)	$_{b}$44	-	.09	-
F	Grindelia squarrosa	-	2	-	.03
F	Lappula occidentalis (a)	$_{b}$36	$_{a}$2	.12	.03
F	Machaeranthera canescens	1	1	.00	.00
F	Penstemon sp.	9	-	.01	-
F	Phlox longifolia	1	-	.00	-
F	Plantago patagonica (a)	$_{b}$178	$_{a}$3	1.02	.00
F	Salsola iberica (a)	4	-	.00	-
F	Sphaeralcea coccinea	$_{b}$159	$_{a}$31	2.25	.59
F	Townsendia sp.	2	-	.00	-
Total for Annual Forbs		262	5	1.25	0.03
Total for Perennial Forbs		180	34	2.34	0.65
Total for Forbs		442	39	3.59	0.69

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

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 15

Species	Percent Cover '07	Percent Cover '09
Artemisia tridentata wyomingensis	6.69	6.09
Gutierrezia sarothrae	.11	.03
Opuntia sp.	.21	.21

BASIC COVER--
Management unit 09R, Study no: 15

Cover Type	Average Cover % '07	'09
Vegetation	41.43	22.67
Rock	.03	.02
Pavement	.15	.10
Litter	46.23	48.15
Cryptogams	1.02	.24
Bare Ground	23.17	28.59

PELLET GROUP DATA--
Management unit 09R, Study no: 15

Type	Quadrat Frequency '07	'09	Days use per acre (ha) '07	'09
Rabbit	49	5	-	-
Grouse	1	-	-	-
Elk	4	5	2 (5)	24 (60)
Deer	48	44	64 (159)	116 (288)
Cattle	1	1	6 (14)	17 (43)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 15

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
07	13/19
09	14/20
Ceratoides lanata	
07	9/10
09	-/-
Gutierrezia sarothrae	
07	8/10
09	9/13
Opuntia sp.	
07	4/12
09	4/13

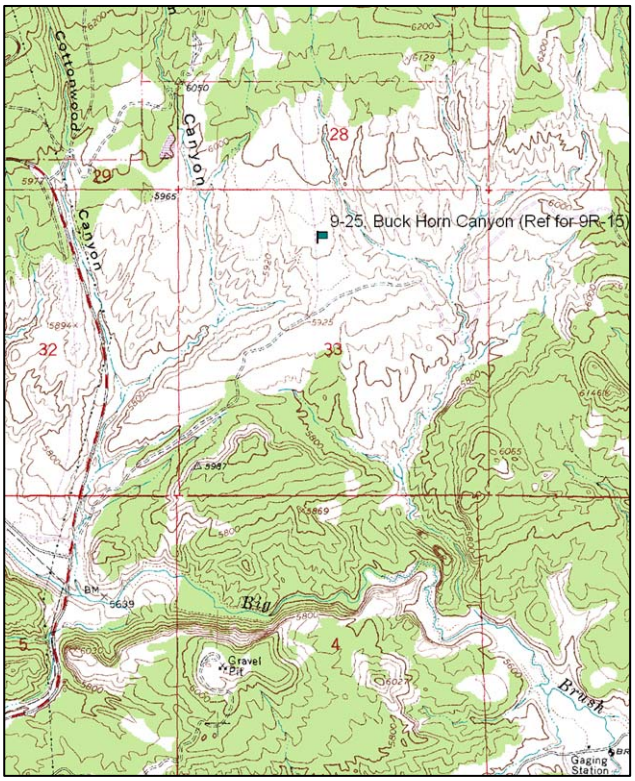
BUCKHORN CANYON, 9-25 (Reference for Brush Creek)

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: 5,892 ft. (1,796 m)
Aspect: South
Slope: 4%-5%
Transect bearing: 158° magnetic
Belt placement: Read Baseline, No Belts

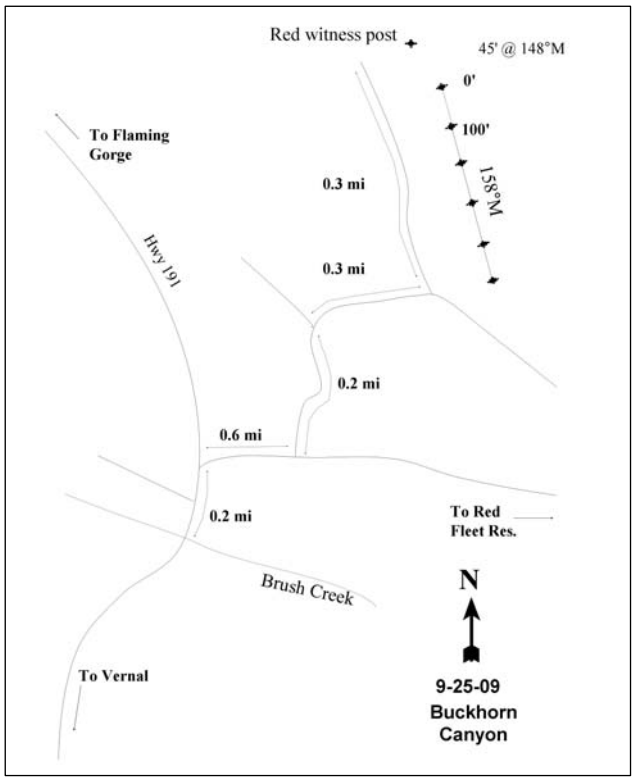
Directions:

From Vernal proceed north on Highway 191. After Highway 191 crosses Brush Creek continue 0.2 miles and turn right onto the road that leads to Red Fleet Reservoir. On this road proceed 0.6 miles. Turn left onto a dirt road. Go 0.2 miles to a fork. Turn right and continue 0.3 miles to another fork. Turn left and go 0.3 miles. The witness post is a red full high t-post about 50 feet to the east. The 0' stake is 45 feet to the south at 148°M. The 0' stake is marked with browse tag #120.

Map Name: Donkey Flat



Diagrammatic Sketch:



Township: 3N Range: 22E Section: 33

GPS: NAD 83, UTM 12S 630895 E 4496130 N

BUCKHORN CANYON - WRI STUDY 9-25
Project #315 Reference

Site Description

Site Information: Buckhorn Canyon is a regular trend study site that was used as a reference site for the Brush Creek Dixie study, 9R-15. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant browse with a robust grass understory. Pellet group data estimated very high deer use in 2001, but in the 2005 and 2009 readings, use was moderate. Elk use has been moderate and slowly declining over the same period. Cattle use has been moderate in all sample years (Table - Pellet Group Data).

Soils: Soils have a clay loam texture and a slightly alkaline pH (7.7). Effective rooting depth was estimated just over 13 inches. Phosphorus and potassium have low availability for plant growth and development at 4.1 ppm and 57.6 ppm, respectively (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground was high in 2001 and 2005, then decreased but was still high, in 2009 with an attendant increase in vegetation cover (Table - Basic Cover). Soil erosion condition was classified as slight in 2005 and 2009, due to flow patterns, pedestaling and soil litter movement.

Browse: Wyoming big sagebrush is the dominant browse. Cover was 21% in 2001, but drought had a large impact in subsequent years and cover had declined to 7% in 2005. By 2009, it appears sagebrush had recovered somewhat with 12% cover. Wyoming big sagebrush provided most of the browse cover in all sample years (Table - Browse Trends).

Herbaceous Understory: The perennial grass understory has increased in cover in each reading since 2001. At the same time cheatgrass (*Bromus tectorum*) has increased almost exponentially in nested frequency and cover. Common species included thickspike wheatgrass (*Agropyron dachystachum*), intermediate wheatgrass (*A. intermedium*), and needle and thread (*Stipa comata*). Forbs are also an important component in this community. Perennial forb cover has increased each sample while annual forbs fluctuated in cover and nested frequency. Scarlet globemallow (*Sphaeralcea coccinea*) is the most common perennial forb (Table - Herbaceous Trends).

Trend Assessments

Browse

- **2001 to 2005 - down (-2):** Wyoming big sagebrush density decreased 16% and cover decreased from 21% to 6%. There was a substantial decrease in the density of mature sagebrush from 2,400 plants/acre to 480 plants/acre, but much of this decrease was masked by a substantial increase in the density of young plants. Decadence of sagebrush increased from 49% to 57% and poor vigor increased from 22% to 44%.
- **2005 to 2009 - up (+2):** Wyoming big sagebrush canopy cover increased from 7% to 13%.

Grass

- **2001 to 2005 - stable (0):** Perennial grass nested frequency remained similar while cover increased from 5% to 8%. Perennial grasses account for 93% of grass cover. Thickspike wheatgrass accounted for 39% of perennial grass cover. Cheatgrass nested frequency increased significantly, but cover is still below 1%.
- **2005 to 2009 - slightly down (-1):** Perennial grass nested frequency decreased 17%, while cover increased from 8% to 14%. Intermediate wheatgrass and needle and thread provided 10% cover, combined. Cheatgrass nested frequency increased six-fold while its cover increased from 1% to 16%.

Forb

- **2001 to 2005 - down (-2):** The sum of nested frequency for perennial forbs decreased 23% while cover increased from 1% to 5%. Scarlet globemallow provided 87% of perennial forb cover in 2005. Weedy annual forb sum of nested frequency increased more than three-fold and cover increased to 10%.
- **2005 to 2009 - stable (0):** The sum of nested frequency and cover for perennial forbs remained similar. Annual forb sum of nested frequency declined 90% while cover decreased from 10% to less than 1%. Scarlet globemallow increased 30% in nested frequency while cover remained at 5%.

HERBACEOUS TRENDS--
Management unit 09, Study no: 25

Type	Species	Nested Frequency			Average Cover %		
		'01	'05	'09	'01	'05	'09
G	Agropyron dasystachyum	$_{b}$187	$_{b}$186	$_{a}$36	2.12	4.30	1.67
G	Agropyron intermedium	-	$_{a}$4	$_{b}$125	-	.03	5.39
G	Bromus tectorum (a)	$_{a}$25	$_{b}$52	$_{c}$366	.09	.58	15.56
G	Oryzopsis hymenoides	2	5	3	.03	.05	.51
G	Poa secunda	$_{b}$106	$_{ab}$84	$_{a}$56	1.23	.94	.77
G	Sitanion hystrix	$_{b}$57	$_{b}$46	$_{a}$17	.96	.26	.66
G	Stipa comata	50	54	76	1.07	2.04	5.09
Total for Annual Grasses		25	52	366	0.09	0.58	15.56
Total for Perennial Grasses		402	379	313	5.42	7.64	14.11
Total for Grasses		427	431	679	5.51	8.22	29.68
F	Aster sp.	-	-	2	-	-	.00
F	Astragalus convallarius	5	5	5	.19	.28	.03
F	Calochortus nuttallii	$_{b}$11	$_{b}$11	-	.02	.03	-
F	Chenopodium leptophyllum(a)	-	4	-	-	.01	-
F	Collinsia parviflora (a)	-	2	-	-	.00	-
F	Cryptantha sp.	-	7	3	-	.07	.01
F	Descurainia pinnata (a)	$_{b}$50	$_{c}$92	$_{a}$6	.11	1.21	.09
F	Eriogonum cernuum (a)	-	1	-	-	.00	-
F	Gilia sp. (a)	-	$_{b}$15	-	-	.38	-
F	Grindelia squarrosa	-	-	$_{b}$13	-	-	.75
F	Lappula occidentalis (a)	$_{b}$100	$_{c}$323	$_{a}$34	.21	7.25	.32
F	Lomatium sp.	-	2	-	-	.00	-
F	Machaeranthera canescens	2	4	-	.01	.03	-
F	Phlox longifolia	$_{c}$124	$_{b}$16	-	.56	.07	-
F	Plantago patagonica (a)	-	-	3	-	-	.00
F	Ranunculus testiculatus (a)	$_{a}$9	$_{b}$37	-	.02	.39	-
F	Salsola iberica (a)	-	$_{c}$68	$_{b}$13	-	.37	.34
F	Sphaeralcea coccinea	$_{a}$67	$_{b}$117	$_{c}$152	.25	4.64	5.05
F	Townsendia sp.	20	14	7	.03	.22	.01
Total for Annual Forbs		159	542	56	0.35	9.63	0.76
Total for Perennial Forbs		229	176	182	1.07	5.36	5.87
Total for Forbs		388	718	238	1.43	15.00	6.63

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

BROWSE TRENDS--
Management unit 09, Study no: 25

Typ	Species	Average Cover % '01	'05	'09
B	Artemisia tridentata wyomingensis	21.31	6.06	12.15
B	Juniperus osteosperma	1.00	.18	.53
B	Opuntia sp.	.45	.65	.33
Total for Browse		22.76	6.89	13.01

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

Species	Percent Cover '01	'05	'09
Artemisia tridentata wyomingensis	-	7.40	17.01
Juniperus osteosperma	-	.20	.60
Opuntia sp.	-	.48	.61

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

Species	Average leader growth (in) '05	'09
Artemisia tridentata wyomingensis	3.5	-

POINT-QUARTER TREE DATA--
Management unit 09, Study no: 25

Species	Trees per Acre '01	'05	'09	Average diameter (in) '01	'05	'09
Juniperus osteosperma	-	-	29	-	-	0.9

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

Cover Type	Average Cover % '01	'05	'09
Vegetation	27.13	25.62	49.94
Rock	.04	.04	.01
Pavement	.46	1.01	.93
Litter	31.23	30.46	33.17
Cryptogams	4.40	2.79	2.53
Bare Ground	50.20	50.00	34.67

SOIL ANALYSIS DATA --
Management unit 9R, Study no: 25, Study Name: Buckhorn Canyon

Effective rooting depth (in)	pH	clay loam % sand	% silt	%clay	%OM	PPM P	PPM K	ds/m
13.2	7.7	35.6	33.8	30.6	1.4	4.1	57.6	0.4

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

Type	Quadrat Frequency		
	'01	'05	'09
Rabbit	25	66	37
Elk	10	9	4
Deer	62	47	48
Cattle	10	5	17

Days use per acre (ha)		
'01	'05	'09
-	-	-
25 (63)	11 (28)	1 (2)
75 (185)	58 (142)	38 (94)
16 (40)	23 (56)	24 (59)

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

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
01	19/28
05	19/27
09	19/27
Atriplex canescens	
01	-/-
05	-/-
09	56/36
Grayia spinosa	
01	-/-
05	24/56
09	29/60
Gutierrezia sarothrae	
01	-/-
05	12/15
09	9/14
Juniperus osteosperma	
01	-/-
05	-/-
09	-/-
Opuntia sp.	
01	3/11
05	4/15
09	4/15

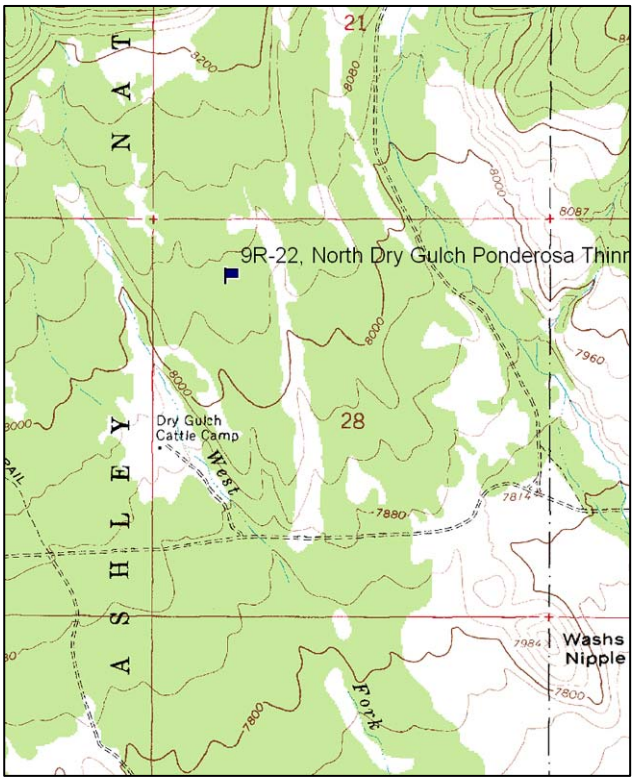
NORTH DRY GULCH WRI, 9R-22

Vegetation Type: Ponderosa Pine
Range Type: Crucial deer summer/Crucial elk summer
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 8,008 ft. (2,441 m)
Aspect: South
Slope: 4%
Transect bearing: 325° magnetic
Belt placement: Read Baseline, No Belts

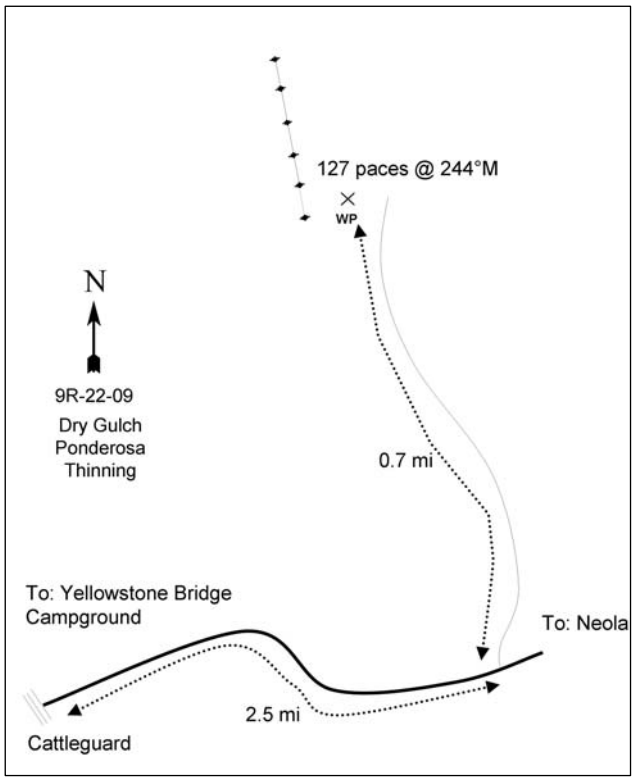
Directions:

From the Yellowstone Bridge Campground go 0.9 miles, turn right and continue for 4.7 miles to a cattleguard in 77 Flat (there should be signs denoting it as 77 Flat). From cattleguard continue east 2.5 miles to a two-track to the left (north) and travel 0.7 miles to a witness post on the west. The 0' stake is 127 paces at 244°M.

Map Name: Heller Lake



Diagrammatic Sketch:



Township: 3S Range: 3W Section: 28

GPS: NAD 83, UTM 12S 564696 E 4488666 N

NORTH DRY GULCH - WRI STUDY 9R-22
Project #1495

Site Description

Site Information: This site was established in 2009 prior to a Ponderosa pine (*Pinus ponderosa*) thinning on substantial deer and elk summer range northeast of Altonah, UT. The dominant species were Ponderosa pine, serviceberry (*Amelanchier alnifolia*), and Kentucky bluegrass (*Poa pratensis*). Pellet group data from 2009 estimated low deer and elk use, and moderate cow use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009, but with flow patterns and rills present. Bare ground is low at 13% (Table - Basic Cover).

Browse: Ponderosa pine provided 13% canopy cover (Table - Canopy Cover) on this site and density was estimated at 216 trees/acre (Table - Point-Quarter Tree Data) in 2009. Serviceberry was the next most common species at 3% canopy cover (Table - Canopy Cover).

Herbaceous Understory: Perennial grasses are diverse and abundant, with seven different species sampled in 2009. Cheatgrass (*Bromus tectorum*) is present, but was found in only one quadrat. Kentucky bluegrass (*Poa pratensis*) dominates the grasses and provided the majority of grass cover in 2009. Other common grasses include Western wheatgrass (*Agropyron smithii*) and bottlebrush squirreltail (*Sitanion hystrix*). Forbs are diverse and very abundant on the site. The dominant forb species is an aster (*Aster sp.*) with other abundant species including western yarrow (*Achillea millefolium*), trailing fleabane (*Erigeron flagellaris*), and hairy goldaster (*Heterotheca villosa*) (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 09R, Study no: 22

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron smithii	70	1.23
G	Bromus tectorum (a)	5	.03
G	Carex sp.	5	.03
G	Koeleria cristata	9	.09
G	Poa fendleriana	37	.48
G	Poa pratensis	275	10.96
G	Poa secunda	7	.21
G	Sitanion hystrix	127	1.52
Total for Annual Grasses		5	0.03
Total for Perennial Grasses		530	14.53
Total for Grasses		535	14.56
F	Achillea millefolium	122	3.19
F	Agoseris glauca	3	.03
F	Allium sp.	4	.00
F	Antennaria rosea	44	.96
F	Arenaria sp.	20	.18
F	Aster sp.	255	7.75
F	Astragalus sp.	4	.03
F	Cirsium sp.	6	.30
F	Collinsia parviflora (a)	3	.01
F	Cordylanthus sp. (a)	4	.01

Type	Species	Nested Frequency '09	Average Cover % '09
F	Cryptantha sp.	26	.05
F	Erigeron flagellaris	146	5.99
F	Eriogonum racemosum	19	.25
F	Eriogonum sp.	22	.45
F	Heterotheca villosa	46	1.09
F	Lupinus sp.	5	.06
F	Microsteris gracilis (a)	6	.01
F	Onobrychis viciaefolia	8	.07
F	Penstemon sp.	3	.00
F	Phlox austromontana	17	.20
F	Polygonum douglasii (a)	32	.10
F	Potentilla sp.	17	.63
F	Sedum lanceolatum	14	.21
F	Taraxacum officinale	13	.13
F	Unknown forb-annual (a)	28	.38
F	Unknown forb-perennial 2	26	.26
Total for Annual Forbs		73	0.51
Total for Perennial Forbs		820	21.89
Total for Forbs		893	22.41

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

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 22

Species	Percent Cover '09
Amelanchier alnifolia	3.09
Artemisia tridentata vaseyana	.58
Pinus ponderosa	12.91
Purshia tridentata	.91
Rosa woodsii	.13
Symphoricarpos oreophilus	1.66

POINT-QUARTER TREE DATA--
Management unit 09R, Study no: 22

Species	Trees per Acre '09	Average diameter (in) '09
Pinus ponderosa	216	6.8

BASIC COVER--
Management unit 09R, Study no: 22

Cover Type	Average Cover % '09
Vegetation	49.98
Rock	7.69
Pavement	.34
Litter	49.02
Cryptogams	.06
Bare Ground	13.23

PELLET GROUP DATA--
Management unit 09R, Study no: 22

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Elk	3	5 (13)
Deer	1	3 (7)
Cattle	4	21 (52)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 22

Yr	Average Height Crown (in)
Amelanchier alnifolia	
09	21/37
Artemisia tridentata vaseyana	
09	16/23
Cercocarpus montanus	
09	10/16
Mahonia repens	
09	2/10
Pinus ponderosa	
09	14/34
Purshia tridentata	
09	12/33
Rosa woodsii	
09	9/11
Symphoricarpos oreophilus	
09	12/27

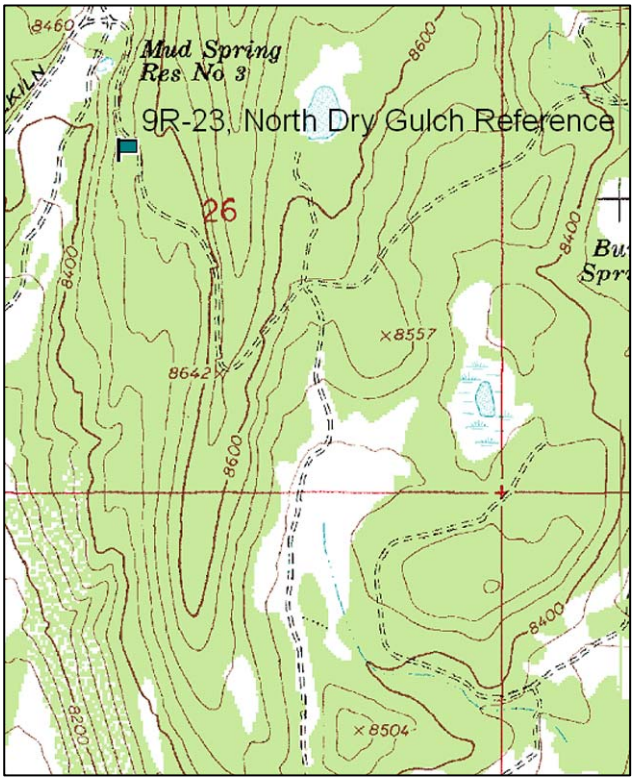
NORTH DRY GULCH REFERENCE WRI, 9R-23

Vegetation Type: Ponderosa Pine
Range Type: Crucial deer summer/Crucial elk summer
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 8,477 ft. (2,584 m)
Aspect: West
Slope: 12%
Transect bearing: 165° magnetic
Belt placement: Read Baseline, No Belts

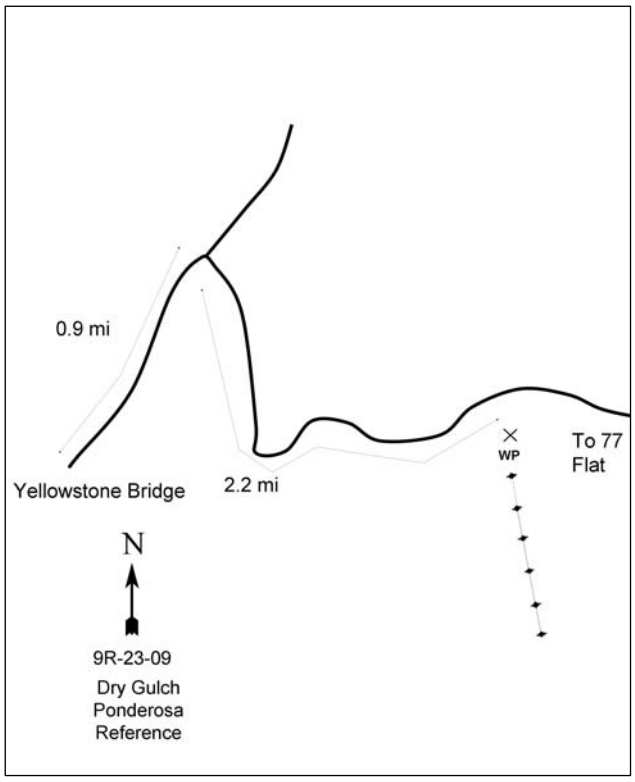
Directions:

From the Yellowstone Bridge Campground go 0.9 miles north, turn right and continue for 2.2 miles to a witness post on the south. The 0 foot stake is 18 paces at 210°M.

Map Name: Heller Lake



Diagrammatic Sketch:



Township: 3S Range: 3W Section: 26

GPS: NAD 83, UTM 12S 558511 E 4488211 N

NORTH DRY GULCH REFERENCE - WRI STUDY 9R-23
Project #1495 Reference

Site Description

Site Information: This site was established in 2009 as a reference to the Ponderosa pine (*Pinus ponderosa*) thinning at the North Dry Gulch study, 9R-22. This area is a Ponderosa pine forest with a good shrub and herbaceous understory east of the Yellowstone Bridge Campground about four miles west of 9R-22. Pellet group data from 2009 estimated low deer and cow use and moderate elk use (Table - Pellet Group Data). Soil erosion condition was classified as slight in 2009, due to flow patterns and soil movement. Bare ground is very low at 5% (Table - Basic Cover).

Browse: Ponderosa pine was the dominant woody species on this site, accounting for 22% canopy cover (Table - Canopy Cover) and an estimated density of 83 trees/acre (Table - Point-Quarter Tree Data). Other species occurring on the site included: serviceberry (*Amelanchier alnifolia*), Oregon grape (*Mahonia repens*), and aspen (*Populus tremuloides*). Aspen occurred in a small area on the southern end of the site, provided 3% canopy cover (Table - Canopy Cover) and had an estimated density of 60 trees/acre (Table - Point-Quarter Tree Data).

Herbaceous Understory: The herbaceous understory is not as diverse or abundant as on the treatment site, 9R-22. Seven perennial grass species were sampled. The dominant species were sheep fescue (*Festuca ovina*) and Letterman's needlegrass (*Stipa lettermani*). The forb component is diverse and heavily dominated by perennials. The most common perennials are hairy goldaster (*Heterotheca villosa*) and cudweed sagewort (*Artemisia ludoviciana*), which combined provided the majority of the perennial forb cover on the site (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 09R, Study no: 23

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron intermedium	2	.00
G	Carex sp.	5	.16
G	Festuca ovina	130	3.51
G	Koeleria cristata	73	.89
G	Poa fendleriana	10	.19
G	Sitanion hystrix	2	.03
G	Stipa lettermani	65	3.19
Total for Annual Grasses		0	0
Total for Perennial Grasses		287	7.99
Total for Grasses		287	7.99
F	Agoseris glauca	1	.00
F	Allium sp.	10	.15
F	Antennaria rosea	10	.34
F	Arabis sp.	7	.04
F	Arenaria sp.	25	.36
F	Artemisia ludoviciana	100	1.50
F	Aster sp.	20	.48
F	Chenopodium album (a)	5	.00
F	Collinsia parviflora (a)	8	.05

Type	Species	Nested Frequency '09	Average Cover % '09
F	Cryptantha sp.	9	.04
F	Heterotheca villosa	49	2.87
F	Machaeranthera canescens	1	.00
F	Microsteris gracilis (a)	31	.05
F	Penstemon sp.	18	.18
F	Phlox austromontana	57	.60
F	Polygonum douglasii (a)	26	.06
F	Potentilla sp.	4	.00
F	Sanguisorba minor	1	.00
F	Sedum lanceolatum	12	.06
F	Taraxacum officinale	3	.03
F	Zigadenus paniculatus	3	.03
Total for Annual Forbs		70	0.17
Total for Perennial Forbs		330	6.71
Total for Forbs		400	6.89

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

CANOPY COVER, LINE INTERCEPT--
Management unit 09R, Study no: 23

Species	Percent Cover '09
Arctostaphylos species	.88
Mahonia repens	1.01
Pinus ponderosa	21.63
Populus tremuloides	3.26

POINT-QUARTER TREE DATA--
Management unit 09R, Study no: 23

Species	Trees per Acre '09	Average diameter (in) '09
Pinus ponderosa	83	13.6
Populus tremuloides	60	1.3

BASIC COVER--
Management unit 09R, Study no: 23

Cover Type	Average Cover % '09
Vegetation	22.46
Rock	1.10
Pavement	.01
Litter	75.00
Cryptogams	.07
Bare Ground	4.64

PELLET GROUP DATA--
Management unit 09R, Study no: 23

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	2	-
Elk	13	32 (78)
Deer	4	5 (12)
Cattle	1	1 (2)

BROWSE CHARACTERISTICS--
Management unit 09R, Study no: 23

Yr	Average Height Crown (in)
Amelanchier alnifolia	
09	11/15
Arctostaphylos sp.	
09	12/45
Artemisia tridentata vaseyana	
09	12/15
Chrysothamnus sp.	
09	12/21
Juniperus communis	
09	17/70
Mahonia repens	
09	4/9
Populus tremuloides	
09	32/29
Purshia tridentata	
09	10/18
Rosa woodsii	
09	9/8
Symphoricarpos oreophilus	
09	28/44

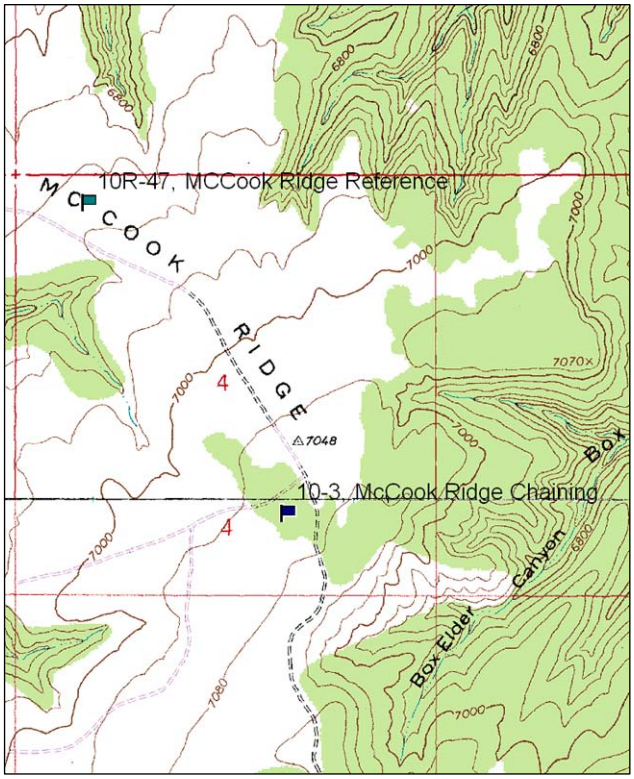
LOWER McCOOK RIDGE CHAINING WRI, 10-3

Vegetation Type: Chained P/J
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Upland Stony Loam (Wyoming big sagebrush), R034XY334UT
Land Ownership: BLM
Elevation: 6,996 ft. (2,132 m)
Aspect: Southwest
Slope: 5%
Transect bearing: 149° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

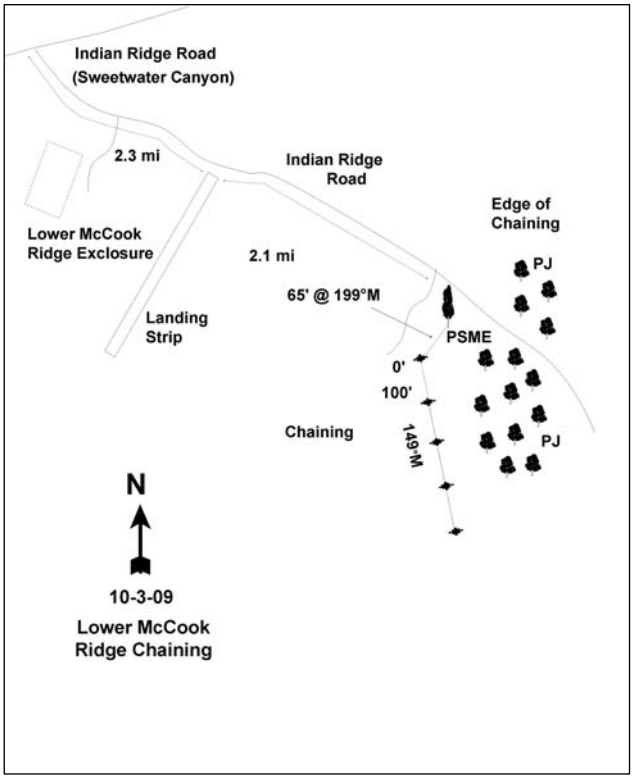
Directions:

From the intersection of the Indian Ridge and McCook Ridge roads, go southeast on McCook Ridge for 2.3 miles to a landing strip on the right side of the road (just past the exclosure). Proceed an additional 2.1 miles up McCook Ridge into a chained area. Turn right off the main road before the edge of the chaining, and proceed over to a large, lone Douglas fir. The 0' stake, marked by browse tag #9036, is 13 paces from the tree at 199°M.

Map Name: Burnt Timber Canyon



Diagrammatic Sketch:



Township: 14S Range: 24E Section: 4

GPS: NAD 83, UTM 12S 651666 E 4387543 N

LOWER McCOOK RIDGE CHAINING - WRI STUDY 10-3
Project #260

Site Description

Site Information: This study was established in 1982 as a permanent range trend study. It was originally chained in the 1960's then retreated in April 2005 by bullhog to remove pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) regrowth. There was no re-seeding during the 2005 treatment. A large wildfire burned to within 1,000 feet of the area in May 2000. The study was sampled in 2007 and 2009 as a Watershed Restoration Initiative monitoring site. Pellet group data estimated moderate deer and elk use, and low cow use from 2000 to 2009 (Table - Pellet Group Data). The soil erosion condition was classified as slight in 2007 and 2009, due to pedestalling, the formation of rills, flow patterns and soil and litter movement. Bare ground cover averaged 32% prior to treatment and remained high in 2007, but fell to 18% in 2009 (Table - Basic Cover).

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the key browse species and dwarf rabbitbrush (*Chrysothamnus depressus*) is the only other common browse species. Both species have averaged 4%-5% canopy cover since 2005 (Table - Canopy Cover). Following the bullhog treatment in 2005 pinyon pine and Utah juniper densities have steadily declined (Table - Point-Quarter Tree Data).

Herbaceous Understory: Thirteen grass species have been sampled on the study, all of which are perennials. From 1995 to 2000, grass cover averaged 13% and has steadily increased since 2005, following the treatment. Crested wheatgrass (*Agropyron cristatum*) is the most abundant grass and has seen a steady increase in nested frequency and cover since 2005. Blue grama (*Bouteloa gracilis*) is also common. The perennial forb community is diverse, but not abundant. Annual forbs are very rare (Table - Herbaceous Trends).

Trend Assessments

Browse

- **1988 to 1995 - stable (0):** Mountain big sagebrush density increased two-fold, perhaps due to a change in sampling methods. Recruitment of young was at 50% and decadence is low at 3%.
- **1995 to 2000 - stable (0):** Mountain big sagebrush density decreased slightly and recruitment is at 5% while decadence increased to 34%. Dwarf rabbitbrush density increased 14% and recruitment was at 10% while density rose to 17%. Pinyon pine density was estimated at 127 trees/acre with a canopy cover of 4%. Juniper density was estimated at 147 trees/acre.

Pre vs. Two Months Post Treatment

- **2000 to 2005:** Following the bullhog treatment, mountain big sagebrush density declined 22% and cover decreased from 8% to 4%. Recruitment was at 3% and decadence decreased slightly to 27%. Dwarf rabbitbrush density decreased 29% while cover remained similar to past years. Pinyon pine density fell to 42 trees/acre while juniper density fell to 65 trees/acre after a brush saw and bullhog treatment.

- **2005 to 2007 - stable (0):** Preferred browse species showed little change. Mountain big sagebrush recruitment increased from 3% to 13%. Black sagebrush (*Artemisia nova*) was sampled for the first time and density was estimated at 140 plants/acre. Two years post-treatment the pinyon pine density fell to 20 trees/acre and juniper density was 51 trees/acre.
- **2007 to 2009 - slightly up (+1):** Browse density was not estimated, so trend is based on canopy cover estimates. Mountain big sagebrush and dwarf rabbitbrush canopy cover both increased from 5% in 2007 to 6% in 2009. Pinyon and juniper densities are 14 trees/acre, each, while canopy cover was below 1%.

Grass

- **1988 to 1995 - up (+2):** Sum of nested frequency for perennial grasses increased 31%.
- **1995 to 2000 - down (-2):** Sum of nested frequency for perennial grasses decreased 22%. However, the nested frequency for crested wheatgrass increased 18% with a 50% increase in cover. Perennial grass species cover is 14%.

Pre vs Two Months Post Treatment

- **2000 to 2005:** After the bullhog treatment, the sum of nested frequency for perennial grasses has changed little. Perennial grass cover was 12%. The nested frequencies of crested wheatgrass and thickspike wheatgrass (*Agropyron dachystachum*) decreased significantly. Crested wheatgrass accounted for 46% of perennial grass cover.

- **2005 to 2007 - up (+2):** Perennial grass sum of nested frequency increased 24% while perennial grass cover increased to 23%. Crested wheatgrass provided 52% of perennial grass cover. Blue grama nested frequency increased significantly while cover increased from 1% to 4%.
- **2007 to 2009 - stable (0):** The sum of nested frequency for perennial grasses was similar to the last reading while cover increased to 33%. Crested wheatgrass cover was 19% (59% of perennial grass cover).

Forb

- **1998 to 1995 - up (+2):** The sum of nested frequency for forbs increased 60% and the number of species sampled increased from nine to 17. Few annual forbs were sampled.
- **1995 to 2000 - down (-2):** The sum of nested frequency for perennial forbs decreased 48% and cover decreased from 4% to 1%.

Pre vs Two Months Post Treatment

- **2000 to 2005:** The sum of nested frequency for perennial forbs decreased 25% and cover decreased to less than 1%.

- **2005 to 2007 - up (+2):** The sum of nested frequency of perennial forbs increased 22%, but perennial forb cover remained less than 1%.
- **2007 to 2009 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 19%, but cover increased to over 1%. Forbs are infrequent, but diverse.

HERBACEOUS TRENDS--
Management unit 10, Study no: 3

Type	Species	Nested Frequency					Average Cover %				
		'95	'00	'05	'07	'09	'95	'00	'05	'07	'09
G	Agropyron cristatum	$_{abc}$198	$_{c}$233	$_{a}$164	$_{ab}$183	$_{bc}$223	6.43	10.21	5.64	11.80	19.17
G	Agropyron dasystachyum	$_{b}$150	$_{b}$117	$_{a}$45	$_{a}$63	$_{a}$64	.56	.64	.37	.69	2.12
G	Agropyron intermedium	$_{b}$24	-	$_{b}$16	$_{b}$28	$_{c}$60	.16	-	.24	.42	.78
G	Agropyron spicatum	$_{b}$17	-	$_{ab}$4	$_{b}$9	$_{b}$9	.16	-	.03	.33	.51
G	Bouteloua gracilis	$_{c}$121	$_{ab}$97	$_{a}$68	$_{ab}$120	$_{abc}$107	1.25	1.59	1.49	4.47	5.09
G	Bromus inermis	$_{b}$25	$_{a}$3	-	-	$_{a}$1	.28	.03	-	-	.03
G	Carex sp.	13	3	11	10	-	.36	.30	.12	.10	-
G	Elymus junceus	$_{a}$14	$_{a}$3	$_{a}$6	$_{b}$33	-	.33	.15	.33	1.00	-
G	Koeleria cristata	$_{b}$56	$_{a}$32	$_{ab}$47	$_{b}$61	$_{ab}$38	.48	.14	.77	1.75	2.08
G	Oryzopsis hymenoides	6	-	8	12	3	.07	-	.19	.24	.30
G	Poa secunda	$_{bc}$88	$_{abc}$78	$_{c}$102	$_{a}$50	$_{ab}$53	2.02	1.40	2.41	.44	1.07
G	Sitanion hystrix	4	-	4	2	-	.01	-	.06	.03	-

Type	Species	Nested Frequency					Average Cover %				
		'95	'00	'05	'07	'09	'95	'00	'05	'07	'09
G	Stipa comata	$_{a}$10	-	$_{ab}$33	$_{c}$59	$_{bc}$43	.01	-	.71	1.35	1.45
Total for Annual Grasses		0	0	0	0	0	0	0	0	0	0
Total for Perennial Grasses		726	566	508	630	601	12.16	14.48	12.39	22.67	32.63
Total for Grasses		726	566	508	630	601	12.16	14.48	12.39	22.67	32.63
F	Achillea millefolium	-	-	-	-	4	-	-	-	-	.03
F	Antennaria rosea	$_{b}$31	$_{a}$12	$_{ab}$20	$_{a}$2	-	.17	.03	.11	.00	-
F	Arabis sp.	$_{b}$34	$_{a}$5	$_{a}$2	$_{ab}$17	-	.87	.01	.03	.03	-
F	Arenaria fendleri	4	6	12	1	-	.03	.04	.02	.01	-
F	Astragalus spatulatus	-	5	-	-	-	-	.03	-	-	-
F	Calochortus nuttallii	6	-	2	-	-	.01	-	.00	-	-
F	Castilleja sp.	$_{a}$23	-	-	-	-	.11	-	-	-	-
F	Crepis acuminata	6	-	-	-	-	.01	-	-	-	-
F	Cymopterus sp.	-	-	6	-	-	-	-	.01	-	-
F	Delphinium sp.	2	-	-	-	-	.00	-	-	-	-
F	Erigeron pumilus	$_{a}$3	$_{ab}$6	$_{a}$1	$_{a}$4	$_{b}$19	.04	.02	.00	.03	.09
F	Erigeron sp.	-	5	-	-	6	-	.01	-	-	.06
F	Haplopappus acaulis	$_{ab}$9	$_{b}$17	$_{a}$8	$_{ab}$10	-	.33	.54	.21	.16	-
F	Hymenoxys acaulis	13	1	3	-	-	.80	.00	.03	-	-
F	Lappula occidentalis (a)	2	-	2	-	-	.00	-	.00	-	-
F	Machaeranthera canescens	-	-	-	$_{a}$11	-	-	-	-	.08	-
F	Machaeranthera grindelioides	$_{a}$13	$_{ab}$24	$_{a}$8	$_{ab}$24	$_{b}$32	.14	.17	.08	.17	.93
F	Medicago sativa	$_{ab}$16	$_{a}$9	$_{a}$5	$_{a}$3	-	1.24	.39	.06	.00	.09
F	Oenothera caespitosa	-	1	-	-	-	-	.00	-	-	-
F	Orthocarpus sp. (a)	4	-	-	-	-	.01	-	-	-	-
F	Penstemon pachyphyllus	3	-	4	-	2	.02	-	.06	.00	.00
F	Penstemon sp.	-	-	-	-	-	-	-	-	-	.00
F	Phlox longifolia	$_{b}$43	$_{a}$14	$_{a}$2	$_{ab}$21	$_{a}$8	.08	.03	.00	.09	.04
F	Physaria acutifolia	-	1	-	-	-	-	.00	-	-	-
F	Physaria sp.	-	-	-	3	-	-	-	-	.00	-
F	Polygonum douglasii (a)	7	-	-	-	-	.02	-	-	-	-
F	Salsola iberica (a)	-	-	-	1	-	-	-	-	.00	-
F	Sphaeralcea coccinea	29	20	18	23	24	.08	.04	.22	.14	.17
F	Streptanthus cordatus	1	-	1	-	-	.00	-	.03	-	-
F	Taraxacum officinale	6	-	-	-	1	.01	-	-	-	.00
Total for Annual Forbs		13	0	2	1	0	0.03	0	0.00	0.00	0
Total for Perennial Forbs		242	126	92	119	96	3.99	1.34	0.89	0.74	1.44
Total for Forbs		255	126	94	120	96	4.02	1.34	0.89	0.74	1.44

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

BROWSE TRENDS--
Management unit 10, Study no: 3

Type	Species	Average Cover %				
		'95	'00	'05	'07	'09
B	Artemisia frigida	-	.15	.03	.03	-
B	Artemisia nova	-	-	-	.30	-
B	Artemisia tridentata vaseyana	5.73	7.76	4.46	4.24	5.03
B	Ceratoides lanata	.09	.01	-	.03	.06
B	Chrysothamnus depressus	5.34	4.88	4.76	4.59	6.71
B	Chrysothamnus nauseosus hololeucus	-	.00	.00	.03	.03
B	Eriogonum microthecum	-	-	-	-	.03
B	Gutierrezia sarothrae	.35	.36	.42	.25	.77
B	Juniperus osteosperma	1.62	1.14	.18	-	.03
B	Leptodactylon pungens	-	.15	-	-	-
B	Opuntia fragilis	.01	-	-	-	-
B	Pediocactus simpsonii	-	-	-	.00	-
B	Pinus edulis	1.79	3.83	.78	-	-
Total for Browse		14.95	18.32	10.67	9.48	12.67

CANOPY COVER, LINE INTERCEPT--
Management unit 10, Study no: 3

Species	Percent Cover				
	'95	'00	'05	'07	'09
Artemisia frigida	-	-	-	-	-
Artemisia nova	-	-	-	.86	-
Artemisia tridentata vaseyana	-	-	4.88	5.31	6.26
Chrysothamnus depressus	-	-	3.40	4.91	5.84
Chrysothamnus nauseosus hololeucus	-	-	-	-	.15
Chrysothamnus viscidiflorus viscidiflorus	-	-	-	-	.05
Gutierrezia sarothrae	-	-	.25	1.39	.63
Juniperus osteosperma	-	-	.61	.05	.06
Pinus edulis	-	4.40	.35	.05	-

POINT-QUARTER TREE DATA--
Management unit 10, Study no: 3

Species	Trees per Acre			
	'00	'05	'07	'09
Juniperus osteosperma	147	65	51	14
Pinus edulis	127	42	20	14

Average diameter (in)			
'00	'05	'07	'09
2.5	3.4	1.3	1.1
4.2	3.2	0.4	3.3

BASIC COVER--
Management unit 10, Study no: 3

Cover Type	Average Cover %				
	'95	'00	'05	'07	'09
Vegetation	32.93	34.54	21.94	33.57	46.65
Rock	2.11	1.52	.46	.97	1.51
Pavement	2.95	1.11	1.33	1.22	1.43
Litter	36.46	34.29	46.71	44.93	51.77
Cryptogams	6.62	5.81	2.19	.69	.28
Bare Ground	26.86	37.16	36.87	31.81	17.64

SOIL ANALYSIS DATA --
Management unit 10R, Study no: 3, Study Name: Lower McCook Ridge Chaining

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
15.7	7.1	34.0	31.4	34.6	4.0	7.8	144.0	0.8

PELLET GROUP DATA--
Management unit 10, Study no: 3

Type	Quadrat Frequency				
	'95	'00	'05	'07	'09
Rabbit	16	33	47	62	21
Elk	24	5	11	18	10
Deer	13	6	18	18	25
Cattle	2	1	1	-	5

Days use per acre (ha)			
'00	'05	'07	'09
-	-	-	-
19 (48)	20 (50)	12 (30)	1 (3)
25 (62)	24 (60)	32 (79)	25 (63)
-	2 (4)	11 (27)	1 (2)

BROWSE CHARACTERISTICS--
Management unit 10, Study no: 3

Yr	Average Height Crown (in)
Artemisia frigida	
95	9/11
00	7/5
05	2/4
07	6/6
09	9/5
Artemisia nova	
95	-/-
00	-/-
05	-/-
07	12/16
09	9/18
Artemisia tridentata vaseyana	
95	24/31
00	23/26
05	19/24
07	23/29
09	20/24

Yr	Average Height Crown (in)
Atriplex canescens	
95	-/-
00	26/24
05	-/-
07	-/-
09	-/-
Ceratoides lanata	
95	6/8
00	9/8
05	5/6
07	5/5
09	6/6
Chrysothamnus depressus	
95	5/11
00	3/10
05	4/8
07	4/12
09	4/11
Chrysothamnus nauseosus	
95	-/-
00	-/-
05	-/-
07	27/29
09	28/30
Chrysothamnus nauseosus hololeucus	
95	36/43
00	37/38
05	18/9
07	26/30
09	35/28
Chrysothamnus viscidiflorus viscidiflorus	
95	-/-
00	-/-
05	-/-
07	-/-
09	7/8

Yr	Average Height Crown (in)
Eriogonum microthecum	
95	-/-
00	-/-
05	-/-
07	-/-
09	1/3
Gutierrezia sarothrae	
95	7/7
00	4/5
05	6/7
07	6/7
09	7/7
Leptodactylon pungens	
95	-/-
00	8/11
05	4/9
07	4/9
09	-/-
Opuntia fragilis	
95	4/14
00	-/-
05	3/12
07	-/-
09	-/-
Opuntia sp.	
95	-/-
00	-/-
05	-/-
07	-/-
09	4/7
Pediocactus simpsonii	
95	-/-
00	0/1
05	1/2
07	-/-
09	1/2

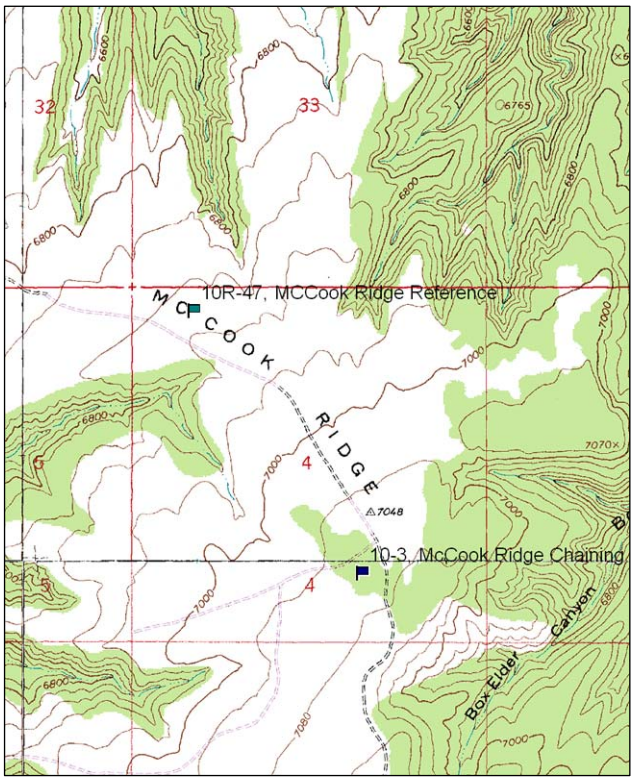
LOWER MCCOOK RIDGE REFERENCE WRI, 10R-47

Vegetation Type: P/J Chaining
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Upland Stony Loam (Wyoming big sagebrush), R034XY334UT
Land Ownership: BLM
Elevation: 6,848 ft. (2,086 m)
Aspect: North
Slope: 4%
Transect bearing: 320° magnetic from 0' to 300', then 250° magnetic from 300' on
Belt placement: Read Baseline, No Belts

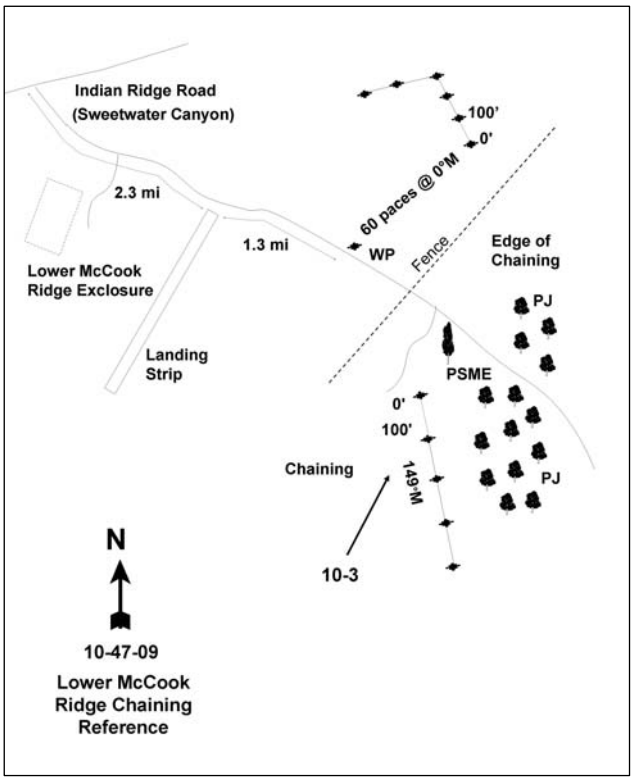
Directions:

From the intersection of the Indian Ridge and McCook Ridge roads, go southeast on McCook Ridge for 2.3 miles to a landing strip on the right side of the road (just past the exclosure). Proceed 1.3 miles to a witness post on the north side of the road, near a large rubber rabbitbrush. 0' stake is located 60 paces away at 0°M.

Map Name: Burnt Timber Canyon



Diagrammatic Sketch:



Township: 14S Range: 24E Section: 4

GPS: NAD 83, UTM 12S 650878 E 4388719 N

LOWER McCOOK RIDGE REFERENCE - WRI STUDY 10R-47
Project #260 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to the McCook Ridge Chaining study, 10-3. It is located in an old pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining area that is again dominated by trees about 0.8 miles northwest of 10-3, along the McCook Ridge. Pellet group data from 2009 estimated moderate deer use, and low elk and cow use (Table - Pellet Group). Soil erosion condition was classified as moderate in 2009, due to pedestalling, flow patterns, and surface rock movement.

Browse: This site was very limited in preferred browse species. Mountain big sagebrush was present, but provided less than 1% canopy cover. In 2009, canopy cover was 13% for juniper and 17% for pinyon pine (Table - Canopy Cover). Juniper density was estimated at 36 trees/acre and pinyon pine density was estimated at 271 trees/acre (Table - Point-Quarter Tree Data).

Herbaceous Understory: The herbaceous understory was very limited by the pinyon/juniper overstory. Grass cover was less than 2% and forb cover was less than 0.5%. Blue grama (*Bouteloa gracilis*) was the most common grass species with about 1% cover (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 10R, Study no: 47

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	16	.16
G	Agropyron dasystachyum	1	.00
G	Agropyron spicatum	6	.06
G	Bouteloua gracilis	52	1.22
G	Koeleria cristata	2	.03
G	Oryzopsis hymenoides	4	.03
G	Poa secunda	17	.13
G	Sitanion hystrix	6	.04
G	Stipa comata	-	.00
Total for Annual Grasses		0	0
Total for Perennial Grasses		104	1.69
Total for Grasses		104	1.69
F	Cryptantha sp.	4	.07
F	Erigeron pumilus	13	.10
F	Erigeron sp.	7	.01
F	Eriogonum alatum	2	.03
F	Eriogonum brevicaule	4	.00
F	Lesquerella sp.	1	.00
F	Machaeranthera grindelioides	6	.04
F	Penstemon sp.	7	.02
F	Phlox austromontana	12	.07
F	Phlox hoodii	11	.08
F	Sphaeralcea coccinea	2	.03
F	Unknown forb-annual (a)	5	.00

Type	Species	Nested Frequency '09	Average Cover % '09
Total for Annual Forbs		5	0.00
Total for Perennial Forbs		69	0.46
Total for Forbs		74	0.47

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

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 47

Species	Percent Cover '09
Artemisia tridentata vaseyana	.66
Chrysothamnus nauseosus	.05
Gutierrezia sarothrae	.18
Juniperus osteosperma	13.35
Opuntia sp.	.03
Pinus edulis	17.20

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 47

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	271	2.1
Pinus edulis	173	4.5

BASIC COVER--
Management unit 10R, Study no: 47

Cover Type	Average Cover % '09
Vegetation	23.35
Rock	1.60
Pavement	6.64
Litter	40.97
Cryptogams	.60
Bare Ground	45.02

PELLET GROUP DATA--
Management unit 10R, Study no: 47

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	25	-
Elk	1	1 (3)
Deer	31	25 (63)
Cattle	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 47

Yr	Average Height Crown (in)
Artemisia tridentata vaseyana	
09	22/26
Chrysothamnus depressus	
09	3/6
Chrysothamnus nauseosus	
09	13/15
Chrysothamnus nauseosus albicaulis	
09	29/48
Chrysothamnus viscidiflorus viscidiflorus	
09	6/7
Gutierrezia sarothrae	
09	7/6
Leptodactylon pungens	
09	4/12
Opuntia sp.	
09	3/11

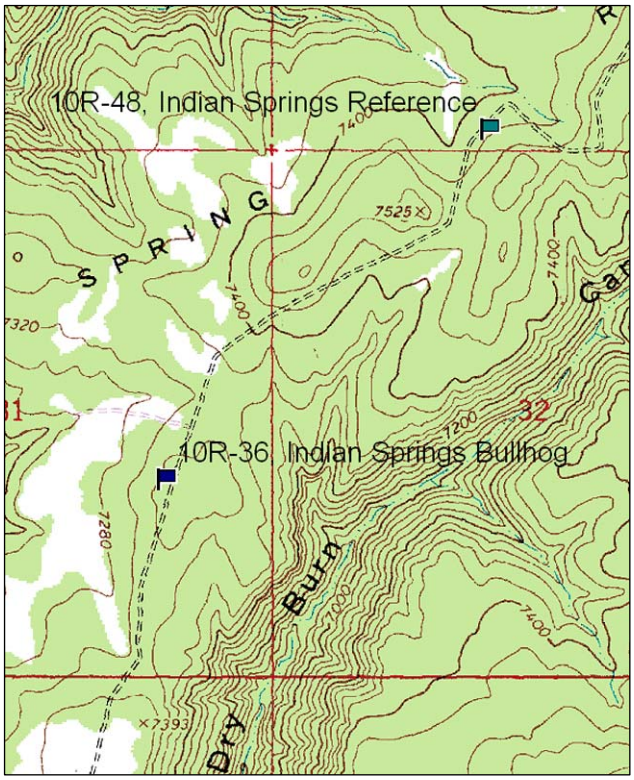
INDIAN SPRINGS BULLHOG WRI, 10R-36

Vegetation Type: Pinyon/Juniper/Black sagebrush
Range Type: Substantial deer summer; crucial elk winter
NRCS Ecological Site Description: Upland Shallow Loam (Pinyon-Utah Juniper), R034XY322UT
Land Ownership: BLM
Elevation: 7,299 ft. (2,224 m)
Aspect: north
Slope: 1%
Transect bearing: 2° magnetic, (baseline was moved slightly so these readings may be somewhat off)
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

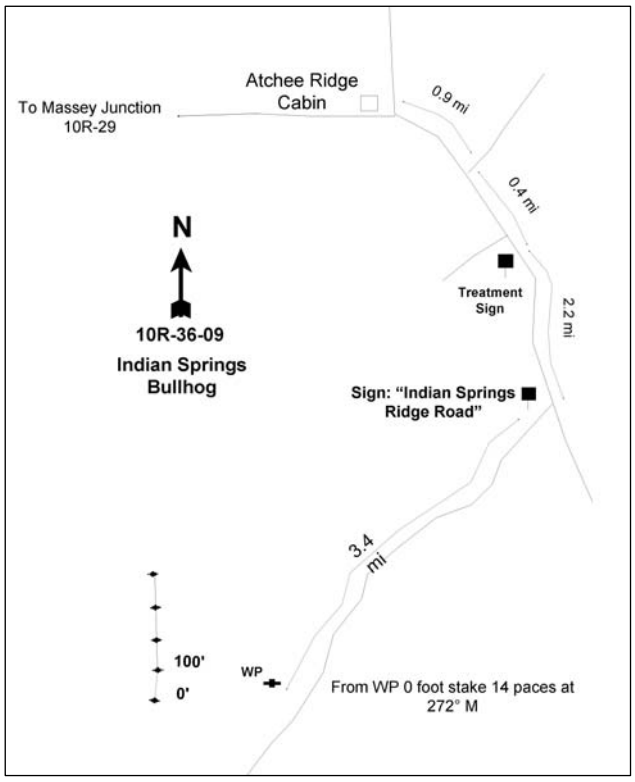
Directions:

From the Seep Ridge Road, about 10 miles north of Pine Spring, turn onto the Bitter Creek Road near McCoy Reservoir. Drive easterly 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". Go right for 3.4 miles to a witness post on the right. The 0' stake with browse tag #156, is 14 paces from the witness post at 272°M.

Map Name: Burnt Timber Canyon



Diagrammatic Sketch:



Township: 13S Range: 25E Section: 31

GPS: NAD 83, UTM 12S 658300 E 4389574 N

INDIAN SPRINGS BULLHOG - WRI STUDY 10R-36
Project #362

Site Description

Site Information: This study was established in 2006 within a dense pinyon-juniper woodland on Indian Springs Ridge to monitor the effects of a bullhog treatment. The treatment was done in the fall of 2006 with the objectives of releasing mountain browse remaining in the understory and allow the BLM and UDWR to establish grasses, forbs, and additional browse on the site. The treatment area receives heavy use by wintering elk and is important early fall/late spring mule deer transition range/migration corridor. The baseline for this study was moved slightly south and east of the original location in 2009 to keep the study within the treatment area. Pellet group data estimated low deer and moderate elk use in 2006 and 2009, and cow use was low in 2009 (Table - Pellet Group). Soil erosion was classified as slight in 2006 and 2009 due to pedestalling, flow patterns, rills, and surface litter movement.

Browse: The key browse species include Utah serviceberry (*Amelanchier utahensis*), black sagebrush (*Artemisia nova*), true mountain mahogany (*Cercocarpus montanus*), and antelope bitterbrush (*Purshia tridentata*). Black sagebrush and bitterbrush increased in canopy cover following the treatment, but serviceberry and mahogany decreased. Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) canopy cover (Table - Canopy Cover) and densities (Table - Point-Quarter Tree Data) were drastically reduced by the treatment. Due to the proximity of the study transect to the treatment edge future density estimates of pinyon and juniper will probably increase instead of continuing to decrease.

Herbaceous Understory: Prior to treatment in 2006, the herbaceous understory was scarce and six species were sampled. Post treatment, there were 14 grass species sampled, including seven seeded species. Slender wheatgrass (*Agropyron trachycaulum*) was the predominant seeded species and mutton bluegrass (*Poa fendleriana*) the most abundant grass species at 4% cover. Forbs are diverse and abundant on the site and increased in 2009, following the treatment. The low forage quality forbs desert phlox (*Phlox austromontana*) and rock goldenrod (*Petradoria pumila*) are the dominant forbs on the site (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Overall, preferred browse cover changed little. In two years since the treatment black sagebrush, dwarf rabbitbrush (*Chrysothamnus depressus*) and antelope bitterbrush have seen increases in canopy cover. Black sagebrush canopy cover increased from 3% to 5%, dwarf rabbitbrush increased from 1% to 3% and antelope bitterbrush increased from 1% to 4%. Species that declined include serviceberry, Gambel oak, and true mountain mahogany. Pinyon and juniper tree cover and density declined due to treatment. Pinyon pine density decreased from 608 trees/acre to 120 trees/acre and canopy cover decreased from 49% to 0%. Juniper density was reduced from 212 trees/acre to 47 trees/acre and canopy cover fell from 4% to 1%.

Grass: The sum of nested frequency of perennial grasses increased more than two-fold and cover increased from 2% to 14%. Cheatgrass (*Bromus tectorum*) was first sampled in 2009, but is rare. Slender wheatgrass is the most common seeded species and provided 4% cover in 2009. Mutton bluegrass was the most frequent species in 2009 and increased in cover from less than 1% to 3%. Other seeded species that provided 1% cover or more include Sandberg bluegrass (*Poa secunda*) and bluebunch wheatgrass (*Agropyron spicatum*). Other less common seeded species sampled include crested wheatgrass (*Agropyron cristatum*), thickspike wheatgrass (*A. dasystachyum*), western wheatgrass (*A. smithii*), and blue grama (*Bouteloua gracilis*).

Forb: The sum of nested frequency of perennial forbs increased more than two-fold and cover increased from 4% to 11%. Desert phlox (*Phlox austromontana*) is the most common forb, it has increased slightly in nested frequency and provides 3% cover. Seeded forb species provide a combined 1% cover. Seeded forb species

sampled at low cover and frequency include blue flax (*Linum lewisii*), alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*).

Seed Mix

Project name: Indian Springs Bullhog
WRI Database #: 362 Size (acre): 350
Mix lot #: ner-mh-ispj-07

Seed type	lbs in mix	lbs/acre
Crested Wheatgrass 'Douglas'	200	0.57
Canby Bluegrass 'Canbar'	100	0.29
Thickspike Wheatgrass 'Bannock'	250	0.71
Western Wheatgrass 'Arriba'	250	0.71
Sandberg Bluegrass 'Toole MT'	175	0.50
Bluebunch WG 'Anatone'	175	0.50
Orchardgrass 'Paiute'	70	0.20
Slender Wheatgrass 'San Luis'	175	0.50
Blue Grama	90	0.26
Western Yarrow	20	0.06
Blue Flax ' Appar	100	0.29
Small Burnet 'Delar'	700	2.00
Alfalfa 'Ladak'	350	1.00
Sainfoin 'Eski'	1050	3.00
Fourwing Saltbush--Juab/Millard UT	350	1.00
Sagebrush, Wyoming--Sanpete UT	350	1.00
Forage Kochia--Beaver UT	100	0.29
BULK POUNDS PER ACRE:		12.87
PLS POUNDS PER ACRE:		10.23

HERBACEOUS TRENDS--
Management unit 10R, Study no: 36

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
G	Agropyron cristatum	-	8	-	.06
G	Agropyron dasystachyum	-	6	-	.30
G	Agropyron trachycaulum	-	a48	-	3.88
G	Agropyron smithii	-	2	-	.03
G	Agropyron spicatum	11	27	.13	1.30
G	Bouteloua gracilis	-	4	-	.00
G	Bromus tectorum (a)	-	4	-	.03
G	Carex sp.	57	34	1.18	1.30
G	Koeleria cristata	a38	b58	.50	1.46
G	Oryzopsis hymenoides	2	14	.01	.79
G	Poa fendleriana	a15	b77	.39	3.34
G	Poa secunda	a9	b29	.05	.97
G	Sitanion hystrix	-	4	-	.21
G	Stipa comata	-	a23	-	.72
Total for Annual Grasses		0	4	0	0.03
Total for Perennial Grasses		132	334	2.27	14.41
Total for Grasses		132	338	2.27	14.44

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
F	Agoseris glauca	-	2	-	.03
F	Antennaria rosea	-	$_{a}$15	-	.20
F	Arabis sp.	7	-	.04	-
F	Aster sp.	-	$_{a}$18	-	.64
F	Astragalus spatulatus	$_{a}$19	-	.09	-
F	Astragalus utahensis	-	2	-	.00
F	Castilleja linariaefolia	-	$_{a}$25	-	.75
F	Collinsia parviflora (a)	2	-	.00	-
F	Comandra pallida	$_{a}$15	$_{b}$37	.06	.33
F	Cordylanthus sp. (a)	9	-	.24	-
F	Crepis acuminata	-	$_{a}$14	-	.13
F	Erigeron pumilus	8	9	.07	.07
F	Erigeron sp.	-	$_{a}$73	-	.95
F	Eriogonum alatum	11	7	.15	.06
F	Haplopappus acaulis	-	2	-	.03
F	Hymenoxys acaulis	-	$_{a}$12	-	.25
F	Ipomopsis aggregata	1	-	.00	-
F	Lesquerella sp.	$_{a}$19	$_{b}$48	.10	.50
F	Linum lewisii	-	-	-	.30
F	Machaeranthera grindelioides	1	-	.00	-
F	Medicago sativa	-	6	-	.04
F	Onobrychis viciaefolia	-	$_{a}$15	-	.19
F	Penstemon sp.	-	10	-	.21
F	Penstemon sp.	6	9	.02	.10
F	Petradoria pumila	41	36	1.35	1.52
F	Phlox austromontana	77	88	2.28	3.45
F	Phlox longifolia	-	$_{a}$18	-	.05
F	Potentilla gracilis	-	1	-	.00
F	Sanguisorba minor	-	$_{a}$14	-	.49
F	Senecio multilobatus	$_{a}$1	$_{b}$32	.00	.34
F	Zigadenus paniculatus	-	3	-	.00
Total for Annual Forbs		11	0	0.24	0
Total for Perennial Forbs		206	496	4.20	10.71
Total for Forbs		217	496	4.44	10.71

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

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 36

Species	Percent Cover '06	'09
Amelanchier utahensis	4.91	.16
Artemisia nova	2.75	4.61
Artemisia tridentata vaseyana	-	.05
Cercocarpus montanus	1.10	-
Chrysothamnus depressus	.93	2.83
Chrysothamnus viscidiflorus viscidiflorus	-	.62
Juniperus osteosperma	4.13	.81
Pinus edulis	48.75	-
Pseudotsuga menziesii	.06	-
Purshia tridentata	.96	4.30
Quercus gambelii	1.96	-
Symphoricarpos oreophilus	.25	-

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 36

Species	Trees per Acre '06	'09	Average diameter (in) '06	'09
Juniperus osteosperma	212	47	1.1	0.8
Pinus edulis	608	120	3.2	0.8

BASIC COVER--
Management unit 10R, Study no: 36

Cover Type	Average Cover % '06	'09
Vegetation	28.15	37.67
Rock	11.41	1.83
Pavement	14.43	12.55
Litter	50.68	43.13
Cryptogams	2.67	.46
Bare Ground	16.11	19.71

PELLET GROUP DATA--
Management unit 10R, Study no: 36

Type	Quadrat Frequency '06	'09	Days use per acre (ha) '06	'09
Rabbit	27	9	-	-
Elk	11	10	17 (41)	21(51)
Deer	1	2	10 (25)	9 (22)
Cattle	-	1	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 36

Yr	Average Height Crown (in)
Amelanchier utahensis	
06	58/50
09	15/29
Artemisia nova	
06	12/19
09	13/19
Artemisia tridentata vaseyana	
06	-/-
09	6/4
Ceratoides lanata	
06	-/-
09	7/12
Cercocarpus montanus	
06	37/31
09	11/11
Chrysothamnus depressus	
06	4/8
09	6/12
Chrysothamnus viscidiflorus viscidiflorus	
06	-/-
09	10/12
Eriogonum microthecum	
06	-/-
09	1/4
Gutierrezia sarothrae	
06	-/-
09	8/10
Juniperus osteosperma	
06	-/-
09	-/-
Kochia prostrata	
06	-/-
09	8/14
Leptodactylon pungens	
06	-/-
09	-/-
Pediocactus simpsonii	
06	1/2
09	-/-
Pinus edulis	
06	-/-
09	-/-

Yr	Average Height Crown (in)
Pseudotsuga menziesii	
06	-/-
09	-/-
Purshia tridentata	
06	16/31
09	15/39
Quercus gambelii	
06	27/29
09	-/-
Symphoricarpos oreophilus	
06	11/17
09	30/50

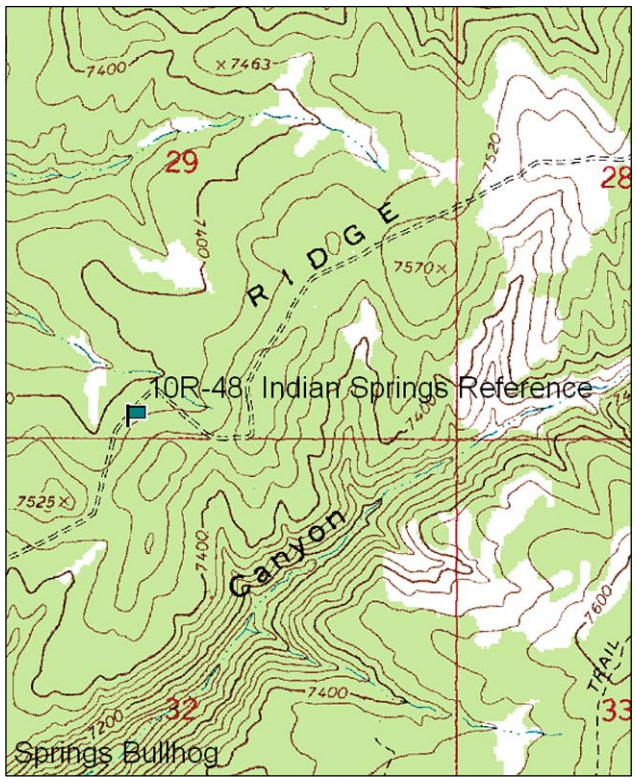
INDIAN SPRINGS REFERENCE WRI, 10R-48

Vegetation Type: Pinyon/Juniper/Mountain Brush
Range Type: Substantial deer summer; crucial elk winter
NRCS Ecological Site Description: Upland Shallow Loam (Pinyon-Utah Juniper), R034XY322UT
Land Ownership: BLM
Elevation: 7,382 ft. (2,250 m)
Aspect: north
Slope: 11%
Transect bearing: 72° magnetic
Belt placement: Read Baseline, No Belts. May need to replace 500' stake with half-high.

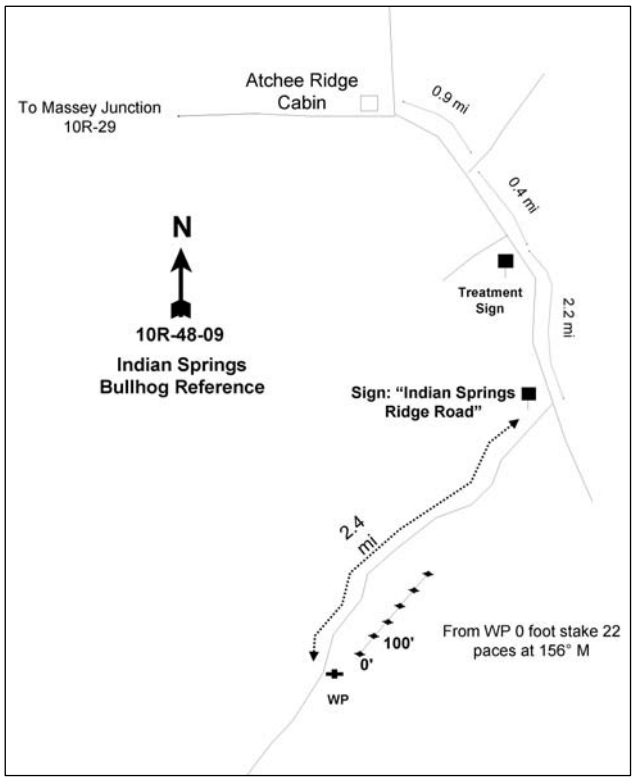
Directions:

From the Seep Ridge Road, about 10 miles north of Pine Spring, turn onto the Bitter Creek Road near McCoy Reservoir. Drive easterly 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". Drive 2.4 miles to a witness post on east side of the road. The 0' stake is located 22 paces away at 156°M.

Map Name: Burnt Timber Canyon



Diagrammatic Sketch:



Township: 13S Range: 25E Section: 29

GPS: NAD 83, UTM 12S 659265 E 4390661 N

INDIAN SPRINGS REFERENCE - WRI STUDY 10R-48
Project #362 Reference

Site Description

Site Information: This study was established as an untreated reference in companion to the Indian Springs Bullhog study, 10R-36. It was established in a pinyon-juniper and mountain shrub community approximately one mile northeast of 10R-36. Although more diverse in woody species, it is also in an area with a heavy overstory and a more limited understory. Pellet group data from 2009 estimated moderate deer use, heavy elk use and low cow use (Table - Pellet Group). Soil erosion condition was classified as stable in 2009.

Browse: Preferred browse species, and their respective percent of canopy cover, found on this site included: Utah serviceberry (*Amelanchier utahensis*) at 9%, true mountain mahogany (*Cercocarpus montanus*) at 8%, and mountain snowberry (*Symphoricarpos oreophilus*) 15%. Pinyon pine (*Pinus edulis*) cover was 43%, while Utah juniper (*Juniperus osteosperma*) cover was 8% (Table - Canopy Cover).

Herbaceous Understory: Two perennial grass species were sampled on this site, providing 2% cover. A sedge (*Carex sp.*) accounted for 94% of grass cover. Total forb cover was 5% with desert phlox (*Phlox austromontana*) was the dominant forb at 3% cover (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 10R, Study no: 48

Type	Species	Nested Frequency '09	Average Cover % '09
G	Carex sp.	52	1.64
G	Poa fendleriana	8	.10
Total for Annual Grasses		0	0
Total for Perennial Grasses		60	1.74
Total for Grasses		60	1.74
F	Collinsia parviflora (a)	3	.00
F	Comandra pallida	5	.06
F	Cryptantha sp.	7	.69
F	Penstemon sp.	10	.21
F	Phlox austromontana	84	3.26
F	Schoencrambe linifolia	4	.04
F	Stellaria jamesiana	22	.61
Total for Annual Forbs		3	0.00
Total for Perennial Forbs		132	4.88
Total for Forbs		135	4.89

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

CANOPY COVER, LINE INTERCEPT--
Management unit 10R, Study no: 48

Species	Percent Cover '09
Amelanchier utahensis	9.06
Cercocarpus montanus	7.73
Juniperus osteosperma	7.81
Mahonia repens	.06
Pachistima myrsinites	3.21
Pediocactus sp.	.41
Pinus edulis	42.76
Quercus gambelii	1.28
Symphoricarpos oreophilus	15.05

POINT-QUARTER TREE DATA--
Management unit 10R, Study no: 48

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	36	6.9
Juniperus scopulorum	7	6.9
Pinus edulis	271	6.2

BASIC COVER--
Management unit 10R, Study no: 48

Cover Type	Average Cover % '09
Vegetation	27.22
Rock	1.58
Pavement	.97
Litter	78.80
Cryptogams	1.77
Bare Ground	6.28

PELLET GROUP DATA--
Management unit 10R, Study no: 48

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	2	-
Elk	10	49 (121)
Deer	5	29 (73)
Cattle	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 10R, Study no: 48

Yr	Average Height Crown (in)
Amelanchier utahensis	
09	49/34
Artemisia tridentata vaseyana	
09	40/55
Cercocarpus montanus	
09	49/46
Chrysothamnus nauseosus	
09	43/43
Chrysothamnus viscidiflorus stenophyllus	
09	19/30
Mahonia repens	
09	4/9
Pachistima myrsinites	
09	2/4
Pediocactus sp.	
09	3/24
Purshia tridentata	
09	15/35
Quercus gambelii	
09	16/22
Symphoricarpos oreophilus	
09	14/22

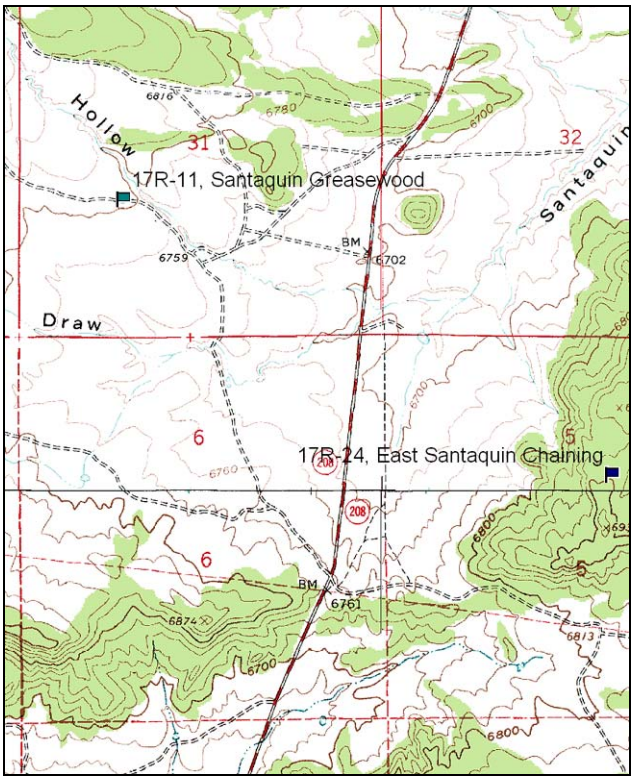
SANTAQUIN GREASEWOOD WRI, 17R-11

Vegetation Type: Black greasewood, Basin big sagebrush
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6,810 ft. (2,075 m)
Aspect: south
Slope: 3%
Transect bearing: 180° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

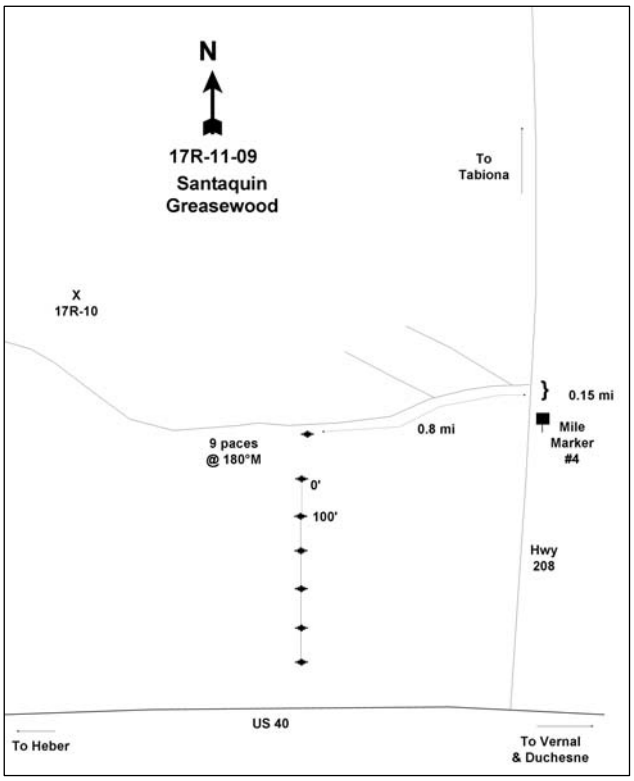
Directions:

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

Map Name: Tabiona



Diagrammatic Sketch:



Township: 2S Range: 7W Section: 31

GPS: NAD 83, UTM 12S 523637 E 4456731 N

SANTAQUIN GREASEWOOD - WRI STUDY 17R-11

Site Description

Site Information: The study monitors a chaining treatment of a greasewood (*Sarcobatus vermiculatus*) and big sagebrush (*Artemisia tridentata*) flat on the Tabby Mountain WMA. Areas within the WMA dominated by sagebrush, greasewood, pinyon pine (*Pinus edulis*), and Utah juniper (*Juniperus osteosperma*) were chained with a smooth chain in 2004. Sagebrush stands within Santaquin draw experienced a die off in 2002 and 2003 attributed to drought conditions. The goal of the chaining treatment was to remove greasewood and to open up the site to establish grasses, forbs, and preferred browse for wildlife winter range. The study site was established in July of 2004 and was chained later that fall. The treatment area was first seeded, chained, then another seed mix including sagebrush and forage kochia (*Kochia prostrata*) was flown onto the treatment. Pellet group data estimated deer use to be very high in 2004, moderate in 2007 and high in 2009. Elk use was moderate in 2004 and 2007 and low in 2009. Cattle use was low in all sample years (Table - Pellet Group Data). Soil erosion condition was classified as slight in 2004 due to pedestalling. Soil condition improved to stable in 2007 and 2009.

Browse: Black greasewood is the dominant shrub on the site and averaged 17% canopy cover since 2004. Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), with a few Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), are the dominant preferred browse species, averaging 6% canopy cover since 2004 (Table - Canopy Cover). Other species found on site include: shadscale (*Atriplex confertifolia*), winterfat (*Ceratoides lanata*) and forage kochia (*Kochia prostrata*).

Herbaceous Understory: Ten perennial and one annual grass species have been sampled across all years. Grasses provided 6% cover in 2007 and 2009, up from 2% in 2004. Western wheatgrass (*Agropyron smithii*), Russian wildrye (*Elymus junceus*) and Sandberg bluegrass (*Poa secunda*) accounted for 75% of grass cover in 2009. Cheatgrass (*Bromus tectorum*) was present, but scarce. Forbs are moderately diverse, but annuals are common. Forb cover has averaged 3% across all sampling years (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Basin big sagebrush had a 28% increase in canopy cover while greasewood increased 33% in canopy cover. The density of basin big sagebrush increased by 42%, with a large increase in the recruitment of young plants. Decadence of sagebrush decreased from 85% to 29% and plants displaying poor vigor decreased from 64% to 27%. This was a greasewood control project, but a reduction in greasewood was not seen.

Grass: Sum of nested frequency of perennial grasses increased nearly three-fold and perennial grass cover increased from 2% to 6%. Three seeded species were sampled in low frequency and cover in 2007, following the treatment; crested wheatgrass (*Agropyron cristatum*), Siberian wheatgrass, and Russian wildrye.

Forb: Sum of nested frequency for perennial forbs increased substantially and cover increased from near 0% to 2%. Weedy annual forb species had dominated the site prior to treatment but saw a 13% decrease in sum of nested frequency and cover decreased from 3% to 2%.

Trend Assessments

Browse

- **2007 to 2009 - stable (0):** Basin big sagebrush and greasewood canopy cover remained similar to past years for both species.

Grass

- **2007 to 2009 - stable (0):** Sum of nested frequency of perennial grasses had little change and cover is still 6%. There was a slight change in composition as there was a significant decrease in the nested frequency of Russian wildrye and a significant increase in crested wheatgrass. Siberian wheatgrass may have been misidentified as bluebunch wheatgrass. No cheatgrass was sampled this year.

Forb

- **2007 to 2009 - up (+2):** Sum of nested frequency of perennial forbs increased 26% while that of weedy annual forbs decreased 85%.

Seed mix

Project name: Santaquin Greasewood

WRI Database #: PDB	Size (acre):	380		Size (acre):	40
Mix lot #: m-ner-mh-sg-05			Mix Lot #: m-ner-mh-sgs-05		
Seed type	lbs in mix	lbs/acre	Seed type	lbs in mix	lbs/acre
Great Basin Wildrye 'Trailhead'	750	1.97	Sagebrush, Wyoming--Sanpete UT	40	1.00
Alfalfa 'Ladak+'	200	0.53	Sainfoin	40	1.00
Thickspike Wheatgrass 'Critana'	750	1.97	Alfalfa 'Ladak+'	20	0.50
Sainfoin	400	1.05	BULK POUNDS PER ACRE:		0.26
Russian Wildrye 'Bozoisky'	750	1.97	PLS POUNDS PER ACRE:		1.71
Fourwing Saltbush--Juab UT	300	0.79			
Siberian Wheatgrass 'Vavilov'	400	1.05			
BULK POUNDS PER ACRE:		9.34			
PLS POUNDS PER ACRE:		8.39			

HERBACEOUS TRENDS--
Management unit 17R, Study no: 11

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'09	'04	'07	'09
G	Agropyron cristatum	-	a3	b49	-	.15	2.74
G	Agropyron fragile	-	4	-	-	.15	-
G	Agropyron smithii	31	36	19	1.12	1.27	.28
G	Agropyron spicatum	-	-	a20	-	-	.40
G	Bromus tectorum (a)	2	7	-	.00	.01	-
G	Elymus cinereus	-	-	1	-	-	.03
G	Elymus junceus	-	b35	a10	-	1.56	.47
G	Oryzopsis hymenoides	-	12	7	-	.71	.10
G	Poa secunda	a35	b78	ab65	.46	1.41	2.03
G	Sitanion hystrix	a1	b16	ab13	.03	.34	.20
G	Stipa comata	-	5	-	-	.01	-
Total for Annual Grasses		2	7	0	0.00	0.01	0
Total for Perennial Grasses		67	189	184	1.63	5.62	6.26
Total for Grasses		69	196	184	1.63	5.63	6.26
F	Alyssum alyssoides (a)	-	1	1	-	.01	.03
F	Arabis sp.	-	a10	-	-	.03	-
F	Chenopodium album (a)	b27	-	a4	.17	-	.01
F	Chenopodium leptophyllum(a)	b111	a18	a39	1.00	.04	.18
F	Collinsia parviflora (a)	5	-	-	.03	-	-
F	Descurainia pinnata (a)	a199	b242	-	1.87	1.23	-
F	Erigeron sp.	a8	b78	b102	.04	2.00	.97

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'09	'04	'07	'09
F	Gilia sp. (a)	3	-	-	.01	-	-
F	Lappula occidentalis (a)	$_{a}$13	$_{b}$48	-	.08	.22	-
F	Linum lewisii	-	3	4	-	.16	.09
F	Phlox longifolia	1	6	2	.00	.01	.03
F	Schoencrambe linifolia	-	$_{a}$11	$_{b}$27	-	.07	.11
F	Sphaeralcea coccinea	-	2	4	-	.00	.01
Total for Annual Forbs		358	309	44	3.18	1.50	0.22
Total for Perennial Forbs		9	110	139	0.05	2.29	1.22
Total for Forbs		367	419	183	3.23	3.80	1.45

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

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 11

Species	Percent Cover		
	'04	'07	'09
Artemisia tridentata tridentata	4.41	5.66	6.50
Artemisia tridentata wyomingensis	-	-	.50
Atriplex confertifolia	.30	.30	.23
Kochia prostrata	-	-	.06
Opuntia sp.	.38	.65	1.18
Sarcobatus vermiculatus	13.98	18.64	18.61

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

Species	Average leader growth (in)		
	'04	'07	'09
Artemisia tridentata tridentata	2.2	1.3	-

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

Cover Type	Average Cover %		
	'04	'07	'09
Vegetation	25.38	25.39	32.08
Rock	.38	.00	.00
Pavement	.16	.08	.00
Litter	44.01	50.01	55.73
Cryptogams	10.02	3.75	.98
Bare Ground	35.42	34.75	27.12

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

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

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

Type	Quadrat Frequency		
	'04	'07	'09
Rabbit	13	42	35
Grouse	-	2	-
Elk	7	17	12
Deer	49	33	27
Cattle	-	-	2

Days use per acre (ha)		
'04	'07	'09
-	-	-
-	-	-
27 (68)	29 (71)	48 (117)
236 (584)	27 (68)	11 (26)
1 (2)	1 (2)	7 (16)

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

Yr	Average Height Crown (in)
Artemisia tridentata tridentata	
04	27/29
07	17/22
09	15/16
Artemisia tridentata wyomingensis	
04	18/37
07	-/-
09	11/13
Atriplex confertifolia	
04	13/19
07	10/16
09	11/17
Ceratoides lanata	
04	-/-
07	-/-
09	-/-
Echinocactus sp.	
04	-/-
07	-/-
09	1/3
Kochia prostrata	
04	-/-
07	5/6
09	4/6
Opuntia sp.	
04	5/12
07	4/10
09	5/9
Sarcobatus vermiculatus	
04	32/50
07	34/50
09	33/45

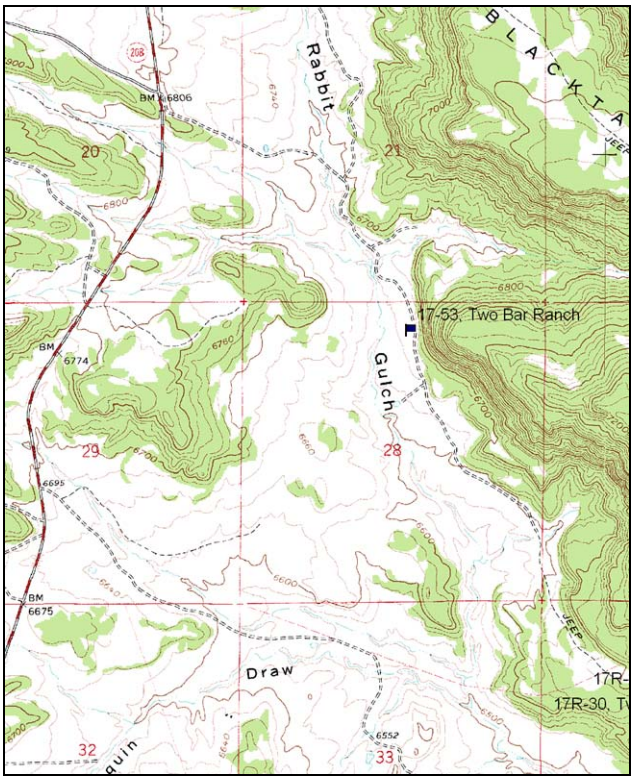
TWO BAR RANCH WRI, 17-53

Vegetation Type: Wyoming big sagebrush
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6,665 ft. (2,011 m)
Aspect: west
Slope: 5%
Transect bearing: 345° magnetic
Belt placement: line 1 (9ft and 85ft), line 2 (26ft), line 3 (45ft), line 4 (60ft)

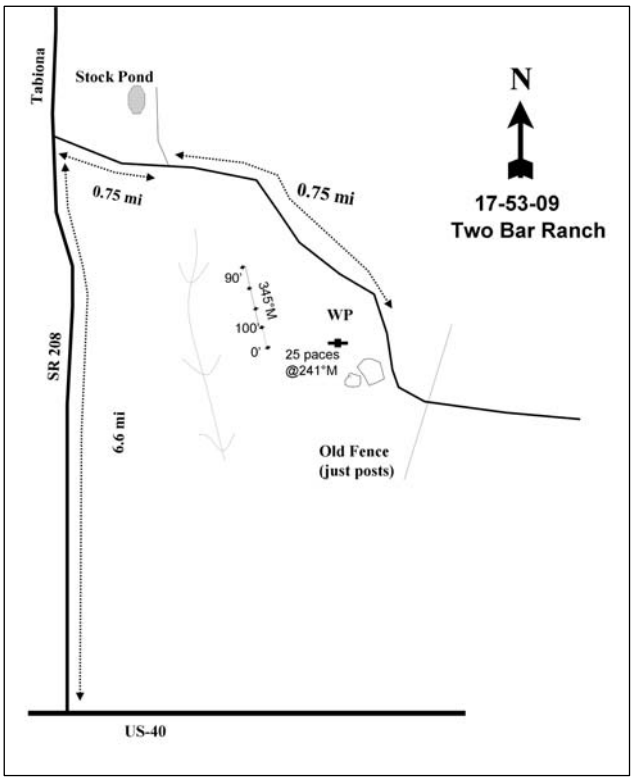
Directions:

From U.S. 40 five miles east of Fruitland, take Rt. 208 north towards Tabiona for 6.6 miles. Just after a small road cut, there is a road to the right. Turn right towards Rabbit Gulch and go 0.75 miles to an intersection. Turn right (south) and go another 0.75 miles down a gully-ridden road to two large rocks on the west side of the road. From the highest point of the first rock, the 0' stake is 25 paces away at 241°M.

Map Name: Tabiona



Diagrammatic Sketch:



Township: 2S Range: 7W Section: 28

GPS: NAD 83, UTM 12S 527287 E 4459012 N

TWO BAR RANCH WRI, 17-53
17R-11 Reference

Site Description

Site Information: This site is a regular range trend study that was read as a reference site in companion to Santaquin Greasewood study, 17R-11, in 2009. The Two Bar Ranch study is located on the upper part of Rabbit Gulch near the base of Blacktail Ridge. This is the lowest elevation for a trend study on the unit. Thermal and escape cover for big game is limited within the sagebrush flat, but good cover is available in the pinyon-juniper woodland along the ridge east of the site. Pellet group data estimated deer and elk use to be moderate or high in all years while cow use has remained low (Table - Pellet Group Data). Soil erosion condition was classified as moderate in 2005 due to pedestalling, soil and litter movement, and rill and gully formation with two large gullies on site. In 2009, the site was rated as stable with grasses growing within the two gullies and no recent soil movement.

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the key browse species. Shadscale (*Atriplex confertifolia*) and black greasewood (*Sarcobatus vermiculatus*) are also present. There was a large decrease in the cover of Wyoming big sagebrush between 2000 and 2005. There has been a steady increase in shadscale and greasewood cover since 1995 (Table - Browse Trends). There was a large die-off of sagebrush between the 2000 and 2005 sample years. Decadence and poor vigor of sagebrush both increased substantially over that period (Table - Browse Characteristics). This decrease in sagebrush is attributed to drier than normal conditions in the years prior to the 2005 sampling. Density measurements were not taken in 2009. Several other preferred browse species that occur on the site in low density are winterfat (*Ceratoides lanata*) and dwarf rabbitbrush (*Chrysothamnus depressus*).

Herbaceous Understory: Seven perennial grass species have been sampled over the history of this study, as has the annual species cheatgrass (*Bromus tectorum*). Perennial grass cover has steadily increased from 7% in 1995 to 15% in 2009. Thickspike wheatgrass (*Agropyron dasystachyum*), Indian ricegrass (*Oryzopsis hymenoides*) and needle and thread (*Stipa comata*) dominate the grass community providing nearly all of the grass cover since 1995. Needle and thread is the most common grass and has steadily increased in nested frequency and cover since 1995. Forbs have fluctuated in frequency and cover over the sample years, but are a small part of the system. Weedy annual forb species are common and tend to inflate forb cover and nested frequency during some years. Scarlet globemallow (*Sphaeralcea coccinea*) is the most common perennial forb on the site (Table - Herbaceous Trends).

Trend Assessments

Browse

- **1982 to 1988 - up (+2):** The number of young Wyoming big sagebrush plants/acre increased combined with a stable mature population.
- **1988 to 1995 - stable (0):** Differences in density may be related to the larger sample area used in 1995; therefore, trend was determined using other parameters. There was little change in the decadence or vigor of the Wyoming big sagebrush population. Recruitment of young Wyoming big sagebrush plants decreased, but remained good.
- **1995 to 2000 - stable (0):** Wyoming big sagebrush density remained similar to past years, although decadence has increased from 15% to 33%. Recruitment of young Wyoming big sagebrush plants continued to decrease, but is still adequate11% of the population.
- **2000 to 2005 - down (-2):** Wyoming big sagebrush density declined 55% and has few young in the population. The cover of sagebrush decreased from 13% to 4%. Decadence in sagebrush increased from 33% to 62% and poor vigor increased from 16% to 56%. Shadscale density decreased 34% as well, but cover increased slightly.

- **2005 to 2009 - stable (0):** Density was not estimated this year, as it was read as a watershed reference study. Wyoming big sagebrush quadrat and canopy cover measurements decreased slightly, but were similar. Shadscale cover measurements were similar to the last reading.

Grass

- **1982 to 1988 - stable (0):** Perennial grass nested frequency increased slightly but is still a minor component of the community.
- **1988 to 1995 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 18% and grasses overall provide 7% cover. There was a significant increase in the nested frequency of thickspike wheatgrass and a significant decrease in sedge (*Carex sp.*).
- **1995 to 2000 - stable (0):** The sum of nested frequency of perennial grasses is similar to the last reading while cover has increased from 7% to 10%. There was a significant increase in the nested frequency of needle-and-thread.
- **2000 to 2005 - down (-2):** The sum of nested frequency of perennial grasses declined 23%, though cover increased to 12%. There was a significant decrease in the nested frequency of thickspike wheatgrass and a significant increase in sedge.
- **2005 to 2009 - up (+2):** The sum of nested frequency for perennial grasses increased 25%and cover increased from to 15%. Thickspike wheatgrass increased significantly in nested frequency and sedge decreased significantly.

Forb

- **1982 to 1988 - stable (0):** Nested frequency is down slightly, but is a very minor component of the community.
- **1988 to 1995 - up (+2):** The sum of nested frequency of perennial forbs increased three-fold, however, forbs are still a minor component of the system providing only 1% cover.
- **1995 to 2000 - down (-2):** Nested frequency decreased by more than half. Forbs are still a minor component of the system and fluctuations are not too drastic.
- **2000 to 2005 - up (+2):** Nested frequency of perennial forbs increased more than double, and cover is at 3%, the highest value of any sample year. There was a significant increase in the nested frequency of scarlet globemallow.
- **2005 to 2009 - down (-2):** Following the pattern of rising and falling nested frequencies perennial forb sum of nested frequency declined 41%. Weedy annual forbs have declined 91% in nested frequency as well.

HERBACEOUS TRENDS--
Management unit 17, Study no: 53

Type	Species	Nested Frequency					Average Cover %			
		'88	'95	'00	'05	'09	'95	'00	'05	'09
G	Agropyron cristatum	-	-	-	-	2	-	-	-	.00
G	Agropyron dasystachyum	$_{b}$132	$_{c}$173	$_{bc}$156	$_{a}$62	$_{b}$119	2.55	3.42	1.81	2.72
G	Bromus tectorum (a)	-	1	-	-	2	.00	-	-	.03
G	Carex sp.	$_{d}$73	$_{bc}$38	$_{b}$15	$_{cd}$43	-	.23	.18	.46	-
G	Oryzopsis hymenoides	40	65	31	39	61	1.10	.87	1.62	2.13
G	Sitanion hystrix	29	29	49	23	29	1.33	1.10	1.16	.92
G	Sporobolus cryptandrus	-	2	-	-	-	.00	-	-	-
G	Stipa comata	$_{a}$29	$_{a}$51	$_{b}$103	$_{b}$106	$_{b}$129	1.82	4.39	6.96	9.59
Total for Annual Grasses		0	1	0	0	2	0.00	0	0	0.03
Total for Perennial Grasses		303	358	354	273	340	7.06	9.97	12.02	15.37
Total for Grasses		303	359	354	273	342	7.07	9.97	12.02	15.40

Type	Species	Nested Frequency					Average Cover %			
		'88	'95	'00	'05	'09	'95	'00	'05	'09
F	Alyssum alyssoides (a)	-	-	-	-	1	-	-	-	.03
F	Arabis sp.	-	7	3	5	-	.04	.00	.01	-
F	Astragalus convallarius	-	-	-	4	-	-	-	.01	-
F	Chenopodium fremontii (a)	-	3	-	6	-	.01	-	.01	-
F	Chenopodium leptophyllum(a)	-	$_{ab}$6	-	$_{b}$18	$_{a}$4	.02	-	.05	.01
F	Collinsia parviflora (a)	-	-	-	1	-	-	-	.00	-
F	Descurainia pinnata (a)	-	$_{a}$1	$_{a}$1	$_{b}$49	-	.00	.00	.60	-
F	Draba sp. (a)	-	3	-	-	-	.00	-	-	-
F	Eriogonum cernuum (a)	-	2	-	8	-	.01	-	.02	-
F	Lappula occidentalis (a)	-	$_{ab}$16	-	$_{b}$112	$_{a}$9	.03	-	2.67	.16
F	Lepidium sp. (a)	-	$_{b}$24	-	$_{a}$5	-	.12	-	.04	-
F	Lychnis drummondii drummondii	1	-	-	-	-	-	-	-	-
F	Machaeranthera canescens	$_{a}$6	$_{b}$32	$_{a}$1	$_{a}$4	-	.22	.03	.06	-
F	Phlox longifolia	$_{a}$3	$_{c}$81	$_{a}$7	$_{b}$43	$_{a}$8	.21	.06	.28	.04
F	Plantago patagonica (a)	-	$_{ab}$9	-	$_{b}$18	$_{a}$5	.07	-	.06	.04
F	Schoencrambe linifolia	2	10	1	3	6	.03	.03	.00	.06
F	Sphaeralcea coccinea	$_{a}$52	$_{a}$65	$_{a}$62	$_{b}$103	$_{ab}$83	.45	.50	2.71	1.68
F	Townsendia incana	-	1	-	2	-	.03	-	.03	-
Total for Annual Forbs		0	64	1	217	19	0.28	0.00	3.46	0.24
Total for Perennial Forbs		64	196	74	164	97	0.99	0.62	3.12	1.78
Total for Forbs		64	260	75	381	116	1.28	0.63	6.59	2.03

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

BROWSE TRENDS--
Management unit 17, Study no: 53

Type	Species	Average Cover %			
		'95	'00	'05	'09
B	Artemisia tridentata wyomingensis	11.23	13.25	4.33	3.55
B	Atriplex confertifolia	2.59	4.47	6.48	6.50
B	Ceratoides lanata	-	-	.00	.03
B	Chrysothamnus depressus	-	-	.03	-
B	Chrysothamnus viscidiflorus viscidiflorus	-	-	.00	-
B	Leptodactylon pungens	-	-	-	.00
B	Opuntia sp.	1.10	.97	1.02	1.86
B	Pediocactus simpsonii	-	-	.00	-
B	Pinus edulis	.15	.38	.38	.63
B	Sarcobatus vermiculatus	1.28	1.25	3.28	4.39
B	Tetradymia canescens	-	-	-	.00
B	Tetradymia spinosa	.00	-	-	-
Total for Browse		16.36	20.32	15.55	16.98

CANOPY COVER, LINE INTERCEPT--
Management unit 17, Study no: 53

Species	Percent Cover				
	'88	'95	'00	'05	'09
Artemisia tridentata wyomingensis	-	-	-	4.13	3.70
Atriplex confertifolia	-	-	-	7.80	8.80
Ceratoides lanata	-	-	-	.13	.08
Juniperus osteosperma	-	-	-	.50	-
Opuntia sp.	-	-	-	.93	.80
Pinus edulis	-	-	-	-	.71
Sarcobatus vermiculatus	-	-	-	4.09	4.88

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17, Study no: 53

Species	Average leader growth (in)	
	'05	'09
Artemisia tridentata wyomingensis	2.9	-

POINT-QUARTER TREE DATA--
Management unit 17, Study no: 53

Species	Trees per Acre			Average diameter (in)		
	'00	'05	'09	'00	'05	'09
Juniperus osteosperma	-	-	<18	-	-	0.59
Pinus edulis	-	-	<18	-	-	1.48

BASIC COVER--
Management unit 17, Study no: 53

Cover Type	Average Cover %				
	'88	'95	'00	'05	'09
Vegetation	2.00	26.45	30.25	28.32	37.82
Rock	0	.06	0	.01	0
Pavement	0	.12	0	.07	.07
Litter	0	29.09	27.65	34.43	42.28
Cryptogams	0	15.82	0	11.37	5.11
Bare Ground	0	33.79	0	43.01	29.33

SOIL ANALYSIS DATA --
Management unit 17, Study no: 53, Study Name: Two Bar Ranch

Effective rooting depth (in)	pH	sandy clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
15.4	7.7	52.6	24.8	22.6	1.2	1.5	92.8	0.5

PELLET GROUP DATA--
Management unit 17, Study no: 53

Type	Quadrat Frequency				
	'88	'95	'00	'05	'09
Rabbit	-	2	3	18	24
Elk	-	17	11	18	19
Deer	-	28	9	28	28
Cattle	-	-	-	-	

Days use per acre (ha)		
'00	'05	'09
-	-	-
35 (86)	17 (43)	64 (159)
39 (93)	23 (57)	23 (58)
-	1 (2)	2 (4)

BROWSE CHARACTERISTICS--
Management unit 17, Study no: 53

Yr	Average Height Crown (in)
Artemisia nova	
88	-/-
95	11/23
00	-/-
05	-/-
09	-/-
Artemisia tridentata tridentata	
88	-/-
95	-/-
00	-/-
05	-/-
09	15/18
Artemisia tridentata wyomingensis	
88	22/21
95	21/30
00	17/25
05	17/23
09	15/19
Atriplex confertifolia	
88	10/10
95	12/19
00	8/15
05	14/22
09	12/23
Ceratoides lanata	
88	-/-
95	6/7
00	-/-
05	13/14
09	9/11

Yr	Average Height Crown (in)
Chrysothamnus viscidiflorus viscidiflorus	
88	-/-
95	10/4
00	9/18
05	14/23
09	11/17
Opuntia sp.	
88	4/3
95	5/15
00	4/9
05	5/15
09	5/15
Pediocactus simpsonii	
88	-/-
95	-/-
00	-/-
05	0/1
09	-/-
Pinus edulis	
88	-/-
95	-/-
00	-/-
05	-/-
09	-/-
Sarcobatus vermiculatus	
88	39/27
95	47/38
00	29/37
05	28/43
09	28/38
Tetradymia canescens	
88	-/-
95	-/-
00	-/-
05	7/11
09	17/14

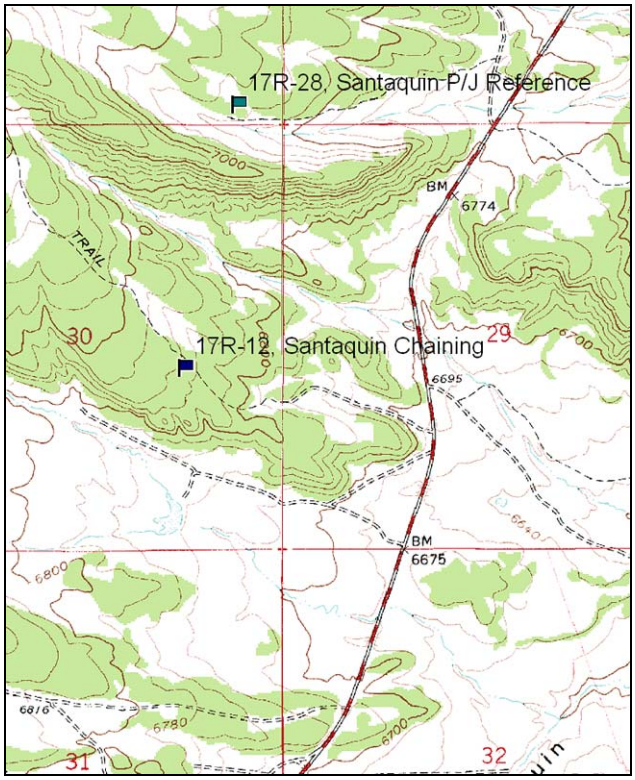
SANTAQUIN CHAINING WRI, 17R-12

Vegetation Type: Pinyon/Juniper
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6,870 ft. (2,076 m)
Aspect: east
Slope: 2%-3%
Transect bearing: 294° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

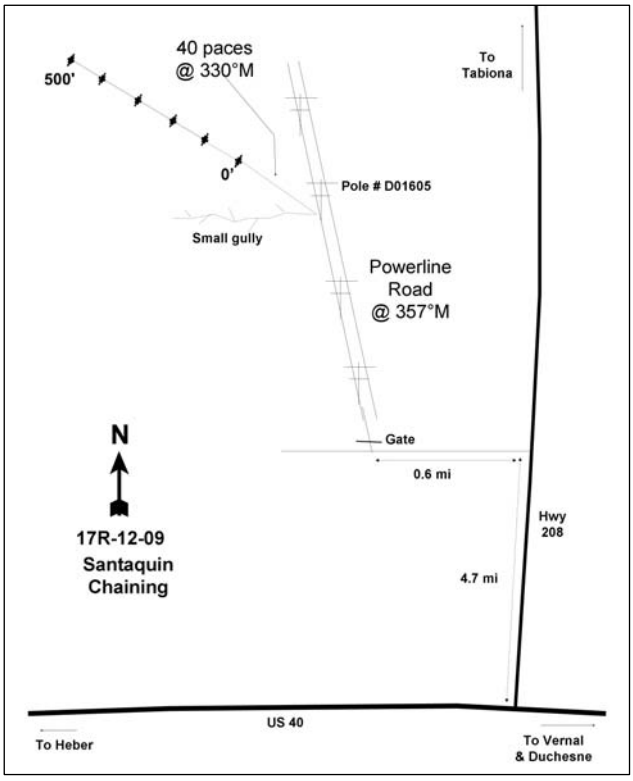
Directions:

From US 40 turn north on Highway 208. Travel 4.7 miles north to a road that comes in from the left (west). Turn here and drive 0.6 miles to the power line road that comes in from the right. Turn here, pass through the gate and travel on this road at 357°M to pole #D01605. The 0-foot stake is 40 paces from this pole at 330°M, and is marked with browse tag #136.

Map Name: Tabiona



Diagrammatic Sketch:



Township: 2S Range: 7W Section: 30

GPS: NAD 83, UTM 12S 524346 E 4458437 N

SANTAQUIN CHAINING - WRI STUDY 17R-12

Site Description

Site Information: This trend study monitors a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining treatment north of Santaquin Draw, on the Tabby Mountain Wildlife Management Area. The trend study was established in September 2004 prior to the chaining treatment that took place about a month later in October 2004. Prior to the treatment this area was dominated by pinyon and juniper woodlands and the chaining treated about 300 acres of a pinyon-juniper covered ridge. The treatment area was first seeded with grasses, then 2-way chained with a 60 lb link Ely chain. Following the chaining another seed mix including Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and forage kochia (*Kochia prostrata*) was flown onto the treatment. Pellet group data estimated that deer use has increased from moderate to high from 2004 to 2009, while elk use increased from moderate to very heavy in the same time period (Table - Pellet Group Data). Soil erosion condition was classified as stable in all sample years.

Browse: Some black sagebrush (*Artemisia nova*) and Wyoming big sagebrush are present on the site but have provided an average of 2.5% canopy cover in all three sample years. Prior to treatment black and Wyoming sagebrush accounted for 19% of browse cover, after treatment they accounted for an average of 66% of browse cover (Table - Browse Trends). Prior to treatment, in 2004, pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) accounted for 46% canopy cover. After chaining, pinyon-juniper canopy cover was below 1% in both 2007 and 2009 (Table - Canopy Cover). Estimated densities for pinyon pine and Utah juniper decreased substantially in 2007, following the treatment, and continued to decrease in 2009 (Table - Point-Quarter Tree Data).

Herbaceous Understory: Perennial grasses have responded well to this treatment and have steadily increased in frequency and cover since 2004. Prior to the treatment in 2004, perennial grasses provided only 2% cover, but increased to 20% cover in 2009. The seeded species crested wheatgrass (*Agropyron cristatum*) and the native species Indian ricegrass (*Oryzopsis hymenoides*) are the most prevalent species on the site. Cheatgrass (*Bromus tectorum*) and rattail fescue (*Festuca myuros*) are the only annual grasses sampled and are found in small quantities. Other common grass species include thickspike wheatgrass (*Agropyron dasystachyum*), western wheatgrass (*A. smithii*), and bottlebrush squirreltail (*Sitanion hystrix*). Forbs have also responded positively to this treatment. Perennial forb cover has steadily increased from 2% in 2004 to 6% in 2009. The seeded species blue flax (*Linum lewisii*) was the dominant forb in 2009. Annual forbs have persisted in small quantities in each sample year.

Pre vs. Three Years Post Treatment

Browse: Black sagebrush has similar cover to the pretreatment condition, though density of black sagebrush decreased 63% from 3,440 plants/acre to 1,260 plants/acre. Decadence of black sagebrush decreased from 48% to 0% and poor vigor decreased from 25% to 5%. The seeded species, Wyoming big sagebrush, increased substantially in cover with most of the sampled plants being young plants. Pinyon and juniper canopy cover decreased to less than 1% and density of both species decreased from more than 200 trees/acre to 37 trees/acre for pinyon and 57 trees/acre for juniper in 2007.

Grass: Sum of nested frequency of perennial grasses increased 88% and cover increased from 2% to 10%. Seeded species that have established and are doing well include crested wheatgrass, orchardgrass (*Dactylis glomerata*), and Russian wildrye (*Elymus junceus*).

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

Trend Assessments

Browse

- **2007 to 2009 - stable (0):** Canopy cover was similar to 2007 levels for both black sagebrush and Wyoming big sagebrush. The area seems ready to improve as Wyoming big sagebrush establishes itself and begins to reproduce.

Grass

- **2007 to 2009 - up (+2):** Sum of nested frequency of perennial grasses increased 24% and cover increased from 10% to 20%. The seeded species, thickspike wheatgrass, was sampled for the first time in 2009.

Forb

- **2007 to 2009 - down (-2):** Sum of nested frequency of perennial forbs decreased 45%, though cover increased slightly from 5% to 6%. Much of the increase in cover came from a significant increase in the nested frequency of blue flax and a large increase in cover. Annual forbs are still a minor part of the system.

Seed mix

Project name: Santaquin Chaining

WRI Database #: PDB Size (acre): 1755

Mix lot #: m-ner-mh-sss-05

Seed type	lbs in mix	lbs/acre
Sagebrush, Wyoming--Sanpete UT	1325	0.75
Forage Kochia 'Immigrant'	800	0.46
Winterfat--Duchesne/Uintah UT	300	0.17
Sainfoin 'Eski'	1000	0.57
Alfalfa 'Ladak+'	1000	0.57
Sagebrush, Wyoming	140	0.08
BULK POUNDS PER ACRE:		2.60
PLS POUNDS PER ACRE:		

Size (acre): 40

Mix Lot #: m-ner-mh-sss-05

Seed type	lbs in mix	lbs/acre
Sagebrush, Wyoming--Sanpete UT	40	1.00
Sainfoin	40	1.00
Winterfat--Duchesne/Uintah UT	20	0.50
Alalfa 'Ladak+'	20	0.50
BULK POUNDS PER ACRE:		3.00
PLS POUNDS PER ACRE:		1.94

Size (acre): 305

Mix Lot #: m-ner-mh-spj-05

Seed type	lbs in mix	lbs/acre
Alfalfa 'Nomad'	100	0.33
Alalfa 'Ladak+'	250	0.82
Small Burnet 'Delar'	600	1.97
Sainfoin	300	0.98
Blue Flax 'Appar'	150	0.49
Thickspike Wheatgrass 'Critana'	350	1.15
Crested Wheatgrass 'Ephraim'	300	0.98
Russian Wildrye 'Bozoisky'	300	0.98
Orchardgrass 'Paiute'	300	0.98
Fourwing Saltbush--Juab UT	300	0.98
BULK POUNDS PER ACRE:		9.67
PLS POUNDS PER ACRE:		8.60

HERBACEOUS TRENDS--
Management unit 17R, Study no: 12

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'09	'04	'07	'09
G	Agropyron cristatum	-	$_{a}$93	$_{a}$110	-	2.36	6.22
G	Agropyron dasystachyum	-	-	$_{a}$48	-	-	1.77
G	Agropyron smithii	45	24	40	.21	.48	2.15
G	Agropyron spicatum	-	$_{b}$56	$_{a}$13	-	1.99	.65
G	Bouteloua gracilis	7	6	6	.03	.03	.18
G	Bromus tectorum (a)	$_{a}$1	$_{c}$62	$_{b}$40	.00	.53	.93
G	Carex sp.	9	19	11	.08	.22	.39
G	Dactylis glomerata	-	6	10	-	.28	.25
G	Elymus junceus	-	3	9	-	.15	.59
G	Festuca myuros (a)	-	1	-	-	.00	-
G	Oryzopsis hymenoides	52	43	60	.66	2.15	4.15
G	Poa secunda	19	17	24	.39	.14	.55
G	Sitanion hystrix	$_{a}$33	$_{b}$55	$_{b}$66	.24	1.79	2.97
G	Stipa comata	9	5	8	.48	.22	.18
Total for Annual Grasses		1	63	40	0.00	0.54	0.93
Total for Perennial Grasses		174	327	405	2.11	9.84	20.06
Total for Grasses		175	390	445	2.12	10.38	21.00
F	Arabis sp.	$_{b}$21	$_{a}$6	-	.06	.01	-
F	Astragalus convallarius	10	-	-	.04	-	-
F	Astragalus sp.	-	-	2	-	-	.03
F	Astragalus utahensis	-	$_{a}$5	$_{b}$19	-	.06	.75
F	Chaenactis douglasii	-	3	6	-	.00	.03
F	Chenopodium album (a)	-	$_{a}$2	$_{b}$20	-	.00	.65
F	Chenopodium leptophyllum(a)	-	-	2	-	-	.00
F	Chenopodium sp. (a)	2	1	-	.00	.03	-
F	Cryptantha sp.	1	12	-	.00	.07	-
F	Cymopterus sp.	11	7	1	.02	.04	.00
F	Descurainia pinnata (a)	$_{a}$4	$_{b}$17	$_{a}$6	.00	.03	.06
F	Erigeron eatonii	1	-	-	.00	-	-
F	Ipomopsis aggregata	4	4	-	.01	.00	-
F	Ipomopsis congesta	-	11	-	-	.19	-
F	Lactuca serriola	-	$_{a}$10	-	-	.08	-
F	Lappula occidentalis (a)	-	$_{b}$29	$_{a}$5	-	.61	.18
F	Linum lewisii	-	$_{a}$37	$_{b}$59	-	1.64	3.99
F	Machaeranthera canescens	3	-	3	.00	-	.00
F	Onobrychis viciaefolia	-	2	-	-	.03	-
F	Penstemon humilis	$_{b}$20	$_{a}$5	-	.48	.45	-
F	Penstemon sp.	-	-	5	-	-	.33
F	Phlox hoodii	19	17	11	.57	.31	.25
F	Polygonum douglasii (a)	5	-	-	.01	-	-
F	Sanguisorba minor	-	$_{a}$22	$_{a}$14	-	.50	.40
F	Schoencrambe linifolia	$_{a}$4	$_{b}$17	$_{ab}$13	.00	.06	.20
F	Senecio multilobatus	$_{b}$87	$_{b}$89	$_{a}$3	.53	1.75	.01

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'09	'04	'07	'09
F	Streptanthus cordatus	-	5	-	-	.03	-
F	Tragopogon dubius	-	-	1	-	-	.00
F	Trifolium sp.	11	3	4	.04	.01	.00
Total for Annual Forbs		11	49	33	0.02	0.68	0.90
Total for Perennial Forbs		192	255	141	1.79	5.27	6.03
Total for Forbs		203	304	174	1.81	5.95	6.93

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

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 12

Species	Percent Cover		
	'04	'07	'09
Artemisia nova	2.98	2.16	3.33
Artemisia tridentata wyomingensis	-	.63	1.06
Gutierrezia sarothrae	-	.11	.10
Juniperus osteosperma	18.50	.01	.13
Kochia prostrata	-	.01	-
Leptodactylon pungens	.23	-	.28
Opuntia fragilis	-	.13	-
Opuntia sp.	.13	.05	-
Pinus edulis	27.33	.40	.40

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 12

Species	Average leader growth (in)		
	'04	'07	'09
Artemisia nova	-	1.1	-
Artemisia tridentata wyomingensis		2.2	-

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

Species	Trees per Acre			Average diameter (in)		
	'04	'07	'09	'04	'07	'09
Juniperus osteosperma	235	37	16	9.6	3.7	2.4
Pinus edulis	208	57	20	4.7	1.3	1.5

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

Cover Type	Average Cover %		
	'04	'07	'09
Vegetation	13.21	22.37	33.31
Rock	2.91	4.47	4.05
Pavement	6.34	2.59	2.28
Litter	61.73	55.81	55.32
Cryptogams	7.78	.43	.15
Bare Ground	17.40	24.82	19.75

SOIL ANALYSIS DATA --
Management unit 17R, Study no: 12, Study Santaquin PJ Chaining

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
6.9	7.0	65.4	15.2	19.5	3.5	16.3	128.0	0.9

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

Type	Quadrat Frequency		
	'04	'07	'09
Rabbit	19	26	18
Elk	11	19	31
Deer	33	25	31
Cattle	-	1	-

Days use per acre (ha)		
'04	'07	'09
-	-	-
17 (41)	36 (89)	108 (266)
26 (64)	40 (98)	47 (116)
-	-	-

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

Yr	Average Height Crown (in)
Artemisia nova	
04	8/15
07	8/15
09	10/14
Artemisia tridentata wyomingensis	
04	-/-
07	14/14
09	13/12
Atriplex canescens	
04	-/-
07	21/16
09	17/16
Atriplex confertifolia	
04	-/-
07	-/-
09	15/13

Yr	Average Height Crown (in)
Ceratoides lanata	
04	-/-
07	8/9
09	6/8
Chrysothamnus depressus	
04	-/-
07	3/6
09	-/-
Chrysothamnus viscidiflorus stenophyllus	
04	-/-
07	13/22
09	-/-
Gutierrezia sarothrae	
04	7/7
07	6/8
09	7/10
Juniperus osteosperma	
04	-/-
07	-/-
09	-/-
Kochia prostrata	
04	-/-
07	7/8
09	8/8
Leptodactylon pungens	
04	5/7
07	4/7
09	4/8
Opuntia fragilis	
04	-/-
07	2/9
09	3/7
Opuntia sp.	
04	3/12
07	4/9
09	3/9
Pediocactus simpsonii	
04	1/3
07	-/-
09	-/-
Pinus edulis	
04	-/-
07	-/-
09	-/-

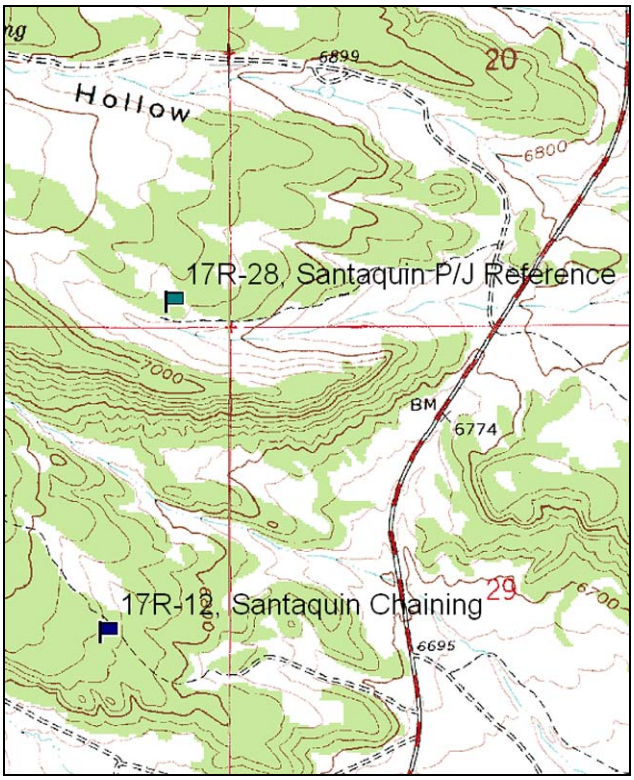
SANTAQUIN CHAINING REFERENCE WRI, 17R-28

Vegetation Type: Pinyon/Juniper
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6,890 ft. (2,100 m)
Aspect: southeast
Slope: 3%
Transect bearing: 68° magnetic
Belt placement: Read Baseline, No Belts

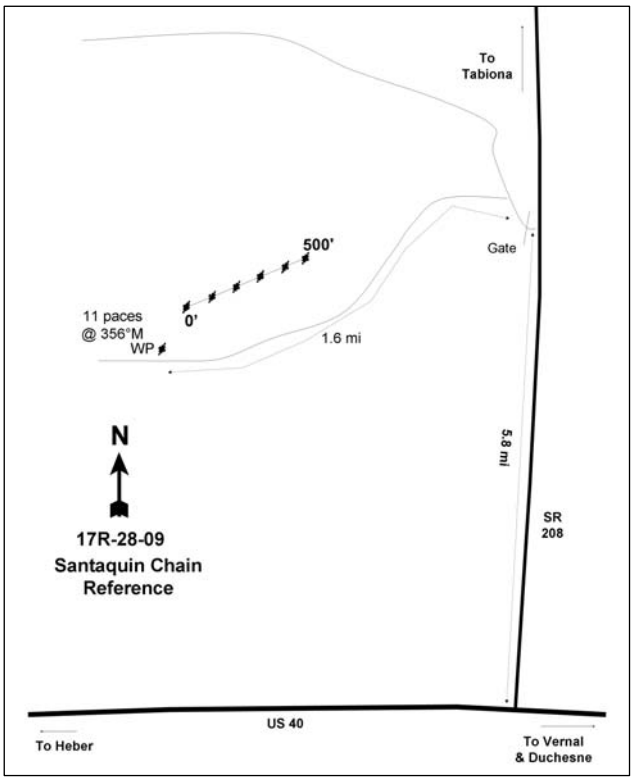
Directions:

From US 40 turn north on Highway 208. Travel 5.8 miles. On the left (west) is a gate. Travel through the gate and notice a two track to the left (south) just inside the gate. Go for another 1.6 miles to a witness post. The track is very faint in some areas; make sure you just follow the slope of the hill around to the south. From witness post the 0' stake is 11.5 paces at 356°M.

Map Name: Tabiona



Diagrammatic Sketch:



Township: 2S Range: 7W Section: 19

GPS: NAD 83, UTM 12S 524548 E 4459427 N

SANTAQUIN CHAINING REFERENCE - WRI STUDY 17R-28

Site Description

Site Information: This site was established as an untreated reference site in companion to the Santaquin Chaining study, 17R-12. The study is located in a pinyon-juniper stand north of the treatment area. Pellet group data from 2009 estimated heavy deer use and moderately heavy elk use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: The site is dominated by pinyon pine (*Pinus edulis*), which provides the majority of the canopy cover, with a large component of Utah juniper (*Juniperus osteosperma*) (Table - Canopy Cover). The closed canopy will probably continue to limit further browse development. The tree density was very high with an estimated 176 Utah juniper trees/acre and 223 pinyon pine trees/acre in 2009 (Table - Point-Quarter Tree Data). Most of the trees are mature with 60% of the pinyon trees sampled being over 12 feet tall. Black sagebrush (*Artemisia nova*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) are present, but combined provide only 1% canopy cover (Table - Canopy Cover).

Herbaceous Understory: As expected in a closed pinyon-juniper system the herbaceous understory is limited in both grasses and forbs. In 2009, grasses provided 1% cover while forbs provided less than 0.5% cover. Seven perennial grass species were sampled in 2009.

HERBACEOUS TRENDS--
Management unit 17R, Study no: 28

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	1	.00
G	Agropyron smithii	34	.16
G	Bouteloua gracilis	12	.21
G	Oryzopsis hymenoides	20	.40
G	Poa fendleriana	13	.19
G	Poa secunda	10	.07
G	Sitanion hystrix	10	.18
Total for Annual Grasses		0	0
Total for Perennial Grasses		100	1.23
Total for Grasses		100	1.23
F	Astragalus utahensis	6	.01
F	Chenopodium album (a)	3	.03
F	Cryptantha sp.	29	.09
F	Cymopterus sp.	8	.02
F	Erigeron sp.	2	.01
F	Ipomopsis congesta	3	.00
F	Penstemon sp.	11	.02
F	Penstemon sp.	3	.03
F	Phlox hoodii	11	.04
F	Phlox longifolia	4	.01
F	Salsola iberica (a)	4	.00
F	Schoencrambe linifolia	3	.00
F	Senecio multilobatus	8	.04
F	Sphaeralcea coccinea	2	.00

Type	Species	Nested Frequency '09	Average Cover % '09
F	Trifolium sp.	3	.01
Total for Annual Forbs		7	0.03
Total for Perennial Forbs		93	0.32
Total for Forbs		100	0.35

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

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 28

Species	Percent Cover '09
Artemisia nova	.30
Artemisia tridentata wyomingensis	.85
Gutierrezia sarothrae	.01
Juniperus osteosperma	7.76
Leptodactylon pungens	.13
Opuntia sp.	.26
Pinus edulis	27.83
Purshia tridentata	.65

POINT-QUARTER TREE DATA--
Management unit 17R, Study no: 28

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	176	4.4
Pinus edulis	223	8.3

BASIC COVER--
Management unit 17R, Study no: 28

Cover Type	Average Cover % '09
Vegetation	8.50
Rock	5.40
Pavement	6.44
Litter	69.80
Cryptogams	2.83
Bare Ground	16.49

PELLET GROUP DATA--
Management unit 17R, Study no: 28

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	8	-
Elk	7	34 (83)
Deer	15	53 (131)
Cattle	1	-

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 28

Yr	Average Height Crown (in)
Artemisia nova	
09	10/16
Artemisia tridentata wyomingensis	
09	17/24
Gutierrezia sarothrae	
09	7/5
Leptodactylon pungens	
09	3/8
Opuntia sp.	
09	5/13
Purshia tridentata	
09	20/56

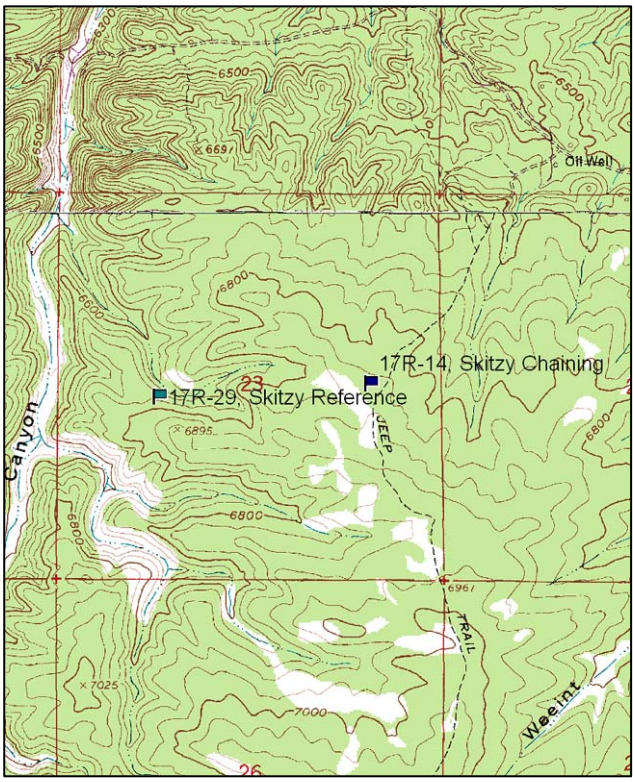
SKITZY CHAINING WRI, 17R-14

Vegetation Type: P/J chaining
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6,807 ft. (2,075 m)
Aspect: northwest
Slope: 11%-13%
Transect bearing: 5° magnetic
Belt placement: line 1 (11ft and 71ft), line 2 (34ft), line 3 (59ft), line 4 (95ft)

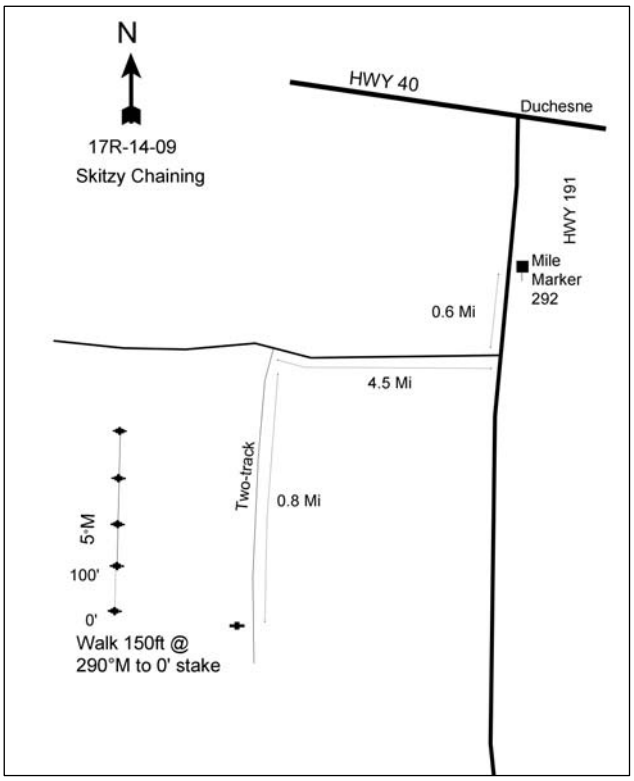
Directions:

From the junction of US 40 and US 191 in Duchesne, drive south on US 191 to mile marker 292. Drive 0.6 miles past the mile marker to a road on the right (west) side. Turn right and drive 4.5 miles to a two-track on the left (south) side of the road. Turn left and drive 0.8 miles to the witness post on the right (west) side of the road. From the witness post, walk 150 feet at 290°M to the 0' stake. The 0' stake is marked with browse tag #240.

Map Name: Buck Knoll



Diagrammatic Sketch:



Township: 4S Range: 6W Section: 23

GPS: NAD 83, UTM 12S 540496 E 4441001 N

SKITZY CHAINING - WRI STUDY 17R-14
Project #69

Site Description

Site Information: The study was established prior to a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining treatment on the Skitzy Canyon WMA, southwest of Duchesne, UT. The two-way chaining treated 730 acres of pinyon-juniper forest within the 5,245-acre Skitzy Canyon WMA. This project was proposed after biologists attributed the loss of one half to one third of the historic herd size to the loss of winter range to pinyon-juniper woodlands encroachment. The area was aerially seeded with grasses and forbs in October of 2005, prior to chaining in December and January of that winter. Approximately 100 acres of unchained pinyon-juniper islands were left unchained to provide protective cover. In February 2006, browse species were aerially seeded on the site. Pellet group data estimated elk use to be low in 2005, and high in 2008 and 2009, following the treatment. Deer use was low in all years and cattle use was low in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in all sample years.

Browse: Browse is sparse on this site. Prior to treatment in 2005, black sagebrush (*Artemisia nova*) was the preferred browse, although it provided less than 1% canopy cover. Since the chaining and seeding, forage kochia (*Kochia prostrata*) entered the system and sagebrush canopy cover has increased to 2%. There appears to have been an identification problem between the seeded species, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and black sagebrush in 2008, so these two species were combined in analysis. Prior to treatment, pinyon pine and Utah juniper provided high amounts of canopy cover and had dense populations. Post treatment, no canopy cover was provided by pinyon pine and juniper, and density was estimated to be less than 18 trees/acre for each species (Table - Canopy Cover, Table - Point-Quarter Tree Data).

Herbaceous Understory: Prior to treatment, perennial grasses provided 4% cover, with no one species providing over 1% cover. Post treatment, seeded grasses did very well and perennial grass cover increased to an average of 16% since 2008. Many native and seeded species are abundant including bottlebrush squirreltail (*Sitanion hystrix*), crested wheatgrass (*Agropyron cristatum*), thickspike wheatgrass (*A. dasystachyum*), and bluebunch wheatgrass (*A. spicatum*). Cheatgrass (*Bromus tectorum*) was the only annual grass species, but occurs infrequently. The forb community is diverse and perennial forbs are doing well, though they are not overly abundant. Forb cover has been consistently around 2%-3% in all sample years.

Pre vs. Two Years Post Treatment

Browse: Sagebrush canopy cover increased from less than 1% prior to treatment to 2% three years after treatment. The seeded species, forage kochia, provided 4% canopy cover in 2008. Pinyon-juniper trees were successfully removed by chaining and decreased in combined canopy cover from 28% prior to the treatment to 0% after treatment. Point-quarter density estimates of pinyon and juniper decreased from 185 tree/acre and 252 trees/acre, respectively, to less than 18 trees/acre for both species in 2008.

Grass: Grasses improved markedly following the treatment. The sum of nested frequency of perennial grasses increased 84% and cover increased four-fold from 4% to 17%. Two seeded species, crested wheatgrass and Russian wildrye were sampled in moderate density and cover. The seeded species thickspike wheatgrass increased markedly in cover, but was present prior to the treatment.

Forb: The sum of nested frequency of perennial forbs increased 22% and cover increased slightly. Three seeded species were sampled at low frequency and cover following the treatment; blue flax (*Linum lewisii*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*).

Trend Assessments

Browse

- **2008 to 2009 - stable (0):** Sagebrush cover changed little, though forage kochia decreased in canopy cover from 4% to 3%. As total browse canopy cover is still only around 5%, none of the changes were large.

Grass

- **2008 to 2009 - stable (0):** The sum of nested frequency of perennial grasses remained similar to 2008, though cover decreased slightly.

Forb

- **2008 to 2009 - down (-2):** The sum of nested frequency of perennial forbs decreased 23%. There was a corresponding decrease in cover of perennial forbs. There was a significant decrease in the nested frequency of the seeded species sainfoin.

Seed mix

Project name: Skitzy Chaining
WRI Database #: 69

Mix lot #: ner-mh-sp1-06	Size (acre):	700
Seed type	lbs in mix	lbs/acre
Crested Wheatgrass 'Ephraim'	700	1.00
Thickspike Wheatgrass 'Critana'	700	1.00
Orchardgrass 'Paiute'	350	0.50
Russian Wildrye 'Bozoisky'	700	1.00
Snake River Wheatgrass 'Secar'	350	0.50
Canby Bluegrass 'Canbar'	175	0.25
Blue Flax	175	0.25
Alfalfa 'Ladak+'	350	0.50
Sainfoin 'Eski'	1400	2.00
Small Burnet 'Delar'	1000	1.43
Small Burnet 'Delar'	400	0.57
Fourwing Saltbush--Emery UT	700	1.00
BULK POUNDS PER ACRE:		10.00
PLS POUNDS PER ACRE:		7.32

Mix Lot #: ner-mh-spj-06	Size (acre):	700
Seed type	lbs in mix	lbs/acre
Canby Bluegrass 'Canbar'	175	0.25
Alfalfa 'Ladak'	350	0.50
Sainfoin 'Eski'	1400	2.00
Small Burnet	1400	2.00
Blue Flax	175	0.25
Thickspike Wheatgrass 'Bannock'	700	1.00
Crested Wheatgrass 'Hycrest'	700	1.00
Russian Wildrye	700	1.00
Orchardgrass 'Paiute'	350	0.50
Fourwing Saltbush--Juab UT	500	0.71
Fourwing Saltbush--Sevier UT	200	0.29
Snake River Wheatgrass 'Secar'	350	0.50
BULK POUNDS PER ACRE:		10.00
PLS POUNDS PER ACRE:		8.73

Mix Lot #: ner-mh-sp2-06	Size (acre):	700
Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak+'	350	0.50
Sainfoin 'Eski'	700	1.00
Sagebrush, Wyoming--Sanpete UT	350	0.50
Whitestem Rubber Rabbitbrush-Sanpete	350	0.50
BULK POUNDS PER ACRE:		2.50
PLS POUNDS PER ACRE:		1.71

Mix Lot #: ner-mh-spjb-06	Size (acre):	700
Seed type	lbs in mix	lbs/acre
Sagebrush, Wyoming--Sanpete UT	700	1.00
Forage Kochia--Beaver UT	700	1.00
Whitestem Rubber Rabbitbrush-Sanpete	350	0.50
BULK POUNDS PER ACRE:		2.50
PLS POUNDS PER ACRE:		1.05

HERBACEOUS TRENDS--
Management unit 17R, Study no: 14

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'09	'05	'08	'09
G	Agropyron cristatum	-	a75	a78	-	2.88	2.48
G	Agropyron dasystachyum	a29	a63	b95	.47	2.75	5.00
G	Agropyron spicatum	b55	a22	a21	.91	1.62	1.39
G	Bouteloua gracilis	1	-	-	.03	-	-
G	Bromus tectorum (a)	a1	b34	b26	.00	.99	.44
G	Carex sp.	3	5	-	.15	.03	-
G	Elymus junceus	-	a10	a15	-	.46	.26
G	Elymus salina	a12	b21	a2	.45	1.52	.15
G	Oryzopsis hymenoides	8	10	15	.04	.44	.65
G	Poa fendleriana	9	18	8	.16	.30	.15
G	Poa secunda	46	63	39	.37	1.54	.59
G	Sitanion hystrix	a75	b156	b137	.84	4.57	3.58
G	Stipa comata	7	7	8	.56	.36	.56
Total for Annual Grasses		1	34	26	0.00	0.99	0.44
Total for Perennial Grasses		245	450	418	4.01	16.52	14.82
Total for Grasses		246	484	444	4.02	17.52	15.27
F	Androsace septentrionalis (a)	8	2	-	.04	.00	-
F	Antennaria rosea	-	3	-	-	.03	-
F	Arabis sp.	a56	-	-	.33	-	-
F	Arenaria sp.	-	6	-	-	.01	-
F	Astragalus convallarius	a2	b27	a14	.00	.25	.05
F	Astragalus sp.	-	1	.	-	.03	-
F	Astragalus utahensis	-	2	14	-	.00	.22
F	Calochortus nuttallii	-	3	-	-	.00	-
F	Castilleja linariaefolia	-	2	2	-	.03	.03
F	Chaenactis douglasii	8	2	7	.04	.03	.15
F	Chenopodium album (a)	b44	-	a6	.79	-	.30
F	Chenopodium fremontii (a)	-	a8	b20	-	.04	.21
F	Chenopodium leptophyllum(a)	9	12	7	.01	.18	.02
F	Cryptantha sp.	5	7	8	.01	.07	.30
F	Descurainia pinnata (a)	a18	-	-	.07	.01	-
F	Hedysarum boreale	37	28	31	1.82	1.08	.37
F	Ipomopsis aggregata	-	-	-	-	.00	-
F	Lactuca serriola	-	-	1	-	-	.00
F	Lappula occidentalis (a)	8	10	9	.04	.10	.03
F	Linum lewisii	-	5	5	-	.04	.03
F	Mentzelia albicaulis (a)	-	1	-	-	.00	-
F	Onobrychis viciaefolia	-	a12	-	-	.18	-
F	Penstemon sp.	10	6	14	.05	.07	.08
F	Phlox austromontana	12	4	3	.08	.04	.09
F	Phlox longifolia	ab11	b15	a2	.05	.06	.00
F	Salsola iberica (a)	-	1	-	-	.03	-
F	Sanguisorba minor	-	a24	a22	-	.71	.44

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'09	'05	'08	'09
F	Schoencrambe linifolia	$_{a}$7	$_{b}$35	$_{a}$19	.04	.49	.06
F	Townsendia sp.	3	3	-	.00	.03	-
Total for Annual Forbs		87	34	42	0.96	0.37	0.57
Total for Perennial Forbs		151	185	142	2.44	3.18	1.85
Total for Forbs		238	219	184	3.40	3.55	2.43

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

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 14

Species	Percent Cover		
	'05	'08	'09
Amelanchier utahensis	.38	-	-
Artemisia nova	.41	-	2.25
Artemisia tridentata wyomingensis	-	2.40	-
Chrysothamnus depressus	.01	-	-
Chrysothamnus viscidiflorus viscidiflorus	.33	.45	.35
Gutierrezia sarothrae	.10	.46	-
Juniperus osteosperma	12.23	-	-
Kochia prostrata	-	4.06	2.70
Opuntia sp.	.06	-	-
Pinus edulis	16.18	-	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 14

Species	Average leader growth (in)		
	'05	'08	'09
Artemisia nova	1.4	-	-

POINT-QUARTER TREE DATA--
Management unit 17R, Study no: 14

Species	Trees per Acre			Average diameter (in)		
	'05	'08	'09	'05	'08	'09
Juniperus osteosperma	252	26	22	12.0	1.9	2.7
Pinus edulis	185	21	<18	4.3	1.1	1.18

BASIC COVER--
Management unit 17R, Study no: 14

Cover Type	Average Cover %		
	'05	'08	'09
Vegetation	16.67	27.52	28.48
Rock	2.87	3.39	2.40
Pavement	22.13	12.96	16.58
Litter	47.67	59.82	54.54
Cryptogams	1.89	0	0
Bare Ground	21.44	6.61	6.15

SOIL ANALYSIS DATA --
Management unit 17R, Study no: 14, Study Name: Skitzy Chaining

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
7.5	7.4	44.0	37.4	18.6	6.4	19.2	131.2	1.3

PELLET GROUP DATA--
Management unit 17R, Study no: 14

Type	Quadrat Frequency		
	'05	'08	'09
Rabbit	31	33	9
Elk	4	28	23
Deer	2	10	17
Cattle			-

Days use per acre (ha)		
'05	'08	'09
-	-	-
16 (40)	42 (104)	75 (185)
14 (35)	6 (15)	11 (28)
-	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 14

Yr	Average Height Crown (in)
Amelanchier utahensis	
05	22/10
08	-/-
09	-/-
Artemisia nova	
05	12/25
08	10/24
09	8/12
Artemisia tridentata wyomingensis	
05	-/-
08	10/13
09	9/12
Atriplex canescens	
05	-/-
08	25/22
09	23/31

Chrysothamnus depressus	
05	7/7
08	7/13
09	5/11
Chrysothamnus nauseosus	
05	-/-
08	14/19
09	14/16
Chrysothamnus viscidiflorus viscidiflorus	
05	13/22
08	12/23
09	11/16
Ephedra viridis	
05	56/76
08	-/-
09	7/16
Gutierrezia sarothrae	
05	7/5
08	11/14
09	8/12
Kochia prostrata	
05	-/-
08	14/16
09	12/12
Opuntia sp.	
05	5/14
08	3/8
09	3/9

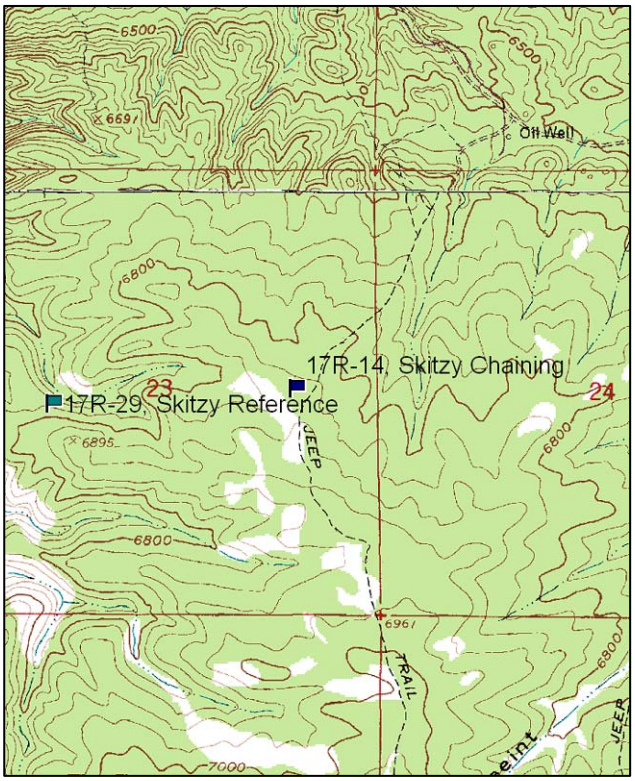
SKITZY CHAINING REFERENCE WRI, 17R-29

Vegetation Type: Pinyon/Juniper
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6,732 ft. (2,052 m)
Aspect: northwest
Slope: 3%-5%
Transect bearing: 314° magnetic
Belt placement: Read Baseline, No Belts

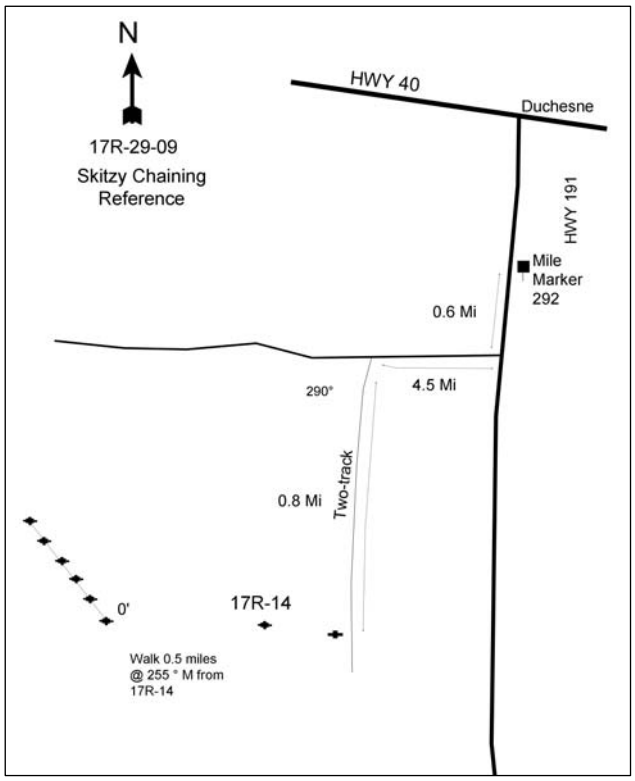
Directions:
To 17R-14:
From the junction of US 40 and US 191 in Duchesne, drive south on US 191 to mile marker 292. Drive 0.6 miles past the mile marker to a road on the right (west) side. Turn right and drive 4.5 miles to a two-track on the left (south) side of the road. Turn left and drive 0.8 miles to the witness post on the right (west) side of the road. From the witness post, walk 150 feet at 290°M to the 0' stake. The 0' stake is marked with browse tag #240.

From the 0' stake of 17R-14 17R-29 is 2,874 ft at 255°M. Continue on the road to 17R-14 just past a gully of trees on the west side of the road and walk from there, the site is off the rim a few hundred feet and stretches along a saddle. The 400' stake is not stable and a cairn of rocks was built to mark its place.

Map Name: Buck Knoll



Diagrammatic Sketch:



Township: 4S Range: 6W Section: 23

GPS: NAD 83, UTM 12S 539624 E 4440940 N

SKITZY CHAINING REFERENCE - WRI STUDY 17R-29

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to the Skitzy Chaining study, 17R-14. The study is located on a finger that points into Skitzy Canyon, just below the rim top where the treatment occurred. As such, it is located in a pinyon-juniper woodland with a shallow layer of soil over layers of rock. Pellet group data estimated low deer use and high elk use in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as slight due to flow pattern and surface rock movement.

Browse: Some limited preferred browse occurs in the form of true mountain mahogany (*Cercocarpus montanus*) and green ephedra (*Ephedra viridis*). Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) combined for 21% canopy cover (Table - Canopy Cover). Density was estimated at 144 pinyon pine trees/acre and 96 Utah juniper trees/acre in 2009 (Table - Point-Quarter Tree Data). Most of the pinyon and juniper trees are very mature with around 50% of all the sampled trees being 12 feet tall or taller in 2009.

Herbaceous Understory: As expected in a dense woodland the herbaceous understory is severely limited. Three perennial grasses occurred on the site, but provided less than 1% cover in 2009. Forb species are similar, providing less than 1% cover.

HERBACEOUS TRENDS--
Management unit 17R, Study no: 29

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron dasystachyum	4	.00
G	Agropyron spicatum	4	.03
G	Poa secunda	20	.07
Total for Annual Grasses		0	0
Total for Perennial Grasses		28	0.11
Total for Grasses		28	0.11
F	Astragalus utahensis	4	.04
F	Cryptantha sp.	16	.04
F	Erigeron sp.	1	.00
F	Eriogonum sp.	11	.07
F	Hymenoxys acaulis	3	.01
F	Lesquerella sp.	28	.06
F	Machaeranthera grindelioides	2	.01
F	Penstemon sp.	6	.01
F	Phlox austromontana	30	.28
F	Phlox hoodii	23	.27
F	Schoencrambe linifolia	2	.00
F	Unknown forb-annual (a)	1	.00
Total for Annual Forbs		1	0.00
Total for Perennial Forbs		126	0.80
Total for Forbs		127	0.81

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

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 29

Species	Percent Cover '09
Cercocarpus montanus	.11
Ephedra viridis	.20
Juniperus osteosperma	6.71
Pinus edulis	14.44

POINT-QUARTER TREE DATA--
Management unit 17R, Study no: 29

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	96	19.9
Pinus edulis	144	8.1

BASIC COVER--
Management unit 17R, Study no: 29

Cover Type	Average Cover % '09
Vegetation	13.02
Rock	9.05
Pavement	37.96
Litter	36.68
Cryptogams	.65
Bare Ground	10.59

PELLET GROUP DATA--
Management unit 17R, Study no: 29

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	8	-
Elk	21	37 (91)
Deer	7	3 (8)

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 29

Yr	Average Height Crown (in)
Cercocarpus montanus	
09	51/59
Ephedra viridis	
09	27/33

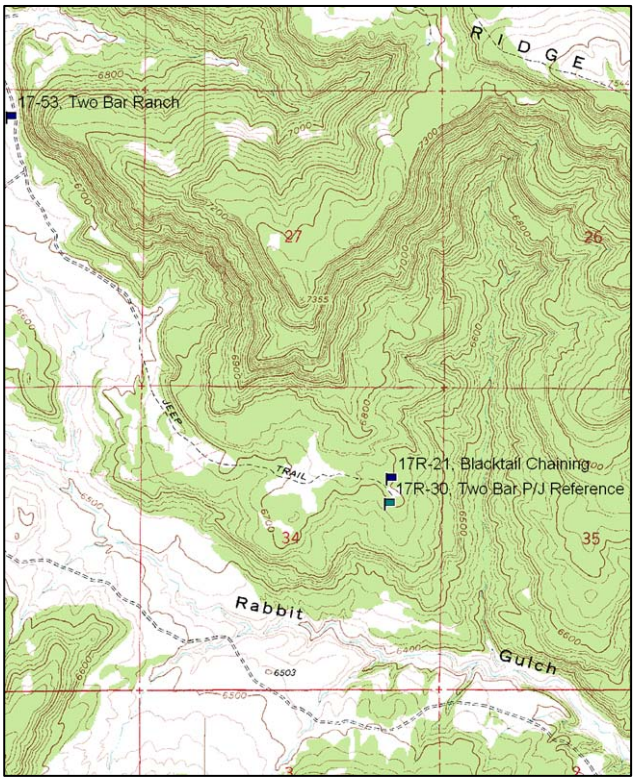
BLACKTAIL CHAINING WRI, 17R-21

Vegetation Type: Pinyon/Juniper
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6,653 ft. (2,028 m)
Aspect: east
Slope: 3%
Transect bearing: 143° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

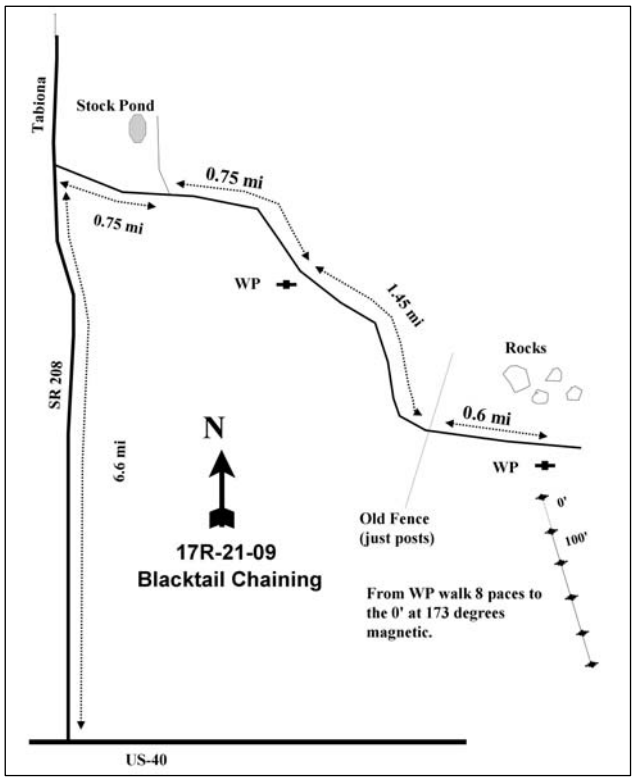
Directions:

From US 40 drive north on SR 208 for 6.6 miles to a road on the right. Turn here and drive 0.75 miles to a junction. Stay straight on this road following it around a bend for 0.75 miles to a witness post on the right. From there drive 1.45 miles to and old fence (just posts remain) following the road as it curves back to the east. Proceed 0.6 miles to a witness post on the right and a rock pile on the left. From the witness post walk 8 paces at 173 degrees magnetic to the 0' stake marked with browse tag #148.

Map Name: Tabiona



Diagrammatic Sketch:



Township: 6S Range: 11E Section: 25

GPS: NAD 83, UTM 12S 529257 E 4457303 N

BLACKTAIL CHAINING - WRI STUDY 17R-21
Project #367

Site Description

Site Information: This study was established in 2006 in the Tabby Mountain WMA, ten miles northeast of Fruitland, UT. The study was established prior to a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining and reseeding in the fall of 2006. The treatment is part of a conservation easement and a larger habitat improvement project on Tabby Mountain and in Rabbit Gulch. Pellet group data from 2006 estimated high deer and elk use. In 2009, deer use was high while elk and cattle use was low (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2006 and 2009.

Browse: Prior to the seeding, the key browse species was Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), which occurred primarily in clearings within the pinyon pine and Utah juniper. Wyoming sagebrush provided 1% canopy cover prior to treatment and less than 1% following treatment in 2009. The seeded species, forage kochia (*Kochia prostrata*), is now the dominant preferred browse on the site and provided 2% canopy in 2009. Pinyon and juniper canopy cover decreased from 21% prior to treatment to 2% in 2009 (Table - Canopy Cover).

Herbaceous Understory: Seven perennial species were sampled prior to treatment, while 11 were sampled after. Two annuals species, cheatgrass (*Bromus tectorum*) and sixweeks fescue (*Vulpia octoflora*), are present, and cheatgrass became fairly abundant in 2009, after the treatment. Perennial grass cover increased from 3% prior to treatment to 19% in 2009. Perennial grasses are a mixture of native and seeded species with the native species needle and thread (*Stipa comata*) being the dominant species in cover. Other common grasses include thickspike wheatgrass (*Agropyron dasystachyum*), western wheatgrass (*A. smithii*), and crested wheatgrass (*A. cristatum*). Forbs have also responded well to the treatment. Perennial forb cover increased form near 0% to 4%, while annual forb cover also increased to 2% (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Wyoming big sagebrush decreased in canopy cover, however, forage kochia was introduced and provided 2% canopy cover. Pinyon and juniper cover was reduced from 21% canopy cover to 2%. The density of pinyon trees decreased from 56 trees/acre to 32 trees/acre and juniper trees decreased from 37 trees/acre to 22 trees/acre. The trees were substantially smaller with decreases in the average diameter of both species.

Grass: The sum of nested frequency of perennial grasses increased slightly, while that of annual grasses declined 23%. Perennial grass cover increased from 3% to 19%, however, annual grass cover also increased slightly. Many of the seeded species were sampled at moderate frequency and density including crested wheatgrass, thickspike wheatgrass, and orchardgrass (*Dactylis glomerata*).

Forb: The sum of nested frequency of perennial forbs increased greatly, primarily due to a very low frequency in 2006. However, there is an upward trend in size and condition of individual plants giving the site good potential for recruitment.

Seed mix

Project name: 2-Bar PJ thinning- Black Tail

WRI Database #: 367

Mix lot #: ner-tm-2bpjtbt-08	Size (acre):	600
Seed type	lbs in mix	lbs/acre
Blue Flax ' Appar	150	0.25
Blue Grama	300	0.50
Canby Bluegrass 'Canbar'	150	0.25
Crested Wheatgrass 'Douglas'	300	0.50
Crested Wheatgrass 'Ephraim'	300	0.50
Great Basin Wildrye 'Trailhead'	300	0.50
Orchardgrass 'Paiute'	300	0.50
Russian Wildrye	450	0.75
Sandberg Bluegrass-Mountain Home ID	150	0.25
Sainfoin 'Eski'	1500	2.50
Small Burnet 'Delar'	1200	2.00
Snake River Wheatgrass 'Secar'	300	0.50
Thickspike Wheatgrass 'Bannock'	600	1.00
BULK POUNDS PER ACRE:		10.00
PLS POUNDS PER ACRE:		8.85

Mix Lot #: ner-tm-2bpjtd-08	Size (acre):	1000
Seed type	lbs in mix	lbs/acre
Bitterbrush--Elko NV	150	0.15
Fourwing Saltbush--Carbon UT	14	0.01
Fourwing Saltbush--Lincoln NV	186	0.19
True Mountain Mahogany-Sevier UT	50	0.05
BULK POUNDS PER ACRE:		0.40
PLS POUNDS PER ACRE:		0.26

HERBACEOUS TRENDS--

Management unit 17R, Study no: 21

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
G	Agropyron cristatum	-	$_{a}$33	-	1.78
G	Agropyron dasystachyum	-	$_{a}$62	-	2.75
G	Agropyron smithii	$_{b}$97	$_{a}$70	.69	3.67
G	Agropyron spicatum	-	7	-	.45
G	Bouteloua gracilis	16	7	.07	.21
G	Bromus tectorum (a)	$_{a}$27	$_{b}$69	.07	1.78
G	Carex sp.	17	-	.03	-
G	Dactylis glomerata	-	21	-	.74
G	Elymus junceus	-	3	-	.21
G	Oryzopsis hymenoides	$_{b}$57	$_{a}$16	.79	.48
G	Poa secunda	26	15	.10	.40
G	Sitanion hystrix	-	12	-	.24
G	Stipa comata	88	101	1.53	7.93
G	Stipa lettermani	$_{b}$19	$_{a}$2	.24	.06
G	Vulpia octoflora (a)	$_{b}$121	$_{a}$45	.64	.39
Total for Annual Grasses		148	114	0.70	2.18
Total for Perennial Grasses		320	349	3.46	18.97
Total for Grasses		468	463	4.17	21.15
F	Astragalus convallarius	-	6	-	.03
F	Astragalus sp.	-	3	-	.03
F	Chenopodium fremontii (a)	-	$_{a}$44	-	.52
F	Chenopodium leptophyllum(a)	-	3	-	.00
F	Cryptantha sp.	2	9	.01	.33

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
F	Descurainia pinnata (a)	3	-	.01	-
F	Draba sp. (a)	3	-	.00	-
F	Gayophytum ramosissimum(a)	-	a14	-	.39
F	Ipomopsis aggregata	2	-	.00	-
F	Lactuca serriola	-	-	-	.00
F	Lappula occidentalis (a)	b62	a24	.21	.64
F	Linum lewisii	-	-	-	.00
F	Medicago sativa	-	5	-	.67
F	Mentzelia albicaulis (a)	-	a13	-	.39
F	Penstemon sp.	1	-	.00	-
F	Polygonum douglasii (a)	20	9	.04	.10
F	Salsola iberica (a)	-	1	-	.30
F	Sanguisorba minor	-	-	-	.00
F	Schoencrambe linifolia	-	b38	-	2.21
F	Senecio multilobatus	-	6	-	.69
F	Tragopogon dubius	-	-	-	.00
Total for Annual Forbs		88	108	0.27	2.38
Total for Perennial Forbs		5	67	0.02	4.00
Total for Forbs		93	175	0.29	6.38

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

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 21

Species	Percent Cover '06	Percent Cover '09
Artemisia tridentata wyomingensis	1.16	.43
Juniperus osteosperma	7.50	.85
Kochia prostrata	-	1.60
Opuntia sp.	1.79	2.09
Pinus edulis	13.64	.91

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 17R, Study no: 21

Species	Average leader growth (in) '06	Average leader growth (in) '09
Artemisia tridentata wyomingensis	1.6	-

POINT-QUARTER TREE DATA--
Management unit 17R, Study no: 21

Species	Trees per Acre '06	Trees per Acre '09	Average diameter (in) '06	Average diameter (in) '09
Juniperus osteosperma	37	22	24	9.4
Pinus edulis	56	32	6.3	1.8

BASIC COVER--
Management unit 17R, Study no: 21

Cover Type	Average Cover % '06	'09
Vegetation	10.14	37.38
Rock	1.12	.15
Pavement	0	.01
Litter	50.79	57.48
Cryptogams	5.64	.79
Bare Ground	40.21	22.59

SOIL ANALYSIS DATA --
Management unit 17R, Study no: 21, Study Name: Blacktail Chaining

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
11.3	6.9	71.3	14.4	14.3	4.5	20.7	131.2	0.9

PELLET GROUP DATA--
Management unit 17R, Study no: 21

Type	Quadrat Frequency '06	'09	Days use per acre (ha) '06	'09
Rabbit	69	63	-	-
Elk	23	22	43 (106)	15 (36)
Deer	20	31	52 (129)	40 (98)
Cattle	-	-	-	1 (2)

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 21

Yr	Average Height Crown (in)
Artemisia nova	
06	11/30
09	-/-
Artemisia tridentata wyomingensis	
06	15/28
09	14/17
Cercocarpus montanus	
06	64/55
09	44/54
Chrysothamnus nauseosus	
06	-/-
09	28/31

Yr	Average Height Crown (in)
Kochia prostrata	
06	-/-
09	12/14
Leptodactylon pungens	
06	2/6
09	-/-
Opuntia sp.	
06	6/20
09	5/15
Purshia tridentata	
06	12/54
09	24/71

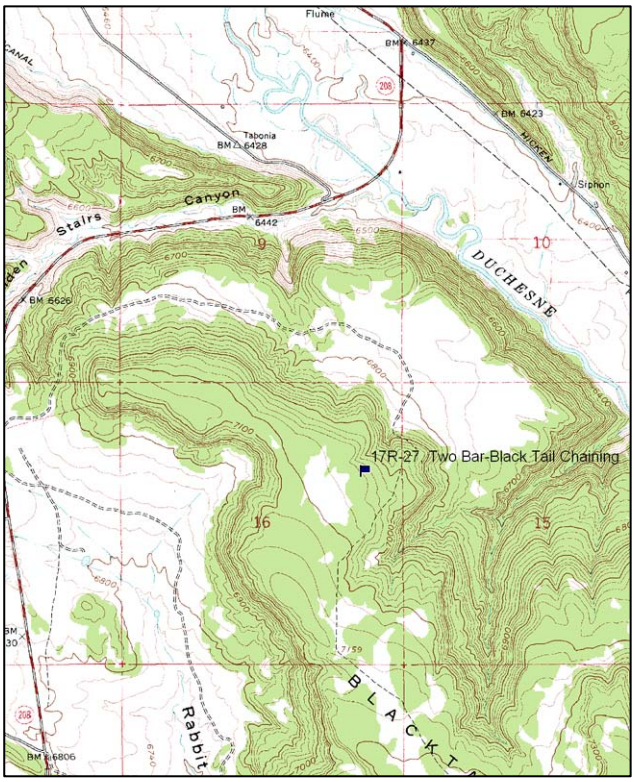
2 BAR/BLACKTAIL CHAINING WRI, 17R-27

Vegetation Type: Pinyon-Juniper
Range Type: Substantial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 7012 ft. (2137 m)
Aspect: Southeast
Slope: 4%
Transect bearing: 179° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (95ft), line 5 (71ft)

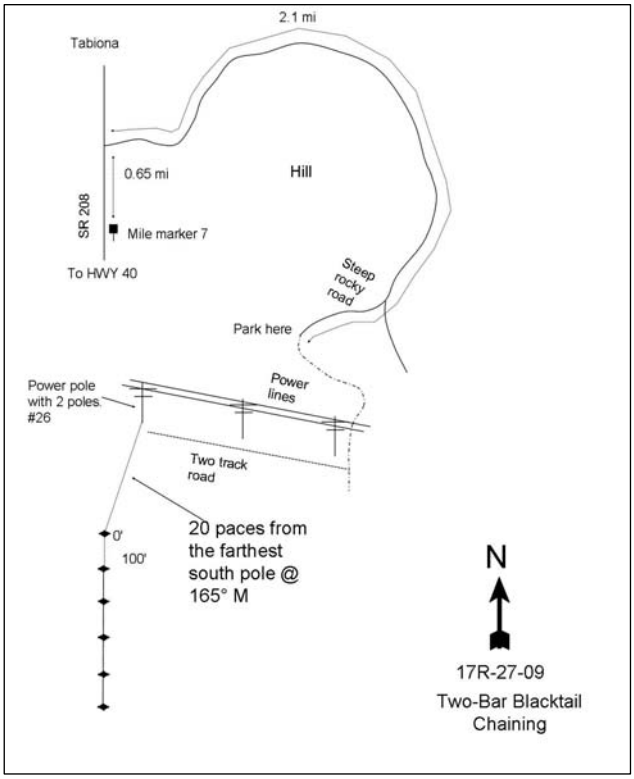
Directions:

From US 40 turn north on Highway 208 and travel to mile marker 7, from here go 0.65 miles to a road coming in from the right turn east here and go 2.1 miles around a hill to a parking area at the bottom of the hill. From the parking area hike up the road turn left at the T in the road, then turn right (west) and walk up the 4-wheeler 2 track below the power lines. Walk to the power line with 2 poles (#26). From here the 0-foot stake is 20 paces at 165 degrees magnetic and 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

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

Site Description

Site Information: This study was established in 2007 to monitor a pinyon-juniper thinning project on the Tabby Mountain WMA. It is located approximately four miles southeast of Tabiona, UT. Approximately 1,000 acres were treated in the fall of 2007 with two passes of an anchor chain, and shrubs were seeded with a dribbler following the chaining. Grass and forb seed was applied aerially shortly before the first chain pass. Deer use was moderate in 2007 and low in 2009. Estimated elk use was high in 2007 and moderate in 2009 (Table - Pellet Group Data). 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. In 2009 the soil erosion condition was classified as slight. Most of the contributing factors to erosion were still present, but in a lesser degree. Areas where gullies had/were forming were filled in with organic material and bars were mechanically constructed to prevent water from running back into gullies.

Browse: Preferred browse species on this site include black sagebrush (*Artemisia nova*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and dwarf rabbitbrush (*Chrysothamnus depressus*). These species provide all of the preferred browse canopy cover on the site. In 2007, the big sagebrush was classified as Wyoming, while in 2009 it was classified as mountain. Prior to treatment in 2007, pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) dominated the site providing 25% canopy cover, whereas they provided only 2% canopy cover in 2009 (Table - Canopy Cover). There was a substantial decrease in the density and average diameter of pinyon and juniper in 2009, after the treatment (Table - Point-Quarter Tree Data).

Herbaceous Understory: A good diversity of perennial grasses were already present on this site prior to treatment, providing 5% cover. After chaining, the 2009 sample showed the sum of nested frequency of perennial grasses was essentially the same as the previous sample, but cover had doubled. In both sample years bluebunch wheatgrass (*Agropyron spicatum*) was the dominant grass providing over 50% of the grass cover since 2007. Cheatgrass (*Bromus tectorum*) is also present, but is scarce. Forbs, both annual and perennial, were rare prior to treatment. Following the chaining, weedy annual species increased greatly from 0% cover in 2007 to 6% in 2009. Perennial forbs increased as well from 1% to 4% cover. The seeded species, blue flax (*Linum lewisii*), was the most common perennial forb at 1% cover in 2009 (Table - Herbaceous Trends).

Pre vs. Two Years Post Treatment

Browse: Pinyon canopy cover decreased from 21% to 1%, and juniper cover decreased from 3% to 2%. The density of pinyon decreased from 185 trees/acre to 32 trees/acre with a decrease in the average diameter from 5.3 inches to 3 inches. Juniper did not have a large decrease in density, but the average diameter of juniper trees decreased from 11.6 inches to 6 inches. 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 still alive. Although preferred browse cover did not increase, the removal of the pinyon-juniper overstory releases the potential for recruitment and sagebrush development. After two growing seasons this may not yet be apparent.

Grass: There was little noticeable change in the sum of nested frequency of perennial grasses, but cover increased from 5% to 12% and most species exhibited good seed production. Diversity also increased with the introduction of many of the seeded species. Several of the introduced species, orchard grass (*Dactylis glomerata*) and Great Basin wildrye (*Elymus cinereus*), may have been seeded with other treatments in the nearby area.

Forb: Perennial forbs had a 59% increase in sum of nested frequency and a four-fold increase in cover from less than 1% to 4%. Annual forbs also had a substantial increase in the sum of nested frequency and cover increased from near 0% to 6%. Three seeded species, blue flax (*Linum lewisii*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*), were present in 2009.

Seed mix

Project name: 2-Bar PJ Thinning
WRI Database #: 368

Mix lot #:ner-tm-2bpjtsw-08	Size (acre):	400
Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	200	0.50
Alfalfa 'Ranger'	200	0.50
Blue Flax ' Appar	100	0.25
Canby Bluegrass 'Canbar'	100	0.25
Crested Wheatgrass 'Douglas'	200	0.50
Crested Wheatgrass 'Hycrest'	200	0.50
Indian Ricegrass 'Rimrock'	400	1.00
Pubescent Wheatgrass	200	0.50
Russian Wildrye	300	0.75
Sand Dropseed	20	0.05
Small Burnet 'Delar'	800	2.00
Snake River Wheatgrass 'Secar'	200	0.50
Thickspike Wheatgrass 'Critana'	400	1.00
BULK POUNDS PER ACRE:		8.30
PLS POUNDS PER ACRE:		7.37

Mix Lot #: ner-tm-2bpjtd-08	Size (acre):	1000
Seed type	lbs in mix	lbs/acre
Bitterbrush--Elko NV	150	0.15
Fourwing Saltbush--Carbon UT	14	0.01
Fourwing Saltbush--Lincoln NV	186	0.19
True Mountain Mahogany--Sevier UT	50	0.05
BULK POUNDS PER ACRE:		0.40
PLS POUNDS PER ACRE:		0.26

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

Type	Species	Nested Frequency		Average Cover %	
		'07	'09	'07	'09
G	Agropyron cristatum	-	[a]30	-	1.66
G	Agropyron intermedium	-	8	-	.07
G	Agropyron smithii	[b]19	[a]2	.09	.03
G	Agropyron spicatum	101	96	3.00	6.53
G	Bromus tectorum (a)	-	[a]19	-	.24
G	Carex sp.	5	-	.03	-
G	Dactylis glomerata	-	[a]28	-	.83
G	Elymus cinereus	-	10	-	.07
G	Elymus junceus	-	1	-	.00
G	Oryzopsis hymenoides	[b]23	[a]2	.36	.03
G	Poa fendleriana	[a]4	[b]30	.38	.70
G	Poa secunda	[b]115	[a]56	1.18	.62
G	Sitanion hystrix	4	2	.04	.06
G	Stipa comata	5	2	.03	.90
Total for Annual Grasses		0	19	0	0.24
Total for Perennial Grasses		276	267	5.13	11.54
Total for Grasses		276	286	5.13	11.78
F	Arabis sp.	9	-	.03	-
F	Astragalus convallarius	-	3	-	.18
F	Astragalus sp.	-	1	-	.00

Type	Species	Nested Frequency '07	Nested Frequency '09	Average Cover % '07	Average Cover % '09
F	Chaenactis douglasii	3	-	.00	-
F	Chenopodium album (a)	-	1	-	.00
F	Chenopodium fremontii (a)	$_{a}$3	$_{b}$77	.00	1.99
F	Chenopodium leptophyllum(a)	-	2	-	.01
F	Crepis acuminata	-	3	-	.03
F	Cryptantha sp.	-	1	-	.00
F	Cymopterus sp.	15	10	.03	.09
F	Descurainia pinnata (a)	1	5	.00	.19
F	Eriogonum sp.	-	$_{a}$10	-	.34
F	Gayophytum ramosissimum(a)	-	$_{a}$29	-	.71
F	Hymenoxys acaulis	-	3	-	.00
F	Ipomopsis aggregata	-	3	-	.15
F	Lappula occidentalis (a)	31	42	.09	2.92
F	Linum lewisii	-	$_{a}$18	-	1.10
F	Machaeranthera canescens	-	5	-	.21
F	Onobrychis viciaefolia	-	$_{a}$9	-	.69
F	Penstemon humilis	$_{a}$23	-	.18	-
F	Penstemon sp.	-	$_{a}$19	-	.20
F	Phlox hoodii	24	20	.58	.31
F	Phlox longifolia	-	4	-	.01
F	Polygonum douglasii (a)	-	2	-	.15
F	Sanguisorba minor	-	9	-	.54
Total for Annual Forbs		35	158	0.09	5.99
Total for Perennial Forbs		74	118	0.83	3.88
Total for Forbs		109	276	0.93	9.88

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

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

Species	Percent Cover '07	Percent Cover '09
Artemisia nova	2.26	1.38
Artemisia tridentata vaseyana	-	.18
Artemisia tridentata wyomingensis	.05	-
Chrysothamnus depressus	.18	-
Juniperus osteosperma	3.29	2.36
Leptodactylon pungens	-	.50
Opuntia sp.	.01	.01
Pinus edulis	21.41	1.25

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

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

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

Cover Type	Average Cover %	
	'07	'09
Vegetation	12.70	28.27
Rock	3.20	3.05
Pavement	1.17	.06
Litter	58.04	65.05
Cryptogams	10.44	.58
Bare Ground	23.95	19.63

SOIL ANALYSIS DATA --
Management unit 17R, Study no: 27, Study Name: 2 Bar/Blacktail Chaining

Effective rooting depth (in)	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		Days use per acre (ha)	
	'07	'09	'07	'09
Rabbit	38	4	-	-
Elk	31	6	42 (104)	31 (76)
Deer	35	14	25 (63)	16 (40)

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

Yr	Average Height Crown (in)
Artemisia nova	
07	10/19
09	14/22
Artemisia tridentata vaseyana	
07	-/-
09	19/28
Artemisia tridentata wyomingensis	
07	17/26
09	13/18

Yr	Average Height Crown (in)
Cercocarpus montanus	
07	19/22
09	22/27
Chrysothamnus depressus	
07	3/9
09	7/15
Chrysothamnus viscidiflorus viscidiflorus	
07	8/10
09	15/17
Kochia prostrata	
07	-/-
09	5/10
Leptodactylon pungens	
07	-/-
09	6/7
Opuntia fragilis	
07	2/6
09	2/9
Opuntia sp.	
07	5/13
09	4/13
Pediocactus simpsonii	
07	1/2
09	-/-
Pinus edulis	
07	-/-
09	-/-

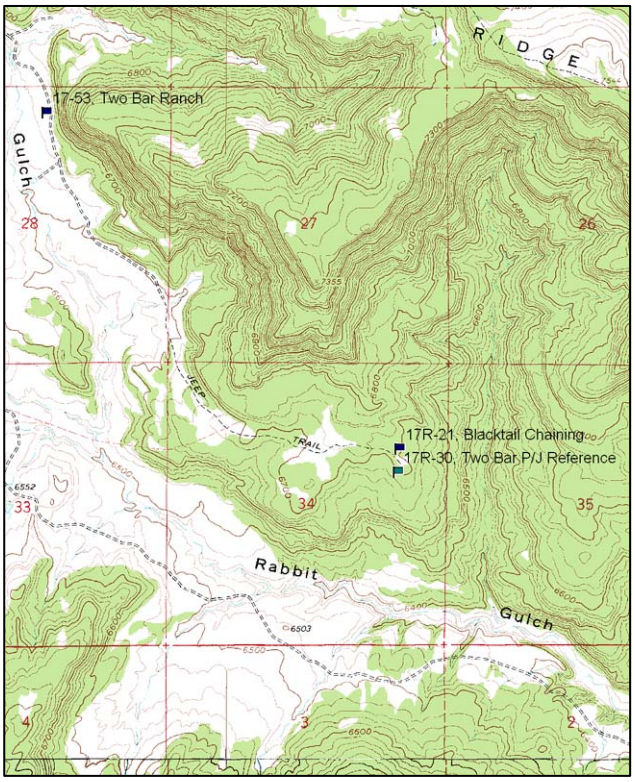
BLACKTAIL-2 BAR REFERENCE WRI, 17R-30

Vegetation Type: Pinyon/Juniper
Range Type: Crucial deer winter; crucial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: UDWR
Elevation: 6700 ft. (2042 m)
Aspect: South
Slope: 3%
Transect bearing: 133° magnetic
Belt placement: Read Baseline, No Belts. Due to bedrock, 300' stake only 90ft long, quad 19 read at 22.5ft and quad 20 read at 72.5ft.

Directions:

From US 40 drive north on SR 208 for 6.6 miles to a road on the right. Turn here and drive 0.75 miles to a junction. Stay straight on this road following it around a bend for 0.75 miles to a witness post on the right. From there drive 1.45 miles to and old fence (just posts remain) following the road as it curves back to the east. Proceed 0.6 miles to a witness post on the right and a rock pile on the left. From the witness post walk 8 paces at 173°M to the 0' stake of 17R-21 marked with browse tag #148. The baseline runs at 143°M. From the 400' stake continue 439 ft at 173°M to get to the 0' stake of 17R-30.

Map Name: Tabiona



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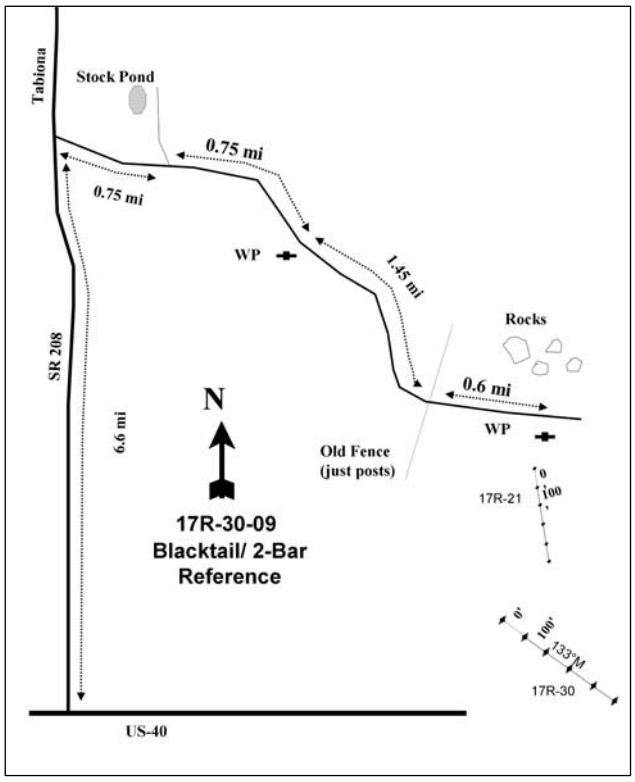


Township: 6S Range: 11E Section: 25

GPS: NAD 83, UTM 12S 529257 E 4457303 N

BLACKTAIL-2 BAR REFERENCE - WRI STUDY 17R-30

Site Description

Site Information: This site was established in 2009 as a reference site for the Blacktail Chaining (17R-21) and 2 Bar Ranch/Blacktail Chaining (17R-27) studies. The study is located in a dense pinyon-juniper woodland with some mountain brush a few hundred feet south of the 400' stake of the Blacktail Chaining study transect. In 2009, pellet group data estimated high deer use, moderate elk use and low cattle use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: True mountain mahogany (*Cercocarpus montanus*) is the key browse species on the site. In 2009, true mountain mahogany provided 3% canopy cover. Pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) combined provided 45% canopy cover in 2009 (Table - Canopy Cover), with densities of 74 and 49 trees/acre, respectively. Most of the trees were mature with large average diameters (Table - Point-Quarter Tree Data).

Herbaceous Understory: As would be expected in dense pinyon-juniper woodland, the herbaceous understory is severely lacking. Grasses and forbs combined provided less than 1% cover in 2009 (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 17R, Study no: 30

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron smithii	12	.04
G	Oryzopsis hymenoides	10	.18
G	Poa secunda	4	.03
G	Sitanion hystrix	2	.03
Total for Annual Grasses		0	0
Total for Perennial Grasses		28	0.28
Total for Grasses		28	0.28
F	Astragalus sp.	1	.01
F	Chenopodium fremontii (a)	7	.04
F	Cryptantha sp.	4	.00
F	Penstemon sp.	-	.00
F	Phlox austromontana	3	.00
F	Phlox longifolia	3	.03
Total for Annual Forbs		7	0.03
Total for Perennial Forbs		11	0.06
Total for Forbs		18	0.10

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

CANOPY COVER, LINE INTERCEPT--
Management unit 17R, Study no: 30

Species	Percent Cover '09
Cercocarpus montanus	2.93
Juniperus osteosperma	9.98
Opuntia sp.	.06
Pinus edulis	34.90

POINT-QUARTER TREE DATA--
Management unit 17R, Study no: 30

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	22	9.4
Pinus edulis	32	1.8

BASIC COVER--
Management unit 17R, Study no: 30

Cover Type	Average Cover % '09
Vegetation	12.35
Rock	8.46
Pavement	.00
Litter	56.94
Cryptogams	5.24
Bare Ground	22.25

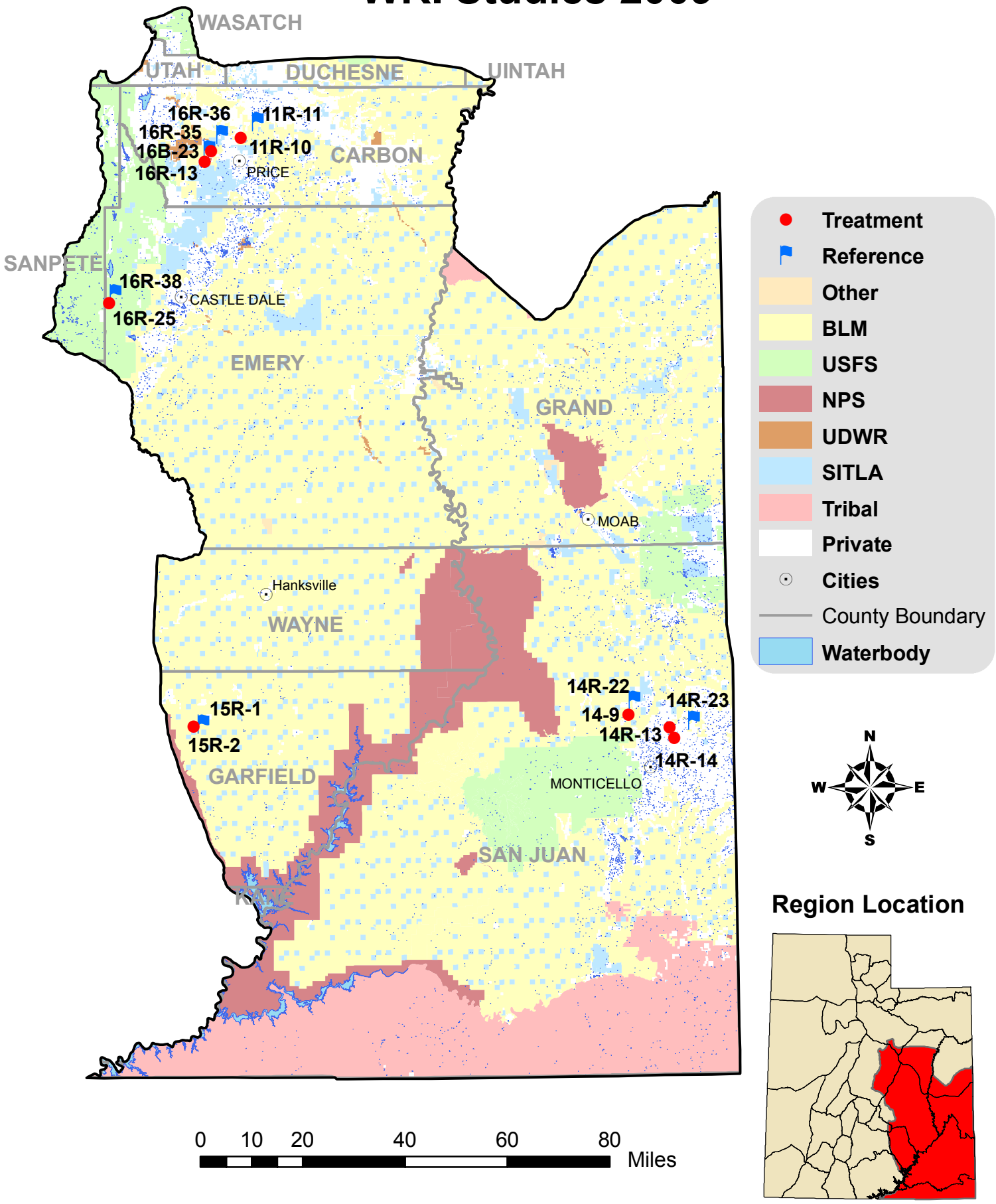
PELLET GROUP DATA--
Management unit 17R, Study no: 30

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	27	
Elk	4	
Deer	17	

BROWSE CHARACTERISTICS--
Management unit 17R, Study no: 30

Yr	Average Height Crown (in)
Cercocarpus montanus	
09	43/47
Opuntia sp.	
09	5/21
Purshia tridentata	
09	20/77

Southeastern Region
WRI Studies 2009



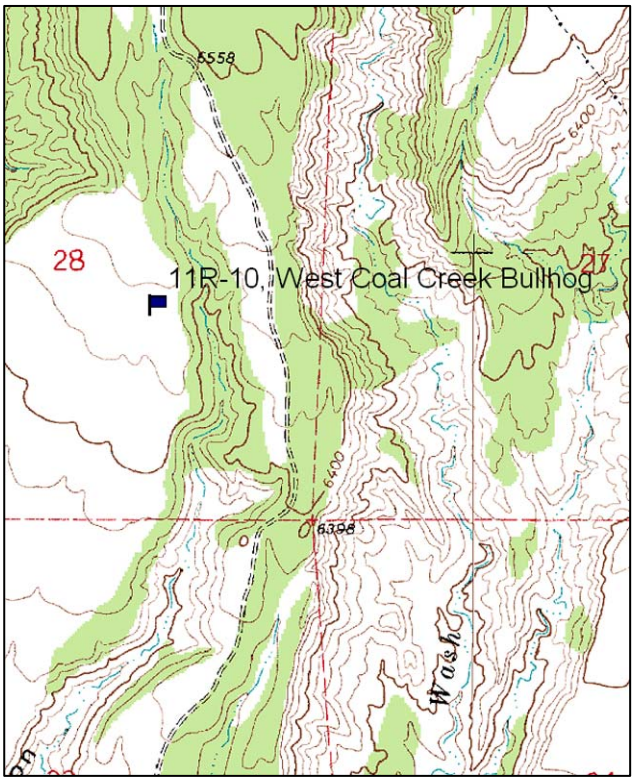
WEST COAL CREEK BULLHOG WRI, 11R-10

Vegetation Type: Black Sagebrush (P-J Bullhog)
Range Type: Crucial deer winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY247UT
Land Ownership: BLM
Elevation: 6387 ft. (1947 m)
Aspect: South
Slope: 3%
Transect bearing: 235° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

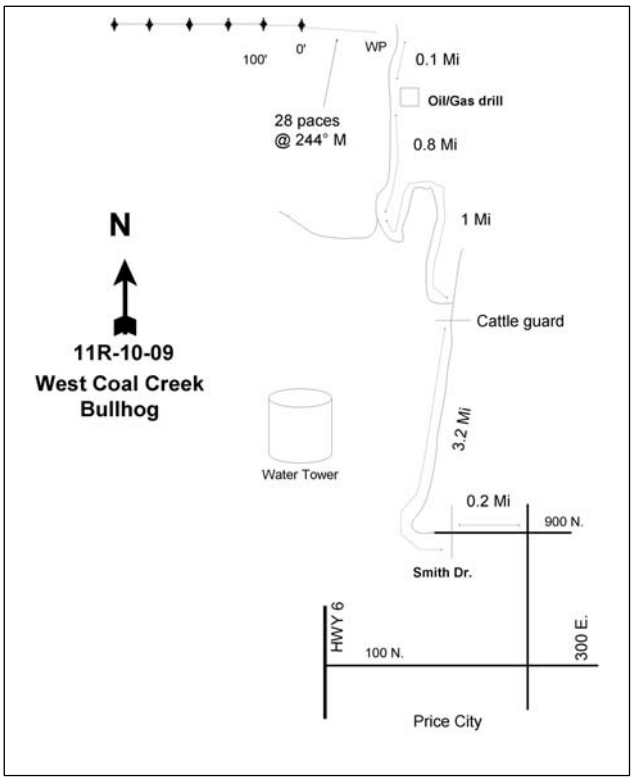
Directions:

From 300 east in Price turn left (west) on 900 north and go 0.2 miles to Smith Dr. Continue west on 900 north eventually heading north past a water tower and out of town 3.2 miles, just past a cattle guard to a fork. Go left and continue on 1 mile to an intersection. Turn right (north) and go 0.8 miles to an oil/gas pump on the right side of the road. From here travel north 0.1 mile to a witness post on the left side of the road. The 0-foot stake is 28 paces from the witness post at 244 degrees magnetic.

Map Name: Helper



Diagrammatic Sketch:



Township: 13S Range: 10E Section: 28

GPS: NAD 83, UTM 12S 516811 E 4390585 N

WEST COAL CREEK BULLHOG - WRI STUDY 11R-10
Project #847

Site Description

Site Information: This study was established in 2007 to monitor a rehabilitation project south of Kenilworth. This area was two-way chained and seeded in the 1950's to reduce pinyon-juniper encroachment and improve the herbaceous understory and shrub components. The objective of this project was to reduce fuel loads from pinyon and juniper encroachment and improve mule deer winter range habitat. In 2007, 1,912 acres were retreated by bullhog to reduce pinyon-juniper cover and improve the understory component. Pellet group data from 2007 and 2009 estimated low deer, elk and cow use (Table - Pellet Group Data). Soil erosion condition was classified as moderate due to surface litter and soil movement, pedestalling, and flow patterns. In 2009, the soil erosion condition was classified as stable.

Browse: Black sagebrush (*Artemisia nova*) was the predominant preferred browse found on the site. It has averaged 11% canopy cover since 2007. In 2007, years after the original chaining treatment, pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) were again established with high canopy cover and density on the site. Following the treatment pinyon and juniper canopy cover (Table - Canopy Cover) and density (Table - Point-Quarter Tree Data) were greatly reduced.

Herbaceous Understory: With the increased encroachment of pinyon and juniper the herbaceous understory had become sparse in 2007. Crested wheatgrass (*Agropyron cristatum*), a seeded species, was the only grass found in any abundance prior to treatment. The seeding treatment successfully improved the herbaceous understory. The treatment increased the diversity of grasses in 2009, though they were still not particularly abundant. Forbs also increased after treatment. Perennial forb cover increased from less than 1% to 4%. No one species provided more than 1% of cover in any sample year. Seeded forb species provided 33% of forb cover in 2009 (Table - Herbaceous Trends).

Pre vs. Two Years Post Treatment

Browse: Black sagebrush canopy cover stayed similar between 10% and 11%. Prior to treatment Utah juniper provided 3% of canopy cover, but had no notable cover in 2009. Pinyon pine canopy cover was 7% prior to treatment and 0% after treatment. Pinyon pine and juniper densities decreased from 121 trees/acre and 178 trees/acre, respectively, to less than 18 trees/acre each in 2009.

Grass: The sum of nested frequency for perennial grasses increased 27% while cover increased from 1% to 5%. Crested wheatgrass was the predominant species, accounting for 89% of grass cover. Four perennial grasses were sampled in 2007, but only crested wheatgrass provided measurable cover at 1%. After treatment four perennial grasses were again sampled, however, only crested wheatgrass was found in both samplings and provided significant cover. In 2009, crested wheatgrass saw a 14% increase in nested frequency and provided 4% cover. Sampled seeded grass species included intermediate wheatgrass (*Agropyron intermedium*), Russian wildrye (*Elymus junceus*), and Indian ricegrass (*Oryzopsis hymenoides*), which combined provided 10% of grass cover.

Forb: The sum of nested frequency for perennial forbs increased three-fold and increased from less than 1% cover to 4%. A seeded penstemon (*Penstemon sp*.) accounted for 31% of total forb cover, but was also present before the treatment. Other seeded forb species such as alfalfa (*Medicago sativa*) and blue flax (*Linum lewisii*) were rare.

Seed Mix

Project name: West Coal Creek
WRI Database #: 847 Size (acre): 1912
Mix lot #: ser-de-wcc-08

Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	600	0.31
Alfalfa 'Ranger'	600	0.31
Alfalfa 'Spredor 4'	600	0.31
Blue Flax ' Appar	500	0.26
Blue Grama	640	0.33
Forage Kochia 'Immigrant'	900	0.47
Fourwing Saltbush--Lincoln NV	1912	1.00
Indian Ricegrass 'Rimrock'	3600	1.88
Intermediate Wheatgrass	2581	1.35
Russian Wildrye	2868	1.50
Sand Dropseed	90	0.05
Siberian Wheatgrass 'Vavilov'	2581	1.35
Snake River Wheatgrass 'Secar'	2581	1.35
*Big Bluegrass 'Sherman'	100	0.05
*Fourwing Saltbush--Carbon UT	400	0.21
*Palmer Penstemon--'Sanpete UT'	150	0.08
*Winterfat--Iron UT	125	0.07
BULK POUNDS PER ACRE:		10.89
PLS POUNDS PER ACRE:		8.41

HERBACEOUS TRENDS--
Management unit 11R, Study no: 10

Type	Species	Nested Frequency '07	Nested Frequency '09	Average Cover % '07	Average Cover % '09
G	Agropyron cristatum	120	137	1.06	4.18
G	Agropyron intermedium	-	3	-	.03
G	Bouteloua gracilis	1	-	.00	-
G	Elymus junceus	-	a13	-	.28
G	Oryzopsis hymenoides	-	4	-	.18
G	Poa secunda	2	-	.00	-
G	Sitanion hystrix	1	-	.00	-
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		124	157	1.07	4.68
Total for Grasses		124	157	1.07	4.68
F	Aster sp.	1	-	.00	-
F	Astragalus convallarius	1	7	.00	.09
F	Astragalus sp.	-	1	-	.06
F	Chenopodium fremontii (a)	-	-	-	.15
F	Chenopodium leptophyllum(a)	-	3	-	.00
F	Descurainia pinnata (a)	2	6	.03	.44
F	Eriogonum cernuum (a)	7	-	.06	-
F	Eriogonum sp.	-	4	-	.04
F	Eriogonum umbellatum	-	a11	-	.49
F	Euphorbia sp.	a12	b27	.20	.77
F	Ipomopsis aggregata	-	1	-	.15

Type	Species	Nested Frequency '07	Nested Frequency '09	Average Cover % '07	Average Cover % '09
F	Lactuca serriola	-	1	-	.18
F	Lesquerella sp.	-	8	-	.53
F	Linum lewisii	-	5	-	.03
F	Medicago sativa	-	1	-	.03
F	Penstemon sp.	$_{a}$30	$_{b}$62	.09	1.37
F	Salsola iberica (a)	-	2	-	.01
F	Townsendia sp.	1	-	.00	-
F	Unknown forb annual	-	9	-	.06
Total for Annual Forbs		9	11	0.09	0.61
Total for Perennial Forbs		45	137	0.30	3.82
Total for Forbs		54	148	0.40	4.43

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

CANOPY COVER, LINE INTERCEPT--
Management unit 11R, Study no: 10

Species	Percent Cover '07	Percent Cover '09
Artemisia nova	10.43	10.83
Juniperus osteosperma	2.70	.03
Opuntia sp.	.13	-
Pinus edulis	7.36	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 11R, Study no: 10

Species	Average leader growth (in) '07	Average leader growth (in) '09
Artemisia nova	1.1	0.83
Cercocarpus montanus	-	5.56
Purshia tridentata	3.7	4.14

POINT-QUARTER TREE DATA--
Management unit 11R, Study no: 10

Species	Trees per Acre '07	Trees per Acre '09	Average diameter (in) '07	Average diameter (in) '09
Juniperus osteosperma	178	<18	3.9	4.3
Pinus edulis	121	<18	3.9	4.6

BASIC COVER--
Management unit 11R, Study no: 10

Cover Type	Average Cover % '07	'09
Vegetation	15.89	18.98
Rock	3.86	2.42
Pavement	13.04	8.25
Litter	39.01	47.68
Cryptogams	4.59	.05
Bare Ground	35.43	26.69

PELLET GROUP DATA--
Management unit 11R, Study no: 10

Type	Quadrat Frequency '07	'09	Days use per acre (ha) '07	'09
Rabbit	81	29	-	-
Elk	1	-	3 (7)	3 (7)
Deer	1	5	3 (8)	16 (40)
Cattle	1	5	2 (4)	7 (18)

BROWSE CHARACTERISTICS--
Management unit 11R, Study no: 10

Yr	Average Height Crown (in)
Artemisia nova	
07	13/22
09	10/19
Artemisia tridentata vaseyana	
07	-/-
09	11/14
Atriplex canescens	
07	48/49
09	12/10
Cercocarpus montanus	
07	-/-
09	37/47
Cowania mexicana stansburiana	
07	43/31
09	32/9
Gutierrezia sarothrae	
07	-/-
09	9/9
Juniperus osteosperma	
07	-/-
09	-/-

Opuntia sp.	
07	3/7
09	3/12
Pinus edulis	
07	-/-
09	-/-
Purshia tridentata	
07	50/86
09	36/54

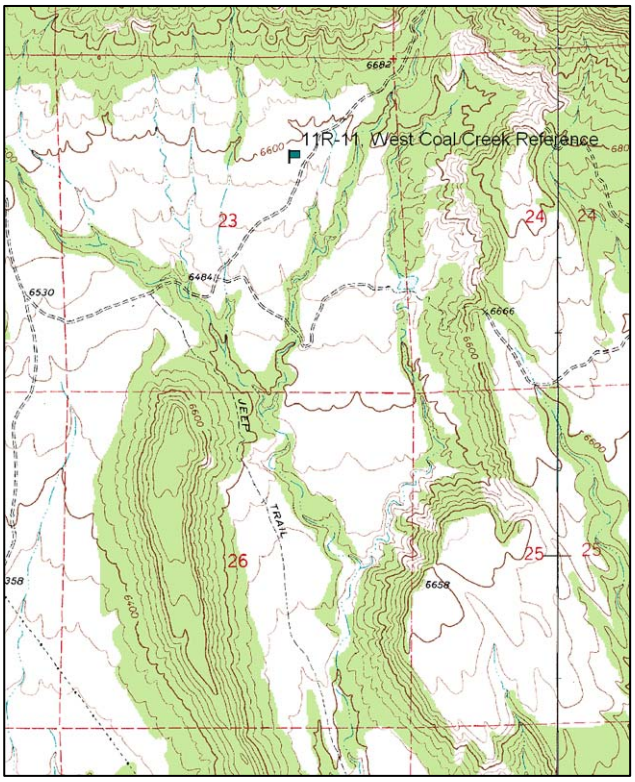
WEST COAL CREEK REFERENCE WRI, 11R-11

Vegetation Type: Black Sagebrush, P-J
Range Type: Crucial deer winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY247UT
Land Ownership: BLM
Elevation: 6528 ft. (1490 m)
Aspect: South
Slope: 4%
Transect bearing: 12° magnetic
Belt placement: Read Baseline, No Belts. May need to replace 100' stake with half-high

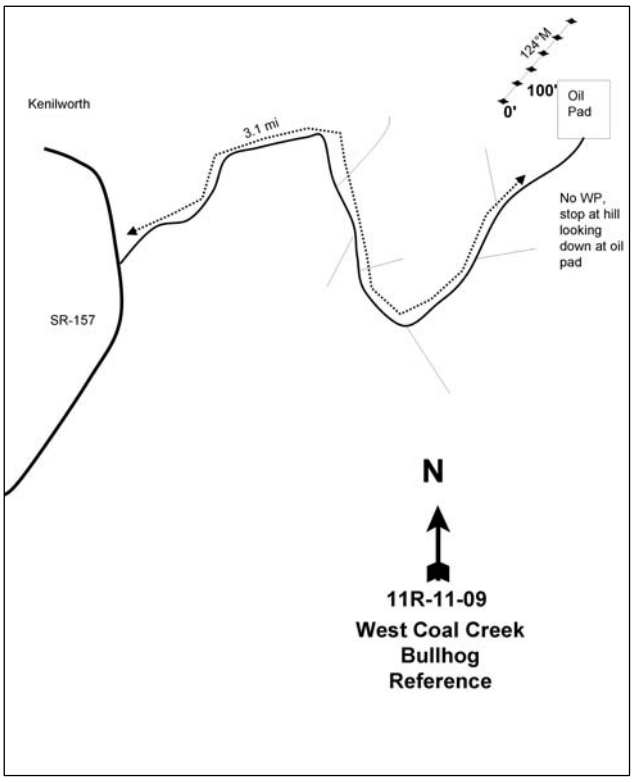
Directions:

From 11R-10, West Coal Creek Bullhog, 11R-11 is 4.33 miles to the north and east. From the witness post at 11R-10, proceed north until you hit the pavement of SR-157, which is the road from Helper to Kenilworth. Proceed north for 0.05 miles and take the dirt road to your right (east). Follow this road for 0.25 miles to a graded dirt road, turn left (east) and follow this road above the quarry. Stay on the main road avoiding the following turns: left, right and right. As you approach this site you will crest a small rise and see an oil pad where the road ends. New roads leading to different oil pads make arriving at this site somewhat difficult.
If you begin from the turnoff from SR-157 the total distance is 3.1 miles.
To get to the 0' stake use the GPS since the pinyon/juniper trees make a direct route impossible.

Map Name: Helper



Diagrammatic Sketch:



Township: 13S Range: 10E Section: 23

GPS: NAD 83, UTM 12S 520099 E 4392657 N

WEST COAL CREEK REFERENCE - WRI STUDY 11R-11
Project #847 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to the West Coal Creek Bullhog study, 11R-10. This site was established in dense pinyon-juniper woodland amid various oil pads four and a half miles northeast of 11R-10, near the mouth of Alrad Canyon. Pellet group data from 2009 estimated moderate deer and low elk use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: Black sagebrush (*Artemisia nova*) was the dominant preferred browse, providing 8% canopy cover. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and green ephedra (*Ephedra viridis*) were also present on the site. In 2009, pinyon pine (*Pinus edulis*) canopy cover was 18% and Utah juniper (*Juniperus osteosperma*) cover was 12% (Table - Canopy Cover). Pinyon pine density was estimated at 190 trees/acre while Utah juniper density was 161 trees/acre (Table - Point-Quarter Tree Data).

Herbaceous Understory: The herbaceous understory was very poor. Grasses and forbs combined for less than 1% cover. Only two grass species and four forb species were sampled (Table - Herbaceous Trends).

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

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	12	.07
G	Poa secunda	1	.00
Total for Annual Grasses		0	0
Total for Perennial Grasses		13	0.07
Total for Grasses		13	0.07
F	Astragalus convallarius	1	.00
F	Cryptantha sp.	3	.01
F	Ipomopsis aggregata	5	.01
F	Penstemon sp.	13	.06
Total for Annual Forbs		0	0
Total for Perennial Forbs		22	0.09
Total for Forbs		22	0.09

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

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

Species	Percent Cover '09
Artemisia nova	8.13
Artemisia tridentata wyomingensis	.65
Ephedra viridis	.20
Juniperus osteosperma	11.96
Pinus edulis	17.68

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

Species	Average leader growth (in) '09
Artemisia nova	1.27

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

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	161	4.8
Pinus edulis	190	4.8

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

Cover Type	Average Cover % '09
Vegetation	25.90
Rock	9.75
Pavement	8.02
Litter	57.77
Cryptogams	.11
Bare Ground	12.35

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

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	9	-
Deer	3	17 (41)
Elk	-	1 (2)

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

Yr	Average Height Crown (in)
Artemisia nova	
09	10/17
Artemisia tridentata wyomingensis	
09	22/24
Cercocarpus montanus	
09	26/25
Cowania mexicana stansburiana	
09	54/52

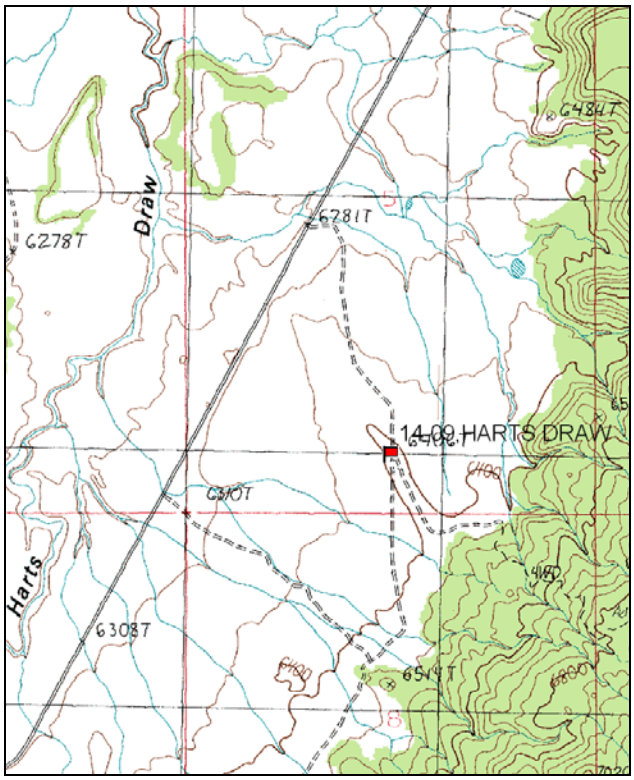
Yr	Average Height Crown (in)
Ephedra viridis	
09	40/46
Eriogonum microthecum	
09	9/13
Purshia tridentata	
09	32/22

HARTS DRAW - TREND STUDY NO. 14-9

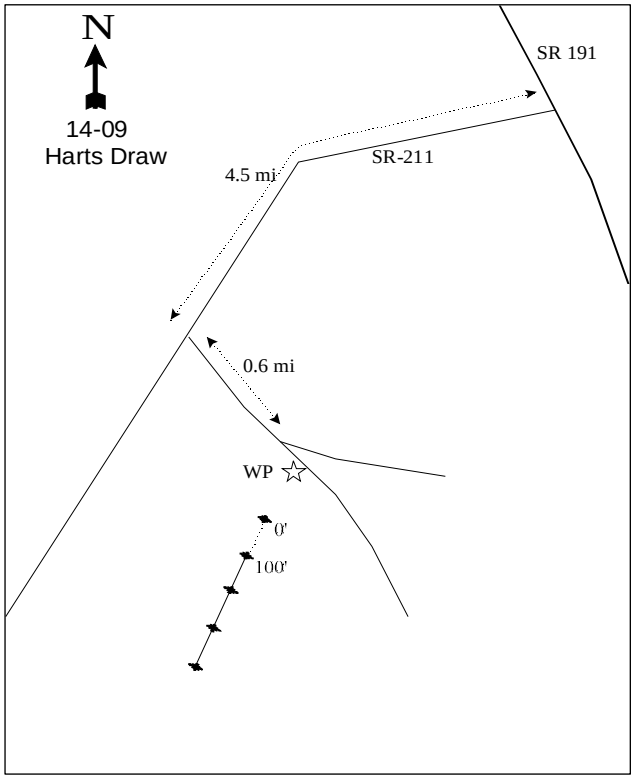
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R035XY306UT
Land Ownership: BLM
Elevation: 6,400 ft (1,951 m)
Aspect: Southwest
Slope: 4%
Transect bearing: 180 degrees magnetic.
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
Go north from Monticello on SR 191 to the turnoff to Canyonlands National Park (0.3 miles north of mile marker 86). Turn left (west) onto SR-211 and proceed approximately 4.0 miles to mile marker 14. Continue 0.5 miles past the mile marker, then turn left onto a dirt road that goes up and along a small ridge. Go 0.6 miles, bearing right at a faint fork and looking for two green fence posts on your left between the roads. There is a witness post on the right hand side of the road. The 0-foot stake is 19 paces away from the witness post at 218°M. The 0 ft baseline stake is also near a small juniper.

Map Name: Photograph Gap



Diagrammatic Sketch:



Township: 32S, Range: 23E, Section: 5

GPS: NAD 83, UTM 12S 6387712 E 4209177 N

HARTS DRAW - TREND STUDY NO. 14-9
Project # 246 and #1231

Site Information

Site Description: The study is located in an extensive Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community below the pinyon-juniper covered slopes of Peters Point Mesa. In the valley below the ridge, sagebrush has been removed and the flat has been planted to crested wheatgrass. Cattle use the flat rather heavily, with sign of grazing less common further up the hill. A pellet group transect located nearby at an elevation of 6,600 feet continually shows the highest use of any transect on the herd unit with a 10 year average ('87-'97) of 91deer days use/acre (225 ddu/ha). Beginning in 2004 the BLM began treating what will be 3,094 acres of decadent Wyoming big sagebrush with a drum aerator. Pellet group data on the site has indicated very heavy use by deer since 1999. Estimated cattle use was mostly light in 1999 and 2004, with more moderate use measured in 2009 (Table - Pellet Group Data).

Browse: The key browse species is Wyoming big sagebrush, but sagebrush has been steadily decreasing on the site in cover and density since 1994 (Table - Herbaceous Trends). Decadence in the sagebrush population has been relatively high, especially in 2004 when it increased to 92% of the population. Sagebrush plants displaying poor vigor have also been relatively high with a large increase to 82% in 2004. Both decadence and vigor returned to more normal levels in 2009. Recruitment of young sagebrush plants has been fairly low over all the sample years. Utilization of sagebrush has been mostly moderate, but there was heavy use in 2004 (Table - Browse Characteristics). Much of the decline in the sagebrush population in 2004 is attributed to drought conditions in the years prior to the 2004 sampling. Two weedy increaser species, narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*) and broom snakeweed (*Gutierrezia sarothrae*), are the only other common browse species on the site.

Herbaceous Understory: Blue grama (*Bouteloua gracilis*), a warm season grass, is fairly abundant on the site and forms thick low mats on the side hill. It has increased steadily in cover since 1999 and was the dominant grass species in 2009. Other native perennial grasses found on the site include bottlebrush squirreltail (*Sitanion hystrix*), needle-and-thread (*Stipa comata*), Indian ricegrass (*Oryzopsis hymenoides*), and galleta (*Hilaria jamesii*). Cheatgrass (*Bromus tectorum*) is common on the site, but cover has fluctuated drastically with climatic variables. Forbs are insignificant with a total cover of only about 1% in each reading (Table - Herbaceous Trends).

Soil: The soil on the site is a reddish sandy loam with a slightly alkaline pH (7.6) and relatively shallow effective rooting depth (Table - Soil Analysis Data). Much of the sandy soil is exposed on the site. Grasses provide good protection against erosion where they occur, but the amount of herbaceous vegetation and litter cover is low and variable. The soil erosion condition was classified as stable in 2004 and 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. The proportion of Wyoming big sagebrush plants displaying poor vigor increased from 16% to 32%. Decadence of sagebrush decreased slightly, but is still high.
- **1994 to 1999 - slightly down (-1):** The density of the primary browse species, Wyoming big sagebrush, decreased by 7% from 3,580 plants/acre to 3,340 plants/acre. Cover of sagebrush also decreased from 12% to 10%, though both decadence and vigor improved. The density of the undesirable species, broom snakeweed, increased more than three-fold and cover increased from 1% to 4%.

- **1999 to 2004 - down (-2):** The density of Wyoming big sagebrush decreased by 37% to 2,120 plants/acre and cover decreased to 7%. Decadence increased to 92% and plants displaying poor vigor increased to 82%. There was, however, a substantial decrease in broom snakeweed as well.

Pre vs. Five Years Post Treatment

- **2004 to 2009:** There was a slight decrease in the density and cover of sagebrush, but decadence and the proportion of plants displaying poor vigor decreased to 37% and 31%, respectively. While these measurements are still relatively high, it is a large improvement over 2004 conditions. Recruitment of young sagebrush plants also increased slightly, but is still low at only 5% of the population.

Grass:

- **1986 to 1994 - stable (0):** There was little change in the sum of nested frequency of perennial grasses. There was a significant increase in nested frequency of bottlebrush squirreltail and a significant decrease in nested frequency of needle-and-thread.
- **1994 to 1999 - slightly down (-1):** There was a slight increase in the sum of nested frequency of perennial grasses, but cover decreased slightly to 8%. There was also a significant decrease in the nested frequency of the dominant perennial grass, blue grama, and a significant increase in the nested frequency of cheatgrass. The cover of cheatgrass increased to nearly 13% and was the dominant species on the site.
- **1999 to 2004 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased by 24%, though cover increased from 8% to 15%. Most of this increase was due to a significant increase in the nested frequency of blue grama and subsequent increase in cover. However, there was a significant decrease in galleta and bottlebrush squirreltail. Cheatgrass also had a significant decrease in nested frequency and had less than 1% cover.

Pre vs. Five Years Post Treatment

- **2004 to 2009:** The sum of nested frequency of perennial grasses increased by 59% while cover increased to 20%. There was a significant increase in the nested frequency of blue grama and bottlebrush squirreltail. Cheatgrass also had a significant increase in nested frequency and cover increased to 3%.

Forb:

- **1986 to 1994 - down (-2):** There was a significant decrease in the nested frequency of the only two common perennial forbs, scarlet globemallow (*Sphaeralcea coccinea*) and low fleabane (*Erigeron pumilus*).
- **1994 to 1999 - stable (0):** There was a slight increase in the sum of nested frequency of perennial forbs, but forbs are so rare that there was little real change.
- **1999 to 2004 - stable (0):** Forbs are very rare on the site with little change in the sum of nested frequency or cover of perennial forbs.

Pre vs. Five Years Post Treatment

- **2004 to 2009:** There was little change in the sum of nested frequency and cover of perennial forbs.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --
Management unit 14, study no: 9

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
94	14.8	1.2	1.0	21.2	-0.5	0.8	0.0	**38.5**	Fair
99	11.9	5.1	0.5	15.0	-9.9	1.3	0.0	**23.9**	Poor-Fair
04	8.9	-12.6	1.0	29.5	-0.4	0.4	0.0	**26.8**	Poor-Fair
09	7.1	3.9	2.5	30.0	-2.4	0.7	0.0	**41.8**	Fair

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

Type	Species	Nested Frequency					Average Cover %			
		'86	'94	'99	'04	'09	'94	'99	'04	'09
G	Agropyron cristatum	a-	a6	a4	a-	b17	.03	.06	-	.34
G	Bouteloua gracilis	b165	b130	a77	b166	c210	5.41	2.97	12.73	17.41
G	Bromus tectorum (a)	-	a16	c344	a19	b165	.07	12.91	.52	3.25
G	Hilaria jamesii	a1	a5	b39	a-	ab15	.04	1.52	-	.31
G	Oryzopsis hymenoides	a-	b15	b20	b9	b27	.39	.27	1.03	.72
G	Sitanion hystrix	a25	b123	c153	a46	b82	4.70	2.62	.93	1.12
G	Sporobolus cryptandrus	-	-	-	2	-	-	-	.00	-
G	Stipa comata	b81	a-	a4	a4	a9	-	.04	.03	.07
G	Vulpia octoflora (a)	-	d240	c99	b11	a-	.55	.33	.02	-
Total for Annual Grasses		0	256	443	30	165	0.62	13.24	0.54	3.25
Total for Perennial Grasses		272	279	297	227	360	10.59	7.50	14.73	19.99
Total for Grasses		272	535	740	257	525	11.21	20.75	15.28	23.25
F	Arnica mollis	7	-	-	-	-	-	-	-	-
F	Astragalus mollissimus	2	-	5	-	-	-	.06	-	-
F	Chenopodium album (a)	-	-	-	3	-	-	-	.01	-
F	Chenopodium sp. (a)	-	2	-	-	-	.00	-	-	-
F	Cryptantha sp.	a-	b12	b20	a-	a-	.03	.23	-	-
F	Descurainia pinnata (a)	-	b38	a1	a10	a7	.09	.00	.21	.44
F	Erigeron pumilus	c44	a1	b17	a1	a3	.03	.31	.01	.03
F	Erigeron sp.	b9	a-	a-	a-	ab3	-	-	-	.04
F	Eriogonum cernuum (a)	-	1	-	-	-	.00	-	-	-
F	Gilia hutchinifolia (a)	-	ab20	a8	b34	a-	.05	.02	.30	-
F	Lappula occidentalis (a)	-	a-	a1	b17	a6	-	.00	.27	.01
F	Lepidium sp. (a)	-	c20	ab7	a3	bc17	.42	.23	.07	.26
F	Leucelene ericoides	-	10	-	7	-	.33	-	.09	-
F	Orobanche fasciculata	-	-	4	-	-	-	.01	-	-
F	Phlox longifolia	-	-	-	3	-	-	-	.00	-
F	Ranunculus testiculatus (a)	-	-	-	1	-	-	-	.00	-
F	Schoencrambe linifolia	-	-	-	-	-	-	-	-	.00
F	Sclerocactus sp.	2	-	-	-	-	-	-	-	-
F	Senecio multilobatus	-	-	-	4	-	-	-	.00	-
F	Sphaeralcea coccinea	b52	a14	a13	a6	a18	.03	.05	.07	.28

Type	Species	Nested Frequency					Average Cover %			
		'86	'94	'99	'04	'09	'94	'99	'04	'09
F	Unknown forb-perennial	-	-	-	1	-	-	-	.03	-
Total for Annual Forbs		0	81	17	68	30	0.58	0.26	0.87	0.71
Total for Perennial Forbs		116	37	59	22	24	0.42	0.67	0.21	0.35
Total for Forbs		116	118	76	90	54	1.00	0.94	1.09	1.07

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

BROWSE TRENDS--
Management unit 14, Study no: 9

Type	Species	Strip Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
B	Artemisia tridentata wyomingensis	77	78	70	64	11.80	9.50	7.10	5.69
B	Chrysothamnus viscidiflorus stenophyllus	10	6	9	10	.18	.46	1.77	1.21
B	Gutierrezia sarothrae	70	94	38	56	1.02	3.95	2.40	1.46
B	Opuntia sp.	11	5	3	4	.04	.18	.18	.30
B	Sclerocactus sp.	0	0	0	4	.01	-	-	.15
Total for Browse		168	183	120	138	13.07	14.11	11.46	8.82

CANOPY COVER, LINE INTERCEPT--
Management unit 14, Study no: 9

Species	Percent Cover	
	'04	'09
Artemisia tridentata wyomingensis	8.23	8.18
Chrysothamnus viscidiflorus stenophyllus	1.01	1.93
Gutierrezia sarothrae	2.53	1.46

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14, Study no: 9

Species	Average leader growth (in)	
	'04	'09
Artemisia tridentata wyomingensis	2.4	0.9

BASIC COVER--
Management unit 14, Study no: 9

Cover Type	Average Cover %				
	'86	'94	'99	'04	'09
Vegetation	4.25	21.01	34.93	28.69	34.25
Rock	0	.45	.09	.04	.06
Pavement	0	1.01	2.01	2.56	3.79
Litter	0	18.98	30.61	27.45	35.43
Cryptogams	0	1.52	1.99	1.28	.57
Bare Ground	0	51.87	41.37	48.84	41.95

SOIL ANALYSIS DATA --
Management unit 14, Study no: 9, Study Name: Hart Draw

Effective rooting depth (in)	pH	sandy loam			%0M	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
13.4	7.6	72.9	12.6	14.6	1.3	8.8	51.2	0.4

PELLET GROUP DATA--
Management unit 14, Study no: 9

Type	Quadrat Frequency			
	'94	'99	'04	'09
Sheep	-	1	-	1
Rabbit	14	53	9	36
Elk	8	1	-	-
Deer	36	40	41	29
Cattle	-	1	5	4

Days use per acre (ha)		
'99	'04	'09
-	-	-
-	-	-
-	-	-
84 (207)	104 (256)	68 (167)
7 (17)	15 (38)	30 (73)

BROWSE CHARACTERISTICS--
Management unit 14, 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)
Artemisia tridentata wyomingensis									
86	**3331**	2	48	50	-	46	14	16	20/19
94	**3580**	2	51	46	40	60	9	32	20/33
99	**3340**	1	66	33	-	53	23	14	23/31
04	**2120**	2	7	92	40	32	63	82	23/34
09	**2000**	5	58	37	-	29	17	31	20/33
Chrysothamnus viscidiflorus stenophyllus									
86	**199**	33	67	0	-	0	0	33	9/11
94	**480**	8	92	0	-	0	0	0	10/18
99	**300**	20	53	27	20	0	0	0	12/16
04	**400**	0	85	15	-	0	0	10	13/23
09	**460**	9	65	26	-	17	4	9	16/26
Gutierrezia sarothrae									
86	**12865**	29	66	5	3533	.51	0	.51	8/6
94	**5480**	11	88	2	260	1	0	2	5/6
99	**19600**	17	82	2	80	0	0	2	7/8
04	**2580**	2	97	2	-	0	0	2	8/11
09	**3020**	16	83	1	40	0	0	.66	6/8
Opuntia sp.									
86	**133**	0	100	0	-	0	0	50	3/6
94	**360**	33	61	0	20	0	0	0	2/10
99	**120**	17	83	0	-	0	0	17	3/7
04	**60**	0	67	33	-	0	0	33	2/4
09	**80**	0	100	0	-	0	0	0	3/7

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Sclerocactus sp.									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	3/9
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**80**	25	75	-	-	0	0	25	1/1

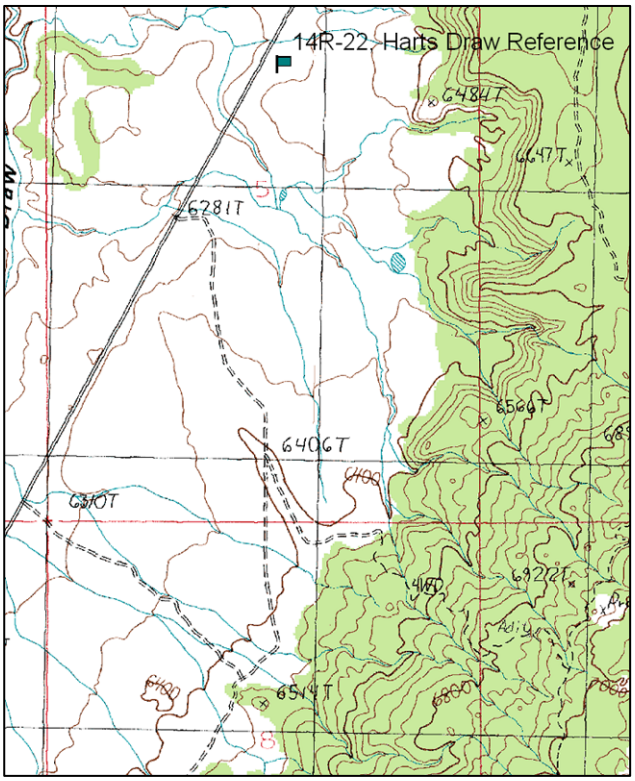
HARTS DRAW REFERENCE WRI, 14R-22

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter
NRCS Ecological Site Description: Not Available
Land Ownership: BLM
Elevation: 6300 ft. (1920 m)
Aspect: Northwest
Slope: 6%
Transect bearing: 154° magnetic
Belt placement: Read Baseline, No Belts

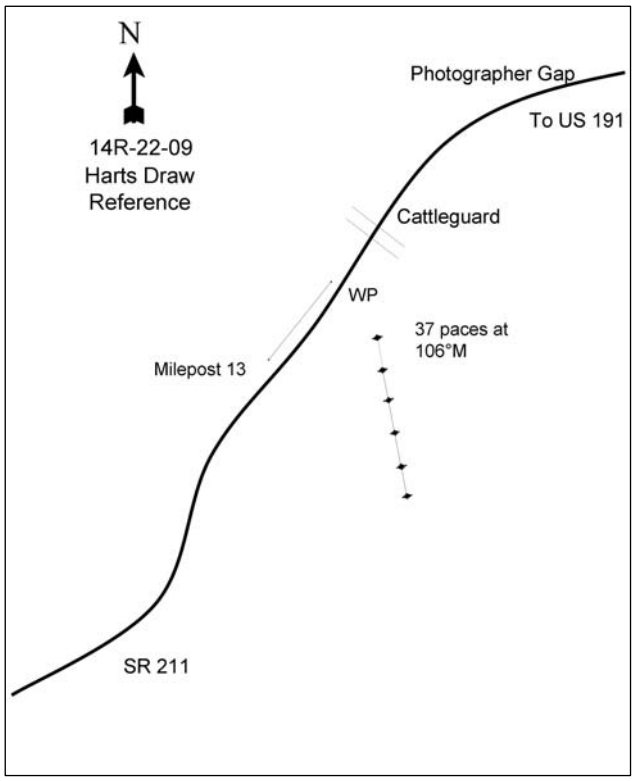
Directions:

Witness post is located 0.7 miles north of mile marker 13 on SR 211 on the east side of the road. From the witness post proceed 37 paces at 106°M. The 0' stake is just east of a rock shelf.

Map Name: Photograph Gap



Diagrammatic Sketch:



Township: 32S Range: 23E Section: 5

GPS: NAD 83, UTM 12S 638763 E 4210629 N

HARTS DRAW REFERENCE - WRI STUDY 14R-22
Project #246 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to the Hart's Draw study, 14-9, and is located one mile north of the treatment site just east of Highway 211. The site is a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community with a good grass understory. Pellet group data from 2009 estimated very heavy deer use and light cow use (Table - Pellet Group Data). Soil erosion condition was classified as critical due to heavy flow patterns, frequent rills and pedestals, and lots of soil and litter movement.

Browse: Wyoming big sagebrush is the predominant browse species on the site providing almost all of the canopy cover (Table - Canopy Cover). Green Ephedra (*Ephedra viridis*) and broom snakeweed (*Gutierrezia sarothrae*) occur infrequently.

Herbaceous Understory: Six perennial and two annual species were sampled. Perennial grasses were predominant and blue grama (*Bouteloa gracilis*) accounted for the majority of the total grass cover. Other perennial species of note were Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). Cheatgrass (*Bromus tectorum*) was present, but rare (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 14R, Study no: 22

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	4	.18
G	Bouteloua gracilis	116	6.88
G	Bromus tectorum (a)	10	.05
G	Hilaria jamesii	1	.00
G	Oryzopsis hymenoides	51	2.29
G	Sitanion hystrix	139	2.31
G	Stipa comata	53	1.71
G	Vulpia octoflora (a)	1	.00
Total for Annual Grasses		11	0.05
Total for Perennial Grasses		364	13.39
Total for Grasses		375	13.45
F	Gayophytum ramosissimum(a)	13	.05
F	Gilia sp. (a)	2	.01
Total for Annual Forbs		15	0.06
Total for Perennial Forbs		0	0
Total for Forbs		15	0.06

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

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 22

Species	Percent Cover '09
Artemisia tridentata wyomingensis	13.44
Gutierrezia sarothrae	.15

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14R, Study no: 22

Species	Average leader growth (in) '09
Artemisia tridentata wyomingensis	1.0

BASIC COVER--
Management unit 14R, Study no: 22

Cover Type	Average Cover % '09
Vegetation	26.55
Rock	.01
Pavement	1.62
Litter	27.01
Cryptogams	3.42
Bare Ground	57.52

PELLET GROUP DATA--
Management unit 14R, Study no: 22

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	35	-
Elk	-	121 (298)
Deer	44	9 (23)
Cattle	4	-

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 22

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	20/37
Atriplex canescens	
09	28/17
Chrysothamnus viscidiflorus stenophyllus	
09	10/15
Gutierrezia sarothrae	
09	6/7
Opuntia sp.	
09	2/7

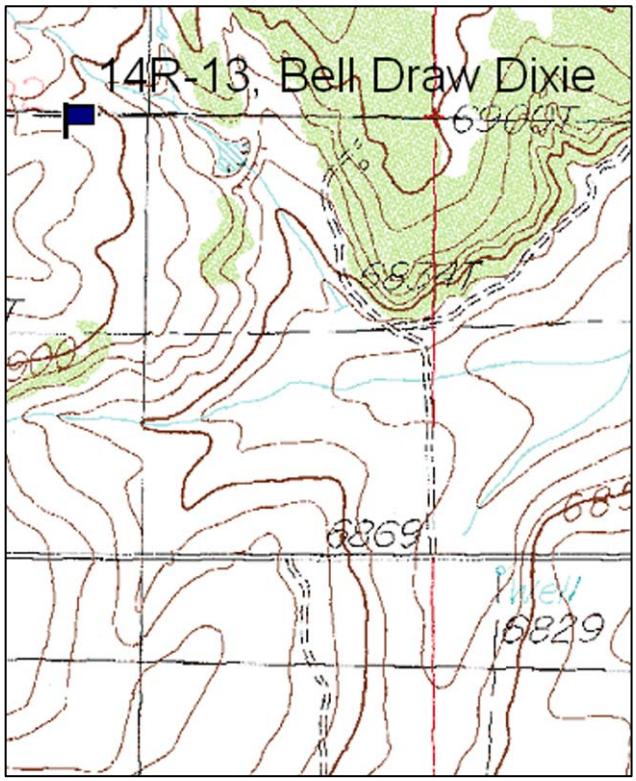
BELL DRAW DIXIE WRI, 14R-13

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer transitional
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R035XY306UT
Land Ownership: Private
Elevation: 6900 ft. (2103 m)
Aspect: Northeast
Slope: 7%
Transect bearing: 249° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

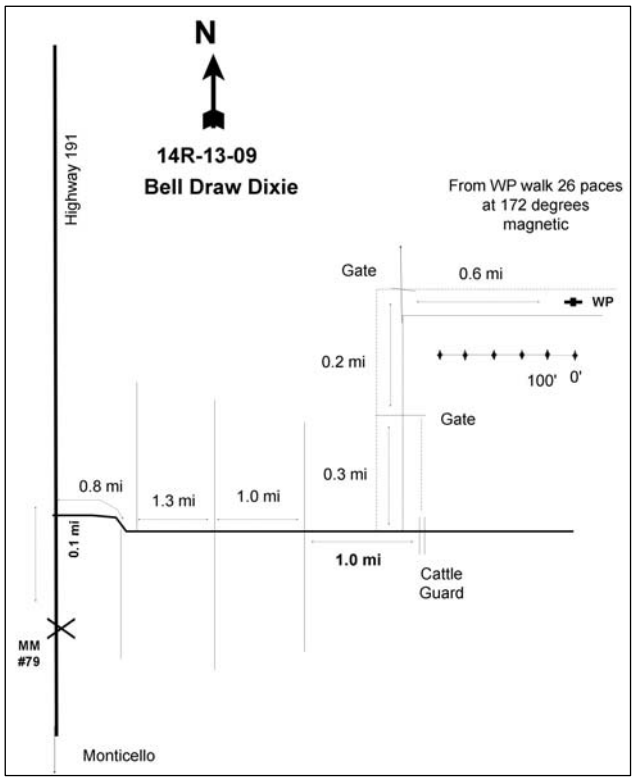
Directions:

From mile marker 79 on highway 191 north of Monticello drive 0.1 miles north and turn right onto a road heading east. Drive 0.8 miles to a junction; stay straight for 1.3 miles to another junction again staying straight for 1.0 mile to another junction again staying straight for another 1.0 mile to a junction. Turn left (north) at this junction and drive 0.3 miles to a gate. Drive 0.2 miles to another gate and turn right on a road just before the gate. Proceed 0.6 miles to a witness post on the left. The witness post is right next to a fence post. The 0' stake is 26 paces from the witness post at 172 degrees magnetic. The 0' stake is marked with browse tag #165.

Map Name: Monticello North



Diagrammatic Sketch:



Township: 32S Range: 24E Section: 22

GPS: NAD 83, UTM 12S 651795 E 4205153 N

BELL DRAW DIXIE - WRI STUDY 14R-13
Project #295

Site Description

Site Information: This study was established in 2006 prior to a dixie harrow treatment in a sagebrush community to create more diverse plant communities completed in the fall of 2006. This study is located seven miles northeast of Monticello. Pellet group data estimated light deer and elk use and moderate cow use in 2006 and heavy deer and light cow use in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as moderate in 2006 due to surface litter movement, pedestalling, and flow patterns. The soil condition was classified as stable in 2009.

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant browse species on the site providing nearly all of the canopy cover. Broom snakeweed (*Gutierrezia sarothrae*) provided considerable cover prior to the treatment, but was less abundant in 2009, following the treatment (Table - Canopy Cover). Other browse sampled on the site include graystem rabbitbrush (*Chrysothamnus nauseosus* ssp. *hololecus*) and prickly pear cactus (*Opuntia sp.*)

Herbaceous Understory: Crested wheatgrass (*Agropyron cristatum*) was the only perennial grass species sampled on the site and also provides nearly all of the herbaceous understory cover. Forbs are fairly diverse, but are not abundant and did not respond well to the treatment with a decrease in nested frequency and cover in 2009 (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Wyoming big sagebrush canopy cover decreased from 23% to 14%. As this was a sagebrush thinning this is good. Broom snakeweed canopy cover also decreased from 8% to less than 1%. Neither of the seeded shrubs was sampled three years after treatment.

Grass: It was hoped that opening up the community would allow for better herbaceous undergrowth. The sum of nested frequency for crested wheatgrass did not change while cover nearly doubled to 12%. No seeded species except crested wheatgrass was sampled, but crested wheatgrass was present prior to the treatment. Cheatgrass (*Bromus tectorum*) was sampled for the first time in 2009, following the treatment, at low frequency and cover. The seeding portion of this treatment was a failure. Diversity has not been increased.

Forb: The sum of nested frequency for perennial forbs decreased by 69% and bur buttercup (*Ranunculus* testiculatus) and annual stickseed (*Lappula occidentalis*) were sampled for the first time. Alfalfa (*Medicago sativa*) was the only seeded species that was sampled. Alfalfa was only sampled in 3% of the quadrats and provided very little cover.

Seed Mix

Project name: Bell Draw Dixie Harrow

WRI Database #: 295	Size (acre):	50		Size (acre):	100
Mix Lot #: ser-dc-bdh-07			Mix Lot #: ser-dc-bdd-07		
Seed type	lbs in mix	lbs/acre	Seed type	lbs in mix	lbs/acre
Orchardgrass 'Paiute'	13	0.26	Orchardgrass 'Paiute'	25	0.25
Tall Wheatgrass 'Alkar'	39	0.78	Tall Wheatgrass 'Alkar'	100	1.00
Newhy Wheatgrass	50	1.00	Newhy Wheatgrass	150	1.50
Pubescent Wheatgrass	100	2.00	Pubescent Wheatgrass	200	2.00
Slender Wheatgrass 'San Luis'	100	2.00	Slender Wheatgrass 'San Luis'	150	1.50
Great Basin Wildrye 'Trailhead'	25	0.50	Great Basin Wildrye 'Trailhead'	50	0.50
Crested Wheatgrass 'Ephraim'	30	0.60	Crested Wheatgrass 'Ephraim'	75	0.75
Crested Wheatgrass 'Hycrest'	30	0.60	Crested Wheatgrass 'Hycrest'	50	0.50
Small Burnet 'Delar'	125	2.50	Small Burnet 'Delar'	250	2.50
Rocky Mountain Beeplant	25	0.50	Rocky Mountain Beeplant	50	0.50
Blue Flax	13	0.26	Blue Flax	25	0.25
Alfalfa 'Ladak'	50	1.00	Alfalfa 'Ladak'	50	0.50
Alfalfa 'Nomad'	50	1.00	Alfalfa 'Nomad'	100	1.00
Fourwing Saltbush--Lincoln NV	75	1.50	Alfalfa 'Ranger'	50	0.50
Forage Kochia--Beaver UT	35	0.70	Fourwing Saltbush--Lincoln NV	150	1.50
Tall Wheatgrass 'Alkar'	10	0.20	Forage Kochia--Beaver UT	75	0.75
BULK POUNDS PER ACRE:		15.40	BULK POUNDS PER ACRE:		15.50
PLS POUNDS PER ACRE:		13.01	PLS POUNDS PER ACRE:		13.02

HERBACEOUS TRENDS--

Management unit 14R, Study no: 13

Type	Species	Nested Frequency		Average Cover %	
		'06	'09	'06	'09
G	Agropyron cristatum	192	194	6.58	11.76
G	Bromus tectorum (a)	-	21	-	.06
Total for Annual Grasses		0	21	0	0.06
Total for Perennial Grasses		192	194	6.58	11.76
Total for Grasses		192	215	6.58	11.82
F	Astragalus convallarius	3	7	.00	.06
F	Erigeron sp.	13	19	.04	.18
F	Euphorbia sp.	46	-	.14	-
F	Lappula occidentalis (a)	-	3	-	.00
F	Machaeranthera grindelioides	1	-	.00	-
F	Medicago sativa	-	4	-	.09
F	Penstemon sp.	4	5	.03	.18
F	Ranunculus testiculatus (a)	-	16	-	.02
F	Senecio multilobatus	128	3	1.72	.01
F	Sphaeralcea coccinea	21	24	.13	.34
F	Trifolium sp.	-	5	-	.01
Total for Annual Forbs		0	19	0	0.02
Total for Perennial Forbs		216	67	2.08	0.87
Total for Forbs		216	86	2.08	0.90

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

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 13

Species	Percent Cover '06	'09
Artemisia tridentata wyomingensis	23.41	14.36
Chrysothamnus nauseosus hololeucus	.43	.30
Gutierrezia sarothrae	8.31	.80
Opuntia sp.	.83	.26

BASIC COVER--
Management unit 14R, Study no: 13

Cover Type	Average Cover % '06	'09
Vegetation	26.28	29.39
Rock	.01	.03
Pavement	.05	.02
Litter	20.48	35.20
Cryptogams	.96	.24
Bare Ground	67.24	54.65

SOIL ANALYSIS DATA --
Management unit 14R, Study no: 13, Study Name: Bell Draw Dixie

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
15.4	7.3	44.2	36.0	19.8	1.4	21.1	172.8	0.6

PELLET GROUP DATA--
Management unit 14R, Study no: 13

Type	Quadrat Frequency '06	'09	Days use per acre (ha) '06	'09
Rabbit	78	61	-	-
Elk	3	2	1 (2)	-
Deer	1	16	3 (7)	43 (106)
Cattle	5	2	27 (66)	6 (14)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 13

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
06	27/40
09	18/26
Chrysothamnus nauseosus hololeucus	
06	19/21
09	15/20
Gutierrezia sarothrae	
06	5/9
09	5/6
Opuntia sp.	
06	6/30
09	5/17

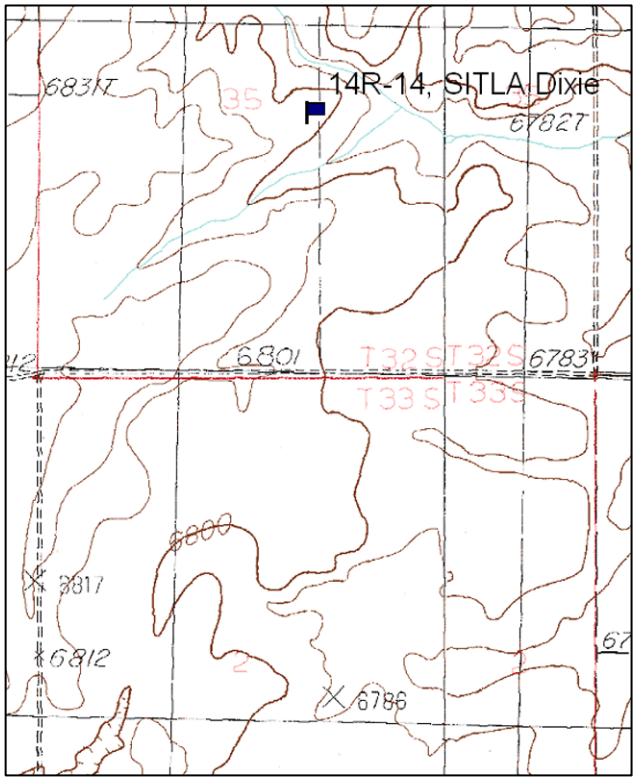
SITLA DIXIE WRI, 14R-14

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R035XY306UT
Land Ownership: SITLA
Elevation: 6800 ft. (2075 m)
Aspect: Southeast
Slope: 2%
Transect bearing: 253° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

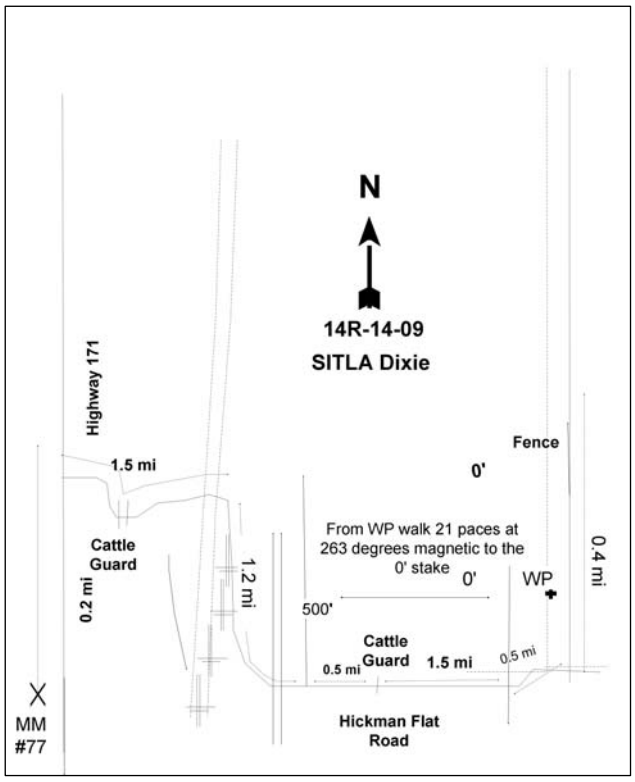
Directions:

From mile marker 77 on highway 191 north of Monticello, drive 0.2 miles north and turn right onto a road heading east (Hickman Flat Road). From there drive for 1.5 miles to some power lines and a southward bend in the road. Go 1.2 miles to a junction staying straight for another 0.5 miles to a cattle guard. From the cattle guard drive 1.5 miles to another junction and continue straight for 0.5 miles. Turn left onto a two-track road and a gate. Proceed 0.4 miles through the gate to a witness post on the left. Walk 21 paces from the witness post at 263 degrees magnetic to the 0' stake marked with browse tag #164.

Map Name: Monticello North



Diagrammatic Sketch:



Township: 32S Range: 24E Section: 35

GPS: NAD 83, UTM 12S 653300 E 4201916 N

SITLA DIXIE - WRI STUDY 14R-14
Project #334

Site Description

Site Information: This study was established in 2006, within a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community approximately 7 miles northeast of Monticello. The study was established to monitor the effects of a dixie harrow treatment to rejuvenate sagebrush stands currently occupied by sage grouse. Pellet group data estimated light cow use in 2006 and 2009, and moderate deer and light sheep use in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as slight in 2006 due to pedestalling, flow patterns and surface litter movement. In 2009, the soil condition was classified as stable.

Browse: Wyoming big sagebrush is the primary browse species accounting for the majority of the browse cover in all sample years. Slenderbush eriogonum (*Eriogonum microthecum*) and dwarf rabbitbrush (*Chrysothamnus depressus*) are the only other preferred browse species sampled on the site. Rubber rabbitbrush (*Chrysothamnus nauseosus spp.*) and some broom snakeweed (*Gutierrezia sarothrae*) also occur with low cover (Table - Canopy Cover).

Herbaceous Understory: : The area had been treated in the past as crested wheatgrass (*Agropyron cristatum*) was present in 2006. Three perennial grass species and one annual grass were sampled in both sample years. The herbaceous understory improved following the treatment. Cheatgrass (*Bromus tectorum*) is the dominant grass on the site and produces the majority of the grass cover. Cheatgrass cover decreased following treatment while perennial grasses increased in frequency of occurrence and cover. Seeded perennial grass species sampled in 2009, following the treatment, included intermediate wheatgrass (*A. intermedium*) and Indian ricegrass (*Oryzopsis hymenoides*). Perennial forbs responded well to the treatment with increases in species diversity, cover and nested frequency. Alfalfa (*Medicago sativa*) was the only seeded forb that was sampled in 2009 at very low frequency and cover (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Wyoming big sagebrush canopy declined from 25% to 16%. As this was a sagebrush thinning treatment this effect is desirable. Dwarf rabbitbrush, which was not sampled prior to treatment, provided 6% canopy cover in 2009 while other browse species combined to provide less than 1% canopy cover.

Grass: The sum of nested frequency of perennial grasses increased over two-fold and cover increased from 0.5% to more than 1%. Two seeded species were sampled, intermediate wheatgrass and Indian ricegrass. Cheatgrass decreased significantly in nested frequency and cover fell from 6% to 4%, but cheatgrass still provided 74% of total grass cover in 2009.

Forb: Perennial forbs have responded very well to the treatment. The sum of nested frequency has increased two-fold and cover has increased from 1% to 5%. Alfalfa was the only seeded forb to be sampled and it was found only once. Scarlet globemallow (*Sphaeralcea coccinea*) cover increased from less than 1% to nearly 2%, and clover (*Trifolium sp.*) increased significantly in nested frequency.

Seed Mix

Project name: Gunnison Sage Grouse Sagebrush Treatments
WRI Database #: 334

Mix lot #: ser-dc-gsg-07	Size (acre):	150
Seed type	lbs in mix	lbs/acre
Bluebunch WG 'Goldar'	300	2.00
Indian Ricegrass 'Rimrock'	300	2.00
Sand Dropseed	10	0.07
Thickspike Wheatgrass 'Bannock'	300	2.00
Pubescent Wheatgrass	150	1.00
Western Wheatgrass 'Arriba'	150	1.00
Alfalfa 'Ladak'	150	1.00
Cicer Milkvetch 'Lutana'	150	1.00
Sainfoin 'Eski'	450	3.00
Small Burnet 'Delar'	300	2.00
Sagebrush, Wyoming--Sanpete UT	150	1.00
BULK POUNDS PER ACRE:		16.07
PLS POUNDS PER ACRE:		14.04

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

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
G	Agropyron cristatum	$_{a}$31	$_{b}$48	.19	.81
G	Agropyron intermedium	-	8	-	.04
G	Bouteloua gracilis	1	-	.00	-
G	Bromus tectorum (a)	$_{b}$274	$_{a}$242	6.00	3.80
G	Oryzopsis hymenoides	-	1	-	.03
G	Sitanion hystrix	$_{a}$6	$_{b}$39	.30	.46
Total for Annual Grasses		274	242	6.00	3.80
Total for Perennial Grasses		38	96	0.50	1.34
Total for Grasses		312	338	6.50	5.15
F	Astragalus convallarius	-	2	-	.03
F	Cirsium sp.	-	-	-	.00
F	Erigeron sp.	$_{b}$15	$_{a}$5	.06	.04
F	Eriogonum sp.	-	$_{a}$15	-	.05
F	Erodium cicutarium (a)	-	7	-	.30
F	Gayophytum ramosissimum(a)	-	8	-	.01
F	Gilia sp. (a)	-	6	-	.01
F	Lappula occidentalis (a)	16	23	.22	.11
F	Medicago sativa	-	2	-	.03
F	Phlox longifolia	$_{a}$6	$_{b}$27	.04	.10
F	Polygonum douglasii (a)	-	9	-	.01
F	Ranunculus testiculatus (a)	-	$_{a}$71	-	.57
F	Salsola iberica (a)	4	2	.03	.01
F	Senecio multilobatus	-	5	-	.01
F	Sphaeralcea coccinea	118	124	.56	1.87
F	Trifolium sp.	$_{a}$6	$_{b}$85	.01	.70
F	Unknown forb-annual (a)	3	10	.01	.78

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
F	Unknown forb-perennial	-	$_a$30	-	2.55
F	Zigadenus paniculatus	-	1	-	.00
Total for Annual Forbs		23	136	0.26	1.81
Total for Perennial Forbs		145	296	0.67	5.40
Total for Forbs		168	432	0.94	7.22

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

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

Species	Percent Cover '06	Percent Cover '09
Artemisia tridentata wyomingensis	24.95	15.85
Chrysothamnus depressus	-	6.08
Chrysothamnus nauseosus	-	.16
Chrysothamnus nauseosus hololeucus	.36	-
Gutierrezia sarothrae	.16	.71

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

Species	Average leader growth (in) '06	Average leader growth (in) '09
Artemisia tridentata wyomingensis	0.9	2.1

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

Cover Type	Average Cover % '06	Average Cover % '09
Vegetation	27.42	24.70
Rock	.66	.55
Pavement	.35	.42
Litter	39.73	40.73
Cryptogams	.35	.44
Bare Ground	51.45	49.08

SOIL ANALYSIS DATA --
Management unit 14R, Study no: 14, Study Name: SITLA Dixie

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
11.2	7.3	38.2	39.0	22.8	1.5	15.5	214.4	0.6

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

Type	Quadrat Frequency '06	'09	Days use per acre (ha) '06	'09
Rabbit	74	63	-	-
Elk	4	2	-	-
Deer	4	21	-	28 (69)
Cattle	1	3	4 (9)	16 (40)

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

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
06	20/28
09	18/25
Chrysothamnus nauseosus	
06	-/-
09	14/19
Chrysothamnus nauseosus hololeucus	
06	15/19
09	-/-
Chrysothamnus viscidiflorus	
06	12/12
09	-/-
Gutierrezia sarothrae	
06	6/9
09	8/11
Opuntia sp.	
06	7/15
09	6/20

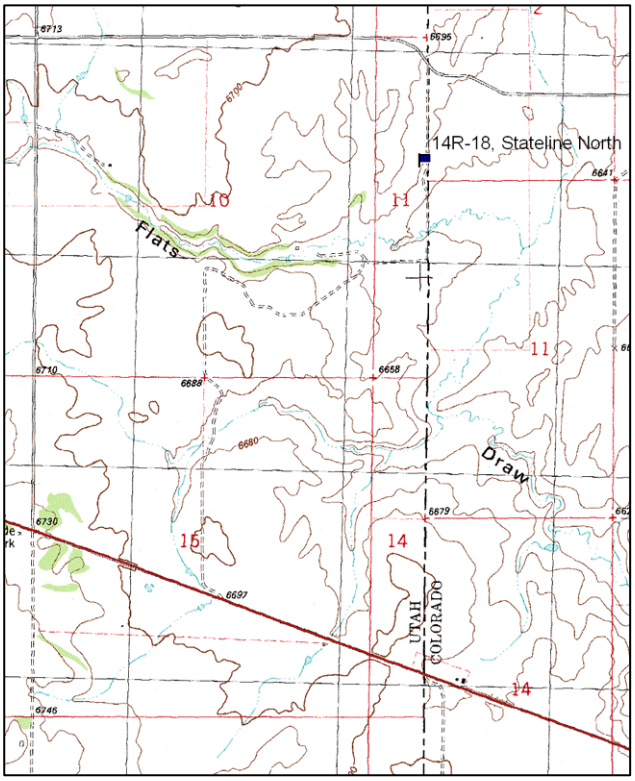
STATELIINE NORTH WRI, 14R-18 – Project #334

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter; substantial year-long elk
NRCS Ecological Site Description: Not Available
Land Ownership: BLM
Elevation: 6679 ft. (2036 m)
Aspect: East
Slope: 4%
Transect bearing: 171° magnetic
Belt placement: We are changing how we read this site. Line 1 (11 & 71ft), Line 2 (34 & 71ft), Line 3 (59ft).

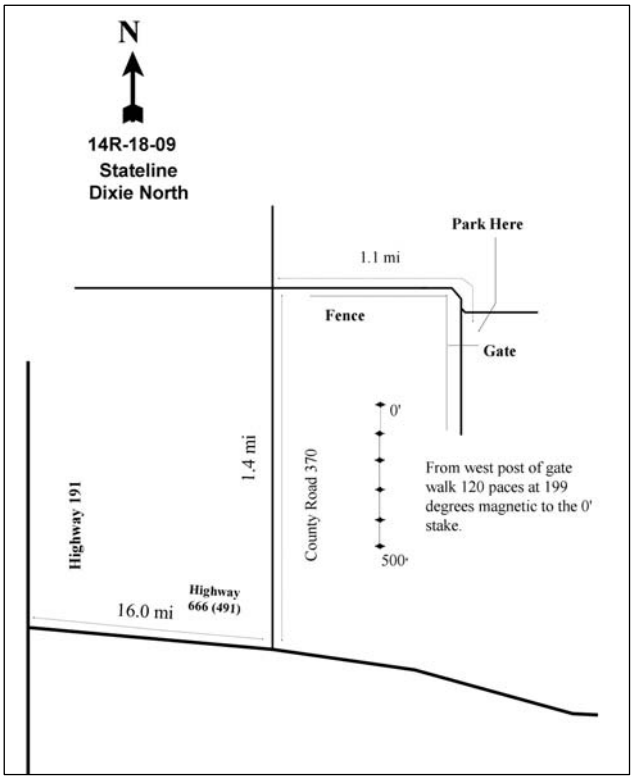
Directions:

From highway 191 turn east onto highway 666 (491). Proceed 16.0 miles to County Road 370. Turn left (north) and drive 1.4 miles to an intersection. Turn right at the intersection and drive 1.1 miles to a road going south. Turn and park by the gate. Walk from the west post (cedar post) of the gate 120 paces at 199 degrees magnetic to the 0' stake marked with browse tag #100.

Map Name: North Dell



Diagrammatic Sketch:



Township: 34S Range: 26E Section: 11

GPS: NAD 83, UTM 12S 672266 E 4189651 N

STATELINE NORTH - WRI STUDY 14R-18
Project #334

Site Description

Site Information: This study was established prior to a dixie harrow treatment in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community in the fall of 2006. The study monitors a dixie harrow treatment to rejuvenate sagebrush stands currently occupied by sage grouse. Pellet group data estimated light deer and cow use in 2006 and 2009 (Table - Pellet Group Data). Soil erosion condition was classified as slight in 2006 and 2009 due to pedestalling, flow patterns, rills, and soil and litter movement.

Browse: Wyoming big sagebrush is the key browse species providing most of the canopy cover on the site. Other browse species include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), and prickly pear cactus (*Opuntia sp.*) which occur with low cover (Table - Canopy Cover).

Herbaceous Understory: Prior to the treatment, perennial grasses were sparse and dominated by one unidentified *Poa sp*. Following the treatment, diversity increased, but the *Poa sp.* still provided the majority of the cover. Cheatgrass (*Bromus tectorum*) was sampled prior to treatment at low frequency and cover, but increased substantially in 2009, after the treatment. Forbs were very rare prior to treatment, but responded well and increased in diversity and abundance in 2009 (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: As a sagebrush thinning, this treatment has been initially successful reducing Wyoming big sagebrush canopy cover from 23% to 15%, although the entire transect was not treated. There was also a slight increase in the canopy cover of the less desirable species sticky leaf low rabbitbrush and broom snakeweed.

Grass: Perennial grasses have not responded as well to the treatment on this site. Perennial grass sum of nested frequency has declined 11% and cover has decreased from 7% to 5%. Cheatgrass has increased significantly in nested frequency and cover increased substantially from near 0% to 5%. Cheatgrass is now the dominant grass on the site. Seeded species sampled were pubescent wheatgrass (*Agropyron intermedium*), bluebunch wheatgrass (*A. spicatum*), and Indian ricegrass (*Oryzopsis hymenoides*) in small amounts.

Forb: Perennial forb sum of nested frequency and cover has increased greatly, but mainly from just one species. Lupine (*Lupinus sp.*) was sampled for the first time in 2009 and provided almost all of the forb cover with a cover of 6%. The number of forbs sampled increased from just three species in 2006 to 13 species in 2009, after the treatment. No seeded forbs were sampled in 2009. Weedy annual species also had increased after treatment with annual stickweed (*Lappula occidentalis*) being very common and providing 7% cover.

Seed Mix

Project name: Gunnison Sage Grouse Sagebrush Treatments
WRI Database #: 334

Mix lot #: ser-dc-gsg-07	Size (acre):	150	Mix Lot #: ser-dc-gsg2-07	Size (acre):	150
Seed type	lbs in mix	lbs/acre	Seed type	lbs in mix	lbs/acre
Bluebunch WG 'Goldar'	300	2.00	Bluebunch WG 'Anatone'	300	2.00
Indian Ricegrass 'Rimrock'	300	2.00	Indian Ricegrass 'Rimrock'	300	2.00
Sand Dropseed	10	0.07	Sand Dropseed	10	0.07
Thickspike Wheatgrass 'Bannock'	300	2.00	Thickspike Wheatgrass 'Bannock'	300	2.00
Pubescent Wheatgrass	150	1.00	Pubescent Wheatgrass	150	1.00
Western Wheatgrass 'Arriba'	150	1.00	Western Wheatgrass 'Arriba'	150	1.00
Alfalfa 'Ladak'	150	1.00	Alfalfa 'Ladak'	150	1.00
Cicer Milkvetch 'Lutana'	150	1.00	Cicer Milkvetch 'Lutana'	150	1.00
Sainfoin 'Eski'	450	3.00	Sainfoin 'Eski'	450	3.00
Small Burnet 'Delar'	300	2.00	Small Burnet 'Delar'	300	2.00
Sagebrush, Wyoming--Sanpete UT	150	1.00	Sagebrush, Wyoming--Sanpete UT	150	1.00
BULK POUNDS PER ACRE:	2410	16.07	BULK POUNDS PER ACRE:	2410	16.07
PLS POUNDS PER ACRE:		14.04	PLS POUNDS PER ACRE:		13.93

HERBACEOUS TRENDS--
Management unit 14R, Study no: 18

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
G	Agropyron cristatum	1	1	.01	.00
G	Agropyron intermedium	-	a17	-	.50
G	Agropyron spicatum	-	13	-	.19
G	Bromus tectorum (a)	a14	b188	.04	4.90
G	Koeleria cristata	-	-	.00	-
G	Oryzopsis hymenoides	-	3	-	.03
G	Poa fendleriana	5	2	.04	.00
G	Poa secunda	8	1	.01	.03
G	Poa sp.	b209	a135	6.65	3.78
G	Sitanion hystrix	a9	b34	.07	.68
Total for Annual Grasses		14	188	0.03	4.90
Total for Perennial Grasses		232	206	6.78	5.24
Total for Grasses		246	394	6.82	10.15
F	Astragalus sp.	-	-	-	.00
F	Cordylanthus sp. (a)	-	7	-	.04
F	Cryptantha sp.	3	-	.00	-
F	Descurainia pinnata (a)	-	1	-	.01
F	Erigeron eatonii	3	2	.00	.00
F	Erodium cicutarium (a)	-	5	-	.00
F	Lactuca serriola	-	4	-	.00
F	Lappula occidentalis (a)	-	a202	-	7.26
F	Lupinus sp.	-	a110	-	6.25
F	Phlox austromontana	-	10	-	.02
F	Phlox hoodii	-	2	-	.00
F	Phlox longifolia	-	a40	-	.11
F	Ranunculus testiculatus (a)	-	a26	-	.36

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
F	Senecio multilobatus	-	-	-	.00
F	Sphaeralcea coccinea	$_{a}$37	$_{b}$55	.10	.79
F	Trifolium sp.	-	$_{a}$31	-	.08
Total for Annual Forbs		0	241	0	7.68
Total for Perennial Forbs		43	254	0.11	7.29
Total for Forbs		43	495	0.11	14.98

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

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 18

Species	Percent Cover '06	Percent Cover '09
Artemisia tridentata wyomingensis	23.00	14.81
Chrysothamnus viscidiflorus viscidiflorus	.68	1.51
Gutierrezia sarothrae	-	.38
Opuntia sp.	.06	.10

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14R, Study no: 18

Species	Average leader growth (in) '06	Average leader growth (in) '09
Artemisia tridentata wyomingensis	0.8	2.95

BASIC COVER--
Management unit 14R, Study no: 18

Cover Type	Average Cover % '06	Average Cover % '09
Vegetation	27.95	35.11
Rock	.69	.72
Pavement	.08	.34
Litter	30.41	40.36
Cryptogams	2.84	1.81
Bare Ground	54.20	43.70

SOIL ANALYSIS DATA --
Management unit 14R, Study no: 18, Study Name: State Line North

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
12.5	7.4	38.2	38.0	23.8	1.0	13.8	70.4	0.4

PELLET GROUP DATA--
Management unit 14R, Study no: 18

Type	Quadrat Frequency		Days use per acre (ha)	
	'06	'09	'06	'09
Rabbit	94	67	-	-
Deer	-	12	3 (8)	11 (28)
Cattle	2	1	2 (5)	1 (2)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 18

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
06	29/36
09	24/30
Chrysothamnus nauseosus	
06	33/36
09	19/13
Chrysothamnus viscidiflorus viscidiflorus	
06	3/7
09	8/12
Gutierrezia sarothrae	
06	5/9
09	7/11
Opuntia sp.	
06	5/18
09	5/19

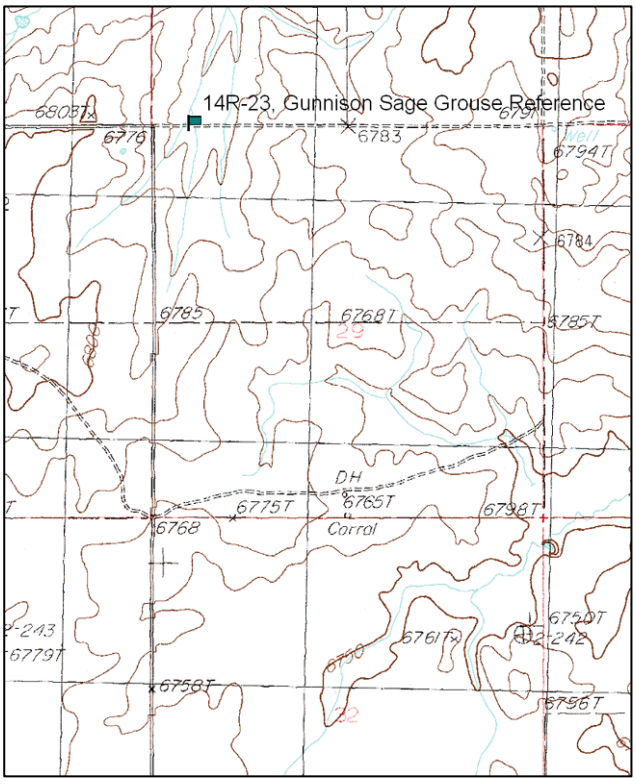
GUNNISON SAGE GROUSE REFERENCE WRI, 14R-23

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R035XY306UT
Land Ownership: BLM
Elevation: 6766 ft. (2062 m)
Aspect: North
Slope: 2%
Transect bearing: 111° magnetic
Belt placement: Read Baseline, No Belts

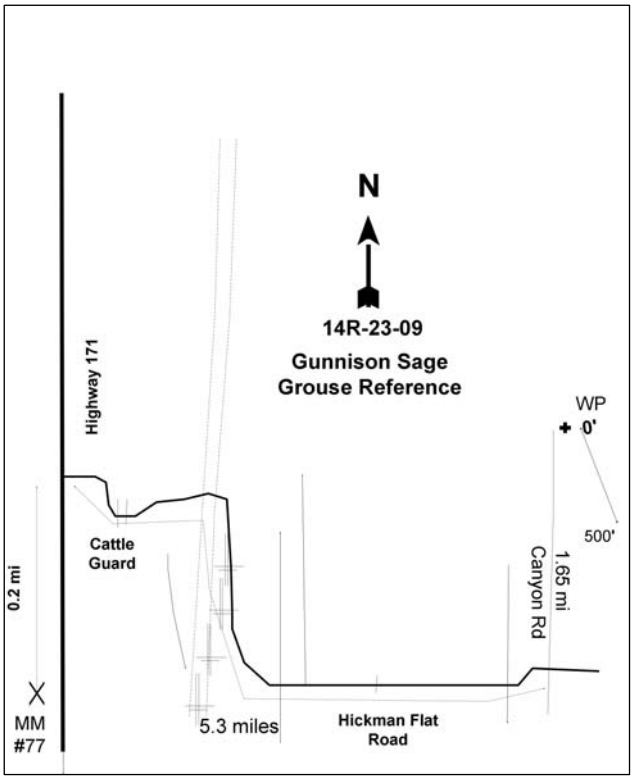
Directions:

From mile marker 79 on highway 191 north of Monticello drive 0.1 miles north and turn right onto a road heading east (Hickman Flat Road). Staying on the main road drive east for 5.3 miles then turn left (Canyon Road) for 1.65 miles to a witness post. If coming from 14R-13, get back on the main road (Peter Spring Road) head east for 2.9 miles; turn south for 0.4 miles to the witness post. From the witness post to the 0' stake is 10 paces at 168°M.

Map Name: Eastland NW



Diagrammatic Sketch:



Township: 32S Range: 25E Section: 29

GPS: NAD 83, UTM 12S 657418 E 4204476 N

GUNNISON SAGE GROUSE REFERENCE - WRI STUDY 14R-23
Project #295 and #334 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to the Bell Draw Dixie study, 14R-13, and the SITLA Dixie study, 14R-14. The study is located a few miles east of both treatment sites along Peter Spring Road in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community with a good herbaceous understory. Pellet group data from 2009 estimated moderate deer and light cow use in 2009, with an estimated 174 sage grouse pellets/acre (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: Wyoming big sagebrush is the dominant browse species providing most of the canopy cover on the site. Winterfat (*Ceratoides lanata*) is also common, accounting for much of the remaining canopy cover (Table - Canopy Cover). Other browse that occur with lower cover include rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), and fishhook cactus (*Sclerocactus sp.*).

Herbaceous Understory: Eight perennial and one annual grass species were sampled in 2009. Of the perennial species western wheatgrass (*Agropyron smithii*) provided the most cover. Other common perennials include crested wheatgrass (*Agropyron cristatum*), blue grama (*Bouteloua gracilis*), and a bluegrass (*Poa sp.*). Cheatgrass (*Bromus tectorum*) was also common on the site with high frequency and cover. Forbs are fairly diverse, but are dominated by annual species. Burr buttercup (*Ranunculus testiculatus*) cover accounted for the majority of the forb cover on the site (Table - Herbaceous Cover).

HERBACEOUS TRENDS--
Management unit 14R, Study no: 23

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	18	1.28
G	Agropyron intermedium	5	.15
G	Agropyron smithii	93	3.15
G	Bouteloua gracilis	37	1.37
G	Bromus tectorum (a)	117	1.56
G	Oryzopsis hymenoides	11	.64
G	Poa sp.	44	1.90
G	Sitanion hystrix	41	.93
G	Stipa comata	2	.03
Total for Annual Grasses		117	1.56
Total for Perennial Grasses		251	9.48
Total for Grasses		368	11.05
F	Chenopodium album (a)	2	.00
F	Chenopodium leptophyllum(a)	1	.00
F	Cirsium sp.	3	.15
F	Cordylanthus sp. (a)	8	.02
F	Erigeron sp.	30	.68
F	Erodium cicutarium (a)	6	.16
F	Lappula occidentalis (a)	5	.01
F	Machaeranthera grindelioides	3	.04

Type	Species	Nested Frequency '09	Average Cover % '09
F	Phlox austromontana	4	.15
F	Phlox longifolia	24	.05
F	Polygonum douglasii (a)	4	.01
F	Ranunculus testiculatus (a)	141	1.97
F	Senecio multilobatus	3	.00
F	Sphaeralcea coccinea	25	.25
F	Tragopogon dubius	2	.03
F	Trifolium sp.	38	.26
F	Unknown forb-annual (a)	4	.01
Total for Annual Forbs		171	2.20
Total for Perennial Forbs		132	1.63
Total for Forbs		303	3.83

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

CANOPY COVER, LINE INTERCEPT--
Management unit 14R, Study no: 23

Species	Percent Cover '09
Artemisia tridentata wyomingensis	23.11
Ceratoides lanata	2.76
Chrysothamnus nauseosus	.83
Gutierrezia sarothrae	.36
Opuntia sp.	.63

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14R, Study no: 23

Species	Average leader growth (in) '09
Artemisia tridentata wyomingensis	1.56

BASIC COVER--
Management unit 14R, Study no: 23

Cover Type	Average Cover % '09
Vegetation	35.24
Rock	.15
Pavement	.03
Litter	34.54
Cryptogams	1.77
Bare Ground	47.81

PELLET GROUP DATA--
Management unit 14R, Study no: 23

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	49	-
Elk	2	-
Deer	9	29 (73)
Cattle	1	3 (7)

BROWSE CHARACTERISTICS--
Management unit 14R, Study no: 23

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	21/35
Ceratoides lanata	
09	6/7
Chrysothamnus nauseosus	
09	22/30
Gutierrezia sarothrae	
09	7/8
Opuntia sp.	
09	4/14
Sclerocactus sp.	
09	4/9
Tetradymia canescens	
09	4/4

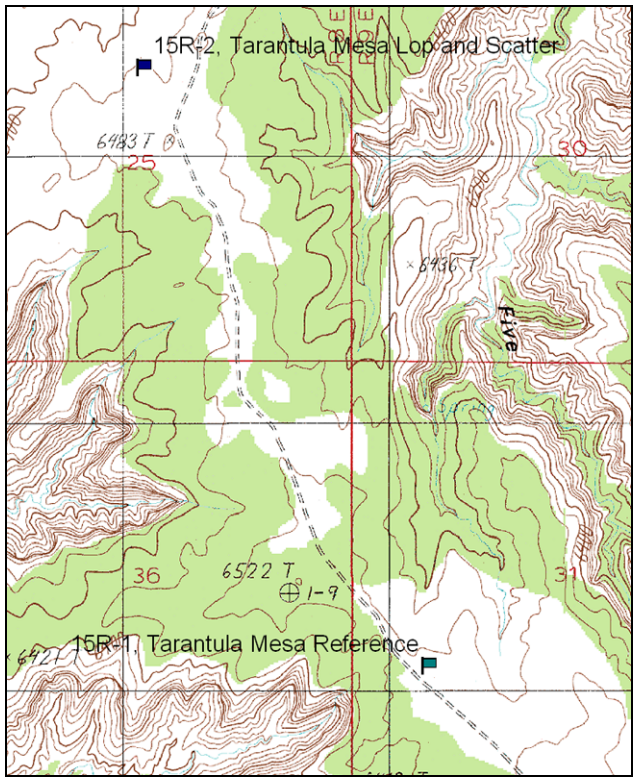
TARANTULA MESA LOP AND SCATTER WRI, 15R-2

Vegetation Type: Wyoming Big Sagebrush, P-J
Range Type: Winter
NRCS Ecological Site Description: Semidesert Sandy Loam (Fourwing Saltbush), R035XY215UT
Land Ownership: BLM
Elevation: 6400 ft. (1951 m)
Aspect: Northwest
Slope: 3%
Transect bearing: 190° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). May need to replace all but 0' stake with half-highs

Directions:

Turn onto G14240 (Tarantula Mesa Rd.), from the road in the bottom of Sweetwater Creek. Drive 4.3 miles to a guzzler with catch basin, then 2.7 miles to a turn, go right (north) 2.2 miles (total of 9.35 miles). Witness post is on the left. Proceed 450 yards at 314°M. 0' stake has browse tag #2__.

Map Name: Cave flat



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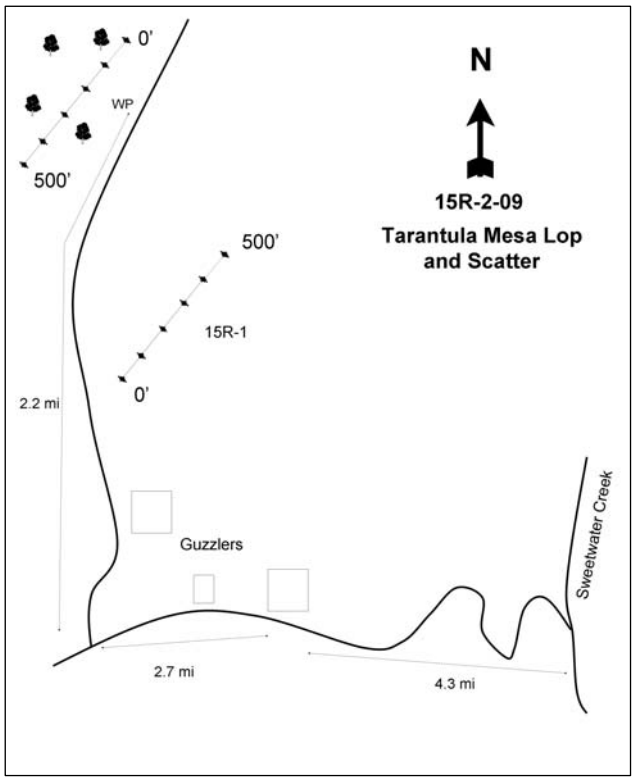


Township: 32S Range: 8E Section: 25

GPS: NAD 83, UTM 12S 501995 E 4205504 N

TARANTULA MESA LOP AND SCATTER - WRI STUDY 15R-2
Project #1336

Site Description

Site Information: This study was established in 2009, prior to treatment later that year, to monitor the effects of a 2,107 acre lop and scatter treatment. The project objectives are: 1. Maintain restoration work that has previously been completed on previously chained BLM property in the Henry Mountains. 2. Reduce pinyon pine and juniper (PJ) trees that are encroaching on sagebrush steppe habitat. 3. Increase abundance of grasses, forbs, and shrubs for wildlife. Pellet group data from 2009 estimated moderate deer and light cow use (Table - Pellet Group Data). Soil erosion condition was classified as moderate to critical in 2009. This was due to rill and gully formation, soil and litter movement, and pedestalling.

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant preferred browse on the site, providing the majority of the canopy cover in 2009. Utah juniper (*Juniperus osteosperma*) provided 4% canopy cover in 2009 and had an estimated density of 44 trees/acre while pinyon pine (*Pinus edulis*) density was estimated to be 8 trees/acre (Table - Point-Quarter Tree Data). Other shrubs include green ephedra (*Ephedra viridis*) at 2% cover and broom snakeweed (*Gutierrezia sarothrae*) at 1% cover (Table - Canopy Cover).

Herbaceous Understory: Four perennial grasses were sampled in 2009, but crested wheatgrass (*Agropyron cristatum*), blue grama (*Bouteloa gracilis*), and galleta (*Hilaria jamesii*) are the only common grass species on the site. These three species produced 8% cover in 2009. No forbs were sampled on the site in 2009.

HERBACEOUS TRENDS--
Management unit 15R, Study no: 2

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	100	3.19
G	Bouteloua gracilis	84	2.38
G	Hilaria jamesii	62	2.40
G	Stipa comata	5	.19
Total for Annual Grasses		0	0
Total for Perennial Grasses		251	8.18
Total for Grasses		251	8.18

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

CANOPY COVER, LINE INTERCEPT--
Management unit 15R, Study no: 2

Species	Percent Cover '09
Artemisia tridentata wyomingensis	15.68
Ephedra viridis	2.41
Gutierrezia sarothrae	1.33
Juniperus osteosperma	3.53
Opuntia sp.	.51

POINT-QUARTER TREE DATA--
Management unit 15R, Study no: 2

Species	Trees per Acre '09		Average diameter (in) '09
Juniperus osteosperma	44		4.2
Pinus edulis	<18		5

BASIC COVER--
Management unit 15R, Study no: 2

Cover Type	Average Cover % '09
Vegetation	25.51
Rock	.60
Pavement	.15
Litter	26.59
Cryptogams	2.62
Bare Ground	55.60

PELLET GROUP DATA--
Management unit 15R, Study no: 2

Type	Quadrat Frequency '09		Days use per acre (ha) '09
Rabbit	50		-
Deer	11		32 (79)
Cattle	2		3 (7)

BROWSE CHARACTERISTICS--
Management unit 15R, Study no: 2

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	21/36
Atriplex canescens	
09	42/47
Ephedra viridis	
09	19/25
Gutierrezia sarothrae	
09	5/6
Leptodactylon pungens	
09	2/5
Opuntia sp.	
09	4/13
Sclerocactus sp.	
09	3/3

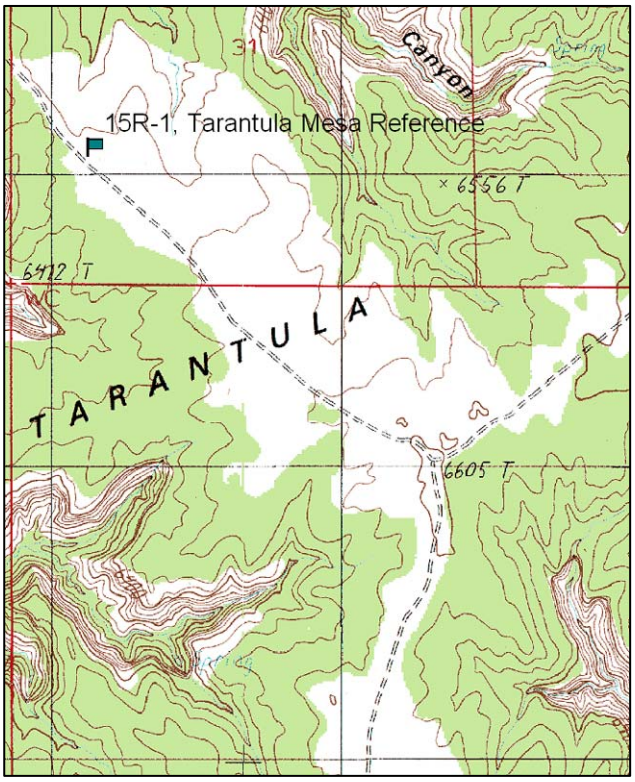
TARANTULA MESA REFERENCE WRI, 15R-1

Vegetation Type: Wyoming Big Sagebrush, P-J
Range Type: Crucial deer winter
NRCS Ecological Site Description: Semidesert Sandy Loam (Fourwing Saltbush), R035XY215UT
Land Ownership: BLM
Elevation: 6450 ft. (1966 m)
Aspect: Northwest
Slope: 6%
Transect bearing: 357° magnetic
Belt placement: Read Baseline, No Belts

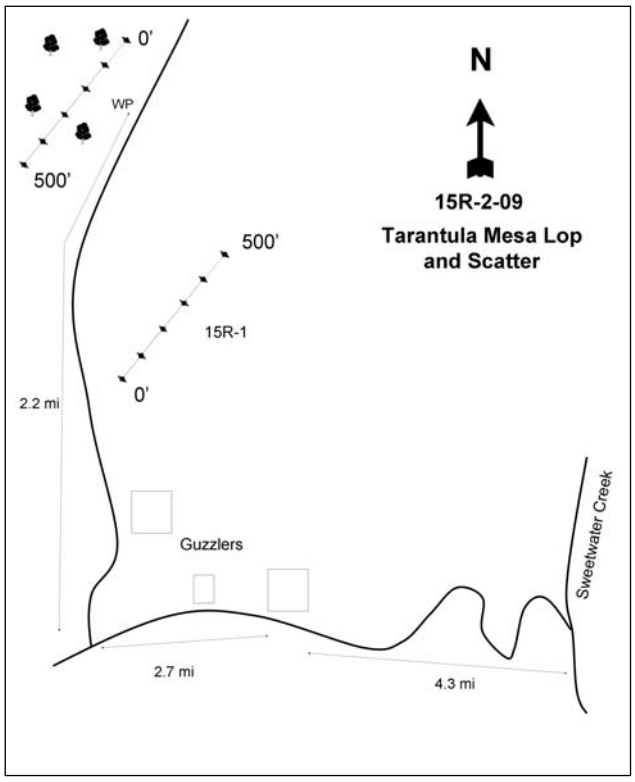
Directions:

Turn onto G14240 (Tarantula Mesa Rd.), from the road in the bottom of Sweetwater Creek. Drive 4.3 miles to a guzzler with catch basin, then 2.7 miles to a turn, go right (north) for 0.8 miles for a total of 7.9 miles. Witness post is on the right and 0' stake (browse tag # 260) is 23 paces at 15°M.

Map Name: Cave Flat



Diagrammatic Sketch:



Township: 32S Range: 9E Section: 31

GPS: NAD 83, UTM 12S 503065 E 4203263 N

TARANTULA MESA REFERENCE - WRI STUDY 15R-1
Project #1336 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to the Tarantula Mesa Lop and Scatter study, 15R-2. The study is located one and a half miles southeast of the treatment site along Tarantula Mesa Road on the northeast side of the mesa in a pinyon/sagebrush community. Pellet data from 2009 estimated moderate deer and light cow use (Table - Pellet Group Data). Soil erosion condition was classified as critical in 2009 due to heavy pedestalling, rill and gully formation, soil and surface litter movement, and flow patterns.

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the predominant browse species and comprises the majority of the canopy cover on the site. Pinyon pine (*Pinus edulis*) provided 1% canopy cover and had an estimated density of 27 trees/acre. Juniper density was estimated at 35 trees/acre (Table - Point-Quarter Tree Data). Other shrubs sampled with low cover include dwarf rabbitbrush (*Chrysothamnus depressus*) and green ephedra (*Ephedra viridis*) (Table - Canopy Cover).

Herbaceous Understory: Six perennial grass species were sampled in 2009. Blue grama (*Bouteloa gracilis*) was the most abundant with 5% cover and no other species providing more than 1% cover. Forbs were sparse with less than 1% cover.

HERBACEOUS TRENDS--
Management unit 15R, Study no: 1

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	37	.78
G	Bouteloua gracilis	120	5.44
G	Oryzopsis hymenoides	46	.81
G	Poa fendleriana	14	.25
G	Sitanion hystrix	13	.78
G	Stipa comata	33	.39
Total for Annual Grasses		0	0
Total for Perennial Grasses		263	8.46
Total for Grasses		263	8.46
F	Agoseris glauca	9	.07
F	Astragalus sp.	2	.00
F	Astragalus sp.	19	.09
F	Cryptantha sp.	6	.06
F	Erigeron sp.	14	.22
F	Hymenoxys richardsonii	4	.18
F	Lesquerella sp.	4	.03
F	Penstemon sp.	2	.06
F	Phlox longifolia	2	.00
F	Plantago patagonica (a)	8	.04
F	Sanguisorba minor	3	.01
F	Senecio multilobatus	7	.04
F	Townsendia sp.	15	.09

Type	Species	Nested Frequency '09	Average Cover % '09
Total for Annual Forbs		8	0.03
Total for Perennial Forbs		87	0.88
Total for Forbs		95	0.92

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

CANOPY COVER, LINE INTERCEPT--
Management unit 15R, Study no: 1

Species	Percent Cover '09
Artemisia tridentata wyomingensis	8.61
Chrysothamnus depressus	2.54
Ephedra viridis	1.06
Gutierrezia sarothrae	.21
Leptodactylon pungens	.53
Pinus edulis	.78

POINT-QUARTER TREE DATA--
Management unit 15R, Study no: 1

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	35	4.7
Pinus edulis	27	4.8

BASIC COVER--
Management unit 15R, Study no: 1

Cover Type	Average Cover % '09
Vegetation	23.64
Rock	1.30
Pavement	.08
Litter	24.27
Cryptogams	3.10
Bare Ground	56.77

PELLET GROUP DATA--
Management unit 15R, Study no: 1

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	55	-
Deer	8	30 (74)
Cattle	1	1 (2)

BROWSE CHARACTERISTICS--
Management unit 15R, Study no: 1

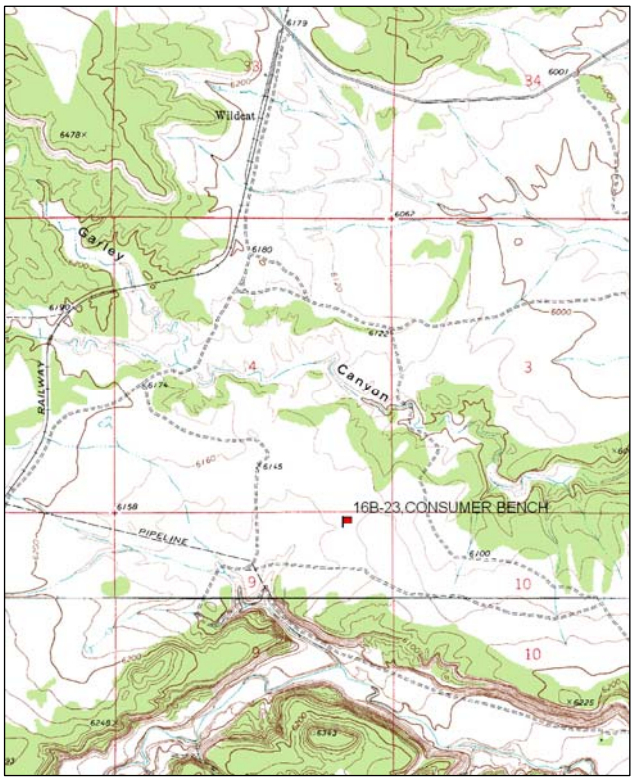
Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	24/45
Chrysothamnus depressus	
09	4/13
Chrysothamnus nauseosus	
09	13/20
Chrysothamnus viscidiflorus viscidiflorus	
09	17/20
Ephedra viridis	
09	18/16
Gutierrezia sarothrae	
09	6/8
Leptodactylon pungens	
09	5/7
Opuntia sp.	
09	4/10
Sclerocactus sp.	
09	4/5
Yucca sp.	
09	10/13

CONSUMER BENCH - TREND STUDY NO. 16B-23

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT
Land Ownership: BLM
Elevation: 6,100 ft (1,859 m)
Aspect: South
Slope: 5%
Transect bearing: 328 degrees magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:
On US 6 south of Helper, turn right (west) on Consumer Road and travel 2.85 miles. Turn left on a dirt road, and go 2.75 miles passing a coal plant. Turn left and travel 0.7 miles to a fork. Stay left for an additional 0.5 miles to another fork. Turn left and go 0.1 miles to a telephone pole (#67). The 0' stake is 42 paces away at 340°M from the telephone pole.

Map Name: Standardville



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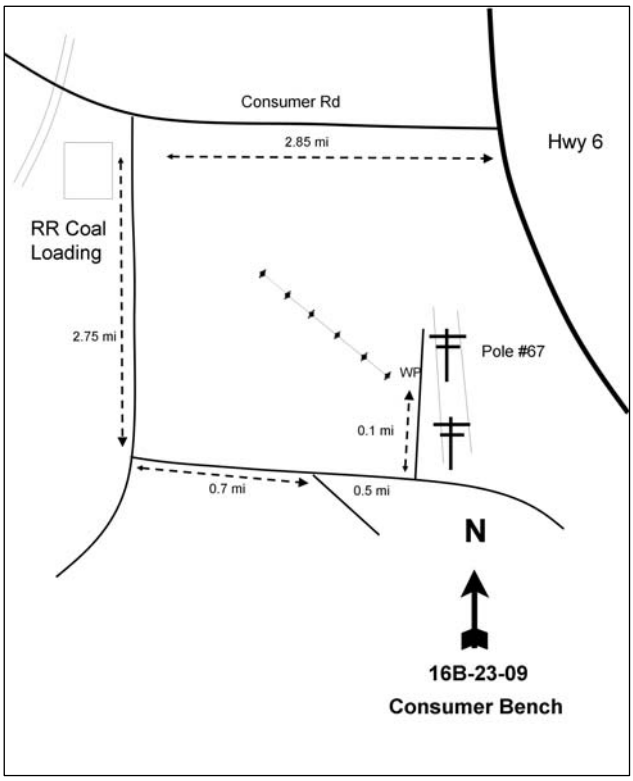


Township: 14S, Range: 9E, Section: 4

GPS: NAD 83, UTM 12S 507432 E 4386548 N

CONSUMER BENCH - TREND STUDY NO. 16B-23

Site Description

Site Information: The study monitors a big sagebrush/grass community with a few scattered junipers. The site occurs within the Consumers Wash allotment, which is allotted for winter and spring sheep grazing. The area was treated with an aerator in the late summer of 2004 through May of 2005. The area has many other land uses than just grazing and wildlife as evidenced by an oil pad about 400 feet to the south, a pressure station about one mile to the west, a coal loading station two miles to the north, and numerous power lines that crisscross the area. Because of difficulties in differentiating between species, deer and sheep use was combined. Pellet group data indicated high sheep/deer use since 1999. Estimated elk use has declined from moderately heavy use in 1999 to lightly moderate use in 2009 (Table - Pellet Group Data).

Browse: The key browse species on the site is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). There was a large die-off of sagebrush between the 1999 and 2004 sample years attributed to a severe drought in the years prior to the 2004 sampling. The cover of sagebrush decreased from an average of 10% in 1994 and 1999 to around 2% after 2004 (Table - Browse Trends). Sagebrush density also decreased substantially from 1999 to 2004 with 94% of the population being classified as decadent in 2004. Sagebrush plants displaying poor vigor also increased to 90% in 2004 and recruitment of young sagebrush plants was very poor. The density of sagebrush remained low in 2009, but had increased with improved recruitment of young sagebrush. Decadence and poor vigor in sagebrush decreased in 2009, as well. Utilization of sagebrush was mostly heavy in 1999 and 2004, but was mostly light in 2009 (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is relatively abundant for a Wyoming big sagebrush site. Perennial native grasses dominate the site. There was a sharp decline in the cover and sum of nested frequency of perennial grasses in 2004, but both returned to near or above 1999 levels in 2009. There was a significant increase in the nested frequency of needle-and-thread (*Stipa comata*) making it the dominant grass on the site. Blue grama (*Bouteloua gracilis*) was the dominant grass at the outset of the study in 1994, but decreased significantly in nested frequency in 2004. Other common grasses on the site include Indian ricegrass (*Oryzopsis hymenoides*) and western wheatgrass (*Agropyron smithii*). Salina wildrye (*Elymus salina*) was prevalent on the site at the outset of the study, but decreased significantly in 2004 and is now rare on the site. Forbs have been fairly diverse and abundant in past sample years, but decreased substantially in 2009. Scarlet globemallow (*Sphaeralcea coccinea*) is the dominant forb on the site providing nearly all of the forb cover (Table -Herbaceous Trends).

Soil: The soil is a sandy loam with a slightly alkaline pH and a moderately deep effective rooting depth. Phosphorus and potassium have limited availability for plant growth and development at 3.3 ppm and 41.6 ppm, respectively (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is fairly high on the site with the majority of protective ground cover coming from litter cover. Cryptogam cover has steadily decreased since 1999 (Table - Basic Cover). A couple of active gullies were noted on the site in 2004 and the soil erosion condition was classified as slight in 2004. The soil erosion condition was classified as stable in 2009.

Trend Assessments

Browse:

- **1994 to 1999 - slightly up (+1):** Density of the primary browse species, Wyoming big sagebrush, increased by 17% from 3,820 plants/acre to 4,480 plants/acre, and cover increased slightly. Decadence and vigor of sagebrush remained good in the population. Recruitment of young sagebrush plants also remained good at 17% of the population.

- **1999 to 2004 - down (-2):** Density of sagebrush decreased by 77% to 1,040 plants/acre and cover decreased from 10% to 2%. Decadence of sagebrush was high at 94% and 90% of the population displayed poor vigor. There was minimal recruitment of young sagebrush plants in the population.

Pre vs. Five Years Post Treatment

- **2004 to 2009:** The density of sagebrush increased to 1,940 plants/acre, though there was little change in cover. Decadence and poor vigor of sagebrush both decreased to more moderate levels of 24% and 18%, respectively. Recruitment of young sagebrush plants increased to 35% of the population.

Grass:

- **1994 to 1999 - stable (0):** There was a slight increase in the sum of nested frequency and cover of perennial grasses, but no significant increases.
- **1999 to 2004 - down (-2):** The sum of nested frequency of perennial grasses decreased by 44% and cover decreased from 16% to 5%. There was a significant decrease in the nested frequency of many of the grass species.

Pre vs. Five Years Post Treatment

- **2004 to 2009 - up (+2):** The sum of nested frequency of perennial grasses increased to near 1999 levels and cover increased to 24%. There was a significant increase in the nested frequency of many grasses including needle-and-thread, which also increased in cover from 3% to 14%.

Forb:

- **1994 to 1999 - up (+2):** The sum of nested frequency of perennial forbs increased by 65%, though there was little change in cover.
- **1999 to 2004 - stable (0):** There was a 13% decrease in the sum of nested frequency of perennial forbs, but cover increased from 2% to 11%.

Pre vs. Five Years Post Treatment

- **2004 to 2009 - down (-2):** The sum of nested frequency of perennial forbs decreased by 21% and cover decreased to 5%.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --
Management unit 16B, study no: 23

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
94	11.5	6.6	8.5	28.7	0.0	2.7	0.0	**57.9**	Good
99	12.9	6.9	8.5	30.0	0.0	4.0	0.0	**62.3**	Good
04	2.3	0.0	0.0	10.9	-0.1	10.0	0.0	**23.1**	Poor-Fair
09	2.7	0.0	0.0	30.0	-0.2	9.1	0.0	**41.6**	Fair

HERBACEOUS TRENDS--
Management unit 16B, Study no: 23

Type	Species	Nested Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
G	Agropyron smithii	a-	a-	b18	c34	-	-	.12	1.41
G	Bouteloua gracilis	b195	b193	a109	a109	6.22	4.79	2.02	2.91
G	Bromus tectorum (a)	-	-	-	1	-	-	-	.00
G	Elymus salina	b86	b105	a1	a3	.95	2.59	.00	.15
G	Oryzopsis hymenoides	ab114	b159	a68	b145	2.06	3.80	.22	5.14
G	Sitanion hystrix	ab24	b22	a1	b19	.39	.56	.03	.46
G	Sporobolus cryptandrus	1	-	1	1	.00	-	.00	.03
G	Stipa columbiana	-	-	-	3	-	-	-	.18
G	Stipa comata	b181	ab142	a147	c268	4.69	4.33	3.02	13.59
G	Vulpia octoflora (a)	a-	a6	b44	c70	-	.01	.10	.23
Total for Annual Grasses		0	6	44	71	0	0.01	0.10	0.24
Total for Perennial Grasses		601	621	345	582	14.33	16.10	5.44	23.88
Total for Grasses		601	627	389	653	14.33	16.11	5.53	24.13
F	Astragalus convallarius	a6	b39	b30	a10	.01	.19	1.57	.04
F	Astragalus sp.	7	-	-	-	.04	-	-	-
F	Calochortus nuttallii	a-	b11	b16	a-	-	.04	.05	-
F	Castilleja linariaefolia	a-	b17	a3	a3	-	.04	.00	.03
F	Chenopodium fremontii (a)	-	-	3	-	-	-	.04	-
F	Chenopodium leptophyllum(a)	-	a-	c162	b33	-	-	1.55	.17
F	Collinsia parviflora (a)	b17	b15	b16	a-	.06	.25	.11	-
F	Comandra pallida	a-	b10	b11	ab8	-	.02	.25	.07
F	Cordylanthus sp. (a)	-	-	1	-	-	-	.00	-
F	Cryptantha sp.	a-	a-	b11	a-	-	-	.27	-
F	Cymopterus sp.	-	3	1	-	-	.00	.00	-
F	Descurainia pinnata (a)	a3	a1	b16	a-	.00	.01	.08	-
F	Eriogonum cernuum (a)	a4	a-	b22	a1	.01	-	.12	.00
F	Eriogonum ovalifolium	5	16	1	3	.04	.34	.03	.01
F	Gayophytum ramosissimum(a)	a-	a-	b65	a-	-	-	.73	-
F	Gilia sp. (a)	a-	a-	b114	a-	-	-	.95	-
F	Lappula occidentalis (a)	a-	a-	b20	a-	-	-	.06	-
F	Lepidium montanum	12	3	3	7	.21	.01	.07	.04
F	Lygodesmia sp.	-	-	3	-	-	-	.06	-
F	Machaeranthera canescens	1	3	2	-	.00	.03	.03	-
F	Penstemon linarioides	3	-	-	-	.00	-	-	-
F	Penstemon sp.	11	3	4	-	.02	.03	.03	-
F	Phlox longifolia	ab26	b50	b30	a8	.05	.15	.18	.01
F	Plantago patagonica (a)	a3	a2	b103	a4	.00	.01	1.00	.01
F	Salsola iberica (a)	a-	a-	b38	a11	-	-	.57	.07
F	Schoencrambe linifolia	a7	ab17	a5	b22	.01	.07	.06	.11
F	Sisymbrium altissimum (a)	-	-	-	2	-	-	-	.00
F	Sphaeralcea coccinea	a128	ab166	b173	ab169	.93	1.04	8.54	4.19
F	Taraxacum officinale	-	-	1	-	-	-	.00	-
F	Tragopogon dubius	-	2	1	4	-	.00	.00	.03

Type	Species	Nested Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
Total for Annual Forbs		27	18	560	51	0.08	0.26	5.25	0.26
Total for Perennial Forbs		206	340	295	234	1.33	2.00	11.18	4.55
Total for Forbs		233	358	855	285	1.41	2.27	16.43	4.82

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

BROWSE TRENDS--
Management unit 16B, Study no: 23

Type	Species	Strip Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
B	Artemisia tridentata wyomingensis	77	74	35	34	9.19	10.31	1.80	1.92
B	Ceratoides lanata	2	1	2	5	.00	.00	.01	.07
B	Chrysothamnus viscidiflorus	1	2	2	5	.00	.15	.01	.01
B	Gutierrezia sarothrae	28	62	11	11	.78	.97	.25	.22
B	Kochia prostrata	0	0	0	0	-	-	-	.15
B	Opuntia polyacantha	29	21	20	20	.51	.66	.64	1.10
B	Pinus edulis	0	1	1	0	-	.00	.03	-
B	Sclerocactus sp.	0	0	0	0	-	-	-	.03
Total for Browse		137	161	71	75	10.49	12.11	2.74	3.50

CANOPY COVER, LINE INTERCEPT--
Management unit 16B, Study no: 23

Species	Percent Cover	
	'04	'09
Artemisia tridentata wyomingensis	1.23	1.00
Ceratoides lanata	.01	.11
Chrysothamnus viscidiflorus	.01	.08
Gutierrezia sarothrae	.20	-
Opuntia polyacantha	.35	.46

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16B, Study no: 23

Species	Average leader growth (in)	
	'04	'09
Artemisia tridentata wyomingensis	4.3	1.9
Ceratoides lanata	9.4	4.4

BASIC COVER--
Management unit 16B, Study no: 23

Cover Type	Average Cover %			
	'94	'99	'04	'09
Vegetation	24.62	32.35	26.23	31.95
Rock	.05	.01	.00	.01
Pavement	.44	.26	.60	.26
Litter	17.95	24.32	30.77	32.55
Cryptogams	1.43	11.09	2.56	.19
Bare Ground	45.88	36.49	51.98	45.53

PELLET GROUP DATA--
Management unit 16B, Study no: 23

Type	Quadrat Frequency			
	'94	'99	'04	'09
Sheep	-	-	-	12
Rabbit	6	66	36	38
Elk	20	17	16	10
Deer	55	58	62	41
Cattle	-	-	-	4

Days use per acre (ha)		
'99	'04	'09
-	-	53 (131)
-	-	-
64 (159)	25 (63)	17 (43)
90 (223)	106 (263)	84 (208)
-	1 (2)	2 (4)

BROWSE CHARACTERISTICS--
Management unit 16B, Study no: 23

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
94	**3820**	17	54	28	260	15	0	10	16/26
99	**4480**	17	55	27	300	26	47	11	17/30
04	**1040**	2	4	94	-	38	54	90	16/19
09	**1940**	35	41	24	60	13	6	18	10/14
Atriplex canescens									
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	34/26
Ceratoides lanata									
94	**60**	0	100	-	-	0	0	0	9/8
99	**20**	100	0	-	-	0	0	0	3/4
04	**40**	0	100	-	20	0	100	0	11/13
09	**220**	36	64	-	20	0	0	0	9/12
Chrysothamnus viscidiflorus									
94	**60**	0	100	-	-	0	0	0	7/18
99	**60**	100	0	-	-	0	0	0	4/10
04	**60**	0	100	-	140	0	0	0	9/13
09	**220**	9	91	-	-	36	0	0	6/10

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae									
94	**1020**	0	96	4	-	0	4	0	8/9
99	**6460**	50	50	0	2220	.30	.61	.30	4/4
04	**340**	6	94	0	-	6	0	0	6/8
09	**240**	42	58	0	-	0	8	0	6/8
Kochia prostrata									
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	9/6
Opuntia polyacantha									
94	**920**	4	91	4	-	0	0	0	3/10
99	**700**	14	71	14	40	0	0	6	3/9
04	**740**	19	81	0	40	0	0	0	4/12
09	**740**	3	86	11	40	0	0	14	3/11
Pinus edulis									
94	**0**	0	0	-	-	0	0	0	-/-
99	**20**	100	0	-	-	0	0	0	-/-
04	**20**	0	100	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
Sclerocactus sp.									
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	20	0	0	0	2/3

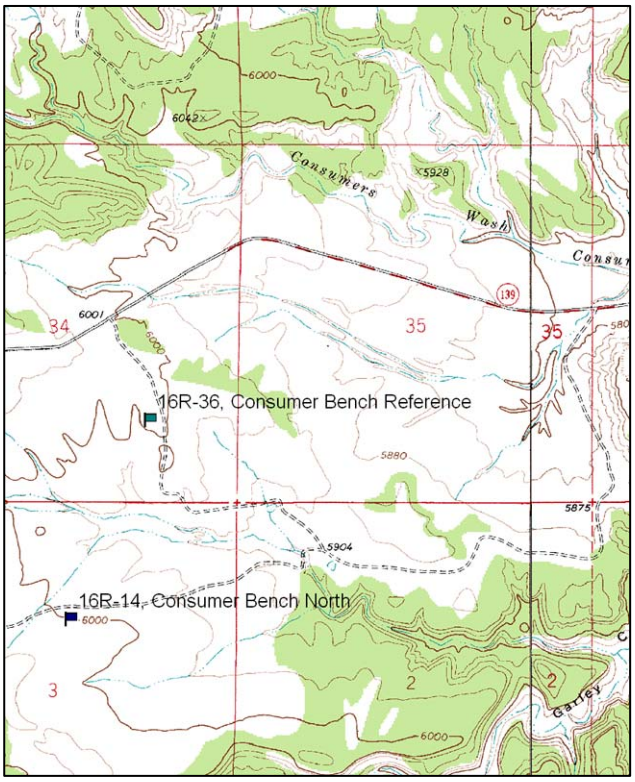
CONSUMER BENCH REFERENCE WRI, 16R-36

Vegetation Type: Wyoming big sagebrush
Range Type: Crucial deer winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R034XY212UT
Land Ownership: SITLA
Elevation: 5,932 ft. (1,808 m)
Aspect: southeast
Slope: 3%-4%
Transect bearing: 225° magnetic
Belt placement: Read Baseline, No Belts

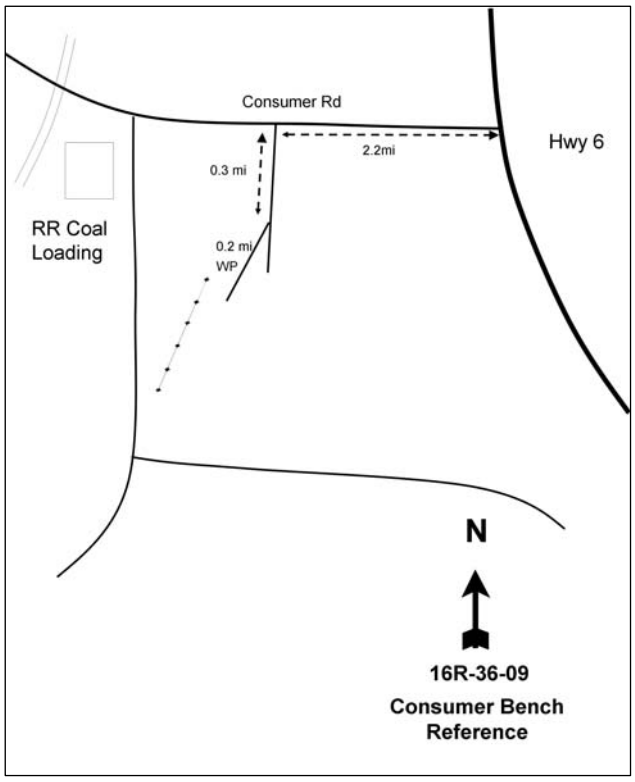
Directions:

From Highway 6 turn onto Consumer Road and proceed 2.2 miles to a cattle guard and turn left (south) continuing for 0.3 miles bearing left at a fork that connects to an old 2-track. Turn right onto the 2-track and drive 0.2 miles to the witness post. From the witness post proceed 46 paces at 235°M to the 0' stake.

Map Name: Standardville



Diagrammatic Sketch:



Township: 13S Range: 9E Section: 34

GPS: NAD 83, UTM 12S 508917 E 4388665 N

CONSUMER BENCH REFERENCE - WRI STUDY 16R-36
Project #228 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference in companion to the Consumer Bench (16B-23) study. This site is located in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community west of Price, UT. Pellet group data estimated very heavy deer use, and light elk, cattle and sheep use in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as slight in 2009 due to pedestalling, flow patterns, and soil litter movement.

Browse: Wyoming big sagebrush is the dominant browse on the site providing nearly all of the preferred browse canopy cover. Narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*) is also common and provided nearly as much cover as sagebrush. Winterfat (*Ceratoides lanata*) was sampled at low canopy cover in 2009 (Tables - Canopy Cover).

Herbaceous Understory: Perennial grasses are fairly diverse and abundant. Blue grama (*Bouteloua gracilis*) is the dominant grass in nested frequency and cover with other common grasses being bottlebrush squirreltail (*Sitanion hystrix*) and western wheatgrass (*Agropyron smithii*). Forbs are rare on this site, providing only 1% cover. The only common forb is scarlet globemallow (*Sphaeralcea coccinea*).

HERBACEOUS TRENDS--
Management unit 16R, Study no: 36

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron smithii	35	1.22
G	Bouteloua gracilis	106	3.17
G	Hilaria jamesii	19	.14
G	Oryzopsis hymenoides	13	.27
G	Sitanion hystrix	65	2.59
G	Stipa comata	7	.16
Total for Annual Grasses		0	0
Total for Perennial Grasses		245	7.56
Total for Grasses		245	7.56
F	Astragalus convallarius	2	.00
F	Chenopodium leptophyllum(a)	3	.00
F	Eriogonum cernuum (a)	2	.00
F	Lepidium sp. (a)	7	.21
F	Penstemon sp.	15	.13
F	Sanguisorba minor	1	.00
F	Sphaeralcea coccinea	41	.61
Total for Annual Forbs		12	0.22
Total for Perennial Forbs		59	0.75
Total for Forbs		71	0.97

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

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 36

Species	Percent Cover '09
Artemisia tridentata wyomingensis	9.01
Ceratoides lanata	.61
Chrysothamnus viscidiflorus stenophyllus	6.91
Gutierrezia sarothrae	.18
Leptodactylon pungens	.40
Opuntia sp.	.63

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 36

Species	Average leader growth (in) '09
Artemisia tridentata wyomingensis	1.15
Ceratoides lanata	1.5

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 36

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	<18	3.7
Pinus edulis	<18	5.9

BASIC COVER--
Management unit 16R, Study no: 36

Cover Type	Average Cover % '09
Vegetation	24.16
Pavement	.93
Litter	18.98
Cryptogams	2.57
Bare Ground	54.16

PELLET GROUP DATA--
Management unit 16R, Study no: 36

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Sheep	1	5 (13)
Rabbit	32	-
Elk	4	15 (36)
Deer	49	102 (253)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 36

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	16/25
Ceratoides lanata	
09	7/7
Chrysothamnus nauseosus	
09	21/27
Chrysothamnus viscidiflorus stenophyllus	
09	8/13
Eriogonum microthecum	
09	4/11
Gutierrezia sarothrae	
09	7/7
Leptodactylon pungens	
09	3/4
Opuntia sp.	
09	4/19

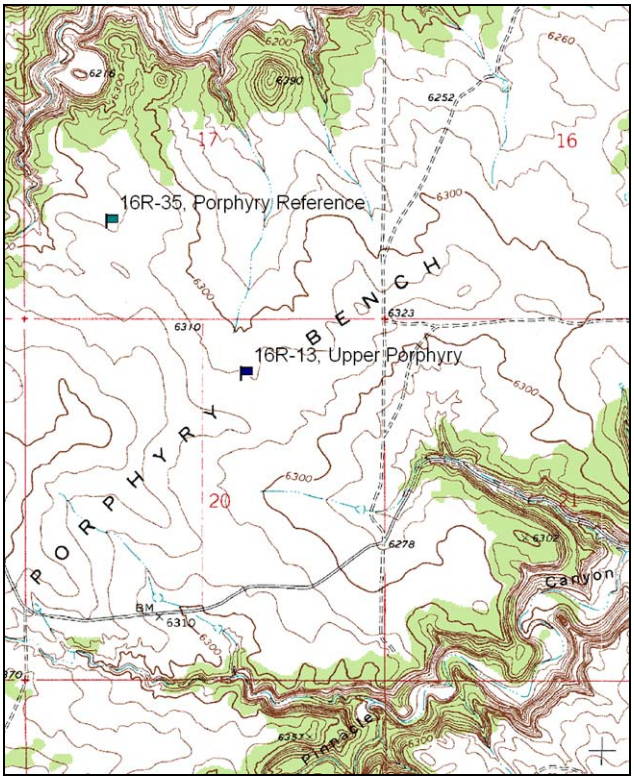
UPPER PORPHYRY BENCH WRI, 16R-13

Vegetation Type: Wyoming big sagebrush
Range Type: Crucial deer winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R047XA308UT
Land Ownership: Private
Elevation: 6,300 ft. (1,920 m)
Aspect: northwest
Slope: 2%
Transect bearing: 249° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

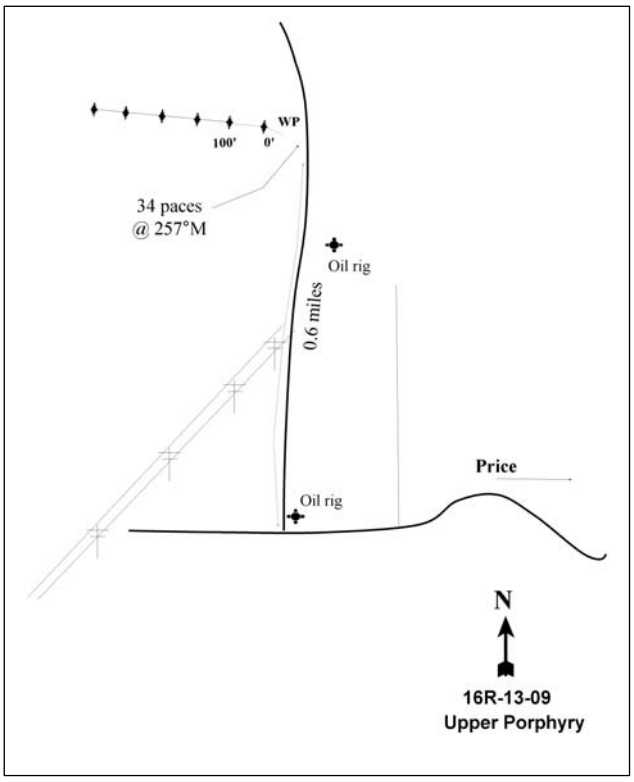
Directions:

Take Westwood Blvd (1550 W) northwest out of Price 2.35 miles to a major intersection. Turn left onto Gordon Creek Road and travel 0.45 miles to a fork. Bear left away from Gordon Creek, going 0.1 miles to a gravel pit. Continue 5.5 miles on the Pinnacle Peak Road to a 3-way fork at the top of the bench. An oil rig is near this intersection. Take the right fork and drive 0.6 miles to the north past another oil rig, to a witness post on the left side of the road. The 0-foot post is 34 paces from the witness post at 257°M, and is marked with browse tag #51.

Map Name: Pinnacle Peak



Diagrammatic Sketch:



Township: 14S Range: 9E Section: 20

GPS: NAD 83, UTM 12S 505484 E 4383157 N

UPPER PORPHYRY BENCH - WRI STUDY 16R-13
Project #229

Site Description

Site Information: In spring 2003, approximately 19,000 acres of sagebrush suffered sever die-off and 24,000 acres suffered moderate die-off within a 50 mile radius of Price, Utah. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) showed the largest amount of die-off, compared with other sagebrush species and subspecies. This project, the first of several phases, was designed to rehabilitate 1,160 acres of crucial deer winter range and greater sage-grouse habitat on private and Utah Division of Wildlife Resources (UDWR) land. Goals of this project were to treat 50% of dead and decadent sage with an aerator and reseed the 1,160 acres behind the aerator aerially from late summer 2004 to late spring 2005. Pellet group data estimated heavy use by deer in 2004, 2007 and 2009. Elk use was low in 2007 and 2009. Cattle use was low in 2004, 2007 and 2009. Horse and sheep use was noted, but minimal, in 2004 and 2009, respectively (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2004, but slight in 2007 and 2009 due to pedestalling, flow patterns, and soil movement.

Browse: Wyoming big sagebrush is the dominant browse species providing the majority of browse canopy cover. Forage kochia (*Kochia prostrata*) has been sampled at low density and canopy cover since 2007. Dwarf rabbitbrush (*Chrysothamnus depressus*) was sampled for the first time in 2009 with moderate canopy cover. Slenderbush eriogonum (*Eriogonum microthecum*) is the only other preferred browse species on the site and occurs in low cover (Table - Canopy Cover). Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) is prevalent on the site.

Herbaceous Understory: Prior to the treatment, the site was dominated by three native perennial grasses; Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). These three species had low nested frequency and provided little cover. Following the treatment, these three species remained prevalent, but increased substantially in nested frequency and cover. Seeded grass species were also sampled following the treatment and now contribute a substantial proportion of the grass cover. Crested wheatgrass (*Agropyron cristatum*) is the most common seeded species with other common seeded grasses including Siberian wheatgrass (*Agropyron fragile*) and Russian wildrye (*Elymus junceus*) Overall, perennial grasses have done well following the treatment with increases in the sum of nested frequency each sample year. Seeded forbs have not done as well with no seeded forb species sampled. However, there is good diversity of forb species on the site, though no species is overly abundant. Annual forbs have steadily decreased in cover since 2004. The most common forbs are two species of globemallow (*Sphaeralcea coccinea* and *S. grossulariaefolia*) (Table - Herbaceous Trends).

Pre vs. Two Years Post Treatment

Browse: Wyoming big sagebrush has provided similar cover percentages in both readings. The density of sagebrush increased by 43% primarily due to a large increase in the density of young sagebrush plants. Decadence of sagebrush decreased from 96% to 47% and poor vigor decreased from 69% to 30%.

Grass: The sum of nested frequency of perennial grasses increased three-fold and cover increased from 1% to 11%. Two seeded species, Siberian wheatgrass and Russian wildrye, were sampled, and there was a significant increase in the nested frequency of the seeded species crested wheatgrass. Significant increases in nested frequency also occurred for bottlebrush squirreltail, western wheatgrass (*Agropyron smithii*), and needle and thread. Annual grasses, including cheatgrass (*Bromus tectorum*) were sampled for the first time, but are a minor component of the system.

Forb: The sum of nested frequency of perennial forbs increased over two-fold and cover increased from 2% to 3%. There was a slight increase in annual forb sum of nested frequency, but cover decreased from 9% to 5%.

Trend Assessments

Browse

- **2007 to 2009 - slightly up (+1):** Wyoming big sagebrush increased slightly in canopy cover. Dwarf rabbitbrush was sampled for the first time at moderately high cover. There was a decrease in canopy cover of stickyleaf low rabbitbrush.

Grasses

- **2007 to 2009 - slightly up (+1):** There was a 6% increase in the sum of nested frequency and cover has increased from 11% to 17%. Cheatgrass decreased significantly in nested frequency and crested wheatgrass increased significantly.

Forbs

- **2007 to 2009 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 40% and cover decreased from 3% to 2%. However, the nested frequency of weedy annual species decreased 83% and cover decreased to 1%.

Seed mix

Project name: Porphyry Bench

WRI Database #: 229 Size (acre): 410

Mix lot #: m-ser-tw-pbC1-05		
Seed type	lbs in mix	lbs/acre
Russian Wildrye 'Bozoisky'	880	2.15
Crested Wheatgrass 'Douglas'	500	1.22
Siberian Wheatgrass 'Vavilov'	450	1.10
Small Burnet 'Delar'	215	0.52
Yellow Sweetclover	225	0.55
Fourwing Saltbush--Emery UT	615	1.50
BULK POUNDS PER ACRE:		7.04
PLS POUNDS PER ACRE:		5.68

Mix Lot #: m-ser-tw-pbB2-05	Size (acre):	495.00
Seed type	lbs in mix	lbs/acre
Sagebrush, Wyoming--Sanpete UT	440	0.89
Fourwing Saltbush--Emery UT	128	0.26
BULK POUNDS PER ACRE:		0.00
PLS POUNDS PER ACRE:		0.37

Mix Lot #: m-ser-tw-pbA-05	Size (acre):	1160
Seed type	lbs in mix	lbs/acre
Forage Kochia 'Immigrant'	865	0.75
Winterfat--Duchesne/Uintah UT	75	0.06
Rice Hulls	800	0.69
BULK POUNDS PER ACRE:		1.50
PLS POUNDS PER ACRE:		0.53

HERBACEOUS TRENDS--
Management unit 16R, Study no: 13

Type	Species	Nested Frequency			Average Cover %		
		'04	'07	'09	'04	'07	'09
G	Agropyron cristatum	$_{a}$1	$_{b}$34	$_{c}$86	.03	.66	4.17
G	Agropyron fragile	-	$_{b}$51	$_{a}$3	-	1.38	.01
G	Agropyron intermedium	-	-	2	-	-	.00
G	Agropyron smithii	9	17	13	.16	.61	.48
G	Bouteloua gracilis	1	8	9	.03	.53	.30
G	Bromus tectorum (a)	-	$_{b}$38	$_{a}$7	-	.22	.01
G	Elymus junceus	-	$_{a}$15	$_{b}$24	-	.13	.75
G	Oryzopsis hymenoides	$_{a}$45	$_{a}$51	$_{b}$85	.15	.76	2.19
G	Sitanion hystrix	$_{a}$59	$_{c}$217	$_{b}$175	.70	5.21	6.98
G	Stipa comata	$_{a}$32	$_{ab}$55	$_{b}$80	.16	1.45	2.28
G	Vulpia octoflora (a)	-	5	-	-	.02	-
Total for Annual Grasses		0	43	7	0	0.25	0.01
Total for Perennial Grasses		147	448	477	1.24	10.74	17.19
Total for Grasses		147	491	484	1.24	10.99	17.20
F	Arabis sp.	2	4	-	.03	.00	-
F	Astragalus convallarius	5	9	3	.09	.21	.03
F	Castilleja sp.	4	-	-	.00	-	-
F	Chenopodium fremontii (a)	3	-	-	.21	-	-
F	Chenopodium leptophyllum(a)	$_{b}$184	-	$_{a}$1	4.44	-	.00
F	Cordylanthus sp. (a)	$_{b}$44	$_{a}$13	-	.64	.02	-
F	Descurainia pinnata (a)	$_{a}$53	$_{a}$43	-	.46	.15	-
F	Draba sp. (a)	-	2	-	-	.01	-
F	Eriogonum cernuum (a)	$_{a}$15	$_{b}$30	$_{b}$31	.16	.12	.26
F	Eriogonum sp.	-	-	1	-	-	.00
F	Gayophytum ramosissimum(a)	$_{a}$50	-	-	1.25	-	-
F	Gilia sp. (a)	2	-	-	.00	-	-
F	Lappula occidentalis (a)	$_{a}$42	$_{b}$273	-	1.02	4.25	-
F	Lesquerella sp.	-	7	1	-	.07	.00
F	Penstemon sp.	1	-	-	.03	-	-
F	Penstemon sp.	6	15	9	.07	.08	.04
F	Phlox hoodii	-	3	-	-	.03	-
F	Phlox longifolia	$_{a}$20	$_{b}$64	$_{a}$16	.09	.22	.12
F	Plantago patagonica (a)	$_{a}$26	$_{b}$75	-	.47	.57	-
F	Salsola iberica (a)	$_{a}$8	$_{b}$27	$_{a}$5	.31	.05	.01
F	Schoencrambe linifolia	-	4	3	-	.01	.00
F	Sphaeralcea coccinea	$_{a}$49	-	$_{b}$85	1.67	-	1.29
F	Sphaeralcea grossulariaefolia	-	$_{b}$124	$_{a}$19	-	2.31	.32
F	Unknown forb-annual (a)	-	-	$_{a}$44	-	-	.70
Total for Annual Forbs		427	463	81	9.01	5.18	0.98
Total for Perennial Forbs		87	230	137	1.98	2.95	1.83
Total for Forbs		514	693	218	11.00	8.14	2.81

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

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 13

Species	Percent Cover		
	'04	'07	'09
Artemisia tridentata wyomingensis	5.78	4.13	6.41
Chrysothamnus depressus	-	-	1.23
Chrysothamnus viscidiflorus viscidiflorus	1.61	3.71	1.51
Eriogonum microthecum	.55	.58	-
Gutierrezia sarothrae	-	.18	.25
Kochia prostrata	-	.01	.01
Opuntia sp.	-	-	.06

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 13

Species	Average leader growth (in)		
	'04	'07	'09
Artemisia tridentata wyomingensis	3.5	1.4	1.2

BASIC COVER--
Management unit 16R, Study no: 13

Cover Type	Average Cover %		
	'04	'07	'09
Vegetation	19.82	30.82	33.70
Pavement	0	.01	0
Litter	26.92	29.48	37.84
Cryptogams	4.80	1.99	2.69
Bare Ground	60.34	52.40	47.34

SOIL ANALYSIS DATA --
Management unit 16R, Study no: 13, Study Name: Upper Porphyry Bench

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
12.8	7.1	43.6	28.9	27.5	1.7	8.9	80.0	0.5

PELLET GROUP DATA--
Management unit 16R, Study no: 13

Type	Quadrat Frequency		
	'04	'07	'09
Rabbit	56	89	63
Elk	1	6	6
Deer	47	52	56
Cattle	3	2	2
Sheep	-	-	-

Days use per acre (ha)		
'04	'07	'09
-	-	-
-	1 (3)	14 (35)
96 (236)	171 (423)	152 (375)
1 (2)	5 (12)	13 (32)
-	-	1 (3)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 13

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
04	20/30
07	20/30
09	15/22
Chrysothamnus depressus	
04	-/-
07	-/-
09	5/9
Chrysothamnus viscidiflorus viscidiflorus	
04	9/13
07	6/9
09	7/9
Eriogonum microthecum	
04	6/7
07	4/4
09	3/7
Gutierrezia sarothrae	
04	-/-
07	7/7
09	9/9
Kochia prostrata	
04	-/-
07	2/3
09	6/6
Opuntia sp.	
04	2/8
07	2/7
09	4/7

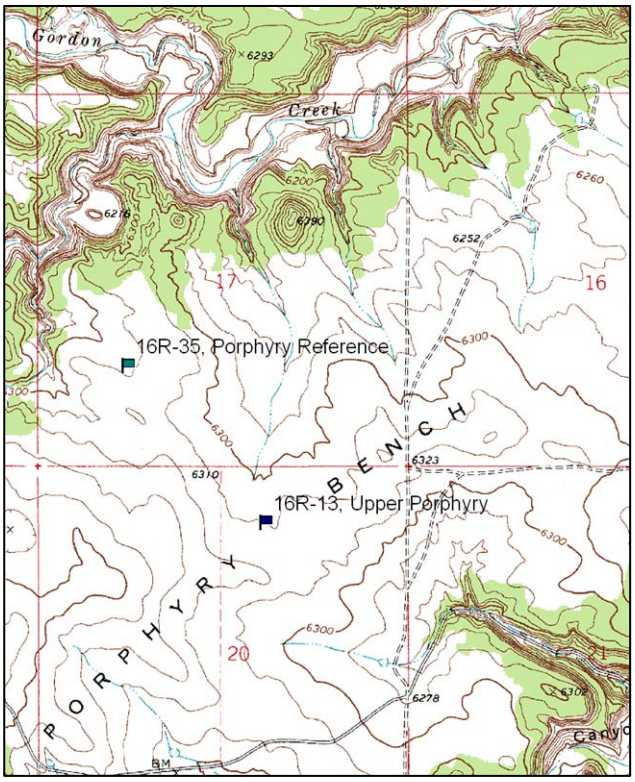
UPPER PORPHYRY REFERENCE WRI, 16R-35

Vegetation Type: Wyoming big sagebrush
Range Type: Crucial deer winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R047XA308UT
Land Ownership: Private
Elevation: 6,276 ft. (1,913 m)
Aspect: northwest
Slope: 5%
Transect bearing: 197° magnetic
Belt placement: Read Baseline, No Belts

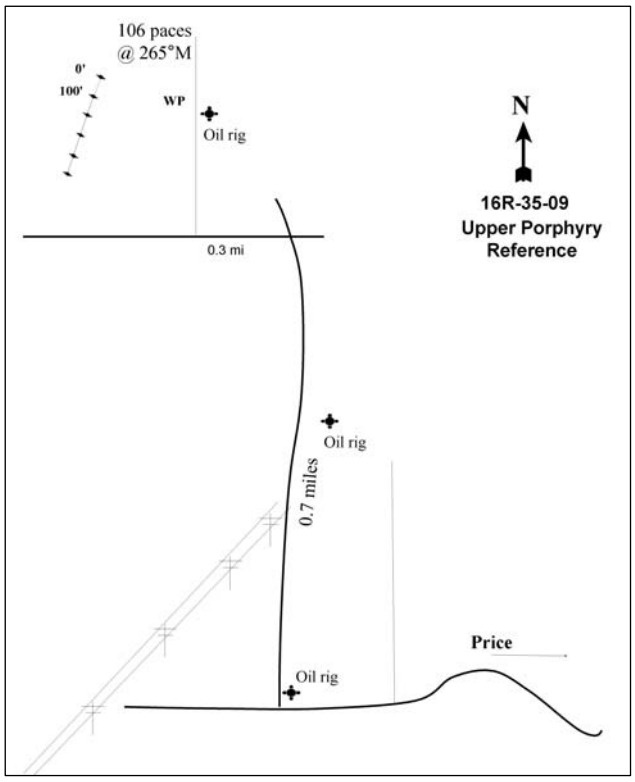
Directions:

Take Westwood Blvd (1550 W) northwest out of Price 2.35 miles to a major intersection. Turn left onto Gordon Creek Road and travel 0.45 miles to a fork. Bear left away from Gordon Creek, going 0.1 miles to a gravel pit. Continue 5.5 miles on the Pinnacle Peak Road to a 3-way fork at the top of the bench. An oil rig is near this intersection. Take the right fork and drive 0.7 to an intersection, turn left (west) and go 0.3 miles and turn right (north). Pass an oil pad and look for the witness post along the left side of the road. From the witness post the 0' stake is 106 paces at 265°M.

Map Name: Pinnacle Peak



Diagrammatic Sketch:



Township: 14S Range: 9E Section: 17

GPS: NAD 83, UTM 12S 504884 E 4383834 N

UPPER PORPHYRY REFERENCE - WRI STUDY 16R-35
Project #229 Reference

Site Description

Site Information: This site was established in 2009 as an untreated reference site in companion to the Upper Porphyry study, 16R-35. This study is situated in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community about a half mile northwest of the Upper Porphyry study site. Pellet group data from 2009 estimated very heavy deer use, light elk use, and heavy cattle use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: Wyoming big sagebrush is the dominant preferred browse on the site in canopy cover, with dwarf rabbitbrush (*Chrysothamnus depressus*) also providing notable cover. Broom snakeweed (*Gutierrezia sarothrae*) and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) are prevalent on the site and each provide about the same cover as sagebrush. Other preferred browse on the site included winterfat (*Ceratoides lanata*) and slenderbush eriogonum (*Eriogonum microthecum*), but these species had no notable cover (Table - Canopy Cover).

Herbaceous Understory: Grasses are diverse and abundant on the site. Needle and thread (*Stipa comata*) is the dominant grass providing the majority of the grass cover, but other perennial grasses including Indian ricegrass (*Oryzopsis hymenoides*), blue grama (*Bouteloua gracilis*), and slender wheatgrass (*Agropyron trachycaulum*) are common and provide substantial cover. The forbs on the site are not as diverse or abundant. Scarlet globemallow (*Sphaeralcea coccinea*) is the most common forb and provides the majority of forb cover (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 16R, Study no: 35

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	23	.49
G	Agropyron smithii	6	.06
G	Agropyron trachycaulum	59	5.41
G	Bouteloua gracilis	107	4.22
G	Oryzopsis hymenoides	123	6.06
G	Secale cereale (a)	-	.00
G	Sitanion hystrix	43	1.37
G	Stipa comata	191	8.67
Total for Annual Grasses		0	0.00
Total for Perennial Grasses		552	26.30
Total for Grasses		552	26.31
F	Astragalus convallarius	21	.32
F	Chenopodium leptophyllum(a)	18	.05
F	Eriogonum cernuum (a)	5	.01
F	Eriogonum sp.	3	.00
F	Penstemon sp.	6	.09
F	Phlox longifolia	1	.00
F	Schoencrambe linifolia	9	.07
F	Sphaeralcea coccinea	128	3.04
Total for Annual Forbs		23	0.06

Type	Species	Nested Frequency '09	Average Cover % '09
Total for Perennial Forbs		168	3.53
Total for Forbs		191	3.60

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

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 35

Species	Percent Cover '09
Artemisia tridentata wyomingensis	1.86
Chrysothamnus depressus	.91
Chrysothamnus viscidiflorus viscidiflorus	1.76
Gutierrezia sarothrae	1.56
Opuntia sp.	.33
Tetradymia canescens	.01

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 35

Species	Average leader growth (in) '09
Artemisia tridentata wyomingensis	1.29

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 35

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	<18	2.0
Pinus edulis	<18	4.7

BASIC COVER--
Management unit 16R, Study no: 35

Cover Type	Average Cover % '09
Vegetation	41.52
Rock	.00
Litter	32.62
Cryptogams	.78
Bare Ground	47.47

PELLET GROUP DATA--
Management unit 16R, Study no: 35

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	59	-
Elk	8	6 (15)
Deer	37	104 (256)
Cattle	14	36 (90)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 35

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	13/16
Ceratoides lanata	
09	5/9
Chrysothamnus depressus	
09	5/8
Chrysothamnus viscidiflorus viscidiflorus	
09	6/8
Eriogonum microthecum	
09	3/4
Gutierrezia sarothrae	
09	8/10
Opuntia sp.	
09	4/14
Tetradymia canescens	
09	15/17

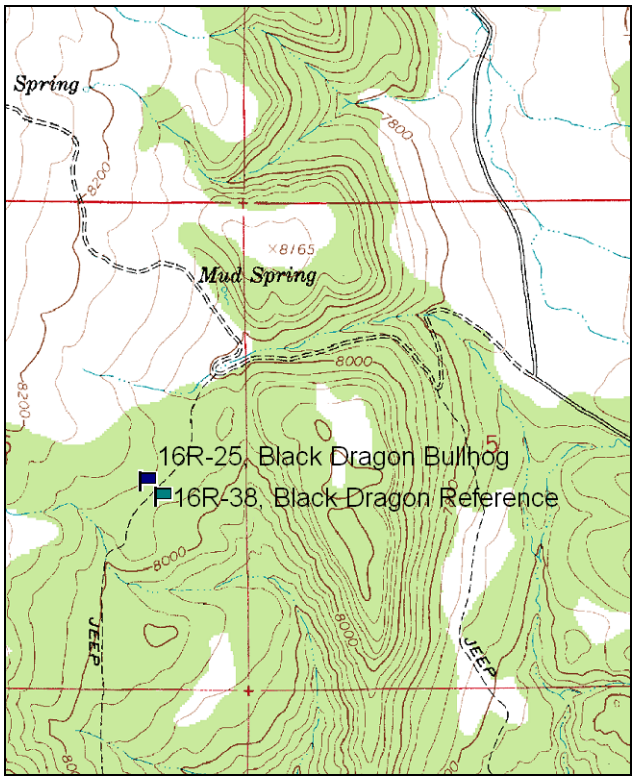
BLACK DRAGON BULLHOG WRI, 16R-25

Vegetation Type: P/J, mountain brush
Range Type: Crucial deer summer; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 7,986 ft. (2,434 m)
Aspect: southeast
Slope: 11%
Transect bearing: 270° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

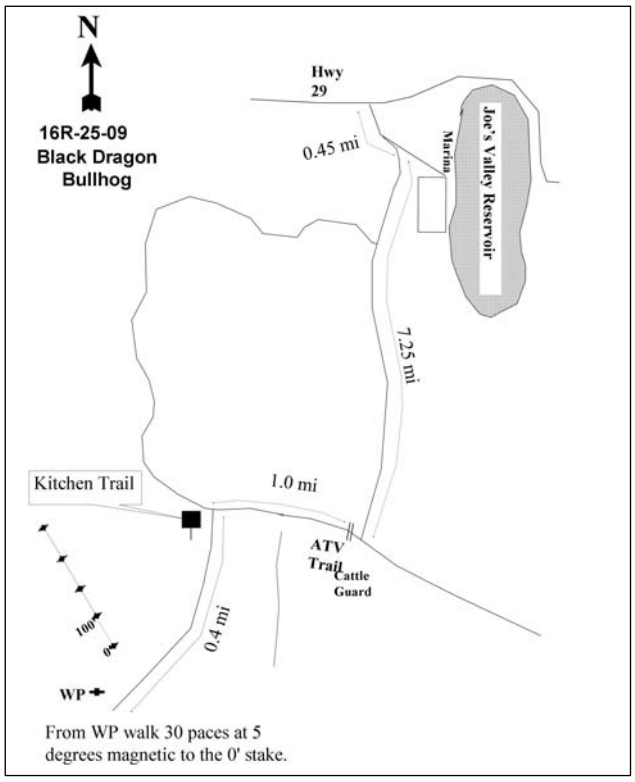
Directions:

Drive west on SR 29 to the west side of Joe's Valley Reservoir. Turn south onto the road that leads to the marina and drive 0.45 miles to a fork and go right. Drive for 7.25 miles to a junction. Turn right and drive 1.0 mile crossing a cattle guard and passing an ATV trail. Turn left onto the road with a sign reading "Kitchen Trail". Drive for 0.4 miles to a witness post on the right. Walk 30 paces at 5 degrees magnetic to the 0' stake marked with browse tag #194.

Map Name: Ferron Canyon



Diagrammatic Sketch:



Township: 19S Range: 6E Section: 6

GPS: NAD 83, UTM 12S 475366 E 4338569 N

BLACK DRAGON BULLHOG - WRI STUDY 16R-25
Project #514

Site Description

Site Information: This study is located 14 miles west of Castle Dale on a bullhog treatment performed in 2006 on 4,500 acres of a mountain browse community in order to thin and reduce encroachment of pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) into the community. Pellet group data estimated low deer and elk use in 2006 and 2009 (Table - Pellet Group Data). Soil erosion condition was classified as slight in 2006 and moderate in 2009 due to soil and rock movement, rill and gully formation, pedestalling and flow patterns.

Browse: Preferred browse species on this site include Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and true mountain mahogany (*Cercocarpus montanus*). True mountain mahogany is the dominant browse species on the site, providing the majority of the browse canopy cover prior to and after the treatment. Pinyon pine and juniper provided a combined canopy cover of 6% prior to the treatment, but no notable cover following the treatment (Table - Canopy Cover).

Herbaceous Understory: Perennial grasses are diverse and abundant on the site. Salina wildrye (*Elymus salina*) and Indian ricegrass (*Oryzopsis hymenoides*) are the most common, with the introduced species intermediate wheatgrass (*Agropyron intermedium*) also being prevalent. No annual grasses were sampled on this site. Forbs are very diverse and fairly abundant. Common perennial forb species include wing eriogonum (*Eriogonum alatum*), rayless tansyaster (*Machaeranthera grindelioides*), and mat penstemon (*Penstemon caespitosus*).

Pre vs. Three Years Post Treatment

Browse: Point-quarter density of pinyon pine decreased from 276 trees/acre to 56 trees/acre and the average diameter decreased from 2.2 inches to 0.8 inches. The density of juniper remained similar, but the average diameter decreased from 2.4 inches to 0.8 inches. All of the trees sampled of both species following the treatment were less than 4 feet tall. The treatment also reduced the canopy cover of all the preferred browse species. True mountain mahogany had the largest decrease from 17% to 8%.

Grass: Perennial grass sum of nested frequency increased 20% and cover increased from 11% to 14%. Indian ricegrass and bottlebrush squirreltail (*Sitanion hystrix*) increased significantly in nested frequency. significantly.

Forb: Perennial forb sum of nested frequency increased 10% and cover increased from 7% to 8%. There was a significant increase in the nested frequency of mat penstemon, bastard toadflax (*Comandra pallida*), and hoary aster (*Machaeranthera canescens*).

HERBACEOUS TRENDS--
Management unit 16R, Study no: 25

Type	Species	Nested Frequency '06	Nested Frequency '09	Average Cover % '06	Average Cover % '09
G	Agropyron intermedium	54	53	1.43	1.74
G	Bromus inermis	12	3	.18	.03
G	Carex sp.	8	18	.11	.28
G	Elymus salina	103	91	6.15	7.18
G	Oryzopsis hymenoides	$_{a}$73	$_{b}$111	2.59	3.28
G	Sitanion hystrix	-	$_{a}$18	-	.55
G	Stipa comata	3	17	.18	.64
G	Stipa lettermani	6	-	.03	-
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		259	311	10.71	13.71
Total for Grasses		259	311	10.71	13.71
F	Arabis sp.	8	-	.02	-
F	Astragalus sp.	1	1	.03	.00
F	Astragalus utahensis	12	8	.05	.07
F	Calochortus nuttallii	-	3	-	.00
F	Castilleja linariaefolia	3	11	.18	.20
F	Caulanthus crassicaulis	10	16	.04	.25
F	Chaenactis douglasii	7	9	.02	.05
F	Comandra pallida	$_{a}$12	$_{b}$30	.08	.39
F	Erigeron sp.	9	4	.09	.01
F	Eriogonum alatum	76	61	2.06	1.56
F	Hymenopappus filifolius	10	15	.48	.82
F	Hymenoxys richardsonii	11	6	.39	.03
F	Ipomopsis aggregata	6	2	.01	.01
F	Lesquerella sp.	$_{a}$4	$_{b}$22	.01	.23
F	Machaeranthera canescens	-	$_{a}$8	-	.63
F	Machaeranthera grindelioides	40	27	.85	1.33
F	Madia glomerata (a)	-	5	-	.06
F	Penstemon caespitosus	$_{a}$57	$_{b}$74	.86	1.07
F	Penstemon pachyphyllus	23	48	.54	.80
F	Penstemon sp.	17	-	.49	-
F	Penstemon sp.	-	8	-	.23
F	Phlox austromontana	22	23	.46	.29
F	Phlox hoodii	2	-	.03	-
F	Schoencrambe linifolia	12	8	.02	.04
F	Senecio multilobatus	6	-	.04	-
F	Taraxacum officinale	1	-	.00	-
F	Unknown forb-annual (a)	-	1	-	.03
Total for Annual Forbs		0	6	0	0.09
Total for Perennial Forbs		349	384	6.83	8.06
Total for Forbs		349	390	6.83	8.16

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

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 25

Species	Percent Cover '06	'09
Amelanchier utahensis	1.75	1.50
Artemisia nova	-	.18
Artemisia tridentata vaseyana	1.14	.50
Cercocarpus montanus	17.39	7.78
Chrysothamnus viscidiflorus stenophyllus	-	.18
Eriogonum corymbosum	.06	-
Gutierrezia sarothrae	.93	1.86
Juniperus scopulorum	1.76	-
Mahonia repens	.28	.43
Pinus edulis	4.33	-
Symphoricarpos oreophilus	.03	.28
Tetradymia canescens	-	.48

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 25

Species	Trees per Acre '06	'09	Average diameter (in) '06	'09
Juniperus scopulorum	30	28	2.4	0.8
Pinus edulis	276	56	2.2	0.8

BASIC COVER--
Management unit 16R, Study no: 25

Cover Type	Average Cover % '06	'09
Vegetation	34.62	28.52
Rock	7.14	5.76
Pavement	20.70	8.57
Litter	33.59	35.20
Cryptogams	.36	.15
Bare Ground	29.17	29.46

SOIL ANALYSIS DATA --
Management unit 16R, Study no: 25, Study Name: Black Dragon Bullhog

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
11.3	7.5	41.2	30.0	28.8	2.3	12.7	137.6	0.6

PELLET GROUP DATA--
Management unit 16R, Study no: 25

Type	Quadrat Frequency '06	'09	Days use per acre (ha) '06	'09
Rabbit	26	11		
Elk	4	-	2 (5)	9 (23)
Deer	1	-	3 (7)	2 (5)
Cattle	1	-	1 (2)	2 (4)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 25

Yr	Average Height Crown (in)
Amelanchier utahensis	
06	53/53
09	25/37
Artemisia nova	
06	10/21
09	10/18
Artemisia tridentata vaseyana	
06	14/21
09	15/22
Artemisia tridentata wyomingensis	
06	-/-
09	13/19
Ceanothus velutinus	
06	14/46
09	-/-
Cercocarpus montanus	
06	51/52
09	27/33
Chrysothamnus nauseosus albicaulis	
06	39/40
09	7/14
Chrysothamnus viscidiflorus stenophyllus	
06	5/8
09	11/17
Eriogonum corymbosum	
06	7/10
09	-/-

Yr	Average Height Crown (in)
Gutierrezia sarothrae	
06	6/7
09	8/10
Juniperus scopulorum	
06	-/-
09	-/-
Mahonia repens	
06	3/4
09	3/4
Pinus edulis	
06	-/-
09	-/-
Symphoricarpos oreophilus	
06	7/12
09	7/17
Tetradymia canescens	
06	9/16
09	9/15

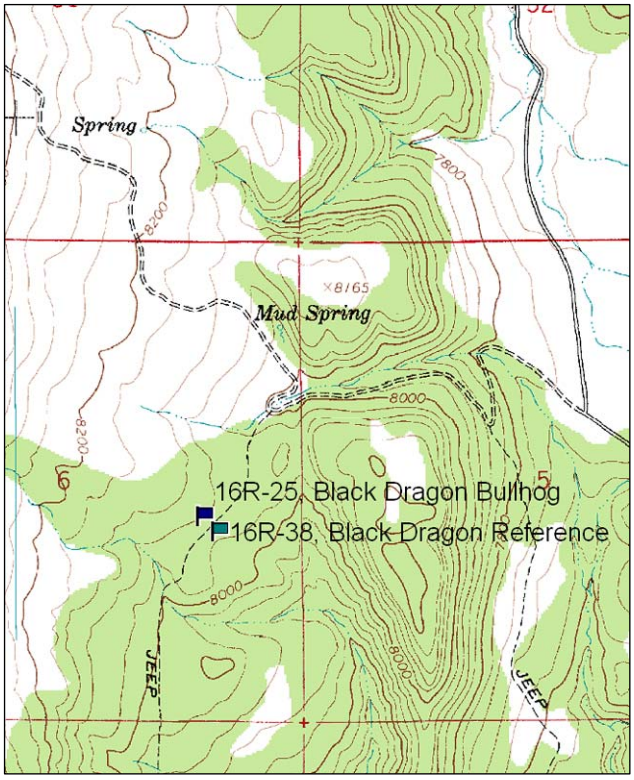
BLACK DRAGON REFERENCE WRI, 16R-38

Vegetation Type: P/J, mountain brush
Range Type: Crucial deer summer; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 7,946 ft. (2,422 m)
Aspect: southeast
Slope: 8%
Transect bearing: 58° magnetic
Belt placement: Read Baseline, No Belts

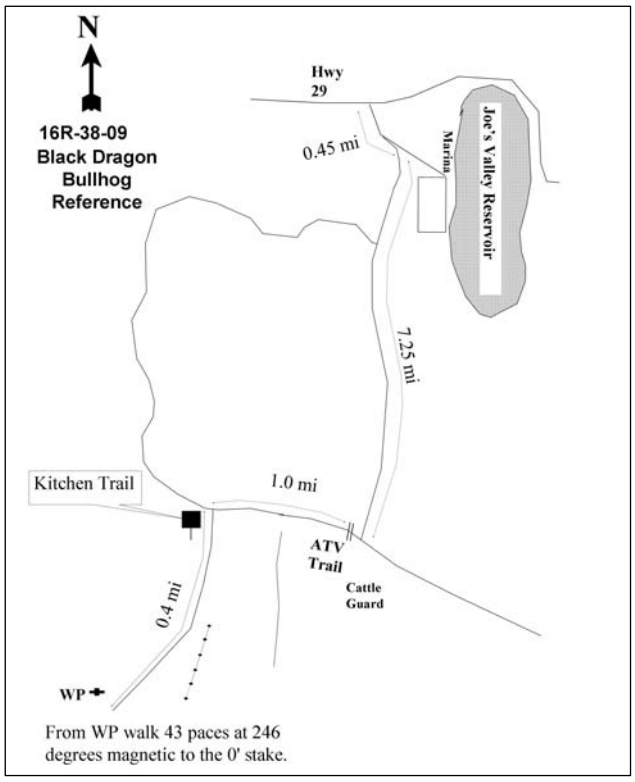
Directions:

Drive west on SR 29 to the west side of Joe's Valley Reservoir. Turn south onto the road that leads to the marina and drive 0.45 miles to a fork and go right. Drive for 7.25 miles to a junction. Turn right and drive 1.0 mile crossing a cattle guard and passing an ATV trail. Turn left onto the road with a sign reading "Kitchen Trail". Drive for 0.4 miles to a witness post on the right. Walk 43 paces at 264°M to the 0' stake marked with browse tag #194.

Map Name: Ferron Canyon



Diagrammatic Sketch:



Township: 19S Range: 6E Section: 6

GPS: NAD 83, UTM 12S 475366 E 4338569 N

BLACK DRAGON REFERENCE - WRI STUDY 16R-38
Project #514 Reference

Site Description

Site Information: This study was established as an untreated reference site in companion to the Black Dragon Bullhog brush thinning study, 16R-25. The site is located in an untreated pinyon-juniper and mountain brush community adjacent to the treated study area southeast of Joe's Valley Reservoir. Pellet group data from 2009 estimated light use by deer, elk and cattle (Table - Pellet Group Data). Soil erosion condition was classified as moderate in 2009 due to pedestalling, flow patterns and rill and gully formation.

Browse: Preferred browse on this site includes Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and true mountain mahogany (*Cercocarpus montanus*), with serviceberry having the highest canopy cover. Pinyon pine (*Pinus edulis*) is the dominant woody species providing the highest proportion of canopy cover (Table - Canopy Cover). Pinyon pine and Utah juniper (*Juniperus osteosperma*) density was moderately high on the site in 2009 (Table - Point-Quarter Data). The pinyon trees were a mix of mature and younger trees with 45% of the sampled trees being smaller than 4 feet tall and 30% over 12 feet tall.

Herbaceous Understory: Six perennial grass species and one sedge (*Carex sp.*) were sampled in 2009, combining to provide 13% cover. Salina wildrye (*Elymus salina*) was the dominant species, providing over half of the grass cover. Indian ricegrass (*Oryzopsis hymenoides*) was the second most common grass species and provided much of the remaining grass cover in 2009. Perennial forbs are diverse and fairly abundant with mat penstemon (*Penstemon caespitosus*) being the most common forb.

HERBACEOUS TRENDS--
Management unit 16R, Study no: 38

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron intermedium	7	.41
G	Carex sp.	5	.18
G	Elymus salina	89	7.77
G	Juncus sp.	7	.06
G	Oryzopsis hymenoides	78	3.50
G	Poa fendleriana	22	.93
G	Sitanion hystrix	12	.16
Total for Annual Grasses		0	0
Total for Perennial Grasses		220	13.04
Total for Grasses		220	13.04
F	Astragalus convallarius	2	.00
F	Astragalus utahensis	7	.02
F	Castilleja linariaefolia	3	.08
F	Caulanthus crassicaulis	3	.01
F	Chaenactis douglasii	3	.01
F	Comandra pallida	1	.01
F	Erigeron sp.	28	.44
F	Eriogonum alatum	47	.76
F	Eriogonum racemosum	11	.07
F	Eriogonum sp.	3	.15

Type	Species	Nested Frequency '09	Average Cover % '09
F	Hymenopappus filifolius	1	.00
F	Hymenoxys richardsonii	-	.00
F	Ipomopsis aggregata	9	.04
F	Lesquerella sp.	9	.01
F	Machaeranthera grindelioides	27	.23
F	Penstemon caespitosus	63	1.52
F	Penstemon pachyphyllus	80	.88
F	Phlox austromontana	43	.39
F	Senecio multilobatus	9	.04
F	Townsendia sp.	7	.01
F	Unknown forb-annual (a)	-	.00
Total for Annual Forbs		0	0.00
Total for Perennial Forbs		356	4.72
Total for Forbs		356	4.73

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

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 38

Species	Percent Cover '09
Amelanchier utahensis	8.56
Artemisia nova	.75
Artemisia tridentata vaseyana	5.16
Cercocarpus montanus	3.84
Gutierrezia sarothrae	.15
Juniperus osteosperma	.38
Pinus edulis	12.36
Symphoricarpos oreophilus	1.54
Tetradymia canescens	.10
Unkown shrub species	1.43

POINT-QUARTER TREE DATA--
Management unit 16R, Study no: 38

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	34	3.9
Pinus edulis	98	2.9

BASIC COVER--
Management unit 16R, Study no: 38

Cover Type	Average Cover % '09
Vegetation	39.60
Rock	2.36
Pavement	13.59
Litter	34.66
Cryptogams	1.63
Bare Ground	31.50

PELLET GROUP DATA--
Management unit 16R, Study no: 38

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	22	-
Elk	1	2 (5)
Deer	3	3 (8)
Cattle	2	4 (9)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 38

Yr	Average Height Crown (in)
Amelanchier utahensis	
09	40/50
Artemisia nova	
09	12/21
Artemisia tridentata vaseyana	
09	16/24
Cercocarpus montanus	
09	42/42
Gutierrezia sarothrae	
09	5/5
Opuntia sp.	
09	6/21
Symphoricarpos oreophilus	
09	9/15
Tetradymia canescens	
09	6/8

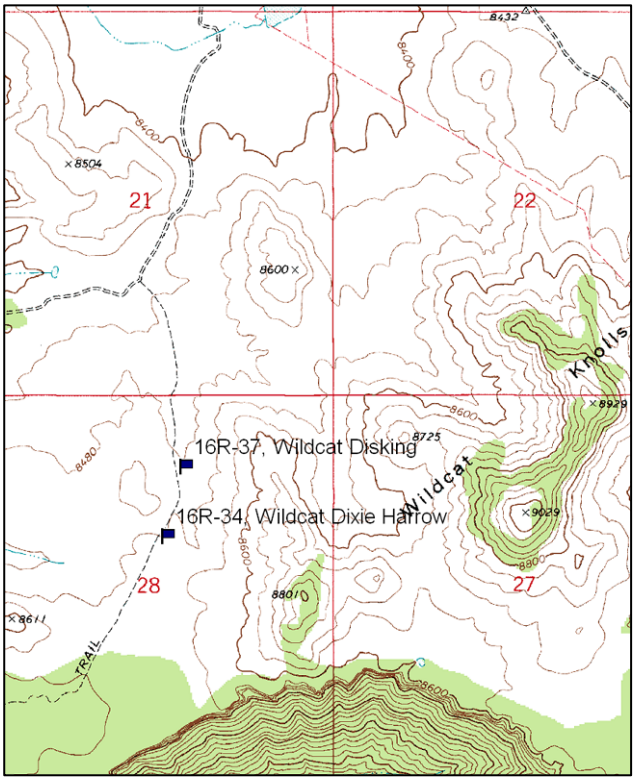
WILDCAT DIXIE HARROW WRI, 16R-34

Vegetation Type: Mountain big sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 8,457 ft. (2,579 m)
Aspect: north
Slope: 4%
Transect bearing: 120° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 4 is 75ft in length

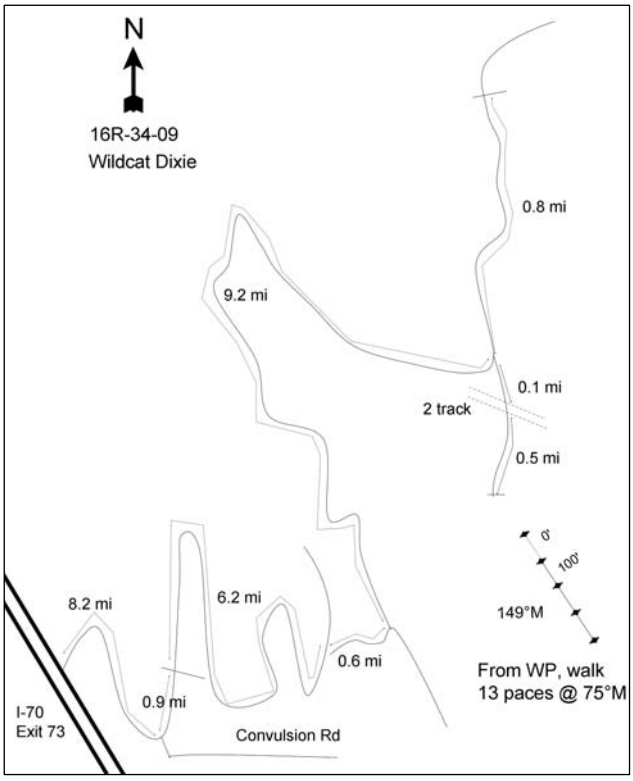
Directions:

From Exit 73 on I-70, drive 8.2 miles to a road on the left and continue 0.9 miles. On Convulsion Road, drive 6.2 miles to a fork. Go right for 0.6 miles to another fork. Go left and continue for 9.2 miles to a two track road on the right. Drive 0.1 miles on the two track to a fork and go right. Continue 0.5 miles to the witness post. The 0' stake is 19 paces from the witness post at 60° M. The 0' stake is marked with browse tag # 235.

Map Name: Emery West



Diagrammatic Sketch:



Township: 21S Range: 5E Section: 28

GPS: NAD 83, UTM 12S 468628 E 4312661 N

WILDCAT DIXIE HARROW - WRI STUDY 16R-34
Study # 1161

Site Description

Site Information: This site was established prior to a dixie harrow treatment designed to diversify the age classes of a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community and invigorate herbaceous understory growth on about 400 acres. The study and treatment are located on a plateau approximately six miles northwest of Emery. The area was seeded with grasses and forbs using a broadcast seeder just prior to the dixie harrow treatment in the fall of 2008. Pellet group data estimated heavy elk use and moderate cattle use in 2008 and 2009, and light deer use in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2008 and 2009.

Browse: Mountain big sagebrush was the predominant browse species prior to, and following the treatment. Canopy cover of sagebrush was reduced substantially by the treatment (Table - Canopy Cover). Two rabbitbrush species, low rabbitbrush (*Chrysothamnus viscidiflorus*) and stickyleaf low rabbitbrush (*C. viscidiflorus* ssp. *viscidiflorus*), are the only other common browse on the site.

Herbaceous Understory: Prior to treatment, in 2008, ten perennial grass species were sampled. In 2009, only seven species were sampled. The dominant grass species on the site is mutton bluegrass (*Poa fendleriana*) with other common species including western wheatgrass (*Agropyron smithii*) and a sedge (*Carex sp.*). The sum of nested frequency of and cover of perennial grasses decreased following the treatment, but are still good. Perennial forb species are diverse and fairly abundant. The nested frequency and cover of forbs decreased after the treatment. Fleabane (*Erigeron sp.*) and Wyoming painted cup (*Castilleja linariaefolia*) are the only species that produced over 1% cover in 2009, following the treatment. The only seeded forb species sampled in 2009 was blue flax (*Linum lewisii*) (Table - Herbaceous Trends).

Pre vs. One Year Post Treatment

Browse: Mountain big sagebrush canopy cover decreased from 32% to 4% and there was a slight decrease in the combined rabbitbrush cover. The average height of sagebrush decreased from 18 inches to 12 inches, while the average crown width decreased from 30 inches to 15 inches.

Grass: The sum of nested frequency of perennial grasses decreased 36% and cover decreased from 17% to 12%, although the site had not yet gone through a complete growing season after the treatment. The only species that showed significant increases in nested frequency and cover was sedge. No seeded grass species were sampled in 2009 that had not already been sampled in 2008.

Forb: Sum of nested frequency of perennial forbs decreased 46% and cover fell from 13% to 7%. Blue flax was the only seeded forb species sampled at low frequency and cover.

Seed mix

Project name: Wildcat Knolls Habitat Improvement

WRI Database #: 1161 Size (acre): 1000

Mix lot #: ser-de-wkhi-09

Seed type	lbs in mix	lbs/acre
Blue Flax 'Appar'	1000	1.00
Bottlebrush Squirreltail 'Toe Jam'	500	0.50
Cicer Milkvetch 'Lutana'	1000	1.00
Great Basin Wildrye 'Trailhead'	1000	1.00
Rocky Mountain Penstemon 'Bandera'	71	0.07
Prickly Lettuce	137	0.14
Sagebrush, Mountain--Sanpete UT	220	0.22
Sagebrush, Mountain--Sevier/Wayne UT	280	0.28
Sandberg Bluegrass--Toole MT	1000	1.00
Showy Goldeneye--Sanpete UT	25	0.03
Slender Wheatgrass 'San Luis'	2027	2.03
Small Burnet 'Delar'	1500	1.50
Utah Sweetvech	249	0.25
Western Wheatgrass 'Arriba'	1000	1.00
Western Yarrow	100	0.10
BULK POUNDS PER ACRE:		10.11
PLS POUNDS PER ACRE:		8.52

HERBACEOUS TRENDS--

Management unit 16R, Study no: 34

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
G	Agropyron smithii	138	128	1.29	2.52
G	Agropyron spicatum	2	8	.00	.45
G	Bromus inermis	7	-	.04	-
G	Carex sp.	a66	b106	.45	2.06
G	Koeleria cristata	a55	-	1.33	-
G	Poa fendleriana	b250	a191	9.88	6.28
G	Poa secunda	16	8	.26	.21
G	Sitanion hystrix	b58	a3	.65	.06
G	Stipa comata	a30	-	.60	-
G	Stipa lettermani	b92	a14	2.04	.22
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		714	458	16.56	11.83
Total for Grasses		714	458	16.56	11.83
F	Antennaria rosea	7	1	.01	.00
F	Arabis sp.	5	-	.01	-
F	Aster sp.	2	-	.01	-
F	Astragalus convallarius	47	44	1.55	.65
F	Castilleja linariaefolia	53	36	1.95	1.53
F	Chaenactis douglasii	4	4	.06	.01
F	Chenopodium album (a)	-	4	-	.00
F	Chenopodium leptophyllum(a)	-	a27	-	.13
F	Collinsia parviflora (a)	a28	-	.04	-

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
F	Comandra pallida	$_{b}$72	$_{a}$34	.52	.52
F	Crepis acuminata	5	3	.10	.00
F	Erigeron sp.	$_{b}$139	$_{a}$64	1.88	1.42
F	Eriogonum racemosum	$_{b}$134	$_{a}$57	3.07	.58
F	Eriogonum sp.	3	-	.00	-
F	Eriogonum umbellatum	$_{a}$25	$_{b}$43	.68	.76
F	Gayophytum ramosissimum(a)	-	7	-	.03
F	Ipomopsis aggregata	$_{b}$18	$_{a}$3	.14	.06
F	Lesquerella sp.	-	5	-	.01
F	Linum lewisii	-	12	-	.02
F	Lithospermum ruderale	1	-	.00	-
F	Lupinus argenteus	$_{b}$32	$_{a}$8	1.97	.48
F	Lupinus sp.	3	-	.00	-
F	Machaeranthera canescens	$_{a}$5	-	.07	.03
F	Orobanche sp.	1	-	.00	-
F	Penstemon sp.	$_{a}$46	-	.27	-
F	Penstemon sp.	30	25	.73	.32
F	Polygonum douglasii (a)	$_{b}$49	$_{a}$2	.09	.00
F	Sanguisorba minor	3	-	.01	-
F	Senecio multilobatus	-	3	-	.01
F	Viguiera multiflora	-	1	-	.15
F	Zigadenus paniculatus	5	-	.06	-
Total for Annual Forbs		77	40	0.13	0.17
Total for Perennial Forbs		640	343	13.15	6.61
Total for Forbs		717	383	13.29	6.79

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

CANOPY COVER, LINE INTERCEPT--
Management unit 16R, Study no: 34

Species	Percent Cover '08	Percent Cover '09
Artemisia tridentata vaseyana	32.08	3.68
Chrysothamnus viscidiflorus	1.81	2.71
Chrysothamnus viscidiflorus viscidiflorus	3.65	.51
Symphoricarpos oreophilus	-	.25
Tetradymia canescens	-	.05

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16R, Study no: 34

Species	Average leader growth (in) '08	Average leader growth (in) '09
Artemisia tridentata vaseyana	0.7	-

BASIC COVER--
Management unit 16R, Study no: 34

Cover Type	Average Cover % '08	'09
Vegetation	55.50	26.02
Rock	0	.03
Pavement	.04	.05
Litter	45.60	44.32
Cryptogams	.27	0
Bare Ground	23.45	40.69

PELLET GROUP DATA--
Management unit 16R, Study no: 34

Type	Quadrat Frequency '08	'09	Days use per acre (ha) '08	'09
Rabbit	10	3	-	-
Grouse	1	-	17 pellets/acre	0
Elk	59	22	63 (155)	38 (94)
Deer	4	23	-	1 (2)
Cattle	2	10	25 (63)	18 (45)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 34

Yr	Average Height Crown (in)
Artemisia nova	
08	-/-
09	9/7
Artemisia tridentata vaseyana	
08	18/30
09	12/15
Chrysothamnus nauseosus	
08	-/-
09	10/13
Chrysothamnus viscidiflorus	
08	5/10
09	8/11
Chrysothamnus viscidiflorus viscidiflorus	
08	9/12
09	6/10
Rosa woodsii	
08	-/-
09	5/6
Symphoricarpos oreophilus	
08	11/25
09	9/10

Yr	Average Height Crown (in)
Tetradymia canescens	
08	9/14
09	5/6

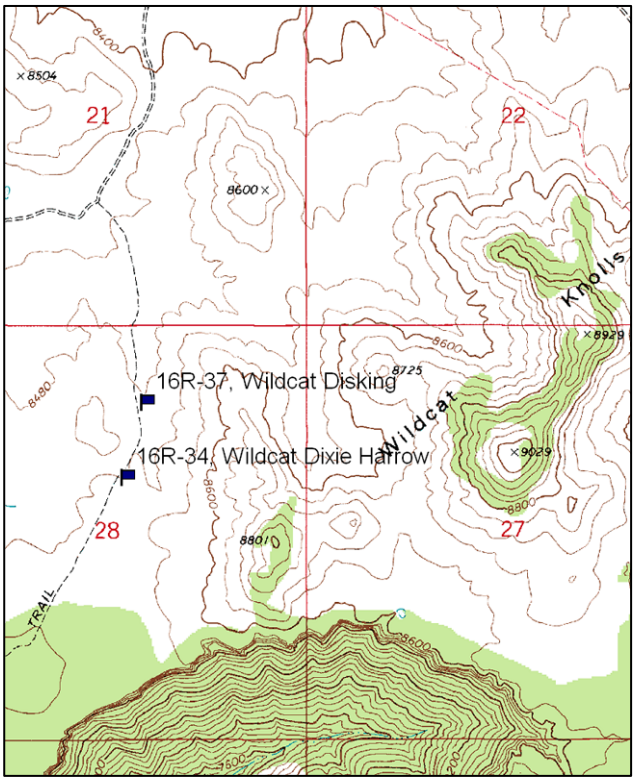
WILDCAT DISKING WRI, 16R-37

Vegetation Type: Mountain big sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 8,425 ft. (2,568 m)
Aspect: north
Slope: 4%
Transect bearing: 160° magnetic
Belt placement: Read Baseline, No Belts

Directions:

From Exit 73 on I-70, drive 8.2 miles to a road on the left and continue 0.9 miles. On Convulsion Road, drive 6.2 miles to a fork. Go right for 0.6 miles to another fork. Go left and continue for 9.2 miles to a two track road on the right. Drive 0.1 miles on the two track to a fork and go right. Continue 0.3 miles to the witness post and then 7 paces at 75 to the 0' stake.

Map Name: Emery West



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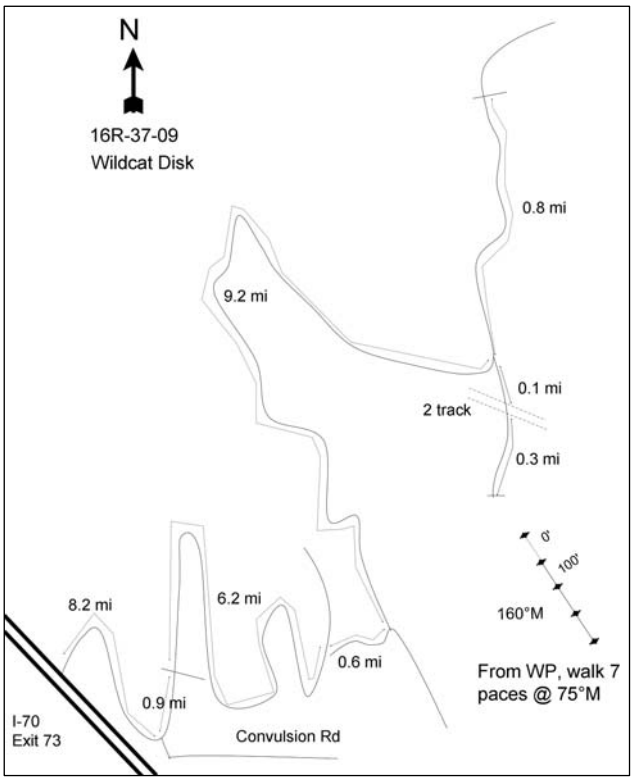


Township: 21S Range: 5E Section: 28

GPS: NAD 83, UTM 12S 468707 E 4312960 N

WILDCAT DISKING - WRI STUDY 16R-37
Project #1161

Site Description

Site Information: This study was established after a double disking treatment in the Wildcat Habitat Improvement project. In 2008 another study (16R-29) was established 1.2 miles north of this study to monitor this disking project. Unfortunately the actual treatment did not take place near 16R-29 and this transect was established to monitor the treatment, therefore pretreatment data is not available for this project. The treatment is located on a plateau about 6 miles northwest of the town of Emery. The area was double disked in the spring of 2009 then grasses and forbs were reseeded using a rangeland drill. The purpose of this treatment is to diversify old crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromus inermis*) seedings which have created a monoculture with no species diversity and lack of forbs for sage grouse. Pellet group data from 2009 indicated light elk and cattle use (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

One Year Post Treatment

Browse: The disking treatment effectively removed all woody vegetation within the treatment area, although it is unknown what the browse component was prior to treatment. There was no canopy cover of any browse species sampled in 2009 (Table - Canopy Cover). Only rubber rabbitbrush (*Chrysothamnus nauseosus*) was sampled solely for height/crown purposes (Table - Browse Characteristics).

Herbaceous Understory: Six perennial grass species were sampled in 2009, providing 5% cover. The seeded species, western wheatgrass (*Agropyron smithii*), is the dominant grass on the site. It is likely that western wheatgrass was well established before the treatment as it is common on other study sites in the immediate proximity. Crested wheatgrass and smooth brome are also fairly common, but were not very abundant in 2009. Much of the grass growth occurred in furrows that ran somewhat parallel to the baseline. Perennial forbs are rare on the site with the seeded species, blue flax (*Linum lewisii*), providing nearly all of the perennial forb cover. Forbs were dominated by annuals with slimleaf goosefoot (*Chenopodium lephtophyllum*) being the dominant species in cover on the site at 24% cover.

This first monitoring of this project was in the first growing season after treatment. It is too early to determine the success or failure of this project.

Seed mix

Project name: Wildcat Knolls Habitat Improvement

WRI Database #: 1161 Size (acre): 1000

Mix lot #: ser-de-wkhi-09

Seed type	lbs in mix	lbs/acre
Blue Flax 'Appar'	1000	1.00
Bottlebrush Squirreltail 'Toe Jam'	500	0.50
Cicer Milkvetch 'Lutana'	1000	1.00
Great Basin Wildrye 'Trailhead'	1000	1.00
Rocky Mountain Penstemon 'Bandera'	71	0.07
Prickly Lettuce	137	0.14
Sagebrush, Mountain--Sanpete UT	220	0.22
Sagebrush, Mountain--Sevier/Wayne UT	280	0.28
Sandberg Bluegrass--Toole MT	1000	1.00
Showy Goldeneye--Sanpete UT	25	0.03
Slender Wheatgrass 'San Luis'	2027	2.03
Small Burnet 'Delar'	1500	1.50
Utah Sweetvech	249	0.25
Western Wheatgrass 'Arriba'	1000	1.00
Western Yarrow	100	0.10
BULK POUNDS PER ACRE:		10.11
PLS POUNDS PER ACRE:		8.52

HERBACEOUS TRENDS--

Management unit 16R, Study no: 37

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	72	.52
G	Agropyron smithii	148	3.27
G	Bromus inermis	27	.71
G	Poa fendleriana	2	.00
G	Poa secunda	10	.13
G	Sitanion hystrix	6	.03
Total for Annual Grasses		0	0
Total for Perennial Grasses		265	4.68
Total for Grasses		265	4.68
F	Astragalus sp.	5	.00
F	Chenopodium leptophyllum(a)	262	24.21
F	Crepis acuminata	1	.01
F	Lactuca serriola	3	.03
F	Linum lewisii	150	1.72
F	Polygonum douglasii (a)	48	.54
F	Sanguisorba minor	12	.02
Total for Annual Forbs		310	24.75
Total for Perennial Forbs		171	1.79
Total for Forbs		481	26.55

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

NO BROWSE SAMPLED

BASIC COVER--
Management unit 16R, Study no: 37

Cover Type	Average Cover % '09
Vegetation	27.95
Rock	.09
Pavement	.01
Litter	24.11
Bare Ground	60.01

PELLET GROUP DATA--
Management unit 16R, Study no: 37

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	3	-
Elk	8	6 (15)
Deer	6	-
Cattle	4	9 (22)

BROWSE CHARACTERISTICS--
Management unit 16R, Study no: 37

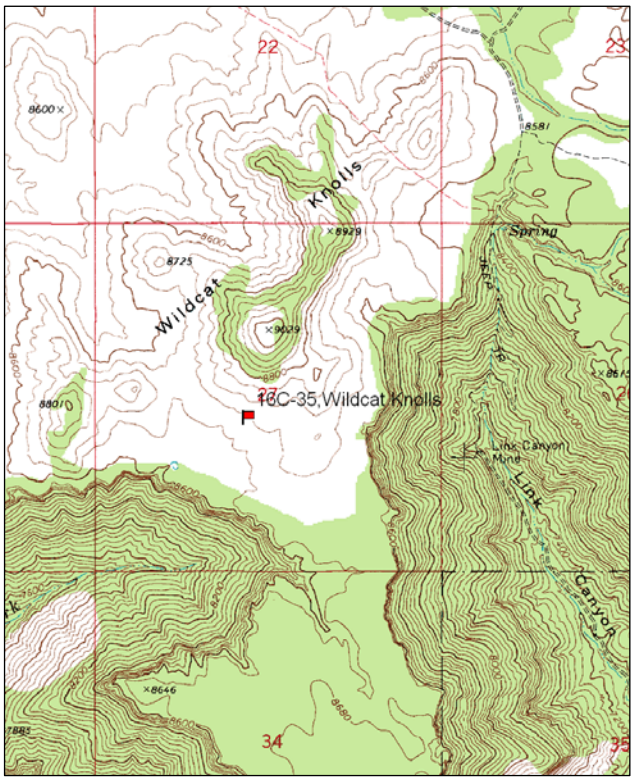
Yr	Average Height Crown (in)
Chrysothamnus nauseosus	
09	16/12

WILDCAT KNOLL - TREND STUDY NO. 16C-35

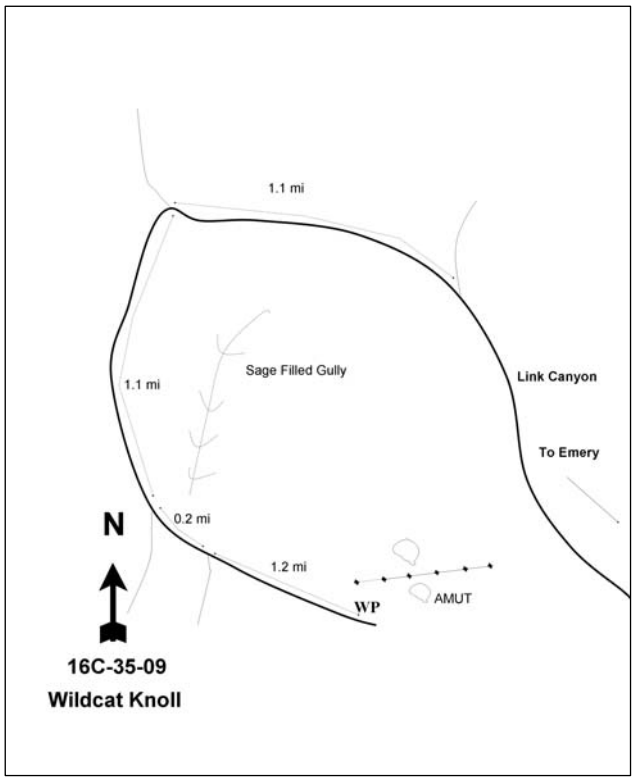
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 8,700 ft (2,652 m)
Aspect: South
Slope: 3%-5%
Transect bearing: 95 degrees magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft)

Directions:
From Center St. in Emery, travel west 1.2 miles. Turn right onto a dirt road and proceed for 0.6 miles. Turn left and travel 8.7 miles (1.7 miles from turnoff to site 16C-35). Bear left at the fork and travel 1.1 miles to another fork. Stay left on F.S. #344 for 1.1 miles to another fork (at 0.1 miles on F.S. #344, go left at the fork). At the fork, bear left and travel 0.2 miles to another fork. At the fork, go left and travel 1.2 miles to the witness post. From the witness post to the 0 ft baseline stake, walk 470 ft at a bearing of 18°M. The 0 ft stake has browse tag #485 attached.

Map Name: Emery West



Diagrammatic Sketch:



Township: 21S, Range: 5E, Section: 27

GPS: NAD 83, UTM 12S 470033 E 4312361 N

WILDCAT KNOLL - TREND STUDY NO. 16C-35

Site Information

Site Description: The study samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), black sagebrush (*A. nova*) and grass community which is considered important for elk. There is little escape or thermal cover on the site, but about half mile away there is good cover provided by Ponderosa pine (*Pinus ponderosa*) trees. This area is managed by the Forest Service as part of the Emery allotment. Water is limited here with guzzlers fairly close, about three-quarters of a mile from the site. Pellet group data has indicated very heavy use by elk and light use by deer since 1999. Estimated cattle use has been light to moderate since 1999 (Table - Pellet Group Data).

Browse: There are several species of palatable browse on the site including Utah serviceberry (*Amelanchier utahensis*), black sagebrush, and mountain big sagebrush. Individual serviceberry plants are large, high lined, and mostly unavailable to browsing. Utilization of serviceberry has been mostly moderate over the study years. Mountain big sagebrush dominates the drainage corridors while black sagebrush, dwarf rabbitbrush (*Chrysothamnus depressus*), and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) dominate the drier areas. It appears that there have been problems identifying dwarf rabbitbrush and stickyleaf low rabbitbrush. Because of the identification problems, dwarf rabbitbrush was not included in the Desirable Components Index. Data since 1999 has classified most of the rabbitbrush as stickyleaf low rabbitbrush. There was a slight die-off of black and mountain big sagebrush between the 1999 and 2004 sample years that is attributed to drought conditions in the years prior to 2004. Even with the decrease in density over those years, both sagebrush populations have remained healthy with low decadence, good vigor, and good recruitment of young plants. Utilization of the two sagebrush species was moderate in 1994 and 1999, but has been mostly light since 2004. Other browse species that occur infrequently include antelope bitterbrush (*Purshia tridentata*), Wood's rose (*Rosa woodsii*), and snowberry (*Symphoricarpos oreophilus*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are diverse and abundant on the site providing an average cover of 15% since 1994. The dominant species are mutton bluegrass (*Poa fendleriana*), Letterman needlegrass (*Stipa lettermani*), and Salina wildrye (*Elymus salina*). Forbs are diverse, but have steadily decreased in sum of nested frequency since 1994. However, perennial forb cover has remained fairly high and has averaged about 3% since 1994 (Table - Herbaceous Trends).

Soil: The soil has a sandy clay loam texture with a slightly acid pH (Table - Soil Analysis Data). The parent material is limestone. Bare ground cover has fluctuated over the sample years with shifts in litter and vegetation cover, but has been mostly moderately low (Table - Basic Cover). The soil erosion condition was classified as stable in 2004 and 2009.

Trend Assessments

Browse:

- **1994 to 1999 - slightly up (+1):** There was a 69% increase in the density of black sagebrush from 4,740 plants/acre to 8,020 plants/acre. Most of the increase in density is due to a large increase in the recruitment of young black sagebrush plants from 1% to 30% of the population. There was little change in the mountain big sagebrush density, but recruitment of young plants increased from 1% to 33% of the population. The density of mature mountain big sagebrush plants actually decreased substantially.
- **1999 to 2004 - down (-2):** The density of both black and mountain big sagebrush decreased by more than 50% with large decreases in cover. Recruitment of young plants decreased to 3% of the population for black sagebrush and to 19% for mountain big sagebrush.

- **2004 to 2009 - up (+2):** There was nearly a three-fold increase in the density of both black and mountain big sagebrush. Almost all of the increase came from a substantial increase in the density of young plants. Cover of both species increased, but did not return to 1999 levels.

Grass:

- **1994 to 1999 - slightly down (-1):** Perennial grass sum of nested frequency decreased by 15%, but cover increased from 11% to 16%. Letterman needlegrass decreased significantly in nested frequency.
- **1999 to 2004 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased by 19% and cover decreased to 13%. Mutton bluegrass decreased significantly in nested frequency.
- **2004 to 2009 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, but cover increased to 20%.

Forb:

- **1994 to 1999 - down (-2):** Perennial forb sum of nested frequency decreased by 22%, but cover increased from 2% to 4%.
- **1999 to 2004 - down (-2):** Perennial forb sum of nested frequency decreased by 20% and annual forb sum of nested frequency increased substantially. The increase in annual forbs was due primarily to a large increase in frequency and cover of a goosefoot (*Chenopodium sp.*)
- **2004 to 2009 - down (-2):** The sum of nested frequency decreased by 52% and forbs are fairly rare on the site. Cover of perennial forbs decreased, but stayed fairly high at near 2%. Annual forbs also decreased in sum of nested frequency and cover.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --
Management unit 16C, study no: 35

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
94	13.0	12.5	0.4	22.1	0.0	4.0	0.0	**51.9**	Poor-Fair
99	20.5	11.4	13.3	30.0	0.0	7.8	0.0	**83.1**	Excellent
04	11.3	13.4	3.9	26.6	0.0	5.1	0.0	**60.2**	Fair
09	16.1	13.5	15.0	30.0	0.0	3.2	0.0	**77.8**	Good

HERBACEOUS TRENDS--
Management unit 16C, Study no: 35

Type	Species	Nested Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
G	Agropyron smithii	$_{a}$42	$_{ab}$36	$_{bc}$74	$_{c}$103	.13	.34	1.91	3.80
G	Agropyron spicatum	$_{a}$3	$_{a}$4	$_{b}$26	$_{ab}$15	.03	.03	.32	.48
G	Carex sp.	$_{b}$99	$_{b}$105	$_{b}$91	$_{a}$16	.21	.67	.94	.18
G	Elymus salina	$_{b}$253	$_{a}$144	$_{a}$116	$_{a}$154	4.10	5.76	4.52	9.26
G	Oryzopsis hymenoides	$_{ab}$20	$_{a}$11	$_{b}$23	$_{a}$8	.25	.04	.19	.30
G	Poa fendleriana	$_{bc}$177	$_{c}$231	$_{a}$111	$_{ab}$157	1.85	5.41	2.23	3.68
G	Sitanion hystrix	11	3	12	3	.02	.04	.16	.01
G	Stipa comata	$_{a}$-	$_{b}$23	$_{a}$8	$_{a}$5	-	.56	.36	.00
G	Stipa lettermani	$_{b}$225	$_{a}$145	$_{a}$111	$_{a}$109	4.43	3.38	2.62	2.57
Total for Annual Grasses		0	0	0	0	0	0	0	0
Total for Perennial Grasses		830	702	572	570	11.04	16.26	13.28	20.31
Total for Grasses		830	702	572	570	11.04	16.26	13.28	20.31

Type	Species	Nested Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
F	Agoseris glauca	-	8	2	2	-	.09	.00	.03
F	Antennaria rosea	4	11	-	5	.06	.36	-	.03
F	Astragalus convallarius	$_{b}$17	$_{a}$8	$_{a}$-	$_{a}$1	.12	.01	.25	.03
F	Astragalus miser	$_{b}$35	$_{b}$38	$_{a}$9	$_{a}$1	.57	.93	.19	.03
F	Astragalus sp.	5	9	9	3	.16	.66	.51	.15
F	Calochortus nuttallii	$_{a}$2	$_{a}$6	$_{b}$29	$_{a}$-	.00	.01	.09	-
F	Castilleja linariaefolia	$_{b}$38	$_{b}$24	$_{a}$1	$_{a}$3	.10	.14	.00	.03
F	Chaenactis douglasii	3	-	4	-	.00	-	.00	-
F	Chenopodium sp. (a)	$_{a}$-	$_{a}$-	$_{c}$267	$_{b}$13	-	-	5.41	.10
F	Cirsium sp.	1	-	-	-	.00	-	-	-
F	Crepis acuminata	$_{b}$40	$_{a}$-	$_{ab}$17	$_{a}$6	.14	-	.21	.01
F	Erigeron eatonii	$_{b}$44	$_{a}$16	$_{a}$8	$_{a}$8	.12	.09	.04	.04
F	Eriogonum alatum	-	3	-	-	-	.03	-	-
F	Eriogonum racemosum	44	38	32	26	.14	.41	.47	.26
F	Eriogonum umbellatum	38	23	28	19	.40	.51	.26	.63
F	Gayophytum ramosissimum(a)	-	-	5	-	-	-	.01	-
F	Lappula occidentalis (a)	$_{a}$-	$_{a}$-	$_{b}$16	$_{a}$-	-	-	.20	-
F	Linum lewisii	-	6	4	-	-	.04	.01	-
F	Lomatium sp.	-	1	-	-	-	.00	-	-
F	Lupinus argenteus	1	10	-	-	.01	.25	-	-
F	Lygodesmia sp.	-	1	6	-	-	.03	.06	-
F	Machaeranthera canescens	6	9	3	-	.03	.04	.01	-
F	Machaeranthera grindelioides	-	1	-	-	-	.03	-	-
F	Mertensia sp.	8	-	-	-	.09	-	-	-
F	Penstemon carnosus	1	1	-	-	.03	.01	-	-
F	Penstemon sp.	-	8	5	8	-	.19	.31	.33
F	Polygonum douglasii (a)	$_{a}$-	$_{a}$-	$_{b}$59	$_{a}$9	-	-	.12	.04
F	Senecio multilobatus	-	2	2	-	-	.03	.00	-
F	Taraxacum officinale	-	3	3	-	-	.01	.00	-
F	Townsendia sp.	-	-	3	-	-	-	.00	-
F	Zigadenus paniculatus	$_{a}$4	$_{a}$-	$_{b}$17	$_{a}$5	.00	.00	.06	.01
Total for Annual Forbs		0	0	347	22	0	0	5.74	0.14
Total for Perennial Forbs		291	226	182	87	2.00	3.91	2.53	1.58
Total for Forbs		291	226	529	109	2.00	3.91	8.27	1.73

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

BROWSE TRENDS--
Management unit 16C, Study no: 35

Type	Species	Strip Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
B	Amelanchier utahensis	1	2	2	1	1.76	2.29	2.96	2.97
B	Artemisia frigida	1	1	1	0				
B	Artemisia nova	58	67	56	60	3.20	6.18	2.37	4.69
B	Artemisia tridentata vaseyana	56	55	42	56	4.34	6.98	2.93	4.64
B	Chrysothamnus depressus	80	5	1	0	2.73	-	-	-
B	Chrysothamnus nauseosus hololeucus	2	0	4	5	-	-	.03	.01
B	Chrysothamnus viscidiflorus viscidiflorus	13	88	82	88	.41	3.90	7.35	4.64
B	Eriogonum corymbosum	4	5	5	7	.03	-	.06	.18
B	Leptodactylon pungens	0	0	0	1				
B	Opuntia sp.	3	0	1	2	.18	.00	.01	.01
B	Purshia tridentata	1	0	2	0	.63	.38	.15	-
B	Rosa woodsii	0	2	1	0	.00	.06	.03	-
B	Symphoricarpos oreophilus	6	1	1	4	.60	.15	.03	.16
B	Tetradymia canescens	4	4	3	5	.03	-	.03	.03
Total for Browse		229	230	201	229	13.94	19.96	15.98	17.34

CANOPY COVER, LINE INTERCEPT--
Management unit 16C, Study no: 35

Species	Percent Cover		
	'99	'04	'09
Amelanchier utahensis	3.20	2.79	3.83
Artemisia nova	-	4.00	4.84
Artemisia tridentata vaseyana	-	4.28	5.61
Chrysothamnus viscidiflorus viscidiflorus	-	9.05	5.31
Eriogonum corymbosum	-	.18	.38
Tetradymia canescens	-	.13	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16C, Study no: 35

Species	Average leader growth (in)	
	'04	'09
Amelanchier utahensis	3.0	1.7
Artemisia tridentata vaseyana	2.2	1.0
Purshia tridentata	4.3	1.5

BASIC COVER--
Management unit 16C, Study no: 35

Cover Type	Average Cover %			
	'94	'99	'04	'09
Vegetation	33.81	43.76	37.09	43.60
Rock	.26	.04	.03	.00
Pavement	.12	.13	.80	.23
Litter	47.01	45.68	34.76	43.19
Cryptogams	.00	0	0	0
Bare Ground	30.31	24.97	44.07	27.50

PELLET GROUP DATA--
Management unit 16C, Study no: 35

Type	Quadrat Frequency			
	'94	'99	'04	'09
Rabbit	10	4	5	7
Elk	65	51	51	55
Deer	24	5	2	2
Cattle	7	3	6	11

Days use per acre (ha)		
'99	'04	'09
-	-	-
109 (269)	97 (240)	46 (112)
9 (22)	6 (15)	3 (8)
29 (72)	30 (73)	16 (39)

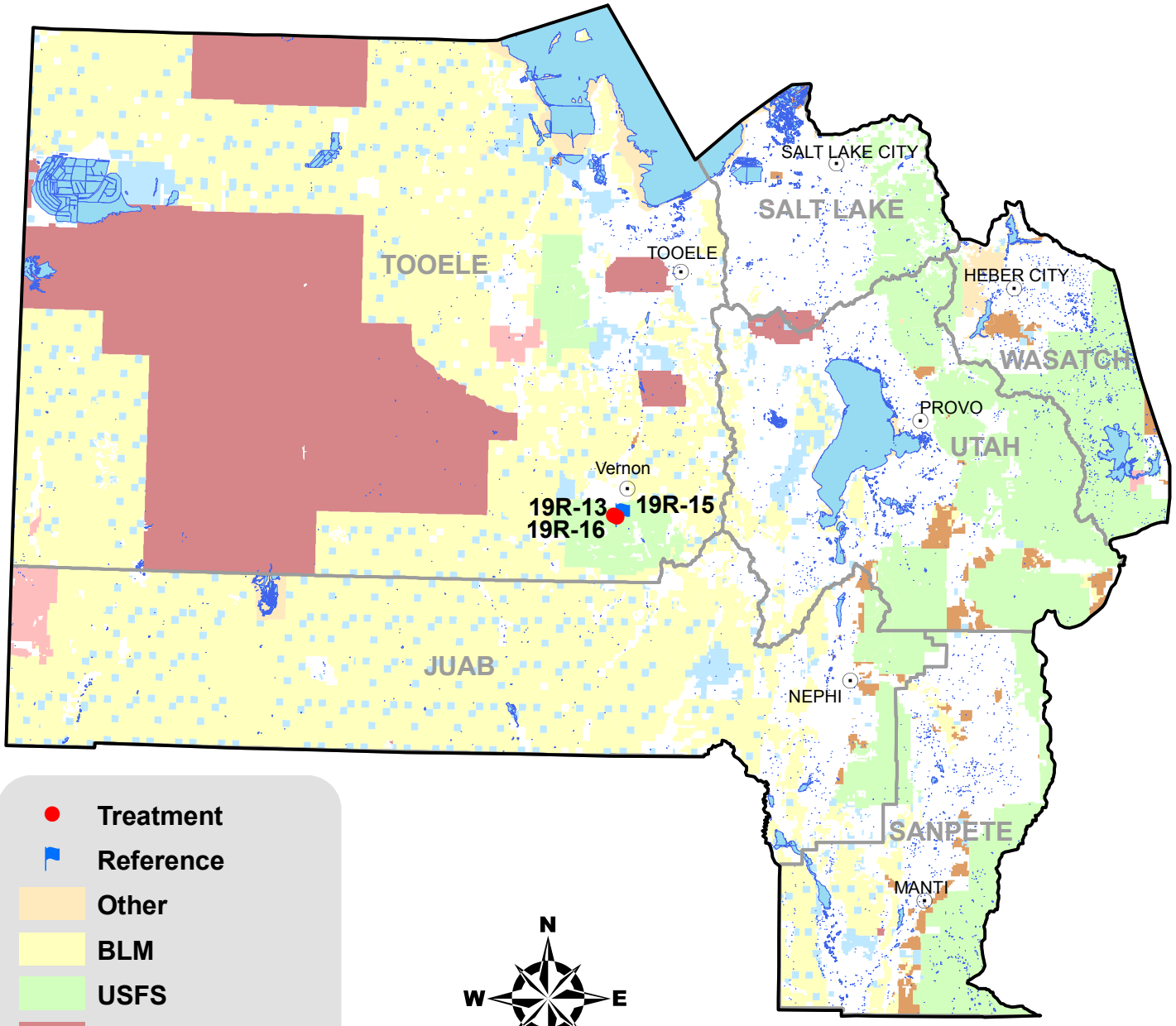
BROWSE CHARACTERISTICS--
Management unit 16C, Study no: 35

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier utahensis									
94	**20**	0	100	-	-	100	0	0	74/88
99	**40**	0	100	-	60	0	50	0	93/115
04	**40**	0	100	-	-	50	0	0	62/67
09	**20**	100	0	-	120	0	0	0	59/79
Artemisia frigida									
94	**80**	0	100	-	-	0	0	0	-/-
99	**40**	0	100	-	-	0	0	0	-/-
04	**40**	0	100	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
Artemisia nova									
94	**4740**	1	86	14	680	58	0	6	10/16
99	**8020**	30	53	17	100	53	23	1	8/15
04	**3660**	3	89	8	600	5	.54	4	7/11
09	**10200**	60	37	3	6780	2	2	14	6/15
Artemisia tridentata vaseyana									
94	**4520**	1	90	9	-	77	0	1	34/36
99	**4560**	33	55	12	400	46	2	4	19/29
04	**2140**	19	72	9	1660	7	7	5	21/26
09	**6140**	53	36	10	3420	13	9	14	16/23

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Chrysothamnus depressus									
94	**11160**	0	98	2	60	0	0	0	3/7
99	**120**	17	83	0	-	0	0	0	4/7
04	**20**	0	100	0	-	0	0	0	-/-
09	**0**	0	0	0	-	0	0	0	-/-
Chrysothamnus nauseosus hololeucus									
94	**60**	0	100	0	-	0	0	0	18/18
99	**0**	0	0	0	-	0	0	0	-/-
04	**120**	0	83	17	-	33	0	17	18/19
09	**140**	14	71	14	-	0	0	14	18/20
Chrysothamnus viscidiflorus viscidiflorus									
94	**1260**	0	98	2	-	0	0	0	7/8
99	**13400**	14	85	2	180	15	0	0	5/9
04	**13400**	6	93	1	240	0	0	.14	7/11
09	**14780**	12	70	19	-	1	0	26	5/9
Eriogonum corymbosum									
94	**100**	0	100	0	-	0	0	0	11/16
99	**160**	38	50	13	-	13	0	0	14/18
04	**140**	0	100	0	-	86	0	0	10/14
09	**140**	29	71	0	20	0	0	0	10/19
Leptodactylon pungens									
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**20**	0	100	-	-	0	0	0	-/-
Opuntia sp.									
94	**100**	20	80	-	-	0	0	0	3/10
99	**0**	0	0	-	20	0	0	0	-/-
04	**60**	0	100	-	-	0	0	0	2/4
09	**60**	0	100	-	-	0	0	0	3/9
Purshia tridentata									
94	**20**	0	0	100	-	100	0	0	23/26
99	**0**	0	0	0	-	0	0	0	26/69
04	**40**	0	100	0	-	0	0	0	25/55
09	**0**	0	0	0	-	0	0	0	22/55
Rosa woodsii									
94	**0**	0	0	-	-	0	0	0	-/-
99	**120**	100	0	-	40	0	0	0	-/-
04	**60**	100	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	9/4

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Symphoricarpos oreophilus									
94	**300**	0	100	-	-	27	0	0	13/23
99	**20**	0	100	-	-	0	0	0	20/39
04	**20**	0	100	-	-	0	0	0	16/29
09	**80**	25	75	-	-	0	25	0	18/38
Tetradymia canescens									
94	**140**	14	86	0	-	0	0	0	7/9
99	**120**	67	33	0	-	0	33	0	6/7
04	**100**	0	100	0	-	0	0	0	7/11
09	**100**	20	60	20	-	20	0	20	7/9

Central Region
WRI Studies 2009



- Treatment
- Reference
- Other
- BLM
- USFS
- DOD
- UDWR
- SITLA
- Tribal
- Private
- County Boundary
- Cities
- Waterbody

N
W E
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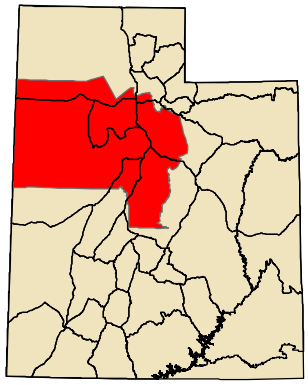
0 5 10 20 30 40 Miles

Region Location



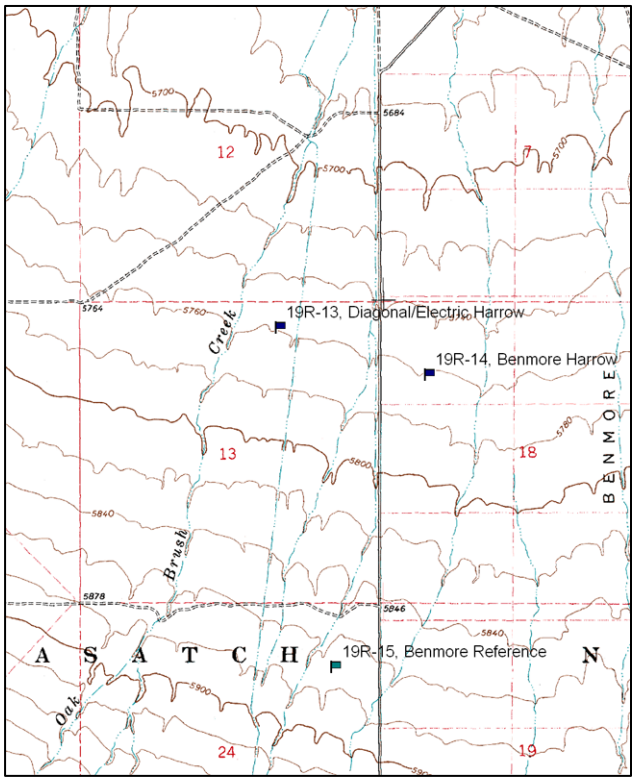
DIAGONAL/ELECTRIC HARROW WRI, 19R-13

Vegetation Type: Wyoming big sagebrush
Range Type: Winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R028AY220UT
Land Ownership: USFS
Elevation: 5,697 ft. (1,736 m)
Aspect: north
Slope: 1%
Transect bearing: 176° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

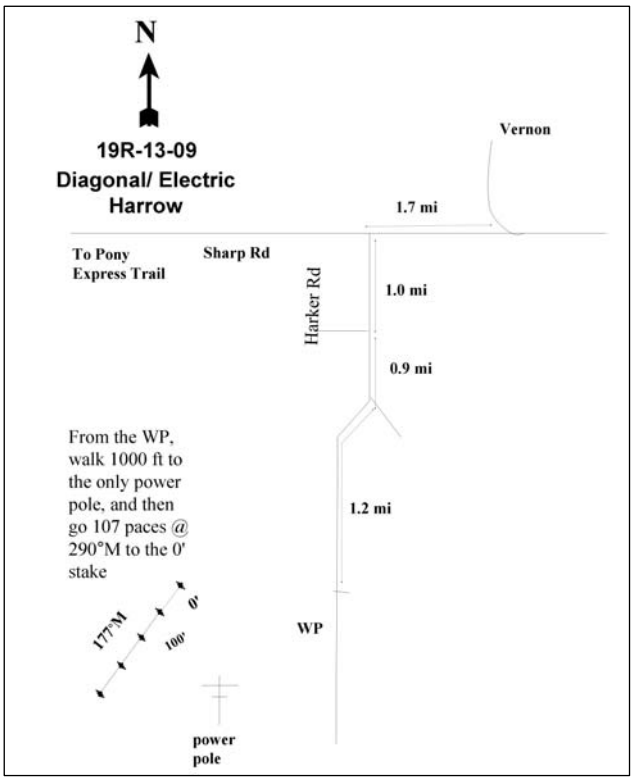
Directions:

From Vernon, drive 1.7 miles on Sharp Road (leads to the Pony Express Trail). Turn left onto Harker Road and drive 1.0 miles to a fork. Stay left and drive 0.9 miles to another fork. Keep to the right and drive 1.2 miles to the witness post. From the witness post, walk 1,000 feet to the only power pole and then go 107 paces at 290° M. The 0' stake does not have a browse tag.

Map Name: Vernon



Diagrammatic Sketch:



Township: 9S Range: 6W Section: 13

GPS: NAD 83, UTM 12S 374945 E 4433229 N

DIAGONAL/ELECTRIC HARROW - WRI STUDY 19R-13
Project #659

Site Description

Site Information: This study was established in 2008 south of Vernon to monitor the effects of a harrow treatment designed to improve a sagebrush population consisting of a single age class (old and decadent). The objectives of the project were to reduce sagebrush cover in treated areas to between 5% and 10%, and improve the herbaceous understory through the establishment of perennial grasses and forbs. The treatment was done in the fall of 2008 and a seed mix was applied at treatment. Pellet group data estimated low cattle use in 2008 and 2009. Rabbit use was very high in 2008, but decreased somewhat in 2009 (Table - Pellet Group Data). Deer sign was present along an established game trail, but was not sampled. A sage grouse chick was flushed while reading the site in 2009. Soil erosion condition was classified as stable in both 2008 and 2009.

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant browse species. Low rabbitbrush (*Chrysothamnus viscidiflorus*) is the only other species that was sampled.

Herbaceous Understory: Crested wheatgrass (*Agropyron cristatum*) is the predominant grass species, providing over 50% of grass cover since 2008. Sandberg bluegrass (*Poa secunda*) is the only other common perennial grass and provided most of the rest of the grass cover. Cheatgrass (*Bromus tectorum*) was sampled for the first time in 2009 at low frequency and cover. Perennial forbs are sparse on the site, although weedy annuals did well. Burr buttercup (*Ranunculus testiculatus*) was the most common forb and provided over 70% of forb cover since 2008. Perennial forb cover has not been over 1% while annual cover increased from 1% to 4% following the treatment (Table - Herbaceous Trends).

Pre vs. One Year Post Treatment

Browse: Following the treatment, the canopy cover of Wyoming big sagebrush was successfully decreased from 13% to 3% (Table – Canopy Cover). The average height decreased from two feet to about a foot tall.

Grass: The nested frequency of perennial grasses decreased 36% and cover declined from17% to 6%, in just the first growing season following treatment. No seeded species were sampled in the year following treatment. Cheatgrass was sampled at low frequency and cover.

Forb: Perennial forbs are rare and provide less than 1% cover. There was a large increase in weedy annual forb sum of nested frequency and cover. Four seeded forb species were sampled at low frequency and cover; blue flax (*Linum lewisii*), alfalfa (*Medicago sativa*), sainfoin (*Onobrychis viciaefolia*), and small burnet (*Sanguisorba minor*).

Seed mix

Project name: Diagonal-Electric Sagebrush Improvement
WRI Database #: 659

Mix lot #: cr-mf-desi-09	Size (acre):	1000
Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	1500	1.50
Blue Flax 'Appar'	500	0.50
Bluebunch WG 'Anatone'	2002	2.00
Great Basin Wildrye 'Trailhead'	976	0.98
Indian Ricegrass 'Rimrock'	1500	1.50
Rocky Mountain Beeplant--Sevier UT	250	0.25
Sainfoin 'Eski'	3000	3.00
Small Burnet 'Delar'	2000	2.00
Snake River Wheatgrass 'Secar'	992	0.99
Western Wheatgrass 'Arriba'	2000	2.00
Western Yarrow	100	0.10
BULK POUNDS PER ACRE:		14.82
PLS POUNDS PER ACRE:		12.87

HERBACEOUS TRENDS--
Management unit 19R, Study no: 13

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
G	Agropyron cristatum	230	216	8.62	4.97
G	Agropyron intermedium	$_{a}$3	$_{b}$9	.15	.01
G	Bromus tectorum (a)	-	3	-	.00
G	Poa secunda	$_{b}$268	$_{a}$94	7.73	1.19
Total for Annual Grasses		0	3	0	0.00
Total for Perennial Grasses		501	319	16.51	6.17
Total for Grasses		501	322	16.51	6.18
F	Alyssum alyssoides (a)	$_{a}$14	-	.03	-
F	Astragalus sp.	1	4	.03	.01
F	Linum lewisii	-	2	-	.00
F	Medicago sativa	-	3	-	.01
F	Onobrychis viciaefolia	-	$_{a}$10	-	.03
F	Phlox austromontana	44	30	.34	.33
F	Phlox longifolia	2	1	.00	.00
F	Ranunculus testiculatus (a)	$_{a}$264	$_{b}$314	1.37	4.17
F	Salsola iberica (a)	-	4	-	.00
F	Sanguisorba minor	-	4	-	.01
F	Senecio multilobatus	1	2	.00	.03
F	Unknown forb-annual (a)	-	5	-	.02
Total for Annual Forbs		278	323	1.41	4.20
Total for Perennial Forbs		48	56	0.38	0.43
Total for Forbs		326	379	1.79	4.63

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

CANOPY COVER, LINE INTERCEPT--
Management unit 19R, Study no: 13

Species	Percent Cover '08	'09
Artemisia tridentata wyomingensis	12.78	3.41
Chrysothamnus viscidiflorus	-	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 19R, Study no: 13

Species	Average leader growth (in) '08	'09
Artemisia tridentata wyomingensis	1.6	-

BASIC COVER--
Management unit 19R, Study no: 13

Cover Type	Average Cover % '08	'09
Vegetation	28.02	14.21
Rock	.02	.30
Pavement	3.16	4.34
Litter	31.36	23.13
Cryptogams	11.80	.53
Bare Ground	40.70	67.86

PELLET GROUP DATA--
Management unit 19R, Study no: 13

Type	Quadrat Frequency '08	'09	Days use per acre (ha) '08	'09
Rabbit	97	49	-	-
Deer	1	6	-	-
Cattle	7	2	9 (23)	1 (2)

BROWSE CHARACTERISTICS--
Management unit 19R, Study no: 13

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
08	24/32
09	13/18
Chrysothamnus nauseosus	
08	17/17
09	-/-
Chrysothamnus viscidiflorus	
08	7/9
09	9/10

Chrysothamnus viscidiflorus viscidiflorus	
08	6/8
09	-/-
Gutierrezia sarothrae	
08	8/8
09	12/13

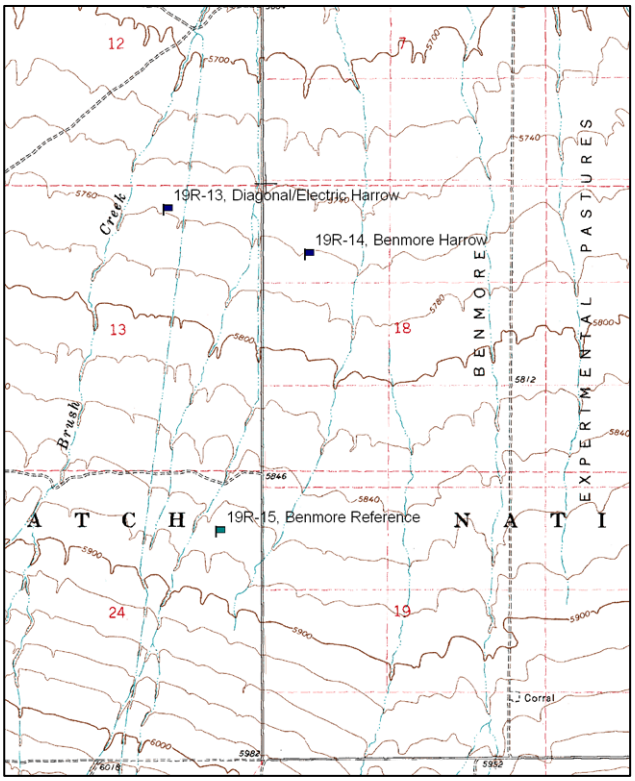
BENMORE HARROW WRI, 19R-16

Vegetation Type: Wyoming big sagebrush
Range Type: Winter
NRCS Ecological Site Description: Semidesert Loam (Wyoming Big Sagebrush), R028AY220UT
Land Ownership: USFS
Elevation: 5,699 ft. (1,737 m)
Aspect: northwest
Slope: 2%
Transect bearing: 350° magnetic
Belt placement: Read Baseline, No Belts

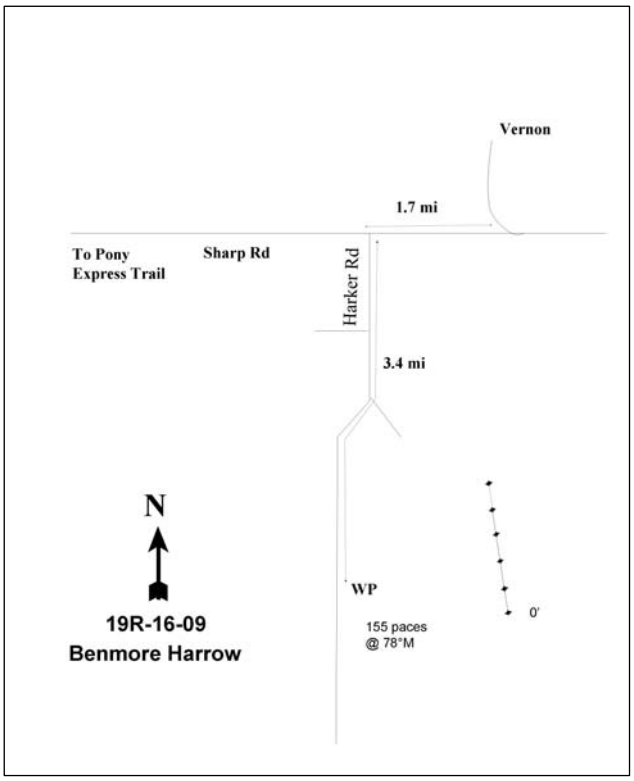
Directions:

From Vernon, drive 1.7 miles on Sharp Road (leads to the Pony Express Trail). Turn left onto Harker Road and drive 1.0 miles to a fork. Stay left and drive 0.9 miles to another fork. Keep to the right and drive 1.5 miles to the witness post on the east side of the road. From witness post proceed 155 paces at 78°M to 0' stake.

Map Name: Vernon



Diagrammatic Sketch:



Township: 9S Range: 5W Section: 18

GPS: NAD 83, UTM 12S 375744 E 4432965 N

BENMORE HARROW - WRI STUDY 19R-16
Project #1361

Site Description

Site Information: This study was established prior to a chain harrow treatment and broadcast seeding scheduled for the fall of 2009. The treatment will be done in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community south of Vernon, UT. The treatment objective is to improve 1,000 acres of brood rearing habitat for sage grouse. Pellet group data estimated moderate deer use in 2009. The pellet frequency of rabbits was very high in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: Wyoming big sagebrush is the only preferred browse species on the site and provided almost all of the browse cover in 2009. Sagebrush canopy cover was moderate at 16% (Table - Canopy Cover) and plants were large with a relatively high average height and crown measurement in 2009 (Table - Browse Characteristics).

Herbaceous Understory: Two perennial grass species were sampled in 2009, crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*). Crested wheatgrass is the dominant grass and accounted for 90% of the grass cover in 2009. Perennial forbs are severely limited while weedy annual species dominate the forb component. Bur buttercup (*Ranunculus testiculatus*) accounted for 98% of forb cover in 2009.

Seed mix

Project name: Benmore Pastures Dixie Harrow
WRI Database #: 1361

Mix lot #: cr-mf-bpdh-10	Size (acre):	900
Seed type	lbs in mix	lbs/acre
Bluebunch WG 'Anatone'	1800	2.00
Great Basin Wildrye 'Trailhead'	900	1.00
Indian Ricegrass 'Rimrock'	900	1.00
Sandberg Bluegrass--Toole MT	225	0.25
Snake River Wheatgrass 'Secar'	900	1.00
Western Wheatgrass 'Arriba'	1800	2.00
Alfalfa 'Ladak'	1800	2.00
Blue Flax 'Appar'	450	0.50
Sainfoin 'Eski'	1800	2.00
Small Burnet 'Delar'	1800	2.00
Western Yarrow	100	0.11
Rocky Mountain Beeplant--Sanpete UT	119	0.13
Rocky Mountain Beeplant--Sevier UT	212	0.24
Rocky Mountain Beeplant--Sanpete/Sevier/Paiute UT	100	0.11
BULK POUNDS PER ACRE:		14.34
PLS POUNDS PER ACRE:		12.93

HERBACEOUS TRENDS--
Management unit 19R, Study no: 16

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	307	11.73
G	Poa secunda	70	1.28
Total for Annual Grasses		0	0
Total for Perennial Grasses		377	13.02
Total for Grasses		377	13.02
F	Alyssum alyssoides (a)	56	.26
F	Astragalus sp.	1	.00
F	Ranunculus testiculatus (a)	329	10.62
Total for Annual Forbs		385	10.89
Total for Perennial Forbs		1	0.00
Total for Forbs		386	10.89

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

CANOPY COVER, LINE INTERCEPT--
Management unit 19R, Study no: 16

Species	Percent Cover '09
Artemisia tridentata wyomingensis	7.88
Gutierrezia sarothrae	1.56

BASIC COVER--
Management unit 19R, Study no: 16

Cover Type	Average Cover % '09
Vegetation	29.64
Rock	.14
Pavement	1.58
Litter	25.32
Cryptogams	3.34
Bare Ground	52.52

PELLET GROUP DATA--
Management unit 19R, Study no: 16

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	64	-
Deer	2	-
Cattle	11	19 (47)

BROWSE CHARACTERISTICS--
Management unit 19R, Study no: 16

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	25/29
Chrysothamnus nauseosus	
09	13/13
Chrysothamnus viscidiflorus	
09	16/22
Gutierrezia sarothrae	
09	9/11

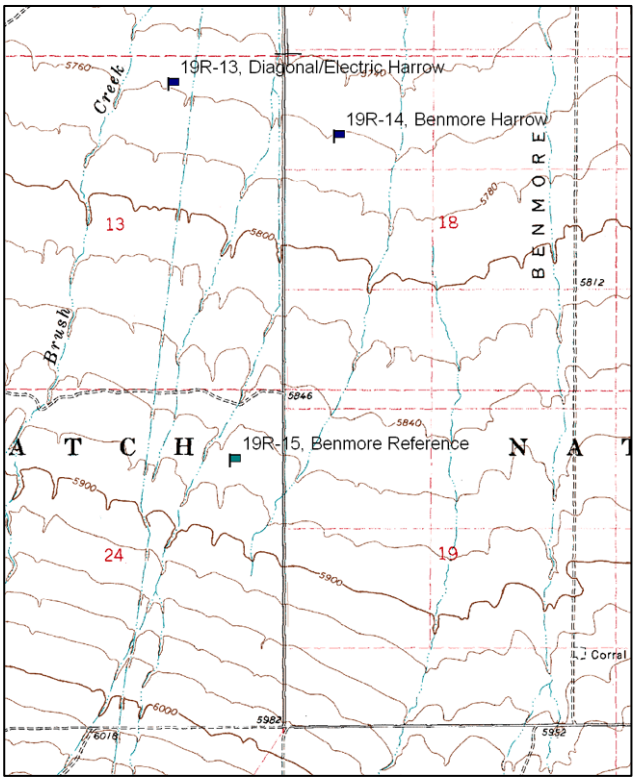
BENMORE REFERENCE WRI, 19R-15

Vegetation Type: Wyoming big sagebrush
Range Type: Winter
NRCS Ecological Site Description: Upland Loam (Mountain Big Sagebrush), R028AY310UT
Land Ownership: USFS
Elevation: 5,804 ft. (1,769 m)
Aspect: west
Slope: 2%
Transect bearing: 180° magnetic
Belt placement: Read Baseline, No Belts

Directions:

From Vernon, drive 1.7 miles on Sharp Road (leads to the Pony Express Trail). Turn left onto Harker Road, continue for 4.25 miles. Witness post is on the west side of the road. From witness post proceed 825 ft (165 paces) at 348°M.

Map Name: Vernon



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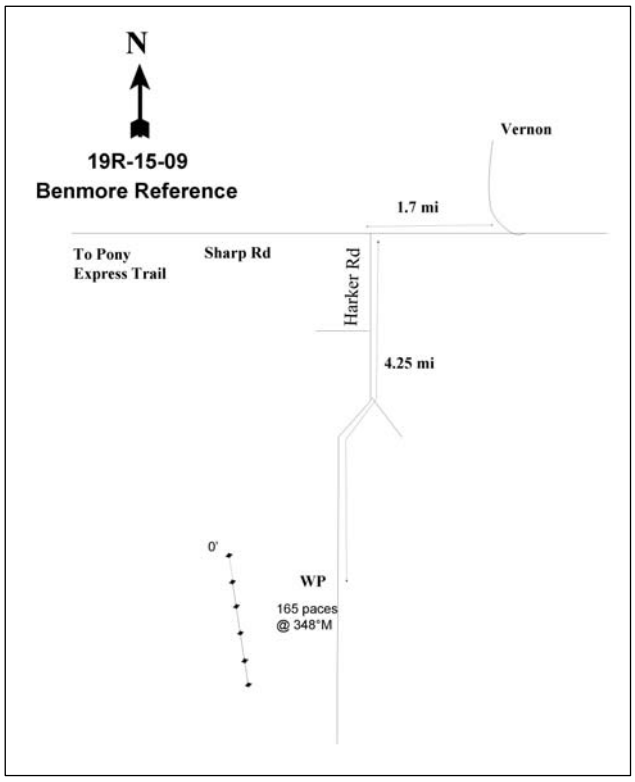


Township: 9S Range: 6W Section: 24

GPS: NAD 83, UTM 12S 375213 E 4431399 N

BENMORE REFERENCE - WRI STUDY 19R-15
Project #659 and Project #1361 Reference

Site Description

Site Information: This site was established in 2009 as an untreated reference site in companion to the Diagonal/Electric Harrow (19R-13) and Benmore Harrow (19R-16) studies. The study is located in a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and crested wheatgrass (*Agropyron cristatum*) community about a mile south of the two treatment sites. Pellet group data estimated low deer use in 2009. The pellet frequency of rabbits was relatively high in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: Wyoming big sagebrush dominates the site and is the only preferred browse species. Sagebrush provides nearly all of the browse cover. Sagebrush canopy cover is moderate at 23% (Table - Canopy Cover) and plants are large with an average height of two feet and crown width of 3 feet (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant, but not diverse with only two perennial and one annual grass sampled in 2009. Crested wheatgrass provides almost all grass cover. Sandberg bluegrass (*Poa secunda*) and cheatgrass (*Bromus tectorum*) were also sampled, but were rare. Perennial forbs were very limited, but annual forbs were quite common in 2009. Burr buttercup (*Ranunculus testiculatus*) is the dominant forb and provided 96% of forb cover in 2009.

HERBACEOUS TRENDS--
Management unit 19R, Study no: 15

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	268	10.61
G	Bromus tectorum (a)	4	.01
G	Poa secunda	12	.04
Total for Annual Grasses		4	0.00
Total for Perennial Grasses		280	10.65
Total for Grasses		284	10.66
F	Agoseris glauca	3	.00
F	Alyssum alyssoides (a)	68	.14
F	Erigeron sp.	17	.11
F	Phlox longifolia	6	.03
F	Ranunculus testiculatus (a)	361	7.62
Total for Annual Forbs		429	7.76
Total for Perennial Forbs		26	0.15
Total for Forbs		455	7.92

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

CANOPY COVER, LINE INTERCEPT--
Management unit 19R, Study no: 15

Species	Percent Cover '09
Artemisia tridentata wyomingensis	11.50
Gutierrezia sarothrae	.23

BASIC COVER--
Management unit 19R, Study no: 15

Cover Type	Average Cover % '09
Vegetation	28.35
Rock	2.76
Pavement	15.16
Litter	23.62
Cryptogams	.29
Bare Ground	43.50

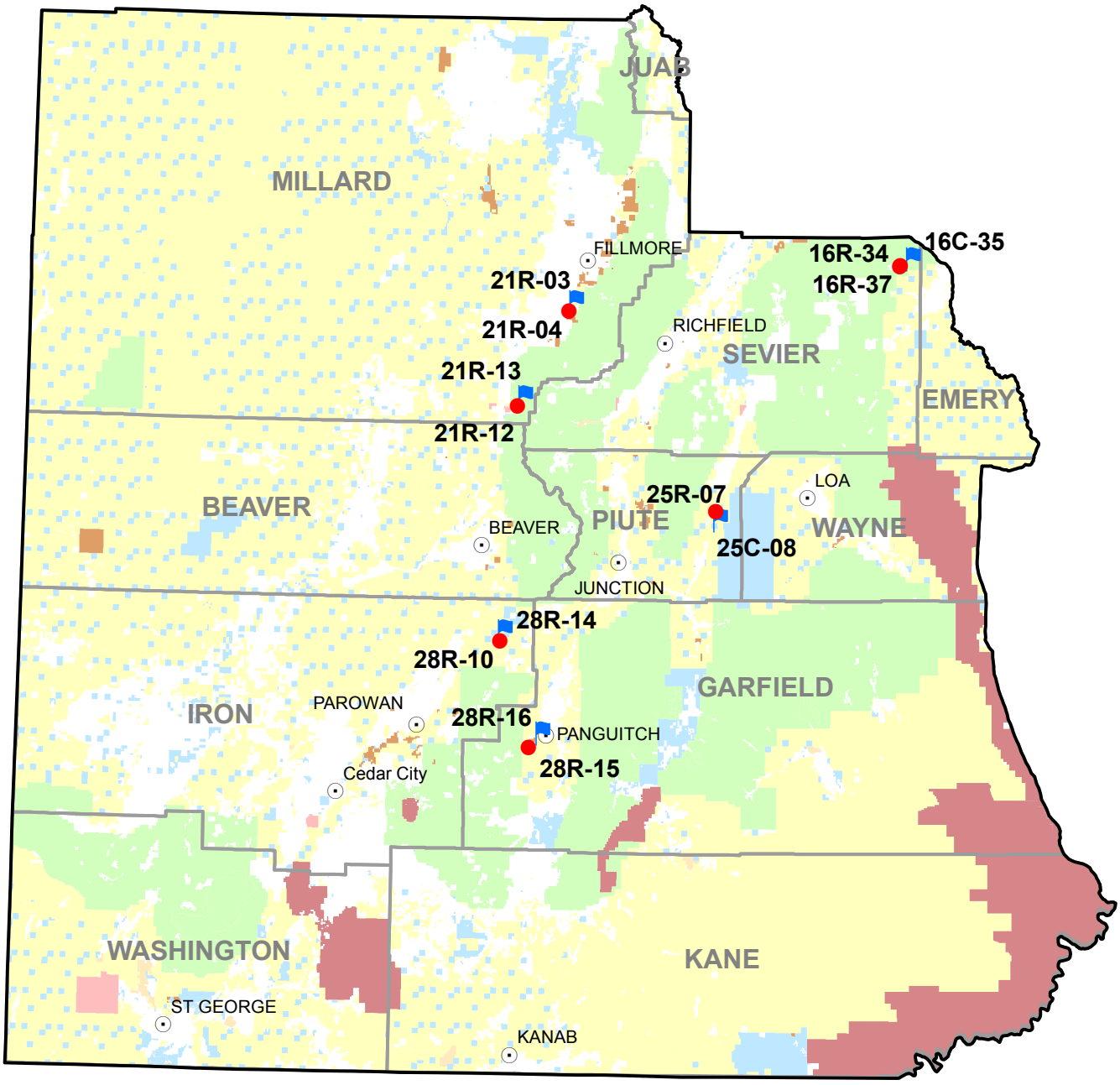
PELLET GROUP DATA--
Management unit 19R, Study no: 15

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	34	-
Deer	2	5 (12)

BROWSE CHARACTERISTICS--
Management unit 19R, Study no: 15

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
09	23/34
Chrysothamnus viscidiflorus	
09	8/12
Gutierrezia sarothrae	
09	8/7

Southern Region
WRI Studies 2009



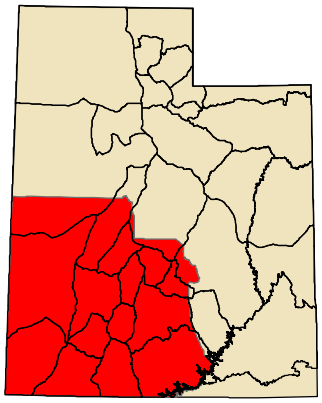
Other
BLM
USFS
NPS
UDWR
SITLA
Tribal
Private

Treatment
Reference
County Boundary
Cities

N
W
E
S

0 4 8 16 24 32
Miles

Region Location



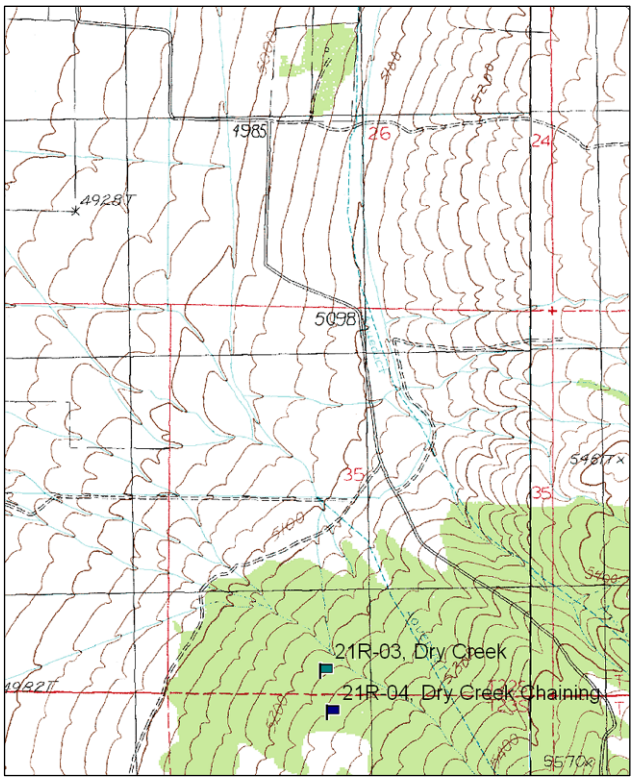
DRY CREEK CHAINING WRI, 21R-4

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R028AY334UT
Land Ownership: Private
Elevation: 5249 ft. (1600 m)
Aspect: West
Slope: 4%
Transect bearing: 161° magnetic
Belt placement: line 1 (11ft and 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 1 on 5ft, belt 4 on 58ft; rest are on 0ft.

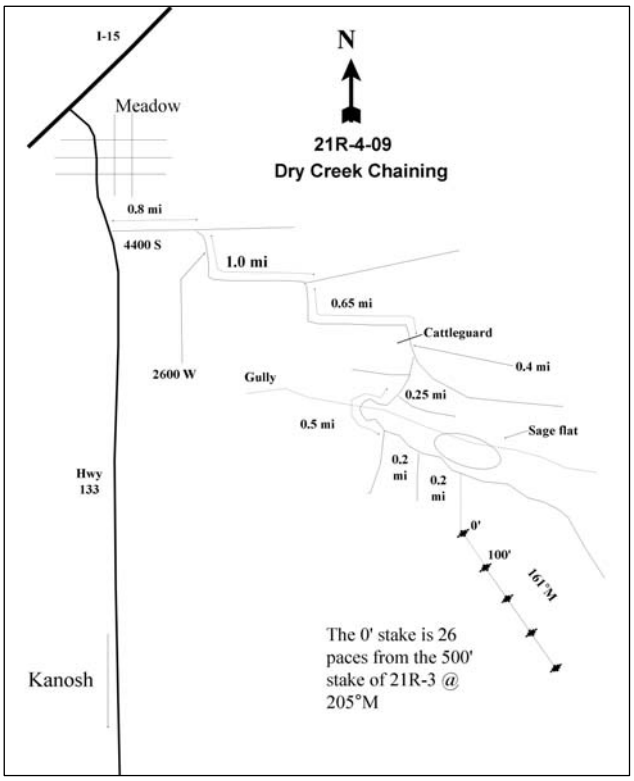
Directions:

Go south from Meadow (southwest of Fillmore) on SR 133 to mile marker 6. Continue approximately 0.05 miles further south on SR 133 and turn east on a gravel road (4400 South). Go east 0.8 miles to a junction. Turn right onto 200 West and follow this road for 1 mile around several bends until the main road turns back to the south. Follow this main road for another 0.65 miles to a cattle guard. Continue 0.4 miles to a road that will come in on the right. Turn right onto this road and drive 0.25 miles staying left at the first fork and going right at the second fork. From the second fork continue 0.5 miles around a 90 degree bend to another fork. From this fork stay left and continue 0.2 miles staying to the left. The 0' stake is 26 paces from the 500 stake of 21R-3 at 205° M. The 0' stake is marked with browse tag#105.

Map Name: Kanosh



Diagrammatic Sketch:



Township: 23S Range: 5W Section: 2

GPS: NAD 83, UTM 12S 379755 E 4300660 N

DRY CREEK CHAINING - WRI STUDY 21R-04
Project #86

Site Description

Site Information: This study was established following a chaining treatment done in the winter of 2006-07 to improve crucial deer and elk winter range south of Meadow. In recent years, there has been insufficient forage due to pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) encroachment. The first chaining occurred in December of 2006 and the area was aerial reseeded in January 2007, with a second chaining done shortly thereafter. Pellet group data estimated moderate deer use in 2008 and heavy use in 2009. Study 21R-3 was established in 2004 prior to treatment to monitor the chaining, but was not treated and is now used as a reference site. There was very light elk use measured in 2009 (Table - Pellet Group Data). The soil erosion condition was classified as stable in 2008 and 2009.

Browse: Following the treatment, browse cover has been very low in the site. Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant browse on this site providing the majority of browse cover (Table - Browse Trends). However, sagebrush canopy cover has only been 1% since 2008 (Table - Canopy Cover). Forage kochia (*Kochia prostrata*) and skunk brush sumac (*Rhus trilobata*) are also found on the site. A good number of Utah juniper survived the treatment (Table - Point-Quarter Data). The juniper population is very young with over 90% of the trees sampled less than four feet tall in 2009. Many of the sampled juniper trees (40%) were tipped over in the chaining, but have survived.

Herbaceous Understory: The herbaceous understory is dominated by cheatgrass (*Bromus tectorum*), which has provided about 90% of grass cover since 2008. Perennial grass species are very diverse on the site, but provide very little cover. Four of the seeded grass species were sampled on the site in low frequency and cover. Forbs are fairly diverse with the majority of cover being provided by the seeded species small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Trend Assessments

Browse

- **2008 to 2009 - stable (0):** Wyoming big sagebrush and forage kochia canopy cover remained similar. The average height and crown of forage kochia increased slightly.

Grass

- **2008 to 2009 - down (-2):** The sum of nested frequency of perennial grasses decreased 29% and cover decreased slightly. There was a significant decrease in the nested frequency of two of the seeded species, crested wheatgrass and slender wheatgrass (*Agropyron cristatum* and *A. trachycaulum*). Cheatgrass continued to dominate the community.

Forb

- **2008 to 2009 - down (-2):** The sum of nested frequency of perennial forbs decreased 20% and cover decreased slightly. There was a significant decrease in the nested frequency of prickly lettuce (*Lactuca serriola*) and a significant increase in small burnet.

Seed mix

Project name: Dry Creek Chaining

WRI Database #: 86 Size (acre): 915

Mix lot #: sr-tt-dc(gs)-07

Seed type	lbs in mix	lbs/acre
Thickspike Wheatgrass 'Bannock'	500	0.55
Bluebunch WG 'Goldar'	550	0.60
Slender Wheatgrass 'San Luis'	550	0.60
Orchardgrass 'Paiute'	100	0.11
Snake River Wheatgrass 'Secar'	500	0.55
Canby Bluegrass 'Canbar'	125	0.14
Western Yarrow 'SID Columbia'	26	0.03
Cicer Milkvetch 'Lutana'	570	0.63
Blue Flax	250	0.27
Alfalfa 'Ladak'	1050	1.15
Sainfoin 'Eski'	2150	2.35
Small Burnet 'Delar'	1050	1.15
Bitterbrush--Millard UT	100	0.11
Crested Wheatgrass 'Douglas'	450	0.49
Crested Wheatgrass 'Hycrest'	450	0.49
Sagebrush, Wyoming--Beaver UT	450	0.49
Forage Kochia--Elko/Lander NV	700	0.77
BULK POUNDS PER ACRE:		10.50
PLS POUNDS PER ACRE:		8.87

HERBACEOUS TRENDS--

Management unit 21R, Study no: 4

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
G	Agropyron cristatum	$_{b}$33	$_{a}$2	.44	.06
G	Agropyron intermedium	20	8	.25	.22
G	Agropyron spicatum	4	12	.05	.21
G	Agropyron trachycaulum	$_{b}$18	$_{a}$6	.60	.10
G	Aristida purpurea	$_{a}$13	$_{b}$31	.82	1.41
G	Bromus tectorum (a)	420	410	28.39	32.77
G	Dactylis glomerata	8	12	.15	.14
G	Poa secunda	$_{b}$60	$_{a}$40	1.01	.53
G	Vulpia octoflora (a)	$_{b}$49	$_{a}$8	.74	.04
Total for Annual Grasses		469	418	29.14	32.81
Total for Perennial Grasses		156	111	3.33	2.68
Total for Grasses		625	529	32.47	35.50
F	Achillea millefolium	1	-	.00	.01
F	Allium sp.	-	1	-	.00
F	Alyssum alyssoides (a)	$_{a}$34	$_{b}$52	.49	.63
F	Astragalus sp.	-	-	-	.00
F	Cryptantha sp.	1	-	.00	-
F	Erigeron sp.	$_{a}$2	$_{b}$8	.00	.22
F	Erodium cicutarium (a)	1	-	.03	-
F	Gayophytum ramosissimum(a)	$_{a}$13	-	.05	-

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
F	Helianthus annuus (a)	$_{a}$23	-	.05	.00
F	Holosteum umbellatum (a)	7	-	.01	-
F	Lactuca serriola	$_{b}$97	$_{a}$24	.63	.09
F	Linum lewisii	16	2	.47	.07
F	Medicago sativa	9	11	.21	.06
F	Microsteris gracilis (a)	3	7	.00	.01
F	Onobrychis viciaefolia	24	17	.45	.46
F	Polygonum douglasii (a)	14	8	.19	.01
F	Ranunculus testiculatus (a)	$_{b}$18	$_{a}$2	.04	.00
F	Sanguisorba minor	$_{a}$41	$_{b}$77	2.66	3.40
F	Tragopogon dubius	1	3	.01	.01
F	Verbascum thapsus	$_{a}$1	$_{b}$9	.18	.10
F	Verbena bracteata	4	6	.53	.21
Total for Annual Forbs		113	69	0.88	0.66
Total for Perennial Forbs		197	158	5.17	4.65
Total for Forbs		310	227	6.06	5.32

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

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 4

Species	Percent Cover '08	Percent Cover '09
Artemisia tridentata wyomingensis	1.10	1.53
Gutierrezia sarothrae	.31	.31
Juniperus osteosperma	1.00	1.48
Kochia prostrata	.11	.46

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 21R, Study no: 4

Species	Average leader growth (in) '08	Average leader growth (in) '09
Artemisia tridentata wyomingensis	-	2.51
Kochia prostrata	-	6.66

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 4

Species	Trees per Acre '08	Trees per Acre '09	Average diameter (in) '08	Average diameter (in) '09
Juniperus osteosperma		106		2.2

BASIC COVER--
Management unit 21R, Study no: 4

Cover Type	Average Cover % '08	'09
Vegetation	38.68	45.56
Rock	19.53	16.55
Pavement	2.53	1.53
Litter	35.88	47.25
Cryptogams	.90	.90
Bare Ground	13.93	10.96

PELLET GROUP DATA--
Management unit 21R, Study no: 4

Type	Quadrat Frequency '08	'09	Days use per acre (ha) '08	'09
Rabbit	9	15	-	-
Elk	-	-	-	2 (5)
Deer	19	27	-	53 (131)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 4

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
08	17/24
09	17/24
Gutierrezia sarothrae	
08	9/12
09	8/13
Juniperus osteosperma	
08	-/-
09	-/-
Kochia prostrata	
08	6/7
09	9/10
Rhus trilobata	
08	-/-
09	59/138
Rhus trilobata	
08	53/121
09	-/-

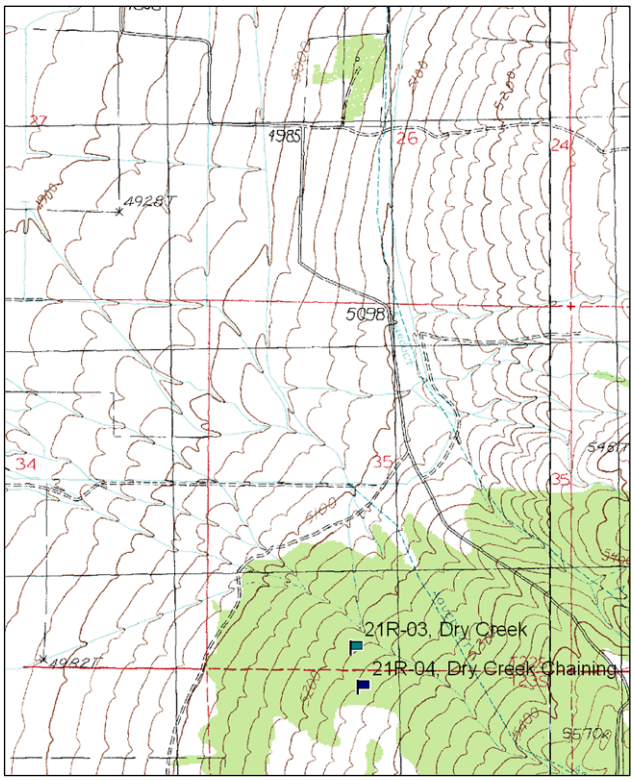
DRY CREEK REFERENCE WRI, 21R-3

Vegetation Type: Wyoming Big Sagebrush/Pinyon-Juniper
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R028AY334UT
Land Ownership: Private
Elevation: 5220 ft. (1591 m)
Aspect: Northwest
Slope: 4%
Transect bearing: 145° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft).

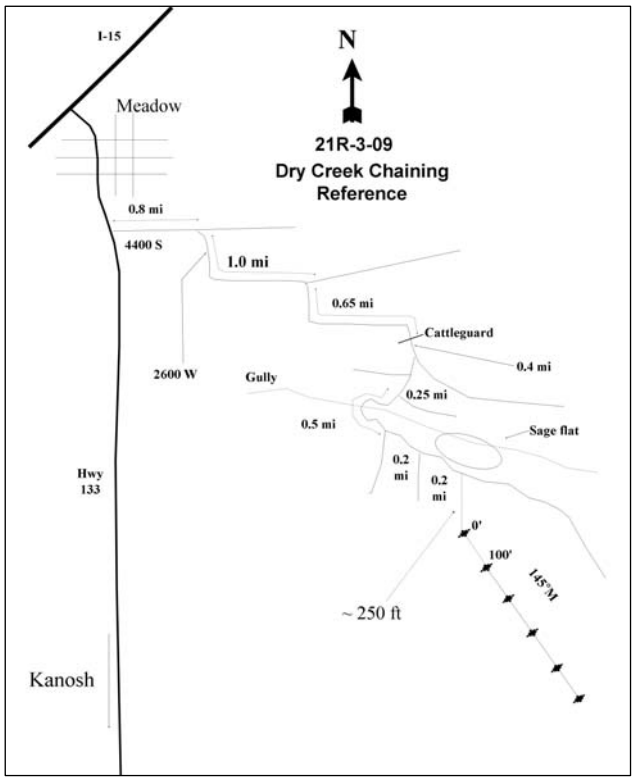
LOCATION DESCRIPTION

Go south from Meadow (southwest of Fillmore) on SR 133 to mile marker 6. Go approximately 0.05 miles further south on SR 133 and turn east on a gravel road (4400 South). Go east 0.8 miles to a junction. Turn right onto 200 West and follow this road for 1 mile around several bends until the main road turns back to the south. Follow this main road for another 0.65 miles to a cattleguard. Continue 0.4 miles to a road that will come in on the right. Turn right onto this road and drive 0.25 miles staying left at the first fork and going right at the second fork. From the second fork continue 0.5 miles around a 90 degree bend to another fork. From this fork stay left and continue 0.2 miles staying to the left. From this point use the GPS and walk to the 0-foot stake.

Map Name: Kanosh



Diagrammatic Sketch



Township 22S , Range 5W , Section 35

GPS: NAD 83, UTM 12S 379790 E, 4300629 N

DRY CREEK CHAINING REFERENCE - WRI STUDY 21R-3
Project #86 Reference

Site Description

Site Information: This study was established as an untreated reference in companion to Dry Creek Chaining, 21R-4. It is located south of Meadow in a pinyon (*Pinus edulis*) and juniper (*Juniperus osteosperma*) woodland. Deer use on this site has increased dramatically, perhaps due to the neighboring treatment while elk and cattle use have remained low in all sample years (Tables – Pellet Group Data). Soil erosion condition was rated as stable is all sample years.

Browse: Browse species are rare, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) averaged fewer than 200 plants/acre across both sample years. Utah juniper is the predominant cover species and had densities of 346 trees/acre and 92 trees/acre in 2004 and 2008, respectively.

Herbaceous Understory: The herbaceous understory is dominated by cheatgrass (*Bromus tectorum*), which has provided 25% or more cover in each sample year. Sandberg bluegrass (*Poa secunda*) is the most abundant perennial grass species with about 1% cover. Forbs are rare on the site and predominantly consist of annual weedy species.

HERBACEOUS TRENDS--
Management unit 21R, Study no: 3

Type	Species	Nested Frequency '04	Nested Frequency '08	Average Cover % '04	Average Cover % '08
G	Aristida purpurea	-	7	-	.33
G	Bromus tectorum (a)	422	441	24.74	24.49
G	Festuca ovina	5	-	.00	-
G	Poa secunda	99	73	1.53	1.00
G	Sitanion hystrix	4	2	.04	.03
G	Vulpia octoflora (a)	4	177	.01	2.36
Total for Annual Grasses		426	618	24.75	26.85
Total for Perennial Grasses		108	82	1.58	1.36
Total for Grasses		534	700	26.34	28.22
F	Alyssum alyssoides (a)	6	66	.01	.37
F	Descurainia pinnata (a)	2	-	.00	-
F	Draba sp. (a)	5	9	.00	.02
F	Erodium cicutarium (a)	-	23	-	.27
F	Gilia sp. (a)	3	4	.01	.00
F	Holosteum umbellatum (a)	-	9	-	.02
F	Lactuca serriola	-	6	-	.02
F	Microsteris gracilis (a)	4	30	.01	.06
F	Polygonum douglasii (a)	1	7	.00	.02
F	Ranunculus testiculatus (a)	2	16	.01	.06
F	Tragopogon dubius	-	2	-	.00
Total for Annual Forbs		23	164	0.05	0.83
Total for Perennial Forbs		0	8	0	0.02
Total for Forbs		23	172	0.05	0.86

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

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 3

Species	Percent Cover	
	'04	'08
Artemisia tridentata wyomingensis	.45	-
Gutierrezia sarothrae	-	.06
Juniperus osteosperma	39.00	26.43

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 3

Species	Trees per Acre		Average diameter (in)	
	'04	'08	'04	'08
Juniperus osteosperma	346	92	6.9	10.8

BASIC COVER--
Management unit 21R, Study no: 3

Cover Type	Average Cover %	
	'04	'08
Vegetation	33.34	39.01
Rock	8.55	9.57
Pavement	3.32	3.90
Litter	52.87	46.00
Cryptogams	3.18	8.37
Bare Ground	16.13	7.41

SOIL ANALYSIS DATA --
Management unit 21R, Study no: 3, Study Name: Dry Creek Reference

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
8.5	6.6	61.4	25.1	13.5	1.9	14.2	134.4	0.6

PELLET GROUP DATA--
Management unit 21R, Study no: 3

Type	Quadrat Frequency		Days use per acre (ha)	
	'04	'08	'04	'08
Rabbit	21	53	-	-
Elk	7	2	8 (20)	4 (10)
Deer	16	37	13 (31)	116 (288)
Cattle	1	1	-	6 (14)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 3

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
04	**240**	0	17	83	-	50	33	50	17/22
08	**100**	0	40	60	-	20	60	60	15/17
Gutierrezia sarothrae									
04	**60**	0	100	-	-	0	0	0	9/12
08	**140**	0	100	-	-	0	0	0	10/12
Juniperus osteosperma									
04	**520**	50	50	0	20	0	4	4	-/-
08	**320**	31	63	6	40	0	0	6	-/-
Rhus sp.									
04	**0**	0	0	-	-	0	0	0	-/-
08	**20**	100	0	-	-	0	0	0	7/11

BROWSE TRENDS--
Management unit 21R, Study no: 3

Species	Strip Frequency '04	'08
Artemisia tridentata wyomingensis	11	5
Gutierrezia sarothrae	3	4
Juniperus osteosperma	21	12
Rhus sp.	0	1

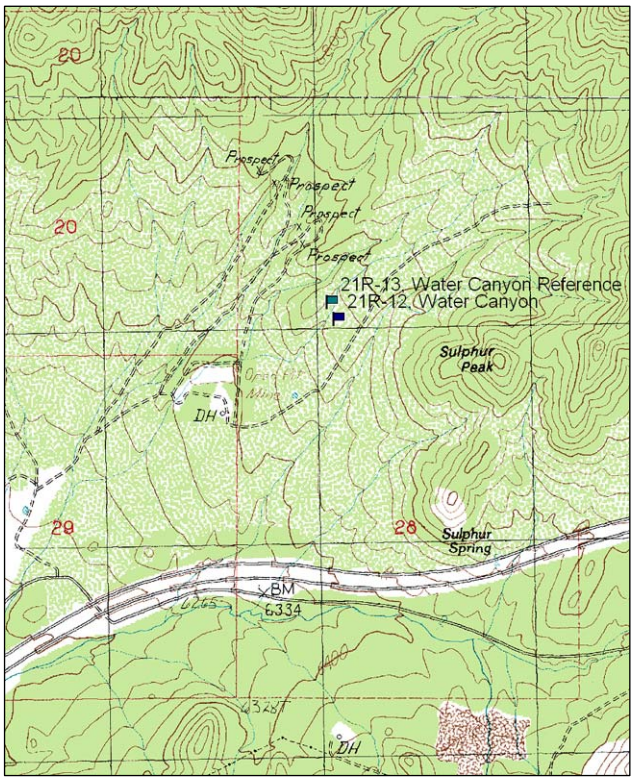
WATER CANYON WRI, 21R-12

Vegetation Type: Juniper/Mountain Big Sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 6479 ft. (1974 m)
Aspect: South
Slope: 4%
Transect bearing: 225° magnetic
Belt placement: Read Baseline, No Belts

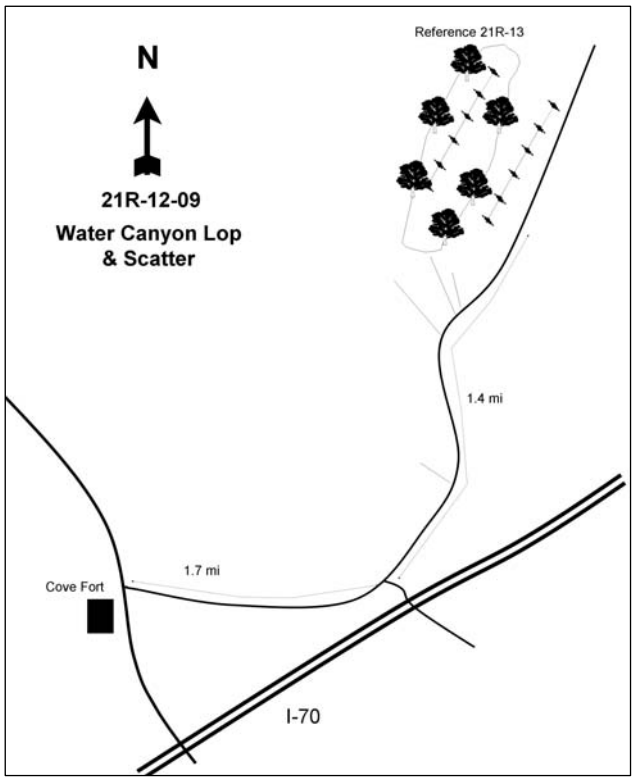
Directions:

From Cove Fort turn east at the road opposite the barn. Drive 1.7 miles to a left turn, continue for 0.3 miles and take the right fork. Drive another 1.4 miles, staying to the right. There is no witness post, please place one. The sites run parallel to the hill side.

Map Name: Cove Fort



Diagrammatic Sketch:



Township: 25S Range: 6W Section: NA

GPS: NAD 83, UTM 12S 366012 E 4275219 N

WATER CANYON - WRI STUDY 21R-12
Project #1493

Site Description

Site Information: The study monitors a brushsaw/bullhog treatment along Interstate 70, two miles east of Cove Fort. The treatment was done to lengthen the value of a chaining that was done decades ago. The goal of this project is to increase desirable and palatable forbs, shrubs, and grasses by 25-30%. Treatment occurred in 2009 prior to the initial sampling. Pellet group data from 2009 estimated light use by deer, elk, and cows (Table - Pellet Group Data). The soil erosion condition was classified as stable in 2009.

Browse: Browse cover was fairly low on the site, but mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) was the most abundant preferred browse sampled. Antelope bitterbrush (*Purshia tridentata*) was also present in low cover. Utah juniper (*Juniperus osteosperma*) was the target of the brush saw/bullhog treatment and provided 1% canopy cover in 2009 (Table - Canopy Cover). Point-quarter measurement showed a fairly dense juniper population, but the average diameter was less than 2 inches. A few pinyon pine (*Pinus edulis*) trees were also sampled, but density was less than 18 trees/acre (Table - Point-Quarter Tree Data). Over half of the juniper trees sampled were less than 4 feet tall and 75% of the juniper trees in the density sample were felled, but alive, in 2009.

Herbaceous Understory: Perennial grasses are diverse, but are not very abundant. Three of the perennial species are introduced grasses including the dominant grass, intermediate wheatgrass (*Agropyron intermedium*). Cheatgrass (*Bromus tectorum*) is present on the site and provided 1% cover in 2009. Forbs are not especially diverse our abundant. Bonneville pea (*Lathyrus brachcalyx*) is the most common forb and accounted for 64% of forb cover in 2009 (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 21R, Study no: 12

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	10	.07
G	Agropyron intermedium	69	1.94
G	Agropyron spicatum	22	.42
G	Bromus inermis	14	.10
G	Bromus tectorum (a)	49	.76
G	Poa fendleriana	13	.25
G	Poa secunda	27	.11
G	Sitanion hystrix	21	.91
Total for Annual Grasses		49	0.75
Total for Perennial Grasses		176	3.81
Total for Grasses		225	4.57
F	Alyssum alyssoides (a)	112	.53
F	Collinsia parviflora (a)	32	.10
F	Eriogonum umbellatum	2	.03
F	Gayophytum ramosissimum(a)	7	.19
F	Lathyrus brachycalyx	85	1.58
F	Microsteris gracilis (a)	3	.00
F	Penstemon sp.	2	.00
F	Polygonum douglasii (a)	4	.01

Type	Species	Nested Frequency '09	Average Cover % '09
F	Ranunculus testiculatus (a)	8	.02
Total for Annual Forbs		166	0.86
Total for Perennial Forbs		89	1.62
Total for Forbs		255	2.48

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

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 12

Species	Percent Cover '09
Artemisia tridentata vaseyana	4.86
Juniperus osteosperma	1.26
Purshia tridentata	.41

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 12

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	118	1.8
Pinus edulis	19	5.9

BASIC COVER--
Management unit 21R, Study no: 12

Cover Type	Average Cover % '09
Vegetation	12.32
Rock	2.18
Pavement	8.53
Litter	59.95
Bare Ground	19.03

PELLET GROUP DATA--
Management unit 21R, Study no: 12

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	22	-
Elk	1	1 (3)
Deer	3	3 (7)
Cattle	2	3 (7)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 12

Yr	Average Height Crown (in)
Artemisia tridentata vaseyana	
09	21/27
Chrysothamnus nauseosus	
09	10/5
Gutierrezia sarothrae	
09	11/10
Opuntia sp.	
09	5/17
Purshia tridentata	
09	14/30

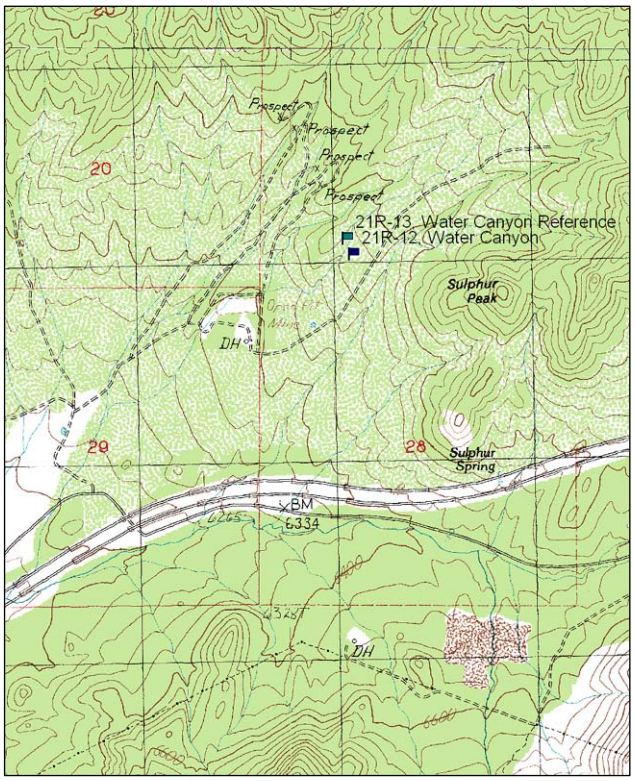
WATER CANYON REFERENCE WRI, 21R-13

Vegetation Type: Juniper
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 6485 ft. (1978 m)
Aspect: East
Slope: 22%
Transect bearing: 210° magnetic
Belt placement: Read Baseline, No Belts. All but 0' stake may need to be replaced with half-highs.

Directions:

From Cove Fort turn east at the road opposite the barn. Drive 1.7 miles to a left turn, continue for 0.3 miles and take the right fork. Drive another 1.4 miles, staying to the right. There is no witness post, please place one. The sites run parallel to the hill slope, about one third of the way up the hill.

Map Name: Cove Fort



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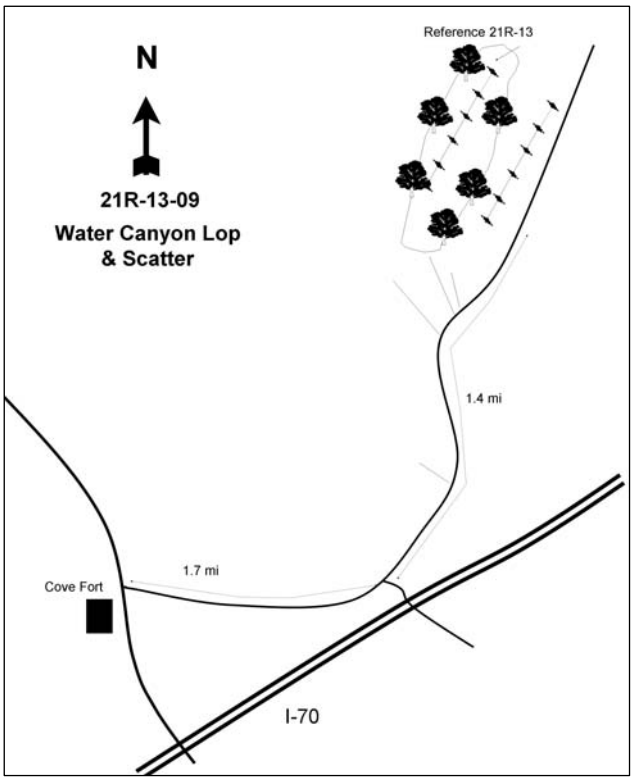


Township: 25S Range: 6W Section: NA

GPS: NAD 83, UTM 12S 365983 E 4275298 N

WATER CANYON RERFERENCE - WRI STUDY 21R-13
Project #1493 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to Water Canyon Chaining (21R-12) in a pinyon-juniper woodland. It is located on a hillside directly above the 21R-12 study. Pellet group data estimated light elk and cow use and moderate deer use in 2009 (Table - Pellet Group Data). The soil erosion condition was classified as stable.

Browse: Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*) are the dominant woody species on the site. Together they provide 17% canopy cover, with no other browse species providing over 1% cover (Table - Canopy Cover). The Utah juniper population is very dense and mature (Table - Point-Quarter Data) with most of the trees being over 8 feet tall in 2009. Pinyon trees are not as dense on the site, but are mostly large mature trees when encountered.

Herbaceous Understory: The herbaceous understory was very comparable to the treated site in 2009, when the area was treated. Five perennial grass species were sampled in 2009, as was cheatgrass (*Bromus tectorum*). Bluebunch wheatgrass (*Agropyron spicatum*) and intermediate wheatgrass (*A.intermedium*) accounted for 4% cover and provided 88% of grass cover. Forbs are very rare and provide less than 1% cover (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 21R, Study no: 13

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron dasystachyum	4	.15
G	Agropyron intermedium	60	1.31
G	Agropyron spicatum	85	2.53
G	Bromus tectorum (a)	58	.35
G	Oryzopsis hymenoides	5	.03
G	Sitanion hystrix	1	.00
Total for Annual Grasses		58	0.34
Total for Perennial Grasses		155	4.03
Total for Grasses		213	4.38
F	Alyssum alyssoides (a)	86	.35
F	Collinsia parviflora (a)	3	.00
F	Descurainia pinnata (a)	1	.00
F	Lathyrus brachycalyx	9	.04
F	Phlox austromontana	1	.15
Total for Annual Forbs		90	0.36
Total for Perennial Forbs		10	0.19
Total for Forbs		100	0.55

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

CANOPY COVER, LINE INTERCEPT--
Management unit 21R, Study no: 13

Species	Percent Cover '09
Chrysothamnus nauseosus	.01
Chrysothamnus viscidiflorus viscidiflorus	.58
Juniperus osteosperma	12.31
Pinus edulis	4.66
Purshia tridentata	.16

POINT-QUARTER TREE DATA--
Management unit 21R, Study no: 13

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	116	8.7
Pinus edulis	25	7.5

BASIC COVER--
Management unit 21R, Study no: 13

Cover Type	Average Cover % '09
Vegetation	17.18
Rock	13.54
Pavement	29.26
Litter	33.84
Cryptogams	.00
Bare Ground	16.45

PELLET GROUP DATA--
Management unit 21R, Study no: 13

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	40	-
Elk	2	1 (2)
Deer	4	35 (88)
Cattle	-	2 (5)

BROWSE CHARACTERISTICS--
Management unit 21R, Study no: 13

Yr	Average Height Crown (in)
Artemisia tridentata vaseyana	
09	30/46
Atriplex canescens	
09	11/13
Chrysothamnus nauseosus	
09	26/36
Chrysothamnus viscidiflorus viscidiflorus	
09	9/18
Opuntia sp.	
09	5/12
Purshia tridentata	
09	13/27
Sambucus sp.	
09	23/34

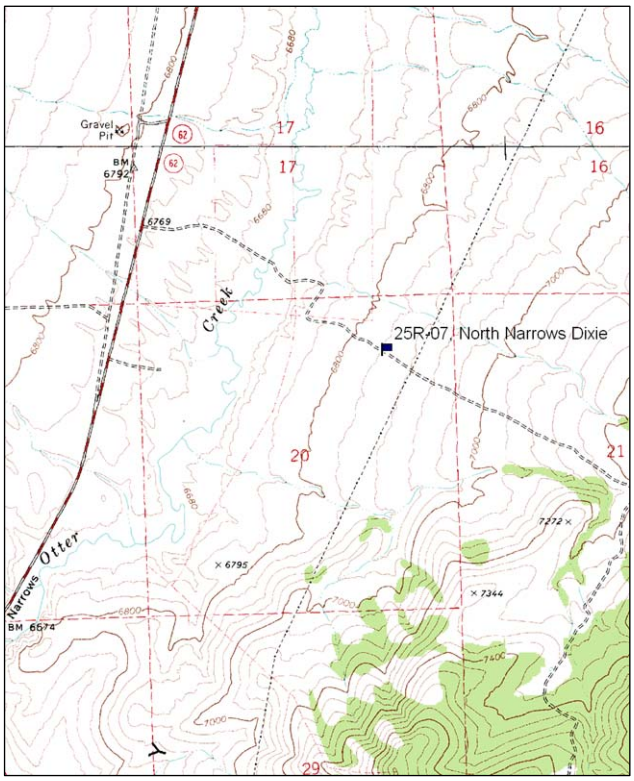
NORTH NARROWS WRI, 25R-7

Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: BLM
Elevation: 6775 ft. (2065 m)
Aspect: West
Slope: 8%
Transect bearing: 177° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

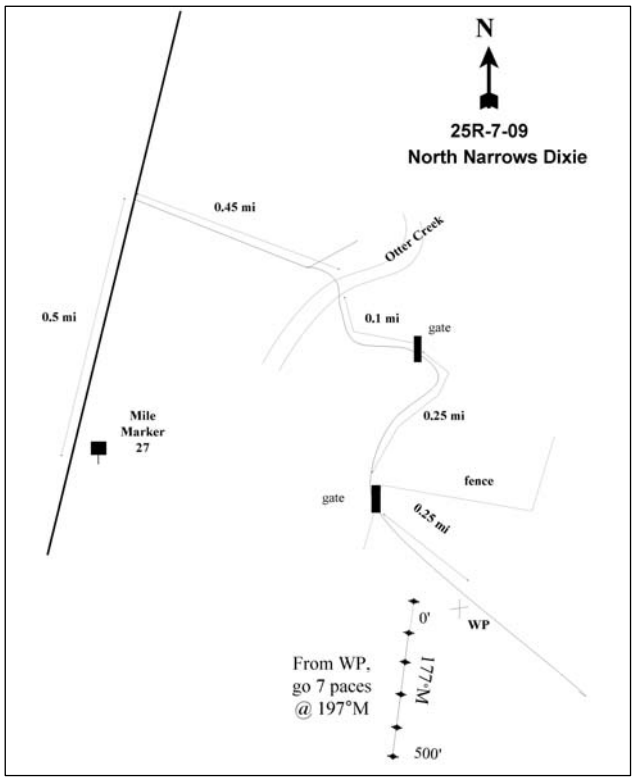
Directions:

Proceed south of Koosharem on SR62. Turn left (east) 0.5 miles before mile marker 27. Drive 0.45 miles to Otter Creek and continue 0.1 miles to a gate. Drive 0.25 miles to another gate, and go 0.25 miles to the witness post on the right, the 0' stake is 7 paces from the witness post at 197° M. The 0' stake is marked with browse tag# 110.

Map Name: Parker Knoll



Diagrammatic Sketch:



Township: 28S Range: 1W Section: 20

GPS: NAD 83, UTM 12S 419225 E 4246756 N

NORTH NARROWS DIXIE - WRI STUDY 25R-7
Project #1155

Site Description

Site Information: This study was established prior to a dixie harrow treatment done in the fall of 2008. The study is located in an old, even aged stand of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) with a very limited understory in Grass Valley. The project was done in order to increase the density and cover of the herbaceous understory and decrease the cover of sagebrush. Pellet group data estimated heavy deer use in 2008, prior to the treatment, and light deer use in 2009 following the treatment. Estimated cattle use was light in both years (Table - Pellet Group Data). A deer shed and carcass were found on the site in 2008, as well as dead rabbit remains. Coyote scat, elk pellets, sage grouse pellets, and horse droppings were also on the site in 2008, but did not fall in the sample area. The soil erosion condition was classified as slight in 2008 due to soil litter movement, flow patterns and surface rock and soil movement. Soil condition improved to stable in 2009.

Browse: The primary browse species on the site is Wyoming big sagebrush. Prior to the treatment, Wyoming big sagebrush had a fairly dense with high decadence, but good recruitment of young plants (Table - Browse Characteristics). Canopy cover of sagebrush was very high prior to the treatment, but decreased substantially following the treatment. Also following the treatment, the seeded species forage kochia (*Kochia prostrata*) was sampled in low cover (Table - Canopy Cover).

Herbaceous Understory: Grasses on the site are fairly diverse, but provided only moderate cover in 2008 and 2009. The dominant grass was Indian ricegrass (*Oryzopsis hymenoides*) with other common grasses including blue grama (*Bouteloua gracilis*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata*). Following the treatment there were three seeded grass species sampled at moderate frequency and cover; crested wheatgrass (*Agropyron cristatum*), pubescent wheatgrass (*Agropyron intermedium*), and Great Basin wildrye (*Elymus cinereus*). Forbs were somewhat diverse and increased from sparse to providing 2.5% cover. There were five seeded forb species sampled in 2009, after the treatment, at moderate frequency and cover (Table - Herbaceous Trends).

Pre vs. One Year Post Treatment

Browse: Sagebrush cover was successfully reduced by the treatment. Canopy cover of sagebrush decreased from 22% to 5%. The average height of sagebrush decreased from 14 inches to 9 inches and the crown from 22 inches to 13 inches following the treatment. The seeded species, forage kochia, was sampled for the first time with small stature and low cover.

Grass: In only the first year after treatment, there was a 20% decrease in the sum of nested frequency of perennial grasses and cover decreased from 9% to 5%. However, diversity of grasses has increased due to the establishment of seeded species. It is expected that the cover and frequency of grass species will increase in the future. Cheatgrass (*Bromus tectorum*) was sampled in 2% of quadrats after the treatment. Cheatgrass cover and nested frequency is low, but should be watched closely in the future.

Forb: The sum of nested frequency of perennial forbs increased more than two-fold after the treatment, but still is very low. Cover of perennial forbs doubled, but is still less than 1%. Diversity of forbs was higher after the treatment. Five seeded species were sampled.

Seed mix:

Project name: North Narrows East

WRI Database #: 155	Size (acre):	2050
Mix lot #: sr-gb-nne-09		
Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	500	0.24
Alfalfa 'Ranger'	500	0.24
Annual Sunflower	941	0.46
Blue Flax 'Appar'	510	0.25
Cicer Milkvetch 'Lutana'	800	0.39
Crested Wheatgrass 'Douglas'	250	0.12
Crested Wheatgrass 'Hycrest'	250	0.12
Fourwing Saltbush--Central UT	500	0.24
Great Basin Wildrye 'Trailhead'	1500	0.73
Pubescent Wheatgrass 'Luna'	3061	1.49
Russian Wildrye 'Bozoisky'	2450	1.20
Sheep Fescue	500	0.24
Small Burnet 'Delar'	6145	3.00
Snake River Wheatgrass 'Secar'	1025	0.50
Yellow Sweetclover	2050	1.00
BULK POUNDS PER ACRE:		10.24
PLS POUNDS PER ACRE:		8.99

	Size (acre):	2050
Mix Lot #: sr-gb-nnek-09		
Seed type	lbs in mix	lbs/acre
Forage Kochia--Humboldt/Lander	1250	0.61
Rice Hulls	650	0.32
BULK POUNDS PER ACRE:		0.93
PLS POUNDS PER ACRE:		0.41

HERBACEOUS TRENDS--
Management unit 25R, Study no: 7

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
G	Agropyron cristatum	-	$_{a}$58	-	.70
G	Agropyron intermedium	-	3	-	.00
G	Bouteloua gracilis	$_{b}$79	$_{a}$33	2.25	.88
G	Bromus tectorum (a)	-	3	-	.03
G	Elymus cinereus	-	$_{a}$31	-	.41
G	Elymus junceus	-	6	-	.09
G	Oryzopsis hymenoides	89	72	3.28	1.90
G	Sitanion hystrix	$_{b}$126	$_{a}$40	1.86	.77
G	Sporobolus cryptandrus	-	4	-	.03
G	Stipa comata	$_{b}$53	$_{a}$29	1.12	.50
Total for Annual Grasses		0	3	0	0.03
Total for Perennial Grasses		347	276	8.53	5.30
Total for Grasses		347	279	8.53	5.34
F	Astragalus cibarius	-	3	-	.06
F	Astragalus sp.	-	1	-	.00
F	Chenopodium album (a)	-	$_{a}$15	-	.42
F	Cymopterus sp.	2	-	.00	-
F	Erigeron pumilus	-	2	-	.03
F	Erigeron sp.	6	4	.02	.09
F	Eriogonum ovalifolium	4	-	.18	-
F	Eriogonum sp.	-	1	-	.00

Type	Species	Nested Frequency '08	Nested Frequency '09	Average Cover % '08	Average Cover % '09
F	Helianthus annuus (a)	-	$_{a}$14	-	.58
F	Lappula occidentalis (a)	6	5	.02	.06
F	Linum lewisii	-	5	-	.06
F	Medicago sativa	-	$_{a}$27	-	.08
F	Melilotus officinalis	-	$_{a}$24	-	.16
F	Phlox longifolia	32	30	.13	.14
F	Salsola iberica (a)	$_{a}$3	$_{b}$15	.00	.72
F	Sanguisorba minor	-	$_{a}$20	-	.04
F	Sphaeralcea grossulariaefolia	-	-	-	.03
F	Trifolium sp.	2	4	.00	.01
F	Unknown forb-annual (a)	-	7	-	.06
Total for Annual Forbs		9	56	0.02	1.85
Total for Perennial Forbs		46	121	0.34	0.72
Total for Forbs		55	177	0.37	2.57

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

CANOPY COVER, LINE INTERCEPT--
Management unit 25R, Study no: 7

Species	Percent Cover '08	Percent Cover '09
Artemisia tridentata wyomingensis	22.70	5.26
Chrysothamnus viscidiflorus	.20	.25
Gutierrezia sarothrae	.10	.01
Kochia prostrata	-	.41
Opuntia sp.	.13	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 25R, Study no: 7

Species	Average leader growth (in) '08	Average leader growth (in) '09
Artemisia tridentata wyomingensis	0.8	1.9
Kochia prostrata	-	4.7

BASIC COVER--
Management unit 25R, Study no: 7

Cover Type	Average Cover % '08	Average Cover % '09
Vegetation	32.04	14.96
Rock	12.76	15.08
Pavement	18.31	8.01
Litter	24.59	24.65
Cryptogams	.39	.26
Bare Ground	23.36	38.77

PELLET GROUP DATA--
Management unit 25R, Study no: 7

Type	Quadrat Frequency '08	'09	Days use per acre (ha) '08	'09
Rabbit	72	24	-	-
Grouse	1	-	-	-
Elk	3	2	2 (5)	-
Deer	20	12	59 (146)	11 (26)
Cattle	1	-	4 (11)	1 (2)

BROWSE CHARACTERISTICS--
Management unit 25R, Study no: 7

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
08	14/22
09	9/13
Chrysothamnus nauseosus	
08	-/-
09	7/9
Chrysothamnus viscidiflorus	
08	4/7
09	6/8
Echinocactus sp.	
08	-/-
09	1/2
Gutierrezia sarothrae	
08	5/6
09	6/7
Kochia prostrata	
08	-/-
09	7/9
Opuntia sp.	
08	4/9
09	3/6
Pediocactus simpsonii	
08	1/2
09	-/-

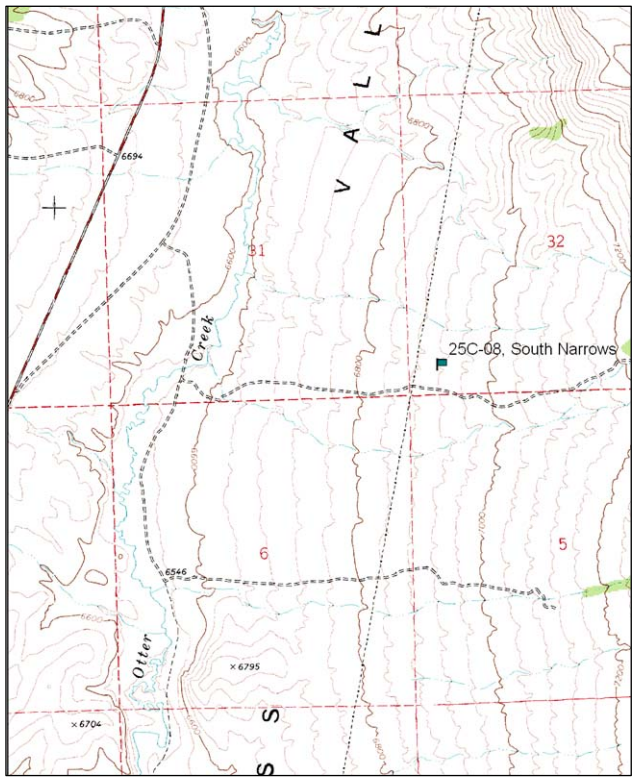
SOUTH NARROWS WRI, 25C-8

Vegetation Type: Wyoming big sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Not Available
Land Ownership: SITLA
Elevation: 6841 ft. (2085 m)
Aspect: West
Slope: 10%
Transect bearing: 180° magnetic
Belt placement: line 1 (11ft and 71ft), line 2 (34ft and 95ft), line 3 (59ft). Rebar: belt 4 on 2ft.

Directions:

Proceed south of Koosharem on SR62. Turn left (east) 0.5 miles south of mile marker 24. Go northeast 0.7 miles and turn right. Go east and turn left. Drive parallel to the power line (north) for 0.2 miles to pole #728. The frequency baseline begins 100 feet east of this power pole. The 0' stake is tagged #7120. All stakes are rebar.

Map Name: Parker Knoll



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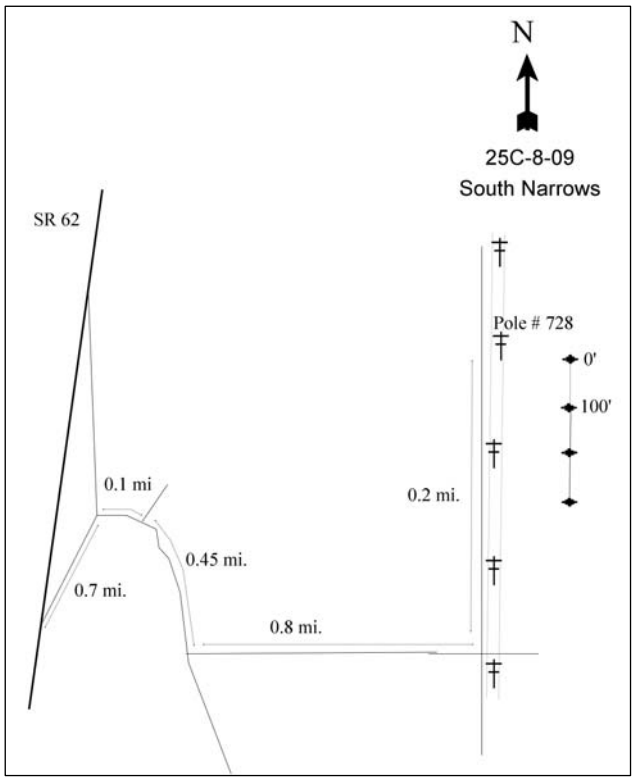


Township: 28S Range: 1W Section: 32

GPS: NAD 83, UTM 12S 418231 E 4242347 N

SOUTH NARROWS - WRI STUDY 25C-08
Project #1155 Reference

Site Description

Study Information: This trend study is located on mule deer and elk winter range west of Parker Mountain in Grass Valley. The study was used as a non-treated reference site in companion to North Narrows Dixie (25R-7) and is located about three miles to the south of the treated study. The foothills slope gently west-southwest toward Otter Creek about a half mile away. The vegetation is a Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*)/grass community in association with scattered pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Pellet group data estimated deer use to have increased steadily from light use in 1991 to heavy use in 2008 and 2009, while elk and cow use has remained low in all sample years (Table - Pellet Group Data).

Browse: The key species is Wyoming big sagebrush, which has provided nearly all of the browse cover on the site since 1994 and increased markedly in 2009 (Table - Browse Trends). Wyoming big sagebrush canopy cover has remained consistent from 2003 to 2009 (Table - Canopy Cover). The only other shrubs found on the site include a few broom snakeweed (*Gutierrezia sarothrae*), winterfat (*Ceratoides lanata*), and two species of cactus (*Opuntia spp*.).

Herbaceous Understory: Grasses on the site are abundant, but the only common perennial grasses found on the site include blue grama (*Bouteloua gracilis*) and needle-and-thread grass (*Stipa comata*). These two species provide nearly all of the grass cover on the site. Indian ricegrass (*Oryzopsis hymenoides*) and bottlebrush squirreltail (*Sitanion hystrix*) are found in small numbers. Forbs are very rare on the site. Total forb cover has totaled less than 1.0% since 1994.

Soil: The soil is a sandy loam with a slightly acidic pH (Table - Soil Analysis Data). Parent material is basalt and rocks and pavement are common on the surface. Rock ranges in size from small gravel to large boulders, and is found throughout the soil profile. Bare ground cover is moderately low on the site with much of the protective cover provided by rock and pavement cover (Table - Basic Cover). Two washes run through the transect area which channel water into Otter Creek during heavy runoff events. The soil erosion condition was classified as stable in 2003, 2008, and 2009.

Trend Assessments

Browse

- **1985 to 1991 - slightly up (+1):** There are not many browse species on this site, but the key species, Wyoming big sagebrush, has increased it's density by 26% with a slight increase in rate of decadence. This would be expected with the drought.
- **1991 to 1994 - stable (0):** The browse trend is regarded as stable even with the slight decrease in the Wyoming big sagebrush density (12%). Young recruitment is marginal.
- **1994 to 1998 - slightly down (-1):** Trend for the key browse species, Wyoming big sagebrush, is slightly down with a lower density and decadence still above 30%. Reproduction has improved slightly.
- **1998 to 2003 - slightly down (-1):** Trend for the key browse, Wyoming big sagebrush, is slightly down. Even though sagebrush density has remained about the same since 1991, and has actually increased 12% since 1998, the sagebrush on this site is showing the effects of drought. Young recruitment is low, vigor is poor on 1/3 of the population, and decadence has increased to 56%.
- **2003 to 2008 - down (-2):** Trend for the primary browse species, Wyoming big sagebrush, is down. Density of sagebrush decreased slightly, decadence increased to 66%, and plants displaying poor vigor increased dramatically to 65%. Recruitment of young plants remains low.

- **2008 to 2009 – stable (0):** Line-intercept cover of Wyoming big sagebrush decreased from 16% to 13%. The average height and crown of sagebrush also increased slightly.

Grass

- **1985 to 1991 - slightly up (+1):** There was a slight increase in the nested frequency of perennial grasses.
- **1991 to 1994 - slightly up (+1):** Sum of nested frequency of grasses continues to increase including a significant increase in the nested frequency of Indian ricegrass.
- **1994 to 1998 - stable (0):** Sum of nested frequency of perennial grasses has remained relatively constant.
- **1998 to 2003 - slightly down (-1):** Sum of nested frequency of perennial grasses has declined slightly (15%) but the frequency of the dominant grasses, blue grama and needle-and-thread, remained about the same. Nested frequency of bottlebrush squirreltail declined significantly. Total grass cover has remained nearly identical to 1998 estimates at about 13.5%
- **2003 to 2008 - slightly up (+1):** The sum of nested frequency of perennial grasses increased minimally, though, the frequency of needle-and-thread grass increased significantly.
- **2008 to 2009 - stable (0):** Sum of nested frequency of perennial grasses is similar to the last reading. Cover remains unchanged at 17%

Forb

- **1985 to 1991 - stable (0):** One problem on this site is that there are no forbs.
- **1991 to 1994 - slightly up (+1):** Some forbs were encountered this year but they are still lacking with a cover value of less than 1% and are comprised mostly of weedy annual species.
- **1994 to 1998 - stable (0):** The sum of nested frequency of perennial forbs has decreased, but so did the frequency of weedy annual forbs, primarily because of the decrease in frequency of stickseed (*Lappula occidentalis*).
- **1998 to 2003 - stable (0):** Trend for forbs is stable, but forbs are still lacking.
- **2003 to 2008 - slightly down (-1):** The sum of nested frequency of perennial forbs continues to decrease and forbs are nearly non-existent.
- **2008 to 2009 - stable (0):** Forbs remain extremely rare on the site.

HERBACEOUS TRENDS--
Management unit 25C, Study no: 8

Type	Species	Nested Frequency							Average Cover %				
		'85	'91	'94	'98	'03	'08	'09	'94	'98	'03	'08	'09
G	Bouteloua gracilis	284	296	289	274	266	255	226	12.30	9.30	10.01	10.74	10.05
G	Bromus tectorum (a)	-	-	$_{a}$1	$_{b}$14	-	-	-	.00	.06	-	-	-
G	Oryzopsis hymenoides	$_{a}$6	$_{ab}$16	$_{c}$49	$_{bc}$24	$_{ab}$8	$_{ab}$12	$_{ab}$14	1.80	.36	.21	.32	.54
G	Sitanion hystrix	$_{ab}$43	$_{b}$52	$_{b}$58	$_{b}$58	$_{a}$21	$_{a}$18	$_{a}$17	.88	.36	.12	.25	.10
G	Sporobolus cryptandrus	-	-	8	3	1	-	-	.10	.03	.03	-	-
G	Stipa columbiana	-	-	-	-	-	-	4	-	-	-	-	.03
G	Stipa comata	$_{a}$75	$_{a}$95	$_{a}$102	$_{b}$165	$_{b}$165	$_{b}$201	$_{b}$155	2.96	3.48	3.16	6.58	4.37
Total for Annual Grasses		0	0	1	14	0	0	0	0.00	0.06	0	0	0
Total for Perennial Grasses		408	459	506	524	461	486	416	18.05	13.55	13.54	17.90	15.10
Total for Grasses		408	459	507	538	461	486	416	18.05	13.61	13.54	17.90	15.10
F	Alyssum alyssoides (a)	-	-	-	-	-	-	1	-	-	-	-	.00
F	Astragalus sp.	-	-	6	3	-	-	-	.04	.04	-	-	-

Type	Species	Nested Frequency							Average Cover %				
		'85	'91	'94	'98	'03	'08	'09	'94	'98	'03	'08	'09
F	Chenopodium album (a)	-	-	-	-	-	-	1	-	-	-	-	.00
F	Descurainia pinnata (a)	-	-	$_{b}$20	$_{a}$2	$_{b}$16	-	-	.05	.00	.15	-	-
F	Draba sp. (a)	-	-	$_{b}$12	$_{ab}$8	-	-	-	.03	.01	-	-	-
F	Erigeron pumilus	-	-	10	9	-	1	2	.07	.06	-	.00	.00
F	Eriogonum sp.	-	-	-	-	-	-	2	-	-	-	-	.00
F	Lappula occidentalis (a)	-	-	$_{c}$62	$_{a}$3	$_{b}$27	-	$_{ab}$6	.15	.01	.18	-	.02
F	Lepidium sp. (a)	-	-	$_{a}$20	-	-	-	-	.05	-	-	-	-
F	Phlox hoodii	-	-	-	-	1	-	-	-	-	.00	-	-
F	Phlox longifolia	-	-	3	-	-	-	-	.00	-	-	-	-
F	Sphaeralcea coccinea	-	-	-	-	3	-	2	-	-	.00	-	.00
Total for Annual Forbs		0	0	114	13	43	0	8	0.28	0.02	0.33	0	0.02
Total for Perennial Forbs		0	0	19	12	4	1	6	0.12	0.10	0.00	0.00	0.01
Total for Forbs		0	0	133	25	47	1	14	0.40	0.13	0.34	0.00	0.04

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

BROWSE TRENDS--
Management unit 25C, Study no: 8

Type	Species	Average Cover %				
		'94	'98	'03	'08	'09
B	Artemisia tridentata wyomingensis	11.14	10.00	14.18	10.44	11.66
B	Chrysothamnus nauseosus	-	-	-	.03	-
B	Echinocereus sp.	.00	-	-	-	-
B	Gutierrezia sarothrae	-	-	.03	-	-
B	Juniperus osteosperma	.15	.03	-	-	-
B	Opuntia sp.	.00	.00	.36	.24	.19
B	Pediocactus simpsonii	-	.07	.01	-	-
B	Tetradymia canescens	-	-	-	-	.00
Total for Browse		11.30	10.10	14.58	10.71	11.85

CANOPY COVER, LINE INTERCEPT--
Management unit 25C, Study no: 8

Species	Percent Cover						
	'85	'91	'94	'98	'03	'08	'09
Artemisia tridentata wyomingensis	-	-	-	-	12.88	15.83	13.38
Chrysothamnus nauseosus	-	-	-	-	-	.05	-
Opuntia sp.	-	-	-	-	.01	.05	.03
Tetradymia canescens	-	-	-	-	-	-	.06

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 25C, Study no: 8

Species	Average leader growth (in)		
	'03	'08	'09
Artemisia tridentata vaseyana	1.3	2.3	1.06
Ceratoides lanata	-	-	3.9

POINT-QUARTER TREE DATA--
Management unit 25C, Study no: 8

Species	Trees per Acre			
	'98	'03	'08	'09
Juniperus osteosperma	41	25	21	<18
Pinus edulis	59	34	23	-

Average diameter (in)			
'98	'03	'08	'09
2.7	3.2	1.4	13.8
1.6	1.9	1.3	-

BASIC COVER--
Management unit 25C, Study no: 8

Cover Type	Average Cover %						
	'85	'91	'94	'98	'03	'08	'09
Vegetation	11.00	13.25	27.00	27.67	28.39	32.65	25.20
Rock	0	0	25.76	25.90	25.40	24.92	20.56
Pavement	0	0	3.57	15.20	15.48	17.00	10.01
Litter	0	0	17.28	26.57	20.55	0	0
Cryptogams	0	0	.33	.92	.51	.53	.42
Bare Ground	0	0	16.27	20.51	17.73	6.91	12.68

SOIL ANALYSIS DATA --
Management unit 25C, Study no: 8, Study Name: South Narrows

Effective rooting depth (in)	pH	sandy loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
8.5	6.3	54.0	31.4	14.6	1.5	13.5	105.6	0.5

PELLET GROUP DATA--
Management unit 25C, Study no: 8

Type	Quadrat Frequency						
	'85	'91	'94	'98	'03	'08	'09
Rabbit	-	-	17	18	23	56	27
Elk	-	-	7	11	5	4	5
Deer	-	-	24	37	23	42	27
Cattle	-	-	3	1	2	4	1

Days use per acre (ha)			
'98	'03	'08	'09
-	-	-	-
9 (22)	9 (22)	7 (18)	-
11 (27)	15 (38)	16 (40)	70 (172)
45 (111)	29 (72)	10 (25)	4 (11)

BROWSE CHARACTERISTICS--
Management unit 25C, Study no: 8

Yr	Average Height Crown (in)
Artemisia tridentata wyomingensis	
85	12/19
91	15/21
94	17/29
98	18/30
03	18/29
08	16/28
09	18/34
Ceratoides lanata	
85	-/-
91	-/-
94	-/-
98	9/6
03	6/10
08	7/7
09	5/6
Chrysothamnus nauseosus	
85	-/-
91	-/-
94	-/-
98	-/-
03	-/-
08	6/11
09	-/-
Gutierrezia sarothrae	
85	-/-
91	-/-
94	-/-
98	7/11
03	-/-
08	-/-
09	-/-
Juniperus osteosperma	
85	-/-
91	-/-
94	-/-
98	-/-
03	-/-
08	-/-
09	-/-

Yr	Average Height Crown (in)
Opuntia sp.	
85	2/2
91	2/4
94	2/3
98	4/6
03	4/10
08	3/10
09	3/9
Pediocactus simpsonii	
85	-/-
91	-/-
94	-/-
98	1/2
03	2/3
08	2/3
09	1/2
Pinus edulis	
85	-/-
91	-/-
94	-/-
98	-/-
03	-/-
08	-/-
09	-/-
Tetradymia canescens	
85	9/4
91	6/4
94	-/-
98	-/-
03	-/-
08	-/-
09	4/10

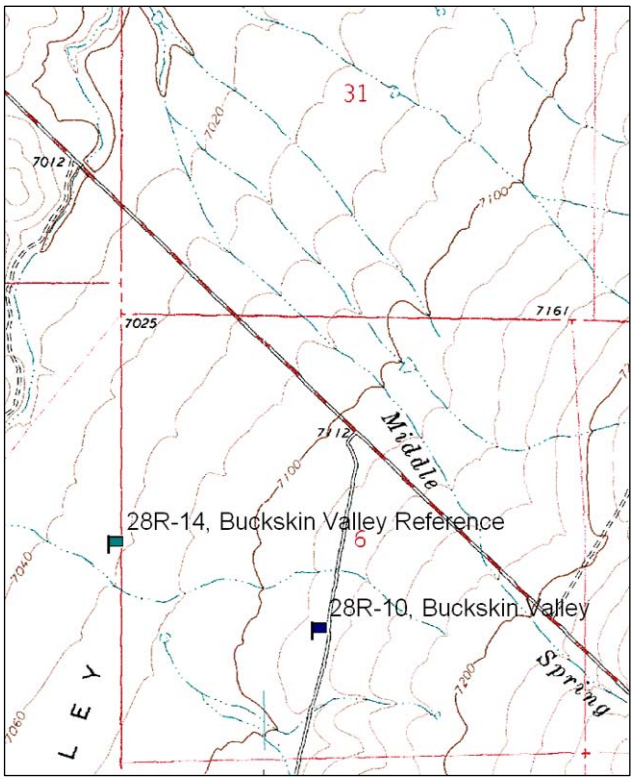
BUCKSKIN VALLEY DIXIE WRI, 28R-10

Vegetation Type: Mountain big sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Upland Loam (Mountain Big Sagebrush-Indian Ricegrass), R047XB308UT
Land Ownership: BLM
Elevation: 7100 ft. (2164 m)
Aspect: West
Slope: 4%
Transect bearing: 280° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

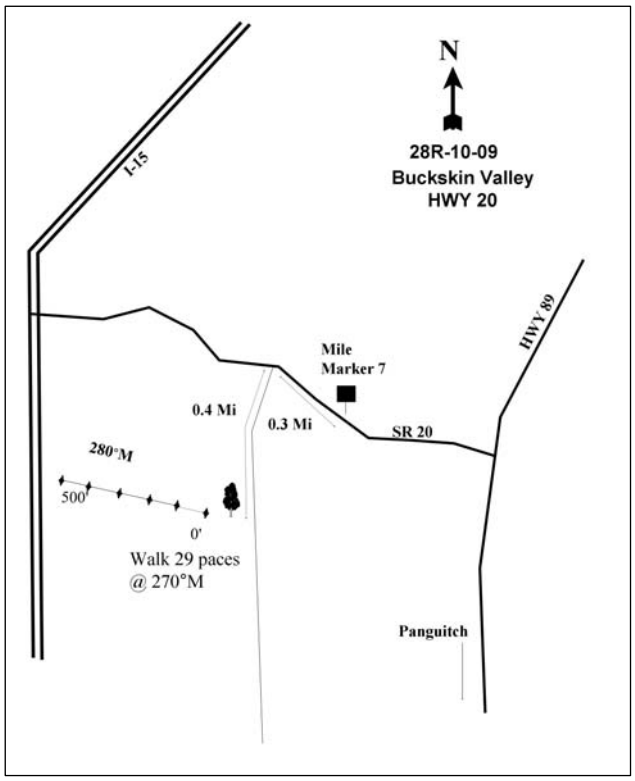
Directions:

From Panguitch, drive north on US 89 to the junction of SR 20. Turn left (west) on SR 20 and drive to mile marker 7. Continue west 0.3 miles to a dirt road on the left (south). Turn left and drive 0.4 miles to the only big Juniper on the right (west) side of the road. From the big juniper, walk 29 paces at 270°M to the 0' stake. The 0' stake is marked with browse tag #74.

Map Name: Burnt Peak



Diagrammatic Sketch:



Township: 32S Range: 7W Section: 6

GPS: NAD 83, UTM 12S 361246 E 4211999 N

BUCKSKIN VALLEY HIGHWAY 20 - WRI STUDY 28R-10
Project #242

Site Description

Site Information: This study was established in 2005 prior to a two-way harrow treatment within the Buckskin Utah prairie dog complex. The treatment, carried out in the fall of 2005, was designed to improve Utah prairie dog habitat for possible natural expansions of existing complexes by reducing shrub cover and increasing herbaceous cover. The treatment area is located approximately 16 miles southeast of Beaver in Buckskin Valley, just south of SR 20. Pellet group data estimated deer use to be minimal over all sample years. Cattle use was moderate in 2005 and 2008, and low in 2009 (Table - Pellet Group Data). Cattle were on the site when read in 2009 and grazing had reduced many species to stubble. The soil erosion condition was classified as stable in all sample years.

Browse: The key browse species on the site is a hybrid between Wyoming big and mountain big sagebrush (*Artemisia tridentata* ssp. *wyomingensis* and *A. tridentata* ssp. *vaseyana*) and was categorized as mountain big sagebrush. Prior to treatment the sagebrush had a fairly dense, but healthy population with low decadence, good vigor and recruitment of young plants. In 2008, after treatment, the density of sagebrush decreased substantially with a large increase in decadence. Utilization was light prior in all years.

Herbaceous Understory: Crested wheatgrass (*Agropyron cristatum*) is the dominant herbaceous species on the site. All other grasses combined provided less than 1% cover in all sample years. Cover and nested frequency of crested wheatgrass remained similar in pre- and post-treatment samplings. Forbs are diverse, but provide little cover. Scarlet globemallow (*Sphaeralcea coccinea*) is the most common forb on the site. Cover of perennial forbs increased from around 2% pre-treatment to around 3% post-treatment. The sum of nested frequency of perennial forbs increased by 75% in 2008, but returned to pre-treatment levels in 2009 (Table - Herbaceous Trends).

Pre vs. Three Years Post Treatment

Browse: Sagebrush density and cover were successfully reduced by the treatment. Sagebrush density decreased by 67% after the treatment from 6,640 plants/acre to 2,180 plants/acre, and line-intercept cover decreased from 20% to 3%. Decadence of sagebrush increased from 20% to 47% and poor vigor increased from 7% to 59% after the treatment. Though the stand remained mostly mature after the treatment, the average height of sagebrush decreased from 2 feet to 1 foot tall. Recruitment of young sagebrush plants remained relatively high at 13% of the population in 2008, after the treatment.

Grasses: Cover of perennial grasses increased slightly from 15% in 2005 to 22% in 2008. Crested wheatgrass still dominates the herbaceous understory providing 22% cover in 2008. Diversity of grasses increased with three of the seeded perennial grass species, Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*), being sampled at low nested frequencies for the first time in 2008.

Forbs: The sum of nested frequency of perennial forbs increased by 75% after the treatment, and cover of perennial forbs increased slightly to about 3% in 2008. Eight perennial forbs were sampled after the treatment that were not sampled prior to the treatment including six seeded species. Scarlet globemallow continued to be the most common forb, followed closely by the seeded species Lewis flax (*Linum lewisii*).

Trend Assessments

Browse

- **2008 to 2009 - stable (0):** Sagebrush canopy cover remained similar between 3% and 4%, though the size of sagebrush increased slightly.

Grass

- **2008 to 2009 - stable (0):** The herbaceous understory is still dominated by crested wheatgrass. Diversity of grasses declined with only three seeded grass species sampled. The sum of nested frequency of perennial grasses was similar between years, but cover decreased from 22% to 17%.

Forb

- **2008 to 2009 - down (-2):** The sum of nested frequency of perennial forbs decreased by 48% to around pre-treatment levels, though cover remained similar at 2.5%. Only three seeded species were sampled with blue flax being the most abundant. Scarlet globemallow remained the most common forb

Seed Mix:

Project name: Buckskin Highway 20		
WRI Database #: 242	Size (acre):	270
Mix lot #: sr-tt-bh-06		
Seed type	lbs in mix	lbs/acre
Bottlebrush Squirreltail	100	0.37
Small Burnet 'Delar'	100	0.37
Galleta	140	0.52
Snake River Wheatgrass 'Secar'	200	0.74
Snake River Wheatgrass 'Secar'	50	0.19
Western Wheatgrass 'Rosana'	152	0.56
Sandberg Bluegrass	100	0.37
Indian Ricegrass 'Nezpar'	400	1.48
Canby Bluegrass 'Canbar'	100	0.37
Bottlebrush Squirreltail	50	0.19
Sand Dropseed	50	0.19
Blue Grama 'Alma'	200	0.74
Alfalfa 'Ladak'	200	0.74
Small Burnet	150	0.56
Lewis Flax 'Appar'	250	0.93
Winterfat--Duchesne UT	125	0.46
Rocky Mtn. Penstemon	50	0.19
Western Yarrow	30	0.11
Sainfoin 'Eski'	500	1.85
Palmer Penstemon 'Washington, UT'	50	0.19
BULK POUNDS PER ACRE:		11.10
PLS POUNDS PER ACRE:		8.06

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

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'09	'05	'08	'09
G	Agropyron cristatum	350	353	361	14.94	22.24	17.27
G	Bouteloua gracilis	6	3	2	.06	.03	.15
G	Oryzopsis hymenoides	-	2	-	-	.00	-
G	Poa fendleriana	-	6	-	-	.01	-
G	Poa secunda	-	3	2	-	.00	.00
G	Sitanion hystrix	-	2	-	-	.00	-
G	Sporobolus cryptandrus	-	-	2	-	-	.00
Total for Annual Grasses		0	0	0	0	0	0
Total for Perennial Grasses		356	369	367	15.00	22.29	17.42
Total for Grasses		356	369	367	15.00	22.29	17.42
F	Achillea millefolium	-	5	5	-	.04	.01
F	Astragalus convallarius	$_{a}$4	-	-	.06	.00	-
F	Astragalus utahensis	-	2	-	-	.00	-
F	Calochortus nuttallii	-	4	-	-	.01	-
F	Collinsia parviflora (a)	-	-	3	-	-	.01
F	Comandra pallida	6	-	1	.01	-	.00
F	Cryptantha sp.	9	3	19	.02	.04	.75
F	Cymopterus sp.	$_{a}$8	$_{b}$35	-	.01	.16	-
F	Eriogonum alatum	4	-	-	.03	-	-
F	Eriogonum racemosum	16	24	13	.10	.06	.16
F	Gayophytum ramosissimum(a)	20	7	5	.07	.03	.01
F	Lappula occidentalis (a)	1	5	8	.00	.01	.02
F	Linum lewisii	-	$_{b}$83	$_{a}$57	-	.57	.45
F	Lotus sp.	11	14	-	.03	.09	-
F	Lupinus argenteus	8	11	1	.21	.08	.00
F	Lupinus sp.	-	-	$_{a}$13	-	-	.17
F	Medicago sativa	-	6	2	-	.01	.01
F	Onobrychis viciaefolia	-	$_{a}$8	-	-	.03	-
F	Penstemon palmeri	-	-	-	-	.00	-
F	Penstemon sp.	-	-	2	-	-	.00
F	Penstemon strictus	-	16	-	-	.08	-
F	Phlox longifolia	$_{a}$80	$_{a}$97	-	.32	.34	-
F	Polygonum douglasii (a)	8	15	-	.01	.02	-
F	Ranunculus testiculatus (a)	$_{a}$3	$_{a}$1	$_{b}$14	.03	.00	.05
F	Salsola iberica (a)	-	-	3	-	-	.00
F	Sanguisorba minor	-	5	-	-	.04	-
F	Sphaeralcea coccinea	$_{a}$96	$_{b}$118	$_{ab}$104	.66	.93	.86
F	Streptanthus cordatus	-	-	3	-	-	.03
F	Tragopogon dubius	-	-	1	-	-	.00
F	Trifolium sp.	8	10	5	.02	.07	.01
F	Unknown forb-annual (a)	-	-	8	-	-	.04
F	Zigadenus paniculatus	2	1	2	.00	.00	.00
Total for Annual Forbs		32	28	41	0.12	0.07	0.15

Type	Species	Nested Frequency			Average Cover %		
		'05	'08	'09	'05	'08	'09
Total for Perennial Forbs		252	442	228	1.49	2.62	2.48
Total for Forbs		284	470	269	1.61	2.69	2.64

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

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

Species	Percent Cover		
	'05	'08	'09
Artemisia tridentata vaseyana	20.45	3.25	3.93
Gutierrezia sarothrae	.08	-	-
Leptodactylon pungens	-	-	.03

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

Species	Average leader growth (in)		
	'05	'08	'09
Artemisia tridentata vaseyana	1.6	1.0	1.84

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

Cover Type	Average Cover %		
	'05	'08	'09
Vegetation	31.26	26.74	24.85
Rock	1.11	4.11	2.82
Pavement	22.16	13.92	9.53
Litter	19.10	32.24	24.50
Cryptogams	.63	0	.00
Bare Ground	40.09	33.23	40.82

SOIL ANALYSIS DATA --
Management unit 28R, Study no: 10, Study Name: Buckskin Valley Hwy 20

Effective rooting depth (in)	pH	loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	%clay				
11.2	6.9	47.1	31.1	21.8	2.2	11.3	131.2	0.6

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

Type	Quadrat Frequency		
	'05	'08	'09
Rabbit	46	89	65
Elk	-	1	-
Deer	2	7	10
Cattle	6	5	9

Days use per acre (ha)		
'05	'08	'09
-	-	-
-	-	-
1 (2)	-	2 (5)
36 (90)	29 (72)	15 (36)

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

Yr	Average Height Crown (in)
Artemisia nova	
05	-/-
08	-/-
09	14/17
Artemisia tridentata vaseyana	
05	21/28
08	13/16
09	15/19
Gutierrezia sarothrae	
05	9/6
08	3/5
09	2/1
Juniperus osteosperma	
05	-/-
08	-/-
09	-/-
Leptodactylon pungens	
05	4/3
08	5/6
09	2/4
Opuntia sp.	
05	7/13
08	3/8
09	-/-

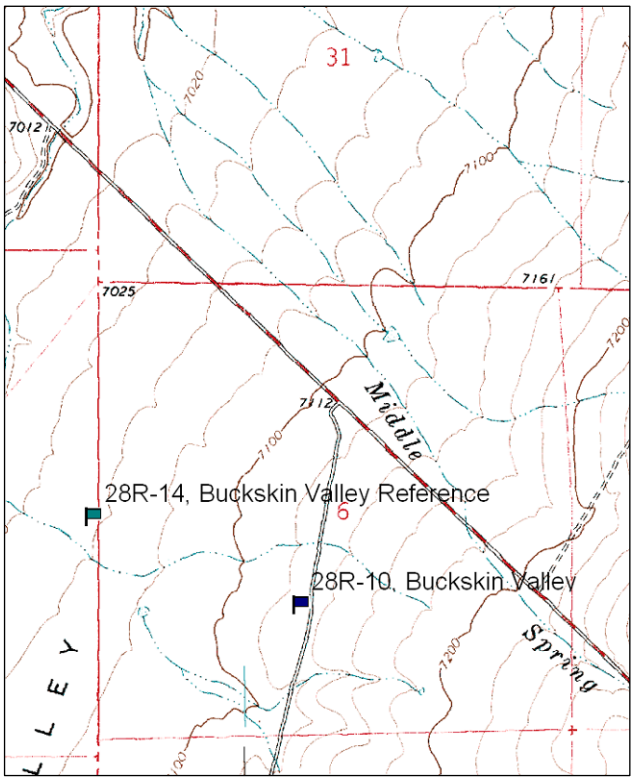
BUCKSKIN VALLEY DIXIE REFERENCE WRI, 28R-14

Vegetation Type: Mountain and Wyoming big sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Upland Loam (Mountain Big Sagebrush-Indian Ricegrass), R047XB308UT
Land Ownership: BLM
Elevation: 7000 ft. (2134 m)
Aspect: West
Slope: 3%
Transect bearing: 293° magnetic
Belt placement: Read Baseline, No Belts

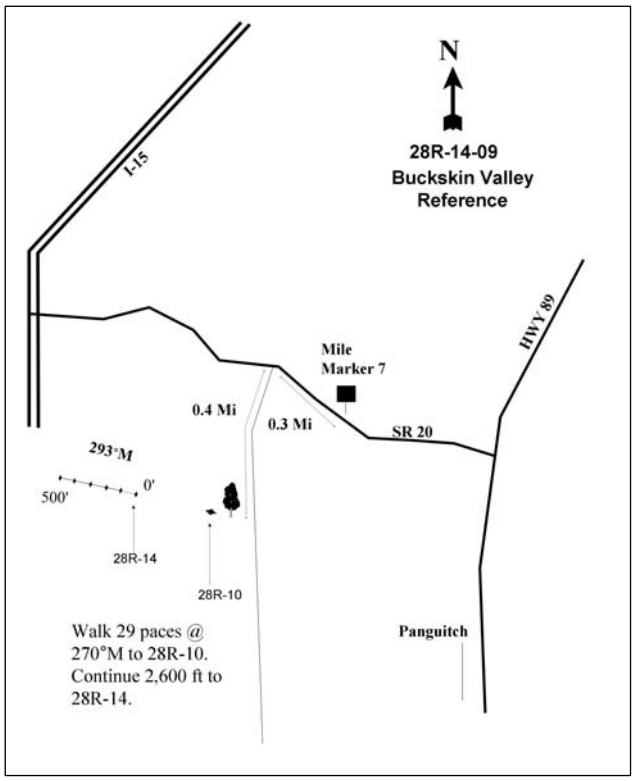
Directions:

From Panguitch, drive north on US 89 to the junction of SR 20. Turn left (west) on SR 20 and drive to mile marker 7. Continue west 0.3 miles to a dirt road on the left (south). Turn left and drive 0.4 miles to the only big Juniper on the right (west) side of the road. From the big juniper, walk 29 paces at 270°M to the 0' stake. The 0' stake is marked with browse tag #74. From the 0' stake of 28R-10 the 0' stake of 28R-14 is 2,610 ft at 281°M.

Map Name: Burnt Peak



Diagrammatic Sketch:



Township: 32S Range: 8W Section: 1

GPS: NAD 83, UTM 12S 361246 E 4211999 N

BUCKSKIN VALLEY HIGHWAY 20 REFERENCE - WRI STUDY 28R-14
Project #242 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site in companion to study 28R-10, Buckskin Valley Highway 20 and is located a short distance away within the same sagebrush flat. Pellet group data estimated very light deer, elk and cow use in 2009 (Table - Pellet Group Data). Soil erosion condition was classified as stable in 2009.

Browse: The dominant browse species is a hybrid between Wyoming big and mountain big sagebrush (*Artemisia tridentata* ssp. *wyomingensis* and *A. tridentata* ssp. *vaseyana*). All sagebrush were classified as mountain big sagebrush. Sagebrush cover was about 15% in 2009 (Table - Canopy Cover) and plants have a large average height of just over two feet (Table - Browse Characteristics). There is also a small component of dwarf rabbitbrush (*Chrysothamnus depressus*) on the site.

Herbaceous Understory: The herbaceous understory is dominated by crested wheatgrass (*Agropyron cristatum*) which provides over 8% cover. Forbs are diverse with 10 perennial species sampled, but forbs provide less than 2% cover. Scarlet globemallow (*Sphaeralcea coccinea*) is the dominant forb (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 28R, Study no: 14

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	354	8.32
G	Agropyron intermedium	2	.00
Total for Annual Grasses		0	0
Total for Perennial Grasses		356	8.32
Total for Grasses		356	8.32
F	Alyssum alyssoides (a)	11	.07
F	Astragalus convallarius	18	.10
F	Cryptantha sp.	10	.08
F	Cymopterus sp.	2	.01
F	Erigeron sp.	-	.00
F	Eriogonum racemosum	19	.13
F	Gayophytum ramosissimum(a)	34	.08
F	Lotus utahensis	46	.19
F	Lupinus argenteus	5	.01
F	Lupinus sp.	5	.30
F	Phlox longifolia	17	.06
F	Polygonum douglasii (a)	3	.00
F	Sphaeralcea coccinea	123	.82
F	Trifolium sp.	9	.02
Total for Annual Forbs		48	0.15
Total for Perennial Forbs		254	1.74
Total for Forbs		302	1.90

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

CANOPY COVER, LINE INTERCEPT--
Management unit 28R, Study no: 14

Species	Percent Cover '09
Artemisia tridentata vaseyana	14.71
Chrysothamnus depressus	.90
Chrysothamnus nauseosus	.13

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 28R, Study no: 14

Species	Average leader growth (in) '09
Artemisia tridentata vaseyana	0.92

BASIC COVER--
Management unit 28R, Study no: 14

Cover Type	Average Cover % '09
Vegetation	25.92
Rock	.57
Pavement	9.59
Litter	32.87
Cryptogams	1.35
Bare Ground	41.09

PELLET GROUP DATA--
Management unit 28R, Study no: 14

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	68	-
Grouse	1	1 (2)
Deer	2	2 (5)
Cattle	12	7 (16)

BROWSE CHARACTERISTICS--
Management unit 28R, Study no: 14

Yr	Average Height Crown (in)
Artemisia tridentata vaseyana	
09	26/34
Artemisia tridentata wyomingensis	
09	34/40
Chrysothamnus depressus	
09	3/7
Gutierrezia sarothrae	
09	3/5
Purshia tridentata	
09	4/5

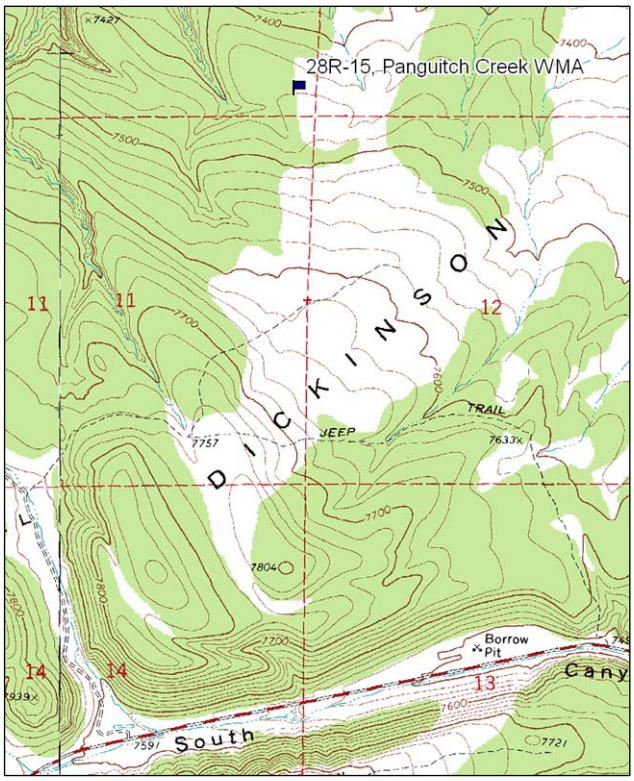
PANGUITCH CREEK WMA WRI, 28R-15

Vegetation Type: P/J, black sagebrush
Range Type: Crucial deer winter; substantial elk winter
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R047XB336UT
Land Ownership: UDWR
Elevation: 7400 ft. (2255 m)
Aspect: Northwest
Slope: 2-3%
Transect bearing: 316° magnetic
Belt placement: Read Baseline, No Belts

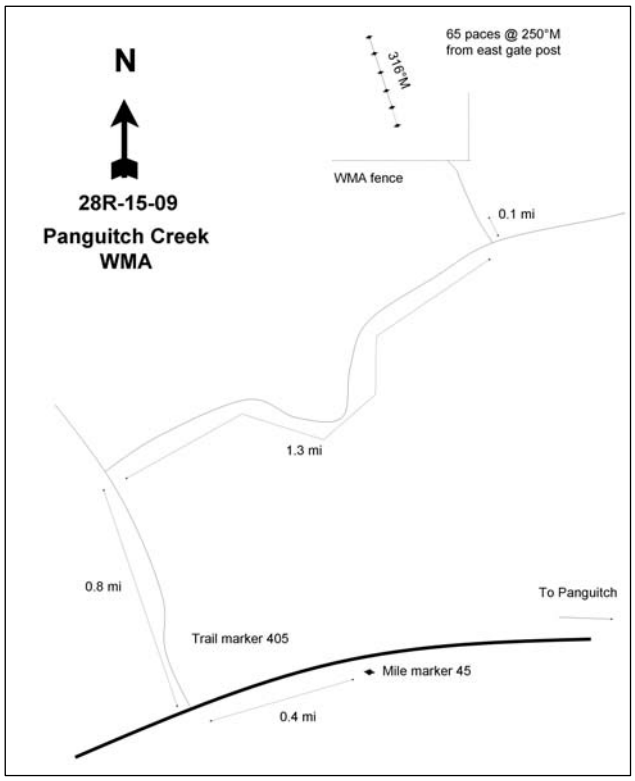
Directions:

From the stoplight in Panguitch, take Highway 143 (also known as "Not 89"). Turn right (north) 0.4 miles west from mile post 45. From Highway trail marker 405 go through gate for 0.8 miles, turn right and go 0.6 miles, turn left and go 0.7 miles, turn left again and go 0.1 miles. Walk down the trail to the WMA fence. From the east gate post proceed 65 paces at 250°M.

Map Name: Panguitch



Diagrammatic Sketch:



Township: 35S Range: 6W Section: 2

GPS: NAD 83, UTM 12S 368890 E 4183562 N

PANGUITCH CREEK WMA - WRI STUDY 28R-15
Project #1206

Site Description

Site Information: The study was established following a pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) chaining and seeding treatment on the Panguitch Creek WMA done in the spring of 2009. Pellet group data estimated light deer use in 2009 (Table - Pellet Group Data). The soil erosion condition was classified as stable in 2009.

One Season Post Treatment

Browse: Following the treatment, there were only four browse species sampled on the site; black sagebrush, broom snakeweed (*Gutierrezia sarothrae*), prickly pear cactus (*Opuntia sp.*), and pinyon pine. The dominant browse species on the site is black sagebrush (*Artemisia nova*) which provided the majority of browse cover on the site (Table - Canopy Cover). After the treatment, point-quarter data estimated a moderately dense, but very young population of pinyon pine. Tree cover was reduced to 3% pinyon cover after treatment. This compares to 30% cover in the untreated reference. There were very few Utah juniper trees sampled in 2009 (Table - Point-Quarter Tree Data). All of the sampled trees were less than 8 feet tall and 25% of the pinyon trees were downed by the chaining, but appeared to still be alive.

Herbaceous Understory: The dominant herbaceous species is blue grama (*Bouteloua gracilis*) which provides 3% cover. Forbs are extremely lacking on the site. Three seeded grasses, intermediate wheatgrass (*Agropyron intermedium*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*), and one seeded forb, alfalfa (*Medicago sativa*), were sampled on the site, but were all rare.

Seed Mix

Project name: Panguitch Creek WMA Bullhog, Chaining

WRI Database #: 1206	Size (acre):	383		Size (acre):	332
Mix lot #: sr-rb-pcwmacb-09			Mix Lot #: sr-rb-pccd-09		
Seed type	lbs in mix	lbs/acre	Seed type	lbs in mix	lbs/acre
Alfalfa 'Ladak'	200	0.52	Bitterbrush--Lincoln NV	150	0.45
Alfalfa 'Ranger'	200	0.52	Curlleaf Mountain Mahogany--Sevier UT	50	0.15
Blue Flax 'Appar'	150	0.39	Stansbury Cliffrose--Millard UT	35	0.11
Bottlebrush Squirreltail 'Toe Jam'	50	0.13	Stansbury Cliffrose--Millard UT	25	0.08
Canby Bluegrass 'Canbar'	150	0.39	Forage Kochia 'Immigrant'	100	0.30
Indian Ricegrass 'Rimrock'	350	0.91	BULK POUNDS PER ACRE:		1.08
Intermediate Wheatgrass 'Oahe'	600	1.57	PLS POUNDS PER ACRE:		0.82
Palmer Penstemon--'White Pine NV'	100	0.26			
Russian Wildrye 'Bozoisky'	400	1.04			
Sagebrush, Mountain--Sanpete UT	200	0.52			
Small Burnet 'Delar'	450	1.17			
Snake River Wheatgrass 'Secar'	400	1.04			
Forage Kochia 'Immigrant'	200	0.52			
BULK POUNDS PER ACRE:		9.01			
PLS POUNDS PER ACRE:		7.34			

HERBACEOUS TRENDS--
Management unit 28R, Study no: 15

Type	Species	Nested Frequency '09	Average Cover % '09
G	Agropyron cristatum	11	.04
G	Agropyron intermedium	6	.03
G	Bouteloua gracilis	88	3.28
G	Oryzopsis hymenoides	16	.11
G	Sitanion hystrix	4	.01
G	Stipa comata	10	.10
Total for Annual Grasses		0	0
Total for Perennial Grasses		135	3.58
Total for Grasses		135	3.58
F	Chenopodium album (a)	1	.00
F	Cryptantha sp.	1	.00
F	Erigeron pumilus	2	.00
F	Medicago sativa	2	.00
F	Phlox longifolia	7	.01
F	Senecio multilobatus	9	.07
Total for Annual Forbs		1	0.00
Total for Perennial Forbs		21	0.10
Total for Forbs		22	0.10

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

CANOPY COVER, LINE INTERCEPT--
Management unit 28R, Study no: 15

Species	Percent Cover '09
Artemisia nova	7.26
Gutierrezia sarothrae	.10
Pinus edulis	2.86

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 28R, Study no: 15

Species	Average leader growth (in) '09
Artemisia nova	1.0

POINT-QUARTER TREE DATA--
Management unit 28R, Study no: 15

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	<18	1.2
Pinus edulis	37	1.6

BASIC COVER--
Management unit 28R, Study no: 15

Cover Type	Average Cover % '09
Vegetation	15.16
Rock	11.15
Pavement	6.37
Litter	52.51
Cryptogams	.30
Bare Ground	18.99

PELLET GROUP DATA--
Management unit 28R, Study no: 15

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	6	-
Elk	1	-
Deer	5	7 (17)

BROWSE CHARACTERISTICS--
Management unit 28R, Study no: 15

Yr	Average Height Crown (in)
Artemisia nova	
09	10/18
Gutierrezia sarothrae	
09	6/6
Opuntia sp.	
09	7/14

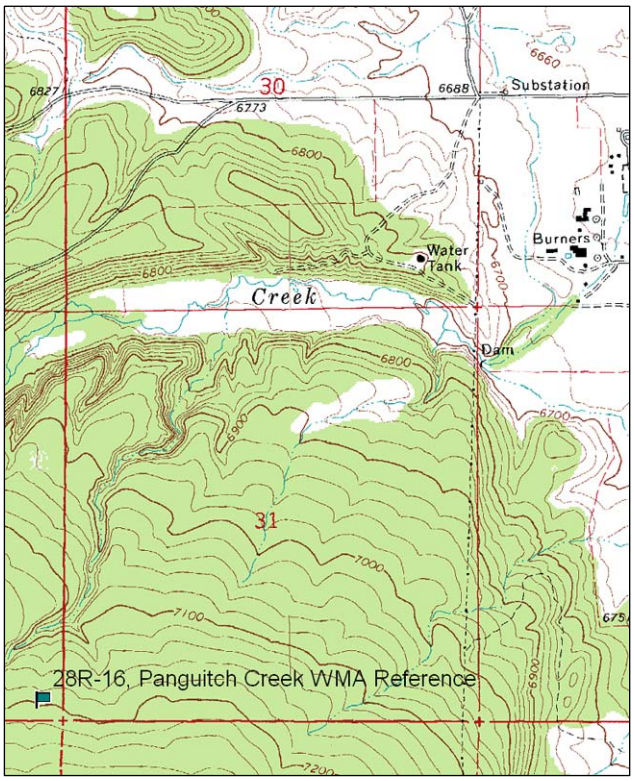
PANGUITCH CREEK WMA REFERENCE WRI, 28R-16

Vegetation Type: Pinyon/Juniper
Range Type: Crucial deer winter
NRCS Ecological Site Description: Upland Stony Loam (Pinyon-Utah Juniper), R047XB333UT
Land Ownership: UDWR
Elevation: 7150 ft. (2179 m)
Aspect: Northwest
Slope: 2-3%
Transect bearing: 263° magnetic
Belt placement: read baseline, the 400' stake is at 97ft long due to deadfalls.

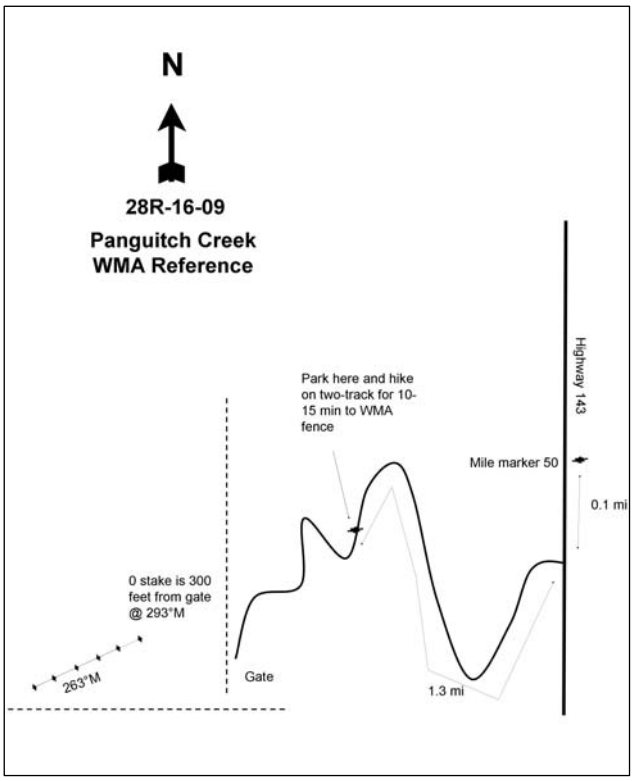
Directions:

From Panguitch proceed south on Highway 143, 0.1 miles south of mile marker 50 turn right and stay on the main road for 1.3 miles. At this point the road becomes impassable to pickup trucks. You now get to walk along a faint road/two track to the corner of the WMA fence. From the corner post the 0' stake is roughly 300 feet away at 293°M, but you will be winding your way through trees.

Map Name: Panguitch



Diagrammatic Sketch:



Township: 34S Range: 6W Section: 36

GPS: NAD 83, UTM 12S 370576 E 4185089 N

PANGUITCH CREEK WMA REFERENCE - WRI STUDY 28R-16
Project #1206 Reference

Site Description

Site Information: This study was established in 2009 as an untreated reference site about one and a half miles northeast of the Panguitch Creek WMA (28R-16) study, which was chained in the spring of 2009. Pellet group data estimated deer use to be moderate in 2009 (Table - Pellet Group Data). The soil erosion condition was classified as stable in 2009.

Browse: Similar to the treated site, diversity of browse species is low. The preferred browse species on the site is black sagebrush (*Artemisia nova*) which provided 3% line-intercept cover in 2009 (Table - Canopy Cover). The average height and crown of sagebrush was 10 inches and 22 inches at study establishment (Table - Browse Characteristics). Point-quarter data shows a very dense, mature stand of pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) on the site (Table - Point-Quarter Tree Data). Pinyon cover was 30% and juniper cover was 5% (Table – Canopy cover). Most of the pinyon trees were mature with 44% of sampled trees being taller than 12 feet.

Herbaceous Understory: The primary herbaceous species on the site is blue grama (*Bouteloua gracilis*). It was the only herbaceous species with a notable cover and nested frequency. Forbs are very rare on the site (Table - Herbaceous Trends).

HERBACEOUS TRENDS--
Management unit 28R, Study no: 16

Type	Species	Nested Frequency '09	Average Cover % '09
G	Bouteloua gracilis	42	1.02
G	Sitanion hystrix	1	.00
G	Stipa comata	2	.01
Total for Annual Grasses		0	0
Total for Perennial Grasses		45	1.03
Total for Grasses		45	1.03
F	Arabis sp.	18	.06
F	Chaenactis douglasii	1	.00
F	Cryptantha sp.	1	.00
F	Ipomopsis aggregata	5	.01
Total for Annual Forbs		0	0
Total for Perennial Forbs		25	0.08
Total for Forbs		25	0.08

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

CANOPY COVER, LINE INTERCEPT--
Management unit 28R, Study no: 16

Species	Percent Cover '09
Artemisia nova	3.15
Gutierrezia sarothrae	.08
Juniperus osteosperma	5.13
Opuntia sp.	.23
Pinus edulis	30.33

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 28R, Study no: 16

Species	Average leader growth (in) '09
Artemisia nova	0.8
Artemisia tridentata vaseyana	1.31

POINT-QUARTER TREE DATA--
Management unit 28R, Study no: 16

Species	Trees per Acre '09	Average diameter (in) '09
Juniperus osteosperma	47	4.7
Pinus edulis	116	6.3

BASIC COVER--
Management unit 28R, Study no: 16

Cover Type	Average Cover % '09
Vegetation	15.11
Rock	17.39
Pavement	16.23
Litter	52.45
Cryptogams	.68
Bare Ground	11.15

PELLET GROUP DATA--
Management unit 28R, Study no: 16

Type	Quadrat Frequency '09	Days use per acre (ha) '09
Rabbit	4	-
Deer	9	19 (46)

BROWSE CHARACTERISTICS--
Management unit 28R, Study no: 16

Yr	Average Height Crown (in)
Amelanchier alnifolia	
09	11/19
Artemisia nova	
09	10/22
Artemisia tridentata vaseyana	
09	17/15
Gutierrezia sarothrae	
09	5/5
Opuntia sp.	
09	6/17
Purshia tridentata	
09	10/20