

# UTAH BIG GAME RANGE TREND STUDIES 2012 VOLUME I Central Region



**PUBLICATION NUMBER 13-10  
REPORT FOR FEDERAL AID PROJECT W-82-R-57**

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

**Utah Big Game Range Trend Studies  
2012 Volume I  
Central Region**

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

Publication No. 13-10

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TABLE OF CONTENTS

PROGRAM NARRATIVE.....	<u>Page</u> iii
REMARKS .....	iv
MAP OF AREA SURVEYED.....	v
RANGE TREND STUDY METHODS.....	vi
REFERENCES .....	xv
REPORT FORMAT .....	xvii

	<u>Page</u>		<u>Page</u>
<b>Wildlife Management Unit 16A,</b>		17-34 Maple Mountain Face.....	289
<b>Central Mountains, Nebo .....</b>	<b>1</b>	17-39 Little Diamond Fork.....	297
16A-2 Santaquin Bench.....	4	17-40 Long Hollow .....	305
16A-3 Santaquin Hill .....	11	17-41 Upper Sheep Creek.....	313
16A-4 Wash Canyon.....	17	17-42 Tank Hollow.....	322
16A-5 Nebo Creek .....	26	17-44 Billies Mountain.....	332
16A-6 Hop Creek Browse.....	33	17-45 North Bench .....	342
16A-7 Willow Creek.....	43	17-46 Lower Tank Hollow .....	349
16A-8 Gardner Canyon.....	51	17-47 Tie Fork East.....	358
16A-9 Birch Creek.....	59	17-60 Center Creek.....	368
16A-10 North Canyon .....	69	17-61 American Fork Canyon .....	375
16A-11 Rees Flat .....	78	17-62 Grove Creek .....	381
16A-12 Tithing Mountain.....	86	17-63 Hobble Creek Bench .....	387
16A-13 Steele Ranch .....	94	17-64 Water Hollow .....	393
16A-14 Big Hollow .....	101	WMU 17 Summary .....	399
16A-15 Old Pinery.....	109	<b>Wildlife Management Unit 18A,</b>	
16A-17 Chicken Creek .....	116	<b>Oquirrh-Stansburry, North .....</b>	<b>408</b>
16A-18 Deep Creek .....	124	18A-23 South Palmer Point.....	410
16A-19 Flat Canyon.....	132	18A-24 Salt Mountain Stock Pond.....	419
16A-20 Triangle Ranch .....	140	18A-25 Below Chokeycherry Spring .....	427
16A-22 Levan North.....	148	18A-26 Salt Mountain .....	435
16A-23 Fountain Green Plateau.....	154	18A-27 South of Broons Canyon .....	442
16A-24 Maple Canyon.....	159	18A-29 Deadman Canyon .....	449
WMU 16A Summary.....	165	18A-30 Hatch Ranch .....	456
<b>Wildlife Management Unit 17,</b>		18A-32 East Hickman Canyon .....	464
<b>Wasatch Mountains .....</b>	<b>170</b>	18A-34 Carr Fork 2 .....	471
17-5 Deer Creek Dam.....	173	18A-35 Magpie Canyon .....	476
17-9 Lower Big Hollow.....	182	WMU 18A Summary.....	481
17-11 Wallsburg Turn.....	190	<b>Wildlife Management Unit 18B,</b>	
17-12 North Wallsburg reseeding.....	197	<b>Oquirrh-Stansburry, South .....</b>	<b>487</b>
17-13 North Wallsburg .....	205	18B-3 Manning Canyon .....	489
17-14 Hoovers Hollow.....	212	18B-5 Big Dip Gulch.....	497
17-15 Island Boat Camp .....	220	18B-6 South of Soldier Creek.....	504
17-16 Rainbow Bay .....	229	18B-34 Three O’Clock .....	511
17-17 Dutch Canyon.....	238	18B-35 Settlement Canyon Reservoir .....	518
17-19 Coyote Canyon .....	246	WMU18B Summary.....	524
17-24 Heisetts Hollow .....	252	<b>Wildlife Management Unit 7,</b>	
17-25 North Battle Creek.....	260	<b>Kamas</b>	
17-26 Orem Water Tank .....	268	7-7 Provo River Canyon.....	528
17-30 Spring Canyon.....	275		
17-31 Round Peak.....	282	<b>References.....</b>	<b>535</b>

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

## PROGRAM NARRATIVE

State: UTAH

Project Number: W-82-R-57

Grant Title: Wildlife Habitat Research and Monitoring

Project Title: Wildlife Habitat Monitoring/Range Trend Studies

Need: The ability to detect changes in vegetation composition (range trend) on big game winter ranges is an important part of the Utah Division of Wildlife Resources (DWR) big game management program. The health and vigor of big game populations are closely correlated to the quality and quantity of forage in key areas. The majority of the permanent range trend studies will be located on deer and elk winter ranges, however on certain management units, studies will be located on spring and/or summer ranges, if vegetation composition on these ranges is the limiting factor for big game populations. Range trend data are used by wildlife biologists for habitat improvement planning purposes, reviewing Bureau of Land Management (BLM) and United States Forest Service (USFS) allotment management plans, and as one of several sources of information for revising deer and elk herd unit management plans.

Objective: Monitor, evaluate, and report range trend at designated key areas throughout the state, and inform DWR biologists, public land managers and private landowners of significant changes in plant community composition in these areas.

Expected Results or Benefits: Range trend studies in each region will be reread every five years, and vegetation condition and trend assessments will be made for key areas. DWR biologists, land management personnel from the USFS and BLM, and private landowners will use the range trend database to evaluate the impact of land management programs on big game habitat. Annual reports will be readily available on the Division's website, on CDs, and in hard copies located in DWR regional offices, BLM and USFS offices, and public libraries. Special studies (habitat project monitoring and big game/livestock forage utilization studies) will give DWR biologists and public land managers additional information to address local resource management problems.

## REMARKS

The work completed during the 2012 field season and reported in this publication involves the reading of interagency range trend studies in the DWR Northern Region. Most trend studies surveyed in these management units were established in the 1980's and reread at 5 year intervals.

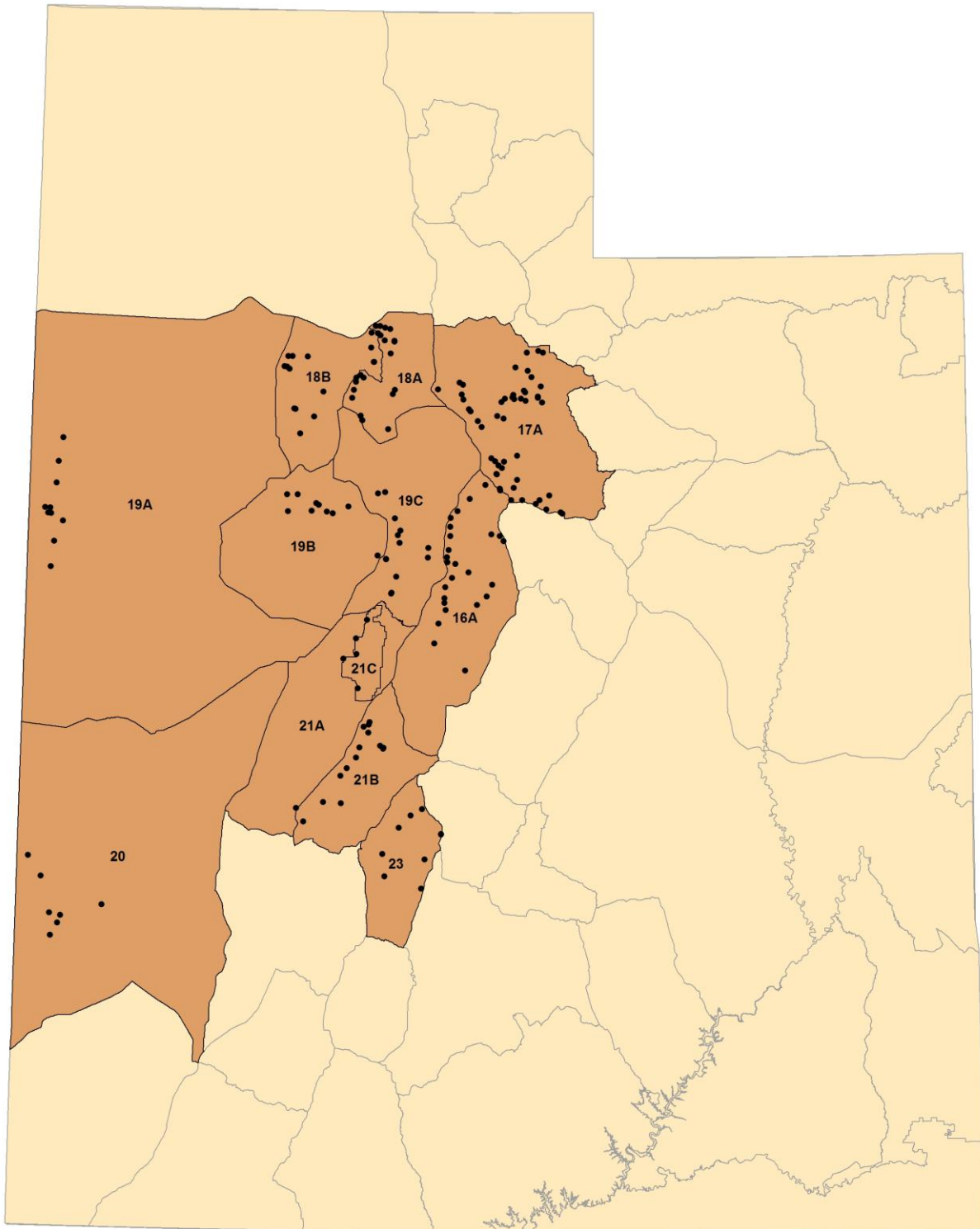
The following Bureau of Land Management and U.S. Forest Service offices provided information and/or assistance in completion of the trend studies which add to the value of this interagency report:

Bureau of Land Management  
Salt Lake Field Office  
Fillmore Field Office  
Richfield Field Office

U.S. Forest Service  
Uinta National Forest  
Fishlake National Forest

Private landowners were cooperative in allowing access to study sites located on their land.

# Utah Mangement Units Surveyed 2012



## RANGE TREND STUDY METHODS

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

### Vegetation Composition

Determining vegetation characteristics for each “key” area is determined by setting up five consecutive 100 foot baseline transects in the area of interest. This 500 foot line is the baseline and one, 100 foot belt is placed perpendicular to each 100 foot section of the baseline at random foot marks and centered on the 50 foot mark. The beginning of each belt is marked by a rebar stake to ensure a more precise alignment of the originally sampled belt. A 1/4 m<sup>2</sup> quadrat is centered every 5 feet along the same side of the belt, starting at the 5 foot mark. Cover and nested frequency values are determined for vegetation, litter, rock, pavement, cryptogams, and bare ground. Cover and nested frequency values are also estimated for all plant species occurring within a quadrat, including annual species. However, prior to 1992 no data was collected for annual species.

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

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

Nested Frequency: Nested frequency values for the quadrat range from 1-5 according to which area or sub-quadrat the plant species or cover type is rooted in. The notation for each sub-quadrat is as follows: 5 = 1% of the area, 4 = 5% of the area, 3 = 25% of the area, 2 = 50% of the area, and 1 = the remainder of the quadrat. Each time a particular plant species or cover type occurs within the quadrat, it is scored relative to which of the smallest nested quadrats it is rooted in (in the case of vegetation) or where it first occurs (for all other cover types). The highest possible score is 5 for each quadrat occurrence and 100 per belt, for a possible score of 500 for each species or cover type at a given site (Figure 2).

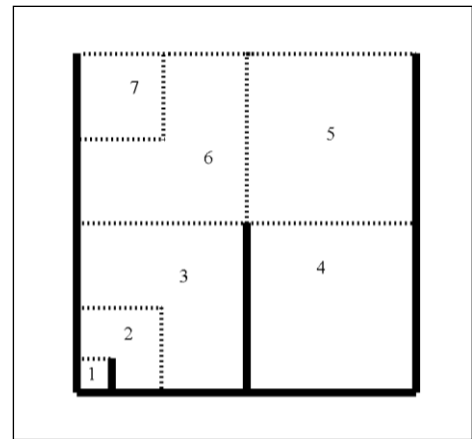
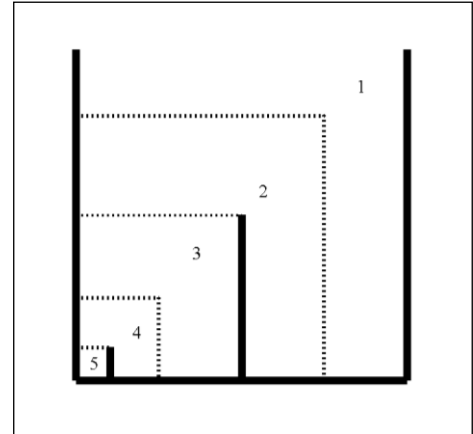


Figure 1. Cover classes of the 1/4 m<sup>2</sup> sampling quadrat.

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



**Figure 2.** Nested frequency sub-quadrats of the 1/4 m<sup>2</sup> sampling quadrat.

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

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

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

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

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

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

**Dead:** A plant which is no longer living.

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

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



Lightly hedged: 0 to 40 percent of twigs browsed.

Moderately hedged: 41 to 60 percent of twigs browsed.

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

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

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

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

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

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

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

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

### **Trend Determination**

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

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

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

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

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

### **Data Interpretation**

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

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

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

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

T y p e	Species	Nested Frequency					Average Cover %			
		'87	'94	'99	'04	'09	'94	'99	'04	'09
G	Agropyron cristatum	b135	ab106	ab100	ab112	a81	2.46	2.50	4.81	2.00
G	Agropyron intermedium	-	-	3	2	3	-	.03	.00	.03
G	Bouteloua gracilis	15	19	17	13	17	1.07	.14	.53	.30
G	Bromus inermis	75	67	63	68	92	.63	2.40	1.00	1.35
G	Bromus tectorum (a)	-	-	3	-	-	-	.00	-	-
G	Hilaria jamesii	-	-	-	2	-	-	-	.03	-
G	Koeleria cristata	b61	a3	a19	a3	a-	.03	.18	.01	-
G	Oryzopsis hymenoides	-	3	3	3	8	.00	.00	.03	.07
G	Poa bulbosa	b220	b256	b250	a129	a136	7.14	8.01	2.43	2.86
G	Poa fendleriana	a-	b16	d53	cd55	bc24	.06	.38	1.24	.33
G	Sitanion hystrix	6	1	-	-	-	.00	-	-	-
G	Stipa comata	b48	a14	bc24	bc30	a21	.11	.23	1.24	.36
Total for Annual Grasses		0	0	3	0	0	0	0.00	0	0
Total for Perennial Grasses		560	485	532	417	382	11.52	13.89	11.35	7.32
Total for Grasses		560	485	535	417	382	11.52	13.90	11.35	7.32
F	Astragalus convallarius	b40	bc17	ab25	b37	a9	.10	.42	.99	.10
F	Calochortus nuttallii	8	-	-	1	-	-	-	.00	-
F	Castilleja chromosa	b38	a4	a-	a-	a-	.01	-	-	-
F	Castilleja linariaefolia	-	2	1	-	-	.01	.03	-	-
F	Comandra pallida	-	-	-	3	-	-	-	.01	-
F	Cordylanthus sp. (a)	-	-	-	5	5	-	-	.16	.01
F	Crepis acuminata	b14	a6	a-	a-	a-	.03	-	-	-
F	Erigeron flagellaris	-	-	3	-	1	-	.15	-	.00
F	Erigeron pumilus	b111	a21	a43	a20	a12	.07	.51	.53	.08
F	Eriogonum racemosum	b63	a30	a34	a25	a28	.14	.30	.35	.21
F	Hymenoxys acaulis	3	-	3	1	-	-	.00	.03	-
F	Lomatium triternatum	b31	a-	a-	a-	a-	-	-	-	-
F	Lupinus argenteus	d162	c57	b20	a-	a-	3.64	.14	-	-
F	Machaeranthera canescens	1	-	2	-	-	-	.01	-	-
F	Penstemon caespitosus	85	2	6	6	5	.01	.03	.07	.02
F	Petradoria pumila	-	-	5	-	-	-	.06	-	-
F	Phlox longifolia	c67	bc53	ab31	a7	a17	.14	.06	.05	.10
F	Polygonum douglasii (a)	-	-	-	-	6	-	-	-	.01
F	Senecio multilobatus	-	1	1	-	-	.00	.00	-	-
F	Sphaeralcea coccinea	58	55	52	49	48	1.24	.38	.60	.59
F	Tragopogon dubius	6	-	-	-	-	-	-	-	-
F	Trifolium gymnocarpon	-	3	3	2	-	.00	.00	.00	-
F	Zigadenus paniculatus	-	-	3	-	1	-	.00	.00	.03
Total for Annual Forbs		0	0	0	5	11	0	0	0.15	0.01
Total for Perennial Forbs		693	251	232	151	121	5.43	2.15	2.66	1.15
Total for Forbs		693	251	232	156	132	5.43	2.15	2.82	1.17

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

**Browse:** The following “Browse Trends” table summarizes strip frequency and cover for all shrub species occurring on this site. All of the shrubs encountered at study number 13A-1 are listed. For example, mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) had a strip frequency of 86 out of a possible 100 in 1994, 82 in 1999 and 85 in 2004 and 2009. Average cover is determined using cover classes in conjunction with the 1/4m<sup>2</sup> quadrat and estimating the percent of the quadrat covered. In this case, mountain big sagebrush cover was estimated to be 16.28% in 1994, 9.40% in 1999, 10.65% in 2004 and 9.94% in 2009.

**BROWSE TRENDS--**

Management unit 13A, Study no: 1

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

To more accurately estimate canopy cover of trees and shrubs, the line-intercept method is used along each 100 foot belt. This data is reported in the “Canopy Cover, Line Intercept” table. For example, mountain big sagebrush had a cover of 13.21% in 2004 and 13.93% in 2009. Compare this to the cover determined using the 1/4m<sup>2</sup> quadrat cover class method. Prior to 2002, only trees species were sampled in the line-intercept transect above eye level. Beginning in 2002, all woody species were included in the line-intercept transect and a total canopy cover (above and below eye level) value for each was determined.

**CANOPY COVER, LINE INTERCEPT--**

Management unit 13A, Study no: 1

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

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

**KEY BROWSE ANNUAL LEADER GROWTH--**  
Management unit 13A, Study no: 1

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

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

**POINT-QUARTER TREE DATA--**  
Management unit 13A, Study no: 1

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

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

**BROWSE CHARACTERISTICS--**  
Management unit 13A, Study no: 1

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

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

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

**BASIC COVER--**

Management unit 13A, Study no: 1

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

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

**SOIL ANALYSIS DATA --**

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

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

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

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

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

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

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

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

It was determined that additional information on pellet groups was necessary. Therefore, a pellet group transect is now sampled in conjunction with the vegetation transects. The pellet group transect utilizes 50, 100ft<sup>2</sup> circular plots which are placed through the study area. These are usually two parallel transects of 25 plots on each side of the vegetation transect which runs 400 feet to 500 feet in length. The number of recent pellet groups for wildlife (usually deer and elk) and pats for cattle are recorded. That number is then converted to days use per acre (hectare) (Neff 1968). Rabbit pellet groups are not included in this sample. In the example, elk days use/acre was estimated at 70 in 1999 and decreased steadily to 4 elk days use/acre in 2009.

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

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

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

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## REPORT FORMAT

An introductory segment at the beginning of each wildlife management unit categorizes the trend studies and provide references to further information on winter range limits, land ownership patterns, livestock management practices, and management unit objectives.

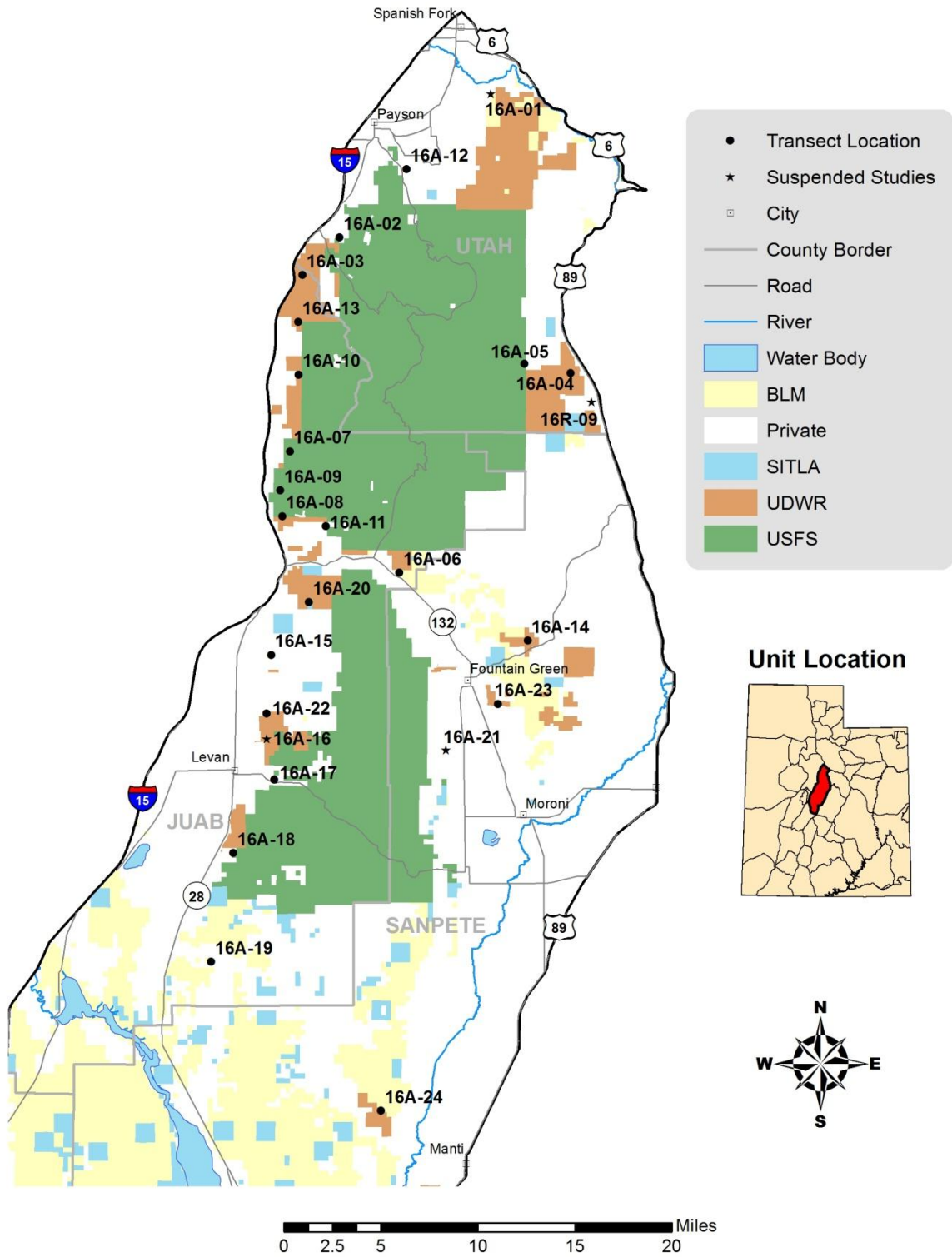
The name and directions for locating the site are given on the location page. Also included on this page are the vegetation type, range type, NRCS ecological site description, land ownership, elevation, aspect, slope, arrangement and diagrammatic sketch of the baseline, and the location on a topographical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

A discussion of the study site includes descriptions of the site's historic characteristics, soil, ground cover, vegetation community, and species composition. 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.

Summaries and evaluations at the end of each management unit address range trends in these key areas. This report will serve to identify and verify changes that are occurring on key areas for big game.

# Management Unit 16A



## MANAGEMENT SUBUNIT 16A - CENTRAL MOUNTAINS, NEBO

### Boundary Description

**Utah, Juab, and Sanpete Counties** - Boundary begins at the junction of I-15 and US-6 in Spanish Fork; southeast on US-6 to US-89 at Thistle Junction; south on US-89 to Gunnison and SR-28; north along SR-28 to I-15 at Nephi; north along I-15 to US-6 in Spanish Fork.

### Management Unit Description

This management subunit incorporates most of the old North and South Nebo deer herd units. The old North Nebo deer herd unit included about 490,240 acres. Physiographically, the unit was dominated by high mountains such as Santaquin Peak, Bald Mountain, and Mount Nebo. Mount Nebo represents the southernmost extension of the Wasatch Range. These mountains constitute the heart of a diverse and productive summer range, making up about 29% of the unit. Normal winter range constitutes approximately 32% of the area. The Mount Nebo summer range has a long history of high hunting success and depredation problems, a growing elk herd, and limited winter range.

The principal limiting factor and management concern in the old North Nebo unit is the lack of good-condition winter range, especially severe winter range on the west side of the unit. In this area, from Spanish Fork Canyon south to Nephi, the normal winter range averages 2 miles or less in width. Severe winter range is even narrower, ranging from as narrow as a few hundred yards, up to 1.5 miles. Total severe winter range accounts for only about 12% of the area. However, the winter range on the east and south sides of the unit is more expansive, and not nearly as critical. Some of the major problems related to the limited winter range on the unit, especially low elevation severe winter range, include: restricted access to traditional wintering areas west of I-15, predominately private ownership of critical ranges (63% of normal winter range), and agricultural depredation. To remedy the situation, the UDWR has acquired approximately 12,800 acres of winter range in the unit (7% of winter range) and has attempted treatments and rehabilitation in these critical areas. This unit remains one of the top deer herd units requiring winter habitat revegetation action. The available winter range, especially critical areas on the west side of the unit, remains threatened by development, mismanagement, and a high fire hazard from cheatgrass.

The key areas identified and sampled with 12 trend studies in 1983 are still priority areas. Three new studies were added in 1989. The majority of the studies are on UDWR land. However, much of the critical range is under private ownership and was not sampled due to restricted access and limited management opportunities. The 15 permanently-marked trend studies originally sampled in early August 1983 were resampled in mid-July of the drier year of 1989, and in late May of 1997, 2002, and 2007. All sample big game winter range areas, although many sites had some evidence of summer deer occupancy. The studies range in elevation from approximately 5,400 feet (1,646 m) to 6,500 feet (1,981 m). The prominent winter range vegetation types that were sampled include: mixed oak/big sagebrush, sagebrush/grass, mountain brush, bitterbrush, and cliffrose.

The San Pitch Mountains make up the majority of the old South Nebo herd unit. This low mountain range contains all of the summer range on the unit and 40% of the area. The surrounding foothills and western slopes provide winter range that makes up the remaining 60% of the range. The upper limit of the winter range is approximately 7,000 feet in elevation, but extends to 8,000 feet on the south exposures in canyons on the west side of the unit. Twenty-five percent of the winter range was classified as severe winter range in the 1976 range inventory. The upper limit of severe winter range is 6,000 feet, while the lower limit (5,200 feet) of the winter range is restricted by highways, reservoirs, agriculture, and small communities.

The Division has acquired several parcels of land totaling 7,200 acres, or 5% of the winter range. Further habitat acquisition and rehabilitation are necessary to adequately maintain the winter range. This unit has been an important deer herd unit for future winter range land purchases.

## **Range Trend Studies**

Twenty-one interagency range trend studies were sampled in Unit 16A during the summer of 2012. A total of twenty-four studies have been established within the Unit 16A since 1983. Thirteen studies were established in 1983, and of these studies five [Santaquin Bench (16A-2), Santaquin Hill (16A-3), Nebo Creek (16A-5), Rees Flat (16A-11), and Strawberry Highline Canal (16A-1)] sample mixed oak and sagebrush communities, two studies [Wash Canyon(16A-4), Levan Farm Chaining (16A-16), and North Canyon (16A-10)] sampled big sagebrush communities, one study [Hop Creek Browse (16A-6)] sample bitterbrush communities, two studies [Willow Creek (16A-7) and Chicken Creek (16A-17)] sample cliffrose communities, and two studies [Gardner Canyon (16A-8) and Birch Creek (16A-9)] sample mountain brush communities. Six studies were established in 1989, and of these studies four studies [Big Hollow (16A-14), Flat Canyon (16A-19), Triangle Ranch (16A-20), and Jerusalem (16A-21)] sample big sagebrush communities, one study [Tithing Mountain (16A-12)] sample a cliffrose communities, and one study [Steele Ranch (16A-13)] sample mixed oak and sagebrush communities. Two studies were established in 2007 and of these studies two studies [Levan North (16A-22) and Fountain Green Plateau (16A-23)] sample Wyoming big sagebrush communities. One study [Maple Canyon (16A-24)] was established in 2012 and samples a pinyon pine and Utah juniper woodland.

In 1997, one study (Jerusalem) was suspended. In 2002, one study (Strawberry Highline Canal) was suspended. In 2012, one study (Levan Farm Chaining) was suspended. These studies were suspended for various reasons and if the need arises in the future these studies can be sampled again. To access maps, discussions, and data tables for suspended studies see: <http://www.wildlife.utah.gov/range>.

SANTAQUIN BENCH - TREND STUDY NO. 16A-2-12

Vegetation Type: Gamble Oak

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#) and [Mountain Loam \(Oak\), R047XA432UT](#)

Land Ownership: Private

Elevation: 5,420 ft (1,620 m)

Aspect: West

Slope: 7%

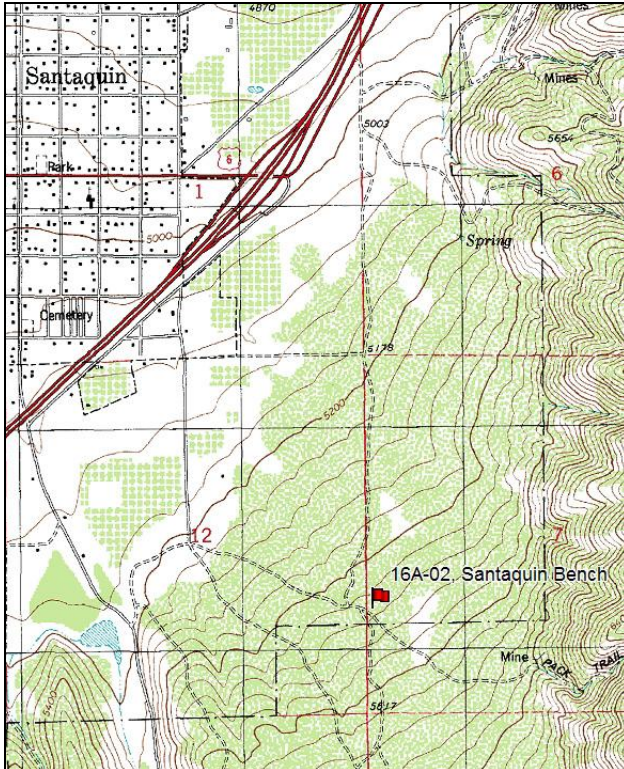
Transect bearing: 28° magnetic

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

Directions:

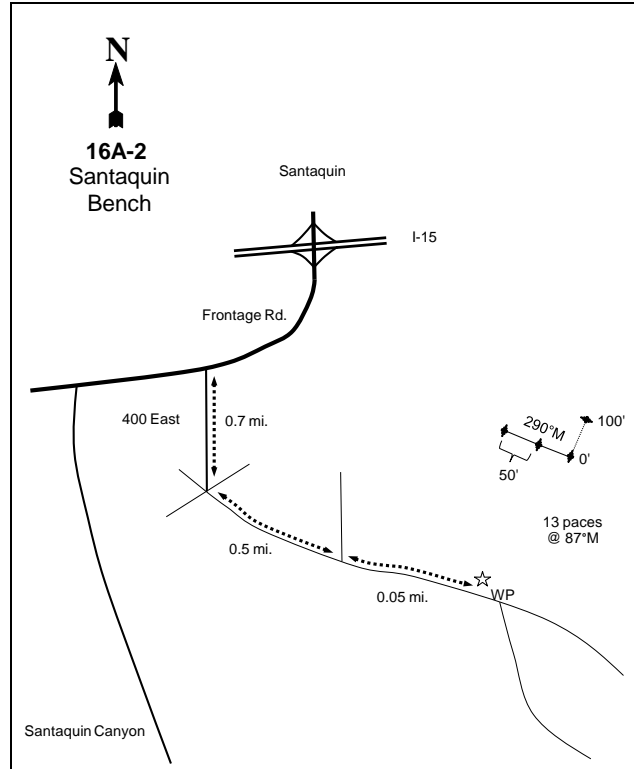
From the I-15 interchange on the east side of Santaquin, proceed southwest on the frontage road (Highland Drive) for a short distance to where there are several forks. Turn left on 400 East which turns due south and passes through some orchards and home sites. Travel 0.7 miles to where the road forks at the end of a maintained road. Turn immediately to the left (east) and travel 0.50 miles to a fork in the road. Stop just beyond the fork at the witness post on the left. The 0-foot baseline stake is located 13 paces from the witness post at an azimuth of 87°M. The 0-foot baseline stake is marked by browse tag #3929. The last baseline is only 50 feet long.

Map Name: Santaquin



Township: 10S Range: 2E Section: 7

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 434518 E 4423386 N

## SANTAQUIN BENCH - TREND STUDY NO. 16A-2

### Site Information

Site Description: The study is located on deer and elk winter range on the Santaquin Bench within the Uinta National Forest. Prior to 2001, the dominant overstory consisted of closely intermixed patches of Gambel oak (*Quercus gambelii*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Stansbury cliffrose (*Cowania mexicana* spp. *stansburiana*), antelope bitterbrush (*Purshia tridentata*), and Utah juniper (*Juniperus osteosperma*) were also occasionally abundant. Surrounding oak clones were thick and appeared to be increasing, leaving smaller openings for sagebrush. The entire area burned in 2001 as part of the Mollie fire, which burned 8,021 acres, removing most of the browse species other than Gambel oak. Deer and elk pellet groups were common in 1983, but few were noted in 1997 and 2002. Pellet groups have been sampled in low abundance for deer and elk since 2002 (Table - Pellet Group Data).

Browse: Before the study burned, the key browse species was mountain big sagebrush, although Gambel oak accounted for half of the browse cover (Table - Browse Trends). The oak formed relatively dense clumps of variable height, and some of the forage was physically unavailable due to either excessive height and/or density. Age structure was indicative of an expanding population with many young plants, especially near the edges of the clones. Vigor had been depressed in the past due to worm infestations, which severely defoliated the oak. Forty-one percent of the oak sampled in 1997 was impacted by these insects. All of the oak was burned in the 2001 fire, but has regenerated in subsequent sample years. Burned stems were left standing with abundant young shoots coming back in 2002. Density of oak has increased to pre-fire levels (Table - Browse Characteristics) and cover has increased to double pre-fire levels (Table - Browse Trends). The population has been mostly mature since 2007 with good vigor, although the plants were noted to have a large number of galls in 2007. Utilization of oak has been light throughout the study (Table - Browse Characteristics).

Prior to the fire, the mountain big sagebrush population occupied the oak interspaces. Between 1983 and 1989, the sagebrush population showed signs of decline with decreased density, increased decadence, and limited recruitment of young plants. Utilization of sagebrush remained mostly light during these years, so the decline was most likely due to oak competition combined with drought in 1989 (Time Series Data 2013). When the study was lengthened in 1997, the extended baseline was placed in more open areas to better sample the sagebrush population. As a result, density estimates were larger compared to previous years (Table - Browse Characteristics). In 1997, sagebrush accounted for nearly half of the shrub cover (Table - Browse Trends). The majority of the population was mature, and decadence declined. The fire in 2001 eliminated all of the sagebrush plants, and very few sagebrush plants have reestablished on the site. The few sagebrush plants that have established on the site have displayed moderate to heavy utilization since 2007 (Table - Browse Characteristics).

Herbaceous Understory: Prior to the fire, perennial grasses were prevalent. Abundance and composition varied greatly between the oak and sagebrush dominated openings. Under the oak canopy, Kentucky bluegrass (*Poa pratensis*) was the most abundant herbaceous plant. In contrast, bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*) were dominant under sagebrush. Annual grasses were not common. After the fire, grass cover initially decreased in 2002, but increased to higher than pre-fire levels following an apparent seeding. Three perennial grasses that were not present before the fire were sampled in 2007 including intermediate wheatgrass (*Agropyron intermedium*), slender wheatgrass (*Bromus inermis*), and basin wildrye (*Elymus cinereus*). Intermediate wheatgrass was the dominant grass species in 2012, with bulbous bluegrass (*Poa bulbosa*) and Sandberg bluegrass also being common (Table - Herbaceous Trends). Jointed goatgrass (*Aegilops cylindrica*), a noxious weed, was also sampled in 2007 and noted to be common along the roadway in 2012. Perennial forbs are common and abundant on the site. The most common perennial species is Bonneville peavine (*Lathyrus brachycalyx*). Alfalfa (*Medicago sativa*) was sampled in 2007 in low numbers following an apparent seeding. Annual forbs fluctuate in frequency and cover on the site, but are typically fairly abundant (Table - Herbaceous Trends).

Soil: The soil is classified within the Dry Creek cobbly loam, which occurs on hills and alluvial fans. The soils in this series formed in alluvium and colluvium from mixed sources. The soils within this classification are characterized as deep and well drained (Soil Survey Staff 2011). The soil texture is a loam with a slightly acidic soil reaction (pH 6.0) (Table - Soil Analysis Data). Prior to 2001, the soil surface was well-protected by abundant litter under the oak clones and by grass and litter cover in the openings. Bare ground cover increased immediately following the fire, but returned to pre-fire levels in 2007. Vegetation and litter cover also returned to pre-fire levels since 2007 (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

## Trend Assessments

### Browse:

- **1983 to 1989 - down (-2)**: The density of mountain big sagebrush decreased 37% from 1,265 plants/acre to 799 plants/acre. Decadence of sagebrush increased from 26% to 42%, though vigor remained similar decreasing from 21% to 17%. Much of this decrease was likely due to competition from an increase in Gambel oak. Density of oak increased from 4,864 stems/acre to 11,798 stems/acre, with 75% of the plants characterized as young in 1989.
- **1989 to 1997 - slightly up (+1)**: Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Decadence of mountain big sagebrush decreased to 16% and poor vigor decreased to 11%. Recruitment of young sagebrush plants increased to 10% of the population.
- **1997 to 2002 - down (-2)**: The study burned in the summer of 2001, eliminating the sagebrush population and reducing the total browse cover from 23% to 3%. Oak resprouted at a density of 7,960 stems/acre and the entire population was made up of young, vigorous plants. However, oak is less desirable for wintering big game than sagebrush.
- **2002 to 2007 - stable (0)**: The sagebrush population did not recover from the fire as quickly as the less-preferred oak. Only 80 sagebrush plants/acre were sampled in 2007, and all were mature and vigorous. Most of the plants displayed heavy use. Oak density continued to increase to 13,560 stems/acre. The population was largely mature, with no decadent plants sampled.
- **2007 to 2012 - stable (0)**: There was little change in the sagebrush population. Density of sagebrush remained low, and the plants displayed moderate to heavy use. Density of oak decreased slightly to 11,100 plants/acre, but cover increased from 22% to 25%.

### Grass:

- **1983 to 1989 - up (+2)**: There was a 20% increase in the sum of nested frequency of perennial grasses. Kentucky bluegrass increased significantly in nested frequency.
- **1989 to 1997 - stable (0)**: The sum of nested frequency, excluding bulbous bluegrass, remained similar. Kentucky bluegrass and bottlebrush squirreltail (*Sitanion hystrix*) decreased significantly in nested frequency. Bulbous bluegrass was sampled for the first time in low abundance on the site.
- **1997 to 2002 - down (-2)**: The perennial grass sum of nested frequency, excluding bulbous bluegrass, decreased 51%, and cover decreased from 18% to 5%. Kentucky bluegrass and bluebunch wheatgrass decreased significantly in nested frequency.
- **2002 to 2007 - slightly up (+1)**: The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, increased two-fold, and cover increased to 15%. Four perennial grass species were sampled for the first time following an apparent seeding, and there was a significant increase in the nested frequency of bluebunch wheatgrass. However, two undesirable species, cheatgrass (*Bromus tectorum*) and bulbous bluegrass, also increased significantly. Additionally, jointed goatgrass, a noxious weed, was sampled in two quadrats.
- **2007 to 2012 - up (+2)**: The perennial grass sum of nested frequency, excluding bulbous bluegrass, increased 20%, and cover increased to 32%. Intermediate wheatgrass increased significantly in nested frequency and became the dominant herbaceous species on the site. The undesirable species



cheatgrass, Japanese chess (*Bromus japonicus*), and bulbous bluegrass decreased significantly in nested frequency.

Forb:

- **1983 to 1989 - up (+2):** The perennial forb sum of nested frequency increased two-fold, due in large part to a significant increase in Bonneville pea.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased to 29%.
- **1997 to 2002 - slightly down (-1):** There was an 18% decrease in the sum of nested frequency of perennial forbs, and cover decreased from 9% to 7%. However, the majority of the species that were sampled in 1997 returned after the fire.
- **2002 to 2007 - down (-2):** The perennial forb sum of nested frequency decreased by 24%, and cover decreased to 5%. Annual forb sum of nested frequency increased substantially, and cover increased from 3% to 8%.
- **2007 to 2012 - up (+2):** The sum of nested frequency of perennial forbs increased 26%, and cover increased to 8%. Annual forb sum of nested frequency decreased markedly, and cover decreased to 3%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 2

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	25.1	12.5	10.9	30.0	-0.5	10.0	0.0	<b>88.1</b>	Excellent
02	2.7	0.0	0.0	9.2	-0.2	10.0	0.0	<b>21.7</b>	Very Poor
07	21.6	15.0	3.0	30.0	-4.3	10.0	0.0	<b>75.2</b>	Good
12	24.6	15.0	14.0	30.0	-0.1	10.0	0.0	<b>93.5</b>	Excellent

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 2

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Aegilops cylindrica</i> (a)	-	-	-	-	7	-	-	-	.06	-
G	<i>Agropyron intermedium</i>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b170	c302	-	-	6.56	21.26
G	<i>Agropyron spicatum</i>	bc89	cd126	d136	b86	cd119	a34	6.75	2.00	5.78	.94
G	<i>Bromus brizaeformis</i> (a)	-	-	-	-	5	-	-	-	.01	-
G	<i>Bromus inermis</i>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b28	a9	-	-	.63	.33
G	<i>Bromus japonicus</i> (a)	-	-	a	a <sup>-</sup>	c208	b18	-	-	3.39	.06
G	<i>Bromus tectorum</i> (a)	-	-	bc50	c56	d162	b25	.30	.23	2.32	.05
G	<i>Elymus cinereus</i>	-	-	-	-	2	3	-	-	.15	.38
G	<i>Festuca myuros</i> (a)	-	-	3	1	-	-	.00	.00	-	-
G	<i>Poa bulbosa</i>	a <sup>-</sup>	a <sup>-</sup>	b30	b21	d193	c124	.96	.32	13.27	8.03
G	<i>Poa fendleriana</i>	-	-	6	-	1	-	.18	-	.00	-
G	<i>Poa pratensis</i>	a52	b124	c202	a71	a39	a36	10.03	2.16	.95	1.31
G	<i>Poa secunda</i>	d167	c127	ab63	a43	a43	bc98	1.23	.43	.90	7.85
G	<i>Sitanion hystrix</i>	b26	b24	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	-	-	-	-
G	Unknown grass - annual (a)	-	-	b47	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.39	-	-	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
	Total for Annual Grasses	0	0	100	57	382	43	0.69	0.23	5.78	0.11
	Total for Perennial Grasses	334	401	437	221	595	606	19.16	4.91	28.26	40.12
	Total for Grasses	334	401	537	278	977	649	19.86	5.15	34.05	40.24
F	Allium sp.	ab22	b46	c81	c90	a12	a-	.30	.30	.03	-
F	Alyssum alyssoides (a)	-	-	b46	ab32	c147	a9	.12	.09	.79	.02
F	Antennaria sp.	-	3	2	1	-	-	.00	.00	-	-
F	Arabis sp.	-	-	4	-	-	-	.01	-	-	-
F	Aster sp.	-	-	4	-	-	-	.01	-	-	-
F	Astragalus cibarius	-	-	-	-	10	6	-	-	.31	.06
F	Astragalus sp.	-	-	6	-	3	3	.07	-	.00	.00
F	Cirsium sp.	1	2	8	6	-	5	.23	.01	.15	.10
F	Collinsia parviflora (a)	-	-	b103	c158	b84	a4	.35	1.15	.26	.01
F	Collomia linearis (a)	4	-	-	-	-	-	-	-	-	-
F	Cymopterus sp.	a7	a5	b30	a5	a7	a-	.12	.04	.04	-
F	Descurainia pinnata (a)	-	-	3	1	-	-	.00	.00	.00	-
F	Draba sp. (a)	-	-	b16	a-	c30	a-	.03	-	.10	-
F	Epilobium brachycarpum (a)	-	-	c84	a3	b38	b53	.30	.01	.17	.12
F	Eriogonum racemosum	ab15	b20	a6	a3	ab7	ab7	.01	.01	.10	.07
F	Eriogonum umbellatum	b22	a2	a8	a-	a-	a-	.04	-	-	-
F	Erodium cicutarium (a)	-	-	-	-	5	3	-	-	.04	.00
F	Galium aparine (a)	-	-	c192	b87	b83	b104	5.72	.89	3.71	2.68
F	Geranium sp.	-	-	2	-	-	9	.00	-	-	.04
F	Holosteum umbellatum (a)	-	-	a7	a4	b134	a26	.02	.01	.51	.09
F	Hydrophyllum occidentale	-	1	-	-	4	5	-	-	.03	.21
F	Hymenoxys acaulis	-	-	-	8	-	-	-	.45	-	-
F	Lactuca serriola (a)	-	-	3	1	8	-	.00	.00	.02	-
F	Lappula occidentalis (a)	-	-	-	2	5	3	-	.03	.15	.00
F	Lathyrus brachycalyx	a43	c157	c153	bc120	b104	c146	7.55	6.11	3.86	7.05
F	Medicago sativa	-	-	-	-	2	3	-	-	.21	.18
F	Microsteris gracilis (a)	-	-	b29	a6	b31	a1	.11	.04	.09	.00
F	Montia perfoliata (a)	-	-	-	-	40	-	-	-	1.22	-
F	Phlox longifolia	a9	a19	a25	ab25	bc50	c71	.13	.15	.24	.43
F	Polygonum douglasii (a)	-	-	ab18	c83	b36	a2	.03	.31	.10	.00
F	Ranunculus testiculatus (a)	-	-	b56	b38	b47	a-	.19	.11	.10	-
F	Sisymbrium altissimum (a)	-	-	-	-	3	-	-	-	.00	-
F	Solidago sp.	a-	a-	a-	b13	a-	a-	-	.02	-	-
F	Taraxacum officinale	-	-	-	-	-	1	-	.00	-	.00
F	Tragopogon dubius (a)	a-	a3	a12	a7	b39	b34	.67	.04	.70	.35
F	Trifolium sp.	-	-	-	1	1	-	-	.00	.03	-
F	Unknown forb-annual (a)	-	-	b63	a-	a-	a-	.31	-	-	-
F	Viola sp.	-	-	-	-	2	3	-	-	.00	.00
F	Wyethia amplexicaulis	-	-	-	-	3	-	-	-	.03	-
F	Zigadenus paniculatus	2	4	5	3	4	4	.06	.06	.03	.06
	Total for Annual Forbs	4	3	632	422	730	239	7.89	2.72	8.02	3.30
	Total for Perennial Forbs	121	259	334	275	209	263	8.57	7.20	5.09	8.23

Type	Species	Nestled Frequency					Average Cover %				
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
Total for Forbs		125	262	966	697	939	502	16.46	9.92	13.11	11.53

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

**BROWSE TRENDS--**

Management unit 16A, Study no: 2

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	71	0	4	3	10.86	.01	-	-
B	Gutierrezia sarothrae	3	0	0	1	.56	-	-	-
B	Quercus gambelii	48	52	52	55	11.56	2.68	21.59	24.55
Total for Browse		122	52	56	59	22.99	2.69	21.59	24.55

**CANOPY COVER, LINE INTERCEPT--**

Management unit 16A, Study no: 2

Species	Percent Cover	
	'07	'12
Quercus gambelii	35.70	40.59

**KEY BROWSE ANNUAL LEADER GROWTH--**

Management unit 16A, Study no: 2

Species	Average leader growth (in)
	'12
Artemisia tridentata vaseyana	2.8

**BASIC COVER--**

Management unit 16A, Study no: 2

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	1.25	3.25	54.34	18.60	67.33	69.30
Rock	2.25	3.75	3.68	4.94	2.91	2.08
Pavement	.25	2.00	1.83	12.90	.81	.88
Litter	91.75	81.75	67.93	19.62	49.53	68.70
Cryptogams	.25	2.25	.23	.03	.19	.01
Bare Ground	4.25	7.00	2.00	55.59	3.16	.91

**SOIL ANALYSIS DATA --**

Management unit 16A, Study no: 2, Santaquin Bench

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
13.5	6.0	46.4	29.1	24.6	3.9	20.2	211.2	0.7

PELLET GROUP DATA--

Management unit 16A, Study no: 2

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	-	-	11	1
Elk	1	1	2	-
Deer	7	2	3	-

Days use per acre (ha)		
'02	'07	'12
-	-	-
-	17 (41)	-
1 (3)	9 (22)	5 (12)

BROWSE CHARACTERISTICS--

Management unit 16A, Study no: 2

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>1265</b>	11	63	26	-	26	5	21	21/21
89	<b>799</b>	0	58	42	66	8	0	17	22/28
97	<b>2540</b>	10	74	16	-	28	4	11	27/39
02	<b>0</b>	0	0	0	20	0	0	0	-/-
07	<b>80</b>	0	100	0	-	0	75	0	12/14
12	<b>60</b>	33	67	0	-	33	33	0	16/18
<i>Gutierrezia sarothrae</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>133</b>	0	100	0	-	0	0	0	7/9
97	<b>80</b>	25	50	25	-	0	0	25	9/12
02	<b>0</b>	0	0	0	-	0	0	0	-/-
07	<b>0</b>	0	0	0	-	0	0	0	-/-
12	<b>20</b>	0	100	0	-	0	0	0	7/6
<i>Quercus gambelii</i>									
83	<b>4864</b>	37	62	1	1866	3	0	1	66/39
89	<b>11798</b>	75	23	3	1466	0	0	.56	120/39
97	<b>5100</b>	33	67	1	280	5	2	0	69/46
02	<b>7960</b>	100	0	0	-	0	3	0	7/9
07	<b>13560</b>	6	94	0	340	0	0	0	45/26
12	<b>11100</b>	28	72	0	40	.36	0	0	52/31

SANTAQUIN HILL - TREND STUDY NO. 16A-3-12

Vegetation Type: Gamble Oak/Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#) and [Mountain Loam \(Oak\), R047XA432UT](#)

Land Ownership: DWR

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

Aspect: West

Slope: 25%

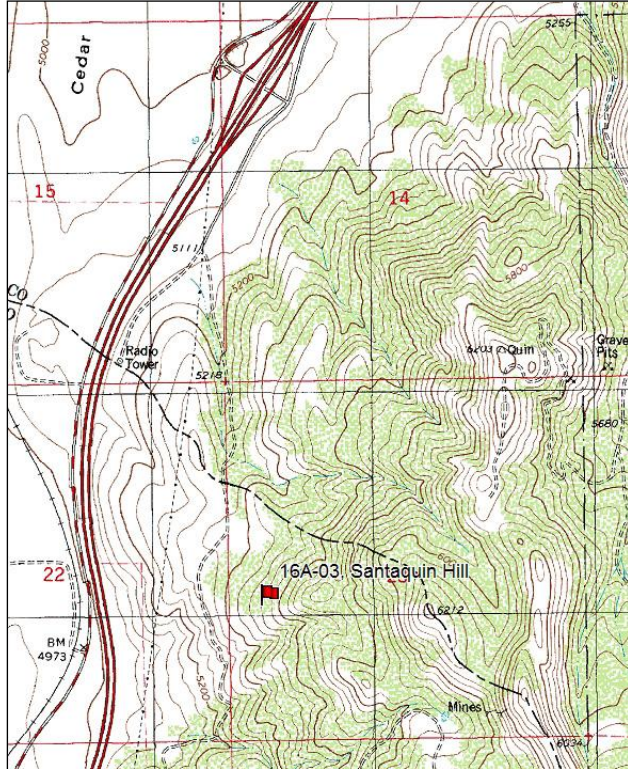
Transect bearing: 350° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft). Stake: 300 stake is missing.

Directions:

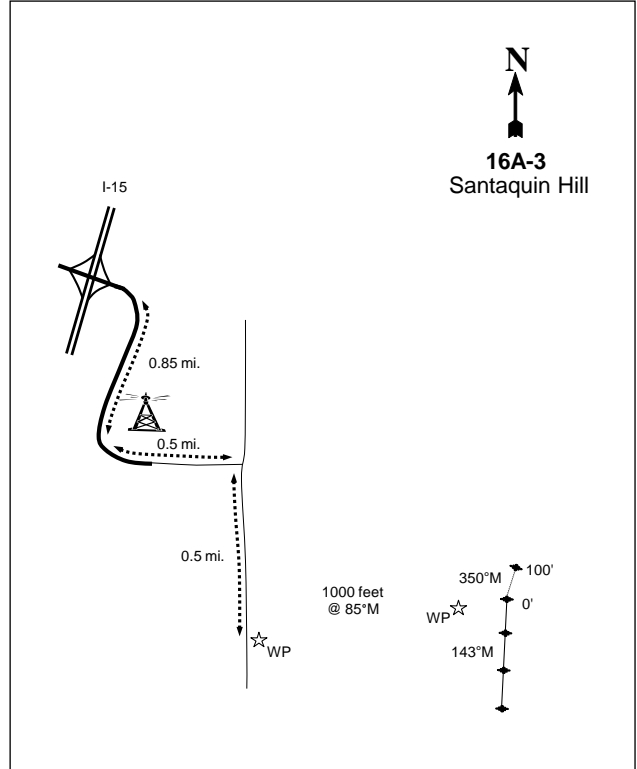
From the south Santaquin exit on I-15, proceed east from the overpass and then southerly onto the frontage road for 0.85 miles to the radio tower. Proceed over the ridge to the east of the radio tower on a faint road for 0.5 miles to an intersection with a dirt road. Proceed south for 0.5 miles to a half high witness post on the east side of the road. From the witness post, walk 1,000 feet at 85 degrees magnetic up the ridge to a full high witness post. The 0-foot baseline stake is 20 feet south of the witness post. A red browse tag, #3967, is attached to the 0-foot baseline stake.

Map Name: Santaquin



Township: 10S Range: 1E Section: 22

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 431422 E 4420247 N

## SANTAQUIN HILL - TREND STUDY NO. 16A-3

### Site Information

Site Description: The study is located on crucial deer and elk winter range on Utah Division of Wildlife Resources (UDWR) property on the boundary between Juab and Utah Counties near the top of Santaquin Hill. The plant community is a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) grassland with interspersed Gambel oak (*Quercus gambelii*). Considerable evidence of deer and elk use in the form of pellet groups, antler drops, and forage use was apparent in 1983. Deer pellet group abundance was very high in 2002 and 2007, but was more moderate in 2012 (Table - Pellet Group Data). Several deer were observed as the site was read in 2007.

Browse: The browse component consists mainly of mountain big sagebrush and Gambel oak. Sagebrush accounts for the majority of the shrub cover (Table - Browse Trends). The mountain big sagebrush stand is a moderately dense population of mostly mature and decadent plants. Recruitment of young plants was poor in all sample years except 1997 when it was considered to be good. Utilization of sagebrush has been mostly moderate to heavy over the course of the study years. Gambel oak is scattered over the site in moderate density. The population has consisted of a mixture of young and mature plants over the sample years, with low decadence and good vigor. The oak plants are low-growing, averaging 27 to 34 inches (69 to 86 cm) in height. Utilization of oak has been mostly light to moderate over the sample years, with the exception of 1997 when use was categorized as moderate to heavy (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is not particularly diverse, but perennial grasses remain an important component on the site. Bluebunch wheatgrass (*Agropyron spicatum*) provides nearly all of the grass cover. The annual grass species cheatgrass (*Bromus tectorum*) and Japanese chess (*B. japonicus*) are common on the site, but have fluctuated in cover over the sample years. Perennial forb composition is fairly diverse, but forbs are not particularly abundant. Annual forbs provide the majority of the forb cover. Pale alyssum (*Alyssum alyssoides*) is the dominant forb. Field bindweed (*Convolvulus arvensis*), a noxious weed, was sampled in one quadrat in 2007.

Soil: The soil is classified as part of the Reebok cobbly loam, which is found on alluvial fans. The parent material consists of alluvium derived from igneous rock and/or colluvium derived from igneous rock. The soils within this classification are characterized as shallow, well drained soils (Soil Survey Staff 2011). There is also a thick lime hardpan beginning approximately 13 to 16 inches (33 to 41 cm) below the surface. The soil texture is a clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is fairly low, with a high amount of protective ground cover provided from vegetation, litter, and rock cover (Table - Basic Cover). The erosion condition was classified as stable in 2002 and 2007, but was moderate in 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - slightly down (-1):** Sagebrush density decreased 15% from 3,198 plants/acre to 2,732 plants/acre. Decadence increased from 25% to 63%, and poor vigor increased from 0% to 20% of the population. Recruitment was low, with young plants comprising only 5% of the population.
- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Decadence of sagebrush decreased to 27%, and recruitment of young sagebrush plants increased to 19% of the population. Plants displaying poor vigor remained stable at 19% of the population.
- **1997 to 2002 - stable (0):** Sagebrush density increased slightly from 2,780 plants/acre to 2,940 plants/acre, but cover decreased from 10% to 9%. However, recruitment of young plants decreased to

only 5% of the population. Plants classified as decadent increased to 39%, poor vigor increased to 26%.

- **2002 to 2007 - stable (0):** Sagebrush density decreased slightly to 2,820 plants/acre, but cover increased to 12%. Recruitment remained low, while decadence increased slightly to 43% of the population. Plants displaying poor vigor remained stable at 26% of the population.
- **2007 to 2012 - slightly down (-1):** Density of mountain big sagebrush decreased 14% to 2,420 plants/acre, but cover increased to near 13%. Decadence decreased to 21%, and poor vigor decreased to 13% of the population. Recruitment of young sagebrush plants increased, but remained low at 7% of the population.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency for perennial grasses increased 54%. Bluebunch wheatgrass and Sandberg wheatgrass (*Poa secunda*) both increased significantly in nested frequency.
- **1989 to 1997 - slightly down (-1):** The sum of nested frequency for perennial grasses decreased by 18%, with a significant decrease in the nested frequency of Sandberg bluegrass.
- **1997 to 2002 - stable (0):** The sum of nested frequency and cover of perennial grasses remained similar. However, the frequency and cover of annual grasses decreased by approximately 50%.
- **2002 to 2007 - stable (0):** The sum of nested frequency for perennial grasses remained similar, but cover decreased slightly from 11% to 9%. Cheatgrass increased significantly in nested frequency, and cover increased from 2% to 5%.
- **2007 to 2012 - stable (0):** Perennial grass sum of nested frequency remained similar, but cover increased to 12%. Annual grass sum of nested frequency remained similar, but cover decreased to 2%.

Forb:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequency for forbs increased two-fold, but perennial forbs remain relatively rare on the site.
- **1989 to 1997 - stable (0):** The perennial forb sum of nested frequency remained similar.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial forbs decreased 22%, cover remained similar. Perennial forbs remain rare on the site, and annual forbs dominate the site.
- **2002 to 2007 - stable (0):** The perennial forb sum of nested frequency decreased by 14%, but cover increased from near 0% to 1%. Annual forb cover increased from 4% to 10%.
- **2007 to 2012 - up (+2):** The sum of nested frequency of perennial forbs increased 52%, and cover increased to 2%. Annual forb cover decreased to 3%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 3

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	22.5	10.3	10.9	22.8	-2.0	0.9	0.0	<b>65.6</b>	Fair-Good
02	16.3	7.5	1.9	22.8	-1.4	0.7	0.0	<b>47.9</b>	Poor
07	22.3	5.3	8.9	18.1	-4.0	2.0	-2.0	<b>50.6</b>	Poor-Fair
12	25.6	11.4	5.6	23.7	-1.1	3.7	0.0	<b>69.0</b>	Good

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 16A, Study no: 3

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Agropyron spicatum</i>	a181	b246	b230	b253	b235	b247	10.56	10.89	8.18	10.66
G	<i>Bromus japonicus</i> (a)	-	-	b129	a-	a6	b115	1.89	-	.04	1.25
G	<i>Bromus tectorum</i> (a)	-	-	b117	b125	c187	a73	.76	1.83	5.26	.22
G	<i>Poa pratensis</i>	8	7	-	3	-	-	-	.03	-	-
G	<i>Poa secunda</i>	a74	b153	a102	a85	a101	a112	.85	.50	.87	1.20
Total for Annual Grasses		0	0	246	125	193	188	2.66	1.83	5.30	1.48
Total for Perennial Grasses		263	406	332	341	336	359	11.42	11.42	9.04	11.86
Total for Grasses		263	406	578	466	529	547	14.09	13.26	14.35	13.34
F	<i>Alyssum alyssoides</i> (a)	-	-	a293	a302	b349	a322	2.36	3.38	9.56	2.42
F	<i>Antennaria rosea</i>	-	-	1	2	-	-	.00	.00	-	-
F	<i>Arabis</i> sp.	ab2	b10	ab7	a-	a-	a-	.02	-	-	-
F	<i>Astragalus beckwithii</i>	a-	a-	a2	a11	ab10	b15	.05	.00	.65	.73
F	<i>Astragalus cibarius</i>	b11	ab5	b11	a-	a-	a-	.21	-	-	-
F	<i>Astragalus eurekensis</i>	a1	a3	a-	a2	a-	b13	-	.01	.00	.59
F	<i>Calochortus nuttallii</i>	ab5	b23	ab12	ab18	ab12	a2	.03	.07	.03	.00
F	<i>Castilleja linariaefolia</i>	a-	a-	a-	ab1	a-	b11	.00	.00	-	.07
F	<i>Chaenactis douglasii</i>	6	5	7	-	-	-	.04	-	-	-
F	<i>Cirsium undulatum</i>	a-	a-	a-	a-	ab5	b8	-	.00	.06	.18
F	<i>Collinsia parviflora</i> (a)	-	-	a21	a17	b52	a10	.05	.07	.17	.03
F	<i>Comandra pallida</i>	-	-	-	4	-	-	-	.01	-	-
F	<i>Convolvulus arvensis</i>	-	-	-	-	1	-	-	-	.00	-
F	<i>Crepis acuminata</i>	-	2	4	2	-	2	.00	.00	-	.00
F	<i>Draba</i> sp. (a)	-	-	3	-	-	-	.00	-	-	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	b36	b21	a-	b32	.08	.05	-	.07
F	<i>Erigeron pumilus</i>	-	-	1	-	-	-	.00	-	-	-
F	<i>Erodium cicutarium</i> (a)	-	-	-	-	4	-	-	-	.00	-
F	<i>Galium aparine</i> (a)	-	-	ab43	a40	b70	a23	.48	.14	.34	.07
F	<i>Helianthus annuus</i> (a)	-	-	3	-	-	-	.00	-	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	ab5	ab7	a-	b8	.01	.01	-	.02
F	<i>Lactuca serriola</i> (a)	-	-	9	1	8	5	.02	.00	.01	.01
F	<i>Microsteris gracilis</i> (a)	-	-	a30	a27	b58	a10	.06	.07	.12	.03
F	<i>Oenothera</i> sp.	-	-	-	-	-	2	-	-	-	.00
F	<i>Petradoria pumila</i>	-	-	1	3	-	4	.03	.15	.15	.15
F	<i>Phlox longifolia</i>	a8	b30	ab28	ab24	ab22	ab19	.05	.05	.08	.10
F	<i>Ranunculus testiculatus</i> (a)	-	-	b50	b67	b61	a17	.13	.25	.14	.04
F	<i>Streptanthus cordatus</i>	1	3	-	-	-	-	-	-	-	-
F	<i>Taraxacum officinale</i>	-	-	-	1	-	-	-	.00	-	-
F	<i>Tragopogon dubius</i> (a)	8	-	2	5	2	3	.03	.01	.03	.01
Total for Annual Forbs		8	0	495	487	604	430	3.24	4.02	10.40	2.73
Total for Perennial Forbs		34	81	74	58	50	76	0.46	0.33	1.00	1.85
Total for Forbs		42	81	569	545	654	506	3.71	4.35	11.40	4.58

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



BROWSE TRENDS--

Management unit 16A, Study no: 3

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	70	72	70	72	10.42	8.92	11.68	12.52
B	Chrysothamnus nauseosus albicaulis	7	3	4	3	.66	.16	.78	.18
B	Gutierrezia sarothrae	23	10	7	8	.81	.03	-	.04
B	Quercus gambelii	30	33	35	38	8.67	4.98	6.70	9.75
Total for Browse		130	118	116	121	20.58	14.10	19.16	22.50

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 3

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	12.94	16.53
Chrysothamnus nauseosus albicaulis	1.20	.88
Gutierrezia sarothrae	-	.46
Quercus gambelii	8.46	15.25

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 3

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.7	2.2	1.6

BASIC COVER--

Management unit 16A, Study no: 3

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	0	7.50	35.97	33.26	43.40	40.35
Rock	17.00	15.00	23.06	25.70	25.57	27.09
Pavement	4.00	14.00	3.11	4.19	2.93	4.27
Litter	61.50	55.25	47.94	47.63	38.72	41.70
Cryptogams	0	1.25	.57	.31	.37	.03
Bare Ground	17.50	7.00	7.12	5.78	7.44	8.84

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 3, Santaquin Hill

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.3	6.8	40.4	29.1	30.6	3.2	16.3	204.8	0.6

PELLET GROUP DATA--

Management unit 16A, Study no: 3

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	11	15	21	16
Elk	2	2	1	3
Deer	20	33	52	17

Days use per acre (ha)		
'02	'07	'12
-	-	-
-	-	-
112 (276)	139 (342)	25 (61)

BROWSE CHARACTERISTICS--

Management unit 16A, Study no: 3

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>3198</b>	4	71	25	-	71	10	0	18/21
89	<b>2732</b>	5	32	63	-	20	0	20	17/22
97	<b>2780</b>	19	54	27	100	43	12	19	17/25
02	<b>2940</b>	5	55	39	20	38	28	26	20/31
07	<b>2820</b>	4	53	43	20	29	45	26	26/35
12	<b>2420</b>	7	72	21	100	33	13	13	24/37
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>140</b>	0	100	0	-	14	14	0	27/35
02	<b>80</b>	0	75	25	-	0	0	25	29/47
07	<b>80</b>	0	0	100	-	0	25	75	29/42
12	<b>60</b>	0	67	33	-	0	0	33	29/46
<i>Gutierrezia sarothrae</i>									
83	<b>533</b>	0	100	0	-	0	0	0	16/10
89	<b>2664</b>	30	60	10	-	0	0	0	9/12
97	<b>740</b>	8	89	3	20	0	0	0	8/7
02	<b>260</b>	8	77	15	-	0	0	15	6/7
07	<b>160</b>	38	63	0	20	0	0	13	9/12
12	<b>560</b>	0	100	0	60	0	0	0	8/11
<i>Quercus gambelii</i>									
83	<b>7131</b>	26	70	4	733	85	0	0	27/18
89	<b>9331</b>	90	9	1	1266	23	0	0	33/21
97	<b>3140</b>	27	71	3	100	26	43	.63	30/29
02	<b>6860</b>	2	98	0	-	.58	16	8	32/20
07	<b>5020</b>	44	51	6	100	7	0	2	34/28
12	<b>5220</b>	17	83	0	380	8	0	0	33/31

WASH CANYON - TREND STUDY NO. 16A-4-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: DWR

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

Aspect: Northeast

Slope: 15-20%

Transect bearing: 315° magnetic

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

Directions:

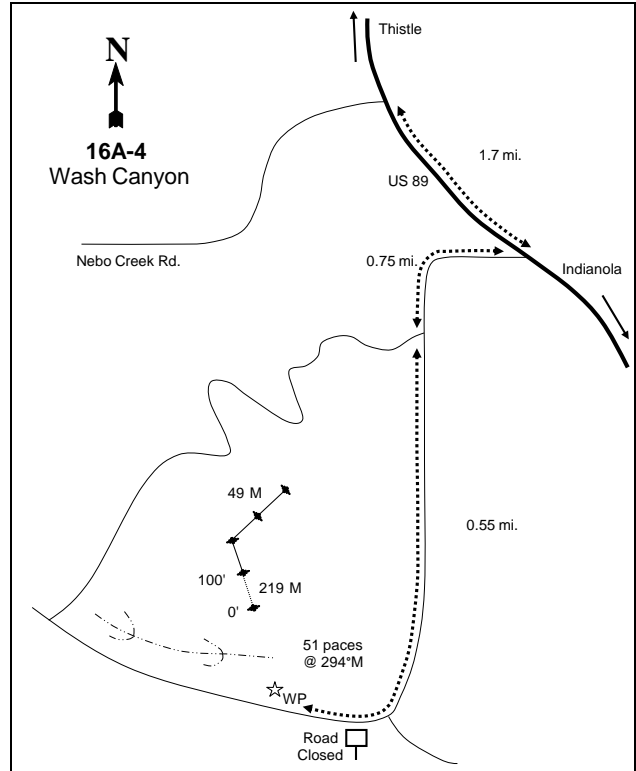
From the intersection of the Nebo Creek Road and U.S. 89, proceed south on U.S. 89 for 1.7 miles (0.6 miles south of mile marker 302) to a road to the west. Turn right (west) and proceed westerly for 0.75 miles, crossing a stream at 0.25 miles and an old railroad bed at 0.30 miles in route to a faint fork in the road. Take the left fork and proceed 0.5 miles to the end of the road. Walk up the old road for 0.05 miles to a half high witness post on the north side of the road. From the witness post, walk 51 paces at an azimuth of 295 degrees magnetic to the 0-foot baseline stake (the baseline stake is 17 paces away from a lone juniper at an azimuth of 56 degree True). The 0-foot baseline stake is a green post located just north of a clump of oak.

Map Name: Spencer Canyon



Township: 11S Range: 3E Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 453707 E 4412101 N

## WASH CANYON - TREND STUDY NO. 16A-4

### Site Information

Site Description: The study samples winter range located in Lower Wash Canyon. It is on Utah Division of Wildlife Resources (UDWR) property surrounded by privately owned land. The vegetation type is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) intermixed with low densities of Utah serviceberry (*Amelanchier utahensis*), true mountain mahogany (*Cercocarpus montanus*), and bitterbrush (*Purshia tridentata*). A few Utah juniper (*Juniperus osteosperma*) trees and Gambel oak (*Quercus gambelii*) clones are scattered over the site and appear to be used as bedding areas. Antler drops and winter killed deer were noted during the 1983 reading. Deer pellet groups have been sampled in high to very high abundance since 1997. Elk pellet groups were sampled in high abundance in 1997, but have been sampled in low abundance since 2002. Cattle pats were sampled in moderate abundance in 1997, but have been sampled in low abundance since 2002 (Table - Pellet Group Data).

Browse: The browse composition is diverse, but big sagebrush provides the majority of the preferred browse cover on the site (Table - Browse Trends). The sagebrush on the site has characteristics of both mountain big sagebrush and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and may be a hybrid of the two big sagebrush subspecies. All of the sagebrush on the site was classified as mountain big sagebrush for the purpose of this study. The big sagebrush stand is a moderately dense population of mostly mature plants. Recruitment of young sagebrush plants has been good throughout the sample years. Decadence within the population has been moderate to low, and vigor has been generally good. In 2007, it was noted that nearly half of the plants were infected by the sagebrush defoliator moth (*Aroga websteri*), and damage to the plants ranged from mild to severe. Utilization of sagebrush has been mostly light to moderate, with the exceptions of 2002 and 2012 when use was more moderate to heavy. Several other species of preferred browse have been sampled infrequently, and include serviceberry, mountain mahogany, and bitterbrush. Due to their low densities and high palatability, use of all three species has been heavy. Mahogany and bitterbrush plants have a short growth form as a result of the high browsing pressure. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*), considered undesirable increaser species, are abundant. However, both species have decreased in density since 1997 (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is diverse and abundant. A mixture of perennial grass species including bluebunch wheatgrass (*Agropyron spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), and needle-and-thread (*Stipa comata*) provides the majority of the herbaceous cover on the site. Cheatgrass (*Bromus tectorum*) was the most abundant grass species sampled in 1997, but has had much lower frequency and cover since then. Perennial forb species are diverse and fairly abundant on the site. Common perennial species include Lewis flax (*Linum lewisii*), scarlet globemallow (*Sphaeralcea coccinea*), and Bonneville peavine (*Lathyrus brachycalyx*). However, annual forb species are also common and have dominated the forb component at times. The most common annual forb species are pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*) (Table - Herbaceous Trends).

Soil: The soil is classified within the Lizzant very cobbly loam series, which occur on mountains and mountain slopes. The parent material consists of colluvium and/or alluvium derived from limestone, sandstone, shale and chert. The soils within this classification are characterized as deep and somewhat excessively drained (Soil Survey Staff 2011). The parent material on this site appears to be limestone. The soil texture is a clay loam with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground cover is moderate, but there is a large amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable since 2002.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly up (+1):** Sagebrush density increased 48% from 1,665 plants/acre to 2,465 plants/acre. However, most of the increase in density was due to a large increase in the recruitment of young plants which may not survive. Decadence increased from 4% to 14%, and poor vigor increased from 2% to 8%, but was still considered good.
- **1989 to 1997 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young plants decreased from 57% to 20% of the population, but recruitment is still considered to be good. Decadence increased to 28%, and poor vigor increased to 17%.
- **1997 to 2002 - slightly up (+1):** Sagebrush density increased 10% from 1,800 plants/acre to 1,980 plants/acre. Decadence decreased to 18%, and poor vigor decreased to 11%. Recruitment of young sagebrush plants decreased to just 4% of the population and is considered to be poor.
- **2002 to 2007 - slightly down (-1):** Sagebrush density decreased 11% to 1,760 plants/acre, but recruitment of young sagebrush plants increased to 17% of the population and is considered good. Decadence increased slightly to 22%, and poor vigor increased to 32%. It was noted that nearly half of the plants were infected by the sagebrush defoliator moth.
- **2007 to 2012 - slightly up (+1):** Density of sagebrush increased 11% to 1,960 plants/acre. Recruitment of young sagebrush plants remained good at 19%. Decadence decreased to 14% and poor vigor decreased to just 5% of the population.

### Grass:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequency of perennial grasses increased by almost 20%. Kentucky bluegrass (*Poa pratensis*) and needle-and-thread increased significantly in nested frequency, while bottlebrush squirreltail (*Sitanion hystrix*) decreased significantly.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequency for perennial grasses increased 16%. Sandberg bluegrass (*Poa secunda*) and bottlebrush squirreltail increased significantly in nested frequency, while needle-and-thread decreased significantly.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass (*Poa bulbosa*), decreased by 12%, though cover increased from 9% to 12%. Bluebunch wheatgrass increased significantly in nested frequency, while cheatgrass decreased significantly. Cheatgrass cover decreased from 6% to less than 1%. Bulbous bluegrass was sampled for the first time, but at a low frequency.
- **2002 to 2007 - stable (0):** The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, increased 4%, but cover decreased to 9%. Sandberg bluegrass increased significantly in nested frequency. However, cheatgrass, bulbous bluegrass, and Japanese chess (*Bromus japonicus*) also increased significantly.
- **2007 to 2012 - slightly up (+1):** The perennial grass sum of nested frequency, excluding bulbous bluegrass, increased 16%, and cover increased to 14%. The undesirable species cheatgrass, bulbous bluegrass, and Japanese chess all decreased significantly in nested frequency.

### Forb:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 10%.
- **1989 to 1997 - down (-2):** The perennial forb sum of nested frequency decreased 48%.
- **1997 to 2002 - down (-2):** The sum of nested frequency for perennial forbs decreased by 40% and cover decreased from 3% to 2%.
- **2002 to 2007 - up (+2):** The sum of nested frequency for perennial species increased two-fold, and cover increased to 4%. However, annual forb sum of nested frequency also increased substantially, and cover increased from 1% to 6%.

- **2007 to 2012 - up (+2):** Perennial forb sum of nested frequency increased by 63%, and cover increased to 8%. Annual forb sum of nested frequency decreased substantially, and cover decreased to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, study no: 4

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	10.2	7.3	9.6	18.4	-4.6	6.1	0.0	<b>46.9</b>	Poor
02	14.3	8.9	4.5	23.0	-0.5	3.8	0.0	<b>54.0</b>	Fair
07	12.9	9.4	7.3	17.2	-2.7	7.0	0.0	<b>51.1</b>	Poor-Fair
12	15.4	10.8	8.2	27.4	-0.3	10.0	0.0	<b>71.5</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 16A, Study no: 4

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	a19	a31	a76	b113	b151	b122	2.19	4.51	5.01	7.46
G	Bromus japonicus (a)	-	-	a-	a4	b28	a-	-	.01	.15	-
G	Bromus tectorum (a)	-	-	d270	c157	d263	b86	6.14	.70	3.40	.43
G	Dactylis glomerata	-	-	1	-	-	-	.00	-	-	-
G	Melica bulbosa	-	-	-	2	-	-	-	.15	-	-
G	Oryzopsis hymenoides	d145	cd128	cb86	b87	a29	a22	1.75	3.75	.53	.87
G	Poa bulbosa	a-	a-	a-	a11	b46	a35	-	.09	.87	.33
G	Poa fendleriana	-	-	4	-	2	6	.15	-	.03	.03
G	Poa pratensis	bc43	c74	b77	b25	a-	bc44	3.04	.22	-	1.20
G	Poa secunda	a3	a3	b47	b38	c81	c116	.86	.46	1.39	2.19
G	Sitanion hystrix	b35	a4	b49	b34	b45	ab24	.58	.84	.60	.41
G	Stipa comata	a19	c75	a25	a22	ab25	b51	.61	1.52	1.00	1.50
Total for Annual Grasses		0	0	270	161	291	86	6.14	0.70	3.55	0.43
Total for Perennial Grasses		264	315	365	332	379	420	9.19	11.58	9.46	14.02
Total for Grasses		264	315	635	493	670	506	15.34	12.29	13.02	14.45
F	Agoseris glauca	a-	a-	ab4	ab8	b16	b12	.01	.04	.18	.05
F	Allium sp.	ab6	ab1	b13	a-	ab10	a-	.03	-	.02	-
F	Alyssum alyssoides (a)	-	-	a107	b185	d307	c241	.29	.80	2.55	1.75
F	Antennaria rosea	-	-	a1	a1	b13	ab5	.03	.00	.19	.15
F	Arabis sp.	-	-	-	-	-	1	-	-	-	.00
F	Aster chilensis	-	-	1	4	5	2	.00	.01	.04	.03
F	Astragalus cibarius	a-	a-	a-	a2	a11	b34	-	.00	.08	.61
F	Astragalus convallarius	b30	b35	a9	a1	a6	a16	.07	.03	.10	.13
F	Astragalus utahensis	a-	a-	a1	a-	ab2	b13	.03	-	.01	.35
F	Balsamorhiza sagittata	-	-	-	-	-	-	-	-	.00	.00
F	Calochortus nuttallii	4	1	5	-	-	2	.01	-	-	.00
F	Camelina microcarpa (a)	-	-	-	-	3	2	-	-	.01	.00

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Castilleja chromosa	a <sup>5</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>3</sup>	b <sup>26</sup>	-	-	.06	.36
F	Chaenactis douglasii	b <sup>29</sup>	a <sup>4</sup>	a <sup>1</sup>	a <sup>-</sup>	a <sup>2</sup>	a <sup>3</sup>	.00	-	.00	.03
F	Chenopodium sp. (a)	-	-	3	-	-	-	.00	-	-	-
F	Cirsium sp.	c <sup>84</sup>	b <sup>56</sup>	a <sup>18</sup>	a <sup>15</sup>	a <sup>10</sup>	a <sup>10</sup>	.17	.24	.22	.20
F	Collinsia parviflora (a)	-	-	a <sup>3</sup>	b <sup>84</sup>	b <sup>116</sup>	a <sup>7</sup>	.00	.23	.31	.02
F	Collomia linearis (a)	-	-	9	1	1	3	.02	.00	.00	.00
F	Comandra pallida	3	3	2	-	5	12	.00	-	.09	.02
F	Crepis acuminata	a <sup>2</sup>	a <sup>4</sup>	a <sup>3</sup>	a <sup>-</sup>	a <sup>10</sup>	b <sup>49</sup>	.00	-	.04	.64
F	Cryptantha sp.	12	28	13	11	10	17	.10	.08	.11	.12
F	Cymopterus sp.	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>2</sup>	b <sup>11</sup>	-	-	.00	.03
F	Descurainia pinnata (a)	-	-	b <sup>39</sup>	a <sup>1</sup>	a <sup>4</sup>	a <sup>-</sup>	.11	.00	.02	-
F	Epilobium brachycarpum (a)	-	-	b <sup>11</sup>	ab <sup>2</sup>	a <sup>2</sup>	a <sup>-</sup>	.05	.01	.00	-
F	Erigeron divergens	a <sup>-</sup>	b <sup>5</sup>	a <sup>1</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.00	-	-	-
F	Erigeron pumilus	6	-	-	-	-	-	-	-	-	-
F	Eriogonum racemosum	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	ab <sup>3</sup>	b <sup>11</sup>	ab <sup>3</sup>	.00	.06	.13	.06
F	Eriogonum umbellatum	9	14	2	1	-	16	.03	.00	-	.05
F	Hackelia patens	36	21	37	36	13	33	.36	.33	.13	.60
F	Holosteum umbellatum (a)	-	-	-	-	-	4	-	-	-	.01
F	Lappula occidentalis (a)	-	-	ab <sup>5</sup>	a <sup>-</sup>	b <sup>21</sup>	ab <sup>5</sup>	.01	-	.17	.01
F	Lathyrus brachycalyx	a <sup>21</sup>	b <sup>55</sup>	a <sup>3</sup>	a <sup>8</sup>	b <sup>66</sup>	c <sup>136</sup>	.01	.01	.58	2.79
F	Linum lewisii	d <sup>125</sup>	c <sup>98</sup>	cd <sup>81</sup>	a <sup>-</sup>	b <sup>8</sup>	b <sup>21</sup>	.72	-	.11	.15
F	Lithophragma sp.	-	-	6	-	-	-	.30	-	-	-
F	Lithospermum ruderales	ab <sup>1</sup>	b <sup>10</sup>	a <sup>-</sup>	ab <sup>1</sup>	ab <sup>1</sup>	ab <sup>4</sup>	-	.03	.19	.18
F	Lomatium sp.	-	4	-	-	5	2	-	-	.02	.00
F	Machaeranthera canescens	3	-	3	-	-	-	.00	-	-	-
F	Microsteris gracilis (a)	-	-	-	2	-	-	-	.00	-	-
F	Oenothera sp.	2	-	2	-	-	-	.03	-	-	-
F	Orobancha fasciculata	-	-	3	-	-	-	.00	-	-	-
F	Penstemon sp.	-	-	-	-	-	-	-	-	-	.03
F	Phlox hoodii	-	-	-	-	-	4	-	-	-	.01
F	Phlox longifolia	a <sup>6</sup>	c <sup>67</sup>	a <sup>3</sup>	a <sup>5</sup>	b <sup>35</sup>	b <sup>38</sup>	.00	.02	.21	.47
F	Polygonum douglasii (a)	-	-	b <sup>19</sup>	a <sup>1</sup>	a <sup>-</sup>	a <sup>-</sup>	.06	.00	-	-
F	Ranunculus testiculatus (a)	-	-	a <sup>-</sup>	b <sup>16</sup>	d <sup>240</sup>	c <sup>60</sup>	-	.05	3.06	.14
F	Schoenocrambe linifolia	-	-	-	7	-	3	-	.02	-	.00
F	Senecio multilobatus	-	2	-	-	-	4	-	-	-	.03
F	Sphaeralcea coccinea	b <sup>137</sup>	b <sup>168</sup>	a <sup>88</sup>	a <sup>77</sup>	a <sup>96</sup>	a <sup>82</sup>	1.04	.98	.95	.71
F	Streptanthus cordatus	-	-	-	-	3	1	-	-	.00	.00
F	Taraxacum officinale	2	-	1	-	-	-	.00	-	-	-
F	Tragopogon dubius (a)	bc <sup>49</sup>	ab <sup>28</sup>	c <sup>67</sup>	a <sup>4</sup>	a <sup>9</sup>	a <sup>20</sup>	.44	.04	.02	.17
Total for Annual Forbs		49	28	263	296	703	342	1.00	1.15	6.18	2.11
Total for Perennial Forbs		523	576	301	180	343	560	3.03	1.91	3.51	7.92
Total for Forbs		572	604	564	476	1046	902	4.03	3.06	9.70	10.03

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

BROWSE TRENDS--

Management unit 16A, Study no: 4

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier utahensis	2	3	2	2	-	.15	-	.00
B	Artemisia tridentata vaseyana	56	57	57	60	7.28	9.81	8.82	10.67
B	Cercocarpus montanus	2	1	2	1	.15	.15	.15	-
B	Chrysothamnus nauseosus albicaulis	1	2	2	2	-	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	90	86	79	65	8.12	6.80	4.78	4.38
B	Gutierrezia sarothrae	71	31	72	27	2.68	.58	2.55	1.15
B	Opuntia sp.	27	30	23	16	.73	1.15	.65	1.27
B	Pinus edulis	1	1	1	1	-	.15	.15	.38
B	Purshia tridentata	7	6	7	6	.56	.42	.56	.86
B	Quercus gambelii	3	3	2	2	-	1.00	.78	.78
B	Ribes sp.	1	0	0	0	-	-	-	-
B	Symphoricarpos oreophilus	0	0	0	1	-	-	-	-
Total for Browse		261	220	247	183	2	20.22	18.46	19.51

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 4

Species	Percent Cover		
	'02	'07	'12
Amelanchier utahensis	.15	.13	.18
Artemisia tridentata vaseyana	7.25	9.98	9.71
Cercocarpus montanus	-	.13	.13
Chrysothamnus nauseosus albicaulis	.25	.51	.61
Chrysothamnus viscidiflorus viscidiflorus	4.00	4.40	3.13
Gutierrezia sarothrae	.70	2.46	.25
Opuntia sp.	.31	.46	.38
Pinus edulis	.36	.40	.71
Purshia tridentata	.50	.35	.48
Quercus gambelii	.18	.26	.41

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 4

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.3	1.6	1.5
Cercocarpus montanus	-	.9	1.1
Purshia tridentata	-	1.3	1.5



POINT-QUARTER TREE DATA--

Management unit 16A, Study no: 4

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	39	25	27	2.6	5.4	3.4

BASIC COVER--

Management unit 16A, Study no: 4

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	4.25	8.75	44.12	32.27	41.40	44.61
Rock	4.00	8.25	5.81	5.52	5.47	6.32
Pavement	8.00	15.50	9.30	6.17	6.27	6.62
Litter	45.25	37.75	40.90	40.87	30.93	36.89
Cryptogams	0	.25	.38	.00	.04	.71
Bare Ground	38.50	29.50	14.36	31.73	25.87	21.55

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 4, Wash Canyon

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.4	6.8	35.0	31.2	33.8	3.4	13.5	99.2	0.6

PELLET GROUP DATA--

Management unit 16A, Study no: 4

Type	Quadrat Frequency				Days use per acre (ha)			
	'97	'02	'07	'12	'97	'02	'07	'12
Rabbit	2	14	22	8	-	-	-	-
Elk	21	12	17	1	64 (159)	12 (30)	9 (23)	3 (8)
Deer	58	68	48	14	80 (198)	169 (417)	92 (228)	37 (91)
Cattle	2	1	1	1	22 (54)	1 (2)	9 (23)	9 (23)

BROWSE CHARACTERISTICS--

Management unit 16A, Study no: 4

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Amelanchier utahensis									
83	0	0	0	0	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
97	40	0	50	50	-	0	50	50	-/-
02	60	33	0	67	-	0	33	0	9/17
07	40	50	50	0	-	100	0	0	14/23
12	40	0	100	0	-	0	100	0	15/22

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>1665</b>	32	64	4	-	0	0	2	27/24
89	<b>2465</b>	57	30	14	-	39	19	8	29/32
97	<b>1800</b>	20	52	28	-	14	0	17	31/38
02	<b>1980</b>	4	78	18	-	39	35	11	25/32
07	<b>1760</b>	17	61	22	420	50	8	32	27/38
12	<b>1960</b>	19	66	14	-	32	24	5	21/32
<i>Cercocarpus montanus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>40</b>	50	50	-	-	0	50	0	11/56
02	<b>20</b>	0	100	-	-	0	100	0	18/23
07	<b>40</b>	0	100	-	-	0	100	0	16/26
12	<b>20</b>	0	100	-	-	100	0	0	18/32
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>20</b>	0	100	0	-	0	0	0	-/-
02	<b>40</b>	0	100	0	-	100	0	0	25/25
07	<b>40</b>	0	50	50	-	0	0	0	38/35
12	<b>40</b>	0	100	0	-	0	0	0	33/44
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>4298</b>	0	98	2	-	0	0	0	13/19
89	<b>10631</b>	17	68	15	-	0	0	27	11/16
97	<b>7280</b>	13	82	6	-	0	0	2	9/14
02	<b>7520</b>	2	65	34	-	1	0	16	9/13
07	<b>6140</b>	4	87	9	420	0	0	3	8/12
12	<b>5300</b>	19	81	0	20	3	0	.37	9/14
<i>Gutierrezia sarothrae</i>									
83	<b>2665</b>	15	85	0	-	0	0	0	13/12
89	<b>7531</b>	22	71	7	-	0	0	2	11/12
97	<b>6420</b>	15	85	1	360	0	0	.62	10/13
02	<b>1600</b>	0	16	84	-	0	3	76	7/7
07	<b>7420</b>	12	86	2	20	0	0	.53	8/7
12	<b>1480</b>	45	54	1	-	0	0	0	7/11
<i>Juniperus osteosperma</i>									
83	<b>66</b>	50	50	-	-	0	0	0	47/30
89	<b>66</b>	50	50	-	-	0	50	0	71/35
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Opuntia sp.</i>										
83	466	0	100	0	-	0	0	0	8/17	
89	1865	16	84	0	33	0	0	0	8/10	
97	920	11	87	2	20	0	0	2	5/12	
02	1240	3	77	19	-	0	0	6	5/10	
07	780	5	87	8	20	0	0	21	6/11	
12	620	3	97	0	-	3	0	0	5/11	
<i>Pinus edulis</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	20	100	0	-	-	0	0	0	-/-	
02	20	100	0	-	-	0	0	0	-/-	
07	20	0	100	-	-	0	0	0	-/-	
12	20	100	0	-	-	0	0	0	30/20	
<i>Purshia tridentata</i>										
83	166	20	80	0	-	0	80	80	23/37	
89	232	43	0	57	33	14	71	14	-/-	
97	140	0	100	0	-	71	29	0	8/39	
02	120	0	33	67	-	0	83	33	9/13	
07	140	14	86	0	-	14	71	0	8/15	
12	140	0	71	29	-	29	71	0	12/31	
<i>Quercus gambelii</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	60	67	33	0	-	33	0	0	-/-	
02	100	60	20	20	-	20	20	80	28/56	
07	300	0	100	0	-	0	0	0	49/35	
12	40	0	100	0	-	0	0	0	-/-	
<i>Ribes sp.</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	40	100	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Symphoricarpos oreophilus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	0	100	-	-	100	0	0	21/23	

NEBO CREEK - TREND STUDY NO. 16A-5-12

Vegetation Type: Stickyleaf Rabbitbrush

Range Type: Crucial Deer Winter/Spring, Substantial Elk Spring/Fall

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

Land Ownership: USFS

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

Aspect: Northeast

Slope: 10%

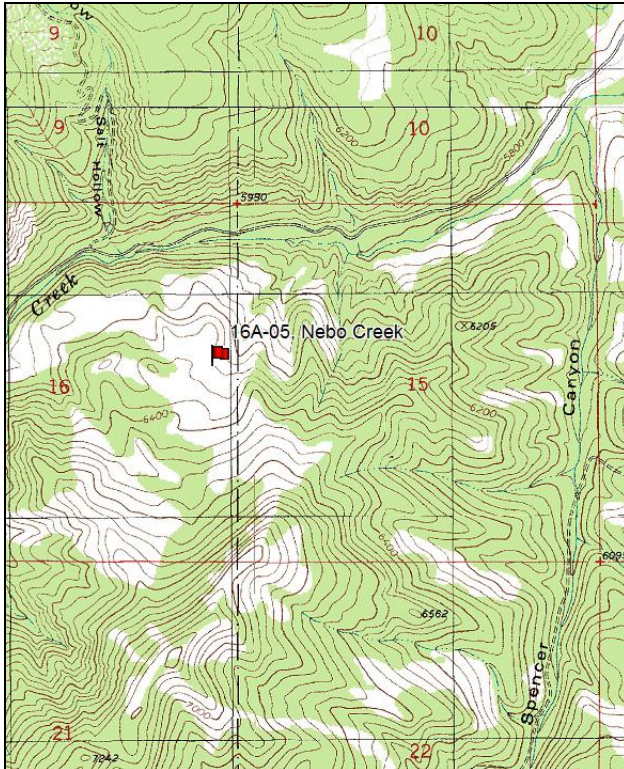
Transect bearing: 226° magnetic

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

Directions:

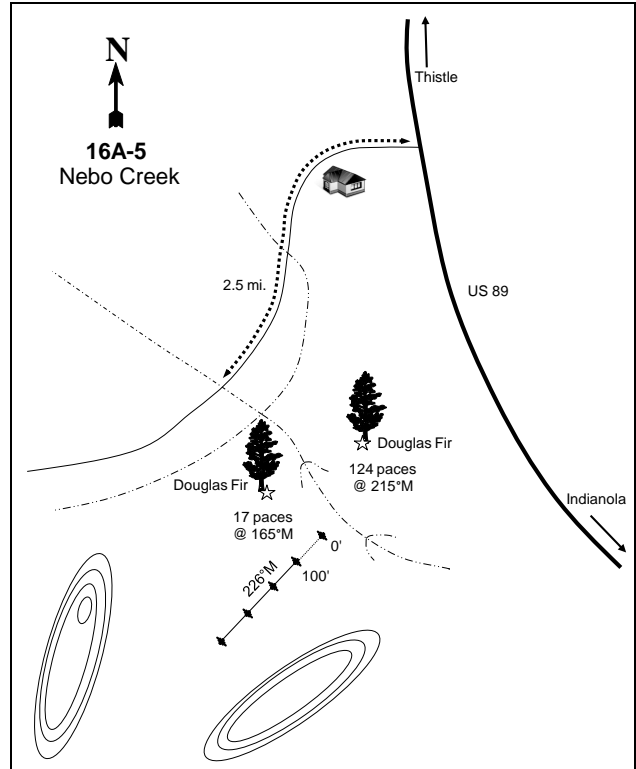
Beginning at the intersection of Highway US-89 and the Nebo Creek Road, proceed 2.5 miles westerly up Nebo Creek to the USFS boundary sign or the cattle guard. Park here. Take an azimuth of 185 degrees magnetic to the top of a lone Douglas fir. Proceed across Nebo Creek and uphill to the Douglas fir tree. From here walk at an azimuth of 215 degrees magnetic up a drainage to a fence line. From the fence line, walk 124 paces at the same azimuth to a second but smaller Douglas fir within a clump of oak brush. From this tree, the 0-foot baseline stake is 17 paces away at an azimuth of 165 degree magnetic.

Map Name: Spencer Canyon



Township: 11S Range: 3E Section: 16

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 449858 E 4412882 N

## NEBO CREEK - TREND STUDY NO. 16A-5

### Site Information

Site Description: The study is located on National Forest land in the Nebo Creek. The study initially sampled a Gambel oak (*Quercus gambelii*) clone, but the transect was moved in 1997 to sample the mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) community that was more prevalent on the slopes. Only data collected since 1997 is included in this report. The entire area burned in the Nebo Creek fire of 2001, which burned 4,378 acres. The fire removed most of the shrub species from the site. The area serves as year-round range for deer and elk, and is grazed by livestock in the summer. During the 1983 reading, numerous fresh deer and elk pellet groups, as well as three live deer were observed. The carcasses of two deer and an elk were observed, along with two separate antler drops. Deer were also observed during the 2007 reading. Deer pellet groups have been sampled in low abundance since 2002. Elk pellet groups were sampled in low abundance in 2002 and 2012, but more moderate abundance in 2007. Sheep pellet groups have been sampled in low abundance since 2002. Due to the difficulty of identifying the differences between elk and sheep pellets, it is likely that some of the sheep pellets were actually elk. Cattle sign was sampled in low abundance in 2002 and 2012, but moderately high abundance in 2007 (Table - Pellet Group Data).

Browse: Prior to the fire, the area was dominated by a stand of basin big sagebrush and mountain big sagebrush, with a large component of sticky leaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*). The big sagebrush population was healthy with good recruitment of young plants, low decadence, and good vigor. Utilization of sagebrush was mostly light. The fire removed all of the big sagebrush in 2001, and no plants have been sampled in density since 2002. Sticky leaf low rabbitbrush was the most common shrub prior to the fire, and has been the only common shrub species sampled following the fire (Table - Browse Characteristics). Several oak clones survived the fire and are scattered across the area.

Herbaceous Understory: Perennial grasses comprise the majority of the herbaceous component. The most prevalent perennial grass species are bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). Kentucky bluegrass (*P. pratensis*) was prevalent prior to the fire, but has been rare since 2002. Cheatgrass (*Bromus tectorum*) is common on the site and has dominated the grass component at times. The undesirable perennial species bulbous bluegrass (*Poa bulbosa*) was sampled for the first time in 2007 and was common on the site in 2012. Perennial forbs are diverse and abundant. Perennial forb species provided as much cover as perennial grasses prior to the fire, but were greatly reduced following the fire. Common perennial forb species include Bonneville peavine (*Lathyrus brachycalyx*), American vetch (*Vicia americana*), stickseed (*Hackelia patens*), and western aster (*Aster chilensis*). Common houndstongue (*Cynoglossum officinale*), a noxious weed, has been sampled at low frequency and cover (Table - Herbaceous Trends).

Soil: The soil is classified as a Lizzant stony loam, which occurs on alluvial fans. The soils in this series are characterized as very deep and somewhat excessively drained. These soils are formed in alluvium and colluvium derived from limestone, sandstone, and shale (Soil Survey Staff 2011). The soil texture is a clay loam with a moderately acidic soil reaction (pH 6.0) (Table - Soil Analysis Data). There is some large rock cobble on the surface and throughout the profile. Bare ground cover was low prior to the fire, but has been moderate to high since 2002. Vegetation provides the majority of the protective ground cover on the site (Table - Basic Cover). The soil erosion condition was classified as slight in 2002, but stable in 2007 and 2012.

### Trend Assessments

#### Browse:

- **1997 to 2002 - down (-2):** Both sagebrush subspecies were eliminated by the fire, and only low densities of rabbitbrush and Gambel oak were sampled.
- **2002 to 2007 - stable (0):** Preferred browse species remained rare on the site.

- **2007 to 2012 - stable (0):** Preferred browse species remained rare on the site.

Grass:

- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial grasses decreased 46%, and cover decreased from 23% to 10%. Cheatgrass decreased significantly in nested frequency.
- **2002 to 2007 - down (-2):** Perennial grass sum of nested frequency, excluding bulbous bluegrass, increased 24%, and cover increased to 15%. However, cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 24%. Bulbous bluegrass was sampled for the first time on the site.
- **2007 to 2012 - up (+2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, increased 27%, and cover increased to 18%. Cheatgrass decreased significantly in nested frequency, and cover decreased to 4%. Bulbous bluegrass increased significantly in nested frequency, and cover increased from less than 1% to 1%.

Forb:

- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial forbs decreased 58%, and cover decreased from 25% to 7%.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 11%, and but cover decreased slightly to 6%.
- **2007 to 2012 - up (+2):** The perennial forb sum of nested frequency increased 22%, though cover remained similar at 6%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 5

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	8.5	14.0	9.0	30.0	-1.9	10.0	-2.0	<b>67.6</b>	Good
02	0.0	0.0	0.0	20.4	-0.4	10.0	0.0	<b>30.0</b>	Very Poor
07	0.0	0.0	0.0	29.5	-18.4	10.0	-2.0	<b>19.2</b>	Very Poor
12	0.0	0.0	0.0	30.0	-2.6	10.0	-2.0	<b>35.4</b>	Very Poor-Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 5

Type	Species	Nested Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	2	-	-	-	.15	-	-	-
G	Agropyron spicatum	cd78	ab28	bc57	d98	3.05	.91	3.37	4.12
G	Bromus japonicus (a)	-	-	1	4	-	-	.00	.00
G	Bromus tectorum (a)	b131	a34	d313	c237	2.50	.53	24.47	3.48
G	Elymus cinereus	5	2	8	14	.97	.15	1.25	.95
G	Elymus junceus	-	6	-	-	-	1.41	-	.03
G	Melica bulbosa	c78	bc52	b43	a18	2.05	1.68	.44	.09
G	Oryzopsis hymenoides	1	-	-	-	.03	-	-	-
G	Poa bulbosa	a-	a-	b19	c55	-	-	.52	1.28
G	Poa fendleriana	-	7	3	5	-	.01	.03	.09

Type	Species	Nested Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Poa pratensis</i>	<sub>b</sub> 173	<sub>a</sub> 24	<sub>a</sub> 33	<sub>a</sub> 25	8.10	.35	.73	.13
G	<i>Poa secunda</i>	<sub>ab</sub> 154	<sub>a</sub> 146	<sub>b</sub> 191	<sub>c</sub> 262	8.42	5.62	8.91	12.68
G	<i>Sitanion hystrix</i>	-	3	-	3	-	.03	-	.00
G	<i>Stipa columbiana</i>	5	-	-	-	.01	-	-	-
G	<i>Stipa lettermani</i>	4	4	1	-	.03	.03	.03	-
Total for Annual Grasses		131	34	314	241	2.50	0.53	24.48	3.49
Total for Perennial Grasses		500	272	355	480	22.83	10.20	15.29	19.40
Total for Grasses		631	306	669	721	25.34	10.74	39.77	22.89
F	<i>Achillea millefolium</i>	<sub>ab</sub> 17	<sub>a</sub> 2	<sub>a</sub> -	<sub>a</sub> -	.88	.00	-	-
F	<i>Agoseris glauca</i>	67	59	58	68	.84	.39	.37	.62
F	<i>Allium campanulatum</i>	<sub>b</sub> 62	<sub>a</sub> 10	<sub>a</sub> 2	<sub>a</sub> -	.33	.13	.01	-
F	<i>Alyssum alyssoides</i> (a)	<sub>a</sub> 6	<sub>a</sub> 24	<sub>b</sub> 106	<sub>c</sub> 167	.04	.22	1.01	2.04
F	<i>Antennaria rosea</i>	-	3	-	3	-	.00	-	.00
F	<i>Arabis</i> sp.	-	-	-	3	-	-	-	.00
F	<i>Artemisia ludoviciana</i>	3	-	7	8	.15	-	.76	.33
F	<i>Aster chilensis</i>	<sub>c</sub> 76	<sub>a</sub> 1	<sub>bc</sub> 67	<sub>ab</sub> 37	1.86	.03	1.60	.70
F	<i>Astragalus beckwithii</i>	<sub>c</sub> 49	<sub>b</sub> 13	<sub>a</sub> -	<sub>ab</sub> 6	1.82	.21	-	.18
F	<i>Astragalus convallarius</i>	-	1	-	-	-	.03	-	-
F	<i>Balsamorhiza sagittata</i>	8	12	5	10	.73	1.23	.16	.61
F	<i>Calochortus nuttallii</i>	6	7	2	-	.01	.01	.00	-
F	<i>Camelina microcarpa</i> (a)	<sub>b</sub> 36	<sub>a</sub> -	<sub>c</sub> 60	<sub>bc</sub> 54	.13	-	.16	.33
F	<i>Chenopodium album</i> (a)	3	-	-	-	.00	-	-	-
F	<i>Cirsium</i> sp.	<sub>b</sub> 13	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 11	.07	-	-	.11
F	<i>Collinsia parviflora</i> (a)	<sub>c</sub> 258	<sub>b</sub> 123	<sub>a</sub> 53	<sub>ab</sub> 81	3.96	.63	.12	.88
F	<i>Collomia linearis</i> (a)	<sub>b</sub> 119	<sub>a</sub> -	<sub>a</sub> 3	<sub>a</sub> 8	.68	-	.00	.21
F	<i>Comandra pallida</i>	-	-	-	2	-	-	-	.03
F	<i>Crepis acuminata</i>	56	55	36	47	.82	1.85	.75	.44
F	<i>Cymopterus longipes</i>	7	-	-	-	.04	-	-	-
F	<i>Cynoglossum officinale</i>	<sub>b</sub> 12	<sub>a</sub> -	<sub>b</sub> 12	<sub>ab</sub> 5	.17	-	.07	.12
F	<i>Delphinium nuttallianum</i>	5	1	-	-	.04	.00	-	-
F	<i>Descurainia pinnata</i> (a)	<sub>a</sub> 10	<sub>a</sub> 14	<sub>b</sub> 34	<sub>b</sub> 35	.06	.16	.10	.17
F	<i>Epilobium brachycarpum</i> (a)	<sub>b</sub> 16	<sub>a</sub> -	<sub>ab</sub> 8	<sub>b</sub> 11	.11	-	.02	.07
F	<i>Eriogonum racemosum</i>	3	4	1	7	.03	.00	.03	.03
F	<i>Hackelia patens</i>	<sub>c</sub> 72	<sub>a</sub> 5	<sub>b</sub> 21	<sub>c</sub> 78	2.07	.09	.34	.99
F	<i>Holosteum umbellatum</i> (a)	<sub>a</sub> -	<sub>a</sub> 3	<sub>a</sub> -	<sub>b</sub> 28	-	.00	-	.09
F	<i>Hymenoxys acaulis</i>	2	-	-	-	.30	-	-	-
F	<i>Lactuca serriola</i> (a)	<sub>ab</sub> 18	<sub>a</sub> 1	<sub>b</sub> 29	<sub>c</sub> 59	.38	.33	.11	.42
F	<i>Lappula occidentalis</i> (a)	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 60	<sub>b</sub> 43	-	-	.32	.40
F	<i>Lathyrus brachycalyx</i>	172	164	154	184	9.14	2.15	1.55	1.52
F	<i>Lithospermum ruderale</i>	10	1	1	-	.48	.01	.03	-
F	<i>Lupinus argenteus</i>	<sub>a</sub> 4	<sub>ab</sub> 4	<sub>ab</sub> 9	<sub>b</sub> 13	.06	.16	.19	.32
F	<i>Microsteris gracilis</i> (a)	<sub>a</sub> -	<sub>b</sub> 23	<sub>c</sub> 160	<sub>b</sub> 30	-	.28	1.22	.29
F	<i>Penstemon</i> sp.	-	-	1	1	-	-	.00	.01
F	<i>Phlox longifolia</i>	<sub>b</sub> 17	<sub>a</sub> 1	<sub>b</sub> 18	<sub>a</sub> 2	.08	.00	.09	.00
F	<i>Polygonum douglasii</i> (a)	<sub>b</sub> 17	<sub>ab</sub> 5	<sub>a</sub> 1	<sub>ab</sub> 13	.06	.01	.00	.02

Type	Species	Nested Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
F	Ranunculus testiculatus (a)	28	20	38	45	.15	.06	.32	.30
F	Senecio integerrimus	<sub>b</sub> 36	<sub>a</sub> -	<sub>a</sub> 4	<sub>a</sub> 2	1.08	-	.06	.00
F	Sisymbrium altissimum (a)	<sub>a</sub> -	<sub>a</sub> -	<sub>c</sub> 109	<sub>b</sub> 17	-	-	1.00	.17
F	Taraxacum officinale	<sub>b</sub> 46	<sub>a</sub> 6	<sub>a</sub> -	<sub>a</sub> 1	.38	.03	-	.00
F	Tragopogon dubius (a)	<sub>b</sub> 16	<sub>a</sub> -	<sub>b</sub> 24	<sub>c</sub> 95	.15	-	.31	.70
F	Veronica biloba (a)	<sub>b</sub> 17	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	.27	-	-	-
F	Vicia americana	<sub>b</sub> 106	<sub>a</sub> 6	<sub>a</sub> 3	<sub>a</sub> -	3.71	.18	.06	-
F	Viguiera multiflora	-	5	-	-	.03	.01	-	-
Total for Annual Forbs		544	213	685	686	6.01	1.71	4.73	6.14
Total for Perennial Forbs		849	360	401	488	25.17	6.57	6.12	6.07
Total for Forbs		1393	573	1086	1174	31.18	8.28	10.85	12.21

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 5

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier utahensis	1	0	0	0	.03	-	-	-
B	Artemisia tridentata tridentata	37	0	0	0	3.98	-	-	-
B	Artemisia tridentata vaseyana	15	0	0	0	2.98	-	-	-
B	Chrysothamnus nauseosus consimilis	1	1	1	2	.15	.03	.15	.00
B	Chrysothamnus viscidiflorus viscidiflorus	72	20	63	62	8.75	.35	8.12	7.30
B	Gutierrezia sarothrae	0	0	0	1	.00	-	-	-
B	Opuntia sp.	3	0	1	0	.06	-	-	-
B	Quercus gambelii	1	0	1	1	.63	-	-	-
Total for Browse		130	21	66	66	16.59	0.38	8.27	7.31

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 5

Species	Percent Cover		
	'02	'07	'12
Chrysothamnus nauseosus consimilis	-	.03	-
Chrysothamnus viscidiflorus viscidiflorus	.38	12.39	9.19
Quercus gambelii	-	-	.30



BASIC COVER--

Management unit 16A, Study no: 5

Cover Type	Average Cover %			
	'97	'02	'07	'12
Vegetation	61.17	18.42	62.62	54.55
Rock	1.88	5.83	2.13	2.61
Pavement	1.65	10.49	1.46	1.55
Litter	55.32	7.27	24.93	25.62
Cryptogams	.54	0	.00	.01
Bare Ground	8.40	64.55	18.93	22.78

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 5, Nebo Creek

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.2	6.0	34.7	34.7	30.6	3.5	39.6	320.0	0.5

PELLET GROUP DATA--

Management unit 16A, Study no: 5

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Sheep	-	2	-	-	1 (3)	-	8 (20)
Elk	4	1	9	4	3 (7)	23 (58)	6 (15)
Deer	7	1	6	3	7 (17)	1 (2)	1 (2)
Cattle	5	-	3	4	1 (2)	29 (72)	7 (18)

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 5

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier utahensis</i>									
97	20	0	100	-	-	0	100	0	29/43
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Artemisia tridentata tridentata</i>									
97	1080	17	83	0	20	0	0	0	40/47
02	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	-/-
12	0	0	0	0	-	0	0	0	36/53
<i>Artemisia tridentata vaseyana</i>									
97	400	25	65	10	-	5	0	0	27/39
02	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	16/18
12	0	0	0	0	-	0	0	0	23/36
<i>Chrysothamnus nauseosus consimilis</i>									
97	20	0	100	-	-	0	0	0	37/41
02	20	0	100	-	-	0	0	0	9/8
07	20	0	100	-	-	100	0	0	31/55
12	40	100	0	-	-	0	0	50	33/63
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
97	3540	1	98	2	-	0	0	2	17/23
02	720	61	39	0	-	0	0	3	6/7
07	2800	1	98	1	-	1	0	0	16/24
12	2560	9	86	5	20	.78	0	48	17/30
<i>Gutierrezia sarothrae</i>									
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
97	80	0	100	-	-	0	0	0	5/12
02	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	5/8
12	0	0	0	-	-	0	0	0	8/15
<i>Quercus gambelii</i>									
97	60	0	100	0	-	0	0	0	21/12
02	0	0	0	0	-	0	0	0	-/-
07	20	0	100	0	-	0	0	0	28/17
12	20	0	100	0	-	0	0	0	60/49

HOP CREEK BROWSE - TREND STUDY NO. 16A-6-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: DWR

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

Aspect: South

Slope: 5%

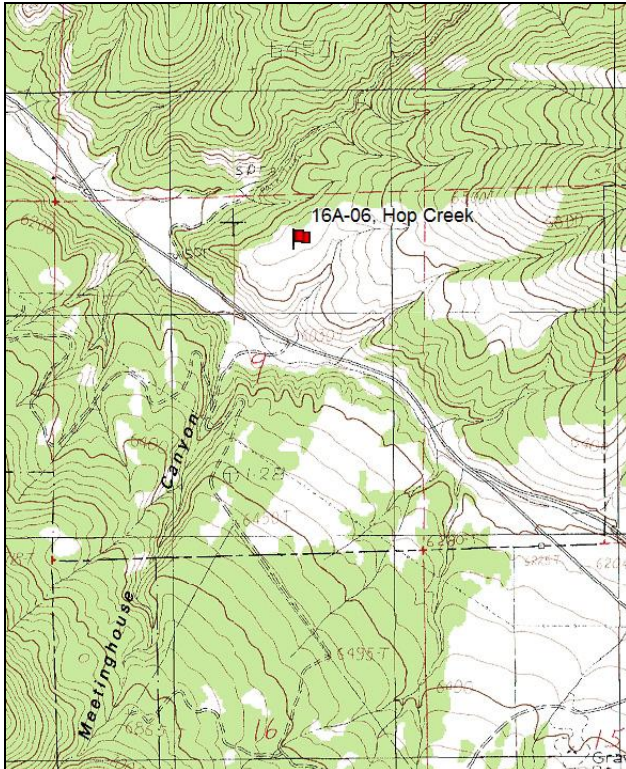
Transect bearing: 163° magnetic

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

Directions:

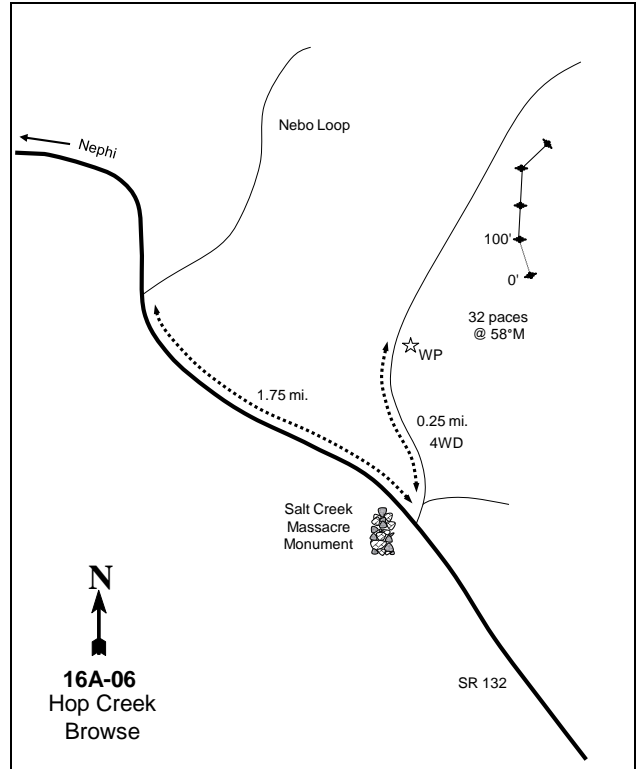
From the intersection of Highway 132 and the Nebo Loop Road, proceed south on Highway 132 for 1.75 miles. Just past the Salt Creek Massacre Monument, stop at a turnoff on the north side of the road. Drive up the left fork of a four-wheel drive road 0.25 miles to a witness post. From the witness post walk 32 paces at 58°M to the 0-foot stake.

Map Name: Fountain Green North



Township: 13S Range: 2E Section: 9

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 439487 E 4395491 N

HOP CREEK BROWSE - TREND STUDY NO. 16A-6

**Site Information**

Site Description: The study is located adjacent to the Hop Creek bitterbrush browse transect, and is found on a broad ridge just north of Salt Creek Canyon. This area is an important wintering area for deer and elk. At the outset of the study, the vegetation composition was dominated by a mixed stand of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*) in association with a moderately diverse and vigorous herbaceous understory. A small population of Utah juniper (*Juniperus osteosperma*) is scattered over the site. Following the site being read in 2007, the entire area burned as part of the Salt Creek wildfire, which burned 25,913 acres. The area was treated with a one-way smooth chain and seeding (Table - Seed Mix) as part of the Salt Creek Wildfire Rehabilitation project ([WRI Project #970](#)) in the fall of 2007 (WRI Database 2013). The wildfire removed most of the shrub and tree species from the site and the area is now dominated by perennial grasses. Abundant evidence of big game use in the form of pellet groups and antler drops was found in 1983. Quadrat frequency from 1997 indicated moderate amounts of both deer and elk pellet groups. Deer pellet groups were sampled in very high abundance in 2002 and 2007, but very low abundance in 2012. Elk pellet groups were sampled in moderate abundance in 2002 and 2007, but low abundance in 2012. Cattle pats have been sampled in low abundance since 2002 (Table - Pellet Group Data).

SEED MIX --

Management unit 16A, study no: 6

Project Name: Salt Creek wildfire Rehabilitation - DWR Lands						
WRI Database #: 970						
Application: Aerial			Acres: 1150		Application: Dribbler	
					Acres: 335	
Seed type			lbs in mix	lbs/acre	Seed type	
					lbs in mix	lbs/acre
G	Bluebunch WG 'Anatone'		1150	1.00	B	Bitterbrush
G	Crested Wheatgrass 'Hycrest'		1150	1.00	B	Small Burnet 'Delar'
G	Crested Wheatgrass 'Nordan'		1150	1.00	Total Pounds:	
G	Indian Ricegrass 'Rimrock'		1150	1.00	300 0.90	
G	Intermediate Wheatgrass 'Oahe'		1150	1.00	PLS Pounds:	
G	Orchardgrass 'Paiute'		575	0.50	0.81	
G	Pubescent Wheatgrass		2300	2.00		
G	Siberian Wheatgrass 'Vavilov'		1150	1.00		
F	Alfalfa 'Ladak'		1150	1.00		
F	Alfalfa 'Ranger'		1150	1.00		
F	Sainfoin 'Eski'		2300	2.00		
F	Small Burnet 'Delar'		1150	1.00		
F	Western Yarrow		115	0.10		
F	Yellow Sweetclover		288	0.25		
B	Sagebrush, Mountain		288	0.25		
B	Sagebrush, Wyoming		288	0.25		
Total Pounds:			16504	14.35		
PLS Pounds:				12.62		

Browse: Prior to the fire, the majority of the browse cover was composed of mountain big sagebrush (Table - Browse Trends). The sagebrush stand was a moderately dense stand with a mixture of young, mature, and decadent plants. Recruitment of young sagebrush plants was good in most sample years. Decadence was moderately high, but vigor was typically good. Utilization was mostly light to moderate. Bitterbrush was also common on the site. Bitterbrush occurs at lower density than sagebrush, with a population that is mostly mature or decadent. Recruitment of young bitterbrush plants was low throughout the pre-fire study years. The majority of the plants were large and vigorous, and use was mostly heavy. A few moderate to heavily used serviceberry (*Amelanchier alnifolia*) plants were also been sampled from 1997 to 2007. Browse species were rare following the fire (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is diverse and productive. Perennial grasses have dominated the herbaceous component on the site. The most abundant perennial grasses are bluebunch wheatgrass (*Agropyron spicatum*), western wheatgrass (*A. smithii*), Sandberg bluegrass (*Poa secunda*), and Kentucky bluegrass (*P. pratensis*). The introduced species crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) were sampled following the wildfire and subsequent reseeding. Cheatgrass (*Bromus tectorum*) is present on the site and increased significantly in 2007 prior to the fire. Perennial forb species are also diverse and abundant, but annual forb species are also common. Common forb species include pale alyssum (*Alyssum alyssoides*), tapertip hawksbeard (*Crepis acuminata*), draba (*Draba* sp.), western aster (*Aster chilensis*), bastard toadflax (*Comandra pallida*), Lewis flax (*Linum lewisii*), blue-eyed Mary (*Collinsia parviflora*), and bur buttercup (*Ranunculus testiculatus*) (Table - Herbaceous Trends).

Soil: The soil is classified within the Sheep Creek very cobbly loam series, which occur on mountain slopes. Parent material consists of residuum and colluvium derived from conglomerate and limestone. The soils in this series are characterized as moderately deep and well-drained (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is moderately low with a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly down (-1):** Sagebrush density decreased 17% from 3,131 plants/acre to 2,599 plants/acre. Decadence of sagebrush increased from 13% to 33%, and plants displaying poor vigor increased from 0% to 8% of the population. Bitterbrush density decreased 25% from 532 plants/acre to 399 plants/acre. Decadence of bitterbrush increased from 25% to 33%, but poor vigor decreased from 88% to 0%.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Decadence decreased to 12% of the sagebrush population and 7% of the bitterbrush population, while the percentage of young plants sampled increased in both species. Poor vigor remained at 8% in the sagebrush population and 11% of the bitterbrush population.
- **1997 to 2002 - slightly up (+1):** Sagebrush density increased 36% from 2,300 plants/acre to 3,120 plants/acre, though cover increased slightly from 9% to 10%. Recruitment of young plants remained very high at 33% of the population. Decadence increased to 31%, and plants displaying poor vigor increased slightly to 13% of the population. Bitterbrush density

decreased slightly from 540 plants/acre to 480 plants/acre, but cover remained similar at 3%. Decadence increased from 7% to 29% of the population, though poor vigor decreased to 4%.

- **2002 to 2007 - slightly down (-1):** Sagebrush density decreased 28% to 2,260 plants/acre, and cover decreased slightly to 9%. Recruitment of young sagebrush plants decreased to only 3% of the population. The majority of the loss in population is due to the loss of young plants. Decadence increased slightly to 34%, and plants displaying poor vigor increased to 22% of the population. Bitterbrush density increased 8% to 520 plants/acre, and recruitment of young bitterbrush plants remained stable at 8% of the population. Decadence increased to 42%, and poor vigor increased to 23% of the population.
- **2007 to 2012 - down (-2):** The wildfire removed nearly the entire browse component from the site.

#### Grass:

- **1983 to 1989 - stable (0):** The sum of nested frequency for perennial grasses remained similar. However, mutton bluegrass (*Poa fendleriana*) and oniongrass (*Melica bulbosa*) both increased significantly in nested frequency.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequency for perennial grasses increased 18%, with significant increases in bluebunch wheatgrass and Kentucky bluegrass.
- **1997 to 2002 - stable (0):** There was little change in the sum of nested frequency of perennial grasses. Kentucky bluegrass and mutton bluegrass decreased significantly in nested frequency while oniongrass increased significantly in nested frequency.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, remained stable, and cover increased from 17% to 26%. However, cheatgrass also increased significantly in nested frequency, and cover increased from 1% to 7%.
- **2007 to 2012 - slightly up (+1):** The perennial grass sum of nested frequency, excluding bulbous bluegrass, remained similar, and cover remained similar at 24%. However, cheatgrass decreased significantly in nested frequency, and cover decreased to 1%. The seeded species crested wheatgrass, intermediate wheatgrass, and orchardgrass (*Dactylis glomerata*) were sampled for the first time at low frequency and cover.

#### Forb:

- **1983 to 1989 - slightly down (-1):** The sum of nested frequency for perennial forbs decreased by 22%. However, most of the decrease was attributed to significant decreases in sego lily (*Calochortus nuttallii*) and bastard toadflax, neither of which are important forage species.
- **1989 to 1997 - up (+2):** The sum of nested frequency for perennial forbs increased almost three-fold, and several individual species increased significantly in nested frequency.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial forbs decreased 22%, and cover decreased from 6% to 4%. Much of the decrease was due to a significant decrease in the nested frequency of Lewis flax, bastard toadflax, and Wyoming painted-cup (*Castilleja linariaefolia*).
- **2002 to 2007 - up (+2):** The sum of nested frequency for perennial forbs increased 43%, and cover increased to 7%. There were significant increases in the nested frequency of desirable species such as tapertip hawksbeard and Lewis flax. Annual forb sum of nested frequency also increased, and cover increased from 4% to 8%.

- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial grasses decreased 16%, but cover remained similar at 7%. Annual forb sum of nested frequency decreased substantially, and cover decreased to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, study no: 6

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	16.1	12.2	12.4	30.0	-0.5	10.0	0.0	<b>80.3</b>	Good-Excellent
02	16.7	7.8	12.8	30.0	-0.6	8.9	0.0	<b>75.6</b>	Good
07	13.7	6.2	2.1	30.0	-4.9	10.0	0.0	<b>57.1</b>	Fair
12	0.0	0.0	0.0	30.0	-0.7	10.0	0.0	<b>39.3</b>	Poor

### Trend Summary

HERBACEOUS TRENDS--  
Management unit 16A, Study no: 6

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a-	a-	a-	a-	a-	b26	-	-	-	.74
G	Agropyron intermedium	a-	a-	a-	a-	a-	b31	-	-	-	1.00
G	Agropyron smithii	b194	b205	a123	a131	a140	b194	1.57	3.15	2.44	3.75
G	Agropyron spicatum	a135	a92	b173	b171	b163	b149	5.03	5.05	12.25	13.18
G	Bromus tectorum (a)	-	-	a65	a82	b218	a87	.67	.84	6.56	.96
G	Dactylis glomerata	-	-	-	-	-	1	-	-	-	.03
G	Festuca ovina	-	-	1	3	-	-	.03	.03	-	-
G	Melica bulbosa	ab15	c36	a9	bc33	a3	a-	.21	1.22	.06	-
G	Oryzopsis hymenoides	-	-	-	3	2	2	-	.15	.15	.03
G	Poa bulbosa	-	-	-	-	3	1	-	-	.03	.00
G	Poa fendleriana	ab50	c94	bc71	a27	a34	a27	1.61	.88	.60	.72
G	Poa pratensis	a74	a50	b172	a80	a57	a42	7.65	2.23	2.24	.93
G	Poa secunda	a35	a39	ab84	bc115	d181	c121	2.47	2.80	7.68	2.85
G	Stipa comata	b59	b53	ab36	ab41	a18	a21	1.04	1.17	.35	.38
Total for Annual Grasses		0	0	65	82	218	87	0.67	0.83	6.56	0.96
Total for Perennial Grasses		562	569	669	604	601	615	19.64	16.70	25.81	23.64
Total for Grasses		562	569	734	686	819	702	20.32	17.54	32.38	24.60
F	Achillea millefolium	-	1	-	-	-	-	-	-	-	-
F	Agoseris glauca	a-	a-	b22	b33	b33	b49	.11	.35	.18	.54
F	Allium sp.	-	2	-	1	-	-	.00	.00	-	-
F	Alyssum alyssoides (a)	-	-	a120	b162	c297	ab165	.51	.83	4.46	1.12
F	Antennaria rosea	1	7	5	7	7	-	.03	.04	.18	-
F	Arabis sp.	-	-	1	-	-	3	.00	-	-	.01
F	Aster chilensis	a2	ab13	bc25	bc28	c35	bc22	1.18	.90	1.14	.30
F	Astragalus convallarius	ab23	c55	a9	a7	bc34	a6	.10	.02	.47	.04
F	Astragalus sp.	-	-	1	2	-	1	.03	.00	-	.03
F	Calochortus nuttallii	c35	a3	a10	bc36	ab16	a3	.03	.11	.04	.00

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Camelina microcarpa (a)	-	-	8	-	6	-	.02	-	.01	-
F	Castilleja linariaefolia	a4	a-	b31	a8	a9	a-	.56	.08	.09	-
F	Chaenactis douglasii	-	-	2	-	-	-	.01	-	-	-
F	Chenopodium album (a)	-	-	-	3	-	-	-	.00	-	-
F	Chorispora tenella (a)	-	-	-	2	-	7	-	.15	-	.18
F	Cirsium undulatum	a3	a3	ab18	ab16	ab13	b31	.23	.33	.30	.21
F	Collinsia parviflora (a)	-	-	c171	c183	b119	a18	1.26	2.20	.43	.04
F	Collomia linearis (a)	-	-	b45	b26	a7	a4	.12	.06	.01	.00
F	Comandra pallida	c123	a51	bc91	a30	b83	a29	.91	.18	.73	.19
F	Conringia orientalis (a)	1	-	-	-	-	-	-	-	-	-
F	Crepis acuminata	a1	a5	b45	b69	c107	d182	.48	1.25	1.58	4.32
F	Cryptantha sp.	-	-	-	-	-	1	-	-	-	.00
F	Cymopterus longipes	a-	a6	b50	b42	b46	b43	.35	.49	.52	.49
F	Descurainia pinnata (a)	-	-	3	6	6	9	.00	.01	.01	.01
F	Draba sp. (a)	-	-	a3	a-	b72	a1	.00	-	1.39	.00
F	Epilobium brachycarpum (a)	-	-	b38	ab24	ab27	a11	.07	.08	.11	.02
F	Eriogonum racemosum	5	3	1	4	1	2	.00	.06	.01	.03
F	Eriogonum umbellatum	-	3	3	3	3	-	.06	.00	.15	-
F	Erysimum sp.	-	-	1	-	-	-	.00	-	-	-
F	Galium sp.	-	-	-	1	-	-	-	.00	-	-
F	Lactuca serriola (a)	-	4	3	-	5	5	.00	-	.01	.01
F	Lappula occidentalis (a)	-	-	-	2	-	9	-	.00	-	.02
F	Linum lewisii	a25	a3	b91	a21	b61	a11	.62	.11	.69	.01
F	Lupinus argenteus	-	-	2	1	2	7	.38	.00	.15	.02
F	Machaeranthera canescens	-	-	-	1	-	-	-	.00	-	-
F	Microsteris gracilis (a)	-	-	a8	b39	b44	a1	.01	.11	.15	.00
F	Phlox longifolia	a-	a11	c38	abc27	c46	ab23	.07	.19	.32	.20
F	Polygonum douglasii (a)	-	-	a3	a4	a4	b25	.01	.01	.01	.06
F	Ranunculus testiculatus (a)	-	-	bc74	ab48	c91	a20	.52	.48	.88	.05
F	Sisymbrium altissimum (a)	-	-	-	-	-	1	-	-	-	.00
F	Sphaeralcea coccinea	-	7	3	1	-	9	.00	.00	-	.04
F	Tragopogon dubius (a)	13	10	16	15	13	16	.10	.13	.25	.04
F	Zigadenus paniculatus	a5	a-	ab24	b32	b33	b33	.22	.26	.26	.41
Total for Annual Forbs		14	14	492	514	691	292	2.66	4.10	7.75	1.58
Total for Perennial Forbs		227	173	473	370	529	445	5.47	4.44	6.86	6.90
Total for Forbs		241	187	965	884	1220	737	8.13	8.54	14.61	8.48

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



BROWSE TRENDS--

Management unit 16A, Study no: 6

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier alnifolia	4	3	3	1	.15	.38	.53	.00
B	Artemisia tridentata vaseyana	56	72	67	1	9.17	9.92	9.13	-
B	Chrysothamnus viscidiflorus viscidiflorus	10	16	14	9	.18	.34	.09	.16
B	Gutierrezia sarothrae	14	23	13	2	.07	1.24	.06	-
B	Juniperus osteosperma	-	-	-	-	.85	.78	.78	-
B	Purshia tridentata	22	19	22	2	2.97	2.51	1.98	.03
B	Tetradymia canescens	3	9	9	9	.03	.48	.18	.30
Total for Browse		109	142	128	24	13.44	15.67	12.77	0.50

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 6

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	-	.16	-
Artemisia tridentata vaseyana	-	13.63	-
Chrysothamnus viscidiflorus viscidiflorus	-	.55	-
Gutierrezia sarothrae	-	.26	-
Juniperus osteosperma	.01	3.90	-
Purshia tridentata	-	2.29	.30
Tetradymia canescens	-	.13	1.50

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 6

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.1	1.5	1.9
Purshia tridentata	1.0	1.2	0.6

POINT-QUARTER TREE DATA--

Management unit 16A, Study no: 6

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	25	38	-	8.5	7.8	-

**BASIC COVER--**

Management unit 16A, Study no: 6

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	4.75	11.75	44.00	43.48	57.77	39.28
Rock	.25	.25	.19	.15	.05	.24
Pavement	.50	0	1.93	1.25	1.25	1.37
Litter	71.25	69.75	51.30	51.80	41.67	56.87
Cryptogams	1.25	1.50	4.62	2.62	3.05	.01
Bare Ground	22.00	16.75	17.71	17.85	14.58	18.15

**SOIL ANALYSIS DATA --**

Management unit 16A, Study no: 6, Hop Creek

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
20.2	6.9	42.4	27.1	30.6	3.2	9.6	67.2	0.6

**PELLET GROUP DATA--**

Management unit 16A, Study no: 6

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	4	18	44	1	-	-	-
Elk	24	17	19	4	23 (56)	23 (58)	5 (12)
Deer	34	43	64	2	146 (360)	142 (364)	1 (2)
Cattle	-	1	-	1	2 (5)	9 (22)	-
Sheep	-	-	-	-	-	-	1 (3)
Horse	-	-	-	-	-	-	1 (1)

**BROWSE CHARACTERISTICS--**

Management unit 16A, Study no: 6

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Amelanchier alnifolia</b>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>0</b>	0	0	0	-	0	0	0	-/-	
97	<b>100</b>	20	60	20	-	80	0	20	30/31	
02	<b>60</b>	0	100	0	-	33	33	0	31/32	
07	<b>60</b>	33	67	0	-	0	67	0	41/41	
12	<b>20</b>	100	0	0	-	0	100	100	16/21	
<b>Artemisia tridentata vaseyana</b>										
83	<b>3131</b>	21	66	13	199	11	0	0	31/36	
89	<b>2598</b>	26	41	33	-	23	5	8	29/33	
97	<b>2300</b>	33	55	12	40	29	4	8	33/45	
02	<b>3120</b>	33	36	31	20	27	5	13	30/39	
07	<b>2260</b>	3	64	34	200	27	9	22	30/37	
12	<b>20</b>	100	0	0	-	0	100	0	13/15	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Chrysothamnus nauseosus consimilis</i>										
83	66	100	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
83	66	0	100	0	-	0	0	0	8/10	
89	66	0	100	0	-	0	0	0	10/14	
97	300	0	100	0	-	0	0	0	13/22	
02	740	14	76	11	-	0	3	8	11/18	
07	640	25	66	9	-	13	9	6	14/19	
12	280	7	93	0	-	7	0	7	13/22	
<i>Gutierrezia sarothrae</i>										
83	66	0	100	0	-	0	0	0	11/19	
89	864	23	69	8	-	0	0	0	8/6	
97	840	36	60	5	20	0	0	5	7/7	
02	1780	6	81	13	-	0	0	1	6/11	
07	480	13	79	8	-	4	0	33	9/12	
12	40	0	100	0	-	0	0	0	6/10	
<i>Juniperus osteosperma</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	20	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Purshia tridentata</i>										
83	532	0	75	25	-	0	100	88	44/38	
89	399	0	67	33	-	50	50	0	38/44	
97	540	4	89	7	40	15	70	11	38/54	
02	480	8	63	29	-	4	92	4	41/48	
07	520	8	50	42	20	15	85	23	45/52	
12	40	0	100	0	20	50	50	0	14/37	
<i>Quercus gambelii</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	39/66	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Rosa woodsii</i>										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>0</b>	0	0	-	-	0	0	0	-/-	
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>0</b>	0	0	-	-	0	0	0	-/-	
12	<b>0</b>	0	0	-	-	0	0	0	15/6	
<i>Symphoricarpos oreophilus</i>										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>0</b>	0	0	-	-	0	0	0	-/-	
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>0</b>	0	0	-	-	0	0	0	16/24	
12	<b>0</b>	0	0	-	-	0	0	0	7/6	
<i>Tetradymia canescens</i>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>133</b>	100	0	0	-	0	0	0	-/-	
97	<b>80</b>	0	100	0	-	0	0	0	14/11	
02	<b>260</b>	15	85	0	-	0	8	0	11/16	
07	<b>220</b>	0	91	9	-	27	9	9	10/17	
12	<b>400</b>	5	95	0	60	0	0	0	10/17	

WILLOW CREEK - TREND STUDY NO. 16A-7-12

Vegetation Type: Cliffrose

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Mountain Very Steep Stony Loam (Browse), R047XA473UT

Land Ownership: USFS

Elevation: 5,850 ft (1,783 m)

Aspect: South

Slope: 40%

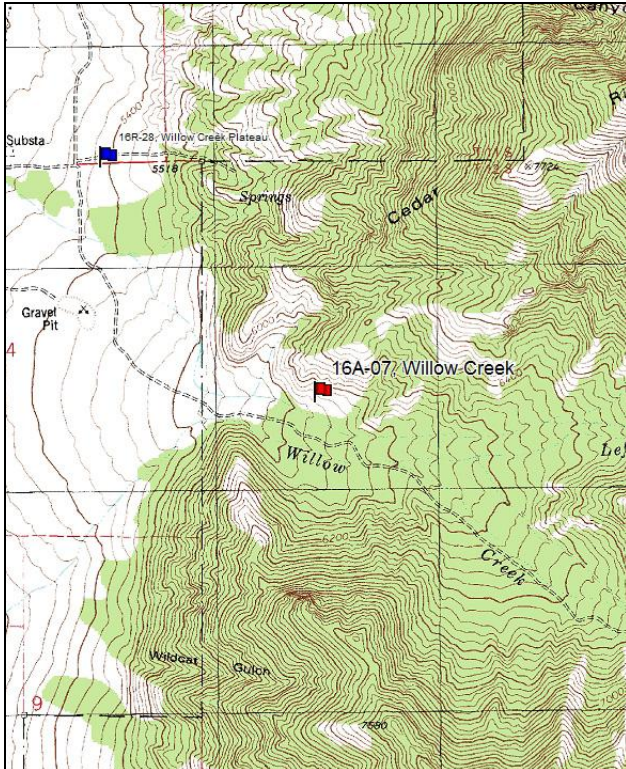
Transect bearing: 0° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: none

Directions:

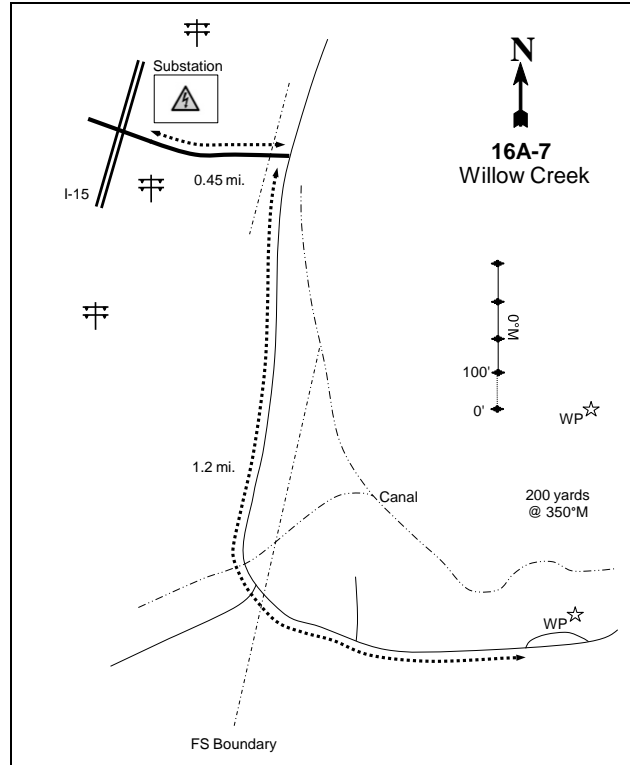
Beginning at the east side of the underpass where Cemetery Road passes over I-15 southeast of Mona, proceed east for 0.45 miles to an intersection. Take the right fork and proceed 1.2 miles on the main road to a pullout. From this point, walk 200 yards at 350 degrees magnetic to the witness post (you will need to cross the irrigation canal). The 0-foot baseline stake is 3 paces west of the witness post. It is a green fencepost with a red browse tag, number 3958, attached. The baseline runs at an azimuth of 0 degrees magnetic.

Map Name: Mona



Township: 12S Range: 1E Section: 3

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 430382 E 4405594 N

## WILLOW CREEK - TREND STUDY NO. 16A-7

### Site Information

Site Description: The study is located at the mouth of Willow Creek Canyon, within the Uinta National Forest. Unfenced, private land lies immediately to the west. The study samples a Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) community that is considered crucial deer and elk winter range. Deer pellet groups have been sampled in high abundance since 2002. Elk pellet groups were sampled in moderate abundance in 2002, but lower abundance in 2007 and 2012 (Table - Pellet Group Data).

Browse: Stansbury cliffrose is the preferred browse species, and has provides the majority of the browse cover on the site (Table - Browse Trends). The cliffrose stand is a moderately dense, scattered population of mostly mature plants. Recruitment of young cliffrose plants has been generally poor over the course of the study years. Decadence has been moderate, and vigor has been good in the cliffrose population. Utilization of cliffrose has been very heavy over the sample years. Other browse species such as mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), fourwing saltbush (*Atriplex canescens*), and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) are found in low densities (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by cheatgrass (*Bromus tectorum*), which provides the majority of the herbaceous cover. Despite the high abundance of cheatgrass, perennial grass species are also common. Perennial grasses have steadily increased in cover since 1997. The most abundant perennial grass is bluebunch wheatgrass (*Agropyron spicatum*). Bulbous bluegrass (*Poa bulbosa*), a low-value perennial, is also fairly abundant. The forb composition is poor and is dominated by annuals. The most abundant forb species are pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*). Scarlet globemallow (*Sphaeralcea coccinea*) and heath aster (*Leuceleone ericoides*) are the most abundant perennial species, but occur infrequently (Table - Herbaceous Trends).

Soil: The soil is classified as the Yeates Hollow very stony loam, which occurs on mountain slopes and hills. Parent material consists of colluvium and alluvium derived from conglomerate, quartzite, and sandstone. The soils within this classification are characterized as deep and well-drained (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 7.0). Organic matter is limited at only 1.8% (Table - Soil Analysis Data). Bare ground cover has generally been low, with a high amount of vegetation, litter, and pavement providing protective ground cover (Table - Basic Cover). There is apparent erosion occurring on the site and the soil erosion condition has been classified as slight since 2002.

### Trend Assessments

Browse:

- **1983 to 1989 - stable (0):** Cliffrose density increased slightly from 965 plants/acre to 1,031 plants/acre. Most of this increase is due to an increase in the recruitment of young plants from 3% to 10% of the population. Decadence increased from 7% to 39% of the population.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore trend was determined using other parameters. There was no new recruitment of young cliffrose plants. Decadence decreased to 3% within the population.

- **1997 to 2002 - slightly up (+1):** Cliffrose density increased 52% from 580 plants/acre to 880 plants/acre, but cover remained similar increasing slightly from 14% to 15%. However, decadence increased to 23%, and plants displaying poor vigor increased from 0% to 16% of the population.
- **2002 to 2007 - slightly down (-1):** Cliffrose density decreased 32% to 600 plants/acre, and cover decreased to 11%. Recruitment of young cliffrose plants increased from 2% to 10% of the population.
- **2007 to 2012 - slightly up (+1):** The density of cliffrose increased 27% to 760 plants/acre, and cover increased to 14%. Recruitment of young cliffrose plants decreased to 5%. Decadence decreased from 20% to 13%, and poor vigor decreased from 10% to 3%.

#### Grass:

- **1983 to 1989 - stable (0):** The trend for grass is stable. The sum of nested frequency for perennial grasses changed little. Bulbous bluegrass and Sandberg bluegrass (*Poa secunda*) were sampled for the first time, but in low frequencies.
- **1989 to 1997 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 22%. Bluebunch wheatgrass decreased significantly in nested frequency.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 13%. Cheatgrass remained the dominant grass species, and bulbous bluegrass increased significantly in nested frequency.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar, and cover increased from 6% to 8%. However, cheatgrass cover increased from 14% to 16% and remained dominant on the site. Bulbous bluegrass increased significantly in nested frequency and cover increased from 2% to 4%.
- **2007 to 2012 - slightly up (+1):** There was a 13% increase in the sum of nested frequency of perennial grasses, excluding bulbous bluegrass, and cover increased to 10%. Bulbous bluegrass decreased significantly in nested frequency, and cover decreased to 1%. However, cheatgrass remained dominant and cover increased to 18%.

#### Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequency of perennial forbs increased slightly, but perennial forbs remain rare on the site and provide little forage.
- **1989 to 1997 - stable (0):** The sum of nested frequency for perennial forbs decreased slightly.
- **1997 to 2002 - stable (0):** The sum of nested frequency for perennial forbs decreased slightly, and cover decreased from 2% to 1%. Annual forbs dominate the forb component.
- **2002 to 2007 - stable (0):** The sum of nested frequency for perennial forbs decreased slightly. The annual, weedy species storksbill increased significantly in nested frequency.
- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial forbs increased slightly, and cover increased from 1% to 2%. Annual forb sum of nested frequency decreased substantially, and cover decreased from 5% to 1%. Most of the decrease in annual forbs was due to a significant decrease in the nested frequency of storksbill.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 7

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	23.4	14.2	0.4	8.6	-13.1	3.3	0.0	<b>36.9</b>	Very Poor-Poor
02	24.3	7.8	0.9	11.3	-11.2	2.4	0.0	<b>35.5</b>	Very Poor-Poor
07	16.8	8.3	4.7	14.9	-11.7	2.1	0.0	<b>35.0</b>	Very Poor-Poor
12	21.7	11.1	2.5	20.4	-13.8	2.9	0.0	<b>44.8</b>	Poor

### Trend Summary

HERBACEOUS TRENDS--

Management unit 16A, Study no: 7

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	b198	b191	a132	a121	a135	a142	4.17	5.55	7.18	9.61
G	Bromus japonicus (a)	-	-	a-	b19	a-	a-	-	.39	-	-
G	Bromus tectorum (a)	-	-	b354	ab336	a335	a327	17.42	14.48	15.65	18.38
G	Festuca myuros (a)	-	-	6	-	4	5	.03	-	.00	.01
G	Poa bulbosa	a-	a10	ab32	b58	c85	b51	1.23	1.50	4.28	1.35
G	Poa secunda	a-	a12	ab27	bc17	c16	b29	.13	.11	.26	.61
Total for Annual Grasses		0	0	360	355	339	332	17.45	14.87	15.66	18.39
Total for Perennial Grasses		198	213	191	196	236	222	5.53	7.17	11.73	11.57
Total for Grasses		198	213	551	551	575	554	22.99	22.04	27.39	29.97
F	Agoseris glauca	-	-	-	1	-	3	-	.00	-	.00
F	Alyssum alyssoides (a)	-	-	b291	a212	a217	a216	3.07	.82	2.46	.99
F	Artemisia ludoviciana	5	6	6	3	-	-	.06	.03	-	-
F	Asclepias sp.	-	-	-	5	-	-	-	.18	-	-
F	Astragalus cibarius	-	-	-	-	3	-	-	-	.03	-
F	Astragalus utahensis	ab2	ab5	b11	a-	a2	ab2	.24	.00	.03	.01
F	Calochortus nuttallii	1	-	-	-	-	-	-	-	-	-
F	Camelina microcarpa (a)	-	-	3	-	-	1	.00	-	-	.00
F	Cerastium sp.	-	3	-	-	-	-	-	-	-	-
F	Cirsium vulgare	1	6	-	-	-	-	-	-	-	-
F	Cryptantha sp.	4	2	-	-	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	b8	ab2	b8	a-	.03	.01	.05	-
F	Draba sp. (a)	-	-	-	-	4	-	-	-	.01	-
F	Erigeron pumilus	b34	b47	a-	a-	a-	a-	-	-	-	-
F	Eriogonum brevicaulis	3	4	7	-	-	-	.06	-	-	-
F	Eriogonum umbellatum	-	-	-	-	1	-	-	-	.03	-
F	Erodium cicutarium (a)	-	-	a35	b93	c141	a24	.18	1.67	2.69	.22
F	Galium aparine (a)	-	-	8	-	1	8	.01	-	.00	.04
F	Hackelia patens	-	-	6	-	-	-	.02	-	-	-
F	Haplopappus acaulis	-	-	-	-	-	-	-	-	.03	-
F	Holosteum umbellatum (a)	-	-	-	3	5	5	-	.00	.01	.01
F	Lactuca serriola (a)	a-	a-	ab1	ab2	b8	ab3	.00	.00	.02	.01



Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Lappula occidentalis (a)	-	-	a-	a1	b17	ab11	-	.00	.05	.02
F	Leucelene ericoides	a-	a-	b14	b18	b18	b14	.26	.19	.39	.25
F	Lygodesmia grandiflora	9	-	-	-	5	-	-	-	.06	-
F	Oenothera sp.	-	-	1	-	-	-	.03	-	-	-
F	Penstemon sp.	-	-	-	1	-	-	-	.03	-	-
F	Phlox longifolia	-	4	3	3	1	3	.01	.15	.03	.03
F	Sphaeralcea coccinea	a8	a14	ab26	b31	ab22	b40	.98	.59	.42	1.18
F	Taraxacum officinale	-	-	3	-	-	-	.00	-	-	-
F	Tragopogon dubius (a)	-	-	-	-	3	4	-	-	.00	.03
Total for Annual Forbs		0	0	346	313	404	272	3.30	2.52	5.31	1.33
Total for Perennial Forbs		67	91	77	62	52	62	1.67	1.18	1.03	1.47
Total for Forbs		67	91	423	375	456	334	4.98	3.70	6.34	2.81

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 7

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	2	2	2	2	.53	.91	.38	.15
	Atriplex canescens	0	1	0	1	-	-	-	-
B	Chrysothamnus nauseosus albicaulis	13	3	3	0	1.04	.53	.30	-
B	Cowania mexicana stansburiana	21	33	26	31	14.32	14.97	10.62	14.31
B	Gutierrezia sarothrae	27	16	17	18	.39	1.25	.24	.90
	Purshia tridentata	0	1	0	0	-	-	-	-
Total for Browse		63	56	48	52	16.29	17.66	11.55	15.36

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 7

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	-	.86	.15
Chrysothamnus nauseosus albicaulis	-	1.43	-
Cowania mexicana stansburiana	.33	23.03	21.81
Gutierrezia sarothrae	-	.08	2.26

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 7

Species	Average leader growth (in)		
	'02	'07	'12
Cowania mexicana stansburiana	1.1	1.1	1.1

**BASIC COVER--**

Management unit 16A, Study no: 7

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	1.25	8.75	40.62	40.11	41.18	48.56
Rock	4.00	8.00	7.40	7.74	9.30	4.84
Pavement	11.50	29.75	15.57	16.68	17.24	14.19
Litter	62.25	44.75	40.29	36.85	35.05	47.36
Cryptogams	0	0	.14	0	.07	.06
Bare Ground	21.00	8.75	12.06	18.06	11.79	7.03

**SOIL ANALYSIS DATA --**

Management unit 16A, Study no: 7, Willow Creek

Effective rooting depth (in)	pH	Sandy Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
17.4	7.0	58.4	25.1	16.6	1.8	6.4	38.4	0.6

**PELLET GROUP DATA--**

Management unit 16A, Study no: 7

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	-	-	2	5	-	-	-
Elk	32	19	6	3	36 (89)	13 (33)	2 (5)
Deer	11	30	35	27	88 (217)	122 (301)	67 (165)

**BROWSE CHARACTERISTICS--**

Management unit 16A, Study no: 7

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata vaseyana</b>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>40</b>	0	100	0	-	50	0	0	28/50
02	<b>40</b>	0	50	50	-	0	50	0	32/54
07	<b>40</b>	0	50	50	-	0	50	50	25/43
12	<b>40</b>	0	50	50	-	50	0	0	23/33
<b>Atriplex canescens</b>									
83	<b>33</b>	0	0	100	-	0	0	100	-/-
89	<b>33</b>	0	100	0	-	0	0	0	43/39
97	<b>0</b>	0	0	0	-	0	0	0	59/46
02	<b>20</b>	0	100	0	-	0	100	0	48/69
07	<b>0</b>	0	0	0	-	0	0	0	78/65
12	<b>20</b>	0	100	0	-	0	0	0	45/70

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Brickellia californica</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	665	15	85	-	-	0	0	0	6/5	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	43/81	
<b>Celtis reticulata</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	77/118	
<b>Chrysothamnus nauseosus albicaulis</b>										
83	66	0	100	0	-	0	0	0	31/51	
89	66	0	50	50	-	0	0	0	41/31	
97	320	13	88	0	-	31	44	0	29/51	
02	60	0	0	100	-	67	0	33	24/38	
07	60	0	33	67	-	0	0	0	31/45	
12	0	0	0	0	-	0	0	0	34/53	
<b>Chrysothamnus viscidiflorus viscidiflorus</b>										
83	33	0	100	-	-	0	0	0	14/17	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<b>Cowania mexicana stansburiana</b>										
83	965	3	90	7	-	21	38	3	52/53	
89	1031	10	52	39	-	39	32	0	81/84	
97	580	0	97	3	20	7	93	0	56/66	
02	880	2	75	23	-	0	95	16	64/67	
07	600	10	70	20	-	7	90	10	68/70	
12	760	5	82	13	20	37	16	3	65/69	
<b>Gutierrezia sarothrae</b>										
83	266	0	100	0	-	0	0	0	13/14	
89	566	0	94	6	-	0	0	12	8/10	
97	1780	49	49	1	20	0	0	0	11/11	
02	520	4	50	46	-	0	0	38	7/10	
07	680	38	62	0	-	0	0	0	11/17	
12	700	17	83	0	120	0	0	0	13/23	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Purshia tridentata</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	78/194	
02	20	100	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<b>Quercus gambelii</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	29/45	
02	0	0	0	-	-	0	0	0	72/57	
07	0	0	0	-	-	0	0	0	76/53	
12	0	0	0	-	-	0	0	0	98/123	
<b>Rhus trilobata</b>										
83	165	60	40	0	-	0	0	0	24/24	
89	132	0	25	75	-	0	0	75	28/30	
97	0	0	0	0	-	0	0	0	-/-	
02	0	0	0	0	-	0	0	0	53/114	
07	0	0	0	0	-	0	0	0	-/-	
12	0	0	0	0	-	0	0	0	111/214	

## GARDNER CANYON - TREND STUDY NO. 16A-8-12

Vegetation Type: Mixed Mountain Brush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Mountain Very Steep Stony Loam (Browse), R047XA473UT

Land Ownership: USFS

Elevation: 5,700 ft (1,737 m)

Aspect: South

Slope: 45%

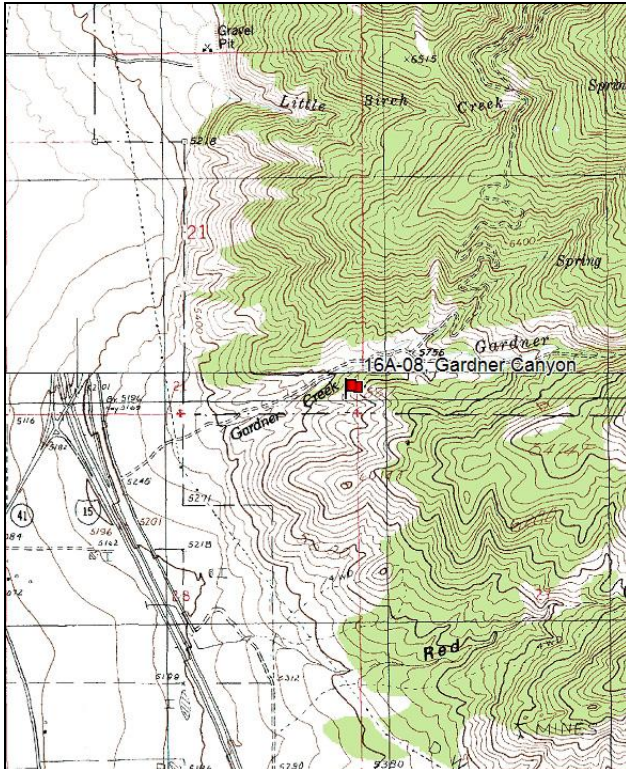
Transect bearing: 62° magnetic

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

### Directions:

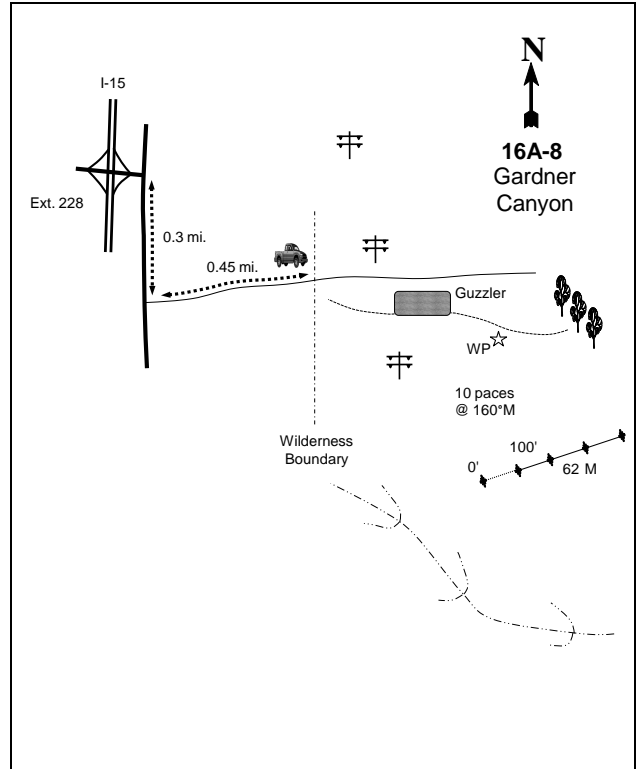
From exit #228 off of I-15, turn south on the frontage road on the east side of the freeway and drive 0.3 miles to an intersection with a gate. Turn left (west) at the intersection and drive 0.45 miles to the wilderness boundary fence. Walk up the old road under some powerlines. To the south, and perpendicular to the road, is a steep slope with a Gambel oak and cliffrose community. Walk up the slope to a guzzler on the ridgetop. The witness post lies 75 yards up the ridge from the guzzler. From the witness post, the 0-foot stake is 10 paces at an azimuth of 160 degrees magnetic. The 0-foot stake has a red browse tag, number 3964, attached.

### Map Name: Nephi



Township: 12S Range: 1E Section: 28

### Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 429755 E 4400200 N

## GARDNER CANYON - TREND STUDY NO. 16A-8

### Site Information

Site Description: The study is located on crucial deer and elk winter range between I-15 and Mt. Nebo. It lies on land managed by the Utah Division of Wildlife Resources (UDWR), near the guzzler in Gardner Canyon. To the northeast of the study is U.S. Forest Service wilderness area. These foothills are heavily used by deer and elk, and carcasses were found in the area during the 1989, 2007, and 2012 readings. Deer pellet groups were sampled in high abundance in 2002 and 2007, but more moderate abundance in 2012. Elk pellet groups have been sampled in low to moderate abundance since 2002 (Table - Pellet Group Data).

Browse: The preferred browse species are Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) and true mountain mahogany (*Cercocarpus montanus*), and these two species provide most of the browse cover on the site (Table - Browse Trends). A few moderately to heavily hedged mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) plants were sampled from 1983 to 1997, but this species has not been sampled in density since 2002. Cliffrose has been steadily decreasing in density since 1997. The cliffrose stand is a moderately dense population of mostly mature plants with relatively high decadence and low recruitment of young plants. Cliffrose plants displaying poor vigor have increased since the outset of the study. The average height of mature plants is approximately 4 feet (1.2 m), making most plants available for wildlife use. Utilization of cliffrose has been mostly heavy since the study began in 1983. Mountain mahogany density is lower than that of cliffrose, but has stayed fairly consistent since 1997. Most plants have been mature, and recruitment of young mahogany plants has been poor over the course of the study. Decadence was low in 1997, but increased in subsequent sample years and was high in 2012. The population has displayed mostly good vigor throughout the study years. The average height of mature plants is approximately 4.5 to 5.5 feet (1.4 to 1.7 m). Utilization of the available portions of the plants has been mostly heavy throughout the study (Table - Browse Characteristics).

Herbaceous Understory: The understory composition is dominated by annuals, biennials, and low-value perennials. Cheatgrass (*Bromus tectorum*) is the dominant grass species. The most abundant perennial grass is bluebunch wheatgrass (*Agropyron spicatum*), which has steadily increased in cover since 1997. The forb component has typically been dominated by annual species. Pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*) together have provided the majority of the forb cover. Scarlet globemallow (*Sphaeralcea coccinea*) is the most abundant perennial forb (Table - Herbaceous Trends).

Soil: The soil is classified within the Lundy series, which occur on hills and mountain slopes. Parent material consists of colluvium derived from limestone and/or residuum weathered from limestone. The soils in this classification are characterized as shallow and somewhat excessively drained (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.0). Organic matter is limited at only 1.6%, and phosphorus may have limited availability for plant growth and development at 4.4 ppm (Tiedemann and Lopez 2004). Bare ground cover is moderate, but a high amount of vegetation, litter, and rock provide ground cover (Table - Basic Cover). There is an abundance of large and small rocks on the surface. Some erosion is occurring due to the steep slope. The soil erosion condition was classified as slight in 2002 and 2007, but was stable in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - stable (0):** Cliffrose density remained the same at 965 plants/acre. Decadence of cliffrose increased from 21% to 52%, and poor vigor increased from 0% to 24% of the population. Recruitment of young cliffrose plants increased from 0% to 24%. The density of mahogany increased 40% from 333 plants/acre to 465 plants/acre. Most of the increase was due to an increase in the recruitment of young plants which increased to 21% of the population.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Cliffrose decadence decreased to 23%, and poor vigor decreased to 7%. Recruitment of cliffrose plants also decreased, but was still good, with 10% of the population consisting of young plants. Recruitment of young mahogany plants decreased to just 8% of the population.
- **1997 to 2002 - stable (0):** Cliffrose density decreased 17% from 600 plants/acre to 500 plants/acre, but cover remained similar at 5%. Recruitment of young cliffrose plants decreased to 4% of the population. Mahogany density increased 25% from 240 plants/acre to 300 plants/acre, but cover remained similar at 3%. Decadence also increased from 8% to 33% of the population. No young mahogany plants were sampled.
- **2002 to 2007 - slightly down (-1):** Cliffrose density decreased 12% to 440 plants/acre, and cover decreased to 4%. Cliffrose decadence increased from 20% to 32%, and poor vigor increased from 8% to 23% of the population. Mahogany density decreased 33% to 200 plants/acre, but cover increased to 4%. Decadence remained similar in mahogany at 30%, but poor vigor increased to 20%. There was no recruitment of young plants in the cliffrose and mahogany populations.
- **2007 to 2012 - stable (0):** The density of cliffrose decreased 14% to 380 plants/acre, and cover decreased to 3%. Recruitment of young cliffrose plants increased to 5%. Decadence remained at 32%, and poor vigor increased slightly to 26% in the cliffrose population. However, mahogany increased in density 50% to 300 plants/acre, and cover increased to 5%. Recruitment of young mahogany plants increased to 7%. Decadence increased to 40%, but poor vigor decreased to 7% of the mahogany population.

### Grass:

- **1983 to 1989 - stable (0):** The only perennial grass sampled in 1989 was bluebunch wheatgrass, which remained stable in nested frequency.
- **1989 to 1997 - stable (0):** The sum of nested frequency for perennial grass changed very little, and was composed primarily of bluebunch wheatgrass.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, decreased 15%, though cover increased slightly from 8% to 9%. However, cheatgrass nested frequency decreased significantly, and cover decreased from 11% to 9%.
- **2002 to 2007 - stable (0):** The sum of nested frequency and cover of perennial grasses remained similar. Cheatgrass cover increased to 12%.
- **2007 to 2012 - slightly up (+1):** The perennial grass sum of nested frequency, excluding bulbous bluegrass, increased 18%, and cover increased to 10%. Cheatgrass decreased in cover to 8%.

Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequency of perennial forbs changed little, but the number of forb species sampled decreased from 10 to only 5.
- **1989 to 1997 - slightly down (-1):** The sum of nested frequency for perennial forbs decreased 19%.
- **1997 to 2002 - stable (0):** The sum of nested frequency for perennial forbs decreased 12%, but cover increased from 1% to 2%. Annual forb sum of nested frequency increased, but cover decreased from 6% to 3%.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 36%, and cover remained similar at 2%. The majority of this increase was attributed to a significant increase in the nested frequency of scarlet globemallow. However, forb composition remained poor.
- **2007 to 2012 - stable (0):** The perennial forb sum of nested frequency remained the same, and cover remained at 2%. Annual forb sum of nested frequency decreased, and cover decreased from 6% to 1%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 8

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	11.6	10.0	3.0	15.3	-8.5	1.7	0.0	<b>33.2</b>	Very Poor-Poor
02	14.1	7.4	1.1	15.7	-7.1	4.3	0.0	<b>35.5</b>	Very Poor-Poor
07	12.9	6.1	0.0	17.6	-9.0	3.0	0.0	<b>30.5</b>	Very Poor
12	12.2	4.1	0.9	19.9	-6.2	3.6	0.0	<b>34.5</b>	Very Poor-Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 8

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	abc234	c231	bc227	ab187	a176	abc202	7.66	7.83	8.78	9.86
G	Bromus japonicus (a)	-	-	a-	a-	a3	b15	-	-	.00	.07
G	Bromus tectorum (a)	-	-	b344	a296	a320	a291	11.33	9.32	11.89	8.20
G	Festuca myuros (a)	-	-	3	6	9	-	.00	.18	.07	-
G	Poa bulbosa	a-	a-	a1	ab5	b13	b15	.00	.64	.48	.37
G	Poa pratensis	2	-	-	-	-	-	-	-	-	-
G	Poa secunda	1	-	-	6	-	5	-	.04	.00	.06
Total for Annual Grasses		0	0	347	302	332	306	11.34	9.50	11.97	8.27
Total for Perennial Grasses		237	231	228	198	189	222	7.67	8.51	9.27	10.30
Total for Grasses		237	231	575	500	521	528	19.01	18.02	21.24	18.58
F	Alyssum alyssoides (a)	-	-	b350	a303	a312	a305	5.48	1.82	3.84	1.19
F	Asclepias sp.	-	-	-	-	-	-	-	.03	-	-
F	Astragalus sp.	-	2	-	-	-	-	-	-	-	-
F	Calochortus nuttallii	3	-	6	-	3	-	.01	-	.00	-



Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Cirsium undulatum</i>	1	-	-	-	2	2	-	-	.01	.03
F	<i>Comandra pallida</i>	3	-	-	-	-	-	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	6	-	-	-	.01	-	-	-
F	<i>Draba</i> sp. (a)	-	-	-	-	1	-	-	-	.00	-
F	<i>Erigeron pumilus</i>	b14	b21	a-	a-	a-	a-	-	-	-	-
F	<i>Eriogonum brevicaula</i>	3	-	-	-	-	-	-	-	-	-
F	<i>Erodium cicutarium</i> (a)	-	-	a12	b86	b116	a23	.05	1.31	1.59	.06
F	<i>Galium aparine</i> (a)	-	-	2	-	-	-	.03	-	-	-
F	<i>Hackelia patens</i>	-	-	4	-	-	-	.00	-	-	-
F	<i>Hedysarum boreale</i>	b17	a-	a-	a-	a-	a-	-	-	-	-
F	<i>Helianthus annuus</i> (a)	-	-	-	3	-	-	-	.01	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	-	-	6	6	-	-	.01	.01
F	<i>Lappula occidentalis</i> (a)	-	-	a-	b16	c42	b13	-	.18	.45	.03
F	<i>Leucelece ericoides</i>	a-	a-	b15	ab8	b17	b15	.27	.21	.10	.25
F	<i>Lygodesmia grandiflora</i>	12	3	5	16	10	9	.03	.14	.06	.10
F	<i>Phlox longifolia</i>	-	-	-	-	1	6	-	-	.00	.01
F	<i>Sphaeralcea coccinea</i>	ab90	ab117	ab80	a80	b108	ab109	.50	1.77	1.29	1.39
F	<i>Streptanthus cordatus</i>	8	3	7	-	-	-	.04	-	-	-
F	<i>Tragopogon dubius</i> (a)	4	-	4	-	-	4	.01	-	-	.01
F	<i>Trifolium</i> sp.	-	-	1	-	-	-	.00	-	-	-
Total for Annual Forbs		4	0	374	408	477	351	5.58	3.32	5.92	1.31
Total for Perennial Forbs		151	146	118	104	141	141	0.87	2.16	1.49	1.79
Total for Forbs		155	146	492	512	618	492	6.46	5.48	7.41	3.10

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 8

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	1	0	0	0	-	-	.00	-
B	<i>Cercocarpus montanus</i>	11	13	9	12	2.78	3.31	4.39	4.96
B	<i>Chrysothamnus nauseosus albicaulis</i>	1	1	0	0	.38	.30	.15	.15
B	<i>Chrysothamnus viscidiflorus stenophyllus</i>	15	13	15	21	.21	.46	.81	2.00
B	<i>Cowania mexicana stansburiana</i>	22	21	22	18	4.65	5.33	3.94	3.04
B	<i>Gutierrezia sarothrae</i>	26	45	34	17	.50	2.07	1.33	1.60
B	<i>Rhus trilobata</i>	0	0	0	0	-	.76	.18	.00
Total for Browse		76	93	80	68	8.54	12.25	10.82	11.77

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 8

Species	Percent Cover	
	'07	'12
<i>Cercocarpus montanus</i>	7.38	6.96
<i>Chrysothamnus viscidiflorus stenophyllus</i>	.85	3.23
<i>Cowania mexicana stansburiana</i>	5.41	6.51
<i>Gutierrezia sarothrae</i>	1.73	1.68

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 8

Species	Average leader growth (in)		
	'02	'07	'12
<i>Cercocarpus montanus</i>	1.6	2.1	1.7
<i>Cowania mexicana stansburiana</i>	1.5	1.6	1.1

BASIC COVER--

Management unit 16A, Study no: 8

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	0	10.25	33.54	33.40	38.12	34.79
Rock	17.00	20.00	18.29	18.00	18.54	16.36
Pavement	2.00	12.75	7.86	5.28	4.10	4.32
Litter	50.50	31.00	30.88	30.60	38.04	40.27
Cryptogams	.25	0	.99	.75	.74	.10
Bare Ground	30.25	26.00	17.82	26.45	17.23	19.53

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 8, Gardner Canyon

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
10.1	7.0	38.7	40.7	20.6	1.6	4.4	57.6	0.5

PELLET GROUP DATA--

Management unit 16A, Study no: 8

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	5	2	11	2
Elk	20	20	15	8
Deer	21	26	51	21

Days use per acre (ha)		
'02	'07	'12
-	-	-
24 (60)	19 (48)	7 (18)
70 (172)	101 (250)	35 (86)

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 8

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Amelanchier alnifolia</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	21/37
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<b>Artemisia tridentata vaseyana</b>									
83	66	0	100	0	-	50	50	0	25/19
89	66	0	0	100	-	50	50	50	-/-
97	40	0	0	100	-	100	0	100	21/35
02	0	0	0	0	-	0	0	0	22/37
07	0	0	0	0	20	0	0	0	23/27
12	0	0	0	0	-	0	0	0	24/36
<b>Cercocarpus montanus</b>									
83	333	0	100	0	-	70	30	0	52/55
89	465	21	79	0	-	36	64	0	62/51
97	240	8	83	8	-	25	75	0	63/79
02	300	0	67	33	-	27	67	7	67/75
07	200	0	70	30	-	10	70	20	66/80
12	300	7	53	40	-	40	20	7	56/72
<b>Chrysothamnus nauseosus albicaulis</b>									
83	0	0	0	0	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
97	20	0	100	0	-	100	0	0	28/71
02	20	0	0	100	-	0	0	0	25/51
07	0	0	0	0	-	0	0	0	21/47
12	0	0	0	0	-	0	0	0	22/47
<b>Chrysothamnus viscidiflorus stenophyllus</b>									
83	632	5	95	0	-	0	0	0	10/13
89	798	33	58	8	-	29	0	8	10/14
97	440	0	91	9	-	0	0	5	13/25
02	360	0	78	22	-	6	0	0	14/25
07	420	0	100	0	-	29	0	0	15/29
12	660	0	100	0	20	0	0	0	16/31

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Cowania mexicana stansburiana</i>									
83	<b>965</b>	0	79	21	-	38	62	0	32/30
89	<b>965</b>	24	24	52	-	31	69	24	25/29
97	<b>600</b>	10	67	23	-	3	80	7	46/48
02	<b>500</b>	4	76	20	-	0	80	8	38/43
07	<b>440</b>	0	68	32	-	0	95	23	49/49
12	<b>380</b>	5	63	32	20	26	68	26	48/51
<i>Eriogonum heracleoides</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	15/30
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
83	<b>1933</b>	0	100	0	-	0	0	0	11/9
89	<b>832</b>	4	32	64	-	0	0	32	9/8
97	<b>1280</b>	45	52	3	60	0	0	2	7/10
02	<b>2280</b>	1	84	15	-	0	0	5	7/12
07	<b>2060</b>	52	44	4	160	0	.97	3	8/12
12	<b>600</b>	0	100	0	-	3	0	0	11/15
<i>Peraphyllum ramosissimum</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	43/57
<i>Quercus gambelii</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	78/81
02	<b>0</b>	0	0	-	-	0	0	0	36/26
07	<b>0</b>	0	0	-	-	0	0	0	57/42
12	<b>0</b>	0	0	-	-	0	0	0	73/66
<i>Rhus trilobata</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	57/188
07	<b>0</b>	0	0	-	-	0	0	0	68/125
12	<b>0</b>	0	0	-	-	0	0	0	75/159

BIRCH CREEK - TREND STUDY NO. 16A-9-12

Vegetation Type: Annual/Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Mountain Very Steep Stony Loam (Browse), R047XA473UT

Land Ownership: USFS

Elevation: 5,730 ft (1,746 m)

Aspect: Southwest

Slope: 55%

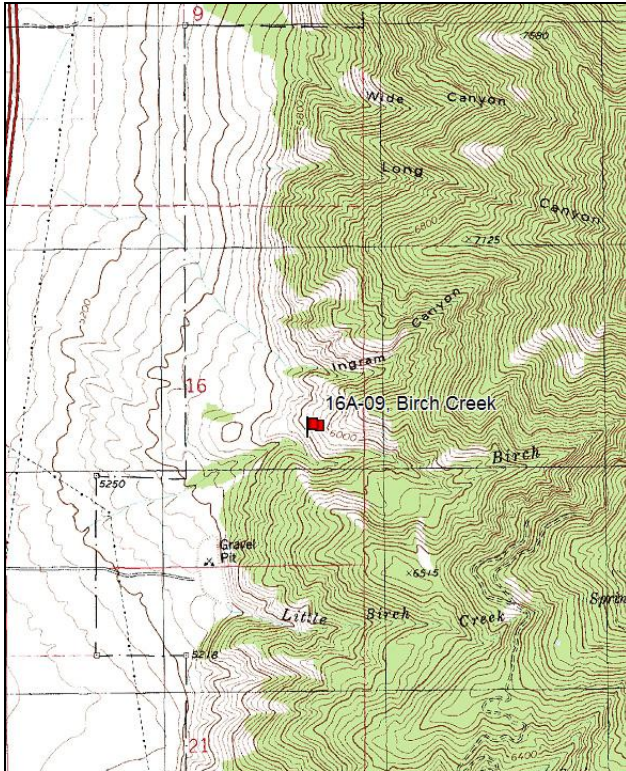
Transect bearing: 20° magnetic

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

Directions:

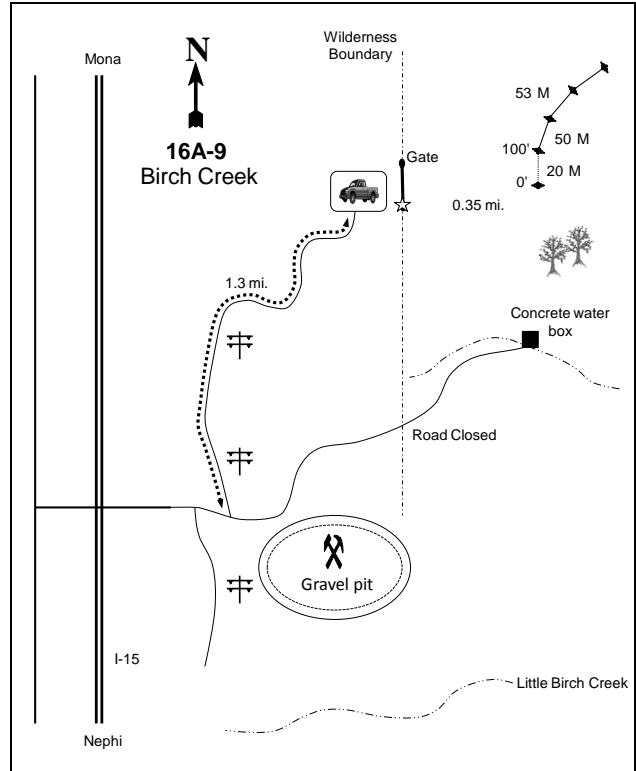
Beginning at the overpass where the road to Little Birch Canyon passes over I-15 (north of the northernmost Nephi exit), take the first left (north) just before the powerlines cross the road. Proceed about 1.3 miles east-northeast to a parking lot. From the wilderness boundary walk east for about 0.35 miles to the 0-foot stake. The 0-foot baseline stake is near a small trail running parallel along the bench. Browse tag #197 marks the 0-foot baseline stake.

Map Name: Mona



Township: 12S Range: 1E Section: 16

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 429592 E 4402342 N

## BIRCH CREEK - TREND STUDY NO. 16A-9

### Site Information

Site Description: The study is located at the mouth of Little Birch Creek. The area is considered crucial deer and elk winter range. The range type is a sparse mixture of Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), Utah serviceberry (*Amelanchier utahensis*), and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Water is available in Birch Creek approximately 150 yards (137 m) downslope from the baseline. The majority of the study burned in 2001, likely as part of the Birch fire that burned 2,681 acres in the area. The upper end of the baseline was not burned, leaving some healthy browse intact. Deer pellet groups have been sampled in moderate abundance since 2002. Elk pellet groups were sampled in moderate abundance in 2002 and 2007, but low abundance in 2012 (Table - Pellet Group Data).

Browse: The main browse species are serviceberry, cliffrose, and true mountain mahogany (*Cercocarpus montanus*), and these species provide the majority of the browse cover on the site (Table - Browse Trends). All three species occur in relatively low density and are scattered over the site. Serviceberry has been sampled at the highest density of the three species. The serviceberry population is a mixture of mature and young plants. Density increased following the fire, but has steadily decreased to pre-fire numbers in subsequent sample years. Health of the population is good with low decadence and good vigor. Utilization has generally been light to moderate. Prior to the fire, the majority of the cliffrose population consisted of large, mature plants. The fire burned most of the cliffrose, but left a few plants unburned upslope at the end of the baseline. Utilization of the available cliffrose has been consistently moderate to heavy throughout the study. True mountain mahogany cover was reduced following the fire, but the population has recovered and returned to pre-fire cover. There has been no new recruitment of young mahogany plants sampled in the study years. The mahogany population is healthy with low decadence and good vigor. Utilization has been moderate to heavy over the course of the study. Prior to the fire, the mountain big sagebrush population consisted of mostly mature plants, with high recruitment. All of the plants were vigorous, and use was moderate to heavy. The fire eliminated most of the sagebrush and the few remaining plants provide limited forage. Other preferred browse including black sagebrush (*Artemisia nova*) and fourwing saltbush (*Atriplex canescens*) have been sampled in very low densities (Table - Browse Characteristics).

Herbaceous Understory: The grass component of the understory is not very diverse, and the majority of the grass cover has been provided by bluebunch wheatgrass (*Agropyron spicatum*) and cheatgrass (*Bromus tectorum*) since 1997. Sandberg bluegrass (*Poa secunda*) also occurs in low frequency. Grass cover has increased since the fire. Forbs are relatively diverse, but provide little quality forage. The majority of the perennial forb cover is provided by northern sweetvetch (*Hedysarum boreale*) and shortstem wild buckwheat (*Eriogonum brevicaulis*). Annual species dominate the forb component of the understory. The most common annuals are storksbill (*Erodium cicutarium*) and pale alyssum (*Alyssum alyssoides*) (Table - Herbaceous Trends).

Soil: The soil is part of the Xeric Torriorthents component, which occur on mountain slopes. Parent material consists of colluvium derived from shale and/or residuum weathered from shale. Soils within this classification are characterized as deep (Soil Survey Staff 2011). The area is extremely rocky, and there are numerous rock outcrops. The soil texture is a sandy loam with a neutral soil reaction (pH 7.1) (Soil Analysis Data). Bare ground cover is low with high amounts of rock,

vegetation, and litter cover providing protective ground cover. Some erosion has occurred due to the steep slope. There are microterraces on the downslope side of the vegetation. The soil erosion condition was classified as slight in 2002, stable in 2007, and critical in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly down (-1):** Serviceberry density decreased 62% from 698 plants/acre to 265 plants/acre, although it is believed that serviceberry density was underestimated in 1989. Recruitment of young serviceberry plants decreased from 29% to 12%, and decadence increased from 0% to 25% in the population. Mountain big sagebrush density decreased from 36% from 731 plants/acre to 465 plants/acre. Recruitment of young sagebrush plants increased from 9% to 29%. Decadence decreased from 36% to 29%, but poor vigor increased from 9% to 14%. Cliffrose density was low, but increased 50% from 66 plants/acre to 99 plants/acre. Decadence of cliffrose increased from 0% to 33%, but vigor decreased from 50% to 0% of the population.
- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. The overall health of the preferred browse improved. Recruitment of young serviceberry plants increased to 41%, and decadence decreased to 3%. Recruitment of young mountain big sagebrush plants decreased, but remained good at 17%. Decadence and poor vigor of sagebrush decreased, with no decadent plants or plants displaying poor vigor sampled. There was still no new recruitment of young cliffrose plants. Decadence of cliffrose decreased to 22%, but plants displaying poor vigor increased to 11% of the population. Mountain mahogany, black sagebrush, and fourwing saltbush were sampled in low frequencies.
- **1997 to 2002 - down (-2):** The fire that burned in 2001 eliminated the majority of the shrubs. Serviceberry responded well to the fire and density increased two-fold from 640 plants/acre to 1,300 plants/acre, but cover decreased from 2% to 1%. Most of the increase in density was due to an increase in the recruitment of young plants which comprised 95% of the population. Sagebrush density decreased 78% from 360 plants/acre to 80 plants/acre, and cover decreased from 1% to near 0%. Decadence of mountain big sagebrush increased to 75%, and poor vigor increased to 50% of the population. Cliffrose density decreased 67% from 180 plants/acre to 60 plants/acre. Decadence of cliffrose increased to 33%, but none of the plants displayed poor vigor.
- **2002 to 2007 - stable (0):** Serviceberry density decreased 29% to 920 plants/acre, but cover increased to 2%. Most of the decrease in density was due to a decrease in the recruitment of young serviceberry plants to 59% of the population. Recruitment is still considered to be high. No mountain big sagebrush plants were sampled in density or cover. Cliffrose, mahogany, and black sagebrush were sampled in low densities. Despite the low densities, mahogany increased in cover from less than 1% to 1%, and cliffrose increased in cover from 1% to 2%.
- **2007 to 2012 - stable (0):** Serviceberry density decreased by 33% to 620 plants/acre, but cover remained similar at 2%. Most of the decrease in density was due to a decrease in the recruitment of young serviceberry plants to 29% of the population. Recruitment is still considered to be good. Mountain big sagebrush was sampled at a density of 60 plants/acre, but there was no notable cover. Mahogany density remained the same at 40 plants/acre, but cover increased slightly. Cliffrose density remained the same at 40 plants/acre, but cover decreased to less than 1%.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased 74%. Both bluebunch wheatgrass and Sandberg bluegrass increased significantly in nested frequency.
- **1989 to 1997 - down (-2):** The sum of nested frequency of perennial grasses decreased 29%, and Sandberg bluegrass decreased significantly in nested frequency.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 18%, and cover decreased from 7% to 6%. Bluebunch wheatgrass decreased significantly in nested frequency. Cheatgrass cover increased from 6% to 10%.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial grasses remained similar, but cover to 12%. However, cheatgrass increased significantly in nested frequency, and increased in cover to 17%.
- **2007 to 2012 - slightly up (+1):** The perennial grass sum of nested frequency increased 12%, but cover decreased slightly to 11%. Cheatgrass decreased significantly in nested frequency, and cover decreased to 13%.

Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequency perennial forbs increased nearly two-fold, but perennial forbs remain rare on the site.
- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial forbs decreased 26%.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial forbs increased 53%, but these species were still rare. Cover of perennial forbs decreased from 2% to 1%.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial forbs decreased 55%, but cover remained similar at 1%. Annual forbs increased substantially in nested frequency, and cover increased from 3% to 6%.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, and cover remained similar at 1%. Annual forb sum of nested frequency increased, but cover decreased to 4%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, 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
97	10.0	12.9	6.9	14.3	-4.6	3.5	0.0	<b>43.0</b>	Poor
02	3.4	0.0	0.0	11.0	-7.4	2.6	0.0	<b>9.7</b>	Very Poor
07	8.9	14.5	15.0	23.1	-13.0	2.3	0.0	<b>50.8</b>	Poor-Fair
12	6.0	0.0	0.0	22.1	-9.5	2.1	0.0	<b>20.6</b>	Very Poor



## Trend Summary

### HERBACEOUS TRENDS--

Management unit 16A, Study no: 9

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Agropyron cristatum</i>	-	-	-	-	-	4	-	-	-	.38
G	<i>Agropyron spicatum</i>	ab188	c259	bc215	a141	ab173	b188	7.00	4.87	11.01	10.50
G	<i>Bromus japonicus</i> (a)	-	-	a-	b45	a3	a4	-	.15	.00	.01
G	<i>Bromus tectorum</i> (a)	-	-	a292	a276	b315	a280	6.13	9.72	17.10	12.60
G	<i>Festuca myuros</i> (a)	-	-	-	-	-	5	-	-	-	.03
G	<i>Poa secunda</i>	a4	d75	abc23	cd54	ab25	cb30	.14	.63	.52	.15
G	<i>Vulpia octoflora</i> (a)	-	-	-	-	7	-	-	-	.18	-
Total for Annual Grasses		0	0	292	321	325	289	6.13	9.88	17.28	12.64
Total for Perennial Grasses		192	334	238	195	198	222	7.14	5.50	11.53	11.03
Total for Grasses		192	334	530	516	523	511	13.27	15.39	28.82	23.68
F	<i>Allium</i> sp.	-	-	-	3	-	-	-	.03	-	-
F	<i>Alyssum alyssoides</i> (a)	-	-	b237	a190	a193	ab197	2.66	1.20	1.30	1.07
F	<i>Arabis</i> sp.	-	-	1	-	-	-	.00	-	-	-
F	<i>Artemisia ludoviciana</i>	2	-	3	3	3	3	.03	.03	.03	.03
F	<i>Calochortus nuttallii</i>	3	-	2	1	-	-	.00	.00	-	-
F	<i>Camelina microcarpa</i> (a)	-	-	a-	ab3	b10	b25	-	.00	.02	.06
F	<i>Castilleja linariaefolia</i>	-	-	3	-	-	-	.00	-	-	-
F	<i>Cirsium undulatum</i>	-	-	6	-	-	1	.01	-	-	.00
F	<i>Collinsia parviflora</i> (a)	-	-	-	3	4	2	-	.00	.03	.00
F	<i>Comandra pallida</i>	-	7	-	-	-	-	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	ab9	b20	b24	a3	.02	.10	.51	.00
F	<i>Epilobium brachycarpum</i> (a)	-	-	-	1	-	-	-	.00	-	-
F	<i>Eriogonum brevicaulis</i>	1	2	8	10	6	13	.73	.48	.39	.13
F	<i>Erodium cicutarium</i> (a)	-	-	a23	ab42	c91	bc61	.09	1.39	2.64	.83
F	<i>Galium aparine</i> (a)	-	-	b57	b57	ab32	a32	.83	.22	.38	.53
F	<i>Gilia</i> sp. (a)	-	-	a9	b19	a-	a-	.01	.11	.00	-
F	<i>Hackelia patens</i>	2	6	-	-	-	1	-	-	-	.00
F	<i>Hedysarum boreale</i>	cd27	d31	bcd21	a2	ab8	abc9	.77	.18	.59	.79
F	<i>Holosteum umbellatum</i> (a)	-	-	a-	b9	c55	d78	-	.02	.21	.51
F	<i>Lactuca serriola</i> (a)	a-	a-	a-	a2	b43	c75	-	.03	.34	.50
F	<i>Lappula occidentalis</i> (a)	-	-	6	7	6	6	.01	.04	.01	.04
F	<i>Lygodesmia grandiflora</i>	ab7	b18	a-	a-	a-	a3	-	-	-	.03
F	<i>Machaeranthera canescens</i>	-	9	10	-	4	-	.04	-	.06	-
F	<i>Phacelia linearis</i>	a-	a-	a-	b68	a8	a2	-	.52	.01	.00
F	<i>Phlox longifolia</i>	a-	b11	ab2	ab5	b10	ab6	.00	.06	.03	.04
F	<i>Ranunculus testiculatus</i> (a)	-	-	-	5	-	-	-	.01	-	-
F	<i>Sisymbrium altissimum</i> (a)	-	-	a-	a-	ab4	b12	-	-	.22	.25
F	<i>Streptanthus cordatus</i>	-	-	5	1	3	1	.15	.00	.03	.00
F	<i>Tragopogon dubius</i> (a)	a2	a-	a1	a-	ab8	b16	.00	-	.10	.07
F	Unknown forb-annual (a)	-	-	b33	a-	a-	a-	.08	-	-	-
Total for Annual Forbs		2	0	375	358	470	507	3.73	3.17	5.80	3.89

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
	Total for Perennial Forbs	42	84	61	93	42	39	1.77	1.32	1.16	1.04
	Total for Forbs	44	84	436	451	512	546	5.51	4.49	6.96	4.93

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 9

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier utahensis	16	16	16	14	1.91	1.05	1.65	2.09
B	Artemisia nova	5	0	4	0	-	-	-	-
B	Artemisia tridentata vaseyana	15	4	0	3	.89	.03	-	-
B	Atriplex canescens	1	0	0	0				
B	Brickellia californica	2	0	1	1	.85	-	-	.03
B	Cercocarpus montanus	2	1	2	2	1.00	.15	1.03	1.48
B	Chrysothamnus viscidiflorus stenophyllus	3	3	3	2	.00	.03	.18	.03
B	Cowania mexicana stansburiana	8	3	2	2	3.01	1.06	2.16	.18
B	Gutierrezia sarothrae	7	2	4	5	-	-	.18	.85
B	Juniperus osteosperma	2	0	0	0	2.89	-	-	-
B	Rhus glabra cismontana	0	2	2	4	-	-	1.64	.33
	Total for Browse	61	31	34	33	10.57	2.32	6.85	5.00

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 9

Species	Percent Cover	
	'07	'12
Amelanchier utahensis	2.90	2.59
Brickellia californica	.18	.16
Cercocarpus montanus	1.43	1.13
Chrysothamnus viscidiflorus stenophyllus	1.20	1.39
Cowania mexicana stansburiana	1.78	.36
Gutierrezia sarothrae	.11	.25
Rhus glabra cismontana	2.00	1.35

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 9

Species	Average leader growth (in)	
	'07	'12
Amelanchier utahensis	1.1	2.8
Cercocarpus montanus	1.2	2.5
Cowania mexicana stansburiana	1.3	1.7

BASIC COVER--

Management unit 16A, Study no: 9

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	2.00	8.50	26.68	22.07	43.54	35.00
Rock	26.25	41.25	48.14	51.06	37.57	36.31
Pavement	25.50	3.25	9.28	9.39	6.91	5.33
Litter	44.50	42.25	26.36	19.13	21.97	33.42
Cryptogams	.25	1.50	.88	.00	.01	.00
Bare Ground	1.50	3.25	7.58	13.19	5.55	4.58

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 9, Birch Creek

Effective rooting depth (in)	pH	Sandy Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
13.8	7.1	54.4	30.1	15.6	3.1	9.7	80.0	0.7

PELLET GROUP DATA--

Management unit 16A, Study no: 9

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	-	-	1	2	-	-	-
Elk	30	12	8	12	20 (50)	38 (94)	9 (22)
Deer	15	25	14	10	44 (109)	39 (96)	19 (46)

BROWSE CHARACTERISTICS--

Management unit 16A, 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)	
<b>Amelanchier utahensis</b>										
83	<b>698</b>	29	71	0	-	81	0	10	34/37	
89	<b>265</b>	12	63	25	-	63	13	0	46/31	
97	<b>640</b>	41	56	3	160	50	34	0	52/62	
02	<b>1300</b>	95	3	2	-	0	5	0	42/53	
07	<b>920</b>	59	35	7	100	17	20	4	26/35	
12	<b>620</b>	29	68	3	40	61	3	0	21/30	
<b>Artemisia nova</b>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>0</b>	0	0	0	-	0	0	0	-/-	
97	<b>120</b>	0	83	17	-	50	17	17	15/27	
02	<b>0</b>	0	0	0	-	0	0	0	6/28	
07	<b>80</b>	0	25	75	-	25	0	75	9/20	
12	<b>0</b>	0	0	0	-	0	0	0	20/24	

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>731</b>	9	55	36	-	59	0	9	22/25
89	<b>465</b>	29	43	29	-	50	7	14	17/29
97	<b>360</b>	17	83	0	-	50	33	0	27/47
02	<b>80</b>	0	25	75	-	0	50	50	19/30
07	<b>0</b>	0	0	0	-	0	0	0	18/30
12	<b>60</b>	0	100	0	-	33	0	0	20/26
<i>Atriplex canescens</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	0	100	-	-	0	100	0	22/37
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	42/59
12	<b>0</b>	0	0	-	-	0	0	0	30/44
<i>Brickellia californica</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>100</b>	0	100	-	-	0	0	0	21/28
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>40</b>	0	100	-	-	0	0	0	14/25
12	<b>40</b>	0	100	-	-	0	0	0	12/27
<i>Cercocarpus montanus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>40</b>	0	100	-	-	0	100	0	55/50
02	<b>20</b>	0	100	-	20	0	100	0	71/56
07	<b>40</b>	0	100	-	-	100	0	0	58/57
12	<b>40</b>	0	100	-	-	100	0	0	66/61
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	60/94
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	35/52
12	<b>0</b>	0	0	-	-	0	0	0	38/80
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
83	<b>133</b>	0	100	0	-	0	0	0	19/33
89	<b>199</b>	0	83	17	-	0	0	0	15/27
97	<b>60</b>	0	100	0	20	0	0	0	16/33
02	<b>60</b>	33	33	33	-	0	0	0	11/18
07	<b>80</b>	0	75	25	-	0	0	0	12/26
12	<b>40</b>	0	100	0	-	0	0	0	16/25

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Cowania mexicana stansburiana</i>									
83	66	0	100	0	33	50	50	50	67/69
89	99	0	67	33	-	100	0	0	75/45
97	180	0	78	22	-	44	44	11	65/77
02	60	0	67	33	-	0	100	0	44/64
07	40	50	50	0	-	50	50	0	55/57
12	40	50	50	0	-	50	50	0	36/43
<i>Gutierrezia sarothrae</i>									
83	66	0	100	0	-	0	0	0	11/10
89	33	0	0	100	-	0	0	0	-/-
97	160	38	63	0	20	0	0	0	8/12
02	60	0	67	33	-	0	0	33	6/10
07	140	43	57	0	20	0	0	0	7/12
12	160	0	100	0	-	0	0	0	14/25
<i>Juniperus osteosperma</i>									
83	33	0	100	-	-	0	0	0	67/81
89	33	0	100	-	-	0	0	0	108/79
97	40	0	100	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Pediocactus simpsonii</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	9/11
<i>Quercus gambelii</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	52/76
<i>Rhus glabra cismontana</i>									
83	33	100	0	-	-	0	0	0	-/-
89	299	0	100	-	-	33	0	0	39/35
97	0	0	0	-	-	0	0	0	35/17
02	40	100	0	-	-	0	0	0	-/-
07	60	0	100	-	20	0	0	0	39/50
12	100	0	100	-	-	100	0	0	44/41

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Rhus trilobata										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	74/154	
12	0	0	0	-	-	0	0	0	63/219	

NORTH CANYON - TREND STUDY NO. 16A-10-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Stony Loam \(Mountain Big Sagebrush\), R047XA461UT](#) and [Mountain Stony Loam \(Oak\), R047XA463UT](#)

Land Ownership: DWR

Elevation: 5,670 ft (1,728 m)

Aspect: West

Slope: 15%

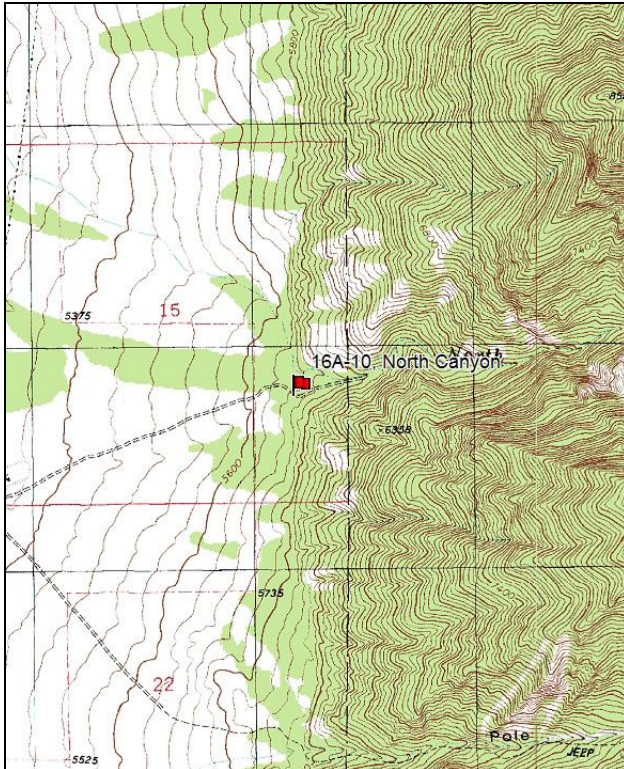
Transect bearing: 267° magnetic

Belt placement: line 1 (11 & 71ft), line 2 (belt 3 on 41ft), line 3 (34ft center on 40, & 95). Rebar: belt 4 on 2ft, belt 2 on 1ft.

Directions:

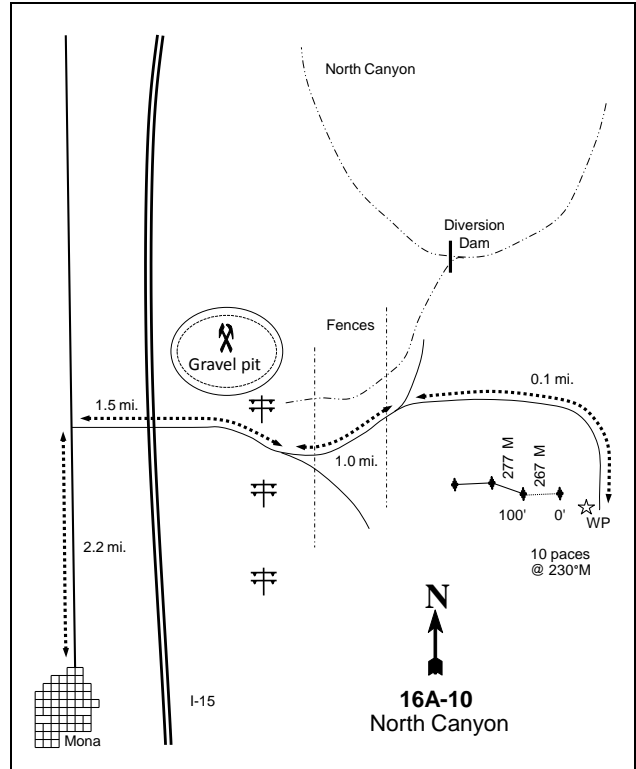
Beginning at the intersection of 200 North and Main Street in Mona, go north on Main Street for 2.2 miles to an improved gravel road on the east side. Take this road east for 1.5 miles (passing beneath the freeway) to where the road forks after crossing an irrigation ditch. Stay left (north) at this fork and continue another mile to where the road faintly forks again. Go 0.1 miles on right (south) fork. The witness post is located 15 feet off the right (south) side of the road. The 0-foot stake is 10 paces at 270 degrees magnetic. A red browse tag, number 3957, is attached to the 0-foot baseline stake.

Map Name: Mona



Township: 11S Range: 1E Section: 15

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 431120 E 4411976 N

## NORTH CANYON - TREND STUDY NO. 16A-10

### Site Information

Site Description: The study is located on Utah Division of Wildlife Resources (UDWR) land near the mouth of North Canyon on an alluvial fan dissected by gullies. The site supports a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and grass community, with lower densities of Gambel oak (*Quercus gambelii*). The area serves as winter range mainly for deer. There is a creek approximately 650 feet (200 m) north of the study. Deer pellet groups were sampled in moderate abundance in 2002, high abundance in 2007, and low abundance in 2012. A few cattle were observed during the 2007 reading, and cattle pats have been sampled in low abundance in 2007 and 2012 (Table - Pellet Group Data).

Browse: The preferred browse species is mountain big sagebrush, which has provided over 50% of the browse cover since 1997 (Table - Browse Trends). The sagebrush stand is a fairly dense population of mostly mature plants. Density has been steadily decreasing since 1997. Recruitment of young sagebrush plants was good in the early sample years, but has been poor since 2002. Decadence was low to moderate from 1983 to 1997, but has been moderate to high since 2002. Sagebrush plants displaying poor vigor has also been higher since 2002. Sagebrush utilization has been mostly light to moderate with some heavy use. Other shrubs that have shown wildlife use include small densities of Gambel oak, curlleaf mountain mahogany (*Cercocarpus ledifolius*), and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is diverse and abundant. Perennial grasses were rare at the outset of the study, but steadily increased on the site from 1983 to 2007. Approximately half of the grass species sampled since 1983 have been natives, and half have been introduced. Sandberg bluegrass (*Poa secunda*), intermediate wheatgrass (*Agropyron intermedium*), and the undesirable species bulbous bluegrass (*Poa bulbosa*) provide the majority of the perennial grass cover. Cheatgrass (*Bromus tectorum*) is also common on the site. Jointed goatgrass (*Aegilops cylindrica*), a noxious weed, was sampled in one quadrat in 2007. The perennial forb composition is diverse, but does not provide abundant cover. Annual species often dominate the forb component on the site. Common houndstongue (*Cynoglossum officinale*), a noxious weed, was sampled in one quadrat in both 1989 and 1997 (Table - Herbaceous Trends).

Soil: The soil is classified as a Lizzant very cobbly loam, which occurs on alluvial fans and mountain slopes. The parent material consists of alluvium derived from limestone and/or colluvium derived from limestone. The soils in this classification are characterized as deep and well-drained (Soil Survey Staff 2011). The parent material on the site was identified as limestone and quartzite. The soil texture is a sandy loam with a neutral soil reaction (pH 7.1). Potassium may have limited availability for plant growth and development at 51.2 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). The soil surface is covered with rocks ranging in size from cobble to boulders. Bare ground cover is low with a high amount of vegetation, litter, rock, and pavement providing protective cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.



## Trend Assessments

### Browse:

- **1983 to 1989 - down (-2):** Mountain big sagebrush density decreased 23% from 6,331 plants/acre to 4,865 plants/acre. Recruitment of young sagebrush plants decreased from 21% to 14%, but is still considered to be good. Decadence of sagebrush increased from 19% to 26%, but plants displaying poor vigor decreased from 20% to 7% of the population.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush plants decreased to 10%, but is still considered to be good. Decadence decreased to 11%, and poor vigor remained similar at 5%.
- **1997 to 2002 - down (-2):** Mountain big sagebrush density decreased 11% from 3,880 plants/acre to 3,460 plants/acre, and cover decreased from 20% to 18%. Recruitment of young sagebrush plants decreased to 3%, which is considered to be poor. Decadence increased to 42%, and poor vigor increased to 21% of the population.
- **2002 to 2007 - slightly down (-1):** Sagebrush density decreased 16% to 2,900 plants/acre, and cover decreased to 14%. Recruitment of young plants remained very low at 2%. Decadence remained high at 39%, and poor vigor remained high at 24% of the population.
- **2007 to 2012 - down (-2):** Density of mountain big sagebrush decreased 38% to 1,800 plants/acre, and cover decreased to 12%. Recruitment of young plants was poor at just 1%. Decadence decreased, but remained high at 29%, and poor vigor decreased to 16%.

### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased 30%, but species diversity was low.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial grass, excluding bulbous bluegrass, increased 32%. Sandberg bluegrass increased significantly in nested frequency.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar, but cover increased from 4% to 11%. Bulbous bluegrass increased significantly in nested frequency and cover increased from less than 1% to 3%.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, increased 20%, and cover increased to 13%. Bulbous bluegrass increased significantly in nested frequency, and cover increased to 8%. The noxious weed jointed goatgrass was sampled, but only in one quadrat.
- **2007 to 2012 - slightly up (+1):** Perennial grass sum of nested frequency, excluding bulbous bluegrass, increased 14%, and cover increased to 15%. Intermediate wheatgrass increased significantly in nested frequency. Bulbous bluegrass decreased significantly in nested frequency, and cover decreased to 5%. Cheatgrass decreased significantly in nested frequency and cover decreased from 6% to 2%.

### Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequency of perennial forbs remained similar. The noxious weed common houndstongue was sampled, but only in one quadrat.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased nearly three-fold, but cover was low at 3%. Common houndstongue was sampled again, but did not increase in quadrat frequency.

- **1997 to 2002 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 23%, and cover decreased to 2%. Although total forb cover did not change, the composition shifted from mostly perennial cover to mostly annual cover.
- **2002 to 2007 - stable (0):** The sum of nested frequency and cover of perennial forbs remained similar. Annual forb sum of nested frequency remained similar, but cover increased from 2% to 6%.
- **2007 to 2012 - slightly up (+1):** The perennial forb sum of nested frequency increased 14%, but cover remained similar at 2%. Annual forb sum of nested frequency decreased substantially, and cover decreased to 1%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 10

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	27.8	12.1	5.5	7.6	-4.5	5.6	-2.0	<b>52.0</b>	Fair
02	29.4	1.9	3.0	21.3	-4.2	3.4	0.0	<b>54.8</b>	Fair
07	23.1	6.2	6.6	25.6	-4.5	4.2	0.0	<b>61.3</b>	Fair
12	24.0	9.6	5.9	29.9	-1.7	4.4	0.0	<b>72.2</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 10

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Aegilops cylindrica (a)	-	-	-	-	1	-	-	-	.00	-
G	Agropyron cristatum	8	22	7	6	11	8	.04	.57	.34	.31
G	Agropyron intermedium	ab40	ab48	a24	ab25	b51	c101	.61	2.76	4.15	6.18
G	Agropyron spicatum	-	-	-	-	1	1	-	-	.00	.18
G	Aristida purpurea	a8	ab7	ab18	ab20	b23	ab18	.80	.76	.82	.46
G	Bromus carinatus	1	-	-	6	-	-	-	.68	-	-
G	Bromus japonicus (a)	-	-	-	3	10	9	-	.03	.02	.39
G	Bromus tectorum (a)	-	-	b274	b284	b274	a151	5.69	5.55	5.60	1.68
G	Festuca myuros (a)	-	-	a29	a4	b75	a26	.30	.01	.31	.22
G	Festuca ovina	a-	a-	ab6	b18	b20	b13	.53	1.01	1.19	.46
G	Poa bulbosa	a-	a-	b15	c60	e161	d112	.24	2.91	7.85	5.28
G	Poa pratensis	-	-	-	2	11	10	-	.03	.10	.39
G	Poa secunda	a75	ab114	c166	bc165	c174	c177	1.37	4.28	4.67	6.05
G	Sitanion hystrix	-	-	7	2	3	4	.01	.06	.09	.01
G	Sporobolus cryptandrus	b15	a-	bc24	bc23	bc27	c34	.41	.46	1.40	.89
G	Vulpia octoflora (a)	-	-	a-	a7	b21	a-	-	.04	.06	-
Total for Annual Grasses		0	0	303	298	381	186	5.99	5.63	6.00	2.30
Total for Perennial Grasses		147	191	267	327	482	478	4.03	13.56	20.65	20.24
Total for Grasses		147	191	570	625	863	664	10.02	19.20	26.66	22.54
F	Allium sp.	-	-	8	-	-	2	.01	-	-	.00
F	Alyssum alyssoides (a)	-	-	a86	c178	b130	bc102	.27	.43	.64	.23

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Antennaria rosea</i>	-	-	-	4	3	-	-	.03	.00	-
F	<i>Aster chilensis</i>	-	-	-	-	3	-	-	-	.00	-
F	<i>Astragalus eurekaensis</i>	a-	a-	a-	b14	ab8	a1	-	.15	.02	.00
F	<i>Astragalus utahensis</i>	a-	a-	ab27	a8	ab15	b25	.33	.09	.30	.50
F	<i>Calochortus nuttallii</i>	-	-	ab18	b25	ab13	a3	.04	.08	.05	.01
F	<i>Castilleja linariaefolia</i>	-	-	-	2	-	3	-	.03	-	.03
F	<i>Cirsium vulgare</i>	3	-	7	-	2	5	.02	.00	.04	.06
F	<i>Collinsia parviflora</i> (a)	-	-	a19	b78	c126	b90	.06	.27	2.87	.43
F	Cruciferae	-	2	-	-	-	-	-	-	-	-
F	<i>Cryptantha</i> sp.	-	-	4	-	1	3	.03	-	.00	.03
F	<i>Cynoglossum officinale</i>	-	2	3	-	-	-	.00	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	-	-	3	-	-	-	.00
F	<i>Draba</i> sp. (a)	-	-	a-	a14	b81	a8	-	.04	.19	.02
F	<i>Epilobium brachycarpum</i> (a)	-	-	10	6	1	1	.02	.02	.00	.00
F	<i>Erigeron pumilus</i>	5	2	8	1	-	1	.09	.00	-	.00
F	<i>Eriogonum racemosum</i>	43	52	73	47	58	43	2.09	.80	.66	.29
F	<i>Galium aparine</i> (a)	-	-	b100	b79	b97	a17	.42	.62	2.36	.06
F	<i>Hackelia patens</i>	-	-	a-	a-	a-	b15	-	-	-	.17
F	<i>Helianthus annuus</i> (a)	ab4	b15	a-	ab8	a-	a-	-	.01	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	a29	b82	ab48	a46	.05	.19	.13	.08
F	<i>Lactuca serriola</i> (a)	-	-	-	-	6	1	-	-	.01	.00
F	<i>Leucelene ericoides</i>	a-	a-	ab6	b14	b19	b20	.03	.36	.40	.35
F	<i>Lithospermum incisum</i>	-	-	4	6	3	10	.03	.04	.04	.04
F	<i>Machaeranthera canescens</i>	6	3	8	-	3	-	.04	-	.15	-
F	<i>Medicago sativa</i>	1	3	2	-	-	-	.03	-	-	-
F	<i>Microsteris gracilis</i> (a)	-	-	a-	b13	ab7	ab5	-	.03	.01	.01
F	<i>Oenothera pallida</i>	-	-	-	3	3	9	-	.03	.06	.45
F	<i>Phlox longifolia</i>	a-	a-	a3	ab9	ab8	b21	.00	.02	.05	.03
F	<i>Ranunculus testiculatus</i> (a)	-	-	bc74	c93	b40	a4	.18	.55	.12	.01
F	<i>Tragopogon dubius</i> (a)	-	-	-	1	-	7	-	.00	-	.01
F	Unknown forb-annual (a)	-	-	2	-	-	-	.01	-	-	-
F	Unknown forb-perennial	3	-	-	-	-	-	-	-	-	-
F	<i>Verbascum thapsus</i>	-	-	-	-	3	3	-	-	.15	.18
F	<i>Wyethia amplexicaulis</i>	-	-	-	-	2	-	-	-	.15	-
F	<i>Zigadenus paniculatus</i>	-	-	4	2	3	4	.01	.03	.03	.03
Total for Annual Forbs		4	15	320	552	536	284	1.02	2.19	6.35	0.87
Total for Perennial Forbs		61	64	175	135	147	168	2.80	1.69	2.12	2.21
Total for Forbs		65	79	495	687	683	452	3.82	3.88	8.47	3.08

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

BROWSE TRENDS--

Management unit 16A, Study no: 10

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	88	74	71	56	19.99	18.17	13.61	11.85
B	Cercocarpus ledifolius	1	1	2	1	.00	-	-	-
B	Chrysothamnus nauseosus albicaulis	2	6	5	5	1.39	3.15	.96	1.51
B	Chrysothamnus viscidiflorus viscidiflorus	1	0	0	0	.38	-	-	-
B	Gutierrezia sarothrae	24	31	33	29	2.14	.36	.94	1.89
B	Opuntia sp.	3	0	0	1	.00	-	-	-
B	Pediocactus simpsonii	0	1	2	1	-	.00	.15	-
B	Quercus gambelii	7	9	11	9	1.06	2.40	4.21	6.34
B	Rhus trilobata	0	0	1	1	-	.38	.66	1.00
Total for Browse		126	122	125	103	24.98	24.47	20.53	22.62

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 10

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	18.11	11.56
Cercocarpus ledifolius	.11	-
Chrysothamnus nauseosus albicaulis	2.34	1.25
Gutierrezia sarothrae	.60	3.33
Quercus gambelii	4.71	7.36
Rhus trilobata	.45	.61

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 10

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.1	2.2	2.2

BASIC COVER--

Management unit 16A, Study no: 10

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	1.00	3.75	34.09	48.70	50.06	48.22
Rock	20.50	25.25	18.35	20.88	16.87	15.76
Pavement	7.00	10.00	15.76	16.25	14.11	10.30
Litter	66.75	56.75	43.20	43.88	39.07	56.50
Cryptogams	0	0	1.19	1.19	.53	.38
Bare Ground	4.75	4.25	4.25	.91	2.50	1.27

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 10, North Canyon

Effective rooting depth (in)	pH	Sandy Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
10.3	7.1	56.4	28.1	15.6	3.2	8.2	51.2	0.8

PELLET GROUP DATA--

Management unit 16A, Study no: 10

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	-	4	3	4	-	-	-
Elk	-	1	-	-	-	-	-
Deer	6	16	26	6	21 (53)	54 (132)	11 (26)
Cattle	-	-	-	1	-	1 (2)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 16A, Study no: 10

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata vaseyana</i>										
83	<b>6331</b>	21	60	19	-	17	24	20	21/24	
89	<b>4865</b>	14	60	26	-	49	40	7	19/28	
97	<b>3880</b>	10	79	11	40	49	17	5	24/40	
02	<b>3460</b>	3	55	42	-	14	.57	21	23/33	
07	<b>2900</b>	2	59	39	20	46	14	24	26/34	
12	<b>1800</b>	1	70	29	80	21	4	16	25/38	
<i>Cercocarpus ledifolius</i>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>0</b>	0	0	0	-	0	0	0	-/-	
97	<b>20</b>	100	0	0	-	0	0	0	-/-	
02	<b>20</b>	0	0	100	-	0	100	0	3/4	
07	<b>40</b>	50	50	0	-	0	100	0	9/10	
12	<b>20</b>	0	100	0	-	0	100	0	9/13	
<i>Chrysothamnus nauseosus albicaulis</i>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>0</b>	0	0	0	-	0	0	0	-/-	
97	<b>40</b>	0	100	0	-	50	0	0	32/33	
02	<b>220</b>	0	9	91	-	9	0	0	37/31	
07	<b>100</b>	0	60	40	-	0	0	20	28/33	
12	<b>120</b>	0	83	17	-	17	0	0	30/41	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	20	0	100	-	-	0	0	0	34/38	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Cowania mexicana stansburiana</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	51/113	
<i>Gutierrezia sarothrae</i>										
83	1065	37	63	0	-	0	0	0	9/8	
89	1731	42	23	35	-	0	0	4	8/5	
97	2020	28	70	2	80	0	0	0	7/8	
02	1700	5	88	7	-	0	0	7	6/6	
07	2660	60	36	4	100	0	0	2	11/17	
12	2680	7	90	2	40	0	.74	.74	9/13	
<i>Opuntia sp.</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	80	0	100	-	-	0	0	0	5/7	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	2/3	
<i>Pediocactus simpsonii</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	40	0	100	-	-	0	0	0	7/7	
07	60	67	33	-	-	0	0	0	6/6	
12	20	0	100	-	-	0	0	0	7/6	
<i>Prunus virginiana</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	72/142	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	98/18	

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<b>Quercus gambelii</b>									
83	<b>199</b>	67	33	-	66	0	0	0	20/31
89	<b>199</b>	100	0	-	-	100	0	0	-/-
97	<b>140</b>	43	57	-	-	57	0	0	65/48
02	<b>420</b>	38	62	-	-	0	0	38	48/35
07	<b>620</b>	39	61	-	-	0	0	0	71/51
12	<b>480</b>	21	79	-	20	0	0	0	-/-
<b>Rhus trilobata</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	62/113
07	<b>20</b>	100	0	-	-	0	0	0	78/143
12	<b>20</b>	100	0	-	-	0	0	0	56/76

REES FLAT - TREND STUDY NO. 16A-11-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#) and [Mountain Gravelly Loam \(Oak\), R047XA410UT](#)

Land Ownership: USFS

Elevation: 6,700 ft (2,042 m)

Aspect: South

Slope: 17%

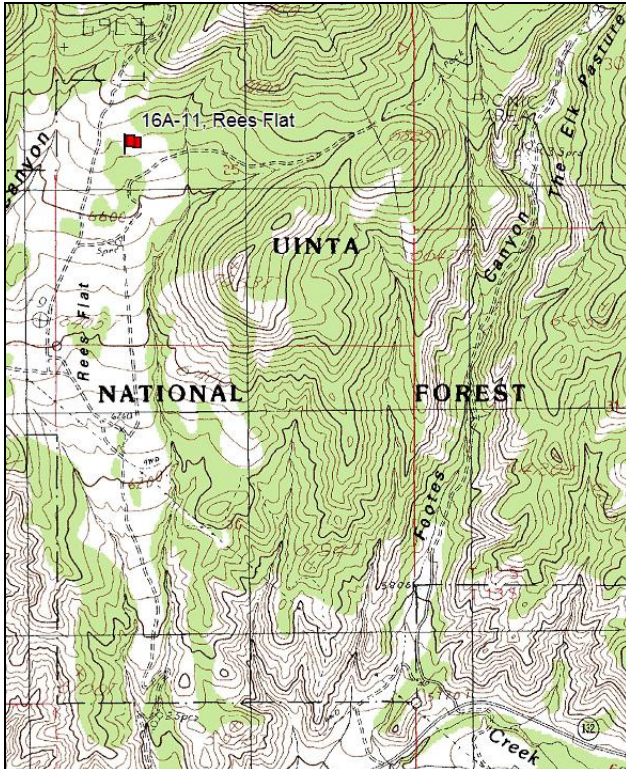
Transect bearing: 344° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft). Rebar: belt 5 on 5ft.

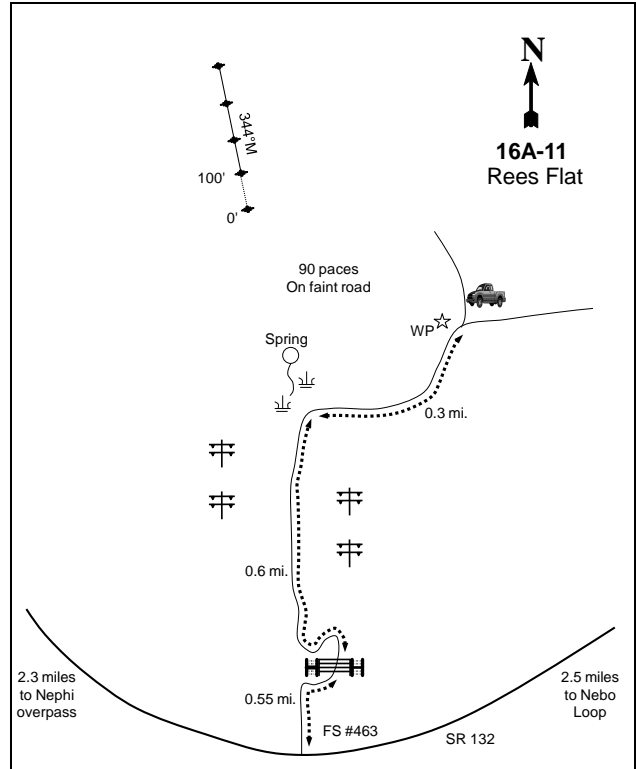
Directions:

Beginning at the overpass where Highway 132 crosses beneath I-15 in Nephi, take Highway 132 east for 2.3 miles. Turn north onto Forest Service Road #463 and go 0.2 miles to a fork in the road. Stay left and go another 0.35 miles to a gate. From the gate, go 0.65 miles to another fork. Stay right on the main road for 0.6 miles passing through a 4-way intersection beneath the powerlines until you come to a spring on the left. Continue 0.3 miles farther along to a 3-foot tall witness post 6 paces northwest of the road near some oak brush. Stop here and walk 90 paces west on a faint road. The 0-foot baseline stake is 9 paces north of the faint road. It is a 12 inch high red post marked by browse tag #3956.

Map Name: Nephi



Diagrammatic Sketch:



Township: 12S Range: 1E Section: 25

GPS: NAD 83, UTM 12S 433389 E 4399358 N



## REES FLAT - TREND STUDY NO. 16A-11

### Site Information

Site Description: The study is located in a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Gambel oak (*Quercus gambelii*) community that was burned and seeded before the study was established. The site is used primarily by deer as high-elevation winter range, but elk have also used it fairly consistently. A moderate number of deer and elk pellet groups, as well as two deer antler drops, were noted in 1983 when the study was established. Deer pellet groups were sampled in high abundance in 2002, moderate abundance in 2007, and low abundance in 2012. Elk pellet groups were sampled in moderate abundance in 2002 and 2007, but low abundance in 2012. Cattle pats have been sampled in low abundance since 2002 (Table - Pellet Group Data). Cattle and horses graze the area in the summer.

Browse: The preferred browse species are mountain big sagebrush and antelope bitterbrush (*Purshia tridentata*). Sagebrush provides the majority of the browse cover on the site, and has steadily increased in cover since 1997 (Table - Browse Trends). Despite increases in cover, density of sagebrush has decreased since 2002. The sagebrush stand is a moderately dense stand of mostly mature plants. Recruitment of young sagebrush plants was high in the early years of the study, but has been poor since 2007. Health of the sagebrush population is good, with low decadence and good vigor. Utilization of sagebrush has been mostly light to moderate. Some of the sagebrush plants were noted to have an insect infestation, most likely the sagebrush defoliator moth (*Aroga websteri*), in 2007. Bitterbrush has been increasing on the site since 1997. The bitterbrush stand is a scattered population of mostly mature plants intermixed with the sagebrush. Recruitment of young bitterbrush plants has been generally good. And the population is healthy with no decadent or plants displaying poor vigor sampled. Utilization of bitterbrush has been mostly moderate to heavy. Bitterbrush plants were infested with tent caterpillars during the 2007 reading, but did not seem to be adversely impacted. Gambel oak is also present in scattered clones, with an average height that has ranged from 4 to 7 feet (1.2 to 2.1 m) since 1983. This species provides some additional forage, but has been generally lightly browsed (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are abundant, but diversity is low with only two species being common on the site. The majority of the total grass cover has been comprised of bulbous bluegrass (*Poa bulbosa*), an undesirable perennial, and smooth brome (*Bromus inermis*). Annual grasses are rare on the site. Perennial forb species are relatively diverse, but occur infrequently (Table - Herbaceous Trends).

Soil: The soil is classified as a Yeates Hollow very stony loam, which occurs on mountain slopes and alluvial fans. The soils in this classification are characterized as deep and well-drained. They formed in alluvium and colluvium derived from conglomerate, sandstone, and quartzite (Soil Survey Staff 2011). The soil texture is a loam with a moderately acidic soil reaction (pH 5.9) (Table - Soil Analysis Data). Bare ground cover is low, with a large amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly down (-1):** Mountain big sagebrush density decreased 60% from 499 plants/acre to 198 plants/acre. Decadence of sagebrush increased from 7% to 17%, and poor vigor increased from 0% to 17%. However, recruitment of young sagebrush plants increased from 0% to 33% of the population. Bitterbrush density increased 80% from 166 plants/acre to 299 plants/acre. Recruitment of young bitterbrush plants increased to 22% of the population.
- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determine using other parameters. Recruitment of young sagebrush plants increased to 72% of the population. Decadence and poor vigor of sagebrush both decreased to 3% of the population. The bitterbrush population remained similar.
- **1997 to 2002 - up (+2):** Mountain big sagebrush density increased 82% from 1,900 plants/acre to 3,460 plants/acre, and cover increased from 4% to 10%. Although recruitment of young sagebrush plants decreased, recruitment is still considered very high at 48% of the population. Both decadence and poor vigor remained low at 6%. Bitterbrush density increased two-fold from 200 plants/acre to 420 plants/acre, and cover increased from 2% to 4%. Recruitment of young bitterbrush plants decreased from 20% to 14% of the population, but recruitment is still considered good.
- **2002 to 2007 - slightly down (-1):** Sagebrush density decreased 16% to 2,900 plants/acre, but cover increased from to 13%. Recruitment of young sagebrush plants decreased to 7% of the population. Decadence decreased to 2%, and poor vigor decreased to 1% of the population. Bitterbrush density remained the same at 420 plants/acre, but cover increased to 5%. Recruitment of young bitterbrush plants decreased to 10% of the population, but is still considered good.
- **2007 to 2012 - slightly up (+1):** The sagebrush stand appears to be going through a period of maturation with decreased recruitment and increased cover of mature plants. Density of mountain big sagebrush decreased 16% to 2,440 plants/acre, but cover increased to 14%. Recruitment of young sagebrush plants decreased to just 2% of the population. Bitterbrush density increased nearly three-fold to 1,180 plants/acre, and cover increased to 8%. Recruitment of young bitterbrush plants increased to 25% of the population.

### Grass:

- **1983 to 1989 - down (-2):** The sum of nested frequency of perennial species, excluding bulbous bluegrass, decreased by 51%. Bulbous bluegrass increased significantly in nested frequency, while Sandberg bluegrass and crested wheatgrass (*Agropyron cristatum*) decreased significantly in nested frequency.
- **1989 to 1997 - stable (0):** The trend for grass is stable. The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar. Bulbous bluegrass and smooth brome increased significantly in nested frequency.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar, and cover increased from 8% to 10%. Smooth brome increased significantly in nested frequency, while crested wheatgrass decreased significantly.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar, and cover increased to 20%. Most of the increase in cover was due to an increase in smooth brome. Bulbous bluegrass cover decreased from 32% to 26%.

- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, excluding bulbous bluegrass, and cover decreased to 16%. Bulbous bluegrass decreased significantly in nested frequency, but still dominates the herbaceous understory with 28% cover.

Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequency of perennial forbs remained similar.
- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial forbs increased slightly, but forbs remain rare.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial forbs decreased 50%, but forbs were already rare on the site.
- **2002 to 2007 - stable (0):** The sum of nested frequency for forbs increased 61%, but forbs remain rare on the site.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial forbs.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 11

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	12.1	14.6	15.0	15.2	-1.7	3.0	0.0	<b>58.3</b>	Fair
02	23.3	13.6	14.8	19.4	0.0	1.8	0.0	<b>72.8</b>	Good
07	27.1	14.1	4.1	30.0	0.0	1.5	0.0	<b>76.8</b>	Good
12	30.0	12.7	5.4	30.0	0.0	2.2	0.0	<b>80.3</b>	Good-Excellent

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 11

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	c159	b117	b94	a33	a43	a12	2.14	.42	.64	.24
G	Agropyron spicatum	a24	ab11	a-	a4	a-	a-	-	.03	.00	-
G	Bromus inermis	a88	a118	b170	c245	cd272	d300	5.09	8.34	18.73	14.54
G	Bromus tectorum (a)	-	-	b48	a-	a-	a3	2.26	-	-	.00
G	Dactylis glomerata	6	2	-	-	-	-	-	-	-	-
G	Poa bulbosa	a3	bc282	d352	d335	cd318	b279	26.80	31.76	26.46	28.11
G	Poa fendleriana	a-	a3	a-	a-	b13	a-	-	-	.09	-
G	Poa pratensis	ab14	b14	a-	ab3	ab7	ab6	-	.38	.18	.30
G	Poa secunda	b290	a18	a25	a29	a8	a17	.37	.51	.04	.49
Total for Annual Grasses		0	0	48	0	0	3	2.26	0	0	0.00
Total for Perennial Grasses		584	565	641	649	661	614	34.42	41.44	46.15	43.69
Total for Grasses		584	565	689	649	661	617	36.69	41.44	46.15	43.70
F	Agoseris glauca	3	-	7	1	-	1	.19	.03	-	.00
F	Artemisia ludoviciana	4	3	-	-	-	-	-	-	-	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Aster chilensis	-	10	-	-	-	-	-	-	-	-
F	Astragalus beckwithii	a-	a-	b15	b14	b21	b25	.43	.16	.40	.73
F	Astragalus convallarius	-	-	2	-	-	-	.03	-	-	-
F	Calochortus nuttallii	3	-	7	-	2	1	.02	-	.00	.00
F	Cirsium sp.	5	6	4	5	2	1	.04	.18	.15	.00
F	Collinsia parviflora (a)	-	-	-	-	3	2	-	-	.01	.00
F	Collomia sp. (a)	-	-	1	-	5	-	.00	-	.02	-
F	Comandra pallida	bc23	c29	ab10	a5	ab8	abc13	.48	.03	.04	.22
F	Cymopterus longipes	10	3	14	6	7	10	.09	.04	.01	.05
F	Draba sp. (a)	-	-	a-	a-	b10	a3	-	-	.05	.01
F	Epilobium brachycarpum (a)	-	-	b19	a-	a-	a-	.04	-	-	-
F	Erigeron divergens	-	-	2	-	-	-	.15	-	-	-
F	Eriogonum brevicaulis	-	-	-	3	-	-	-	.00	-	-
F	Lactuca serriola (a)	-	-	1	-	1	-	.00	-	.00	-
F	Lathyrus brachycalyx	2	-	-	-	-	-	-	-	-	-
F	Machaeranthera canescens	-	9	2	-	-	-	.00	-	-	-
F	Phlox longifolia	16	15	26	11	31	15	.05	.40	.14	.04
F	Polygonum douglasii (a)	-	-	-	3	-	-	-	.00	-	-
F	Solidago sparsiflora	2	-	-	-	-	-	-	-	-	-
F	Stellaria sp.	5	-	-	-	-	-	-	-	-	-
F	Tragopogon dubius (a)	b14	ab6	ab6	a3	a-	a-	.01	.00	-	-
F	Unknown forb-annual (a)	-	-	2	-	-	-	.00	-	-	-
F	Viguiera multiflora	b9	a-	a-	a-	a-	a-	-	-	-	-
F	Zigadenus paniculatus	-	-	3	1	3	6	.03	.03	.00	.06
Total for Annual Forbs		14	6	29	6	19	5	0.07	0.00	0.09	0.01
Total for Perennial Forbs		82	75	92	46	74	72	1.52	0.89	0.76	1.12
Total for Forbs		96	81	121	52	93	77	1.59	0.90	0.86	1.14

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 11

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	45	55	57	59	4.21	9.89	12.74	13.85
B	Chrysothamnus nauseosus albicaulis	1	1	1	0	.15	.03	.03	-
B	Chrysothamnus viscidiflorus viscidiflorus	0	2	0	1	-	-	-	.00
B	Gutierrezia sarothrae	18	37	23	16	.52	1.52	.24	.03
B	Purshia tridentata	7	15	17	20	1.54	4.21	5.19	8.40
B	Quercus gambelii	14	16	16	14	4.35	4.57	3.32	.95
Total for Browse		85	126	114	110	10.79	20.23	21.52	23.25

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 11

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	16.43	17.43
Chrysothamnus nauseosus albicaulis	.05	-
Gutierrezia sarothrae	.30	.08
Purshia tridentata	5.56	9.61
Quercus gambelii	6.46	4.28

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 11

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.6	1.7	1.5
Purshia tridentata	1.4	1.6	1.0

BASIC COVER--

Management unit 16A, Study no: 11

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	.25	8.25	50.06	57.61	63.02	60.41
Rock	7.50	7.75	2.80	3.06	2.80	3.58
Pavement	3.50	8.25	5.17	2.70	4.69	1.70
Litter	54.50	50.00	33.86	38.47	33.59	57.45
Cryptogams	.50	3.00	8.60	4.12	1.22	1.84
Bare Ground	33.75	22.75	7.52	11.90	11.02	3.64

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 11, Rees Flat

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
15.4	5.9	40.4	33.1	26.6	2.4	29.8	179.2	0.4

PELLET GROUP DATA--

Management unit 16A, Study no: 11

Type	Quadrat Frequency			
	'97	'02	'07	'12
Sheep	-	-	-	3
Rabbit	2	3	5	3
Elk	38	13	9	16
Deer	26	29	33	14
Cattle	2	4	1	-

Days use per acre (ha)		
'02	'07	'12
-	-	1 (2)
-	-	-
27 (66)	22 (55)	13 (33)
56 (137)	25 (61)	13 (33)
9 (22)	2 (4)	-

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 11

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>499</b>	0	93	7	-	13	0	0	18/26
89	<b>198</b>	33	50	17	-	17	17	17	17/13
97	<b>1900</b>	72	25	3	560	6	4	3	24/44
02	<b>3460</b>	48	46	6	360	18	5	6	18/36
07	<b>2900</b>	7	91	2	-	14	.68	1	22/36
12	<b>2440</b>	2	85	13	-	27	4	5	22/36
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>20</b>	0	100	0	-	100	0	0	9/13
02	<b>20</b>	0	0	100	-	100	0	100	19/37
07	<b>80</b>	0	100	0	-	0	0	0	19/18
12	<b>0</b>	0	0	0	-	0	0	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	10/28
02	<b>40</b>	50	50	-	-	0	0	0	9/22
07	<b>0</b>	0	0	-	-	0	0	0	7/14
12	<b>20</b>	100	0	-	-	0	0	0	11/17
<i>Grayia spinosa</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	20	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
83	<b>2198</b>	67	32	2	733	0	0	0	8/6
89	<b>1597</b>	6	81	12	-	0	0	0	9/7
97	<b>1500</b>	33	60	7	380	0	0	7	5/8
02	<b>2600</b>	5	72	23	-	0	0	8	4/7
07	<b>2140</b>	64	27	8	80	10	0	.93	7/8
12	<b>740</b>	19	81	0	60	0	0	0	6/9

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Purshia tridentata</i>										
83	<b>166</b>	0	100	-	-	80	0	0	16/28	
89	<b>299</b>	22	78	-	66	78	11	0	23/39	
97	<b>200</b>	20	80	-	40	60	10	0	27/81	
02	<b>420</b>	14	86	-	-	10	81	0	27/72	
07	<b>420</b>	10	90	-	-	19	52	0	30/66	
12	<b>1180</b>	25	75	-	-	61	17	0	24/57	
<i>Quercus gambelii</i>										
83	<b>4898</b>	4	96	0	133	0	0	0	46/24	
89	<b>3965</b>	31	51	18	1033	.84	0	3	77/36	
97	<b>1740</b>	38	62	0	40	1	0	0	86/76	
02	<b>2480</b>	4	90	6	-	0	14	31	62/32	
07	<b>1640</b>	10	79	11	20	0	0	99	68/47	
12	<b>1200</b>	15	85	0	-	0	0	2	84/81	

TITHING MOUNTAIN - TREND STUDY NO. 16A-12-12

Vegetation Type: Cliffrose

Range Type: Crucial Elk Winter

NRCS Ecological Site Description: Mountain Stony Loam (Browse), R047XA460UT

Land Ownership: Private

Elevation: 5,675 ft (1,729 m)

Aspect: South

Slope: 15%

Transect bearing: 140° magnetic

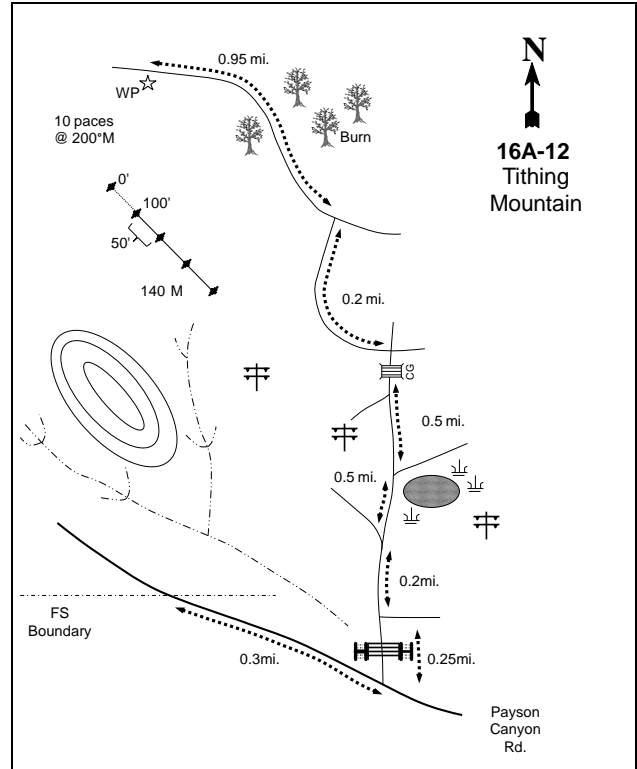
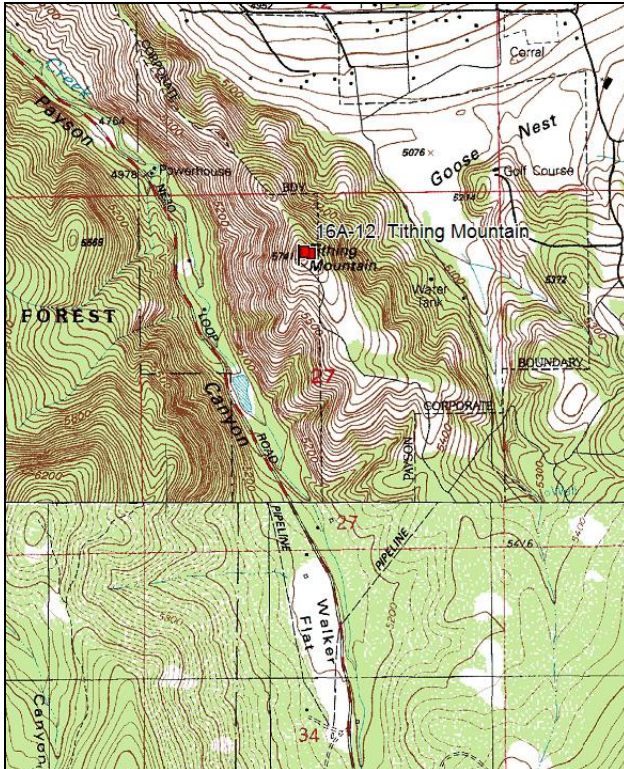
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:

[A key is needed to get in the gate]. Starting from 100 North and 600 East in Payson, head south on 600 East, which turns into the Payson Canyon Road. Go 2.9 miles to a flood control basin and a wide spot in the road. Either park here, cross the creek, follow the pipeline south to the first draw, then walk approximately 1/2 mile northwest up this draw to the burn, the road and the transect; **OR** continue driving up the Payson Canyon Road another 1.6 miles to the Forest Service boundary. Go another 0.3 miles and take a rough dirt road on the left (north). Go another 0.25 miles to a side road. Stay straight (left) 0.1 miles further until you cross a cattle guard. Go 0.1 miles beyond the cattle guard until you come to an intersection. At the intersection, go straight for 0.5 miles passing a pond and crossing beneath the powerlines to another fork in the road. Go straight (north) for another 0.5 miles to a 4-way intersection. Stay left (west) and go 0.2 miles to a 3-way intersection where you will turn right (west). Go 0.95 miles up the ridge to a witness post/rock pile on the left side of the road. From here, the 0-foot baseline stake (marked by browse tag #9083) is 10 paces away at 200 degrees magnetic.

Map Name: Spanish Fork

Diagrammatic Sketch:



Township: 9S Range: 2E Section: 27

GPS: NAD 83, UTM 12S 440081 E 4429054 N



## TITHING MOUNTAIN - TREND STUDY NO. 16A-12

### Site Information

Site Description: The study is located on private land to monitor crucial deer and elk winter range southeast of Payson. The ridge is occupied by a stand of cliffrose (*Cowania mexicana* ssp. *stansburiana*). The area has been used in the past by wintering deer and elk, as well as domestic sheep and cattle. Deer pellet groups have been sampled at moderate to very high abundance since 2002. Three deer were observed during the 2007 reading, and deer bedding areas were noted on and around the site. Elk pellet groups were sampled in low abundance in 2002 and moderate abundance in 2007. No elk pellets were sampled in 2012. Both sheep and cattle pellets have been sampled in very low abundance in different sample years (Table - Pellet Group Data).

Browse: The preferred browse is Stansbury cliffrose, which provides nearly all of the browse cover (Table - Browse Trends). The cliffrose stand is a fairly dense population of large, mature and decadent plants. Recruitment of young cliffrose plants has been minimal throughout the study years. Decadence and poor vigor were generally low throughout the sample years, but increased substantially in 2012. In 1989 it was noted that the older, taller cliffrose had large branches broken down. Mature plants have been measured up to 8.1 feet (2.5 m) in height. Utilization of cliffrose has been moderate to heavy over the course of the study. Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) was common on the site at the outset of the study, but has decreased steadily over the course of the study. Sagebrush is now rare on the site. A small population of Gambel oak (*Quercus gambelii*) provides some additional forage on the site, but use of oak has been light (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant on the site, but are comprised of weedy annual and low-value perennial species. Bulbous bluegrass (*Poa bulbosa*) and cheatgrass (*Bromus tectorum*) are the only common species and provide nearly all of the grass cover. Cheatgrass has been common on the site since the study was established. Bulbous bluegrass has steadily increased in frequency and cover throughout the sample years. The noxious weed jointed goatgrass (*Aegilops cylindrica*) has been sampled in low frequency and cover since 2007. Forbs are diverse, but are dominated by annuals and weedy species. Whitetop (*Cardaria draba*), a noxious weed, has been sampled since 1989 and is the most abundant perennial forb on the site. Annual forb species have dominated the forb component in most years. Storksbill (*Erodium cicutarium*) is the most common annual species (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Henefer-Rake association, likely as part of the Rake component which occur on ridges and mountain slopes. The Rake series consists of shallow to lime-cemented hardpan soils that formed in colluvium and local alluvium derived from limestone and minor amounts of quartz. The soil on the site is well-drained and moderately shallow (Soil Survey Staff 2011). The texture is a clay loam with slightly acidic soil reaction (pH 6.3) (Table - Soil Analysis Data). Cobble-sized rocks are common throughout the soil profile. Bare ground cover is very low, with a high amount of vegetation and litter providing ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

### Trend Assessments

#### Browse:

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. The cliffrose plants were mostly mature, and decadence decreased from 21% to 13% of the population. Recruitment of young cliffrose plants decreased from 21% to 0%. Plants showing poor vigor increased from 0% to 8% of the population. Decadence of mountain big sagebrush decreased from 30% to 11% of the population. Recruitment also decreased, but was still high with 26% of the population composed of young plants. Vigor improved from 15% of the plants displaying poor vigor to only 3%.

- **1997 to 2002 - down (-2):** Cliffrose density decreased 24% from 760 plants/acre to 580 plants/acre, but cover remained similar at 14%. Decadence of cliffrose increased from 13% to 17%, and plants displaying poor vigor increased from 14% of the population. Sagebrush density decreased 66% from 700 plants/acre to 240 plants/acre, and cover decreased from 3% to less than 1%. Recruitment of young sagebrush plants decreased to 0% of the population. Decadence of sagebrush increased to 17% of the population.
- **2002 to 2007 - slightly down (-1):** Cliffrose density remained the same at 580 plants/acre, but cover decreased to 9%. Decadence of cliffrose remained the same at 17%, and poor vigor decreased to 10%. Sagebrush density decreased by 58% to 100 plants/acre, and there was almost no notable cover. All of the plants sampled were decadent, and poor vigor increased to 60%.
- **2007 to 2012 - down (-2):** The density of cliffrose decreased 24% to 440 plants/acre, though cover remained similar at 10%. Decadence of cliffrose increased to 50%, and poor vigor increased to 32% of the population. Sagebrush density decreased 40% to 60 plants/acre, with no notable cover.

#### Grass:

- **1989 to 1997 - slightly down (-1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 12%. Bulbous bluegrass increased significantly on the site, though it was not common.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 84%. Perennial species other than bulbous bluegrass are rare on the site. Bulbous bluegrass increased significantly in nested frequency, and cover increased from 1% to 6%. Annual grass cover decreased from 29% to 16%
- **2002 to 2007 - down (-2):** Perennial grasses other than bulbous bluegrass are extremely rare on the site. Bulbous bluegrass also increased significantly in nested frequency, and cover doubled to 12%. Cheatgrass increased significantly in nested frequency, and cover increased from 16% to 36%. The noxious weed jointed goatgrass was sampled for the first time.
- **2007 to 2012 - down (-2):** There were no perennial grass species other than bulbous bluegrass sampled on the site. Bulbous bluegrass increased significantly in nested frequency, and cover increased to 28%. Cheatgrass remained prevalent on the site.

#### Forb:

- **1989 to 1997 - slightly down (-1):** Perennial forbs, excluding the noxious weed whitetop, are rare on the site. Prickly lettuce and yellow salsify (*Tragopogon dubius*) increased significantly in nested frequency. Both these species are annual species which are used by big game. However, whitetop also increased significantly in nested frequency. The majority of forb species, including those of benefit to big game, are weedy exotics
- **1997 to 2002 - slightly up (+1):** The sum of nested frequency for perennial forbs, excluding whitetop, increased nearly two-fold, and cover increased from 2% to 3%. Most of the increase in frequency came from a number of perennial species that had not been sampled before. Most of the increase in cover was due to an increase in dandelion (*Taraxacum officinale*). Prickly lettuce decreased significantly in nested frequency, while whitetop and storksbill increased significantly in nested frequency.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequency for perennial forbs, excluding whitetop, decreased 77%, and cover decreased to less than 1%. Dandelion decreased significantly in nested frequency. Storksbill increased significantly in nested frequency, and cover increased from 11% to 13%.
- **2007 to 2012 - slightly up (+1):** The perennial forb sum of nested frequency, excluding whitetop, increased slightly, and cover increased to 2%. Whitetop decreased significantly in nested frequency. Annual forb sum of nested frequency decreased substantially, and cover decreased from 19% to 5%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 12

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	25.9	8.6	1.8	1.6	-20.0	10.0	-2.0	<b>25.9</b>	Very Poor
02	22.6	10.1	1.5	0.1	-11.6	10.0	-2.0	<b>30.6</b>	Very Poor
07	14.4	8.9	0.0	0.0	-20.0	10.0	-2.0	<b>11.3</b>	Very Poor
12	15.6	0.8	3.9	0.0	-20.0	10.0	-6.0	<b>4.4</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 12

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Aegilops cylindrica</i> (a)	-	-	-	2	6	-	-	.03	.41
G	<i>Agropyron spicatum</i>	10	3	-	1	-	.03	-	.00	-
G	<i>Bromus brizaeformis</i> (a)	-	a-	a-	b12	ab7	-	-	.05	.76
G	<i>Bromus japonicus</i> (a)	-	c297	a-	b44	a3	15.63	-	.10	.00
G	<i>Bromus tectorum</i> (a)	-	a300	a267	b375	b378	12.92	15.48	35.83	32.12
G	<i>Festuca myuros</i> (a)	-	b47	a-	c156	b37	.18	-	4.50	.44
G	<i>Poa bulbosa</i>	a-	b15	c104	d167	e279	1.45	5.55	11.68	28.27
G	<i>Poa pratensis</i>	5	5	3	-	-	.03	.00	-	-
G	<i>Poa secunda</i>	b28	b30	a3	a-	a-	.74	.04	-	-
G	<i>Secale cereale</i> (a)	-	-	-	-	2	-	-	-	.00
Total for Annual Grasses		0	644	267	589	433	28.74	15.48	40.53	33.74
Total for Perennial Grasses		43	53	110	168	279	2.26	5.59	11.69	28.27
Total for Grasses		43	697	377	757	712	31.01	21.08	52.22	62.01
F	<i>Agoseris glauca</i>	-	-	-	3	8	-	-	.00	.04
F	<i>Allium</i> sp.	6	-	2	-	-	-	.00	-	-
F	<i>Alyssum alyssoides</i> (a)	-	b98	a16	b67	a3	.56	.05	.18	.00
F	<i>Asclepias asperula</i>	3	-	-	-	-	-	-	-	-
F	<i>Boraginaceae</i> (a)	-	a-	a-	c86	b35	-	-	2.43	.17
F	<i>Calochortus nuttallii</i>	-	-	2	-	-	.00	.00	-	-
F	<i>Camelina microcarpa</i> (a)	-	ab9	ab9	b20	a3	.04	.02	.38	.00
F	<i>Cardaria draba</i>	a49	b112	c188	c176	b120	4.88	7.82	6.57	3.16
F	<i>Collinsia parviflora</i> (a)	-	c61	c70	b11	a-	.30	.49	.05	-
F	<i>Convolvulus arvensis</i>	-	-	-	-	2	-	-	-	.01
F	<i>Cymopterus longipes</i>	ab7	ab15	b15	ab8	a3	.11	.10	.04	.00
F	<i>Cynoglossum officinale</i>	-	-	-	-	44	-	-	-	2.03
F	<i>Epilobium brachycarpum</i> (a)	-	b59	a9	b48	a6	.91	.04	.20	.01
F	<i>Erigeron divergens</i>	-	-	3	-	3	-	.15	-	.00
F	<i>Eriogonum brevicaulis</i>	-	-	11	-	2	-	.02	-	.00
F	<i>Eriogonum ovalifolium</i>	-	-	2	-	-	-	.03	-	-
F	<i>Erodium cicutarium</i> (a)	-	b197	c229	d292	a134	4.78	10.46	12.71	3.23
F	<i>Galium aparine</i> (a)	c104	cd140	d179	b52	a-	6.00	7.63	1.32	-

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Grindelia squarrosa	-	-	-	-	4	-	-	-	.01
F	Helianthus annuus (a)	9	-	-	-	-	-	-	-	-
F	Holosteum umbellatum (a)	-	<sub>b</sub> 67	<sub>a</sub> 19	<sub>a</sub> 17	<sub>a</sub> 11	.28	.05	.04	.02
F	Lactuca serriola (a)	<sub>b</sub> 148	<sub>c</sub> 204	<sub>a</sub> 89	<sub>a</sub> 81	<sub>a</sub> 82	5.83	.86	.42	.52
F	Lappula occidentalis (a)	-	-	-	4	-	-	-	.01	-
F	Lomatium sp.	-	-	6	-	-	-	.06	-	-
F	Medicago sativa	-	2	-	-	-	.00	-	-	-
F	Microsteris gracilis (a)	-	9	-	1	-	.01	-	.00	-
F	Montia perfoliata (a)	-	<sub>a</sub> -	<sub>b</sub> 33	<sub>a</sub> -	<sub>a</sub> -	-	.22	-	-
F	Phlox longifolia	2	-	-	-	-	-	-	-	-
F	Polygonum douglasii (a)	-	3	5	9	-	.00	.01	.02	-
F	Ranunculus sp.	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 37	<sub>a</sub> -	<sub>a</sub> -	-	.41	-	-
F	Ranunculus testiculatus (a)	-	<sub>b</sub> 22	<sub>b</sub> 29	<sub>a</sub> -	<sub>a</sub> -	.09	.09	-	-
F	Taraxacum officinale	<sub>a</sub> 3	<sub>bc</sub> 39	<sub>c</sub> 61	<sub>ab</sub> 20	<sub>a</sub> -	1.21	2.37	.22	-
F	Tragopogon dubius (a)	<sub>a</sub> 25	<sub>b</sub> 62	<sub>ab</sub> 41	<sub>ab</sub> 53	<sub>a</sub> 31	.62	.46	.29	.29
F	Unknown forb-annual (a)	-	<sub>b</sub> 19	<sub>c</sub> 56	<sub>a</sub> -	<sub>a</sub> -	.38	3.12	-	-
F	Unknown forb-perennial	-	4	-	-	-	.38	-	-	-
F	Verbascum thapsus	-	-	-	-	3	-	-	-	.15
F	Veronica biloba (a)	-	<sub>ab</sub> 37	<sub>b</sub> 46	<sub>ab</sub> 32	<sub>a</sub> 13	.57	.66	.59	.39
F	Zigadenus paniculatus	1	3	3	2	-	.00	.00	.00	-
Total for Annual Forbs		286	987	830	773	318	20.41	24.19	18.67	4.65
Total for Perennial Forbs		71	175	330	209	189	6.60	10.99	6.85	5.44
Total for Forbs		357	1162	1160	982	507	27.02	35.18	25.53	10.10

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 12

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	29	12	5	3	2.54	.66	.00	.03
B	Cowania mexicana stansburiana	32	26	26	20	13.96	14.17	9.32	9.56
B	Opuntia sp.	0	1	1	0	.03	.15	.00	-
B	Purshia tridentata	1	0	0	1	-	-	-	-
B	Quercus gambelii	2	2	2	2	1.82	.53	.41	1.25
Total for Browse		64	41	34	26	18.37	15.51	9.75	10.85

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 12

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	.13	.08
Cowania mexicana stansburiana	21.16	17.35
Quercus gambelii	.30	1.26
Rosa woodsii	.26	.33

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 12

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	-	2.7	2.7
Cowania mexicana stansburiana	0.8	2.7	2.8

BASIC COVER--

Management unit 16A, Study no: 12

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	2.50	59.62	64.40	73.30	75.24
Rock	5.25	9.61	7.72	9.42	10.91
Pavement	.25	3.13	1.05	.20	.05
Litter	84.25	61.15	40.52	32.36	42.32
Cryptogams	.75	.06	0	.09	.00
Bare Ground	7.00	3.39	6.54	.83	.34

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 12, Tithing Mountain

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
9.4	6.3	38.4	29.1	32.6	3.4	22.0	92.8	0.6

PELLET GROUP DATA--

Management unit 16A, Study no: 12

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	-	2	4	2
Elk	-	-	6	1
Deer	7	21	31	23
Cattle	-	-	-	1
Sheep	-	-	-	-

Days use per acre (ha)		
'02	'07	'12
-	-	-
3 (8)	25 (63)	-
68 (167)	93 (230)	29 (71)
-	1 (2)	-
3 (8)	-	-

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 12

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
89	<b>664</b>	40	30	30	-	30	20	15	20/38
97	<b>700</b>	26	63	11	-	3	14	3	24/37
02	<b>240</b>	0	83	17	-	25	25	0	24/31
07	<b>100</b>	0	0	100	-	0	40	60	26/35
12	<b>60</b>	0	67	33	-	33	0	67	26/27
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>20</b>	0	100	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Cowania mexicana stansburiana</i>									
89	<b>464</b>	21	57	21	-	50	29	0	56/58
97	<b>760</b>	0	87	13	-	26	61	8	97/105
02	<b>580</b>	0	83	17	-	10	48	14	87/89
07	<b>580</b>	0	83	17	-	17	34	10	97/97
12	<b>440</b>	0	50	50	-	45	9	32	84/88
<i>Grayia spinosa</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	103/72
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	3/7
07	<b>20</b>	0	100	-	-	0	0	0	6/22
12	<b>0</b>	0	0	-	-	0	0	0	3/4
<i>Purshia tridentata</i>									
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>20</b>	0	100	0	-	100	0	0	-/-
02	<b>0</b>	0	0	0	-	0	0	0	-/-
07	<b>0</b>	0	0	0	-	0	0	0	-/-
12	<b>20</b>	0	0	100	-	0	100	100	25/32

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Quercus gambelii</b>										
89	<b>0</b>	0	0	0	-	0	0	0	-/-	
97	<b>100</b>	0	100	0	-	0	0	0	37/39	
02	<b>140</b>	86	0	14	-	0	0	14	72/56	
07	<b>60</b>	0	100	0	-	0	0	0	35/27	
12	<b>440</b>	68	27	5	-	0	0	5	47/32	
<b>Rosa woodsii</b>										
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>0</b>	0	0	-	-	0	0	0	-/-	
02	<b>0</b>	0	0	-	-	0	0	0	73/91	
07	<b>0</b>	0	0	-	-	0	0	0	-/-	
12	<b>0</b>	0	0	-	-	0	0	0	55/69	

STEELE RANCH - TREND STUDY NO. 16A-13-12

Vegetation Type: Gamble Oak/Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Gravelly Loam \(Mountain Big Sagebrush\), R047XA406UT](#) and [Mountain Gravelly Loam \(Oak\), R047XA410UT](#)

Land Ownership: DWR

Elevation: 5,650 ft (1,728 m)

Aspect: West

Slope: 15%

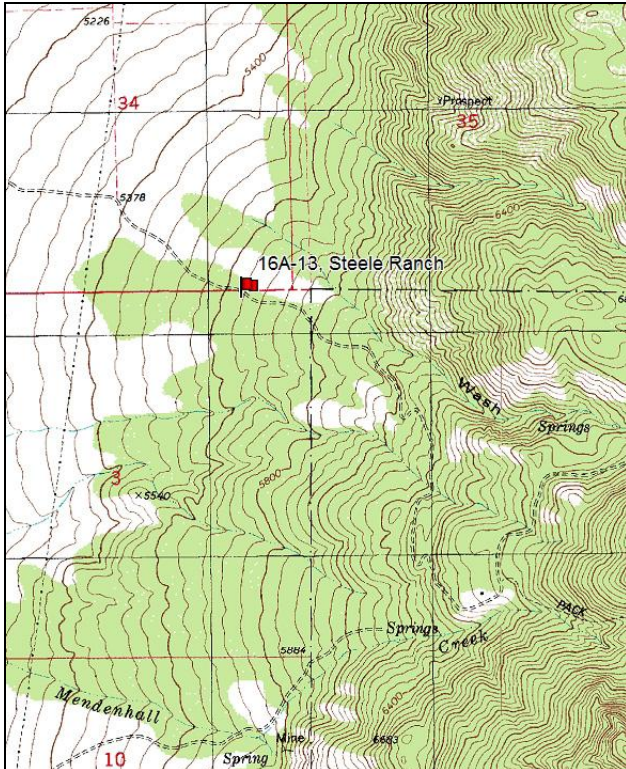
Transect bearing: 185° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (55ft), line 3 (59ft), line 4 (71ft)

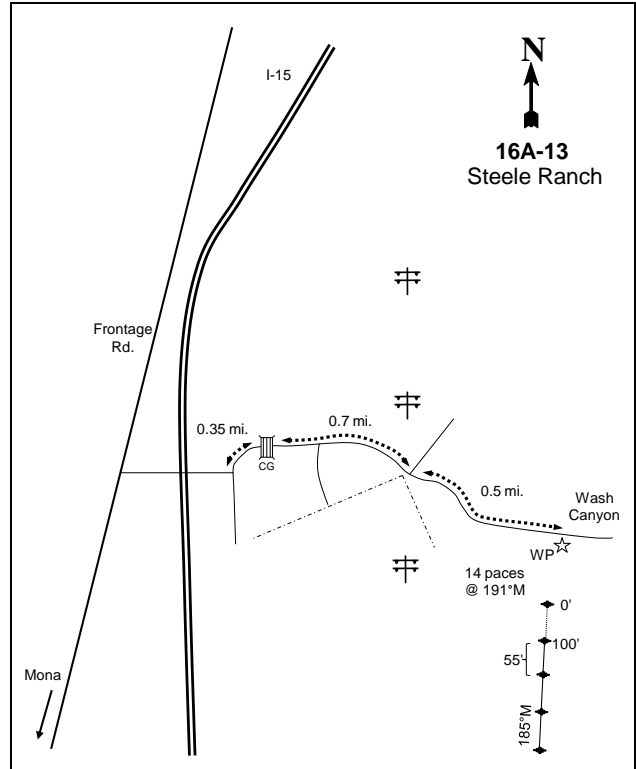
Directions:

From 200 North Main Street in Mona, take the frontage road north towards Santaquin. Go 5.35 miles and turn east onto a gravel road that goes beneath the I-15 overpass. After passing beneath I-15, the road comes to a "T", go left 0.35 miles to a cattle guard. Continue up the road 0.7 miles to a fence corner and a fork in the road. Stay to the right (south) for 0.5 miles to the witness post on the south side of the road. From the witness post the 0-foot baseline stake is 14 paces away at 187 degrees magnetic. The 0-foot stake is marked with browse tag #182.

Map Name: Santaquin



Diagrammatic Sketch:



Township: 11S Range: 1E Section: 3

GPS: NAD 83, UTM 12S 431085 E 4416365 N



## STEELE RANCH - TREND STUDY NO. 16A-13

### Site Information

Site Description: The study is on Utah Division of Wildlife Resources (UDWR) property and is typical of a mixed Gambel oak (*Quercus gambelii*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community type along the foothills of the Wasatch Front. Much of this type of community has been developed, converted to agriculture, or has been heavily grazed by domestic livestock. However, the study is representative of the remaining native winter range along the mountain front. Depending on the severity of the winter, the area receives moderate to heavy use by deer and light use from elk. Deer pellet groups were sampled in very high abundance in 2002 and 2007, but more moderate abundance in 2012. Elk pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: Mountain big sagebrush and Gambel oak provide nearly all of the browse cover on the site. Sagebrush cover has been decreasing and oak cover has been increasing since 1997 (Table - Browse Trends). The sagebrush stand is a fairly dense population of mature and decadent plants. Recruitment of young sagebrush plants has been good in several years, but has been generally poor over the course of the study. Decadence and poor vigor were low at the outset of the study, but have been high in the sagebrush population since 2002. Utilization of sagebrush has been mostly light to moderate, but with several years of heavy use. Gambel oak is patchy in its distribution, with a population of mostly young and mature plants. Recruitment of young oak plants has been high in most sample years. The oak population is healthy with low decadence and good vigor. There was some poor vigor in 2002 due to frost damage on the oak. Utilization of oak has been low throughout the study years (Table - Browse Characteristics). The oak height is variable, with some clones growing to 10 feet (3 m) while others are less than two feet (0.6 m).

Herbaceous Understory: Perennial grasses are neither diverse nor abundant. Sandberg bluegrass (*Poa secunda*) is the most abundant perennial grass and provides the majority of the grass cover. Other perennial grasses such as bluebunch wheatgrass (*Agropyron spicatum*), mutton bluegrass (*Poa fendleriana*), and sheep fescue (*Festuca ovina*) were sampled only occasionally. Cheatgrass (*Bromus tectorum*) is present, but has provided less than 1% cover since 1997. Forbs are diverse, but provide little quality forage and are dominated by annual species. The annual forb species pale alyssum (*Alyssum alyssoides*), bedstraw (*Galium aparine*), holosteum (*Holosteum umbellatum*), and bur buttercup (*Ranunculus testiculatus*) are the most abundant forb species (Table - Herbaceous Trends).

Soil: The soil is classified as Lizzant very cobbly loam, which occurs on alluvial fans and mountain slopes. Soils in this series are very deep and well-drained, and formed from alluvium and/or colluvium derived from limestone (Soil Survey Staff 2011). The soil texture is a loam with a neutral soil reaction (pH 7.2) (Table - Soil Analysis Data). Rocks are common on the surface and within the profile. Bare ground cover is low, with a high amount of vegetation, litter, rock, pavement, and cryptogams providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2002 and 2007, but was slight in 2012.

### Trend Assessments

Browse:

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush plants decreased from 11% to 1% of the population. Decadence of sagebrush decreased from 55% to 19%, and poor vigor decreased from 9% to 7% of the population.
- **1997 to 2002 - slightly up (+1):** Sagebrush density increased 35% from 2,480 plants/acre to 3,340 plants/acre, but cover increased slightly from 13% to 14%. Recruitment of young sagebrush plants increased to 7%, but is still not considered to be good. Decadence of sagebrush increased to 60%, and poor vigor increased to 35% of the population.

- **2002 to 2007 - down (-2):** Sagebrush density decreased 20% to 2,680 plants/acre, and cover decreased to 13%. Recruitment of young sagebrush plants decreased to 4%. Decadence of sagebrush remained high at 53%, and poor vigor increased to 39% of the population. Gambel oak cover increased from 14% to 23%. The population structure of oak shifted from 94% of the plants being mature to 55% mature and 40% young.
- **2007 to 2012 - slightly down (-1):** The density of mountain big sagebrush decreased 17% to 2,220 plants/acre, and cover decreased to 7%. Recruitment of young sagebrush plants increased to 14% of the population. Decadence of sagebrush decreased to 41%, but is still considered very high. Poor vigor decreased to 23%, but is also still considered to be high. Gambel oak cover increased to 27%.

Grass:

- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial grasses remained similar.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses remained similar, but cover increased from 3% to 5%.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial grasses remained relatively unchanged, but cover increased to 7%.
- **2007 to 2012 - slightly down (-1):** The perennial grass sum of nested frequency decreased 11%, and cover decreased to 5%.

Forb:

- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased two-fold.
- **1997 to 2002 - up (+2):** The sum of nested frequency of perennial forbs increased 29%, but cover remained similar at about 1%. Although diverse, the forb component has relatively few species beneficial to big game.
- **2002 to 2007 - up (+2):** The sum of nested frequency of perennial forbs increased 27%, though cover remained at 1%. Annual forb sum of nested frequency increased substantially, and cover increased from 3% to 8%.
- **2007 to 2012 - down (-2):** The perennial forb sum of nested frequency decreased 35%, but cover remained at 1%. Annual forb sum of nested frequency decreased substantially, and cover decreased to 4%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, study no: 13

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	30.0	12.3	4.9	6.7	-0.3	1.8	0.0	<b>55.4</b>	Fair
02	30.0	5.9	3.3	10.8	-0.5	2.3	0.0	<b>51.8</b>	Poor-Fair
07	30.0	8.4	13.6	12.9	-0.8	2.7	0.0	<b>66.8</b>	Fair-Good
12	30.0	12.1	15.0	9.3	-0.3	2.0	0.0	<b>68.2</b>	Good

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 16A, Study no: 13

T y p e	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	a-	a-	a8	b19	ab21	-	.09	.53	.90
G	Bromus tectorum (a)	-	100	131	120	116	.29	.65	.90	.46
G	Festuca myuros (a)	-	b	a-	b48	a3	.06	-	.12	.00
G	Festuca ovina	-	-	-	3	-	-	-	.02	-
G	Poa fendleriana	a1	ab16	b26	ab17	a8	.08	.61	.31	.53
G	Poa secunda	b235	b233	ab218	ab207	a179	3.29	4.68	5.60	2.98
G	Sitanion hystrix	a-	a-	ab2	a-	b10	-	.03	-	.24
Total for Annual Grasses		0	130	131	168	119	0.35	0.64	1.02	0.46
Total for Perennial Grasses		236	249	254	246	218	3.37	5.42	6.46	4.67
Total for Grasses		236	379	385	414	337	3.73	6.07	7.49	5.13
F	Agoseris glauca	a-	ab8	a5	c12	b8	.02	.04	.05	.18
F	Allium sp.	-	2	-	-	4	.00	-	-	.01
F	Alyssum alyssoides (a)	-	234	163	255	212	.51	.83	3.74	.95
F	Antennaria rosea	-	-	1	-	-	-	.00	-	-
F	Arabis sp.	5	1	2	6	-	.00	.00	.01	-
F	Astragalus beckwithii	a3	b11	a-	a-	a-	.08	-	-	-
F	Astragalus eurekaensis	a-	a-	c30	b14	ab15	-	.18	.04	.11
F	Astragalus utahensis	-	2	-	-	-	.03	-	-	-
F	Calochortus nuttallii	a21	a34	b77	b67	a12	.08	.23	.18	.02
F	Castilleja linariaefolia	a-	a6	a6	a6	b22	.04	.06	.10	.05
F	Castilleja sp.	6	3	-	-	-	.01	-	-	-
F	Cirsium undulatum	-	-	-	6	3	-	-	.01	.15
F	Collinsia parviflora (a)	-	6	21	10	14	.01	.04	.02	.02
F	Comandra pallida	-	-	4	12	6	-	.03	.09	.03
F	Crepis acuminata	-	-	5	8	6	-	.07	.21	.07
F	Cryptantha sp.	-	3	-	1	-	.00	-	.00	-
F	Draba sp. (a)	-	a-	a1	c121	b30	-	.00	.48	.09
F	Epilobium brachycarpum (a)	-	a12	a6	a7	b113	.03	.02	.02	.29
F	Erigeron pumilus	-	-	-	-	-	-	.00	-	-
F	Eriogonum racemosum	3	2	-	9	8	.00	-	.01	.04
F	Galium aparine (a)	-	ab77	a58	b108	a74	.96	.23	1.70	.83
F	Helianthella uniflora	-	-	-	4	-	-	-	.03	-
F	Helianthus annuus (a)	-	-	-	4	-	-	-	.06	-
F	Holosteum umbellatum (a)	-	ab51	a32	c157	b84	.13	.06	.97	.27
F	Lactuca serriola (a)	a-	a-	a3	b23	b14	-	.00	.06	.04
F	Linum lewisii	-	-	-	-	1	-	-	-	.00
F	Lomatium sp.	a5	bc33	ab23	c46	bc38	.48	.36	.37	.23
F	Microsteris gracilis (a)	-	a-	a6	b51	a7	-	.01	.13	.02
F	Montia perfoliata (a)	-	-	-	7	8	-	-	.04	.02
F	Petradoria pumila	3	-	1	2	8	-	.00	.06	.04
F	Phlox longifolia	a20	ab35	ab24	b38	a15	.10	.11	.14	.04

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Ranunculus testiculatus (a)	-	<sub>b</sub> 116	<sub>b</sub> 147	<sub>b</sub> 116	<sub>a</sub> 10	.47	1.95	.57	.02
F	Sanguisorba minor	-	-	-	3	-	-	-	.00	-
F	Tragopogon dubius (a)	<sub>a</sub> 3	<sub>a</sub> 4	<sub>a</sub> 1	<sub>b</sub> 32	<sub>c</sub> 71	.01	.01	.23	.29
F	Unknown forb-annual (a)	-	6	-	-	-	.01	-	-	-
F	Veronica biloba (a)	-	<sub>ab</sub> 2	<sub>ab</sub> 6	<sub>b</sub> 7	<sub>a</sub> -	.00	.01	.07	-
F	Viola sp.	-	3	5	-	2	.01	.01	-	.01
F	Zigadenus paniculatus	-	-	1	-	5	.01	.01	-	.01
Total for Annual Forbs		3	508	444	898	637	2.16	3.19	8.13	2.86
Total for Perennial Forbs		66	143	184	234	153	0.90	1.15	1.36	1.02
Total for Forbs		69	651	628	1132	790	3.07	4.35	9.49	3.88

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 13

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	75	75	72	63	13.34	13.93	12.58	7.21
B	Chrysothamnus viscidiflorus viscidiflorus	0	0	0	1	-	-	-	-
B	Gutierrezia sarothrae	2	5	5	9	.06	.19	.01	.42
B	Quercus gambelii	55	58	62	63	18.79	13.64	22.78	26.68
Total for Browse		132	138	139	136	32.20	27.76	35.38	34.32

#### BROWSE TRENDS--

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 13

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	16.26	11.26
Gutierrezia sarothrae	.23	.56
Quercus gambelii	42.70	44.20

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 13

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.8	0.9	2.0

BASIC COVER--

Management unit 16A, Study no: 13

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	3.00	38.51	36.13	47.69	44.59
Rock	3.75	5.61	5.34	5.85	4.54
Pavement	26.75	9.78	8.90	7.96	6.61
Litter	56.75	58.58	60.54	52.81	65.50
Cryptogams	5.75	3.87	4.72	5.41	5.26
Bare Ground	4.00	4.83	6.14	3.49	5.70

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 13, Steele Ranch

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.6	7.2	37.1	41.1	21.8	4.0	9.1	86.4	0.7

PELLET GROUP DATA--

Management unit 16A, Study no: 13

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	5	3	8	5	-	-	-
Deer	7	15	19	9	62 (154)	90 (223)	34 (83)
Elk	-	-	-	-	-	-	2 (5)

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 13

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
89	<b>3132</b>	11	34	55	66	55	0	9	22/23
97	<b>2480</b>	1	81	19	80	44	22	7	26/40
02	<b>3340</b>	7	32	60	40	29	37	35	25/36
07	<b>2680</b>	4	43	53	180	28	17	39	23/33
12	<b>2220</b>	14	45	41	1460	31	15	23	23/31
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>0</b>	0	0	0	-	0	0	0	-/-
02	<b>0</b>	0	0	0	-	0	0	0	-/-
07	<b>0</b>	0	0	0	-	0	0	0	-/-
12	<b>40</b>	0	50	50	-	0	0	50	-/-
<i>Gutierrezia sarothrae</i>									
89	<b>531</b>	75	12	12	199	0	0	0	4/2
97	<b>80</b>	0	100	0	-	0	0	0	6/9
02	<b>120</b>	0	83	17	-	0	0	0	4/5
07	<b>360</b>	39	56	6	1160	0	0	0	9/11
12	<b>1000</b>	20	80	0	220	0	0	0	9/12
<i>Quercus gambelii</i>									
89	<b>9531</b>	76	13	11	733	22	.69	.69	33/24
97	<b>10320</b>	16	81	2	260	0	0	.19	54/40
02	<b>15940</b>	6	94	0	20	4	11	25	44/27
07	<b>10560</b>	40	55	5	920	2	1	2	42/28
12	<b>12720</b>	37	62	1	440	6	0	.47	46/37

BIG HOLLOW - TREND STUDY NO. 16A-14-12

Vegetation Type: Annual/Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: DWR

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

Aspect: Southeast

Slope: 10-15%

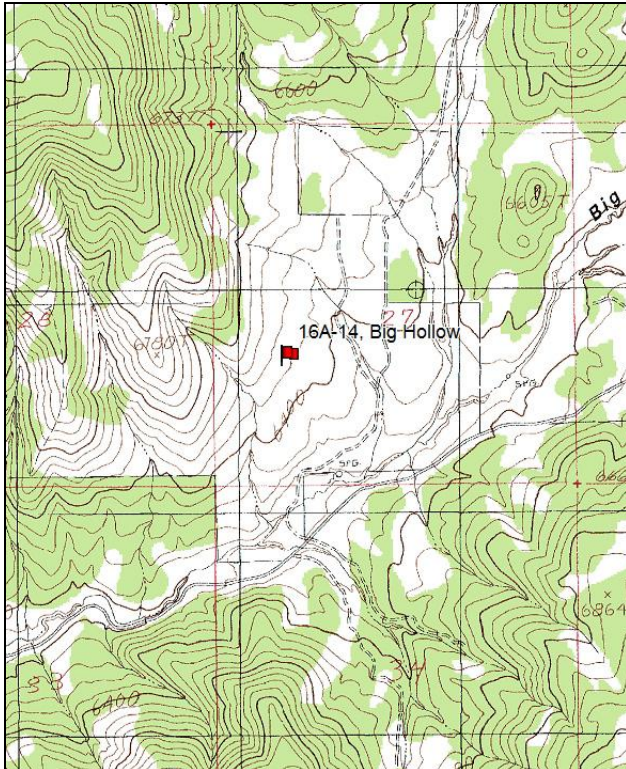
Transect bearing: 165° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: none

Directions:

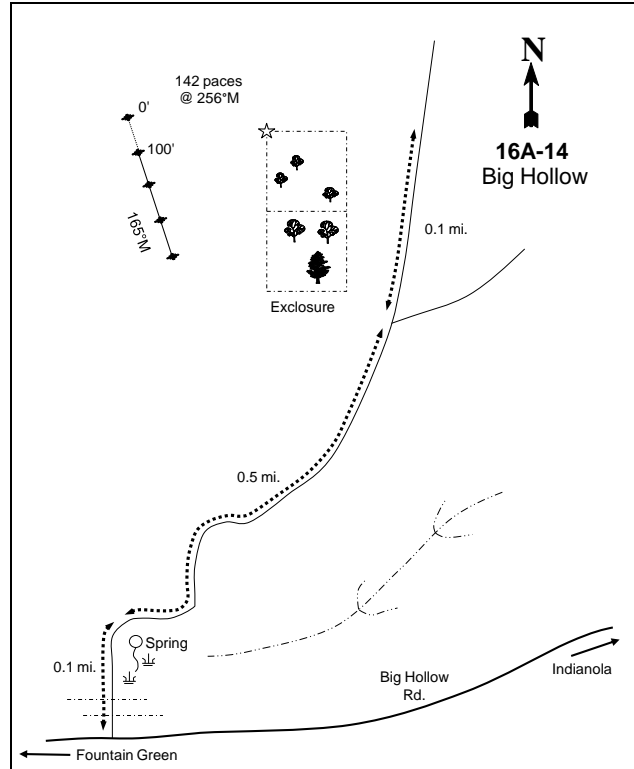
At the intersection of State Street and 100 North in Fountain Green, go east on 100 North for 0.3 miles to the old dump. Continue up Big Hollow for 3.3 miles to a gate parallel to the road onto DWR land. Turn left (north) through the gates and go 0.1 miles to a spring in a wash. Continue on this road for 0.5 miles to a fork. Stay left and go 0.1 miles to the north end of an enclosure. Park here. From the northwest corner of the enclosure, walk 142 paces at a bearing of 256 degrees M to a tall fencepost. This 4-foot tall green fencepost is the 0-foot baseline stake.

Map Name: Big Hollow



Township: 13S Range: 3E Section: 27

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 450137 E 4389862 N

## BIG HOLLOW - TREND STUDY NO. 16A-14

### Site Information

Site Description: The study is located on the Utah Division of Wildlife Resources (UDWR) Big Hollow Wildlife Management Area (WMA) east of Fountain Green within a large area that was chained in 1964. However, little evidence of the treatment remained at the establishment of this study in 1989. It does not appear that dense trees were ever present, and no seeded species have been sampled. Other areas of the chaining were apparently more heavily seeded. After the site was read in 2007, the area burned as part of the Salt Creek wildfire which burned 25,913 acres. Several fingers of unburned sagebrush were left on the site. The area was seeded (Table - Seed Mix) and treated with a 1-way Ely chain in November of 2007 ([WRI Project # 970](#)). After the site was read in 2012, the area burned again as part of the Wood Hollow wildfire which burned 47,387 acres. Prior to the fires, the dominant vegetation was basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) interspersed with a smaller density of antelope bitterbrush (*Purshia tridentata*). There is a perennial spring 200 yards (183 m) to the southeast of the study. Due to the availability of water during the dry year of 1989, deer were using the area during the summer. However, the majority of big game use usually occurs in winter and spring. A winter-killed fawn was found in 1989, and an antler drop was noted in 2007. Deer pellet groups were sampled in moderate to high abundance from 1997 to 2007, but were sampled in low abundance in 2012. Elk pellet groups have been sampled in low abundance since 1997. Cattle pats have been sampled in low abundance since 1997. Rabbits have been common on the site at times, with high amounts of quadrat frequency in 2002 and 2007 (Table - Pellet Group Data).

Browse: Prior to the fires, basin big sagebrush was the dominant browse species and provided the majority of the browse cover on the site (Table - Browse Trends). The basin big sagebrush stand was comprised of a moderately dense population of mostly mature and decadent plants. Recruitment of young plants was good at the outset of the study, but had been poor in 2002 and 2007. Decadence was generally high, but vigor was low in most sample years. Utilization of sagebrush was mostly light to moderate over the course of the study. The Salt Creek fire removed much of the sagebrush from the site, but several fingers of mature plants were left alive. Prior to the fire, a small population of bitterbrush was scattered over the site. The bitterbrush population was comprised of large, mature plants that averaged heights over 5 ft. There was a high amount of decadence in the population, but vigor was generally good. Recruitment of young bitterbrush plants was good at the outset of the study, but has been poor since 2002. Utilization of bitterbrush was mostly moderate to heavy over the course of the study (Table - Browse Characteristics). Many of the bitterbrush plants survived the Salt Creek fire, and cover of bitterbrush remained similar to before the fire (Table - Browse Trends). The surviving bitterbrush plants were much smaller, with an average height of less than 2 ft. The undesirable species broom snakeweed (*Gutierrezia sarothrae*) has fluctuated in density on the site, and has been prevalent at times (Table - Browse Characteristics). Utah juniper (*Juniperus osteosperma*) has been sampled in a scattered population on the site since 2002 (Table - Point-Quarter Tree Data).

Herbaceous Understory: Prior to the fires, grasses were diverse, but not particularly productive. Following the Salt Creek fire, perennial grasses became the dominant vegetation on the site. Several perennial grass species were seeded, including several species that already occurred on the site (Table - Seed Mix). The seeded species crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) were sampled for the first time. Bluebunch wheatgrass (*A. spicatum*) and Indian ricegrass (*Oryzopsis hymenoides*) also increased, but were present on the site prior to the seeding. Other common perennial species include needle-and-thread (*Stipa comata*) and sedge (*Carex* sp.). Cheatgrass (*Bromus tectorum*) is common on the site, and has dominated the grass component at times. The forb composition is made up of mostly annual species and few desirable perennial species. The seeded species alfalfa (*Medicago sativa*) and small burnet (*Onobrychis viciaefolia*) were sampled in low frequency and cover in 2012, following the Salt Creek fire (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Deer Creek stony silt loam, which occur on mountain slopes. The soils in this series are deep and well-drained, and formed from alluvium and colluvium derived from



sandstone, limestone, quartzite, and mixed igneous rocks (Soil Survey Staff 2011). The soil texture is a sandy clay loam, with a neutral soil reaction (pH 6.8) (Table - Soil Analysis Data). Bare ground soil is moderately low with a high amount of vegetation, litter, and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

## Trend Assessments

### Browse:

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush decreased from 13% to 10%, but is still considered to be good. Decadence of sagebrush decreased from 33% to 27%, but is still considered to be high. Sagebrush plants displaying poor vigor increased from 3% to 9%. Recruitment of young bitterbrush plants increased from 22% to 29%. Decadence decreased from 33% to 21%, but poor vigor increased from 0% to 21% of the population.
- **1997 to 2002 - stable (0):** Sagebrush density increased slightly from 1,780 plants/acre to 1,880 plants/acre, and cover remained similar at 15%. Recruitment of young sagebrush plants decreased to 7%, which is considered poor. Decadence of sagebrush increased to 35%, but poor vigor decreased to 19% of the population. Bitterbrush density increased slightly from 280 plants/acre to 320 plants/acre, though cover remained similar at 2%. However, no new recruitment of young bitterbrush plants was sampled. Decadence of bitterbrush increased to 63%, and poor vigor remained high at 25% of the population.
- **2002 to 2007 - slightly down (-1):** The density of sagebrush decreased 16% to 1,580 plants/acre, and cover decreased to 10%. Recruitment of young sagebrush plants decreased to just 1% of the population. Decadence increased to 46%, and poor vigor increased to 29%. Bitterbrush density decreased 19% to 260 plants/acre, but cover remained similar at 2%. There was no new recruitment of young bitterbrush plants sampled. Decadence increased to 77%, but poor vigor decreased to 8% of the population.
- **2007 to 2012 - down (-2):** The Salt Creek fire removed most of the browse from the site. Basin big sagebrush density decreased 72% to 440 plants/acre, and cover decreased to 1%. There was no new recruitment of young sagebrush plants sampled. Decadence of sagebrush decreased to 18%, and poor vigor decreased to 9% of the population. Bitterbrush density decreased 46% to 140 plants/acre, but cover remained similar at around 2%. There was no new recruitment of young bitterbrush plants sampled. Decadence of bitterbrush decreased to 14%, and none there were no plants displaying poor vigor sampled.

### Grass:

- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial grasses increased 27%.
- **1997 to 2002 - up (+2):** The sum of nested frequency of perennial grasses increased 20%, and cover increased from 5% to 9%.
- **2002 to 2007 - down (-2):** The sum of nested frequency of perennial grasses decreased 18%, though cover remained similar at 9%. Cheatgrass increased significantly in nested frequency, and its average cover increased from 5% to 13%.
- **2007 to 2012 - up (+2):** The perennial grass sum of nested frequency increased 63%, and cover increased to 17%. Two seeded species, crested wheatgrass and intermediate wheatgrass, were sampled for the first time. Cheatgrass decreased significantly in nested frequency, and cover decreased to 5%.

### Forb:

- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial forbs increased, but perennial forbs remain rare on the site.

- **1997 to 2002 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, and cover remained near 1%.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial forbs remained similar, and cover remained near 1%. Annual forbs increased substantially, and cover increased from 2% to 9%.
- **2007 to 2012 - slightly up (+1):** The perennial forb sum of nested frequency increased 84%, but cover remained similar at 1%. Annual forb sum of nested frequency decreased substantially, and cover decreased to 4%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
 Management unit 16A, study no: 14

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	22.2	7.3	6.2	10.4	-2.8	1.3	0.0	<b>44.6</b>	Poor
02	22.9	3.8	2.9	18.3	-3.7	2.0	0.0	<b>46.3</b>	Poor
07	15.1	-0.2	0.4	17.3	-10.0	1.4	0.0	<b>24.0</b>	Very Poor
12	5.6	0.0	0.0	30.0	-3.7	2.2	0.0	<b>34.2</b>	Very Poor-Poor

SEED MIX --  
 Management unit 16A, study no: 14

Project Name: Salt Creek wildfire rehabilitation - DWR lands							
WRI Database #: 970							
Application: Aerial		Acres: 1150		Application: Dribbler			
Acres: 335							
Seed type	lbs in mix	lbs/acre	Seed type	lbs in mix	lbs/acre		
G	Bluebunch WG 'Anatone'	1150	1.00	F	Small Burnet 'Delar'	150	0.45
G	Crested Wheatgrass 'Hycrest'	1150	1.00	B	Bitterbrush	150	0.45
G	Crested Wheatgrass 'Nordan'	1150	1.00	Total Pounds:		300	0.90
G	Indian Ricegrass 'Rimrock'	1150	1.00	PLS Pounds:			0.81
G	Intermediate Wheatgrass 'Oahe'	1150	1.00				
G	Orchardgrass 'Paiute'	575	0.50				
G	Pubescent Wheatgrass	2300	2.00				
G	Siberian Wheatgrass 'Vavilov'	1150	1.00				
G	Western Yarrow	115	0.10				
F	Alfalfa 'Ladak'	1150	1.00				
F	Alfalfa 'Ranger'	1150	1.00				
F	Sainfoin 'Eski'	2300	2.00				
F	Small Burnet 'Delar'	1150	1.00				
F	Yellow Sweetclover	288	0.25				
B	Sagebrush, Mountain	288	0.25				
B	Sagebrush, Wyoming	288	0.25				
Total Pounds:		16504	14.35				
PLS Pounds:			12.62				

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 16A, Study no: 14

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Agropyron cristatum</i>	a-	a-	a-	a-	b50	-	-	-	2.35
G	<i>Agropyron dasystachyum</i>	a-	a-	a5	b31	b49	-	.04	.96	2.25
G	<i>Agropyron intermedium</i>	a-	a-	a-	a-	b37	-	-	-	.91
G	<i>Agropyron spicatum</i>	a11	a39	ab38	ab35	b59	.70	2.45	2.25	2.30
G	<i>Bromus japonicus</i> (a)	-	a-	b21	a-	a3	-	.09	-	.15
G	<i>Bromus tectorum</i> (a)	-	a238	a242	b337	a227	3.74	4.85	13.36	4.73
G	<i>Carex</i> sp.	a-	b41	bc61	bc57	c71	.74	2.33	1.46	4.58
G	<i>Oryzopsis hymenoides</i>	74	67	45	42	70	1.85	1.14	1.36	3.33
G	<i>Poa secunda</i>	-	3	-	-	-	.00	-	-	-
G	<i>Sitanion hystrix</i>	c89	b40	c79	ab26	a7	.86	2.18	1.09	.18
G	<i>Stipa comata</i>	a12	b46	b54	b41	ab34	1.05	1.00	1.54	1.32
Total for Annual Grasses		0	238	263	337	230	3.74	4.95	13.36	4.88
Total for Perennial Grasses		186	236	282	232	377	5.21	9.17	8.67	17.26
Total for Grasses		186	474	545	569	607	8.96	14.12	22.03	22.14
F	<i>Alyssum alyssoides</i> (a)	-	a148	b241	d338	bc288	1.02	2.07	8.43	3.27
F	<i>Arabis</i> sp.	-	-	-	6	-	-	-	.02	-
F	<i>Astragalus eurekaensis</i>	1	-	3	-	5	-	.00	-	.01
F	<i>Calochortus nuttallii</i>	a-	ab2	ab5	b14	ab8	.01	.01	.04	.04
F	<i>Camelina microcarpa</i> (a)	-	a-	a-	a-	b7	-	-	-	.02
F	<i>Chaenactis douglasii</i>	a12	b21	a5	a6	a2	.11	.02	.04	.03
F	<i>Chenopodium album</i> (a)	-	-	-	1	-	-	-	.00	-
F	<i>Chenopodium</i> sp. (a)	-	2	-	-	-	.00	-	-	-
F	<i>Cirsium</i> sp.	ab8	b17	b17	a-	b25	.04	.31	-	.13
F	<i>Collinsia parviflora</i> (a)	-	a-	ab4	b11	a-	-	.00	.02	-
F	<i>Cryptantha</i> sp.	-	-	-	3	-	-	-	.00	-
F	<i>Descurainia pinnata</i> (a)	-	a-	a1	b45	a5	-	.00	.32	.01
F	<i>Draba</i> sp. (a)	-	-	-	3	-	-	-	.00	-
F	<i>Eriogonum cernuum</i> (a)	1	2	3	1	-	.00	.00	.00	-
F	<i>Erodium cicutarium</i> (a)	-	-	4	9	-	-	.00	.04	-
F	<i>Gilia</i> sp. (a)	-	1	-	6	-	.00	-	.01	-
F	<i>Hackelia patens</i>	-	4	-	-	-	.03	-	-	-
F	<i>Lactuca serriola</i> (a)	-	1	-	6	1	.00	-	.01	.00
F	<i>Lappula occidentalis</i> (a)	-	a-	a-	b37	a-	-	-	.15	-
F	<i>Machaeranthera canescens</i>	-	-	-	-	3	-	-	-	.03
F	<i>Medicago sativa</i>	-	-	-	-	3	-	-	-	.00
F	<i>Microsteris gracilis</i> (a)	-	-	11	-	-	-	.03	-	-
F	<i>Onobrychis viciaefolia</i>	-	-	-	-	7	-	-	-	.07
F	<i>Orobanche fasciculata</i>	-	1	-	-	-	.00	-	-	-
F	<i>Penstemon</i> sp.	-	-	1	-	-	-	.00	-	-
F	<i>Polygonum douglasii</i> (a)	-	b15	a2	a-	a-	.05	.01	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	a-	b30	b37	a6	-	.08	.12	.02

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Sisymbrium altissimum (a)	-	-	-	3	2	-	-	.00	.00
F	Sphaeralcea coccinea	42	35	43	38	70	.47	.64	.60	.79
F	Tragopogon dubius (a)	<sub>a</sub> 8	<sub>a</sub> 3	<sub>a</sub> 1	<sub>a</sub> 3	<sub>b</sub> 72	.01	.00	.01	.62
Total for Annual Forbs		9	172	297	500	381	1.11	2.22	9.15	3.96
Total for Perennial Forbs		63	80	74	67	123	0.67	1.00	0.71	1.12
Total for Forbs		72	252	371	567	504	1.78	3.22	9.86	5.08

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 14

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata tridentata	61	57	52	19	14.77	14.69	9.95	1.19
B	Artemisia tridentata vaseyana	1	1	0	0	.30	.78	-	.85
B	Gutierrezia sarothrae	79	8	74	25	5.73	.01	7.35	.14
B	Juniperus osteosperma	0	1	0	0	-	.00	.15	-
B	Opuntia sp.	5	2	3	2	.18	-	.15	.03
B	Pediocactus simpsonii	0	0	0	1	-	-	-	-
B	Purshia tridentata	12	13	10	7	2.27	2.38	1.76	2.04
Total for Browse		158	82	139	54	23.27	17.87	19.37	4.26

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 14

Species	Percent Cover	
	'07	'12
Artemisia tridentata tridentata	13.53	1.96
Gutierrezia sarothrae	7.09	.43
Juniperus osteosperma	.10	-
Opuntia sp.	.05	.10
Purshia tridentata	2.00	3.40

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 14

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata tridentata	1.7	1.7	1.4
Purshia tridentata	0.5	1.6	3.2

#### POINT-QUARTER TREE DATA--

Management unit 16A, Study no: 14

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	24	34	21	6.0	6.5	9.5

**BASIC COVER--**

Management unit 16A, Study no: 14

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	3.25	33.79	35.76	48.65	35.89
Rock	3.75	5.09	4.71	4.12	3.27
Pavement	26.25	17.61	15.09	13.10	4.83
Litter	49.00	44.18	38.18	35.58	44.45
Cryptogams	.50	1.59	5.34	4.57	.00
Bare Ground	17.25	11.16	20.92	13.19	13.00

**SOIL ANALYSIS DATA --**

Management unit 16A, Study no: 14, Big Hollow

Effective rooting depth (in)	pH	Sandy Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.7	6.8	48.0	27.1	24.9	2.9	13.3	166.4	0.5

**PELLET GROUP DATA--**

Management unit 16A, Study no: 14

Type	Quadrat Frequency				Days use per acre (ha)			
	'97	'02	'07	'12	'97	'02	'07	'12
Rabbit	26	73	50	2	-	-	-	-
Elk	2	1	3	4	2 (5)	1 (2)	5 (12)	3 (8)
Deer	32	14	9	1	31 (78)	62 (154)	58 (144)	1 (2)
Cattle	1	3	3	4	6 (14)	8 (20)	8 (20)	4 (9)

**BROWSE CHARACTERISTICS--**

Management unit 16A, Study no: 14

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<b>Artemisia tridentata tridentata</b>									
89	<b>2598</b>	13	54	33	199	18	0	3	31/33
97	<b>1780</b>	10	63	27	80	3	0	9	29/41
02	<b>1880</b>	7	57	35	180	18	6	19	44/51
07	<b>1580</b>	1	53	46	20	22	1	29	35/44
12	<b>440</b>	0	82	18	-	0	0	9	16/24
<b>Artemisia tridentata vaseyana</b>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	0	100	-	-	0	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	25/31
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Cowania mexicana stansburiana</i>										
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	65/94	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Gutierrezia sarothrae</i>										
89	799	8	92	0	-	0	0	0	6/4	
97	22560	30	70	0	20	.44	0	.08	9/13	
02	160	100	0	0	20	0	0	0	-/-	
07	9400	1	98	0	1120	0	0	11	9/12	
12	840	14	71	14	-	17	0	17	5/8	
<i>Juniperus osteosperma</i>										
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	20	0	100	-	-	100	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Opuntia sp.</i>										
89	0	0	0	0	-	0	0	0	-/-	
97	160	13	88	0	-	0	0	0	-/-	
02	60	0	67	33	-	67	0	0	5/10	
07	60	0	100	0	-	0	0	0	6/14	
12	40	0	100	0	-	0	0	50	4/6	
<i>Pediocactus simpsonii</i>										
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	3/4	
<i>Purshia tridentata</i>										
89	598	22	44	33	-	67	11	0	24/38	
97	280	29	50	21	-	36	29	21	46/76	
02	320	0	38	63	-	6	94	25	68/59	
07	260	0	23	77	-	8	69	8	59/61	
12	140	0	86	14	-	57	0	0	20/34	
<i>Tetradymia canescens</i>										
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	8/14	
12	0	0	0	-	-	0	0	0	-/-	

OLD PINERY - TREND STUDY NO. 16A-15-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: Private

Elevation: 5,670 ft (1,728 m)

Aspect: West

Slope: 5%

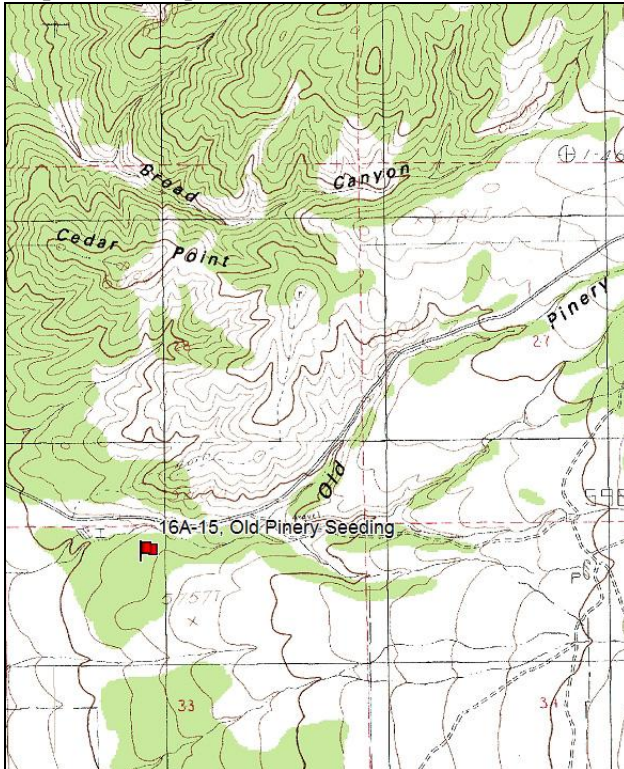
Transect bearing: 175° magnetic

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

Directions:

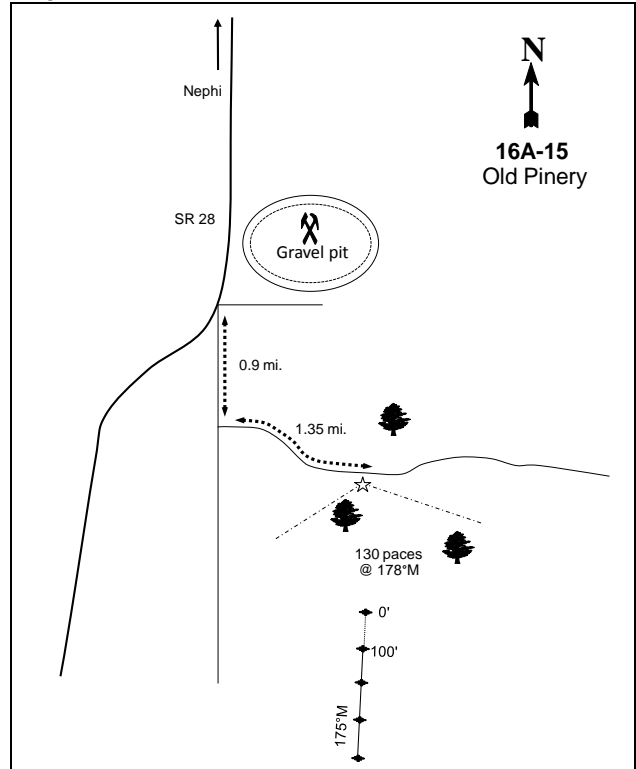
From the southern exit (exit 222) of I-15 in Nephi, proceed south on U.S. 28 for about 1.0 mile to a dirt road just past a gravel pit. Turn left on the dirt road and proceed south 0.9 miles to another intersection. Turn left at the intersection and proceed southeast for 1.35 miles toward Old Pinery Canyon. Stop at the corner of the fence line. From the easternmost of the two middle fenceposts, the 0-foot marker of the baseline is located 130 paces away at an azimuth of 178 degrees magnetic. The 0-foot baseline stake is marked by browse tag #3960.

Map Name: Nephi



Township: 13S Range: 1E Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 428825 E 4388666 N

## OLD PINERY - TREND STUDY NO. 16A-15

### Site Information

Site Description: The study is located on privately owned land south of Old Pinery Creek. The area was dominated by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*), but was chained and seeded prior to study establishment in 1983. Animal presence on the site was very low in 1983, likely due to a lack of cover and forage. Deer pellet groups were sampled in high abundance in 2002 and 2007, but low abundance in 2012. Cattle sign was sampled in moderate abundance in 2002, but low abundance in 2007 and 2012 (Table - Pellet Group Data). A dead deer and cow were noted on the study in 2007.

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the main browse species and provides nearly all of the browse cover on the site (Table - Browse Trends). The sagebrush stand is comprised of a moderately dense population of mostly mature plants. The early years of the study sampled the reestablishment of sagebrush on the site with a large component of young plants being recruited into the population. As the stand has matured, recruitment of young sagebrush plants has decreased and has been poor since 2007. The health of the stand has been generally good with low decadence and good vigor over the course of the study years. Utilization of sagebrush was light in the initial years of the study, but has been light to moderate since 2002. Antelope bitterbrush (*Purshia tridentata*) has also been sampled in low density since 1997. All of the sampled bitterbrush plants have been mature, vigorous, and heavily used (Table - Browse Characteristics). A small, scattered population of Utah juniper trees have reestablished on the site (Table - Point-Quarter Tree Data). Most of the sampled trees have been large mature trees.

Herbaceous Understory: The pictures of the site show herbaceous understory was dominated by cheatgrass (*Bromus tectorum*) in 1983. Since the initial establishment of the study, native and seeded perennial species have increased and are now prevalent on the site. However, the undesirable perennial species bulbous bluegrass (*Poa bulbosa*) has also increased substantially and now dominates the herbaceous component on the site. Other common perennial grass species include crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*A. spicatum*), western wheatgrass (*A. smithii*), and Sandberg bluegrass (*Poa secunda*). Cheatgrass also remains prevalent on the site. The forb component is diverse, but provides little valuable forage. Annual forbs dominate the forb component. Pale alyssum (*Alyssum alyssoides*), bur buttercup (*Ranunculus testiculatus*), blue-eyed Mary (*Collinsia parviflora*), and storksbill (*Erodium cicutarium*) are the most abundant forbs. Field bindweed (*Convolvulus arvensis*), a noxious weed, was sampled at low nested and quadrat frequencies in 1997 and 2007 (Table - Herbaceous Trends).

Soil: The soil is classified as a Borvant cobbly loam, which occur on alluvial fans. The soils in this series are shallow and somewhat excessively drained, with possible petrocalcic horizons. They are formed in alluvium derived from limestone and sandstone (Soil Survey Staff 2011). The soil texture is a loam with a slightly acidic soil reaction (pH 6.2) (Table - Soil Analysis Data). Bare ground cover is moderately low, with high amounts of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2002 and 2007, but was slight in 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - up (+2):** Mountain big sagebrush density increased over three-fold from 1,332 plants/acre to 4,532 plants/acre. Most of the increase in density was due to new recruitment of young sagebrush plants, which increased from 0% of the population to 76%.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young plants remained similar at 69% of the population. Decadence decreased slightly from 4% to 1%, and vigor remained excellent in the population.



- **1997 to 2002 - up (+2):** Mountain big sagebrush density increased from 2,040 plants/acre to 3,340 plants/acre, and cover increased from 6% to 10%. Recruitment of young sagebrush plants decreased 35% of the population, but is still considered to be excellent.
- **2002 to 2007 - slightly down (-1):** Mountain big sagebrush density decreased 19% to 2,700 plants/acre, but cover increased to 13%. Recruitment of young plants decreased to just 4% of the population, and is considered to be poor.
- **2007 to 2012 - slightly down (-1):** Mountain big sagebrush density decreased 18% to 2,220 plants/acre, but cover increased to 16%. Recruitment of young sagebrush plants remained poor at 6%.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased nearly three-fold. Crested wheatgrass, western wheatgrass, and Sandberg bluegrass increased significantly in nested frequency.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, increased 29%. Western wheatgrass, bluebunch wheatgrass, and Sandberg bluegrass increased significantly in nested frequency.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 9%, but cover increased from 14% to 16%. Bulbous bluegrass increased significantly in nested frequency, and cover increased from less than 1% to 15%. Cheatgrass cover also increased from 2% to 3%.
- **2002 to 2007 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 34%, and cover decreased to 5%. Bulbous bluegrass increased significantly in nested frequency, and cover increased to 29%. Cheatgrass also increased significantly in nested frequency, and cover increased to 9%.
- **2007 to 2012 - stable (0):** The perennial grass sum of nested frequency, excluding bulbous bluegrass, remained similar, but cover increased to 10%. Bulbous bluegrass frequency remained similar, but cover increased to 35%. Cheatgrass decreased significantly, and cover decreased to 2%.

Forb:

- **1983 to 1989 - slightly up (+1):** Seven perennial forb species were sampled, which was an improvement from 1983 when no forbs were sampled. Perennial forbs remained rare on the site.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 77%. The number of sampled perennial species doubled from seven to 14. However, bindweed was sampled in one quadrat. Annual forb sum of nested frequency increased substantially, and annual forbs dominate the forb component.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 58%, and cover remained less than 1%. Bindweed was not sampled. Annual forb sum of nested frequency decreased substantially, and cover decreased to 3%.
- **2002 to 2007 - stable (0):** The sum of nested frequency and cover of perennial forbs remained similar. Annual forb sum of nested frequency increased substantially, and cover increased from 3% to 7%. Most of the increase was due to a significant increase in nested frequency of storksbill. Additionally, bindweed was sampled in one quadrat.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, and cover remained less than 1%. Annual forb sum of nested frequency decreased markedly, and cover decreased to less than 1%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 15

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	7.5	14.7	15.0	27.8	-5.9	1.8	-2.0	<b>58.9</b>	Fair
02	12.6	13.5	15.0	30.0	-2.6	0.8	0.0	<b>69.3</b>	Good
07	15.8	13.8	2.0	8.9	-7.6	0.9	-2.0	<b>31.8</b>	Very Poor
12	21.7	12.5	2.8	19.7	-1.4	0.7	0.0	<b>56.0</b>	Fair

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 15

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a <sub>35</sub>	b <sub>121</sub>	b <sub>110</sub>	b <sub>107</sub>	b <sub>87</sub>	a <sub>10</sub>	5.19	6.10	1.00	.26
G	Agropyron smithii	a <sub>23</sub>	b <sub>148</sub>	c <sub>163</sub>	bc <sub>144</sub>	bc <sub>131</sub>	bc <sub>148</sub>	3.49	3.78	1.63	2.76
G	Agropyron spicatum	ab <sub>23</sub>	a <sub>7</sub>	bc <sub>36</sub>	c <sub>60</sub>	bc <sub>37</sub>	ab <sub>28</sub>	1.39	3.37	1.23	1.52
G	Bromus japonicus (a)	-	-	a <sub>-</sub>	b <sub>18</sub>	b <sub>10</sub>	a <sub>-</sub>	-	.04	.05	-
G	Bromus tectorum (a)	-	-	b <sub>259</sub>	b <sub>259</sub>	c <sub>317</sub>	a <sub>170</sub>	2.30	3.27	9.00	1.83
G	Festuca myuros (a)	-	-	c <sub>277</sub>	b <sub>81</sub>	b <sub>105</sub>	a <sub>4</sub>	5.50	.20	1.08	.03
G	Poa bulbosa	a <sub>-</sub>	a <sub>-</sub>	b <sub>64</sub>	c <sub>246</sub>	d <sub>346</sub>	d <sub>320</sub>	.89	14.90	29.20	34.66
G	Poa pratensis	b <sub>55</sub>	a <sub>-</sub>	a <sub>-</sub>	a <sub>4</sub>	a <sub>-</sub>	a <sub>-</sub>	-	.15	-	-
G	Poa secunda	a <sub>4</sub>	c <sub>104</sub>	d <sub>190</sub>	c <sub>138</sub>	b <sub>45</sub>	c <sub>139</sub>	3.79	2.79	.59	5.28
G	Sitanion hystrix	-	8	-	3	-	3	-	.03	-	.00
Total for Annual Grasses		0	0	536	358	432	174	7.80	3.52	10.14	1.86
Total for Perennial Grasses		140	388	563	702	646	648	14.77	31.14	33.66	44.50
Total for Grasses		140	388	1099	1060	1078	822	22.58	34.68	43.81	46.37
F	Agoseris glauca	-	-	7	4	5	2	.01	.01	.01	.01
F	Allium sp.	a <sub>-</sub>	b <sub>57</sub>	b <sub>47</sub>	a <sub>4</sub>	a <sub>-</sub>	a <sub>-</sub>	.13	.01	-	-
F	Alyssum alyssoides (a)	-	-	c <sub>281</sub>	b <sub>127</sub>	a <sub>47</sub>	a <sub>13</sub>	.91	.31	.27	.02
F	Astragalus sp.	a <sub>-</sub>	a <sub>-</sub>	b <sub>9</sub>	ab <sub>4</sub>	ab <sub>1</sub>	ab <sub>3</sub>	.10	.03	.00	.00
F	Astragalus utahensis	-	-	2	3	3	2	.15	.00	.00	.03
F	Calochortus nuttallii	-	-	11	3	1	-	.02	.00	.00	-
F	Cerastium sp.	a <sub>-</sub>	b <sub>16</sub>	a <sub>-</sub>	a <sub>-</sub>	a <sub>-</sub>	a <sub>-</sub>	-	-	-	-
F	Cirsium sp.	-	-	9	3	1	-	.05	.06	.03	-
F	Collinsia parviflora (a)	-	-	c <sub>196</sub>	b <sub>103</sub>	b <sub>106</sub>	a <sub>1</sub>	.78	.57	.59	.00
F	Convolvulus arvensis	-	-	2	-	1	-	.00	-	.00	-
F	Cymopterus longipes	a <sub>-</sub>	ab <sub>3</sub>	b <sub>17</sub>	ab <sub>7</sub>	ab <sub>10</sub>	a <sub>2</sub>	.21	.06	.02	.00
F	Descurainia pinnata (a)	-	3	-	-	-	-	-	-	-	-
F	Draba sp. (a)	-	-	a <sub>-</sub>	a <sub>5</sub>	b <sub>132</sub>	a <sub>16</sub>	-	.01	.72	.18
F	Epilobium brachycarpum (a)	-	-	b <sub>75</sub>	a <sub>7</sub>	a <sub>-</sub>	a <sub>2</sub>	.14	.01	-	.00
F	Erigeron sp.	-	-	2	-	-	-	.00	-	-	-
F	Eriogonum racemosum	-	-	6	5	1	-	.04	.01	.00	-
F	Erodium cicutarium (a)	-	-	b <sub>158</sub>	a <sub>31</sub>	c <sub>236</sub>	a <sub>22</sub>	1.72	.57	4.87	.04
F	Galium aparine (a)	-	-	-	-	1	-	-	-	.00	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Grindelia squarrosa</i>	-	-	3	-	-	-	.00	-	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	a <sup>-</sup>	a <sup>6</sup>	b <sup>65</sup>	b <sup>36</sup>	-	.01	.14	.10
F	<i>Lactuca serriola</i> (a)	a <sup>-</sup>	b <sup>26</sup>	a <sup>11</sup>	a <sup>-</sup>	a <sup>3</sup>	a <sup>5</sup>	.02	-	.01	.01
F	<i>Microsteris gracilis</i> (a)	-	-	b <sup>58</sup>	a <sup>5</sup>	a <sup>12</sup>	a <sup>-</sup>	.16	.01	.03	-
F	<i>Phlox longifolia</i>	a <sup>-</sup>	b <sup>9</sup>	bcd <sup>32</sup>	bc <sup>24</sup>	cd <sup>41</sup>	d <sup>52</sup>	.09	.08	.22	.28
F	<i>Polygonum douglasii</i> (a)	-	-	b <sup>23</sup>	a <sup>1</sup>	a <sup>1</sup>	a <sup>-</sup>	.05	.00	.00	-
F	<i>Ranunculus testiculatus</i> (a)	-	-	d <sup>287</sup>	c <sup>163</sup>	b <sup>33</sup>	a <sup>-</sup>	2.15	1.01	.10	-
F	<i>Sphaeralcea coccinea</i>	-	3	-	-	1	-	-	-	.00	-
F	<i>Tragopogon dubius</i> (a)	a <sup>-</sup>	a <sup>3</sup>	b <sup>9</sup>	a <sup>-</sup>	a <sup>3</sup>	a <sup>3</sup>	.05	-	.00	.01
F	<i>Vicia americana</i>	a <sup>-</sup>	a <sup>-</sup>	ab <sup>9</sup>	ab <sup>9</sup>	b <sup>9</sup>	ab <sup>8</sup>	.06	.12	.12	.02
Total for Annual Forbs		0	32	1098	448	639	98	6.01	2.52	6.76	0.37
Total for Perennial Forbs		0	88	156	66	74	69	0.88	0.40	0.44	0.35
Total for Forbs		0	120	1254	514	713	167	6.89	2.92	7.20	0.73

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 15

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	46	66	64	57	5.53	10.01	12.58	15.82
B	<i>Gutierrezia sarothrae</i>	19	17	25	11	.53	.83	.06	.30
B	<i>Juniperus osteosperma</i>	1	1	1	1	.15	.76	.76	.98
B	<i>Purshia tridentata</i>	3	4	5	3	.42	.07	.06	1.28
Total for Browse		69	88	95	72	6.63	11.67	13.47	18.39

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 15

Species	Percent Cover	
	'07	'12
<i>Artemisia tridentata vaseyana</i>	14.93	20.60
<i>Gutierrezia sarothrae</i>	.10	.41
<i>Juniperus osteosperma</i>	1.58	2.15
<i>Purshia tridentata</i>	-	1.41

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 15

Species	Average leader growth (in)		
	'02	'07	'12
<i>Artemisia tridentata vaseyana</i>	2.8	1.6	2.5

POINT-QUARTER TREE DATA--  
Management unit 16A, Study no: 15

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	21	23	24	6.8	9.7	8.9

BASIC COVER--  
Management unit 16A, Study no: 15

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	3.00	9.50	43.06	53.96	61.49	66.77
Rock	2.25	.25	4.32	1.16	.98	.74
Pavement	0	.50	.67	1.03	1.56	1.47
Litter	75.00	63.00	36.01	38.60	35.81	41.74
Cryptogams	1.50	0	5.95	1.58	3.71	3.51
Bare Ground	18.25	26.75	14.39	16.45	11.89	4.60

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 15, Old Pinery

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
19.1	6.2	37.4	39.7	22.8	1.8	19.2	208.0	0.4

PELLET GROUP DATA--  
Management unit 16A, Study no: 15

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	12	12	77	13	-	-	-
Elk	-	1	4	1	-	-	-
Deer	41	58	67	28	94 (233)	90 (222)	19 (48)
Cattle	18	9	7	4	22 (54)	12 (29)	2 (4)

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 15

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>1332</b>	0	95	5	-	0	0	3	13/13
89	<b>4532</b>	76	21	4	8166	1	0	.73	15/16
97	<b>2040</b>	69	30	1	920	11	10	0	22/41
02	<b>3340</b>	35	60	5	140	23	8	1	18/27
07	<b>2700</b>	4	92	4	40	35	17	3	24/35
12	<b>2220</b>	6	85	9	20	17	5	5	25/38
<i>Gutierrezia sarothrae</i>									
83	<b>633</b>	0	100	0	-	0	0	0	11/13
89	<b>8565</b>	46	48	5	-	0	0	0	11/9
97	<b>1560</b>	18	82	0	140	0	0	0	7/8
02	<b>900</b>	0	76	24	-	0	0	4	7/8
07	<b>1100</b>	24	73	4	60	0	0	0	8/8
12	<b>320</b>	6	94	0	-	0	0	0	8/8
<i>Juniperus osteosperma</i>									
83	<b>33</b>	100	0	-	-	0	0	0	-/-
89	<b>33</b>	100	0	-	-	0	0	0	-/-
97	<b>20</b>	100	0	-	-	0	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	-/-
07	<b>20</b>	0	100	-	-	0	0	0	-/-
12	<b>20</b>	0	100	-	-	0	0	0	135/91
<i>Opuntia sp.</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	5/22
<i>Purshia tridentata</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>60</b>	0	100	-	-	0	100	0	11/43
02	<b>80</b>	0	100	-	-	0	100	0	16/49
07	<b>100</b>	0	100	-	-	0	100	0	17/51
12	<b>60</b>	0	100	-	-	0	100	0	21/64

CHICKEN CREEK - TREND STUDY NO. 16A-17-12

Vegetation Type: Mixed Mountain Brush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Mountain Very Steep Loam (Browse), R047XA473UT

Land Ownership: Private/USFS?

Elevation: 5,775 ft (1,760 m)

Aspect: South

Slope: 10-60%

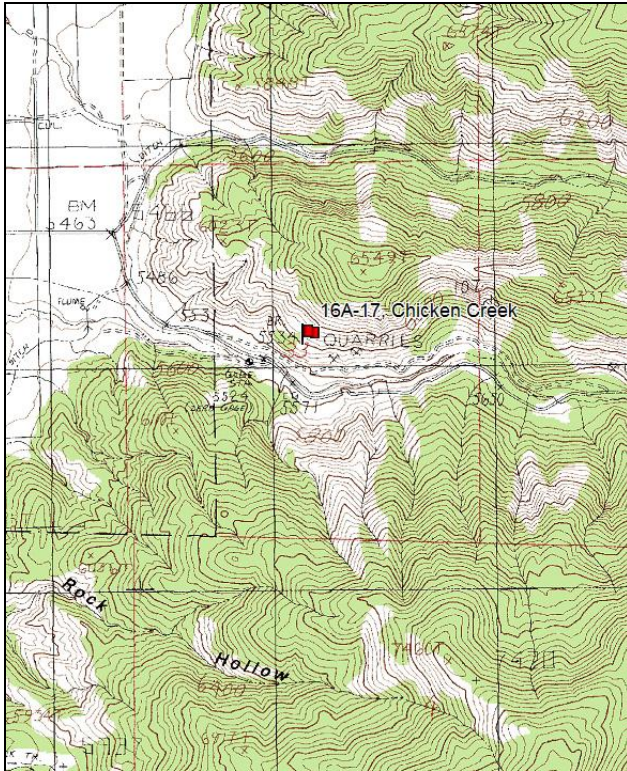
Transect bearing: 280° magnetic

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

Directions:

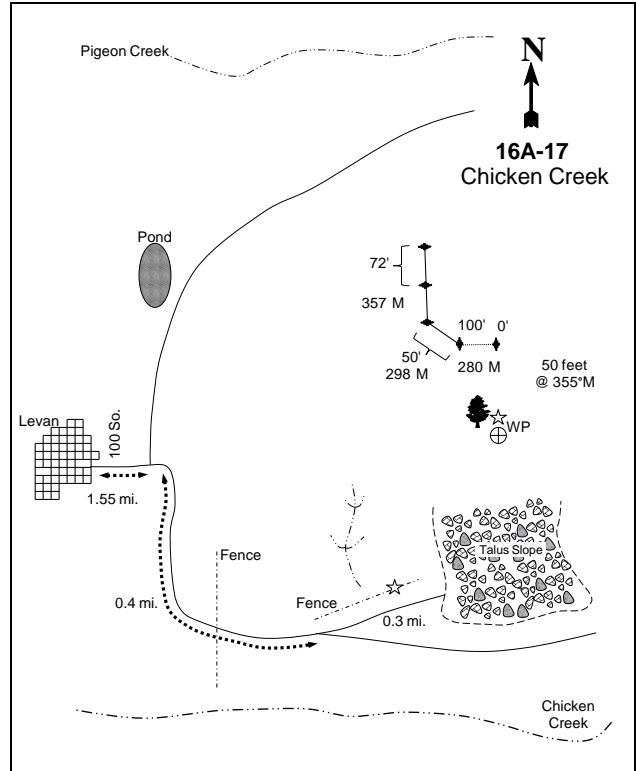
From the intersection of 100 South and Main Street in Levan, proceed east on 100 South for 1.55 miles to a fork. Turn right (south) and proceed 0.40 miles toward Chicken Creek to a road to the left. Turn left and proceed east for 0.30 miles to a green steel "T" fencepost on the north side of the road (fencepost may no longer exist). From the fencepost, walk up slope at an azimuth of 344 degrees true to the eastern most juniper on the ridge. There is a section marker and witness post next to the juniper. The 0-foot baseline stake is located 50 feet away at an azimuth 355 degrees magnetic.

Map Name: Levan



Township: 14S Range: 1E Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 429073 E 4378304 N

## CHICKEN CREEK - TREND STUDY NO. 16A-17

### Site Information

Site Description: The study is located on crucial deer and elk winter range near the mouth of Chicken Creek, and samples a Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) community intermixed with Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), Utah juniper (*Juniperus osteosperma*), and Gambel oak (*Quercus gambelii*). Pellet groups of wildlife were abundant in 1983. Deer pellet groups were sampled high abundance in 2002 and 2007, but were sampled in more moderate abundance in 2012. Three live and two dead deer were noted during the 2007 sampling. Elk pellet groups have been sampled in very low abundance since 2002 (Table - Pellet Group Data).

Browse: The preferred browse species are diverse, but somewhat limited in cover on the site. Stansbury cliffrose has historically been the dominant browse in cover, but cover decreased in 2002. Gambel oak now provides the majority of browse cover (Table - Browse Trends), but has shown minimal use through the study years. The cliffrose stand is a scattered population of large, mature plants. Density of cliffrose has been steadily decreasing since 2002. Recruitment of young cliffrose plants has been minimal over the course of the study. Decadence and poor vigor in the cliffrose population have been very high throughout most of the study years, but were low in 2012. Utilization of cliffrose has been mostly heavy, although many of the mature plants are tall and partly unavailable for browsing. Serviceberry occurs less frequently than cliffrose. The majority of the serviceberry plants have been either young or decadent in each sample year. Vigor has been good on all serviceberry plants, and utilization has been moderate-heavy. Other shrubs that provide additional forage but occur infrequently are mountain big sagebrush, true mountain mahogany (*Cercocarpus montanus*), white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), and chokecherry (*Prunus virginiana*) (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are abundant, but only one species is common. Bluebunch wheatgrass (*Agropyron spicatum*) has provided almost all of the perennial grass cover. Cheatgrass (*Bromus tectorum*) is also abundant, but is concentrated mostly under the crowns of juniper trees. The forb component of the understory is diverse, but few forbs are particularly abundant. Forb composition is a mixture of annual and perennial forbs (Table - Herbaceous Trends).

Soil: The soil is part of the Xerix Torriorthents series, which occurs on mountain slopes. These soils are formed from colluvium derived from shale and/or residuum weathered from shale. This series is characterized as a deep soil (Soil Survey Staff 2011). There are many gravel-sized fragments covering the surface and large rock outcrops are also present. The soil texture is a clay loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Pedestalling is common, and several large cracks in the ground surface were noted in 1983, which are indicative of high potential for slippage or landslides. Bare ground cover is low with high amounts of vegetation, litter, rock, and pavement providing protective ground cover. The soil erosion condition was classified as slight in 2002 and 2007, and moderate in 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - down (-2):** Cliffrose density decreased 50% from 399 plants/acre to 199 plants/acre, and decadence remained high at 83% of the population. Plants displaying poor vigor decreased slightly from 42% to 33% of the population. Serviceberry density decreased 60% from 165 plants/acre to 66 plants/acre. Decadence increased from 60% of the sampled plants to 100%.
- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Decadence of cliffrose decreased to 33%, and poor vigor decreased to 17% of the population. Recruitment of young serviceberry plants increased to 75% of the population, and there were no decadent serviceberry plants sampled.

- **1997 to 2002 - slightly up (+1):** Cliffrose density increased 92% from 240 plants/acre to 460 plants/acre, though cover remained similar at 3%. Decadence of cliffrose increased to 61%, and plants displaying poor vigor increased slightly to 22% of the population. Serviceberry density decreased slightly to 60 plants/acre, and all of the sampled plants were decadent.
- **2002 to 2007 - slightly down (-1):** Cliffrose density decreased 30% to 320 plants/acre, and cover decreased to 2%. Decadence of cliffrose decreased slightly to 50%, but is still considered very high. Plants showing poor vigor increased to 38% of the population. Serviceberry density increased slightly to 80 plants/acre, and decadence decreased from 100% of the sampled plants to 50%.
- **2007 to 2012 - slightly down (-1):** Density of cliffrose decreased 31% to 220 plants/acre, but cover remained similar at 2%. Decadence of cliffrose decreased to 18%, and poor vigor decreased to 9%. Serviceberry density increased 75% to 140 plants/acre, though cover remained less than 1%. Most of the increase in density of serviceberry was due to a large recruitment of young plants, which comprised 86% of the population.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased 40%, and Sandberg bluegrass (*Poa secunda*) was sampled for the first time.
- **1989 to 1997 - down (-2):** The sum of nested frequency of perennial grasses decreased 25%.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 14%, and cover decreased from 13% to 12%.
- **2002 to 2007 - up (+2):** The sum of nested frequency of perennial grasses increased 28%, and cover increased to 13%.
- **2007 to 2012 - stable (0):** There was no change in the sum of nested frequency of perennial grasses, though cover increased to 16%.

Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequency of perennial forbs decreased, but perennial forbs were already rare on the site.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased nearly three-fold.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial forbs decreased 55%, and cover decreased from 3% to 1%.
- **2002 to 2007 - stable (0):** The sum of nested frequency for perennial forbs remained similar, but cover increased slightly to 2%.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 57%, and cover increased to 3%. Perennial forbs remain fairly rare on the site.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 16A, study no: 17

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	7.9	8.5	15.0	25.6	-7.7	5.0	0.0	<b>54.2</b>	Fair
02	7.1	1.1	7.7	23.6	-6.5	2.5	0.0	<b>35.5</b>	Very Poor-Poor
07	4.8	0.0	0.0	25.8	-7.8	4.0	0.0	<b>26.8</b>	Very Poor
12	9.2	12.7	15.0	30.0	-5.1	5.8	-2.0	<b>65.5</b>	Fair-Good



## Trend Summary

### HERBACEOUS TRENDS--

Management unit 16A, Study no: 17

T y P e	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Agropyron spicatum</i>	ab150	b185	ab139	a121	ab146	ab154	12.44	11.67	12.23	15.61
G	<i>Bromus japonicus</i> (a)	-	-	-	7	-	-	-	.04	-	-
G	<i>Bromus tectorum</i> (a)	-	-	b260	b253	b253	a192	10.29	8.61	10.41	6.83
G	<i>Poa bulbosa</i>	-	-	-	-	-	2	-	-	-	.03
G	<i>Poa secunda</i>	a-	b25	b19	b15	b28	b18	.38	.13	.65	.28
Total for Annual Grasses		0	0	260	260	253	192	10.29	8.65	10.41	6.83
Total for Perennial Grasses		150	210	158	136	174	174	12.82	11.80	12.88	15.93
Total for Grasses		150	210	418	396	427	366	23.11	20.46	23.29	22.76
F	<i>Allium</i> sp.	-	-	-	1	1	-	-	.00	.03	-
F	<i>Alyssum alyssoides</i> (a)	-	-	a-	a-	b15	c65	-	-	.05	.21
F	<i>Artemisia ludoviciana</i>	-	-	-	-	3	4	-	-	.15	.03
F	<i>Camelina microcarpa</i> (a)	-	-	a23	a12	a6	b51	.06	.07	.04	.20
F	<i>Chorisporea tenella</i> (a)	-	-	ab7	b14	ab8	a2	.01	.07	.08	.01
F	<i>Cirsium</i> sp.	-	-	b17	a3	a1	a2	.53	.45	.33	.04
F	<i>Collinsia parviflora</i> (a)	-	-	-	2	-	1	-	.00	-	.00
F	Cruciferae	-	-	12	-	-	-	.54	-	-	-
F	<i>Cryptantha flavoculata</i>	-	5	-	-	-	-	-	-	-	-
F	<i>Cryptantha</i> sp.	b14	ab6	a-	ab2	ab3	ab1	-	.01	.00	.00
F	<i>Cryptantha</i> sp.(a)	-	-	-	-	2	8	-	-	.00	.06
F	<i>Cymopterus</i> sp.	-	-	-	1	-	10	-	.01	-	.09
F	<i>Cynoglossum officinale</i>	-	-	-	-	-	3	-	-	-	.38
F	<i>Descurainia pinnata</i> (a)	-	-	21	7	8	14	.12	.02	.02	.03
F	<i>Erigeron pumilus</i>	-	-	-	-	2	10	-	-	.03	.34
F	<i>Eriogonum brevicaula</i>	9	14	11	5	6	11	.52	.09	.10	.81
F	<i>Erodium cicutarium</i> (a)	-	-	13	25	19	16	.07	.33	.12	.11
F	<i>Galium aparine</i> (a)	-	-	62	55	45	57	2.00	.94	1.60	1.20
F	<i>Gilia</i> sp. (a)	-	-	-	5	3	3	-	.04	.00	.00
F	<i>Hackelia patens</i>	a2	a-	b19	a3	ab14	ab9	.44	.42	.80	.51
F	<i>Holosteum umbellatum</i> (a)	-	-	-	-	8	8	-	-	.04	.01
F	<i>Lactuca serriola</i> (a)	b27	a-	a6	a7	a3	ab28	.02	.02	.03	.08
F	<i>Lappula occidentalis</i> (a)	-	-	ab8	b22	ab16	a2	.02	.24	.18	.00
F	<i>Lathyrus brachycalyx</i>	a2	a2	b25	a7	ab12	ab17	.31	.04	.40	.52
F	<i>Lithospermum ruderales</i>	-	-	-	4	-	-	-	.06	-	-
F	<i>Machaeranthera canescens</i>	4	-	1	-	-	-	.00	-	-	-
F	<i>Phacelia</i> sp.	-	-	-	9	-	-	-	.04	-	-
F	<i>Phlox longifolia</i>	a-	a3	b21	a6	ab9	ab13	.07	.04	.07	.02
F	<i>Physalis hederifolia</i>	-	7	2	-	-	-	.00	-	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	-	a6	b14	ab8	ab7	.01	.10	.02	.01
F	<i>Sisymbrium altissimum</i> (a)	-	-	b35	a12	a6	a4	.18	.12	.07	.01
F	<i>Streptanthus cordatus</i>	a3	a8	b23	ab18	ab18	ab28	.06	.06	.08	.13
F	<i>Tragopogon dubius</i> (a)	2	-	-	-	-	6	.00	-	.00	.03

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Unknown forb-annual (a)	-	-	5	-	-	-	.03	-	-	-
F	Veronica biloba (a)	-	-	-	5	3	-	-	.03	.01	-
Total for Annual Forbs		29	0	186	180	150	272	2.54	2.01	2.31	2.00
Total for Perennial Forbs		34	45	131	59	69	108	2.50	1.25	2.01	2.89
Total for Forbs		63	45	317	239	219	380	5.05	3.27	4.32	4.89

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 17

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier utahensis	3	1	3	2	.41	-	.38	.38
B	Cercocarpus montanus	1	1	0	2	-	.38	-	.38
B	Chrysothamnus nauseosus albicaulis	6	5	4	2	.90	.71	.53	.50
B	Cowania mexicana stansburiana	12	13	16	10	3.00	3.21	1.52	1.93
B	Gutierrezia sarothrae	5	4	2	3	.01	.15	-	.15
B	Juniperus osteosperma	0	1	1	1	-	1.00	2.11	2.21
B	Mahonia repens	20	21	23	22	.07	.31	1.02	1.28
B	Prunus virginiana	6	2	3	4	.00	-	-	.00
B	Quercus gambelii	9	6	7	10	1.58	.83	1.33	3.72
B	Rhus glabra cismontana	0	0	0	1	.03	-	-	.03
B	Rhus trilobata	0	0	0	0	-	-	-	.76
Total for Browse		62	54	59	57	6.03	6.60	6.92	11.36

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 17

Species	Percent Cover	
	'07	'12
Amelanchier utahensis	.50	.53
Artemisia tridentata vaseyana	-	.26
Cercocarpus montanus	.01	.71
Chrysothamnus nauseosus albicaulis	1.46	.91
Cowania mexicana stansburiana	2.01	3.38
Gutierrezia sarothrae	.16	.11
Juniperus osteosperma	4.71	7.53
Mahonia repens	.76	1.60
Prunus virginiana	-	.25
Quercus gambelii	8.18	10.96
Rhus trilobata	-	.56

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 17

Species	Average leader growth (in)		
	'02	'07	'12
<i>Cowania mexicana stansburiana</i>	3.8	1.6	0.8

BASIC COVER--

Management unit 16A, Study no: 17

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	2.25	7.00	29.85	29.54	31.93	40.13
Rock	4.75	4.25	13.62	22.55	20.35	18.51
Pavement	52.00	57.25	26.51	26.07	22.63	26.97
Litter	33.50	29.75	27.93	30.74	32.72	38.00
Cryptogams	0	0	.26	.15	.05	.00
Bare Ground	7.50	1.75	8.96	5.48	2.97	2.65

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 17, Chicken Creek

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
21.7	6.9	39.4	30.7	29.8	2.8	11.6	192.0	1.2

PELLET GROUP DATA--

Management unit 16A, Study no: 17

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	-	2	11	9	-	-	-
Elk	2	-	3	-	2 (5)	-	1 (2)
Deer	39	36	26	14	74 (181)	52 (129)	26 (65)

BROWSE CHARACTERISTICS--

Management unit 16A, Study no: 17

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Amelanchier utahensis									
83	<b>165</b>	20	20	60	-	40	40	0	18/8
89	<b>66</b>	0	0	100	-	0	100	0	-/-
97	<b>80</b>	75	25	0	-	75	25	0	49/69
02	<b>60</b>	0	0	100	-	0	100	0	51/64
07	<b>80</b>	50	0	50	-	25	50	0	38/54
12	<b>140</b>	86	14	0	-	14	0	0	52/77

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata vaseyana</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	34/30	
02	0	0	0	-	-	0	0	0	25/36	
07	0	0	0	-	-	0	0	0	30/28	
12	0	0	0	-	-	0	0	0	30/34	
<i>Cercocarpus montanus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	20	0	100	-	-	100	0	0	88/86	
02	20	0	100	-	-	0	100	0	61/82	
07	0	0	0	-	-	0	0	0	89/105	
12	60	33	67	-	-	33	0	0	68/100	
<i>Chrysothamnus nauseosus albicaulis</i>										
83	99	0	100	0	-	0	0	0	27/33	
89	232	57	43	0	-	0	0	0	28/34	
97	120	17	50	33	-	33	0	17	26/40	
02	100	0	40	60	-	0	40	0	26/34	
07	80	0	25	75	-	25	0	50	31/43	
12	40	0	50	50	-	50	0	50	29/44	
<i>Cowania mexicana stansburiana</i>										
83	399	0	17	83	-	25	75	42	43/72	
89	199	0	17	83	-	33	50	33	114/126	
97	240	0	67	33	20	25	50	17	50/48	
02	460	0	39	61	-	4	57	22	55/60	
07	320	0	50	50	-	6	75	38	63/65	
12	220	9	73	18	-	9	27	9	63/68	
<i>Gutierrezia sarothrae</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	180	22	78	0	-	0	0	0	9/15	
02	140	0	57	43	-	0	0	14	5/11	
07	40	50	50	0	-	0	0	0	16/27	
12	140	0	100	0	-	0	0	0	15/20	
<i>Juniperus osteosperma</i>										
83	33	0	100	-	-	0	0	0	67/118	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	116/145	
02	20	0	100	-	-	0	0	0	-/-	
07	20	0	100	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	393/268	

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Mahonia repens</b>									
83	<b>4932</b>	27	73	0	-	0	0	0	5/4
89	<b>4165</b>	70	30	0	-	10	0	0	4/5
97	<b>2740</b>	17	83	0	-	0	0	0	3/4
02	<b>4840</b>	10	87	3	-	0	0	.41	2/4
07	<b>7300</b>	7	93	0	-	0	0	0	3/5
12	<b>6140</b>	37	63	0	-	0	0	0	4/5
<b>Prunus virginiana</b>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>300</b>	73	20	7	80	20	13	0	15/15
02	<b>40</b>	0	50	50	-	50	50	50	6/8
07	<b>60</b>	100	0	0	-	0	100	0	8/12
12	<b>320</b>	0	100	0	-	0	0	0	8/12
<b>Quercus gambelii</b>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>2060</b>	83	17	0	280	0	0	0	113/140
02	<b>2180</b>	95	5	0	-	0	0	0	104/65
07	<b>2900</b>	0	99	1	-	0	0	0	20/15
12	<b>2240</b>	88	13	0	220	0	0	0	17/16
<b>Rhus glabra cismontana</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	88/128
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>20</b>	100	0	-	-	0	0	0	84/85
<b>Rhus trilobata</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	102/142
12	<b>0</b>	0	0	-	-	0	0	0	73/113

DEEP CREEK - TREND STUDY NO. 16A-18-12

Vegetation Type: True Mountain Mahogany

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Upland Loam (Birchleaf Mountain Mahogany), R047XA309UT

Land Ownership: USFS

Elevation: 5,670 ft (1,728 m)

Aspect: Northwest

Slope: 15-25%

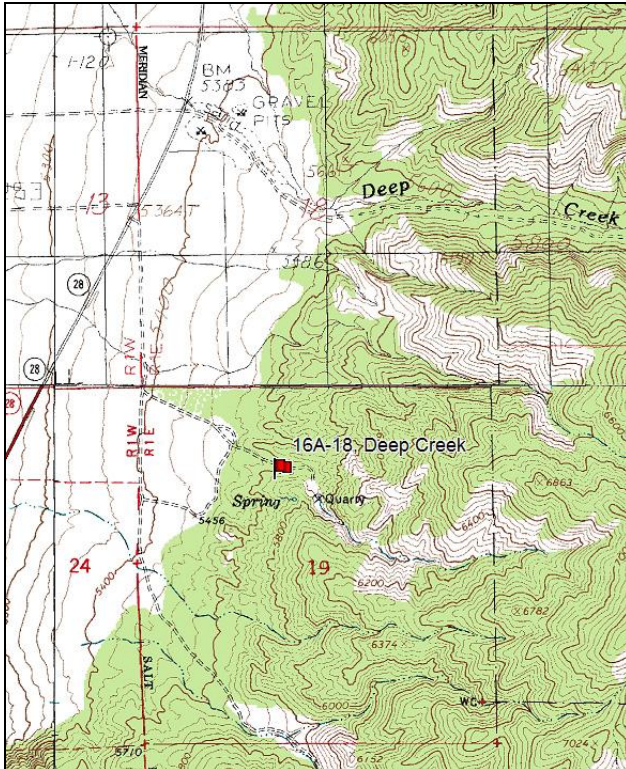
Transect bearing: 235° magnetic

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

Directions:

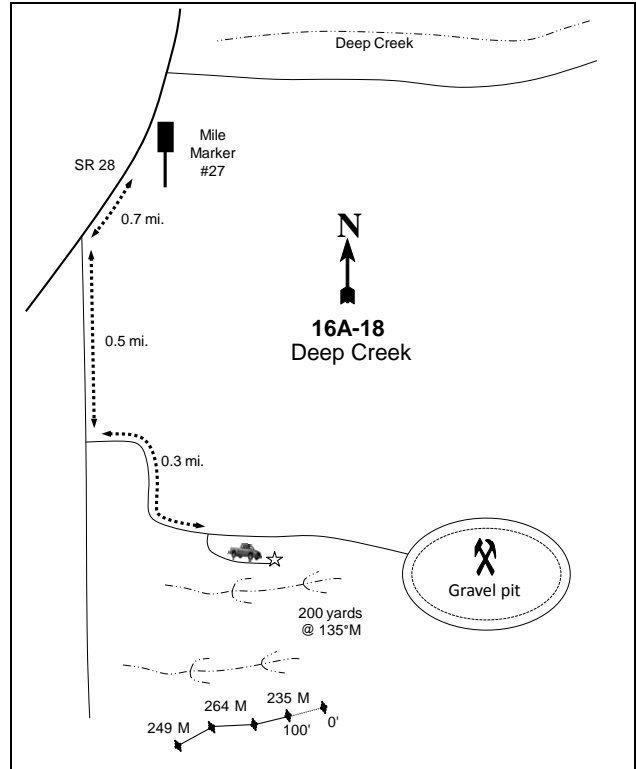
From the post office in Levan (75 N. Main St.) go south on US-28 for 3.8 miles. Turn left 0.7 miles past mile marker 27 (east then south) and go 0.5 miles to a fork in the road. Take a left (east) and go 0.3 miles to another fork. Take the old road to the right and park when it ends. From here, the 0-foot baseline stake is 200 yards at an azimuth of 135 degrees magnetic. There are some large boulders around the 100-foot baseline stake.

Map Name: Chriss Canyon



Township: 15S Range: 1E Section: 19

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 425691 E 4372189 N

## DEEP CREEK - TREND STUDY NO. 16A-18

### Site Information

Site Description: The study monitors crucial deer winter range located just south of Deep Creek, on a narrow ridge running east to west. The vegetation composition is typical of the west-facing foothills from Levan south to the unit boundary. The site supports a sparse pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) stand associated with a mixture of understory browse species. Deer use of the area was reported moderate-heavy in 1983 and 1989, and several deer carcasses were found in 1989. Deer pellet groups have been sampled in low abundance since 2002. Sheep pellet groups were sampled in high abundance in 2002 and 2007, but no sheep pellets were sampled in 2012. Several cattle pats were sampled in 2012 (Table - Pellet Group Data).

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), and green ephedra (*Ephedra viridis*) provide preferred browse. Mahogany provides the majority of the preferred browse cover (Table - Pellet Group Data). Mahogany density appeared to increase over the initial years of the study, but has decreased steadily since 2002. Recruitment of young mahogany plants has been good in most of the sample years, though was poor in 2002 and 2007. Decadence of mahogany has also been generally low, but was high in 2002 and 2007. Vigor of mahogany has generally been good. Utilization of mahogany has been moderate to heavy in all sample years. Mountain big sagebrush density has decreased over the course of the study years. Recruitment of young sagebrush plants has been very poor over the course of the study. Decadence has been high in the sagebrush population, but poor vigor has fluctuated between good and poor condition over the course of the study. Utilization of sagebrush was moderate to heavy in 1983 and 1989, but has been light to moderate since 1997. Green ephedra occurs at moderate density, and the population is generally good with low vigor. Recruitment of young ephedra plants was low at the outset of the study, but has been good since 2007. Decadence has fluctuated, but has generally been high. Utilization of ephedra has typically been light with some moderate use (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is sparsely distributed, and most shrub and tree interspaces lack vegetation cover. Bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*) are the most abundant perennial grasses, and occur most often near the base of shrubs. Cheatgrass (*Bromus tectorum*) is common and is found mostly under the crowns of juniper trees. Forbs are diverse, but provide poor forage value. The most abundant forbs have included tapertip hawksbeard (*Crepis acuminata*), Hood's phlox (*Phlox hoodii*), and bur buttercup (*Ranunculus testiculatus*) (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Xeric Torriorthents component, which occur on mountain slopes. These soils are formed from colluvium derived from shale and/or residuum weathered from shale, and are characterized as deep (Soil Survey Staff 2011). The soil texture is a clay with a neutral soil reaction (pH 7.2). Soil phosphorus may have marginal availability for plant growth and development at 6.6 ppm (Tiedemann and Lopez 2004). Organic matter is also low at 1.2% (Table - Soil Analysis Data). The soil has poor structure, and erosion is apparent. Bare ground cover is high, but vegetation and litter provide a good amount of protective ground cover. Rock and pavement cover is also common (Table - Basic Cover). The soil erosion condition has been classified as slight since 2002. The steep slope increases erosion potential on the study.

### Trend Assessments

#### Browse:

- **1983 to 1989 - stable (0):** Mahogany density increased slightly from 432 plants/acre to 465 plants/acre, and mountain big sagebrush density decreased slightly from 532 plants/acre to 498 plants/acre. Recruitment of young mahogany plants decreased slightly from 31% to 29% of the population. Decadence of mahogany increased 0% to 14%, and poor vigor also increased from 0% to

14%. Decadence of sagebrush increased from 44% to 66%, and poor vigor increased from 0% to 33%.

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young mahogany plants decreased to 14% of the population, but is still considered to be good. Decadence of mahogany remained similar at 14%, but poor vigor decreased to 2% of the population. Decadence of sagebrush decreased to 33%, but is still considered to be high. Poor vigor of sagebrush decreased to 13%.
- **1997 to 2002 - slightly up (+1):** Mahogany density increased 21% from 860 plants/acre to 1,040 plants/acre, and cover increased from 5% to 6%. However, recruitment of young mahogany plants decreased to 4%, and decadence increased to 35% of the population. Plants displaying poor vigor increased from 2% of the population to 10%. Sagebrush density decreased 20% from 300 plants/acre to 240 plants/acre, but cover remained similar at around 1%. Decadence of sagebrush increased to 50%, but poor vigor decreased slightly to 8%.
- **2002 to 2007 - down (-2):** Mahogany density decreased 29% to 740 plants/acre, and cover decreased to 3%. There was no new recruitment of young mahogany plants sampled. Decadence of mahogany almost doubled to 68%, and poor vigor increased to 59%. Sagebrush density decreased 33% to 160 plants/acre, though cover remained similar at around 1%. Decadence of sagebrush decreased to 25%, but poor vigor increased to 13% of the population.
- **2007 to 2012 - slightly up (+1):** Density of mahogany decreased slightly to 600 plants/acre, but cover increased to 9%. Recruitment of young mahogany plants increased to 20% of the population. Decadence decreased to just 10%, and poor vigor decreased to just 7% of the population. Density of sagebrush remained similar at 180 plants/acre, and cover remained similar at 1%. Decadence decreased slightly to 22%, and poor vigor increased to 22%.

#### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased 64%, and bluebunch wheatgrass increased significantly in nested frequency.
- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial grasses remained similar.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses remained similar, but cover decreased from 8% to 3%. Cheatgrass decreased significantly in nested frequency.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 20%, and increased to 8%. However, cheatgrass increased significantly in nested frequency, and cover increased from less than 1% to 3%.
- **2007 to 2012 - stable (0):** The perennial grass sum of nested frequency remained similar, but cover decreased slightly to 7%. Cheatgrass decreased significantly in nested frequency, and cover decreased to 1%.

#### Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequency of perennial forbs did not change substantially.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 17%.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial forbs decreased 32%, and cover decreased from 5% to 3%. Annual forb sum of nested frequency decreased substantially, and cover decreased from 4% to 1%.
- **2002 to 2007 - stable (0):** The sum of nested frequency and cover of perennial forbs remained similar. Annual forb sum of nested frequency increased substantially, and cover increased to 4%.
- **2007 to 2012 - slightly up (+1):** The perennial forb sum of nested frequency increased 17%, and cover increased to 5%. Annual forb sum of nested frequency decreased substantially, and cover decreased to 1%.



DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, study no: 18

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	11.3	10.3	4.4	15.3	-0.8	9.6	0.0	<b>50.1</b>	Poor-Fair
02	14.4	4.7	2.1	6.9	-0.2	5.5	0.0	<b>33.3</b>	Very Poor-Poor
07	9.4	0.9	3.1	15.2	-2.6	5.7	0.0	<b>31.7</b>	Very Poor
12	18.3	11.2	8.9	13.2	-0.8	9.6	0.0	<b>60.5</b>	Fair

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 16A, Study no: 18

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	a79	b141	b127	b120	b123	b123	6.26	3.11	6.06	4.68
G	Bromus japonicus (a)	-	-	-	-	4	-	-	-	.03	-
G	Bromus tectorum (a)	-	-	b105	a33	c163	a48	1.05	.28	3.36	1.02
G	Oryzopsis hymenoides	2	-	-	-	4	2	-	-	.01	.00
G	Poa fendleriana	-	2	-	-	4	2	-	-	.15	.03
G	Poa secunda	a25	a31	abc62	bcd66	cd91	d90	1.37	.33	1.37	1.88
G	Sitanion hystrix	-	-	-	-	2	-	-	-	.00	-
Total for Annual Grasses		0	0	105	33	167	48	1.05	0.28	3.40	1.02
Total for Perennial Grasses		106	174	189	186	224	217	7.64	3.44	7.60	6.61
Total for Grasses		106	174	294	219	391	265	8.69	3.72	11.01	7.64
F	Agoseris glauca	a-	a-	a-	ab4	ab3	b9	-	.01	.04	.02
F	Alyssum alyssoides (a)	-	-	a5	a-	b98	c165	.01	-	.39	.72
F	Arabis sp.	ab1	a-	ab5	b6	ab6	ab4	.01	.02	.07	.03
F	Astragalus sp.	-	-	-	1	7	-	-	.00	.01	-
F	Calochortus nuttallii	b9	ab3	b10	b7	b8	a-	.02	.02	.02	-
F	Camelina microcarpa (a)	-	-	-	-	1	-	-	-	.00	-
F	Chaenactis douglasii	3	-	-	2	-	-	-	.00	-	-
F	Chorispora tenella (a)	-	-	a-	a-	b27	a-	-	-	.06	-
F	Collinsia parviflora (a)	-	-	a4	a1	b26	a8	.00	.00	.06	.01
F	Crepis acuminata	a14	a17	b53	a16	a13	ab27	2.03	.08	.06	.44
F	Cruciferae	a-	a-	b43	a-	a-	a-	.12	-	-	-
F	Cryptantha sp.	b78	a30	a27	a11	a13	a24	.12	.02	.09	.54
F	Descurainia pinnata (a)	-	-	ab18	a12	b31	a-	.03	.02	.07	-
F	Draba sp. (a)	-	-	-	-	3	-	-	-	.01	-
F	Erigeron sp.	b19	a3	a2	a-	a-	a-	.00	-	-	-
F	Eriogonum brevicaulis	3	7	7	7	2	-	.01	.04	.00	-
F	Galium aparine (a)	-	-	16	5	10	6	.20	.01	.05	.01
F	Gilia sp. (a)	-	-	ab12	b29	b15	a-	.02	.05	.04	-
F	Hackelia patens	ab5	b9	a-	b10	a-	a-	-	.03	-	-
F	Haplopappus acaulis	-	-	4	-	3	-	.15	-	.15	-
F	Lactuca serriola (a)	-	-	-	2	3	1	-	.00	.00	.00

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Leucelene ericoides	a-	a-	b16	ab11	a7	ab8	.24	.04	.09	.33
F	Machaeranthera canescens	-	1	-	-	-	-	-	-	-	-
F	Microsteris gracilis (a)	-	-	-	-	4	-	-	-	.01	-
F	Penstemon sp.	-	-	6	-	-	-	.01	-	-	-
F	Phlox hoodii	a112	b155	a89	a102	a84	a85	1.88	2.34	2.09	3.01
F	Phlox longifolia	ab26	a30	bc56	abc40	abc49	c67	.20	.09	.22	.22
F	Physalis hederifolia	-	-	1	-	-	-	.00	-	-	-
F	Physaria australis	4	-	-	-	5	2	-	-	.01	.00
F	Ranunculus testiculatus (a)	-	-	d275	b139	c197	a62	3.50	.85	2.95	.13
F	Senecio multilobatus	-	-	-	-	-	6	-	-	-	.16
F	Stanleya pinnata	ab7	b17	a-	a-	a-	a-	-	-	-	-
F	Unknown forb-annual (a)	-	-	b8	a-	a-	a-	.10	-	-	-
F	Veronica biloba (a)	-	-	a-	a-	b17	b24	-	-	.06	.04
F	Zigadenus paniculatus	-	1	1	-	-	1	.00	-	-	.00
Total for Annual Forbs		0	0	338	188	432	266	3.87	0.93	3.71	0.92
Total for Perennial Forbs		281	273	320	217	200	233	4.82	2.73	2.87	4.78
Total for Forbs		281	273	658	405	632	499	8.70	3.67	6.59	5.70

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 18

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	13	10	8	8	.74	1.02	1.14	.91
B	Cercocarpus montanus	26	29	24	23	4.73	5.89	3.26	8.78
B	Chrysothamnus viscidiflorus stenophyllus	5	8	6	9	.36	.21	.21	.18
B	Ephedra viridis	18	20	17	15	2.62	3.43	2.49	3.19
B	Juniperus osteosperma	3	2	2	3	3.95	2.48	4.56	6.55
B	Pinus edulis	0	2	1	1	-	.66	.03	.53
Total for Browse		65	71	58	59	12.42	13.70	11.73	20.17

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 18

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	.41	.76
Cercocarpus montanus	3.95	10.28
Chrysothamnus viscidiflorus stenophyllus	.50	.20
Ephedra viridis	5.05	2.41
Juniperus osteosperma	6.00	12.51
Pinus edulis	-	.20

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 18

Species	Average leader growth (in)		
	'02	'07	'12
Cercocarpus montanus	2.5	2.6	1.9

POINT-QUARTER TREE DATA--

Management unit 16A, Study no: 18

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	63	56	54	11.0	13.9	10.4
Pinus edulis	-	21	<18	-	4.1	4.9

BASIC COVER--

Management unit 16A, Study no: 18

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	2.50	9.75	27.87	23.49	26.98	32.21
Rock	2.25	5.25	8.19	7.31	7.28	8.42
Pavement	6.75	20.50	20.05	10.19	13.63	6.88
Litter	46.50	33.75	25.98	27.82	19.12	27.83
Cryptogams	2.00	0	.67	.88	1.11	1.61
Bare Ground	40.00	30.75	25.02	47.01	47.02	39.78

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 18, Deep Creek

Effective rooting depth (in)	pH	Clay			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
18.3	7.2	28.7	19.4	51.8	1.2	6.6	124.8	0.4

PELLET GROUP DATA--

Management unit 16A, Study no: 18

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Sheep	-	12	23	-	56(137)	48 (117)	-
Rabbit	9	15	36	8	-	-	-
Elk	2	1	-	-	-	-	-
Deer	16	1	10	-	9 (23)	7 (17)	5 (12)
Cattle	-	-	-	1	-	-	4 (9)

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 18

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>532</b>	0	56	44	-	50	38	0	28/34
89	<b>498</b>	0	40	60	-	47	40	33	21/19
97	<b>300</b>	7	60	33	-	13	0	13	26/30
02	<b>240</b>	0	50	50	-	58	0	8	24/25
07	<b>160</b>	0	75	25	-	38	13	13	24/33
12	<b>180</b>	0	78	22	-	33	11	22	30/36
<i>Cercocarpus montanus</i>									
83	<b>432</b>	31	69	0	-	77	15	0	35/36
89	<b>465</b>	29	57	14	-	79	21	14	40/41
97	<b>860</b>	14	72	14	-	63	35	2	39/48
02	<b>1040</b>	4	62	35	-	42	27	10	42/50
07	<b>740</b>	0	32	68	80	14	81	59	48/61
12	<b>600</b>	20	70	10	100	57	23	7	41/52
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
83	<b>99</b>	0	100	0	-	0	0	0	11/14
89	<b>133</b>	0	100	0	-	25	0	0	10/13
97	<b>100</b>	0	80	20	-	0	0	0	10/16
02	<b>200</b>	0	70	30	-	20	20	0	10/20
07	<b>140</b>	0	57	43	-	43	57	0	11/17
12	<b>200</b>	20	80	0	20	10	0	10	14/20
<i>Cowania mexicana stansburiana</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>66</b>	0	100	-	-	100	0	0	26/35
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	18/18
07	<b>0</b>	0	0	-	-	0	0	0	67/47
12	<b>0</b>	0	0	-	20	0	0	0	57/61
<i>Ephedra viridis</i>									
83	<b>298</b>	11	67	22	-	11	0	0	40/48
89	<b>332</b>	0	40	60	-	0	0	0	35/24
97	<b>440</b>	0	86	14	-	27	0	5	41/56
02	<b>700</b>	6	66	29	-	14	0	6	42/53
07	<b>460</b>	17	52	30	-	13	13	9	43/66
12	<b>480</b>	17	67	17	20	4	0	17	41/53

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Gutierrezia sarothrae</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	7/10
<b>Juniperus osteosperma</b>									
83	66	0	100	-	-	0	0	0	67/207
89	66	0	100	-	-	0	0	0	165/136
97	60	0	100	-	-	0	33	0	-/-
02	60	0	100	-	-	0	0	0	-/-
07	40	0	100	-	-	0	0	0	-/-
12	80	0	100	-	-	0	0	0	-/-
<b>Kochia prostrata</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	51/77
<b>Pinus edulis</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	40	0	100	-	-	0	0	0	-/-
07	20	100	0	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	40/51
<b>Quercus gambelii</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	20	0	0	0	-/-
12	20	100	0	-	-	0	0	0	-/-

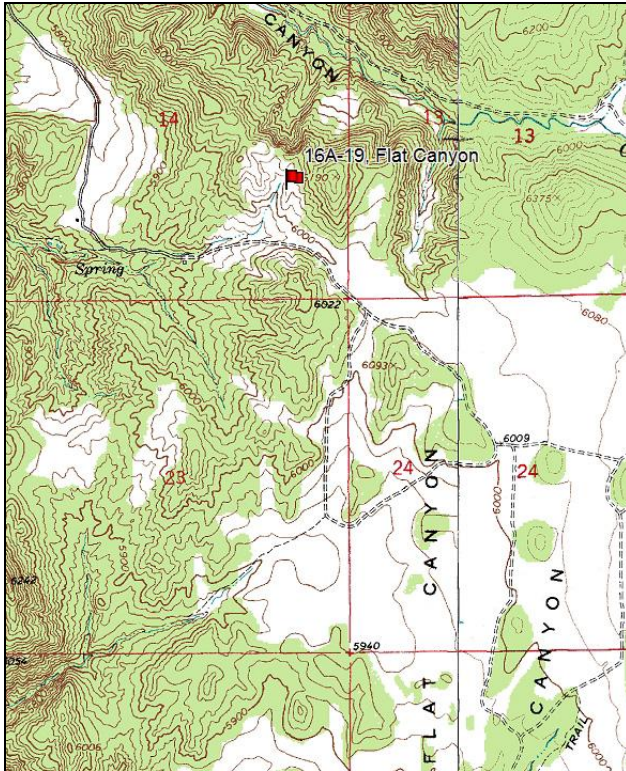
FLAT CANYON - TREND STUDY NO. 16A-19-12

Vegetation Type: Mountain Big Sagebrush/Bitterbrush  
Range Type: Crucial Deer Winter, Crucial Elk Winter  
NRCS Ecological Site Description: Upland Stony Loam (Mountain Big Sagebrush), R047XA334UT  
Land Ownership: BLM  
Elevation: 6,040 ft (1,841 m)  
Aspect: Southwest  
Slope: 30%  
Transect bearing: 204° magnetic  
Belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft)

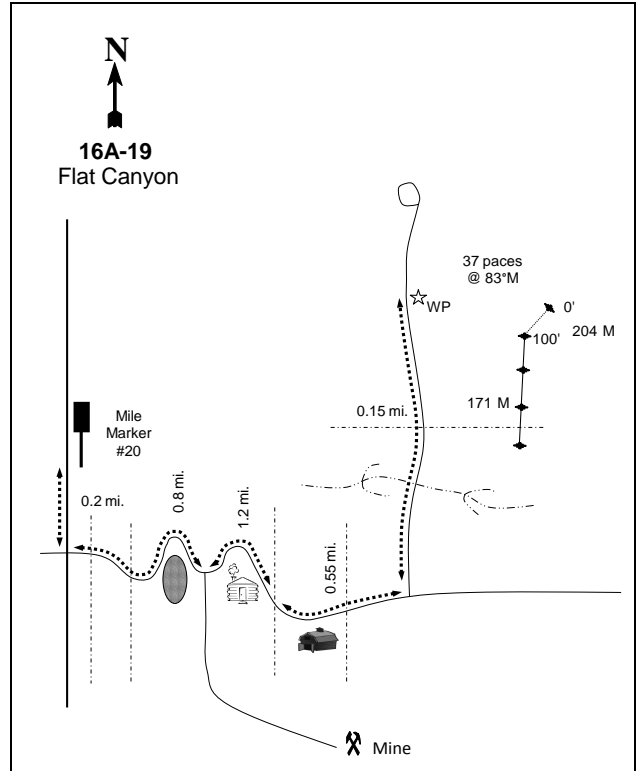
Directions:

From Levan, go south on Highway 28 to 0.2 miles south of mile marker #20. Turn left (east) and go 0.8 miles to a fork. Keep left at the fork and continue 1.2 miles to an old fence by an old cabin where the road makes a 90° turn to the east. Continue up the main road for 0.55 miles to a faint road which turns off to the left down into the sagebrush. Follow this road for 0.15 miles to a witness post on the right side of the road. From here walk up the hill about 37 paces at a bearing of 83 degrees magnetic to the 0-foot baseline stake, which is marked with browse tag #9084.

Map Name: Skinner Peaks



Diagrammatic Sketch:



Township: 16S Range: 1W Section: 14

GPS: NAD 83, UTM 12S 423840 E 4363153 N

## FLAT CANYON - TREND STUDY NO. 16A-19

### Site Information

Site Description: The study is located on the crucial deer winter range on land managed by the Bureau of Land Management (BLM) in the hills around Flat and Chriss Canyons, north of Gunnison. Most of the surrounding land is privately owned. The study is located on a small ridge. The original baseline sampled the steeper side of the ridge, while the extended baseline samples the ridge top. The vegetation is typical of the higher elevation range in the area and is composed of a moderately dense stand of Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*), with a shrub understory of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and bitterbrush (*Purshia tridentata*). Big game use was reportedly heavy in 1989. Deer pellet groups were sampled in high abundance in 2002, but low abundance in 2007 and 2012. Elk pellet groups have been sampled in low abundance in 2007. Cattle and sheep sign has been sampled in low abundance since 2002 (Table - Pellet Group Data).

Browse: The preferred browse cover is composed mostly of mountain big sagebrush and bitterbrush, with a very low density of green ephedra (*Ephedra viridis*). The sagebrush stand is comprised of a moderately dense population of mostly mature and decadent plants. Recruitment of young sagebrush plants was good at the outset of the study, but has been poor since 2002. Decadence has been high over the course of the study years, but poor vigor has generally been low. Utilization of sagebrush has been mostly light to moderate in most sample years. The bitterbrush stand is comprised of less dense population of mostly mature plants. Recruitment of young bitterbrush plants has been poor over the course of the study. Decadence has generally been low, and vigor good within the bitterbrush population. Utilization of bitterbrush has been mostly moderate to heavy throughout the course of the study (Table - Browse Characteristics).

Herbaceous Understory: Perennial bunchgrasses are fairly common, but widely spaced. The most common perennial grass is bluebunch wheatgrass (*Agropyron spicatum*), with other common perennial species including Sandberg bluegrass (*Poa secunda*) and needle-and-thread (*Stipa comata*). Cheatgrass (*Bromus tectorum*) is found primarily under the canopies of shrubs and trees, and has at times dominated the grass component on the site. Forbs are diverse, but few have been abundant. Annual forb species often dominate the forb component (Table - Herbaceous Trends).

Soil: The soil is classified within the Saxby series, which occurs on hills. The soils in this series are shallow and somewhat excessively drained. These soils are formed in colluvium and residuum derived dominantly from igneous rocks, quartzite, and sandstone (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 7.2). Soil phosphorus may have limited availability for plant growth and development at 4.4 ppm (Tiedemann and Lopez 2004). Organic matter is limited at only 1.6% (Table - Soil Analysis Data). Bare ground cover is moderate, but with a moderate amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2002 and slight in 2007 and 2012.

### Trend Assessments

#### Browse:

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush plants decreased from 24% to 13% of the population, but still remained good. Decadence of sagebrush decreased from 26% to 15%, and poor vigor decreased from 21% to 2%. Recruitment of young bitterbrush plants increased from 0% to 17%. Decadence of bitterbrush increased from 0% to 3%, but is still considered to be low.
- **1997 to 2002 - stable (0):** Sagebrush density increased slightly from 1,220 plants/acre to 1,280 plants/acre, and cover increased from 9% to 11%. Recruitment of young sagebrush plants decreased

6% of the population, which is considered poor. Decadence of sagebrush increased to 22%, and poor vigor increased to 11% of the population. Bitterbrush density remained relatively similar increasing from 600 plants/acre to 620 plants/acre, and cover increased from 3% to 4%. Recruitment of young bitterbrush plants decreased to just 3% of the population. Decadence of bitterbrush increased to 13%, and poor vigor increased from 0% to 10%.

- **2002 to 2007 - stable (0):** Sagebrush density increased slightly to 1,340 plants/acre, but cover decreased to 7%. Recruitment of young sagebrush plants decreased to 3%. Decadence increased to 42%, and poor vigor increased to 21%. Bitterbrush density remained the same at 620 plants/acre, but cover increased slightly to 5%. Decadence of bitterbrush increased to 19%, and poor vigor increased to 13% of the population.
- **2007 to 2012 - slightly up (+1):** The density of mountain big sagebrush decreased 19% to 1,080 plants/acre, and cover decreased to 6%. Recruitment of young sagebrush plants comprised just 2% of the population. Decadence decreased to 30%, and poor vigor decreased to 11% of the population. Bitterbrush density increased 52% to 940 plants/acre, and cover increased to 7%. There was no new recruitment of bitterbrush sampled. Decadence of bitterbrush decreased to 2%, and no plants displaying poor vigor were sampled.

Grass:

- **1989 to 1997 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 11%.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses remained similar, but cover increased from 6% to 10%. Cheatgrass decreased significantly in nested frequency, and cover decreased from 6% to 1%.
- **2002 to 2007 - stable (0):** The sum of nested frequency and cover of perennial grasses remained similar. The sum of nested frequency for annual grasses increased 52%. Cheatgrass cover increased from 12%.
- **2007 to 2012 - stable (0):** The perennial grass sum of nested frequency and cover remained similar. Cheatgrass decreased significantly in nested frequency, and cover decreased to 4%.

Forb:

- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased substantially.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial forbs decreased 59%, returning to 1989 levels. Perennial forb cover decreased from 2% to less than 1%.
- **2002 to 2007 - stable (0):** There was little change in the sum of nested frequency or cover of perennial forbs.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency or cover of perennial forbs.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, study no: 19

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	15.6	11.4	7.0	12.5	-4.4	3.4	0.0	<b>45.6</b>	Poor
02	19.8	9.1	2.6	20.1	-0.9	0.6	0.0	<b>51.3</b>	Poor-Fair
07	15.9	5.1	1.5	18.5	-9.3	0.9	0.0	<b>32.6</b>	Very Poor
12	18.2	10.6	0.5	19.1	-3.1	1.1	0.0	<b>46.3</b>	Poor



## Trend Summary

### HERBACEOUS TRENDS--

Management unit 16A, Study no: 19

T y P e	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Agropyron spicatum</i>	c171	ab122	bc150	ab121	a106	3.44	6.67	5.55	3.59
G	<i>Bromus japonicus</i> (a)	-	a-	b20	a-	a-	-	.06	-	-
G	<i>Bromus tectorum</i> (a)	-	b275	a211	c350	b247	5.80	1.19	12.38	4.10
G	<i>Oryzopsis hymenoides</i>	b27	ab11	a-	b16	a2	.10	.01	.52	.04
G	<i>Poa fendleriana</i>	-	-	-	-	2	-	-	-	.03
G	<i>Poa secunda</i>	a20	b65	b55	b72	c115	1.22	1.53	1.27	3.61
G	<i>Sitanion hystrix</i>	2	6	-	10	-	.15	-	.09	-
G	<i>Stipa comata</i>	ab38	a26	ab41	ab39	b55	1.33	1.82	1.81	2.25
Total for Annual Grasses		0	275	231	350	247	5.80	1.26	12.38	4.10
Total for Perennial Grasses		258	230	246	258	280	6.25	10.05	9.25	9.53
Total for Grasses		258	505	477	608	527	12.05	11.31	21.64	13.64
F	<i>Agoseris glauca</i>	a-	b20	ab11	ab8	a-	.27	.05	.04	-
F	<i>Allium</i> sp.	-	-	2	-	-	-	.00	-	-
F	<i>Alyssum alyssoides</i> (a)	-	a1	a25	b166	c275	.00	.04	1.15	1.51
F	<i>Arabis</i> sp.	-	-	1	-	-	-	.00	-	-
F	<i>Astragalus agrestis</i>	-	4	5	6	6	.07	.04	.16	.05
F	<i>Astragalus eurekaensis</i>	-	-	6	6	9	-	.04	.04	.04
F	<i>Calochortus nuttallii</i>	a-	c41	b15	b6	a-	.16	.05	.03	-
F	<i>Camelina microcarpa</i> (a)	-	-	-	2	-	-	-	.00	-
F	<i>Castilleja linariaefolia</i>	-	2	-	-	1	.06	-	-	.00
F	<i>Chaenactis douglasii</i>	a-	b25	a2	a-	ab9	.69	.00	-	.02
F	<i>Chorispora tenella</i> (a)	-	4	3	-	-	.03	.00	-	-
F	<i>Cirsium</i> sp.	-	5	-	-	3	.04	-	-	.15
F	<i>Collinsia parviflora</i> (a)	-	-	3	2	1	-	.00	.00	.00
F	<i>Crepis acuminata</i>	-	-	-	-	3	-	.00	.00	.00
F	<i>Cryptantha</i> sp.	ab6	b16	a-	ab9	ab4	.11	-	.02	.01
F	<i>Descurainia pinnata</i> (a)	-	a-	ab7	b14	a-	-	.01	.03	-
F	<i>Draba</i> sp. (a)	-	-	-	1	2	-	-	.00	.00
F	<i>Epilobium brachycarpum</i> (a)	-	3	7	2	3	.00	.02	.00	.03
F	<i>Eriogonum racemosum</i>	-	-	2	-	3	-	.03	-	.03
F	<i>Erodium cicutarium</i> (a)	-	2	3	10	7	.00	.00	.07	.03
F	<i>Erysimum</i> sp.	-	-	-	-	3	-	-	-	.03
F	<i>Galium aparine</i> (a)	-	-	1	2	-	-	.00	.01	-
F	<i>Gilia</i> sp. (a)	-	c61	b11	b18	a-	2.15	.03	.05	-
F	<i>Lactuca serriola</i> (a)	-	4	-	2	3	.00	-	.00	.00
F	<i>Lappula occidentalis</i> (a)	-	a-	a-	b13	a2	-	-	.06	.01
F	<i>Machaeranthera canescens</i>	3	-	-	-	2	.00	-	-	.03
F	<i>Microsteris gracilis</i> (a)	-	-	3	1	2	-	.01	.00	.00
F	<i>Phlox austromontana</i>	-	6	-	3	3	.18	-	.15	.15
F	<i>Phlox longifolia</i>	9	9	6	6	1	.04	.02	.01	.00
F	<i>Polygonum douglasii</i> (a)	-	3	-	-	-	.00	-	-	-

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Ranunculus testiculatus (a)	-	-	-	8	3	-	-	.01	.01
F	Streptanthus cordatus	3	5	1	2	-	.04	.00	.00	-
F	Tragopogon dubius (a)	a-	b <sup>9</sup>	a-	ab <sup>2</sup>	ab <sup>1</sup>	.10	-	.06	.00
F	Veronica biloba (a)	-	-	2	2	1	-	.00	.00	.00
F	Zigadenus paniculatus	-	-	3	-	-	-	.03	-	-
Total for Annual Forbs		0	87	65	245	300	2.31	0.15	1.48	1.63
Total for Perennial Forbs		21	133	54	46	47	1.69	0.28	0.47	0.54
Total for Forbs		21	220	119	291	347	4.00	0.43	1.96	2.18

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 19

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	43	44	44	39	8.83	10.96	7.23	5.96
B	Chrysothamnus viscidiflorus viscidiflorus	4	4	4	4	.15	.06	-	.03
B	Ephedra viridis	0	0	0	2	-	.00	.03	.00
B	Gutierrezia sarothrae	7	4	4	4	.35	.30	.00	.15
B	Juniperus osteosperma	1	4	5	5	2.96	6.56	6.59	5.00
B	Opuntia sp.	3	0	4	2	.03	-	-	-
B	Purshia tridentata	14	18	15	21	3.04	4.09	4.55	7.19
B	Quercus gambelii	0	1	1	1	-	-	.00	-
Total for Browse		72	75	77	78	15.37	21.99	18.42	18.35

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 19

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	6.09	7.68
Chrysothamnus viscidiflorus viscidiflorus	.05	.20
Juniperus osteosperma	16.85	18.28
Purshia tridentata	4.36	9.00
Quercus gambelii	-	.21

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 19

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.1	2.1	0.9
Purshia tridentata	1.7	2.7	1.4

POINT-QUARTER TREE DATA--  
Management unit 16A, Study no: 19

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	45	41	46	7.5	8.8	7.0
Pinus edulis	<18	19	<18	4.6	7.9	-

BASIC COVER--  
Management unit 16A, Study no: 19

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	4.75	26.96	31.86	37.45	38.65
Rock	8.75	7.50	9.19	7.91	6.68
Pavement	21.00	15.75	11.90	14.13	8.80
Litter	42.25	32.46	35.46	33.34	33.34
Cryptogams	1.25	.92	.76	.30	1.47
Bare Ground	22.00	28.46	30.32	23.53	24.86

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 19, Flat Canyon

Effective rooting depth (in)	pH	Sandy Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
17.2	7.2	70.4	15.8	13.8	1.6	4.4	153.6	0.5

PELLET GROUP DATA--  
Management unit 16A, Study no: 19

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Sheep	-	-	2	-	-	2 (5)	-
Rabbit	2	23	59	16	-	-	-
Horse	-	1	-	-	-	-	-
Elk	1	-	1	-	-	3 (7)	-
Deer	28	29	12	4	44 (109)	15 (36)	6 (15)
Cattle	-	2	2	-	2 (5)	2 (5)	-

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 19

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
89	<b>2531</b>	24	50	26	66	39	8	21	20/24
97	<b>1220</b>	13	72	15	120	10	0	2	22/35
02	<b>1280</b>	6	72	22	-	33	2	11	19/29
07	<b>1340</b>	3	55	42	-	31	13	21	27/34
12	<b>1080</b>	2	69	30	20	2	0	11	25/34
<i>Chrysothamnus nauseosus albicaulis</i>									
89	<b>132</b>	50	50	-	-	0	50	0	20/13
97	<b>0</b>	0	0	-	-	0	0	0	28/33
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	23/17
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
89	<b>465</b>	14	72	14	-	14	14	14	12/13
97	<b>140</b>	29	71	0	-	0	0	0	13/19
02	<b>120</b>	17	50	33	-	0	0	0	11/15
07	<b>120</b>	0	67	33	-	0	0	17	10/11
12	<b>120</b>	50	50	0	-	0	0	0	13/15
<i>Ephedra viridis</i>									
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>0</b>	0	0	0	-	0	0	0	18/13
02	<b>0</b>	0	0	0	-	0	0	0	16/13
07	<b>0</b>	0	0	0	-	0	0	0	43/54
12	<b>60</b>	0	67	33	-	0	67	33	42/55
<i>Gutierrezia sarothrae</i>									
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>1400</b>	83	17	0	180	0	0	0	10/14
02	<b>400</b>	0	25	75	-	0	0	75	4/6
07	<b>80</b>	50	50	0	20	0	0	0	12/11
12	<b>120</b>	0	100	0	-	0	0	0	7/12
<i>Juniperus osteosperma</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	0	100	-	-	0	0	0	-/-
02	<b>80</b>	0	100	-	-	0	0	0	-/-
07	<b>100</b>	20	80	-	20	0	0	0	-/-
12	<b>100</b>	0	100	-	20	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Opuntia</i> sp.										
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>80</b>	0	100	-	-	0	0	0	3/10	
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>100</b>	20	80	-	-	0	0	0	3/7	
12	<b>60</b>	0	100	-	-	0	0	0	4/6	
<i>Purshia tridentata</i>										
89	<b>533</b>	0	100	0	-	63	38	0	15/32	
97	<b>600</b>	17	80	3	-	67	27	0	57/46	
02	<b>620</b>	3	84	13	-	23	45	10	21/56	
07	<b>620</b>	3	77	19	-	23	71	13	25/60	
12	<b>940</b>	0	98	2	-	34	0	0	30/56	
<i>Quercus gambelii</i>										
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>0</b>	0	0	-	-	0	0	0	-/-	
02	<b>20</b>	0	100	-	-	0	0	0	-/-	
07	<b>20</b>	100	0	-	-	0	0	0	-/-	
12	<b>20</b>	100	0	-	-	0	0	0	88/100	

TRIANGLE RANCH - TREND STUDY NO. 16A-20-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: DWR

Elevation: 6,200 ft (1,889 m)

Aspect: West

Slope: 15%

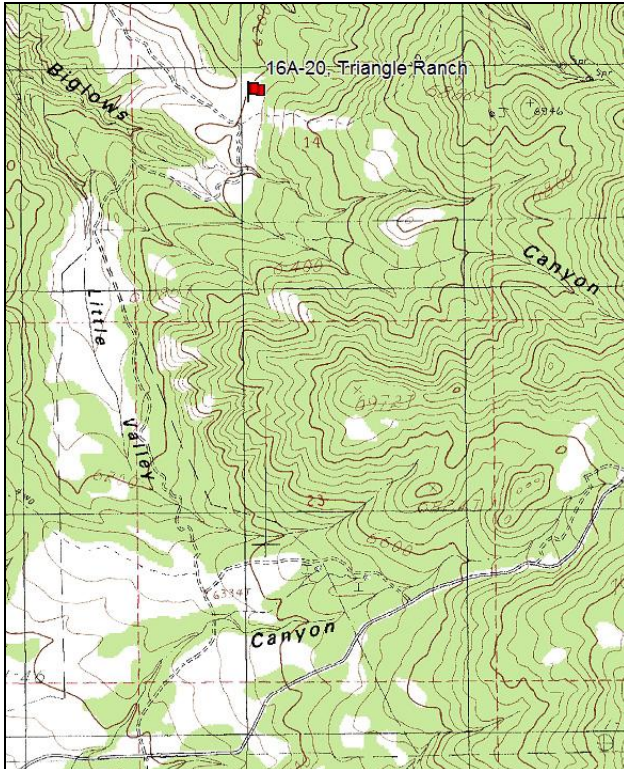
Transect bearing: 256° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft) 50' baseline, line 4 (71ft). Rebar: belt 5 on 4ft.

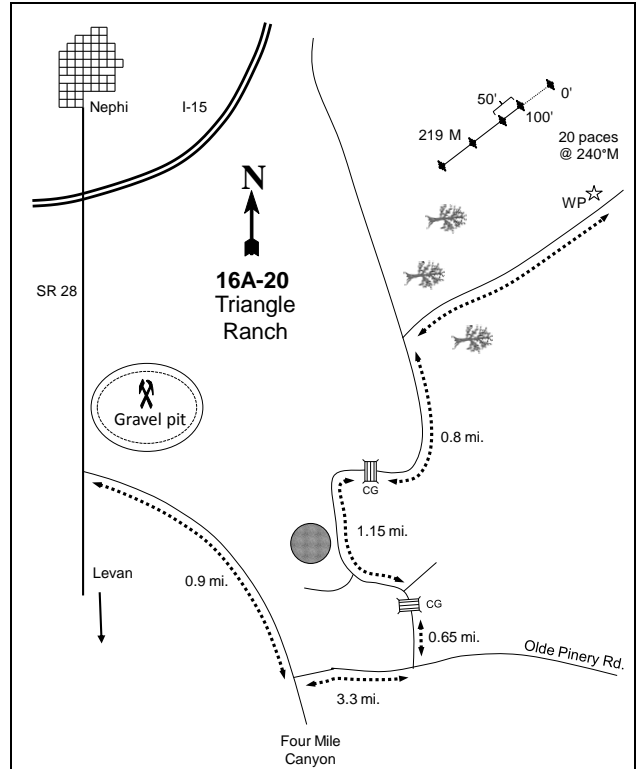
Directions:

Just south of Nephi on Highway 28, turn south past the gravel pit onto a graded road. Go 0.9 miles to a fork. Bear left on the Old Pinery Road. Go 3.3 miles to an intersection. Turn left here and go 0.65 miles to a cattle guard at the top of the hill, then drive through Little Valley 1.1 miles to a gate at the north end of the valley and 0.05 more to a cattle guard. Proceed up the jeep trail 0.8 miles to a fork in a chaining. Take the right fork 0.05 miles to the witness post. From the witness post, go 20 paces at 341 degrees magnetic to the 0-foot baseline stake.

Map Name: Nephi



Diagrammatic Sketch:



Township: 13S Range: 1E Section: 14

GPS: NAD 83, UTM 12S 431971 E 4393043 N

## TRIANGLE RANCH - TREND STUDY NO. 16A-20

### Site Information

Site Description: The study is located within a chaining treatment on the Utah Division of Wildlife Resources (UDWR) Triangle Ranch property in a valley between the low hills south of Nephi. The area provides a variety and abundance of browse and herbaceous forage. The area supports a stand of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and perennial grass, although Gambel oak (*Quercus gambelii*) and Utah juniper (*Juniperus osteosperma*) have reestablished since the treatment. In 1989, there was sign of moderate use by deer and elk. Deer pellets were sampled in moderate to high abundance in 2002 and 2007, but in low abundance in 2012. Cattle sign has been sampled in low abundance since 2002 (Table - Pellet Group Data).

Browse: Mountain big sagebrush provides most of the preferred browse cover on the site (Table - Browse Trends), but there is a low density population of antelope bitterbrush (*Purshia tridentata*). Sagebrush density has steadily decreased over the course of the study despite good recruitment of young plants in most sample years. Decadence of sagebrush has been fairly high, but vigor has generally been good throughout the study years. Utilization of sagebrush has been mostly light to moderate, though with some years of heavy use (Table - Browse Characteristics). Utah juniper has reestablished since the treatment, and has been increasing in density since 2002 (Table - Point-Quarter Tree Data).

Herbaceous Understory: The herbaceous understory is diverse and dominated by perennial species. Perennial grasses provide the majority of the herbaceous understory, but are dominated by the undesirable species bulbous bluegrass (*Poa bulbosa*). Bulbous bluegrass has steadily increased on the site since the outset of the study. Other abundant perennial grass species include sheep fescue (*Festuca ovina*), orchardgrass (*Dactylis glomerata*), intermediate wheatgrass (*Agropyron intermedium*), and Kentucky bluegrass (*Poa pratensis*). Cheatgrass (*Bromus tectorum*) is present, but at a low frequency. Few forbs are particularly abundant. Chickpea milkvetch (*Astragalus cibaricus*) is the only prevalent forb species (Table - Herbaceous Trends).

Soil: The soil is classified as a Lizzant very cobbly loam, which occurs on fans and hills. The soils in this series are deep and well-drained, and formed in alluvium and/or colluvium derived from limestone (Soil Survey Staff 2011). The soil texture is a loam with a slightly acidic soil reaction (pH 6.2) (Table - Soil Analysis Data). Bare ground cover is low, with a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

### Trend Assessments

#### Browse:

- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush plants increased from 12% to 28% of the population. Decadence of sagebrush decreased from 60% to 8%, and poor vigor increased from 0% to 5%.
- **1997 to 2002 - stable (0):** Mountain big sagebrush density decreased 9% from 3,180 plants/acre to 2,900 plants/acre, though cover increased from 12% to 14%. Recruitment of young sagebrush plants decreased to 10%, but is still considered good. Decadence of sagebrush increased to 29%, and poor vigor increased to 11% of the population.
- **2002 to 2007 - down (-2):** Sagebrush density decreased 20% to 2,320 plants/acre, and cover decreased to 9%. Recruitment of young sagebrush plants decreased to just 6% of the population. Decadence increased to 35%, and poor vigor increased to 28% of the population.
- **2007 to 2012 - slightly down (-1):** Density of sagebrush decreased 16% to 1,940 plants/acre, but cover remained similar at 9%. Recruitment of young sagebrush plants increased to 14%. Decadence of sagebrush decreased to 23%, and poor vigor decreased to 18%.

Grass:

- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar. Bulbous bluegrass was sampled for the first time at moderate frequency.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 23%, and cover decreased from 24% to 22%. Bulbous bluegrass increased significantly in nested frequency, and cover increased from 2% to 8%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 10%, though cover increased to 32%. Bulbous bluegrass increased significantly in nested frequency, and increased to 14%.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, excluding bulbous bluegrass, but cover decreased to 28%. Bulbous bluegrass still dominates the site at 15% cover.

Forb:

- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased two-fold.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 10%, though cover increased slightly from 3% to 4%.
- **2002 to 2007 - down (-2):** The sum of nested frequency of perennial forbs decreased 21%, but cover remained similar at 4%.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, though cover decreased to 3%. Annual forb sum of nested frequency decreased substantially, and cover decreased from 1% to less than 1%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, study no: 20

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	16.0	12.7	13.2	30.0	-0.3	6.6	0.0	<b>78.3</b>	Good-Excellent
02	18.7	6.3	4.6	30.0	-0.1	7.5	0.0	<b>67.0</b>	Fair-Good
07	12.7	4.6	3.1	30.0	-0.6	8.1	0.0	<b>57.8</b>	Fair
12	11.9	8.7	7.4	30.0	0.0	6.7	0.0	<b>64.7</b>	Fair-Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 16A, Study no: 20

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	b40	a17	a13	a11	a15	.78	.36	.37	.45
G	Agropyron intermedium	62	109	122	96	94	4.19	3.47	6.07	5.96
G	Agropyron smithii	c330	b140	a71	a74	a74	1.06	.81	.81	1.17
G	Agropyron spicatum	4	-	-	1	6	-	-	.03	.21
G	Bromus inermis	a13	ab37	abc47	cb51	c72	1.17	2.71	3.95	3.64
G	Bromus japonicus (a)	-	a-	a-	b24	a-	-	-	.22	-
G	Bromus tectorum (a)	-	b71	b51	b52	a7	.39	.12	.62	.01
G	Dactylis glomerata	a28	b83	ab60	b73	b83	2.34	3.06	6.34	4.94
G	Elymus cinereus	-	1	3	6	10	.00	.78	.53	1.14



Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Elymus salina</i>	-	5	-	2	2	.76	-	.03	.15
G	<i>Festuca ovina</i>	a30	b89	b85	bc114	c139	4.06	6.15	11.03	8.53
G	<i>Poa bulbosa</i>	a-	b64	c189	d252	d261	2.33	7.94	13.91	15.02
G	<i>Poa fendleriana</i>	a-	a1	a-	a-	b8	.03	-	-	.07
G	<i>Poa pratensis</i>	ab74	c182	b112	a44	a50	8.13	3.63	1.81	.71
G	<i>Poa secunda</i>	b82	ab59	ab47	a34	a32	1.19	.84	.78	.49
Total for Annual Grasses		0	71	51	76	7	0.39	0.12	0.84	0.01
Total for Perennial Grasses		663	787	749	758	846	26.09	29.79	45.68	42.51
Total for Grasses		663	858	800	834	853	26.48	29.92	46.52	42.52
F	<i>Agoseris glauca</i>	5	90	58	28	23	.80	.32	.15	.10
F	<i>Alyssum alyssoides</i> (a)	-	a39	b85	b70	a13	.08	.25	.18	.03
F	<i>Antennaria rosea</i>	-	6	-	-	-	.01	-	-	-
F	<i>Arabis</i> sp.	10	10	2	-	-	.02	.00	-	-
F	<i>Aster chilensis</i>	-	-	3	4	-	-	.15	.18	-
F	<i>Astragalus cibarius</i>	a-	b60	b76	b66	b77	1.83	2.09	2.37	2.50
F	<i>Astragalus convallarius</i>	b25	a6	a2	a-	a2	.06	.18	.03	.00
F	<i>Balsamorhiza sagittata</i>	-	3	3	-	-	.00	.00	-	.03
F	<i>Calochortus nuttallii</i>	a-	b9	b14	b10	a-	.02	.04	.02	-
F	<i>Camelina microcarpa</i> (a)	-	-	-	2	-	-	-	.00	-
F	<i>Castilleja linariaefolia</i>	-	-	-	-	3	-	-	-	.03
F	<i>Cerastium</i> sp.	4	-	-	-	-	-	-	-	-
F	<i>Cirsium</i> sp.	-	-	-	-	1	.03	-	-	.00
F	<i>Collinsia parviflora</i> (a)	-	c198	c165	b65	a9	.63	.64	.16	.02
F	<i>Collomia linearis</i> (a)	-	b7	b9	a-	a-	.05	.02	-	-
F	<i>Crepis acuminata</i>	a14	a12	ab31	ab30	b42	.13	.69	.80	.46
F	<i>Cymopterus</i> sp.	8	4	8	6	6	.03	.02	.01	.02
F	<i>Draba</i> sp. (a)	-	3	-	2	-	.00	-	.00	-
F	<i>Epilobium brachycarpum</i> (a)	-	c66	ab20	b26	a6	.17	.05	.07	.01
F	<i>Eriogonum racemosum</i>	5	3	1	5	2	.00	.00	.01	.01
F	<i>Eriogonum umbellatum</i>	6	6	6	6	3	.06	.03	.06	.00
F	<i>Galium aparine</i> (a)	-	b25	a-	b25	a9	.50	-	.81	.04
F	<i>Holosteum umbellatum</i> (a)	-	-	-	1	2	-	-	.00	.00
F	<i>Lactuca serriola</i> (a)	5	2	-	1	3	.00	-	.00	.00
F	<i>Lappula occidentalis</i> (a)	-	b12	a-	a-	a-	.02	-	-	-
F	<i>Linum lewisii</i>	ab13	b19	a6	a-	ab7	.15	.04	.07	.04
F	<i>Medicago sativa</i>	-	-	-	1	-	-	-	.00	-
F	<i>Microsteris gracilis</i> (a)	-	a-	b21	b5	a-	-	.04	.02	-
F	<i>Penstemon</i> sp.	-	-	2	-	-	-	.00	-	-
F	<i>Phlox longifolia</i>	18	21	20	22	6	.04	.04	.09	.04
F	<i>Polygonum douglasii</i> (a)	-	8	3	-	-	.01	.00	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	c101	b44	b27	a1	.26	.14	.14	.00
F	<i>Sanguisorba minor</i>	1	-	-	-	-	-	-	-	-
F	<i>Sphaeralcea coccinea</i>	b12	ab9	a3	ab5	a3	.02	.01	.01	.03
F	<i>Taraxacum officinale</i>	-	1	-	-	-	.00	-	-	-
F	<i>Tragopogon dubius</i> (a)	b45	b53	a12	a6	a16	.57	.08	.04	.21

Type	Species	Nestled Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Unknown forb-annual (a)	-	b <sup>22</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.05	-	-	-
F	Vicia americana	-	-	-	3	2	-	-	.15	.00
F	Viola sp.	-	b <sup>5</sup>	ab <sup>1</sup>	a <sup>-</sup>	ab <sup>7</sup>	.02	.00	.00	.01
F	Zigadenus paniculatus	1	6	7	5	6	.04	.07	.06	.03
Total for Annual Forbs		50	536	359	230	59	2.39	1.24	1.44	0.33
Total for Perennial Forbs		122	270	243	191	190	3.32	3.73	4.07	3.35
Total for Forbs		172	806	602	421	249	5.71	4.97	5.51	3.68

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 20

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	62	64	58	53	12.08	13.80	9.26	8.93
B	Chrysothamnus nauseosus albicaulis	6	6	4	1	.06	.68	.18	-
B	Cowania mexicana stansburiana	0	0	0	1	-	-	-	-
B	Gutierrezia sarothrae	6	28	16	3	.02	.26	.45	.01
B	Juniperus osteosperma	2	8	8	5	1.14	3.04	4.75	4.30
B	Purshia tridentata	2	1	0	0	.15	-	-	-
B	Quercus gambelii	0	2	3	2	.63	.63	.85	.78
Total for Browse		78	109	89	65	14.09	18.43	15.51	14.02

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 20

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	7.76	9.51
Chrysothamnus nauseosus albicaulis	.28	-
Gutierrezia sarothrae	.05	.05
Juniperus osteosperma	.68	6.88
Quercus gambelii	-	3.09

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 20

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.5	1.6	1.3

POINT-QUARTER TREE DATA--  
Management unit 16A, Study no: 20

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	110	117	131	7.4	4.2	5.0

BASIC COVER--  
Management unit 16A, Study no: 20

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	6.50	48.11	55.36	60.52	60.58
Rock	1.00	.22	.22	.13	.08
Pavement	.50	1.14	1.77	2.41	1.52
Litter	79.75	51.00	42.92	40.18	45.34
Cryptogams	1.25	.07	.15	.18	.09
Bare Ground	11.00	12.95	19.10	12.50	9.61

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 20, Triangle Ranch

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
21.3	6.2	42.0	31.4	26.6	1.9	17.7	185.6	0.4

PELLET GROUP DATA--  
Management unit 16A, Study no: 20

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	2	8	13	16	-	-	-
Elk	-	-	1	-	-	-	-
Deer	-	9	11	2	35 (88)	40 (99)	5 (12)
Cattle	7	5	2	4	4 (11)	4 (11)	4 (9)

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 20

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier utahensis</i>									
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	32/30
02	0	0	0	-	-	0	0	0	44/42
07	0	0	0	-	-	0	0	0	32/33
12	0	0	0	-	-	0	0	0	38/31
<i>Artemisia tridentata vaseyana</i>									
89	3331	12	28	60	66	54	0	0	22/24
97	3180	28	65	8	140	16	3	5	26/38
02	2900	10	61	29	20	26	0	11	25/37
07	2320	6	59	35	-	27	28	28	26/39
12	1940	14	63	23	-	16	1	18	25/33
<i>Chrysothamnus nauseosus albicaulis</i>									
89	0	0	0	0	-	0	0	0	-/-
97	140	29	57	14	-	0	0	14	34/29
02	140	0	43	57	-	71	0	0	29/31
07	80	0	0	100	-	50	25	75	32/32
12	20	100	0	0	-	0	0	0	25/25
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	11/15
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	19/19
<i>Cowania mexicana stansburiana</i>									
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	40/52
<i>Gutierrezia sarothrae</i>									
89	3198	17	75	8	-	0	0	6	7/8
97	240	42	58	0	20	0	0	0	5/3
02	1320	21	73	6	-	0	0	5	4/7
07	520	4	77	19	20	0	0	4	7/8
12	80	50	50	0	-	0	0	0	6/7

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Juniperus osteosperma</b>									
89	0	0	0	-	-	0	0	0	-/-
97	40	100	0	-	-	0	0	0	-/-
02	160	0	100	-	-	0	0	0	71/43
07	160	25	75	-	-	0	0	0	-/-
12	120	50	50	-	-	0	0	0	50/45
<b>Peraphyllum ramosissimum</b>									
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	51/64
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	64/63
<b>Purshia tridentata</b>									
89	0	0	0	-	-	0	0	0	-/-
97	40	0	100	-	-	0	100	0	23/32
02	20	0	100	-	-	0	100	0	19/51
07	0	0	0	-	-	0	0	0	30/39
12	0	0	0	-	-	0	0	0	30/94
<b>Quercus gambelii</b>									
89	199	100	0	0	66	0	0	0	-/-
97	0	0	0	0	-	0	0	0	-/-
02	300	0	100	0	-	53	0	0	64/36
07	220	9	73	18	-	0	0	27	-/-
12	160	25	75	0	-	0	0	0	38/34
<b>Symphoricarpos oreophilus</b>									
89	132	0	50	50	-	0	100	0	40/34
97	0	0	0	0	-	0	0	0	-/-
02	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	-/-
12	0	0	0	0	-	0	0	0	56/63

LEVAN NORTH - TREND STUDY NO. 16A-22-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter

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

Land Ownership: DWR

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

Aspect: Northwest

Slope: 8-10%

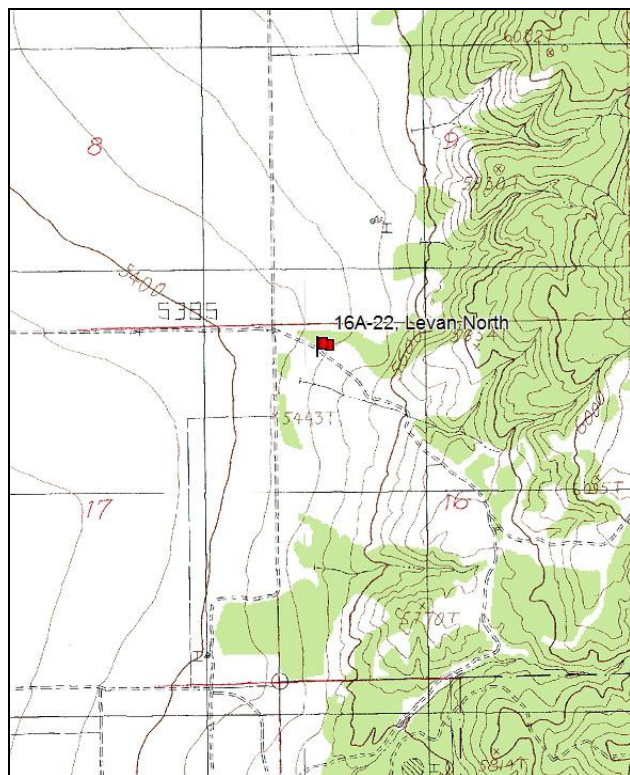
Transect bearing: 202° magnetic

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

Directions:

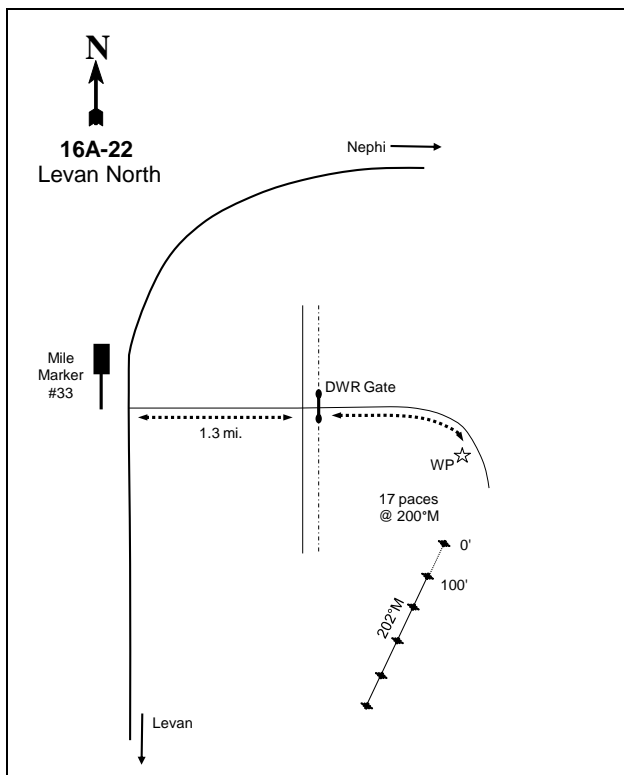
From Nephi travel south on Highway 28 and turn left (east) at mile marker 33. Travel east for 1.3 miles; cross a road and a UDWR fence that is immediately after the road. Continue east for 0.15 miles to a witness post on the right (south). From the witness post the 0-foot baseline stake is 17 paces at 200 degrees magnetic. The 0-stake is marked by browse tag #184.

Map Name: Levan



Township: 13S Range: 1E Section: 14

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 428445 E 4383802 N

## LEVAN NORTH - TREND STUDY NO. 16A-22

### Site Information

Site Description: The study lies northeast of Levan within the South Nebo Wildlife Management Area (WMA), Levan/Deep Creek Unit. It was established in 2007 to monitor a lop-and-scatter treatment of Utah juniper (*Juniperus osteosperma*) that took place in the summer of 2007 on an old chaining as part of the Levan Farm WMA Habitat Improvement project ([WRI Project #271](#)) (WRI Database 2013). This study was also established to replace the Levan Farm Chaining (16A-16) study. The vegetation composition consists of a mostly decadent stand of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) intermixed with mature Utah juniper (*Juniperus osteosperma*) trees. The area is used by big game as winter range, and grazed by cattle in the summer. Deer pellet groups were sampled in moderate abundance in 2007, but low abundance in 2012. Elk pellet groups were sampled in low abundance in 2007. Cattle sign was sampled in low abundance in 2007 and 2012 (Table - Pellet Group Data).

Browse: Mountain big sagebrush provides the majority of the preferred browse cover (Table - Browse Trends). The sagebrush stand is comprised of a scattered population of mature and decadent plants. Recruitment of young sagebrush plants has been poor since 2007. Poor vigor was high in the sagebrush population in 2007, but no plants displaying poor vigor were sampled in 2012. Utilization of sagebrush has been moderate to heavy. Antelope bitterbrush (*Purshia tridentata*) and Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) are also present at very low densities. Utilization of bitterbrush was very heavy in 2012 (Table - Browse Characteristics). The lop-and-scatter treatment removed several Utah juniper trees, but density remained similar with a large number of mature trees left on the site (Table - Point-Quarter Tree Data).

Herbaceous Understory: Perennial grasses are diverse and abundant on the site. Crested wheatgrass (*Agropyron cristatum*) is the dominant grass species, but other abundant perennial grasses included bluebunch wheatgrass (*Agropyron spicatum*), and Sandberg bluegrass (*Poa secunda*). The undesirable perennial grass species bulbous bluegrass (*P. bulbosa*) is also common. Cheatgrass (*Bromus tectorum*) is prevalent and provides a large amount of cover. The forb component of the understory is less productive and has provided little forage. Annual forbs are common and have dominated the forb component at times. Field bindweed (*Convolvulus arvensis*), a noxious weed, has been sampled in low frequency and cover (Table - Herbaceous Trends).

Soil: The soil is classified as a Hupp gravelly loam, which occur on alluvial fans. The soils in this series are very deep and well-drained, and formed in alluvium derived from limestone, sandstone, and quartzite (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 6.9) (Table - Soil Analysis Data). Bare ground cover is low, with a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2007.

### Trend Assessments

#### Browse:

- **2007 to 2012 - slightly up (+1):** Mountain big sagebrush density decreased 21% from 480 plants/acre to 380 plants/acre, but canopy cover remained similar at 2%. Decadence of sagebrush decreased from 83% to 42%, and poor vigor decreased from 79% to 0%. Bitterbrush density increased substantially from 20 plants/acre to 180 plants/acre, and canopy cover increased from less than 1% to 1%.

#### Grass:

- **2007 to 2012 - up (+2):** The perennial grass sum of nested frequency, excluding bulbous bluegrass, increased 25%, and cover increased from 21% to 24%. Cheatgrass decreased significantly in nested frequency, and cover decreased from 10% to 3%. Bulbous bluegrass increased significantly in nested frequency, and cover increased from 1% to 8%.

Forb:

- **2007 to 2012 - slightly up (+1):** Perennial forb sum of nested frequency increased 35%, but perennial forbs remained rare. Perennial forb cover remained similar at around 1%. Annual forb sum of nested frequency decreased substantially, and cover decreased from 3% to 1%.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --  
Management unit 16A, study no: 22

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
07	1.3	0.0	0.0	30.0	-7.8	1.3	-2.0	<b>22.8</b>	Very Poor
12	1.5	0.0	0.0	30.0	-2.3	2.2	-2.0	<b>29.4</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 16A, Study no: 22

Type	Species	Nested Frequency		Average Cover %	
		'07	'12	'07	'12
G	Agropyron cristatum	276	234	15.13	10.58
G	Agropyron intermedium	<sub>a</sub> 14	<sub>b</sub> 39	.25	1.04
G	Agropyron spicatum	80	122	2.43	4.35
G	Bromus inermis	1	1	.03	.00
G	Bromus japonicus (a)	45	40	.18	.16
G	Bromus tectorum (a)	<sub>b</sub> 352	<sub>a</sub> 155	9.49	2.94
G	Dactylis glomerata	5	9	.23	.95
G	Festuca myuros (a)	<sub>b</sub> 79	<sub>a</sub> 8	.66	.01
G	Festuca ovina	-	7	-	.30
G	Poa bulbosa	<sub>a</sub> 54	<sub>b</sub> 200	1.24	7.61
G	Poa secunda	<sub>a</sub> 109	<sub>b</sub> 192	2.59	6.58
Total for Annual Grasses		476	203	10.34	3.12
Total for Perennial Grasses		539	804	21.93	31.44
Total for Grasses		1015	1007	32.27	34.56
F	Alyssum alyssoides (a)	<sub>b</sub> 302	<sub>a</sub> 184	1.42	.62
F	Astragalus eurekaensis	7	6	.01	.06
F	Calochortus nuttallii	-	5	-	.02
F	Camelina microcarpa (a)	4	-	.00	-
F	Collinsia parviflora (a)	37	33	.08	.06
F	Convolvulus arvensis	29	26	.39	.17
F	Draba sp. (a)	14	17	.05	.04
F	Eriogonum racemosum	1	3	.00	.06
F	Erodium cicutarium (a)	<sub>b</sub> 58	<sub>a</sub> 12	.42	.02
F	Holosteum umbellatum (a)	<sub>b</sub> 140	<sub>a</sub> 61	.83	.29
F	Lactuca serriola (a)	6	-	.01	-
F	Leucelene ericoides	9	11	.07	.34
F	Microsteris gracilis (a)	13	5	.02	.01
F	Phlox longifolia	<sub>a</sub> 2	<sub>b</sub> 11	.00	.03



Type	Species	Nested Frequency		Average Cover %	
		'07	'12	'07	'12
F	Ranunculus testiculatus (a)	<sub>b</sub> 64	<sub>a</sub> 38	.22	.13
F	Sisymbrium altissimum (a)	1	-	.00	-
F	Sphaeralcea coccinea	17	26	.16	.41
F	Tragopogon dubius (a)	<sub>a</sub> 6	<sub>b</sub> 23	.01	.21
Total for Annual Forbs		645	373	3.09	1.40
Total for Perennial Forbs		65	88	0.64	1.11
Total for Forbs		710	461	3.73	2.51

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

#### BROWSE TRENDS--

Management unit 16A, Study no: 22

Type	Species	Strip Frequency		Average Cover %	
		'07	'12	'07	'12
B	Artemisia tridentata vaseyana	20	14	1.00	1.20
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	-	-
B	Gutierrezia sarothrae	4	10	.03	.09
B	Juniperus osteosperma	4	8	6.55	5.10
B	Pinus edulis	0	1	-	-
B	Purshia tridentata	1	4	-	-
Total for Browse		29	38	7.59	6.40

#### CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 22

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	1.79	1.58
Gutierrezia sarothrae	.16	.01
Juniperus osteosperma	9.66	8.26
Purshia tridentata	.15	1.29

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 22

Species	Average leader growth (in)	
	'07	'12
Artemisia tridentata wyomingensis	2.4	2.9
Cowania Mexicana stansburiana	3.0	3.0
Purshia tridentata	3.2	1.5

POINT-QUARTER TREE DATA--

Management unit 16A, Study no: 22

Species	Trees per Acre		Average diameter (in)	
	'07	'12	'07	'12
Juniperus osteosperma	38	35	8.7	6.6

BASIC COVER--

Management unit 16A, Study no: 22

Cover Type	Average Cover %	
	'07	'12
Vegetation	45.96	52.25
Rock	3.72	4.69
Pavement	4.16	3.48
Litter	47.31	51.23
Cryptogams	2.67	1.00
Bare Ground	9.20	9.56

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 22, Levan North

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
-	6.9	67.2	15.5	17.3	2.9	11.9	227.2	0.9

PELLET GROUP DATA--

Management unit 16A, Study no: 22

Type	Quadrat Frequency		Days use per acre (ha)	
	'07	'12	'07	'12
Rabbit	52	9	-	-
Elk	5	-	1 (3)	-
Deer	23	6	38 (93)	11 (28)
Cattle	6	3	12 (30)	14 (34)

BROWSE CHARACTERISTICS--  
Management unit 16A, Study no: 22

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
07	<b>480</b>	0	17	83	-	21	54	79	26/33
12	<b>380</b>	5	53	42	1020	26	16	0	25/31
<i>Chrysothamnus nauseosus albicaulis</i>									
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	13/13
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
07	<b>0</b>	0	0	-	-	0	0	0	9/19
12	<b>20</b>	0	100	-	-	100	0	0	10/20
<i>Cowania mexicana stansburiana</i>									
07	<b>0</b>	0	0	-	-	0	0	0	63/46
12	<b>0</b>	0	0	-	-	0	0	0	59/53
<i>Ephedra viridis</i>									
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	36/41
<i>Gutierrezia sarothrae</i>									
07	<b>80</b>	50	50	-	-	0	0	0	8/11
12	<b>260</b>	62	38	-	60	0	0	0	8/11
<i>Juniperus osteosperma</i>									
07	<b>80</b>	25	75	0	-	0	0	0	-/-
12	<b>160</b>	13	75	13	20	0	13	13	94/100
<i>Pinus edulis</i>									
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>20</b>	0	100	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
07	<b>20</b>	0	100	-	-	0	0	0	27/49
12	<b>180</b>	0	100	-	-	11	89	0	27/42

FOUNTAIN GREEN PLATEAU - TREND STUDY NO. 16A-23-12

Vegetation Type: Wyoming Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: DWR

Elevation: 5,775 ft. (1,760 m)

Aspect: Southwest

Slope: 5%

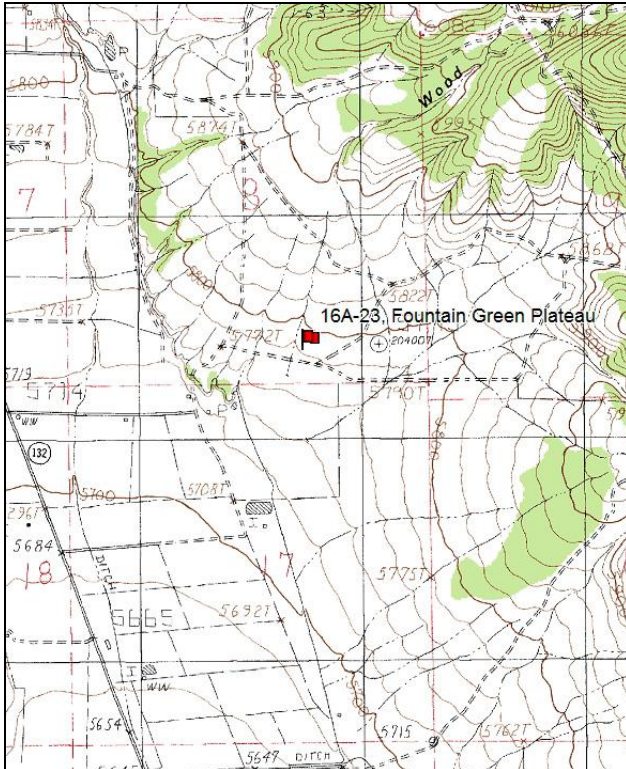
Transect bearing: 15° magnetic

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

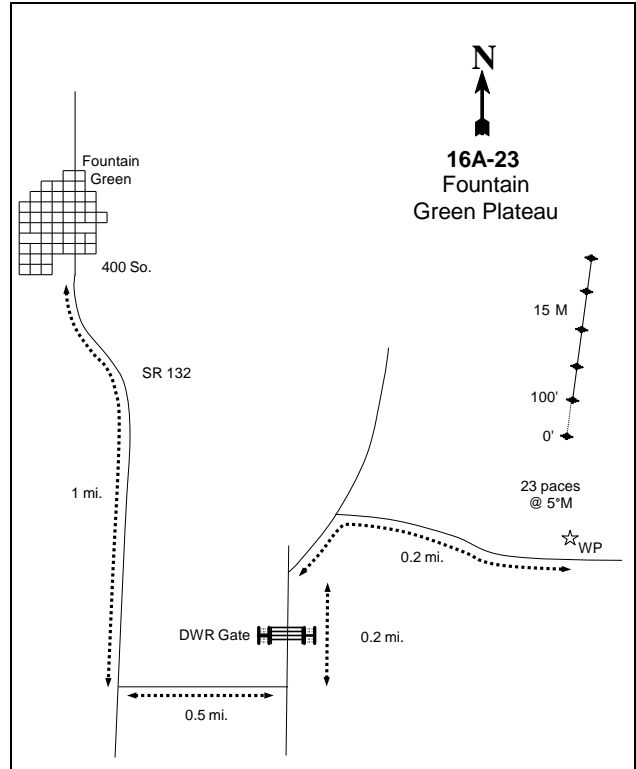
Directions:

From curve in SR-132 on the south end of Fountain Green, travel south on SR-132 for 1 mile and turn left (east) on a dirt road that goes toward the GBRC farm. Travel on this road 0.5 miles to a T-intersection and turn left (north) up the hill. Travel 0.2 miles up the hill, passing through a gate to the DWR property, to an intersection. Turn right (east) and travel 0.2 miles to the witness post on the left (north) side of the road. From the witness post, the 0-foot baseline stake is 23 paces at 5 degrees magnetic. The 0-stake is marked by browse tag #193.

Map Name: Moroni



Diagrammatic Sketch:



Township: 13S Range: 1E Section: 14

GPS: NAD 83, UTM 12S 12S 447673 E 4384595 N

## Site Information

Site Description: The study is located southeast of Fountain Green within the North Nebo Wildlife Management Area (WMA), Fountain Green Unit. It was established in 2007 to monitor a Plateau® (Imazapic) herbicide treatment to eliminate cheatgrass (*Bromus tectorum*) as part of the Fountain Green WMA Habitat Improvement ([WRI Project #288](#)). The area was heavily grazed by sheep early in the spring of 2007 to reduce cheatgrass, and was sprayed with herbicide in the fall of 2007 (WRI Database 2013). The vegetation cover consists of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) intermixed with a smaller density of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), and a cheatgrass understory. The area is used by deer and elk as wintering habitat, and grazed by sheep in the summer. Deer pellet groups were sampled in moderate abundance in 2007, but low abundance in 2012. Two deer carcasses were found on the site in 2007. Elk pellet groups have been sampled in low abundance since 2007. Sheep pellet groups were sampled in high abundance in 2007, due to the use of sheep as part of the treatment, but were sampled in more moderate abundance in 2012 (Table - Pellet Group Data). Sheep were on the site when it was read in May of 2012. Sheep and game trails are common throughout the site.

Browse: Mountain big sagebrush is the preferred browse species, and may be hybridizing with the few basin big sagebrush plants that are present. The mountain big sagebrush stand is comprised of a fairly dense stand of mostly mature and decadent plants. Recruitment of young mountain big sagebrush plants was low in 2007, but young plants comprised nearly half of the population in 2012. Poor vigor was high at the outset of the study in 2007, but decreased substantially in 2012. Utilization of mountain big sagebrush has been moderate to heavy (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are abundant, but western wheatgrass (*Agropyron smithii*) is the only common perennial grass species. Cheatgrass (*Bromus tectorum*) is common and dominated the herbaceous understory prior to the treatment. Perennial forb species are rare on the site, and the forb component is dominated by annual species (Table - Herbaceous Trends).

Soil: The soil is classified as a Snake Hollow gravelly fine sandy loam, which occur on alluvial flats and alluvial fans. The soils in this series are very deep and well drained, and are formed in alluvium from conglomerate, quartzite, and sandstone (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is moderately high, though there is a large amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2007.

## Trend Assessments

### Browse:

- **2007 to 2012 - up (+2):** Mountain big sagebrush density increased two-fold from 1,180 plants/acre to 2,460 plants/acre, and canopy cover increased from 3% to 8%. The increase in density was primarily due to an increase in the recruitment of young plants, which increased to 47% of the population. Decadence decreased from 68% to 15%, and poor vigor decreased from 56% to 7%.

### Grass:

- **2007 to 2012 - up (+2):** The sum of nested frequency of perennial grasses increased 65%, and cover increased from 2% to 15%. Cheatgrass decreased significantly in nested frequency, and cover decreased from 27% to 10%.

Forb:

- **2007 to 2012 - stable (0):** Perennial forbs remained rare on the site. Annual forb sum of nested frequency decreased substantially, and cover decreased from 4% to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --  
Management unit 16A, 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
07	4.6	0.0	0.0	3.8	-20.0	0.7	0.0	<b>-10.9</b>	Very Poor
12	10.2	10.5	15.0	30.0	-7.4	0.2	0.0	<b>58.6</b>	Fair

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 16A, Study no: 23

Type	Species	Nested Frequency		Average Cover %	
		'07	'12	'07	'12
G	Agropyron smithii	202	336	1.19	14.20
G	Agropyron spicatum	10	13	.27	.93
G	Bromus brizaeformis (a)	-	5	-	.03
G	Bromus tectorum (a)	<sub>b</sub> 475	<sub>a</sub> 307	27.20	9.79
G	Poa secunda	4	9	.06	.07
G	Secale cereale (a)	11	-	.09	-
G	Sitanion hystrix	8	-	.09	-
G	Sporobolus cryptandrus	-	3	-	.03
G	Stipa comata	<sub>a</sub> 10	<sub>b</sub> 25	.27	.11
G	Vulpia octoflora (a)	3	-	.00	-
Total for Annual Grasses		489	312	27.30	9.82
Total for Perennial Grasses		234	386	1.89	15.36
Total for Grasses		723	698	29.20	25.18
F	Alyssum alyssoides (a)	<sub>b</sub> 376	<sub>a</sub> 239	2.01	1.04
F	Crepis acuminata	-	3	-	.01
F	Erigeron divergens	-	2	-	.00
F	Eriogonum umbellatum	-	1	-	.00
F	Erodium cicutarium (a)	<sub>b</sub> 103	<sub>a</sub> 9	1.70	.03
F	Lappula occidentalis (a)	<sub>a</sub> 1	<sub>b</sub> 13	.00	.03
F	Lotus utahensis	-	1	-	.00
F	Phlox longifolia	-	3	-	.00
F	Ranunculus testiculatus (a)	160	138	.49	.81
F	Salsola iberica (a)	-	3	-	.00
F	Sisymbrium altissimum (a)	2	-	.03	-
F	Sphaeralcea coccinea	<sub>b</sub> 77	<sub>a</sub> 36	.37	.08
Total for Annual Forbs		642	402	4.25	1.92
Total for Perennial Forbs		77	46	0.36	0.11
Total for Forbs		719	448	4.61	2.04

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

BROWSE TRENDS--

Management unit 16A, Study no: 23

Type	Species	Strip Frequency		Average Cover %	
		'07	'12	'07	'12
B	Artemisia tridentata tridentata	1	0	-	-
B	Artemisia tridentata vaseyana	45	52	3.45	8.19
B	Chrysothamnus viscidiflorus	0	2	-	.00
B	Mahonia repens	0	1	-	-
B	Opuntia sp.	15	19	1.11	.98
B	Symphoricarpos oreophilus	0	1	-	-
Total for Browse		61	75	4.55	9.18

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 23

Species	Percent Cover	
	'07	'12
Artemisia tridentata tridentata	.60	-
Artemisia tridentata vaseyana	3.09	8.16
Chrysothamnus viscidiflorus	-	.01
Opuntia sp.	.78	1.61

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 23

Species	Average leader growth (in)	
	'07	'12
Artemisia tridentata vaseyana	0.9	1.3

BASIC COVER--

Management unit 16A, Study no: 23

Cover Type	Average Cover %	
	'07	'12
Vegetation	42.00	35.97
Rock	2.22	2.46
Pavement	.47	.27
Litter	44.88	39.37
Cryptogams	1.80	.84
Bare Ground	19.69	21.48

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 23, Fountain Green Plateau

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
-	7.0	56.2	19.8	24.0	1.6	12.3	486.4	0.6

PELLET GROUP DATA--

Management unit 16A, Study no: 23

Type	Quadrat Frequency		Days use per acre (ha)	
	'07	'12	'07	'12
Sheep	31	15	65 (160)	39 (96)
Rabbit	60	42	-	-
Elk	5	-	1 (3)	1 (2)
Deer	26	10	22 (55)	7 (18)

BROWSE CHARACTERISTICS--

Management unit 16A, Study no: 23

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata tridentata</i>									
07	20	0	0	100	-	0	100	0	55/60
12	0	0	0	0	-	0	0	0	-/-
<i>Artemisia tridentata vaseyana</i>									
07	1180	0	32	68	-	12	86	56	28/39
12	2460	47	38	15	760	26	9	7	30/39
<i>Chrysothamnus viscidiflorus</i>									
07	0	0	0	-	-	0	0	0	21/49
12	40	50	50	-	-	0	100	50	-/-
<i>Mahonia repens</i>									
07	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
07	440	0	91	9	-	0	0	0	8/20
12	480	4	83	13	-	4	8	8	7/27
<i>Symphoricarpos oreophilus</i>									
07	0	0	0	-	-	0	0	0	-/-
12	20	0	100	-	-	0	0	0	-/-



MAPLE CANYON - TREND STUDY NO. 16A-24-12

Vegetation Type: Pinyon/Juniper

Range Type: Crucial Deer Winter/Spring

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

Land Ownership: DWR

Elevation: 6,660 ft (2,030 m)

Aspect: West

Slope: 5%

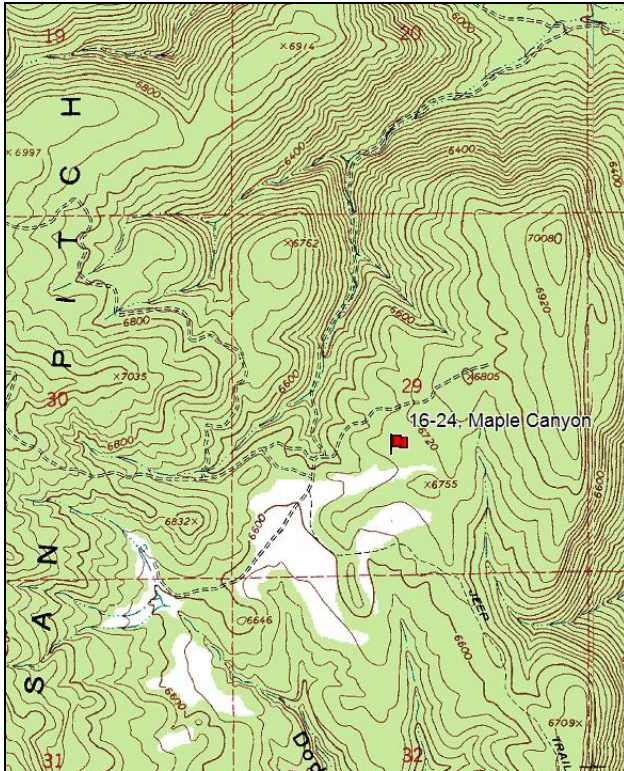
Transect bearing: 355° magnetic

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

Directions:

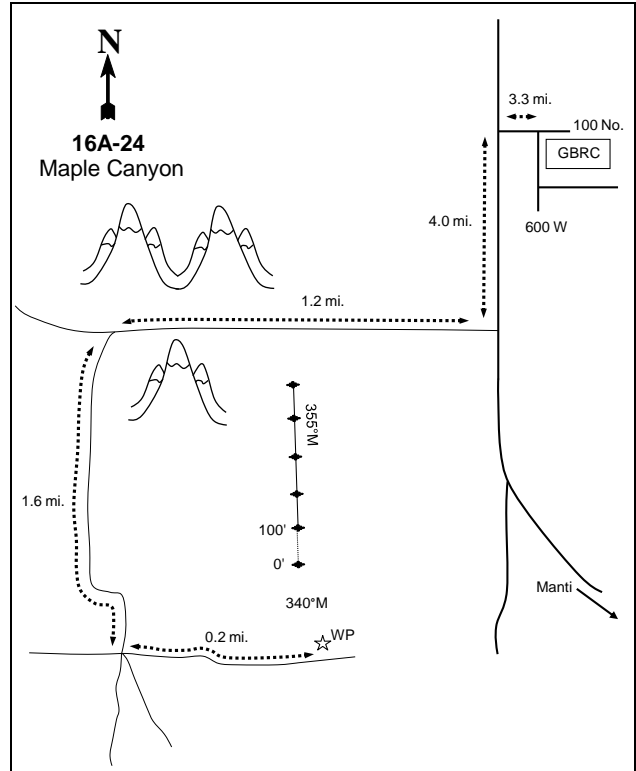
Starting at the intersection of 100 North and 600 West in Ephraim, travel 3.3 miles west on 100 North. Turn left (south) at the intersection and travel 4.0 miles to another intersection. Turn right (west). Travel for 1.2 miles up the canyon to a “Y” intersection and turn left (south). Travel 1.6 miles to five point intersection on top of the ridge. Take the furthest left (east) and travel 0.2 miles to a witness post on the north side of the road. The 0-foot stake (browse tag #179) is found at 340 degrees magnetic from the witness post.

Map Name: Manti



Township: 17S Range: 2E Section: 29

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 437954 E 4350784 N

MAPLE CANYON - TREND STUDY NO. 16A-24

**Site Information**

Site Description: The study is located west of Manti within the Maple Canyon Wildlife Management Area (WMA). The study was established prior to a bullhog treatment to remove Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*) from the site in the winter of 2012 and 2013. When established, the site was dominated by juniper and pinyon trees intermixed with low densities of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and antelope bitterbrush (*Purshia tridentata*). Deer pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: Utah juniper and pinyon pine dominate the site in high density (Table - Point-Quarter Tree Data). Most of the trees were mature and 4 to 12 feet tall. Mountain big sagebrush and bitterbrush provide the majority of the preferred browse cover on the site (Table - Browse Trends). The mountain big sagebrush consists of a small population of mature and decadent plants. Recruitment of young sagebrush plants was good, and poor vigor was low. Utilization of sagebrush was mostly light to moderate. Bitterbrush consists of a small population of mostly decadent plants. There was no new recruitment of young sagebrush plants, and poor vigor is high. Utilization of bitterbrush was mostly heavy. Other preferred browse species Utah serviceberry (*Amelanchier utahensis*), white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), dwarf rabbitbrush (*C. depressus*), and green ephedra (*Ephedra viridis*) were sampled at very low density (Table - Browse Characteristics).

Herbaceous Understory: The perennial grass component is fairly diverse and abundant. The dominant perennial grass species is crested wheatgrass (*Agropyron cristatum*), with other common species including bluebunch wheatgrass (*A. spicatum*), sheep fescue (*Festuca ovina*), and Sandberg bluegrass (*Poa secunda*). No annual grass species were sampled on the site. Perennial forb species are fairly diverse, but are not abundant (Table - Herbaceous Trends).

Soil: The soils on this site are classified as part of the Borvant-Lodar complex, likely as part of the Lodar component, which occur on hills and alluvial fans. These soils are formed from alluvium, colluvium, and residuum derived from limestone, and are characterized as shallow and somewhat excessively drained (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.0). Phosphorus may have limited availability for plant growth and development at 4.1 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderately high, with vegetation, litter, and pavement providing the majority of the protective ground cover (Table - Basic Cover). The soil erosion condition was classified as moderate in 2012.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 16A, study no: 24

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
12	3.3	0.0	0.0	21.7	0.0	1.8	0.0	<b>26.8</b>	Very Poor

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 16A, Study no: 24

T y p e	Species	Nested	Average
		Frequency	Cover %
		'12	'12
G	Agropyron cristatum	130	5.48
G	Agropyron intermedium	3	.03
G	Agropyron smithii	4	.03
G	Agropyron spicatum	36	1.07
G	Elymus junceus	12	.36
G	Festuca ovina	32	1.21
G	Poa secunda	104	2.66
Total for Annual Grasses		0	0
Total for Perennial Grasses		321	10.86
Total for Grasses		321	10.86
F	Agoseris glauca	2	.00
F	Alyssum alyssoides (a)	24	.04
F	Antennaria sp.	18	.06
F	Astragalus sp.	11	.06
F	Astragalus utahensis	4	.01
F	Collinsia parviflora (a)	8	.02
F	Crepis acuminata	1	.00
F	Cymopterus sp.	25	.06
F	Eriogonum brevicaule	3	.00
F	Haplopappus acaulis	3	.03
F	Lathyrus brachycalyx	5	.01
F	Microsteris gracilis (a)	28	.07
F	Phlox austromontana	46	.49
F	Phlox longifolia	3	.00
F	Ranunculus testiculatus (a)	69	.13
F	Streptanthus cordatus	3	.00
F	Trifolium longipes	30	.11
Total for Annual Forbs		129	0.27
Total for Perennial Forbs		154	0.88
Total for Forbs		283	1.16

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

BROWSE TRENDS--

Management unit 16A, Study no: 24

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Artemisia tridentata vaseyana	16	1.24
B	Amelanchier utahensis	1	-
B	Chrysothamnus depressus	6	.06
B	Gutierrezia sarothrae	3	-
B	Juniperus osteosperma	6	8.57
B	Pinus edulis	8	6.05
B	Purshia tridentata	3	1.16
Total for Browse		43	17.10

CANOPY COVER, LINE INTERCEPT--

Management unit 16A, Study no: 24

Species	Percent Cover
	'12
Amelanchier utahensis	.05
Artemisia tridentata vaseyana	.80
Juniperus osteosperma	11.03
Pinus edulis	7.61
Purshia tridentata	.11

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 16A, Study no: 24

Species	Average leader growth (in)
	'12
Artemisia tridentata vaseyana	0.9
Purshia tridentata	1.0

POINT-QUARTER TREE DATA--

Management unit 16A, Study no: 24

Species	Trees per Acre	Average diameter (in)
	'12	'12
Juniperus osteosperma	226	3.9
Pinus edulis	165	3.3

BASIC COVER--

Management unit 16A, Study no: 24

Cover Type	Average Cover % '12
Vegetation	30.59
Rock	4.45
Pavement	14.60
Litter	38.59
Cryptogams	2.54
Bare Ground	21.72

SOIL ANALYSIS DATA --

Management unit 16A, Study no: 24, Maple Canyon

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
-	7.0	32.4	33.1	34.5	3.5	4.1	92.0	1.0

PELLET GROUP DATA--

Management unit 16A, Study no: 24

Type	Quadrat Frequency '12	Days use per acre (ha) '12
Rabbit	18	-
Deer	13	6 (15)
Sheep	-	1 (2)

BROWSE CHARACTERISTICS--

Management unit 16A, Study no: 24

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Amelanchier utahensis</i>									
12	60	0	100	-	-	0	0	0	19/52
<i>Artemisia tridentata vaseyana</i>									
12	400	10	60	30	40	35	10	5	19/24
<i>Chrysothamnus depressus</i>									
12	140	0	100	-	-	0	0	0	3/6
<i>Chrysothamnus nauseosus albicaulis</i>									
12	0	0	0	-	-	0	0	0	37/18
<i>Ephedra viridis</i>									
12	0	0	0	-	-	0	0	0	41/35
<i>Gutierrezia sarothrae</i>									
12	80	0	100	-	-	25	0	0	7/11

		Age class distribution			Utilization				
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Juniperus osteosperma									
12	<b>160</b>	38	50	13	20	0	0	0	-/-
Peraphyllum ramosissimum									
12	<b>0</b>	0	0	-	-	0	0	0	19/23
Pinus edulis									
12	<b>160</b>	50	38	13	40	0	0	13	-/-
Purshia tridentata									
12	<b>60</b>	0	33	67	-	0	67	67	13/41

SUMMARY  
WILDLIFE MANAGEMENT UNIT 16A - CENTRAL MOUNTAINS, NEBO

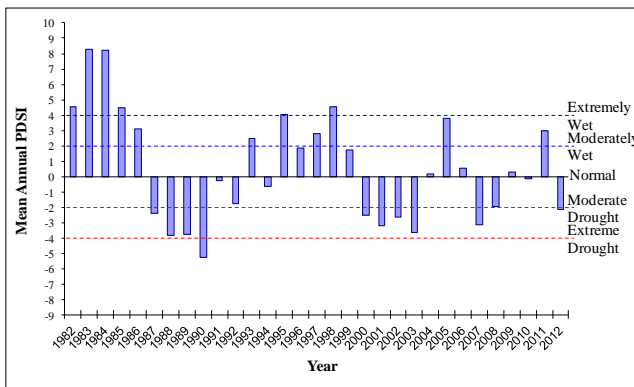
**Community Types**

Deer winter range within a unit is summarized into three categories based on ecological potentials which include **low potential**, **mid-level potential** and **high potential**. Low potential sites include desert shrub, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) communities. Mid-level potential sites include mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) communities. High potential sites include mountain brush communities. Low sagebrush (*A. arbuscula*), black sagebrush (*A. nova*), and basin big sagebrush (*A. tridentata* ssp. *tridentata*) communities are placed within the low potential or mid-level potential scales based on precipitation and elevation. Deer **summer range** is summarized separately from winter range as a fourth category and typically includes aspen (*Populus tremuloides*) and high elevation mountain brush communities. Twenty one interagency range trend studies were sampled in Unit 16A during the summer of 2012.

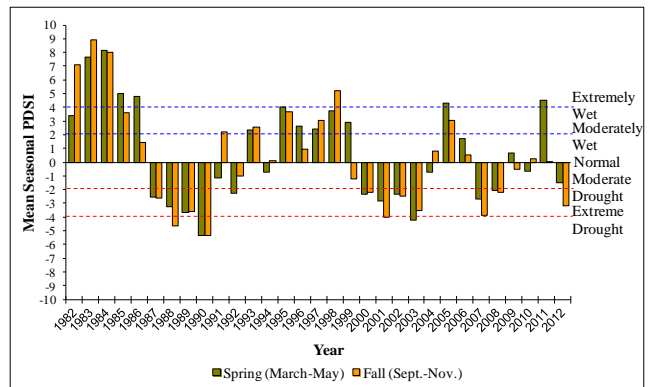
All of the studies[Santaquin Bench (16A-2), Santaquin Hill (16A-3), Wash Canyon (16A-4), Nebo Creek (16A-5), Hop Creek Browse (16A-6), Willow Creek (16A-7), Gardner Canyon (16A-8), Birch Creek (16A-9), North Canyon (16A-10), Rees Flat (16A-11), Tithing Mountain (16A-12), Steele Ranch (16A-13), Big Hollow (16A-14), Old Pinery (16A-15), Chicken Creek (16A-17), Deep Creek (16A-18), Flat Canyon (16A-19), Triangle Ranch (16A-20), Levan North (16A-22), Fountain Green Plateau 16A-23), and Maple Canyon (16A-24)] are categorized as mid-level potential sites for deer winter range, and sample mountain big sagebrush, basin big sagebrush, cliffrose (*Cowania mexicana* ssp. *stansburiana*), or mixed brush communities. All of these studies except for the Santaquin Bench, Levan North, and Maple Canyon studies are also considered to be elk winter range. Because it was established in 2012, the Maple Canyon study is not included in this summary. For further information regarding this study, refer to the study discussion section.

**Precipitation**

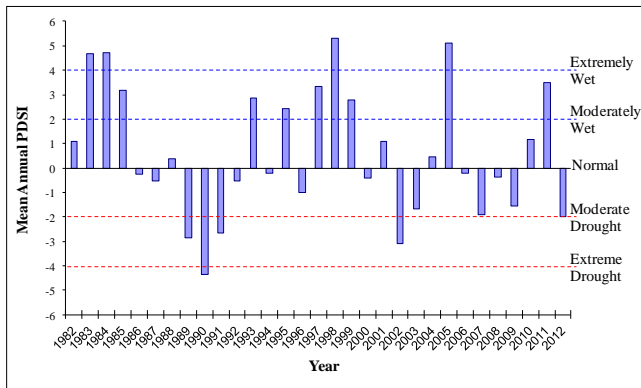
Vegetation trends are dependent upon annual and seasonal precipitation patterns. Precipitation and Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of both the North Central (Division 3) and



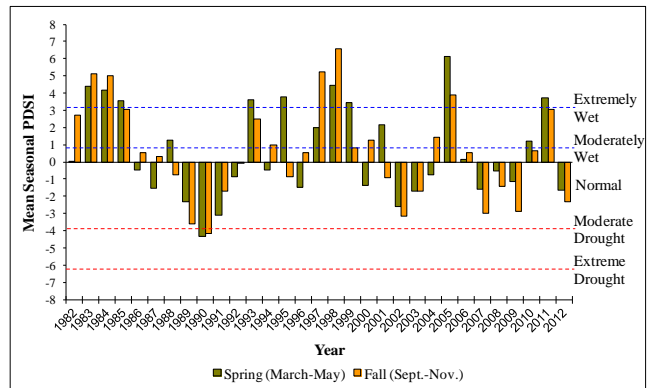
**Figure 1.** The 31 year mean annual Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).



**Figure 2.** The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).



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



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

South Central (Division 4) divisions. Studies that are located in the North Central division include the Santaquin Bench, Santaquin Hill, Wash Canyon, Nebo Creek, Hop Creek Browse, Willow Creek, Gardner Canyon, Birch Creek, North Canyon, Rees Flat, Tithing Mountain, and Steele Ranch studies. The North Central division had a historic annual mean precipitation of 16.51 inches from 1895 to 2012. Studies that are located in the South Central division include the Big Hollow, Old Pinery, Chicken Creek, Deep Creek, Flat Canyon, Triangle Ranch, Levan North, Fountain Green Plateau, and Maple Canyon studies. The South Central division had a historic annual mean precipitation of 12.52 inches from 1895 to 2012. The mean annual PDSI of both the North Central and the South Central divisions display a cycle of several wet years followed by several drought years over the course of study years (Figure 1, Figure 2, Figure 3, and Figure 4) (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 12-14 in. on the Fountain Green Plateau study; 14-16 in. on the Old Pinery, Deep Creek, Flat Canyon, Triangle Ranch, Levan North, and Maple Canyon studies; 16-18 in. on the Santaquin Hill, Wash Canyon, Hop Creek Browse, Gardner Canyon, Birch Creek, Big Hollow, and Chicken Creek studies; 18-20 in. on the Santaquin Bench, Nebo Creek, Willow Creek, Tithing Mountain, and Steele Ranch studies; and 20-24 in. on the North Canyon and Rees Flat studies (PRISM Climate Group 2011).

### Mid-Level Potential Deer Range

**Browse:** The mid-level potential site cumulative median browse trend decreased slightly in 1989, and again in 2007 (Figure 7). Mountain big sagebrush is a dominant sagebrush species on most of the study sites, but basin big sagebrush is dominant on the Nebo Creek and Big Hollow studies. These big sagebrush species were summarized together in this report. The mean density and cover of big sagebrush has steadily decreased since 2002 (Figure 6a and Figure 6b). Much of this decrease is due to wildfires that occurred on the Santaquin Bench, Nebo Creek, Hop Creek Browse, and Big Hollow studies. However, if these studies are removed, the trend remains the same. The mean decadence of big sagebrush steadily increased from 1997 to 2007, but decreased significantly in 2012 returning to 1997 levels (Figure 6c).

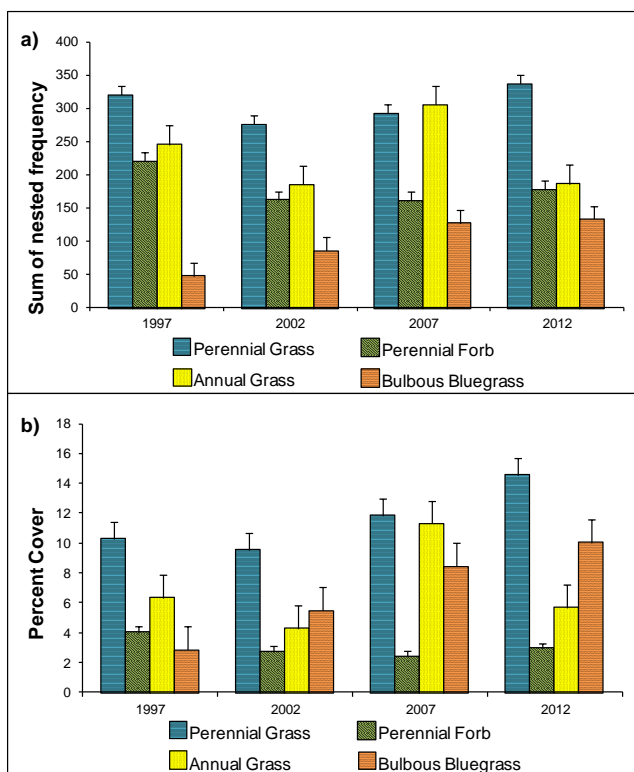
Gambel oak (*Quercus gambelii*) is common on many of the mid-level potential studies. The mean density of oak increased significantly in 2002 and has remained high in subsequent sample years (Figure 6a). The mean cover of oak increased significantly in 2007 (Figure 6b). Much of the increase in both density and cover was due to the reestablishment of oak following wildfire on the Santaquin Bench study. Decadence of oak has



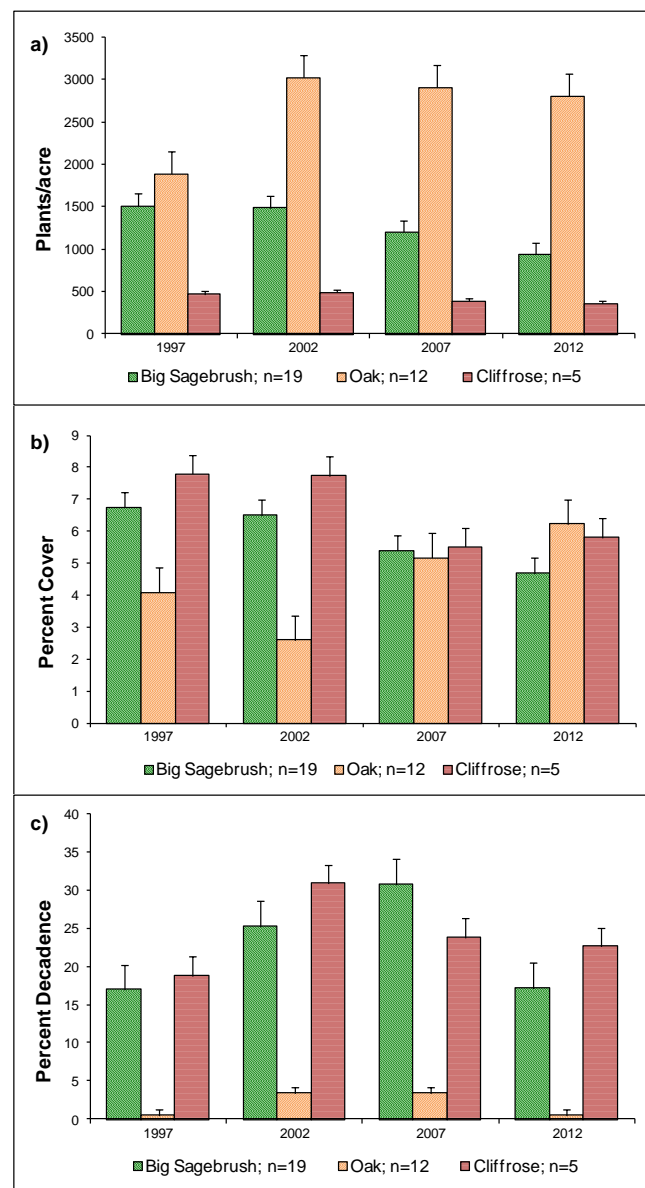
been very low over the course of the study (Figure 6c).

Cliffrose is common on the Willow Creek, Gardner Canyon, Birch Creek, Tithing Mountain, and Chicken Creek studies. The mean density and cover of cliffrose decreased significantly in 2007 (Figure 6a and Figure 6b). The mean decadence of cliffrose has been moderately high on most studies over the course of the study years, but was significantly higher in 2002 than other sample years (Figure 6c).

**Herbaceous Understory:** The mid-level potential median cumulative grass trend increased in 1989, decreased slightly in 2002, then increased slightly in 2012 (Figure 7). The mean sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased significantly in 2002, but has steadily increased since 2002 (Figure 5a). The mean cover of perennial grass species has steadily increased since 2002, and was significantly higher in 2012 than the other sample years (Figure 5b). Annual grass species including cheatgrass (*Bromus tectorum*) are prevalent on many of the sites. The mean sum of nested frequency and cover of annual grasses was significantly higher in 2007 than the other sample years (Figure 5a and Figure 5b). The weedy perennial species bulbous bluegrass is also common on many of the mid-level potential study sites, and appears to be increasing throughout the area. There has been a steady increase in the mean nested frequency and cover of bulbous bluegrass since 1997 (Figure 5a and Figure 5b).



**Figure 5.** a) Mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass sum of nested frequency by year for WMU 16A, Central Mountains, Nebo. b) Mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass cover by year for WMU 16A.



**Figure 6.** a) Mid-level potential sites mean density of big sagebrush (*Artemisia tridentata* spp.), Gambel oak (*Quercus gambelii*), and cliffrose (*Cowania mexicana* ssp. *stansburiana*) by year for WMU 16A, Central Mountains, Nebo. b) Mid-level potential sites mean cover of big sagebrush, Gambel oak, and cliffrose by year for WMU 16A. c) Mid-level potential mean decadence of big sagebrush, Gambel oak, and cliffrose by year for WMU 16A.

The mid-level potential median cumulative forb trend has remained relatively stable since the outset of the study (Figure 7). The mean sum of nested frequency and cover of perennial forb species decreased significantly in 2002 and remained lower in the subsequent sample years (Figure 5a and Figure 5b).

Occupancy: Pellet group transect data indicates that deer predominantly occupy these mid-level potential study areas. The mean abundance of deer pellet groups was high on most studies in 1997 and 2007, but was substantially lower in 2012. The decrease in pellet abundance is likely due to the mild winter of 2011-2012 which allowed animals to remain on higher elevation range. The mean abundance of elk and livestock sign has been generally low since 1998 (Figure 8). Sheep pellet groups were abundant on the Deep Creek and Fountain Green Plateau studies in several sample years.

Deer Desirable Components Index (DCI): The mid-level potential deer DCI has remained relatively stable at poor to poor-fair ranking since 1997. The low score is attributed to the low preferred browse cover score (Table 1 and Figure 9).

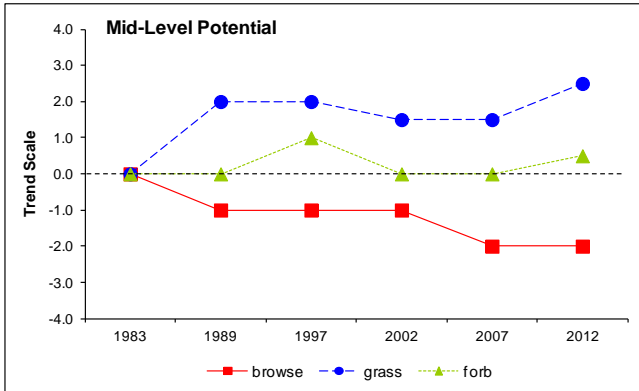
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	13.4	8.0	6.1	18.8	-3.6	7.8	-1.2	<b>49.2</b>	Poor-Fair
02	14.9	4.9	3.2	17.6	-3.4	6.1	-1.2	<b>42.1</b>	Poor
07	11.8	5.6	2.5	18.6	-5.5	6.3	-1.2	<b>38.1</b>	Poor
12	14.1	8.2	4.4	20.0	-4.9	5.9	-1.2	<b>46.6</b>	Poor

**Table 1.** Mid-level potential scale mean deer DCI scores and rankings (n=20) by year for WMU 16A, Central Mountains, Nebo. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

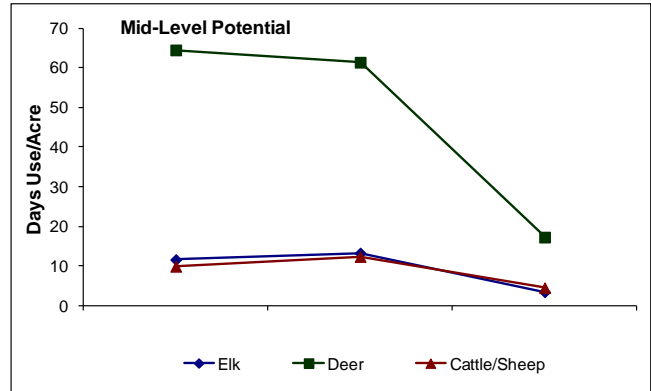
Discussion: Decreases in the preferred browse species sagebrush and cliffrose are a cause of concern on these mid-level potential sites. Wildfire's on the Santaquin Bench, Nebo Creek, Hop Creek Browse, and Big Hollow studies has certainly contributed to the decrease in sagebrush, but are not the singular cause. Gambel oak is increasing on several sites and may be competing directly with sagebrush. This seems to be the case particularly on the Santaquin Bench, North Canyon, and Steele Ranch studies. Decreases in cover and density of cliffrose are particularly pronounced on the Tithing Mountain study, but are also occurring on the Gardner Canyon, Birch Creek, and Chicken Creek studies.

The abundance of weedy annual species and bulbous bluegrass is likely contributing to decreases in both the sagebrush and cliffrose populations on these mid-level potential sites. These weedy species can form dense mats of cover that compete with other more desirable herbaceous species and with seedlings and young shrubs which limits establishment of new plants into the population. Annual grass species can also increase fuel loads and increase the chance of a catastrophic fire event. Bulbous bluegrass is a particular concern on the Santaquin Bench, Rees Flat, Tithing Mountain, Old Pinery, and Triangle Ranch studies. Cheatgrass and other annual grasses are a particular concern on the Nebo Creek, Willow Creek, Gardner Canyon, Birch Creek, Tithing Mountain, Big Hollow, Old Pinery, Chicken Creek, and Flat Canyon studies.

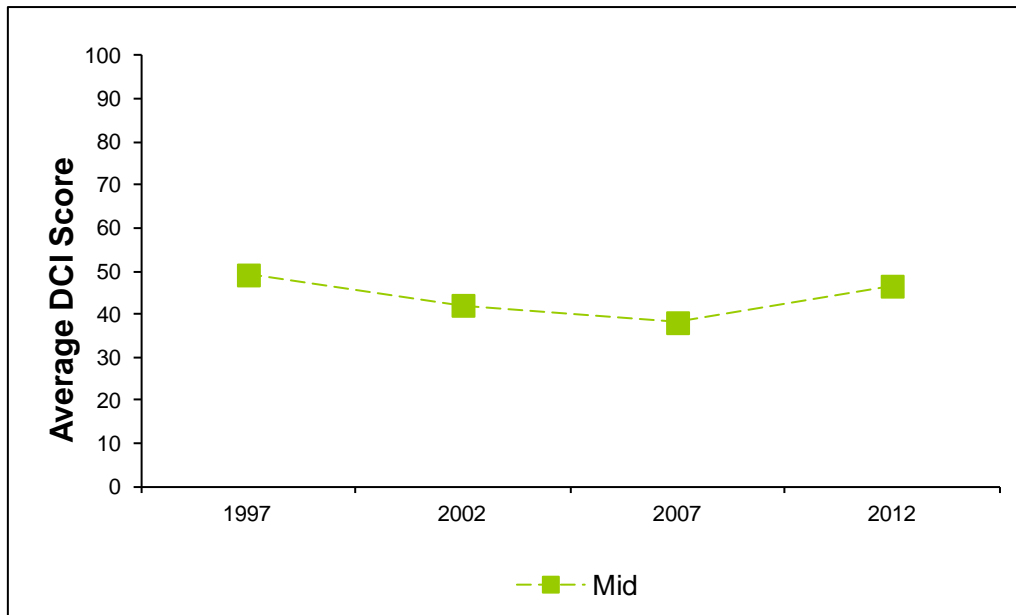
Heavy utilization by animals may be compounding problems from competition. Deer pellet groups have been particularly abundant on the Santaquin Hill, Wash Canyon, Hop Creek Browse, Willow Creek, Gardner Canyon, Tithing Mountain Steele Ranch, and Old Pinery studies. Livestock utilization appears to be relatively light on most of these studies, but sheep pellets have been abundant at times on the Deep Creek and Fountain Green Plateau study.



**Figure 7.** Mid-level potential sites cumulative median browse, grass, and forb trends by year for WMU 16A, Central Mountain, Nebo.

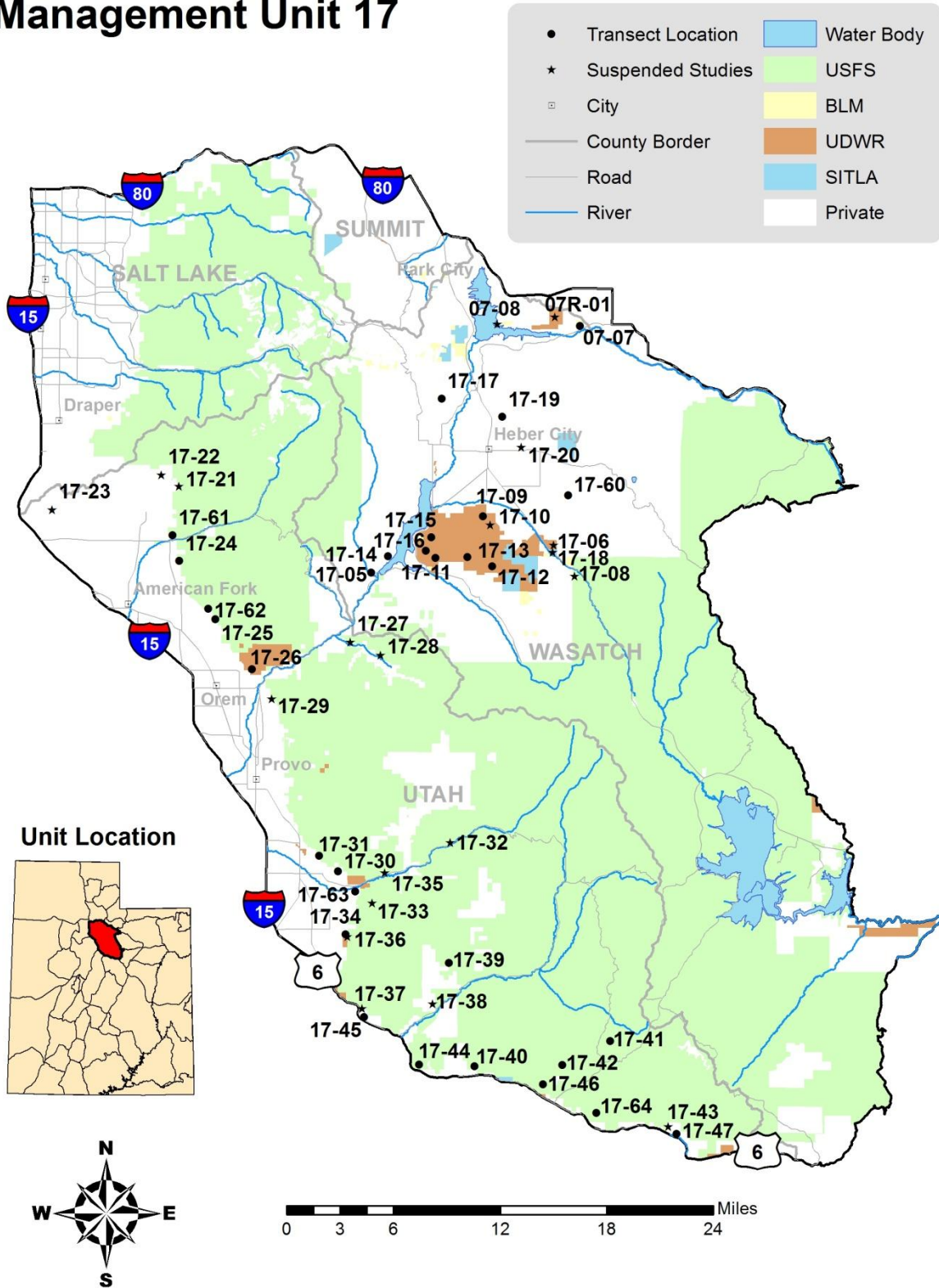


**Figure 8.** Mid-level potential sites mean animal days use/acre (n=20) by year for WMU 16A, Central Mountains, Nebo.



**Figure 9.** Mean mid-level (n=20) potential scale deer DCI scores by year for WMU 16A, Central Mountain, Nebo. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

# Management Unit 17



## MANAGEMENT UNIT 17 - WASATCH MOUNTAINS

### Boundary Description

**Salt Lake, Summit, Wasatch, Duchesne, Carbon, and Utah Counties** - Boundary begins at the junction of I-15 and I-80 in Salt Lake City; east on I-80 to US-40; south on US-40 to SR-32; east on SR-32 to SR-35; southeast on SR-35 to SR-87; south on SR-87 to Duchesne and US-191; south on US-191 to US-6; northeast on US-6 to I-15; north on I-15 to I-80 in Salt Lake City and beginning point.

### Management Unit Description

Management unit 17 is divided into eight smaller, more manageable subunits. These are: Diamond Fork, Hobble Creek, Timpanogos, Salt Lake County-East Bench, Heber, Carrant Creek, Avintaquin, and Price Canyon. The 2012 report covers only the Diamond Fork, Hobble Creek, Timpanogos, and Heber subunits. The Salt Lake County-East Bench subunit no longer contains range trend studies due to lack of access and development. The Carrant Creek and Avintaquin subunits are monitored as part of the Division's Northeastern Region rotation which were last read in 2010 and will be reread in 2015. The Price Canyon subunit is monitored as part of the Division's Northeastern Region rotation which was last read in 2010 and will be reread in 2015.

Of the total area within this management unit, 63% is summer range, 35% is winter range, and 2% is classified as year-long range. The areas of most concern in this unit are the winter ranges, which are very limited in quantity and quality. Residential developments along the Wasatch Front have consumed much of the critical winter range that was available to wildlife, and this will continue in the future. Because most of the winter range in this unit now lies on private land, managing wildlife populations is a challenge. Critical issues facing management of big game in unit 17 include crop depredation, habitat quantity and quality, and highway mortality (Hersey and McLaughlin 2006).

### Range Trend Studies

Twenty-nine interagency range trend studies were sampled in Diamond Fork, Hobble Creek, Timpanogos, and Heber subunits during the summer of 2012. A total of forty-seven studies have been established within Diamond Fork, Hobble Creek, Timpanogos, and Heber subunits since 1983. Thirty-six studies were established in 1983 and 1984, and of these studies Fourteen studies [Deer Creek Dam (17-5), Daniels Canyon (17-6), Wallsburg Turn (17-11), North Wallsburg (17-13), Hoovers Hollow (17-14), Rainbow Bay (17-16), Coyote Canyon (17-19), Heissetts Hollow (17-24), Above Edgemont (17-29), Maple Mountain Face (17-34), North Fork Diamond Canyon (17-38), Little Diamond Fork (17-39), Long Hollow (17-40), and Billies Mountain (17-44)] sample mountain big sagebrush communities, one study [Schoolhouse Springs (17-22)] sample bitterbrush communities, eight studies [Whiskey Springs (17-8), Upper Big Hollow (17-10), Lake Creek Road (17-20), South Fork Provo River (17-27), Right Fork-Hobble Creek (17-32), Maple Canyon (17-33), Hobble Creek Golf Course (17-35), Cold Spring (17-37)] sample Gambel oak communities, five studies [Orem Water Tank (17-26), Lower Big Hollow (17-9), North Wallsburg Reseeding (17-12), Dutch Canyon (17-17), and Oak Hollow (17-23)] sample a mix oak and sagebrush communities, six studies [Island Boat Camp (17-15), Upper Sheep Creek (17-41), Tank Hollow (17-42), Spring Hollow (17-28), Tie Fork (17-43), and Box Elder Canyon (17-21)] sample mountain brush communities, one study [Round Peak (17-31)] sample smooth sumac communities, and two studies

[North Battle Creek (17-25) and Spring Canyon (17-30)] sample cliffrose communities. Five studies were established in 1989, and of these studies two studies [North Bench (17-45) and Big Slide (17-36)] sample mountain big sagebrush communities, one study [Lower Take Hollow (17-46)] sample a pinyon and juniper communities, and two studies [Daniels (17-18) and Tie Fork East (17-47)] sample mountain brush communities. Five studies were established in 2002, of these studies two study [Center Creek (17-60) and American Fork Canyon (17-61)] sample mountain big sagebrush communities, one study [Hobble Creek Bench (17-63)] sample bitterbrush communities, one study [Water Hollow (17-64)] sample pinyon and juniper communities, and one study [Grove Creek (17-62)] sample cliffrose communities.

In 1989, four studies (Whiskey Springs, South Fork Provo River, Right Fork-Hobble Creek, and Cold Spring) were suspended. In 1997, one study (Daniels) was suspended. In 2002, thirteen studies (Daniel Canyon, Upper Big Hollow, Lake Creek Road, Box Elder Canyon, Schoolhouse Springs, Spring Hollow, Above Edgemont, Maple Canyon, Hobble Creek Golf Course, Big Slide, North Fork Diamond Canyon, and Tie Fork) were suspended. Several studies were suspended in 2002 due to lack of access and loss to development. Some studies were not read because they no longer are representative of critical winter range. Several new studies were established in 2002 to monitor new areas considered critical for big game, including a few for Rocky Mountain bighorn sheep. The suspension of old studies and the establishment of new sites is done with input from Division biologists and federal land managers and if the need arises in the future these studies can be sampled again. To access maps, discussions, and tables for suspended studies see: <http://www.wildlife.utah.gov/range>.

DEER CREEK DAM - TREND STUDY NO. 17-5-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: UDP&R

Elevation: 5,540 ft (1,689 m)

Aspect: Southeast

Slope: 12-20%

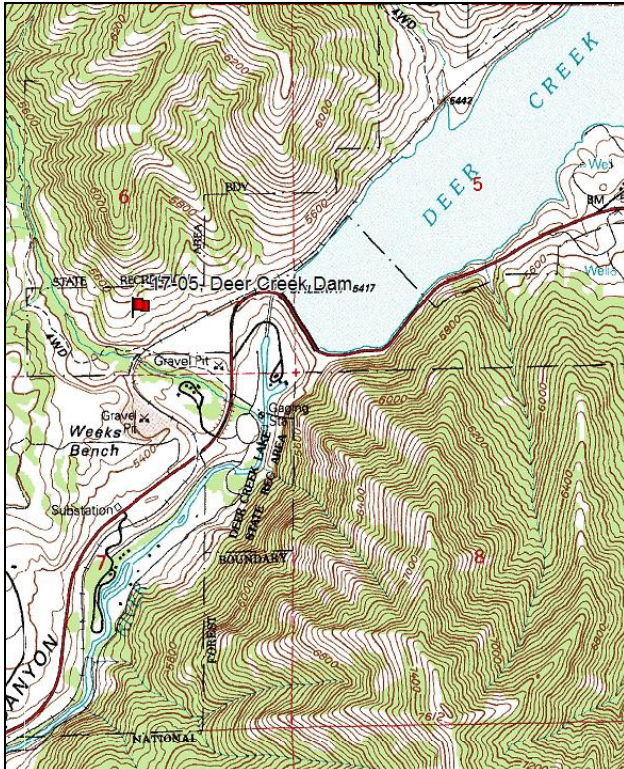
Transect bearing: 180° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (71ft), line 3 (34ft), line 4 (59ft). Rebar not found on belts 2,3, &4.

Directions:

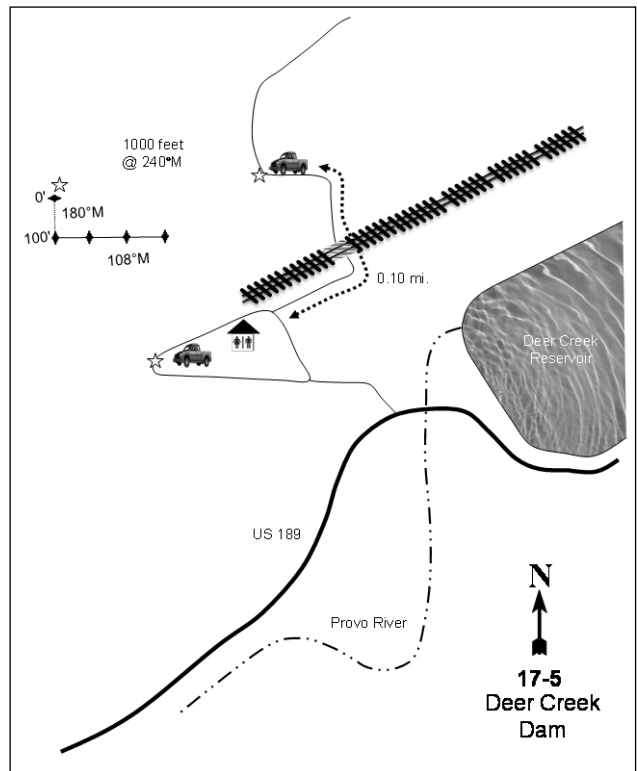
From the dam at the south end of Deer Creek Reservoir, proceed south on U.S. 189 for 0.10 miles to an intersection to the west that enters a gravel pit. Turn right toward Deer Creek and proceed northwesterly to the intersection of the Denver and Rio-Grande railroad tracks. Continue for 0.1 miles to where the road bends to the north. Walk 1000 feet at heading of 240 degrees to a full high witness post. The 0-foot baseline stake is 20 feet from the witness post. A red browse tag, number 3914, is attached to the 0-foot baseline stake. Line 4 belt 3 was mistakenly put at 71 feet, and in order to be consistent, belt 3 has not been moved to 59 feet.

Map Name: Aspen Grove



Township: 5S Range: 4E Section: 6

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 454470 E 4473073 N

## DEER CREEK DAM - TREND STUDY NO. 17-5

### Site Information

Site Description: The study is located a half mile west of Deer Creek Dam on land administered by the Utah Division of Parks and Recreation (UDPR), and is located within deer winter range on a moderately sloped bench populated by mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*) and mountain snowberry (*Symphoricarpos oreophilus*) at the mouth of Deer Creek. Land on and near the study has experienced multiple disturbances. Prior to site establishment in 1989, power line construction disturbed the ground along the end of the frequency lines, which resulted in a decrease in the mountain big sagebrush population and an increased presence of annual weedy species. In 2007, the study was approximately one thousand feet to the west of a gravel pit staging area used as a part of the US-189 realignment project. Deer pellet groups have been sampled in moderate abundance in 2002 and 2007, but in low abundance in 2012. Elk pellet groups have been sampled in low abundance since 1996 (Table - Pellet Group Data).

Browse: The most abundant browse species found on the site is mountain big sagebrush, which has maintained a moderately dense population of mature plants throughout the duration of the study. Sagebrush decadence has been minor in past readings, but has recently become moderate in scale. Utilization of mountain big sagebrush has been light to moderate over the sampled years. Recruitment of young sagebrush plants has ranged between low to moderate over the course of the study. Other preferred species sampled in low densities include Chokecherry (*Prunus virginiana*), Saskatoon serviceberry (*Amelanchier alnifolia*), antelope bitterbrush (*Purshia tridentata*), snowberry (*Symphoricarpos oreophilus*), and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) (Table - Browse Trends).

Herbaceous Understory: The herbaceous understory is weedy in composition. Since annual grasses were initially measured in 1996, annual grasses have had higher nested and quadrat frequencies than perennial grasses. In 1996 and 2007, cheatgrass (*Bromus tectorum*) was the dominant understory species. Japanese brome (*Bromus japonicus*) and jointed goatgrass (*Aegilops cylindrica*), a noxious weed, were first sampled in 2002. Japanese brome has since become the most abundant grass component. Perennial grass species present on the site are bluebunch wheatgrass (*Agropyron spicatum*) and Kentucky bluegrass (*Poa pratensis*). The cover of bluebunch wheatgrass has increased with every reading, while Kentucky bluegrass has maintained low cover. Many of the annual and perennial forb species sampled are increasers and weedy. The most abundant forbs are pale alyssum (*Alyssum alyssoides*), longleaf phlox (*Phlox longifolia*), bur buttercup (*Ranunculus testiculatus*), and yellow salsify (*Tragopogon dubius*). The noxious weed species Dalmatian toadflax (*Linaria dalmatica*) and houndstongue (*Cynoglossum officinale*) have also been sampled on site (Table - Herbaceous Trends).

Soil: The soil is in the Burgi-Agassiz association, and is likely part of the Agassiz component, which is found on ridges. The parent material consists of colluvium over residuum weathered from sedimentary rock (Soil Survey Staff). The soil texture is a clay loam with a soil reaction that is neutral (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). The erosion condition was classified as stable in all sample years.

### Trend Assessments

#### Browse:

- **1983 to 1989 - down (-2):** The density for mountain big sagebrush decreased 53% from 2,531 plants/acre to 1,198 plants/acre. Decadence within the sagebrush population decreased from 24% to 11%. Mountain big sagebrush population decreased in poor vigor from 53% to 0%. Young sagebrush recruitment increased from 5% to 17%.



- **1989 to 1996 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore trend was determined using other parameters. Decadence within the sagebrush population decreased to 8%. However, poor vigor within the population increased to 14%.
- **1996 to 2002 - up (+2):** The density for mountain big sagebrush increased 29% from 4,120 plants/acre to 5,320 plants/acre. Decadence within the sagebrush population increased to 15%. While poor vigor within the population decreased to 5%. Young sagebrush recruitment decreased from 38 % to 15%.
- **2002 to 2007 - down (-2):** The density for mountain big sagebrush decreased 47% to 2,800 plants/acre. Decadence within the sagebrush population increased to 34%, and poor vigor increased to 11%. Recruitment of young sagebrush plants to the population decreased to 4%.
- **2007 to 2012 - stable (0):** The density for mountain big sagebrush remained similar at 2,940 plants/acre. Decadence within the sagebrush population decreased to 25%, while poor vigor increased to 18% of the population. Recruitment of young sagebrush increased to 30%.

#### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial grasses increased two-fold. Kentucky bluegrass had a significant increase in nested frequency and was the dominant perennial grass species.
- **1989 to 1996 - down (-2):** The sum of nested frequencies for perennial grasses decreased 21%. Kentucky bluegrass had a significant decrease in nested frequency and had a cover of 1%. The weedy annual grass cheatgrass was measured for the first time and was the dominant grass species.
- **1996 to 2002 - slightly down (-1):** The sum of nested frequencies for perennial grasses decreased 10%. Kentucky bluegrass had a significant decrease in nested frequency, and had a cover less than 1%. Cheatgrass decreased significantly in nested frequency, while Japanese brome increased significantly in nested frequency.
- **2002 to 2007 - down (-2):** The sum of nested frequencies for perennial grass species decreased 35%. The weedy species cheatgrass increased significantly in nested frequency and increased in cover from near 2% to 9%, while Japanese brome had a significant decrease in nested frequency.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequencies for perennial grass species increased 43%. Sandberg bluegrass had a significant increase in nested frequency, and increased in cover from near 0% to over 2%. Japanese brome maintained similar frequency, but increased in cover from 1% to near 2%.

#### Forb:

- **1983 to 1989 - down (-2):** The sum of nested frequencies for perennial forbs decreased 55%. Northern sweetvetch (*Hedysarum boreale*) had a significant decrease in nested frequency.
- **1989 to 1996 - down (-2):** The sum of nested frequencies for perennial forbs increased nearly six-fold. Long leaf phlox had a significant increase in nested frequency, and had a cover of 2%. Bedstraw (*Galium sp.*) increased significantly in nested frequency and had a cover of 1%. The noxious weedy species Dalmatian toadflax and houndstongue increased significantly in nested frequency, and had covers of 1% and 2% respectively.
- **1996 to 2002 - stable (0):** The sum of nested frequencies for perennial forbs decreased 27%. Bedstraw decreased significantly in nested frequency, but maintained similar cover. Dalmatian toadflax maintained similar frequency, but increased in cover to over 1%. Houndstongue had a significant decrease in nested frequency.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies for perennial forbs remained similar. Dalmatian toadflax increased significantly in nested frequency, and increased in cover to 2%. The annual forb species pale alyssum, bur buttercup, and yellow salsify all increased significantly in nested frequency.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequencies for perennial forbs increased 37%. No frequency increases were observed in Dalmatian toadflax or houndstongue; however, Dalmatian

toadflax increased in cover to over 2%. Bastard toadflax (*Comandra pallida*) had a significant increase in nested frequency and increased in cover from less than 1% to 4%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 5

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	27.8	12.5	15.0	7.0	-14.4	10.0	-4.0	<b>53.9</b>	Fair
02	30.0	10.4	7.0	6.3	-2.3	10.0	-2.0	<b>59.4</b>	Fair
07	20.2	5.1	4.6	8.6	-7.3	10.0	-4.0	<b>37.2</b>	Poor
12	18.8	8.3	13.2	17.1	-2.1	10.0	-4.0	<b>61.3</b>	Fair

Trend Summary

HERBACEOUS TRENDS--

Management unit 17, Study no: 5

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	Aegilops cylindrica (a)	-	-	-	3	2	-	-	.03	.03	-
G	Agropyron cristatum	-	-	-	3	2	8	-	.03	.06	.91
G	Agropyron spicatum	a5	ab37	bc70	c93	bc63	bc60	2.07	2.19	2.90	4.06
G	Bromus japonicus (a)	-	-	a-	c171	b111	b103	-	1.43	.99	1.60
G	Bromus tectorum (a)	-	-	d356	b125	c276	a58	19.20	1.63	8.72	1.22
G	Elymus cinereus	-	-	5	-	4	3	.18	.00	.78	.38
G	Elymus junceus	-	-	-	-	-	3	-	-	-	.00
G	Melica bulbosa	-	-	3	7	3	-	.00	.21	.18	-
G	Oryzopsis hymenoides	-	-	-	3	-	-	-	.15	-	-
G	Poa bulbosa	-	-	-	-	-	3	-	-	-	.00
G	Poa fendleriana	3	10	-	-	1	-	-	-	.03	-
G	Poa pratensis	b96	c164	b92	a43	a26	a22	1.24	.52	.35	.79
G	Poa secunda	a1	a3	a-	a1	a-	b42	-	.00	-	2.37
G	Sitanion hystrix	-	-	-	3	-	1	-	.03	-	.00
Total for Annual Grasses		0	0	356	299	389	161	19.20	3.11	9.75	2.82
Total for Perennial Grasses		105	214	170	153	99	142	3.50	3.15	4.30	8.54
Total for Grasses		105	214	526	452	488	303	22.70	6.26	14.05	11.37
F	Agoseris glauca	-	-	-	-	3	-	-	-	.00	-
F	Allium sp.	ab31	a9	a16	b46	ab21	a10	.06	.44	.10	.04
F	Alyssum alyssoides (a)	-	-	a96	b157	c229	c201	.36	.81	1.75	1.02
F	Artemisia ludoviciana	3	-	6	6	5	7	.06	.21	.16	.19
F	Astragalus beckwithii	a-	a-	a-	b24	a7	a8	-	.78	.24	.09
F	Astragalus cibarius	-	-	-	-	4	-	-	-	.15	-
F	Astragalus convallarius	ab13	a5	abc24	abc25	c45	bc25	.24	.50	1.67	.49
F	Astragalus utahensis	-	-	-	1	-	3	-	.00	-	.00
F	Calochortus nuttallii	14	3	-	7	2	3	-	.02	.00	.01
F	Camelina microcarpa (a)	-	-	a-	a3	b47	a-	-	.03	.21	-
F	Cirsium undulatum	a21	a12	b47	a20	a12	ab32	.82	.35	.21	1.99

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	<i>Collinsia parviflora</i> (a)	-	-	-	2	2	9	-	.00	.01	.16
F	<i>Collomia linearis</i> (a)	-	-	-	9	6	3	-	.02	.01	.00
F	<i>Comandra pallida</i>	a-	a-	a <sup>2</sup>	a <sup>3</sup>	b <sup>24</sup>	c <sup>191</sup>	.00	.01	.11	3.55
F	<i>Cynoglossum officinale</i>	a-	a <sup>2</sup>	b <sup>37</sup>	a-	a <sup>9</sup>	a <sup>3</sup>	2.34	-	.39	.18
F	<i>Epilobium brachycarpum</i> (a)	-	-	a-	a-	a <sup>3</sup>	b <sup>9</sup>	-	-	.00	.02
F	<i>Eriogonum brevicale</i>	-	7	6	1	2	-	.18	.00	.00	-
F	<i>Erodium cicutarium</i> (a)	-	-	a-	a <sup>11</sup>	b <sup>28</sup>	ab <sup>16</sup>	-	.09	.59	.08
F	<i>Galium</i> sp.	-	-	c <sup>147</sup>	b <sup>60</sup>	a <sup>27</sup>	a <sup>8</sup>	1.05	1.14	1.54	.09
F	<i>Gayophytum ramosissimum</i> (a)	-	-	b <sup>20</sup>	a <sup>3</sup>	a-	a-	.04	.00	-	-
F	<i>Hackelia patens</i>	-	3	-	-	1	-	-	-	.03	-
F	<i>Hedysarum boreale</i>	c <sup>69</sup>	ab <sup>13</sup>	b <sup>28</sup>	a-	a <sup>8</sup>	ab <sup>11</sup>	.63	-	.04	.63
F	<i>Helianthella uniflora</i>	-	-	-	-	-	4	-	-	-	.03
F	<i>Helianthus annuus</i> (a)	-	1	-	5	-	-	-	.03	-	-
F	<i>Lactuca serriola</i> (a)	-	20	17	3	12	20	.04	.01	.11	1.11
F	<i>Linaria dalmatica</i>	-	-	ab <sup>52</sup>	a <sup>41</sup>	b <sup>71</sup>	b <sup>95</sup>	.85	1.37	2.01	2.42
F	<i>Lithospermum ruderales</i>	1	3	6	6	8	5	.44	.18	.53	.24
F	<i>Lupinus argenteus</i>	8	1	2	-	1	4	.15	.16	.06	.18
F	<i>Machaeranthera canescens</i>	2	5	1	-	6	4	.00	.03	.01	.03
F	<i>Melilotus officinalis</i>	-	-	9	-	-	8	.04	-	-	.33
F	<i>Microsteris gracilis</i> (a)	-	-	-	4	8	-	-	.01	.02	-
F	<i>Oenothera</i> sp.	a <sup>4</sup>	b <sup>10</sup>	a <sup>3</sup>	a-	a <sup>1</sup>	ab <sup>7</sup>	.00	-	.03	.15
F	<i>Phlox longifolia</i>	a <sup>26</sup>	a <sup>15</sup>	b <sup>109</sup>	b <sup>123</sup>	b <sup>115</sup>	b <sup>82</sup>	2.21	2.59	1.79	.65
F	<i>Polygonum douglasii</i> (a)	-	-	-	-	-	3	-	-	-	.00
F	<i>Ranunculus testiculatus</i> (a)	-	-	a <sup>12</sup>	a <sup>30</sup>	b <sup>125</sup>	a <sup>24</sup>	.06	.13	1.33	.05
F	<i>Solidago</i> sp.	3	-	-	-	-	-	-	-	-	-
F	<i>Tragopogon dubius</i> (a)	a-	b <sup>10</sup>	c <sup>61</sup>	d <sup>92</sup>	e <sup>141</sup>	de <sup>105</sup>	.39	1.08	1.78	1.97
F	<i>Veronica biloba</i> (a)	-	-	-	-	-	2	-	-	-	.00
Total for Annual Forbs		0	31	206	319	601	392	0.89	2.22	5.86	4.43
Total for Perennial Forbs		195	88	495	363	372	510	9.12	7.82	9.12	11.37
Total for Forbs		195	119	701	682	973	902	10.02	10.05	14.98	15.80

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

BROWSE TRENDS--

Management unit 17, Study no: 5

T y p e	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	<i>Acer grandidentatum</i>	0	1	0	0	-	-	-	-
B	<i>Amelanchier alnifolia</i>	2	3	3	2	-	.53	.15	.15
B	<i>Artemisia tridentata vaseyana</i>	78	82	74	62	20.79	23.60	14.10	12.31
B	<i>Chrysothamnus nauseosus albicaulis</i>	18	16	13	16	.90	.58	.96	1.09
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	39	31	33	27	3.54	1.55	1.34	2.61
B	<i>Crataegus douglasii</i>	0	1	0	0	-	-	-	-
B	<i>Gutierrezia sarothrae</i>	26	40	15	17	.32	1.21	.42	.89
B	<i>Mahonia repens</i>	0	10	0	0	-	.36	-	-
B	<i>Prunus virginiana</i>	3	11	4	3	.36	.63	.91	1.00
B	<i>Purshia tridentata</i>	2	1	1	2	.15	-	.03	.38
B	<i>Quercus gambelii</i>	0	0	1	0	-	-	-	-
B	<i>Rosa woodsii</i>	0	2	0	0	-	-	-	-
B	<i>Symphoricarpos oreophilus</i>	19	17	11	14	3.25	3.36	1.25	3.23
Total for Browse		187	215	155	143	29.33	31.84	19.17	21.68

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 5

Species	Percent Cover		
	'02	'07	'12
<i>Amelanchier alnifolia</i>	.20	.96	1.11
<i>Artemisia tridentata vaseyana</i>	24.79	15.64	12.25
<i>Chrysothamnus nauseosus albicaulis</i>	1.31	1.54	1.98
<i>Chrysothamnus viscidiflorus viscidiflorus</i>	1.50	2.91	3.18
<i>Gutierrezia sarothrae</i>	2.54	.25	.66
<i>Mahonia repens</i>	.63	-	-
<i>Prunus virginiana</i>	.93	.61	1.33
<i>Symphoricarpos oreophilus</i>	4.93	1.66	4.08

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 5

Species	Average leader growth (in)		
	'02	'07	'12
<i>Artemisia tridentata vaseyana</i>	3.4	1.4	1.6

**BASIC COVER--**

Management unit 17, Study no: 5

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	4.25	9.25	56.32	46.84	51.81	44.53
Rock	1.25	1.75	5.36	3.31	3.42	7.60
Pavement	5.50	15.25	5.72	6.73	5.44	11.27
Litter	82.75	68.50	57.25	45.51	46.59	46.19
Cryptogams	.25	0	0	0	0	0
Bare Ground	6.00	5.25	6.69	17.03	9.81	10.84

**PELLET GROUP DATA--**

Management unit 17, Study no: 5

Type	Quadrat Frequency			
	'96	'02	'07	'12
Rabbit	-	-	2	-
Elk	1	3	-	-
Deer	15	11	5	-

Days use per acre (ha)		
'02	'07	'12
-	-	-
6 (15)	17 (41)	-
32 (79)	30 (74)	7 (18)

**BROWSE CHARACTERISTICS--**

Management unit 17, Study no: 5

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	%	%	%	Seedling (plants/acre)	%	%	% poor vigor	Average Height Crown (in)	
		Young	Mature	Decadent		moderate	heavy			
<b>Acer grandidentatum</b>										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
96	<b>0</b>	0	0	-	-	0	0	0	-/-	
02	<b>40</b>	0	100	-	-	0	0	0	15/6	
07	<b>0</b>	0	0	-	-	0	0	0	-/-	
12	<b>0</b>	0	0	-	-	0	0	0	-/-	
<b>Amelanchier alnifolia</b>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>66</b>	0	0	100	-	0	100	100	-/-	
96	<b>40</b>	0	50	50	-	0	100	50	25/26	
02	<b>60</b>	0	67	33	-	0	33	0	52/46	
07	<b>60</b>	0	33	67	-	33	67	33	33/34	
12	<b>40</b>	0	100	0	-	50	0	0	53/57	
<b>Artemisia tridentata vaseyana</b>										
83	<b>2531</b>	5	71	24	-	32	18	53	23/33	
89	<b>1198</b>	17	72	11	20999	0	0	0	27/41	
96	<b>4120</b>	38	54	8	2020	18	2	14	24/39	
02	<b>5320</b>	15	70	15	-	17	2	5	24/28	
07	<b>2800</b>	4	63	34	-	27	16	11	29/39	
12	<b>2940</b>	30	45	25	3280	11	0	18	26/36	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Chrysothamnus nauseosus albicaulis</b>										
83	0	0	0	0	-	0	0	0	-/-	
89	66	0	100	0	-	0	0	0	21/27	
96	580	14	69	17	-	3	21	24	23/26	
02	520	0	69	31	-	0	0	23	17/20	
07	320	0	56	44	-	0	0	19	26/26	
12	460	9	70	22	-	0	0	9	27/34	
<b>Chrysothamnus viscidiflorus viscidiflorus</b>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
96	2060	14	86	0	120	11	0	0	12/21	
02	1760	0	98	2	-	0	0	1	12/17	
07	1300	9	80	11	-	0	0	8	12/20	
12	1080	0	93	7	-	0	0	31	14/24	
<b>Crataegus douglasii</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	-/-	
02	40	0	100	-	-	0	100	0	28/40	
07	0	0	0	-	-	0	0	0	31/33	
12	0	0	0	-	-	0	0	0	-/-	
<b>Gutierrezia sarothrae</b>										
83	0	0	0	0	-	0	0	0	-/-	
89	66	0	100	0	133	0	0	0	19/20	
96	1140	30	67	4	600	2	2	5	6/9	
02	2940	3	90	7	-	0	0	3	10/13	
07	600	7	93	0	20	0	0	0	10/9	
12	1420	76	24	0	80	0	0	4	12/15	
<b>Mahonia repens</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	-/-	
02	5180	0	100	-	-	0	0	0	4/5	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<b>Prunus virginiana</b>										
83	0	0	0	0	-	0	0	0	-/-	
89	266	100	0	0	-	0	0	0	-/-	
96	320	88	13	0	420	13	0	0	46/23	
02	680	3	94	3	-	12	68	0	11/8	
07	700	100	0	0	-	0	0	0	-/-	
12	280	14	86	0	-	7	0	0	29/31	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Purshia tridentata</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	100	20	80	-	20	80	0	0	14/42	
02	20	0	100	-	-	100	0	0	19/33	
07	20	0	100	-	-	0	100	0	12/42	
12	40	0	100	-	-	100	0	0	20/65	
<b>Quercus gambelii</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	37/27	
07	20	0	100	-	-	0	0	100	19/32	
12	0	0	0	-	-	0	0	0	22/16	
<b>Ribes aureum</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	43/39	
<b>Rosa woodsii</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	-/-	
02	40	100	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<b>Symphoricarpos oreophilus</b>										
83	0	0	0	0	-	0	0	0	-/-	
89	66	0	0	100	-	100	0	0	-/-	
96	540	11	89	0	-	7	11	0	25/33	
02	480	4	79	17	-	8	8	0	25/31	
07	300	7	80	13	-	27	7	7	19/32	
12	420	0	90	10	-	19	0	57	25/35	

LOWER BIG HOLLOW - TREND STUDY NO. 17-9-12

Vegetation Type: Gamble Oak and Mountain Big Sagebrush

Range Type: Crucial Deer Winter/Spring, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: DWR

Elevation: 6,200 ft (1,890 m)

Aspect: Southwest

Slope: 30-35%

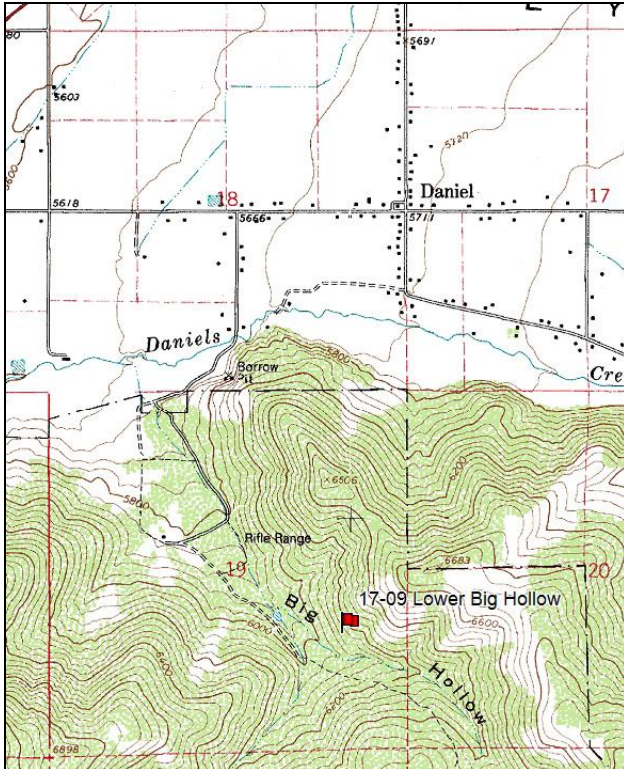
Transect bearing: 346° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (71ft), line 3 (59ft), line 4 (34ft). Rebar: belt 5 on 3ft.

Directions:

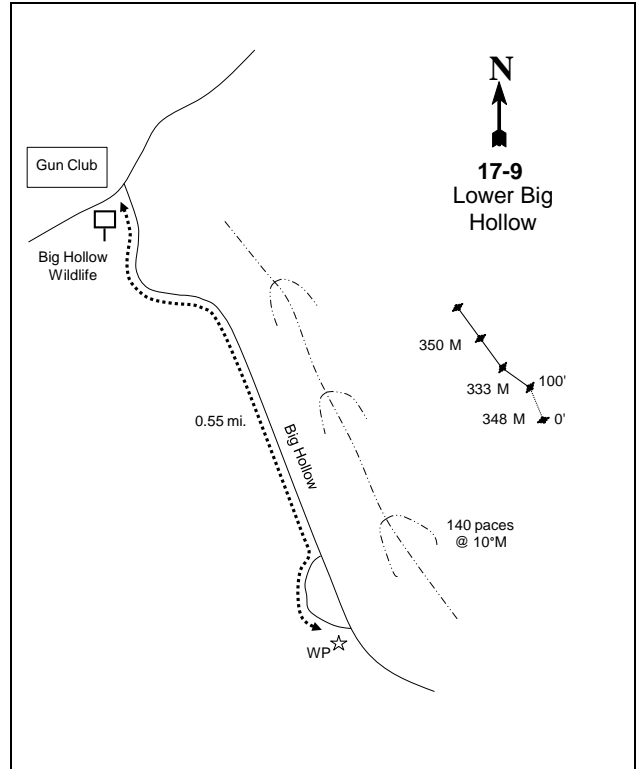
Beginning at the gun club parking lot at the mouth of Big Hollow, proceed east 0.10 miles to the road which runs up Big Hollow. Turn right and proceed up Big Hollow for 0.55 miles to a turnoff to the south and a green steel "T" fencepost. From the fencepost, the 0-foot baseline stake is located 140 paces away across Big Hollow, at an azimuth of 10 degrees magnetic. A red browse tag, number 67, is attached to the 0-foot stake of the frequency baseline.

Map Name: Charleston



Township: 4S Range: 5E Section: 19

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 464569 E 4478191 N



## LOWER BIG HOLLOW - TREND STUDY NO. 17-9

### Site Information

Site Description: This study is located on Division of Wildlife Resources (DWR) property approximately 0.5 miles above the mouth of Big Hollow, which samples a mountain brush community with a rather sparse native understory. There is an ephemeral stream 200 feet to the west. The majority of Big Hollow, at least the portion south of the stream, was consumed by an extremely hot fire in 1976 and was seeded the following fall with perennial grasses and forbs. In management terms the area is likely significant as fawn-rearing habitat for deer and spring-fall range for elk. During 1983, at least two yearling bucks and several doe with fawns were observed in the vicinity. In 1996, several deer and a deer carcass were observed on the study. Cattle were observed in the clearing below the study, and several deer skeletons were found on and around the study in 2007. Deer pellet groups have been sampled in moderate abundance since 2002. Elk pellet groups have been sampled in low abundance since 2002. Moose pellet groups were seen on the site, but not sampled (Table - Pellet Group Data).

Browse: Although all sagebrush plants were classified as mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), some plants had characteristics of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). Mountain big sagebrush has maintained a mature population since 1996, but was mostly decadent in 1989. Decadence has been moderate to low since 1996, and poor vigor has been low since 1996. In 1989, both measurements were high. During early readings, utilization was moderate, but later samplings have been light in utilization. Recruitment of young sagebrush has been poor for the duration of the study. Gambel oak (*Quercus gambelii*) is the second most abundant browse species. A small population of mature Saskatoon serviceberry (*Amelanchier alnifolia*) is found on the study. Decadence and poor vigor has been very low during study readings; however in 2002, decadence and poor vigor were high and moderate, respectively. Serviceberry utilization has been heavily moderate since 1996. Young serviceberry recruitment was high through 1989 to 2002, but has since become negligible. The antelope bitterbrush (*Purshia tridentata*) population is present in low densities. Bitterbrush decadence was high in 2002, but generally low within the population. Poor vigor has also been very low within the bitterbrush population. The bitterbrush population receives periodic heavy use. Young bitterbrush recruitment has been minimal over the study years. No oak were sampled in 1983 or 1989. However, after the sample area increased in 1996, the estimated density had increased. Decadent oak plants and plants with poor vigor have been low in all sample years. Oak utilization has been light. The oak clones provide some escape and cover for wildlife during the summer and fall. Other shrub species present are numbers of broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia* sp.).

Herbaceous Understory: The herbaceous understory has fairly high diversity, but desirable species are limited. The dominant perennial species include bluebunch wheatgrass (*Agropyron spicatum*), intermediate wheatgrass (*A. intermedium*), smooth brome (*Bromus inermis*), and Sandberg bluegrass (*Poa secunda*). The weedy perennial species bulbous bluegrass (*Poa bulbosa*) has been increasing in frequency and cover since it was sampled in 1996. The weedy annual species cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicus*) were sampled beginning in 1996. Cheatgrass has become the most frequently occurring grass on the study site. Forbs make up a small component of the understory. The dominant species have been pale alyssum (*Alyssum alyssoides*) and arrowleaf balsamroot (*Balsamorhiza sagittata*).

Soil: The soil is in the Wallsburg-Rock outcrop complex, and is part of the Wallsburg component, which is found on mountainsides. The parent material consists of colluvium over residuum weathered from sedimentary rock (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH of 7.1) (Table - Soil Analysis Data). Bare ground cover is low, with a high amount of litter and vegetation cover providing protective ground cover (Table - Basic Cover). The soil surface and profile has an abundance of large rocks and cobbles. The erosion condition was classified as slight in 2002 and 2007, but stable in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly down (-1):** The density of mountain big sagebrush increased 21% from 1,599 plants/acre to 1,931 plants/acre. Decadence within the sagebrush population increased from 21 % to 76% of the population. Poor vigor increased from 4% to 28% of the sagebrush population. Recruitment of young sagebrush increased from 8% to 10% of the population. The density of antelope bitterbrush increased two-fold from 66 plants/acre to 133 plants/acre. Decadence and poor vigor did not contribute to the population.
- **1989 to 1996 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Both decadence and poor vigor for sagebrush decreased significantly to 18% and 1%, respectively. Recruitment of young sagebrush increased from 10% to 22% of the population. The antelope bitterbrush population increased in decadence to 14%.
- **1996 to 2002 - slightly up (+1):** The density of mountain big sagebrush increased 25% from 1,540 plants/acre to 1,920 plants/acre. Health of the sagebrush population decreased with decadence increasing to 24%, and poor vigor increasing to 10%. Recruitment of young sagebrush decreased to 3% of the population.
- **2002 to 2007 - slightly down (-1):** The density of mountain big sagebrush decreased 22% to 1,500 plants/acre. Health of the sagebrush population was mixed. Decadence of sagebrush decreased to 16%, while poor vigor increased to 13%. Recruitment of young sagebrush decreased to 0% of the population. The density of Gamble oak decreased 33% from 2,840 plants/acre to 1,900 plants/acre. Decadence and poor vigor within the oak population remained low.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush decreased 9% to 1,360 plants/acre. The health of the sagebrush population was mixed with decadence remaining the same, while poor vigor decreased to 3%. Recruitment of young sagebrush remained similar at 4%. The density of Gamble oak increased 21% to 2,300 plants/acre. Decadence and poor vigor remained insignificant within the oak population.

### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies of perennial grasses increased nearly four-fold. Sandberg bluegrass increased significantly in nested frequency.
- **1989 to 1996 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased by 58%. Bluebunch wheatgrass increased significantly in nested frequency. The weedy annual species cheatgrass was measured for the first time with a measured cover of near 14%.
- **1996 to 2002 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased by 15%. No significant changes were measured within the perennial community. Bulbous bluegrass was measured for the first time in 1996. The annual species cheatgrass decreased significantly in nested frequency, and decreased in cover to 7%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. No significant changes were measured within the perennial community. However, the annual cheatgrass increased significantly in nested frequency, and increased in cover to 17%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 18%. The increase in the sum of nested frequencies is not due to any one specific species, and is likely due to small, accumulative increases in nested frequency across the perennial grass community. The weedy annual species cheatgrass decreased significantly in nested frequency, and decreased in cover to 4%.

Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial forbs increased by 65%. Hoary aster (*Machaeranthera canescens*) increased significantly in nested frequency.
- **1989 to 1996 - slightly up (+1):** The sum of nested frequencies for perennial forbs increased by 25%. Lobeleaf groundsel (*Senecio multilobatus*) decreased significantly in nested frequency.
- **1996 to 2002 - down (-2):** The sum of nested frequencies for perennial forbs decreased by 68%. Hoary aster and daisy fleabane (*Erigeron* sp.) decreased significantly in nested frequency.
- **2002 to 2007 - stable (0):** The sum of nested frequencies for perennial forbs increased by 24%. The increase in the sum of nested frequency is not due to any one specific species, and is likely due to small, accumulative increases in nested frequency for the perennial forb community.
- **2007 to 2012 - up (+2):** The sum of nested frequency for perennial forbs increased over two-fold. Daisy fleabane increased significantly in nested frequency.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, 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
96	27.0	11.7	9.3	11.6	-10.1	4.4	0.0	<b>53.8</b>	Fair
02	27.0	9.1	6.9	13.1	-5.5	3.5	0.0	<b>54.1</b>	Fair
07	18.3	11.6	1.5	13.1	-12.6	3.9	0.0	<b>35.7</b>	Very Poor-Poor
12	25.6	12.0	7.9	17.1	-2.8	6.8	0.0	<b>66.5</b>	Fair-Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 9

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	Agropyron intermedium	-	-	16	12	10	11	.81	.76	.54	1.00
G	Agropyron spicatum	a8	a15	b64	b51	b52	b77	3.34	3.95	4.01	5.84
G	Bromus inermis	a-	a2	a3	a6	b16	ab13	.15	.33	1.08	.83
G	Bromus japonicus (a)	-	-	2	8	6	4	.00	.16	.01	.01
G	Bromus tectorum (a)	-	-	b298	a240	b311	a198	13.48	7.15	16.84	3.74
G	Dactylis glomerata	-	3	1	-	1	1	.00	-	.00	.03
G	Poa bulbosa	a-	a-	a1	ab7	bc21	c33	.03	.53	.49	.90
G	Poa fendleriana	1	8	9	5	2	2	.56	.18	.03	.03
G	Poa pratensis	6	19	24	-	-	-	.28	-	-	-
G	Poa secunda	a10	b48	ab32	b50	b46	b46	.62	1.14	.89	.80
G	Sitanion hystrix	-	-	1	3	-	-	.03	.15	-	-
Total for Annual Grasses		0	0	300	248	317	202	13.49	7.31	16.85	3.75
Total for Perennial Grasses		25	95	151	134	148	183	5.84	7.06	7.06	9.44
Total for Grasses		25	95	451	382	465	385	19.33	14.38	23.92	13.19
F	Agoseris glauca	-	1	-	-	1	5	-	-	.03	.01
F	Alyssum alyssoides (a)	-	-	b163	a102	a74	b157	1.13	.82	.18	.56
F	Arabis sp.	b28	ab17	ab18	a-	a-	a3	.03	-	-	.03
F	Aster sp.	-	7	7	6	-	11	.03	.03	-	.56

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	Astragalus sp.	-	2	-	-	-	1	-	-	-	.03
F	Balsamorhiza sagittata	-	7	5	9	2	13	.68	1.14	1.11	1.86
F	Calochortus nuttallii	-	3	-	2	-	-	-	.00	-	-
F	Camelina microcarpa (a)	-	-	-	4	1	3	-	.08	.00	.00
F	Castilleja chromosa	3	2	-	-	3	-	-	-	.03	-
F	Chaenactis douglasii	-	-	4	-	-	-	.06	-	-	-
F	Cirsium sp.	-	-	6	-	-	-	.23	-	-	-
F	Collinsia parviflora (a)	-	-	-	3	-	1	-	.00	-	.00
F	Collomia linearis (a)	a <sup>5</sup>	a <sup>-</sup>	a <sup>2</sup>	b <sup>29</sup>	a <sup>7</sup>	a <sup>6</sup>	.03	.06	.01	.01
F	Comandra pallida	-	-	6	3	1	3	.01	.00	.00	.03
F	Crepis acuminata	-	-	-	11	-	13	-	.30	-	.10
F	Descurainia sp. (a)	-	-	3	-	3	7	.00	-	.01	.05
F	Epilobium brachycarpum (a)	-	-	2	-	-	-	.00	-	-	-
F	Erigeron sp.	a <sup>-</sup>	a <sup>-</sup>	b <sup>25</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>23</sup>	.42	-	-	.28
F	Galium sp.	-	-	-	3	6	-	-	.15	.15	-
F	Grindelia squarrosa	-	-	3	-	-	-	.00	-	-	-
F	Hackelia patens	a <sup>9</sup>	ab <sup>26</sup>	b <sup>37</sup>	a <sup>9</sup>	ab <sup>26</sup>	ab <sup>26</sup>	.38	.09	.56	.24
F	Holosteum umbellatum (a)	-	-	-	11	9	3	-	.06	.05	.00
F	Ipomopsis aggregata	-	6	3	-	3	3	.00	-	.00	.03
F	Lactuca serriola (a)	-	7	1	-	-	4	.01	-	-	.01
F	Lappula occidentalis (a)	-	-	-	4	-	7	-	.03	-	.01
F	Machaeranthera canescens	a <sup>-</sup>	b <sup>16</sup>	b <sup>20</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>2</sup>	.22	-	-	.03
F	Microsteris gracilis (a)	-	-	a <sup>-</sup>	b <sup>26</sup>	a <sup>-</sup>	a <sup>4</sup>	-	.27	-	.01
F	Orobanche sp.	-	-	-	-	9	16	-	-	.04	.14
F	Orthocarpus tolmiei (a)	-	-	3	12	-	3	.03	.02	-	.00
F	Phlox longifolia	-	-	-	-	5	-	-	-	.01	-
F	Polygonum douglasii (a)	-	-	2	-	-	-	.00	-	-	-
F	Senecio multilobatus	b <sup>25</sup>	b <sup>25</sup>	a <sup>3</sup>	a <sup>2</sup>	a <sup>-</sup>	a <sup>4</sup>	.07	.00	-	.03
F	Sisymbrium altissimum (a)	-	-	-	-	-	1	-	-	-	.00
F	Solidago sparsiflora	3	-	-	-	-	-	-	-	-	-
F	Tragopogon dubius (a)	ab <sup>7</sup>	ab <sup>10</sup>	b <sup>19</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>3</sup>	.17	-	-	.03
F	Viguiera multiflora	-	-	3	-	-	-	.01	-	-	-
Total for Annual Forbs		12	17	195	191	94	199	1.39	1.36	0.26	0.71
Total for Perennial Forbs		68	112	140	45	56	123	2.19	1.74	1.94	3.39
Total for Forbs		80	129	335	236	150	322	3.59	3.10	2.21	4.10

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

BROWSE TRENDS--

Management unit 17, Study no: 9

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	Amelanchier alnifolia	4	5	2	1	1.93	2.29	.00	-
B	Artemisia tridentata vaseyana	49	59	52	51	11.55	12.98	10.48	13.79
B	Cowania mexicana stansburiana	0	0	1	0	-	-	-	-
B	Gutierrezia sarothrae	5	0	0	1	.06	-	-	.38
B	Opuntia sp.	1	0	0	1	.18	.03	.03	.03
B	Purshia tridentata	7	6	5	5	1.82	.68	-	.38
B	Quercus gambelii	6	6	0	2	6.91	6.28	5.18	7.77
B	Rhus trilobata	24	30	25	28	-	-	-	-
B	Symphoricarpos oreophilus	4	7	8	15	.06	.56	.21	1.21
Total for Browse		100	113	93	104	22.52	22.85	15.91	23.56

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 9

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	.86	-	.08
Artemisia tridentata vaseyana	16.50	15.44	20.95
Cowania mexicana stansburiana	-	1.14	-
Gutierrezia sarothrae	-	-	.25
Opuntia sp.	.18	.11	.06
Purshia tridentata	1.73	-	1.60
Quercus gambelii	8.56	6.33	10.75
Symphoricarpos oreophilus	.20	.46	.76

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 9

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.9	2.1	1.6

BASIC COVER--

Management unit 17, Study no: 9

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	.50	5.50	43.07	38.29	44.39	42.18
Rock	7.75	13.75	10.48	13.89	11.75	16.98
Pavement	1.75	9.50	2.45	5.50	3.29	4.55
Litter	79.00	65.00	58.93	54.93	47.44	42.14
Cryptogams	1.50	.75	.15	.56	.07	.06
Bare Ground	9.50	5.50	3.63	12.10	6.88	10.54

PELLET GROUP DATA--

Management unit 17, Study no: 9

Type	Quadrat Frequency			
	'96	'02	'07	'12
Rabbit	3	-	3	-
Elk	3	2	2	1
Deer	8	8	8	7

Days use per acre (ha)		
'02	'07	'12
-	-	-
4 (10)	2 (5)	3 (7)
38 (94)	30 (73)	27 (68)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 9

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>266</b>	100	0	0	-	0	0	0	-/-
96	<b>120</b>	33	67	0	-	17	0	0	47/73
02	<b>400</b>	65	20	15	-	65	15	45	29/24
07	<b>40</b>	0	100	0	-	100	0	0	36/55
12	<b>20</b>	0	100	0	-	0	0	0	28/30
<i>Artemisia tridentata vaseyana</i>									
83	<b>1599</b>	8	71	21	-	25	0	4	31/46
89	<b>1931</b>	10	14	76	-	66	0	28	28/30
96	<b>1540</b>	22	60	18	140	22	0	1	26/50
02	<b>1920</b>	3	73	24	-	15	1	10	28/43
07	<b>1500</b>	0	84	16	-	29	5	13	32/46
12	<b>1360</b>	4	81	15	80	13	1	3	35/52
<i>Cercocarpus montanus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>66</b>	0	100	-	-	100	0	0	45/39
96	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	69/82
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	71/56
<i>Cowania mexicana stansburiana</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
96	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>20</b>	0	100	-	-	0	100	0	98/108
12	<b>0</b>	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
83	199	0	100	-	-	0	0	0	13/6	
89	1666	0	100	-	-	0	0	0	11/12	
96	360	17	83	-	40	0	0	0	12/16	
02	0	0	0	-	-	0	0	0	9/10	
07	0	0	0	-	-	0	0	0	13/18	
12	20	0	100	-	-	0	0	0	14/19	
<i>Mahonia repens</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	20	0	100	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	2/5	
<i>Opuntia sp.</i>										
83	933	0	100	0	-	0	0	0	6/8	
89	1198	50	50	0	-	0	0	0	6/14	
96	200	0	100	0	-	0	0	0	5/14	
02	160	0	50	50	-	0	0	38	4/11	
07	100	0	100	0	-	0	0	0	5/10	
12	140	0	100	0	-	0	0	0	6/12	
<i>Purshia tridentata</i>										
83	66	0	100	0	-	0	0	0	16/24	
89	133	0	100	0	-	100	0	0	12/18	
96	140	0	86	14	-	71	29	0	27/75	
02	120	0	50	50	-	0	83	17	26/66	
07	0	0	0	0	-	0	0	0	24/65	
12	40	50	50	0	-	0	0	0	32/53	
<i>Quercus gambelii</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
96	1200	17	82	2	-	2	0	2	36/35	
02	2840	15	82	2	-	8	0	1	32/19	
07	1900	9	85	5	40	3	0	0	35/20	
12	2300	35	63	3	100	20	0	0	38/29	
<i>Symphoricarpos oreophilus</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
96	100	20	80	0	-	0	0	0	19/29	
02	160	0	100	0	-	0	13	0	25/29	
07	160	0	88	13	-	0	0	13	21/30	
12	480	0	88	13	-	4	0	17	26/27	

WALLSBURG TURN - TREND STUDY NO. 17-11-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: DWR

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

Aspect: West

Slope: 25%

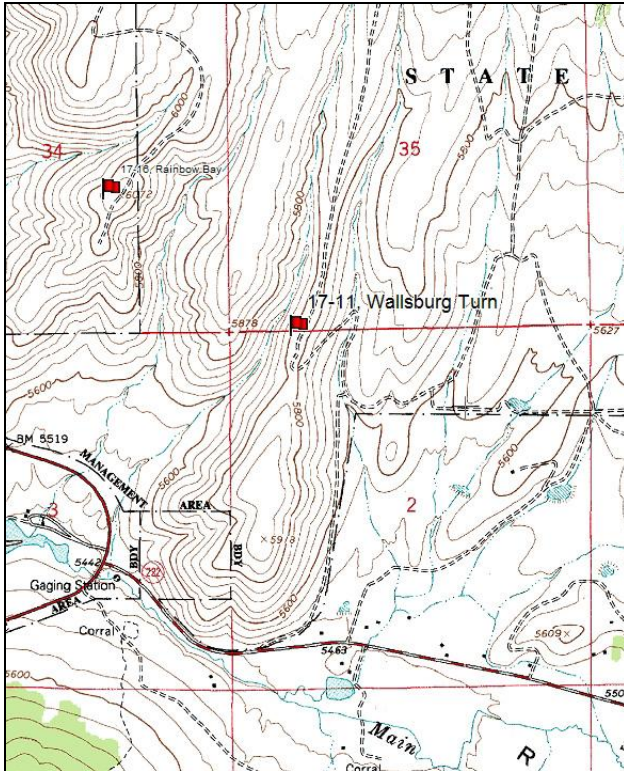
Transect bearing: 338° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 5 on 1ft., belt 4 on 2ft.

Directions:

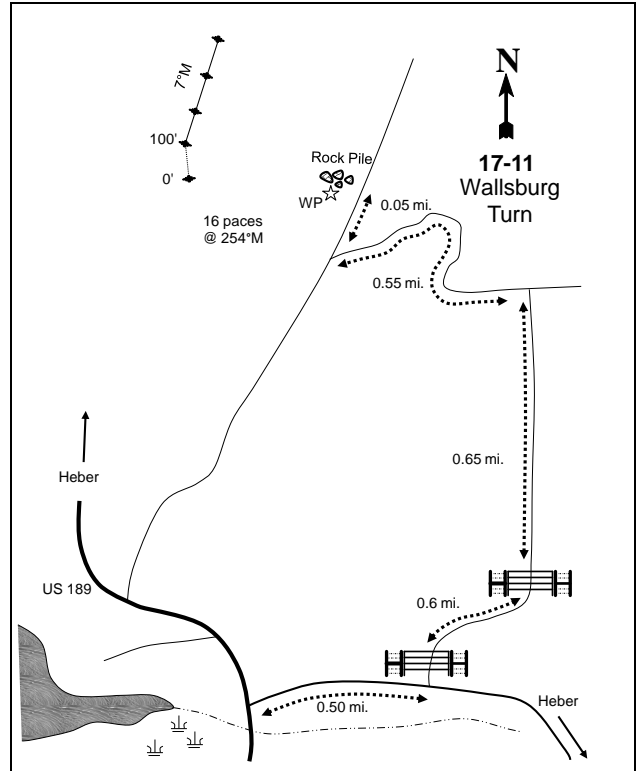
Beginning at the intersection of U.S. 189 and the Wallsburg turnoff, proceed 0.50 miles towards Wallsburg to an intersection. Turn left at the intersection and proceed northerly for 0.8 miles passing through two DWR gates. Continue on this road for 0.65 miles to an intersection. Take a left at the intersection and go 0.55 miles to another intersection. Go right for 0.05 miles to a small rock pile on the left (east) side of the road. From the rock monument, walk 16 paces at an azimuth of 264 degrees magnetic to the 0-foot baseline stake. The frequency baseline is marked by green steel "T" fenceposts approximately 12 to 18 inches in height.

Map Name: Charleston



Township: 5S Range: 4E Section: 2

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 460271 E 4474422 N



## WALLSBURG TURN - TREND STUDY NO. 17-11

### Site Information

Site Description: This study is on crucial deer winter range located Utah Division of Wildlife Resources property approximately 0.75 miles northeast of the junction of highways US-189 and SR-222. In August 1976, an exceptionally hot wildfire burned virtually all the vegetation. A seeding effort conducted immediately after the fire appears to have been successful, which resulted in increased grass cover and resurgent mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) population that is moderately dense. Deer pellet groups were sampled in high abundance since 2002. Elk pellet groups were sampled in low abundance in 2002 and 2012, but in moderate abundance in 2007. Cattle pats were sampled in low abundance in 2007 and 2012 (Table - Pellet Group Data).

Browse: Mountain big sagebrush has a moderately dense, mature population. The sagebrush population has had mostly moderate utilization throughout the duration of the study. Decadence within the sagebrush population has been moderate to high since 2002. Poor vigor for sagebrush has steadily increased and was at its highest in 2012. Recruitment of young sagebrush has steadily decreased since 1989 and recruitment was at its lowest in 2007. Sagebrush plant size has not changed over the course of the study. Broom snakeweed (*Gutierrezia sarothrae*) and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) are also present, but have had widely varying densities. The density of snakeweed and rabbitbrush has fluctuated from sparse to dense populations. Antelope bitterbrush (*Purshia tridentata*) was sampled as having a sparse population in 1983 and 1989; however, bitterbrush plants have not been sampled in density methods since 1996, but have been captured in height and crown measurements (Table- Browse Characteristics). The remaining bitterbrush plants have been heavily hedged.

Herbaceous Understory: The herbaceous understory dominates the vegetative component. Crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), and Sandberg bluegrass (*Poa secunda*) are the most abundant perennial grass species. The weedy perennial grass species bulbous bluegrass (*P. bulbosa*) was first sampled in 2007 at low frequency. Cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicus*) are present, but in lower frequencies than the perennial species (Table - Herbaceous Trends). There has been a moderately diverse community of forbs, including seeded species. The dominant perennial forb species is alfalfa (*Medicago sativa*). The dominant annual forb was blue-eyed Mary (*Collinsia parviflora*). Bur buttercup (*Ranunculus testiculatus*) pale alyssum (*Alyssum alyssoides*), and (*Holosteum umbellatum*) are the most common of the annual forbs (Table - Herbaceous Trends).

Soil: The soil is in the Henefer-Bradshaw association, and is part of the Henefer component, which is found on mountainsides. The parent material consists of colluvium derived from sedimentary rock (Soil Survey Staff 2011). The soil texture is a silty clay loam with a slightly alkaline soil reaction (pH 7.6) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of vegetation and litter cover, which provides ample protective ground cover (Table - Basic Cover). Pedestalling at the base of sagebrush and bunchgrass stems is abundant and provides the most evidence of past erosion. The erosion condition was classified as stable in 2002 and 2007, but was classified as moderate in 2012.

### Trend Assessments

Browse:

- **1983 to 1989 - slightly up (+1):** The density of mountain big sagebrush increased 12% from 1,366 plants/acre to 1,532 plants/acre. The health of the sagebrush population remained healthy with no decadence and poor vigor being observed. Recruitment of young sagebrush increased from 17% to 30% of the population. A measurably small population of antelope bitterbrush increased in density 29% from 566 plants/acre to 732 plants/acre. Decadence and poor vigor was not observed within the bitterbrush population. Recruitment of young bitterbrush increased from 0% to 14% of the population.

The bitterbrush population received mostly moderate use in 1983, but use was measured as moderate in 1989.

- **1989 to 1996 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. The health of the mountain big sagebrush population remained similar with minimal change in decadence and poor vigor. Recruitment of young sagebrush decreased to 8% of the population. Sagebrush plant size in height and crown increased respectively from 18in. by 19in. to 20in. by 36in. In 1996, the antelope bitterbrush population was no longer measureable using density capturing methods. However, bitterbrush plant size in height and crown increased respectively from 15in. by 32in. to 18in. by 69in.
- **1996 to 2002 - slightly down (-1):** The density of mountain big sagebrush decreased 7% from 2,320 plants/acre to 2,160 plants/acre. The health of the sagebrush population decreased with decadence increasing from 1% to 26%, and poor vigor increasing from 4% to 14%. Recruitment of young sagebrush to the population decreased to 2%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 18% to 1,780 plants/acre. Health of the sagebrush population became increasingly poor. Decadence increased to 53% of the sagebrush population, and poor vigor remained similar at 11%. Recruitment of young sagebrush to the population was not measurable.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush remained similar at 1,700 plants/acre. Health of the sagebrush population remained poor. Decadence decreased to 24% of the population while poor vigor increased to 29% of the sagebrush population. Recruitment on young sagebrush increased to 6% of the population.

#### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial grasses increased 74%. The perennial grass species Sandberg bluegrass had a significant increase in nested frequency with a similar cover of 2%. However, bluebunch wheatgrass had a significant decrease in nested frequency.
- **1989 to 1996 - down (-2):** The sum of nested frequencies for perennial grasses decreased 22%. Sandberg wheatgrass had a significant decrease in nested frequency. The weedy annual species cheatgrass was measured for the first time, but was a minor component of the understory.
- **1996 to 2002 - stable (0):** The sum of nested frequencies for perennial grasses remained similar. Intermediate wheatgrass had a significant increase in nested frequency. Additionally, crested wheatgrass and intermediate wheatgrass both increased in cover from 9% to 11% and 5% to 8%, respectively.
- **2002 to 2007 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. Sandberg bluegrass had a significant increase in nested frequency, and increased in cover from 2% to 5%. The weedy annual cheatgrass increased significantly in nested frequency, and increased in cover from under 1% to 3% becoming one of the major components of the understory.
- **2007 to 2012 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. Cheatgrass had a significant decrease in nested frequency and decreased in cover to less than 1%.

#### Forb:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequencies for perennial forbs increased over two-fold. However, perennial forbs are rare on the site. The annual species annual sunflower (*helianthus annuus*) increased significantly in nested frequency.
- **1989 to 1996 - up (+2):** The sum of nested frequencies for perennial forbs increased over two-fold. Perennial forbs are rare on the site, but the perennial forb community has increased in diversity. Alfalfa is the most dominant forb on the site with a cover of 11%. Annual forbs were measured for the first time with pale alyssum, blue-eyed Mary, slenderleaf collomia (*Collomia linearis*), and jagged chickweed (*Holosteum umbellatum*) are the most frequent annual species.

- **1996 to 2002 -down (-2):** The sum of nested frequencies for perennial forbs decreased 25%. Cover for alfalfa decreased to 9%. Spreading fleabane (*Erigeron divergens*) had a significant decrease in nested frequency, while wild onion (*Allium* sp.) had a significant increase nested frequency. The annual species blue-eyed Mary had a significant increase in nested frequency.
- **2002 to 2007 - down (-2):** The sum of nested frequencies for perennial forbs decreased 31%. Alfalfa decreased in cover to 4%.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies for perennial forbs decreased 18%. The decrease in the sum of nested frequency is not due to any one specific species, and is likely due to small, accumulative decreases in nested frequency for the perennial forb community. The perennial for alfalfa decreased in cover to 3%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 11

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	12.7	14.7	4.0	30.0	-0.4	10.0	0.0	<b>71.0</b>	Good
02	15.8	7.2	1.0	30.0	-0.5	10.0	0.0	<b>63.5</b>	Fair-Good
07	16.1	-0.9	0.0	30.0	-2.5	9.8	0.0	<b>52.5</b>	Fair
12	17.6	7.8	3.0	30.0	-0.3	7.1	0.0	<b>65.3</b>	Fair-Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 11

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	Agropyron cristatum	a169	ab195	b220	ab196	ab200	b221	8.60	11.37	8.46	17.09
G	Agropyron intermedium	a84	ab260	bc138	d191	cd158	cd159	4.97	7.65	6.93	4.90
G	Agropyron spicatum	b53	a-	a7	a3	a16	a5	.53	.38	.54	.18
G	Bromus japonicus (a)	-	-	-	3	10	2	-	.01	.07	.00
G	Bromus tectorum (a)	-	-	a28	a36	b156	a38	.57	.62	3.26	.34
G	Festuca ovina	3	-	-	-	-	-	-	-	-	-
G	Poa bulbosa	-	-	-	-	5	7	-	-	.01	.09
G	Poa secunda	a54	c178	b126	b127	c188	bc165	1.93	2.11	4.49	3.26
G	Vulpia octoflora (a)	-	-	-	2	-	-	-	.00	-	-
Total for Annual Grasses		0	0	28	41	166	40	0.56	0.63	3.33	0.34
Total for Perennial Grasses		363	633	491	517	567	557	16.04	21.52	20.44	25.54
Total for Grasses		363	633	519	558	733	597	16.61	22.16	23.78	25.89
F	Agoseris glauca	-	-	12	8	7	4	.08	.04	.04	.03
F	Allium sp.	a1	a2	a1	b23	a3	a-	.00	.17	.01	-
F	Alyssum alyssoides (a)	-	-	b124	a11	b93	a44	.33	.03	.23	.11
F	Artemisia ludoviciana	-	1	-	-	-	-	-	-	-	-
F	Aster chilensis	-	-	-	-	-	3	-	-	-	.00
F	Astragalus miser	a-	a-	b40	b20	b26	a5	1.05	.16	.30	.06
F	Calochortus nuttallii	1	-	-	2	4	4	-	.01	.01	.00
F	Castilleja linariaefolia	-	-	8	8	1	-	.01	.22	.03	-
F	Castilleja sp.	-	-	8	-	-	-	.04	-	-	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	Cirsium sp.	-	-	3	-	-	-	.00	-	-	-
F	Collinsia parviflora (a)	-	-	a146	b245	b252	a142	1.02	8.10	3.74	.45
F	Collomia linearis (a)	-	-	b82	a6	a1	a11	.18	.01	.00	.05
F	Cymopterus sp.	-	-	17	8	9	3	.09	.07	.07	.01
F	Delphinium nuttallianum	-	-	1	-	-	-	.00	-	-	-
F	Descurainia pinnata (a)	-	-	-	-	3	-	-	-	.00	-
F	Draba sp. (a)	-	-	a30	a28	b125	a17	.22	.05	.46	.03
F	Erigeron divergens	a-	a-	b45	a-	a-	a-	.13	-	-	-
F	Eriogonum racemosum	8	16	22	15	12	19	.27	.18	.10	.33
F	Gayophytum ramosissimum(a)	-	-	3	-	-	-	.01	-	-	-
F	Helianthus annuus (a)	a3	b23	a-	a3	a-	a-	-	.00	-	-
F	Holosteum umbellatum (a)	-	-	b194	a97	b173	a111	.53	.56	.77	.28
F	Lactuca serriola (a)	b16	a-	a6	a-	a-	a-	.01	-	-	-
F	Medicago sativa	a22	ab77	ab78	b95	b61	ab63	10.93	8.77	4.33	3.08
F	Microsteris gracilis (a)	-	-	-	11	10	3	-	.02	.02	.01
F	Polygonum douglasii (a)	-	-	2	2	2	-	.01	.00	.00	-
F	Ranunculus testiculatus (a)	-	-	b29	b36	c59	a2	.06	.12	.30	.00
F	Sanguisorba minor	2	-	-	-	-	-	-	-	-	-
F	Sphaeralcea coccinea	3	-	2	-	-	-	.03	-	-	-
F	Tragopogon dubius (a)	-	-	2	-	-	-	.01	-	-	-
Total for Annual Forbs		19	23	618	439	718	330	2.40	8.92	5.56	0.93
Total for Perennial Forbs		37	96	237	179	123	101	12.67	9.63	4.90	3.54
Total for Forbs		56	119	855	618	841	431	15.08	18.55	10.47	4.48

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

#### BROWSE TRENDS--

Management unit 17, Study no: 11

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	Artemisia tridentata vaseyana	62	64	64	61	10.17	12.65	12.85	14.11
B	Chrysothamnus viscidiflorus viscidiflorus	8	28	25	32	.52	.61	1.25	1.06
B	Gutierrezia sarothrae	42	10	4	0	1.18	.05	.03	-
B	Opuntia sp.	6	5	6	7	.16	.30	.15	.78
Total for Browse		118	107	99	100	12.04	13.61	14.28	15.96

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 11

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	13.66	14.81	15.71
Chrysothamnus viscidiflorus viscidiflorus	.66	.90	1.89
Gutierrezia sarothrae	.05	-	-
Opuntia sp.	.18	.11	.46

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 11

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.4	1.4	1.3

BASIC COVER--

Management unit 17, Study no: 11

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	5.75	18.75	44.34	48.84	53.00	50.44
Rock	10.75	15.50	11.94	8.77	6.86	7.85
Pavement	19.00	32.00	9.28	7.74	8.35	8.51
Litter	39.25	27.00	41.57	44.34	37.93	44.07
Cryptogams	18.50	1.50	2.24	1.72	.69	1.02
Bare Ground	6.75	5.25	11.85	8.97	7.08	6.80

PELLET GROUP DATA--

Management unit 17, Study no: 11

Type	Quadrat Frequency				Days use per acre (ha)		
	'96	'02	'07	'12	'02	'07	'12
Rabbit	2	5	14	-	-	-	-
Elk	7	6	6	4	17 (43)	35 (86)	5 (12)
Deer	12	21	20	8	54 (134)	52 (129)	10 (25)
Cattle	2	-	-	-	-	6 (14)	7 (16)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 11

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana									
83	<b>1366</b>	17	83	0	33	0	0	0	14/13
89	<b>1532</b>	30	70	0	-	48	4	0	18/19
96	<b>2320</b>	8	91	1	40	66	17	4	20/36
02	<b>2160</b>	2	72	26	-	41	44	14	25/35
07	<b>1780</b>	0	47	53	20	29	1	11	31/43
12	<b>1700</b>	6	71	24	-	36	13	29	28/39

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>66</b>	50	50	0	-	0	0	0	10/17
89	<b>265</b>	75	12	12	-	0	0	0	5/5
96	<b>200</b>	40	60	0	80	0	0	0	10/17
02	<b>1360</b>	1	90	9	-	0	0	0	7/11
07	<b>1200</b>	0	98	2	-	0	0	13	10/12
12	<b>1200</b>	0	100	0	-	0	0	8	10/15
<i>Ephedra viridis</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
96	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	21/22
<i>Gutierrezia sarothrae</i>									
83	<b>133</b>	0	100	0	-	0	0	0	10/13
89	<b>0</b>	0	0	0	-	0	0	0	-/-
96	<b>2600</b>	12	88	0	440	0	0	0	8/12
02	<b>400</b>	0	80	20	-	0	0	0	7/5
07	<b>100</b>	0	100	0	-	0	0	0	9/10
12	<b>0</b>	0	0	0	-	0	0	0	11/19
<i>Opuntia sp.</i>									
83	<b>99</b>	0	100	0	-	0	0	0	6/8
89	<b>99</b>	0	100	0	-	0	0	0	6/14
96	<b>120</b>	0	100	0	20	0	0	0	5/19
02	<b>140</b>	0	100	0	-	0	0	0	5/36
07	<b>120</b>	0	67	33	-	0	0	17	6/19
12	<b>320</b>	0	100	0	-	0	0	6	5/10
<i>Purshia tridentata</i>									
83	<b>566</b>	0	100	-	-	94	0	0	16/20
89	<b>732</b>	14	86	-	-	27	23	0	15/32
96	<b>0</b>	0	0	-	-	0	0	0	18/69
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	14/36
12	<b>0</b>	0	0	-	-	0	0	0	18/38

## NORTH WALLSBURG RESEEDING - TREND STUDY NO. 17-12-12

Vegetation Type: Gamble Oak

Range Type: Crucial Deer Winter/Spring, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Stony Loam \(Mountain Big Sagebrush\), R047XA461UT](#) and [Mountain Stony Loam \(Gambel Oak\), R047XA463UT](#)

Land Ownership: DWR

Elevation: 6,400 ft (1,951 m)

Aspect: Southwest

Slope: 10-15%

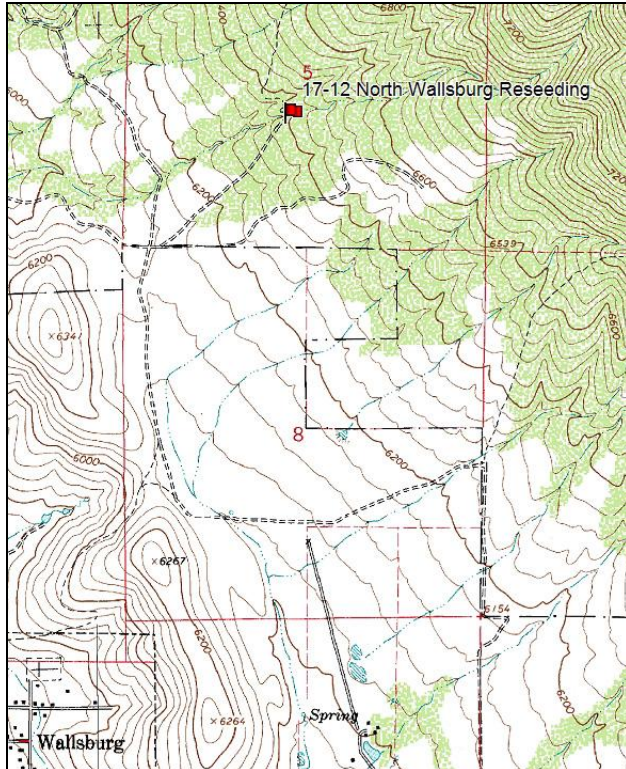
Transect bearing: 172° magnetic

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

### Directions:

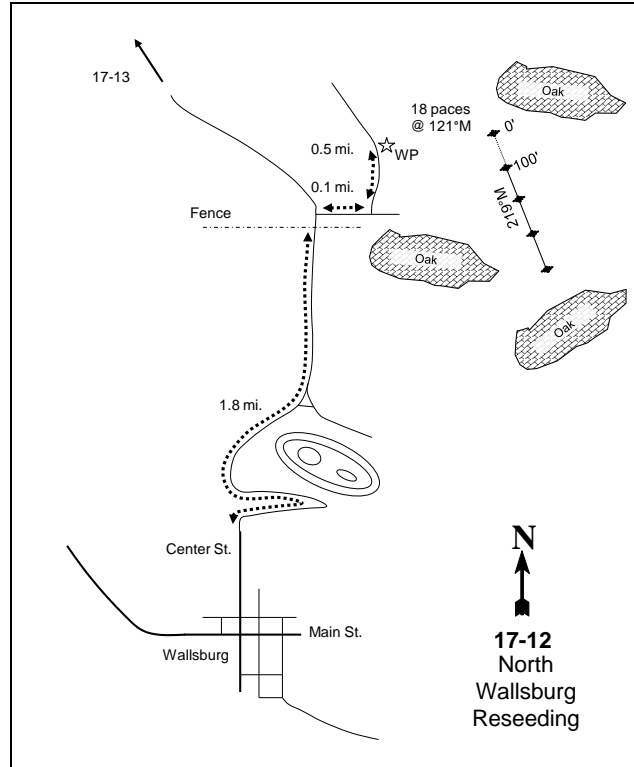
From the town of Wallsburg, take Center St., going north for 1.8 miles, staying on the main road until coming to a gate. Proceed through the gate and turn east immediately after passing through the gate. Proceed east traveling along the fenceline for 0.10 miles to another intersection. Turn left at the intersection and proceed north for 0.50 miles to a green steel "T" fencepost on the right (i.e., east) side of the road. From the fencepost the 0-foot baseline stake is 18 paces away at an azimuth of 121 degrees magnetic. A red browse tag, number 3953, is attached to the 0-foot baseline stake.

### Map Name: Charleston



Township: 5S Range: 5E Section: 5

### Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 465440 E 4473635 N

## NORTH WALLSBURG RESEEDING - TREND STUDY NO. 17-12

### Site Information

Site Description: This study is located on deer and elk winter range northeast of Wallsburg. The study is within the boundaries of a 1976 wildfire between Main Canyon and Daniels Canyon. The fire varied in intensity, leaving patches of shrubs that survived. The area was seeded later that year. The study currently samples a Gambel oak (*Quercus gambelii*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community intermixed with antelope bitterbrush (*Purshia tridentata*). Deer pellet groups were sampled in high abundance in 2002 and 2007, but in low abundance in 2012. Elk pellet groups have been sampled in low abundance since 2002 (Table - Pellet Group Data). A deer skeleton was found near the 400-foot stake in 2007.

Browse: The most abundant preferred browse species is a population of mature, healthy gambel oak. Utilization of oak has been mostly light, except in 1989 and 1996 where utilization was mostly moderate. Decadence and poor vigor within the oak population have been low for the duration of the study. However in 2002, oak experienced a moderate amount of poor vigor. Recruitment of young gambel oak has continually increased over the course of the study. Other valuable species in terms of preference for wildlife that occur in relatively small abundance are mountain big sagebrush and antelope bitterbrush. Mountain big sagebrush is a mature, moderately healthy population. . Utilization of sagebrush has been mostly moderate throughout the course of the study. Decadence within the sagebrush population has varied between low to moderate during earlier samplings, but has recently become more decadent. Poor vigor within the sagebrush population mirrors the same trend. Recruitment of young sagebrush to the population was high in 1983 and 1989, but has since decreased to unobservable numbers. The antelope bitterbrush population is sparse but healthy. Bitterbrush utilization has been mostly moderate to heavy. The populations of stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*) are larger than the sagebrush and bitterbrush populations, though they provide less cover. Rabbitbrush and snakeweed densities have followed a similar pattern of increasing from 1983 to 1989, and then sharply decreasing since 1996 (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are the dominant component of the community. Crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) were the most frequent grasses in 1983 and 1989. In subsequent sample years, sheep fescue (*Festuca ovina*) has been the dominant grass. Since 1996, the weedy perennial bulbous bluegrass (*Poa bulbosa*) has steadily increased in frequency and cover. The invasive annual species cheatgrass (*Bromus tectorum*) has also been present, but has not contributed much to the herbaceous understory. Forbs have been an insignificant component of the understory. Alfalfa (*Medicago sativa*) was seeded following the 1976 wildfire, but has only been sampled in low frequencies. Since the sampling of annual species began in 1996, pale alyssum (*Alyssum alyssoides*) has been the most frequently occurring of all forbs (Table - Herbaceous Trends).

Soil: The soil is part of the Yeates Hollow component, which is found on alluvial fans and mountain slopes. The parent material consists of colluvium and/or slope alluvium derived from sedimentary rock (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). There is a large amount of vegetation and litter keeping bare ground cover moderately low. The soil erosion condition was classified as stable in 2002 and 2007, but slight in 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - down (-2):** The density of mountain big sagebrush decreased 35% from 1,432 plants/acre to 932 plants/acre. Health of the sagebrush population was varied. Decadence within the sagebrush population increased from 0% to 14%, while poor vigor remained similar near 0%. Recruitment of young sagebrush decreased from 84% to 68% of the population. The density of



Gamble oak increased 35% from 666 plants/acre to 899 plants/acre. The health of the oak population remained good, with decadence and poor vigor remaining at 0%. Recruitment of your oak increased to 48%.

- **1989 to 1996 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. The health of the sagebrush population improved, with decadence within the population decreasing to 6%, and poor vigor remaining near 0%. Recruitment of young sagebrush was not observed. Cover for sagebrush was measured near 2%. Decadence within the Gamble oak population increased to 1% and poor vigor increased to 6%. Recruitment of young oak decreased to 20%. Cover for oak was measured at 5%.
- **1996 to 2002 - stable (0):** The density of mountain big sagebrush remained similar at 320 plants/acre, and cover increased to 4%. Decadence within the sagebrush population increased to 13%. Poor vigor was not observed within the population. Recruitment of young sagebrush was not observed in the population. The density of Gamble oak increased 55% from 2,840 plants/acre to 4,400 plants/acre. The health of the oak population was varied. Decadence within the oak population remained similar at 2%, while poor vigor increased to 30%. Recruitment of young oak to the population increased to 26%. Cover for oak increased to 6%.
- **2002 to 2007 - stable (0):** The density of mountain big sagebrush increased 13% to 360 plants/acre. However, the health of the sagebrush population became increasingly poor. Decadence and poor vigor increased to 44% and 11%, respectively. Young recruitment was not observed entering the population. Cover for sagebrush decreased to over 3%. The density of gamble oak increased 21% to 5,320 plants/acre. However, the health of the oak population was varied with decadence increasing to 15%, but poor vigor decreased to 11%. Recruitment of young oak to the population increased to 45%. Cover for oak decreased to near 4%.
- **2007 to 2012 - slightly up (+1):** The density of mountain big sagebrush decreased 22% to 280 plants/acre. The health of the sagebrush population remained poor. Decadence within the population decreased to 36%, while poor vigor increased to 36%. Cover of sagebrush remained similar to 2007. The density of Gamble oak decreased 40% to 3,200 plants/acre, though cover increased from 4% to 7%. Health of the oak population increased with decadence and poor vigor decreasing to 0% and 1%, respectively. Cover for oak increased to over 7%. The density of bitterbrush increased three-fold from 80 plants/acre to 240 plants/acre.

#### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial grasses increased 66%. Intermediate wheatgrass, crested wheatgrass, and sheep fescue had significant increases in nested frequency.
- **1989 to 1996 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. Sheep fescue had a significant increase in nested frequency, and was the most dominant grass species with a cover of 15%. Sandberg bluegrass (*Poa secunda*) had a significant increase in nested frequency. Crested wheatgrass and intermediate wheatgrass both decreased significantly in nested frequency, and had covers over 2% and 3%, respectively. The weedy perennial grass species bulbous bluegrass was sampled for the first time with a cover of less than 1%.
- **1996 to 2002 - slightly down (-1):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. Sandberg bluegrass had a significant decrease in nested frequency. The weedy species bulbous bluegrass had a significant increase in nested frequency, and increased in cover to 3%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased 10%. The increase in the sum of nested frequencies is not due to any one specific species, and is likely due to small, accumulative increases in nested frequency within the perennial grass community. Bulbous bluegrass increased in cover to over 4%.

- **2007 to 2012 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. Sheep fescue had a significant increase in nested frequency, and increased in cover from 16% to 27%. Bulbous bluegrass retained a cover of 4%.

Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequencies for perennial forbs decreased by 31%. The decrease in the sum of nested frequencies is not due to any one specific species, and is likely due to small, accumulative decreases in nested frequency within the perennial forb community.
- **1989 to 1996 - stable (0):** The sum of nested frequencies for perennial forbs increased four-fold. Longleaf phlox (*Phlox longifolia*) had a significant increase in nested frequency.
- **1996 to 2002 - stable (0):** The sum of nested frequencies for perennial forbs decreased 20%. Perennial forbs remain moderately diverse, but sparse on the study site.
- **2002 to 2007 - stable (0):** The sum of nested frequencies for perennial forbs increased 20%. Perennial forbs remain moderately diverse, but sparse on the study site.
- **2007 to 2012 - stable (0):** The sum of nested frequencies for perennial forbs decreased 7%. No mentionable change occurred within the forb community.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 12

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	9.6	13.5	7.9	30.0	-0.1	3.1	0.0	<b>64.0</b>	Fair-Good
02	14.1	13.4	6.5	30.0	-0.4	1.2	0.0	<b>64.9</b>	Fair-Good
07	11.0	8.5	9.2	30.0	-0.7	2.2	0.0	<b>60.2</b>	Fair
112	17.1	11.8	14.5	30.0	-0.1	2.6	0.0	<b>75.9</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 12

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	Agropyron cristatum	b90	c148	ab66	ab56	ab56	a41	2.41	1.25	2.25	2.21
G	Agropyron intermedium	a117	c192	ab135	abc157	c182	bc171	3.32	5.92	7.19	5.57
G	Bromus tectorum (a)	-	-	ab16	a7	b33	ab21	.10	.53	.57	.13
G	Dactylis glomerata	8	7	-	-	3	9	-	.00	.03	.04
G	Festuca myuros (a)	-	-	-	-	3	-	-	-	.41	-
G	Festuca ovina	a42	b96	c190	c171	c196	d238	14.72	8.35	16.30	26.93
G	Oryzopsis hymenoides	2	7	-	4	-	4	-	.18	-	.15
G	Poa bulbosa	a-	a-	b32	c92	bc115	d129	.62	2.79	4.23	4.05
G	Poa fendleriana	-	8	-	-	-	2	-	-	-	.00
G	Poa pratensis	27	8	26	8	-	-	.41	.04	-	-
G	Poa secunda	a-	a3	b24	a7	a8	a5	.08	.06	.09	.03
G	Sitanion hystrix	-	6	1	1	-	-	.00	.00	-	-
G	Stipa comata	-	-	-	2	1	2	-	.03	.03	.03
Total for Annual Grasses		0	0	16	7	36	21	0.10	0.53	0.98	0.13
Total for Perennial Grasses		286	475	474	498	561	601	21.57	18.66	30.14	39.05

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
	Total for Grasses	286	475	490	505	597	622	21.67	19.19	31.12	39.19
F	Agoseris glauca	-	-	2	1	1	1	.00	.00	.00	.00
F	Allium sp.	-	2	-	2	1	-	-	.00	.00	-
F	Alyssum alyssoides (a)	-	-	<sub>b</sub> 134	<sub>a</sub> 22	<sub>b</sub> 86	<sub>a</sub> 11	.36	.08	.45	.02
F	Aster chilensis	-	-	-	-	2	5	-	-	.03	.06
F	Astragalus convallarius	-	-	-	-	8	4	-	-	.09	.16
F	Astragalus sp.	-	2	1	9	8	6	.03	.05	.10	.06
F	Astragalus utahensis	3	1	10	10	5	4	.33	.07	.16	.04
F	Balsamorhiza sagittata	-	-	-	-	1	-	-	-	.03	-
F	Calochortus nuttallii	5	-	-	2	3	-	-	.00	.01	-
F	Chaenactis douglasii	-	2	3	-	-	-	.03	-	-	-
F	Cirsium sp.	2	-	6	-	4	7	.26	-	.01	.04
F	Collomia linearis (a)	-	-	-	5	1	-	-	.01	.00	-
F	Comandra pallida	-	-	-	3	-	-	-	.00	-	-
F	Descurainia pinnata (a)	-	-	-	4	8	-	-	.01	.02	-
F	Draba sp. (a)	-	-	-	-	19	-	-	-	.11	-
F	Epilobium brachycarpum (a)	-	-	3	-	-	-	.00	-	-	-
F	Erigeron sp.	-	-	1	-	-	2	.03	-	-	.00
F	Eriogonum racemosum	-	-	7	3	6	4	.05	.04	.03	.16
F	Euphorbia brachycera	-	-	-	-	-	3	-	-	-	.00
F	Gayophytum ramosissimum(a)	-	-	-	-	-	4	-	-	-	.01
F	Grindelia squarrosa	-	-	3	5	-	-	.06	.01	-	-
F	Helianthus annuus (a)	-	-	-	-	-	3	-	-	-	.00
F	Holosteum umbellatum (a)	-	-	-	-	-	3	-	-	-	.00
F	Lactuca serriola (a)	8	-	-	-	-	1	-	-	-	.00
F	Linum lewisii	-	-	3	1	1	-	.00	.03	.00	-
F	Lithospermum ruderales	-	-	1	11	2	8	.15	.13	.19	.36
F	Medicago sativa	3	1	10	4	2	3	.33	.21	.30	.26
F	Orthocarpus sp. (a)	-	-	2	-	-	-	.00	-	-	-
F	Phlox longifolia	<sub>a</sub> -	<sub>a</sub> 2	<sub>b</sub> 23	<sub>ab</sub> 11	<sub>b</sub> 29	<sub>b</sub> 22	.06	.03	.14	.10
F	Polygonum douglasii (a)	-	-	5	-	1	-	.01	-	.00	-
F	Ranunculus testiculatus (a)	-	-	-	-	3	-	-	-	.00	-
F	Sphaeralcea coccinea	3	3	-	1	2	-	-	.00	.00	-
F	Tragopogon dubius (a)	<sub>b</sub> 28	<sub>a</sub> 7	<sub>a</sub> 8	<sub>a</sub> 2	<sub>a</sub> 1	<sub>a</sub> 1	.01	.01	.00	.00
F	Viguiera multiflora	<sub>b</sub> 11	<sub>ab</sub> 7	<sub>ab</sub> 9	<sub>a</sub> -	<sub>a</sub> 1	<sub>a</sub> -	.19	-	.00	-
F	Zigadenus paniculatus	2	-	-	-	-	2	-	-	-	.00
	Total for Annual Forbs	36	7	152	33	119	23	0.39	0.10	0.60	0.05
	Total for Perennial Forbs	29	20	79	63	76	71	1.54	0.61	1.12	1.29
	Total for Forbs	65	27	231	96	195	94	1.93	0.72	1.73	1.35

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

BROWSE TRENDS--

Management unit 17, Study no: 12

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	Amelanchier utahensis	0	2	2	2	-	.41	.18	.06
B	Artemisia tridentata vaseyana	12	11	12	11	1.62	3.91	3.24	3.52
B	Cercocarpus montanus	1	0	0	0	.03	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	35	13	10	8	.72	.04	.06	.15
B	Gutierrezia sarothrae	21	4	4	1	.47	.03	.03	-
B	Opuntia sp.	6	4	4	3	.03	-	-	-
B	Purshia tridentata	5	4	4	10	1.59	1.69	1.95	3.46
B	Quercus gambelii	26	25	26	26	5.13	6.09	3.73	7.39
B	Symphoricarpos oreophilus	1	0	0	0	.15	-	-	-
B	Tetradymia canescens	7	8	7	7	.06	.51	.48	.09
Total for Browse		114	71	69	68	9.81	12.69	9.69	14.69

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 12

Species	Percent Cover		
	'02	'07	'12
Amelanchier utahensis	.26	.13	.15
Artemisia tridentata vaseyana	4.56	4.28	2.45
Chrysothamnus viscidiflorus viscidiflorus	.25	.91	.88
Gutierrezia sarothrae	-	.05	-
Opuntia sp.	.01	.01	.05
Purshia tridentata	2.06	1.98	4.23
Quercus gambelii	11.25	7.91	11.08
Tetradymia canescens	.78	.81	.38

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 12

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.0	2.1	1.7
Purshia tridentata	2.2	2.6	3.5

BASIC COVER--

Management unit 17, Study no: 12

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	1.50	4.25	35.09	33.00	48.28	57.15
Rock	5.75	5.50	6.78	5.06	3.71	3.36
Pavement	6.25	10.75	10.14	4.41	2.83	3.71
Litter	65.00	59.75	40.23	58.65	42.93	38.56
Cryptogams	1.50	.25	.81	.06	.10	.08
Bare Ground	20.00	19.50	12.07	20.63	14.95	10.47

PELLET GROUP DATA--

Management unit 17, Study no: 12

Type	Quadrat Frequency			
	'96	'02	'07	'12
Rabbit	8	-	17	-
Elk	5	5	6	5
Deer	27	24	30	6
Cattle	5	-	-	-

Days use per acre (ha)		
'02	'07	'12
-	-	-
10 (25)	19 (46)	3 (7)
69 (170)	48 (119)	17 (43)
-	-	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 12

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Amelanchier utahensis</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
96	0	0	0	-	-	0	0	0	-/-
02	40	0	100	-	-	50	50	0	31/35
07	40	0	100	-	-	50	0	0	27/35
12	120	83	17	-	-	17	0	0	27/32
<b>Artemisia tridentata vaseyana</b>									
83	1432	84	16	0	-	0	0	0	26/30
89	932	68	18	14	-	39	0	4	28/36
96	340	18	76	6	-	53	6	0	28/47
02	320	0	88	13	-	44	56	0	27/40
07	360	0	56	44	-	39	6	11	30/49
12	280	0	64	36	-	64	36	36	26/48
<b>Cercocarpus montanus</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
96	20	0	100	-	-	0	100	0	32/38
02	0	0	0	-	-	0	0	0	27/35
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<b>Chrysothamnus viscidiflorus viscidiflorus</b>									
83	5332	8	92	0	-	0	0	0	8/7
89	7765	3	89	8	33	0	0	18	10/13
96	1300	15	78	6	60	0	0	2	11/20
02	480	4	92	4	-	0	0	4	7/13
07	340	0	76	24	-	0	0	6	9/13
12	300	13	87	0	-	7	0	0	9/16

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
83	4932	17	83	0	-	0	0	0	8/9	
89	7531	1	97	2	-	0	0	15	9/9	
96	840	33	67	0	20	0	0	0	8/10	
02	120	0	83	17	-	0	0	0	7/9	
07	80	0	75	25	-	0	0	25	9/12	
12	20	0	100	0	-	0	0	0	8/13	
<i>Opuntia sp.</i>										
83	266	0	100	0	-	0	0	0	6/8	
89	199	0	100	0	-	0	0	33	6/18	
96	160	0	100	0	-	0	13	0	5/23	
02	80	0	100	0	-	0	0	0	5/8	
07	80	0	75	25	-	0	0	0	5/11	
12	60	0	100	0	-	0	0	0	4/11	
<i>Purshia tridentata</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
96	100	0	100	0	-	40	0	0	31/78	
02	80	0	100	0	-	0	50	0	36/77	
07	80	0	100	0	-	75	0	0	41/80	
12	240	0	92	8	-	42	42	8	37/73	
<i>Quercus gambelii</i>										
83	666	0	100	0	-	0	0	0	53/34	
89	899	48	52	0	133	93	7	0	89/37	
96	2840	20	74	6	240	51	4	.70	50/32	
02	4400	26	71	2	-	0	0	30	47/26	
07	5320	45	40	15	-	3	0	11	81/48	
12	3200	56	44	0	480	4	0	1	37/24	
<i>Symphoricarpos oreophilus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	20	0	100	-	-	0	0	0	35/35	
02	0	0	0	-	-	0	0	0	24/48	
07	0	0	0	-	-	0	0	0	41/74	
12	0	0	0	-	-	0	0	0	35/38	
<i>Tetradymia canescens</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
96	400	20	80	0	-	0	0	0	9/15	
02	640	16	84	0	-	0	0	0	9/22	
07	680	9	85	6	-	0	0	26	9/17	
12	560	0	100	0	-	0	0	0	6/12	

NORTH WALLSBURG - TREND STUDY NO. 17-13-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: UDP&R

Elevation: 5,900 ft (1,798 m)

Aspect: West

Slope: 20%

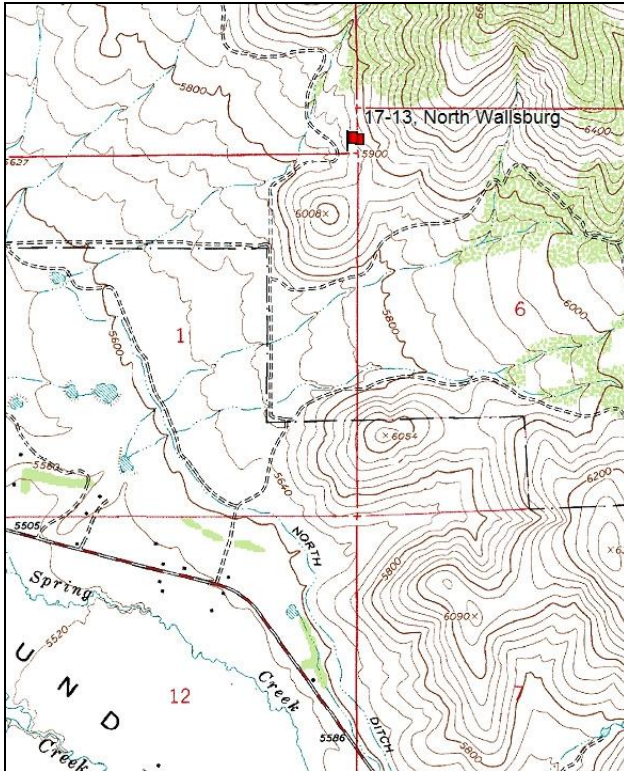
Transect bearing: 0° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 5 on 5ft.

Directions:

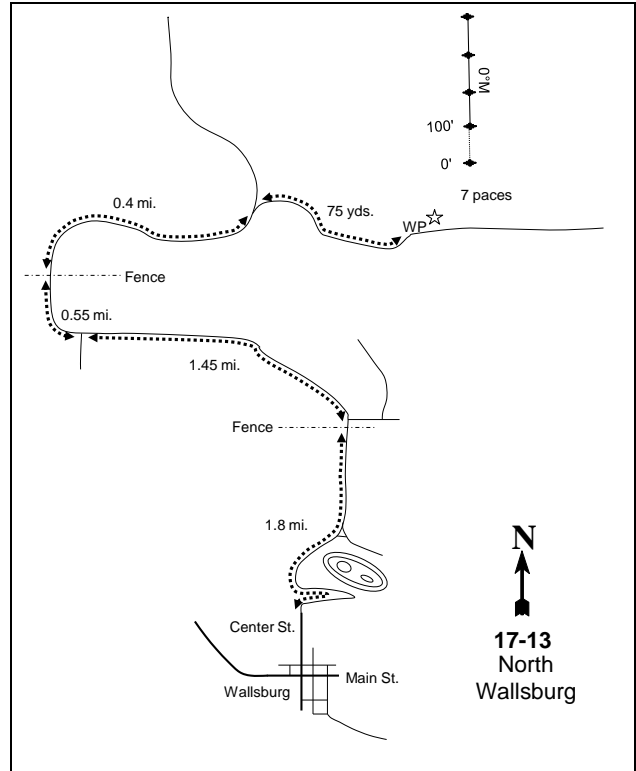
Beginning at the town of Wallsburg, proceed northerly for 1.80 miles staying on the main road. At 1.80 miles the road will come to a fence line and a gate, proceed through the gate and turn left. Proceed west for 1.45 miles to where the road bends northward at the DWR fence line. Continue on the same road northward for 0.55 additional miles to a cattle guard. Cross the fence and take the immediate right fork, then proceed 0.40 miles to another fork in the road. Walk 75 yards up the old road to a red steel fencepost and a full high witness post on the left side of the road and stop. From the fencepost, the 0-foot stake of the baseline is 7 paces to the northeast.

Map Name: Charleston



Township: 4S Range: 4E Section: 36

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 463193 E 4474484 N

## NORTH WALLSBURG - TREND STUDY NO. 17-13

### Site Information

Site Description: This study is on Division of Wildlife Resources (DWR) property located north of Wallsburg. The study site samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and grass community. There is an ephemeral stream 700 feet to the west, and a group of stock ponds approximately 1 mile to the southwest. Deer pellet groups have been sampled in very high abundance since 2002. Elk pellet groups were sampled in low abundance 2002 and 2012, but in moderate abundance in 2007 (Table - Pellet Group Data). Numerous winter-killed fawns were found in 1989, and there were scattered bones near the baseline in 2007. There were three older deer carcasses found on the site in 2012.

Browse: Mountain big sagebrush is the dominant browse species. The density of the sagebrush population has been moderately dense throughout the course of the study. However, health of the sagebrush population has been poor for the same duration with the exception of the 2012 sample year. Decadence within the sagebrush population has been high every year, except in 2012 where decadence was measured as moderate. Poor vigor has been low to moderate over the course of the study. Utilization of sagebrush has been moderate to heavy over the sampled years. Recruitment of young sagebrush has been poor, but recruitment was at its highest in 1996. Other browse species on the site include white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) and the increaser broom snakeweed (*Gutierrezia sarothrae*). White rubber rabbitbrush were first sampled in 1996 when the baseline was extended and a larger area was sampled. The density of snakeweed has varied from low in 1983 to high in 1996 (Table - Browse Characteristics).

Herbaceous Understory: Grasses account for approximately three-quarters of the total vegetation cover. The grass component consists primarily of two weedy species, the annual species cheatgrass (*Bromus tectorum*) and the perennial species bulbous bluegrass (*Poa bulbosa*). Other perennial species that have been present, but much less frequent, include four species of wheatgrass (*Agropyron* sp.), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread grass (*Stipa comata*). Forbs, especially perennial species, have been a small component in all years. Frequency of perennial forbs was highest in 1989, and sego lily (*Calochortus nuttallii*) was the dominant species. Since being included in 1996, annuals have been more frequent and provide more cover than perennial species. Pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*) have been the most dominant (Table - Herbaceous Trends). Although not sampled in the study, alfalfa (*Medicago sativa*) was observed to be heavily utilized in 2012 (Table - Herbaceous Trends).

Soil: The soil is part of the Yeates Hollow component, which is found on alluvial fans and mountain slopes. The parent material consists of colluvium and/or slope alluvium (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.1) (Table - Soil Analysis Data). The soil is moderately deep with some rocks on the surface and throughout the profile. Bare ground cover is moderately low with high a high amount of vegetation and litter cover, and a moderate amount of rock cover. There was evidence of soil erosion when the study was established; however, in 2002 and 2012, the erosion condition was classified as stable. In 2007, the erosion condition was slight.

### Trend Assessments

#### Browse:

- **1983 to 1989 - down (-2):** The density of mountain big sagebrush decreased 40% from 2,865 plants/acre to 1,731 plants/acre. Health of sagebrush was mixed with decadence within population increasing from 26% to 69%, but with poor vigor decreasing from 16% to 12%. Recruitment of young sagebrush decreased from 7% of the population to 4%.
- **1989 to 1996 - up (+2):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Health in the sagebrush population improved



with decadence decreasing to 31%, and poor vigor decreasing to 8%. Recruitment of young sagebrush increased to 14% of the population. Cover for sagebrush was recorded at 9%.

- **1996 to 2002 - slightly up (+1):** The density of mountain big sagebrush increased 13% from 2,240 plants/acre to 2,540 plants/acre. Health within the sagebrush population remained stable with decadence increasing slightly to 33%, and poor vigor decreasing slightly to 8%. However, recruitment of young sagebrush decreased to 5% of the population. Cover for sagebrush increased to nearly 14%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 29% to 1,800 plants/acre. Health of the sagebrush population decreased with decadence increasing to 42%, and poor vigor increasing slightly to 14%. Recruitment of young sagebrush was low at 2% of the population. Cover for sagebrush decreased to 11%.
- **2007 to 2012 - slightly down (-1):** Density of mountain big sagebrush decreased 10% to 1,620 plants/acre. Health within the sagebrush population improved slightly with decadence decreasing to 17%, and poor vigor decreasing to 11%. Recruitment of young sagebrush remained poor at 1% of the population.

#### Grass:

- **1983 to 1989 stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased nearly four-fold. Sandberg bluegrass had a significant increase in nested frequency. Moreover, the weedy species bulbous bluegrass had a significant increase in nested frequency and subsequently became the most common perennial grass on the study.
- **1989 to 1996 - slightly down (-1):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased over two-fold. Sandberg bluegrass had a significant increase in nested frequency, and had a cover of 4%. Western wheatgrass decreased significantly in nested frequency. The weedy species bulbous bluegrass had a significantly increased in nested frequency, and had a cover of 8%. The weedy annual species cheatgrass was measured as the most frequently occurring grass, and had the highest cover of all species within the community at 16%.
- **1996 to 2002 - down (-2):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. The weedy species bulbous blue grass increased significantly in nested frequency, and increased in cover to 23%. Bulbous bluegrass remains the most dominate species within the community. However, cheatgrass decreased significantly in nested frequency and cover decreased to 5%. Despite the decrease in frequency and cover, cheatgrass is the second most common grass species on the study.
- **2002 to 2007 - down (-2):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, decreased 20%. Bulbous bluegrass continued to maintain high frequency, and cover was similar at 24%. Cheatgrass increased significantly in nested frequency, and increased in cover to 9%.
- **2007 to 2012 - down (-2):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, decreased 23%. Sandberg bluegrass decreased significantly in nested frequency, and cover decreased to just over 1%. Bulbous bluegrass increased slightly in frequency and in cover to 30%. Cheatgrass decreased significantly in nested frequency, and cover decreased slightly to 7%. Despite the decrease, cheatgrass is the second most common grass on the study.

#### Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial forbs increased four-fold. Segolily and longleaf phlox (*Phlox longifolia*) both increased significantly in nested frequency. Foothill deathcamas (*Zigadenus paniculatus*) increased significantly in nested frequency.
- **1989 to 1996 - down (-2):** The sum of nested frequencies for perennial forbs decreased 89%. Segolily and longleaf phlox both decreased significantly in nested frequency. Foothill deathcamas also decreased significantly in nested frequency. Annual species occur commonly on the study with pale alyssum occurring most frequently with a cover near 1%.
- **1996 to 2002 - stable (0):** The sum of nested frequencies for perennial forbs decreased 24%. Perennial forbs remain rare within the community.

- **2002 to 2007 - stable (0):** The sum of nested frequencies for perennial forbs increased 77%; however, forbs remain rare on the site with low diversity.
- **2007 to 2012 - stable (0):** The sum of nested frequency for perennial forbs increased 52%. Daisy fleabane (*Erigeron* sp.) increased significantly in nested frequency. Forbs remain rare on the site with low diversity.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 13

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	13.7	6.1	7.6	8.6	-12.1	0.2	0.0	<b>24.1</b>	Very Poor
02	18.5	4.0	2.3	8.7	-3.9	0.1	0.0	<b>29.6</b>	Very Poor
07	15.0	1.5	0.9	8.4	-6.8	0.3	0.0	<b>19.3</b>	Very Poor
12	14.3	9.6	0.5	4.7	-5.4	1.2	0.0	<b>25.0</b>	Very Poor

Trend Summary

HERBACEOUS TRENDS--

Management unit 17, Study no: 13

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	<i>Agropyron cristatum</i>	-	-	-	2	3	7	-	.03	.30	.41
G	<i>Agropyron intermedium</i>	-	-	-	10	6	-	-	.68	.15	-
G	<i>Agropyron smithii</i>	ab10	b14	a-	a-	a-	a-	-	-	-	-
G	<i>Agropyron spicatum</i>	-	-	-	-	1	13	-	-	.00	.22
G	<i>Bromus tectorum</i> (a)	-	-	c303	a200	c305	b247	16.14	5.23	9.12	7.18
G	<i>Oryzopsis hymenoides</i>	10	13	6	17	5	10	.36	.74	.21	.24
G	<i>Poa bulbosa</i>	a5	b69	c157	d285	de299	e317	7.55	22.75	23.93	29.94
G	<i>Poa secunda</i>	a2	b53	c166	c140	c123	b69	3.73	2.66	3.52	1.41
G	<i>Sitanion hystrix</i>	-	-	9	3	-	2	.19	.03	-	.03
G	<i>Stipa comata</i>	-	-	-	4	3	8	-	.18	.00	.04
Total for Annual Grasses		0	0	303	200	305	247	16.14	5.23	9.12	7.18
Total for Perennial Grasses		27	149	338	461	440	426	11.84	27.09	28.14	32.31
Total for Grasses		27	149	641	661	745	673	27.98	32.32	37.27	39.49
F	<i>Agoseris glauca</i>	-	-	4	-	-	2	.01	-	-	.00
F	<i>Alyssum alyssoides</i> (a)	-	-	b101	a13	a8	a1	.69	.03	.02	.00
F	<i>Arabis</i> sp.	-	3	1	-	-	-	.03	-	-	-
F	<i>Astragalus eurekaensis</i>	-	-	-	-	-	-	-	.00	-	-
F	<i>Astragalus</i> sp.	3	3	-	-	-	-	-	-	-	-
F	<i>Astragalus utahensis</i>	3	-	1	4	2	5	.03	.01	.03	.01
F	<i>Calochortus nuttallii</i>	b25	c112	a-	a1	ab7	a-	-	.00	.02	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	-	3	-	-	-	.00	-
F	<i>Draba</i> sp. (a)	-	-	-	-	28	-	-	-	.10	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	9	-	-	-	.02	-	-	-
F	<i>Erigeron</i> sp.	a-	a-	a6	a-	a-	b23	.04	-	.00	.56
F	<i>Eriogonum racemosum</i>	2	6	5	3	3	3	.01	.00	.03	.03

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	<i>Erodium cicutarium</i> (a)	-	-	bc49	ab28	c64	a8	.23	.08	.90	.04
F	<i>Helianthus annuus</i> (a)	-	-	-	2	-	-	-	.00	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	a-	c34	c49	b9	-	.11	.37	.05
F	<i>Machaeranthera canescens</i>	2	-	-	-	-	-	-	-	-	-
F	<i>Phlox longifolia</i>	a-	b21	a-	a5	ab8	a2	-	.01	.02	.01
F	<i>Polygonum douglasii</i> (a)	-	-	4	-	-	-	.01	-	-	-
F	<i>Sisymbrium altissimum</i> (a)	-	-	-	5	-	4	-	.01	.00	.04
F	<i>Tragopogon dubius</i> (a)	a1	a6	b31	a-	a1	a14	.17	-	.00	.03
F	<i>Zigadenus paniculatus</i>	a2	b9	a-	a-	a3	a-	-	-	.03	-
Total for Annual Forbs		1	6	194	82	153	36	1.12	0.25	1.40	0.17
Total for Perennial Forbs		37	154	17	13	23	35	0.12	0.03	0.13	0.62
Total for Forbs		38	160	211	95	176	71	1.25	0.28	1.54	0.79

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

#### BROWSE TRENDS--

Management unit 17, Study no: 13

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	74	71	56	60	9.16	13.57	11.05	10.58
B	<i>Chrysothamnus nauseosus albicaulis</i>	15	14	10	7	1.79	1.22	.94	.85
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	0	1	0	1	-	-	-	-
B	<i>Gutierrezia sarothrae</i>	39	14	21	25	1.99	.10	.15	.35
B	<i>Opuntia</i> sp.	19	15	11	13	.35	.18	.18	.18
Total for Browse		147	115	98	106	13.30	15.08	12.32	11.96

#### CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 13

Species	Percent Cover		
	'02	'07	'12
<i>Artemisia tridentata vaseyana</i>	16.06	17.64	22.39
<i>Chrysothamnus nauseosus albicaulis</i>	1.16	1.79	2.40
<i>Gutierrezia sarothrae</i>	.18	.58	1.23
<i>Opuntia</i> sp.	-	.25	-

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 13

Species	Average leader growth (in)		
	'02	'07	'12
<i>Artemisia tridentata vaseyana</i>	1.2	1.6	1.6

BASIC COVER--

Management unit 17, Study no: 13

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	1.50	4.00	44.31	47.95	54.80	55.57
Rock	8.50	8.75	12.07	11.63	11.07	16.53
Pavement	3.75	14.00	3.82	4.53	2.47	3.59
Litter	64.75	53.25	44.58	41.18	39.22	34.15
Cryptogams	3.00	2.00	1.00	.87	.22	.61
Bare Ground	18.50	18.00	4.32	12.44	6.54	8.02

PELLET GROUP DATA--

Management unit 17, Study no: 13

Type	Quadrat Frequency				Days use per acre (ha)		
	'96	'02	'07	'12	'02	'07	'12
Sheep	1	-	-	1	-	-	-
Rabbit	11	6	2	-	-	-	-
Elk	12	4	10	10	9 (21)	38 (93)	5 (12)
Deer	36	47	56	45	147 (364)	87 (215)	90 (222)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 13

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>2865</b>	7	67	26	-	16	40	16	26/45
89	<b>1731</b>	4	27	69	-	73	0	12	22/22
96	<b>2240</b>	16	53	31	380	38	8	8	23/44
02	<b>2540</b>	5	62	33	-	31	30	11	21/30
07	<b>1800</b>	2	56	42	-	39	13	14	27/39
12	<b>1620</b>	1	81	17	100	33	20	11	28/43
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
96	<b>360</b>	11	67	22	120	11	6	11	33/50
02	<b>280</b>	0	21	79	-	0	0	29	20/22
07	<b>280</b>	0	21	79	-	0	0	36	29/32
12	<b>140</b>	0	71	29	-	0	0	0	28/36
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
96	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	8/11
07	<b>0</b>	0	0	-	-	0	0	0	11/16
12	<b>20</b>	0	100	-	-	0	0	0	5/6

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
83	<b>399</b>	33	67	0	66	0	0	0	11/11	
89	<b>1266</b>	0	100	0	-	0	0	0	10/15	
96	<b>4500</b>	12	88	0	100	0	0	0	9/13	
02	<b>520</b>	0	77	23	-	0	0	8	9/8	
07	<b>660</b>	12	82	6	20	0	0	0	9/9	
12	<b>1880</b>	52	48	0	80	0	0	0	10/12	
<i>Opuntia sp.</i>										
83	<b>466</b>	29	71	0	-	0	0	0	6/14	
89	<b>799</b>	17	83	0	-	8	0	0	7/22	
96	<b>420</b>	10	81	10	-	0	0	0	5/18	
02	<b>380</b>	11	79	11	-	0	0	0	5/11	
07	<b>260</b>	0	92	8	-	0	0	8	6/12	
12	<b>400</b>	5	90	5	-	0	0	10	5/12	

HOOVERS HOLLOW - TREND STUDY NO. 17-14-12

Vegetation Type: Annual and Perennial Grass

Range Type: Crucial Deer Winter,

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: UDP&R

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

Aspect: Southwest

Slope: 30%

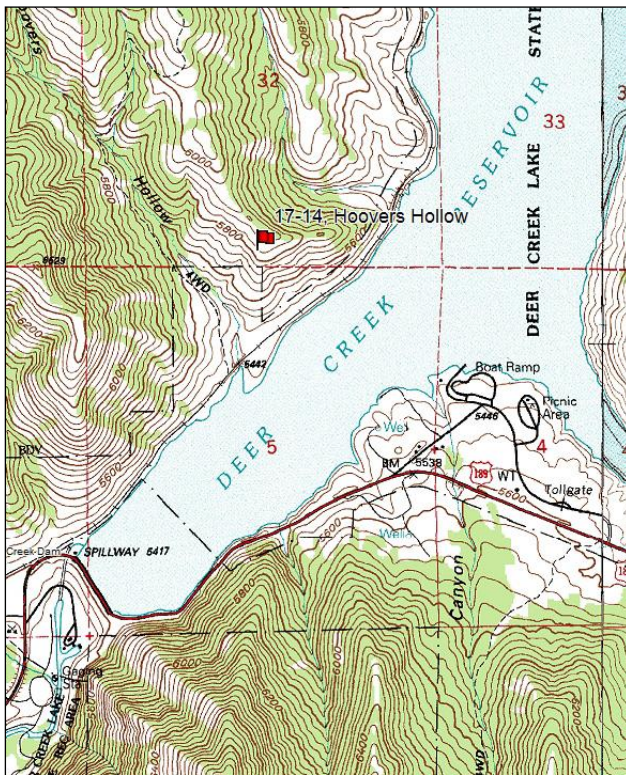
Transect bearing: 343° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 5 on 1ft.

Directions:

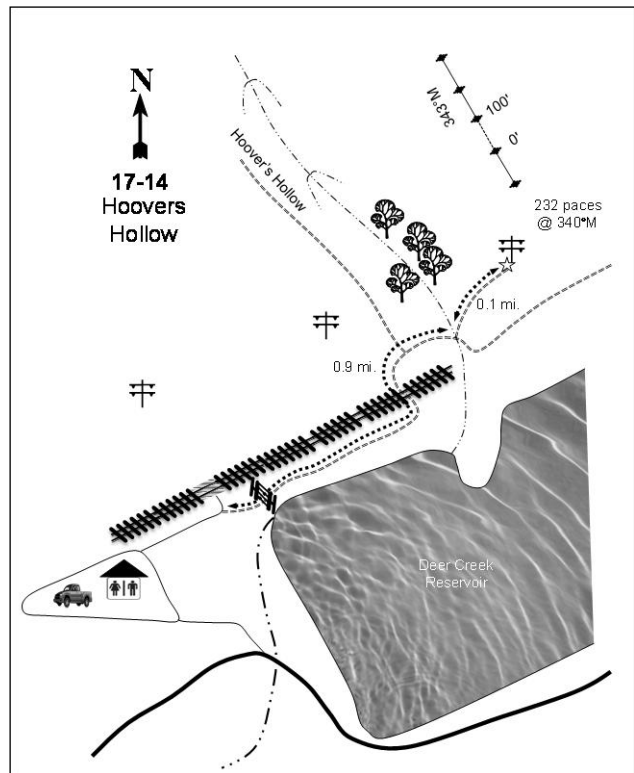
From the locked gate at the southwest corner of Deer Creek Reservoir, walk 0.9 miles on the maintenance road along the northern edge of the reservoir, crossing the railroad tracks. Stop where the road crosses Hoovers Hollow. Follow a faint road that leads through the brush, across the hollow, and then leads to the first power pole northeast of the hollow. From the power pole, walk 232 paces at an azimuth of 340 degrees magnetic, to the 0-foot baseline stake. A red browse tag, number 3949, is attached to the 0-foot baseline stake.

Map Name: Aspen Grove



Township: 4S Range: 4E Section: 32

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 455968 E 4474548 N

## HOOVERS HOLLOW - TREND STUDY NO. 17-14

### Site Information

Site Description: This study is located on a ridge top near the mouth of Hoovers Hollow, and on the west side of Deer Creek Reservoir. The study samples a grass and forb community with limited amount mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). The area burned as a part of the Cascade wildfire in 2003. The fire was hot enough to kill most of the sagebrush, but did not consume the plants. There were no efforts to reseed the study area, or the surrounding hillside. Deer Creek Reservoir is approximately 0.75 miles to the east. Deer pellet groups were sampled in high abundance since 2002. Elk pellet groups were sampled in moderate abundance in 2002 and 2012, but in high abundance in 2007. Cattle pats occurred in low abundance in 2002 (Table - Pellet Group Data). It was reported in 1989 that domestic sheep had made a significant impact on this site for many years.

Browse: The browse component was noted to be limited before the 2003 wildfire, and was even more limited following the wildfire. Since 1989, density of sagebrush has continually to decrease; and in 2012, sagebrush plants were not sampled within density strips, though there were a few plants scattered across the study area. In 2007, the sagebrush population consisted of two plants; both of which were considered decadent. Over the course of the study, sagebrush utilization has been moderate to heavy. Recruitment of young sagebrush in 1983 and 1989 was high, but recruitment has been absent since 2002. Sagebrush was at its climax in 2002 with decadence and poor vigor at its lowest, and the number of mature plants at its highest. Other preferred browse species that are present include white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), serviceberry (*Amelanchier alnifolia*), and a few scattered antelope bitterbrush (*Purshia tridentata*) plants. The densities of these species have decreased or remained low since 1996. The density of broom snakeweed (*Gutierrezia sarothrae*), a less desirable increaser, has fluctuated widely. Pricklypear cactus (*Opuntia* sp.) is also present on the study (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by annual grass and forb species. The grass component has low diversity. Perennial grass cover remained constant from 1996 to 2007, but increased in 2012 largely due to Bluebunch wheatgrass (*Agropyron spicatum*). The invasive annual species cheatgrass (*Bromus tectorum*) has maintained similar nested frequency values over the duration of the study, but has generally decreased in cover over the same period. Since 1996, cheatgrass has been the dominant grass species. Bluebunch wheatgrass and Sandberg bluegrass (*Poa secunda*) are the most common perennial grass species. The most frequently occurring annual forbs include pale alyssum (*Alyssum alyssoides*), storksbill (*Erodium cicutarium*), blue-eyed Mary (*Collinsia parviflora*), common sunflower (*Helianthus annuus*), and bur buttercup (*Ranunculus testiculatus*). The perennial forb composition has been composed of mostly less than desirable species such as thistle (*Cirsium* sp.) and hairy goldaster (*Heterotheca villosa*). Houndstongue (*Cynoglossum officinale*) and Dalmatian toadflax (*Linaria dalmatica*) are two noxious weed species that have also been sampled, but have had no significant increases (Table - Herbaceous Trends).

Soil: The soil is part of the Wallsburg component, which is found on mountainsides. The parent material consists of colluvium over residuum weathered from sedimentary rock (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH of 7.3) (Table - Soil Analysis Data). The soil is shallow and very rocky, both on the surface and throughout the profile. Bare ground cover is low with a high amount of vegetation and litter providing protective ground cover. Rock and pavement provided a moderate amount of cover (Table - Basic Cover). However, the majority of the vegetation cover comes from annual grasses and forbs which can be highly inconsistent from year to year. In past years, a high rate of erosion was reported and a loss of topsoil resulted. Since 1996, surface erosion has been minimal, and the soil erosion condition was classified as stable in 2002 and 2007, but slight in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly up (+1):** The density of mountain big sagebrush increased 56% from 265 plants/acre to 398 plants/acre. Decadence decreased from 37% to 25%, and poor vigor decreased from 25% to 8%. However, recruitment of young sagebrush decreased from 50% to 42% of the population. Average height and crown measurements of sagebrush decreased from 20in by 22in to 15in by 18in.
- **1989 to 1996 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Decadence decreased to 18%, and poor vigor decreased to 6%. Recruitment of young sagebrush decreased considerably to 18% of the population. Average height and crown measurement of sagebrush increased slightly to 17in. by 31in. Cover for sagebrush was measured at 1%.
- **1996 to 2002 - slightly down (-1):** The density of mountain big sagebrush displayed no change at 340 plant/acre. Decadence decreased to 12%, and poor vigor decreased to 0%. Recruitment of young sagebrush to the population was not observed. Average height and crown measurement of sagebrush increased slightly to 19in by 32in. Sagebrush cover remained near 1%. The density of white rubber rabbitbrush decreased 63% from 480 plants/acre to 180 plants/acre.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 94% to 20 plants/acre. Average height and crown measurement of sagebrush increased slightly to 20in. by 37in. Cover for sagebrush decreased to less than 1%.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush could not be measured do to the loss of plants.

### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial grasses increased four-fold. Sandberg bluegrass had a significant increase in nested frequency.
- **1989 to 1996 - stable (0):** The sum of nested frequencies for perennial grasses remained similar. Perennial grasses had no notable changes. Bluebunch wheatgrass and Sandberg bluegrass had covers of 4%. Cheatgrass was recorded for the first time, and was the most dominant grass within the community. Cheatgrass had a cover of 6%.
- **1996 to 2002 - slightly down (-1):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased 12%. The perennial grass species bluebunch wheatgrass increased to 5%. Japanese brome (*Bromus japonicus*) was recorded for the first time, which had a significant increase in nested frequency. Cheatgrass did not change in nested frequency, but had a large increase in cover at 20%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased 12%. Bluebunch wheatgrass decreased in cover to 3%, while Sandberg bluegrass increased in cover to 4%. The annual species Japanese brome had a significant decreased in nested frequency. Cheatgrass had no significant change in nested frequency, but decreased in cover to 15%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased 21%. Bluebunch wheatgrass had a significant increase in nested frequency, and increased in cover to 9%. Sandberg bluegrass increased in cover to 5%. The annual species Japanese brome increased significantly in nested frequency. Cheatgrass maintained dominance within the community with a cover of 12%.

### Forb:

- **1983 to 1989 - stable (0):** Perennial forbs remained rare on the study. The noxious weed houndstongue was recorded for the first time, but in low frequency.
- **1989 to 1996 - up (+2):** The sum of nested frequencies for perennial forbs increased over three-fold, and had a cover of 4%. The Dalmatian toadflax was present on the site but was not common, and had very little cover.



- **1996 to 2002 - down (-2):** The sum of nested frequencies for perennial forbs decreased 63%, and decreased in cover to 2%. The Dalmatian toadflax was present on the site but was not common, and had very little cover.
- **2002 to 2007 - up (+2):** The sum of nested frequencies for perennial forbs increased 31%, and increased in cover to 4%. The Dalmatian toadflax was present on the site but was not common, and had very little cover.
- **2007 to 2012 - stable (0):** The sum of nested frequency for perennial forbs remained similar, but increased in cover to 7%. Hairy goldaster increased significantly in nested frequency, and increased in cover to 5%. The Dalmatian toadflax was present on the site but was not common, and had very little cover.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 14

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	2.6	0.0	0.0	14.7	-4.4	7.5	-2.0	<b>18.4</b>	Very Poor
02	3.6	0.0	0.0	14.0	-15.7	4.2	-2.0	<b>4.1</b>	Very Poor
07	1.1	0.0	0.0	13.7	-11.0	7.7	-2.0	<b>9.5</b>	Very Poor
12	0.6	0.0	0.0	26.6	-9.6	10.0	-2.0	<b>25.6</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 14

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	Agropyron cristatum	-	1	-	-	-	-	-	-	-	-
G	Agropyron spicatum	a18	ab37	bc65	c101	c96	d142	3.63	4.47	3.11	8.82
G	Bromus japonicus (a)	-	-	a-	c92	a6	b32	-	.57	.06	.37
G	Bromus tectorum (a)	-	-	346	347	353	333	5.82	20.35	14.66	12.43
G	Poa bulbosa	-	-	-	2	6	11	-	.01	.15	.56
G	Poa secunda	a35	bc180	b159	b155	bc190	c204	3.69	2.52	3.75	4.45
G	Sporobolus cryptandrus	-	-	4	-	-	-	.03	-	-	-
Total for Annual Grasses		0	0	346	439	359	365	5.82	20.92	14.72	12.81
Total for Perennial Grasses		53	218	228	258	292	357	7.35	7.00	7.02	13.84
Total for Grasses		53	218	574	697	651	722	13.17	27.92	21.75	26.65
F	Agoseris glauca	a-	a-	b32	a1	a-	a7	.19	.00	-	.02
F	Allium acuminatum	a-	a3	b18	b31	a-	a-	.05	.13	-	-
F	Alyssum alyssoides (a)	-	-	b302	a198	b288	a265	1.58	2.08	1.61	1.65
F	Astragalus beckwithii	-	-	-	4	-	-	-	.15	-	-
F	Astragalus tenellus	-	-	4	-	-	-	.04	-	-	-
F	Astragalus utahensis	2	2	13	6	10	7	.08	.19	.07	.21
F	Calochortus nuttallii	-	6	12	13	-	-	.03	.04	-	-
F	Castilleja linariaefolia	2	-	8	1	-	-	.10	.15	-	-
F	Cirsium sp.	b65	b78	b67	a2	a7	a14	1.11	.01	.05	.25
F	Collinsia parviflora (a)	-	-	b182	b147	a20	a29	1.11	1.20	.04	.04
F	Collomia linearis (a)	-	-	b21	a3	a-	b29	.05	.00	-	.12

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	Cymopterus sp.	-	-	31	32	42	28	.10	.39	.12	.39
F	Cynoglossum officinale	-	4	-	-	-	-	-	-	-	-
F	Draba sp. (a)	-	-	b50	a-	a17	a7	.10	-	.06	.01
F	Epilobium brachycarpum (a)	-	-	-	5	-	8	-	.01	-	.01
F	Eriogonum racemosum	-	1	11	1	4	7	.02	.01	.19	.09
F	Erodium cicutarium (a)	-	-	c312	a81	d336	b246	6.44	.80	10.44	6.24
F	Galium aparine (a)	-	-	1	-	-	-	.00	-	-	-
F	Gilia sp. (a)	-	-	-	1	-	-	-	.00	-	-
F	Helianthella uniflora	-	-	-	-	2	-	-	-	.15	-
F	Helianthus annuus (a)	a6	c173	a-	b100	a-	a-	-	.27	-	-
F	Heterotheca villosa	a5	a18	c88	ab31	b58	c80	1.67	.94	2.50	5.11
F	Holosteum umbellatum (a)	-	-	190	171	231	209	2.63	.94	1.00	.70
F	Lactuca serriola (a)	-	3	2	-	-	11	.01	-	-	.05
F	Lappula occidentalis (a)	-	-	-	3	3	-	-	.00	.00	-
F	Linaria dalmatica	-	-	4	1	11	3	.03	.03	.05	.09
F	Machaeranthera spp	-	-	44	-	-	-	.08	-	-	-
F	Oenothera pallida	a-	a-	bc24	b8	a-	c28	.04	.02	-	.23
F	Polygonum douglasii (a)	-	-	3	-	-	-	.00	-	-	-
F	Ranunculus testiculatus (a)	-	-	a58	ab66	b105	ab73	.20	.23	.42	.38
F	Sanguisorba minor	-	-	-	-	10	6	-	-	.18	.21
F	Saxifragaceae	-	-	-	-	28	-	-	-	.49	-
F	Tragopogon dubius (a)	c64	a10	c73	a3	b39	bc58	.78	.00	.25	.64
F	Verbascum thapsus	-	-	4	-	-	-	.15	-	-	-
Total for Annual Forbs		70	186	1194	778	1039	935	12.94	5.59	13.85	9.87
Total for Perennial Forbs		74	112	360	131	172	180	3.74	2.08	3.83	6.62
Total for Forbs		144	298	1554	909	1211	1115	16.68	7.67	17.68	16.50

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

#### BROWSE TRENDS--

Management unit 17, Study no: 14

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	Amelanchier alnifolia	2	1	1	1	.15	.38	.63	.38
B	Artemisia tridentata vaseyana	15	15	1	0	1.16	1.28	.15	-
B	Chrysothamnus nauseosus albicaulis	18	9	1	2	.72	1.17	-	.03
B	Gutierrezia sarothrae	73	6	3	6	1.55	-	.15	.30
B	Opuntia sp.	40	36	30	29	2.77	1.54	.57	.90
B	Symphoricarpos oreophilus	1	1	1	0	.15	.15	.15	-
Total for Browse		149	68	37	38	6.51	4.54	1.65	1.61

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 14

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	-	.10	.20
Artemisia tridentata vaseyana	2.33	-	-
Chrysothamnus nauseosus albicaulis	1.36	.28	.25
Gutierrezia sarothrae	-	.21	.08
Opuntia sp.	1.75	.70	1.21

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 14

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	3.2	-	-

BASIC COVER--

Management unit 17, Study no: 14

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	2.00	9.25	36.09	45.96	50.93	41.40
Rock	9.25	13.50	18.57	17.48	16.91	16.28
Pavement	12.25	41.75	7.71	9.44	6.25	11.50
Litter	62.75	20.50	28.28	23.36	28.89	40.01
Cryptogams	.25	.75	2.79	1.22	.31	.07
Bare Ground	13.50	14.25	12.42	15.90	10.87	8.29

PELLET GROUP DATA--

Management unit 17, Study no: 14

Type	Quadrat Frequency			
	'96	'02	'07	'12
Rabbit	1	2	-	1
Elk	10	12	36	16
Deer	28	29	32	28
Cattle	-	-	-	-

Days use per acre (ha)		
'02	'07	'12
-	-	-
21 (51)	58 (144)	34 (83)
68 (169)	119 (293)	40 (99)
2 (4)	-	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 14

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
83	0	0	0	0	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
96	40	0	50	50	-	50	50	0	13/21
02	20	0	100	0	-	0	100	0	18/25
07	20	0	100	0	-	0	0	0	22/29
12	20	0	100	0	-	100	0	0	29/38
<i>Artemisia tridentata vaseyana</i>									
83	265	50	12	37	-	0	50	25	20/22
89	398	42	33	25	-	25	58	8	15/18
96	340	18	65	18	80	47	29	6	17/31
02	340	0	88	12	-	65	12	0	19/32
07	20	0	0	100	-	100	0	0	20/37
12	0	0	0	0	-	0	0	0	20/33
<i>Chrysothamnus nauseosus albicaulis</i>									
83	533	0	100	0	-	0	0	0	24/30
89	365	9	36	55	-	45	9	18	18/20
96	480	8	67	25	40	33	21	17	23/39
02	180	0	44	56	-	11	11	22	31/39
07	20	0	100	0	-	0	0	0	23/28
12	40	0	100	0	-	0	0	0	23/37
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
96	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	17/17
<i>Gutierrezia sarothrae</i>									
83	3266	0	100	0	-	0	0	0	9/11
89	2464	4	69	27	3333	0	0	19	8/10
96	11540	59	41	0	21280	0	0	0	5/8
02	160	13	75	13	-	0	0	13	5/8
07	80	0	100	0	-	0	0	0	9/13
12	160	25	75	0	-	0	0	0	11/20

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Opuntia</i> sp.									
83	<b>6099</b>	0	100	0	-	0	0	0	6/6
89	<b>731</b>	46	41	14	99	0	0	27	5/22
96	<b>1000</b>	4	56	40	20	0	0	18	6/33
02	<b>1400</b>	11	61	27	-	0	1	13	5/16
07	<b>1000</b>	6	92	2	-	0	0	0	5/11
12	<b>1660</b>	1	99	0	-	1	0	31	6/16
<i>Purshia tridentata</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
96	<b>0</b>	0	0	-	-	0	0	0	7/28
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	8/38
12	<b>0</b>	0	0	-	-	0	0	0	11/69
<i>Quercus gambelii</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
96	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	48/78
<i>Symphoricarpos oreophilus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
96	<b>20</b>	100	0	-	-	0	0	0	6/11
02	<b>20</b>	0	100	-	-	0	0	0	7/14
07	<b>20</b>	0	100	-	-	0	100	0	4/8
12	<b>0</b>	0	0	-	-	0	0	0	17/33

ISLAND BOAT CAMP - TREND STUDY NO. 17-15-12

Vegetation Type: Mixed Mountain Brush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: BOR

Elevation: 6,100 ft (1,860 m)

Aspect: Northeast

Slope: 5%

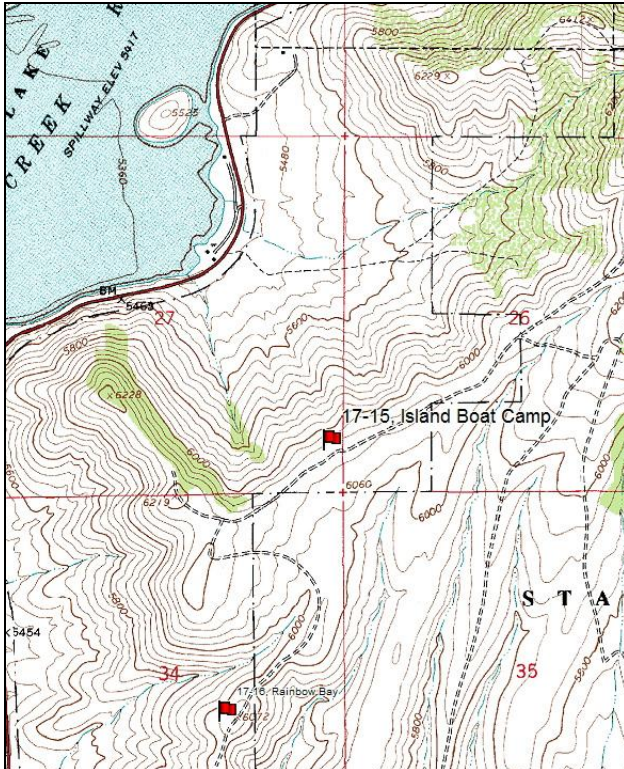
Transect bearing: 355° magnetic

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

Directions:

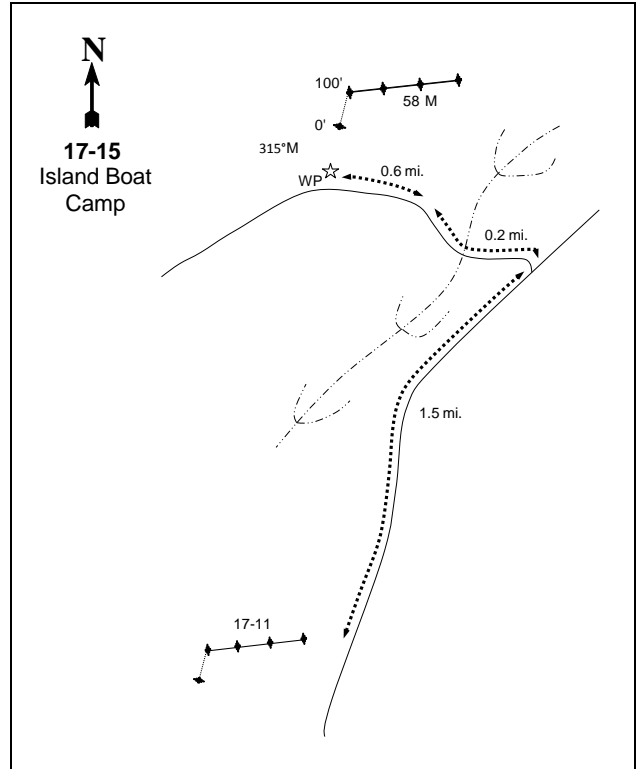
Beginning at the intersection of U.S. 189 and the Wallsburg turnoff, proceed 0.50 miles towards Wallsburg to an intersection. Turn left at the intersection and proceed northerly for just over 1 mile passing through two DWR gates to another intersection, and turn right. Proceed 0.05 miles to a small rock pile on the left (i.e., east) side of the road which marks study #17-11, Wallsburg Turn. Continue down the road traveling north passing a left fork for 1.5 miles to a fork. Bear left and go 0.2 miles thru a drainage to another ridge top and bear left. Drive along the ridge 0.6 miles to a witness post on the north side of the road. 0-foot stake marked with a browse tag #415.

Map Name: Charleston



Township: 4S Range: 4E Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 459901 E 4476255 N

## ISLAND BOAT CAMP - TREND STUDY NO. 17-15

### Site Information

Site Description: This winter range study is located on a ridge overlooking both Wallsburg and the Island Boat Camp. It is representative of the unburned mountain brush community that existed on better quality sites between Wallsburg and Deer Creek Reservoir. Virtually all of the winter range to the north, east and south of this site was burned in 1976. The nearest source of perennial water is Deer Creek Reservoir at 1.4 miles to the northwest. Deer pellet groups were sampled in high abundance since 2002. Elk pellet groups were sampled in moderate abundance in 2002, but in low abundance in 2007 and 2012. Cattle pat groups were sampled in low abundance in 2007 and 2012 (Table - Pellet Group Data).

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), Saskatoon serviceberry (*Amelanchier alnifolia*), and antelope bitterbrush (*Purshia tridentata*) are the dominant preferred browse species. The sagebrush population has had a large decrease in density with the health of the population being poor for the duration of the study. Density of sagebrush is considered to be moderately sparse. Decadence within the sagebrush population has been high every year. Poor vigor within the sagebrush population has been moderate to high over the duration of the study. Utilization has been mostly moderate; however, the sample years of 2007 and 2012 experienced heavier utilization. Recruitment of young sagebrush to the population has been poor throughout the course of the study. Since 1996, sagebrush has decreased in abundance on the study site. In 2007, the sagebrush were infested with the sagebrush defoliator moth (*Aroga websteri*), which corresponds with the high decadence and poor vigor of that year. The antelope bitterbrush population is moderately dense and poor in health. Density of the mature bitterbrush population has fluctuated slightly from year to year, but has generally maintained a relatively stable, moderately dense population size. Health of the bitterbrush population has been mixed. Decadence has been high every year, except in 1996. Poor vigor has been low to moderate, except in 2012 where poor vigor was high. Utilization of the bitterbrush population has been moderate to heavy throughout the course of the study. Recruitment of bitterbrush to the population has been poor since 1996. Saskatoon serviceberry has fluctuated in density from moderately sparse to moderately dense. Decadence of serviceberry was high in 1983, 1989, and 2002; however, decadence was low all other sampled years. Poor vigor within the serviceberry population was high in early sampled years, but has since been low, except in 2012 where poor vigor was moderate. Utilization of serviceberry receives moderate to heavy use. The most abundant browse species is stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*). Other browse species present include snowberry (*Symphoricarpos oreophilus*), gray horsebrush (*Tetradymia canescens*), and broom snakeweed (*Gutierrezia sarothrae*) (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is abundant and diverse. Bluebunch wheatgrass (*Agropyron spicatum*), mutton bluegrass (*Poa fendleriana*), and Sandberg bluegrass (*P. secunda*) are the dominant grasses. Other grasses sampled include Indian ricegrass (*Oryzopsis hymenoides*), crested wheatgrass (*Agropyron cristatum*), and oniongrass (*Melica bulbosa*). The weedy annual species cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicus*), and also the weedy perennial grass species bulbous bluegrass (*Poa bulbosa*) are also present, but are not abundant. Of these three, only cheatgrass has been sampled in moderate abundance (Table - Herbaceous Trends). Perennial forb diversity and abundance are higher at this study when compared to other studies near Deer Creek Reservoir and Wallsburg. Silky milkvetch (*Astragalus cibaricus*), arrowleaf balsamroot (*Balsamorhiza sagittata*), sulfur eriogonum (*Eriogonum umbellatum*), and silvery lupine (*Lupinus argenteus*) have been the dominant perennial forbs. The dominant annual forbs are pale alyssum (*Alyssum alyssoides*), blue-eyed Mary (*Collinsia parviflora*) and Douglas knotweed (*Polygonum douglasii*). The noxious weed houndstongue (*Cynoglossum officinale*) was sampled in 1996 (Table - Herbaceous Trends).

Soil: The soil is in the Watkins Ridge-Deer Creek complex, and is part of the Watkins Ridge component, which is found on ridges. The parent material consists of colluvium and /or slope alluvium derived from sedimentary rock (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.8) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of vegetation and litter

cover providing protective ground cover (Table - Basic Cover). Though there are few rocks on the surface, rocks are abundant throughout the profile. The soil erosion condition was classified as stable in 2002 and 2007, but slight in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - down (-2):** The density of mountain big sagebrush decreased 21% from 3,198 plants/acre to 2,531 plants/acre. Decadence increased from 21% to 42%, and poor vigor increased from 0% to 29%. Recruitment of young sagebrush decreased from 19% to 8%. The density of antelope bitterbrush increased 7% from 930 plants/acre to 998 plants/acre. Decadence increased from 29% to 40%, but poor vigor was not observed within the population. Recruitment of young bitterbrush to the population increased from 0% to 30%. The density of Saskatoon serviceberry increased nearly three-fold from 532 plants/acre to 1,531 plants/acre. Decadence increased from 50% to 57%, and poor vigor increased from 25% to 48%. Recruitment of young serviceberry to the population increased from 0% to 30%.
- **1989 to 1996 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Sagebrush decadence decreased to 27%, and poor vigor decreased to 10%. Recruitment of young sagebrush decreased to 2%. Cover for sagebrush was measured at 10%. Bitterbrush decreased in decadence to 13%, but poor vigor increased to 10%. Recruitment of young bitterbrush decreased to 0%. Cover of bitterbrush was recorded at 5%. Saskatoon serviceberry decadence decreased to 7%, and poor vigor decreased to 0%. Recruitment of young serviceberry to the population increased to 33%. Cover for serviceberry was recorded at 4%.
- **1996 to 2002 - down (-2):** The density of mountain big sagebrush decreased 16% from 2,080 plants/acre to 1,740 plants/acre. Decadence increased to 38%, and poor vigor remained similar at 11%. Recruitment of young sagebrush increased to 6%. Cover for sagebrush remained similar near 11%. The density of antelope bitterbrush decreased 7% from 600 plants/acre to 560 plants/acre. Decadence increased to 29% and poor vigor remained similar at 11%. Recruitment of bitterbrush to the population was not observed. Cover of bitterbrush increased to 8%. The density of Saskatoon serviceberry decreased 43% from 1,220 plants/acre to 700 plants/acre. Decadence decreased to 29%, and poor vigor increased slightly to 6%. Cover for serviceberry decreased to 3%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 70% to 520 plants/acre. Cover for sagebrush decreased to 1%. Decadence increased considerably to 65%, and poor vigor increased to 23%. Recruitment of young sagebrush to the population increased to 15%; however, with the small population size the increase is negligible. The density of antelope bitterbrush decreased 29% to 400 plants/acre. Cover for bitterbrush decreased to 3%. Decadence increased to 35%, and poor vigor decreased to 5%. Recruitment of young bitterbrush to the population was not observed. The density of Saskatoon serviceberry increased 11% to 780 plants/acre. Cover for serviceberry increased to 4%. Decadence decreased to 5%, and poor vigor decreased to 0%.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush increased 8% to 560 plants/acre. Cover for sagebrush increased to 2%. Decadence decreased to 39%, and poor vigor remained similar at 25%. Recruitment of young sagebrush to the population decreased to 7%. The density of antelope bitterbrush increased 50% to 600 plants/acre. Cover for bitterbrush increased to over 4%. Decadence decreased to 23%, and poor vigor increased to 20%. Recruitment of young bitterbrush was minimal. The density of Saskatoon serviceberry increased 3% to 800 plants/acre. Cover of serviceberry increased to 4%. Decadence increased to 8%, and poor vigor increased to 18%.

### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial grasses increased 61%. Indian ricegrass, mutton bluegrass, and Sandberg bluegrass all has significant increases in nested frequency.
- **1989 to 1996 - up (+2):** The sum of nested frequencies for perennial grasses increased 22%. Bluebunch wheatgrass increased significantly in nested frequency, and had a cover of 6%. Mutton



bluegrass had a cover of 5%. The annual species cheatgrass was recorded on the study site with a cover just under 5%.

- **1996 to 2002 - up (+2):** The sum of nested frequencies for perennial grasses increased 23%. Sandberg bluegrass had a significant increase in nested frequency, and increased in cover from 1% to 3%. Bluebunch wheatgrass increased in cover to 11%.
- **2002 to 2007 - down (-2):** The sum of nested frequencies for perennial grasses decreased 24%. Indian ricegrass decreased significantly in nested frequency, and cover decreased from over 1% to near 0%. Mutton bluegrass decreased significantly in nested frequency, and decreased in cover from 5% to 1%. The annual species cheatgrass had a significant increase in nested frequency, and increased in cover from near 0% to 2%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies for perennial grasses remained similar. Crested wheatgrass increased significantly in nested frequency, and increased in cover from 2% to 6%. The weedy annual species cheatgrass decreased significantly in nested frequency, and decreased in cover to less 1%.

Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial forbs increased two-fold. Longleaf phlox (*Phlox longifolia*) and narrowleaf lomatium (*Lomatium triternatum*) increased significantly in nested frequency.
- **1989 to 1996 - up (+2):** The sum of nested frequencies for perennial forbs increased over two-fold. Violet (*Viola* sp.), blue flax (*Linum lewisii*), Nuttall larkspur (*Delphinium nuttallianum*), spring parsley (*Cymopterus longipes*), arrowleaf balsamroot, and sulfur eriogonum all increased in nested frequency.
- **1996 to 2002 - down (-2):** The sum of nested frequencies for perennial forbs decreased 41%. Violet, Nuttall larkspur, spring parsley, tapertip hawksbeard (*Crepis acuminata*) all decreased significantly in nested frequency.
- **2002 to 2007 - down (-2):** The sum of nested frequencies for perennial forbs decreased 46%. Spring parsley, sulfur eriogonum, and longleaf phlox decreased significantly in nested frequency.
- **2007 to 2012 - stable (0):** The sum of nested frequencies for perennial forbs remained similar.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 15

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	26.4	9.2	3.9	27.4	-0.5	10.0	-2.0	<b>74.4</b>	Good
02	30.0	5.1	3.1	30.0	0.0	10.0	0.0	<b>78.2</b>	Good-Excellent
07	9.4	7.5	2.3	30.0	-1.8	10.0	0.0	<b>57.4</b>	Fair
12	14.9	8.8	2.8	30.0	-0.2	10.0	0.0	<b>66.4</b>	Fair-Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 15

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	Agropyron cristatum	a-	a8	a8	a25	a31	b88	.06	1.82	1.73	6.08
G	Agropyron spicatum	a104	a119	b178	b205	b198	b183	6.32	10.72	12.36	9.11
G	Bromus japonicus (a)	-	-	-	-	1	3	-	-	.00	.00

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	Bromus tectorum (a)	-	-	b67	a7	c172	b102	.68	.02	2.37	.32
G	Festuca ovina	b15	a-	a-	a-	a2	a-	-	-	.03	-
G	Melica bulbosa	a-	a-	ab4	b7	a-	a-	.06	.19	.00	-
G	Oryzopsis hymenoides	ab19	c46	abc24	bc32	a2	a5	.91	1.35	.03	.09
G	Poa bulbosa	-	-	-	-	1	-	-	-	.00	-
G	Poa fendleriana	a103	b172	b198	b172	a46	a69	5.01	4.99	.82	2.24
G	Poa pratensis	-	12	5	7	8	13	.06	.18	.33	.51
G	Poa secunda	a-	b30	b60	c125	c159	c117	1.27	2.52	2.93	3.54
G	Poa sp.	-	-	-	15	-	-	-	1.52	-	-
G	Sitanion hystrix	-	-	-	-	-	-	-	.00	-	-
G	Stipa comata	3	5	-	-	-	-	-	-	-	-
G	Stipa lettermani	-	-	-	-	-	2	-	-	-	.03
Total for Annual Grasses		0	0	67	7	173	105	0.68	0.01	2.38	0.32
Total for Perennial Grasses		244	392	477	588	447	477	13.72	23.32	18.27	21.62
Total for Grasses		244	392	544	595	620	582	14.40	23.34	20.65	21.95
F	Agoseris glauca	a5	a-	c141	b36	b30	ab31	.95	.23	.15	.11
F	Allium sp.	ab9	c70	b31	c93	ab19	a3	.08	.36	.09	.00
F	Alyssum alyssoides (a)	-	-	b105	a19	c263	b81	.18	.04	3.64	.16
F	Antennaria rosea	a-	b21	b40	b32	a-	a2	.52	.64	-	.00
F	Arabis sp.	5	-	-	-	3	3	-	-	.00	.00
F	Astragalus cibarius	a-	a-	c93	b50	a23	a1	2.68	.66	.12	.03
F	Astragalus convallarius	13	9	3	11	15	11	.01	.05	.31	.07
F	Balsamorhiza sagittata	ab18	a33	c85	bc56	c75	bc65	4.46	4.77	5.32	4.52
F	Calochortus nuttallii	ab7	b15	ab13	a3	ab3	a-	.03	.00	.01	-
F	Castilleja linariaefolia	-	3	2	4	-	4	.03	.06	-	.01
F	Castilleja sp.	-	-	3	-	-	-	.03	-	-	-
F	Chaenactis douglasii	-	-	1	-	3	6	.03	-	.03	.04
F	Cirsium sp.	2	-	3	1	-	3	.00	.03	-	.00
F	Collinsia parviflora (a)	-	-	b198	b216	b191	a26	.70	1.07	.98	.05
F	Collomia linearis (a)	-	-	b30	a3	b47	a2	.11	.01	.11	.00
F	Comandra pallida	ab24	b27	ab22	a3	a6	ab23	.10	.01	.01	.13
F	Cordylanthus sp. (a)	-	-	-	-	-	2	-	-	-	.03
F	Crepis acuminata	a-	a4	b95	a26	a24	a17	.84	.55	.40	.18
F	Cryptantha sp.	2	-	-	-	3	3	-	-	.00	.06
F	Cymopterus longipes	a-	a-	c70	b29	a-	a2	.33	.12	-	.00
F	Cymopterus sp.	-	-	-	-	3	-	-	-	.03	-
F	Cynoglossum officinale	-	-	3	-	-	-	.00	-	-	-
F	Delphinium nuttallianum	a-	a-	b41	a3	a-	a-	.11	.03	-	-
F	Descurainia pinnata (a)	-	-	a-	a-	b22	a6	-	-	.04	.01
F	Erigeron divergens	-	-	-	10	6	-	-	.24	.15	-
F	Erigeron pumilus	a-	a6	ab23	ab18	b25	ab15	.07	.14	.15	.16
F	Eriogonum ovalifolium	-	-	-	3	-	-	-	.00	-	-
F	Eriogonum racemosum	ab25	b25	ab14	ab16	a7	a6	.06	.16	.06	.12
F	Eriogonum umbellatum	ab74	ab80	c143	bc107	a51	a58	2.49	2.04	.56	.61
F	Galium sp.	-	-	3	-	-	-	.01	-	-	-

T y p e	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	Hackelia patens	ab <sup>5</sup>	ab <sup>16</sup>	b <sup>20</sup>	ab <sup>10</sup>	a <sup>-</sup>	a <sup>2</sup>	.07	.05	-	.01
F	Holosteum umbellatum (a)	-	-	-	-	3	3	-	-	.01	.00
F	Lactuca serriola (a)	2	-	-	-	-	-	-	-	-	-
F	Linum lewisii	a <sup>3</sup>	a <sup>3</sup>	b <sup>21</sup>	ab <sup>13</sup>	a <sup>3</sup>	a <sup>3</sup>	.22	.13	.03	.00
F	Lomatium triternatum	a <sup>-</sup>	b <sup>24</sup>	b <sup>17</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>3</sup>	.04	-	-	.03
F	Lupinus argenteus	ab <sup>21</sup>	ab <sup>34</sup>	b <sup>43</sup>	ab <sup>19</sup>	a <sup>18</sup>	a <sup>14</sup>	1.00	.43	1.08	.39
F	Machaeranthera canescens	ab <sup>11</sup>	b <sup>22</sup>	a <sup>3</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>1</sup>	.00	-	-	.15
F	Machaeranthera spp	5	-	-	-	-	-	-	-	-	-
F	Mertensia sp.	-	-	8	-	-	-	.05	-	-	-
F	Microsteris gracilis (a)	-	-	-	6	14	11	-	.01	.03	.02
F	Orthocarpus sp. (a)	-	-	9	-	-	-	.05	-	-	-
F	Penstemon humilis	-	3	-	-	-	-	-	-	-	-
F	Phlox longifolia	a <sup>-</sup>	ab <sup>90</sup>	b <sup>134</sup>	b <sup>144</sup>	a <sup>62</sup>	b <sup>113</sup>	.30	.86	.31	.40
F	Polygonum douglasii (a)	-	-	b <sup>19</sup>	a <sup>3</sup>	a <sup>-</sup>	ab <sup>4</sup>	.03	.00	-	.01
F	Ranunculus testiculatus (a)	-	-	3	-	10	2	.00	-	.04	.00
F	Senecio multilobatus	b <sup>23</sup>	a <sup>6</sup>	ab <sup>13</sup>	a <sup>8</sup>	a <sup>-</sup>	a <sup>-</sup>	.04	.04	-	-
F	Sisymbrium altissimum (a)	-	-	-	-	2	1	-	-	.00	.00
F	Taraxacum officinale	-	-	1	4	-	-	.00	.03	-	-
F	Tragopogon dubius (a)	ab <sup>23</sup>	b <sup>23</sup>	b <sup>27</sup>	b <sup>29</sup>	a <sup>1</sup>	a <sup>2</sup>	.09	.19	.00	.01
F	Vicia americana	-	6	-	-	-	7	-	-	-	.01
F	Viola sp.	a <sup>-</sup>	a <sup>-</sup>	b <sup>103</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	1.35	-	-	-
Total for Annual Forbs		25	23	391	276	553	140	1.18	1.33	4.87	0.31
Total for Perennial Forbs		252	497	1192	699	379	396	15.99	11.70	8.87	7.11
Total for Forbs		277	520	1583	975	932	536	17.18	13.04	13.74	7.43

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

#### BROWSE TRENDS--

Management unit 17, Study no: 15

T y p e	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	Amelanchier alnifolia	41	30	33	33	3.92	4.71	3.04	3.86
B	Artemisia tridentata vaseyana	62	56	22	25	10.25	10.47	.92	2.09
B	Chrysothamnus viscidiflorus viscidiflorus	81	81	74	78	7.44	7.40	9.36	10.58
B	Gutierrezia sarothrae	10	6	8	7	.34	.45	.21	.76
B	Purshia tridentata	27	27	19	24	5.14	7.72	2.47	4.36
B	Symphoricarpos oreophilus	18	19	21	29	1.90	3.75	3.42	3.39
B	Tetradymia canescens	8	7	6	4	.03	.15	.18	.03
Total for Browse		247	226	183	200	29.05	34.68	19.63	25.10

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 15

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	5.58	4.78	9.00
Artemisia tridentata vaseyana	10.21	3.04	2.79
Chrysothamnus viscidiflorus viscidiflorus	7.30	13.16	7.40
Gutierrezia sarothrae	.21	.48	.20
Purshia tridentata	7.88	3.70	6.56
Symphoricarpos oreophilus	2.04	3.68	.81
Tetradymia canescens	-	.06	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 15

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.2	2.0	2.0
Purshia tridentata	2.4	3.5	4.2

BASIC COVER--

Management unit 17, Study no: 15

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	.50	12.00	54.79	60.15	61.49	56.93
Rock	1.00	1.25	1.50	.68	.66	.47
Pavement	2.75	17.25	2.71	4.29	3.43	4.94
Litter	75.75	58.75	61.57	55.50	39.52	45.40
Cryptogams	.75	1.25	.64	.98	.44	.00
Bare Ground	19.25	9.50	8.54	7.38	7.30	5.73

PELLET GROUP DATA--

Management unit 17, Study no: 15

Type	Quadrat Frequency			
	'96	'02	'07	'12
Rabbit	5	1	2	-
Elk	19	17	12	4
Deer	35	52	29	20
Cattle	1	-	6	1

Days use per acre (ha)		
'02	'07	'12
-	-	-
31 (78)	9 (22)	4 (10)
125 (309)	66 (164)	62 (152)
-	19 (47)	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 15

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
83	<b>532</b>	0	50	50	-	75	13	25	26/18
89	<b>1531</b>	30	13	57	199	48	17	48	47/43
96	<b>1220</b>	33	61	7	60	26	11	0	31/40
02	<b>700</b>	17	54	29	-	26	54	6	32/36
07	<b>780</b>	5	90	5	-	36	10	0	35/36
12	<b>800</b>	8	85	8	-	33	38	18	36/36
<i>Artemisia tridentata vaseyana</i>									
83	<b>3198</b>	19	60	21	-	27	2	0	24/26
89	<b>2531</b>	8	50	42	-	37	0	29	25/30
96	<b>2080</b>	2	71	27	-	56	12	10	27/43
02	<b>1740</b>	6	56	38	-	34	17	11	29/35
07	<b>520</b>	15	19	65	40	31	23	23	34/38
12	<b>560</b>	7	54	39	60	18	25	25	27/30
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>4066</b>	0	100	0	-	0	0	0	9/9
89	<b>4465</b>	3	84	13	66	0	0	9	13/16
96	<b>6060</b>	11	89	0	60	.66	0	0	12/21
02	<b>4760</b>	4	95	1	-	0	.42	.42	11/17
07	<b>4140</b>	1	90	9	-	0	0	.48	14/23
12	<b>4480</b>	1	96	3	280	0	0	23	12/19
<i>Gutierrezia sarothrae</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
96	<b>920</b>	28	61	11	100	0	0	0	8/10
02	<b>580</b>	0	93	7	-	0	3	7	6/6
07	<b>820</b>	0	98	2	-	0	0	0	8/9
12	<b>720</b>	6	94	0	-	0	0	0	8/10
<i>Purshia tridentata</i>									
83	<b>931</b>	29	43	29	-	50	14	0	43/54
89	<b>998</b>	27	33	40	66	93	7	0	38/47
96	<b>600</b>	0	87	13	-	20	77	10	40/71
02	<b>560</b>	0	71	29	-	18	79	11	43/62
07	<b>400</b>	0	65	35	-	40	55	5	40/48
12	<b>600</b>	3	73	23	-	43	37	20	41/57

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b><i>Symphoricarpos oreophilus</i></b>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>0</b>	0	0	0	66	0	0	0	-/-	
96	<b>560</b>	32	68	0	20	4	0	0	23/29	
02	<b>540</b>	0	96	4	-	0	0	4	27/31	
07	<b>520</b>	8	92	0	280	0	0	4	30/42	
12	<b>960</b>	0	98	2	-	4	0	60	26/30	
<b><i>Tetradymia canescens</i></b>										
83	<b>464</b>	43	43	14	-	0	0	0	12/12	
89	<b>199</b>	67	33	0	-	0	0	0	6/10	
96	<b>160</b>	63	38	0	-	13	0	0	8/12	
02	<b>160</b>	25	75	0	-	13	0	0	8/16	
07	<b>120</b>	0	83	17	-	17	0	0	9/17	
12	<b>120</b>	0	100	0	-	0	0	50	9/13	

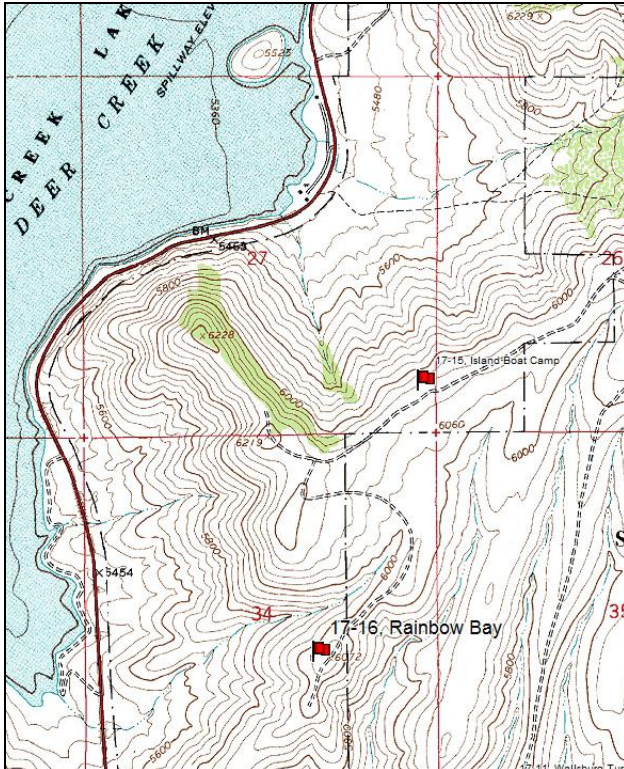
RAINBOW BAY - TREND STUDY NO. 17-16-12

Vegetation Type: Mountain Big Sagebrush and Antelope Bitterbrush  
Range Type: Crucial Deer Winter, Crucial Elk Winter  
NRCS Ecological Site Description: [Mountain Stony Loam \(Mountain Big Sagebrush\), R047XA461UT](#)  
Land Ownership: BOR  
Elevation: 6,000 ft (1,830 m)  
Aspect: West  
Slope: 15-20%  
Transect bearing: 345° magnetic  
Belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft)

Directions:

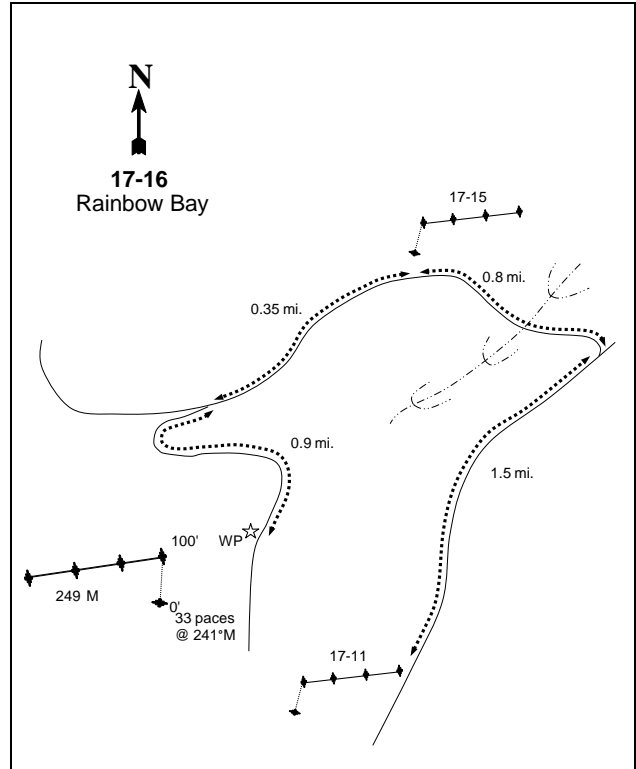
Beginning at the intersection of U.S. 189 and the Wallsburg turnoff, proceed 0.50 miles towards Wallsburg to an intersection. Turn left at the intersection and proceed northerly for just over 1 mile passing through two DWR gates to another intersection, and turn right. Proceed 0.05 miles to a small rock pile on the left (east) side of the road which marks study #17-11, Wallsburg Turn. Continue down the road 1.5 miles from study 17-11 to a fork. Bear left and go 0.2 miles thru a drainage to another ridge top and bear left. Drive along the ridge 0.6 miles to a witness post on the north side of the road which marks study #17-15. Continue down this road 0.35 miles to an intersection with a short telephone post and a Mountain Bell wire warning sign. Turn left and stay left for 0.9 miles to a witness post on the north side of the road. From the witness post, the 0-foot stake is 33 paces away at an azimuth of 241 degrees magnetic, marked with browse tag #3947.

Map Name: Charleston



Township: 4S Range: 4E Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 459422 E 4475040 N

## RAINBOW BAY - TREND STUDY NO. 17-16

### Site Information

Site Description: This study is located on mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and grass rangeland near the top of the high knoll immediately east of Rainbow Bay on Deer Creek Reservoir. This area, although within a short distance of the 1976 burn, was spared from the fire. However, the presence of numerous fire scarred sagebrush stumps provides evidence of a past fire on the site, before 1976. Deer pellet groups were sampled in high abundance in 2002 and 2007, but in moderate abundance in 2012. Elk pellet groups were sampled in low abundance in 2007 and 2012, but in moderate abundance in 2002 (Table - Pellet Group Data). Cattle were seen below the study in 1996.

Browse: Mountain big sagebrush and antelope bitterbrush (*Purshia tridentata*) are the dominant preferred browse species on the site. The sagebrush population was a fairly dense population in 1983, but has steadily decreased in density over the duration of the study. Sagebrush density is considered to be sparse. Decadence within the sagebrush population has been high between the 1989 and 2007 sample years. In 1983 and 2012, the sagebrush population was considered moderately decadent. Poor vigor within the sagebrush population was low in the early years of the study, but poor vigor has increased to moderate levels. Utilization of sagebrush has been light to moderate throughout the duration of the study. Recruitment of young sagebrush to the population was moderate in 1983 and 1989, but has since become minor component of the population. The antelope bitterbrush population has largely consisted of mature, healthy plants. Bitterbrush has varied slightly in density, and is considered sparse. Decadence within the bitterbrush population has gradually increased over the course of the study. Additionally, poor vigor has been low to absent most sample years; however, poor vigor was high in 2012. Recruitment of young bitterbrush to the population was moderate in 1983 and 1996, but high in 1989. Recruitment has not been measured since 2002. Utilization of bitterbrush has varied between light to moderate in 1983, 1989, and 2007 to mostly heavy in 1996, 2002, and 2012. Saskatoon serviceberry (*Amelanchier alnifolia*) is rare on the site, and receives moderate to heavy use. Other common browse species are broom snakeweed (*Gutierrezia sarothrae*) and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*). Broom snakeweed increased in density from 1983 to 1996, and then gradually declined from 2002 to 2012. Most of the broom snakeweed exists in open patches near the ridge top. The stickyleaf low rabbitbrush density has varied largely in density (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is abundant and diverse. The dominant perennial grasses include crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*A. spicatum*), and Sandberg bluegrass (*Poa secunda*). Bluebunch wheatgrass is the most dominant species on the study site and provides the majority of the cover. Since 1996, cheatgrass (*Bromus tectorum*) cover has increased on the site from 1996 to 2002, but decreased substantially in 2012. Japanese brome (*B. japonicus*) is also present, but at low frequencies. Since Bulbous bluegrass (*Poa bulbosa*) was first measured in 1989, bulbous bluegrass has gradually increased in frequency on the study (Table - Herbaceous Trends). The perennial forb community is fairly common and diverse. The dominant perennial forb species have been silky milkvetch (*Astragalus cibarius*) and arrowleaf balsamroot (*Balsamorhiza sagittata*). Annual forb species are also diverse. The dominant annual species are pale alyssum (*Alyssum alyssoides*), blue-eyed Mary (*Collinsia parviflora*), and holosteum (*Holosteum umbellatum*). The noxious weed Dalmatian toadflax (*Linaria dalmatica*), a noxious weed, is also present (Table - Herbaceous Trends).



Soil: The soil is in the Whipstock component, which occurs on mountainsides. The parent material consists of colluviums and/or slope alluvium derived from sedimentary rock (Soil Survey Staff 2011). The soil has a clay loam texture with a neutral soil reaction (pH of 7.2) (Table - Soil Analysis Data). Bare ground cover is low, with high amounts of vegetation and litter, and a moderate amount pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in sampled years.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly down (-1)**: The density of mountain big sagebrush decreased 20% from 4,731 plants/acre to 3,764 plants/acre. Decadence increased from 16% to 45%, and poor vigor changed little from 0% to 3%. Recruitment of young sagebrush to the population decreased from 17% to 12%. The density for antelope bitterbrush increased over two-fold from 299 plants/acre to 699 plants/acre. Decadence and poor vigor was not observed within the population. Recruitment of young bitterbrush to the population increased from 22% to 38%.
- **1989 to 1996 - down (-2)**: Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Mountain big sagebrush increased in both decadence and poor vigor to 51% and 12%, respectively. Recruitment of young sagebrush to the population decreased to 1%. Antelope bitterbrush population increased in decadence to 4%, but poor vigor not being observed within the population. Recruitment of young bitterbrush decreased to 17%.
- **1996 to 2002 - down (-2)**: The density of mountain big sagebrush decreased 30% from 1,520 plants/acre to 1,060 plants/acre. Cover for sagebrush decreased from 9% to 6%. Decadence remained similar at 49%, but poor vigor increased to 25%. Recruitment of young sagebrush to the population increased to 6%. The density for antelope bitterbrush decreased 29% from 480 plants/acre to 340 plants/acre. Cover for bitterbrush increased from 4% to 7%. Decadence increased to 12%, and poor vigor was not observed. Recruitment of young bitterbrush to the population was also not observed.
- **2002 to 2007 - slightly down (-1)**: The density of mountain big sagebrush decreased 19% to 860 plants/acre. Cover for sagebrush decreased to 4%. Decadence remained similar at 51%, and poor vigor remained similar at 23%. Recruitment of young sagebrush to the population remained poor at 5%. The density of antelope bitterbrush increased 6% to 360 plants/acre. Cover of bitterbrush decreased to 4%. Decadence remained similar at 11%, and poor vigor was not observed. Recruitment of young bitterbrush to the population was also not observed.
- **2007 to 2012 - down (-2)**: The density of mountain big sagebrush decreased 28% to 620 plants/acre. Cover for sagebrush decreased to 3%. Decadence decreased to 19%, and poor vigor decreased slightly to 19%. Recruitment of young sagebrush to the population remained poor at 6%. The density of antelope bitterbrush decreased 17% to 300 plants/acre. The cover of bitterbrush increased to 5%. Decadence within the bitterbrush population increased to 20%, and poor vigor increased substantially to 60%. Recruitment of young bitterbrush to the population was not observed.

### Grass:

- **1983 to 1989 - up (+2)**: The sum of nested frequencies for perennial grasses increased nearly three-fold. Bluebunch wheatgrass and Sandberg bluegrass increased significantly in nested frequency. The weedy perennial species bulbous bluegrass was observed for the first time.

- **1989 to 1996 - up (+2):** The sum of nested frequencies for perennial grasses increased 51%. Bluebunch wheatgrass increased significantly in nested frequency, and had a cover of 11%. The weedy annual species cheatgrass was measured for the first time and was the most frequently occurring grass species, and had a cover of 3%.
- **1996 to 2002 - slightly up (+1):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. Sandberg bluegrass increased significantly in nested frequency, and increased in cover from 1% to 2%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. The weedy annual species cheatgrass increased significantly in nested frequency, and increased in cover from 8% to 9%.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased 19%. Cover for crested wheatgrass and Sandberg bluegrass increased from 2% to 11% and 2% to 3%. The weedy annual species cheatgrass decreased significantly in nested frequency, and decreased in cover to 1%.

Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial grasses increased five-fold. Penstemon (*Penstemon* sp.), spring parsley (*Cymopterus longipes*), bastard toadflax (*Comandra pallida*), sego lily (*Calochortus nuttallii*), and arrowleaf balsamroot (*Balsamorhiza sagittata*) all increased in nested frequency.
- **1989 to 1996 - up (+2):** The sum of nested frequency for perennial forbs increased 86%. Spring parsley increased significantly in nested frequency. Perennial forb cover was high at 12%.
- **1996 to 2002 - down (-2):** The sum of nested frequencies for perennial forbs decreased 52%. Perennial forb cover decreased to 7%, while annual forb cover increased from 6% to 7%.
- **2002 to 2007 - down (-2):** The sum of nested frequencies for perennial forbs decreased 36%. Perennial for cover remained similar at 7%. Annual forb cover decreased to 4%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies for perennial forbs increased 49%. Perennial forb cover remained similar at 7%, but annual forb cover decreased to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 16

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	17.2	3.8	2.8	26.6	-2.3	10.0	0.0	<b>58.2</b>	Fair
02	17.5	6.1	1.5	30.0	-6.1	10.0	-2.0	<b>57.0</b>	Fair
07	10.4	6.1	1.2	30.0	-6.8	10.0	0.0	<b>50.8</b>	Poor-Fair
12	10.7	9.1	1.2	30.0	-1.1	10.0	-2.0	<b>57.9</b>	Fair

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 17, Study no: 16

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	<i>Agropyron cristatum</i>	a6	a13	a18	ab41	ab26	b53	1.39	3.54	2.08	4.00
G	<i>Agropyron intermedium</i>	-	2	12	8	-	-	.22	.02	-	-
G	<i>Agropyron spicatum</i>	a70	b150	c222	bc182	bc197	bc206	10.96	10.41	11.19	10.55
G	<i>Bromus japonicus</i> (a)	-	-	-	43	37	56	-	.18	.17	.35
G	<i>Bromus tectorum</i> (a)	-	-	b270	b261	c310	a139	3.04	7.90	8.92	1.08
G	<i>Oryzopsis hymenoides</i>	-	11	11	4	-	-	.19	.18	.00	-
G	<i>Poa bulbosa</i>	a-	a3	a-	b25	ab19	b32	-	.58	.41	.84
G	<i>Poa fendleriana</i>	-	-	6	-	-	5	.06	-	-	.06
G	<i>Poa secunda</i>	a5	bc26	b42	c89	cd111	d134	.45	1.95	2.01	2.64
G	<i>Sitanion hystrix</i>	-	1	-	1	2	1	-	.03	.03	.03
Total for Annual Grasses		0	0	270	304	347	195	3.04	8.07	9.09	1.44
Total for Perennial Grasses		81	206	311	350	355	431	13.28	16.71	15.75	18.14
Total for Grasses		81	206	581	654	702	626	16.32	24.79	24.84	19.58
F	<i>Agoseris glauca</i>	a-	a2	c91	ab17	ab12	b29	.82	.10	.10	.18
F	<i>Allium acuminatum</i>	a-	a-	b14	c41	a-	a-	.18	.17	-	-
F	<i>Alyssum alyssoides</i> (a)	-	-	b289	a83	b258	a118	1.41	.28	1.83	.32
F	<i>Arabis</i> sp.	-	11	3	3	1	7	.01	.00	.00	.01
F	<i>Artemisia ludoviciana</i>	3	1	-	-	-	3	-	-	-	.00
F	<i>Astragalus cibarius</i>	a-	a-	c123	b22	b17	b9	4.16	.11	.30	.03
F	<i>Astragalus convallarius</i>	-	-	2	-	-	-	.00	-	-	-
F	<i>Astragalus utahensis</i>	ab19	b17	ab6	a1	a-	ab5	.03	.00	-	.01
F	<i>Balsamorhiza sagittata</i>	a7	b44	c76	bc67	c77	c87	4.84	5.31	5.19	5.74
F	<i>Calochortus nuttallii</i>	a1	b41	a12	a13	a-	a-	.03	.03	.00	-
F	<i>Castilleja linariaefolia</i>	a-	a-	b40	a11	a3	a6	.22	.36	.09	.16
F	<i>Chaenactis douglasii</i>	-	3	-	-	-	-	-	-	-	-
F	<i>Cirsium</i> sp.	a3	a-	b8	a-	a3	ab4	.05	-	.15	.06
F	<i>Collinsia parviflora</i> (a)	-	-	c252	d328	b209	a117	2.10	5.61	.81	.45
F	<i>Collomia linearis</i> (a)	-	-	b101	a3	a2	a-	.28	.01	.01	-
F	<i>Comandra pallida</i>	a8	b22	a-	a-	a7	ab8	-	-	.19	.02
F	<i>Crepis acuminata</i>	4	20	12	12	6	15	.08	.16	.30	.08
F	<i>Cymopterus longipes</i>	a-	ab22	c101	b27	a5	ab5	.80	.15	.04	.02
F	<i>Delphinium nuttallianum</i>	-	-	11	5	-	1	.07	.01	-	.00
F	<i>Descurainia pinnata</i> (a)	-	-	-	1	-	5	-	.00	-	.01
F	<i>Draba</i> sp. (a)	-	-	b58	ab34	c96	a20	.16	.08	.39	.04
F	<i>Erigeron pumilus</i>	-	-	9	-	1	6	.01	-	.03	.01
F	<i>Eriogonum brevicaule</i>	-	-	-	2	1	1	-	.00	.00	.03
F	<i>Eriogonum racemosum</i>	12	37	22	30	18	25	.15	.26	.09	.22
F	<i>Eriogonum umbellatum</i>	-	-	4	-	3	6	.01	-	.01	.04
F	<i>Erodium cicutarium</i> (a)	-	-	a-	a-	c41	b17	-	-	.18	.05
F	<i>Gayophytum ramosissimum</i> (a)	-	-	3	-	-	6	.00	-	-	.01
F	<i>Hackelia patens</i>	-	-	3	8	-	-	.03	.02	-	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	<i>Helianthus annuus</i> (a)	a <sup>5</sup>	c <sup>83</sup>	a <sup>-</sup>	b <sup>24</sup>	a <sup>-</sup>	a <sup>-</sup>	-	.07	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	b <sup>179</sup>	a <sup>89</sup>	b <sup>160</sup>	a <sup>117</sup>	1.15	.29	.44	.33
F	<i>Lactuca serriola</i> (a)	-	-	-	-	5	4	-	-	.01	.01
F	<i>Linaria dalmatica</i>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>4</sup>	a <sup>-</sup>	b <sup>33</sup>	-	.15	-	.32
F	<i>Lithospermum ruderales</i>	-	3	8	8	3	2	.05	.06	.01	.06
F	<i>Lupinus argenteus</i>	3	4	5	1	-	1	.27	.15	-	.00
F	<i>Machaeranthera canescens</i>	-	3	2	-	-	-	.00	-	-	-
F	<i>Medicago sativa</i>	3	-	-	-	-	-	-	-	-	-
F	<i>Microsteris gracilis</i> (a)	-	-	a <sup>-</sup>	c <sup>43</sup>	b <sup>18</sup>	bc <sup>29</sup>	-	.18	.06	.06
F	<i>Orthocarpus</i> sp. (a)	-	-	3	-	-	-	.00	-	-	-
F	<i>Penstemon</i> sp.	a <sup>1</sup>	b <sup>66</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	-	-	-	-
F	<i>Phlox longifolia</i>	-	-	8	-	5	6	.02	-	.01	.01
F	<i>Polygonum douglasii</i> (a)	-	-	c <sup>103</sup>	a <sup>-</sup>	a <sup>7</sup>	b <sup>29</sup>	.22	-	.02	.07
F	<i>Ranunculus testiculatus</i> (a)	-	-	4	9	4	1	.00	.01	.01	.00
F	<i>Sisymbrium altissimum</i> (a)	-	-	a <sup>-</sup>	a <sup>-</sup>	b <sup>14</sup>	a <sup>1</sup>	-	-	.34	.00
F	<i>Sphaeralcea coccinea</i>	-	-	-	1	-	-	-	.03	-	-
F	<i>Sphaeralcea grossulariifolia</i>	-	-	-	2	1	1	-	.03	.03	.03
F	<i>Taraxacum officinale</i>	-	-	3	-	-	-	.00	-	-	-
F	<i>Tragopogon dubius</i> (a)	a <sup>2</sup>	b <sup>31</sup>	c <sup>76</sup>	a <sup>-</sup>	a <sup>3</sup>	ab <sup>24</sup>	.45	-	.03	.10
F	Unknown forb-perennial	-	7	-	-	-	-	-	-	-	-
F	<i>Vicia americana</i>	-	2	-	-	10	-	-	-	.04	-
F	<i>Viguiera multiflora</i>	-	1	6	-	2	-	.04	-	.00	-
Total for Annual Forbs		7	114	1068	614	817	488	5.83	6.56	4.15	1.49
Total for Perennial Forbs		64	306	569	275	175	260	11.93	7.17	6.63	7.11
Total for Forbs		71	420	1637	889	992	748	17.76	13.73	10.79	8.60

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

#### BROWSE TRENDS--

Management unit 17, Study no: 16

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	<i>Amelanchier alnifolia</i>	3	3	3	3	-	.03	-	.00
B	<i>Artemisia tridentata vaseyana</i>	57	41	34	27	9.22	6.10	3.50	3.08
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	19	22	32	27	1.37	2.20	3.25	1.23
B	<i>Gutierrezia sarothrae</i>	91	58	29	33	3.22	2.12	.70	.60
B	<i>Opuntia</i> sp.	14	14	19	22	.12	.36	.42	.74
B	<i>Purshia tridentata</i>	20	16	17	14	3.81	6.55	3.99	4.54
B	<i>Symphoricarpos oreophilus</i>	0	1	0	0	-	.03	-	-
B	<i>Tetradymia canescens</i>	0	1	0	1	.15	.38	-	-
Total for Browse		204	156	134	127	17.91	17.79	11.86	10.22

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 16

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	.13	.25	.35
Artemisia tridentata vaseyana	6.01	3.81	4.31
Chrysothamnus viscidiflorus viscidiflorus	1.76	2.03	1.63
Gutierrezia sarothrae	.86	.58	.66
Opuntia sp.	.05	.03	.80
Purshia tridentata	6.25	3.90	5.00
Tetradymia canescens	.46	.05	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 16

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.8	1.9	1.9
Purshia tridentata	3.0	4.4	4.6

BASIC COVER--

Management unit 17, Study no: 16

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	1.50	6.25	49.61	48.02	53.79	47.25
Rock	2.75	3.50	6.05	3.92	2.34	2.48
Pavement	33.25	36.75	6.51	10.85	7.23	10.00
Litter	57.75	46.25	49.93	48.27	41.40	40.52
Cryptogams	.25	3.25	1.35	.76	.08	.00
Bare Ground	4.50	4.00	7.23	11.08	6.58	8.25

PELLET GROUP DATA--

Management unit 17, Study no: 16

Type	Quadrat Frequency			
	'96	'02	'07	'12
Rabbit	-	4	1	-
Elk	21	9	9	3
Deer	40	53	45	29
Cattle	1	-	-	-

Days use per acre (ha)		
'02	'07	'12
-	-	-
26 (64)	13 (31)	3 (8)
100 (248)	111 (274)	22 (55)
-	-	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 16

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Amelanchier alnifolia</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	33	100	0	-	-	0	100	100	-/-	
96	60	67	33	-	-	67	0	0	15/18	
02	60	67	33	-	-	33	67	0	11/11	
07	60	33	67	-	-	33	67	0	18/22	
12	60	0	100	-	-	67	33	33	20/24	
<i>Artemisia tridentata vaseyana</i>										
83	4731	17	67	16	-	26	8	0	26/28	
89	3764	12	42	45	166	49	4	3	26/31	
96	1520	1	47	51	20	59	1	12	23/43	
02	1060	6	45	49	-	38	11	25	27/42	
07	860	5	44	51	60	28	5	23	28/40	
12	620	6	74	19	60	26	19	19	22/35	
<i>Chrysothamnus nauseosus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	35/46	
12	0	0	0	-	-	0	0	0	32/22	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
83	1766	0	100	0	-	0	0	0	9/9	
89	3165	25	74	1	33	0	0	1	12/13	
96	640	0	100	0	-	0	0	0	12/23	
02	820	0	98	2	-	0	0	2	11/18	
07	1200	3	88	8	-	0	0	3	13/23	
12	980	0	96	4	-	0	0	37	11/20	
<i>Gutierrezia sarothrae</i>										
83	1932	0	98	2	-	0	0	2	10/13	
89	4732	12	83	5	99	0	0	0	11/11	
96	14580	31	68	1	17520	0	0	.13	7/10	
02	3500	0	72	28	-	0	0	14	7/8	
07	1700	5	95	0	-	0	0	0	9/8	
12	1220	10	90	0	160	0	0	7	9/12	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Opuntia</i> sp.										
83	0	0	0	0	-	0	0	0	-/-	
89	33	100	0	0	-	0	0	0	-/-	
96	280	29	57	14	-	0	0	7	5/13	
02	300	13	67	20	-	0	0	7	5/11	
07	400	5	90	5	-	0	0	5	7/13	
12	620	6	94	0	-	0	3	16	6/15	
<i>Purshia tridentata</i>										
83	299	22	78	0	-	33	11	0	41/124	
89	699	38	62	0	33	19	5	0	41/81	
96	480	17	79	4	-	21	58	0	24/59	
02	340	0	88	12	-	6	94	0	30/62	
07	360	0	89	11	-	33	11	0	30/55	
12	300	0	80	20	-	27	67	60	29/59	
<i>Symphoricarpos oreophilus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	-/-	
02	20	100	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Tetradymia canescens</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	0	0	0	-	-	0	0	0	15/23	
02	20	0	100	-	-	0	0	0	15/24	
07	0	0	0	-	20	0	0	0	11/22	
12	20	0	100	-	60	0	0	0	14/32	

DUTCH CANYON - TREND STUDY NO. 17-17-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#) and [Mountain Loam \(Oak\), R047XA432UT](#)

Land Ownership: UDP&R

Elevation: 6,200 ft (1,890 m)

Aspect: South

Slope: 15%

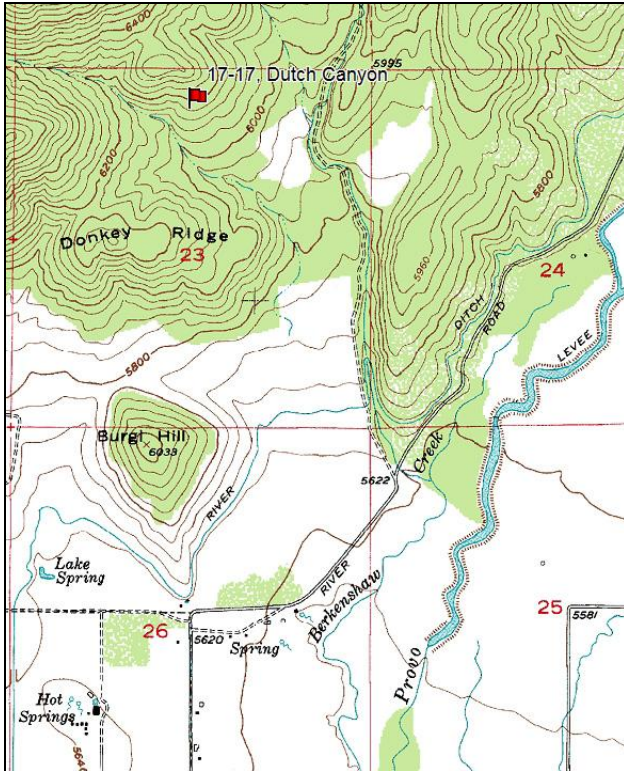
Transect bearing: 359° magnetic

Belt placement: line 1 (11, 59, & 95ft), line 2 (34ft), line 3 (71ft). Rebar: none on belt 3

Directions:

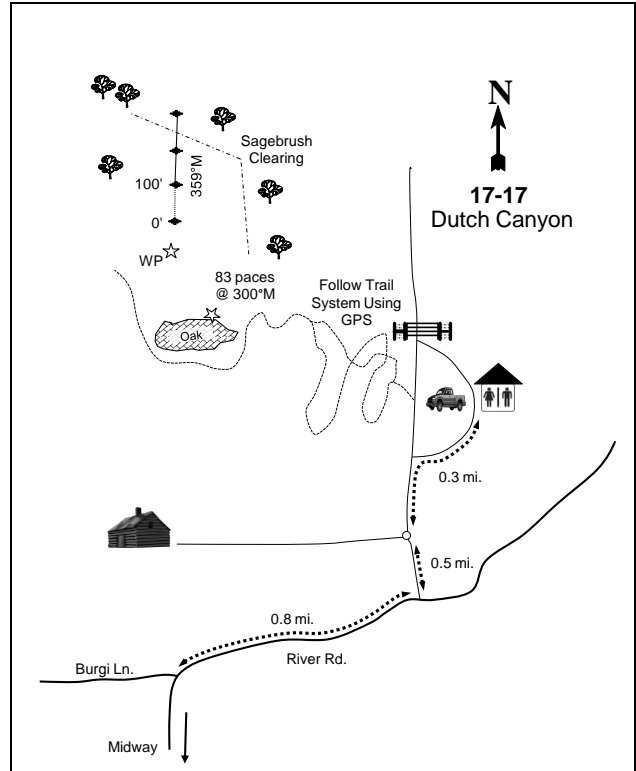
Beginning at the intersection of River Road and Burgi Lane (north of Midway), proceed northward on River Road for 0.80 miles to an intersection. Turn left and proceed 0.50 miles to a circular parking area. Take a dirt Forest Service road on the east side of the parking area for 0.3 miles to a dirt parking area with an outhouse. Across from the parking area is the Dutchman Way Trail head. Park in the dirt lot and take this trail up to the site (0.44 miles). The frequency baseline is marked by green steel "T" fenceposts, approximately 12 to 18 inches in height. A red browse tag, number 3952, is attached to the 0-foot baseline stake.

Map Name: Heber



Township: 3S Range: 4E Section: 23

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 460836 E 4488842 N



## DUTCH CANYON - TREND STUDY NO. 17-17

### Site Information

Site Description: The study is located in a small mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and grass clearing that is surrounded by thick Gambel oak (*Quercus gambelii*). Several of the baseline posts were missing in 2002, so the baseline was reset and is now only 300 feet in length. Therefore, the sample area has changed twice; once in 1996 when the baseline was extended, and then again in 2002 when the baseline was contracted. Changes to the baseline and the sample area are likely to have an impact on the changes in cover, frequency, and density data. The nearest perennial source of water is a stream flowing down Dutch Hollow located 0.35 miles to the east. A deer skeleton was found at the north edge of the baseline in 2007. Deer pellet groups were sampled in low abundance in 2002 and 2012, but in moderate abundance in 2007. Elk pellet groups were sampled in low abundance in 2002 and 2012, but in moderate abundance in 2007 (Table - Pellet Group Data).

Browse: The browse component is dominated by mountain big sagebrush and Gambel oak. Mountain big sagebrush is a moderately dense, mature population. Utilization of sagebrush has been light to moderate. In 2007, sagebrush received mostly moderate use. The health of the sagebrush population has been good to moderately poor. Decadence was at its highest in 1989, and poor vigor was at its highest in 2007. Recruitment of young sagebrush to the population has steadily decreased over the course of the study, and is negligible. Some of the changes in the browse component are likely the result of the change in sample area. Gambel oak clones surround the sagebrush opening sampled by the baseline. Where localized, Gambel oak is a moderately dense, mature population. Utilization of oak has been light to moderate. The health of the oak population has been good, with decadence being slightly moderate in 1989 and 2002. Poor vigor within the oak population has been low in most of the sampled years; however in 2007, poor vigor was moderately high. Recruitment of young oak to the population has been good to excellent. Young oak plants made up the majority of the population in 1983 and 1989. Antelope bitterbrush (*Purshia tridentata*) is present and has slowly increased in density over the sample years. Although not abundant, bitterbrush utilization has been generally heavy over the course of the study (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by annual species cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicus*). The dominant perennial grasses are Kentucky bluegrass (*Poa pratensis*) and bulbous bluegrass (*Poa bulbosa*). Although bulbous bluegrass is a perennial species, it is considered weedy with behaviors similar to cheatgrass. Nearly all of the perennial grasses sampled were found growing in or near oak clones. Forbs are diverse, but composition is poor. Leafy spurge (*Euphorbia esula*), a noxious weed, is one of the most abundant perennial species and is higher in density near the 300' stake. Dalmatian toadflax (*Linaria dalmatica*), another noxious weed, was sampled in 2007. Other perennial species that have been sampled with relatively moderate frequencies include prickly lettuce (*Lactuca serriola*), yellow salsify (*Tragopogon dubius*), and showy goldeneye (*Viguiera multiflora*). Pale alyssum (*Alyssum alyssoides*) is the dominant annual forb species, and has increased in percent cover since 1996, but decreased considerably in cover in 2012 (Table - Herbaceous Trends).

Soil: The soil is in the Cloud Rim component, which occurs on mountainsides. The parent material consists of colluvium and/or slope alluvium derived from sedimentary rock (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH of 6.9) (Table - Soil Analysis Data). Ground cover is low with high amounts of litter and vegetation providing protective ground cover. The profile is rocky, but surface rock and pavement cover are low (Table - Basic Cover). The soil erosion condition has been classified as slight in 2002 and 2007, but stable in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly down (-1):** The density of mountain big sagebrush decreased 51% from 2,798 plants/acre to 1,364 plants/acre. Decadence increased from 24% to 44%, and poor vigor increased slightly from 0% to 2%. Recruitment of young sagebrush to the population was good, though decreasing from 45% to 34%. The density of Gamble oak increased 85% from 1,531 plants/acre to 2,831 plants/acre. Decadence increased from 6% to 13%. Poor vigor was not observed within the oak population. Recruitment of young oak to the population decreased from 87% to 59%.
- **1989 to 1996 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Decadence of mountain big sagebrush decreased to 16%, and poor vigor increased to 10%. Recruitment of young sagebrush to the population decreased to 16%. Cover of sagebrush was measured at 9%. Oak decadence decreased to 4%, and poor vigor was not observed within the oak population. Recruitment of young oak decreased to 38%.
- **1996 to 2002 - up (+2):** The density of mountain big sagebrush increased 72% from 1,380 plants/acre to 2,380 plants/acre. Cover of sagebrush increased to 19%. Decadence remained similar at 15%, and poor vigor remained at 10%. Recruitment of young sagebrush to the population decreased to 3%. The density of Gamble oak increased 18% from 2,200 plants/acre to 2,600 plants/acre. Cover of oak decreased from 7% to 5%. Decadence increased to 13%, and poor vigor increased to 16%. Recruitment of young oak to the population decreased to 28%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 30% to 1,660 plants/acre. Cover of sagebrush decreased to 15%. Decadence increased to 23%, and poor vigor increased to 29%. Recruitment of young sagebrush to the population remained poor at 0%. The density of Gamble oak decreased 31% to 1,800 plants/acre. Cover of oak remained similar at 5%. Decadence decreased slightly to 11%, and poor vigor increased substantially to 30%. Recruitment of young oak to the population decreased to 20%.
- **2007 to 2012 - slightly down (-1):** The density of mountain big sagebrush decreased 12% to 1,460 plants/acre. Cover of sagebrush decreased slightly at 14%. Decadence increased to 30%, and poor vigor decreased to 25%. Recruitment of young sagebrush to the population was minimal at 1%. The density of Gamble oak increased 6% to 1,900 plants/acre. The cover of oak increased slightly to 6%. Decadence decreased to 2%, and poor vigor decreased to 4%. Recruitment of young oak to the population was poor at 6%.

### Grass:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequencies for perennial grasses increased three-fold. Perennial grasses are rare on the study with Kentucky bluegrass being the most abundant.
- **1989 to 1996 - stable (0):** The sum of nested frequencies for perennial grasses increased 36%. The perennial grasses community is small, so any changes within the community affect trend only slightly. The weedy annual species cheatgrass was recorded for the first time, and was the most abundant herbaceous species.
- **1996 to 2002 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, remained similar. Any increases in the sum of nested frequencies for perennial grasses have little effect on trend due to the small community size. The weedy perennial grass species bulbous bluegrass was observed on the study for the first time, and had a cover of 1%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, decreased 30%. Perennial grasses remained rare on the site. Bulbous bluegrass maintained a cover of 1%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies for perennial grasses, excluding bulbous bluegrass, increased 20%. Perennial grasses remained rare on the site.

Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial forbs increased substantially. The cover for perennial forbs increased from 2% to 9%. Showy goldeneye (*Viguiera multiflora*) increased significantly in nested frequency.
- **1989 to 1996 - slightly down (-1):** The sum of nested frequencies for perennial forbs decreased 33%. Showy goldeneye decreased significantly in nested frequency. Daisy fleabane (*Erigeron* sp.) increased significantly in nested frequency. The annual species yellow salsify (*Tragopogon dubius*) increased in nested frequency, and had a cover of 1%.
- **1996 to 2002 - down (-2):** The sum of nested frequencies for perennial forbs increased 56%. The noxious weed species leafy spurge (*Euphorbia esula*) had a significant increase in nested frequency, and was observed for the first on the study. Cover for leafy spurge was measured at 8%. Cover for perennial forbs increased from 2% to 9%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies for perennial forbs increased 37%. Leafy spurge maintained frequency, but decreased in cover to 6%. Leafy spurge is the dominant for species. The weedy species dalmation toadflax increased in nested frequency, and was observed for the first time on the study. Daisy fleabane increased significantly in nested frequency.
- **2007 to 2012 - down (-2):** The sum of nested frequencies for perennial forbs increased 37%. Leafy spurge increased significantly in nested frequency, but decreased in cover to 3%. Dalmation toadflax increased significantly in nested frequency, and increased in cover to near 1%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 17

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	19.0	11.9	12.6	2.9	-6.1	3.3	0.0	<b>43.5</b>	Poor
02	30.0	11.1	4.3	2.2	-6.7	10.0	-2.0	<b>48.9</b>	Poor-Fair
07	27.1	9.6	2.6	1.3	-4.2	10.0	-4.0	<b>42.3</b>	Poor
12	27.8	9.3	6.6	3.1	-1.8	8.5	-4.0	<b>49.5</b>	Poor-Fair

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 17

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
G	<i>Agropyron spicatum</i>	-	-	-	-	3	1	-	.00	.00	.03
G	<i>Bromus carinatus</i>	-	-	2	-	-	1	.00	-	-	.03
G	<i>Bromus inermis</i>	-	5	10	-	-	-	.33	-	-	-
G	<i>Bromus japonicus</i> (a)	-	-	-	81	70	99	-	.70	.86	1.19
G	<i>Bromus tectorum</i> (a)	-	-	<sub>d</sub> 336	<sub>b</sub> 228	<sub>c</sub> 280	<sub>a</sub> 116	8.16	8.21	4.71	1.14
G	<i>Poa bulbosa</i>	-	-	-	17	21	10	-	.86	1.44	.16
G	<i>Poa fendleriana</i>	-	7	-	-	-	-	-	-	-	-
G	<i>Poa pratensis</i>	10	18	30	36	22	28	1.11	.56	.60	.73
G	<i>Poa secunda</i>	-	1	-	7	5	6	-	.56	.06	.76
Total for Annual Grasses		0	0	336	309	350	215	8.16	8.91	5.57	2.34
Total for Perennial Grasses		10	31	42	60	51	46	1.44	1.98	2.10	1.71
Total for Grasses		10	31	378	369	401	261	9.61	10.90	7.68	4.06

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'96	'02	'07	'12	'96	'02	'07	'12
F	<i>Alyssum alyssoides</i> (a)	-	-	<sub>b</sub> 245	<sub>a</sub> 198	<sub>b</sub> 283	<sub>b</sub> 275	2.12	2.73	6.74	1.98
F	<i>Artemisia dracunculus</i>	3	2	-	-	-	-	-	-	-	-
F	<i>Artemisia ludoviciana</i>	3	3	8	1	3	4	.33	.03	.06	.15
F	<i>Aster chilensis</i>	-	-	-	-	-	-	-	-	.00	-
F	<i>Astragalus</i> sp.	-	-	-	1	-	-	-	.00	-	-
F	<i>Calochortus nuttallii</i>	<sub>ab</sub> 5	<sub>b</sub> 21	<sub>a</sub> -	<sub>a</sub> 4	<sub>a</sub> 2	<sub>a</sub> -	-	.01	.01	-
F	<i>Camelina microcarpa</i> (a)	-	-	-	3	4	-	-	.00	.01	-
F	<i>Chenopodium fremontii</i> (a)	-	-	3	5	-	-	.00	.04	-	-
F	<i>Cirsium</i> sp.	-	-	9	2	4	4	.02	.04	.21	.15
F	<i>Collinsia parviflora</i> (a)	-	-	-	3	-	2	-	.00	-	.00
F	<i>Collomia linearis</i> (a)	-	-	<sub>ab</sub> 16	<sub>b</sub> 36	<sub>a</sub> 9	<sub>a</sub> -	.04	.15	.04	-
F	<i>Cryptantha</i> sp.	-	2	-	-	-	-	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	-	14	4	-	-	.10	.01
F	<i>Draba</i> sp. (a)	-	-	-	2	11	3	-	.00	.19	.01
F	<i>Epilobium brachycarpum</i> (a)	-	-	4	5	3	-	.04	.01	.00	-
F	<i>Erigeron</i> sp.	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 18	<sub>a</sub> -	<sub>bc</sub> 21	<sub>c</sub> 34	.16	-	.32	.38
F	<i>Eriogonum brevicaulis</i>	-	-	-	1	-	-	-	.00	-	-
F	<i>Eriogonum racemosum</i>	-	4	10	3	1	3	.03	.06	.00	.01
F	<i>Erodium cicutarium</i> (a)	-	-	-	-	3	6	-	-	.01	.01
F	<i>Euphorbia esula</i>	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 114	<sub>b</sub> 127	<sub>c</sub> 156	-	7.96	5.71	2.74
F	<i>Galium aparine</i> (a)	-	-	-	-	2	-	-	-	.03	-
F	<i>Gayophytum ramosissimum</i> (a)	-	-	-	2	3	2	-	.00	.00	.00
F	<i>Heterotheca villosa</i>	-	-	-	-	-	-	.15	-	-	.00
F	<i>Holosteum umbellatum</i> (a)	-	-	-	20	21	8	-	.14	.11	.02
F	<i>Lactuca serriola</i> (a)	<sub>a</sub> 3	<sub>ab</sub> 14	<sub>b</sub> 34	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	.24	-	-	-
F	<i>Linaria dalmatia</i>	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 13	<sub>c</sub> 39	-	-	.07	.59
F	<i>Lupinus argenteus</i>	-	-	5	6	4	8	.21	.45	.15	.16
F	<i>Polygonum douglasii</i> (a)	-	-	<sub>b</sub> 28	<sub>a</sub> 8	<sub>a</sub> 6	<sub>a</sub> 2	.05	.02	.01	.00
F	<i>Sisymbrium altissimum</i> (a)	-	-	6	3	-	6	.07	.03	-	.02
F	<i>Taraxacum officinale</i>	-	-	-	1	-	-	-	.03	-	-
F	<i>Tragopogon dubius</i> (a)	<sub>a</sub> 2	<sub>ab</sub> 17	<sub>c</sub> 93	<sub>b</sub> 31	<sub>ab</sub> 10	<sub>a</sub> 10	.76	.36	.05	.02
F	Unknown forb-annual (a)	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 96	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	2.63	-	-	-
F	<i>Verbascum thapsus</i>	2	7	6	-	-	-	.39	-	-	-
F	<i>Vicia americana</i>	-	10	-	-	3	-	-	-	.00	-
F	<i>Viguiera multiflora</i>	<sub>a</sub> 6	<sub>c</sub> 78	<sub>b</sub> 31	<sub>a</sub> 3	<sub>a</sub> 7	<sub>a</sub> -	.36	.04	.09	.00
F	<i>Zigadenus paniculatus</i>	-	3	-	-	1	6	.00	-	.00	.01
Total for Annual Forbs		5	31	525	316	369	318	5.98	3.52	7.32	2.10
Total for Perennial Forbs		19	130	87	136	186	254	1.67	8.63	6.66	4.23
Total for Forbs		24	161	612	452	555	572	7.66	12.15	13.99	6.33

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

BROWSE TRENDS--

Management unit 17, Study no: 17

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	Artemisia tridentata vaseyana	37	60	51	53	8.92	18.89	15.18	14.14
B	Chrysothamnus viscidiflorus viscidiflorus	1	2	2	1	-	.03	.00	.03
B	Gutierrezia sarothrae	44	31	12	11	2.31	1.21	.27	.62
B	Purshia tridentata	3	10	9	13	.45	2.61	2.14	2.82
B	Quercus gambelii	31	23	22	24	7.17	5.42	4.88	5.92
Total for Browse		116	126	96	102	18.86	28.18	22.49	23.55

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 17

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	24.61	24.60	23.56
Chrysothamnus viscidiflorus viscidiflorus	.28	-	.35
Gutierrezia sarothrae	1.93	.43	.83
Purshia tridentata	5.21	4.86	4.08
Quercus gambelii	8.11	9.91	9.83

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 17

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.6	1.2	1.5
Purshia tridentata	3.4	2.4	2.9

BASIC COVER--

Management unit 17, Study no: 17

Cover Type	Average Cover %					
	'83	'89	'96	'02	'07	'12
Vegetation	0	3.25	34.90	50.00	44.14	39.80
Rock	5.00	2.25	2.64	2.45	2.12	1.94
Pavement	6.00	11.50	2.76	2.95	3.27	4.05
Litter	67.25	78.50	71.23	58.48	65.83	63.59
Cryptogams	.25	0	.10	.30	.22	.03
Bare Ground	21.50	4.50	2.18	11.38	6.58	4.58

PELLET GROUP DATA--

Management unit 17, Study no: 17

Type	Quadrat Frequency			
	'96	'02	'07	'12
Sheep	1	-	-	-
Rabbit	6	8	7	2
Moose	-	-	-	2
Horse	-	-	1	-
Elk	-	2	8	4
Deer	25	24	28	19
Cattle	-	1	-	-

Days use per acre (ha)		
'02	'07	'12
-	-	-
-	-	-
-	-	-
-	-	-
9 (23)	25 (63)	1 (3)
65 (160)	62 (152)	13 (33)
-	-	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 17

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
96	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	22/28
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Artemisia tridentata vaseyana</i>									
83	2798	31	45	24	-	17	1	0	22/40
89	1364	22	34	44	99	22	5	2	23/22
96	1380	16	68	16	60	0	0	10	23/43
02	2380	3	82	15	-	15	2	10	27/44
07	1660	0	77	23	20	63	11	29	30/47
12	1460	1	68	30	-	19	21	25	29/51
<i>Cercocarpus ledifolius</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
96	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	29/11
<i>Chrysothamnus nauseosus albicaulis</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
96	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	33/28

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
96	20	0	100	-	-	0	0	0	19/40	
02	60	0	100	-	-	0	0	0	20/32	
07	60	0	100	-	-	0	0	0	21/37	
12	40	0	100	-	-	0	0	0	15/24	
<i>Gutierrezia sarothrae</i>										
83	499	27	73	0	366	0	0	0	9/11	
89	4565	1	91	8	99	0	0	0	11/13	
96	2740	1	77	23	-	0	0	2	8/13	
02	1660	0	90	10	-	0	0	6	9/11	
07	300	0	93	7	-	0	0	7	9/11	
12	600	40	60	0	-	0	0	0	9/15	
<i>Purshia tridentata</i>										
83	66	0	100	-	-	0	100	0	13/25	
89	99	0	100	-	-	33	67	0	15/31	
96	80	0	100	-	-	75	25	0	19/87	
02	220	9	91	-	-	9	73	0	17/76	
07	240	8	92	-	-	8	83	0	22/73	
12	420	10	90	-	-	14	71	14	17/47	
<i>Quercus gambelii</i>										
83	1531	87	6	6	533	37	0	0	39/21	
89	2831	59	28	13	433	42	1	0	30/13	
96	2200	38	58	4	240	2	0	0	58/50	
02	2600	28	59	13	-	28	8	16	34/25	
07	1800	20	69	11	140	17	6	30	52/34	
12	1900	44	54	2	120	29	0	4	30/27	

COYOTE CANYON - TREND STUDY NO. 17-19-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: Private

Elevation: 5,900 ft (1,798 m)

Aspect: South

Slope: 7%

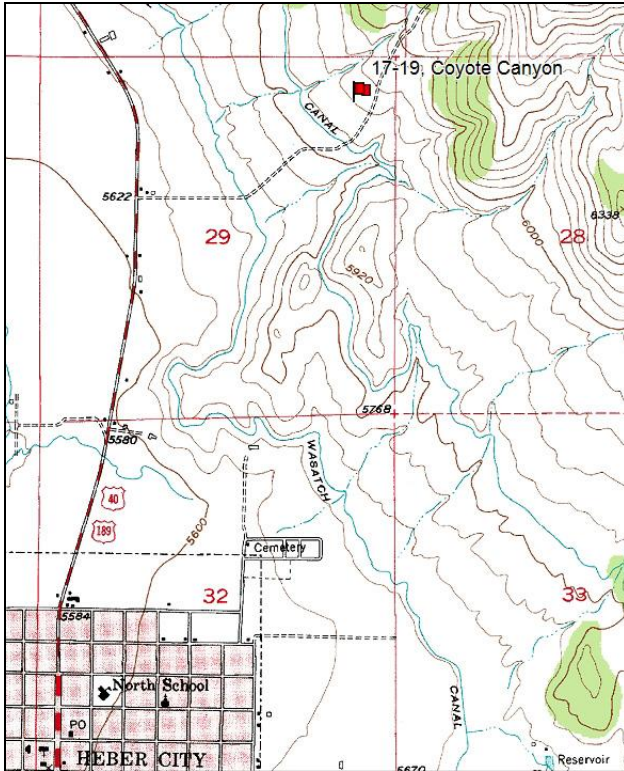
Transect bearing: 187° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 1 on 5ft.

Directions:

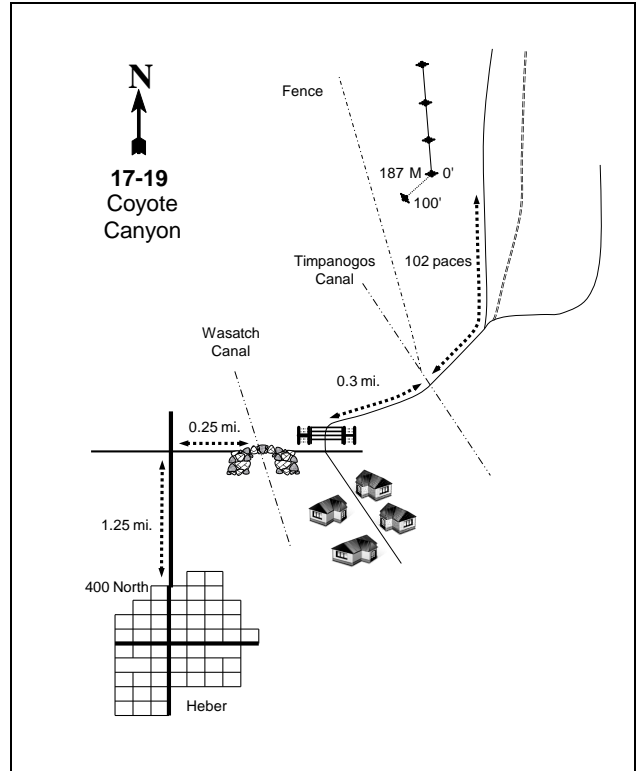
From 400 North and Highway 40 (Main) in Heber, travel north for 1.25 miles and turn right onto a paved road. Proceed east for 0.25 miles to a left turn just past the Wasatch Canal (will need a key or combination to pass thru locked gate). Follow this road 0.3 miles to a fork immediately past Timpanogos Canal (locked gate with two combo locks). From the canal, take a left and walk 102 paces up the road. From this point, walk 10 paces west from the edge of the road to the 100-foot baseline stake. The 0-foot baseline stake is marked by a red browse tag. The baseline runs 187 degrees magnetic. The rest of the baseline runs off the 0-foot baseline stake in a direction of 345 degrees magnetic.

Map Name: Heber



Township: 3S Range: 5E Section: 29

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 466328 E 4487184 N



## COYOTE CANYON - TREND STUDY NO. 17-19

### Site Information

Site Description: Prior to 2002, this study was known as Northeast of Heber. The study is located on the northeast side of the Heber Valley and samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community. A new housing development was built approximately 1,000 feet to the southwest in 1996. The 100 foot stake had to be moved approximately 25 feet to the west to avoid sampling on a newly built road. Some seeded grasses and forbs that were planted along the road occur on several of the belts. The nearest source of perennial water is Timpanogos Canal, 600 feet to the southwest. Part of a deer skeleton was observed near the baseline in 2007. Deer pellet groups were sampled in high abundance since 2002. Elk pellet groups were sampled in moderate abundance in 2002, high abundance in 2007, and low abundance in 2012. Sheep pellet groups were sampled in moderate abundance in 2002, but in low abundance in 2012. Domestic horse pellet groups were sampled in low abundance and 2012 (Table - Pellet Group Analysis).

Browse: Mountain big sagebrush is the dominant browse species. Sagebrush is a mature, moderately healthy population. Utilization of sagebrush has been mostly moderate with heavier use being recorded in 2002. Decadence within the sagebrush population has been moderate to high over the course of the study. Conversely, poor vigor has been low within the population throughout the duration of the study; however in 2002, poor vigor within the sagebrush population was moderate. Recruitment of young sagebrush to the population has been low over the sampled year, but moderate in 1996. The sagebrush defoliator moth (*Aroga websteri*) had infected half of the population in 2007. However, the moth infestation has not manifested itself through increased decadence and poor vigor; however, the density of sagebrush has decreased slightly since 2007. Other less dominant shrubs present on the study include rubber rabbitbrush (*Chrysothamnus nauseosus*), pricklypear cactus (*Opuntia* sp.), and antelope bitterbrush (*Purshia tridentata*). The bitterbrush population is comprised of a small population of scattered mature plants, and the density of bitterbrush has remained low over the course of the study. Browse use on bitterbrush has been moderate to heavy (Table - Browse Characterizes).

Herbaceous Understory: The herbaceous understory largely consists of annual species. Although it was not recorded until 1996, cheatgrass (*Bromus tectorum*) has dominated the understory since 1984. Crested wheatgrass (*Agropyron cristatum*) and bottlebrush squirreltail (*Sitanion hystrix*) are the most common perennial species. Perennial grasses are sparsely scattered throughout the study with most found beneath sagebrush plants or along the nearby road. . The forb component is dominated by weedy species and comprises very little ground cover. Annual species account for more cover than perennial species. Pale alyssum (*Alyssum alyssoides*) is the most abundant forb species (Table - Herbaceous Trends).

Soil: The soil is in the Bezzant component, which occurs on mountainsides. The parent material consists of colluvium and /or slope alluvium over residuum weathered from sedimentary rock (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a slightly acidic soil reaction (pH of 6.4) (Table - Soil Analysis Data). Bare ground cover is high with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). Due to surface litter translocation and active gully formation, the erosion condition was classified as slight in 2002 and 2007, but stable in 2012.

### Trend Assessments

#### Browse:

- **1984 to 1996 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Mountain big sagebrush decadence and poor vigor decreased from 42% to 22% and 9% to 2%, respectively. Recruitment of young sagebrush to the population increased from 0% to 18%.

- **1996 to 2002 - stable (0):** The density of mountain big sagebrush increased 9% from 3,820 plants/acre to 4,180 plants/acre. The cover of sagebrush increased from 18% to 20%. Decadence within the sagebrush population increased to 38%, and poor vigor increased to 23%. Recruitment of young sagebrush to the population decreased to 8%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 22% to 3,240 plants/acre. The cover of sagebrush decreased to 12%. Decadence decreased to 31%, and poor vigor decreased to 9%. Recruitment of young sagebrush to the population remained stable at 8%.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush remained similar at 3,180 plants/acre. Cover of sagebrush increased to 19%. Decadence decreased to 20%, and poor vigor decreased to 6%. Recruitment of young sagebrush to the population did not change.

Grass:

- **1984 to 1996 - stable (0):** The sum of nested frequencies of perennial grasses increased 54%. Crested wheatgrass increased significantly in nested frequency. However, perennial grasses remained rare on the study. The weedy annual cheatgrass was measured for the first time and was the dominant grass on the study.
- **1996 to 2002 - slightly up (+1):** The sum of nested frequencies of perennial grasses increased 30%. Crested wheatgrass increased significantly in nested frequency, and increased in cover from 1% to 2%. Perennial grasses remained rare on the site. Cheatgrass decreased significantly in nested frequency, and decreased in cover from 21% to 2%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial grasses decreased 13%. Sandberg wheatgrass increased significantly in nested frequency. Cheatgrass increased significantly in nested frequency, and increased in cover to 20%.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial grasses decreased 68%. Crested wheatgrass decreased significantly in nested frequency, and decreased in cover to less than 1%. Cheatgrass decreased significantly in nested frequency, and decreased in cover to 7%.

Forb:

- **1984 to 1996 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased eight-fold. Perennial forbs are rare on the site.
- **1996 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 72%. Perennial forbs remain rare on the site.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs increased over two-fold. Perennial forbs remain rare on the site.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial forbs decreased 35%. Perennial forbs remain rare on the site.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 19

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	23.3	8.4	8.9	4.2	-16.0	1.2	0.0	<b>30.0</b>	Very Poor
02	25.5	3.7	3.9	4.4	-2.1	0.1	0.0	<b>35.4</b>	Very Poor-Poor
07	15.4	6.1	3.8	3.6	-14.9	0.4	0.0	<b>14.4</b>	Very Poor
12	23.9	9.1	3.9	1.1	-5.2	0.1	0.0	<b>33.0</b>	Very Poor

## Trend Summary

HERBACEOUS TRENDS--  
Management unit 17, Study no: 19

Type	Species	Nested Frequency					Average Cover %			
		'84	'96	'02	'07	'12	'96	'02	'07	'12
G	<i>Agropyron cristatum</i>	a <sup>-</sup>	bc <sup>24</sup>	d <sup>40</sup>	cd <sup>32</sup>	b <sup>10</sup>	1.26	1.95	1.17	.33
G	<i>Agropyron intermedium</i>	-	-	6	3	-	.06	.04	.03	.00
G	<i>Agropyron spicatum</i>	8	7	-	-	-	.06	-	-	-
G	<i>Bromus japonicus</i> (a)	-	2	8	-	7	.00	.04	-	.01
G	<i>Bromus tectorum</i> (a)	-	c <sup>368</sup>	a <sup>236</sup>	c <sup>353</sup>	b <sup>249</sup>	21.32	2.78	19.87	6.92
G	<i>Oryzopsis hymenoides</i>	-	-	-	2	1	.03	-	.03	.00
G	<i>Poa secunda</i>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>12</sup>	b <sup>9</sup>	-	-	.07	.19
G	<i>Sitanion hystrix</i>	b <sup>33</sup>	b <sup>31</sup>	b <sup>32</sup>	ab <sup>21</sup>	a <sup>3</sup>	.66	.17	.47	.01
G	<i>Stipa comata</i>	-	1	4	1	-	.03	.03	.03	-
Total for Annual Grasses		0	370	244	353	256	21.33	2.82	19.87	6.93
Total for Perennial Grasses		41	63	82	71	23	2.12	2.21	1.81	0.55
Total for Grasses		41	433	326	424	279	23.45	5.03	21.69	7.49
F	<i>Agoseris glauca</i>	-	6	-	-	-	.01	-	-	-
F	<i>Allium acuminatum</i>	a <sup>6</sup>	ab <sup>11</sup>	a <sup>6</sup>	b <sup>16</sup>	a <sup>2</sup>	.03	.01	.06	.00
F	<i>Alyssum alyssoides</i> (a)	-	a <sup>92</sup>	a <sup>133</sup>	c <sup>314</sup>	b <sup>265</sup>	.81	.64	3.16	1.15
F	<i>Calochortus nuttallii</i>	-	-	-	3	-	-	-	.00	-
F	<i>Collinsia parviflora</i> (a)	-	a <sup>2</sup>	a <sup>3</sup>	b <sup>20</sup>	a <sup>4</sup>	.01	.01	.06	.01
F	<i>Collomia linearis</i> (a)	-	b <sup>13</sup>	a <sup>-</sup>	b <sup>36</sup>	a <sup>-</sup>	.04	-	.07	-
F	<i>Epilobium brachycarpum</i> (a)	-	b <sup>23</sup>	a <sup>-</sup>	a <sup>2</sup>	a <sup>3</sup>	.06	-	.00	.00
F	<i>Erodium cicutarium</i> (a)	-	a <sup>-</sup>	a <sup>-</sup>	b <sup>18</sup>	a <sup>-</sup>	-	-	.25	-
F	<i>Gayophytum ramosissimum</i> (a)	-	a <sup>-</sup>	b <sup>29</sup>	a <sup>5</sup>	a <sup>-</sup>	-	.09	.01	-
F	<i>Grindelia squarrosa</i>	-	-	-	10	3	-	-	.09	.03
F	<i>Hedysarum boreale</i>	-	2	-	-	-	.00	-	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	-	1	-	-	-	.00	-
F	<i>Lactuca serriola</i> (a)	-	-	-	5	-	.00	-	.03	-
F	<i>Lappula occidentalis</i> (a)	-	-	-	1	-	-	-	.00	-
F	<i>Linum lewisii</i>	a <sup>-</sup>	b <sup>25</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.49	-	-	-
F	<i>Madia glomerata</i> (a)	-	b <sup>9</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.03	-	-	-
F	<i>Medicago sativa</i>	-	1	1	-	-	.03	.00	-	-
F	<i>Microsteris gracilis</i> (a)	-	8	7	19	3	.02	.01	.07	.01
F	<i>Orthocarpus</i> sp. (a)	-	b <sup>38</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	1.05	-	-	-
F	<i>Phlox longifolia</i>	a <sup>-</sup>	ab <sup>5</sup>	ab <sup>4</sup>	a <sup>2</sup>	b <sup>14</sup>	.02	.01	.00	.03
F	<i>Polygonum douglasii</i> (a)	-	b <sup>46</sup>	a <sup>5</sup>	a <sup>8</sup>	a <sup>5</sup>	.09	.01	.01	.01
F	<i>Ranunculus testiculatus</i> (a)	-	a <sup>-</sup>	a <sup>1</sup>	b <sup>15</sup>	a <sup>2</sup>	-	.00	.10	.00
F	<i>Schoenrambe linifolia</i>	-	-	3	-	-	-	.00	-	-
F	<i>Sisymbrium altissimum</i> (a)	-	-	4	-	1	-	.01	-	.00
F	<i>Sphaeralcea coccinea</i>	-	-	-	1	-	-	-	.00	-
F	<i>Tragopogon dubius</i> (a)	-	2	3	3	-	.01	.00	.00	-
F	<i>Trifolium</i> sp.	-	-	-	2	3	-	-	.00	.01
Total for Annual Forbs		0	233	185	447	283	2.14	0.78	3.81	1.20
Total for Perennial Forbs		6	50	14	34	22	0.59	0.03	0.18	0.07

Type	Species	Nested Frequency					Average Cover %			
		'84	'96	'02	'07	'12	'96	'02	'07	'12
Total for Forbs		6	283	199	481	305	2.73	0.82	3.99	1.28

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

#### BROWSE TRENDS--

Management unit 17, Study no: 19

Type	Species	Strip Frequency				Average Cover %			
		'96	'02	'07	'12	'96	'02	'07	'12
B	Artemisia tridentata vaseyana	89	88	83	88	18.38	20.00	11.68	18.77
B	Chrysothamnus nauseosus	0	0	2	1	-	-	.15	.15
B	Opuntia sp.	30	19	16	19	1.27	.52	.21	.72
B	Purshia tridentata	4	4	4	4	.21	.30	.53	.30
Total for Browse		123	111	105	112	19.87	20.82	12.56	19.94

#### CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 19

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	21.50	14.35	25.51
Chrysothamnus nauseosus	-	-	.21
Opuntia sp.	.60	5.41	.55
Purshia tridentata	.11	.18	.58

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 19

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.4	1.5	1.6

#### BASIC COVER--

Management unit 17, Study no: 19

Cover Type	Average Cover %				
	'84	'96	'02	'07	'12
Vegetation	2.00	39.08	25.59	39.96	29.15
Rock	6.25	8.19	8.55	9.02	9.62
Pavement	3.50	.35	.54	.65	.34
Litter	71.00	56.29	48.02	41.11	35.65
Cryptogams	1.75	.43	.45	.36	.41
Bare Ground	15.50	11.37	32.95	23.32	37.16

PELLET GROUP DATA--

Management unit 17, Study no: 19

Type	Quadrat Frequency				Days use per acre (ha)		
	'96	'02	'07	'12	'02	'07	'12
Sheep	-	12	2	6	21 (51)	-	18 (45)
Rabbit	11	14	21	1	-	-	-
Horse	-	-	2	-	-	-	4 (10)
Elk	5	3	17	1	21 (53)	55 (136)	4 (10)
Deer	47	58	44	38	166 (410)	47 (116)	46 (112)
Cattle	-	1	2	-	-	-	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 19

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Artemisia tridentata vaseyana</i>									
84	<b>6865</b>	0	58	42	-	35	4	9	26/32
96	<b>3820</b>	18	60	22	400	35	2	2	23/41
02	<b>4180</b>	8	54	38	-	20	48	23	20/31
07	<b>3240</b>	8	60	31	400	29	16	9	26/36
12	<b>3180</b>	8	72	20	260	32	11	6	26/38
<i>Chrysothamnus nauseosus</i>									
84	<b>0</b>	0	0	-	-	0	0	0	-/-
96	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>120</b>	50	50	-	-	0	0	0	11/7
12	<b>60</b>	0	100	-	-	0	0	0	35/46
<i>Opuntia sp.</i>									
84	<b>1132</b>	29	71	0	-	0	0	0	5/12
96	<b>1020</b>	8	86	6	80	0	0	8	5/13
02	<b>560</b>	4	86	11	-	0	4	11	6/12
07	<b>400</b>	0	70	30	20	0	0	25	6/16
12	<b>540</b>	7	78	15	-	0	0	19	6/15
<i>Purshia tridentata</i>									
84	<b>266</b>	0	50	50	-	50	50	50	17/22
96	<b>80</b>	0	75	25	-	100	0	0	15/31
02	<b>80</b>	0	75	25	-	0	100	0	14/41
07	<b>80</b>	0	100	0	-	0	100	0	24/37
12	<b>80</b>	0	100	0	20	25	50	0	24/37

HIESETTS HOLLOW - TREND STUDY NO. 17-24-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: USFS

Elevation: 5,600 ft (1,710 m)

Aspect: West

Slope: 5-22%

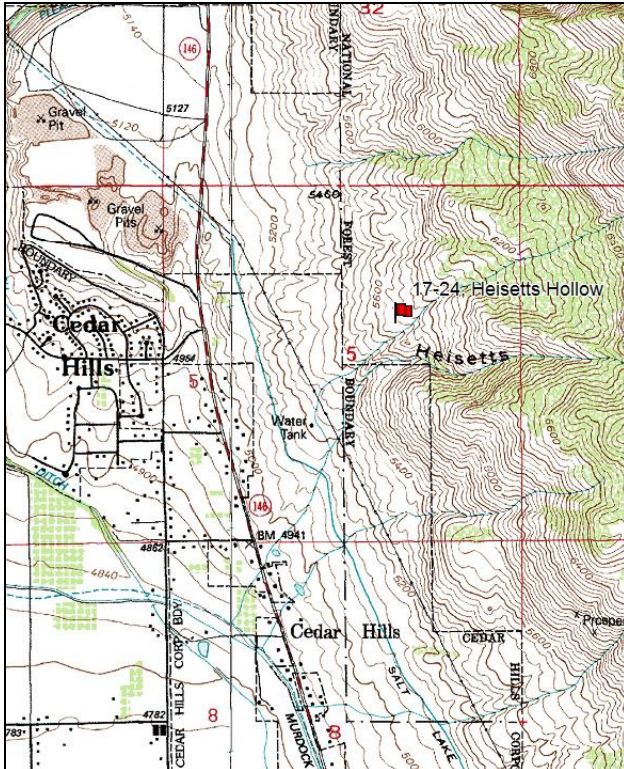
Transect bearing: 136° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft). Rebar: belt 1 on 18ft., belt 3 on 2ft.

Directions:

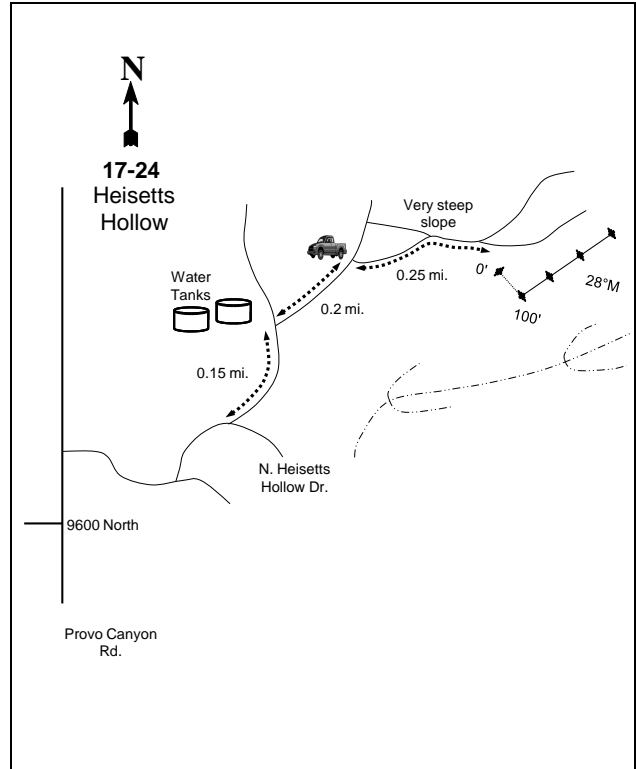
North of Pleasant Grove, turn east off Canyon Road (Rt 146) onto West Box Elder Drive. Take the next left onto North Heisetts Hollow Drive. Follow this road to a couple of large water tanks (about 0.15 miles). Continue 0.2 miles to a level parking area. There will be signs indicating that vehicle are not permitted beyond this point. From here, walk up the road 0.25 miles to the 0-foot baseline stake, staying to the right. You will pass numerous forks and trails, and a GPS unit will help you navigate to the study.

Map Name: Timpanogos Cave



Township: 5S Range: 2E Section: 5

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 437051 E 4474127 N

## HEISETTS HOLLOW - TREND STUDY NO. 17-24

### Site Information

Site Description: This study is located on the upper Lake Bonneville terrace near the mouth of Heisette Hollow and uphill from the Salt Lake Aqueduct. This study is within an area of crucial deer winter range, and samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community. The nearest perennial source of water is Heisette Hollow, and is approximately 550 feet to the south. Some camping occurs in the area of the study. Deer pellet groups were sampled in high abundance in 2002 and 2007, but in moderate abundance in 2012. Elk pellet groups were sampled in low abundance in 2002 and 2012, but in high abundance in 2007. Bighorn sheep were sampled in low abundance in 2007 (Table - Pellet Group Data).

Browse: The preferred browse component found on the study is a sparse population of mountain big sagebrush. The density of the sagebrush population has been relatively stable. Health of the sagebrush population has been moderate to moderately poor. Decadence within the sagebrush population has varied between fair to moderately poor. Poor vigor has been low to moderate. Utilization of sagebrush has been moderate to heavy. Recruitment of young sagebrush to the population has been minimal. Other preferred browse species occur in small numbers and include true mountain mahogany (*Cercocarpus ledifolius*), white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), and Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*). Browse use on mahogany has been heavy. The few cliffrose on the site are tall and mostly unavailable to browsing (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are the dominant herbaceous understory component. Bluebunch wheatgrass (*Agropyron spicatum*) and bulbous bluegrass (*Poa bulbosa*) are the most abundant species. Cheatgrass (*Bromus tectorum*) and Japanese brome (*B. japonicus*) are present, but are a much smaller component of the understory. Forbs are relatively diverse but occur infrequently. The more common perennial species include northern sweetvetch (*Hedysarum boreale*), longleaf phlox (*Phlox longifolia*), and yellow salsify (*Tragopogon dubius*). Pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*) are the most common annual species (Table - Herbaceous Trend).

Soil: Natural Resource Conservation Service (NRCS) soil data was not available for this site. The soil texture is a clay loam with neutral soil reaction (pH 7.1). Phosphorous may have limited availability for plant growth and development at 5.7 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderate with a moderate amount of litter cover, and a high amount of vegetation providing protective ground cover (Table - Basic Cover). The steeper slopes are somewhat terraced and there are pedestals surround plants. Some soil movement is evident on a foot trail located directly north of the site. There did not appear to be any significant erosion occurring recently; the erosion condition was classified as stable in 2002 and 2007, but slight in 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - stable (0):** The density of mountain big sagebrush remained similar at 865 plants/acre. Decadence increased from 19% to 46%, but poor vigor decreased from 35% to 4%. Recruitment of young sagebrush to the population remained at 4%.
- **1989 to 1997 - stable (0):** differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Mountain big sagebrush decadence decreased to 23%, and poor vigor increased to 13%. Recruitment of young sagebrush to the population increased slightly to 7%.
- **1997 to 2002 - down (-2):** The density of mountain big sagebrush decreased 18% from 1,120 plants/acre to 920 plants/acre. Cover of sagebrush decreased from 8% to 7%. Decadence increased to

41%, and poor vigor increased to 24%. Recruitment of young sagebrush to the population was maintained at 7%.

- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 30% to 640 plants/acre. Cover of sagebrush decreased to 5%. Decadence decreased to 34%, and poor vigor remained similar at 25%. Recruitment of young sagebrush was not observed.
- **2006 to 2007 - up (+2):** The density of mountain big sagebrush increased 25% to 800 plants/acre. The cover of sagebrush increased to 6%. Decadence decreased to 23% and poor vigor decreased to 20%. Recruitment of young sagebrush to the population was not observed.

#### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 89%. Sandberg bluegrass increased significantly in nested frequency. Bulbous bluegrass decreased significantly in nested frequency, and was the third most abundant grass.
- **1989 to 1997 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 43%. Bluebunch wheatgrass increased significantly in nested frequency. Bulbous bluegrass increased significantly in nested frequency, and was the most abundant grass on the study. Sandberg bluegrass decreased significantly in nested frequency. The weedy annual species cheatgrass was recorded for the first time, and was the third most abundant grass on the study.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar. Kentucky bluegrass (*Poa pratensis*) increased significantly in nested frequency, and increased in cover from 0% to 1%. The weedy perennial species Bulbous bluegrass increased in cover from 17% to 19%. The weedy annual species cheatgrass decreased significantly in nested frequency, and decreased in cover from 2% to less than 1%.
- **2002 to 2007 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 31%. Kentucky bluegrass decreased significantly in nested frequency, and decreased in cover to near 0%. Bulbous bluegrass increased significantly in nested frequency, but decreased in cover to 15%.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, increased 32%. Bluebunch wheatgrass increased significantly in nested frequency, and increased in cover from 15% to 21%. Bulbous bluegrass decreased in cover to 12%, and was the second most abundant grass species. The weedy annual species cheatgrass increased in cover from 1% to 3%.

#### Forb:

- **1984 to 1990 - stable (0):** The sum of nested frequencies of perennial forbs increased 92%. The weedy species western ragweed (*Ambrosia psilostachya*) increased significantly in nested frequency. Perennial forb species occur infrequently on the study.
- **1990 to 1996 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 35%. Longleaf phlox (*Phlox longifolia*) increased significantly in nested frequency.
- **1996 to 2001 - stable (0):** The sum of nested frequency of perennial forbs decreased 18%, and decreased in cover from 2% to 1%. The weedy species western ragweed decreased significantly in nested frequency.
- **2001 to 2006 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 34%, and cover increased to 2%.
- **2006 to 2011 - slightly up (+1):** The sum of nested frequency of perennial forbs increased 35%, and cover remained similar at 2%. Perennial forbs are moderately diverse, but remained rare on the study.



DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
 Management unit 17, study no: 24

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	10.8	8.4	3.4	30.0	-1.1	3.5	0.0	<b>54.9</b>	Fair
02	9.8	3.6	3.2	30.0	-0.1	2.1	0.0	<b>48.5</b>	Poor-Fair
07	6.8	5.8	1.6	30.0	-0.9	3.4	0.0	<b>46.7</b>	Poor
12	8.4	8.9	0.0	30.0	-1.9	3.0	-2.0	<b>46.4</b>	Poor

**Trend Summary**

HERBACEOUS TRENDS--  
 Management unit 17, Study no: 24

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Aegilops cylindrica</i> (a)	-	-	-	-	-	2	-	-	-	.03
G	<i>Agropyron cristatum</i>	9	7	-	-	3	9	-	-	.03	.19
G	<i>Agropyron dasystachyum</i>	<sub>b</sub> 86	<sub>a</sub> 8	<sub>a</sub> -	<sub>a</sub> 2	<sub>a</sub> 3	<sub>a</sub> 6	-	.00	.06	.18
G	<i>Agropyron spicatum</i>	<sub>a</sub> 196	<sub>a</sub> 237	<sub>d</sub> 289	<sub>bc</sub> 254	<sub>b</sub> 210	<sub>cd</sub> 264	20.39	13.22	14.84	20.47
G	<i>Bromus japonicus</i> (a)	-	-	-	-	13	-	-	-	.05	-
G	<i>Bromus tectorum</i> (a)	-	-	<sub>b</sub> 133	<sub>a</sub> 39	<sub>b</sub> 101	<sub>b</sub> 95	1.51	.19	1.18	2.48
G	<i>Poa bulbosa</i>	<sub>bc</sub> 284	<sub>a</sub> 120	<sub>c</sub> 307	<sub>c</sub> 303	<sub>b</sub> 241	<sub>b</sub> 225	16.68	19.25	15.22	12.24
G	<i>Poa pratensis</i>	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 42	<sub>a</sub> 6	<sub>a</sub> -	-	.59	.06	-
G	<i>Poa secunda</i>	<sub>a</sub> -	<sub>c</sub> 299	<sub>b</sub> 28	<sub>b</sub> 32	<sub>ab</sub> 7	<sub>b</sub> 24	.17	1.48	.07	.97
Total for Annual Grasses		0	0	133	39	114	97	1.51	0.19	1.23	2.50
Total for Perennial Grasses		575	671	624	633	470	528	37.25	34.56	30.29	34.06
Total for Grasses		575	671	757	672	584	625	38.76	34.76	31.53	36.57
F	<i>Allium</i> sp.	-	-	3	-	-	-	.00	-	-	-
F	<i>Alyssum alyssoides</i> (a)	-	-	<sub>b</sub> 128	<sub>a</sub> 87	<sub>b</sub> 123	<sub>a</sub> 55	.49	.18	.47	.17
F	<i>Ambrosia psilostachya</i>	<sub>a</sub> -	<sub>d</sub> 52	<sub>c</sub> 35	<sub>a</sub> 4	<sub>ab</sub> 10	<sub>bc</sub> 33	.18	.06	.10	.39
F	<i>Arabis perennans</i>	-	-	2	-	-	-	.03	-	-	-
F	<i>Artemisia ludoviciana</i>	3	2	-	-	-	-	-	-	-	-
F	<i>Astragalus</i> sp.	<sub>a</sub> -	<sub>a</sub> 2	<sub>a</sub> -	<sub>b</sub> 17	<sub>a</sub> -	<sub>a</sub> 3	-	.35	-	.15
F	<i>Astragalus utahensis</i>	-	-	3	6	6	2	.15	.06	.18	.03
F	<i>Calochortus nuttallii</i>	7	1	-	4	-	1	-	.01	-	.00
F	<i>Castilleja chromosa</i>	7	1	2	5	2	-	.00	.04	.03	-
F	<i>Cirsium undulatum</i>	-	2	11	12	11	14	.19	.09	.10	.11
F	<i>Collinsia parviflora</i> (a)	-	-	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> 2	<sub>b</sub> 13	-	-	.00	.03
F	<i>Comandra pallida</i>	4	8	3	-	-	5	.01	-	-	.01
F	<i>Convolvulus arvensis</i>	-	-	-	-	-	10	-	-	-	.05
F	<i>Crepis acuminata</i>	-	-	5	7	8	1	.01	.04	.06	.15
F	<i>Descurainia pinnata</i> (a)	-	-	-	5	-	-	-	.01	-	-
F	<i>Draba</i> sp. (a)	-	-	-	-	12	-	-	-	.01	-
F	<i>Erodium cicutarium</i> (a)	-	-	<sub>b</sub> 44	<sub>b</sub> 55	<sub>ab</sub> 29	<sub>a</sub> 10	.26	1.37	.18	.07
F	<i>Hedysarum boreale</i>	12	11	26	4	10	14	.71	.16	.99	.51
F	<i>Helianthus annuus</i> (a)	-	17	-	14	-	-	-	.03	-	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Lactuca serriola</i> (a)	-	-	1	5	-	-	.00	.01	-	-
F	<i>Lappula occidentalis</i> (a)	-	-	-	23	-	3	-	.05	-	.00
F	<i>Lithospermum ruderales</i>	-	3	3	-	-	-	.01	-	-	-
F	<i>Lygodesmia</i> sp.	-	-	-	13	7	2	-	.12	.15	.03
F	<i>Oenothera</i> sp.	2	-	5	1	-	2	.33	.00	-	.03
F	<i>Orobancha</i> sp.	5	-	-	-	-	-	-	-	-	-
F	<i>Phlox longifolia</i>	3	6	28	21	8	3	.08	.08	.04	.01
F	<i>Sedum lanceolatum</i>	-	-	-	1	-	-	-	.00	-	-
F	<i>Sphaeralcea coccinea</i>	8	7	6	13	9	6	.03	.03	.05	.02
F	<i>Tragopogon dubius</i> (a)	2	-	31	7	16	6	.24	.10	.04	.01
F	Unknown forb-perennial	-	3	-	-	-	-	-	-	-	-
Total for Annual Forbs		2	17	204	196	182	87	1.00	1.76	0.72	0.30
Total for Perennial Forbs		51	98	132	108	71	96	1.75	1.07	1.71	1.52
Total for Forbs		53	115	336	304	253	183	2.76	2.84	2.44	1.82

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

#### BROWSE TRENDS--

Management unit 17, Study no: 24

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	35	32	28	32	8.28	6.99	4.79	5.78
B	<i>Atriplex confertifolia</i>	1	1	1	0	.03	.15	-	-
B	<i>Cercocarpus montanus</i>	1	1	2	1	.15	.41	.53	.76
B	<i>Chrysothamnus nauseosus albicaulis</i>	4	2	1	1	.15	.03	-	-
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	0	0	0	1	-	-	-	-
B	<i>Cowania mexicana stansburiana</i>	0	0	0	1	-	.15	-	.00
B	<i>Gutierrezia sarothrae</i>	72	6	18	31	3.59	.01	.22	2.27
B	<i>Juniperus osteosperma</i>	0	0	0	1	-	-	-	.98
B	<i>Quercus gambelii</i>	0	0	1	0	-	-	-	-
Total for Browse		113	42	51	68	12.21	7.75	5.55	9.80

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 24

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	.20	4.83	6.01
Cercocarpus montanus	-	1.08	1.03
Chrysothamnus nauseosus albicaulis	-	-	.03
Cowania mexicana stansburiana	-	.08	.05
Gutierrezia sarothrae	-	1.03	1.70
Juniperus osteosperma	-	-	.50

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 24

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.9	1.5	1.5

BASIC COVER--

Management unit 17, Study no: 24

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	7.00	22.25	53.82	49.99	41.43	53.46
Rock	3.00	4.50	4.96	7.68	2.88	6.22
Pavement	6.75	19.75	6.84	8.94	6.31	7.67
Litter	72.50	41.00	39.14	31.17	31.23	28.66
Cryptogams	.25	0	.59	.22	.06	.15
Bare Ground	10.50	12.50	7.46	14.68	9.37	17.87

PELLET GROUP DATA--

Management unit 17, Study no: 24

Type	Quadrat Frequency			
	'97	'02	'07	'12
Sheep	-	-	-	-
Rabbit	1	3	13	5
Elk	1	1	34	4
Deer	43	46	12	19

Days use per acre (ha)		
'02	'07	'12
-	1 (2)	-
-	-	-
3 (8)	43 (106)	5 (13)
65 (160)	78 (193)	22 (55)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 24

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
83	33	0	100	-	-	0	100	100	30/35
89	33	0	100	-	-	0	100	100	28/31
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Artemisia tridentata vaseyana</i>									
83	865	4	77	19	-	35	54	35	22/28
89	865	4	50	46	-	15	85	4	24/29
97	1120	7	70	23	60	54	30	13	25/47
02	920	7	52	41	-	11	85	24	22/35
07	640	0	66	34	-	28	50	25	24/39
12	800	0	78	23	-	40	33	20	26/38
<i>Atriplex confertifolia</i>									
83	0	0	0	0	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
97	20	0	100	0	-	100	0	0	15/27
02	40	0	50	50	-	0	100	0	6/16
07	40	0	100	0	-	0	0	0	8/16
12	0	0	0	0	-	0	0	0	-/-
<i>Cercocarpus montanus</i>									
83	0	0	0	-	-	0	0	0	-/-
89	33	100	0	-	-	0	100	0	-/-
97	20	0	100	-	20	0	100	0	70/127
02	40	0	100	-	-	100	0	0	89/113
07	60	33	67	-	-	67	33	0	83/89
12	40	0	100	-	-	0	0	0	79/81
<i>Chrysothamnus nauseosus albicaulis</i>									
83	33	0	100	0	-	0	0	0	20/24
89	66	0	100	0	-	0	0	0	26/26
97	80	0	100	0	-	0	0	0	28/48
02	40	0	50	50	-	50	50	0	27/44
07	40	0	100	0	-	0	0	0	33/55
12	20	0	100	0	-	0	0	0	40/70

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	24/38	
<i>Cowania mexicana stansburiana</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	38/48	
02	0	0	0	-	-	0	0	0	66/57	
07	0	0	0	-	-	0	0	0	66/75	
12	20	0	100	-	-	100	0	0	43/44	
<i>Gutierrezia sarothrae</i>										
83	1232	59	41	0	4099	0	0	0	11/8	
89	1432	0	51	49	-	0	0	44	9/8	
97	10300	42	58	0	8900	0	0	0	6/7	
02	120	33	67	0	-	0	0	17	7/7	
07	660	12	85	3	-	3	0	3	9/10	
12	1200	3	95	2	20	0	0	8	11/15	
<i>Juniperus osteosperma</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	0	100	-	-	100	0	0	-/-	
<i>Quercus gambelii</i>										
83	132	25	75	-	-	25	75	50	33/35	
89	365	55	45	-	-	0	91	0	59/33	
97	0	0	0	-	-	0	0	0	52/43	
02	0	0	0	-	-	0	0	0	-/-	
07	20	0	100	-	-	0	0	0	37/24	
12	0	0	0	-	-	0	0	0	31/23	
<i>Rosa woodsii</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	94/102	

NORTH BATTLE CREEK - TREND STUDY NO. 17-25-12

Vegetation Type: Cliffrose

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: USFS

Elevation: 5,500 ft (1,676 m)

Aspect: West

Slope: 55-65%

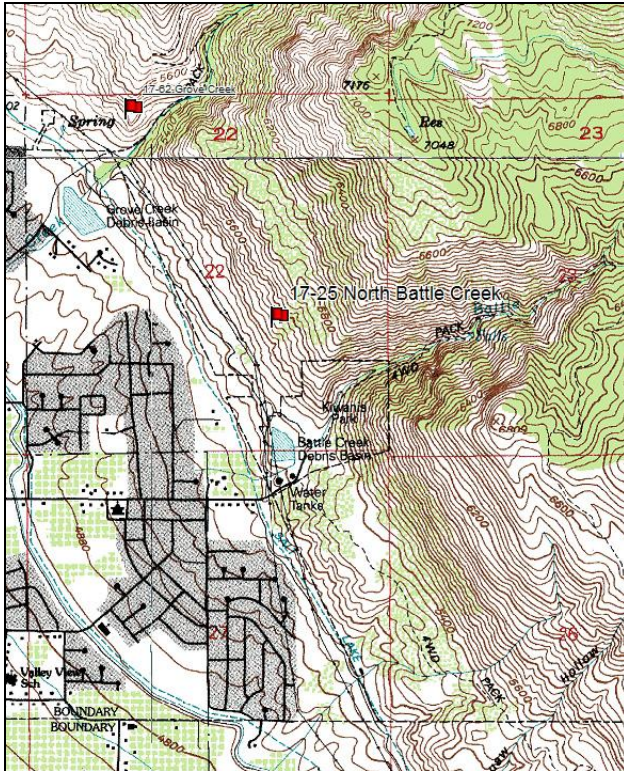
Transect bearing: 192° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34 & 71ft). No rebar.

Directions:

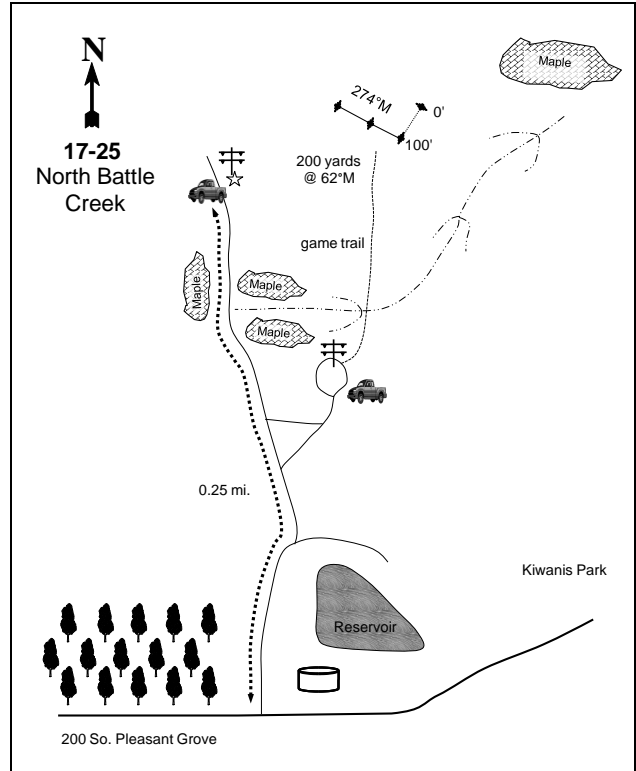
From Pleasant Grove, go up 200 South towards Battle Creek Canyon. The paved road ends at a water tank. Follow one of the many dirt roads north along the base of the foothill under the powerlines. From the water tank, go about 1/4 mile to a 2<sup>nd</sup> reservoir. Stop on the south end. From the powerline pole on the south end of the old reservoir, the 0-foot stake is about 200 yards at 62 degrees magnetic. The study samples the first face or slope below the second terrace, in a fairly dense cliffrose type, just north of a small drainage. A red browse tag, #3988, is attached to the 0-foot stake.

Map Name: Orem



Township: 5S Range: 2E Section: 22

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 440346 E 4468842 N

## NORTH BATTLE CREEK - TREND STUDY NO. 17-25

### Site Information

Site Description: This study is located north of Battle Creek above the city of Pleasant Grove. The study is typical of the crucial winter range in this area, and samples a cliffrose (*Cowania mexicana* ssp. *stansburiana*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community. The Battle Creek and Grove Creek debris basins, which act as small reservoirs in the spring, are located below the site to the north and south. Otherwise, the nearest perennial source of water is Grove Creek, which is located 0.7 miles (1.1 km) to the northwest. Residential subdivisions have been constructed up to the base of the foothill just below the site. The area is moderately browsed by deer. Deer pellet groups were sampled in high abundance in 2002 and 2007, but in moderate abundance in 2012. In 2012, bighorn sheep pellet groups were difficult to distinguish from deer pellets; therefore, deer and sheep pellet groups were all identified as deer. Three deer skeletons were found on the study in 2007. Elk pellet groups were sampled in low abundance in 2002. Bighorn sheep pellet groups were sampled in low abundance in 2007 (Table - Pellet Group Data).

Browse: The dominant preferred browse species is Stansbury cliffrose. Cliffrose is a moderately sparse, mature population that has maintained a stable population size over the course of the study. The health of the cliffrose population has been good to moderate. Decadence has been moderate most sample years, but low in 1997 and 2007. Poor vigor within the cliffrose population has been low over most sample years, and was more moderate in 1983 and 2012. Recruitment of young cliffrose to the population has been near absent over the course of the study. Utilization of cliffrose has been moderate to heavy over the duration of the study. Mountain big sagebrush provides some additional forage for wildlife. Sagebrush is a sparse, mature population. The health of the sagebrush population has been good over the course of the study; however in 2012, sagebrush health was poor. Decadence within the sagebrush population has been low to moderate, but high in 2012. Poor vigor within the sagebrush population has been low over the duration of the study, but high in 2012. Recruitment of young sagebrush to the population has been absent over the course of the study. Density of the sagebrush has decreased over the course of the study. Utilization of sagebrush has been moderate to heavy (Table - Browse Characteristics).

Herbaceous Understory: Bluebunch wheatgrass (*Agropyron spicatum*) is the dominant perennial grass species, has steadily decreased in frequency over the course of the study. Cheatgrass (*Bromus tectorum*) is the dominant annual species. Other grasses that have been sampled at low frequencies include crested wheatgrass (*Agropyron cristatum*), bulbous bluegrass (*Poa bulbosa*), Sandberg bluegrass (*P. secunda*) winter rye (*Secale cereale*), and Japanese brome (*Bromus japonicus*). The forb component is dominated by the annual species pale alyssum (*Alyssum alyssoides*), storksbill (*Erodium cicutarium*), catchweed bedstraw (*Galium aparine*), and bur buttercup (*Ranunculus testiculatus*). Bonneville pea (*Lathyrus brachycalyx*) and northern sweetvetch (*Hedysarum boreale*) have been the dominant perennial species. However, it is likely that these two species have been misidentified as they are difficult to distinguish without the flower. Yellow starthistle (*Centaurea solstitialis*) and field bindweed (*Convolvulus arvensis*) are two noxious weed species that have been sampled on the study (Table - Herbaceous Trend).

Soil: Natural Resource Conservation Service (NRCS) soil data was not available for this site. The soil has a clay loam texture with a neutral soil reaction (pH of 7.1). Potassium may have limited availability for plant growth and development at (38.4 ppm) (Tiedemann and Lopez 2004) (Table - Soil Data Analysis). Bare ground cover is moderate with high amounts of vegetation, rock, and litter cover providing protective ground cover (Table - Basic Cover). Rock cover is high on the lower half of the transect where the baseline crosses a talus slope. The erosion condition was classified as slight in 2002, stable in 2007, and critical in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - stable (0):** The density of cliffrose increased 20% from 332 plants/acre to 399 plants/acre. Decadence increased from 20% to 33%, and poor vigor decreased from 40% to 0%. Recruitment of young cliffrose to the population was not observed. The density of sagebrush decreased 6% from 1,065 plants/acre to 998 plants/acre. Decadence increased from 0% to 20%, and poor vigor increased from 0% to 7%. Recruitment of young sagebrush to the population decreased from 19% to 0%.
- **1989 to 1997 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Cliffrose population decadence decreased to 10%, and poor vigor remained similar at 3%. Recruitment of young cliffrose was not observed. Mountain big sagebrush decadence remained similar at 18%, and poor vigor increased to 18%. Recruitment of young sagebrush to the population was not observed.
- **1997 to 2002 - slightly down (-1):** The density of cliffrose decreased 10% from 800 plants/acre to 720 plants/acre. Cliffrose cover increased from 7% to 9%. Decadence increased to 31%, and poor vigor increased to 11%. Recruitment of young cliffrose was not observed. The density of mountain big sagebrush decreased 45% from 220 plants/acre to 120 plants/acre. Cover of sagebrush decreased from 1% to less than 1%. Decadence remained similar at 17%, and poor vigor decreased to 0%. Recruitment of young sagebrush to the population was not observed.
- **2002 to 2007 - slightly down (-1):** The density of cliffrose decreased 11% to 640 plants/acre. Cover of cliffrose decreased to 7%. Decadence decreased to 6%, and poor vigor remained similar at 9%. Recruitment of young cliffrose to the population increased slightly to 3%. The density of mountain big sagebrush remained similar. Cover for sagebrush increased to 1%. Decadence decreased to 0%, and poor vigor remained at 0%. Recruitment of young sagebrush to the population was not observed.
- **2007 to 2012 - slightly down (-1):** The density of cliffrose decreased 9% to 580 plants/acre. Cover of cliffrose decreased to 5%. Decadence increased to 17%, and poor vigor increased to 28%. Recruitment of young cliffrose to the population was not observed. The density of mountain big sagebrush increased 17% to 140 plants/acre. Cover of sagebrush decreased to less than 1%. Decadence increased to 43%, and poor vigor increased to 71%. Recruitment of young sagebrush to the population was not observed.

### Grass:

- **1983 to 1989 - stable (0):** The sum of nested frequencies of perennial grasses remained similar. Bluebunch wheatgrass is the dominant perennial grass.
- **1989 to 1997 - down (-2):** The sum of nested frequencies of perennial grasses decreased 44%. Bluebunch wheatgrass decreased significantly in nested frequency. The weedy annual species cheatgrass was recorded for the first time and was the most frequently occurring grass on the study. The weedy annual species winter rye (*Secale cereale*) recorded for the first time, but was low in frequency and cover.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. The weedy annual species cheatgrass decreased significantly in nested frequency.
- **2002 to 2007 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 46%. Cover for bluebunch wheatgrass decreased from 4% to 1%. The weedy annual species cheatgrass and winter rye increased significantly in nested frequency, and increased in cover from less than 1% to 7% and 0% to 1%, respectively.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial grasses decreased 21%. The weedy annual species cheatgrass and winter rye increased significantly in nested frequency, and increased in cover to 1% and 11%.



Forb:

- **1983 to 1989 - down (-2):** The sum of nested frequencies of perennial forbs decreased 24%.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased over two-fold. Diversity of perennial forb community increased. The noxious weed field bindweed was sampled for the first time.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial forbs increased 18%. The weedy perennial species western ragweed (*Ambrosia psilostachya*) decreased significantly in nested frequency. Cover of perennial forbs decreased from 5% to 4%
- **2002 to 2007 - down (-2):** The sum of nested frequencies of perennial forbs decreased 48%.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 8%. The weedy perennial species western ragweed increased significantly in nested frequency, and increased in cover to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 25

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	12.2	11.8	0.0	7.4	-1.9	10.0	-2.0	<b>37.4</b>	Poor
02	14.1	6.2	0.4	7.8	-0.2	8.2	-2.0	<b>34.5</b>	Very Poor-Poor
07	10.9	13.3	1.4	2.8	-6.2	1.6	-4.0	<b>19.8</b>	Very Poor
12	8.4	9.5	0.0	3.2	-20.0	1.9	-2.0	<b>1.0</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 17, Study no: 25

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	-	-	1	7	-	1	.00	.18	-	.00
G	Agropyron spicatum	cd128	d117	bc65	bcd71	ab42	a26	3.48	3.71	1.42	1.52
G	Bromus brizaeformis (a)	-	-	-	-	-	5	-	-	-	.01
G	Bromus japonicus (a)	-	-	-	-	3	5	-	-	.00	.15
G	Bromus tectorum (a)	-	-	b159	a38	c216	d309	2.51	.24	7.43	18.58
G	Poa bulbosa	-	-	-	2	-	-	-	.00	-	-
G	Poa secunda	15	13	6	-	-	6	.18	-	-	.06
G	Secale cereale (a)	-	-	a2	a-	b37	c195	.00	-	.88	11.44
G	Unknown grass - perennial	-	3	3	-	-	-	.03	-	-	-
Total for Annual Grasses		0	0	161	38	256	514	2.51	0.24	8.31	30.20
Total for Perennial Grasses		143	133	75	80	42	33	3.70	3.90	1.42	1.59
Total for Grasses		143	133	236	118	298	547	6.22	4.14	9.74	31.79
F	Allium sp.	a20	a6	a16	b121	a2	a-	.08	.86	.00	-
F	Alyssum alyssoides (a)	-	-	a81	a60	b140	c224	.30	.30	.84	1.88
F	Ambrosia psilostachya	-	-	bc13	a1	ab4	c17	.21	.00	.18	.19
F	Artemisia ludoviciana	-	-	b5	a-	a-	a1	.30	-	-	.15
F	Astragalus sp.	-	-	-	1	-	-	-	.03	-	-
F	Camelina microcarpa (a)	-	-	-	-	7	2	-	-	.01	.03

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Centaurea solstitialis</i>	a-	a-	a-	a-	b12	a-	-	-	.07	-
F	<i>Cirsium undulatum</i>	-	-	1	2	-	-	.00	.03	-	-
F	<i>Collinsia parviflora</i> (a)	-	-	-	-	-	4	-	-	-	.01
F	<i>Convolvulus arvensis</i>	-	-	11	14	19	22	.36	.49	.16	.17
F	<i>Descurainia pinnata</i> (a)	-	-	-	-	2	-	-	-	.00	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	4	7	-	3	.01	.02	-	.00
F	<i>Erodium cicutarium</i> (a)	-	-	c213	a91	c196	b138	6.43	1.01	3.82	2.12
F	<i>Galium aparine</i> (a)	-	-	b59	c99	a31	a2	.84	2.61	.55	.00
F	<i>Grindelia squarrosa</i>	-	-	-	-	-	-	-	-	.03	-
F	<i>Hackelia patens</i>	-	-	14	10	7	-	.05	.07	.04	-
F	<i>Hedysarum boreale</i>	b57	b52	a-	a7	a3	a-	-	.01	.03	-
F	<i>Holosteum umbellatum</i> (a)	-	-	-	-	-	1	-	-	-	.00
F	<i>Lactuca serriola</i> (a)	a-	a-	b17	a1	a7	a10	.16	.00	.03	.07
F	<i>Lappula occidentalis</i> (a)	-	-	a-	a-	a-	b16	-	-	-	.05
F	<i>Lathyrus brachycalyx</i>	a-	a-	d111	c58	bc28	b25	4.23	2.51	.25	.42
F	<i>Machaeranthera canescens</i>	2	1	-	-	-	-	-	-	.00	-
F	<i>Medicago sativa</i>	-	-	3	-	-	-	.03	-	-	-
F	<i>Microsteris gracilis</i> (a)	-	-	-	-	-	2	-	-	-	.00
F	<i>Oenothera latifolia</i>	2	-	-	-	-	-	-	-	-	-
F	<i>Phlox longifolia</i>	ab6	b13	ab11	ab9	a-	a3	.05	.05	-	.00
F	<i>Ranunculus testiculatus</i> (a)	-	-	c166	b124	b89	a3	1.64	.95	.68	.01
F	<i>Salsola iberica</i> (a)	-	-	-	-	-	2	-	-	-	.03
F	<i>Sisymbrium altissimum</i> (a)	-	-	3	4	1	2	.00	.01	.03	.00
F	<i>Stanleya pinnata</i>	b24	b12	a-	a-	a-	a-	-	-	-	-
F	<i>Taraxacum officinale</i>	-	-	6	2	-	-	.07	.03	-	-
F	<i>Tragopogon dubius</i> (a)	a-	a-	b18	b16	ab10	a1	.11	.08	.04	.03
F	<i>Trifolium</i> sp.	-	-	-	-	-	1	-	-	-	.00
F	Unknown forb-annual (a)	-	-	a1	b44	a-	a-	.15	1.33	-	-
Total for Annual Forbs		0	0	562	446	483	410	9.65	6.35	6.03	4.27
Total for Perennial Forbs		111	84	191	225	75	69	5.39	4.10	0.78	0.95
Total for Forbs		111	84	753	671	558	479	15.05	10.46	6.82	5.22

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

BROWSE TRENDS--

Management unit 17, Study no: 25

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	8	5	6	7	.83	.36	.60	.33
B	Celtis reticulata	0	0	1	1	-	-	-	.03
B	Chrysothamnus nauseosus albicaulis	2	2	1	1	.78	.38	-	.03
B	Cowania mexicana stansburiana	32	26	25	24	7.41	8.80	6.78	5.31
B	Gutierrezia sarothrae	12	6	4	6	.56	.39	-	.56
B	Purshia tridentata	0	4	0	0	-	.30	-	-
Total for Browse		54	43	37	39	9.59	10.23	7.38	6.26

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 25

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	.21	1.39	.60
Celtis reticulata	-	-	.35
Chrysothamnus nauseosus albicaulis	-	-	-
Cowania mexicana stansburiana	.16	12.71	10.60
Gutierrezia sarothrae	-	.21	.03

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 25

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	-	2.0	1.7
Cowania mexicana stansburiana	1.1	2.7	2.4

BASIC COVER--

Management unit 17, Study no: 25

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	3.50	7.00	30.84	26.16	26.63	46.26
Rock	8.75	20.50	28.40	32.22	22.88	26.86
Pavement	20.25	26.00	11.94	9.89	19.18	10.31
Litter	48.75	30.50	19.88	15.82	25.24	23.52
Cryptogams	.75	.25	.01	.04	0	0
Bare Ground	18.00	15.75	16.89	27.09	20.08	11.04

PELLET GROUP DATA--

Management unit 17, Study no: 25

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	-	-	2	-
Elk	-	1	3	-
Deer	47	18	22	10

Days use per acre (ha)		
'02	'07	'12
-	-	-
1 (2)	-	-
44 (109)	72 (177)	28 (69)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 25

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>1065</b>	19	81	0	-	0	0	0	20/35
89	<b>998</b>	0	80	20	-	100	0	7	22/26
97	<b>220</b>	0	82	18	-	36	55	18	26/40
02	<b>120</b>	0	83	17	-	100	0	0	28/46
07	<b>120</b>	0	100	0	-	67	0	0	31/53
12	<b>140</b>	0	57	43	-	43	57	71	29/52
<i>Celtis reticulata</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>20</b>	100	0	-	-	0	0	0	-/-
12	<b>20</b>	100	0	-	-	0	0	0	27/39
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>66</b>	0	100	0	-	0	0	0	23/30
89	<b>66</b>	0	100	0	-	100	0	0	20/37
97	<b>60</b>	0	33	67	-	0	0	67	22/30
02	<b>40</b>	50	0	50	-	0	0	50	18/33
07	<b>20</b>	0	0	100	-	0	0	100	27/38
12	<b>20</b>	0	100	0	-	0	0	0	31/46
<i>Cowania mexicana stansburiana</i>									
83	<b>332</b>	0	80	20	-	60	40	40	50/60
89	<b>399</b>	0	67	33	-	83	17	0	58/59
97	<b>800</b>	0	90	10	-	10	90	3	50/57
02	<b>720</b>	0	69	31	20	11	58	11	54/63
07	<b>640</b>	3	91	6	-	56	13	9	59/66
12	<b>580</b>	0	83	17	-	24	28	28	55/60

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	860	14	86	0	-	0	0	0	9/11	
02	140	0	43	57	-	0	0	43	7/15	
07	80	0	100	0	-	0	0	0	14/15	
12	200	0	100	0	-	0	0	0	11/14	
<i>Purshia tridentata</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	80	25	75	-	40	25	50	0	13/8	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<i>Rhus trilobata</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	65/136	
<i>Rosa woodsii</i>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	46/83	

OREM WATER TANK - TREND STUDY NO. 17-26-12

Vegetation Type: Gamble Oak

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: DWR

Elevation: 5,500 ft (1,676 m)

Aspect: West

Slope: 8-30%

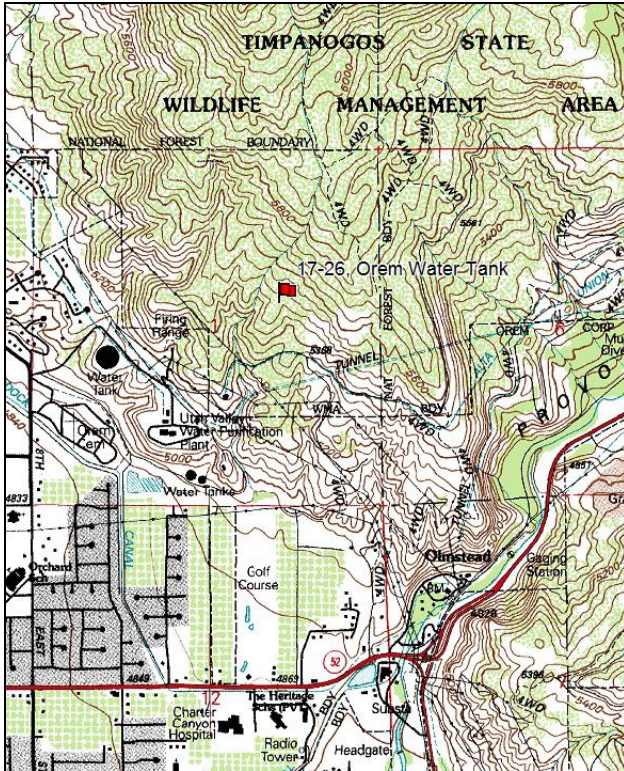
Transect bearing: 38° magnetic

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

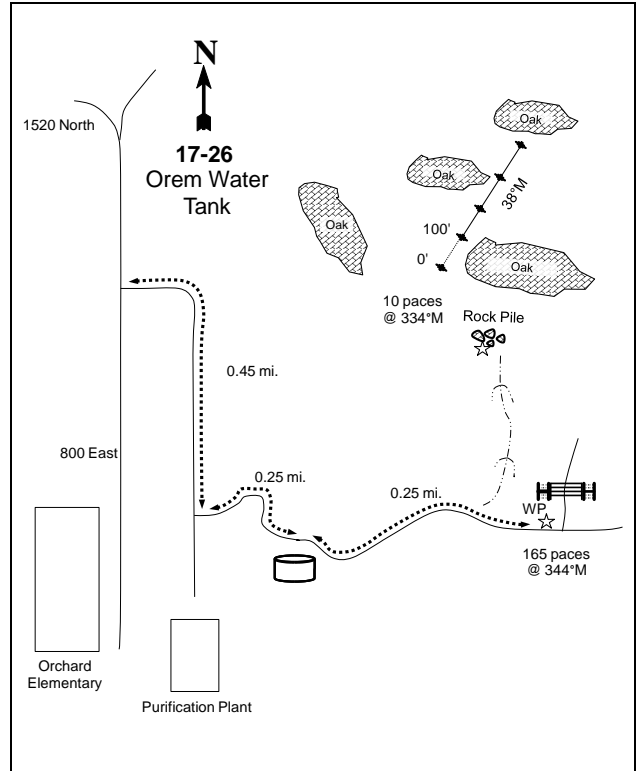
Directions:

You will need a key from Orem City to access this site. On the north side of Orem, go east up 1600 North (which turns into 1520 North) to 800 East. Just south of this intersection on 800 East, turn up the road towards the water purification plant. Go 0.45 miles, turn left and go 0.25 miles to a water tank. Continue on this road 0.25 miles and park. The old road towards the study site is closed, but a witness post should mark the junction. From there, walk about 165 paces (275 yards) to a rock pile at the head of a small drainage or gully. From the rockpile, walk north 10 paces at 334 degrees magnetic to the 0-foot baseline stake at the edge of the oakbrush. It is marked by a red browse tag #3913.

Map Name: Orem



Diagrammatic Sketch:



Township: 6S Range: 2E Section: 1

GPS: NAD 83, UTM 12T 443622 E 4464321 N

## OREM WATER TANK - TREND STUDY NO. 17-26

### Site Information

Site Description: This study was established in 1983 on a burned, seeded Gambel oak (*Quercus gambelii*) community immediately north of the Orem Water Treatment Plant. The nearest source of perennial water is found in the residential area 0.5 miles to the southwest. In the summer of 1996, a fire burned through the area again, and consumed what browse had come back from the previous fire. Following the fire, re-sprouting Gambel oak was nearly the only browse species remaining. Livestock are excluded to protect watershed quality. In 1983, grasshopper damage was apparent on the oak, but not enough to impact vigor. Deer pellet groups were sampled in high abundance in 2002, but in low abundance in 2007 and 2012. Deer carcasses were found near the study in 2007. Elk pellet groups were sampled in high abundance in high abundance in 2002 and 2007 (Table - Pellet Group Data).

Browse: The Gambel oak population is dense and mature. The health of the oak population is healthy. Decadence within the oak population has been low over the course of the study. Additionally, poor vigor has also been low over the course of the study. Utilization of oak has been light for the majority of the study, but was mostly moderate in 1983. Recruitment of young oak to the population has been prolific. Young oak plants were at their highest in 1989 and 1997; additionally, young plants comprised the majority of the population. Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) had a low density in 1989. All sagebrush plants were consumed by the 1996 fire, and none have been sampled since. Fourwing saltbush (*Atriplex canescens*) was seeded, but not sampled in the density strips in any reading. Forage kochia (*Kochia prostrata*) was sampled for the first time in 2012 (Table - Browse Characteristics).

Herbaceous Understory: Smooth brome (*Bromus inermis*) is the dominant perennial grass in the oak understory, while intermediate wheatgrass (*Agropyron intermedium*) and crested wheatgrass (*Agropyron cristatum*) are dominant in the interspaces. The weedy annual species cheatgrass (*Bromus tectorum*) is the dominant annual species. The weedy perennial species bulbous bluegrass (*Poa bulbosa*) was sampled for the first time in 2002, but was found in low frequency and cover on the study. Perennial forb cover has steadily decreased in cover over the course of the study. Alfalfa (*Medicago sativa*) has been the dominant species, and has been healthy and robust despite animal use. Other perennial forbs were seldom sampled. The noxious weed Dalmatian toadflax (*Linaria dalmatica*) has been sampled in a low, but increasing frequency since 1997.

Soil: The soil is part of the Dry Creek component, which is found on ridges and mountain slopes. The parent material consists of colluvium and/or slope alluvium derived from missed sources (Soil Survey Staff 2011).. The soil has a clay loam texture with a neutral soil reaction (pH of 6.7). Except in 1997, bare ground cover has been very low with a high abundance of vegetation and litter providing protective ground cover (Table - Basic Cover). Bare ground cover was high in 1997 because of the 1996 wildfire. The erosion condition was classified as stable in 2002 and 2007, but slight in 2012.

### Trend Assessments

Browse:

- **1983 to 1989 - stable (0):** The density of Gable oak decreased 7% from 15,331 plants/acre to 14,331 plants/acre. Decadence increased from 1% to 13%, and poor vigor increased from 0% to 7%. Recruitment of young sagebrush increased considerably from 27% to 63%. The sparse population of mountain big sagebrush decreased in density 17% from 399 plants/acre to 333 plants/acre. Decadence increased from 67% to 100%, and poor vigor increased from 0% to 60%. Recruitment of young sagebrush was not observed.
- **1989 to 1997 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Gambel oak decadence decreased to 0%, and poor vigor decreased to 2%. Recruitment of young oak to the population

remained excellent and increased to 77%. The sparse, but heavily utilized population of mountain big sagebrush was lost in the fire of 1996.

- **1997 to 2002 - up (+2):** The density of Gambel oak increased 78% from 10,560 plants/acre to 18,820 plants/acre. Cover of oak increased from 8% to 17%. Decadence was maintained at 0%, and poor vigor was less than 1%. Recruitment of young oak to the population decreased to 16%.
- **2002 to 2007 - stable (0):** The density of Gambel oak remained similar at 19,340 plants/acre. The cover of oak increased to 23%. The Decadence remained at 1%, and poor vigor remained less than 1%. Recruitment of young oak to the population increased to 23%.
- **2007 to 2012 - slightly down (-1):** The density of Gabel oak decreased 17% to 16,140 plants/acre. The cover of oak decreased to 20%. Decadence and poor vigor remained similar to the previous trend. Recruitment of young oak to the population increased to 52%.

#### Grass:

- **1983 to 1989 - stable (0):** The sum of nested frequencies of perennial grasses remained similar. Smooth brome increased significantly in nested frequency.
- **1989 to 1997 - slightly down (-1):** The sum of nested frequencies of perennial grasses decreased 13%. Crested wheatgrass increased significantly in nested frequency. The decrease in nested frequencies is primarily due to the decrease in nested frequency of intermediate wheatgrass. The weedy annual species cheatgrass was measured for the first time and was abundant on the study.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. The perennial species crested wheatgrass decreased in cover from 2% to 1%. Intermediate wheatgrass and smooth brome increased in cover from 5% to 7% and from 14% to 18%, respectively. The weedy annual species cheatgrass increased significantly in nested frequency, and increased in cover from 3% to 9%. The weedy perennial species bulbous bluegrass was observed for the first time, but in low frequency and cover.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. The weedy perennial species bulbous bluegrass increased significantly in nested frequency, but remained trivial within the community. The weedy annual species cheatgrass increased significantly in nested frequency, and increased in cover to 16%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 39%. Intermediate wheatgrass increased significantly in nested frequency, and increased in cover from 5% to 21%. Smooth brome increased in cover from 11% to 23%. Cheatgrass decreased significantly in nested frequency, and decreased in cover to 4%.

#### Forb:

- **1983 to 1989 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 47%. Northern sweetvetch (*Hedysarum boreale*) and sego lily (*Calochortus nuttallii*) decreased significantly in nested frequency. Perennial forbs are rare on the study.
- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial forbs increased nearly four-fold. The noxious weedy Dalmatian toadflax was sampled in low frequency for the first time.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial forbs increased 12%. Alfalfa increased significantly in nested frequency, but decreased in cover from 12% to 8%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Perennial forb cover decreased from 8% to 6%.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies of perennial forbs increased 27%. The noxious weed Dalmatian toad flax increased significantly in nested frequency. The cover of perennial forbs decreased to 3%.



DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 26

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	7.7	15.0	15.0	30.0	-2.5	10.0	-2.0	<b>73.1</b>	Good
02	16.6	15.0	8.0	30.0	-7.8	10.0	-2.0	<b>69.9</b>	Good
07	23.2	14.7	11.5	30.0	-12.3	10.0	-2.0	<b>75.1</b>	Good
12	19.8	14.1	15.0	30.0	-3.1	6.3	-2.0	<b>80.1</b>	Good-Excellent

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 26

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a8	a1	b41	ab18	a17	a7	1.68	.45	1.44	.15
G	Agropyron intermedium	a173	a166	a103	a121	a111	b226	4.96	6.98	4.75	21.22
G	Agropyron spicatum	-	-	-	-	-	1	-	-	-	.00
G	Bromus inermis	a235	b268	ab232	ab224	a202	ab234	13.45	18.14	11.19	23.00
G	Bromus japonicus (a)	-	-	b37	c60	a-	b25	.86	1.03	-	.19
G	Bromus tectorum (a)	-	-	a105	b161	c254	b159	2.49	9.32	16.13	3.88
G	Poa bulbosa	a-	a-	a-	a3	b18	b18	-	.18	.19	.75
G	Poa pratensis	-	3	-	1	-	-	-	.00	-	-
G	Poa secunda	3	7	10	6	18	14	.06	.04	.22	.05
G	Vulpia octoflora (a)	-	-	2	3	12	-	.00	.00	.21	-
Total for Annual Grasses		0	0	144	224	266	184	3.36	10.36	16.34	4.07
Total for Perennial Grasses		419	445	386	373	366	500	20.17	25.80	17.82	45.19
Total for Grasses		419	445	530	597	632	684	23.54	36.16	34.16	49.26
F	Alyssum alyssoides (a)	-	-	b101	ab79	a55	a62	.73	.46	.16	.17
F	Astragalus sp.	-	2	-	-	-	-	-	-	-	-
F	Calochortus nuttallii	b20	a1	b14	a1	a-	a-	.04	.00	-	-
F	Collinsia parviflora (a)	-	-	-	-	-	2	-	-	-	.00
F	Collomia linearis (a)	-	-	-	1	-	-	-	.00	-	-
F	Comandra pallida	-	-	-	-	4	-	-	-	.03	-
F	Descurainia pinnata (a)	-	-	10	5	10	-	.02	.01	.03	-
F	Draba sp. (a)	-	-	-	-	7	-	-	-	.01	-
F	Epipactis gigantea	-	-	2	-	-	-	.00	-	-	-
F	Eriogonum racemosum	5	3	5	-	-	2	.03	-	-	.03
F	Erodium cicutarium (a)	-	-	bc28	ab16	c34	a5	.21	.51	1.17	.03
F	Galium aparine (a)	-	-	a6	a4	b42	a12	.04	.01	1.02	.05
F	Hedysarum boreale	b22	a-	a-	a-	a-	a-	-	-	-	-
F	Holosteum umbellatum (a)	-	-	a2	bc14	c18	ab5	.00	.04	.04	.01
F	Lactuca serriola (a)	-	-	2	-	-	1	.18	-	-	.00
F	Lappula occidentalis (a)	-	-	7	-	-	3	.02	-	-	.01
F	Linaria dalmatica	a-	a-	a3	a4	a13	b40	.03	.01	.26	.41
F	Medicago sativa	a14	a22	b99	c140	bc110	bc124	12.19	7.60	5.55	2.69

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Phlox longifolia	-	-	-	-	1	2	-	-	.00	.00
F	Polygonum douglasii (a)	-	-	2	-	-	-	.00	-	-	-
F	Sphaeralcea coccinea	6	8	6	-	5	2	.04	.00	.03	.00
F	Tragopogon dubius (a)	1	-	5	-	-	4	.06	-	-	.03
F	Zigadenus paniculatus	1	-	-	-	1	-	-	-	.03	-
Total for Annual Forbs		1	0	163	119	166	94	1.28	1.04	2.46	0.31
Total for Perennial Forbs		68	36	129	145	134	170	12.35	7.62	5.92	3.14
Total for Forbs		69	36	292	264	300	264	13.64	8.67	8.38	3.46

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

#### BROWSE TRENDS--

Management unit 17, Study no: 26

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Chrysothamnus nauseosus albicaulis	1	0	0	0	-	-	-	-
B	Kochia prostrata	0	0	0	1	-	-	-	.03
B	Quercus gambelii	57	59	57	61	7.65	16.63	23.18	19.76
Total for Browse		58	59	57	62	7.65	16.63	23.18	19.79

#### CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 26

Species	Percent Cover		
	'02	'07	'12
Quercus gambelii	24.86	38.26	32.46

#### BASIC COVER--

Management unit 17, Study no: 26

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	1.50	3.00	42.85	59.75	65.31	71.16
Rock	.50	1.00	3.87	.69	.87	.71
Pavement	.75	1.00	1.99	.11	.05	.01
Litter	95.50	91.50	34.48	72.68	60.89	47.13
Cryptogams	.25	0	.00	.00	.04	0
Bare Ground	1.50	3.50	23.51	1.08	.48	.07

#### PELLET GROUP DATA--

Management unit 17, Study no: 26

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Elk	7	15	14	-	60 (147)	88 (217)	-
Deer	36	11	5	1	49 (121)	8 (20)	12 (30)

BROWSE CHARACTERISTICS--  
Management unit 17, Study no: 26

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	399	0	33	67	66	0	100	0	31/26
89	333	0	0	100	-	40	60	60	-/-
97	0	0	0	0	-	0	0	0	-/-
02	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	-/-
12	0	0	0	0	-	0	0	0	-/-
<i>Atriplex canescens</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	16/13
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus nauseosus albicaulis</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	20	100	0	-	-	0	100	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
83	133	0	0	100	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
97	0	0	0	0	-	0	0	0	-/-
02	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	11/17
12	0	0	0	0	-	0	0	0	-/-
<i>Kochia prostrata</i>									
83	0	0	0	0	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
97	0	0	0	0	-	0	0	0	-/-
02	0	0	0	0	-	0	0	0	-/-
07	0	0	0	0	-	0	0	0	-/-
12	20	0	0	100	-	0	0	100	13/10

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Quercus gambelii										
83	<b>15331</b>	27	71	1	1399	92	1	0	40/15	
89	<b>14331</b>	63	25	13	2666	13	0	7	46/19	
97	<b>10560</b>	77	23	0	4580	0	0	2	13/10	
02	<b>18820</b>	16	84	0	-	6	0	.10	31/16	
07	<b>19340</b>	23	75	1	20	6	0	.31	40/21	
12	<b>16140</b>	45	52	3	-	16	2	12	38/22	

SPRING CANYON - TREND STUDY NO. 17-30-12

Vegetation Type: Annual and Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Mountain Stony Loam (Browse), R047XA460UT

Land Ownership: USFS

Elevation: 5,200 ft (1,585 m)

Aspect: Southeast

Slope: 65%

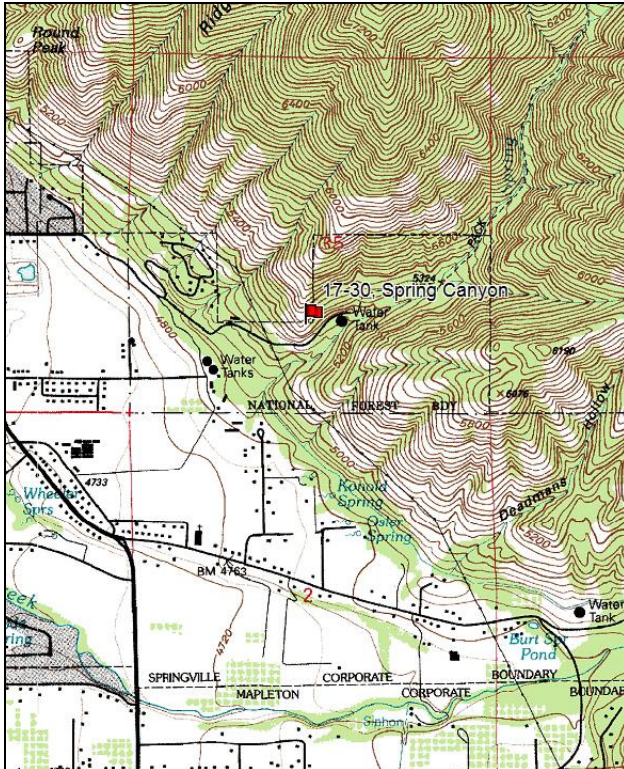
Transect bearing: 348° magnetic

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

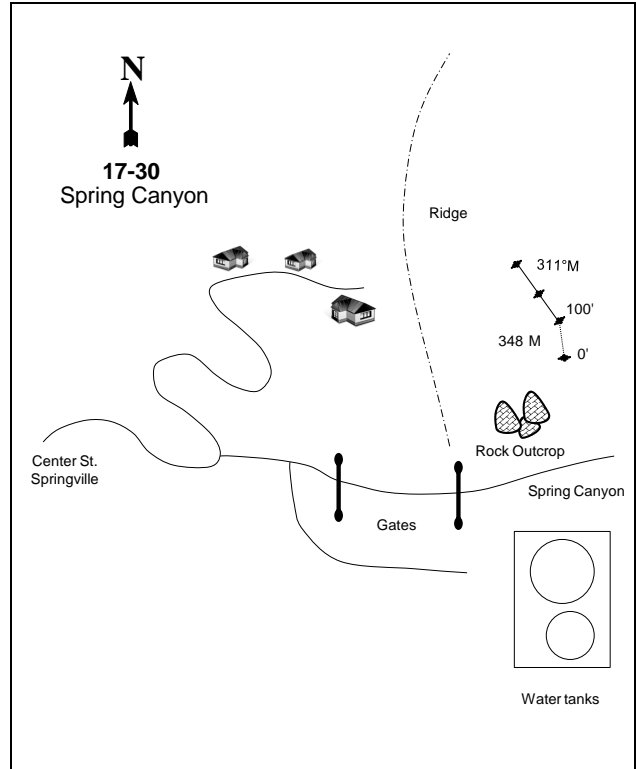
Directions:

Follow Center Street in Springville easterly toward the mountain. From the first switchback where the main road goes up to houses on the bench north of Spring Canyon, continue towards the canyon mouth to the first gate. Continued development may alter the approach to the canyon. In 1989, you could walk 1/2 mile from the first locked gate to another gate up in the canyon. From this gate, continue 119 paces east up Spring Canyon. Uphill to the northwest (azimuth 271 degrees) there is a conspicuous group of rock outcroppings. Walk up the side hill to the uppermost rock near the top of the ridge. The 0-foot stake, marked with a red browse tag #177, is north of the rock.

Map Name: Springville



Diagrammatic Sketch:



Township: 7S Range: 3E Section: 35

GPS: NAD 83, UTM 12T 451466 E 4446006 N

## SPRING CANYON - TREND STUDY NO. 17-30

### Site Information

Site Description: The study is located near the mouth of Spring Canyon, and samples a Stansbury cliffrose community (*Cowania mexicana* ssp. *stansburiana*) within crucial winter range. During the winter, the area is intensively occupied by deer and may also be occupied by elk. Deer pellet group were sampled in low abundance in 2007, in moderate abundance in 2012, and in high abundance in 2002. Elk pellet groups were sampled in low abundance in 2002 and 2012, but in high abundance in 2007 (Table - Pellet Group Data). Pellet groups were sampled more frequently within the cliffrose stand in 2012.

Browse: The dominant browse species is Stansbury cliffrose, which has a sparse, mature stand on the study site. The health of the cliffrose population has been good with periodic increases in decadence and poor vigor. Decadence within the cliffrose population had been low most sample years, but moderate in 1997 and 2007. Poor vigor of cliffrose has been low for every sample year, except in 1983 where poor vigor was high. Utilization of cliffrose has been mostly heavy over the duration of the study. Recruitment of young cliffrose to the population has been moderately low with no recruitment being measured in 1997 and 2007. Though not a preferred species, broom snakeweed (*Gutierrezia sarothrae*) is also present with a sparse, mature population. A short distance up the canyon there are a few patches of Gambel oak (*Quercus gambelii*), netleaf hackberry (*Celtis reticulata*), and Rocky Mountain smooth sumac (*Rhus glabra*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses are the dominant component of vegetation cover. However, species diversity of perennial grasses is low. The weedy perennial species bulbous bluegrass (*Poa bulbosa*) was the most abundant grass, but has generally decreased in cover over the course of the study. Bluebunch wheatgrass (*Agropyron spicatum*) is also present. The weedy annual species cheatgrass (*Bromus tectorum*) has steadily increased in cover over the duration of the study, and was the most dominant grass in 2012. The forbs present in the understory have a low forage value. Much of the increase was attributed to storksbill (*Erodium cicutarium*) and pale alyssum (*Alyssum alyssoides*). Otherwise, the dominant perennial forbs include cudweed sageswort (*Artemisia ludoviciana*) and shortstem wild buckwheat (*Eriogonum brevicale*).

Soil: Natural Resource Conservation Service (NRCS) soil data was not available for this site. The soil has a sandy loam texture with a neutral soil reaction (pH 7.0). Both phosphorous and potassium may have limited availability for plant growth and development at 5.9 ppm and 57.6 ppm respectively (Tiedemann and Lopez 2004) (Table - Soil Data Analysis). Surface rock is variable in size and appears to be limestone. Bare ground cover is low with high amount of vegetation and litter, and a moderate amount of rock and pavement providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2002 and 2007, but stable in 2012.

### Trend Assessments

Browse:

- **1983 to 1989 - up (+2):** The density of Stansbury cliffrose increased 37% from 266 plants/acre to 365 plants/acre. Decadence increased slightly to 9%, and poor vigor decreased considerably from 63% to 0%. Recruitment of young cliffrose to the population increased from 12% to 18%.
- **1989 to 1997 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Stansbury cliffrose decadence increased to 22%, and poor vigor was maintained at 0%. Recruitment of young cliffrose to the population decreased to 0%.
- **1997 to 2002 - up (+2):** The density of Stansbury cliffrose increased 33% from 180 plants/acre to 240 plants/acre. Cover of cliffrose was maintained near 3%. Decadence decreased to 8%, and poor vigor was maintained at 0%. Recruitment of young cliffrose increased slightly to 8%.

- **2002 to 2007 - up (+2):** The density of Stansbury cliffrose increased 58% to 380 plants/acre. Cover of cliffrose increased to 4%. Decadence increased to 21%, and poor vigor increased to 11%. Recruitment of young cliffrose to the population was not observed.
- **2007 to 2012 - down (-2):** The density of Stansbury cliffrose decreased 63% to 140 plants/acre. Cover of cliffrose decreased to 2%. Both decadence and poor vigor decreased to 0%. Recruitment of young cliffrose increased to 14%.

Grass:

- **1983 to 1989 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 38%. Bluebunch wheatgrass decreased significantly in nested frequency. Bulbous blue grass was the most abundant perennial grass on the study.
- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 73%. Bluebunch wheatgrass increased significantly in nested frequency. The weedy perennial species bulbous bluegrass increased significantly in nested frequency, and had a cover of 25%. The weedy annual species cheatgrass was measured for the first time, and was the second most frequently occurring grass species on the site.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 11%. Cover of bluebunch wheatgrass increased in cover to 6%. The weedy perennial species bulbous bluegrass increased slightly in cover to 27%. The weedy annual species increased to 6%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. The weedy perennial species bulbous bluegrass decreased in cover to 17%. The weedy annual cheatgrass increased in cover to 14%.
- **2007 to 2012 - stable (0):** The sum of frequencies of perennial grasses, excluding bulbous bluegrass, decreased remained similar. The weedy perennial species bulbous bluegrass decreased significantly in nested frequency, and decreased in cover to 13%. The weedy annual species cheatgrass increased considerably to 23%.

Forb:

- **1983 to 1989 - down (-2):** The sum of nested frequencies of perennial forbs decreased 21%. Species composition remains low.
- **1989 to 1997 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Species composition remains low.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Forbs are rare on the site.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Forbs increased in diversity.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial forbs decreased 17%. The weedy perennial species western ragweed (*Ambrosia psilostachya*) increased significantly in nested frequency, and increased in cover to 1%. Diversity of the forb community decreased.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 30

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	5.0	0.0	0.0	8.1	-2.6	5.9	0.0	<b>16.4</b>	Very Poor
02	6.8	0.0	0.0	11.5	-4.5	5.7	0.0	<b>19.4</b>	Very Poor
07	6.1	0.0	0.0	12.2	-10.6	8.3	0.0	<b>16.0</b>	Very Poor
12	5.4	0.0	0.0	11.6	-17.0	4.4	0.0	<b>4.3</b>	Very Poor

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 17, Study no: 30

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Agropyron spicatum</i>	bc157	a97	c162	c148	bc139	ab107	3.85	5.75	5.75	4.95
G	<i>Aristida purpurea</i>	-	-	-	-	2	4	-	-	.15	.15
G	<i>Bromus carinatus</i>	-	-	-	-	-	2	-	-	-	.15
G	<i>Bromus tectorum</i> (a)	-	-	a288	a295	b344	b344	3.47	6.02	14.17	22.67
G	<i>Poa bulbosa</i>	b294	b320	d348	cd345	bc314	a184	24.68	26.57	17.18	13.38
G	<i>Poa secunda</i>	a-	a-	a6	a1	a8	b33	.18	.00	.19	.55
G	<i>Secale cereale</i> (a)	-	-	-	-	-	2	-	-	-	.06
Total for Annual Grasses		0	0	288	295	344	346	3.47	6.02	14.17	22.73
Total for Perennial Grasses		451	417	516	494	463	330	28.73	32.32	23.28	19.19
Total for Grasses		451	417	804	789	807	676	32.20	38.35	37.46	41.92
F	<i>Alyssum alyssoides</i> (a)	-	-	a53	a17	b131	b148	.14	.04	.53	.55
F	<i>Ambrosia psilostachya</i>	a-	a-	a-	a-	b17	c37	-	-	.40	.73
F	<i>Amsinckia tessellata</i>	-	-	-	-	2	-	-	-	.01	-
F	<i>Artemisia ludoviciana</i>	39	28	27	29	35	40	.28	.39	1.12	1.08
F	<i>Aster</i> sp.	-	-	-	3	-	-	-	.03	-	-
F	<i>Astragalus utahensis</i>	-	-	6	2	4	-	.06	.03	.01	-
F	<i>Cirsium undulatum</i>	8	15	16	-	4	2	.59	-	.05	.01
F	<i>Cryptantha</i> sp.	-	-	-	3	1	-	-	.00	.01	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	-	8	-	-	-	.01	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	-	-	4	-	-	-	.03	-
F	<i>Erigeron pumilus</i>	-	-	-	-	-	-	-	-	.00	-
F	<i>Eriogonum brevicaulis</i>	c89	bc64	bc52	bc72	ab36	a9	1.88	2.33	2.31	.21
F	<i>Eriogonum racemosum</i>	-	-	-	1	-	-	-	.03	-	-
F	<i>Erodium cicutarium</i> (a)	-	-	a4	a30	b88	c128	.01	.17	2.35	1.58
F	<i>Galium aparine</i> (a)	-	-	-	-	-	-	-	-	.03	-
F	<i>Gilia</i> sp. (a)	-	-	-	14	-	-	-	.03	-	-
F	<i>Grindelia squarrosa</i>	-	-	-	-	-	4	-	-	-	.15
F	<i>Heterotheca villosa</i>	-	-	2	-	6	-	.03	.00	.04	-
F	<i>Lactuca serriola</i> (a)	-	-	-	-	7	3	-	-	.02	.01
F	<i>Lappula occidentalis</i> (a)	-	-	a-	b17	a2	a-	-	.04	.03	-
F	<i>Lomatium</i> sp.	-	-	2	-	-	-	.00	-	-	-
F	<i>Machaeranthera canescens</i>	-	1	3	-	-	-	.04	-	-	-
F	<i>Oenothera caespitosa</i>	-	-	-	-	-	-	-	-	.00	-
F	<i>Penstemon</i> sp.	-	-	3	-	1	1	.03	-	.15	.00
F	<i>Phlox longifolia</i>	-	-	-	-	6	-	-	-	.01	-
F	<i>Sisymbrium altissimum</i> (a)	-	-	-	-	4	2	-	-	.01	.00
F	<i>Tragopogon dubius</i> (a)	1	-	1	2	8	1	.03	.00	.04	.03
Total for Annual Forbs		1	0	58	80	252	282	0.18	0.29	3.06	2.17
Total for Perennial Forbs		136	108	111	110	112	93	2.94	2.83	4.13	2.19
Total for Forbs		137	108	169	190	364	375	3.12	3.13	7.20	4.37

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



BROWSE TRENDS--

Management unit 17, Study no: 30

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Celtis reticulata</i>	0	0	0	0	.03	.53	.41	1.69
B	<i>Chrysothamnus nauseosus albicaulis</i>	1	1	0	0	.00	.38	-	-
B	<i>Cowania mexicana stansburiana</i>	9	10	17	7	2.66	3.34	3.57	1.63
B	<i>Gutierrezia sarothrae</i>	48	22	26	20	1.89	.09	.19	.46
B	<i>Purshia tridentata</i>	0	4	1	0	-	.03	-	-
B	<i>Quercus gambelii</i>	1	1	1	1	1.03	1.23	.79	2.94
Total for Browse		59	38	45	28	5.63	5.61	4.97	6.73

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 30

Species	Percent Cover		
	'02	'07	'12
<i>Celtis reticulata</i>	-	.26	3.71
<i>Cowania mexicana stansburiana</i>	.25	6.40	3.79
<i>Gutierrezia sarothrae</i>	-	.80	.95
<i>Quercus gambelii</i>	.20	2.50	3.26

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 30

Species	Average leader growth (in)		
	'02	'07	'12
<i>Cowania mexicana stansburiana</i>	0.8	1.1	3.8

BASIC COVER--

Management unit 17, Study no: 30

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	4.50	8.25	39.04	48.04	48.13	49.18
Rock	14.00	12.50	13.13	16.63	17.46	17.68
Pavement	45.00	56.25	28.82	28.96	18.38	17.61
Litter	31.00	14.25	17.02	15.57	22.85	24.58
Cryptogams	.75	0	.43	0	.30	.69
Bare Ground	4.75	8.75	10.95	2.64	9.08	10.17

PELLET GROUP DATA--

Management unit 17, Study no: 30

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	-	1	-	2
Elk	22	2	17	2
Deer	38	32	47	17

Days use per acre (ha)		
'02	'07	'12
-	-	-
3 (8)	9 (22)	1 (2)
42 (104)	60 (147)	21 (51)

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

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Celtis reticulata</i>									
83	0	0	0	-	-	0	0	0	-/-
89	33	0	100	-	-	100	0	0	46/67
97	0	0	0	-	-	0	0	0	24/104
02	0	0	0	-	-	0	0	0	26/103
07	0	0	0	-	-	0	0	0	42/96
12	0	0	0	-	-	0	0	0	53/113
<i>Chrysothamnus nauseosus albicaulis</i>									
83	0	0	0	0	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
97	20	0	100	0	-	0	100	0	17/41
02	20	0	0	100	-	100	0	100	13/31
07	0	0	0	0	-	0	0	0	28/30
12	0	0	0	0	-	0	0	0	-/-
<i>Cowania mexicana stansburiana</i>									
83	266	12	88	0	-	38	63	63	52/81
89	365	18	73	9	33	18	82	0	55/64
97	180	0	78	22	80	0	100	0	76/83
02	240	8	83	8	-	8	58	0	65/87
07	380	0	79	21	-	0	89	11	61/75
12	140	14	86	0	20	14	57	0	70/81
<i>Gutierrezia sarothrae</i>									
83	899	59	41	0	-	0	0	0	11/14
89	865	11	73	15	-	0	0	15	6/5
97	2760	29	71	0	300	0	0	0	8/11
02	580	28	41	31	20	3	0	10	5/7
07	1140	12	86	2	-	2	4	2	8/11
12	580	24	72	3	20	0	0	38	10/17
<i>Purshia tridentata</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	100	20	80	-	-	40	60	0	38/9
07	20	0	100	-	-	0	100	0	6/11
12	0	0	0	-	-	0	0	0	-/-

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Quercus gambelii									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	0	100	-	-	0	0	0	94/114
02	<b>60</b>	0	100	-	20	0	0	0	65/76
07	<b>40</b>	0	100	-	140	0	0	0	119/148
12	<b>20</b>	0	100	-	-	0	0	0	-/-

ROUND PEAK - TREND STUDY NO. 17-31-12

Vegetation Type: Mountain Brush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Mountain Stony Loam \(Mountain Big Sagebrush\), R047XA461UT](#)

Land Ownership: USFS

Elevation: 5,100 ft (1,555 m)

Aspect: South

Slope: 25-45%

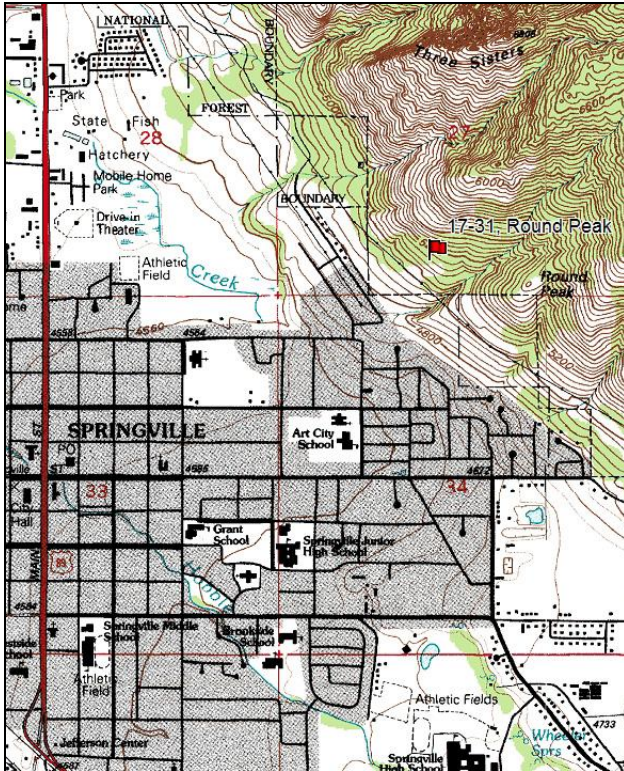
Transect bearing: 349° magnetic

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

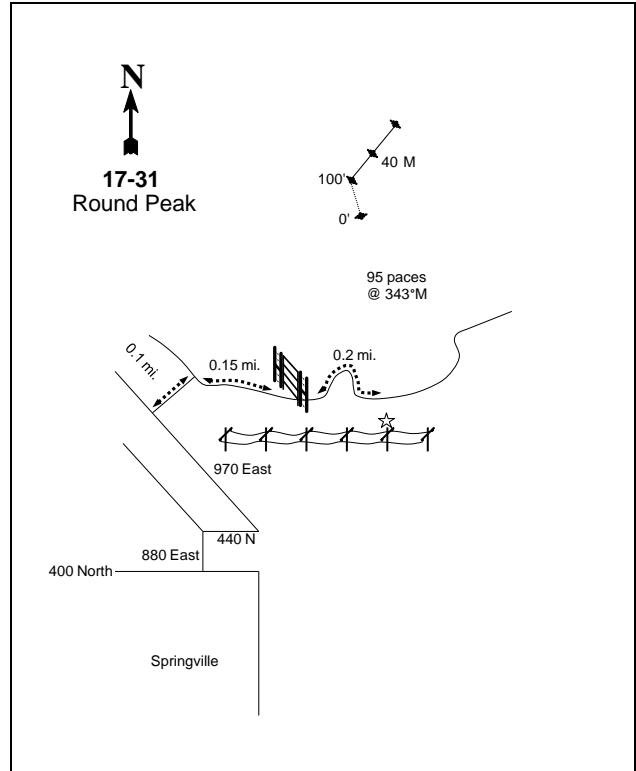
Directions:

From the town of Springville, take 440 North and 970 East to an intersection at the end of the paved road. Turn right and proceed 0.1 miles to an intersection. Turn right and go southeast along the foothills for 0.15 miles to a locked gate. Walk 0.2 miles along the road and stop even with 2 power poles which are 50 yards south of the road. From the power poles, the 0-foot baseline stake is 95 paces north (343 degrees) marked with browse tag #419.

Map Name: Springville



Diagrammatic Sketch:



Township: 7S Range: 3E Section: 27

GPS: NAD 83, UTM 12T 449748 E 4447396 N

## ROUND PEAK - TREND STUDY NO. 17-31

### Site Information

Site Description: The study is located on Uinta National Forest land to the east of Springville and samples a Rocky Mountain smooth sumac (*Rhus glabra* ssp. *cismontana*) community on crucial winter range. The nearest source of perennial water is the Spring Creek wetland 0.8 miles to the northwest. In the summer of 1989, several fawn carcasses were found, most likely winter-killed from the deep snows of the 1988-89 winter. In 2007, a deer skeleton was found on the baseline, and there were several game trails traversing the study. Deer pellet groups were sampled in high abundance in 2002 and 2007, but in moderate abundance in 2012. Elk pellet groups were sampled in low abundance in 2002 and 2012, but in moderate abundance in 2007 (Table - Pellet Group Data).

Browse: The preferred browse species is Rocky Mountain smooth sumac, which is an increaser and invader species. Sumac has maintained a moderately stable population of mature, moderately dense stand of plants. The health of the sumac population has been good to moderate over the course of the study with decadence being low most sample years, but moderate in 1997 and 2002. Poor vigor within the sumac population has been low over the duration of the study. Utilization of sumac has ranged from light to heavy. Recruitment of young sumac to the population has been moderate most sample years, but was low in 1983 and 2012. The most common browse species is broom snakeweed (*Gutierrezia sarothrae*), and has fluctuated in density each sample year. Other shrubs found on the site include netleaf hackberry (*Celtis reticulata*), skunkbush sumac (*Rhus trilobata*), and Gambel oak (*Quercus gambelii*) (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by perennial grasses. The two perennial grass species present bulbous bluegrass (*Poa bulbosa*) and bluebunch wheatgrass (*Agropyron spicatum*). Bulbous bluegrass has accounted for slightly more cover than bluebunch wheatgrass since 1997. Annual grasses are present on the study include wildoat (*Avena fatua*), cheatgrass (*Bromus tectorum*), rattlesnake brome (*Bromus brizaeformis*), and Japanese brome (*B. japonicus*). Most of the species present have low forage value, and perennial forbs are more abundant than annual forbs. The dominant perennial forbs include western ragweed (*Ambrosia psilostachya*), Louisiana sagebrush (*Artemisia ludoviciana*), and Bonneville pea (*Lathyrus brachycalyx*). Storksbill (*Erodium cicutarium*) and pale alyssum (*Alyssum alyssoides*) are the most abundant annual species (Table - Herbaceous Trends).

Soil: The soil is part of the Pleasant Grove component, which occurs on alluvial fans. The parent material consists of colluvium and/or slope alluvium derived from limestone, quartzite, and shale (Soil Survey Staff 2011). The soil has a clay loam texture with a neutral soil reaction (pH of 7.2) (Table - Soil Analysis Data). Bare ground cover has been low in all sample years with a high amount of vegetation, litter, and rock providing protective ground cover (Table - Basic Cover). A talus slide occupies the northern one-third of the study, and is composed of rocks too large to be transported by runoff. However, erosion and soil compaction are evident on the many trails interconnecting the area. The erosion condition was classified as stable in 2002 and 2007, but slight in 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - up (+2):** The density of Rocky Mountain smooth sumac increased in density 60%. Decadence remained similar at 6%, and poor vigor remained at 0%. Recruitment of young sumac to the population increased from 7% to 22%.
- **1989 to 1997 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Rocky Mountain smooth sumac decadence increased to 24%, and poor vigor remained similar at 4%. Recruitment of young sumac to the population decreased slightly to 15%.

- **1997 to 2002 - stable (0):** The density of Rocky Mountain smooth sumac population increased 4% from 1,100 plants/acre to 1,140 plants/acre. Cover of sumac decreased from 2% to 1%. Decadence decreased to 19%, and poor vigor increased to 11%. Recruitment of young sumac to the population was similar at 16%.
- **2002 to 2007 - down (-2):** The density of Rocky Mountain smooth sumac population decreased 35% to 740 plants/acre. Cover of sumac increased to 2%. Decadence decreased to 5%, and poor vigor decreased to 0%. Recruitment of young sumac to the population increased to 16%.
- **2007 to 2012 - stable (0):** The density of Rocky Mountain smooth sumac population had no change at 740 plants/acre. Cover of sumac increased to 5%. Decadence decreased to 0%, and poor vigor remained at 0%. Recruitment of young sumac to the population decreased to 3%.

Grass:

- **1983 to 1989 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. Bluebunch wheatgrass was the second most common grass on the study. The weedy annual species bulbous bluegrass increased significantly in nested frequency. The annual species wildoat increased significantly in nested frequency.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 11%. The weedy perennial grass species bulbous bluegrass was the most common grass species on the study, and had a cover of 13%. The weedy annual species cheatgrass was measured for the first time, and cover was at 1%.
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 26%. Bluebunch wheatgrass decreased significantly in nested frequency, but increased in cover from 12% to 13%. Bulbous bluegrass increased in cover to 18%. The annual species wildoat increased significantly in nested frequency, and had a cover of 1%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 15%. Bluebunch wheatgrass decreased in cover to 9%. The weedy perennial species bulbous bluegrass decreased in cover to 11%. The weedy annual species cheatgrass increased significantly in nested frequency, and increased in cover from 1% to 4%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. The weedy annual species cheatgrass increased in cover to 9%.

Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequencies for perennial forbs increased 74%.
- **1989 to 1997 - slightly down (-1):** The sum of nested frequencies of perennial forbs increased 17%. The weedy species western ragweed was sampled for the first time, and had a cover of 3%.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 58%. The weedy species western ragweed decreased significantly in nested frequency, and decreased in cover to near 0%. Narrowleaf gromwell (*Lithospermum incisum*) decreased significantly in nested frequency.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs increased two-fold. The weedy species western ragweed increased significantly in nested frequency, and increased in cover to 3%.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial forbs decreased 26%. Beckwith milkvetch (*Astragalus beckwithii*) decreased significantly in nested frequency, and decreased in cover from 1% to 0%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
 Management unit 17, study no: 31

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	2.3	0.0	0.0	23.4	-0.6	10.0	0.0	<b>35.0</b>	Very Poor-Poor
02	1.1	0.0	0.0	25.0	-1.2	9.9	0.0	<b>34.9</b>	Very Poor-Poor
07	2.3	0.0	0.0	17.4	-3.3	10.0	0.0	<b>26.4</b>	Very Poor
12	4.0	0.0	0.0	18.7	-7.0	10.0	0.0	<b>25.7</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--  
 Management unit 17, Study no: 31

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Aegilops cylindrica</i> (a)	-	-	-	-	-	3	-	-	-	.15
G	<i>Agropyron spicatum</i>	b214	b223	b247	a184	a156	a153	11.68	12.51	8.71	9.32
G	<i>Avena fatua</i> (a)	-	d119	a-	cd139	c75	b37	-	.85	.69	.16
G	<i>Bromus brizaeformis</i> (a)	-	a1	b23	a-	a-	a-	.12	-	.00	-
G	<i>Bromus japonicus</i> (a)	-	-	21	9	6	12	.09	.02	.01	.02
G	<i>Bromus tectorum</i> (a)	-	-	a121	a128	b221	b243	.59	.76	3.70	9.02
G	<i>Poa bulbosa</i>	-	c304	bc257	abc307	ab220	a213	12.75	17.63	10.84	10.90
Total for Annual Grasses		0	120	165	276	302	295	0.80	1.63	4.40	9.35
Total for Perennial Grasses		214	527	504	491	376	366	24.43	30.15	19.54	20.23
Total for Grasses		214	647	669	767	678	661	25.23	31.78	23.95	29.59
F	<i>Allium</i> sp.	-	-	4	1	-	-	.00	.00	-	-
F	<i>Alyssum alyssoides</i> (a)	-	-	c132	a28	c118	b65	.35	.06	.46	.16
F	<i>Ambrosia psilostachya</i>	-	-	c126	a2	b104	b98	2.98	.06	3.37	2.74
F	<i>Artemisia ludoviciana</i>	c54	bc36	ab20	a17	abc36	ab16	.15	.15	.50	.26
F	<i>Aster</i> sp.	-	-	3	4	-	-	.38	.01	-	-
F	<i>Astragalus beckwithii</i>	a-	a-	a2	a2	b35	a-	.15	.38	.68	-
F	<i>Calochortus nuttallii</i>	-	-	-	1	-	-	-	.00	-	-
F	<i>Cirsium undulatum</i>	a1	ab11	b28	a5	a-	a-	.58	.04	-	-
F	<i>Collinsia parviflora</i> (a)	-	-	-	-	-	3	-	-	-	.00
F	Cruciferae	a-	b10	a-	a-	a-	a-	-	-	-	-
F	<i>Cryptantha nana</i>	1	-	-	-	-	-	-	-	-	-
F	<i>Cryptantha</i> sp.	-	-	-	-	6	-	-	-	.15	-
F	<i>Cymopterus longipes</i>	-	-	-	-	2	-	-	-	.00	-
F	<i>Cymopterus</i> sp.	-	-	17	6	-	2	.49	.33	-	.00
F	<i>Draba</i> sp. (a)	-	-	-	-	1	-	-	-	.00	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	5	-	-	-	.01	-	-	-
F	<i>Erigeron divergens</i>	1	-	-	-	2	8	.00	-	.03	.21
F	<i>Eriogonum brevicaulis</i>	-	-	-	-	2	-	-	-	.03	-
F	<i>Eriogonum racemosum</i>	-	-	-	3	-	-	-	.01	-	-
F	<i>Erodium cicutarium</i> (a)	-	-	a13	bc56	c63	ab23	.05	.41	.41	.49
F	<i>Galium aparine</i> (a)	-	-	c37	b15	b14	a-	.18	.04	.13	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Grindelia squarrosa</i>	-	-	-	14	-	10	-	.25	-	.22
F	<i>Helianthus annuus</i> (a)	a <sup>-</sup>	b <sup>19</sup>	a <sup>3</sup>	a <sup>-</sup>	a <sup>-</sup>	ab <sup>5</sup>	.01	-	-	.01
F	<i>Heterotheca villosa</i>	-	-	-	-	3	2	-	-	.03	.00
F	<i>Holosteum umbellatum</i> (a)	-	-	b <sup>32</sup>	b <sup>26</sup>	a <sup>-</sup>	b <sup>14</sup>	.07	.05	-	.03
F	<i>Lappula occidentalis</i> (a)	-	-	a <sup>1</sup>	b <sup>25</sup>	a <sup>-</sup>	a <sup>-</sup>	.00	.05	-	-
F	<i>Lathyrus brachycalyx</i>	ab <sup>54</sup>	b <sup>62</sup>	b <sup>57</sup>	b <sup>54</sup>	a <sup>22</sup>	ab <sup>49</sup>	3.20	3.63	.31	1.85
F	<i>Lithospermum incisum</i>	ab <sup>18</sup>	c <sup>105</sup>	ab <sup>8</sup>	a <sup>6</sup>	b <sup>29</sup>	a <sup>-</sup>	.22	.01	.17	-
F	<i>Lithospermum ruderales</i>	ab <sup>5</sup>	b <sup>16</sup>	a <sup>10</sup>	a <sup>-</sup>	ab <sup>7</sup>	a <sup>3</sup>	.01	-	.93	.00
F	<i>Macheranthera commixta</i>	3	-	-	-	-	-	-	-	-	-
F	<i>Phlox longifolia</i>	4	5	11	2	8	1	.02	.06	.02	.00
F	<i>Taraxacum officinale</i>	-	-	-	2	-	-	-	.00	-	-
F	<i>Tragopogon dubius</i> (a)	c <sup>29</sup>	a <sup>-</sup>	ab <sup>5</sup>	ab <sup>3</sup>	bc <sup>18</sup>	a <sup>1</sup>	.04	.01	.19	.00
Total for Annual Forbs		29	19	228	153	214	111	0.72	0.64	1.22	0.70
Total for Perennial Forbs		141	245	286	119	256	189	8.21	4.97	6.25	5.31
Total for Forbs		170	264	514	272	470	300	8.94	5.61	7.47	6.02

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

#### BROWSE TRENDS--

Management unit 17, Study no: 31

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Celtis reticulata</i>	3	2	6	7	1.88	2.36	3.40	5.40
B	<i>Gutierrezia sarothrae</i>	31	24	41	52	1.57	1.61	.75	5.26
B	<i>Quercus gambelii</i>	0	0	0	1	-	-	-	-
B	<i>Rhus glabra cismontana</i>	35	30	24	20	2.25	1.10	2.33	3.95
B	<i>Rhus trilobata</i>	0	0	1	0	-	-	-	-
Total for Browse		69	56	72	80	5.71	5.08	6.48	14.63

#### CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 31

Species	Percent Cover	
	'07	'12
<i>Celtis reticulata</i>	6.58	6.83
<i>Gutierrezia sarothrae</i>	.78	5.83
<i>Quercus gambelii</i>	-	.15
<i>Rhus glabra cismontana</i>	6.06	4.16



**BASIC COVER--**

Management unit 17, Study no: 31

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	.75	9.00	39.23	46.85	43.36	46.81
Rock	30.25	26.50	22.02	22.23	20.86	27.13
Pavement	22.00	24.50	12.78	14.84	16.57	10.37
Litter	44.00	37.50	29.04	24.94	29.02	30.18
Cryptogams	.50	0	.37	.02	.00	0
Bare Ground	2.50	2.50	3.45	.62	3.30	3.08

**PELLET GROUP DATA--**

Management unit 17, Study no: 31

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	3	-	-	2
Grouse	-	-	-	1
Elk	22	8	24	1
Deer	19	20	11	11

Days use per acre (ha)		
'02	'07	'12
-	-	-
-	-	-
9 (23)	36 (89)	7 (18)
44 (107)	74 (184)	30 (74)

**BROWSE CHARACTERISTICS--**

Management unit 17, Study no: 31

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Celtis reticulata</b>									
83	<b>33</b>	0	100	0	-	0	0	0	39/26
89	<b>33</b>	100	0	0	-	0	0	100	-/-
97	<b>60</b>	33	67	0	140	0	0	0	80/225
02	<b>40</b>	0	50	50	20	0	0	50	28/53
07	<b>300</b>	0	93	7	-	0	0	7	36/39
12	<b>180</b>	0	100	0	-	0	0	22	72/111
<b>Chrysothamnus nauseosus</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	25/54
<b>Gutierrezia sarothrae</b>									
83	<b>1798</b>	56	44	0	366	0	0	0	7/4
89	<b>1032</b>	16	71	13	-	0	0	19	8/10
97	<b>3280</b>	41	59	0	880	0	0	8	9/15
02	<b>1400</b>	1	90	9	-	0	0	0	9/11
07	<b>3820</b>	5	95	0	-	0	0	.52	8/9
12	<b>4020</b>	41	57	2	640	2	0	54	11/18

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Mahonia repens</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	3/4
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	4/7
<b>Quercus gambelii</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	20	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	15/17
<b>Rhus glabra cismontana</b>									
83	1432	7	93	0	33	19	79	0	50/34
89	2298	22	72	6	-	45	16	0	66/41
97	1100	15	62	24	-	60	29	4	49/37
02	1140	16	65	19	-	11	44	11	31/23
07	740	22	73	5	20	3	11	0	45/42
12	740	3	97	0	-	5	0	0	28/25
<b>Rhus trilobata</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	38/73
12	0	0	0	-	-	0	0	0	30/43

MAPLE MOUNTAIN FACE - TREND STUDY NO. 17-34-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter

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

Land Ownership: DWR

Elevation: 5,100 ft (1,555 m)

Aspect: Northwest

Slope: 2%

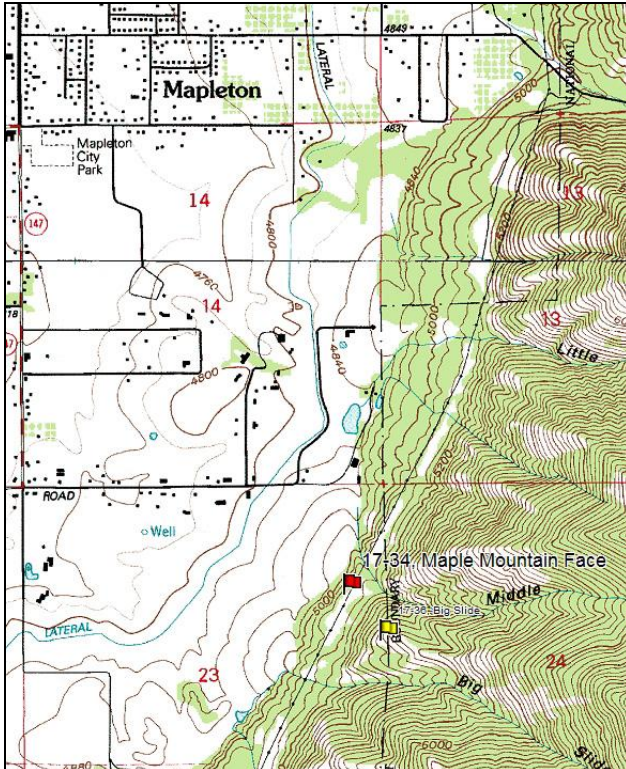
Transect bearing: 192° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (87ft)

Directions:

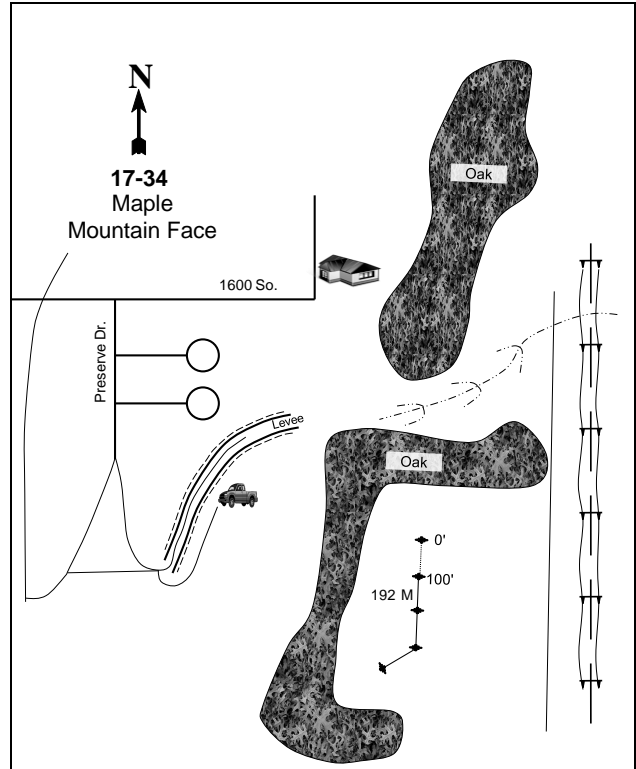
Drive up 1600 South in Mapleton to the end of road. Park and hike east for 0.4 miles to the old road that runs parallel to power lines. A small sagebrush clearing west of the road is where the site is located. The 0-foot baseline stake is in the north end of the clearing, 33 paces from power pole #349 at an azimuth of 342 degrees magnetic. The 0-foot stake has browse tag #442 attached. The study stakes are 12-18" tall green fenceposts.

Map Name: Spanish Fork Peak



Township: 8S Range: 3E Section: 23

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 452132 E 4440284 N

## MAPLE MOUNTIAN FACE - TREND STUDY NO. 17-34

### Site Information

Site Description: This study is located on one of the few remaining crucial winter ranges located on the Lake Bonneville terrace southeast of Mapleton, which samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and grass community. The area is administered by Utah Division of Wildlife (UDWR) on the Hobbles Creek Wildlife Management Area. The nearest source of perennial water is a canal located 0.4 miles to the west. A fire burned through the study prior to the 1997 sampling, and was seeded post-fire. In addition to being occupied by deer and elk in the winter, the study has been occasionally grazed in the spring by cattle. An old road to the north of the trail was being used as an ATV and horse trail in 2007. There was also a housing development being constructed 0.5 miles to the west of the study in 2007. Deer pellet groups were sampled in low abundance in 2002, but in high abundance in 2007 and 2012. Elk pellet groups were sampled in low abundance in 2002, but in moderate abundance in 2007. Cattle pats were sampled in low abundance in 2002 and 2007. Domestic horse pellet groups were sampled in low abundance in 2007 (Table - Pellet Group Data).

Browse: The preferred browse species that are present include mountain big sagebrush and antelope bitterbrush (*Purshia tridentata*). The sagebrush population has had large swings in density, but has generally increased in density over the course of the study. The health of the sagebrush population has improved throughout the duration of the study, with poor decadence being observed in 1983 and 1989, but decadence being negligible each following sample year. Poor vigor within the sagebrush population was poor in 1989, but insignificant for all other sample years. Recruitment of young sagebrush to the population has been moderate over each sample year. Although seedlings cannot be used as good indicator of an increasing population due to their fragility, seedlings in 2007 likely survived to maturity between 2007 and 2012, which likely contributed to the large increase of mature plants in 2012. After the wildfire, few dead sagebrush plants were sampled in 1997. Antelope bitterbrush was not sampled prior to the 1997 wildfire. However, it is probable that bitterbrush were present but not sampled until the baseline was extended in 1997. Bitterbrush has a sparse, mature population on the study. The health of the bitterbrush population has been good throughout the duration of the study. Decadence and poor vigor have not been observed within the population. Recruitment of young bitterbrush has been absent most sample years and was minimal in 2002. Utilization of bitterbrush has been light to moderate from 1997 through 2007. Gambel oak (*Quercus gambelii*) clones surround the study site, but do not exhibit signs of any hedging. Skunkbush sumac (*Rhus trilobata*) is present at low densities, and a few plants have exhibited moderate and heavy use. There was also some curl-leaf mountain mahogany (*Cercocarpus ledifolius*) planted after the burn but it has not been sampled in the density strips (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by perennial grasses and forbs. The grass component is abundant and diverse. The dominant perennial grass is the weedy species bulbous bluegrass (*Poa bulbosa*). Other common perennial grasses include orchardgrass (*Dactylis glomerata*), and Sandberg bluegrass (*Poa secunda*). Annual grasses were reported to be very abundant before the wildfire. Additionally, since 1997, cheatgrass (*Bromus tectorum*), Japanese brome (*B. japonicus*), and rattlesnake brome (*B. brizaeformis*) have been sampled. Annual grass cover has been low since 1997. The forb component is also abundant and diverse. Much of the decrease in forb cover over the sample years can be attributed to decreasing arrowleaf balsamroot (*Balsamorhiza sagittata*) cover, which has dominated the forb community over the course of the study. The other dominant perennial species are spreading fleabane (*Erigeron divergens*) and curlycup gumweed (*Grindelia squarrosa*). The noxious weed field bindweed (*Convolvulus arvensis*) was first sampled in 1989, but frequency and cover have remained low.

Soil: This soil is located in the Cleverly component, which occurs on alluvial fans. The parent material consists of slope alluvium derived from quartzite and/or sandstone (Soil Survey Staff 2011). The soil has a loam texture with a slightly acidic soil reaction (pH of 6.3) (Table - Soil Analysis Data). Bare ground cover is fairly low with a high amount of litter and vegetation providing protective ground cover (Table - Basic Ground

Cover). The erosion condition was classified as stable in all sample years.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly down (-1):** The density of mountain big sagebrush decrease 13% from 498 plants/acre to 432 plants/acre. Health of the sagebrush became increasing poor with decadence increasing from 40% to 85%. Poor vigor within the sagebrush population increased from 0% to 15%. Recruitment of young sagebrush to the population was not observed.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Mountain big sagebrush decadence and poor vigor was not observed within the population. The population of sagebrush was made up entirely of young plants.
- **1997 to 2002 - up (+2):** The density of mountain big sagebrush increased two-fold from 220 plants/acre to 440 plants/acre. Cover of sagebrush increased from less than 1% to 2%. Decadence and poor vigor within the population was observed. Recruitment of young sagebrush to the population decreased to 0%. The density of antelope bitterbrush increased 13% from 0 plants/acre to 120 plants/acre. Cover of bitterbrush increased from 0% to 1%.
- **2002 to 2007 - up (+2):** The density of mountain big sagebrush increased 32% to 580 plants/acre. Cover of sagebrush increased to 5%. Decadence remained similar at 3%, and poor vigor remained at 0%. Recruitment of young sagebrush increased to 24%. Antelope bitterbrush had no change in density or cover.
- **2007 to 2012 - up (+2):** The density of mountain big sagebrush increased more than three-fold to 2,000 plants/acre. Cover of sagebrush increased to 12%. Decadence decreased to 1%, and poor vigor increased to 1%. Recruitment of young sagebrush to the population decreased to 12%. The density of antelope bitterbrush increased 14% to 160 plants/acre. Cover of bitterbrush increased to 3%.

### Grass:

- **1983 to 1989 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased substantially. Onion grass (*Melica bulbosa*), Kentucky bluegrass (*Poa pratensis*), and Sandberg bluegrass decreased significantly in nested frequency and were not sampled in 1989. The weedy species bulbous bluegrass increased significantly in nested frequency and was the only grass species sampled on the site.
- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased three-fold. Orchardgrass and Sandberg wheatgrass increased significantly in nested frequency. The weedy species bulbous bluegrass was the most common grass on the site, but had no increases.
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 20%. Crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*A. spicatum*), and sand dropseed (*Sporobolus cryptandrus*) increased significantly in nested frequency. Sandberg bluegrass decreased significantly in nested frequency, and decreased in cover from 4% to 1%. The weedy species bulbous bluegrass remained the most common grass on the study, and increased in cover from 42% to 58%.
- **2002 to 2007 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 30%. Sandberg bluegrass increased significantly in nested frequency, and increased in cover to 2%. The weedy perennial species bulbous bluegrass remained the dominant grass on the study, but decreased in cover to 44%.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 29%. Intermediate wheatgrass (*Agropyron intermedium*) increased significantly in nested frequency, and increased in cover from 1% to 3%. Sandberg bluegrass decreased significantly in nested frequency, but cover remained similar. The weedy perennial species bulbous

bluegrass decreased significantly in nested frequency, and decreased in cover to 36%. The weedy annual species jointed goatgrass (*Aegilops cylindrica*) was observed for the first time with a significant increase in nested frequency, and had a cover of 1%.

Forb:

- **1983 to 1989 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 11%. The most abundant perennial forb is arrowleaf balsamroot. Perennial forbs remain communally homogenous.
- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial forbs increased nearly five-fold. Likely due to the seeding after the fire, the diversity of the forb community increased and forbs were common across the study site. Alfalfa (*Medicago sativa*) and small burnet (*Sanguisorba minor*) were sampled for the first time with cover of 1% and 2%, respectively. Arrowleaf balsamroot was the most dominant forb; moreover, increased significantly in nested frequency, and had a cover of 34%
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial forbs decreased 53%. The forb community decreased in diversity, and perennial forbs were less frequent across the study site.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 71%. Arrowleaf balsamroot decreased significantly in nested frequency, and decreased in cover from 29% to 4%. The weedy species curlycup gumweed increased significantly in nested frequency, and increased in cover from 0% to 3%.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial forbs decreased 26%. Arrowleaf balsamroot increased in cover to 14%. The noxious weed field bindweed increased significantly in nested frequency. Forbs remain abundant and moderately diverse.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 34

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	1.8	0.0	0.0	8.9	-0.4	10.0	-2.0	<b>18.3</b>	Very Poor
02	5.1	0.0	0.0	4.3	-0.2	10.0	-2.0	<b>17.3</b>	Very Poor
07	9.3	13.7	8.8	9.8	-1.1	10.0	-2.0	<b>48.5</b>	Poor-Fair
12	22.7	14.8	9.2	16.8	-2.9	10.0	-2.0	<b>68.7</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 34

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Aegilops cylindrica</i> (a)	a-	a-	a-	a-	a-	b33	-	-	-	.49
G	<i>Agropyron cristatum</i>	a-	a-	a-	b15	ab10	b13	-	.11	.63	.45
G	<i>Agropyron intermedium</i>	a-	a-	a4	a-	a8	b24	.03	-	.76	2.90
G	<i>Agropyron spicatum</i>	a-	a-	a-	b21	a1	a8	-	.17	.03	.57
G	<i>Agropyron triticeum</i> (a)	-	-	-	-	-	11	-	-	-	.02
G	<i>Aristida purpurea</i>	-	-	-	-	5	9	-	.00	.09	.36
G	<i>Bromus brizaeformis</i> (a)	-	-	a-	a3	b49	a-	-	.00	.26	-
G	<i>Bromus japonicus</i> (a)	-	-	a-	b12	b35	c179	-	.05	.20	.86
G	<i>Bromus tectorum</i> (a)	-	-	83	48	60	80	.55	.15	.94	2.43
G	<i>Dactylis glomerata</i>	a-	a-	c66	b22	b21	b13	.75	.64	1.00	1.67

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Elymus glaucus</i>	2	-	-	2	-	-	-	.03	-	-
G	<i>Melica bulbosa</i>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>17</sup>	b <sup>22</sup>	a <sup>-</sup>	-	.11	.42	-
G	<i>Poa bulbosa</i>	a <sup>360</sup>	b <sup>395</sup>	b <sup>372</sup>	b <sup>387</sup>	b <sup>378</sup>	a <sup>313</sup>	41.55	58.08	44.19	35.80
G	<i>Poa fendleriana</i>	-	-	-	-	1	4	-	-	.00	.02
G	<i>Poa pratensis</i>	b <sup>61</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>5</sup>	a <sup>1</sup>	a <sup>3</sup>	-	.03	.03	.03
G	<i>Poa secunda</i>	b <sup>24</sup>	a <sup>-</sup>	c <sup>124</sup>	b <sup>62</sup>	c <sup>119</sup>	b <sup>61</sup>	3.67	.78	1.51	1.55
G	<i>Sporobolus cryptandrus</i>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>13</sup>	b <sup>16</sup>	ab <sup>9</sup>	-	.21	.36	.83
Total for Annual Grasses		0	0	83	63	144	303	0.55	0.21	1.40	3.81
Total for Perennial Grasses		447	395	566	544	582	457	46.02	60.18	49.07	44.21
Total for Grasses		447	395	649	607	726	760	46.56	60.39	50.47	48.02
F	<i>Allium</i> sp.	-	-	1	-	1	-	.00	-	.00	-
F	<i>Astragalus</i> sp.	-	-	5	-	-	-	.04	.00	-	-
F	<i>Balsamorhiza sagittata</i>	a <sup>103</sup>	a <sup>99</sup>	c <sup>248</sup>	b <sup>156</sup>	a <sup>82</sup>	a <sup>104</sup>	34.34	28.52	4.27	13.80
F	<i>Calochortus nuttallii</i>	ab <sup>5</sup>	a <sup>-</sup>	b <sup>15</sup>	ab <sup>2</sup>	ab <sup>4</sup>	a <sup>-</sup>	.03	.01	.01	-
F	<i>Cirsium</i> sp.	-	-	3	2	1	-	.00	.00	.15	-
F	<i>Collinsia parviflora</i> (a)	-	-	3	-	-	-	.00	-	-	-
F	<i>Convolvulus arvensis</i>	a <sup>-</sup>	a <sup>1</sup>	a <sup>3</sup>	a <sup>7</sup>	a <sup>3</sup>	b <sup>21</sup>	.18	.09	.03	.16
F	<i>Crepis acuminata</i>	-	-	-	-	-	1	-	-	-	.00
F	Cruciferae	-	-	3	-	-	-	.03	-	-	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	3	1	3	-	.00	.00	.00	-
F	<i>Erigeron divergens</i>	a <sup>7</sup>	a <sup>1</sup>	b <sup>59</sup>	a <sup>-</sup>	c <sup>119</sup>	b <sup>86</sup>	1.50	-	8.25	1.88
F	<i>Erodium cicutarium</i> (a)	-	-	a <sup>3</sup>	a <sup>9</sup>	b <sup>46</sup>	b <sup>51</sup>	.00	.02	1.16	.21
F	<i>Galium aparine</i> (a)	-	-	3	4	1	-	.00	.01	.03	-
F	<i>Grindelia squarrosa</i>	-	-	-	-	96	25	-	-	3.28	.27
F	<i>Helianthus annuus</i> (a)	-	5	-	7	-	3	-	.02	-	.03
F	<i>Heterotheca villosa</i>	-	-	-	-	-	-	-	-	-	.03
F	<i>Lactuca serriola</i> (a)	a <sup>-</sup>	b <sup>15</sup>	ab <sup>10</sup>	a <sup>-</sup>	a <sup>-</sup>	ab <sup>6</sup>	.04	.00	-	.01
F	<i>Lathyrus brachycalyx</i>	4	6	8	1	4	6	.09	.01	.03	.06
F	<i>Linum lewisii</i>	-	-	8	-	-	-	.02	-	-	-
F	<i>Medicago sativa</i>	-	-	28	29	34	18	.67	.64	1.36	1.15
F	<i>Phlox longifolia</i>	-	-	9	13	23	23	.04	.05	.18	.12
F	<i>Plantago patagonica</i> (a)	-	-	a <sup>-</sup>	a <sup>-</sup>	b <sup>12</sup>	b <sup>14</sup>	-	-	.02	.36
F	<i>Polygonum douglasii</i> (a)	-	-	-	4	-	-	-	.01	-	-
F	<i>Sanguisorba minor</i>	a <sup>-</sup>	a <sup>-</sup>	c <sup>98</sup>	b <sup>21</sup>	b <sup>26</sup>	ab <sup>7</sup>	2.21	.48	.49	.09
F	<i>Sisymbrium altissimum</i> (a)	-	-	b <sup>15</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.10	-	-	-
F	<i>Sphaeralcea coccinea</i>	-	-	-	-	-	-	-	.00	-	-
F	<i>Taraxacum officinale</i>	-	-	3	-	-	1	.03	-	-	.00
F	<i>Tragopogon dubius</i> (a)	b <sup>18</sup>	a <sup>-</sup>	ab <sup>4</sup>	b <sup>12</sup>	b <sup>12</sup>	c <sup>44</sup>	.06	.09	.11	.19
F	Unknown forb-perennial	1	-	-	-	-	-	-	-	-	-
F	<i>Verbascum thapsus</i>	-	-	1	-	-	-	.15	-	-	-
F	<i>Zigadenus paniculatus</i>	-	-	-	-	1	-	-	-	.03	-
Total for Annual Forbs		18	20	41	37	74	118	0.23	0.17	1.33	0.80
Total for Perennial Forbs		120	107	492	231	394	292	39.36	29.82	18.12	17.60
Total for Forbs		138	127	533	268	468	410	39.60	29.99	19.46	18.40

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

BROWSE TRENDS--

Management unit 17, Study no: 34

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	6	15	23	52	.18	1.69	5.39	12.18
B	Gutierrezia sarothrae	0	0	2	6	-	-	.00	.33
B	Purshia tridentata	6	7	7	6	.00	.93	1.07	3.05
B	Quercus gambelii	2	1	2	4	1.48	1.48	.91	2.94
B	Rhus trilobata	2	2	1	0	.06	.15	.00	-
Total for Browse		16	25	35	68	1.73	4.26	7.38	18.51

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 34

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	8.96	12.78
Gutierrezia sarothrae	-	.35
Purshia tridentata	3.63	4.06
Quercus gambelii	1.79	2.41

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 34

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	4.0	1.9	3.5
Purshia tridentata	4.0	1.9	2.1

BASIC COVER--

Management unit 17, Study no: 34

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	4.00	50.75	68.12	80.30	74.11	77.86
Rock	.75	.75	1.31	.59	.46	.18
Pavement	3.00	6.75	6.49	2.96	1.87	.12
Litter	91.00	28.75	18.82	24.19	29.54	50.45
Cryptogams	0	0	3.25	1.59	.55	.01
Bare Ground	1.25	13.00	9.97	2.82	3.34	.69

PELLET GROUP DATA--

Management unit 17, Study no: 34

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Horse	-	-	3	-	-	10 (24)	-
Elk	4	-	10	-	2 (5)	28 (69)	-
Deer	1	2	16	17	4 (10)	41 (101)	54 (134)
Cattle	9	12	-	-	19 (47)	1 (2)	-



BROWSE CHARACTERISTICS--  
Management unit 17, Study no: 34

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>498</b>	0	60	40	-	60	20	0	23/32
89	<b>432</b>	0	15	85	-	0	15	15	13/16
97	<b>220</b>	100	0	0	200	0	0	0	13/18
02	<b>440</b>	0	100	0	20	5	0	0	20/27
07	<b>580</b>	24	72	3	1600	0	0	0	30/52
12	<b>2000</b>	13	86	1	1620	1	0	1	24/36
<i>Cercocarpus ledifolius</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	10/16
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	14/23
<i>Gutierrezia sarothrae</i>									
83	<b>33</b>	0	100	0	-	0	0	0	14/28
89	<b>165</b>	20	20	60	-	0	0	0	14/15
97	<b>0</b>	0	0	0	-	0	0	0	-/-
02	<b>0</b>	0	0	0	-	0	0	0	13/19
07	<b>40</b>	50	50	0	20	0	0	0	11/14
12	<b>200</b>	0	100	0	-	0	0	0	9/15
<i>Purshia tridentata</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>120</b>	83	17	0	-	83	0	0	10/11
02	<b>140</b>	0	100	0	-	57	43	0	17/38
07	<b>140</b>	0	86	14	-	29	29	0	37/70
12	<b>160</b>	13	88	0	-	0	0	0	32/63
<i>Quercus gambelii</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>280</b>	100	0	-	-	0	0	0	-/-
02	<b>360</b>	33	67	-	-	0	0	0	45/40
07	<b>180</b>	0	100	-	340	56	0	0	51/37
12	<b>260</b>	46	54	-	-	0	0	0	67/58

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Rhus trilobata										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>40</b>	0	100	-	-	0	0	0	-/-	
02	<b>40</b>	50	50	-	-	50	50	0	14/30	
07	<b>20</b>	0	100	-	-	0	100	0	26/60	
12	<b>0</b>	0	0	-	-	0	0	0	40/98	

LITTLE DIAMOND FORK - TREND STUDY NO. 17-39-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: USFS

Elevation: 5,850 ft (1,785 m)

Aspect: South

Slope: 5-10%

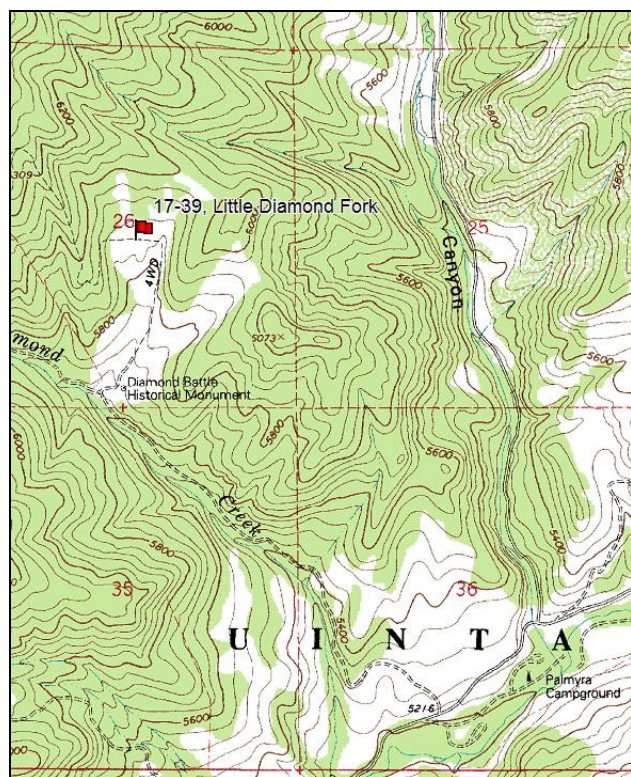
Transect bearing: 154° magnetic

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

Directions:

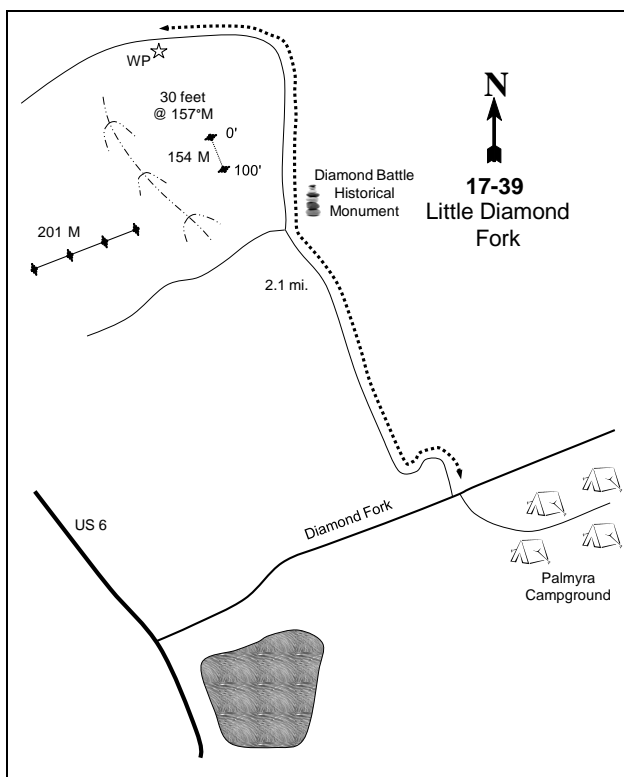
From the intersection of Highway 6 and Diamond Fork Canyon proceed northeasterly up Diamond Fork to Palmyra Campground. From Palmyra Campground take the road to the northwest 2.10 miles up Little Diamond Creek to a distinct sagebrush-grass plateau, and a witness post. From the witness post road, walk 30 feet at 157 degrees magnetic to the 0-foot baseline stake. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height. A red browse tag, number 3923, is attached to the 0-foot baseline stake.

Map Name: Billies Mountain



Township: 9S Range: 4E Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 461515 E 4437712 N

## LITTLE DIAMOND FORK - TREND STUDY NO. 17-39

### Site Information

Site Description: The study samples an important deer and elk winter range located approximately 0.5 miles north of the Diamond Battle Historical Monument in Little Diamond Creek drainage. The area is administered by the United States Forest Service (USFS) as part of the Diamond Fork grazing allotment. The site is part of a USFS's 1,500 acre Lower Diamond Revegetation Project. The study was chained and aerially seeded with four perennial grass species in 1969. The nearest source of perennial water is Little Diamond Creek, located 0.5 miles to the south. Deer pellet groups were sampled in low abundance in 2007 and 2012, and moderate abundance in 2002. Elk pellet groups were sampled in low abundance since 2002. Cattle pats were sampled in low abundance in 2012, and in high abundance in 2002 and 2007 (Table - Pellet Group Data).

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant preferred browse species, and is a mature, moderately dense population. Density of the sagebrush population has gradually increased over the course of the study. Decadence within the sagebrush population has been high most sample years, but was low in 2012. Poor vigor within the sagebrush population has been low most sample years, but was moderate in 1997. Recruitment of young sagebrush to the population has been low to moderate within the population. Initially, utilization of sagebrush was mostly moderate, but has become light since 1997. Other browse species that are present include Utah serviceberry (*Amelanchier utahensis*), white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), broom snakeweed (*Gutierrezia sarothrae*), and Woods rose (*Rosa woodsii*). Utah serviceberry and white rubber rabbitbrush are the only species with any browse use, but these species occur at a very low density (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by perennial grasses and forbs. The most abundant species is the weedy perennial bulbous bluegrass (*Poa bulbosa*). Three of the four species that were aerially seeded in 1969, intermediate wheatgrass (*Agropyron intermedium*), western wheatgrass (*A. smithii*), and smooth brome (*Bromus inermis*) have accounted for the majority of the remaining grass cover. Identification of the perennial grasses on the study has been difficult in the past when sampling is preceded by cattle grazing. The only annual species present is cheatgrass (*Bromus tectorum*), which was sampled for the first time in 2007. Since 1997, perennial forb cover has remained steady. The most abundant species include western aster (*Aster chilensis*), spreading fleabane (*Erigeron divergens*), and silvery lupine (*Lupinus argenteus*). The two noxious weeds Musk thistle (*Carduus nutans*) and houndstongue (*Cynoglossum officinale*) have also been sampled on the site (Table - Herbaceous Trends). The composition of the forb species is indicative of heavy cattle grazing.

Soil: Natural Resource Conservation Service (NRCS) soil data was not available for this site. The soil has a sandy clay loam texture with a moderately acidic soil reaction (pH of 5.9) (Table - Soil Data Analysis). Bare ground cover is low with high vegetation and litter providing protective ground cover (Table - Basic Cover). The soil surface is hard and appears to have been compacted from grazing animals. An ephemeral channel runs through the middle of the valley, cutting a 10-15 foot deep gully through the sagebrush flat. There is no accelerated erosion apparent, and nearby gullies have become re-vegetated. The erosion condition was classified as stable in all sample years.

### Trend Assessments

#### Browse:

- **1983 to 1989 - slightly up (+1):** The density of mountain big sagebrush increased 40% from 665 plants/acre to 932 plants/acre. Decadence increased from 20% to 57%. Poor vigor was not observed within the sagebrush population. Recruitment of young sagebrush decreased from 10% to 0%.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Mountain big sagebrush decadence

decreased to 43%, but poor vigor increased to 25%. Recruitment of young sagebrush to the population increased to 15%.

- **1997 to 2002 - up (+2):** The density of mountain big sagebrush increased 27% from 1,200 plants/acre to 1,520 plants/acre. The cover of sagebrush increased from 6% to 9%. Decadence decreased to 16%, and poor vigor decreased to 3%. Recruitment of young sagebrush to the population decreased slightly to 7%.
- **2002 to 2007 - stable (0):** The density of mountain big sagebrush decreased 8% to 1,400 plants/acre. of sagebrush remained at 9%. Decadence decreased to 11%, and poor vigor increased slightly to 6%. Recruitment of young sagebrush to the population increased slightly to 13%. Cover
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush increased 9% to 1,520 plants/acre. Cover of sagebrush increased to 13%. Decadence decreased to 7%, and poor vigor decreased slightly to 4%. Recruitment of young sagebrush to the population decreased to 9%.

#### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass increased 82%. Intermediate wheatgrass and Sandberg bluegrass (*Poa secunda*) increased significantly in nested frequency. Western wheatgrass decreased significantly in nested frequency. The weedy species bulbous bluegrass decreased significantly in nested frequency.
- **1989 to 1997 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 35%. Intermediate wheatgrass and Sandberg bluegrass decreased significantly in nested frequency. Western wheatgrass and smooth brome increased significantly in nested frequency. The weedy perennial species bulbous bluegrass increased significantly in nested frequency.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar. Bulbous bluegrass remained the dominant grass on the study, and increased in cover from 28% to 35%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 27%. Western wheatgrass decreased significantly in nested frequency, and decreased in cover from 2% to 1%. The weedy species bulbous bluegrass remained the dominant grass, and increased in cover to 38%.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 29%. Smooth brome and Sandberg bluegrass increased significantly in nested frequency. Smooth brome increased in cover from 13% to 19%. The weedy perennial species bulbous bluegrass decreased significantly in nested frequency, and decreased in cover to 31%.

#### Forb:

- **1983 to 1989 - down (-2):** The sum of nested frequencies of perennial forbs decreased 26%. The perennial forb community is homogeneous in structure. Perennial forbs are common on the site. There was a significant decrease in the nested frequency of silvery lupine, and American vetch (*Vicia americana*). The weedy species houndstongue was sampled for the first time.
- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial forbs increased 89%. The perennial species bigflower agoseris (*Agoseris grandiflora*), spreading fleabane, and silvery lupine increased significantly in nested frequency. The annual species yellow salsify (*Tragopogon dubius*) also increased significantly in nested frequency. Additionally, the weedy species wavyleaf thistle (*Cirsium undulatum*) and the noxious weed houndstongue increased significantly in nested frequency.
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial forbs decreased 40%. Spreading fleabane and silvery lupine decreased significantly in nested frequency. The noxious weed musk thistle was observed for the first time, and had a cover of less than 1%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 26%. Bigflower agoseris decreased significantly in nested frequency, and no noxious weeds were observed on the study.

- **2007 to 2012 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 18%. Noxious weeds were not sampled on the site.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 39

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	8.0	2.4	8.4	21.3	0.0	10.0	-2.0	<b>48.1</b>	Poor-Fair
02	11.6	10.4	3.3	28.5	0.0	10.0	-2.0	<b>61.8</b>	Fair
07	11.6	12.0	7.6	30.0	0.0	10.0	0.0	<b>71.1</b>	Good
12	17.5	12.9	4.4	30.0	0.0	10.0	-2.0	<b>72.7</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 39

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron intermedium	a <sup>-</sup>	d <sup>267</sup>	bc <sup>57</sup>	c <sup>64</sup>	c <sup>64</sup>	b <sup>24</sup>	2.35	4.18	3.54	.95
G	Agropyron smithii	d <sup>227</sup>	a <sup>-</sup>	c <sup>105</sup>	c <sup>99</sup>	b <sup>31</sup>	b <sup>60</sup>	.89	1.46	1.05	1.10
G	Agropyron sp.	-	-	7	-	-	-	.41	-	-	-
G	Bromus inermis	a <sup>3</sup>	a <sup>13</sup>	b <sup>89</sup>	c <sup>127</sup>	c <sup>151</sup>	d <sup>215</sup>	5.55	8.04	12.58	19.31
G	Bromus tectorum (a)	-	-	-	-	2	1	-	-	.00	.00
G	Poa bulbosa	c <sup>364</sup>	a <sup>240</sup>	b <sup>321</sup>	bc <sup>351</sup>	c <sup>369</sup>	b <sup>317</sup>	28.03	34.79	37.54	30.76
G	Poa fendleriana	2	7	2	8	-	-	.00	.01	-	-
G	Poa pratensis	c <sup>49</sup>	bc <sup>25</sup>	c <sup>58</sup>	b <sup>15</sup>	a <sup>-</sup>	a <sup>-</sup>	.95	.22	-	-
G	Poa secunda	a <sup>-</sup>	c <sup>189</sup>	b <sup>12</sup>	b <sup>25</sup>	a <sup>-</sup>	b <sup>18</sup>	.47	.30	-	.05
G	Stipa lettermani	-	10	-	-	-	-	-	-	-	-
Total for Annual Grasses		0	0	0	0	2	1	0	0	0.00	0.00
Total for Perennial Grasses		645	751	651	689	615	634	38.69	49.03	54.72	52.18
Total for Grasses		645	751	651	689	617	635	38.69	49.03	54.73	52.18
F	Agoseris grandiflora	a <sup>8</sup>	a <sup>3</sup>	b <sup>23</sup>	b <sup>22</sup>	a <sup>3</sup>	a <sup>3</sup>	.24	.11	.00	.00
F	Antennaria rosea	-	4	-	-	-	-	-	-	-	-
F	Arabis sp.	-	1	3	-	3	-	.03	-	.00	-
F	Artemisia ludoviciana	-	-	3	8	9	7	.85	.33	.59	.30
F	Aster chilensis	ab <sup>185</sup>	b <sup>198</sup>	ab <sup>165</sup>	ab <sup>160</sup>	ab <sup>163</sup>	a <sup>140</sup>	9.25	10.82	8.16	6.31
F	Aster sp.	-	-	-	-	3	-	-	-	.00	-
F	Astragalus cibarius	-	-	-	-	-	16	-	-	-	.86
F	Astragalus convallarius	a <sup>9</sup>	a <sup>6</sup>	a <sup>15</sup>	b <sup>37</sup>	ab <sup>21</sup>	b <sup>48</sup>	.75	.60	.58	1.74
F	Astragalus sp.	-	-	1	2	-	-	.00	.03	-	-
F	Brodiaea douglasii	2	-	-	-	-	-	-	-	-	-
F	Carduus nutans (a)	-	-	-	5	-	-	-	.38	-	-
F	Cirsium undulatum	a <sup>10</sup>	a <sup>4</sup>	b <sup>32</sup>	a <sup>12</sup>	a <sup>-</sup>	a <sup>2</sup>	.93	.26	-	.03
F	Collinsia parviflora (a)	-	-	15	5	5	-	.02	.01	.01	-
F	Collomia linearis (a)	-	-	b <sup>10</sup>	b <sup>13</sup>	ab <sup>9</sup>	a <sup>-</sup>	.02	.03	.04	-
F	Crepis acuminata	-	-	-	1	3	3	-	.00	.03	.15

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Cynoglossum officinale	a-	a6	b24	a-	a-	a2	.27	-	-	.38
F	Descurainia pinnata (a)	-	-	3	-	-	-	.00	-	-	-
F	Epilobium brachycarpum (a)	-	-	3	14	8	-	.01	.03	.02	-
F	Erigeron divergens	b49	b44	c143	a1	a10	a3	2.08	.03	.20	.00
F	Erigeron eatonii	-	-	-	-	6	-	-	-	.21	-
F	Eriogonum racemosum	7	4	3	-	-	4	.00	-	-	.03
F	Eriogonum umbellatum	-	-	4	3	-	9	.03	.03	-	.01
F	Erodium cicutarium (a)	-	-	1	-	-	-	.00	-	-	-
F	Galium aparine (a)	-	-	2	-	-	-	.00	-	-	-
F	Gilia sp. (a)	-	-	-	2	-	-	-	.00	-	-
F	Holosteum umbellatum (a)	-	-	-	3	-	-	-	.00	-	-
F	Lactuca serriola (a)	-	-	7	3	3	-	.07	.00	.01	-
F	Lupinus argenteus	b100	a42	b115	a61	a31	a42	5.40	3.80	1.37	1.09
F	Medicago sativa	-	-	3	-	-	4	.00	-	-	.03
F	Microsteris gracilis (a)	-	-	-	1	-	-	-	.00	-	-
F	Oenothera sp.	-	-	16	20	-	-	.11	.13	-	-
F	Polygonum douglasii (a)	-	-	b42	a5	a-	a-	.12	.01	-	-
F	Taraxacum officinale	-	-	27	8	-	11	.27	.05	-	.12
F	Tragopogon dubius (a)	ab62	a41	b78	ab60	a37	a33	.71	.51	.73	.51
F	Unknown forb-annual (a)	-	-	1	-	-	-	.00	-	-	-
F	Unknown forb-perennial	-	2	-	-	-	-	-	-	-	-
F	Verbascum thapsus	4	2	-	3	2	-	-	.03	.00	-
F	Vicia americana	c50	a-	b18	b23	b12	b20	.16	.32	.07	.29
F	Zigadenus paniculatus	3	1	5	-	-	-	.03	-	-	-
Total for Annual Forbs		62	41	162	111	62	33	0.98	0.99	0.82	0.51
Total for Perennial Forbs		427	317	600	361	266	314	20.45	16.56	11.25	11.39
Total for Forbs		489	358	762	472	328	347	21.44	17.56	12.07	11.91

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

#### BROWSE TRENDS--

Management unit 17, Study no: 39

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier alnifolia	0	1	1	1	-	-	-	-
B	Artemisia tridentata vaseyana	48	45	46	48	6.21	8.78	8.55	13.43
B	Chrysothamnus nauseosus albicaulis	1	1	1	1	-	.03	.15	.38
B	Chrysothamnus viscidiflorus viscidiflorus	2	2	2	3	.00	-	-	.06
B	Gutierrezia sarothrae	15	19	13	6	.96	.49	.71	.33
B	Opuntia sp.	3	4	2	2	-	.16	.03	.00
B	Rosa woodsii	4	4	4	4	.15	.44	.56	.15
Total for Browse		73	76	69	65	7.33	9.90	10.00	14.36

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 39

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	-	.05	.06
Artemisia tridentata vaseyana	8.16	13.38	10.71
Chrysothamnus nauseosus albicaulis	-	.31	.16
Chrysothamnus viscidiflorus viscidiflorus	-	.03	-
Gutierrezia sarothrae	.93	.70	.30
Opuntia sp.	.10	-	-
Rosa woodsii	-	.41	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 39

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.5	2.6	2.3

BASIC COVER--

Management unit 17, Study no: 39

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	2.50	16.00	56.77	69.70	75.70	71.70
Rock	0	.25	.25	.50	.39	.09
Pavement	0	.75	.84	1.20	.26	.22
Litter	82.50	66.50	36.25	37.31	22.00	45.27
Cryptogams	.25	.25	.78	.22	.33	.01
Bare Ground	14.75	16.25	8.65	11.30	7.35	5.72

PELLET GROUP DATA--

Management unit 17, Study no: 39

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Sheep	-	1	-	-	-	-	-
Rabbit	-	-	1	1	-	-	-
Elk	3	-	2	-	16 (40)	1 (3)	3 (7)
Deer	3	12	3	2	29 (73)	15 (38)	3 (7)
Cattle	2	14	12	1	41 (100)	40 (99)	15 (36)



BROWSE CHARACTERISTICS--

Management unit 17, Study no: 39

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	22/27
02	20	0	100	-	-	100	0	0	24/23
07	40	0	100	-	-	100	0	0	24/22
12	20	0	100	-	-	100	0	0	28/28
<i>Artemisia tridentata vaseyana</i>									
83	665	10	70	20	-	60	0	0	30/41
89	932	0	43	57	-	21	0	0	22/25
97	1200	15	42	43	80	7	0	25	25/37
02	1520	7	78	16	20	18	0	3	22/32
07	1400	13	76	11	220	10	3	6	29/41
12	1520	9	84	7	260	9	1	4	27/40
<i>Chrysothamnus nauseosus albicaulis</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	20	0	100	-	-	100	0	0	42/59
02	20	0	100	-	-	0	100	0	26/36
07	20	0	100	-	-	0	0	0	21/33
12	40	0	100	-	-	100	0	0	31/23
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	60	0	100	-	-	0	0	0	12/14
02	60	0	100	-	-	0	0	0	15/26
07	60	0	100	-	-	0	0	0	15/19
12	80	0	100	-	-	0	0	0	17/25
<i>Gutierrezia sarothrae</i>									
83	1399	81	19	0	-	0	0	0	11/13
89	3065	4	85	11	-	0	0	0	10/7
97	1580	32	68	0	180	0	0	0	10/11
02	1820	0	99	1	-	0	0	0	8/11
07	900	2	96	2	-	0	0	2	8/8
12	380	0	100	0	20	0	0	0	7/10

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<b>Opuntia sp.</b>									
83	<b>466</b>	0	100	0	-	0	0	0	7/16
89	<b>598</b>	67	33	0	199	0	0	0	7/23
97	<b>440</b>	0	100	0	-	0	0	0	7/13
02	<b>300</b>	0	13	87	-	0	0	80	6/19
07	<b>40</b>	0	100	0	-	0	0	0	7/21
12	<b>40</b>	0	100	0	-	0	0	50	8/12
<b>Quercus gambelii</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	37/14
07	<b>0</b>	0	0	-	-	0	0	0	55/44
12	<b>0</b>	0	0	-	-	0	0	0	73/64
<b>Rosa woodsii</b>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>280</b>	93	7	0	20	0	0	0	23/21
02	<b>280</b>	0	100	0	-	0	0	0	9/14
07	<b>420</b>	52	48	0	-	0	0	0	11/9
12	<b>520</b>	4	85	12	-	4	96	8	11/8
<b>Symphoricarpos oreophilus</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	18/19
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-

LONG HOLLOW - TREND STUDY NO. 17-40-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: USFS

Elevation: 5,760 ft (1,755 m)

Aspect: South

Slope: 5-10%

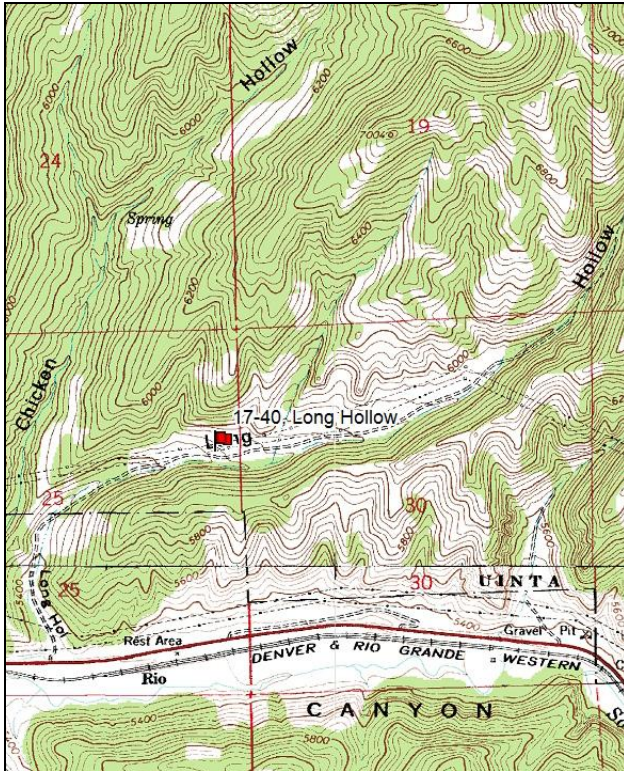
Transect bearing: 354° magnetic

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

Directions:

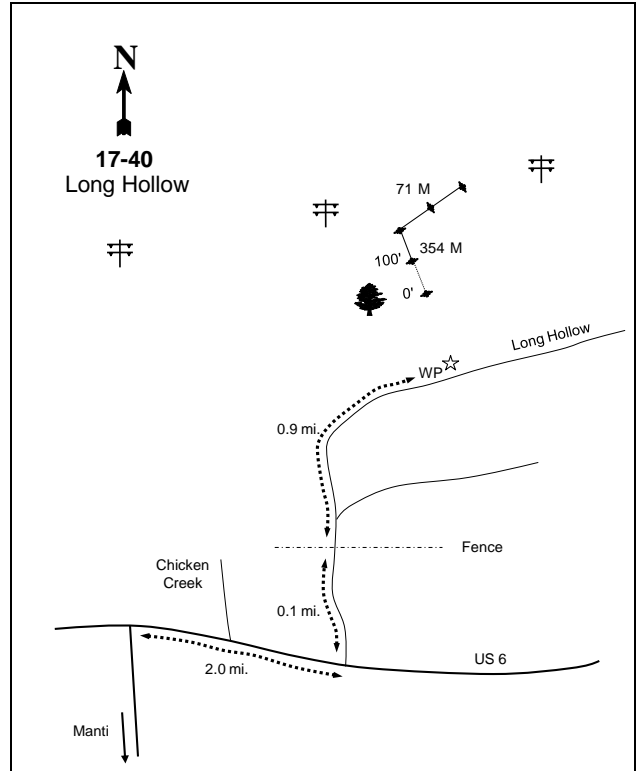
Beginning at the intersection of Highway 6 and Long Hollow Road, proceed northerly up Long Hollow for 0.10 miles to a fork. At the fork, stay to the left and proceed an additional 0.90 miles up Long Hollow, to a green steel "T" fencepost on the left side of the road. From the stake, the 0-foot marker of the baseline is 15 feet to the north, near a juniper. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height. A red browse tag, number 3946, is attached to the 0-foot baseline stake. High tension power lines run above the study site.

Map Name: Billies Mountain



Township: 9S Range: 5E Section: 25

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 463842 E 4428342 N

## LONG HOLLOW - TREND STUDY NO. 17-40

### Site Information

Site Description: This study samples crucial deer and elk winter range located in Long Hollow, which is administered by the United States Forest Service (USFS) as part of the Diamond Fork grazing allotment. Long Hollow is a narrow canyon that drains directly into the Spanish Fork River. The nearest perennial source of water is Soldier Creek and is approximately one mile to the south. A portion of the baseline passes beneath a high-tension powerline. Long Hollow has been occupied by deer and elk in the winter, and has been grazed by cattle in the summer. Three winter-killed deer were found on the site in 1983. Deer pellet groups were sampled in high abundance in 2002, but in moderate abundance in 2007. Elk pellet groups were sampled in moderate abundance in 2002, but in high abundance in 2007. Cattle pats were sampled in low abundance in 2002 and 2007. Horse pellets groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: The preferred browse species that are present include basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and fourwing saltbush (*Atriplex canescens*). In 1983 and 1989, all sagebrush was classified as mountain big sagebrush. In subsequent sample years, sagebrush was split into the two subspecies. Mountain big sagebrush has continued to be the more abundant of the two subspecies. Mountain big sagebrush is a mature, scattered population and has steadily decreased in density over the course of the study. The health of the mountain big sagebrush population has been moderately poor over the duration of the study, but in 1997, decadence in the sagebrush population was good. Earlier in the study, poor vigor was low, but has increased to moderate levels in later samplings. Recruitment of young of mountain big sagebrush was high earlier in the study, but decreased dramatically in 1997. Mountain big sagebrush utilization has been low to moderate over the course of the study. The low density of basin big sagebrush likely does not affect trend, but does add to the communities' diversity. Fourwing saltbush was first sampled in 1997, and is a sparse, mature population. Density of fourwing saltbush has been stable over the course of the study. The health of the saltbush population has been moderate most sample years, but was poor in 2002. Since 1997, fourwing saltbush utilization has ranged from moderate to heavy. Other species that are present on the study include pricklypear cactus (*Opuntia* sp.), broom snakeweed (*Gutierrezia sarothrae*), and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*). There was some moderate browse use on rabbitbrush in 1997 and 2002 (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by perennial grass and forb species. The dominant grass species has been bulbous bluegrass (*Poa bulbosa*) for the majority of the study. The remaining grass cover is largely comprised of crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), bluebunch wheatgrass (*A. spicatum*), and sand dropseed (*Sporobolus cryptandrus*). Crested and intermediate wheatgrass were seeded around the powerline towers after the powerline was constructed. The weedy annual species cheatgrass (*Bromus tectorum*) is the second most frequently occurring grass on the site. Perennial forb composition is moderately diverse. Louisiana sagebrush (*Artemisia ludoviciana*), spotted stickseed (*Hackelia patens*), and scarlet globemallow (*Sphaeralcea coccinea*) have been the dominant perennial species. The noxious weed species whitetop (*Cardaria draba*) and houndstongue (*Cynoglossum officinale*) have been sampled on the study (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.2) (Table - Soil Data Analysis). Cobblestones and gravel are distributed throughout the soil profile and on the surface. Bare ground cover is low with high amounts of vegetation, litter, and rock providing protective ground cover (Table - Basic Cover). The study is traversed by dormant gullies. The erosion condition was classified as slight in 2002 and 2007, but stable in 2012.

## Trend Assessments

### Browse:

- **1983 to 1989 - stable (0):** The density of mountain big sagebrush increased 3% from 4,599 plants/acre to 4,732 plants/acre. Decadence increased from 12% to 18%, and poor vigor remained similar at 3%. Recruitment of young sagebrush to the population decreased from 51% to 41%.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Mountain big sagebrush decadence decreased to 7%, and poor vigor remained similar at 0%. Recruitment of young sagebrush to the population decreased to 9%. Saltbush decadence and poor vigor were not observed. Recruitment of young saltbush to the population was low at 10%.
- **1997 to 2002 - slightly up (+1):** The density of mountain big sagebrush increased 41% from 880 plants/acre to 1,240 plants/acre. Cover of sagebrush decreased from 3% to 1%. Decadence increased to 47%, and poor vigor increased 15%. Recruitment of young sagebrush to the population increased slightly to 13%. The density of fourwing saltbush increased 40% from 200 plants/acre to 280 plants/acre. Cover of saltbush remained under 1%. Decadence increased to 50%, and poor vigor increased to 21%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 24% to 940 plants/acre. Cover for sagebrush decreased to 4%. Decadence decreased to 28%, and poor vigor increased to 32%. Recruitment of young sagebrush to the population decreased to 2%. The density of fourwing saltbush decreased 50% to 140 plants/acre. Decadence decreased to 14%, and poor vigor decreased to 0%. Recruitment of young saltbush decreased to 10%.
- **2007 to 2012 - down (-2):** The density of mountain big sagebrush decreased 15% to 800 plants/acre. Cover of sagebrush increased to 7%. Decadence decreased to 25%, and poor vigor decreased to 18%. Recruitment of young sagebrush to the population increased 8%. The density of fourwing saltbush increased 29% to 180 plants/acre. Decadence and poor vigor both increased to 22%. Recruitment of young saltbush to the population increased to 11%.

### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 71%. Crested wheatgrass and Sandberg wheatgrass increased significantly in nested frequency. The perennial grass community is moderately diverse and is common across the study.
- **1989 to 1997 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. Crested wheatgrass decreased significantly in nested frequency. The weedy perennial species bulbous bluegrass increased significantly in nested frequency. The weedy annual species cheatgrass was the most common grass on the study, and had a cover of 14%.
- **1997 to 2002 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 32%. Sandberg wheatgrass increased significantly in nested frequency. The weedy species bulbous bluegrass increased significantly in nested frequency, and increased in cover from 14% to 24%. The weedy annual species cheatgrass decreased significantly in nested frequency, and decreased in cover to 1%.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar. However, cover of perennial grasses, excluding bulbous bluegrass, increased from 9% to 17%. Intermediate wheatgrass increased significantly in nested frequency, and increased in cover from 4% to 10%. Bulbous bluegrass decreased significantly in nested frequency, and decreased in cover to 16%.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. The weedy species bulbous bluegrass increased significantly in nested frequency, and increased in cover to 34%.

Forb:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 54%. Perennial forbs are low in diversity, but are common on the study. Spotted stickseed and longleaf phlox increased significantly in nested frequency. There was a significant decrease in the nested frequency of the annual yellow salsify (*Tragopogon dubius*).
- **1989 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 25%. Segolily (*Calochortus nuttallii*), spotted stickseed, and scarlet globemallow increased significantly in nested frequency. The noxious weed whitetop increased significantly in nested frequency, and had a cover of 2%. Houndstongue was sampled for the first time, but was not common.
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial forbs decreased 28%. Whitetop increased significantly in nested frequency, but decreased in cover to 1%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 14%. Segolily, spotted stickseed, and yellow salsify decreased significantly in nested frequency. Whitetop decreased significantly in nested frequency, and decreased in cover to near 0%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial forbs increased in 19%. Spreading fleabane (*Erigeron divergens*) increased significantly in nested frequency. Whitetop remains on the site in low abundance.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 40

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	14.2	11.5	4.5	17.4	-5.9	10.0	-4.0	<b>47.6</b>	Poor
02	13.3	-1.4	5.3	17.7	-0.5	10.0	-2.0	<b>42.4</b>	Poor
07	10.0	8.8	1.1	30.0	-0.5	10.0	-2.0	<b>57.4</b>	Fair
17	12.4	8.8	3.6	15.0	-0.4	10.0	-2.0	<b>47.5</b>	Poor

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 17, Study no: 40

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a27	b50	a26	ab35	ab47	ab46	2.00	1.41	3.16	1.58
G	Agropyron intermedium	a-	a-	b36	bc50	d74	cd65	2.80	3.67	9.74	2.15
G	Agropyron spicatum	a18	ab21	ab35	ab36	c67	bc62	1.68	2.25	2.74	2.10
G	Bromus inermis	a-	a-	a-	a-	a-	b19	-	-	-	.38
G	Bromus japonicus (a)	-	-	a-	ab6	b11	ab6	-	.04	.02	.03
G	Bromus tectorum (a)	-	-	b285	a96	a99	a82	7.91	.67	.61	.51
G	Festuca sp.	-	-	12	-	-	-	.02	-	-	-
G	Oryzopsis hymenoides	-	3	-	-	1	-	-	-	.03	-
G	Poa bulbosa	a6	a16	b229	c306	b223	d359	14.18	23.46	16.19	34.06
G	Poa pratensis	a1	a2	ab16	b21	a-	a-	.25	.11	-	-
G	Poa secunda	a1	d40	a6	bc35	abc20	ab5	.01	.39	.50	.07
G	Sitanion hystrix	3	8	-	3	6	1	-	.15	.06	.00
G	Sporobolus cryptandrus	ab76	b91	ab67	ab81	a51	ab59	1.89	.87	1.00	1.22
Total for Annual Grasses		0	0	285	102	110	88	7.91	0.71	0.63	0.54

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
	Total for Perennial Grasses	132	231	427	567	489	616	22.87	32.32	33.43	41.58
	Total for Grasses	132	231	712	669	599	704	30.79	33.04	34.07	42.12
F	Allium sp.	a-	a-	b11	a-	a3	a-	.03	-	.00	-
F	Alyssum alyssoides (a)	-	-	b69	a-	a1	a-	.22	-	.00	-
F	Arabis sp.	-	1	-	2	1	-	-	.00	.00	-
F	Artemisia dracunculus	7	5	3	4	3	-	.00	.01	.15	-
F	Artemisia ludoviciana	ab101	b140	a86	a76	ab110	b130	2.83	2.37	4.24	3.48
F	Aster sp.	-	8	-	-	1	-	-	-	.03	-
F	Astragalus sp.	-	-	4	-	-	-	.01	-	-	-
F	Astragalus utahensis	4	6	3	-	1	4	.15	-	.00	.06
F	Calochortus nuttallii	ab10	a1	b18	a1	ab7	a-	.06	.00	.63	-
F	Cardaria draba	a-	a-	bc24	c31	ab9	b16	2.36	1.01	.04	.33
F	Castilleja linariaefolia	-	-	1	1	-	-	.03	.00	-	-
F	Cirsium sp.	14	26	10	15	5	12	.46	.50	.12	.25
F	Collinsia parviflora (a)	-	-	-	-	4	-	-	-	.00	-
F	Cymopterus sp.	-	-	2	2	2	1	.00	.01	.03	.00
F	Cynoglossum officinale	-	-	1	-	-	-	.15	-	.00	-
F	Descurainia pinnata (a)	-	-	-	-	2	-	-	-	.00	-
F	Draba sp. (a)	-	-	2	-	-	-	.00	-	-	-
F	Epilobium brachycarpum (a)	-	-	1	-	-	-	.00	-	-	-
F	Erigeron divergens	a-	a-	ab16	a2	a10	b26	.37	.01	.36	.45
F	Erigeron sp.	-	-	-	-	3	-	-	-	.03	-
F	Eriogonum racemosum	3	5	2	3	4	5	.03	.04	.16	.19
F	Erodium cicutarium (a)	-	-	b64	a7	a15	a11	.63	.04	.13	.12
F	Hackelia patens	ab20	c51	d105	bc44	ab24	a11	2.51	.77	1.06	.41
F	Helianthus annuus (a)	a-	b26	a2	a1	a-	a-	.00	.00	-	-
F	Lactuca pulchella	a-	a8	b20	a-	a-	a5	.07	-	-	.03
F	Lactuca serriola (a)	b50	a-	a-	a-	a-	a-	-	-	-	-
F	Lithospermum ruderales	-	4	-	-	-	3	.03	.03	.15	.03
F	Medicago sativa	a-	a-	a2	ab5	ab5	b15	.45	.79	.44	.47
F	Oenothera sp.	-	-	-	-	-	1	.00	-	-	.00
F	Phlox longifolia	a-	b15	ab9	ab8	a1	ab7	.02	.02	.00	.01
F	Polygonum douglasii (a)	-	-	9	-	-	-	.01	-	-	-
F	Ranunculus testiculatus (a)	-	-	5	3	-	-	.03	.00	-	-
F	Sisymbrium altissimum (a)	-	-	3	-	-	-	.03	-	-	-
F	Solidago sp.	b16	a-	a-	a-	a-	a-	-	-	-	-
F	Sphaeralcea coccinea	a44	a69	bc106	c109	a73	ab76	3.06	2.75	.68	.95
F	Tragopogon dubius (a)	c68	a1	b40	a3	a3	a4	.36	.15	.00	.04
F	Vicia americana	-	-	-	1	1	-	-	.00	.03	-
F	Zigadenus paniculatus	1	-	-	-	-	-	-	-	-	-
	Total for Annual Forbs	118	27	195	14	25	15	1.31	0.20	0.14	0.15
	Total for Perennial Forbs	220	339	423	304	263	312	12.68	8.35	8.22	6.72
	Total for Forbs	338	366	618	318	288	327	14.00	8.55	8.37	6.88

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

BROWSE TRENDS--

Management unit 17, Study no: 40

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata tridentata	15	6	2	3	3.11	1.21	1.00	.03
B	Artemisia tridentata vaseyana	25	34	30	27	4.18	7.35	3.93	7.43
B	Atriplex canescens	7	6	4	7	.19	.21	.06	.71
B	Chrysothamnus nauseosus albicaulis	30	27	22	20	3.86	1.90	3.02	1.78
B	Chrysothamnus viscidiflorus viscidiflorus	1	2	1	3	-	-	-	-
B	Gutierrezia sarothrae	45	57	51	59	.97	1.93	3.07	2.99
B	Juniperus osteosperma	0	1	1	0	1.00	2.67	-	-
B	Opuntia sp.	6	9	8	11	.04	.06	-	-
Total for Browse		129	142	119	130	13.37	15.36	11.09	12.95

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 40

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	4.38	6.50
Atriplex canescens	.66	.78
Chrysothamnus nauseosus albicaulis	2.96	4.73
Chrysothamnus viscidiflorus viscidiflorus	-	.16
Gutierrezia sarothrae	1.56	3.41
Juniperus osteosperma	-	-
Opuntia sp.	-	.05

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 40

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.4	1.7	2.1

BASIC COVER--

Management unit 17, Study no: 40

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	.50	7.25	48.81	57.68	46.87	64.52
Rock	25.50	24.00	17.10	17.57	16.14	18.67
Pavement	1.50	4.25	2.41	1.37	1.52	.83
Litter	64.25	59.00	49.95	37.77	28.17	49.48
Cryptogams	1.00	1.00	3.50	2.16	.45	.19
Bare Ground	7.25	4.50	1.49	2.09	2.67	.24



PELLET GROUP DATA--

Management unit 17, Study no: 40

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	-	-	1	-	-	-	-
Horse	-	-	-	11	-	-	13 (33)
Elk	63	15	14	-	23 (58)	49 (121)	-
Deer	32	51	32	6	87 (215)	31 (76)	-
Cattle	-	2	10	2	10 (25)	6 (14)	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 40

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata tridentata</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	460	9	74	17	-	13	0	9	34/42	
02	180	0	0	100	-	44	0	89	59/45	
07	40	0	100	0	-	50	0	50	59/77	
12	60	0	100	0	-	0	0	0	42/60	
<i>Artemisia tridentata vaseyana</i>										
83	4599	51	38	12	-	16	4	0	26/15	
89	4732	41	41	18	533	6	3	3	23/18	
97	880	9	84	7	80	59	0	0	26/42	
02	1240	13	40	47	-	34	16	15	26/35	
07	940	2	70	28	20	30	6	32	28/38	
12	800	8	68	25	20	18	0	18	32/42	
<i>Atriplex canescens</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	200	10	90	0	-	0	90	0	31/33	
02	280	0	50	50	-	29	7	21	18/22	
07	140	0	86	14	-	43	0	0	40/66	
12	180	11	67	22	-	67	0	22	25/28	
<i>Chrysothamnus nauseosus albicaulis</i>										
83	1532	0	43	57	-	0	0	0	25/21	
89	998	0	40	60	-	7	0	7	27/31	
97	1060	9	77	13	-	36	19	11	34/35	
02	900	9	36	56	-	38	2	33	19/22	
07	680	3	79	18	-	3	0	12	26/30	
12	640	3	94	3	-	0	0	19	30/41	

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>199</b>	0	100	0	-	0	0	0	20/26
89	<b>398</b>	0	50	50	-	0	0	17	13/14
97	<b>20</b>	0	100	0	-	0	0	0	14/19
02	<b>40</b>	0	50	50	-	0	0	50	14/17
07	<b>20</b>	0	100	0	-	0	0	0	15/22
12	<b>60</b>	0	100	0	-	0	0	0	19/28
<i>Gutierrezia sarothrae</i>									
83	<b>2999</b>	2	98	0	-	0	0	0	13/9
89	<b>6865</b>	6	92	2	-	0	0	0	14/13
97	<b>3840</b>	54	43	3	200	0	0	.52	11/10
02	<b>4620</b>	2	81	17	-	0	0	5	8/9
07	<b>4380</b>	11	85	4	-	0	0	.45	11/12
12	<b>5000</b>	46	53	2	700	0	0	.40	11/15
<i>Juniperus osteosperma</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>40</b>	50	50	-	-	50	0	0	-/-
07	<b>20</b>	100	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
83	<b>732</b>	36	64	-	-	0	0	36	6/10
89	<b>533</b>	100	0	-	-	0	0	0	-/-
97	<b>180</b>	22	78	-	-	0	0	0	7/10
02	<b>240</b>	8	92	-	-	0	0	0	5/14
07	<b>180</b>	22	78	-	20	0	0	22	6/14
12	<b>240</b>	0	100	-	-	0	0	0	6/17
<i>Rhus trilobata</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	50/76
12	<b>0</b>	0	0	-	-	0	0	0	66/98

UPPER SHEEP CREEK - TREND STUDY NO. 17-41-12

Vegetation Type: Mixed Mountain Brush

Range Type: Crucial Deer Winter/Spring, Substantial Elk Spring/Fall

NRCS Ecological Site Description: Mountain Clay (Mountain Big Sagebrush), R047XA403UT

Land Ownership: USFS

Elevation: 7,500 ft (2,285 m)

Aspect: South

Slope: 12-40%

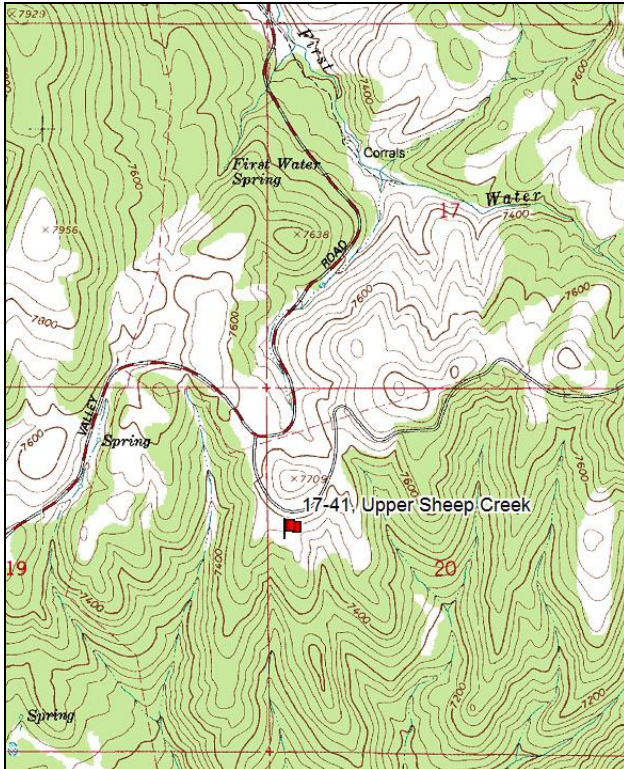
Transect bearing: 168° magnetic

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

Directions:

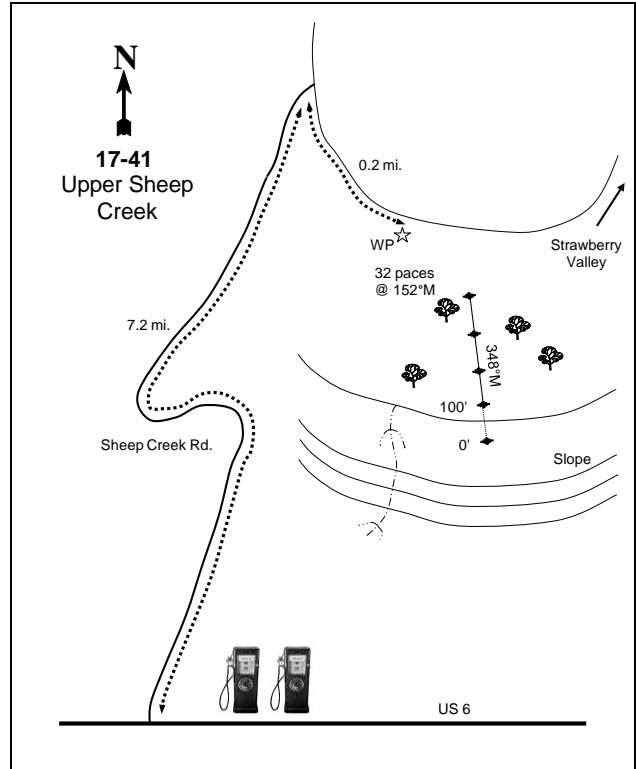
Beginning at the intersection of Sheep Creek Road and Rays Valley, proceed northerly up Rays Valley Road for 7.2 miles to an intersection (0.20 miles past a cattle guard). Turn right at the intersection and proceed easterly for 0.60 miles to another intersection. Turn right at the intersection and proceed 0.10 miles to a "Y" in the road. Take the left side of the "Y" and proceed another 0.10 miles to a faint road to the right. Turn right on the faint road and proceed 0.10 miles to a green steel "T" fencepost to the left. From the stake, the 0-foot stake of the baseline is 32 paces away at an azimuth of 152 degrees magnetic. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height.

Map Name: Ray's Valley



Township: 9S Range: 5E Section: 20

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 476139 E 4430595 N

## UPPER SHEEP CREEK - TREND STUDY NO. 17-41

### Site Information

Site Description: This study is located near the upper limit of deer and elk winter range above US-6 in Spanish Fork Canyon, and samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community. The area is administered by the United States Forest Service (USFS) as part of the Diamond Fork grazing allotment. The elevation makes it unlikely that any big game is using this area after mid-November. Some early spring use probably occurs as the snow melts. The study area drains into Sheep Creek, but is near the divide with First Water Creek. Both creeks are located within 1.1 miles from the study. Deer pellet groups were sampled in high abundance since 2002. Elk pellet groups have been sampled in low abundance since 2002. Cattle pats have been sampled in low abundance since 2002 (Table - Pellet Group Data). Cattle were near the site when sampled in 2012.

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is a mature, dense population. The density of mature sagebrush plants has steadily decreased over the course of the study. The health of the sagebrush population has been moderately poor over the duration of the study. Recruitment of young sagebrush to the population has been a minor component of the population. Recruitment was at its highest in 1997. Utilization of sagebrush has been moderate to heavy throughout the duration of the study. Antelope bitterbrush (*Purshia tridentata*) is a mature, dense population. Bitterbrush density has been stable over the course of the study. Health of the bitterbrush population has been good for the majority of the study; however in 2012, decadence and poor vigor were moderate. Recruitment of serviceberry has been low throughout the course of the study. Utilization of serviceberry has been strongly moderate to heavy. Saskatoon serviceberry (*Amelanchier alnifolia*) is a mature, scattered population. The density of serviceberry has remained stable since the 1997 sampling. Health of the serviceberry population has been good over the course of the study with decadence and poor vigor being low over the same period. Recruitment of young serviceberry to the population has varied between low and moderate over the course of the study. Utilization of serviceberry has been moderate to strongly moderate throughout the course of the study. Other browse species that are present include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), Wyeth eriogonum (*Eriogonum heracleoides*), Woods' rose (*Rosa woodsii*), and snowberry (*Symphoricarpos oreophilus*). Browse use has been predominantly light on these species. There were some moderately browsed snowberry plants in 1983, and Wyeth eriogonum plants in 2007.

Herbaceous Understory: The herbaceous understory is diverse, but is not very abundant. The dominant perennial species are bluebunch wheatgrass (*Agropyron spicatum*), smooth brome (*Bromus inermis*), and mutton bluegrass (*Poa fendleriana*). Ten other perennial grass species have been sampled at low frequencies. Cheatgrass (*Bromus tectorum*) is the only annual species present. Perennial forb species including wild onion (*Allium* sp.), western aster (*Aster chilensis*), arrowleaf balsamroot (*Balsamorhiza sagittata*), and penstemon (*Penstemon* sp.) have accounted for most of the total forb cover. The noxious weed houndstongue (*Cynoglossum officinale*) was sampled in 2002. Otherwise, there have been no noxious weeds sampled.

Soil: The soil has a clay texture with a neutral soil reaction (pH of 7.2) (Table - Soil Analysis Data). The parent material appears to be limestone or shale. Bare ground cover is moderate with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). Because of the disparity in slope and the evidences of erosion that exist along the baseline the erosion condition was classified in two parts in 2007. For the steeper portion of the baseline the erosion condition was classified as slight in 2007. For the remainder of the baseline, the erosion condition was classified as stable in all other sample years.

## Trend Assessments

### Browse:

- **1983 to 1997 - up (+2):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Sagebrush decadence remained similar at 13%, and poor vigor decreased from 41% to 7%. Recruitment of young sagebrush to the population increased from 0% to 10%. Bitterbrush decadence remained similar at 3%, and poor vigor was not observed within the population. Recruitment of young bitterbrush remained similar at 4%. Decadence remained at 0%, and poor vigor decreased from 14% to 0%. Recruitment of young serviceberry to the population increased from 9% to 15%.
- **1997 to 2002 - stable (0):** The density of mountain big sagebrush remained similar at 2,200 plants/acre. Cover of sagebrush increased from 12% to 17%. Decadence increased to 30%, and poor vigor increased to 10%. Recruitment of young sagebrush to the population decreased to 3%. The density of antelope bitterbrush increased remained similar at 1,640 plants/acre. Cover of bitterbrush increased from 12% to 14%. The health of the bitterbrush population remained good with decadence and poor vigor not being observed within the population. Recruitment of young bitterbrush increased to 11%. The density of Saskatoon serviceberry increased 48% to 800 plants/acre. Cover of serviceberry remained at 2%. Decadence increased to 10%, and poor vigor remained similar at 5%. Recruitment of young serviceberry to the population increasing to 35%.
- **2002 to 2007 - slightly down (-1):** The density of mountain big sagebrush decreased 15% to 1,880 plants/acre. Cover of sagebrush decreased to 11%. Decadence increased to 32%, and poor vigor increased to 24%. Recruitment of young sagebrush to the population remained similar at 2%. The density of antelope bitterbrush remained similar at 1,620 plants/acre. Cover of bitterbrush decreased to 10%. Decadence increased to 2%, and poor vigor increased to 5%. Recruitment of young bitterbrush to the population was not observed. The density of Saskatoon serviceberry decreased 30% to 560 plants/acre. Cover of serviceberry decreased to 1%. Decadence decreasing to 4%, and poor vigor decreasing to 0%. Recruitment of young serviceberry to the population decreased to 7%.
- **2007 to 2012 - slightly up (+1):** The density of mountain big sagebrush increased 14% to 1,920 plants/acre. Cover of sagebrush decreased to 8%. Decadence decreased to 27%, and poor vigor increased to 52%. Recruitment of young sagebrush to the population remained similar at 4%. The density of antelope bitterbrush increased 25% to 2,020 plants/acre. Cover of bitterbrush increased to 11%. Decadence increased to 13%, and poor vigor increased to 21%. Recruitment you young bitterbrush to the population increased to 13%. The density of Saskatoon serviceberry increased 14% to 640 plants/acre. Cover of serviceberry remained at 1%. Decadence decreased to 0%, and poor vigor increased slightly to 6%. Recruitment of young serviceberry to the population increased to 25%.

### Grass:

- **1983 to 1997 - up (+2):** The sum of nested frequencies of perennial grasses increased four-fold. Bluebunch wheatgrass, smooth brome, onion grass (*Melica bulbosa*), Kentucky bluegrass (*Poa pratensis*) and mutton bluegrass increased significantly in nested frequency.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial grasses decreased 11%. Onion grass and mutton bluegrass decreased significantly in nested frequency. Bluebunch wheatgrass was the most dominant grass on the site, and increased in cover from 5% to 6%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial grasses remained similar. Letterman needlegrass (*Stipa lettermani*) decreased significantly in nested frequency. Bluebunch wheatgrass decreased in cover to 3%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses decreased 10%. Bluebunch wheatgrass increased significantly in nested frequency, and increased in cover to 8%. Mutton bluegrass and Kentucky bluegrass decreased significantly in nested frequency, and decreased in cover from 2% to less than 1% and from 1% to 0%, respectively.

Forb:

- **1983 to 1997 - up (+2):** The sum of nested frequencies of perennial forbs increased five-fold. Perennial forbs are common and diverse.
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial forbs decreased 35%. Forbs are common and diverse. The noxious weed hounds tongue was observed on the study and was rare on the study.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Forbs remain common and diverse on the study. The noxious weed hounds tongue was not observed on the site.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial forbs decreased 50%. Perennial forbs occur less frequently, but remain diverse on the study. Perennial forb cover decreased from 7% to 4%. The noxious weed hounds tongue was observed on the site, but was rare on the study.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 41

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	30.0	12.8	4.2	23.6	0.0	10.0	0.0	<b>80.7</b>	Good-Excellent
02	30.0	10.3	4.3	20.5	0.0	10.0	-2.0	<b>73.0</b>	Good
07	30.0	9.2	0.6	21.0	-0.1	10.0	0.0	<b>70.8</b>	Good
12	29.7	9.8	5.2	24.4	0.0	7.4	-2.0	<b>74.4</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 41

Type	Species	Nested Frequency					Average Cover %			
		'83	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	a84	bc164	bc178	b137	c196	5.03	5.61	3.39	8.32
G	Bromus inermis	a-	b45	b50	b52	b56	1.74	2.26	2.16	2.07
G	Bromus tectorum (a)	-	ab6	ab3	b9	a-	.01	.03	.07	-
G	Carex sp.	2	1	-	4	7	.03	-	.04	.23
G	Koeleria cristata	a-	a2	ab4	b17	a-	.03	.03	.36	-
G	Melica bulbosa	a-	b12	a-	a3	a1	.15	-	.00	.00
G	Oryzopsis hymenoides	a2	ab4	ab4	b16	ab7	.16	.05	.54	.25
G	Phleum pratense	-	9	-	-	-	.16	-	-	-
G	Poa fendleriana	a-	d107	c53	c66	b20	3.47	.88	2.15	.40
G	Poa pratensis	a-	b13	b26	b26	a-	.45	.75	.95	-
G	Poa secunda	ab19	a1	a3	ab14	b19	.00	.03	.76	.79
G	Sitanion hystrix	1	-	-	-	-	-	-	.00	-
G	Stipa comata	-	9	-	1	-	.36	-	.00	-
G	Stipa lettermani	a-	ab15	b24	a13	a8	.22	.62	.12	.10
Total for Annual Grasses		0	6	3	9	0	0.00	0.03	0.07	0
Total for Perennial Grasses		108	382	342	349	314	11.82	10.25	10.52	12.18
Total for Grasses		108	388	345	358	314	11.83	10.28	10.59	12.18
F	Achillea millefolium	-	5	3	3	-	.04	.00	.03	-
F	Agoseris glauca	a-	b32	a6	ab15	a2	.16	.04	.20	.01

Type	Species	Nested Frequency					Average Cover %			
		'83	'97	'02	'07	'12	'97	'02	'07	'12
F	Allium sp.	a <sup>1</sup>	c <sup>107</sup>	b <sup>49</sup>	c <sup>103</sup>	a <sup>-</sup>	1.06	.14	.49	-
F	Alyssum alyssoides (a)	-	-	11	-	-	-	.04	-	-
F	Androsace septentrionalis (a)	-	2	-	-	-	.00	-	-	-
F	Arabis sp.	-	-	3	-	-	-	.06	-	-
F	Aster chilensis	9	27	34	33	27	.67	1.17	.61	.40
F	Astragalus beckwithii	a <sup>-</sup>	c <sup>58</sup>	bc <sup>31</sup>	b <sup>27</sup>	a <sup>-</sup>	1.77	.63	.74	-
F	Astragalus convallarius	-	-	1	2	-	-	.03	.03	-
F	Balsamorhiza sagittata	7	14	8	16	18	1.12	1.13	1.52	1.40
F	Calochortus nuttallii	a <sup>-</sup>	b <sup>18</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>1</sup>	.08	-	-	.00
F	Castilleja linariaefolia	-	2	-	1	-	.15	-	.03	-
F	Chaenactis douglasii	b <sup>13</sup>	a <sup>-</sup>	a <sup>3</sup>	a <sup>-</sup>	a <sup>-</sup>	-	.00	-	-
F	Cirsium sp.	3	9	4	2	3	.16	.04	.00	.03
F	Collinsia parviflora (a)	-	b <sup>87</sup>	b <sup>92</sup>	c <sup>128</sup>	a <sup>12</sup>	.27	.39	.72	.02
F	Comandra pallida	16	37	15	39	38	.22	.08	.76	.49
F	Cynoglossum officinale	-	-	1	-	2	-	.00	-	.00
F	Descurainia pinnata (a)	-	-	-	-	4	-	-	-	.06
F	Eriogonum ovalifolium	-	-	6	2	-	-	.01	.00	-
F	Eriogonum umbellatum	a <sup>9</sup>	a <sup>3</sup>	a <sup>1</sup>	a <sup>6</sup>	b <sup>24</sup>	.15	.03	.06	.36
F	Galium aparine (a)	-	b <sup>17</sup>	a <sup>7</sup>	a <sup>2</sup>	a <sup>-</sup>	.08	.01	.03	-
F	Hackelia patens	a <sup>3</sup>	b <sup>14</sup>	ab <sup>5</sup>	a <sup>4</sup>	a <sup>3</sup>	.37	.04	.03	.03
F	Lappula occidentalis (a)	-	a <sup>-</sup>	ab <sup>5</sup>	ab <sup>3</sup>	b <sup>14</sup>	-	.03	.00	.07
F	Lygodesmia sp.	-	-	4	-	-	-	.03	-	-
F	Machaeranthera canescens	6	4	2	13	1	.01	.01	.13	.00
F	Orobanche fasciculata	a <sup>-</sup>	b <sup>30</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.64	-	-	-
F	Orthocarpus tolmiei (a)	a <sup>12</sup>	b <sup>55</sup>	b <sup>57</sup>	a <sup>4</sup>	a <sup>4</sup>	1.28	.37	.01	.01
F	Penstemon humilis	a <sup>7</sup>	a <sup>7</sup>	b <sup>28</sup>	ab <sup>25</sup>	b <sup>32</sup>	.09	.59	.43	.50
F	Penstemon sp.	ab <sup>21</sup>	bc <sup>43</sup>	c <sup>62</sup>	bc <sup>53</sup>	a <sup>12</sup>	1.00	1.81	1.91	.24
F	Phlox longifolia	a <sup>-</sup>	bc <sup>38</sup>	c <sup>58</sup>	bc <sup>35</sup>	b <sup>28</sup>	.15	.30	.29	.21
F	Polygonum douglasii (a)	-	b <sup>49</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.16	-	-	-
F	Senecio integerrimus	a <sup>-</sup>	b <sup>58</sup>	a <sup>23</sup>	a <sup>8</sup>	a <sup>-</sup>	.48	.25	.07	-
F	Sphaeralcea coccinea	-	-	3	-	-	-	.15	-	-
F	Stanleya pinnata	-	1	-	2	-	.00	-	.03	-
F	Streptanthus cordatus	1	-	4	1	2	-	.06	.00	.01
F	Viola sp.	a <sup>-</sup>	b <sup>41</sup>	a <sup>7</sup>	a <sup>-</sup>	a <sup>-</sup>	.13	.04	-	-
F	Zigadenus paniculatus	a <sup>-</sup>	b <sup>14</sup>	a <sup>2</sup>	a <sup>-</sup>	a <sup>-</sup>	.08	.03	-	-
Total for Annual Forbs		12	210	172	137	34	1.81	0.86	0.76	0.17
Total for Perennial Forbs		96	562	363	390	193	8.61	6.75	7.39	3.71
Total for Forbs		108	772	535	527	227	10.43	7.61	8.16	3.88

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

BROWSE TRENDS--

Management unit 17, Study no: 41

T y p e	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier alnifolia	23	24	23	22	1.68	2.04	1.10	1.19
B	Artemisia tridentata vaseyana	72	64	52	66	12.18	17.21	11.07	8.26
B	Chrysothamnus depressus	0	1	1	0	-	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	73	74	66	67	7.76	9.29	7.04	6.84
B	Eriogonum heracleoides	26	27	23	7	1.19	1.06	.87	.36
B	Juniperus osteosperma	1	3	2	3	.00	1.63	1.26	2.14
B	Mahonia repens	31	41	21	26	1.91	1.44	.83	.58
B	Purshia tridentata	53	54	50	58	12.17	14.23	10.11	11.23
B	Rosa woodsii	14	19	18	12	.99	.69	.85	.57
B	Symphoricarpos oreophilus	68	78	65	73	6.60	7.40	8.35	6.45
Total for Browse		361	385	321	334	44.53	55.04	41.51	37.66

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 41

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	2.38	.80	1.56
Artemisia tridentata vaseyana	17.29	10.94	15.14
Chrysothamnus viscidiflorus viscidiflorus	9.51	10.23	8.89
Eriogonum heracleoides	.61	1.03	.08
Juniperus osteosperma	2.28	3.90	4.05
Mahonia repens	1.73	1.25	.88
Purshia tridentata	18.75	7.18	18.16
Rosa woodsii	.55	1.10	1.06
Symphoricarpos oreophilus	7.43	12.80	12.96

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 41

Species	Average leader growth (in)		
	'02	'07	'12
Amelanchier alnifolia	-	3.0	0.9
Artemisia tridentata vaseyana	1.6	1.9	0.4
Purshia tridentata	0.9	2.2	0.4



**BASIC COVER--**

Management unit 17, Study no: 41

Cover Type	Average Cover %				
	'83	'97	'02	'07	'12
Vegetation	4.25	55.15	59.53	47.49	49.21
Rock	7.50	2.80	4.45	2.86	5.25
Pavement	16.50	4.88	2.00	3.19	.80
Litter	53.50	54.82	47.53	31.39	54.79
Cryptogams	0	.18	.04	.00	0
Bare Ground	18.25	10.18	13.63	16.07	17.10

**PELLET GROUP DATA--**

Management unit 17, Study no: 41

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	-	2	6	-	-	-	-
Elk	5	3	2	7	3 (7)	11 (28)	11 (26)
Deer	33	23	21	12	46 (114)	66 (162)	40 (99)
Cattle	6	2	1	2	13 (32)	12 (29)	4 (9)

**BROWSE CHARACTERISTICS--**

Management unit 17, Study no: 41

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<b>Amelanchier alnifolia</b>									
83	<b>1466</b>	9	91	0	-	77	14	14	30/20
97	<b>540</b>	15	85	0	140	30	4	0	30/35
02	<b>800</b>	35	55	10	-	43	13	5	33/33
07	<b>560</b>	7	89	4	40	36	25	0	32/27
12	<b>640</b>	25	75	0	-	34	0	6	30/28
<b>Artemisia tridentata vaseyana</b>									
83	<b>1132</b>	0	88	12	-	18	0	41	29/35
97	<b>2160</b>	10	77	13	-	22	5	7	31/41
02	<b>2200</b>	3	67	30	20	21	4	10	31/37
07	<b>1880</b>	2	66	32	20	38	13	24	31/38
12	<b>1920</b>	4	69	27	-	47	32	52	39/40
<b>Cercocarpus montanus</b>									
83	<b>66</b>	0	100	-	-	100	0	0	67/77
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Chrysothamnus depressus</b>										
83	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	20	0	100	-	-	0	0	0	6/15	
07	20	0	100	-	-	0	0	0	5/13	
12	0	0	0	-	-	0	0	0	9/16	
<b>Chrysothamnus viscidiflorus viscidiflorus</b>										
83	2999	0	100	0	-	0	0	0	18/18	
97	5000	2	98	0	-	0	0	0	13/19	
02	8720	2	93	5	20	.91	0	2	12/15	
07	7200	3	97	0	-	0	0	0	11/16	
12	4720	0	97	3	-	0	0	35	11/15	
<b>Eriogonum heracleoides</b>										
83	0	0	0	-	-	0	0	0	-/-	
97	840	7	93	-	20	0	0	0	6/11	
02	1620	5	95	-	-	0	0	0	8/11	
07	1020	0	100	-	-	27	0	0	6/11	
12	260	8	92	-	-	85	0	0	3/11	
<b>Juniperus osteosperma</b>										
83	199	33	67	-	-	0	0	0	55/41	
97	20	100	0	-	-	0	0	0	115/105	
02	60	33	67	-	-	0	0	0	-/-	
07	40	50	50	-	-	0	0	0	-/-	
12	80	25	75	-	-	0	0	0	-/-	
<b>Mahonia repens</b>										
83	932	7	93	0	-	0	0	0	4/6	
97	3640	16	84	0	20	0	0	0	4/6	
02	5480	1	97	2	-	0	0	3	3/5	
07	4140	10	89	1	-	0	0	.96	3/4	
12	3940	5	95	0	-	0	0	4	3/5	
<b>Purshia tridentata</b>										
83	1066	0	100	0	-	50	0	0	19/26	
97	1600	4	94	3	100	34	30	0	20/43	
02	1640	11	89	0	-	55	28	0	23/52	
07	1620	0	91	9	20	38	54	5	23/43	
12	2020	13	74	13	-	40	43	21	20/39	
<b>Rosa woodsii</b>										
83	3732	93	7	0	-	0	0	18	30/10	
97	840	33	64	2	20	0	0	5	11/12	
02	700	17	83	0	-	0	0	0	14/15	
07	1180	0	100	0	-	0	0	0	8/8	
12	540	19	81	0	40	4	0	0	15/9	

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Sambucus cerulea</b>										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>0</b>	0	0	-	-	0	0	0	-/-	
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>0</b>	0	0	-	-	0	0	0	-/-	
12	<b>0</b>	0	0	-	-	0	0	0	70/26	
<b>Symphoricarpos oreophilus</b>										
83	<b>6066</b>	15	85	0	-	14	0	3	19/17	
97	<b>4380</b>	13	87	0	60	0	.45	.45	15/23	
02	<b>5420</b>	13	86	1	-	1	0	0	14/20	
07	<b>4140</b>	11	89	0	-	.48	0	0	16/25	
12	<b>8660</b>	11	89	0	20	2	0	54	15/18	

TANK HOLLOW - TREND STUDY NO. 17-42-12

Vegetation Type: Mixed Mountain Brush

Range Type: Crucial Deer Winter/Spring, Crucial Elk Winter

NRCS Ecological Site Description: Mountain Loam (Shrub), R047XA443UT

Land Ownership: USFS

Elevation: 6,800 ft (2,073 m)

Aspect: South

Slope: 20%

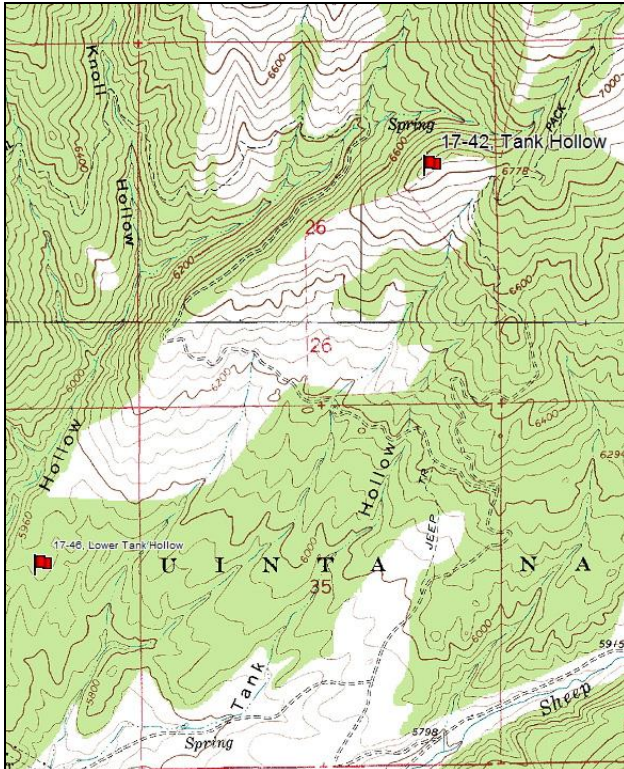
Transect bearing: 191° magnetic

Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 5 on 3ft.

Directions:

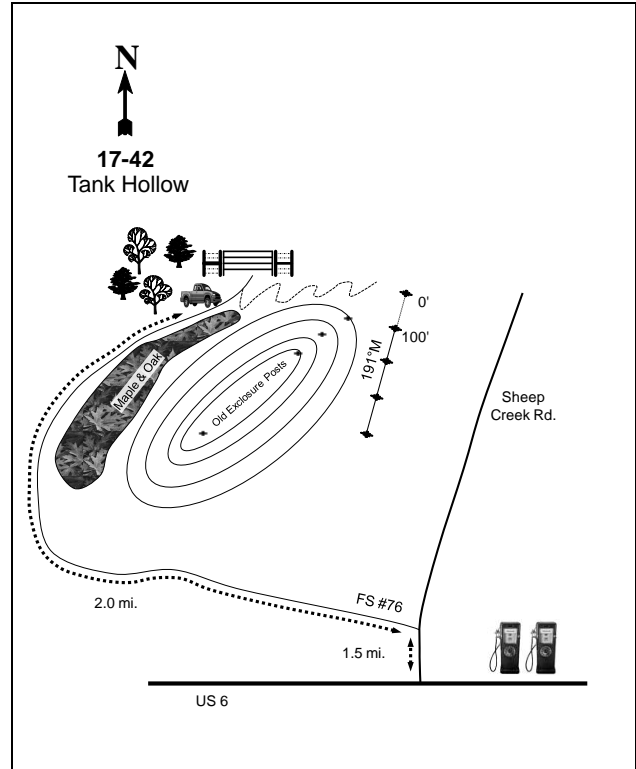
Turn north off of Highway US-6 (near mile post 195) onto the new Sheep Creek Road. Go 1.5 miles on the paved road to an intersection with Forest Service road #076. Turn left and go west 0.8 miles to a fence. Continue 0.05 miles on the road to the southwest corner of a large enclosure. Park here, and follow the trail along the outside of the enclosure to the northeast corner. Continue 60 paces northeast along an old road, the 0-foot stake is 3 paces off the right side of the road. The study runs south. The 0-foot stake is marked by browse tag #176. From FS road drive approximately 2 miles to a large gate. Park near the gate a hike 134 feet to the site location.

Map Name: Ray's Valley



Township: 9S Range: 5E Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 471440 E 4428455 N

## TANK HOLLOW - TREND STUDY NO. 17-42

### Site Information

Site Description: This mountain brush study is located upslope of the Tank Hollow big game exclosure on land administered by the United States Forest Service (USFS) as part of the Diamond Fork grazing allotment. The nearest perennial source of water is a spring located 1,000 feet to the northwest, on the opposite side of the ridge. Both deer and elk have occupied the study site with moderate to high frequency, which at this elevation, is indicative of mild winters. Deer pellet groups were sampled in high abundance in 2002 and 2012, but in moderate abundance in 2007. Elk pellet groups were sampled in high abundance in 2002 and 2007, but in low abundance in 2012. Cattle pats were sampled in low abundance since 2002 (Table - Pellet Group Data). In 2012, there were remnants of the old exclosure surrounding the study site.

Browse: Saskatoon serviceberry (*Amelanchier alnifolia*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), and antelope bitterbrush (*Purshia tridentata*) are the dominant preferred browse species on the study. Mountain big sagebrush is a moderately sparse, mature population. The density of mature sagebrush was high when the study was initially established but has steadily decreased over the course of the study. Decadence within the sagebrush population has been high each sample year, and poor vigor has ranged from low to moderately-high levels. Recruitment of young sagebrush to the population has been minimal for the duration of the study. Utilization of sagebrush has been moderate to heavy with the heaviest being in 2002. Antelope bitterbrush is a moderately dense, mature population. The density of mature bitterbrush has varied over the course of the study. The health of the bitterbrush population has been good most sample years, but was poor in 2002 with high decadence and poor vigor. Recruitment of young bitterbrush to the population has been minimal for most sample years. Utilization of bitterbrush has been moderate to heavy over the duration of the study. True mountain mahogany is a sparse, mature population. Mahogany was first sampled in 1997, and was likely captured due to the extension of the study in 1997. The density of mature mahogany has varied over the course of the study. The health of the mahogany population has been good most sample years, but was high in decadence and poor vigor in 2002. Utilization of mahogany has been heavy since 1997. Saskatoon serviceberry is a sparse, mature population. The density of mature serviceberry has varied over the course of the study. Mature serviceberry were absent from the population in 2002. Serviceberry decadence and poor vigor was at its highest in 2002. Recruitment of young serviceberry to the population has been minimal each sample year. Utilization of serviceberry has varied from moderate to heavy. Other species that are present include broom snakeweed (*Gutierrezia sarothrae*), stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), snowberry (*Symphoricarpos oreophilus*), Gambel oak (*Quercus gambelii*), Oregon grape (*Mahonia repens*), and pricklypear cactus (*Opuntia* sp.). Gambel oak was infested with insects in 2007 (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by perennial grasses, and between seven and nine perennial species have been sampled. Perennial grass cover increased from 11% in 1997 to 16% in 2007. The dominant perennial species are crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), bluebunch wheatgrass (*A. spicatum*), and Sandberg bluegrass (*Poa secunda*). The weedy species Bulbous bluegrass (*P. bulbosa*) was first sampled in 2002, but in low frequency. Cheatgrass is scattered throughout the study and cover of cheatgrass has been low since 1997. The perennial forb community is diverse on the site, but has become rare over the duration of the study. Perennial forbs found on the site include western aster (*Aster chilensis*), thistle (*Cirsium* sp.), spotted stickseed (*Hackelia patens*), Lewis flax (*Linum lewisii*), longleaf phlox (*Phlox longifolia*), and American vetch (*Vicia americana*). The annual forb pale alysium (*Alyssum alyssoides*) has been common on the site since 2007 (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil has a clay loam texture with a neutral soil reaction (pH 7.1). There is little rock or pavement on the surface; however, there are rocks throughout the profile. Phosphorous and potassium ppm may have limited availability for plant growth and development at 6.8ppm and 64ppm, respectively (Tiedemann and Lopez

2004) (Table - Soil Data Analysis). Bare ground cover has been moderate to high with a high amount of litter and vegetation cover providing protective ground cover (Table - Basic Cover). Some slight soil movement was reported in the past; however, the erosion condition was classified as stable for all sampled years.

## Trend Assessments

### Browse:

- **1983 to 1989 - slightly up (+1):** The density of mountain big sagebrush increased 25% from 2,399 plants/acre to 2,998 plants/acre. Decadence increased from 28% to 56%, and poor vigor increased from 0% to 13%. Recruitment of young sagebrush to the population was minimal at 4%. The density of antelope bitterbrush did not change at 2,065 plants/acre. Decadence increased from 0% to 23%, and poor vigor was not observed. Recruitment of young bitterbrush to the population decreased from 10% to 3%. The density of Saskatoon serviceberry increased two-fold from 66 plants/acre to 132 plants/acre. Decadence increased from 0% to 50%, but poor vigor was not observed within the population.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Mountain big sagebrush decadence decreased to 31%, and poor vigor increased to 23%. Recruitment of young sagebrush to the population was nominal at 5%. Antelope bitterbrush decadence decreased to 0%, and poor vigor remained at 0%. Recruitment of young bitterbrush to the population increased to 14%. Saskatoon serviceberry decadence decreased to 0%, and poor vigor remained at 0%. Recruitment of young serviceberry increased to 40%.
- **1997 to 2002 - down (-2):** The density of mountain big sagebrush remained similar at 1,780 plants/acre. Cover of sagebrush decreased from 13% to 8%. Decadence decreased to 31%, and poor vigor increased to 23%. Recruitment of young sagebrush plants to the population decreased to 2%. The density of antelope bitterbrush increased 9% from 1,960 plants/acre to 2,140 plants/acre. Cover of bitterbrush decreased from 10% to 5%. Decadence increased to 85%, and poor vigor increased to 48%. Recruitment of young bitterbrush to the population decreased to 1%. The density of true mountain mahogany increased 19% from 320 plants/acre to 380 plants/acre. Cover of mahogany increased from 1% to 2%. Decadence increased from 0% to 68%, and poor vigor increased from 0% to 58%. Recruitment of young mahogany to the population was not observed. The density of Saskatoon serviceberry decreased 10% to 180 plants/acre. Cover of serviceberry remained similar at 1%. Decadence increased to 56%, and poor vigor increased to 22%. Recruitment of young serviceberry to the population increased from 40% to 44%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 39% to 1,080 plants/acre. Cover of sagebrush decreased to 4%. Decadence decreased to 50%, and poor vigor decreased to 28%. Recruitment of young sagebrush to the population remained nominal at 2%. The density of antelope bitterbrush decreased 52% to 1,020 plants. Cover of bitterbrush decreased to 3%. Decadence decreased to 18%, and poor vigor decreased to 6%. Recruitment of young bitterbrush to the population increased to 16%. The density of true mountain mahogany decreased 53% to 180 plants/acre. Cover of mahogany decreased to 1%. Decadence and poor vigor both decreased to 11%. Recruitment of young mahogany to the population was not observed. The density of Saskatoon serviceberry decreased 11% to 160 plants/acre. Decadence decreased to 25%, and poor vigor decreased to 13%. Recruitment of young serviceberry to the population decreased to 25%.
- **2007 to 2012 - slightly down (-1):** The density of mountain big sagebrush decreased 17% to 900 plants/acre. Cover of sagebrush remained at 4%. Decadence decreased to 42%, and poor vigor increased to 40%. Recruitment of young sagebrush to the population remained nominal at 2%. The density of antelope bitterbrush remained similar at 1,040 plants. Cover of bitterbrush increased to 5%. Decadence and poor vigor both decreased to 0%. Recruitment of young bitterbrush to the population decreased to 2%. The density of true mountain mahogany increased 22% to 220 plants/acre. Cover of mahogany increased to 2%. Decadence decreased to 0%, and poor vigor decreased to 9%. Recruitment of young mahogany to the population was not observed. The density of Saskatoon

serviceberry decreased 38% to 100 plants/acre. Cover of serviceberry remained under 1%. Decadence and poor vigor both decreased to 0%. Recruitment of young serviceberry to the population decreased to 0%.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies of perennial grasses increased 33%. Intermediate wheatgrass increased significantly in nested frequency.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial greases increased 15%. Sandberg bluegrass increased significantly in nested frequency. The annual weedy species cheatgrass was recorded for the first time, and was the second most common grass on the study.
- **1997 to 2002 - slightly up (+1):** The sum of nested frequencies of perennial grasses excluding bulbous bluegrass, increased 20%. Crested wheatgrass increased significantly in nested frequency, and increased in cover from 7% to 10%. The weedy perennial species bulbous bluegrass was observed for the first time, but with low frequency and cover. The weedy annual species cheatgrass decreased in cover to less than 1%.
- **2002 to 2007 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 60%. Crested wheatgrass and bluebunch wheatgrass increased significantly in nested frequency, and increased in cover to 10% and from 2% to 3%, respectively.
- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar. Crested wheatgrass and intermediate wheatgrass increased significantly in nested frequency, and increased in cover to 23% and from 1% to 4%, respectively. The weedy annual species cheatgrass decreased significantly in nested frequency, and decreased in cover from 2% to less than 1%.

Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Perennial forbs are common and diverse on the study.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 13%. Lewis flax increased significantly in nested frequency, and had a cover of 6%. Lewis flax was the most common forb on the study.
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial forbs decreased 61%. Lewis flax decreased significantly in nested frequency, and decreased in cover to 0%.
- **2002 to 2007 - down (-2):** The sum of nested frequencies of perennial forbs decreased 27%.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial forbs decreased 51%. Perennial forbs are less common and diverse on the site.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 42

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	30.0	10.1	5.2	22.2	-0.7	10.0	0.0	<b>76.8</b>	Good
02	20.9	-6.3	2.3	23.6	-0.1	5.5	0.0	<b>45.9</b>	Poor
07	10.4	4.5	3.8	30.0	-1.1	6.1	0.0	<b>53.7</b>	Fair
12	16.4	10.5	1.9	30.0	-0.2	2.2	0.0	<b>60.9</b>	Fair

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 17, Study no: 42

T y P e	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a29	ab62	b80	c126	d200	e234	5.39	7.13	9.66	23.04
G	Agropyron intermedium	a37	bc52	abc49	abc45	ab36	c76	2.48	1.44	.94	4.05
G	Agropyron spicatum	b48	b51	a27	a24	c91	bc67	1.02	1.70	2.84	4.04
G	Bromus carinatus	6	3	5	6	-	7	.06	.53	-	.78
G	Bromus inermis	-	-	-	-	7	-	-	-	.53	-
G	Bromus tectorum (a)	-	-	bc70	ab38	c86	a24	.93	.17	1.49	.26
G	Oryzopsis hymenoides	6	5	6	9	3	8	.06	.21	.06	.19
G	Poa bulbosa	a-	a-	a-	b11	ab6	a2	-	.12	.03	.00
G	Poa fendleriana	14	13	3	10	14	1	.01	.06	.08	.03
G	Poa pratensis	a-	a-	ab5	b11	ab6	a-	.66	.10	.30	-
G	Poa secunda	a-	a4	b43	b30	b61	b45	1.38	.63	1.45	1.93
G	Sitanion hystrix	3	-	-	-	-	-	-	-	-	-
Total for Annual Grasses		0	0	70	38	86	24	0.93	0.17	1.49	0.26
Total for Perennial Grasses		143	190	218	272	424	440	11.08	11.94	15.91	34.09
Total for Grasses		143	190	288	310	510	464	12.02	12.11	17.40	34.36
F	Agoseris glauca	-	-	-	12	2	-	.01	.02	.00	-
F	Allium sp.	a10	b83	a19	a18	a3	a-	.06	.07	.03	-
F	Alyssum alyssoides (a)	-	-	a-	a3	b35	b46	-	.01	.09	.13
F	Arabis sp.	b29	a4	a8	a3	a-	a-	.04	.00	-	-
F	Artemisia dracunculus	3	-	-	-	-	-	-	-	-	-
F	Aster chilensis	23	17	24	13	10	13	.93	.15	.12	.27
F	Astragalus beckwithii	-	-	4	-	-	-	.21	-	-	-
F	Astragalus convallarius	-	-	10	-	-	-	.04	-	-	-
F	Astragalus sp.	-	-	2	-	-	-	.00	-	-	-
F	Balsamorhiza sagittata	-	-	1	3	3	2	.15	.15	.15	.03
F	Camelina microcarpa (a)	-	-	b14	b17	c53	a-	.05	.25	.20	-
F	Castilleja linariaefolia	-	-	4	-	-	-	.03	-	-	-
F	Chaenactis douglasii	b62	a7	a-	a-	a-	a-	-	-	-	-
F	Chenopodium album (a)	-	-	2	-	-	-	.00	-	-	-
F	Cirsium sp.	b55	b36	b50	a2	a2	a4	1.75	.01	.38	.04
F	Collinsia parviflora (a)	-	-	b23	ab11	a1	a5	.04	.02	.00	.06
F	Collomia linearis (a)	-	-	8	-	-	1	.02	-	-	.00
F	Comandra pallida	ab19	b27	a3	a-	a-	a2	.02	-	-	.00
F	Crepis acuminata	a7	b45	b56	a10	a1	a-	.57	.23	.03	-
F	Cryptantha sp.	7	-	-	-	-	-	-	-	-	-
F	Cymopterus sp.	a-	d44	cd33	a-	bc21	b9	.24	-	.13	.02
F	Descurainia pinnata (a)	-	-	7	8	6	-	.01	.06	.01	-
F	Erigeron pumilus	-	-	1	-	-	-	.00	.00	-	-
F	Eriogonum brevicaulis	ab8	b9	a-	ab3	ab4	a-	-	.06	.06	.00
F	Hackelia patens	bc58	c69	bc79	bc56	ab47	a15	3.04	.76	1.10	.31
F	Lappula occidentalis (a)	-	-	5	-	-	-	.01	-	-	-



Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Linum lewisii</i>	c42	bc27	d161	a-	b12	b11	6.36	-	.16	.08
F	<i>Lithospermum ruderales</i>	6	16	5	6	7	2	.33	.56	.22	.15
F	<i>Lomatium sp.</i>	-	-	-	-	3	-	-	-	.00	-
F	<i>Machaeranthera canescens</i>	b75	a3	a7	a1	a1	a-	.06	.03	.00	-
F	<i>Microsteris gracilis (a)</i>	-	-	ab5	c38	b14	a-	.01	.10	.03	-
F	<i>Penstemon humilis</i>	b19	ab11	ab8	a3	a-	a-	.06	.03	-	-
F	<i>Phlox longifolia</i>	c86	c102	b45	b40	ab25	a8	.29	.14	.28	.02
F	<i>Polygonum douglasii (a)</i>	-	-	1	-	-	-	.00	-	-	-
F	<i>Ranunculus testiculatus (a)</i>	-	-	-	-	7	3	-	-	.02	.00
F	<i>Senecio multilobatus</i>	3	4	7	-	-	-	.09	-	-	-
F	<i>Streptanthus cordatus</i>	6	4	9	8	2	5	.16	.04	.01	.01
F	<i>Taraxacum officinale</i>	-	3	-	-	-	-	-	-	-	-
F	<i>Thalictrum sp.</i>	-	-	-	-	1	-	-	-	.15	-
F	<i>Tragopogon dubius (a)</i>	c30	ab4	b17	a-	ab12	a-	.06	-	.06	-
F	<i>Trifolium sp.</i>	-	-	-	2	-	-	-	.03	-	-
F	<i>Veronica biloba (a)</i>	-	-	b155	a-	a9	a-	1.44	-	.02	-
F	<i>Vicia americana</i>	a21	a23	b74	b58	a29	a13	1.54	.44	.20	.16
F	<i>Viola sp.</i>	-	-	3	-	-	-	.00	-	-	-
F	<i>Zigadenus paniculatus</i>	2	9	-	-	-	-	-	-	-	-
Total for Annual Forbs		30	4	237	77	137	55	1.66	0.44	0.44	0.20
Total for Perennial Forbs		541	543	613	238	173	84	16.07	2.74	3.06	1.12
Total for Forbs		571	547	850	315	310	139	17.74	3.19	3.50	1.32

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

#### BROWSE TRENDS--

Management unit 17, Study no: 42

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Amelanchier alnifolia</i>	8	9	8	5	.56	.57	.18	.16
B	<i>Artemisia tridentata vaseyana</i>	63	62	40	39	13.34	8.41	4.17	4.19
B	<i>Cercocarpus montanus</i>	12	12	7	8	1.14	1.60	.49	2.07
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	23	25	23	24	1.96	2.03	1.93	2.65
B	<i>Gutierrezia sarothrae</i>	53	56	54	17	1.99	1.87	2.16	.25
B	<i>Juniperus osteosperma</i>	4	3	2	1	2.49	2.99	3.63	.15
B	<i>Mahonia repens</i>	1	0	1	1	.03	-	.03	-
B	<i>Opuntia sp.</i>	1	2	4	1	-	.01	.06	.06
B	<i>Purshia tridentata</i>	55	51	31	32	9.88	4.64	2.72	5.03
B	<i>Quercus gambelii</i>	3	4	3	4	.41	.15	.06	.30
B	<i>Symphoricarpos oreophilus</i>	25	30	22	19	2.11	1.64	1.13	1.63
Total for Browse		248	254	195	151	33.94	23.95	16.60	16.53

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 42

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	.18	.11	-
Artemisia tridentata vaseyana	5.88	5.58	5.65
Cercocarpus montanus	.81	1.18	2.91
Chrysothamnus viscidiflorus viscidiflorus	1.88	1.95	2.38
Gutierrezia sarothrae	.60	1.23	.53
Juniperus osteosperma	.83	3.54	.80
Opuntia sp.	-	.06	.03
Purshia tridentata	2.63	3.16	7.51
Quercus gambelii	.20	.20	.65
Symphoricarpos oreophilus	1.85	1.18	1.50

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 42

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.0	1.3	1.1
Cercocarpus montanus	2.0	2.9	1.2
Purshia tridentata	1.7	3.1	1.9

POINT-QUARTER TREE DATA--

Management unit 17, Study no: 42

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	33	59	36	5.6	5.2	3.4

BASIC COVER--

Management unit 17, Study no: 42

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	1.25	14.00	52.99	38.21	42.77	56.42
Rock	4.50	5.75	4.18	3.29	3.54	3.69
Pavement	3.25	6.25	1.67	.88	1.62	.91
Litter	61.00	51.25	53.51	50.02	41.36	59.61
Cryptogams	0	0	.31	.68	.35	.51
Bare Ground	30.00	22.75	11.94	23.39	24.59	11.92

PELLET GROUP DATA--

Management unit 17, Study no: 42

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	1	6	4	3	-	-	-
Elk	36	20	33	4	49 (121)	46 (114)	14 (35)
Deer	38	52	31	23	155 (384)	21 (53)	46 (112)
Cattle	-	4	3	1	5 (13)	2 (5)	7 (16)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 42

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
83	<b>66</b>	0	100	0	-	100	0	0	25/17
89	<b>132</b>	0	50	50	-	50	0	0	23/15
97	<b>200</b>	40	60	0	40	20	20	0	32/33
02	<b>180</b>	44	0	56	-	11	78	22	24/21
07	<b>160</b>	25	50	25	-	50	0	13	28/24
12	<b>100</b>	0	100	0	40	80	20	0	32/28
<i>Artemisia tridentata vaseyana</i>									
83	<b>2399</b>	0	72	28	-	50	36	0	31/37
89	<b>2998</b>	4	40	56	-	27	56	13	24/43
97	<b>1720</b>	5	64	31	-	57	13	23	30/46
02	<b>1780</b>	2	33	65	-	16	81	44	26/33
07	<b>1080</b>	2	48	50	60	37	46	28	28/36
12	<b>900</b>	2	56	42	-	47	27	40	25/28
<i>Cercocarpus montanus</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>320</b>	6	94	0	-	19	75	0	33/40
02	<b>380</b>	11	21	68	-	0	95	58	33/32
07	<b>180</b>	0	89	11	20	44	56	11	29/27
12	<b>220</b>	0	100	0	-	45	55	9	35/35
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>399</b>	0	100	0	-	0	0	0	10/17
89	<b>599</b>	0	100	0	-	0	0	0	11/13
97	<b>1460</b>	7	93	0	20	0	0	0	12/17
02	<b>1700</b>	4	95	1	-	4	1	0	9/13
07	<b>1340</b>	1	97	1	-	0	0	0	9/16
12	<b>1360</b>	1	96	3	-	0	0	3	11/18
<i>Gutierrezia sarothrae</i>									
83	<b>2399</b>	0	100	0	-	0	0	0	12/8
89	<b>3732</b>	0	86	14	-	0	0	7	10/10
97	<b>5420</b>	22	77	0	400	0	0	0	10/10
02	<b>3840</b>	1	73	27	20	0	0	9	8/8
07	<b>3460</b>	3	92	5	20	0	0	2	8/9
12	<b>600</b>	3	97	0	20	0	0	3	8/10

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Juniperus osteosperma</b>										
83	133	0	100	-	-	0	50	0	67/12	
89	66	0	100	-	-	0	0	0	106/79	
97	80	0	100	-	-	0	0	0	82/79	
02	60	0	100	-	-	0	33	0	-/-	
07	40	50	50	-	-	0	0	0	-/-	
12	20	100	0	-	-	0	0	0	-/-	
<b>Mahonia repens</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	80	25	75	-	-	0	0	0	3/6	
02	0	0	0	-	-	0	0	0	-/-	
07	120	0	100	-	-	0	0	0	-/-	
12	20	0	100	-	-	0	0	0	3/4	
<b>Opuntia sp.</b>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	20	0	100	0	-	0	0	0	4/5	
02	60	33	33	33	-	0	0	67	3/7	
07	100	20	80	0	-	0	0	0	6/9	
12	20	0	100	0	-	0	0	0	6/7	
<b>Purshia tridentata</b>										
83	2065	10	90	0	-	13	13	0	16/19	
89	2065	3	74	23	-	48	45	0	15/24	
97	1960	14	86	0	20	52	36	0	29/49	
02	2140	1	14	85	-	7	89	48	12/26	
07	1020	16	67	18	-	41	31	6	16/33	
12	1040	2	98	0	-	69	27	0	21/35	
<b>Quercus gambelii</b>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	140	71	29	0	20	0	0	0	51/35	
02	160	50	0	50	-	0	38	50	26/27	
07	120	33	67	0	-	0	0	0	90/57	
12	180	89	11	0	-	0	0	0	31/32	
<b>Ribes sp.</b>										
83	0	0	0	-	-	0	0	0	-/-	
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	19/70	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Symphoricarpos oreophilus</i>									
83	<b>2265</b>	21	79	0	66	0	0	0	19/14
89	<b>2132</b>	9	91	0	-	22	0	50	15/14
97	<b>1000</b>	10	90	0	-	0	0	0	18/36
02	<b>960</b>	21	65	15	-	21	8	2	12/24
07	<b>900</b>	69	31	0	-	0	0	7	13/18
12	<b>840</b>	26	74	0	-	21	0	2	16/18

BILLIES MOUNTAIN - TREND STUDY NO. 17-44-12

Vegetation Type: Mixed Mountain Brush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Mountain Clay (Mountain Big Sagebrush), R047XA403UT

Land Ownership: USFS

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

Aspect: Southwest

Slope: 5-20%

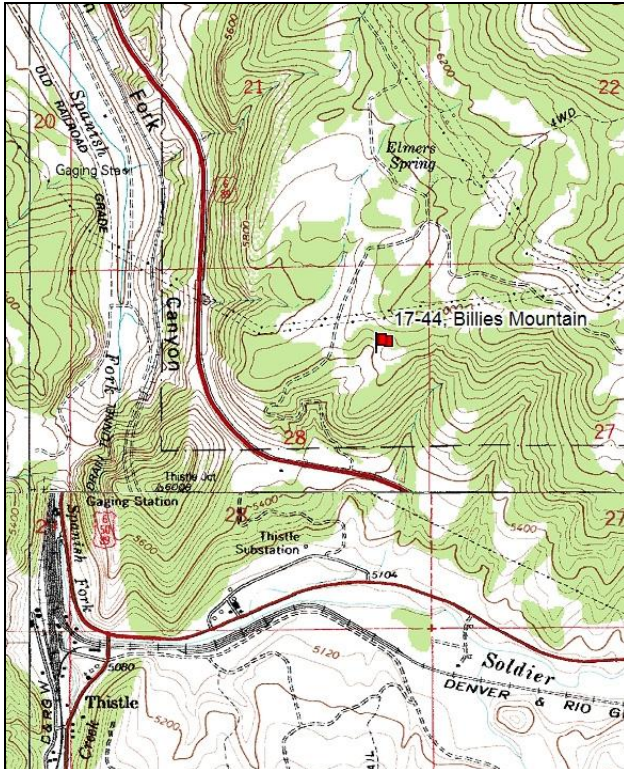
Transect bearing: 204° magnetic

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

Directions:

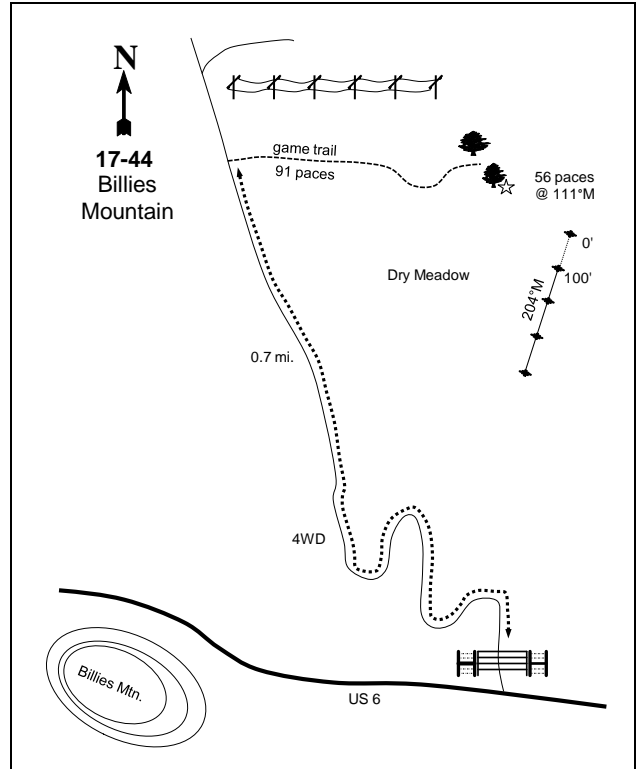
On Highway 6 and 89 in Spanish Fork Canyon, east of the new road cut through Billies Mountain and 0.9 miles west of the junction of Route 89 south to Manti and US 6, turn north onto a dirt road. Cross a cattle guard and follow the road up 0.7 miles to where it breaks out into a sagebrush/grass flat. On the right, at the head of a small drainage, a game trail heads east towards a small meadow. Follow this trail approximately 150 yards to 2 large junipers at the edge of the meadow. From the junipers, walk up the near slope 56 paces bearing 111 degrees to the 0-foot baseline stake. This fencepost is marked by browse tag number 3951.

Map Name: Billies Mountain



Township: 9S Range: 4E Section: 28

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 458808 E 4428476 N

## Site Information

Site Description: This winter range study is located east of US-6 near the town of Thistle on land administered by the United States Forest Service (USFS) as part of a Billies Mountain grazing allotment. The nearest perennial source of water is Spanish Fork 0.7 miles to the west, on the far side of US-6. The study samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and grass community with a variety of other shrubs interspersed throughout. Deer pellet groups were sampled in moderate abundance in 2002 and 2007, but in low abundance in 2012. Elk pellet groups were sampled in low abundance in 2002 and 2012, but in high abundance in 2007. Cattle pats have been sampled in low abundance since 2002. Horse pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: The study site supports a variety of browse species. Mountain big sagebrush is the dominant species, which is a sparse, mature population. The mature sagebrush population has varied in density over the course of the study, and has remained sparse. The health of the sagebrush population has been poor most sample years, but the population was in its best health in 2012 with decadence and poor vigor being moderate. Recruitment of young sagebrush to the population has been minimal each sample year. Utilization of sagebrush has ranged from moderate to heavy over the course of the study. A sparse, mature population of antelope bitterbrush (*Purshia tridentata*) provides additional forage. Bitterbrush has varied slightly in density and has been stable much of the study. The health of the bitterbrush population has been good most sample years. Decadence has been low most study years, but was high in 2002. Additionally, poor vigor has been low most samplings, but was high in 2012. Utilization of bitterbrush has been light to heavy over the sample years. Other browse species that are present include serviceberry (*Amelanchier alnifolia*), dwarf rabbitbrush (*Chrysothamnus depressus*), white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), chokecherry (*Prunus virginiana*), Woods rose (*Rosa woodsii*), snowberry (*Symphoricarpos oreophilus*), and gray horsebrush (*Tetradymia canescens*) (Table - Browse Characteristics). These populations have either changed very little since 1983, or have shown little browse use.

Herbaceous Understory: The herbaceous understory is abundant and exceptionally diverse. The dominant perennial species are bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). Other abundant perennial species include crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), smooth brome (*Bromus inermis*), prairie junegrass (*Koeleria cristata*), the weedy species bulbous bluegrass (*Poa bulbosa*), and Kentucky bluegrass (*P. pratensis*). The invasive annual species cheatgrass (*Bromus tectorum*) is also present. The dominant perennial forb is western aster (*Aster chilensis*). Other common perennial species include western yarrow (*Achillea millefolium*), cudweed sagewort (*Artemisia ludoviciana*), thistle (*Cirsium* sp.), rock goldenrod (*Petradoria pumila*), and American vetch (*Vicia americana*). The composition of the dominant forbs is indicative of heavy grazing pressure in the past. The noxious weed houndstongue (*Cynoglossum officinale*) was sampled in 1997 and 2002.

Soil: Natural Resources Conservation Service (NRCS) soil data was not available of this site. The soil is relatively deep, grey in color, and has little rock. The soil has a clay texture and has a mildly alkaline soil reaction (pH of 7.4). Phosphorus may have limited availability for plant growth and development at 4.6ppm (Tiedemann and Lopez 2004) (Table - Soil Data Analysis). Bare ground cover has been moderate with high amounts of vegetation and litter providing protective ground cover. The erosion condition was classified as stable for all sample years.

## Trend Assessments

### Browse:

- **1983 to 1989 - stable (0):** The density of mountain big sagebrush increased 4% from 2,332 plants/acre to 2,432 plants/acre. Decadence increased from 53% to 86%, but poor vigor decreased from 63% to 12%. Recruitment of young sagebrush to the population remained absent. The density of antelope bitterbrush increased 12% from 266 plants/acre to 299 plants/acre. Decadence and poor vigor remained at 0%. Recruitment of young bitterbrush to the population decreased from 12% to 0%.
- **1989 to 1997 - slightly down (-1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. The health of the sagebrush population remained poor with decadence decreasing to 54%, and poor vigor increasing to 40%. Recruitment of young sagebrush to the population remained nominal at 5%. Decadence and poor vigor both increased to 7%. Recruitment of young bitterbrush to the population remained nominal at 4%.
- **1997 to 2002 - stable (0):** The density of mountain big sagebrush decreased 8% from 1,260 plants/acre to 1,160 plants/acre. Cover of sagebrush decreased slightly from 5% to 4%. Decadence increased slightly to 57%, and poor vigor decreased to 29%. Recruitment of young sagebrush to the population increased slightly to 10%. The density of antelope bitterbrush decreased 30% from 540 plants/acre to 380 plants/acre. Cover of bitterbrush increased from 2% to 3%. Decadence increased to 21%, and poor vigor remained similar at 5%. Recruitment of young bitterbrush to the population was not observed.
- **2002 to 2007 - slightly down (-1):** The density of mountain big sagebrush decreased 16% to 980 plants/acre. Cover of sagebrush remained similar at 4%. Decadence decreased slightly to 53%, but poor vigor increased to 41%. Recruitment of young sagebrush to the population remained at 10%. The density of antelope bitterbrush increased 5% to 400 plants/acre. Cover of bitterbrush decreased to 2%. Decadence and poor vigor both decreasing to 0%. Recruitment of young bitterbrush to the population improved slightly to 10%.
- **2007 to 2012 - down (-2):** The density of mountain big sagebrush decreased 39% to 600 plants/acre. Cover of sagebrush decreased to 3%. Decadence decreased to 23%, and poor vigor decreased to 20%. Recruitment of young sagebrush to the population decreased slightly to 7%. The density of bitterbrush increased 30% to 520 plants/acre. Cover of bitterbrush remained at 2%. Decadence remained similar at 4%, but poor vigor increased to 50%. Recruitment of young bitterbrush to the population increased to 35%.

### Grass:

- **1983 to 1989 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 11%. Kentucky bluegrass increased significantly in nested frequency. Mutton bluegrass and Letterman needlegrass (*Stipa lettermani*) decreased significantly in nested frequency.
- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 15%. Crested wheatgrass, Kentucky bluegrass, and Sandberg bluegrass increased significantly in nested frequency. Bluebunch wheatgrass and Kentucky bluegrass had covers of 9% and 7%. The weedy perennial species bulbous bluegrass increased significantly in nested frequency, and had a cover of 2%.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 11%. Crested wheatgrass increased significantly in nested frequency, and increased in cover from 1% to 2%. The weedy perennial species bulbous bluegrass increased in cover to 3%. The invasive annual species cheatgrass decreased significantly in nested frequency, and decreased in cover from 1% to near 0%.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 13%. Intermediate wheatgrass and prairie junegrass increased



significantly in nested frequency. The weedy perennial species bulbous bluegrass decreased in cover to 2%.

- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. Western wheatgrass increased significantly in nested frequency, and increased in cover from 1% to 3%. The weedy species bulbous bluegrass increased in cover to 3%.

Forb:

- **1983 to 1989 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Forbs are common and diverse.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial forbs remained similar. Forbs remain common, and increased in diversity. The noxious weed hounds tongue was sampled on the site, but with low nested frequency and cover.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 12%. Hounds tongue remains infrequent and low in cover. Perennial forbs remain common and diverse. Perennial forb cover decreased from 19% to 18%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Hounds tongue was not observed on the study. Perennial forbs remain common and diverse. Cover of perennial forbs remains at 18%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Forbs remain common and diverse. The cover of perennial forbs decreased to 11%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 44

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	9.7	4.2	2.8	30.0	-0.7	10.0	-2.0	<b>54.0</b>	Fair
02	10.0	2.3	3.5	30.0	0.0	10.0	-2.0	<b>53.9</b>	Fair
07	8.0	4.8	5.1	30.0	-0.4	10.0	0.0	<b>57.5</b>	Fair
12	7.6	5.8	7.7	30.0	-0.2	10.0	0.0	<b>60.8</b>	Fair

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 17, Study no: 44

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a-	a-	b11	c55	c45	c48	.48	1.99	2.62	2.75
G	Agropyron intermedium	a-	a-	a-	a-	b22	ab8	-	-	1.26	.04
G	Agropyron smithii	a-	a6	a13	ab21	b51	c85	.05	.58	1.03	2.59
G	Agropyron spicatum	a149	ab182	b202	ab175	ab167	ab164	8.94	9.46	8.42	6.84
G	Agropyron trachycaulum	ab9	b22	a-	ab13	b26	ab5	-	.19	.84	.01
G	Bromus inermis	a-	a-	ab7	ab10	ab12	b19	.30	.79	1.16	.85
G	Bromus japonicus (a)	-	-	a-	a-	b63	a1	-	-	.20	.00
G	Bromus tectorum (a)	-	-	c60	a4	ab19	bc33	.87	.01	.35	.27
G	Carex sp.	6	-	-	-	2	13	-	-	.00	.13
G	Elymus cinereus	-	-	-	-	-	3	-	-	-	.38
G	Elymus glaucus	9	-	3	-	-	-	.63	-	-	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Elymus junceus</i>	-	-	-	4	4	4	-	.63	.38	.04
G	<i>Koeleria cristata</i>	ab24	a4	ab26	a7	b32	ab12	.70	.09	1.20	.03
G	<i>Melica bulbosa</i>	ab14	b24	b38	ab13	a3	a3	1.52	.13	.01	.00
G	<i>Oryzopsis hymenoides</i>	4	2	-	-	2	13	-	-	.03	.18
G	<i>Poa bulbosa</i>	a5	a7	b58	bc82	c96	c88	1.60	2.79	2.14	2.52
G	<i>Poa fendleriana</i>	b37	a16	a13	ab31	a16	ab22	.66	.66	.49	.29
G	<i>Poa pratensis</i>	bc99	d156	cd126	abc97	ab66	a52	6.76	1.46	1.83	2.15
G	<i>Poa secunda</i>	a-	a1	bc69	b34	bc71	c115	1.58	.35	1.91	6.62
G	<i>Secale cereale</i> (a)	-	-	-	-	-	2	-	-	-	.03
G	<i>Sitanion hystrix</i>	ab16	b23	a7	a-	a4	a4	.06	-	.04	.01
G	<i>Stipa lettermani</i>	b44	a22	a10	a8	a4	a4	.31	.07	.03	.03
Total for Annual Grasses		0	0	60	4	82	36	0.87	0.00	0.55	0.30
Total for Perennial Grasses		416	465	583	550	623	662	23.62	19.21	23.44	25.54
Total for Grasses		416	465	643	554	705	698	24.50	19.22	24.00	25.85
F	<i>Achillea millefolium</i>	b89	a32	a33	a41	a47	a56	1.06	.91	1.43	.92
F	<i>Allium</i> sp.	a3	b15	b22	ab12	ab6	a1	.05	.39	.02	.00
F	<i>Alyssum alyssoides</i> (a)	-	-	2	-	1	-	.00	-	.00	-
F	<i>Antennaria rosea</i>	10	-	-	-	-	1	-	-	-	.03
F	<i>Artemisia ludoviciana</i>	ab37	b55	ab42	ab45	b58	a32	1.49	1.05	1.91	.31
F	<i>Aster chilensis</i>	bc301	c310	a225	ab248	ab245	ab254	8.27	10.07	8.68	7.59
F	<i>Astragalus convallarius</i>	cd68	d82	bcd58	a24	abc40	ab32	.78	.34	.57	.11
F	<i>Astragalus</i> sp.	3	7	-	-	-	-	-	-	-	-
F	<i>Astragalus utahensis</i>	12	14	14	10	12	5	.25	.33	.22	.04
F	<i>Calochortus nuttallii</i>	b11	b19	b21	b19	b17	a-	.05	.07	.05	-
F	<i>Camelina microcarpa</i> (a)	-	-	ab16	a1	b13	a-	.13	.00	.06	-
F	<i>Cirsium</i> sp.	a7	ab21	b47	ab36	ab31	b37	1.50	.39	.62	.18
F	<i>Collomia linearis</i> (a)	-	-	7	-	1	3	.02	-	.00	.01
F	<i>Comandra pallida</i>	a-	a-	b11	a1	a-	a-	.03	.00	-	-
F	<i>Crepis acuminata</i>	a-	a-	ab6	ab8	b11	b12	.02	.09	.30	.02
F	<i>Cymopterus</i> sp.	a-	a-	b9	b12	b16	b15	.07	.37	.13	.03
F	<i>Cynoglossum officinale</i>	-	-	5	2	-	-	.01	.01	-	.00
F	<i>Descurainia pinnata</i> (a)	-	-	a-	a-	b20	a-	-	-	.06	-
F	<i>Epilobium brachycarpum</i> (a)	-	-	c81	b33	a6	a2	.51	.06	.01	.00
F	<i>Eriogonum brevicaulis</i>	ab4	ab6	b11	ab3	b7	a-	.10	.04	.10	-
F	<i>Eriogonum racemosum</i>	-	-	-	1	-	-	-	.00	-	-
F	<i>Eriogonum umbellatum</i>	-	3	5	3	6	2	.01	.03	.06	.00
F	<i>Galium aparine</i> (a)	-	-	c29	bc22	ab6	a2	.56	.19	.01	.00
F	<i>Hackelia patens</i>	ab11	ab2	b12	a4	a-	ab2	.03	.00	.00	.00
F	<i>Helianthus annuus</i> (a)	1	-	-	-	-	-	-	-	-	-
F	<i>Lactuca serriola</i> (a)	a-	b12	c33	a-	a-	a-	.24	-	-	-
F	<i>Lappula occidentalis</i> (a)	-	-	-	-	3	-	-	-	.01	-
F	<i>Lithospermum ruderales</i>	a-	a-	a1	a1	b14	a3	.03	.15	.29	.04
F	<i>Medicago sativa</i>	c113	ab10	ab18	a-	a-	b30	.35	-	-	.26
F	<i>Melilotus officinalis</i>	a-	a-	a-	a-	b13	ab3	-	-	.22	.03
F	<i>Petradoria pumila</i>	a-	a-	b25	bc32	c37	bc27	1.05	1.81	2.49	.84

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Phlox longifolia	a <sup>4</sup>	e <sup>128</sup>	cd <sup>67</sup>	d <sup>88</sup>	ab <sup>15</sup>	bc <sup>38</sup>	.21	.66	.05	.10
F	Polygonum douglasii (a)	-	-	2	1	-	1	.00	.00	-	.00
F	Sphaeralcea coccinea	-	-	-	3	3	6	-	.00	.00	.01
F	Taraxacum officinale	1	1	-	-	-	-	-	-	-	-
F	Tragopogon dubius (a)	12	16	31	9	34	31	.90	.06	.35	.25
F	Veronica biloba (a)	-	-	-	3	-	-	-	.00	-	-
F	Vicia americana	a <sup>-</sup>	a <sup>-</sup>	c <sup>131</sup>	b <sup>98</sup>	bc <sup>106</sup>	b <sup>84</sup>	2.65	.89	.71	.44
F	Viguiera multiflora	b <sup>17</sup>	b <sup>22</sup>	b <sup>30</sup>	ab <sup>10</sup>	a <sup>-</sup>	ab <sup>11</sup>	.56	.04	-	.18
Total for Annual Forbs		13	28	201	69	84	39	2.37	0.33	0.53	0.27
Total for Perennial Forbs		691	727	793	701	684	651	18.63	17.70	17.90	11.20
Total for Forbs		704	755	994	770	768	690	21.01	18.04	18.43	11.48

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

#### BROWSE TRENDS--

Management unit 17, Study no: 44

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier alnifolia	2	3	1	0	.03	-	-	-
B	Artemisia tridentata vaseyana	50	48	41	28	4.69	4.34	3.80	3.17
B	Chrysothamnus depressus	7	6	6	6	.03	.03	.06	.04
B	Chrysothamnus nauseosus albicaulis	21	16	14	17	.48	.54	.54	.72
B	Chrysothamnus viscidiflorus viscidiflorus	24	25	23	16	1.67	1.21	1.29	.37
B	Gutierrezia sarothrae	17	20	10	4	.31	.16	.04	.03
B	Juniperus osteosperma	2	2	4	3	1.78	1.78	2.14	6.63
B	Prunus virginiana	1	2	1	1	.15	-	.15	.03
B	Purshia tridentata	14	12	13	14	1.89	2.50	1.47	1.77
B	Rosa woodsii	3	3	3	1	.15	.15	.15	.00
B	Symphoricarpos oreophilus	9	10	10	11	1.16	1.82	1.60	1.47
B	Tetradymia canescens	9	9	12	10	.30	.09	.39	.10
Total for Browse		159	156	138	111	12.67	12.66	11.67	14.36

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 44

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	4.28	2.20
Chrysothamnus depressus	.18	.05
Chrysothamnus nauseosus albicaulis	1.20	1.45
Chrysothamnus viscidiflorus viscidiflorus	1.21	1.00
Gutierrezia sarothrae	.13	-
Juniperus osteosperma	7.18	7.23
Prunus virginiana	.43	.23
Purshia tridentata	2.56	1.85
Rosa woodsii	.03	-
Symphoricarpos oreophilus	2.78	1.68
Tetradymia canescens	.35	.56

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 44

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.1	1.7	1.1
Purshia tridentata	-	2.0	1.3

BASIC COVER--

Management unit 17, Study no: 44

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	5.25	12.50	46.86	54.50	56.66	61.42
Rock	.50	.75	.68	.42	.27	.84
Pavement	1.25	4.75	1.09	1.27	2.65	.75
Litter	64.00	58.25	54.79	38.76	38.87	32.62
Cryptogams	0	0	1.70	.42	.15	.15
Bare Ground	29.00	23.75	14.87	19.72	16.60	17.36

PELLET GROUP DATA--

Management unit 17, Study no: 44

Type	Quadrat Frequency			
	'97	'02	'07	'12
Sheep	-	1	-	-
Rabbit	-	1	2	-
Horse	-	-	-	2
Elk	25	18	12	2
Deer	37	15	33	7
Cattle	2	9	7	7

Days use per acre (ha)		
'02	'07	'12
1 (2)	-	-
-	-	-
-	-	3 (7)
11 (28)	51 (126)	1 (2)
36 (89)	29 (73)	7 (17)
15 (38)	2 (4)	12 (29)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 44

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Amelanchier alnifolia</b>									
83	<b>99</b>	33	67	-	-	33	67	0	34/40
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>40</b>	0	100	-	-	50	0	0	21/25
02	<b>60</b>	33	67	-	-	33	33	0	23/34
07	<b>20</b>	0	100	-	-	100	0	0	34/32
12	<b>0</b>	0	0	-	-	0	0	0	31/46
<b>Artemisia tridentata vaseyana</b>									
83	<b>2332</b>	0	47	53	99	54	33	63	22/34
89	<b>2432</b>	0	14	86	-	56	26	12	24/20
97	<b>1260</b>	5	41	54	20	52	2	40	27/37
02	<b>1160</b>	10	33	57	-	26	55	29	27/31
07	<b>980</b>	10	37	53	-	55	10	41	25/34
12	<b>600</b>	7	70	23	20	23	27	20	23/32
<b>Chrysothamnus depressus</b>									
83	<b>133</b>	0	100	0	-	0	0	0	9/11
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>460</b>	4	96	0	-	0	0	0	8/11
02	<b>180</b>	0	89	11	-	11	0	0	7/10
07	<b>220</b>	0	100	0	-	0	0	0	7/12
12	<b>200</b>	10	90	0	20	10	0	0	5/9
<b>Chrysothamnus nauseosus albicaulis</b>									
83	<b>365</b>	18	82	0	-	36	0	0	18/13
89	<b>732</b>	23	45	32	-	5	0	0	20/17
97	<b>660</b>	9	91	0	-	3	0	0	19/19
02	<b>420</b>	0	67	33	-	19	5	0	22/30
07	<b>320</b>	0	88	13	-	13	0	0	28/33
12	<b>420</b>	5	95	0	-	0	0	5	24/28
<b>Chrysothamnus viscidiflorus viscidiflorus</b>									
83	<b>832</b>	12	88	0	-	0	0	0	16/13
89	<b>1698</b>	22	69	10	-	0	0	2	14/16
97	<b>700</b>	3	94	3	-	0	0	0	15/18
02	<b>720</b>	8	92	0	-	0	0	0	11/17
07	<b>680</b>	0	94	6	-	0	0	0	15/22
12	<b>520</b>	15	85	0	-	0	0	12	14/17

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Gutierrezia sarothrae</i>										
83	<b>399</b>	17	83	0	-	0	0	0	9/8	
89	<b>666</b>	0	95	5	-	0	0	5	9/10	
97	<b>920</b>	30	65	4	-	0	0	0	9/8	
02	<b>940</b>	0	98	2	-	0	0	0	8/6	
07	<b>320</b>	0	81	19	20	0	0	6	9/8	
12	<b>80</b>	25	75	0	-	0	0	0	8/9	
<i>Juniperus osteosperma</i>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>0</b>	0	0	0	-	0	0	0	-/-	
97	<b>40</b>	0	100	0	20	0	0	0	-/-	
02	<b>60</b>	0	100	0	-	0	0	0	-/-	
07	<b>120</b>	67	17	17	-	0	0	0	-/-	
12	<b>60</b>	67	33	0	-	0	0	33	-/-	
<i>Prunus virginiana</i>										
83	<b>133</b>	100	0	0	33	100	0	25	-/-	
89	<b>199</b>	100	0	0	-	0	0	0	-/-	
97	<b>60</b>	0	100	0	-	0	0	0	16/16	
02	<b>40</b>	0	50	50	-	0	50	0	27/23	
07	<b>20</b>	0	100	0	-	0	0	0	28/35	
12	<b>40</b>	0	100	0	-	0	100	0	17/21	
<i>Purshia tridentata</i>										
83	<b>266</b>	12	88	0	-	38	25	0	16/33	
89	<b>299</b>	0	100	0	-	11	0	0	16/29	
97	<b>540</b>	4	89	7	-	37	56	7	20/37	
02	<b>380</b>	0	79	21	-	16	79	5	15/34	
07	<b>400</b>	10	90	0	20	60	15	0	22/45	
12	<b>520</b>	35	62	4	-	0	100	50	23/47	
<i>Rosa woodsii</i>										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>100</b>	40	60	-	-	0	0	0	10/13	
02	<b>160</b>	63	38	-	-	0	0	0	7/10	
07	<b>180</b>	67	33	-	-	0	0	0	8/9	
12	<b>20</b>	100	0	-	-	0	0	0	7/6	
<i>Symphoricarpos oreophilus</i>										
83	<b>1299</b>	67	33	0	33	18	3	3	13/14	
89	<b>1332</b>	42	58	0	-	0	0	0	17/11	
97	<b>320</b>	69	31	0	20	0	0	0	20/47	
02	<b>680</b>	26	74	0	-	6	0	0	15/32	
07	<b>520</b>	8	88	4	-	31	27	0	18/36	
12	<b>500</b>	0	100	0	200	0	0	4	19/26	

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Tetradymia canescens									
83	<b>66</b>	100	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>520</b>	23	77	0	-	0	0	0	10/14
02	<b>560</b>	14	86	0	60	4	0	0	8/15
07	<b>640</b>	9	66	25	-	3	0	0	9/16
12	<b>360</b>	17	83	0	-	0	0	0	10/11

NORTH BENCH - TREND STUDY NO. 17-45-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: Private

Elevation: 5,100 ft (1,554 m)

Aspect: 3-10%

Slope: South

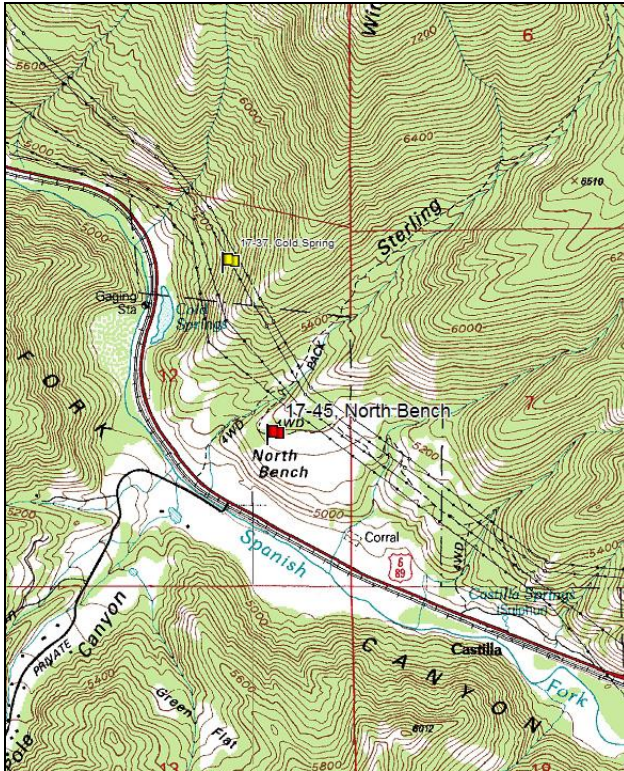
Transect bearing: 162° magnetic

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

Directions:

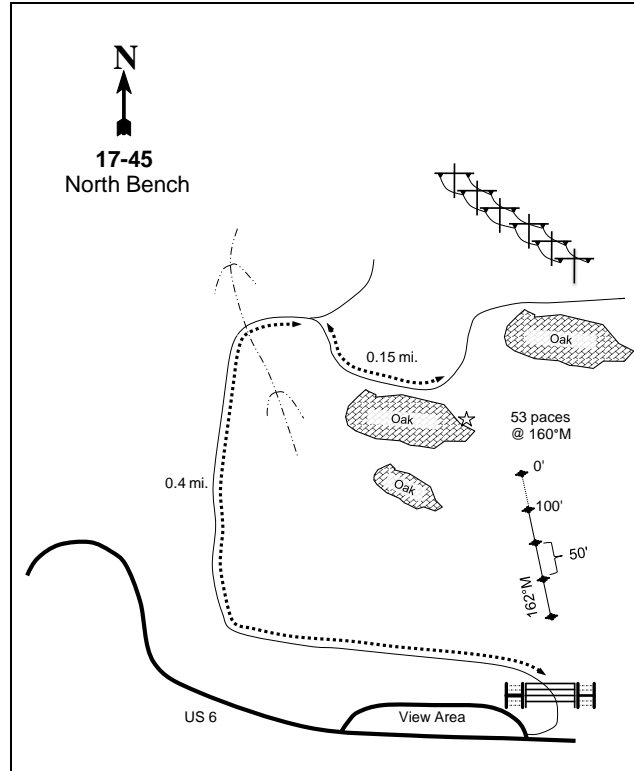
From the west side of the view area in lower Spanish Fork Canyon (about 3.5 miles up from the mouth) look for a dirt road going up through a gate and by an old corral. Take this rough road for 0.4 miles to an intersection. Turn right and go 0.15 miles to the top of the bench and an old fence line. From the wood post near the left hand side of the road, walk 53 paces bearing 160 degrees into the sage flat. The first stake marks the 0-foot end of the baseline. The remainder of the study stakes are south at 100 foot intervals.

Map Name: Spanish Fork Peak



Township: 9S Range: 3E Section: 12

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 453800 E 4432787 N



## NORTH BENCH - TREND STUDY NO. 17-45

### Site Information

Site Description: This study is located on a 40 acre section of private land in lower Spanish Fork Canyon, and is on the north side of US-6. The nearest perennial sources of water are Spanish Fork 0.2 miles to the southwest and Cold Springs 0.4 miles to the northwest. Spanish Fork is on the opposite side of US-6, but Cold Springs is on the same side as the study, which may make it the primary water source. The slope to the west of the study was being developed when the study was sampled in 2007. Deer pellet groups were sampled in low abundance since 2002. Elk pellet groups were sampled in low abundance in 2007 and 2012. Cattle pat groups were sampled in low abundance in 2002 and 2012, but in moderate abundance in 2007 (Table - Pellet Group Data). Grasshoppers were abundant in 2002 and some utilization on herbaceous plants was apparent.

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant preferred species on the study. Sagebrush is a moderately dense, mature population, which has decreased slightly in density over the course of the study. The health of the sagebrush population has been good to moderate throughout the duration of the study. Recruitment of young sagebrush to the population has been poor to moderate for most sample years, but was excellent in 1997 where the majority of the population was considered to be young. Utilization of sagebrush has been low to moderate over the course of the study. Broom snakeweed (*Gutierrezia sarothrae*) is abundant on the site. Clumps of large, mature Gambel oak (*Quercus gambelii*) occur on the slopes near the bench and dominate the hillsides above, which also provided escape and thermal cover. Rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) and antelope bitterbrush (*Purshia tridentata*) have also been sampled on the study in low abundance (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory has accounted for the majority of the vegetation cover since 1997. The perennial grasses crested wheatgrass (*Agropyron cristatum*) and the weedy species bulbous bluegrass (*Poa bulbosa*) are the dominant species. The other common perennial grass species found on the site is Kentucky bluegrass (*Poa pratensis*). The invasive annual species cheatgrass (*Bromus tectorum*) was sampled in 1997 and 2012. The most abundant forb species is hairy goldaster (*Heterotheca villosa*). Other common perennial species include curlycup gumweed (*Grindelia squarrosa*), silvery lupine (*Lupinus argenteus*), alfalfa (*Medicago sativa*), and dandelion (*Taraxacum officinale*). The annual species yellow salsify (*Tragopogon dubius*) is also present on the site. Whitetop (*Cardaria draba*) and houndstongue (*Cynoglossum officinale*) are two noxious weed species that have been sampled on the site (Table - Herbaceous Trends).

Soil: The soil is in the Collard component and is found on alluvial fans. The parent material consists of alluvium derived from sandstone, limestone, and quartzite (Soil Survey Staff 2011). The soil is a loamy texture with a soil reaction that is slightly acidic soil (pH 6.1) (Table - Soil Data Analysis). The soil surface is quite compacted, which has likely been caused by livestock as suggested by the numerous cattle paths crossing the study. Bare ground cover has varied from moderate to low with a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The erosion condition was classified as stable in 2002 and 2007, but in slight in 2012.

### Trend Assessments

#### Browse:

- **1989 to 1997 - up (+2):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Mountain big sagebrush decadence decreased from 58% to 9%, and poor vigor remained at 4%. Recruitment of young sagebrush to the population increased substantially from 2% to 56%.
- **1997 to 2002 - stable (0):** The density of mountain big sagebrush decreased 9% from 5,500 plants/acre to 5,000 plants/acre. Cover of sagebrush increased from 9% to 13%. Decadence increased

to 21%, and poor vigor increased slightly to 6%. Recruitment of young sagebrush to the population decreased considerably to 11%.

- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 32% to 3,380 plants/acre. Cover of sagebrush decreased to 12%. Decadence decreased to 14%, and poor vigor remained at 6%. Recruitment of young sagebrush to the population decreased to 2%.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush decreased 5% to 3,200 plants/acre. Cover of sagebrush remained at 12%. Decadence increased to 24%, and poor vigor increased to 27%. Recruitment of young sagebrush to the population increased to 16%.

#### Grass:

- **1989 to 1997 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 37%. Kentucky bluegrass increased significantly in nested frequency. However, Sandberg bluegrass decreased significantly in nested frequency. The weedy species bulbous bluegrass increased significantly in nested frequency, and was the most common grass on the study.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. The weedy species bulbous bluegrass increased in cover from 32% to 33%, and remained the dominant species on the study.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. Crested wheatgrass decreased significantly in nested frequency, and decreased in cover from 12% to 6%. The weedy perennial species bulbous bluegrass decreased significantly in nested frequency, and decreased in cover to 12%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar. Crested wheatgrass and orchardgrass (*Dactylis glomerata*) increased significantly in nested frequency. Crested wheatgrass increased in cover from 6% to 16%, and was the most dominant grass on the study. Kentucky bluegrass decreased significantly in nested frequency, and decreased in cover from 8% to 1%. Sandberg bluegrass increased in cover from near 0% to 4%. The weedy species bulbous bluegrass decreased significantly in nested frequency, and decreased in cover to 10%.

#### Forb:

- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial forbs increased nearly six-fold. The noxious weed houndstongue was sampled for the first time, which consequently increased significantly in nested frequency, and had a cover of 1%.
- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial forbs decreased 22%. Hairy goldaster increased significantly in nested frequency, and increased in cover from 4% to 9%. Houndstongue decreased significantly in nested frequency. Whitetop increased significantly in nested frequency.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 18%. Hairy goldaster increased significantly in nested frequency, and increased in cover to 10%. Houndstongue and whitetop decreased significantly in nested frequency, and both decreased in cover to 0%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial forbs remained similar. Hairy goldaster decreased significantly in nested frequency, and decreased in cover to 4%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 45

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	11.0	12.3	15.0	29.0	-0.1	10.0	-2.0	<b>75.3</b>	Good
02	16.6	8.7	5.5	30.0	0.0	10.0	-4.0	<b>66.8</b>	Fair-Good
07	15.3	10.8	1.0	29.6	0.0	10.0	-2.0	<b>64.7</b>	Fair-Good
12	14.3	7.8	8.0	30.0	0.0	10.0	-2.0	<b>68.1</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 45

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	ab202	ab198	bc221	a173	c272	9.33	12.38	6.33	15.51
G	Agropyron spicatum	-	-	-	3	-	-	-	.00	-
G	Bromus tectorum (a)	-	14	-	-	4	.07	-	-	.01
G	Dactylis glomerata	a5	a12	a17	a11	b32	.70	.74	.25	.52
G	Poa bulbosa	a144	c358	c368	b260	a179	31.65	33.20	12.41	9.61
G	Poa pratensis	a43	b135	bc143	c185	a76	4.02	4.80	8.17	1.09
G	Poa secunda	b314	a13	a9	a10	a36	.45	.03	.04	3.90
Total for Annual Grasses		0	14	0	0	4	0.07	0	0	0.00
Total for Perennial Grasses		708	716	758	642	595	46.17	51.15	27.22	30.65
Total for Grasses		708	730	758	642	599	46.24	51.15	27.22	30.66
F	Agoseris glauca	a-	a-	a-	a1	b19	-	-	.00	.05
F	Antennaria rosea	a-	a-	a-	a1	b43	-	-	.03	1.20
F	Artemisia ludoviciana	-	3	2	4	8	.15	.15	.03	.18
F	Aster chilensis	a-	ab4	ab6	b14	ab7	.15	.18	.25	.04
F	Astragalus cibaricus	-	-	-	-	3	-	-	-	.03
F	Cardaria draba	a-	a-	b29	a-	a-	-	.35	-	-
F	Cirsium sp.	a-	b25	a10	a3	a-	.68	.02	.00	-
F	Collinsia parviflora (a)	-	2	-	-	5	.00	-	-	.01
F	Collomia linearis (a)	-	-	2	-	-	-	.00	-	-
F	Comandra pallida	a1	a-	b8	a-	a-	-	.04	-	-
F	Cynoglossum officinale	a-	c63	b19	a1	a2	.72	.42	.00	.03
F	Epilobium brachycarpum (a)	-	c152	b57	ab34	a11	.40	.20	.11	.02
F	Erigeron pumilus	a1	b31	a-	a2	a3	.15	-	.03	.03
F	Grindelia squarrosa	ab25	d80	a7	bc41	cd66	1.09	.06	.66	.75
F	Helianthus annuus (a)	b35	b28	a5	a2	a8	.25	.01	.03	.04
F	Heterotheca villosa	a-	b131	c193	d245	b136	3.53	9.06	9.98	4.30
F	Lactuca serriola (a)	ab6	ab6	a-	ab3	b11	.01	-	.01	.20
F	Lithospermum sp.	b47	a-	a-	a-	a-	-	-	-	-
F	Lupinus argenteus	a-	b20	bc27	cd46	d61	.95	1.26	2.62	1.94
F	Machaeranthera canescens	-	-	-	8	-	-	-	.04	-
F	Medicago sativa	a1	ab14	b20	ab11	b21	.90	1.48	.34	1.01

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Melilotus officinalis	a <sup>-</sup>	a <sup>4</sup>	a <sup>1</sup>	a <sup>8</sup>	b <sup>46</sup>	.15	.00	.05	1.03
F	Phlox longifolia	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	ab <sup>5</sup>	b <sup>12</sup>	-	-	.01	.25
F	Polygonum douglasii (a)	-	3	-	-	-	.00	-	-	-
F	Taraxacum officinale	a <sup>-</sup>	c <sup>53</sup>	b <sup>14</sup>	ab <sup>5</sup>	b <sup>15</sup>	1.07	.32	.03	.03
F	Tragopogon dubius (a)	a <sup>61</sup>	c <sup>205</sup>	b <sup>133</sup>	a <sup>61</sup>	b <sup>106</sup>	2.44	2.50	.36	.83
F	Verbascum thapsus	-	-	-	-	6	-	-	-	.04
Total for Annual Forbs		102	396	197	100	141	3.12	2.72	0.52	1.10
Total for Perennial Forbs		75	428	336	395	448	9.56	13.38	14.11	10.95
Total for Forbs		177	824	533	495	589	12.69	16.10	14.64	12.05

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

#### BROWSE TRENDS--

Management unit 17, Study no: 45

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Acer grandidentatum	0	0	0	1	-	-	-	-
B	Artemisia tridentata vaseyana	89	85	80	79	8.82	13.24	12.17	11.46
B	Chrysothamnus nauseosus albicaulis	1	0	1	1	-	-	.03	-
B	Gutierrezia sarothrae	27	41	43	34	1.20	2.37	1.57	1.21
B	Purshia tridentata	0	0	1	0	-	-	-	-
B	Quercus gambelii	0	0	1	1	-	-	-	-
Total for Browse		117	126	126	116	10.02	15.61	13.77	12.67

#### CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 45

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	18.68	10.73
Chrysothamnus nauseosus albicaulis	.08	.05
Gutierrezia sarothrae	.73	1.11

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 45

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	3.4	2.1	2.0

**BASIC COVER--**

Management unit 17, Study no: 45

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	24.00	59.20	71.77	56.59	55.25
Rock	.75	.10	.02	0	.66
Pavement	1.25	.28	.14	.03	.00
Litter	58.25	39.26	37.77	42.80	52.28
Cryptogams	0	.97	.81	.04	.02
Bare Ground	15.75	10.44	5.02	13.96	3.70

**PELLET GROUP DATA--**

Management unit 17, Study no: 45

Type	Quadrat Frequency			
	'97	'02	'07	'12
Elk	-	1	4	-
Deer	1	7	4	1
Cattle	2	5	3	1

Days use per acre (ha)		
'02	'07	'12
-	4 (10)	1 (2)
8 (20)	4 (10)	1 (2)
6 (14)	31 (77)	9 (22)

**BROWSE CHARACTERISTICS--**

Management unit 17, Study no: 45

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Acer grandidentatum</b>									
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	40	100	0	-	-	0	0	0	14/7
<b>Artemisia tridentata vaseyana</b>									
89	2998	2	40	58	266	16	0	4	29/31
97	5500	56	35	9	1480	3	0	4	36/42
02	5000	11	68	21	40	10	2	6	19/23
07	3380	2	85	14	380	24	7	6	21/29
12	3200	16	59	24	60	9	.62	27	20/26
<b>Chrysothamnus nauseosus albicaulis</b>									
89	0	0	0	-	-	0	0	0	-/-
97	20	0	100	-	-	0	0	0	27/46
02	0	0	0	-	-	0	0	0	19/28
07	40	0	100	-	-	0	0	0	27/24
12	20	0	100	-	-	0	0	0	25/16

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Gutierrezia sarothrae</i>									
89	<b>398</b>	50	50	0	466	0	0	0	6/8
97	<b>3400</b>	39	59	2	1100	0	0	0	6/7
02	<b>4800</b>	4	88	8	20	.41	0	.41	8/8
07	<b>2180</b>	5	94	1	20	7	2	.91	9/10
12	<b>1440</b>	3	96	1	-	0	1	19	8/8
<i>Purshia tridentata</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>20</b>	0	100	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Quercus gambelii</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>20</b>	100	0	-	-	0	0	0	33/28
12	<b>20</b>	100	0	-	-	100	0	0	23/10
<i>Symphoricarpos oreophilus</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	14/16
12	<b>0</b>	0	0	-	-	0	0	0	37/27

LOWER TANK HOLLOW - TREND STUDY NO. 17-46-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: USFS

Elevation: 5,900 ft (1,798 m)

Aspect: Southwest

Slope: 10%

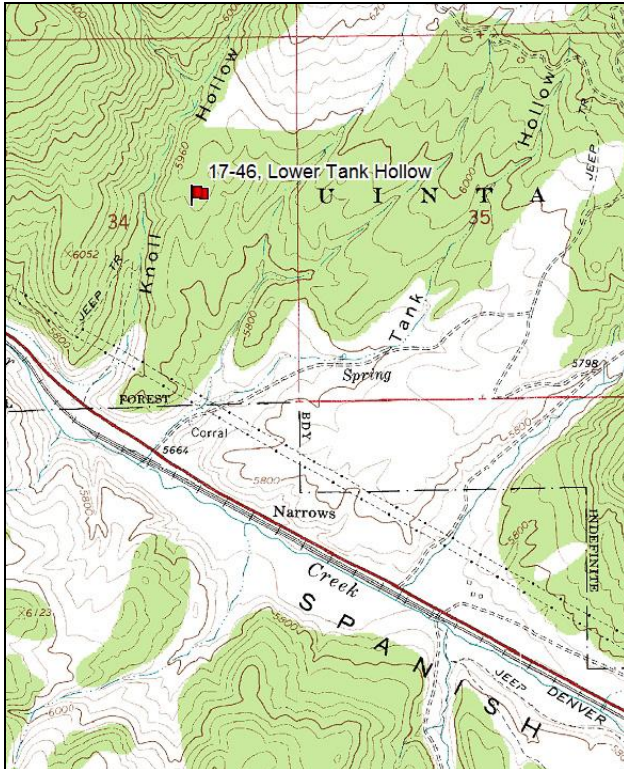
Transect bearing: 175° magnetic

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

Directions:

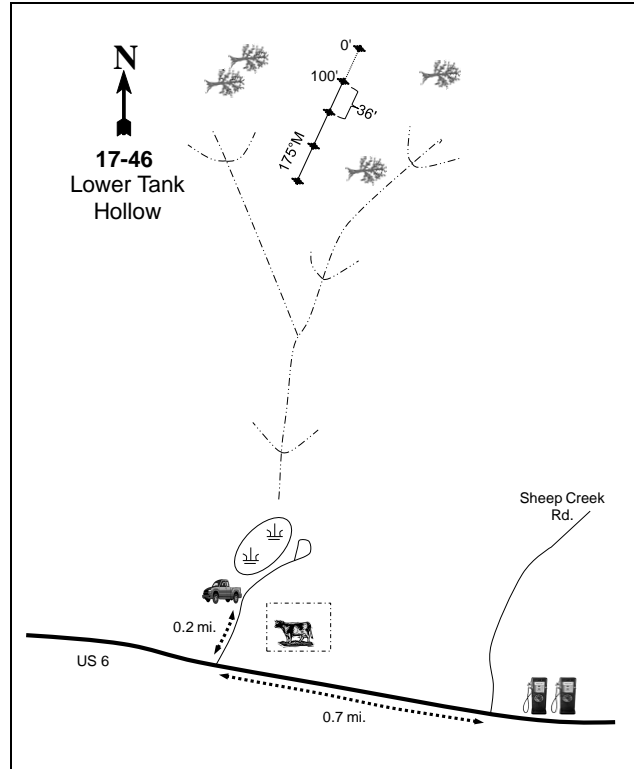
In Spanish Fork Canyon, turn north up Tank Hollow, which is 0.7 miles west of the Sheep Creek Road and cafe on Highway 6. Drive about 0.2 miles and stop by a small stock pond in the forks of the drainage. From here, walk north about 1/2 mile up the left fork, and keep left at two other major forks. Where the wash starts to flatten out at the head, there is a chained ridge to the right. The study site is on the ridge, about 20 paces from the center of the drainage. The 0-foot baseline stake is near the highest point on the ridge.

Map Name: Mill Fork



Township: 9S Range: 5E Section: 34

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 470019 E 4426679 N

## LOWER TANK HOLLOW - TREND STUDY NO. 17-46

### Site Information

Site Description: The study is located on a small ridge that is on land administered by the United States Forest Service (USFS), and is part of the Diamond Fork grazing allotment. The study samples a chaining and seeding treatment on crucial winter range that was completed in 1971. In 2007 and 2008, Utah juniper (*Juniperus osteosperma*) and pinyon pines (*Pinus edulis*) were lopped and scattered as part of the Tank Hollow improvement Project ([WRI Project #658](#)). The nearest perennial source of water is Soldier Creek at 0.7 miles to the south and a stock pond 0.5 miles to the south. Deer pellet groups were sampled in high abundance in 2002, but in moderate abundance in 2007 and 2012. Elk pellet groups have been sampled in low abundance since 2002. Cattle pat groups have been sampled in low abundance since 2002 (Table - Pellet Group Data). Cattle were present when the study was sampled in 2002. .

Browse: Before the 1971 chaining and seeding, the overstory was dominated by a mature stand of pinyon pine and Utah juniper. Though the chaining was effective in pulling the trees over, several of the juniper trees survived. Some of the trees were not all chained and have grown since the chaining. Juniper tree density and average diameters increased between 2002 and 2007, but decreased in 2012 as a result of the 2007-2008 lop and scatter treatment. Prior to lop and scatter treatment, the woodland succession stage was considered to be in Phase II, but is now considered to be in Phase I (Tausch et al. 2009). Preferred browse is somewhat limited. Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and antelope bitterbrush (*Purshia tridentata*) are the most abundant preferred species. Basin big sagebrush is a sparse, mature population. Sagebrush has varied in density over the course of the study. Both decadence and poor vigor has been moderate to moderately-high throughout the course of the study. Recruitment of young sagebrush to the population has decreased over the course of the study and is a minor component of the sagebrush population. In 2007, nearly half of the sagebrush population was infested with the sagebrush defoliator moth (*Aroga websteri*). Utilization of sagebrush has varied from light to heavy throughout the study. Antelope bitterbrush is a sparse, mature population. The density of bitterbrush has gradually increased over the course of the study. The health of the bitterbrush population has been good most sample years, but was poor in 2002 with decadence and poor vigor being high and moderate, respectively. Recruitment of young bitterbrush to the population has been minimal. Utilization of bitterbrush has been mostly heavy over the course of the study. Other low-density populations of browse species include Utah serviceberry (*Amelanchier utahensis*), dwarf rabbitbrush (*Chrysothamnus depressus*), white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), Parry's rabbitbrush (*Chrysothamnus parryi*), Woods rose (*Rosa woodsii*), and snowberry (*Symphoricarpos oreophilus*). Utilization has been light on all but serviceberry, Parry's rabbitbrush, and snowberry. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) is the most abundant browse species, but browse use has been light in all sample years (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is diverse and fairly abundant. Crested wheatgrass (*Agropyron cristatum*) is the dominant perennial grass on the study. Other seeded grasses include intermediate wheatgrass (*A. intermedium*), smooth brome (*Bromus inermis*), and orchardgrass (*Dactylis glomerata*). The invasive annual grass species cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicus*) are the only annual species present and are found in low abundance. Perennial forb species are not common on the site, but the community is moderately diverse. Perennial forbs sampled on the study include western aster (*Aster chilensis*), mat penstemon (*Penstemon caespitosus*), and phlox (*Phlox hoodii*). The noxious weeds whitetop (*Cardaria draba*) and musk thistle (*Carduus nutans*) have been sampled on the study in low abundance (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. The soil texture is a clay loam with a neutral soil reaction (pH of 7.2) (Table - Soil Data Analysis). It is underlain by a layer of shale. Ground cover is high with a high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). There is evidence of substantial past erosion in the form of exposed roots and pedestalled plants. The soil erosion condition was classified as slight in 2002 and 2007, but moderate in 2012.



## Trend Assessments

### Browse:

- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Basin big sagebrush decadence and poor vigor decreased from 33% to 14% and 33% to 10%, respectively. Recruitment of young sagebrush to the population decreased from 33% to 24%. The average height and crown size of sagebrush plants increased from 26in. by 22in. to 40in. by 38in., respectively. Antelope bitterbrush decadence and poor vigor was not observed within the population. The average height and crown size of bitterbrush plants increased from 10in. by 35in to 16in. by 55in., respectively.
- **1997 to 2002 - slightly down (-1):** The density of basin big sagebrush decreased 10% from 420 plants/acre to 380 plants/acre. Cover of sagebrush increased from 1% to 2%. Decadence increased to 37%, and poor vigor increased to 21%. Recruitment of young sagebrush plants to the population decreased to 11%. The average height and crown size of sagebrush plants decreased to 32in by 32 in., respectively. The density of antelope bitterbrush increased over two-fold from 120 plants/acre to 260 plants/acre. The cover of bitterbrush increased from 2% to 3%. Decadence increased to 69%, and poor vigor increased to 38%. Recruitment of young bitterbrush to the population was not observed. Average height and crown measurement remained similar.
- **2002 to 2007 - stable (0):** The density of basin big sagebrush decreased 42% to 220 plants/acre. Cover of sagebrush decreased to less than 1%. Decadence increased to 55%, and poor vigor remained similar to 18%. Recruitment of young sagebrush to the population remained similar at 9%. The density of antelope bitterbrush increased 54% to 400 plants/acre. The cover of bitterbrush decreased to 2%. Decadence decreased to 5%, and poor vigor decreased to 0%. The average height and crown size of bitterbrush plants decreased to 15in. by 31in., respectively.
- **2007 to 2012 - up (+2):** The density of basin big sagebrush increased 27% to 280 plants/acre. The cover of sagebrush increased to 1%. Decadence decreased to 29%, and poor vigor increased slightly to 21%. Recruitment of young sagebrush to the population remained similar at 7%. The average height and crown size of sagebrush plants increased to 35in. by 36in., respectively. The density of antelope bitterbrush increased 55% to 620 plants/acre. Cover of bitterbrush increased to 3%. Decadence decreased to 0%, and poor vigor increased to 13%. Recruitment of young bitterbrush to the population remained poor. The average height and crown size of bitterbrush plants increased to 17in. by 40in., respectively.

### Grass:

- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial grasses increased 43%. Crested wheatgrass, bluebunch wheatgrass, Kentucky bluegrass, and Sandberg bluegrass increased significantly in nested frequency. Mutton bluegrass (*Poa fendleriana*) and Indian ricegrass (*Oryzopsis hymenoides*) decreased significantly in nested frequency.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial grasses decreased 11%. Crested wheatgrass increased significantly in nested frequency, and increased in cover from 13% to 15%. Bluebunch wheatgrass and Kentucky bluegrass decreased significantly in nested frequency, and decreased in cover from 3% to near 0% and 1% to less than 1%, respectively. The invasive annual grass species cheatgrass decreased significantly in nested frequency, and decreased in cover from 1% to near 0%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial grasses remained similar. The annual grass species increased in significantly in nested frequency.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses remained similar.

### Forb:

- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial forbs increased 38%. Musk thistle was sampled for the first time in moderate frequency and cover.

- **1997 to 2002 - down (-2):** The sum of nested frequencies of perennial forbs decreased 62%. Whitetop was sampled for the first time in low frequency and cover. Musk thistle decreased significantly in nested frequency.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 14%. The perennial forb community increased in diversity. Musk thistle was sampled in low frequency and cover. Whitetop was not sampled on the study.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 18%. Noxious weeds were not observed on the study site.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 46

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	4.7	0.0	0.0	30.0	-0.4	10.0	-2.0	<b>42.3</b>	Poor
02	7.7	-1.6	6.7	30.0	0.0	3.5	-2.0	<b>44.4</b>	Poor
07	4.1	0.0	0.0	30.0	-0.1	3.8	-2.0	<b>35.9</b>	Very Poor-Poor
12	5.9	13.7	0.5	30.0	0.0	3.5	0.0	<b>53.6</b>	Fair

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 17, Study no: 46

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a71	b164	c224	c238	c253	12.57	14.51	17.55	19.57
G	Agropyron intermedium	b31	ab19	ab23	ab12	a3	.18	.19	.16	.01
G	Agropyron spicatum	a7	b36	a4	a3	a1	2.79	.03	.06	.00
G	Bromus inermis	b30	a7	a-	a-	a-	.21	-	-	-
G	Bromus japonicus (a)	-	a-	a-	b14	a-	-	-	.08	-
G	Bromus tectorum (a)	-	b29	a6	a9	a1	.51	.01	.04	.00
G	Dactylis glomerata	-	1	3	-	-	.03	.01	-	-
G	Leucopoa kingii	11	-	-	-	-	-	-	-	-
G	Oryzopsis hymenoides	c56	b30	b36	ab23	a1	.68	.79	.47	.03
G	Poa fendleriana	b36	a1	a1	a-	a2	.03	.00	-	.00
G	Poa pratensis	a-	b59	a15	a3	a-	1.44	.33	.00	-
G	Poa secunda	a-	b20	ab3	b15	ab9	.55	.03	.38	.04
G	Sitanion hystrix	-	-	1	-	-	-	.00	-	-
G	Stipa comata	4	-	-	-	-	-	-	-	-
G	Stipa lettermani	-	14	4	-	-	.72	.06	-	-
Total for Annual Grasses		0	29	6	23	1	0.50	0.00	0.11	0.00
Total for Perennial Grasses		246	351	314	294	269	19.22	15.98	18.63	19.67
Total for Grasses		246	380	320	317	270	19.73	15.99	18.75	19.67
F	Achillea millefolium	-	1	-	-	-	.00	-	-	-
F	Agoseris glauca	-	5	-	2	-	.01	-	.01	-
F	Allium sp.	-	10	2	6	-	.02	.00	.01	-
F	Alyssum alyssoides (a)	-	b63	a2	c120	b63	1.16	.01	.55	.17

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Aster chilensis</i>	b100	b93	a22	a6	a5	1.16	.26	.09	.03
F	<i>Astragalus cibarius</i>	-	-	-	3	6	-	-	.03	.01
F	<i>Astragalus convallarius</i>	abc13	bc25	a3	c28	ab4	.36	.03	.26	.01
F	<i>Astragalus sp.</i>	3	-	-	-	-	-	-	-	-
F	<i>Astragalus utahensis</i>	5	4	-	3	7	.06	-	.01	.06
F	<i>Calochortus nuttallii</i>	-	2	-	1	4	.01	-	.00	.06
F	<i>Camelina microcarpa</i> (a)	-	b13	a1	a3	a-	.03	.00	.01	-
F	<i>Cardaria draba</i>	-	-	12	-	-	-	.04	-	-
F	<i>Carduus nutans</i> (a)	-	b22	a-	a4	a-	.37	-	.01	-
F	<i>Castilleja linariaefolia</i>	-	8	-	-	3	.04	-	-	.03
F	<i>Chaenactis douglasii</i>	a2	b19	a-	a4	a-	.12	-	.01	-
F	<i>Cirsium sp.</i>	c39	b22	ab4	a3	ab9	.45	.06	.00	.07
F	<i>Collinsia parviflora</i> (a)	-	-	-	-	2	-	-	-	.00
F	<i>Comandra pallida</i>	a-	b32	a-	a-	a1	.40	-	-	.00
F	<i>Crepis acuminata</i>	-	1	-	-	-	.00	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	4	-	3	4	.02	-	.01	.03
F	<i>Epilobium brachycarpum</i> (a)	-	1	-	-	5	.00	-	-	.30
F	<i>Erigeron pumilus</i>	b27	a-	a2	a-	a-	-	.00	-	-
F	<i>Eriogonum brevicaulis</i>	c21	abc10	ab8	a2	bc25	.33	.46	.06	.36
F	<i>Hackelia patens</i>	4	4	-	3	-	.04	-	.03	-
F	<i>Hedysarum boreale</i>	-	4	-	-	-	.18	-	-	-
F	<i>Iva axillaris</i>	a-	a-	a-	b17	a-	-	-	.30	-
F	<i>Lactuca serriola</i> (a)	-	-	-	3	-	-	-	.00	-
F	<i>Lappula occidentalis</i> (a)	-	10	-	-	-	.19	-	-	-
F	<i>Lithospermum ruderales</i>	a-	b18	b13	ab4	ab6	.46	.28	.04	.04
F	<i>Lomatium sp.</i>	-	3	-	-	2	.01	-	-	.01
F	<i>Machaeranthera canescens</i>	b9	a-	a-	ab2	a-	-	-	.03	-
F	<i>Penstemon caespitosus</i>	a-	ab7	ab10	ab4	b11	.33	.04	.03	.22
F	<i>Phlox hoodii</i>	15	16	19	20	21	.42	.42	.63	.75
F	<i>Phlox longifolia</i>	11	11	18	15	17	.02	.06	.08	.04
F	<i>Ranunculus testiculatus</i> (a)	-	4	-	8	-	.01	-	.02	-
F	<i>Salsola pestifer</i> (a)	8	-	-	-	-	-	-	-	-
F	<i>Sphaeralcea coccinea</i>	-	3	5	2	1	.15	.01	.01	.00
F	<i>Taraxacum officinale</i>	-	2	1	-	-	.00	.00	-	-
F	<i>Tragopogon dubius</i> (a)	a2	b17	a4	a2	a3	.10	.03	.00	.01
F	<i>Verbascum thapsus</i>	-	5	-	-	-	.03	-	-	-
F	<i>Vicia americana</i>	a-	c35	b11	bc23	a-	.27	.05	.22	-
F	<i>Viola sp.</i>	-	3	-	-	-	.15	-	-	-
Total for Annual Forbs		10	134	7	143	77	1.89	0.05	0.61	0.52
Total for Perennial Forbs		249	343	130	148	122	5.09	1.76	1.91	1.73
Total for Forbs		259	477	137	291	199	6.99	1.81	2.52	2.25

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

BROWSE TRENDS--

Management unit 17, Study no: 46

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier utahensis	4	3	2	2	.78	.53	.41	.56
B	Artemisia tridentata tridentata	17	18	11	12	1.04	1.73	.36	.59
B	Chrysothamnus depressus	13	3	4	5	.43	-	.15	.01
B	Chrysothamnus nauseosus albicaulis	3	1	1	1	.00	-	-	.15
B	Chrysothamnus parryi	0	11	10	11	-	.40	.40	.24
B	Chrysothamnus viscidiflorus viscidiflorus	34	37	28	26	1.88	1.71	.85	1.14
B	Gutierrezia sarothrae	10	19	5	10	.36	.07	.04	.01
B	Juniperus osteosperma	10	8	10	4	6.30	10.64	7.44	1.36
B	Opuntia sp.	3	8	6	5	.18	.01	.18	.15
B	Purshia tridentata	5	10	10	10	1.49	3.17	2.02	2.73
B	Rhus trilobata	0	1	0	0	-	-	-	-
B	Rosa woodsii	0	1	0	0	-	-	.03	.00
B	Symphoricarpos oreophilus	3	5	5	4	.15	.15	.04	.56
Total for Browse		102	125	92	90	12.64	18.44	11.94	7.53

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 46

Species	Percent Cover		
	'02	'07	'12
Amelanchier utahensis	1.28	.76	1.10
Artemisia tridentata tridentata	1.31	.78	1.23
Chrysothamnus depressus	.06	.08	.26
Chrysothamnus nauseosus albicaulis	-	-	.26
Chrysothamnus parryi	.45	.61	.83
Chrysothamnus viscidiflorus viscidiflorus	1.38	.58	1.38
Gutierrezia sarothrae	.03	-	.18
Juniperus osteosperma	5.83	13.19	3.73
Opuntia sp.	-	.11	-
Purshia tridentata	2.43	2.34	3.48
Symphoricarpos oreophilus	.18	.40	1.13

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 46

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata tridentata	1.5	1.9	1.7
Purshia tridentata	1.6	2.3	1.4

POINT-QUARTER TREE DATA--

Management unit 17, Study no: 46

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	74	75	33	6.4	7.0	5.8

BASIC COVER--

Management unit 17, Study no: 46

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	6.00	36.93	34.80	33.98	28.89
Rock	1.25	.73	1.97	.87	1.33
Pavement	9.75	5.83	3.66	4.63	4.07
Litter	45.25	41.37	40.40	28.22	50.84
Cryptogams	0	1.41	2.48	2.65	.87
Bare Ground	37.75	24.28	35.84	40.81	25.45

PELLET GROUP DATA--

Management unit 17, Study no: 46

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	3	8	7	5	-	-	-
Elk	11	14	4	1	5 (13)	12 (30)	1 (3)
Deer	30	36	42	18	47 (116)	24 (60)	20 (50)
Cattle	1	2	5	4	7 (16)	8 (20)	12 (30)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 46

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>									
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>100</b>	40	60	0	-	0	60	0	28/36
02	<b>60</b>	0	67	33	-	0	100	33	32/38
07	<b>40</b>	0	100	0	-	50	50	0	39/41
12	<b>40</b>	0	100	0	-	100	0	50	30/33
<b>Artemisia tridentata tridentata</b>									
89	<b>99</b>	33	33	33	-	0	67	33	26/22
97	<b>420</b>	24	62	14	-	10	5	10	40/38
02	<b>380</b>	11	53	37	-	16	68	21	32/32
07	<b>220</b>	9	36	55	-	45	18	18	30/25
12	<b>280</b>	7	64	29	200	36	7	21	35/36

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Chrysothamnus depressus</b>									
89	0	0	0	0	-	0	0	0	-/-
97	860	9	91	0	80	0	0	0	6/14
02	120	0	83	17	-	0	0	0	4/9
07	180	0	100	0	-	0	0	0	7/12
12	120	17	67	17	-	50	17	17	6/16
<b>Chrysothamnus nauseosus albicaulis</b>									
89	33	100	0	0	-	0	0	0	-/-
97	60	67	33	0	-	33	0	0	24/27
02	20	0	0	100	-	0	0	100	26/40
07	40	0	100	0	-	0	0	0	19/15
12	40	0	100	0	-	100	0	0	23/24
<b>Chrysothamnus parryi</b>									
89	0	0	0	0	-	0	0	0	-/-
97	0	0	0	0	-	0	0	0	-/-
02	900	0	82	18	-	60	16	11	6/13
07	520	23	77	0	-	23	0	0	8/11
12	1160	21	79	0	20	34	28	0	15/21
<b>Chrysothamnus viscidiflorus viscidiflorus</b>									
89	3032	8	84	9	-	0	0	5	11/12
97	1320	11	79	11	-	0	2	2	14/14
02	2020	3	66	31	-	16	5	18	8/12
07	1280	13	64	23	-	6	3	14	9/13
12	1000	10	84	6	240	12	0	54	11/19
<b>Eriogonum microthecum</b>									
89	33	0	100	-	-	0	0	0	4/8
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<b>Gutierrezia sarothrae</b>									
89	0	0	0	0	-	0	0	0	-/-
97	480	21	75	4	60	0	0	0	11/11
02	680	3	53	44	-	3	3	41	8/10
07	160	0	88	13	-	0	0	0	9/9
12	320	25	75	0	-	0	0	0	10/13
<b>Juniperus osteosperma</b>									
89	0	0	0	-	-	0	0	0	-/-
97	220	36	64	-	40	0	9	0	74/101
02	160	13	88	-	20	0	0	0	-/-
07	200	20	80	-	-	0	0	0	-/-
12	80	100	0	-	-	0	0	0	-/-

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Opuntia</i> sp.									
89	<b>33</b>	0	100	-	33	0	0	0	7/9
97	<b>140</b>	29	71	-	80	0	0	0	3/15
02	<b>160</b>	13	88	-	-	0	0	0	4/12
07	<b>120</b>	17	83	-	-	0	0	0	5/11
12	<b>120</b>	17	83	-	-	0	0	0	3/9
<i>Purshia tridentata</i>									
89	<b>33</b>	0	100	0	-	0	100	0	10/35
97	<b>120</b>	17	83	0	-	17	67	0	16/55
02	<b>260</b>	0	31	69	-	0	100	38	16/57
07	<b>400</b>	0	95	5	-	0	100	0	15/31
12	<b>620</b>	0	100	0	-	23	77	13	17/40
<i>Rhus trilobata</i>									
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>0</b>	0	0	0	-	0	0	0	-/-
02	<b>20</b>	0	0	100	-	0	0	0	-/-
07	<b>0</b>	0	0	0	-	0	0	0	12/6
12	<b>0</b>	0	0	0	-	0	0	0	67/100
<i>Rosa woodsii</i>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>20</b>	100	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	4/7
12	<b>0</b>	0	0	-	20	0	0	0	2/2
<i>Symphoricarpos oreophilus</i>									
89	<b>66</b>	0	50	50	-	50	50	50	15/17
97	<b>80</b>	0	100	0	-	0	0	0	22/35
02	<b>100</b>	0	80	20	-	20	0	0	16/22
07	<b>100</b>	20	80	0	-	40	0	0	13/17
12	<b>180</b>	0	100	0	-	0	0	0	18/28

TIE FORK EAST - TREND STUDY NO. 17-47-12

Vegetation Type: Pinyon-Juniper

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: Mountain Stony Loam (Browse), R047XA460UT

Land Ownership: Private

Elevation: 6,400 ft (1,951 m)

Aspect: North

Slope: 18%

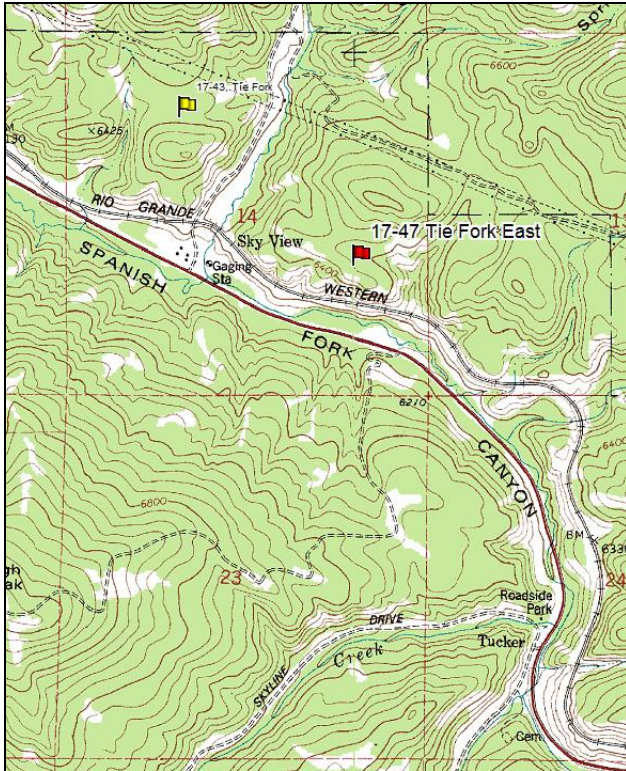
Transect bearing: 0° magnetic

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

Directions:

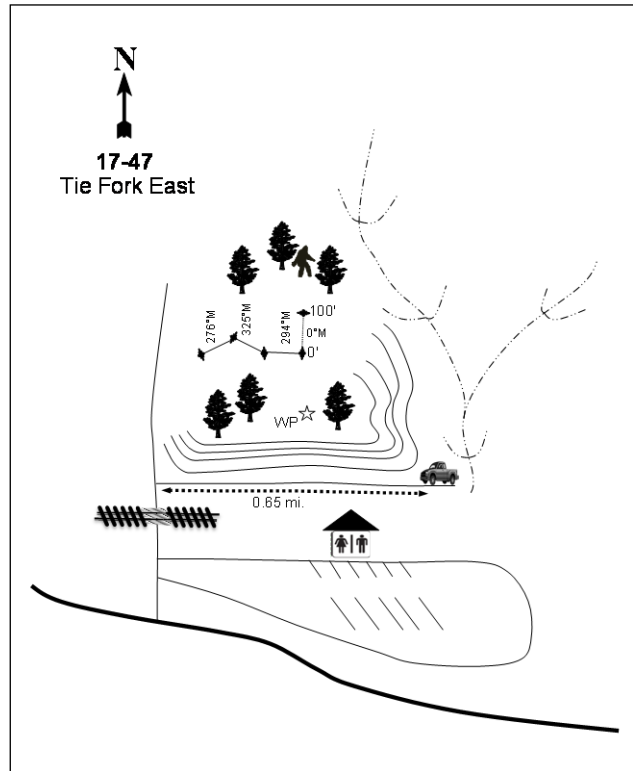
From the intersection of Highway U.S. 6 and Tie Fork at Sky View in Spanish Fork Canyon, go north up to the railroad tracks. Cross the tracks and turn right. Follow the road along the railroad tracks for 0.65 miles. Stop at a pullout at the mouth of a small side canyon with a huge pit on the north side of the road. Walk up the ridge to the west 200 yards to a witness post in a small rock outcrop on the bare ridgetop, by some mahogany. From the witness post, walk 18 paces north (3 degrees) to the 0-foot baseline stake.

Map Name: Tucker



Township: 10S Range: 6E Section: 14

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 482147 E 4422199 N



## Site Information

Site Description: This study is located on private land found on the north side of US-6 and east of the community of Sky View. The study was established in 1989 and replaced Tie Fork study (17-43). This study is more xeric than Tie Fork, and supports a scattered Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*) community with a mountain brush understory. The nearest perennial sources of water are Tie Fork at 0.4 miles to the east and Spanish Fork at 750 feet to the south. However, Spanish Fork is on the opposite side of US-6. No livestock are present in the area, but sheep are thought to trail through. Approximately a third of the deer pellet groups sampled in 2012 was fresh sign. Some sign was likely from fawn presence in 2012. Deer pellet groups were sampled in high abundance in 2002 and 2007, and in moderate abundance in 2012. Elk pellet groups were sampled in low abundance since 2002 (Table - Pellet Group Data).

Browse: The browse community is a combination of large Utah juniper and pinyon pine in association with a shrub understory. The woodland succession stage is considered to be in Phase II (Tausch et al. 2009). The Utah juniper population is moderately dense, mature stand of large trees. The juniper population has varied in density over the course of the study. The pinyon pine population is a sparse, young stand of trees. The pinyon pine population has increased in density over the course of the study. (Table - Point-Quarter Data). Several preferred forage species occur in the understory including Saskatoon serviceberry (*Amelanchier alnifolia*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and true mountain mahogany (*Cercocarpus montanus*). Saskatoon serviceberry is a sparse, mature population. The density of the serviceberry population has gradually decreased throughout the duration of the study. The health of the serviceberry population has been good to fair over the same period. Recruitment of young serviceberry to the population has been minimal. Utilization of serviceberry has varied between light to heavy use. Mountain big sagebrush is a sparse, mature population. The density of the sagebrush population has remained relatively stable throughout the duration of the study. The health of the sagebrush population has been poor over the course of the study with high decadence, and moderate poor vigor. Recruitment of young sagebrush to the population has been a minor component of the population. Utilization of sagebrush has received light to moderate use. True mountain mahogany is a moderately dense, mature population. Health of the mahogany population has been fair to poor. Recruitment of young mahogany to the population has been low to moderate over the course of the study. Utilization of mahogany has been mostly heavy throughout the duration of study (Table - Browse Characteristics).

Herbaceous Understory: Total herbaceous cover is relatively low, and diversity of the herbaceous understory is considered moderate. The dominant perennial grass species include bluebunch wheatgrass (*Agropyron spicatum*), sedge (*Carex* sp.), Sandberg wheatgrass (*Poa secunda*), and Indian ricegrass (*Oryzopsis hymenoides*). The invasive species cheatgrass (*Bromus tectorum*) and Japanese brome (*B. japonicus*) have both been sampled. Perennial forb diversity is moderate, but most species are not abundant. The dominant perennial species include Wasatch penstemon (*Penstemon cyananthus*) and spotted stickseed (*Hackelia patens*). The noxious weeds musk thistle (*Carduus nutans*) and houndstongue (*Cynoglossum officinale*) have been sampled on the study. Both species have been low in cover and frequency since 2002 (Table - Herbaceous Trends).

Soil: National Resources Conservation Services (NRCS) soil data was not available. The soil texture is a clay loam with a neutral soil reaction (pH of 7.3) (Table - Soil Data Analysis). Bare ground cover is high with has high amount of litter and vegetation providing protective ground cover (Table - Basic Cover). There are areas of localized erosion with active gullies forming below the site. The soil erosion condition class was determined to be slight in 2002 and 2007, but stable in 2012.

## Trend Assessments

### Browse:

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Saskatoon serviceberry decadence decreased from 23% to 0%, and poor vigor decreased from 8% to 0%. Recruitment of young serviceberry to the population was excellent increasing from 54% to 87%. Mountain big sagebrush decadence increased from 47% to 50%, and poor vigor increased from 7% to 13%. Recruitment of young sagebrush to the population decreased from 33% to 0%. True mountain mahogany decadence decreased from 16% to 11%, and poor vigor decreased from 5% to 0%. Recruitment of young mahogany decreased from 32% to 11%.
- **1997 to 2002 - up (+2):** The density of Saskatoon serviceberry decreased 7% from 300 plants/acre to 280 plants/acre. Decadence and poor vigor remained at 0%. Recruitment of young serviceberry to the population decreased to 43%. The density of mountain big sagebrush increased 63% from 160 plants/acre to 260 plants/acre. Decadence decreased to 38%, but poor vigor increased to 23%. Recruitment of young sagebrush to the population increased 15%. The density of true mountain mahogany increased 30% from 540 plants/acre to 700 plants/acre. Cover of mahogany decreased from 3% to 2%. Decadence increased to 23%, and poor vigor increased to 11%. Recruitment of young mahogany plants decreased to 6%.
- **2002 to 2007 - stable (0):** The density of Saskatoon serviceberry decreased 36% to 180 plants/acre. Decadence and poor vigor both increased to 11%. The density of mountain big sagebrush decreased 38% to 160 plants/acre. Decadence increased to 50%, and poor vigor remained similar at 25%. Recruitment of young sagebrush to the population increased to 38%. The density of true mountain mahogany decreased 17% to 580 plants/acre. Cover remained near 2%. Decadence increased to 34%, and poor vigor remained similar at 10%. Recruitment of young mahogany plants to the population increased to 14%.
- **2007 to 2012 - stable (0):** The density of Saskatoon serviceberry decreased 22% to 140 plants/acre. Decadence decreased to 0%, and poor vigor increased to 29%. Recruitment of young serviceberry to the population decreased to 29%. The density of mountain big sagebrush increased 25% to 200 plants/acre. Decadence decreased to 20%, and poor vigor increased slightly to 30%. Recruitment of young sagebrush plants to the population decreased to 20%. The density of true mountain mahogany decreased 7% to 540 plants/acre. Cover of mahogany decreased to 1%. Decadence decreased to 26%, and poor vigor increased to 41%. Recruitment of young mahogany to the population increased to 19%.

### Grass:

- **1989 to 1997 - up (+2):** The sum of nested frequencies of perennial grasses increased 20%. Bluebunch wheatgrass and Letterman needlegrass (*Stipa lettermani*) increased significantly in nested frequency. Indian ricegrass decreased significantly in nested frequency.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial grasses decreased 23%. The invasive annual species cheatgrass decreased significantly in nested frequency, and decreased in cover from 1% to near 0%. Indian ricegrass increased in cover from 3% to 4%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial grasses remained similar. Cheatgrass increased significantly in nested frequency, and increased in cover to 1%. Indian ricegrass decreased in cover to 2%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial grasses increased 20%. Sandberg bluegrass increased significantly in nested frequency, and increased in cover from near 0% to 1%. Indian ricegrass cover remained near 2%.

Forb:

- **1989 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 19%. There was a significant increase in the nested frequency of Wasatch penstemon, and a significant decrease in houndstongue. Musk thistle was sampled for the first time.
- **1997 to 2002 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 41%. There were significant decreases in the nested frequencies of thistle (*Cirsium* sp.) and Wasatch penstemon. However, there was also a significant decrease in the nested frequency houndstongue, which decreased in cover from 1% to 0%.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 18%. Musk thistle and houndstongue were sampled in low abundance.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial forbs decreased 45%. Noxious weeds were sampled in low abundance. The annual forb pale alyssum (*Alyssum alyssoides*) increased significantly in nested frequency, and increased in cover from 1% to 3%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 47

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	7.5	12.1	13.3	16.1	-0.4	9.6	-4.0	<b>54.2</b>	Fair
02	5.2	0.0	0.0	10.6	0.0	7.1	-4.0	<b>18.9</b>	Very Poor
07	5.4	0.0	0.0	10.3	-0.9	10.0	-4.0	<b>20.8</b>	Very Poor
12	4.6	0.0	0.0	13.1	-0.8	4.2	-2.0	<b>19.1</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 17, Study no: 47

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	a8	c42	a12	ab25	bc47	2.20	.31	1.20	1.87
G	Bromus tectorum (a)	-	b101	a11	b89	a37	.48	.03	1.19	1.06
G	Carex sp.	a6	ab25	b34	b33	ab12	1.14	.78	1.07	.39
G	Oryzopsis hymenoides	b121	a77	a77	ab82	a75	3.03	3.55	1.56	2.38
G	Poa fendleriana	-	-	4	-	11	-	.16	-	.72
G	Poa pratensis	b24	ab19	ab10	ab6	a1	.13	.10	.41	.00
G	Poa secunda	a-	a6	a-	a2	b42	.30	-	.03	.79
G	Sitanion hystrix	7	16	11	12	5	.13	.14	.57	.18
G	Stipa columbiana	10	7	8	7	4	.41	.04	.33	.18
G	Stipa lettermani	a1	b20	ab8	a-	ab4	.67	.21	-	.01
Total for Annual Grasses		0	101	11	89	37	0.48	0.03	1.19	1.06
Total for Perennial Grasses		177	212	164	167	201	8.05	5.30	5.17	6.53
Total for Grasses		177	313	175	256	238	8.53	5.33	6.36	7.59
F	Achillea millefolium	5	6	4	6	6	.18	.01	.18	.04
F	Agoseris glauca	-	1	11	-	-	.00	.02	-	-
F	Alyssum alyssoides (a)	-	a-	a-	b100	c242	-	-	1.05	3.23
F	Androsace septentrionalis (a)	-	-	-	-	4	-	-	-	.01
F	Antennaria rosea	7	7	-	-	-	.41	-	-	-

Type	Species	Nested Frequency					Average Cover %			
		'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Astragalus convallarius</i>	3	8	10	6	4	.02	.08	.07	.15
F	<i>Carduus nutans</i> (a)	-	13	23	5	8	.42	.30	.07	.10
F	<i>Castilleja linariaefolia</i>	2	-	4	-	-	.01	.03	.00	-
F	<i>Chaenactis douglasii</i>	7	4	-	3	-	.03	-	.03	-
F	<i>Chenopodium album</i> (a)	-	1	-	-	-	.00	-	-	-
F	<i>Cirsium</i> sp.	ab4	b21	a2	ab15	a3	.28	.03	.32	.00
F	<i>Collinsia parviflora</i> (a)	-	a13	a8	b32	a10	.03	.01	.18	.01
F	<i>Crepis acuminata</i>	-	-	-	3	-	-	-	.00	-
F	<i>Cryptantha</i> sp.	4	1	12	5	7	.03	.22	.01	.19
F	<i>Cynoglossum officinale</i>	c107	b50	a2	a2	a-	.99	.00	.01	-
F	<i>Delphinium nuttallianum</i>	-	1	-	-	-	.00	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	b29	a2	c63	a2	.09	.00	.28	.00
F	<i>Epilobium brachycarpum</i> (a)	-	3	4	-	2	.00	.03	-	.01
F	<i>Erigeron</i> sp.	-	2	-	5	-	.01	-	.01	-
F	<i>Gayophytum ramosissimum</i> (a)	-	a-	a1	b7	a-	-	.03	.04	-
F	<i>Hackelia patens</i>	a-	b16	b21	b29	b20	.41	.44	1.08	.34
F	<i>Lactuca serriola</i> (a)	-	-	2	-	-	-	.00	-	-
F	<i>Lappula occidentalis</i> (a)	-	1	-	9	-	.00	-	.01	-
F	<i>Linum lewisii</i>	-	-	-	-	1	-	-	-	.03
F	<i>Lithospermum ruderae</i>	-	-	2	-	-	-	.06	-	-
F	<i>Machaeranthera canescens</i>	ab11	b27	ab9	ab10	a4	.13	.03	.07	.06
F	<i>Melilotus officinalis</i>	-	1	-	-	-	.00	-	-	-
F	<i>Penstemon cyananthus</i>	a58	b101	a69	ab78	a-	1.96	2.35	3.26	-
F	<i>Penstemon humilis</i>	b16	a-	ab2	ab6	c47	-	.03	.15	1.04
F	<i>Phlox hoodii</i>	-	-	1	-	1	-	.00	-	.15
F	<i>Phlox longifolia</i>	3	3	-	4	5	.01	-	.03	.06
F	<i>Ranunculus testiculatus</i> (a)	-	3	3	5	3	.00	.00	.03	.00
F	<i>Schoenocrambe linifolia</i>	a-	b16	ab9	a5	a5	.16	.04	.07	.01
F	<i>Sedum lanceolatum</i>	-	-	-	-	1	-	-	-	.00
F	<i>Senecio multilobatus</i>	3	2	-	3	2	.03	-	.01	.00
F	<i>Streptanthus cordatus</i>	-	-	-	-	-	.00	-	-	-
F	<i>Taraxacum officinale</i>	-	2	-	10	-	.00	-	.04	-
F	<i>Tragopogon dubius</i> (a)	-	6	3	2	-	.04	.01	.01	-
F	Unknown forb-perennial	3	-	-	-	-	-	-	-	-
F	<i>Verbascum thapsus</i>	-	7	4	1	-	.07	.18	.00	-
Total for Annual Forbs		0	69	46	223	271	0.61	0.40	1.68	3.38
Total for Perennial Forbs		233	276	162	191	106	4.78	3.56	5.40	2.11
Total for Forbs		233	345	208	414	377	5.39	3.97	7.09	5.49

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

BROWSE TRENDS--

Management unit 17, Study no: 47

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Amelanchier alnifolia	13	9	7	20	.21	.09	.24	.15
B	Artemisia tridentata vaseyana	8	8	7	9	.45	.36	.12	.04
B	Cercocarpus montanus	22	26	21	6	2.58	2.12	1.87	1.35
B	Chrysothamnus nauseosus albicaulis	1	2	1	0	-	.00	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	4	8	5	5	.06	.06	.00	.15
B	Juniperus osteosperma	10	12	6	10	2.23	4.59	2.69	11.55
B	Juniperus scopulorum	0	0	0	1	-	-	-	-
B	Mahonia repens	1	1	2	2	-	-	.00	.00
B	Opuntia sp.	3	1	1	3	-	-	-	.00
B	Pinus edulis	0	2	0	1	-	-	.63	2.83
B	Purshia tridentata	1	0	0	0	.01	-	-	-
B	Quercus gambelii	9	8	10	10	2.01	1.16	2.01	2.33
B	Ribes sp.	0	1	0	0	-	-	-	-
B	Rosa woodsii	11	12	4	1	.57	.22	.03	-
B	Symphoricarpos oreophilus	58	67	62	64	11.46	13.06	11.52	12.04
B	Tetradymia canescens	2	3	3	0	-	.15	-	-
Total for Browse		143	160	129	132	19.61	21.84	19.14	30.48

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 47

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	.08	-	.05
Artemisia tridentata vaseyana	.26	.15	-
Cercocarpus montanus	2.63	3.38	2.36
Chrysothamnus viscidiflorus viscidiflorus	.41	.10	-
Juniperus osteosperma	4.43	14.50	21.79
Juniperus scopulorum	-	-	3.58
Pinus edulis	1.61	2.00	2.83
Quercus gambelii	1.96	3.08	4.23
Rosa woodsii	.06	.10	-
Symphoricarpos oreophilus	18.33	19.61	16.48

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 47

Species	Average leader growth (in)		
	'02	'07	'12
Cercocarpus montanus	1.6	1.5	1.5

POINT-QUARTER TREE DATA--  
Management unit 17, Study no: 47

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	174	209	176	7.8	6.3	7.1
Pinus edulis	30	30	50	4.8	6.4	2.3

BASIC COVER--  
Management unit 17, Study no: 47

Cover Type	Average Cover %				
	'89	'97	'02	'07	'12
Vegetation	7.25	31.06	31.76	33.81	42.83
Rock	2.25	4.31	4.36	5.40	5.13
Pavement	13.50	4.74	8.36	4.43	3.30
Litter	50.50	50.47	48.48	40.59	56.44
Cryptogams	0	.70	3.32	.84	1.07
Bare Ground	26.50	15.30	24.68	27.17	21.77

PELLET GROUP DATA--  
Management unit 17, Study no: 47

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Sheep	-	1	-	6	-	-	-
Rabbit	23	21	37	7	-	-	-
Elk	12	3	-	4	8 (20)	17 (43)	5 (12)
Deer	38	33	47	27	76 (187)	66 (164)	22 (55)

BROWSE CHARACTERISTICS--  
Management unit 17, Study no: 47

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<b>Amelanchier alnifolia</b>									
89	<b>431</b>	54	23	23	-	23	8	8	27/20
97	<b>300</b>	87	13	0	-	7	7	0	26/29
02	<b>280</b>	43	57	0	-	7	29	0	22/18
07	<b>180</b>	44	44	11	40	0	11	11	24/35
12	<b>140</b>	29	71	0	-	43	14	29	12/17
<b>Artemisia tridentata vaseyana</b>									
89	<b>498</b>	33	20	47	66	7	7	7	20/10
97	<b>160</b>	0	50	50	-	38	13	13	27/32
02	<b>260</b>	15	46	38	-	31	23	23	23/31
07	<b>160</b>	38	13	50	-	13	0	25	29/33
12	<b>200</b>	20	60	20	20	30	0	30	26/34

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Cercocarpus montanus</b>									
89	<b>631</b>	32	53	16	33	5	63	5	67/79
97	<b>540</b>	11	78	11	-	37	44	0	33/29
02	<b>700</b>	6	71	23	-	9	74	11	31/26
07	<b>580</b>	14	52	34	-	38	41	10	32/28
12	<b>540</b>	19	56	26	-	22	48	41	24/24
<b>Chrysothamnus nauseosus albicaulis</b>									
89	<b>198</b>	17	33	50	-	17	33	0	35/22
97	<b>20</b>	0	0	100	-	0	0	0	24/23
02	<b>40</b>	50	0	50	-	0	0	0	24/23
07	<b>20</b>	0	100	0	-	0	0	0	20/15
12	<b>0</b>	0	0	0	-	0	0	0	23/23
<b>Chrysothamnus viscidiflorus viscidiflorus</b>									
89	<b>1965</b>	53	36	12	-	0	0	0	18/24
97	<b>100</b>	0	100	0	-	0	0	0	12/12
02	<b>280</b>	7	93	0	-	29	0	0	11/16
07	<b>140</b>	0	100	0	-	0	0	0	11/14
12	<b>160</b>	25	75	0	-	38	0	50	15/17
<b>Juniperus osteosperma</b>									
89	<b>99</b>	67	33	0	33	0	33	0	197/122
97	<b>220</b>	55	45	0	-	0	0	0	3/5
02	<b>280</b>	29	57	14	40	0	0	29	-/-
07	<b>120</b>	33	67	0	60	0	0	17	-/-
12	<b>240</b>	75	25	0	80	0	0	8	-/-
<b>Juniperus scopulorum</b>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>20</b>	0	100	-	-	0	0	0	-/-
<b>Mahonia repens</b>									
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	0	100	-	-	0	0	0	3/5
02	<b>20</b>	0	100	-	-	0	0	0	2/3
07	<b>40</b>	50	50	-	-	0	0	0	3/4
12	<b>40</b>	0	100	-	-	0	0	100	3/3
<b>Opuntia sp.</b>									
89	<b>99</b>	33	67	0	-	0	0	0	5/6
97	<b>60</b>	33	33	33	-	0	0	33	5/7
02	<b>20</b>	0	100	0	-	0	0	0	6/16
07	<b>20</b>	100	0	0	-	0	0	0	5/8
12	<b>60</b>	67	33	0	-	0	0	0	4/7

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Pinus edulis</b>										
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	40	100	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	20	100	0	-	40	0	0	0	-/-	
<b>Purshia tridentata</b>										
89	0	0	0	-	-	0	0	0	-/-	
97	20	0	100	-	-	100	0	0	12/24	
02	0	0	0	-	-	0	0	0	13/33	
07	0	0	0	-	-	0	0	0	8/18	
12	0	0	0	-	-	0	0	0	11/20	
<b>Quercus gambelii</b>										
89	0	0	0	0	33	0	0	0	-/-	
97	820	34	63	2	40	24	0	0	49/29	
02	1000	12	84	4	-	24	0	18	33/18	
07	1280	41	53	6	-	6	0	0	33/16	
12	860	19	79	2	-	5	0	2	36/18	
<b>Rhus trilobata</b>										
89	0	0	0	-	-	0	0	0	-/-	
97	0	0	0	-	-	0	0	0	-/-	
02	0	0	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	30/71	
12	0	0	0	-	-	0	0	0	-/-	
<b>Ribes sp.</b>										
89	66	0	100	-	-	100	0	0	18/22	
97	0	0	0	-	-	0	0	0	-/-	
02	20	100	0	-	-	0	0	0	-/-	
07	0	0	0	-	-	0	0	0	-/-	
12	0	0	0	-	-	0	0	0	-/-	
<b>Rosa woodsii</b>										
89	0	0	0	0	-	0	0	0	-/-	
97	660	70	27	3	80	0	3	0	22/14	
02	420	67	29	5	-	0	0	5	6/6	
07	140	86	14	0	-	0	0	0	11/7	
12	20	0	100	0	-	0	0	0	8/6	
<b>Symphoricarpos oreophilus</b>										
89	4731	16	82	2	33	22	5	0	20/26	
97	5300	11	89	0	140	15	4	0	43/62	
02	6200	4	91	5	-	5	9	2	18/35	
07	3320	4	93	2	-	4	0	.60	18/45	
12	6280	17	82	1	200	42	5	10	17/25	



		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Tetradymia canescens										
89	<b>0</b>	0	0	0	-	0	0	0	-/-	
97	<b>60</b>	0	100	0	-	100	0	0	13/11	
02	<b>60</b>	0	100	0	-	0	0	0	13/16	
07	<b>60</b>	0	33	67	-	33	0	0	11/14	
12	<b>0</b>	0	0	0	-	0	0	0	-/-	

CENTER CREEK - TREND STUDY NO. 17-60-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter

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

Land Ownership: Private

Elevation: 6,600 ft (2,011 m)

Aspect: West

Slope: 25%

Transect bearing: 170° magnetic

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

Directions:

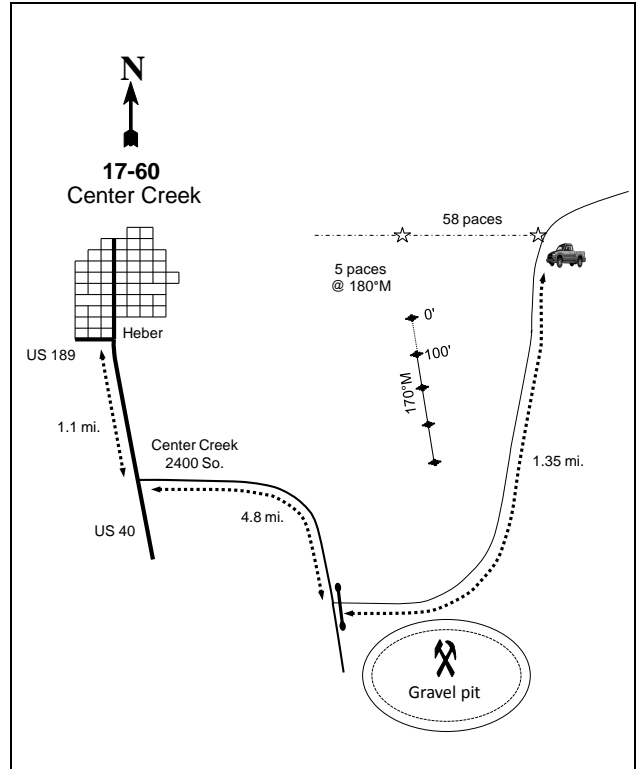
From Heber City, proceed on Highway 40 towards Daniel's Canyon for 1.1 miles to Center Creek Road (2400 South). Go 3.0 miles until the road changes to a gravel road. Continue for another 1.8 miles to a gravel pit. Turn left and go 1.35 miles to a fence line, park here. Go 58 paces down the fence line. The 0-foot stake is 25 feet south of the fence line marked by browse tag # 174.

Map Name: Center Creek



Township: 4S Range: 5E Section: 13

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 472300 E 4480073 N

## CENTER CREEK - TREND STUDY NO. 17-60

### Site Information

Site Description: This trend study was established in 2002 to monitor important winter range on the east foothills of the Heber Valley. The study is located on private land, and the nearest perennial source of water is Center Creek 0.6 miles to the west. Deer pellet groups were sampled in high abundance in all sample years. Elk pellet groups were sampled in low abundance in 2002 and 2012, but in moderate abundance in 2007. Horse pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data). A dead deer carcass was found near the study site baseline in 2002, and another carcass was found on the study in 2007. There was also some sign of horses and cattle using the area. A quarry is located 1 mile to the south. In 2007, the quarry was active and gravel was being transported on the road that is adjacent to the study.

Browse: The browse component is dominated by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Some of the sagebrush have characteristics of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), and it is apparent that there is some hybridization between these two subspecies. Mountain big sagebrush is a dense, mature population. The density of sagebrush has steadily decreased over the course of the study. The health of the sagebrush population has been moderate for the same duration. Decadence within the sagebrush population has been moderate while poor vigor has steadily decreased over the course of the study. Recruitment of young sagebrush to the population has been minimal. Utilization of sagebrush has been mostly moderate to heavy. Other preferred species occur in limited numbers, which include Saskatoon serviceberry (*Amelanchier alnifolia*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), and antelope bitterbrush (*Purshia tridentata*). All of these species displayed heavy use and have a hedged growth form on available plants. Broom snakeweed (*Gutierrezia sarothrae*) is abundant, but has decreased in density over the course of the study (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is diverse, but perennial species are not very abundant. Bluebunch wheatgrass (*Agropyron spicatum*) and Indian ricegrass (*Oryzopsis hymenoides*) are the dominant perennial grasses. The invasive annual grass species cheatgrass (*Bromus tectorum*) and Japanese brome (*B. japonicus*) are dominant. The weedy perennial species bulbous bluegrass (*Poa bulbosa*) is also present, but is not common and provides little cover. The forb component is also diverse, but does not provide much forage. The dominant perennial forbs include hairy goldaster (*Heterotheca villosa*) and heath aster (*Leucelene ericoides*). Annual species common on the study include pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*). Pale alyssum has been the most common forb on the study for every sample year (Table - Herbaceous Trends).

Soil: The soil is part of the Bezzant component, which is found on mountainsides. The parent material consists of colluvium and/or slope alluvium over residuum weathered from sedimentary rock (Soil Survey Staff 2011). The soil is a clay loam texture with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is low with a high amount of vegetation and litter, and moderate amount of rock and pavement providing protective ground cover (Table - Basic Cover). Bare soil is exposed mostly on trails which crisscross the site. The soil erosion condition class was determined to be slight in 2002, but stable was determined to be slight in 2002 and 2012, but stable in 2007.

### Trend Assessments

#### Browse:

- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 30% from 3,020 plants/acre to 2,120 plants/acre. Cover of sagebrush decreased from 22% to 16%. Decadence increased from 28% to 32%, and poor vigor decreased from 21% to 16%. Recruitment of young sagebrush to the population remained poor at 1%.

- **2007 to 2012 - stable (0):** The density of mountain big sagebrush remained similar at 2,040 plants/acre. Cover of sagebrush increased to 19%. Decadence decreased to 17%, and poor vigor decreased to 4%. Recruitment of young sagebrush plants to the population remained similar at 1%.

Grass:

- **2002 to 2007 - down (-2):** The sum of nested frequencies of perennial grasses decreased 37%. Mutton bluegrass (*Poa fendleriana*) and Sandberg bluegrass (*P. secunda*) decreased significantly in nested frequency. Cheatgrass increased significantly in nested frequency, and increased in cover from 3% to 10%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 82%. Bluebunch wheatgrass and Sandberg bluegrass increased significantly in nested frequency. Bluebunch wheatgrass increased in cover from 2% to 4%. Cheatgrass decreased significantly in nested frequency, and decreased in cover to 8%.

Forb:

- **2002 to 2007 - down (-2):** The sum of nested frequencies of perennial forbs decreased 61%. Perennial forbs decreased in abundance and diversity.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial forbs increased 69%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 60

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02	27.9	6.8	1.2	7.7	-3.3	3.8	0.0	<b>44.2</b>	Poor
07	20.4	5.6	0.7	6.1	-7.7	1.6	0.0	<b>26.7</b>	Very Poor
12	26.4	10.2	1.1	10.9	-5.8	3.5	0.0	<b>46.2</b>	Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 60

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	<i>Agropyron dasystachyum</i>	5	1	14	.18	.00	.13
G	<i>Agropyron spicatum</i>	<sub>a</sub> 37	<sub>a</sub> 45	<sub>b</sub> 94	1.02	1.56	3.83
G	<i>Bromus japonicus</i> (a)	<sub>b</sub> 185	<sub>a</sub> 93	<sub>a</sub> 56	1.25	.34	.34
G	<i>Bromus tectorum</i> (a)	<sub>a</sub> 217	<sub>c</sub> 382	<sub>b</sub> 273	3.11	9.93	7.45
G	<i>Oryzopsis hymenoides</i>	39	30	43	1.65	.97	.88
G	<i>Poa bulbosa</i>	1	3	3	.00	.00	.03
G	<i>Poa fendleriana</i>	<sub>b</sub> 23	<sub>a</sub> 4	<sub>a</sub> 7	.12	.04	.03
G	<i>Poa pratensis</i>	10	-	10	.09	-	.12
G	<i>Poa secunda</i>	<sub>b</sub> 42	<sub>a</sub> 17	<sub>b</sub> 43	.39	.16	.37
G	<i>Sitanion hystrix</i>	<sub>b</sub> 32	<sub>ab</sub> 12	<sub>a</sub> 3	.29	.20	.03
G	<i>Stipa comata</i>	2	9	1	.06	.07	.03
Total for Annual Grasses		402	475	329	4.36	10.28	7.79
Total for Perennial Grasses		191	121	218	3.84	3.03	5.47
Total for Grasses		593	596	547	8.21	13.31	13.26

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
F	<i>Agoseris glauca</i>	6	-	-	.03	-	-
F	<i>Allium</i> sp.	<sub>b</sub> 47	<sub>a</sub> 14	<sub>a</sub> 5	.10	.03	.01
F	<i>Alyssum alyssoides</i> (a)	<sub>b</sub> 175	<sub>c</sub> 353	<sub>a</sub> 104	.76	1.92	.31
F	<i>Antennaria rosea</i>	6	-	-	.15	-	-
F	<i>Arabis</i> sp.	1	-	2	.00	-	.00
F	<i>Artemisia ludoviciana</i>	3	1	-	.01	.00	-
F	<i>Astragalus convallarius</i>	3	4	6	.00	.02	.01
F	<i>Calochortus nuttallii</i>	<sub>b</sub> 13	<sub>a</sub> -	<sub>a</sub> -	.04	-	-
F	<i>Camelina microcarpa</i> (a)	5	-	-	.01	-	-
F	<i>Castilleja linariaefolia</i>	3	-	-	.06	-	-
F	<i>Chaenactis douglasii</i>	4	-	-	.00	-	-
F	<i>Chenopodium</i> sp. (a)	3	-	-	.03	-	-
F	<i>Cirsium</i> sp.	<sub>a</sub> 7	<sub>a</sub> 7	<sub>b</sub> 26	.07	.16	.23
F	<i>Collinsia parviflora</i> (a)	-	15	1	-	.02	.00
F	<i>Collomia linearis</i> (a)	5	4	-	.01	.00	-
F	<i>Cymopterus</i> sp.	<sub>b</sub> 15	<sub>a</sub> 4	<sub>a</sub> 4	.06	.01	.00
F	<i>Epilobium brachycarpum</i> (a)	<sub>b</sub> 20	<sub>a</sub> -	<sub>a</sub> 2	.04	-	.00
F	<i>Eriogonum brevicaulis</i>	1	-	-	.00	-	-
F	<i>Eriogonum racemosum</i>	4	1	2	.03	.00	.03
F	<i>Erodium cicutarium</i> (a)	<sub>a</sub> 20	<sub>b</sub> 113	<sub>a</sub> 5	.08	1.17	.04
F	<i>Gilia</i> sp. (a)	1	2	-	.00	.00	-
F	<i>Helianthus annuus</i> (a)	2	-	-	.01	-	-
F	<i>Heterotheca villosa</i>	<sub>b</sub> 32	<sub>a</sub> 10	<sub>ab</sub> 26	.41	.22	.61
F	<i>Holosteum umbellatum</i> (a)	-	-	3	-	-	.00
F	<i>Lactuca serriola</i> (a)	-	-	3	-	-	.00
F	<i>Leucelene ericoides</i>	19	17	23	.52	.21	.33
F	<i>Mentzelia</i> sp.	-	2	4	-	.00	.03
F	<i>Microsteris gracilis</i> (a)	<sub>b</sub> 27	<sub>a</sub> 3	<sub>a</sub> -	.13	.00	-
F	<i>Phlox longifolia</i>	<sub>b</sub> 18	<sub>a</sub> 1	<sub>ab</sub> 7	.06	.00	.04
F	<i>Ranunculus testiculatus</i> (a)	-	1	2	-	.00	.00
F	<i>Sphaeralcea coccinea</i>	20	17	15	.28	.09	.19
F	<i>Tragopogon dubius</i> (a)	-	-	4	-	-	.04
F	<i>Viguiera multiflora</i>	<sub>a</sub> 3	<sub>a</sub> -	<sub>b</sub> 15	.03	-	.25
F	<i>Viola</i> sp.	-	2	-	-	.03	-
Total for Annual Forbs		258	491	124	1.07	3.14	0.41
Total for Perennial Forbs		205	80	135	1.90	0.81	1.76
Total for Forbs		463	571	259	2.98	3.95	2.18

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

BROWSE TRENDS--

Management unit 17, Study no: 60

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	Amelanchier alnifolia	7	6	4	.41	.15	1.00
B	Artemisia tridentata vaseyana	76	70	69	21.50	15.72	19.43
B	Chrysothamnus viscidiflorus viscidiflorus	3	1	2	.15	-	.00
B	Gutierrezia sarothrae	38	30	35	1.99	.31	1.25
B	Leptodactylon pungens	0	0	1	-	-	-
B	Mahonia repens	5	9	5	.45	.25	.45
B	Opuntia sp.	31	32	31	.28	.35	.11
B	Purshia tridentata	8	10	7	.30	.38	.38
B	Tetradymia canescens	15	11	14	.59	1.08	.77
Total for Browse		183	169	168	25.68	18.25	23.42

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 60

Species	Percent Cover		
	'02	'07	'12
Amelanchier alnifolia	.01	.01	-
Artemisia tridentata vaseyana	20.68	18.60	24.50
Chrysothamnus viscidiflorus viscidiflorus	.13	.05	.16
Gutierrezia sarothrae	2.18	.26	2.90
Mahonia repens	.33	.61	.53
Opuntia sp.	.15	.18	.15
Purshia tridentata	.51	.11	-
Tetradymia canescens	.88	1.21	1.64

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 60

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.7	1.6	1.4

BASIC COVER--

Management unit 17, Study no: 60

Cover Type	Average Cover %		
	'02	'07	'12
Vegetation	36.21	42.93	41.28
Rock	18.43	12.69	21.71
Pavement	12.66	10.21	10.38
Litter	33.97	39.47	31.52
Cryptogams	.22	0	.00
Bare Ground	15.71	7.41	9.83

PELLET GROUP DATA--

Management unit 17, Study no: 60

Type	Quadrat Frequency			Days use per acre (ha)		
	'02	'07	'12	'02	'07	'12
Sheep	-	-	1	-	-	-
Rabbit	7	29	1	-	-	-
Elk	1	5	8	5 (13)	39 (96)	15 (38)
Deer	27	45	32	117 (289)	53 (131)	69 (170)
Cattle	1	1	-	-	-	-

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 60

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier alnifolia</i>									
02	<b>160</b>	25	75	0	-	13	88	0	17/27
07	<b>140</b>	14	71	14	-	0	100	0	11/14
12	<b>80</b>	25	75	0	20	0	75	0	20/28
<i>Artemisia tridentata vaseyana</i>									
02	<b>3020</b>	2	70	28	-	32	23	21	28/39
07	<b>2120</b>	1	67	32	-	30	27	16	28/39
12	<b>2040</b>	1	82	17	380	30	14	4	26/39
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
02	<b>60</b>	0	100	-	-	0	0	33	9/16
07	<b>20</b>	0	100	-	-	0	0	0	7/10
12	<b>40</b>	0	100	-	-	0	0	0	9/10
<i>Cowania mexicana stansburiana</i>									
02	<b>0</b>	0	0	-	-	0	0	0	85/67
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
02	<b>3620</b>	0	94	6	-	0	0	4	8/10
07	<b>1160</b>	9	90	2	360	3	5	7	8/7
12	<b>1520</b>	7	93	0	200	0	0	0	10/14
<i>Leptodactylon pungens</i>									
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>40</b>	0	100	-	-	0	0	0	-/-
<i>Mahonia repens</i>									
02	<b>2260</b>	0	100	-	-	0	0	0	3/4
07	<b>4400</b>	1	99	-	-	0	0	1	3/4
12	<b>2040</b>	0	100	-	-	0	0	0	4/5

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Opuntia</i> sp.									
02	<b>1080</b>	11	87	2	-	0	0	2	4/8
07	<b>1000</b>	8	88	4	20	0	0	6	4/8
12	<b>940</b>	4	96	0	-	0	2	4	5/10
<i>Purshia tridentata</i>									
02	<b>160</b>	0	88	13	-	0	100	0	9/26
07	<b>220</b>	10	80	10	-	0	70	10	9/24
12	<b>140</b>	0	100	0	-	0	100	0	9/18
<i>Rhus trilobata</i>									
02	<b>0</b>	0	0	-	-	0	0	0	27/51
07	<b>0</b>	0	0	-	-	0	0	0	25/56
12	<b>0</b>	0	0	-	-	0	0	0	33/65
<i>Ribes</i> sp.									
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	33/74
<i>Tetradymia canescens</i>									
02	<b>360</b>	0	94	6	-	6	6	0	10/16
07	<b>320</b>	0	94	6	-	6	0	6	11/21
12	<b>480</b>	0	88	13	-	0	0	4	12/20



AMERICAN FORK CANYON - TREND STUDY NO. 17-61-12

Vegetation Type: Juniper

Range Type: Deer Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: USFS

Elevation: 5,700 ft (1,737 m)

Aspect: West

Slope: 20 to 25%

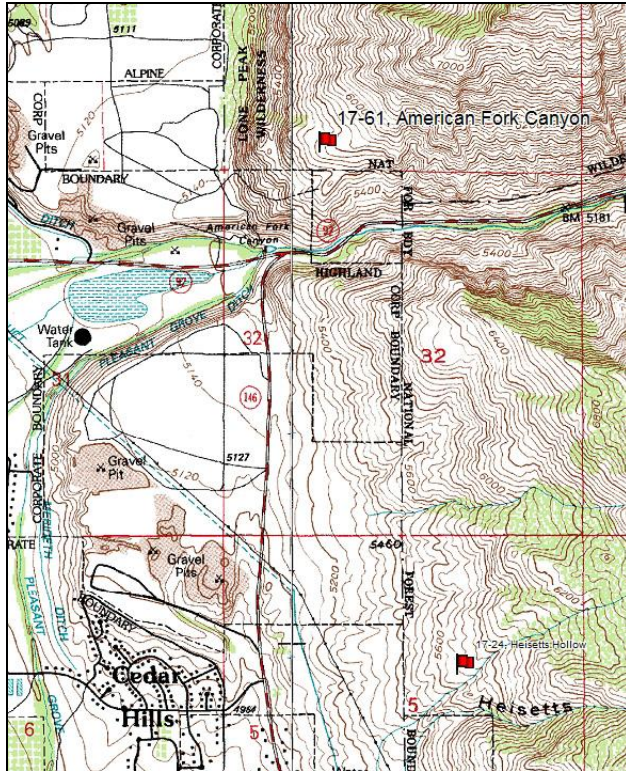
Transect bearing: 330° magnetic

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

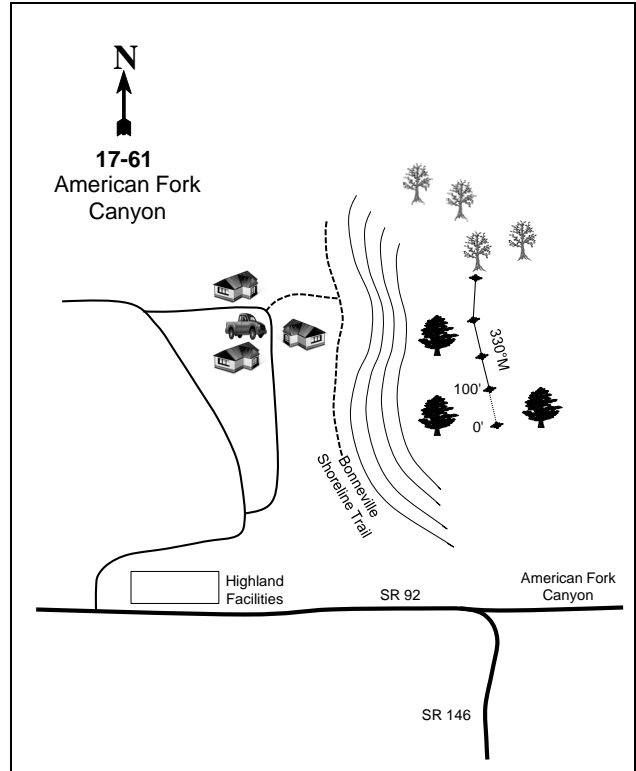
Directions:

Go to American Fork Canyon on Highway 92. Toward the mouth of the canyon, there is a gravel pit on the north side of the road along with Highland Facilities building. Turn left on the road going north just before the buildings. Continue up this road until a steep slope is encountered. The site lies on the first bench of this slope. Park here. Walk east up the steep slope about 1/4 of a mile to another bench that has been burned. The site is just south of the burn. GPS coordinates will be helpful on this site. Trail access is found in the neighborhood.

Map Name: Lehi



Diagrammatic Sketch:



Township: 4S Range: 2E Section: 29

GPS: NAD 83, UTM 12S 436451 E 4476462 N

### Site Information

Site Description: This winter range study was established at the mouth of American Fork Canyon and within the boundary of the Lone Peak Wilderness area on land administered by the United States Forest Service (USFS) to monitor Rocky Mountain bighorn sheep use. The bighorn sheep were transplanted to the area towards the end of 1999, but the study was not established until 2002. The nearest perennial source of water is American Fork 0.25 miles to the south. In addition to bighorn sheep, the area has also been occupied by deer and elk. Deer pellet groups were sampled in moderate abundance in 2002 and 2007, but in high abundance in 2012. Elk pellet groups were sampled in low abundance in 2002 and 2007. Bighorn sheep were sampled in high abundance in 2002, moderate abundance in 2007, and low abundance in 2012. There was some difficulty distinguishing between deer and bighorn sheep pellets since 2002. Most of the big game pellet groups appear to be from winter presence in 2002 and 2007. The area immediately north of the study may have burned in a wildfire in the late 1990's, the name of which was hard to determine.

Browse: The overstory is dominated by Utah juniper (*Juniperus osteosperma*). Juniper is a moderately dense, mature stand of trees that has generally increased in density and tree size over the course of the study (Table - Point-Quarter Tree Data). Cover of juniper has steadily increased each sample year (Table - Canopy Cover, Line Intercept). Due to the high frequency of wildfire in the area and the increase in fuel load, this valuable winter range may be vulnerable to stand replacement. The woodland succession stage is considered to be in Phase II (Tausch et al. 2009). The understory consists of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), and Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*). Mountain big sagebrush is a moderately sparse, mature population. Density of sagebrush has gradually decreased over the course of the study. The health of the sagebrush population has been generally poor throughout the duration of the study. Recruitment of young sagebrush to the population has been minimal. Utilization of sagebrush has been moderate to heavy throughout over the sample years. Cliffrose is a sparse, mature population. The health of the cliffrose population has been poor with high decadence observed each sample year. Recruitment of young cliffrose to the population has been poor over the sample years. Utilization of cliffrose has been moderate to heavy over the course of the study. Other browse species sampled include white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia* sp.) (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory has low species diversity and is dominated by annual species; moreover, the invasive annual grass species cheatgrass (*Bromus tectorum*) accounts for most of the annual cover on the study. Perennial grasses have steadily increased each sample year. Bluebunch wheatgrass (*Agropyron spicatum*) is the dominant perennial species. The weedy perennial grass species bulbous bluegrass (*Poa bulbosa*) is also present, and has steadily increased in frequency and cover each year sampled. Annual forb species are the dominant component of the forb community. The dominant forb species are holosteum (*Holosteum umbellatum*), and pale alyssum (*Alyssum alyssoides*), and storksbill (*Erodium cicutarium*) (Table - Herbaceous Trends).

Soil: National Resources Conservation Service (NRCS) soil data was not available. The soil is shallow and extremely rocky. The parent material is limestone, which is exposed in large bed rock outcrops. The soil texture is a loam with a slightly alkaline soil reaction (pH of 7.4) (Table - Soil Data Analysis). Bare ground cover has been low with high amount of vegetation, litter, and rock providing protective ground cover (Table - Basic Cover). Due to the low bare ground cover and high rock, vegetation, and litter cover, the erosion condition was classified as stable in all sampled years.

## Trend Assessments

### Browse:

- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 33% from 1,500 plants/acre to 1,000 plants/acre. Cover of sagebrush decreased from 4% to 3%. Decadence decreased from 25% to 12%, and poor vigor decreased from 17% to 4%. Recruitment of young sagebrush to the population was minimal decreasing from 3% to 2%. The density of Stansbury cliffrose did not change at 120 plants/acre. Decadence increased from 67% to 83%, and poor vigor remained at 17%. Cover of cliffrose remained near 1%.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush remained similar at 980 plants/acre. However, cover of sagebrush increased to 6%. Decadence remained similar at 14%, but poor vigor increased to 69%. Recruitment of young sagebrush to the population was poor at 2%. The density of Stansbury cliffrose decreased 17% to 100 plants/acre. The health of the cliffrose population remained poor but improved with decadence decreasing to 60%, and poor vigor decreasing to 0%.

### Grass:

- **2002 to 2007 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased substantially. Bluebunch wheatgrass and Sandberg bluegrass increased significantly in nested frequency. Cheatgrass decreased in cover from 41% to 38%.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 15%. Sandberg bluegrass decreased significantly in nested frequency, though cover remained similar. Bluebunch wheatgrass increased in cover to 5%. Bulbous bluegrass increased significantly in nested frequency, and increased in cover to 1%. Cheatgrass decreased significantly in nested frequency, and decreased in cover to 33%.

### Forb:

- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial forbs increased three-fold. Perennial forbs remained rare.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies of perennial forbs increased nearly three-fold. Perennial forbs remained rare on the study.

### DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 61

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02	5.0	0.0	0.0	0.1	-20.0	0.0	0.0	<b>-14.9</b>	Very Poor
07	5.0	0.0	0.0	4.6	-20.0	0.0	0.0	<b>-10.3</b>	Very Poor
12	5.0	0.0	0.0	4.6	-20.0	0.0	0.0	<b>-10.3</b>	Very Poor

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 17, Study no: 61

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	Agropyron smithii	-	2	-	-	.00	-
G	Agropyron spicatum	<sub>a</sub> 2	<sub>b</sub> 66	<sub>b</sub> 83	.03	1.92	4.45
G	Bromus japonicus (a)	3	-	-	.00	-	-

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	<i>Bromus tectorum</i> (a)	<sub>ab</sub> 425	<sub>b</sub> 457	<sub>a</sub> 412	41.21	37.77	32.59
G	<i>Poa bulbosa</i>	<sub>a</sub> 6	<sub>a</sub> 14	<sub>b</sub> 29	.01	.44	1.25
G	<i>Poa secunda</i>	<sub>a</sub> 1	<sub>b</sub> 46	<sub>a</sub> 14	.00	.38	.42
Total for Annual Grasses		428	457	412	41.22	37.77	32.59
Total for Perennial Grasses		9	128	126	0.04	2.75	6.13
Total for Grasses		437	585	538	41.27	40.52	38.73
F	<i>Alyssum alyssoides</i> (a)	<sub>a</sub> 63	<sub>a</sub> 54	<sub>b</sub> 128	.18	.17	1.28
F	<i>Collinsia parviflora</i> (a)	<sub>a</sub> -	<sub>a</sub> 2	<sub>b</sub> 32	-	.01	.12
F	<i>Cryptantha</i> sp.	-	3	1	-	.01	.03
F	<i>Descurainia pinnata</i> (a)	4	7	3	.01	.02	.00
F	<i>Draba</i> sp. (a)	<sub>a</sub> 4	<sub>b</sub> 38	<sub>a</sub> 7	.01	.06	.01
F	<i>Erigeron</i> sp.	-	-	7	-	-	.06
F	<i>Erodium cicutarium</i> (a)	<sub>a</sub> 30	<sub>b</sub> 134	<sub>a</sub> 8	.56	1.95	.03
F	<i>Heterotheca villosa</i>	1	-	-	.00	-	-
F	<i>Holosteum umbellatum</i> (a)	<sub>a</sub> 3	<sub>c</sub> 199	<sub>b</sub> 123	.01	1.48	.49
F	<i>Lappula occidentalis</i> (a)	<sub>a</sub> -	<sub>b</sub> 16	<sub>b</sub> 10	-	.03	.03
F	<i>Ranunculus testiculatus</i> (a)	5	2	-	.19	.00	-
F	<i>Salsola iberica</i> (a)	1	-	-	.00	-	-
F	<i>Sisymbrium altissimum</i> (a)	5	7	14	.24	.08	.05
F	<i>Tragopogon dubius</i> (a)	-	1	2	-	.00	.03
Total for Annual Forbs		115	460	327	1.21	3.82	2.05
Total for Perennial Forbs		1	3	8	0.00	0.01	0.09
Total for Forbs		116	463	335	1.22	3.84	2.15

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

#### BROWSE TRENDS--

Management unit 17, Study no: 61

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	40	26	26	3.49	3.37	6.00
B	<i>Chrysothamnus nauseosus albicaulis</i>	1	1	2	-	-	.03
B	<i>Cowania mexicana stansburiana</i>	6	6	4	.45	.53	.18
B	<i>Gutierrezia sarothrae</i>	0	4	3	-	.06	.39
B	<i>Juniperus osteosperma</i>	5	5	5	7.80	4.60	12.06
B	<i>Opuntia</i> sp.	4	4	4	-	-	.05
Total for Browse		56	46	44	11.74	8.57	18.72

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 61

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	4.36	7.19	10.43
Chrysothamnus nauseosus albicaulis	-	-	.01
Cowania mexicana stansburiana	2.59	1.04	1.04
Gutierrezia sarothrae	-	.15	-
Juniperus osteosperma	14.83	15.89	19.16
Opuntia sp.	-	.15	.35

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 61

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	3.1	1.4	1.0
Cowania mexicana stansburiana	3.8	1.9	1.5

POINT-QUARTER TREE DATA--

Management unit 17, Study no: 61

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	41	39	45	9.1	12.5	13.2

BASIC COVER--

Management unit 17, Study no: 61

Cover Type	Average Cover %		
	'02	'07	'12
Vegetation	52.60	51.55	59.95
Rock	21.68	17.44	22.11
Pavement	1.52	.33	.73
Litter	40.96	43.37	34.67
Cryptogams	.09	.34	.54
Bare Ground	4.66	1.52	3.92

PELLET GROUP DATA--

Management unit 17, Study no: 61

Type	Quadrat Frequency			Days use per acre (ha)		
	'02	'07	'12	'02	'07	'12
Bighorn Sheep	32	17	3	56 (17)	33 (81)	5 (12)
Rabbit	18	8	12	-	-	-
Grouse	-	-	1	-	-	-
Elk	7	3	-	17 (43)	7 (17)	-
Deer	13	23	25	29 (73)	23 (56)	70 (174)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 61

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
02	1500	3	72	25	-	19	20	17	22/31
07	1000	2	86	12	80	30	52	4	24/36
12	980	2	84	14	60	20	57	69	25/35
<i>Chrysothamnus nauseosus albicaulis</i>									
02	20	0	0	100	-	0	0	0	23/44
07	20	0	0	100	-	0	0	0	26/38
12	40	0	50	50	-	0	0	50	27/37
<i>Cowania mexicana stansburiana</i>									
02	120	0	33	67	-	50	50	17	39/43
07	120	0	17	83	-	33	67	17	53/50
12	100	40	0	60	-	20	0	0	48/44
<i>Gutierrezia sarothrae</i>									
02	0	0	0	-	-	0	0	0	-/-
07	100	0	100	-	-	0	0	0	8/10
12	80	0	100	-	20	0	0	0	12/18
<i>Juniperus osteosperma</i>									
02	100	0	100	-	-	0	0	0	-/-
07	100	0	100	-	-	0	0	0	-/-
12	100	0	100	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
02	80	25	75	0	-	0	0	0	3/5
07	120	17	83	0	-	0	0	0	4/15
12	160	0	88	13	-	0	0	13	4/10

GROVE CREEK - TREND STUDY NO. 17-62-12

Vegetation Type: Cliffrose

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Mountain Shallow Loam \(Mountain Big Sagebrush\), R047XA446UT](#)

Land Ownership: USFS

Elevation: 5,340 ft (1,628 m)

Aspect: Southwest

Slope: 40%

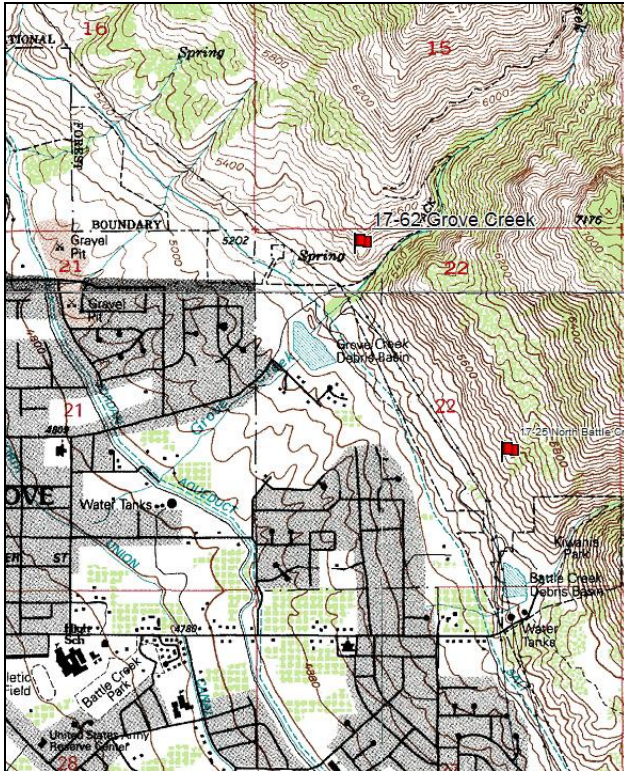
Transect bearing: 355° magnetic

Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft). Rebar: belt 2 on 3ft., belt 3 on 2ft., and belt 4 on 4ft.

Directions:

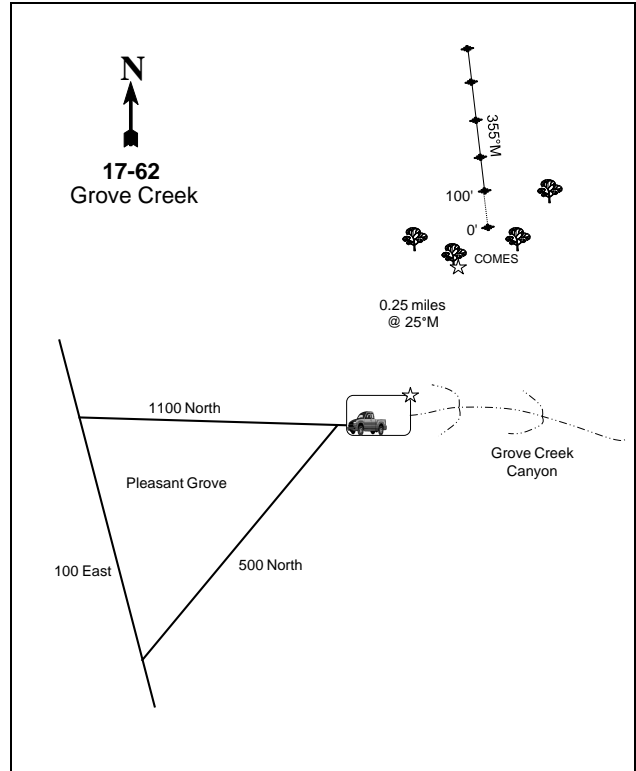
From the junction of Highway's 89 (State St.) and 146 in Pleasant Grove, continue on Highway 146 until 500 North, just before the school. Continue on this road until it comes to the parking lot at the mouth of Grove Creek Canyon. From the parking lot, follow the ridge for 0.25 miles at 25 degrees magnetic to the 0-foot stake in the cliffrose.

Map Name: Lehi



Township: 4S Range: 2E Section: 29

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 439692 E 4469781 N

## GROVE CREEK - TREND STUDY NO. 17-62

### Site Information

Site Description: This study was established in 2002 to monitor deer and bighorn sheep winter range above Pleasant Grove on land administered by the United States Forest Service (USFS). Bighorn sheep were transplanted into the area in the late 1990's. The nearest perennial source of water is Grove Creek, which is 400 feet to the south. This study has become increasingly important winter range as a result of the expansion of residential development. The only remaining available winter range is found on the steeper slopes on USFS land. Big game bedding areas were noted to be on the study in 2012. Deer pellet groups were sampled in high abundance in 2002 and 2007, and moderate abundance in 2012. Elk pellet groups were sampled in low abundance in 2002 and 2007. Bighorn sheep pellet groups were sampled in moderate abundance in 2002 and 2007, but in low abundance in 2012 (Table - Pellet Group Data). It is important to note that it has been difficult to differentiate between the pellet groups of bighorn sheep and mule deer for each sampled year.

Browse: The dominant browse species are Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Stansbury cliffrose is a sparse, mature population that has varied in density over the course of the study. The health of the cliffrose population has been good most sample years, but was poor in 2007 with decadence and poor vigor being high. Recruitment of young cliffrose to the population has been minimal to absent. Cover of cliffrose has generally increased over the course of the study. Utilization has been light to moderate. Mountain big sagebrush is a sparse, mature population that has decreased in density throughout the duration of the study. The health of the sagebrush population has been moderate to poor with decadence decreasing over the course of the study, but poor vigor generally increasing over the same duration. Recruitment of young sagebrush to the population has been minimal. Utilization of sagebrush has been moderate to heavy (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is in poor condition and is dominated by annual species. These annual species are likely to be limiting successful establishment of shrub seedlings. Cheatgrass (*Bromus tectorum*) accounted for most of the annual grass cover. In 2012, cheatgrass showed signs of a rust and was in poor health. The dominant perennial grass is bluebunch wheatgrass (*Agropyron spicatum*). Bulbous bluegrass (*Poa bulbosa*) is present, but uncommon on the site. Annual forbs are common and diverse on the study site. The most common annual forbs on the study include storksbill (*Erodium cicutarium*) and bur buttercup (*Ranunculus testiculatus*). The dominant perennial forb was Bonneville pea (*Lathyrus brachycalyx*), but the weedy western ragweed (*Ambrosia psilostachya*) has since become dominant on the site. Yellow starthistle (*Centaurea solstitialis*) and field bindweed (*Convolvulus arvensis*) are two noxious weed species that have been sampled on the study since 2007 (Table - Herbaceous Trends).

Soil: The soil is part of the Rake component, which is found on hills. The parent material consists of colluvium derived from limestone and quartzite (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (pH 7.3) (Table - Soil Data Analysis). Limestone is exposed as bedrock and large rock outcrops on the site. Bare ground cover is moderate with a high amount of vegetation and litter, and a moderate amount of pavement providing protective ground cover (Table - Basic Cover). The hillslope is terraced and has numerous game trails and flow paths. The soil erosion condition was classified as slight in all sample years.

### Trend Assessments

#### Browse:

- **2002 to 2007 - slightly down (-1):** The density of Stansbury cliffrose decreased 33% from 120 plants/acre to 80 plants/acre. Cover of cliffrose decreased from 3% to 1%. Decadence and poor vigor increased from 0% to 25%. Recruitment of young cliffrose to the population was poor in 2007. The density of mountain big sagebrush decreased 37% from 380 plants/acre to 240 plants/acre. Cover of



sagebrush decreased from 2% to less than 1%. Decadence decreased from 53% to 42%, but poor vigor increased slightly from 37% to 42%. Recruitment of young sagebrush to the population was poor.

- **2007 to 2012 - stable (0):** The density of Stansbury cliffrose increased 75% to 140 plants/acre. Cover of cliffrose increased to 4%. The health of the cliffrose population was good with decadence and poor vigor decreasing to 0%. Recruitment of young cliffrose to the population increased to 29%. The density of mountain big sagebrush decreased 33% to 160 plants/acre. Cover of sagebrush increased to 1%. The health of the sagebrush population improved with decadence decreasing to 13%, and poor vigor decreasing to 25%. Recruitment of young sagebrush to the population was poor.

Grass:

- **2002 to 2007 - down (-2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, decreased 24%. The dominant perennial grass on the study is bluebunch wheatgrass. Sandberg bluegrass decreased significantly in nested frequency.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 27%. Bluebunch wheatgrass increased in nested frequency, though not significantly, and increased in cover from 4% to 9%.

Forb:

- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 10%. Yellow starthistle and field bindweed were not common on the study.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial forbs increased 78%. The weedy species western ragweed increased significantly in nested frequency, and increased in cover from near 0% to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 17, study no: 62

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02	8.0	7.2	11.9	8.4	-14.5	1.1	0.0	<b>22.1</b>	Very Poor
07	3.4	0.0	0.0	8.4	-15.1	0.7	-4.0	<b>-6.6</b>	Very Poor
12	8.3	14.3	9.7	17.4	-15.5	3.3	-4.0	<b>33.5</b>	Very Poor-Poor

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 17, Study no: 62

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	Aegilops cylindrica (a)	-	-	2	-	-	.00
G	Agropyron spicatum	114	106	143	3.82	4.14	8.61
G	Bromus japonicus (a)	<sub>b</sub> 60	<sub>a</sub> 9	<sub>a</sub> -	.25	.02	-
G	Bromus tectorum (a)	<sub>a</sub> 396	<sub>b</sub> 432	<sub>ab</sub> 406	19.07	20.13	20.67
G	Poa bulbosa	6	2	4	.09	.00	.15
G	Poa fendleriana	1	-	-	.00	-	-
G	Poa secunda	<sub>b</sub> 37	<sub>a</sub> 10	<sub>a</sub> 4	.40	.07	.09
Total for Annual Grasses		456	441	408	19.32	20.15	20.67
Total for Perennial Grasses		158	118	151	4.31	4.22	8.86

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
	Total for Grasses	614	559	559	23.64	24.37	29.54
F	Alyssum alyssoides (a)	<sub>a</sub> 135	<sub>a</sub> 174	<sub>b</sub> 273	.40	.58	1.76
F	Ambrosia psilostachya	<sub>a</sub> 6	<sub>a</sub> 5	<sub>b</sub> 44	.15	.03	1.45
F	Antennaria rosea	1	-	-	.03	-	-
F	Artemisia ludoviciana	5	2	2	.03	.00	.06
F	Astragalus utahensis	-	-	-	.00	-	-
F	Camelina microcarpa (a)	3	-	12	.00	-	.02
F	Centaurea solstitialis	-	6	5	-	.01	.01
F	Cirsium sp.	-	1	-	-	.03	-
F	Collinsia parviflora (a)	-	-	2	-	-	.00
F	Convolvulus arvensis	-	2	4	-	.00	.03
F	Cryptantha sp.	-	1	-	-	.03	-
F	Descurainia pinnata (a)	-	-	1	-	-	.03
F	Erodium cicutarium (a)	<sub>a</sub> 145	<sub>c</sub> 281	<sub>b</sub> 195	2.34	5.26	4.46
F	Galium aparine (a)	-	-	2	-	-	.03
F	Holosteum umbellatum (a)	<sub>a</sub> 5	<sub>b</sub> 43	<sub>a</sub> 9	.01	.14	.02
F	Lactuca serriola (a)	-	3	-	-	.00	-
F	Lappula occidentalis (a)	4	1	9	.18	.00	.02
F	Lathyrus brachycalyx	28	19	9	.31	.25	.11
F	Ranunculus testiculatus (a)	<sub>b</sub> 154	<sub>a</sub> 16	<sub>a</sub> 10	.83	.03	.04
F	Sisymbrium altissimum (a)	<sub>a</sub> 7	<sub>a</sub> 4	<sub>b</sub> 21	.09	.03	.08
F	Tragopogon dubius (a)	4	-	-	.00	-	-
	Total for Annual Forbs	457	522	534	3.88	6.06	6.49
	Total for Perennial Forbs	40	36	64	0.53	0.36	1.66
	Total for Forbs	497	558	598	4.42	6.43	8.15

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

#### BROWSE TRENDS--

Management unit 17, Study no: 62

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	Artemisia tridentata vaseyana	19	12	8	1.65	.21	1.12
B	Celtis reticulata	0	1	0	-	-	-
B	Chrysothamnus nauseosus albicaulis	8	5	5	1.50	1.01	.91
B	Cowania mexicana stansburiana	6	4	7	2.70	1.14	3.84
B	Gutierrezia sarothrae	2	5	7	-	.30	.21
B	Rhus trilobata	0	0	0	.03	.15	-
	Total for Browse	35	27	27	5.90	2.82	6.10

CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 62

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	.75	.25	1.43
Celtis reticulata	-	.01	-
Chrysothamnus nauseosus albicaulis	1.20	.75	1.64
Cowania mexicana stansburiana	2.73	4.96	5.34
Gutierrezia sarothrae	-	-	.16
Rhus trilobata	-	-	.20

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 62

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	6.3	2.0	1.6
Cowania mexicana stansburiana	3.3	4.1	2.0

BASIC COVER--

Management unit 17, Study no: 62

Cover Type	Average Cover %		
	'02	'07	'12
Vegetation	35.56	35.43	47.11
Rock	9.63	6.43	8.89
Pavement	16.01	12.40	10.57
Litter	31.64	51.47	34.49
Cryptogams	.21	.22	0
Bare Ground	22.88	10.94	10.94

PELLET GROUP DATA--

Management unit 17, Study no: 62

Type	Quadrat Frequency		
	'02	'07	'12
Bighorn Sheep	25	-	-
Rabbit	-	8	-
Elk	1	14	1
Deer	11	36	26

Days use per acre (ha)		
'02	'07	'12
36 (89)	32 (79)	2 (5)
-	-	-
5 (12)	1 (3)	-
72 (177)	90 (223)	36 (88)

BROWSE CHARACTERISTICS--  
Management unit 17, Study no: 62

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
02	<b>380</b>	0	47	53	-	26	37	37	24/35
07	<b>240</b>	0	58	42	-	17	58	42	25/41
12	<b>160</b>	0	88	13	-	38	13	25	30/43
<i>Celtis reticulata</i>									
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>20</b>	100	0	-	-	0	0	0	42/107
12	<b>0</b>	0	0	-	-	0	0	0	17/34
<i>Chrysothamnus nauseosus albicaulis</i>									
02	<b>180</b>	0	56	44	-	11	0	22	28/50
07	<b>140</b>	0	71	29	-	0	0	14	37/62
12	<b>100</b>	0	100	0	-	0	0	60	35/65
<i>Cowania mexicana stansburiana</i>									
02	<b>120</b>	50	50	0	-	17	17	0	65/79
07	<b>80</b>	0	75	25	-	50	25	25	66/85
12	<b>140</b>	29	71	0	-	29	0	0	69/96
<i>Gutierrezia sarothrae</i>									
02	<b>40</b>	0	100	0	-	0	0	0	8/12
07	<b>100</b>	0	100	0	-	20	0	0	10/14
12	<b>180</b>	0	89	11	60	0	0	22	12/20
<i>Rhus trilobata</i>									
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	50/121

HOBBLE CREEK BENCH - TREND STUDY NO. 17-63-12

Vegetation Type: Antelope Bitterbrush

Range Type: Crucial Deer Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: Private

Elevation: 5,200 ft (1,585 m)

Aspect: West

Slope: 7%

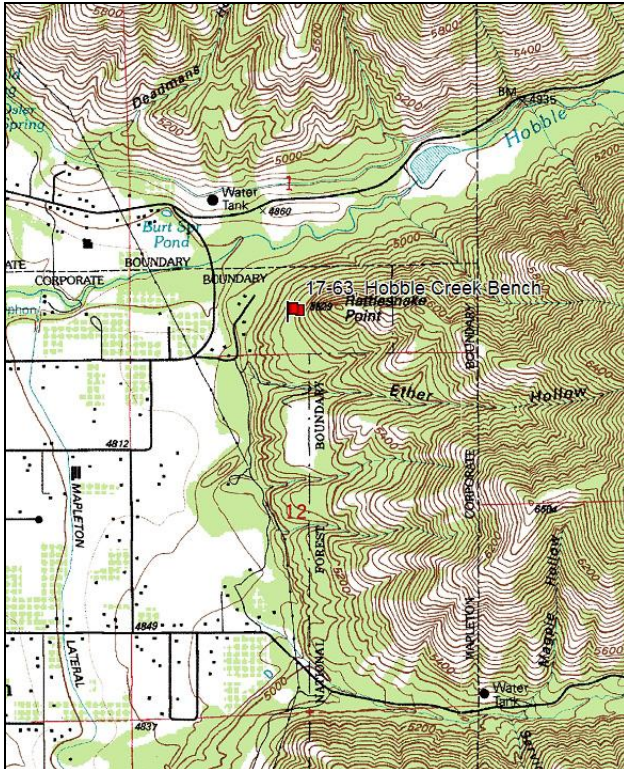
Transect bearing: 197° magnetic

Belt placement: line 1 (97ft), line 2 (11ft, 37ft & 95ft), line 3 (34ft)

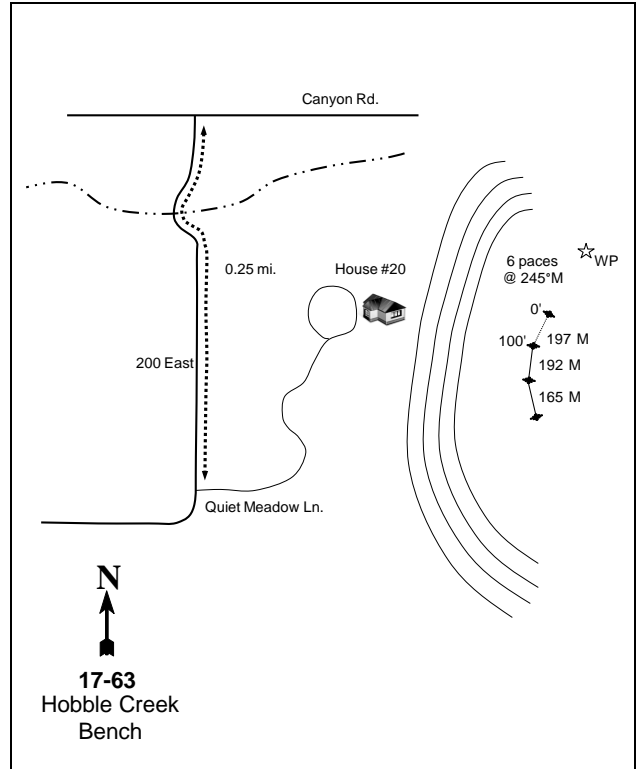
Directions:

On Highway 89 in Mapleton, take 1650 South which will change into 1600 North. Follow 1600 North until it junctions with Quiet Meadow Lane (1600 North ends at this point). Park in front of house # 20. Ask owner, Mark Petersen, for permission to walk into his backyard. Go up his driveway to a footpath up the hill. Go up the steep hill until a bench is reached. A half high witness post is located in a clearing. The 0-foot stake is 6 paces at 245 degrees magnetic from the witness post and is marked by browse tag #183.

Map Name: Lehi



Diagrammatic Sketch:



Township: 8S Range: 3E Section: 1

GPS: NAD 83, UTM 12S 4443956 E 453083 N

## HOBBLE CREEK BENCH - TREND STUDY NO. 17-63

### Site Information

Site Description: This study is located on private land approximately 700 feet above a residential neighborhood. The study is situated on a lake terrace left by ancient Lake Bonneville, and samples crucial winter range populated by a Gambel oak (*Quercus gambelii*) community. The terrace is occupied by a sizable population of antelope bitterbrush (*Purshia tridentata*), which is important forage to big game during the winter. Deer pellet groups were sampled in high abundance in all sample years. Elk pellet groups were sampled in moderate abundance in all sample years (Table - Pellet Group Data).

Browse: Antelope bitterbrush is the dominant species within the browse component and is associated with small populations of Gambel oak and mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*). Bitterbrush is a dense, mature population that has increased considerably in density over the course of the study. Decadence of bitterbrush decreased, but poor vigor increased on the site. Recruitment of young bitterbrush to the population was minimal in 2002, but fair in 2012. Utilization of bitterbrush has been mostly heavy. Gambel oak is a moderately sparse, mature population that has increased in density over the course of the study. The health of the oak population has been good with decadence and poor absent within the population. Recruitment of young oak to the population was absent in 2002, but young plants made up half of the population in 2012. Utilization of oak has been light for all sampled years. Mountain big sagebrush is a moderately sparse, mature population that has decreased in density over the course of the study. Health of the sagebrush population has improved and is fair with decadence and poor vigor decreasing throughout the duration of the study. Recruitment of young sagebrush has been minimal. Utilization of sagebrush has been light to moderate (Table - Browse Characteristics).

Herbaceous Understory: Herbaceous perennial species are common and abundant. The weedy perennial grass species bulbous bluegrass (*Poa bulbosa*) is the dominant species within the understory. Other perennial grass species include purple three-awn (*Aristida purpurea*), sand dropseed (*Sporobolus cryptandrus*), and needle-and-thread (*Stipa comata*). The invasive annual grass species cheatgrass has increased on the site and is the second most dominant species on the study. Perennial forb species are relatively common and diverse on the study. Spreading fleabane (*Erigeron divergens*), stone seed (*Lithospermum ruderales*) hairy goldaster (*Heterotheca villosa*), and arrowleaf balsamroot (*Balsamorhiza sagittata*) are common, but are low in cover (Table - Herbaceous Trends).

Soil: The soil part of the Parleys component, which is found on lake terraces. The parent material consists of lacustrine deposits derived from mixed sources (Soil Survey Staff 2011). The soil texture is a sandy loam with a neutral soil reaction (pH 6.9) (Table - Soil Data Analysis). Bare ground cover is low with high amounts of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition class was estimated to be stable in all sample years.

### Trend Assessments

#### Browse:

- **2002 to 2012 - up (+2):** The density of antelope bitterbrush increased 88% from 1,040 plants/acre to 1,960 plants/acre. Bitterbrush decreased in cover from 14% to 10%. Decadence decreased from 12% to 6%, but poor vigor increased from 2% to 44%. Recruitment of young bitterbrush to the population increased from 4% to 10%. The density of Gambel oak increased 78% from 180 plants/acre to 320 plants/acre. Cover of oak was maintained at 1%. Decadence and poor vigor was low within the population. Recruitment of oak increased from 0% to 50%. The density of mountain big sagebrush decreased 31% from 640 plants/acre to 440 plants/acre. Cover of sagebrush remained at 2%. Decadence decreased from 31% to 18%, and poor vigor decreased from 22% to 9%. Recruitment of young sagebrush to the population was poor.

Grass:

- **2002 to 2012 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 36%. Purple three-awn increased significantly in nested frequency, and increased in cover from 1% to 6%. Needle-and-thread increased in cover from 1% to 4%. Bulbous bluegrass decreased significantly in nested frequency, and decreased in cover from 53% to 32%. Cheatgrass increased significantly in nested frequency, and increased in cover from 1% to 17%.

Forb:

- **2002 to 2012 - up (+2):** The sum of nested frequencies of perennial forbs increased three-fold. Spreading fleabane increased significantly in nested frequency, and increased in cover from 0% to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 63

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02	23.6	10.8	1.9	8.7	-0.4	5.2	0.0	<b>49.7</b>	Poor-Fair
12	3.4	0.0	0.0	8.4	-15.1	0.7	-4.0	<b>-6.6</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 63

Type	Species	Nested Frequency		Average Cover %	
		'02	'12	'02	'12
G	Agropyron spicatum	<sub>b</sub> 29	<sub>a</sub> 8	.53	.46
G	Aristida purpurea	<sub>a</sub> 44	<sub>b</sub> 82	1.09	5.68
G	Bromus tectorum (a)	<sub>a</sub> 65	<sub>b</sub> 348	.57	16.82
G	Elymus glaucus glaucus	-	-	-	.03
G	Poa bulbosa	<sub>b</sub> 460	<sub>a</sub> 343	52.47	31.80
G	Poa secunda	5	9	.01	.33
G	Sporobolus cryptandrus	32	54	1.47	2.20
G	Stipa comata	29	36	1.23	3.67
Total for Annual Grasses		65	348	0.57	16.82
Total for Perennial Grasses		599	532	56.81	44.19
Total for Grasses		664	880	57.38	61.02
F	Agoseris glauca	2	7	.00	.01
F	Alyssum alyssoides (a)	3	-	.00	-
F	Artemisia ludoviciana	-	4	-	.15
F	Astragalus utahensis	-	3	.00	.03
F	Balsamorhiza sagittata	14	11	.82	1.56
F	Calochortus nuttallii	2	-	.01	-
F	Comandra pallida	4	3	.03	.03
F	Crepis acuminata	2	-	.03	-
F	Cymopterus sp.	1	5	.00	.01
F	Erigeron divergens	<sub>a</sub> -	<sub>b</sub> 91	-	2.05
F	Erodium cicutarium (a)	<sub>a</sub> 5	<sub>b</sub> 39	.04	.16
F	Euphorbia sp.	-	3	-	.00

Type	Species	Nested Frequency		Average Cover %	
		'02	'12	'02	'12
F	Galium aparine (a)	4	2	.03	.15
F	Gayophytum ramosissimum(a)	-	1	-	.00
F	Heterotheca villosa	6	14	.63	.98
F	Holosteum umbellatum (a)	-	2	-	.03
F	Lactuca serriola (a)	-	7	-	.30
F	Linum lewisii	-	3	-	.00
F	Lithospermum ruderales	12	23	.92	.81
F	Microsteris gracilis (a)	2	-	.00	-
F	Oenothera caespitosa	-	4	-	.03
F	Phlox longifolia	<sub>b</sub> 16	<sub>a</sub> 2	.11	.00
F	Sphaeralcea coccinea	-	-	.00	-
F	Tragopogon dubius (a)	<sub>a</sub> 6	<sub>b</sub> 143	.10	1.13
Total for Annual Forbs		20	194	0.18	1.78
Total for Perennial Forbs		59	173	2.58	5.71
Total for Forbs		79	367	2.76	7.50

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

#### BROWSE TRENDS--

Management unit 17, Study no: 63

Type	Species	Strip Frequency		Average Cover %	
		'02	'12	'02	'12
B	Artemisia tridentata vaseyana	25	18	2.08	1.84
B	Gutierrezia sarothrae	3	4	.18	.15
B	Opuntia sp.	1	2	.15	.15
B	Purshia tridentata	36	45	13.60	10.32
B	Quercus gambelii	3	4	.63	.56
Total for Browse		68	73	16.64	13.03

#### CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 63

Species	Percent Cover	
	'02	'12
Artemisia tridentata vaseyana	2.06	1.96
Gutierrezia sarothrae	-	.63
Opuntia sp.	-	.01
Purshia tridentata	17.93	21.50
Quercus gambelii	2.50	2.43

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 63

Species	Average leader growth (in)	
	'02	'12
Artemisia tridentata vaseyana	3.0	1.6
Purshia tridentata	5.0	4.3



BASIC COVER--

Management unit 17, Study no: 63

Cover Type	Average Cover %	
	'02	'12
Vegetation	75.90	79.33
Rock	.07	.05
Pavement	.50	.13
Litter	26.54	38.00
Cryptogams	8.05	2.04
Bare Ground	3.07	.91

PELLET GROUP DATA--

Management unit 17, Study no: 63

Type	Quadrat Frequency		Days use per acre (ha)	
	'02	'12	'02	'12
Rabbit	2	5	-	-
Elk	13	6	23 (56)	11 (28)
Deer	28	45	58 (144)	62 (154)

BROWSE CHARACTERISTICS--

Management unit 17, Study no: 63

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
02	<b>640</b>	3	66	31	-	13	0	22	22/34
12	<b>440</b>	0	82	18	-	50	14	9	20/39
<i>Cercocarpus montanus</i>									
02	<b>0</b>	0	0	-	-	0	0	0	96/122
12	<b>0</b>	0	0	-	-	0	0	0	88/101
<i>Chrysothamnus nauseosus</i>									
02	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	33/69
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
02	<b>0</b>	0	0	-	-	0	0	0	24/60
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
02	<b>80</b>	0	50	50	-	0	0	25	16/16
12	<b>80</b>	0	100	0	-	0	0	0	15/24
<i>Opuntia sp.</i>									
02	<b>80</b>	0	100	-	-	0	0	0	3/8
12	<b>60</b>	0	100	-	-	0	0	0	4/13
<i>Purshia tridentata</i>									
02	<b>1040</b>	4	85	12	-	8	79	2	28/78
12	<b>1960</b>	10	84	6	-	16	82	44	21/54

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Quercus gambelii										
02	<b>180</b>	0	100	-	-	0	0	0	34/27	
12	<b>320</b>	50	50	-	-	6	0	0	37/40	

WATER HOLLOW - TREND STUDY NO. 17-64-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: USFS

Elevation: 6,240 ft (1,902 m)

Aspect: South

Slope: 11%

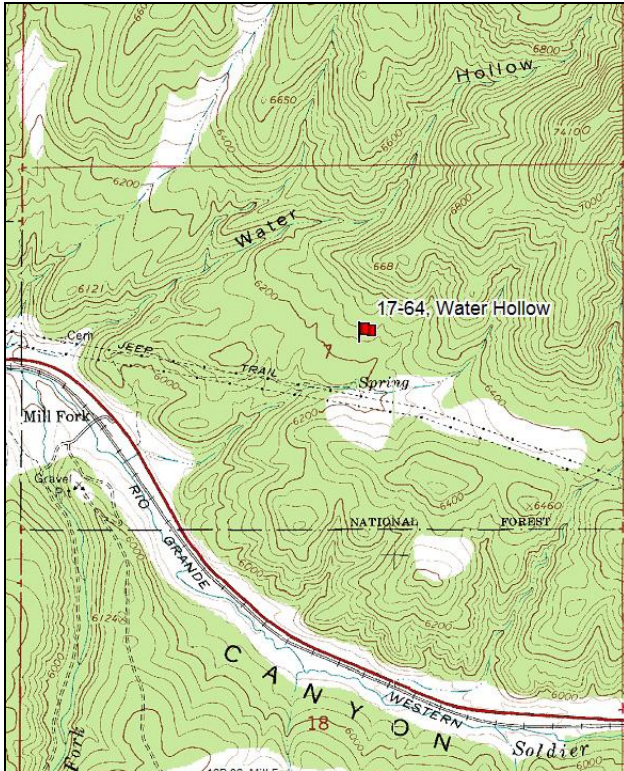
Transect bearing: 277° magnetic

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

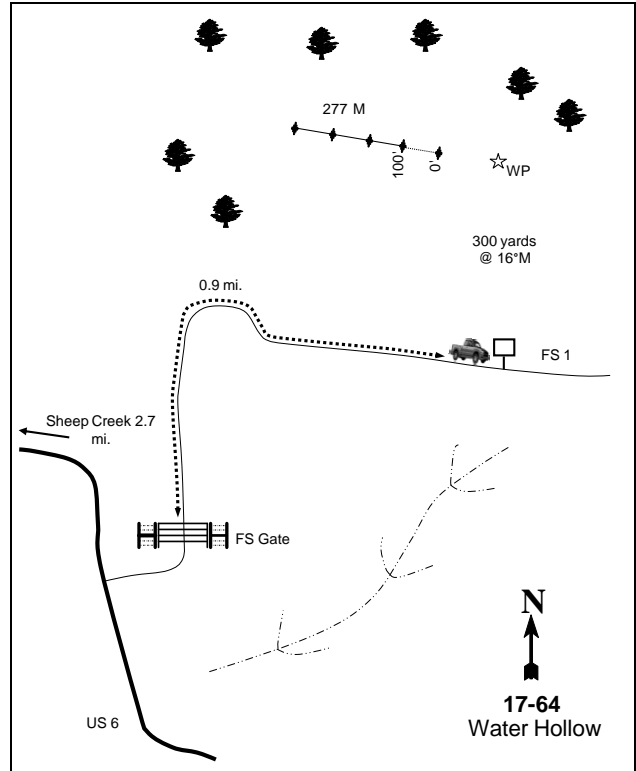
Directions:

From Spanish Fork Canyon, take Highway 6 to the Sheep Creek turnoff. Continue on Highway 6 for 2.2 miles to a road on the north side of the road (left). Turn left again just after exiting highway 6. Follow this road to a Forest Service gate. From the gate, go 0.9 miles to a Forest Service sign. Park here and walk 300 yards at 16 degrees magnetic to the witness post. A large clump of chained P-J is in front of the post. The 0-foot stake is just west of the witness post and is marked with browse tag # 132. Extra rebar and T-posts present on the site from another unrelated study.

Map Name: Mill Fork



Diagrammatic Sketch:



Township: 10S Range: 6E Section: 7

GPS: NAD 83, UTM 12S 474876 E 4424105 N

## WATER HOLLOW - TREND STUDY NO. 17-64

### Site Information

Site Description: This winter range study monitors a pinyon-juniper chaining on the north side of US-6 in Spanish Fork Canyon on land administered by the United State Forest Service (USFS), which is located on a grazing watershed closure. The nearest perennial source of water is Soldier Creek, on the opposite side of US-6, 0.75 miles to the southwest. The chaining was part of a mosaic of small chaining and seeding treatments that were completed on south-facing slopes in the 1990s. The objectives of these treatments were to improve winter range and stabilize the watersheds to the north of US-6. This study is located within a 60-acre area that was treated using a smooth chain. Deer pellet groups were sampled in moderate abundance in 2002 and 2007, but in low abundance in 2012. Elk pellet groups were sampled in high abundance in 2002 and 2007, but in low abundance in 2012 (Table - Pellet Group Data).

Browse: Prior to the chaining, this study was dominated by Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*) trees. The woodland succession stage is considered to be in Phase I following the treatment (Tausch et al. 2009). Utah juniper is a sparse, young population that has been increasing in density over the course of the study. Pinyon pine is a sparse, young population that has varied in density over the course of the study (Table - Point-Quarter Data). The shrub understory is very sparse. Preferred browse species include fourwing saltbush (*Atriplex canescens*) and antelope bitterbrush (*Purshia tridentata*), which were seeded using a dribbler as a part of the treatment. Fourwing saltbush and antelope bitterbrush are sparse populations. Small numbers of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), which were included within the aerial seed mix were also sampled (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are common and diverse on the study. The common perennial grass species are crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), smooth brome (*Bromus inermis*), and Great Basin wildrye (*Elymus cinereus*). The invasive annual species cheatgrass (*Bromus tectorum*) and Japanese brome (*B. japonicus*) are both present, but are not common on the study. Perennial forbs are rare and provide little forage. Lewis flax (*Linum lewisii*) and cryptantha (*Cryptantha* sp.) are the most abundant perennial species. The noxious weed musk thistle (*Carduus nutans*) was sampled in 2002, but was not abundant on the study (Table - Herbaceous Trends).

Soil: The soil texture is a sandy clay loam with a slightly alkaline reaction soil reaction (pH of 7.4) (Table - Soil Data Analysis). There is little rock on the surface or within the profile. Bare ground cover has been high to moderate with high amounts of vegetation and litter providing protective ground cover (Table - Basic Cover). The soils on the study appear to be highly erodible, and severe erosion is apparent outside of the seeded area. Due to surface litter, soil movement, flow patterns, and the formation of pedestals, the soil erosion condition class was determined to be slight in all sampled years. It appears that chained trees may have been placed in the gullies to minimize channel erosion.

### Trend Assessments

Browse:

- **2002 to 2007 - slightly up (+1):** The density of fourwing saltbush increased 50% from 40 plants/acre to 60 plants/acre. The density of antelope bitterbrush increased 33% from 60 plants/acre to 80 plants/acre. Cover of bitterbrush increased from 0% to less than 1%.
- **2007 to 2012 - down (-2):** The density of fourwing saltbush remained similar at 60 plants/acre. Cover of saltbush remained near 1%. The density of antelope bitterbrush decreased 25% to 60 plants/acre. Cover of bitterbrush increased to 1%.

Grass:

- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial grasses increased 16%. The perennial grass species mountain brome (*Bromus carinatus*) increased significantly in nested frequency, and increased in cover from less than 1% to 1%. Crested wheatgrass remained the dominant grass species on the study. The invasive annual grass species cheatgrass and Japanese brome increased significantly in nested frequency.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses remained similar. Western wheatgrass (*Agropyron smithii*) and Sandberg bluegrass (*Poa secunda*) increased significantly in nested frequency. Western wheatgrass increased in cover from 1% to 4%. The invasive annual species cheatgrass and Japanese brome decreased significantly in nested frequency.

Forb:

- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs increased 73%. Perennial forbs are rare on the study. Musk thistle was not observed on the site.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial forbs decreased 53%. Lewis flax decreased significantly in nested frequency. The perennial forbs are rare on the study.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 17, study no: 64

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02	1.3	0.0	0.0	30.0	0.0	0.7	-2.0	<b>29.9</b>	Very Poor
07	1.8	0.0	0.0	30.0	-0.4	0.9	0.0	<b>32.3</b>	Very Poor
17	3.1	0.0	0.0	30.0	-0.1	0.2	0.0	<b>33.2</b>	Very Poor-Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 17, Study no: 64

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	Agropyron cristatum	156	196	200	6.66	7.28	13.07
G	Agropyron intermedium	128	106	140	3.11	5.44	5.84
G	Agropyron smithii	<sub>a</sub> 42	<sub>a</sub> 52	<sub>b</sub> 66	2.02	1.40	1.29
G	Agropyron spicatum	9	16	17	.41	1.21	.81
G	Bromus carinatus	<sub>a</sub> 6	<sub>b</sub> 28	<sub>a</sub> 1	.18	.96	.00
G	Bromus inermis	103	111	94	2.67	3.35	2.37
G	Bromus japonicus (a)	<sub>a</sub> 3	<sub>b</sub> 40	<sub>a</sub> 1	.00	.12	.00
G	Bromus tectorum (a)	<sub>a</sub> 5	<sub>b</sub> 66	<sub>a</sub> 10	.01	.40	.16
G	Carex sp.	-	-	1	.00	-	.00
G	Dactylis glomerata	<sub>b</sub> 19	<sub>a</sub> 5	<sub>a</sub> 5	.56	.22	.03
G	Elymus cinereus	24	36	44	3.69	2.94	7.50
G	Oryzopsis hymenoides	13	6	2	.93	.19	.15
G	Poa fendleriana	-	5	7	-	.06	.09
G	Poa pratensis	-	4	-	-	.18	-
G	Poa secunda	<sub>a</sub> 12	<sub>ab</sub> 24	<sub>c</sub> 47	.02	.58	1.35
G	Secale montanum	-	7	-	.00	.18	-

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	Sitanion hystrix	7	7	-	.21	.16	-
Total for Annual Grasses		8	106	11	0.01	0.52	0.16
Total for Perennial Grasses		519	603	624	20.52	24.19	32.55
Total for Grasses		527	709	635	20.54	24.71	32.72
F	Alyssum alyssoides (a)	a-	b21	c77	-	.06	.17
F	Astragalus sp.	2	-	3	.01	-	.00
F	Camelina microcarpa (a)	a-	b15	a-	-	.07	-
F	Carduus nutans (a)	5	-	-	.01	-	-
F	Chaenactis douglasii	-	3	4	-	.03	.01
F	Cirsium sp.	-	1	-	.00	.00	-
F	Cryptantha sp.	-	1	3	-	.15	.03
F	Descurainia pinnata (a)	-	9	-	-	.02	-
F	Draba sp. (a)	-	-	2	-	-	.00
F	Gilia sp. (a)	4	10	-	.03	.05	-
F	Lactuca serriola (a)	1	3	-	.00	.00	-
F	Lappula occidentalis (a)	-	18	-	-	.05	-
F	Linum lewisii	ab18	b26	a3	.28	.18	.03
F	Lithospermum ruderales	-	-	-	.00	.03	-
F	Medicago sativa	-	-	-	.00	-	-
F	Penstemon caespitosus	1	7	1	.03	.04	.03
F	Streptanthus cordatus	1	-	4	.00	-	.00
F	Tragopogon dubius (a)	9	8	-	.02	.04	-
Total for Annual Forbs		19	84	79	0.07	0.31	0.17
Total for Perennial Forbs		22	38	18	0.34	0.43	0.11
Total for Forbs		41	122	97	0.40	0.75	0.29

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

#### BROWSE TRENDS--

Management unit 17, Study no: 64

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	Atriplex canescens	2	3	2	.63	.41	.85
B	Juniperus osteosperma	1	3	4	1.86	1.86	1.18
B	Purshia tridentata	2	2	3	-	.15	1.03
Total for Browse		5	8	9	2.49	2.42	3.07

#### CANOPY COVER, LINE INTERCEPT--

Management unit 17, Study no: 64

Species	Percent Cover		
	'02	'07	'12
Atriplex canescens	.48	.80	.76
Juniperus osteosperma	2.46	1.48	2.58
Purshia tridentata	.31	.88	1.33

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 17, Study no: 64

Species	Average leader growth (in)		
	'02	'07	'12
Atriplex canescens	3.4	4.1	4.1
Purshia tridentata	4.0	2.8	1.5

POINT-QUARTER TREE DATA--

Management unit 17, Study no: 64

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	30	39	51	4.6	5.4	3.0
Pinus edulis	<18	22	<18	2.1	3.3	4.0

BASIC COVER--

Management unit 17, Study no: 64

Cover Type	Average Cover %		
	'02	'07	'12
Vegetation	25.31	36.94	39.86
Rock	1.94	.70	1.79
Pavement	3.73	3.69	2.12
Litter	56.09	45.00	66.08
Cryptogams	.23	.56	.03
Bare Ground	30.10	23.16	16.43

PELLET GROUP DATA--

Management unit 17, Study no: 64

Type	Quadrat Frequency			Days use per acre (ha)		
	'02	'07	'12	'02	'07	'12
Rabbit	27	9	-	-	-	-
Elk	36	31	10	115 (284)	110 (273)	9 (23)
Deer	14	11	1	25 (63)	25 (63)	19 (46)

BROWSE CHARACTERISTICS--  
Management unit 17, Study no: 64

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
02	0	0	0	-	-	0	0	0	19/26
07	0	0	0	-	-	0	0	0	22/31
12	0	0	0	-	-	0	0	0	30/44
<i>Atriplex canescens</i>									
02	40	0	100	0	-	50	0	0	45/51
07	60	0	100	0	-	33	0	0	55/73
12	60	33	0	67	-	100	0	0	51/61
<i>Cercocarpus ledifolius</i>									
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	23/26
<i>Chrysothamnus nauseosus albicaulis</i>									
02	0	0	0	-	-	0	0	0	29/43
07	0	0	0	-	-	0	0	0	32/41
12	0	0	0	-	-	0	0	0	52/87
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
02	0	0	0	-	-	0	0	0	14/24
07	0	0	0	-	-	0	0	0	23/32
12	0	0	0	-	-	0	0	0	22/36
<i>Gutierrezia sarothrae</i>									
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	20/25
12	0	0	0	-	-	0	0	0	-/-
<i>Juniperus osteosperma</i>									
02	20	100	0	-	-	0	0	0	-/-
07	60	0	100	-	-	0	0	0	-/-
12	80	25	75	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
02	60	67	33	-	-	0	100	0	17/28
07	80	0	100	-	-	25	75	0	27/42
12	60	0	100	-	-	33	33	0	39/55
<i>Symphoricarpos oreophilus</i>									
02	0	0	0	-	-	0	0	0	12/18
07	0	0	0	-	-	0	0	0	14/16
12	0	0	0	-	-	0	0	0	25/32

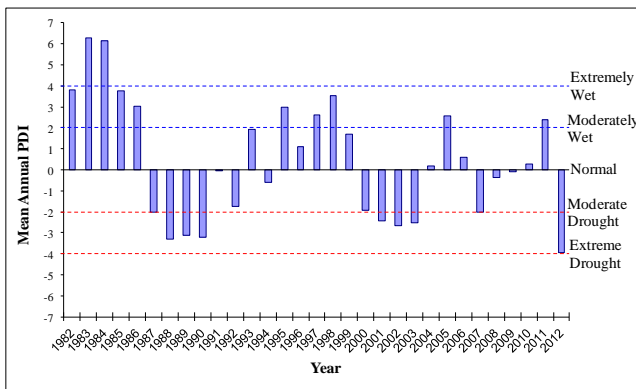


SUMMARY  
WILDLIFE MANAGEMENT UNIT 17 - WASATCH MOUNTAINS

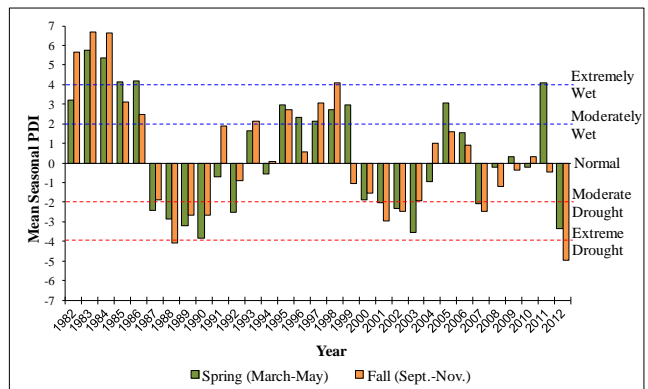
**Community Types**

Deer winter range within a unit is summarized into three categories based on ecological potentials which include **low potential**, **mid-level potential** and **high potential**. Low potential sites include desert shrub, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) communities. Mid-level potential sites include mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) communities. High potential sites include mountain brush communities. Low sagebrush (*A. arbuscula*), black sagebrush (*A. nova*), and basin big sagebrush (*A. tridentata* ssp. *tridentata*) communities are placed within the low potential or mid-level potential scales based on precipitation and elevation. Deer **summer range** is summarized separately from winter range as a fourth category and typically includes aspen (*Populus tremuloides*) and high elevation mountain brush communities. Twenty nine interagency range trend studies were sampled in Unit 17 during the summer of 2012.

All 29 of the studies in the unit are categorized as mid-level potential sites for deer winter range, and sample mountain big sagebrush, cliffrose (*Cowania mexicana* ssp. *stansburiana*), or mixed brush communities. All of the studies except the Deer Creek Dam, Hoovers Hollow, North Battle Creek, Round Peak, Maple Mountain Face, North Bench, and Tie Fork East studies are also considered to be elk winter range. The unit was summarized in this report in three distinct geographic areas consisting of the Heber Valley, Bonneville Shoreline, and Spanish Fork Canyon areas. Studies that were sampled in the Heber Valley include Deer Creek Dam (17-5), Lower Big Hollow (17-9), Wallsburg Turn (17-11), North Wallsburg Reseeding (17-12), North Wallsburg (17-13), Hoovers Hollow (17-14), Island Boat Camp (17-15), Rainbow Bay (17-16), Dutch Canyon (17-17), Coyote Canyon (17-19), and Center Creek (17-60). Studies that were sampled along the Bonneville Shoreline include Heissetts Hollow (17-24), North Battle Creek (17-25), Orem Water Tank (17-26), Spring Canyon (17-30), Round Peak (17-31), Maple Mountain Face (17-34), American Fork Canyon (17-61), Grove Creek (17-62), and Hobble Creek Bench (17-63). Studies sampled in Spanish Fork Canyon include Little Diamond Fork (17-39), Long Hollow (17-40), Upper Sheep Creek (17-41), Tank Hollow (17-42), Billies Mountain (17-44), North Bench (17-45captio), Lower Tank Hollow (17-46), Tie Fork East (17-47), and Water Hollow (17-64).



**Figure 1.** The 31 year mean annual Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).



**Figure 2.** The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for the Northern Mountains division (Division 5). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).

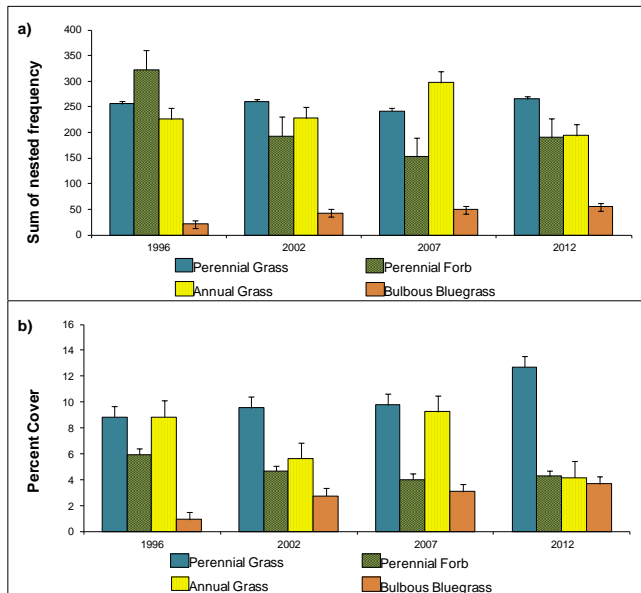
## Precipitation

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Precipitation and Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the Northern Mountains division (Division 5). The Northern Mountains division had a historic annual mean precipitation of 19.13 inches from 1895 to 2012. The mean annual PDSI of the Northern Mountains division displays a cycle of several wet years followed by several drought years over the course of study years (Figure 1 and Figure 2) (Time Series Data 2013).

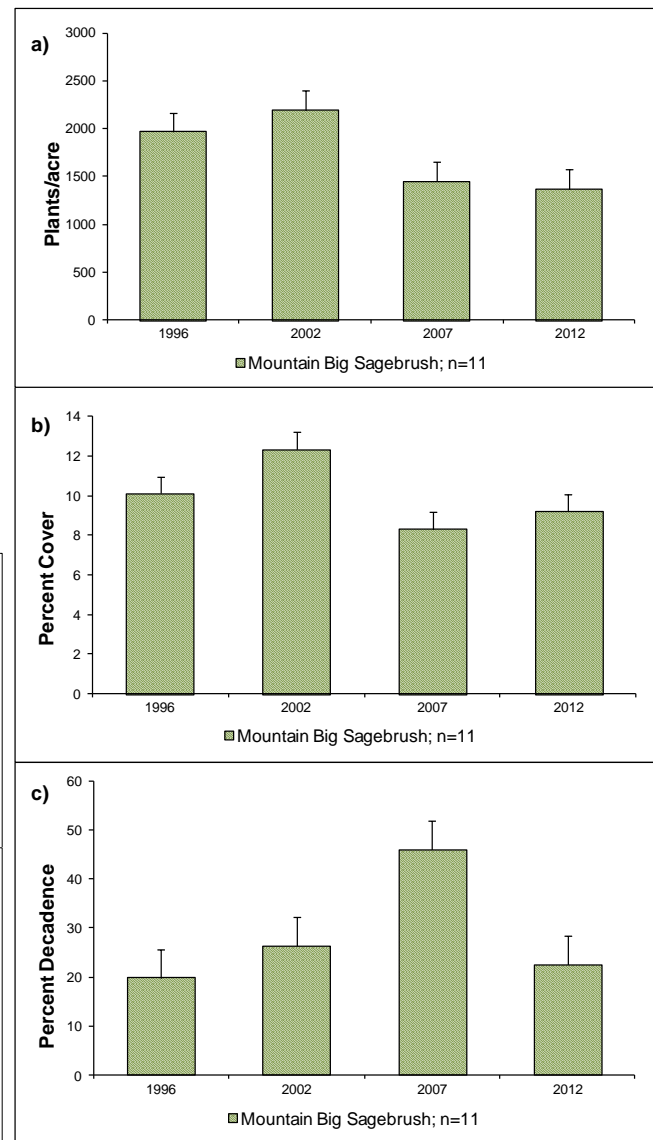
The 1961-1990 mean annual precipitation was 14-16 in. on the Tie Fork East study; 16-18 in. on the Coyote Canyon, Long Hollow, Billies Mountain, American Fork Canyon, and Water Hollow studies; 18-20 in. on the Lower Big Hollow, Wallsburg Turn, North Wallsburg, Island Boat Camp, Rainbow Bay, Heissetts Hollow, North Battle Creek, Tank Hollow, North Bench, Lower Tank Hollow, and Grove Creek studies; and 20-24 in. on the Deer Creek Dam, North Wallsburg Reseeding, Hoovers Hollow, Dutch Canyon, Orem Water Tank, Spring Canyon, Round Peak, Maple Mountain Face, Little Diamond Fork, Upper sheep Creek, Center Creek, and Hobble Creek Bench studies (PRISM Climate Group 2011).

## Heber Valley

Browse: The mid-level potential site cumulative median browse trend for the Heber Valley decreased slightly in 1989, but was down in 2007 (Figure 10a). Mountain big sagebrush is a primary browse species on all of these mid-level potential studies. The mean density and cover of mountain big sagebrush decreased significantly in 2007, and remained at



**Figure 3.** a) Heber Valley mid-level potential sites in the mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass sum of nested frequency by year for WMU 17, Wasatch Mountains. b) Heber Valley mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass cover by year for WMU 17.



**Figure 4.** a) Heber Valley mid-level potential sites mean density of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) by year for WMU 17, Wasatch Mountains. b) Heber Valley mid-level potential sites mean cover of mountain big sagebrush by year for WMU 17. c) Heber Valley mid-level potential mean decadence of mountain big sagebrush by year for WMU 17.

reduced levels in 2012 (Figure 4a and Figure 4b). These decreases were similar across most of the study sites. The mean decadence of mountain big sagebrush was significantly higher in 2007 than the other sample years (Figure 4c). An infestation of the sagebrush defoliator moth (*Aroga websteri*) likely occurred throughout the Heber Valley from 2002 to 2007 affecting many of the studies adversely.

**Herbaceous Understory:** The mid-level potential site cumulative median grass trend for the Heber Valley increased in 1989, but decreased slightly in 2007 (Figure 10a). Perennial grass species are fairly abundant on the studies in this area. However, annual grasses, primarily cheatgrass (*Bromus tectorum*), are common and dominate the grass component on many of the sites. The weedy species bulbous bluegrass (*Poa bulbosa*) is sampled on most of the studies in this area, but typically occurs at low frequency and cover. The study that is the exception to this is the North Wallsburg study which bulbous bluegrass is the dominant grass species on. The mean sum of nested frequency of perennial grasses, excluding bulbous bluegrass, has remained fairly stable since 1996 (Figure 3a). The mean cover of perennial grasses, excluding bulbous bluegrass, remained similar from 1996 to 2007, but increased significantly in 2012 (Figure 3b). The mean sum of nested frequency of annual grasses was significantly higher in 2007 than the other sample years (Figure 3a). The mean cover of annual grasses was significantly higher in 1996 and 2007 than in 2002 and 2012 (Figure 3b). The mean sum of nested frequency and cover of bulbous bluegrass increased significantly in 2002, and has remained higher in subsequent sample years (Figure 3a and Figure 3b).

The mid-level potential median cumulative forb trend for the Heber Valley increased in 1989 and 1996, but then decreased in 2002 and 2007 (Figure 10a). Perennial forbs have been diverse and abundant within the sampled communities. The mean sum of nested frequency and cover of perennial forbs decreased significantly in 2002, and has remained at decreased levels throughout subsequent sample years (Figure 3a and Figure 3b).

**Occupancy:** Pellet group transect data indicates that deer predominately occupy these mid-level potential winter range studies. The mean abundance of deer pellet groups has steadily decreased since 2002. Elk pellet groups are typically sampled in low to moderate abundance. The mean abundance of elk pellet groups was slightly higher in 2007 than the other sample years. Livestock sign from cattle and sheep is typically sampled in low abundance on these studies (Figure 11a).

**Deer Desirable Components Index (DCI):** The mid-level potential deer DCI of the Heber Valley has been poor-fair to fair since 1996 except for 2007 when it was ranked as very poor-poor. The decrease in 2007 is likely due to damage caused by the sagebrush defoliator moth to sagebrush populations throughout the area (Table 1 and Figure 9).

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	17.9	9.2	7.2	16.3	-6.6	6.0	-0.8	<b>49.1</b>	Poor-Fair
02	21.8	7.0	3.4	16.0	-4.2	5.7	-0.7	<b>49.0</b>	Poor-Fair
07	14.9	5.5	2.4	15.9	-7.0	6.0	-0.9	<b>36.9</b>	Very Poor-Poor
12	18.0	8.7	5.0	18.2	-3.1	6.3	-1.1	<b>52.0</b>	Fair

**Table 1.** Mid-level potential scale mean deer DCI scores and rankings for the Heber Valley area (n=11) by year for WMU 17, Wasatch Mountains. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

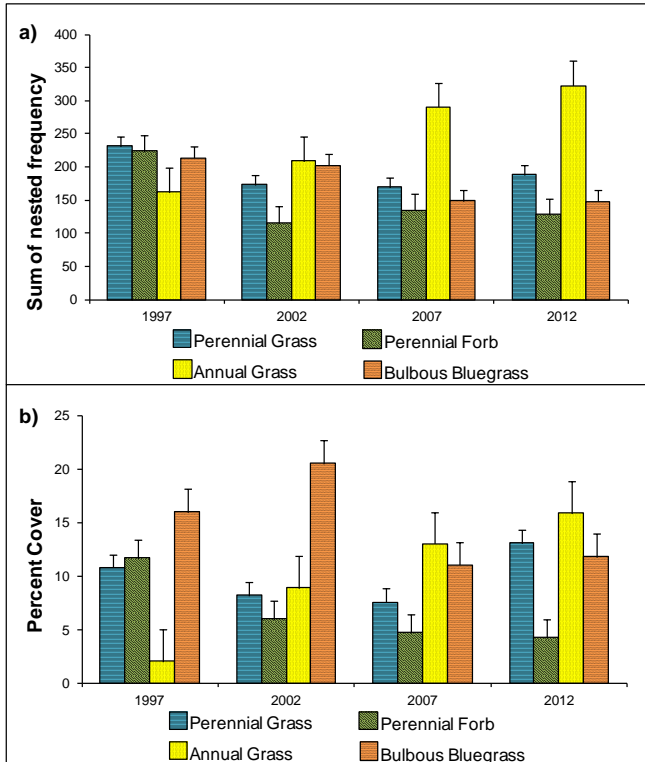
**Discussion:** The large decrease in density and cover of mountain big sagebrush in 2007 is the main trend of note in the Heber Valley area. An infestation of the sagebrush defoliator moth (*Aroga websteri*) likely occurred throughout the Heber Valley from 2002 to 2007 affecting many of the studies adversely. The sagebrush defoliator moth was noted in 2007 on the Deer Creek Dam, Lower Big Hollow, Wallsburg Turn, North Wallsburg, Rainbow Bay, Dutch Canyon, and Coyote Canyon studies, but appeared to have impacted the Island Boat Camp study as well. The health of these sagebrush populations appears to be improving with decadence decreasing in 2012 to 1996 and 2002 levels, but density and cover of sagebrush remained at

reduced levels. The abundance of weedy annual species and bulbous bluegrass is a particular concern on these mid-level potential sites and may inhibit the recovery of sagebrush in the areas. These weedy species can form dense mats of cover that compete with other more desirable herbaceous species and with seedlings and young shrubs which limits establishment of new plants into the population. Annual grass species can also increase fuel loads and increase the chance of a catastrophic fire event.

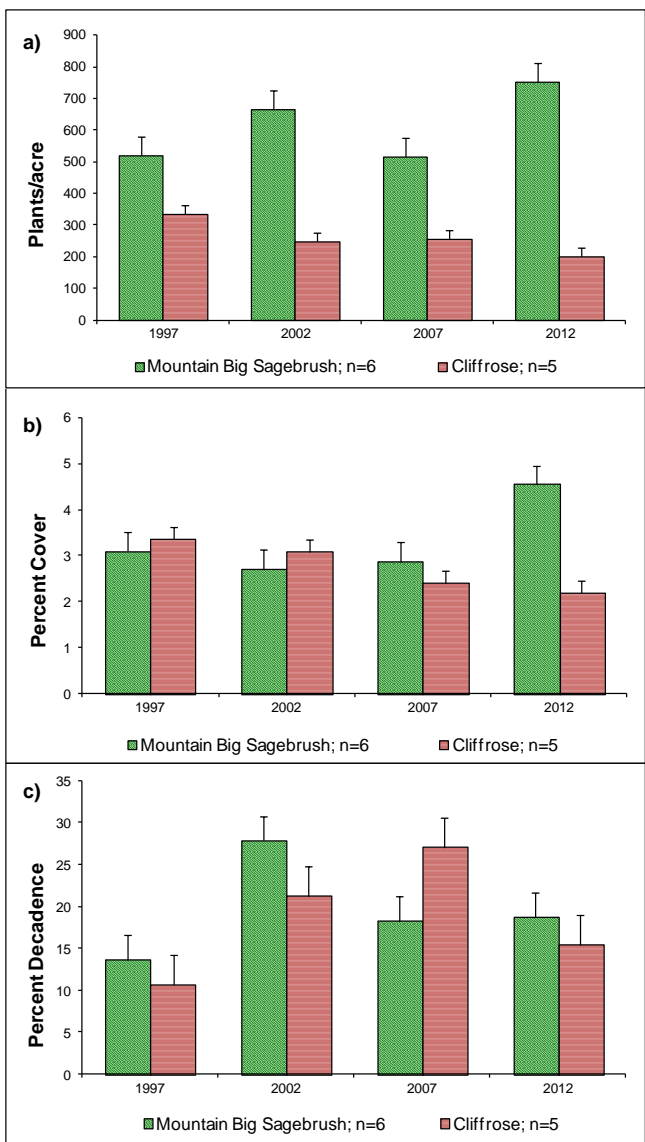
### Bonneville Shoreline

**Browse:** The mid-level potential site cumulative median browse trend of the Bonneville Shoreline studies, decreased slightly in 1997, increased slightly in 2002, then decreased slightly again in 2007 (Figure 10b). Browse species are typically limited on these mid-potential sites. Mountain big sagebrush is a primary browse species on the Heisetts Hollow, North Battle Creek, Maple Mountain Face, American Fork Canyon, Grove Creek, and Hobble Creek Bench studies. The mean density of mountain big sagebrush has fluctuated but has generally increased since 1997 (Figure 6a). The mean cover of mountain big sagebrush increased significantly in 2012 (Figure 6b). Most of the increase in mountain big sagebrush is due to increases on the Maple mountain face. The mean decadence of mountain big sagebrush was significantly higher in 2002 than in the other sample years (Figure 6c).

Stansbury cliffrose is a primary browse species on the Heisetts Hollow, North Battle Creek, Spring



**Figure 5. a)** Bonneville Shoreline mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass sum of nested frequency by year for WMU 17, Wasatch Mountains. **b)** Bonneville Shoreline mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass cover by year for WMU 17.



**Figure 6. a)** Bonneville Shoreline mid-level potential sites mean density of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and cliffrose (*Cowania mexicana* ssp. *stanburiana*) by year for WMU 17, Wasatch Mountains. **b)** Bonneville Shoreline mid-level potential sites mean cover of mountain big sagebrush and cliffrose by year for WMU 17. **c)** Bonneville Shoreline mid-level potential mean decadence of mountain big sagebrush and cliffrose by year for WMU 17.

Canyon, American Fork Canyon, and Grove Creek studies. The mean density of cliffrose decreased significantly in 2002, but remained similar in subsequent sample years (Figure 6a). The mean cover of cliffrose decreased significantly in 2007, and remained lower in 2012 (Figure 6b). The mean decadence of cliffrose increased steadily from 1997 to 2007, but decreased significantly in 2012 (Figure 6c).

**Herbaceous Understory:** The mid-level potential median cumulative grass trend of the Bonneville Shoreline decreased slightly in 1989, then decreased steadily in 2002 and 2007 (Figure 10b). Annual grass species including cheatgrass and the weedy perennial bulbous bluegrass dominate the grass component on many of the sites. The mean sum of nested frequency and cover of annual grasses has steadily increased since 1997 (Figure 5a and Figure 5b). The sum of nested frequency and cover of bulbous bluegrass decreased significantly in 2007 (Figure 5a and Figure 5b). The mean sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased significantly in 2002 and remained at lower levels through subsequent sample years (Figure 5a). The mean cover of perennial grass species, excluding bulbous bluegrass, decreased significantly in 2002, but increased significantly again in 2012 (Figure 5b).

The mid-level potential median cumulative forb trend of the Bonneville Shoreline studies decreased slightly in 1989, increased slightly in 1997, then steadily decreased from 2002 to 2012 (Figure 10b). Perennial forb species are relatively rare on most of these studies. The mean sum of nested frequency and cover of perennial forb species decreased significantly in 2002 and remained at lower levels throughout subsequent sample years (Figure 5a and Figure 5b).

**Occupancy:** Pellet group transect data indicates that deer predominantly occupy these Bonneville Shoreline study areas. The mean abundance of deer pellet groups has been moderate to high since 2002, with slightly higher abundance in 2007. The mean abundance of elk pellet groups has been generally low to moderate, with a slightly higher abundance in 2007. Bighorn sheep pellets were sampled on the American Fork and Grove Creek studies in moderate abundance in 1998, but pellet group abundance has steadily decreased on these studies since that time (Figure 11b).

**Deer Desirable Components Index (DCI):** The mid-level potential deer DCI of the Bonneville Shoreline studies has ranked from poor to very poor since 1997. Low amounts of preferred browse cover and high amounts of annual grass cover are the primary reasons for the low scores (Table 2 and Figure 9).

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	6.6	5.9	3.1	18.0	-1.5	8.2	-1.0	<b>39.2</b>	Poor
02	10.0	4.7	2.8	14.0	-5.4	5.8	-0.7	<b>31.3</b>	Very Poor
07	8.4	5.9	2.9	14.4	-8.7	5.5	-1.5	<b>27.0</b>	Very Poor
12	11.2	8.2	4.3	17.5	-11.1	5.4	-1.3	<b>34.2</b>	Very Poor-Poor

**Table 2.** Mid-level potential scale mean deer DCI scores and rankings for the Bonneville Shoreline area (n=9) by year for WMU 17, Wasatch Mountains. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

**Discussion:** The lack of browse species is an artifact of historic wildfires on many of these studies. The abundance of weedy annual species and bulbous bluegrass is a particular concern on these mid-level potential sites. These weedy species can form dense mats of cover that compete with other more desirable herbaceous species and with seedlings and young shrubs which limits establishment of new plants into the population. Annual grass species can also increase fuel loads and increase the chance of a catastrophic fire event.

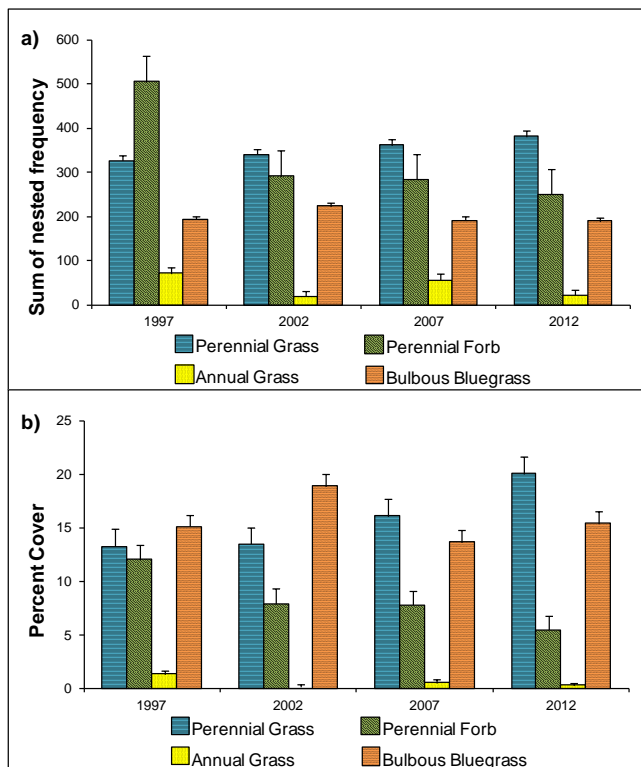
### Spanish Fork Canyon

**Browse:** The mid-level potential site cumulative median browse trend of the Spanish Fork Canyon studies remained relatively stable over the duration of the study years (Figure 10c). Mountain big sagebrush is a

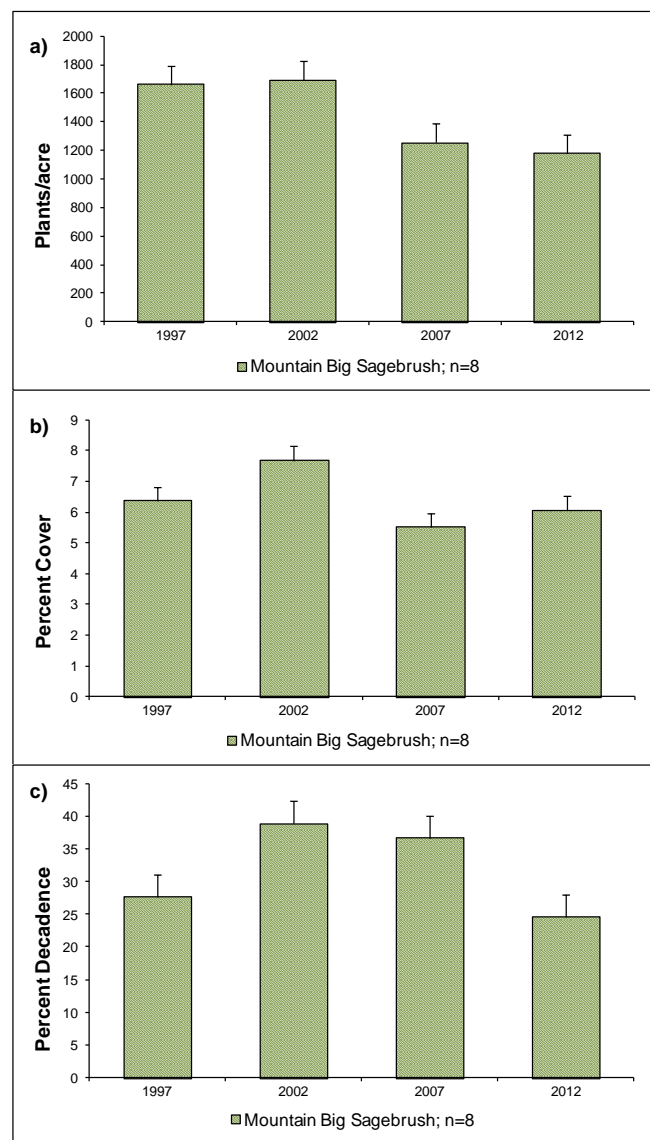
primary browse species on all but the Water Hollow study. The mean density of mountain big sagebrush decreased significantly in 2007 and remained at reduced levels in 2012 (Figure 8a). The mean cover of mountain big sagebrush was significantly higher in 2002 than the other sample years (Figure 8b). The mean decadence of mountain big sagebrush has been high since 1997, but was significantly higher in 2002 and 2007 than the other sample years (Figure 8c).

**Herbaceous Understory:** The mid-level potential median cumulative grass trend of the Spanish Fork Canyon studies increased in 1989 and again in 1997, but has remained similar since 1997 (Figure 10c). Perennial grass species are generally diverse and abundant on these study sites. The mean sum of nested frequency and cover of perennial grasses, excluding bulbous bluegrass, has steadily increased since 1997 (Figure 7a and Figure 7b). The weedy perennial species bulbous bluegrass is also common on many of the mid-level potential study sites, and is the dominant grass species on the Little Diamond Fork and Long Hollow studies. Bulbous bluegrass was the dominant grass species on the North Bench study in 1998, but has steadily decreased on that site since 2002. There have been fluctuations in both nested the mean sum of nested frequency and cover of bulbous bluegrass on these studies, but it does not appear that bulbous bluegrass is increasing or decreasing on any of the sites other than North Bench (Figure 7a and Figure 7b). Annual grass species including cheatgrass are typically rare on these study sites (Figure 7a and Figure 7b).

The mid-level potential median cumulative forb trend of the Spanish Fork Canyon studies increased in 1997, but decreased again in 2002 (Figure 10c). Perennial forb species are generally diverse and abundant on



**Figure 7.** a) SF Canyon mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass sum of nested frequency by year for WMU 17, Wasatch Mountains. b) SF Canyon mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass cover by year for WMU 17.



**Figure 8.** a) SF Canyon mid-level potential sites mean density of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) by year for WMU 17, Wasatch Mountains. b) SF Canyon mid-level potential sites mean cover of mountain big sagebrush by year for WMU 17. c) SF mid-level potential sites mean decadence of mountain big sagebrush by year for WMU 17.

most of the studies. The mean sum of nested frequency and cover of perennial forb species decreased significantly in 2002 and remained at reduced levels throughout the subsequent sample years (Figure 7a and Figure 7b).

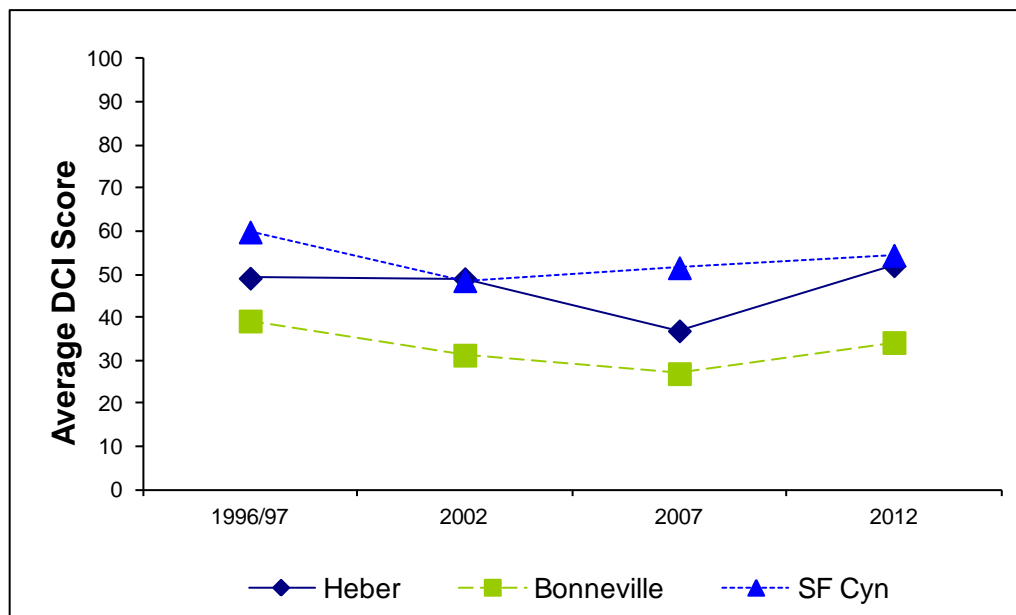
Occupancy: Pellet group transect data indicates that deer predominantly occupy these mid-level potential study areas in the Spanish Fork Canyon. The mean abundance of deer pellet groups was high on most studies in 2002, but has steadily decreased to low abundance in 2012. The mean abundance of elk pellet groups has been low to moderate, but with a large decrease in 2012. Livestock sign from cattle has been very low abundance on all of the studies since 1997 except for the Little Diamond Fork study, which had some years of high abundance of cattle sign (Figure 11c).

Deer Desirable Components Index (DCI): The mid-level potential deer DCI of the Spanish Fork Canyon studies has remained poor-fair to fair since 1997. Most of the fluctuation in the DCI ranking is due to changes in decadence and recruitment of young preferred browse species (Table 3 and Figure 9).

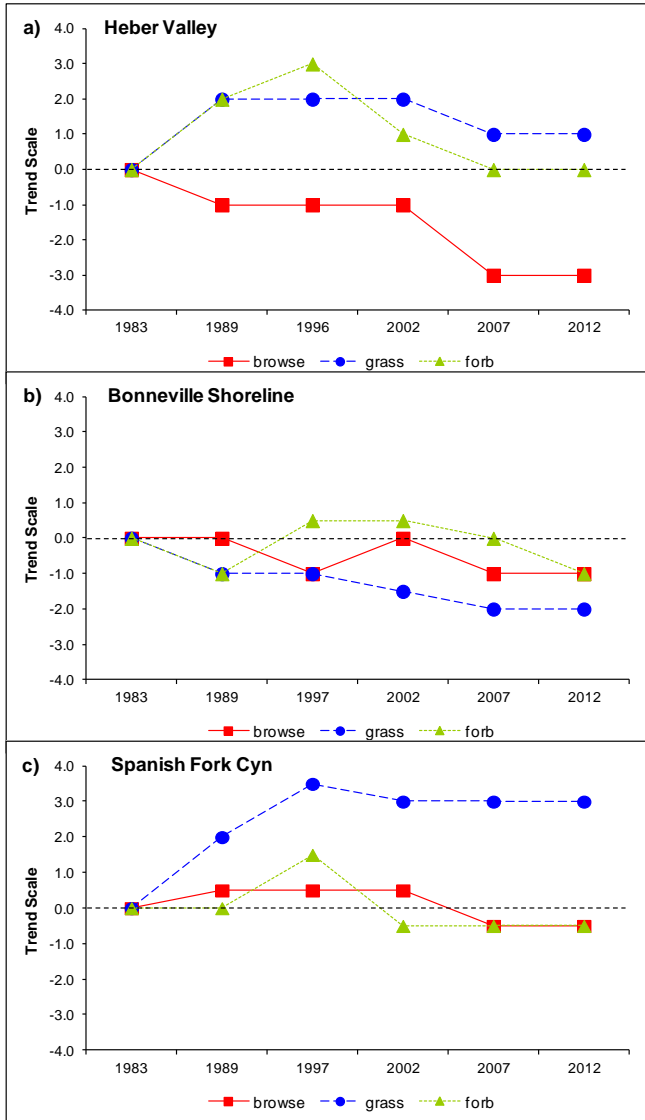
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	14.4	8.2	6.7	23.7	-1.0	9.9	-2.0	<b>59.9</b>	Fair
02	12.9	2.5	3.4	24.5	-0.1	7.4	-2.2	<b>48.6</b>	Poor-Fair
07	10.7	5.6	2.1	26.8	-0.4	7.9	-1.1	<b>51.6</b>	Poor-Fair
12	12.4	7.7	3.5	25.8	-0.2	6.4	-1.1	<b>54.5</b>	Fair

**Table 3.** Spanish Fork Canyon mid-level potential scale mean deer DCI scores and rankings (n=9) by year for WMU 17, Wasatch Mountains. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

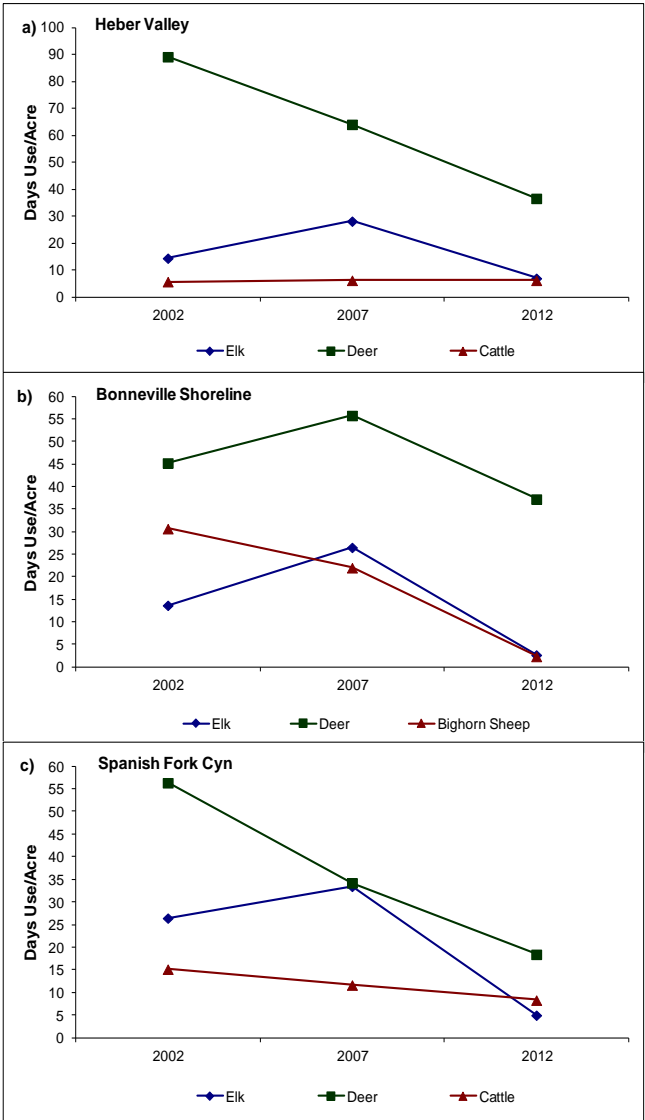
Discussion: The abundance of the weedy grass species bulbous bluegrass is a particular concern on these sites. This weedy species can form dense mats of cover that compete with other more desirable herbaceous species and with seedlings and young shrubs which limits establishment of new plants into the population. A desirable trend is the increase in perennial grass species on many of these studies, particularly the Little Diamond Fork, Tank Hollow, North Bench, and Water Hollow studies.



**Figure 9.** Heber Valley (n=11), Bonneville Shoreline (n=9), and Spanish Fork Canyon (n=9) mean mid-level potential scale deer DCI scores by year for WMU 17, Wasatch Mountains. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.



**Figure 10.** a) Heber Valley mid-level potential sites cumulative median browse, grass and forb trends by year for WMU 17, Wasatch Mountains. b) Bonneville Shoreline mid-level potential sites cumulative median browse, grass, and forb trends by year for WMU 17. c) Spanish Fork Canyon mid-level potential sites cumulative median browse, grass, and forb trends by year for WMU 17.



**Figure 11.** a) Heber Valley mid-level potential sites mean animals days use/acre (n=11) by year for WMU 17, Wasatch Mountains. b) Bonneville Shoreline mid-level potential sites mean animal days use/acre (n=9) by year for WMU 17. c) Spanish Fork Canyon mid-level potential sites mean animal days use/acre (n=9) by year for WMU 17.



## MANAGEMENT UNIT 18 - OQUIRRH-STANSBURY

### Boundary Description

**Salt Lake, Utah, and Tooele counties** - Boundary begins at the junction of I-15 and I-80 in Salt Lake City; south on I-15 to SR-73; west on SR-73 to SR-36; south on SR-36 to the Pony Express road located just south of Faust; west on this road to the Skull Valley-Dugway-Timpie road; north on this road to I-80 at Rowley Junction; east on I-80 to I-15 and beginning point.

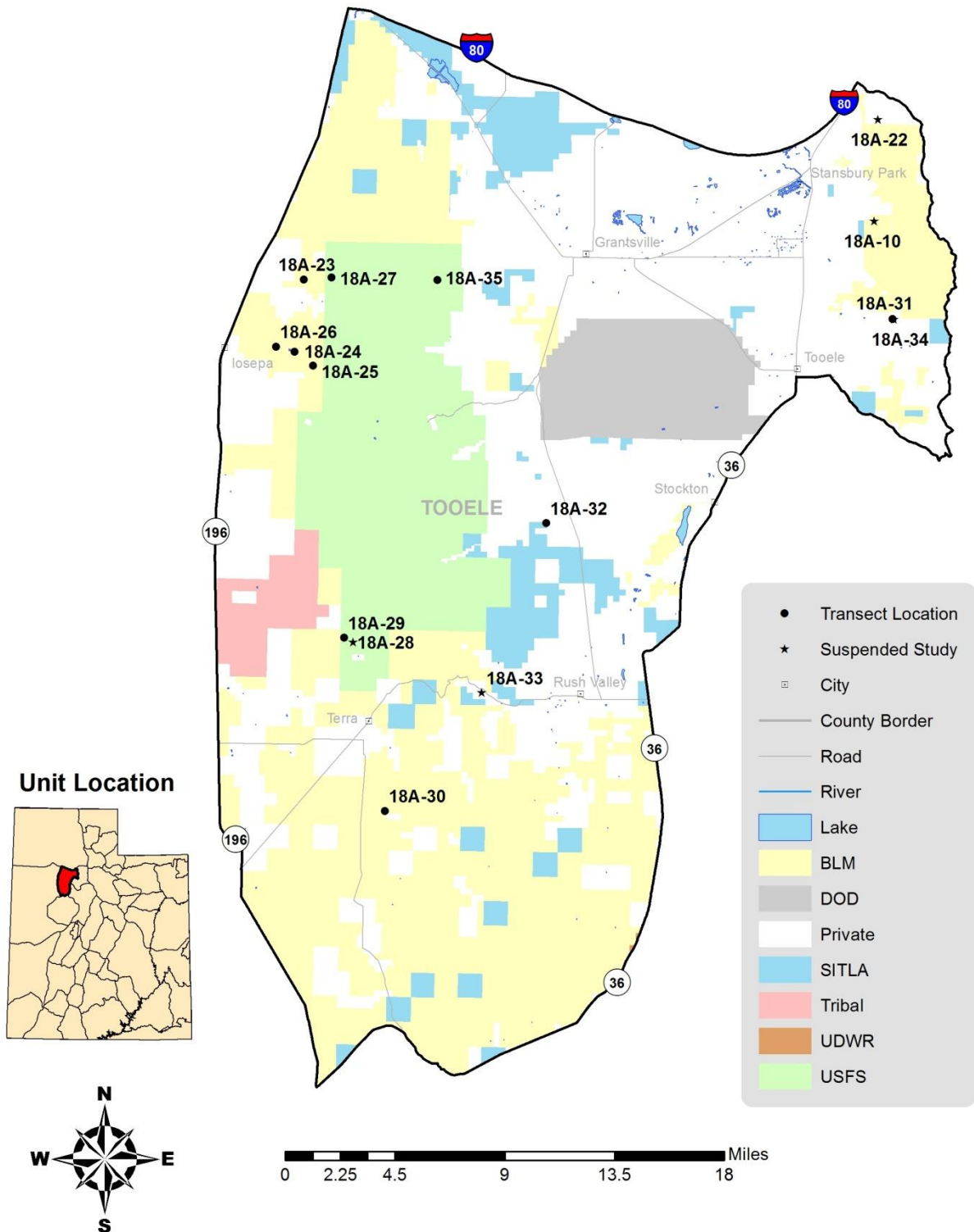
### Unit Description

This management unit includes the Stansbury, Oquirrh, and Onaqui Mountains and is divided into two subunits. Big game activity within the unit centers around the Oquirrh Mountains and the Stansbury Mountains with their southern foothills. These two mountain ranges are both fairly isolated from surrounding ranges by valleys and are the only lands suitable for big game habitat.

The winter range for the Oquirrh Mountains is limited to land below 7,000 feet and makes up approximately 48% of the land classified as suitable for big game. The remainder is located at an elevation range of 7,000 to 7,500 feet and is classified as summer range. During severe winters, the available winter habitat is reduced to almost half this area; a particularly major management problem for the Oquirrh Mountains. Another major concern is that 63% of the summer and 45% of winter range are under private ownership. The area has a history of heavy grazing (almost year round) by cattle, sheep, wild horses, and goats. Although current use is less intense than in the past, the winter range condition has continued to decline.

Air pollution from smelters has created management difficulties for the area surrounding the northern Oquirrh Mountains. Historically, pollution eliminated almost all vegetation within drainages adjacent to the smelter (personal communication with Ann Neville, Kennecott biologist resource specialist, 2007). Accumulations of mine tailings in Bingham and Mercur Canyons have covered significant acreages on both summer and winter ranges. Access to studies on private land also poses difficulty in this unit. Kennecott Copper Corporation, the largest single land owner, allows very limited hunting access for elk and deer hunting. The Stansbury Mountains winter range is located below 6,800 feet and makes up approximately 55% of the big game range. Summer range is limited to about 6,800 to 7,000 feet. The proportion of private land on this big game habitat is 6% of the summer and 14% of the winter range. Although the overall winter range condition is generally more satisfactory than that of the Oquirrh Mountains, there is a high abundance of invasive weeds restricting the reproduction and establishment of browse species. Big Game Management Objectives

# Management Unit 18A



## MANAGEMENT SUBUNIT 18A - OQUIRRH-STANSBURY, NORTH

### **Subunit Boundary Description**

**Tooele County** - Boundary begins at Lake Point Junction on I-80; south on the Tooele/Salt Lake County boundary to Middle Canyon Road; west on Middle Canyon Road to SR-36; south on SR-36 to the Pony Express road located just south of Faust; west on this road to the Skull Valley-Dugway-Timpie road; north on this road to I-80 at Rowley Junction; east on I-80 to Lake Point Junction and beginning point.

### **Range Trend Studies**

Ten interagency range trend studies were sampled in Subunit 18A during the summer of 2012. A total of fifteen studies have been established within Subunit 18A since 1983. Nine studies were established in 1983: Bates Canyon (18A-10), South Palmer Point (18A-23), Salt Mountain Stock Pond (18A-24), Below Chokecherry Spring (18A-25), Salt Mountain (18A-26), South of Broons Canyon (18A-27), and Deadman Canyon (18A-29), Condie Meadows (18A-28), and Hatch Ranch (18A-30); one study was established in 1990: Rodgers Canyon (18A-22); three studies were established in 1997: Carr Fork (18A-31), East Hickman Canyon (18A-32)], and Clover Creek (18A-33); and two studies were established in 2012: Carr Fork 2 (18A-34) and Magpie Canyon (18A-35).

In 2002, four studies (Bates Canyon, Condie Meadows, Rodgers Canyon, and Clover Creek) were suspended. In 2012, one study (Carr Fork) was suspended. These studies were suspended for various reasons and if the need arises in the future these studies can be sampled again. To access maps, discussions, and data tables for suspended studies see: <http://www.wildlife.utah.gov/range>.

SOUTH PALMER POINT - TREND STUDY NO. 18A-23-12

Vegetation Type: Annual Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter/Spring

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#) or Upland Loam (Wyoming Big Sagebrush), R028AY309UT

Land Ownership: BLM

Elevation: 5,100 ft (1,155 m)

Aspect: West

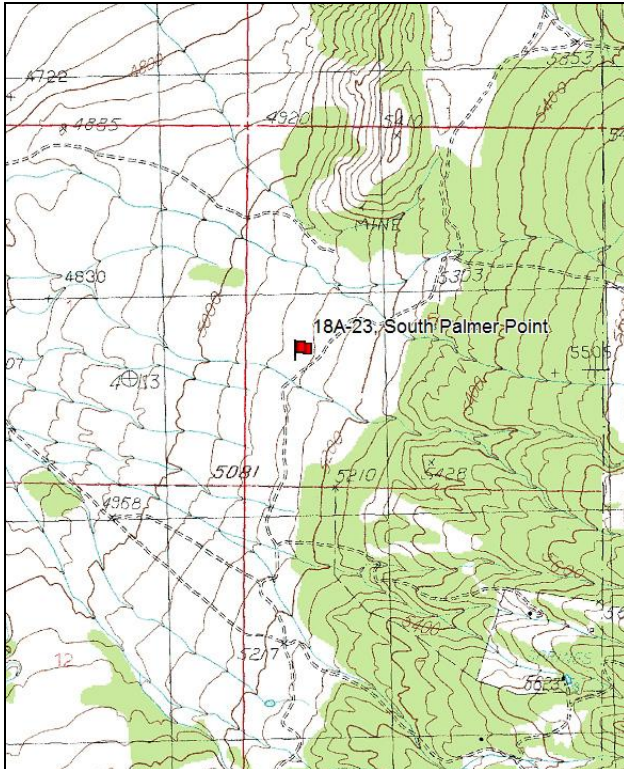
Slope: 5%

Transect bearing: 29° magnetic

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

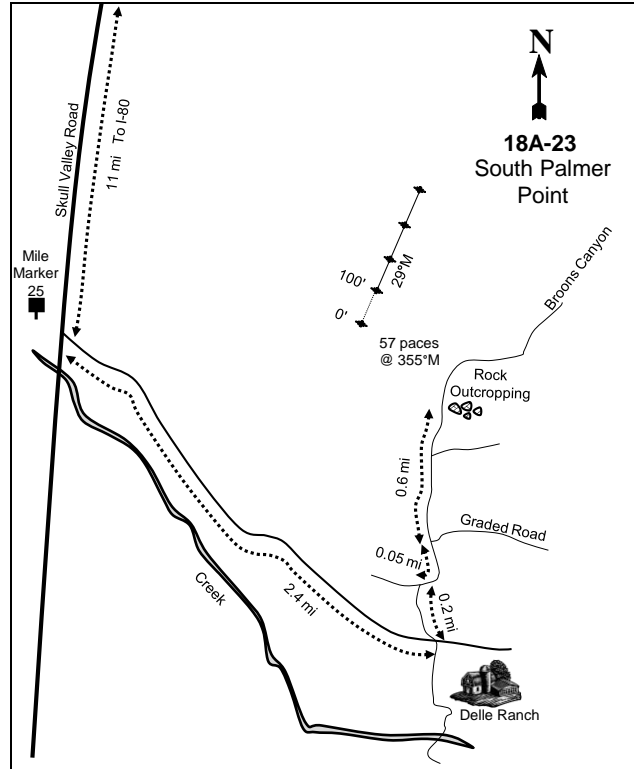
Directions: From I-80, proceed south on Skull Valley Road for 11 miles. Turn east of a dirt road (between mile posts 25 and 26) and continue along this road for 2.4 miles to Delle Ranch. From the creek crossing on the road at Delle Ranch, proceed north towards Broons Canyon for 0.2 miles to an intersection. Go east for 0.5 miles to another intersection. Turn left, and go north 0.60 miles until you reach a rock outcropping on the right hand side of the road. From the base of the rock outcropping, walk 57 paces at an azimuth of 29 degrees magnetic, and is marked by green "T" fencepost approximately 12 to 19 inched high. The 0-foot baseline stake has a red browse tag, number 3984, attached.

Map Name: Salt Mountain



Township: 3S Range: 7W Section: 6

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 357525 E 4493900 N

## SOUTH PALMER POINT - TREND STUDY NO. 18A-23

### Site Information

Site Description: The study monitors deer winter range on land administered by the Bureau of Land Management (BLM) as part of the Salt Mountain allotment. The study was treated in November 2004 as part of the Round Canyon treatment. The treatment treated 780 acres through aerially seeding sagebrush and perennial grasses and forbs (Table - Seed Mix I). After the seeding, bullhogs were used to reduce the density of Utah juniper (*Juniperus osteosperma*). The whole area then burned as part of the Big Pole wildfire in 2009, which burned 44,470 acres. The area was treated by the BLM through aerial seeding (Table - Seed Mix II) and chaining as part of an Emergency Stabilization and Rehabilitation (ESR) project. Several species were sampled that were not in the BLM seed mix, but may have come from the nearby Stansbury Wildfire Rehabilitation- Ensign Ranch ([WRI Project #1592](#)) aerial seeding project (WRI Database 2013). Prior to the fire, the site was dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and Utah juniper. The fire removed most of the shrub and tree species from the site. Deer pellet groups have been sampled in low abundance since 2002 (Table - Pellet Group Data).

Browse: Prior to the fire, Wyoming big sagebrush was the primary browse species, and provided the majority of the browse cover on the site (Table - Browse Trends). The sagebrush stand was comprised of a moderately dense population of mostly mature plants. Recruitment of young sagebrush plants was generally good, but was absent in 2012. Decadence of sagebrush was high at the outset of the study, but more moderate from 1997 to 2007. Utilization of sagebrush was mostly light to moderate. The wildfire removed almost all sagebrush from the site. Broom snakeweed (*Gutierrezia sarothrae*) was the only browse species that was common on the site. A small population of the seeded species forage kochia (*Kochia prostrata*) was sampled following the fire (Table - Browse Characteristics). This species was likely seeded from aerial seeding treatments of surrounding burned area. A mature population of Utah juniper was established on the site throughout the early years of the study. Canopy cover of juniper was reduced substantially by the bullhog treatment (Table - Canopy Cover, Line-Intercept), but density remained similar due to a large number of young trees re-establishing (Table - Point-Quarter Tree Data). The wildfire removed all of the juniper trees from the site.

Herbaceous Understory: The most common grasses are Sandberg bluegrass (*Poa secunda*), bluebunch wheatgrass (*Agropyron spicatum*), and cheatgrass (*Bromus tectorum*). Other perennial grass species occur infrequently. The seeded species intermediate wheatgrass (*Agropyron intermedium*) was sampled following the fire. Cheatgrass dominates the herbaceous component on the site. The majority of forbs present are low growing species of rather poor forage value. However, western yarrow (*Achillea millefolium*), blue flax (*Linum perenne*), and alfalfa (*Medicago sativa*) were seeded in 2004 and were first sampled in 2007. All of these species except for alfalfa were sampled in 2012, following the fire (Table - Herbaceous Trends).

Soil: The soil is classified as an Abela very gravelly loam, which occurs on fan remnants. Soils in this series are deep and well-drained. The parent material consists of alluvium derived from limestone, sandstone, and quartzite (Soil Survey Staff 2011). The soil texture is a loam with a moderately alkaline soil reaction (pH 7.9). The soil phosphorus may have limited availability for plant growth and development at 3.4 ppm (Tiedemann and Lopez 2004). Bare ground cover was moderate to high prior to the fire, but was very high in 2012. Vegetation and litter provide the majority of the protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

### Trend Assessments

#### Browse:

- **1983 to 1989 - down (-2):** Sagebrush density decreased 60% from 2,399 plants/acre to 964 plants/acre. Recruitment of young sagebrush plants increased from 1% to 7% of the population. Decadence increased from 47% to 83%, and poor vigor increased from 47% to 72% of the population.

- **1989 to 1997 - up (+2):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush plants increased to 40%. Decadence of sagebrush decreased to 20%, and poor vigor decreased to 12%
- **1997 to 2002 - up (+2):** Sagebrush density increased 58% from 2,420 plants/acre to 3,820 plants/acre, though cover decreased from 12% to 10%. Recruitment of young sagebrush plants remained very good at 40% of the population. Decadence of sagebrush remained similar at 19%, and poor vigor decreased to 7%.
- **2002 to 2004 - down (-2):** Sagebrush density decreased 31% to 2,640 plants/acre, though cover remained similar at 10%. Recruitment of young sagebrush plants decreased to 7% of the population. Decadence increased to 28%, and poor vigor increased to 11%.
- **2004 to 2007 - up (+2):** Sagebrush density increased nearly three-fold to 7,200 plants/acre following the 2004 seeding, and cover increased to 12%. The majority of this increase was attributed to the recruitment of young sagebrush plants, which increased to 65% of the population. Decadence decreased to 8%, and poor vigor decreased to 4% of the population. Due to the treatment, juniper canopy cover decreased from 13% to 4%.
- **2007 to 2012 - down (-2):** The wildfire removed almost all browse from the site. Forage kochia was sampled for the first time at low density and cover. Broom snakeweed is the most prevalent browse species.

Grass:

- **1983 to 1989 - up (+2):** The perennial grass sum of nested frequency increased 55%.
- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial grasses remained similar.
- **1997 to 2002 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, and cover remained similar at 9%.
- **2002 to 2004 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 13%, and cover decreased to 7%.
- **2004 to 2007 - stable (0):** The perennial grass sum of nested frequency increased 12%, and cover increased to 9%. However, there was a significant increase in the nested frequency of cheatgrass, and cover increased from 12% to 18%.
- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial grasses decreased 65%, and cover decreased to 5%. Cheatgrass remained prevalent, and cover remained high at 17%.

Forb:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequency of perennial forbs increased, but many of the species present are weedy.
- **1989 to 1997 - stable (0):** Perennial forb sum of nested frequency remained similar. The majority of the forb cover is derived from annuals and weedy species.
- **1997 to 2002 - down (-2):** The perennial forb sum of nested frequency decreased 57%, and cover decreased from 2% to less than 1%.
- **2002 to 2004 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, and cover remained less than 1%.
- **2004 to 2007 - up (+2):** Perennial forb sum of nested frequency increased nearly six-fold, and cover increased to 5%. Perennial forbs such as western yarrow, blue flax, and alfalfa were established due to the seeding.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, though cover increased to 8%.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --  
 Management unit 18A, 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
97	14.8	9.0	15.0	17.1	-6.5	4.4	0.0	<b>53.8</b>	Good
02	11.9	9.3	15.0	18.6	-9.6	0.9	0.0	<b>46.1</b>	Fair-Good
04	12.2	6.6	3.5	13.7	-9.1	0.5	0.0	<b>27.4</b>	Fair
07	14.4	12.6	15.0	17.6	-13.7	9.1	0.0	<b>55.1</b>	Good
12	0.7	0.0	0.0	10.6	-12.7	10.0	-2.0	<b>6.5</b>	Very Poor

SEED MIX I

Management Unit 18A, study no: 23

Project Name: Round Canyon		
Application: Aerial		Acres: 780
Seed type		lbs/acre
G	Siberian Wheatgrass "Vavilov"	2
G	Russian Wildrye "Bozoski"	2
G	Western Wheatgrass "Arriba"	2
F	Lewis Flax	1
F	Western Yarrow	0.25
F	Alfalfa "Ladak"	0.5
Total Pounds/Acre:		7.75

SEED MIX II

Management Unit 18A, study no: 23

Project Name: BLM Big Pole Fire ESR					
Application: Aerial		Acres: 9,808	Application: Aerial		Acres: 4,900
Seed type		lbs in mix	lbs/acre	Seed type	
G	Crested Wheatgrass	19616	2.00	B	Wyoming Big Sagebrush
G	Siberian Wheatgrass	19616	2.00	Total Pounds:	
G	Russian Wildrye	9808	1.00	PLS Pounds:	
G	Western or Thickspike Wheatgrass	19616	2.00		
G	Canby Bluegrass	9808	1.00		
F	Lewis Blue Flax	7356	0.75		
F	Alfalfa	4904	0.50		
F	Western Yarrow	2452	0.25		
Total Pounds:		93176	9.50		
PLS Pounds:			6.85		

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 18A, Study no: 23

Type	Species	Nested Frequency						Average Cover %					
		'83	'89	'97	'02	'04	'07	'12	'97	'02	'04	'07	'12
G	Agropyron cristatum	-	-	-	-	-	7	-	-	-	-	.22	-
G	Agropyron intermedium	-	-	-	-	-	-	8	-	-	-	-	.19
G	Agropyron spicatum	ab12	a6	ab11	ab21	ab19	b26	b28	.61	.93	1.27	1.61	3.36
G	Aristida purpurea	-	-	-	3	-	-	-	-	.03	-	-	-
G	Bromus tectorum (a)	-	-	a308	a301	a308	b347	b344	8.61	12.80	12.14	18.24	16.96
G	Poa secunda	b160	d244	cd224	cd236	bc195	bcd200	a53	7.65	7.92	4.84	6.17	1.71
G	Sitanion hystrix	ab9	bc31	abc21	abc10	bc21	c30	a3	.29	.39	.75	.80	.03
G	Vulpia octoflora (a)	-	-	-	-	-	2	-	-	-	-	.00	-
Total for Annual Grasses		0	0	308	301	308	349	344	8.61	12.80	12.14	18.24	16.96
Total for Perennial Grasses		181	281	256	270	235	263	92	8.56	9.28	6.86	8.82	5.29
Total for Grasses		181	281	564	571	543	612	436	17.17	22.09	19.01	27.07	22.26
F	Achillea millefolium	a-	a-	a-	a-	a-	b15	b20	-	-	-	.36	.61
F	Agoseris glauca	-	-	-	1	-	3	-	-	.00	-	.00	-
F	Allium sp.	-	-	-	-	-	3	-	-	-	-	.00	-
F	Alyssum alyssoides (a)	-	-	a-	a-	a-	b27	c212	-	-	-	.18	3.41
F	Antennaria rosea	ab12	ab18	a5	a6	a-	b27	a-	.06	.19	-	.51	-
F	Argemone munita	-	-	-	-	-	-	10	-	-	-	-	.12
F	Astragalus cibarius	a9	a12	b36	a-	a5	a-	a-	1.39	-	.01	-	-
F	Astragalus lentiginosus	a-	a-	a-	a-	a-	b23	b14	-	-	-	.72	.48
F	Astragalus utahensis	ab7	ab13	ab15	a1	a1	a7	b26	.23	.00	.00	.19	.82
F	Calochortus nuttallii	ab11	ab19	ab10	a4	a6	b27	a-	.03	.01	.01	.10	-
F	Castilleja chromosa	3	-	-	-	-	2	-	-	-	-	.03	-
F	Chaenactis douglasii	ab1	ab4	b8	a-	a-	a-	ab1	.02	-	-	-	.00
F	Cirsium undulatum	ab5	ab2	b10	a-	a-	a1	ab11	.13	-	-	.00	.28
F	Collinsia parviflora (a)	-	-	4	3	-	-	-	.01	.00	-	-	-
F	Comandra pallida	-	-	3	6	4	4	4	.01	.03	.03	.03	.03
F	Convolvulus arvensis	-	-	-	-	-	-	5	-	-	-	-	.03
F	Cryptantha sp.	-	3	-	-	-	-	-	-	-	-	-	-
F	Delphinium nuttallianum	-	-	-	-	1	-	-	-	-	.00	-	-
F	Draba sp. (a)	-	-	-	4	-	-	1	-	.00	-	-	.00
F	Eriogonum umbellatum	-	-	-	-	-	-	3	-	-	-	-	.03
F	Erodium cicutarium (a)	-	-	a1	ab11	b28	b30	c172	.03	.25	.39	.70	4.25
F	Helianthus annuus (a)	-	-	-	-	-	-	7	-	-	-	-	.07
F	Holosteum umbellatum (a)	-	-	b34	ab18	a5	c153	a5	.31	.09	.01	2.01	.01
F	Lactuca serriola (a)	a-	b7	b8	a-	a-	b20	b12	.04	-	-	.07	.06
F	Lathyrus brachycalyx	ab10	b24	a-	a-	a-	ab10	a-	-	-	-	.25	-
F	Linum lewisii	a-	a-	a-	a-	a-	b53	b45	-	-	-	1.76	2.49
F	Lygodesmia sp.	-	-	3	-	-	-	-	.01	-	-	-	-
F	Medicago sativa	-	-	-	-	-	1	-	-	-	-	.00	.15
F	Melilotus officinalis	-	-	-	-	-	1	2	-	-	-	.03	.15
F	Microsteris gracilis (a)	-	-	1	4	1	4	-	.00	.01	.00	.01	-



Type	Species	Nested Frequency						Average Cover %					
		'83	'89	'97	'02	'04	'07	'12	'97	'02	'04	'07	'12
F	Phlox longifolia	a10	b32	ab24	ab29	ab21	bc40	c65	.25	.16	.17	.53	2.62
F	Ranunculus testiculatus (a)	-	-	ab154	a122	ab148	b185	a117	1.09	.44	1.28	1.48	.45
F	Sisymbrium altissimum (a)	-	-	-	-	-	-	1	-	-	-	-	.00
F	Tragopogon dubius (a)	a-	a-	ab7	a-	a-	a1	b15	.04	-	-	.00	.11
F	Zigadenus paniculatus	-	-	1	2	-	1	3	.03	.06	.00	.00	.03
Total for Annual Forbs		0	7	209	162	182	420	542	1.53	0.80	1.69	4.47	8.39
Total for Perennial Forbs		68	127	115	49	38	218	209	2.19	0.47	0.25	4.57	7.88
Total for Forbs		68	134	324	211	220	638	751	3.73	1.27	1.94	9.04	16.27

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

#### BROWSE TRENDS--

Management unit 18A, Study no: 23

Type	Species	Strip Frequency					Average Cover %				
		'97	'02	'04	'07	'12	'97	'02	'04	'07	'12
B	Artemisia tridentata wyomingensis	64	77	65	76	1	11.78	9.55	9.73	11.48	.15
B	Chrysothamnus nauseosus albicaulis	1	0	0	2	0	.03	-	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	0	0	0	0	.00	-	-	-	-
B	Gutierrezia sarothrae	38	45	12	20	24	.34	2.18	.36	.62	.61
B	Juniperus osteosperma	6	9	9	8	0	7.68	8.89	8.79	1.09	-
B	Kochia prostrata	0	0	0	0	8	-	-	-	-	.31
B	Quercus gambelii	0	0	0	1	0	-	-	-	-	-
Total for Browse		110	131	86	107	33	19.85	20.63	18.88	13.20	1.06

#### CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 23

Species	Percent Cover			
	'02	'04	'07	'12
Artemisia tridentata wyomingensis	9.63	10.21	12.44	-
Gutierrezia sarothrae	1.43	.48	.40	.45
Juniperus osteosperma	10.93	13.10	3.71	-
Kochia prostrata	-	-	-	.51

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 23

Species	Average leader growth (in)			
	'02	'04	'07	'12
Artemisia tridentata wyomingensis	3.4	1.6	1.4	-

POINT-QUARTER TREE DATA--

Management unit 18A, Study no: 23

Species	Trees per Acre				Average diameter (in)			
	'02	'04	'07	'12	'02	'04	'07	'12
Juniperus osteosperma	72	73	68	-	7.1	12.3	6.4	-

BASIC COVER--

Management unit 18A, Study no: 23

Cover Type	Average Cover %						
	'83	'89	'97	'02	'04	'07	'12
Vegetation	1.50	6.00	39.91	42.34	40.34	47.69	37.62
Rock	3.25	6.25	2.59	2.93	2.64	2.06	3.76
Pavement	1.25	10.00	5.13	5.51	5.60	4.85	8.44
Litter	63.50	53.75	43.77	37.09	42.76	39.32	24.91
Cryptogams	.25	3.75	10.16	12.06	6.88	2.56	0
Bare Ground	30.25	20.25	10.21	16.87	19.49	14.95	29.64

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 23, South Palmer Point

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
-	7.9	42.0	33.1	24.9	2.1	3.4	259.2	0.5

PELLET GROUP DATA--

Management unit 18A, Study no: 23

Type	Quadrat Frequency					Days use per acre (ha)			
	'97	'02	'04	'07	'12	'02	'04	'07	'12
Rabbit	18	3	8	14	-	-	-	-	-
Elk	-	-	-	1	-	-	-	-	-
Deer	16	5	8	10	-	23(56)	13 (31)	14 (35)	1 (2)
Cattle	2	-	-	-	-	-	-	-	-

BROWSE CHARACTERISTICS--  
Management unit 18A, Study no: 23

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
83	<b>2399</b>	1	51	47	66	29	69	47	19/26
89	<b>964</b>	7	10	83	-	83	0	72	39/29
97	<b>2420</b>	40	40	20	940	14	0	12	28/45
02	<b>3820</b>	24	58	19	-	5	0	7	21/31
04	<b>2640</b>	7	65	28	-	13	0	11	20/27
07	<b>7200</b>	65	27	8	7200	11	2	4	22/30
12	<b>20</b>	0	100	0	-	0	0	0	13/13
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	0	100	-	-	0	0	0	15/18
02	<b>0</b>	0	0	-	-	0	0	0	-/-
04	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>40</b>	50	50	-	-	0	0	0	26/33
12	<b>0</b>	0	0	-	-	0	0	0	17/23
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	100	0	-	-	0	0	0	6/5
02	<b>0</b>	0	0	-	-	0	0	0	-/-
04	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
83	<b>3199</b>	40	60	0	1966	0	0	0	9/11
89	<b>3732</b>	21	79	1	33	0	0	3	13/14
97	<b>2520</b>	30	70	0	60	3	0	0	7/6
02	<b>2600</b>	1	71	28	-	0	0	6	8/11
04	<b>460</b>	0	83	17	-	0	0	13	8/11
07	<b>860</b>	21	77	2	80	0	0	2	7/9
12	<b>1380</b>	25	75	0	-	0	1	1	10/13
<i>Juniperus osteosperma</i>									
83	<b>166</b>	20	80	0	66	0	0	0	62/44
89	<b>265</b>	75	25	0	-	0	0	0	335/118
97	<b>120</b>	17	83	0	40	0	0	0	-/-
02	<b>200</b>	30	70	0	20	0	0	0	-/-
04	<b>200</b>	40	60	0	-	0	0	0	-/-
07	<b>180</b>	78	0	22	40	0	0	11	-/-
12	<b>0</b>	0	0	0	-	0	0	0	-/-

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Kochia prostrata</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	720	0	100	-	-	3	0	0	8/13
<b>Quercus gambelii</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
07	20	100	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<b>Rhus trilobata</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
04	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	20	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-

## SALT MOUNTAIN STOCK POND - TREND STUDY NO. 18A-24-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter/Spring

NRCS Ecological Site Description: [Semidesert Loam \(Wyoming Big Sagebrush\), R028AY220UT](#) or Upland Loam (Wyoming Big Sagebrush), R028AY309UT

Land Ownership: BLM

Elevation: 5,400 ft. (1,646 m)

Aspect: Southwest

Slope: 8%

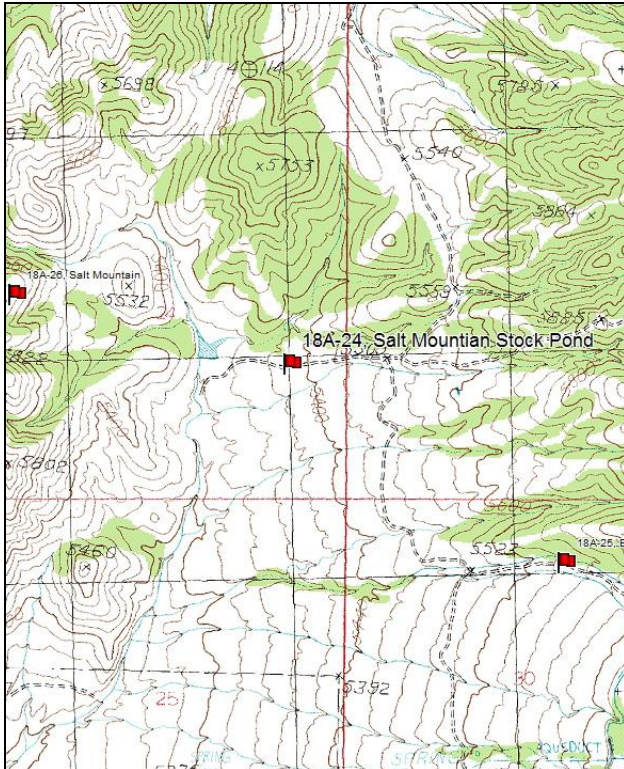
Transect bearing: 190° magnetic

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

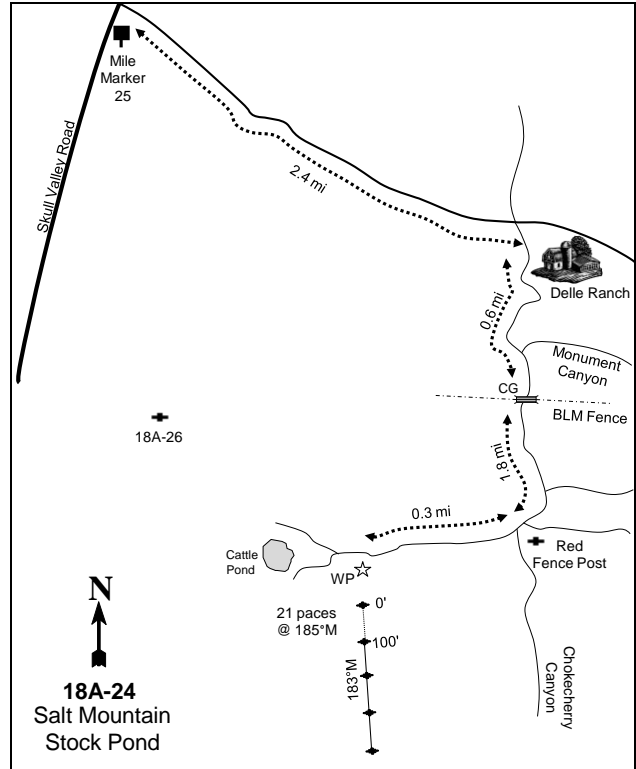
Note: Rebar is placed on the 13-foot mark on belt 4, and the 1-foot mark on belt 2, line 2 is 65 feet long, line 4 is 78 feet long.

Directions: Turn east off Skull Valley Road between mile mark 25 and 26, and go 2.4 miles staying right on the main road to Delle Ranch ponds and trees. The road then turns south. From Delle Ranch, proceed south for 2.4 miles to an intersection to the right (west) heading to Salt Mountain. There will be a red post on the east side of the road. Turn right and proceed 0.3 miles to a witness post on the left side of the road. From the witness post, the 0-foot baseline stake is 21 paces away at an azimuth of 185 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height. The 0-foot baseline stake has a browse tag, number 5926, attached.

Map Name: Salt Mountain



Diagrammatic Sketch:



Township: 3S Range: 8W Section: 24

GPS: NAD 83, UTM 12S 356915 E 4489116 N

## SALT MOUNTAIN STOCK POND - TREND STUDY NO. 18A-24

### Site Information

Site Description: The study is located on a chained and seeded Utah juniper (*Juniperus osteosperma*) woodland immediately east of Salt Mountain in Skull Valley. The study monitors deer winter range on land administered by the Bureau of Land Management (BLM) as part of the Salt Mountain allotment. The area was treated again between the 1983 and 1989 samplings to remove most of the remaining juniper trees. The whole area then burned as part of the Big Pole wildfire in 2009, which burned 44,470 acres. The area was treated by the BLM through aerial seeding (Table - Seed Mix) and chaining as part of an Emergency Stabilization and Rehabilitation (ESR) project. A stock pond lies approximately 1,000 feet west of the study. In wet years, the pond could serve as a water source, but is typically dry. Historically, the area has been important deer winter range and also provides summer grazing for cattle. An old pellet group transect traverses the study area. Deer pellet groups were sampled in moderate abundance in 2002, but in low abundance since 2007. Elk pellet groups were sampled in low abundance in 2007. Cattle sign has been sampled in low abundance since 2002 (Table - Pellet Group Data).

Browse: Prior to the fire, the vegetation composition was dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) interspersed with Utah juniper trees that were re-establishing following the treatments. Sagebrush provided the majority of the browse cover on the site prior to 2007 (Table - Browse Trends). The sagebrush stand was a moderately dense population of mostly mature and decadent plants. Recruitment of young sagebrush plants was good in 1997 and 2002, but was poor in all other sample years. Utilization of sagebrush was mostly light to moderate. Sagebrush was not sampled on the site in 2012 (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are abundant on the site, but diversity is low. Crested wheatgrass (*Agropyron cristatum*) was the dominant grass species both before and after the fire. The only other common perennial grass species is Sandberg bluegrass (*Poa secunda*). Cheatgrass (*Bromus tectorum*) is present, and occurs in moderate cover on the site. Forb composition is diverse, but most species occur infrequently. Forb composition is composed almost entirely of native species, but offers little forage value to wintering deer. Several seeded species were sampled in 2012 (Table - Herbaceous Trends).

Soil: The soil is characterized as an Abela very gravelly loam, which occurs on fan remnants. The soils in this series are formed from alluvium derived from limestone and/or quartzite. These soils are characterized as being very deep and well drained (Soil Survey Staff 2011). The soil is a sandy clay loam with a moderately alkaline soil reaction (pH 7.9). Phosphorus may have limited availability for plant growth and development at 4.8 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover was low prior to the fire, but was moderately high in 2012. Vegetation and litter provide the majority of the protective ground cover (Table - Basic Cover). A few large rocks are present on the soil surface. The soil erosion condition was classified as slight in 2002, but stable in 2007 and 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - down (-2):** The density of sagebrush decreased 35% from 4,731 plants/acre to 3,066 plants/acre. There were a large number of seedlings, but no young plants were sampled. Decadence remained high, increasing from 40% to 43%, but poor vigor decreased from 23% to 15% of the population.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush plants increased from 0% to 18% of the population. Decadence decreased to 33%, and poor vigor increased to 20% of the population.

- **1997 to 2002 - stable (0):** Wyoming big sagebrush density remained unchanged at 3,060 plants/acre, though cover decreased from 10% to 8%. Recruitment of young plants increased slightly to 22% of the population. Decadence decreased slightly to 31%, and poor vigor decreased to 16%.
- **2002 to 2007 - slightly down (-1):** The sagebrush density decreased 11% to 2,720 plants/acre. Recruitment of young sagebrush planted decreased to 7% of the population. Decadent plants increased slightly to 35%, and poor vigor increased to 20%. The sagebrush defoliator moth (*Aroga websteri*) had infested 15% of the population.
- **2007 to 2012 - down (-2):** The fire removed all of the sagebrush from the site.

Grass:

- **1983 to 1989 - slightly up (+1):** There was 10% increase in the sum of nested frequency of perennial grasses.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial grasses increased 22%. Crested wheatgrass increased significantly in nested frequency.
- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial grasses remained similar, though cover increased from 20% to 26%.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial grasses increased 12%, though cover decreased slightly to 24%. However, cheatgrass increased significantly in nested frequency, and cover increased from 2% to 5%.
- **2007 to 2012 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, though cover increased to 31%.

Forb:

- **1983 to 1989 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 56%. Forbs were already a minor component of the understory.
- **1989 to 1997 - slightly up (+1):** There was a large increase in the nested frequency of perennial forbs, but perennial forbs remain rare on the site.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial forbs decreased substantially. Almost no perennial forbs were sampled on the site.
- **2002 to 2007 - up (+2):** The perennial forb sum of nested frequency returned to 1997 levels, and cover increased from near 0% to 4%. Most of the increase was due to significant increase in silky milkvetch (*Astragalus cibarius*). Annual forb sum of nested frequency also increased substantially, and cover increased from less than 1% to 5%.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 37%, but were already somewhat rare on the site. Perennial forb cover decreased to 2%.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --

Management unit 18A, study no: 24

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	12.0	5.1	9.0	30.0	-1.4	1.7	0.0	<b>56.4</b>	Good
02	10.1	5.7	11.0	30.0	-1.7	0.1	0.0	<b>55.2</b>	Good
07	9.7	4.5	3.5	30.0	-3.5	8.7	0.0	<b>52.9</b>	Good
12	0.0	0.0	0.0	30.0	-2.7	4.0	0.0	<b>31.3</b>	Fair

SEED MIX

Management Unit 18A, study no: 24

Project Name: BLM Big Pole Fire ESR									
Application: Aerial			Acres:	9,808	Application: Aerial			Acres:	4,900
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre		
G	Crested Wheatgrass	19616	2.00	B	Wyoming Big Sagebrush	2450	0.50		
G	Siberian Wheatgrass	19616	2.00	Total Pounds:		2450	0.50		
G	Russian Wildrye	9808	1.00	PLS Pounds:			0.08		
G	Western or Thickspike Wheatgrass	19616	2.00						
G	Canby Bluegrass	9808	1.00						
F	Lewis Blue Flax	7356	0.75						
F	Alfalfa	4904	0.50						
F	Western Yarrow	2452	0.25						
Total Pounds:		93176	9.50						
PLS Pounds:			6.85						

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 18A, Study no: 24

T y P e	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a102	a145	b267	c283	c277	c277	16.01	23.15	18.07	24.48
G	Agropyron intermedium	a-	a-	a-	a-	a-	b24	-	-	-	.53
G	Agropyron spicatum	b10	ab3	a-	b12	b13	b8	-	.68	.83	.16
G	Bromus japonicus (a)	-	-	b25	b27	b37	a5	.11	.09	.10	.01
G	Bromus tectorum (a)	-	-	a134	a152	c283	b215	1.77	2.19	4.52	3.62
G	Poa bulbosa	a-	a-	a-	a-	a-	b11	-	-	-	.22
G	Poa secunda	b239	b221	ab205	a169	b233	a164	3.64	2.03	5.46	5.26
G	Sitanion hystrix	a1	b18	a-	a3	a1	a-	-	.15	.03	-
G	Vulpia octoflora (a)	-	-	-	1	-	1	-	.00	-	.00
Total for Annual Grasses		0	0	159	180	320	221	1.88	2.28	4.62	3.64
Total for Perennial Grasses		352	387	472	467	524	484	19.65	26.02	24.41	30.68
Total for Grasses		352	387	631	647	844	705	21.54	28.30	29.03	34.31
F	Achillea millefolium	a-	a-	a-	a-	a-	b19	-	-	-	.56
F	Agoseris glauca	b10	b12	ab8	ab4	ab7	a-	.02	.01	.04	-
F	Alyssum alyssoides (a)	-	-	a5	a2	a26	b103	.01	.01	.05	.60
F	Antennaria rosea	b25	b24	a6	a2	a-	a-	.03	.00	-	-
F	Astragalus cibarius	b36	a-	ab29	a3	c82	a-	.35	.01	3.66	-
F	Astragalus sp.	-	-	1	-	-	-	.00	-	-	-
F	Astragalus utahensis	1	2	2	-	2	7	.07	-	.03	.04
F	Calochortus nuttallii	bc17	a-	ab17	a1	c29	a-	.04	.00	.17	-
F	Camelina microcarpa (a)	-	-	ab12	a2	a1	b13	.02	.00	.00	.03
F	Castilleja linariaefolia	2	-	2	-	4	-	.00	-	.01	-
F	Castilleja sp.	-	-	3	-	-	-	.00	-	-	-



Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Chaenactis douglasii</i>	ab5	a1	b18	a-	ab8	a-	.06	-	.22	-
F	<i>Cirsium neomexicanum</i>	6	5	5	-	-	-	.06	-	-	-
F	<i>Collinsia parviflora</i> (a)	-	-	3	10	10	2	.00	.02	.02	.00
F	<i>Crepis acuminata</i>	-	-	2	-	3	3	.00	-	.03	.18
F	<i>Cryptantha</i> sp.	-	2	-	-	-	-	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	3	-	3	-	.00	-	.00
F	<i>Draba</i> sp. (a)	-	-	ab5	a-	b18	b18	.01	-	.03	.08
F	<i>Epilobium brachycarpum</i> (a)	-	-	9	-	-	-	.07	-	-	-
F	<i>Eriogonum</i> sp.	2	-	-	-	-	-	-	-	-	-
F	<i>Erodium cicutarium</i> (a)	-	-	a-	a6	a9	b29	-	.03	.07	.44
F	<i>Helianthus annuus</i> (a)	-	9	-	-	-	-	-	-	-	-
F	<i>Heterotheca villosa</i>	-	-	-	-	3	-	-	-	.03	-
F	<i>Holosteum umbellatum</i> (a)	-	-	a5	b42	d270	c206	.01	.12	4.19	.59
F	<i>Lactuca serriola</i> (a)	-	-	1	-	-	-	.00	-	-	-
F	<i>Linum lewisii</i>	a-	a-	a-	a-	a-	b48	-	-	-	.74
F	<i>Machaeranthera canescens</i>	a4	a3	b20	a-	a-	a2	.06	-	-	.03
F	<i>Microsteris gracilis</i> (a)	-	-	4	8	-	2	.00	.02	-	.00
F	<i>Oenothera</i> sp.	2	-	-	-	-	-	-	-	-	-
F	<i>Penstemon</i> sp.	a-	ab2	b10	a-	a-	a-	.08	-	-	-
F	<i>Phlox longifolia</i>	a-	a-	ab8	a1	b18	ab14	.01	.00	.14	.12
F	<i>Ranunculus testiculatus</i> (a)	-	-	b167	a48	b119	a47	1.67	.15	.35	.11
F	<i>Sanguisorba minor</i>	-	-	-	-	-	6	-	-	-	.33
F	<i>Senecio multilobatus</i>	6	-	-	1	-	-	-	.00	-	-
F	<i>Solanum triflorum</i> (a)	-	-	-	-	1	-	-	-	.00	-
F	<i>Tragopogon dubius</i> (a)	ab4	a-	b7	a-	a-	ab3	.07	-	-	.00
F	<i>Trifolium</i> sp.	-	-	1	-	-	-	.00	-	-	-
F	<i>Zigadenus paniculatus</i>	-	-	2	-	-	-	.00	-	-	-
Total for Annual Forbs		4	9	218	121	454	426	1.89	0.37	4.74	1.89
Total for Perennial Forbs		116	51	134	12	156	99	0.84	0.04	4.35	2.00
Total for Forbs		120	60	352	133	610	525	2.74	0.41	9.10	3.89

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

BROWSE TRENDS--

Management unit 18A, Study no: 24

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata wyomingensis	73	63	67	0	9.63	8.08	7.72	-
B	Atriplex canescens	0	1	0	0	-	-	-	-
B	Chrysothamnus nauseosus	1	0	0	1	.00	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	1	2	1	-	.15	-	-
B	Gutierrezia sarothrae	63	70	28	14	1.08	2.32	.47	.30
B	Juniperus osteosperma	5	5	6	0	-	1.62	1.57	-
B	Opuntia sp.	2	2	1	0	-	-	-	-
Total for Browse		145	142	104	16	10.71	12.18	9.77	0.30

CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 24

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata wyomingensis	9.03	8.64	-
Gutierrezia sarothrae	2.76	.56	.33
Juniperus osteosperma	1.31	1.50	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 24

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata wyomingensis	1.5	1.6	-

POINT-QUARTER TREE DATA--

Management unit 18A, Study no: 24

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	51	67	-	1.9	2.7	-

BASIC COVER--

Management unit 18A, Study no: 24

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	2.25	15.00	36.75	41.09	49.45	37.22
Rock	.25	.50	.83	1.85	1.75	2.42
Pavement	10.00	7.25	7.19	4.97	6.96	6.76
Litter	52.00	49.50	45.63	48.98	40.97	32.61
Cryptogams	2.00	.50	3.69	2.94	2.01	.01
Bare Ground	33.50	27.25	16.01	16.11	16.11	33.30

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 24, Salt Mountain Stock Pond

Effective rooting depth (in)	pH	Sandy Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
12.7	7.6	52.0	20.4	27.6	2.1	4.8	224.0	0.5

PELLET GROUP DATA--

Management unit 18A, Study no: 24

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Sheep	2	-	-	-	-	-	-
Rabbit	12	49	64	-	-	-	-
Elk	-	-	2	-	-	5 (12)	-
Deer	18	12	20	-	27 (74)	4 (10)	1 (3)
Cattle	2	4	3	-	8 (22)	10 (25)	1 (2)

BROWSE CHARACTERISTICS--

Management unit 18A, Study no: 24

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata wyomingensis</i>									
83	<b>4731</b>	1	58	40	-	42	44	23	24/42
89	<b>3066</b>	0	57	43	1799	9	1	15	19/25
97	<b>3060</b>	18	49	33	520	29	8	20	20/36
02	<b>3060</b>	22	48	31	-	14	0	16	19/28
07	<b>2720</b>	7	57	35	-	25	15	20	22/32
12	<b>0</b>	0	0	0	-	0	0	0	-/-
<i>Atriplex canescens</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Chrysothamnus nauseosus</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	100	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>20</b>	0	100	-	-	0	0	0	12/14

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	20	0	100	-	-	0	0	0	6/9
02	20	0	100	-	-	0	0	0	7/7
07	60	0	100	-	-	0	67	0	6/7
12	20	0	100	-	-	0	0	0	8/11
<i>Gutierrezia sarothrae</i>									
83	0	0	0	0	-	0	0	0	-/-
89	199	0	100	0	-	0	0	0	10/11
97	4540	29	69	2	320	.44	0	.88	11/19
02	4680	0	88	12	-	0	0	12	6/9
07	1000	10	62	28	140	8	2	20	7/10
12	280	0	100	0	-	0	0	0	9/13
<i>Juniperus osteosperma</i>									
83	298	33	67	-	-	0	0	22	56/56
89	99	100	0	-	-	0	0	0	-/-
97	100	80	20	-	20	0	0	0	-/-
02	100	20	80	-	-	0	0	0	-/-
07	120	50	50	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	40	0	100	-	-	0	0	0	4/9
02	40	0	100	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	4/7
12	0	0	0	-	-	0	0	0	-/-
<i>Purshia tridentata</i>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	8/28
02	0	0	0	-	-	0	0	0	10/54
07	0	0	0	-	-	0	0	0	22/64
12	0	0	0	-	-	0	0	0	22/36

BELOW CHOKECHERRY SPRING - TREND STUDY NO. 18A-25-12

Vegetation Type: Annual/Perennial Grass

Range Type: Crucial Deer Winter/Spring, Crucial Elk Winter/Spring

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

Land Ownership: BLM

Elevation: 5,600 ft. (1,707 m)

Aspect: West

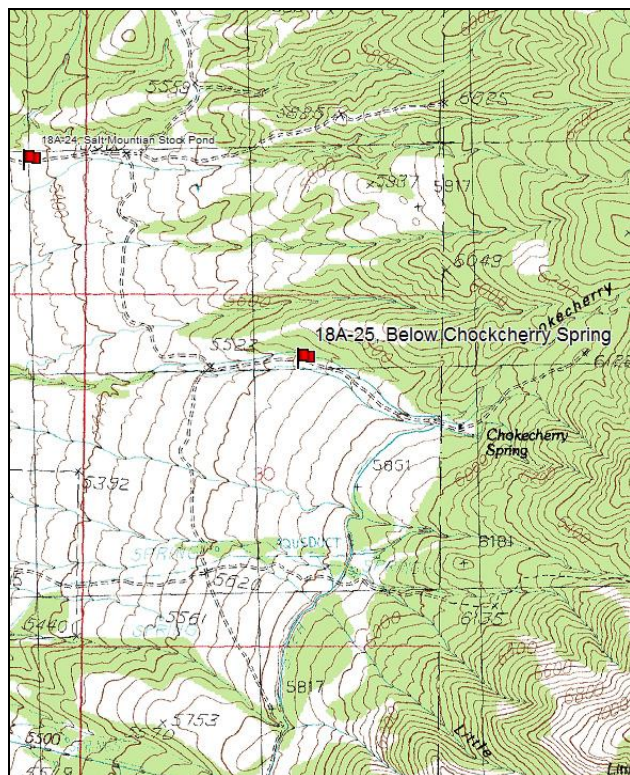
Slope: 5-10%

Transect bearing: 154° magnetic

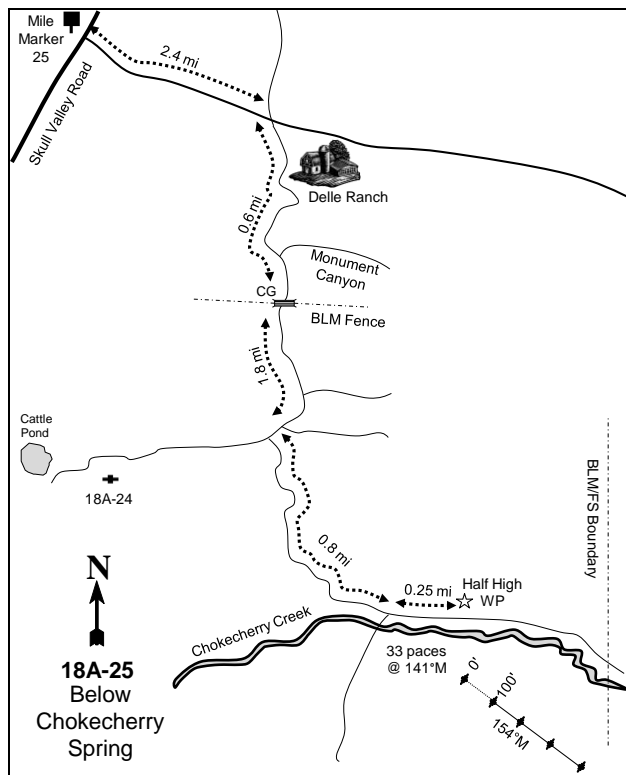
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: Turn east off Skull Valley Road between mile mark 25 and 26, and go 2.4 miles staying right on the main road to Delle Ranch ponds and trees. The road then turns south. From Delle Ranch, proceed south for 2.4 miles to an intersection to the right (west) heading to Salt Mountain. There will be a red post on the east side of the road. Stay to the left (south) and continue for 0.8 miles to another intersection. Turn left (east) and go 0.25 miles along Chokecherry Creek. From this point, walk south across the creek bed into the chaining where the study is located. The 0-foot baseline is 33 paces from witness post at 141 degrees magnetic. Browse tag number 135 is attached to the 0-foot marker of the baseline.

Map Name: Salt Mountain



Diagrammatic Sketch:



Township: 3S Range: 7W Section: 30

GPS: NAD 83, UTM 12S 358137 E 4488204 N

## BELOW CHOKECHERRY SPRING - TREND STUDY NO. 18A-25

### Site Information

Site Description: The study is located a half mile west of Chokecherry Spring, on a low-lying alluvial site near an intermittent drainage channel. The study monitors deer winter range on land administered by the Bureau of Land Management (BLM) as part of the Salt Mountain allotment. Historically, the area was a large mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community surrounded by singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) woodland. The woodland was apparently chained and seeded prior to study establishment, and some of the pinyon-juniper trees on the periphery of the study had been bullhogged prior to the 2007 sampling. The whole area then burned as part of the Big Pole wildfire in 2009, which burned 44,470 acres. The area was treated by the BLM through aerial seeding (Table - Seed Mix) and chaining as part of an Emergency Stabilization and Rehabilitation (ESR) project. Water is available for livestock and wildlife use in a moderately-incised perennial stream 40 feet to the north of the study. According to the local conservation officer in 1983, 400-500 deer customarily wintered in this area. Deer pellet groups were sampled in moderate abundance in 2002, low abundance in 2007, and no pellets groups were sampled in 2012. Elk pellet groups were sampled in moderate abundance in 2007. Grazing by cattle was noted to be heavy in 1983. The stream banks and corridor were being grazed by cattle while the study was sampled in 2007 and 2012. Cattle sign was sampled in low abundance in 2002 and 2012, but very high abundance in 2007 (Table - Pellet Group Data).

Browse: Prior to the fire, mountain big sagebrush provided most of the browse cover on the site (Table - Browse Trends). The sagebrush stand was comprised of a fairly dense population of mature and young plants. Recruitment of young sagebrush plants comprised a large portion of the sagebrush population in most sample years. Decadence and poor vigor were low in the population. Utilization of sagebrush was mostly light with some moderate use. Most of the sagebrush was removed by the Big Pole fire, but a small population of young and mature plants was sampled in 2012. In 2007, 34% of the plants sampled were infested with black, unidentified insects. Other browse that occur infrequently are white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), and broom snakeweed (*Gutierrezia sarothrae*). The rabbitbrush species have reestablished in similar densities following the fire (Table - Browse Characteristics).

Herbaceous Understory: There is a moderate-high abundance of perennial grasses, and forage production has increased since the study was established. Vigor was somewhat suppressed as a result of heavy grazing use by cattle in early samplings. Crested wheatgrass (*Agropyron cristatum*) dominated the grass component in cover prior to the fire, but both Sandberg bluegrass (*Poa secunda*) and cheatgrass (*Bromus tectorum*) were also common. Cheatgrass cover was decreasing prior to the fire, but increased markedly following the fire. The weedy species bulbous bluegrass (*Poa bulbosa*) is found on the site, but occurs at low frequency and cover. The seeded species intermediate wheatgrass (*Agropyron intermedium*) was sampled following the fire. Forbs have a diverse composition, yet most species only occur occasionally. Forb cover has been moderately high at 5% to 7% since 1997. The most abundant perennial species is Bonneville pea (*Lathyrus brachycalyx*) which provides nearly all of the perennial forb cover. Several seeded species were sampled following the fire including Western yarrow (*Achillea millefolium*), Lewis flax (*Linum lewisii*), alfalfa (*Medicago sativa*), and small burnet (*Sanguisorba minor*) (Table - Herbaceous Trends).

Soil: The soil is classified within the Kapod very cobbly loam, which occur on fan remnants. Soils in this series are comprised of alluvium derived from sandstone and limestone. These soils are characterized as very deep and well-drained (Soil Survey Staff 2011). The soil texture is a loam with a neutral to mildly alkaline soil reaction (pH 7.3) (Table - Soil Analysis Data). Vegetation and litter cover are moderately high, and there is little exposed bare ground (Table - Basic Cover). Erosion is not a significant problem because of the gentle slope and protective herbaceous cover. The soil erosion condition has been classified as stable since 2002.

## Trend Assessments

### Browse:

- **1983 to 1989 - up (+2):** The mountain big sagebrush density increased 38% from 966 plants/acre to 1,332 plants/acre. Recruitment of young sagebrush plants decreased from 34% to 10%.
- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young plants increased to 68% of the population and a large number of seedlings were sampled. Decadence decreased from 17% to 3% of the population.
- **1997 to 2002 - stable (0):** Density of mountain big sagebrush remained similar, increasing slightly from 10,840 plants/acre to 10,920 plants/acre. Cover of sagebrush increased from 15% to 18%. Recruitment of young sagebrush plants decreased to 27% of the population. It appears as though many of the plants classified as young in 1997 were classified as mature in 2002.
- **2002 to 2007 - slightly down (-1):** Density of sagebrush decreased 42% to 6,320 plants/acre, but cover increased to 20%. The decrease in density was most likely due to self-thinning, as young plants competed for more resources as they matured and increased in size. A decrease in the recruitment of young sagebrush plants to just 2% of the population also contributed to the decrease in density.
- **2007 to 2012 - down (-2):** The fire decreased the density of sagebrush to 320 plants/acre, with no notable cover sampled. Recruitment of young plants accounted for 50% of the small population.

### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased 67%, and there was a significant increase in the nested frequency of Sandberg bluegrass. Photographs also show a substantial decrease in the cover of cheatgrass on the site.
- **1989 to 1997 - stable (0):** Perennial grass sum of nested frequency remained similar. Crested wheatgrass increased significantly in nested frequency, but Sandberg bluegrass and mutton bluegrass (*Poa fendleriana*) decreased significantly in nested frequency.
- **1997 to 2002 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, though cover increased from 20% to 27%. Cheatgrass was still abundant, and although its cover decreased from 9% to 7%, the nested frequency did not change significantly. The weedy species bulbous bluegrass was sampled for the first time in low frequency and cover.
- **2002 to 2007 - up (+2):** The sum of nested frequency of perennial grasses increased 33%, but cover decreased to 23%. There was a significant increase in the nested frequency of Sandberg bluegrass. The nested frequencies of cheatgrass and Japanese brome (*Bromus japonicus*) remained similar, but cheatgrass cover decreased from 7% to 4%.
- **2007 to 2012 - down (-2):** The perennial grass sum of nested frequency decreased 20%, though cover increased to 27%. There was a significant decrease in the nested frequency of crested wheatgrass and Sandberg bluegrass. Cheatgrass nested frequency remained similar, but cover increased to 16%.

### Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial forbs increased by 26%.
- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial forbs remained similar.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial forbs decreased 57%, though cover increased from 5% to 7%.
- **2002 to 2007 - up (+2):** The sum of nested frequency of perennial forbs increased 42%, but cover remained similar at 6%.
- **2007 to 2012 - slightly up (+1):** There was little change in the sum of nested frequency of perennial forbs, but cover increased to 17%. Most of the increase in cover was due to a substantial increase in the cover of Bonneville pea. Several seeded species were sampled at low frequency and cover.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
 Management unit 18A, study no: 25

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	19.6	14.1	15.0	30.0	-7.0	10.0	0.0	<b>81.7</b>	Good-Excellent
02	23.2	13.6	13.4	30.0	-5.0	10.0	0.0	<b>85.1</b>	Excellent
07	24.5	9.9	1.0	30.0	-3.1	10.0	0.0	<b>72.3</b>	Good
12	0.2	0.0	0.0	30.0	-12.0	10.0	0.0	<b>28.2</b>	Very Poor

SEED MIX

Management Unit 18A, study no: 25

Project Name: BLM Big Pole Fire ESR									
Application: Aerial			Acres: 9,808		Application: Aerial			Acres: 4,900	
Seed type			lbs in mix	lbs/acre	Seed type			lbs in mix	lbs/acre
G	Crested Wheatgrass		19616	2.00	B	Wyoming Big Sagebrush	2450	0.50	
G	Siberian Wheatgrass		19616	2.00	Total Pounds:			2450	0.50
G	Russian Wildrye		9808	1.00	PLS Pounds:				0.08
G	Western or Thickspike Wheatgrass		19616	2.00					
G	Canby Bluegrass		9808	1.00					
F	Lewis Blue Flax		7356	0.75					
F	Alfalfa		4904	0.50					
F	Western Yarrow		2452	0.25					
Total Pounds:			93176	9.50					
PLS Pounds:				6.85					

Trend Summary

HERBACEOUS TRENDS--

Management unit 18A, Study no: 25

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a <sup>57</sup>	a <sup>96</sup>	b <sup>169</sup>	c <sup>241</sup>	c <sup>225</sup>	ab <sup>195</sup>	12.91	20.81	13.88	15.64
G	Agropyron intermedium	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>32</sup>	-	-	-	2.52
G	Agropyron spicatum	a <sup>7</sup>	a <sup>4</sup>	a <sup>14</sup>	a <sup>-</sup>	b <sup>37</sup>	a <sup>8</sup>	.27	-	1.52	.83
G	Bromus japonicus (a)	-	-	3	9	14	11	.00	.01	.05	.22
G	Bromus tectorum (a)	-	-	b <sup>261</sup>	a <sup>163</sup>	a <sup>172</sup>	a <sup>191</sup>	9.35	6.71	4.11	15.74
G	Poa bulbosa	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>45</sup>	b <sup>28</sup>	b <sup>42</sup>	-	2.37	.41	1.52
G	Poa fendleriana	a <sup>-</sup>	b <sup>37</sup>	a <sup>2</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.03	-	-	-
G	Poa secunda	bc <sup>184</sup>	d <sup>281</sup>	c <sup>214</sup>	a <sup>131</sup>	c <sup>233</sup>	ab <sup>140</sup>	6.39	3.82	7.41	6.24
G	Sitanion hystrix	b <sup>7</sup>	b <sup>6</sup>	ab <sup>2</sup>	a <sup>-</sup>	ab <sup>1</sup>	a <sup>-</sup>	.03	-	.03	-
G	Sporobolus cryptandrus	-	2	1	-	-	1	.03	-	-	.00
Total for Annual Grasses		0	0	264	172	186	202	9.36	6.72	4.17	15.96
Total for Perennial Grasses		255	426	402	417	524	418	19.69	27.00	23.26	26.77
Total for Grasses		255	426	666	589	710	620	29.05	33.73	27.43	42.73



Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Achillea millefolium</i>	-	-	-	-	-	4	-	-	-	.10
F	<i>Agoseris glauca</i>	-	4	-	3	2	-	.00	.03	.03	-
F	<i>Allium</i> sp.	a8	b81	b73	a3	b71	a10	.61	.01	.33	.04
F	<i>Alyssum alyssoides</i> (a)	-	-	a-	a3	a4	b13	-	.00	.03	.03
F	<i>Antennaria rosea</i>	-	3	-	-	-	-	-	-	-	-
F	<i>Artemisia ludoviciana</i>	3	1	-	-	-	-	-	-	-	-
F	<i>Astragalus</i> sp.	-	-	7	-	3	-	.04	-	.06	-
F	<i>Astragalus utahensis</i>	-	-	3	-	-	-	.03	-	-	-
F	<i>Calochortus nuttallii</i>	ab7	ab6	ab6	a-	b12	ab5	.02	-	.03	.19
F	<i>Cirsium neomexicanum</i>	3	-	7	-	-	-	.19	-	-	-
F	<i>Collinsia parviflora</i> (a)	-	-	b85	b97	b82	a19	.18	.52	.21	.06
F	<i>Crepis acuminata</i>	-	2	-	-	-	-	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	-	8	1	-	-	.02	.00
F	<i>Descurainia</i> sp. (a)	-	-	11	-	-	-	.02	-	-	-
F	<i>Draba</i> sp. (a)	-	-	a22	a3	b173	a27	.05	.00	1.35	.05
F	<i>Epilobium brachycarpum</i> (a)	-	-	5	-	-	-	.01	-	-	-
F	<i>Erodium cicutarium</i> (a)	-	-	a5	a8	a12	b89	.01	.01	.05	3.11
F	<i>Galium aparine</i> (a)	-	-	-	-	1	-	-	-	.00	-
F	<i>Hackelia patens</i>	ab4	ab4	b10	a-	a-	a-	.35	-	-	-
F	<i>Helianthus</i> sp.	-	4	-	-	-	-	-	-	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	a55	a56	b267	c307	.13	.33	4.27	3.09
F	<i>Lactuca serriola</i> (a)	a-	b26	a-	a-	a5	a2	-	-	.01	.00
F	<i>Lathyrus brachycalyx</i>	b207	a149	a139	ab150	ab163	c228	3.36	5.82	5.32	15.18
F	<i>Linum lewisii</i>	-	-	-	-	-	1	-	-	-	.03
F	<i>Lomatium</i> sp.	a-	a-	a-	b31	b15	a2	.00	.57	.09	.03
F	<i>Lygodesmia</i> sp.	-	-	2	-	-	-	.00	-	-	-
F	<i>Medicago sativa</i>	-	-	-	-	-	7	-	-	-	.21
F	<i>Microsteris gracilis</i> (a)	-	-	a2	a3	b19	a4	.00	.01	.05	.01
F	<i>Montia perfoliata</i> (a)	-	-	-	-	3	-	-	-	.03	-
F	<i>Phlox longifolia</i>	a13	b55	b54	ab37	b52	ab42	.40	.14	.46	.60
F	<i>Polygonum douglasii</i> (a)	-	-	3	-	-	-	.01	-	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	-	b19	a-	b27	a5	.03	-	.08	.01
F	<i>Sanguisorba minor</i>	-	-	-	-	-	4	-	-	-	.15
F	<i>Sphaeralcea grossulariifolia</i>	-	-	-	-	-	4	-	-	-	.18
F	<i>Taraxacum officinale</i>	ab3	ab4	b14	a-	a-	ab2	.05	-	-	.03
F	<i>Tragopogon dubius</i> (a)	a3	b23	b33	a-	a-	a-	.17	-	-	-
F	<i>Verbena bracteata</i>	-	-	-	-	-	1	-	-	-	.03
F	<i>Veronica biloba</i> (a)	-	-	b19	a-	a-	ab8	.05	-	-	.02
Total for Annual Forbs		3	49	259	170	601	475	0.68	0.88	6.13	6.40
Total for Perennial Forbs		248	313	315	224	318	310	5.08	6.58	6.34	16.79
Total for Forbs		251	362	574	394	919	785	5.77	7.46	12.47	23.20

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

BROWSE TRENDS--

Management unit 18A, Study no: 25

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	85	89	83	16	15.28	18.18	19.63	-
B	Chrysothamnus nauseosus albicaulis	10	8	4	3	.40	.36	-	.15
B	Chrysothamnus viscidiflorus viscidiflorus	26	17	24	21	1.98	1.09	1.75	1.13
B	Gutierrezia sarothrae	50	41	0	1	.79	1.90	-	-
B	Juniperus osteosperma	2	0	2	0	-	.56	3.62	-
Total for Browse		173	155	113	41	18.47	22.11	25.02	1.28

CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 25

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	18.56	22.38	.05
Chrysothamnus nauseosus albicaulis	.30	-	.25
Chrysothamnus viscidiflorus viscidiflorus	1.06	2.06	2.04
Gutierrezia sarothrae	1.89	-	-
Juniperus osteosperma	2.31	6.31	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 25

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.0	1.3	2.1

BASIC COVER--

Management unit 18A, Study no: 25

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	.25	10.25	53.84	60.31	67.05	66.65
Rock	1.75	3.00	2.17	3.63	3.26	4.94
Pavement	1.75	1.50	1.57	1.81	2.23	1.12
Litter	70.00	71.75	54.59	50.27	35.90	56.62
Cryptogams	0	3.25	6.73	2.73	.99	.02
Bare Ground	26.25	10.25	2.66	2.91	8.03	9.23

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 25, Below Chokecherry Spring

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
8.6	7.3	44.0	31.4	24.6	3.2	6.3	236.8	0.6

PELLET GROUP DATA--

Management unit 18A, Study no: 25

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	44	31	31	-
Elk	1	1	-	-
Deer	11	16	16	-
Cattle	11	4	10	4

Days use per acre (ha)		
'02	'07	'12
-	-	-
-	21 (53)	-
29 (73)	11 (26)	-
14 (34)	66 (163)	9 (22)

BROWSE CHARACTERISTICS--

Management unit 18A, Study no: 25

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
83	<b>966</b>	34	66	0	-	0	0	0	29/37
89	<b>1332</b>	10	73	17	-	20	3	0	27/38
97	<b>10840</b>	68	30	3	2420	20	.36	2	26/41
02	<b>10920</b>	27	69	4	-	8	.54	2	20/23
07	<b>6320</b>	2	81	17	-	23	13	9	25/29
12	<b>320</b>	50	50	0	-	0	0	6	11/9
<i>Chrysothamnus nauseosus albicaulis</i>									
83	<b>66</b>	50	50	0	-	0	0	0	39/77
89	<b>132</b>	25	75	0	-	0	0	0	41/63
97	<b>460</b>	57	39	4	20	0	0	0	21/23
02	<b>160</b>	13	50	38	-	13	13	13	25/31
07	<b>80</b>	50	25	25	-	0	25	50	23/28
12	<b>300</b>	13	87	0	-	0	0	0	15/22
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	<b>66</b>	0	100	0	-	0	0	0	16/14
89	<b>165</b>	60	40	0	-	0	0	0	15/23
97	<b>1320</b>	12	86	2	-	2	0	0	16/25
02	<b>840</b>	2	81	17	-	0	0	19	18/22
07	<b>1100</b>	2	80	18	40	5	0	18	15/21
12	<b>820</b>	2	98	0	-	0	0	0	13/19
<i>Gutierrezia sarothrae</i>									
83	<b>15565</b>	87	13	0	1733	0	0	0	13/13
89	<b>12999</b>	18	59	23	799	0	0	11	13/11
97	<b>2900</b>	10	87	3	-	0	0	0	10/10
02	<b>2120</b>	1	68	31	-	.94	0	18	9/10
07	<b>0</b>	0	0	0	-	0	0	0	8/12
12	<b>20</b>	100	0	0	-	0	0	0	9/11

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Juniperus osteosperma</b>										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>40</b>	50	50	-	-	0	0	50	-/-	
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>40</b>	0	100	-	-	100	0	0	-/-	
12	<b>0</b>	0	0	-	-	0	0	0	-/-	
<b>Purshia tridentata</b>										
83	<b>66</b>	0	100	0	-	0	100	50	14/24	
89	<b>33</b>	0	0	100	-	0	100	100	-/-	
97	<b>0</b>	0	0	0	-	0	0	0	15/55	
02	<b>0</b>	0	0	0	-	0	0	0	-/-	
07	<b>0</b>	0	0	0	-	0	0	0	22/49	
12	<b>0</b>	0	0	0	-	0	0	0	-/-	
<b>Rhus trilobata</b>										
83	<b>0</b>	0	0	-	-	0	0	0	-/-	
89	<b>0</b>	0	0	-	-	0	0	0	-/-	
97	<b>0</b>	0	0	-	-	0	0	0	-/-	
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>0</b>	0	0	-	-	0	0	0	-/-	
12	<b>0</b>	0	0	-	-	0	0	0	41/106	

SALT MOUNTAIN - TREND STUDY NO. 18A-26-12

Vegetation Type: Annual/Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter/Spring

NRCS Ecological Site Description: [Semidesert Shallow Loam \(Utah Juniper-Bluebunch Wheatgrass\), R028AY238UT](#)

Land Ownership: BLM

Elevation: 5,600 ft. (1,707 m)

Aspect: Southeast

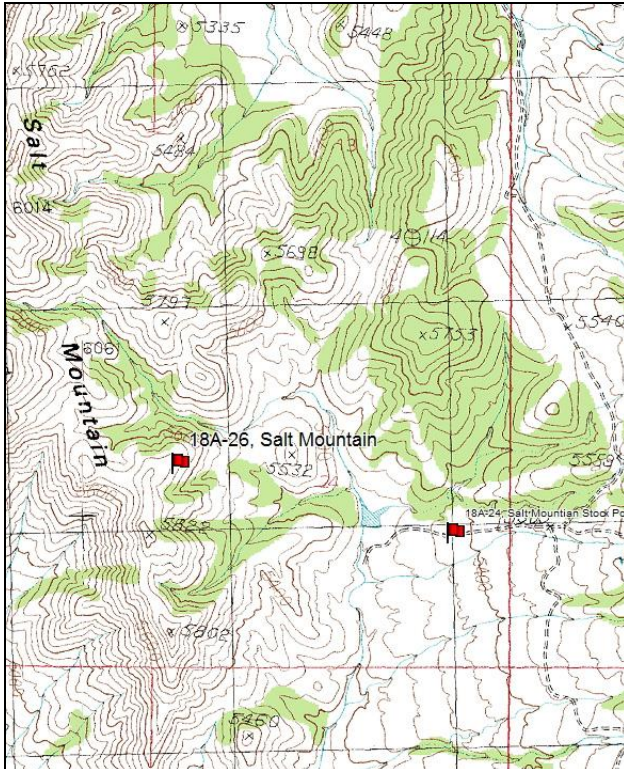
Slope: 55%

Transect bearing: 180° magnetic (line 1), 163° magnetic (line 2), 25° magnetic (line 3), ?° magnetic (line 4),

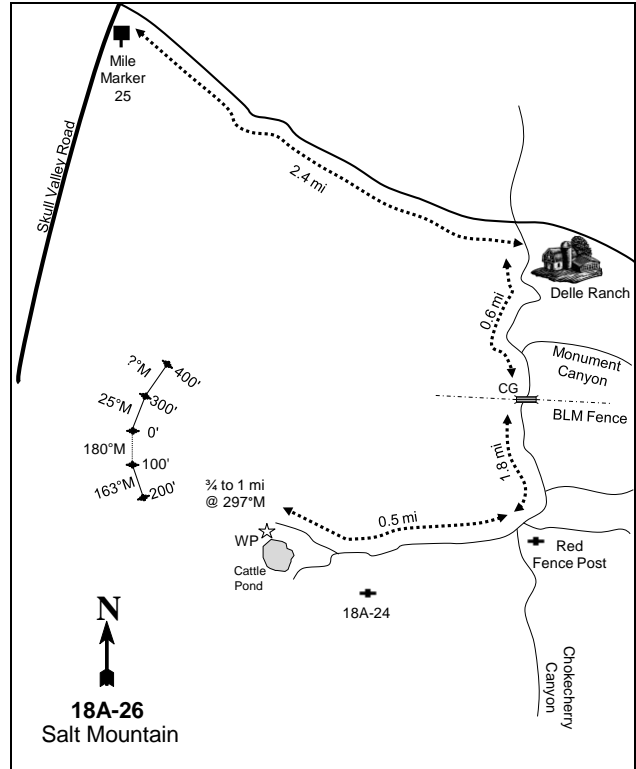
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions: Turn east off Skull Valley Road between mile mark 25 and 26, and go 2.4 miles staying right on the main road to Delle Ranch ponds and trees. The road then turns south. From Delle Ranch, proceed south for 2.4 miles to an intersection to the right (west) heading to Salt Mountain. There will be a red post on the east side of the road. Turn right (west) and continue for 0.5 miles to a stock pond, passing study 18A-s4. From the right fork or road to the north of the stock ponds, walk at 297 degrees magnetic for 0.75 to 1.0 miles to the study area. An old, marked browse study runs along the ridge at the top of this slope, while the trend study is located among the sparse junipers and cliffrose below the ridge. The baseline runs north across the slope. The 0-foot baseline stake has a browse tag, number 169, attached.

Map Name: Salt Mountain



Diagrammatic Sketch:



Township: 3S Range: 8W Section: 24

GPS: NAD 83, UTM 12S 355675 E 4489457 N

## SALT MOUNTAIN - TREND STUDY NO. 18A-26

### Site Information

Site Description: The study is located on the east side of Salt Mountain, on land administered by the Bureau of Land Management (BLM) as part of the Salt Mountain allotment. The area was comprised of a Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) community at the time of study establishment. The whole area then burned as part of the Big Pole wildfire in 2009, which burned 44,470 acres. The fire removed all of the sagebrush and cliffrose from the site. The area was treated by the BLM through aerial seeding (Table - Seed Mix) as part of an Emergency Stabilization and Rehabilitation (ESR) project. There is also a browse transect located within the immediate vicinity of the study. Utilization of cliffrose and sagebrush was moderate-heavy in 1983 with large numbers of deer pellet groups present. Deer pellet groups were sampled in high to moderate abundance in 2002 and 2007, but low abundance in 2012. A deer mandible was also noted on the site in 2007. Elk pellet groups were sampled in low abundance in 2007 (Table - Pellet Group Data).

Browse: Prior to the fire, the browse composition consisted of a sparse stand of Stansbury cliffrose and Wyoming big sagebrush with occasional individuals of gray horsebrush (*Tetradymia canescens*), Utah juniper (*Juniperus osteosperma*), and broom snakeweed (*Gutierrezia sarothrae*). Recruitment of young cliffrose and sagebrush plants was good in 2002 and 2007, and the populations were healthy with low decadence and good vigor. Utilization of cliffrose was mostly moderate to heavy. Utilization of sagebrush was mostly light to moderate. In 2007, the sagebrush defoliator moth (*Aroga websteri*) had infested 36% of the sagebrush plants. The only browse species sampled following the fire was broom snakeweed, which occurred in very low density (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are fairly abundant, but are not diverse on the site. The annual grass species cheatgrass (*Bromus tectorum*) has been the most abundant grass species on the site since 2002. Perennial grasses include bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). These species occur as scattered bunches within the uniform cover of cheatgrass. Forbs are sparse, and the few perennial or biennial species that occur are rare and have little value for forage or erosion protection. The annual forb species storksbill (*Erodium cicutarium*) has provided the majority of forb cover since 2002. Several seeded species including western yarrow (*Achillea millefolium*), blue flax (*Linum perenne*), and alfalfa (*Medicago sativa*) were sampled in low cover and frequency in 2012 (Table - Herbaceous Trends).

Soil: The soil is classified within the Amtoft series, which occurs on mountainsides and hillsides. Soils in this series are formed from colluvium derived from limestone and/or residuum weathered from limestone. The soils are characterized as shallow and somewhat excessively drained (Soil Survey Staff 2011). The soil has a sandy clay loam texture and a moderately alkaline soil reaction (pH 7.4) (Table - Soil Analysis Data). The surface is covered with dark-colored rock. Bare ground cover is moderately low, with a high amount of vegetation, litter, and rock providing protective ground cover (Table - Basic Cover). Erosion is not a significant problem, despite the steep slope. The erosion condition has been classified as stable since 2002.

### Trend Assessments

#### Browse:

- **1983 to 1989 - down (-2):** Cliffrose density decreased 78% from 598 plants/acre to 133 plants/acre, and all of the plants were classified as decadent. The plants that were not available to wildlife were noted as having good seed production, but no seedling or young plants were sampled. The sagebrush population remained at a density of 199 plants/acre.
- **1989 to 2002 - up (+2):** Differences in density may be related to the larger sample area used in 2002; therefore, trend was determined using other parameters. Recruitment of young cliffrose increased from 0% to 33%, and recruitment young sagebrush plants increased from 0% to 10% of the

population. Decadence of cliffrose decreased to 0%, and decadence of sagebrush decreased from 33% to 8%.

- **2002 to 2007 - stable (0):** The density of cliffrose remained similar at 100 plants/acre, though cover increased from less than 1% to 1%. Recruitment of young cliffrose plants decreased slightly to 20% of the population. Sagebrush density increased slightly from 960 plants/acre to 1,000 plants/acre. Recruitment of young sagebrush plants increased to 14% of the population. There were worm infestations on some cliffrose plants and a rust infestation on gray horsebrush. The sagebrush defoliator moth had infested 36% of the sagebrush population.
- **2007 to 2012 - down (-2):** All of the cliffrose and sagebrush was removed by the Big Pole fire. Browse species are very limited on the site.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased 63%. The nested frequencies of both bluebunch wheatgrass and Sandberg bluegrass increased significantly. Observations indicated less cheatgrass due to dry conditions.
- **1989 to 2002 - stable (0):** The sum of nested frequency of perennial grasses remained similar.
- **2002 to 2007 - down (-2):** The sum of nested frequency of perennial grasses decreased 20%, though cover remained similar at 12%. The nested frequency of cheatgrass increased significantly, and cover increased from 9% to 19%.
- **2007 to 2012 - down (-2):** The perennial grass sum of nested frequency decreased 29%, and cover decreased to 10%. Cheatgrass cover increased to 26%.

Forb:

- **1983 to 1989 - stable (0):** Perennial forb species are rare on the site.
- **1989 to 2002 - stable (0):** Perennial forb species are rare on the site.
- **2002 to 2007 - stable (0):** Perennial forb species are rare on the site. Annual forb species increased substantially and dominate the forb component.
- **2007 to 2012 - stable (0):** There was a slight increase in the perennial forb sum of nested frequency, though they remain rare. Cover of perennial forbs increased from near 0% to 2%. Most of the increase in cover was due to the seeded species alfalfa. However, annual forb cover also increased substantially from 2% to 11%.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --  
Management unit 18A, study no: 26

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02	4.8	0.0	0.0	23.9	-6.4	0.0	0.0	<b>22.2</b>	Poor
07	6.9	12.7	7.7	23.2	-13.7	0.0	0.0	<b>36.8</b>	Fair
12	0.0	0.0	0.0	20.3	-19.7	3.8	0.0	<b>4.4</b>	Very Poor

SEED MIX

Management Unit 18A, study no: 26

Project Name: BLM Big Pole Fire ESR								
Application: Aerial			Acres:	9,808	Application: Aerial		Acres:	4,900
Seed type		lbs in mix	lbs/acre	Seed type		lbs in mix	lbs/acre	
G	Crested Wheatgrass	19616	2.00	B	Wyoming Big Sagebrush	2450	0.50	
G	Siberian Wheatgrass	19616	2.00	Total Pounds:		2450	0.50	
G	Russian Wildrye	9808	1.00	PLS Pounds:			0.08	
G	Western or Thickspike Wheatgrass	19616	2.00					
G	Canby Bluegrass	9808	1.00					
F	Lewis Blue Flax	7356	0.75					
F	Alfalfa	4904	0.50					
F	Western Yarrow	2452	0.25					
Total Pounds:		93176	9.50					
PLS Pounds:			6.85					

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 18A, Study no: 26

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'02	'07	'12	'02	'07	'12
G	Agropyron spicatum	<sub>b</sub> 183	<sub>c</sub> 222	<sub>ab</sub> 160	<sub>ab</sub> 135	<sub>a</sub> 121	6.60	7.88	7.77
G	Bromus tectorum (a)	-	-	<sub>a</sub> 306	<sub>b</sub> 366	<sub>b</sub> 368	8.57	18.28	26.29
G	Oryzopsis hymenoides	1	-	-	-	1	-	-	.00
G	Poa secunda	<sub>a</sub> 73	<sub>bc</sub> 198	<sub>c</sub> 224	<sub>b</sub> 174	<sub>a</sub> 97	5.32	3.74	2.34
Total for Annual Grasses		0	0	306	366	368	8.57	18.28	26.29
Total for Perennial Grasses		257	420	384	309	219	11.93	11.62	10.13
Total for Grasses		257	420	690	675	587	20.51	29.91	36.43
F	Achillea millefolium	-	-	-	-	12	-	-	.12
F	Agoseris glauca	-	4	-	1	2	-	.00	.06
F	Allium sp.	-	4	3	-	-	.02	-	-
F	Alyssum alyssoides (a)	-	-	-	-	3	-	-	.00
F	Calochortus nuttallii	1	-	-	3	-	-	.00	-
F	Cirsium neomexicanum	<sub>b</sub> 4	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	-	.00	-
F	Collinsia parviflora (a)	-	-	-	-	3	-	-	.01
F	Delphinium nuttallianum	-	1	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	9	-	-	.04	-
F	Draba sp. (a)	-	-	<sub>a</sub> -	<sub>b</sub> 67	<sub>a</sub> -	-	.15	-
F	Erodium cicutarium (a)	-	-	<sub>a</sub> 67	<sub>b</sub> 114	<sub>c</sub> 294	1.22	1.61	10.86
F	Gilia sp. (a)	-	-	1	-	-	.00	-	-
F	Holosteum umbellatum (a)	-	-	<sub>a</sub> -	<sub>b</sub> 17	<sub>c</sub> 53	-	.03	.12
F	Lactuca serriola (a)	-	8	2	3	8	.01	.00	.04
F	Lappula occidentalis (a)	-	-	<sub>a</sub> 4	<sub>b</sub> 24	<sub>a</sub> -	.01	.07	-
F	Linum lewisii	-	-	-	-	-	-	-	.01



Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'02	'07	'12	'02	'07	'12
F	<i>Medicago sativa</i>	a-	a-	a-	a-	b15	-	-	1.74
F	<i>Microsteris gracilis</i> (a)	-	-	-	-	2	-	-	.00
F	<i>Ranunculus testiculatus</i> (a)	-	-	a10	b68	a13	.02	.21	.03
F	<i>Senecio</i> sp.	2	-	-	-	-	-	-	-
F	<i>Tragopogon dubius</i> (a)	a-	a-	a-	a-	b18	-	-	.33
Total for Annual Forbs		0	8	84	302	394	1.26	2.14	11.41
Total for Perennial Forbs		7	9	3	4	29	0.01	0.01	1.92
Total for Forbs		7	17	87	306	423	1.28	2.15	13.34

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

#### BROWSE TRENDS--

Management unit 18A, Study no: 26

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	<i>Artemisia tridentata wyomingensis</i>	28	30	0	3.55	4.06	-
B	<i>Cowania mexicana stansburiana</i>	6	5	0	.21	1.21	-
B	<i>Gutierrezia sarothrae</i>	1	1	1	-	-	.15
B	<i>Juniperus osteosperma</i>	2	2	0	2.23	1.42	-
B	<i>Opuntia</i> sp.	2	2	0	.15	.03	-
B	<i>Tetradymia canescens</i>	2	2	0	.18	.03	-
Total for Browse		41	42	1	6.32	6.76	0.15

#### CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 26

Species	Percent Cover		
	'02	'07	'12
<i>Artemisia tridentata wyomingensis</i>	4.38	5.01	-
<i>Cowania mexicana stansburiana</i>	2.41	2.83	-
<i>Gutierrezia sarothrae</i>	.08	.01	-
<i>Juniperus osteosperma</i>	2.59	3.03	-
<i>Opuntia</i> sp.	-	.15	-
<i>Tetradymia canescens</i>	.03	-	-

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 26

Species	Average leader growth (in)		
	'02	'07	'12
<i>Artemisia tridentata wyomingensis</i>	1.9	1.7	-
<i>Cowania mexicana stansburiana</i>	4.3	1.9	-

POINT-QUARTER TREE DATA--  
Management unit 18A, Study no: 26

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	42	40	-	8.5	12.1	-

BASIC COVER--  
Management unit 18A, Study no: 26

Cover Type	Average Cover %				
	'83	'89	'02	'07	'12
Vegetation	.50	10.75	29.36	38.68	48.65
Rock	19.00	8.50	16.42	17.04	23.77
Pavement	15.50	33.25	7.93	9.13	5.19
Litter	41.75	34.50	30.76	29.57	31.90
Cryptogams	5.00	.50	5.21	7.20	.04
Bare Ground	18.25	12.50	18.84	12.68	10.79

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 26, Salt Mountain

Effective rooting depth (in)	pH	Sandy Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
8.6	7.4	47.3	20.7	32.0	1.7	6.0	156.8	0.7

PELLET GROUP DATA--  
Management unit 18A, Study no: 26

Type	Quadrat Frequency			Days use per acre (ha)		
	'02	'07	'12	'02	'07	'12
Rabbit	19	52	8	-	-	-
Elk	-	2	-	-	3 (8)	-
Deer	17	18	3	56 (139)	38 (94)	3 (7)
Cattle	-	1	-	-	-	-

BROWSE CHARACTERISTICS--  
Management unit 18A, Study no: 26

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
Artemisia tridentata wyomingensis									
83	<b>199</b>	0	67	33	-	0	100	33	12/17
89	<b>199</b>	0	67	33	-	0	0	0	15/16
02	<b>960</b>	10	81	8	20	33	0	0	22/31
07	<b>1000</b>	14	82	4	100	26	2	4	27/42
12	<b>0</b>	0	0	0	-	0	0	0	-/-

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Cowania mexicana stansburiana</i>									
83	<b>598</b>	17	78	6	-	50	33	11	56/47
89	<b>133</b>	0	0	100	-	75	25	0	-/-
02	<b>120</b>	33	67	0	-	17	17	0	50/57
07	<b>100</b>	20	60	20	-	40	40	0	48/48
12	<b>0</b>	0	0	0	-	0	0	0	-/-
<i>Ephedra nevadensis</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	38/50
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
83	<b>1399</b>	48	52	-	-	0	0	2	14/16
89	<b>99</b>	0	100	-	-	0	0	0	8/12
02	<b>60</b>	0	100	-	-	0	0	0	13/19
07	<b>100</b>	0	100	-	40	0	0	0	6/8
12	<b>20</b>	100	0	-	-	0	0	0	5/6
<i>Juniperus osteosperma</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>40</b>	0	100	-	-	0	0	0	-/-
07	<b>40</b>	0	100	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Opuntia sp.</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>80</b>	0	100	-	-	0	0	0	4/11
07	<b>80</b>	0	100	-	-	0	0	0	6/7
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Tetradymia canescens</i>									
83	<b>99</b>	0	100	0	-	0	0	0	22/30
89	<b>99</b>	0	33	67	-	0	0	33	22/23
02	<b>0</b>	0	0	0	-	0	0	0	26/51
07	<b>20</b>	0	0	100	-	0	0	100	27/48
12	<b>0</b>	0	0	0	-	0	0	0	-/-

SOUTH OF BROONS CANYON - TREND STUDY NO. 18A-27-12

Vegetation Type: Crucial Deer Winter/Spring, Substantial Elk Spring/Fall

Range Type: Annual Grass

NRCS Ecological Site Description: Mountain Stony Loam (Antelope Bitterbrush), R028AY456UT

Land Ownership: USFS

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

Aspect: West

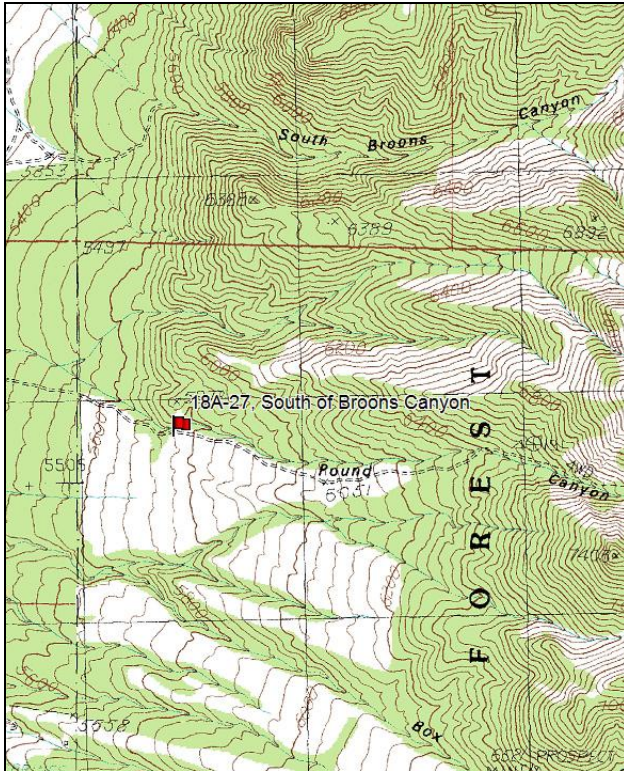
Slope: 18%

Transect bearing: 178° magnetic

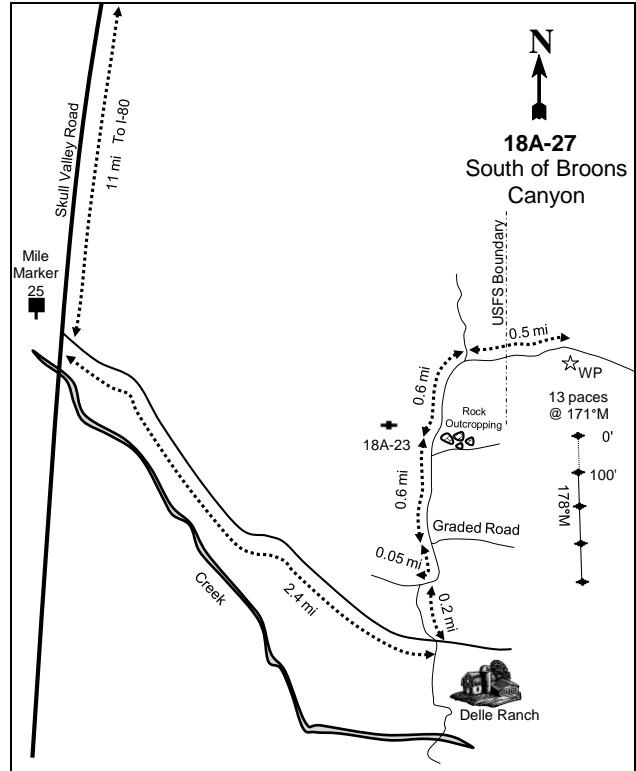
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: From I-80, proceed south on Skull Valley Road for 11 miles. Turn east of a dirt road (between mile posts 25 and 26) and continue along this road for 2.4 miles to Delle Ranch. From the creek crossing on the road at Delle Ranch, proceed north towards Broons Canyon for 0.2 miles to an intersection. Go east for 0.5 miles to another intersection. Turn left, and go north 0.65 miles until you reach a rock outcropping on the right hand side of the road and location of study 18A-23. Continue 0.6 miles to a fork, go right (east). Continue approximately 0.5 miles to the USFS boundary fence. From the fence, go 0.4 miles to a witness post on the right side of the road. From this short fencepost, walk 13 paces south to the 0-foot baseline stake.

Map Name: Salt Mountain



Diagrammatic Sketch:



Township: 3S Range: 7W Section: 5

GPS: NAD 83, UTM 12S 359357 E 4494036 N

## SOUTH OF BROONS CANYON - TREND STUDY NO. 18A-27

### Site Information

Site Description: The study lies on land administered by the U.S. Forest Service just above the enclosure located in Round Canyon. The area was an antelope bitterbrush (*Purshia tridentata*) community with interspersed mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) at study establishment. The site was treated as part of the Stansbury juniper prescribed burn and mechanical treatment project in the fall of 2007 ([WRI Project # 727](#)), following the site being read that year (WRI Database 2013). The whole area then burned as part of the Big Pole wildfire in 2009, which burned 44,470 acres. The wildfire removed all of the shrub species from the site. During the 1983 reading, deer pellet groups were abundant. Deer pellet groups were sampled in high abundance in 2002 and 2007, but no pellet groups were sampled in 2012. Other animal sign has been sampled in very low abundance (Table - Pellet Group Data).

Browse: Prior to the fire, this area possessed an especially hardy and productive population of antelope bitterbrush. This ecotype exhibited a semi-erect growth form with some smaller shrubs growing under the canopies of the larger individuals. There appeared to be some hybridization with Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*). Bitterbrush provided the majority of the browse cover (Table - Browse Trends), and the population was comprised mostly of mature plants for the duration of the study. In 1983, the majority of the plants showed moderate use, but use fluctuated from moderate-heavy to light in subsequent years. Vigor of bitterbrush was good and there were few decadent plants. Sagebrush was also present in moderate numbers, but was of secondary importance for wildlife. At the outset of the study the population was mostly young plants, but the age structure shifted to a mostly mature population in subsequent years. Decadence increased through the sample years as recruitment decreased. Utilization of sagebrush was mostly light, and vigor was good. In 2007, 29% of the sampled sagebrush was infested with insects. Broom snakeweed (*Gutierrezia sarothrae*), Utah juniper (*Juniperus osteosperma*), and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* spp. *viscidiflorus*) were also present in low densities. The fire removed all browse species from the site, and no browse was sampled in 2012 (Table - Browse Characteristics).

Herbaceous Understory: The grass component on the site is dominated by cheatgrass (*Bromus tectorum*), and perennial grass species are rare. Cheatgrass provided the majority of the total vegetation cover on the site following the fire. The only perennial grass species that provide any notable cover are bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). Prior to the fire, the site supported a diverse composition of forbs, but with a large component of annual and weedy species. Following the fire, the site was dominated by annual and weedy forb species (Table - Herbaceous Trends).

Soil: The soil is classified as a Kapod very cobbly loam, which occur on fan remnants. These soils are formed from alluvium derived from limestone and sandstone, and are characterized as very deep and well drained (Soil Survey Staff 2011). The soil texture is a sandy clay loam with a neutral soil reaction (pH 6.7) (Table - Soil Analysis Data). Large to medium sized rocks are common on the soil surface and provide a moderate amount of cover. Bare ground cover is low, with a high amount of vegetation and litter cover providing protective ground cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2002.

### Trend Assessments

#### Browse:

- **1983 to 1989 - slightly down (-1):** The density of bitterbrush decreased 31% from 966 plants/acre to 665 plants/acre. Recruitment of young bitterbrush plants decreased from 14% to 5%, and decadence increased from 0% to 15%. Sagebrush density decreased 27% from 731 plants/acre to 532 plants/acre. Most of the decrease in density was due to a decrease in the recruitment of young sagebrush plants from 55% to 6% of the population. Decadence of sagebrush increased from 5% to 25%.

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young bitterbrush plants decreased to 3%, and recruitment of young sagebrush plants increased to 8% of the population. Decadence of bitterbrush decreased to 0%, and decadence of sagebrush decreased to 14%.
- **1997 to 2002 - up (+2):** The density of bitterbrush increased two-fold from 680 plants/acre to 1,580 plants/acre, and cover increased from 23% to 34%. Recruitment of young bitterbrush plants remained poor at 1%. Sagebrush density increased 31% from 1,700 plants/acre to 2,220 plants/acre, but cover remained similar at 13%.
- **2002 to 2007 - down (-2):** The density of bitterbrush decreased 43% to 900 plants/acre, and cover decreased to 20%. Recruitment of young bitterbrush remained poor at 2%, and decadence remained good at 9%. The density of sagebrush decreased 10% to 2,000 plants/acre, and cover decreased to 12%. Recruitment of young sagebrush plants decreased from 5% to 1%. Sagebrush decadence increased from 14% to 35%, and the plants classified with poor vigor increased from 5% to 12%.
- **2007 to 2012 - down (-2):** The fire removed almost all browse from the site.

Grass:

- **1983 to 1989 - stable (0):** The sum of nested frequency of perennial grasses remained similar.
- **1989 to 1997 - stable (0):** There was little change in the sum of nested frequency of perennial grass species.
- **1997 to 2002 - down (-2):** The sum of nested frequency of perennial grasses decreased 73%, and cover decreased from 8% to 2%. There was also a significant decrease in the nested frequency of the primary perennial species, bluebunch wheatgrass and Sandberg bluegrass. Cheatgrass was abundant and remained stable in frequency, but cover increased from 11% to 25%.
- **2002 to 2007 - up (+2):** The sum of nested frequency of perennial grasses increased more than two-fold, and cover increased to 6%. The nested frequency of cheatgrass remained similar, but cover decreased to 16%.
- **2007 to 2012 - down (-2):** The perennial grass sum of nested frequency decreased 50%, and cover decreased to 3%. Cheatgrass increased significantly in nested frequency, and cover increased to 40%.

Forb:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial forbs increased more than two-fold, but perennial forbs were sampled infrequently.
- **1989 to 1997 - up (+2):** The sum of nested frequency of perennial forbs increased by 32%.
- **1997 to 2002 - down (-2):** The perennial forb sum of nested frequency decreased 60%, and cover decreased from 6% to 3%.
- **2002 to 2007 - up (+2):** Perennial forb sum of nested frequency increased three-fold, and cover increased to 15%. However, annual forb sum of nested frequency increased markedly, and cover increased from less than 1% to 12%.
- **2007 to 2012 - down (-2):** The sum of nested frequency of perennial grasses decreased to 66%, and cover decreased to 5%. Annual forb sum of nested frequency increased, and cover increased to 14%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 18A, study no: 27

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	30.0	13.5	2.4	16.4	-8.1	10.0	0.0	<b>64.1</b>	Fair-Good
02	30.0	11.9	1.0	3.4	-19.1	5.1	0.0	<b>32.4</b>	Very Poor
07	30.0	9.4	0.8	12.4	-12.0	10.0	0.0	<b>50.5</b>	Poor-Fair
12	0.0	0.0	0.0	6.4	-20.0	9.0	0.0	<b>-4.6</b>	Very Poor

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 18A, Study no: 27

T y P e	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	b138	bc109	b124	a45	ab69	a34	3.69	.96	3.38	2.04
G	Bromus tectorum (a)	-	-	a338	a339	a342	b374	10.86	25.41	16.01	39.61
G	Festuca myuros (a)	-	-	-	-	-	3	-	-	-	.03
G	Melica bulbosa	-	-	ab20	a7	b20	ab9	.30	.36	.24	.22
G	Poa bulbosa	a-	a-	a-	a-	a-	b18	-	-	-	.08
G	Poa fendleriana	-	5	4	4	1	5	.00	.15	.00	.18
G	Poa secunda	b138	b159	b141	a21	b116	a38	4.19	.22	2.57	.76
Total for Annual Grasses		0	0	338	339	342	377	10.86	25.41	16.01	39.63
Total for Perennial Grasses		276	273	289	77	206	104	8.20	1.70	6.19	3.30
Total for Grasses		276	273	627	416	548	481	19.07	27.11	22.20	42.94
F	Agoseris glauca	a-	b18	a3	a-	ab9	a1	.00	-	.51	.03
F	Allium sp.	a3	ab24	c63	ab27	bc34	a11	.53	.49	.16	.02
F	Alyssum alyssoides (a)	-	-	ab41	a26	b63	c237	.16	.12	.46	2.84
F	Antennaria rosea	2	-	-	-	-	-	-	-	-	-
F	Astragalus sp.	a2	b17	a1	a-	a4	a-	.00	-	.06	-
F	Balsamorhiza sagittata	-	1	2	1	-	-	.21	.03	.00	-
F	Calochortus nuttallii	3	3	5	-	2	-	.02	-	.00	-
F	Castilleja linariaefolia	-	-	5	-	-	-	.01	-	-	-
F	Chenopodium sp. (a)	-	-	4	-	-	-	.00	-	-	-
F	Cirsium neomexicanum	a6	ab12	ab5	a-	a1	b18	.20	-	.03	1.63
F	Collinsia parviflora (a)	-	-	31	27	62	65	.11	.13	1.34	.61
F	Comandra pallida	-	-	-	-	5	2	.00	-	.03	.03
F	Crepis intermedia	5	7	4	11	11	14	.09	.15	.16	.45
F	Descurainia sp. (a)	-	-	a3	a-	b51	a-	.00	-	.46	-
F	Draba sp. (a)	-	-	-	-	5	3	-	-	.01	.00
F	Epilobium brachycarpum (a)	-	-	b15	a-	a-	b11	.06	-	-	.02
F	Eriogonum racemosum	-	1	2	-	1	-	.03	-	.00	-
F	Erodium cicutarium (a)	-	-	a32	a5	b85	c129	.31	.03	.89	5.52
F	Galium boreale	a-	b33	b17	a-	c152	a-	.37	-	8.05	-
F	Hackelia patens	b39	b28	c88	b40	b41	a-	3.30	1.24	1.50	-
F	Holosteum umbellatum (a)	-	-	b99	a13	d266	c218	.66	.05	7.50	3.08
F	Lactuca serriola (a)	-	-	a11	a-	a5	b89	.06	-	.04	.48
F	Lappula occidentalis (a)	-	-	-	-	-	1	-	-	-	.00
F	Lithospermum ruderales	3	2	3	2	4	-	.56	.30	.53	.01
F	Lomatium grayi	a17	a22	a19	a9	b66	a18	.38	.10	3.26	1.47
F	Lygodesmia sp.	a-	a-	b13	a-	a-	a-	.06	-	-	-
F	Machaeranthera canescens	a-	a-	b14	a-	a-	a-	.04	-	-	-
F	Microsteris gracilis (a)	-	-	ab11	a3	b57	bc40	.18	.01	.38	.09
F	Montia perfoliata (a)	-	-	a-	a-	b36	a-	-	-	.74	-
F	Phlox hoodii	-	-	-	-	2	-	-	-	.00	-
F	Phlox longifolia	a23	ab56	ab56	ab31	ab35	b61	.25	.22	.26	.83

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	<i>Polygonum douglasii</i> (a)	-	-	2	-	-	-	.00	-	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	-	a5	a7	b48	a1	.03	.01	.21	.00
F	<i>Sisymbrium altissimum</i> (a)	-	-	-	2	6	8	-	.03	.03	.56
F	<i>Tragopogon dubius</i> (a)	b48	a4	a11	a3	a-	a11	.08	.03	-	.38
F	<i>Zigadenus paniculatus</i>	-	4	-	-	-	1	-	-	-	.00
Total for Annual Forbs		48	4	265	86	684	813	1.68	0.43	12.10	13.62
Total for Perennial Forbs		103	228	300	121	367	126	6.10	2.55	14.60	4.49
Total for Forbs		151	232	565	207	1051	939	7.79	2.99	26.71	18.11

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

#### BROWSE TRENDS--

Management unit 18A, Study no: 27

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	50	54	59	0	13.35	12.59	11.84	-
B	<i>Chrysothamnus nauseosus albicaulis</i>	0	1	1	0	-	-	-	-
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	5	4	3	0	.06	.33	.00	-
B	<i>Gutierrezia sarothrae</i>	18	7	1	0	.70	.15	.38	-
B	<i>Juniperus osteosperma</i>	0	1	1	0	-	1.00	.76	-
B	<i>Purshia tridentata</i>	29	47	36	0	23.27	33.45	19.59	-
Total for Browse		102	114	101	0	37.38	47.53	32.58	0

#### CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 27

Species	Percent Cover		
	'02	'07	'12
<i>Artemisia tridentata vaseyana</i>	15.14	16.66	-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>	-	.03	-
<i>Gutierrezia sarothrae</i>	.33	-	-
<i>Juniperus osteosperma</i>	.23	1.78	-
<i>Purshia tridentata</i>	39.34	32.01	-

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 27

Species	Average leader growth (in)		
	'02	'07	'12
<i>Artemisia tridentata vaseyana</i>	9.5	2.7	-
<i>Purshia tridentata</i>	11.6	2.0	-



POINT-QUARTER TREE DATA--  
Management unit 18A, Study no: 27

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	62	62	-	4.3	6.8	-

BASIC COVER--  
Management unit 18A, Study no: 27

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	2.75	16.00	56.69	66.97	68.68	54.45
Rock	5.00	8.75	7.96	8.05	10.65	18.05
Pavement	.50	2.00	1.64	.60	1.18	1.23
Litter	84.25	65.50	62.09	49.21	35.11	44.37
Cryptogams	1.00	.75	1.17	1.01	1.39	.03
Bare Ground	6.50	7.00	3.67	3.98	4.51	4.55

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 27, South of Broons Canyon

Effective rooting depth (in)	pH	Sandy Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
12.1	6.7	50.0	27.4	22.6	3.6	16.8	275.2	0.4

PELLET GROUP DATA--  
Management unit 18A, Study no: 27

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	35	36	32	1	-	-	-
Elk	1	-	8	-	-	-	-
Deer	27	24	17	-	56 (137)	79 (195)	-
Cattle	1	-	-	-	-	-	-

BROWSE CHARACTERISTICS--  
Management unit 18A, Study no: 27

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
Amelanchier utahensis									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	91/113
12	0	0	0	-	-	0	0	0	-/-

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata vaseyana</i>										
83	731	55	41	5	-	36	5	5	30/40	
89	532	6	69	25	-	38	6	0	21/24	
97	1700	8	78	14	140	18	0	5	27/37	
02	2220	5	82	14	-	12	0	5	29/38	
07	2000	1	64	35	240	7	0	12	34/49	
12	0	0	0	0	-	0	0	0	-/-	
<i>Chrysothamnus nauseosus albicaulis</i>										
83	0	0	0	0	-	0	0	0	-/-	
89	0	0	0	0	-	0	0	0	-/-	
97	0	0	0	0	-	0	0	0	-/-	
02	20	0	100	0	-	100	0	0	15/20	
07	20	0	0	100	-	0	0	100	-/-	
12	0	0	0	0	-	0	0	0	23/36	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
83	66	50	50	0	-	50	0	0	20/31	
89	132	50	50	0	99	25	0	0	12/12	
97	100	20	80	0	-	0	0	0	16/29	
02	120	0	100	0	-	0	0	0	15/23	
07	60	0	67	33	-	0	0	0	14/22	
12	0	0	0	0	-	0	0	0	14/29	
<i>Gutierrezia sarothrae</i>										
83	3198	50	50	0	133	0	0	0	13/14	
89	1932	19	48	33	-	2	0	17	8/10	
97	840	12	88	0	40	0	0	0	12/12	
02	220	0	82	18	-	0	0	0	10/12	
07	20	0	100	0	-	0	0	0	10/16	
12	0	0	0	0	-	0	0	0	-/-	
<i>Juniperus osteosperma</i>										
83	66	0	50	50	-	0	0	0	67/51	
89	66	0	50	50	-	50	0	0	89/94	
97	0	0	0	0	-	0	0	0	-/-	
02	20	0	100	0	-	0	0	0	-/-	
07	20	0	100	0	-	0	0	0	-/-	
12	0	0	0	0	-	0	0	0	-/-	
<i>Purshia tridentata</i>										
83	966	14	86	0	33	83	10	0	45/41	
89	665	5	80	15	-	70	15	0	46/86	
97	680	3	97	0	20	15	0	0	52/91	
02	1580	1	90	9	-	56	29	3	54/94	
07	900	2	89	9	40	27	22	0	56/89	
12	0	0	0	0	-	0	0	0	13/18	

DEADMAN CANYON - TREND STUDY NO. 18A-29-12

Vegetation Type: Wyoming Big Sagebrush and Cliffrose

Range Type: Crucial Deer Winter, Substantial Elk Spring/Fall

NRCS Ecological Site Description: [Upland Gravelly Loam \(Wyoming Big Sagebrush\), R028AY307UT](#)

Land Ownership: USFS

Elevation: 5,880 ft. (1,792 m)

Aspect: West

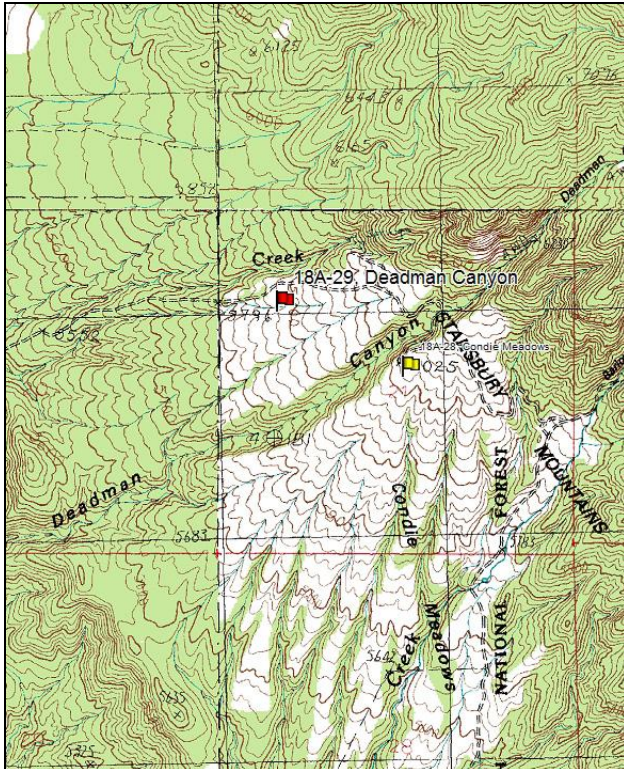
Slope: 10%

Transect bearing: 185° magnetic

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

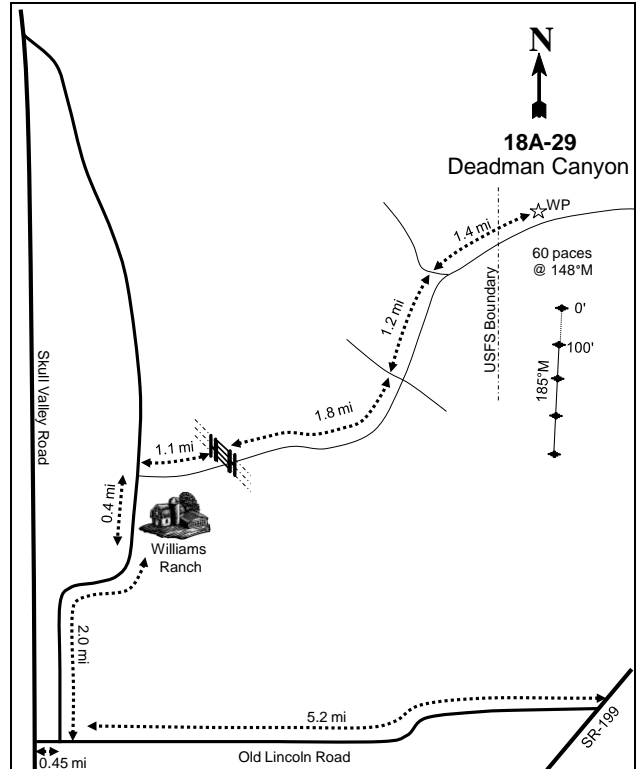
Directions: From SR-199, go 5.2 miles west on Old Lincoln Road. Turn north and go 2.0 miles to the Williams Ranch. Continue 0.4 mile and turn right at the fork just past a fence. Go 1.1 miles to a gate. Continue 1.8 miles to an intersection, continue northeasterly. Go 2.6 miles to the USFS boundary fence. From the cattle guard, go 0.15 miles to a witness post on the right side of the road. From this fence post, walk 60 paces south (148°M) to the 0-foot baseline stake. It is marked by a red browse tag, number 3927.

Map Name: Terra



Township: 5S Range: 7W Section: 21

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 360195 E 4470211 N

## DEADMAN CANYON - TREND STUDY NO. 18A-29

### Site Information

Site Description: The study samples a singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) chaining that was seeded with perennial grasses. Initially, there was no evidence that any shrub or forb species were included in the seed mixture, but a fair browse stand remains. The area is administered by the U.S. Forest Service (USFS) as part of the Barlow Deadman allotment. Deer pellet groups were sampled in high abundance in 2002, but low abundance since 2007. Elk pellet groups have been sampled in low abundance since 2002. Rabbit pellet frequency has been moderate to high since 1997 (Table - Pellet Group Data).

Browse: The browse composition consists of a mixed stand of Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), and Utah juniper. Other shrub species occur infrequently. The Wyoming big sagebrush stand is comprised of a scattered population of mostly mature plants. Recruitment of young sagebrush plants was good at the outset of the study, but has been minimal since 2002. Decadence of sagebrush has been low in all sample years except for 2007, when it was high. Vigor has generally been good in the population. Utilization of sagebrush has been light to moderate. The cliffrose stand is comprised of a low density population of large, mature plants. Recruitment of young cliffrose plants has been generally low. Decadence of cliffrose has fluctuated from low to high rates over the course of the study. Vigor has been generally good in the population. Utilization was moderate to heavy in early sample years, but has been light to moderate since 1997. The juniper population has remained at a relatively stable density since 1989 (Table - Browse Characteristics), but the trees have increased in size in pictures throughout the sample years.

Herbaceous Understory: The herbaceous understory is composed mostly of perennial grasses. In 1983, common seeded species included crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*). Natives, such as bluebunch wheatgrass (*A. spicatum*) and Sandberg bluegrass (*Poa secunda*), were dominant. Since 1983, the seeded species have decreased and become a minor component. The native species, particularly bluebunch wheatgrass, have provided the majority of the grass cover since 1997. Cheatgrass (*Bromus tectorum*) is common on the site, but provides limited cover. The weedy perennial species bulbous bluegrass (*Poa bulbosa*) is present, and has increased on the site since 2002. Forb composition and abundance have been poor. Forage production from this component is low, and annual forb species dominate the component (Table - Herbaceous Trends).

Soil: The soil is classified as an Abela very gravelly loam, which occur on fan remnants. These soils are formed from alluvium derived from limestone and/or quartzite. These soils are characterized as deep and well-drained (Soil Survey Staff 2011). The soil has a clay loam texture with a neutral soil reaction (pH 7.3) (Table - Soil Analysis Data). Bare ground cover is relatively low, with a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). Grasses, especially bluebunch wheatgrass (*Agropyron spicatum*), are well-established and provide valuable protection from erosion. Moderate erosion was thought to be occurring in 1983. The soil erosion condition was classified as slight in 2002 and 2007, but was stable in 2012.

### Trend Assessments

#### Browse:

- **1983 to 1989 - slightly up (+1):** The density of sagebrush increased 67% from 499 plants/acre to 832 plants/acre. Recruitment continued to be high, and increased from 47% to 56% of the population. Decadence was very low, but increased slightly from 0% to 4% of the population. The density of cliffrose remained similar, decreasing from 199 plants/acre to 165 plants/acre. Decadence increased

from 17% to 60%, and recruitment from young plants decreased from 17% to 0% of the population. Poor vigor increased from 17% to 20%.

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young sagebrush decreased slightly to 48%, but is still considered to be very good. Decadence of sagebrush remained low at 3% of the population. Decadence and poor vigor of cliffrose decreased to 0%. Young recruitment of cliffrose remained low at 11% of the population.
- **1997 to 2002 - stable (0):** The sagebrush density increased slightly from 800 plants/acre to 880 plants/acre, and cover increased from 3% to 5%. Recruitment of young sagebrush plants decreased to 2% of the population. Decadence remained low at 9% of the population. The density of cliffrose decreased slightly from 180 plants/acre to 120 plants/acre, and cover decreased from 4% to 3%.
- **2002 to 2007 - stable (0):** Sagebrush density continued to increase to 1,000 plants/acre, but cover decreased to 4%. There was no new recruitment of young sagebrush plants sampled. Decadence of sagebrush increased to 42%, and poor vigor increased from 0% to 18% of the population. Density of cliffrose increased slightly to 140 plants/acre, and cover remained similar at 3%. No young cliffrose plants were sampled. Decadence of cliffrose increased from 0% to 43%, and poor vigor increased from 0% to 14% of the population.
- **2007 to 2012 - stable (0):** Sagebrush density decreased 26% to 740 plants/acre, though cover increased to 5%. Decadence of sagebrush decreased to 5%, and poor vigor decreased to 0%. Cliffrose density decreased 29% to 100 plants/acre, but cover increased to 4%. Decadence of cliffrose decreased to 20%, and poor vigor decreased to 0%.

#### Grass:

- **1983 to 1989 - slightly down (-1):** The sum of the nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 20%. There were significant decreases in the nested frequencies of intermediate wheatgrass and bottlebrush squirreltail (*Sitanion hystrix*), while the nested frequency of crested wheatgrass increased significantly.
- **1989 to 1997 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, excluding bulbous bluegrass.
- **1997 to 2002 - slightly up (+1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass remained similar, and cover increased from 16% to 18%. There was a significant decrease in the nested frequency of cheatgrass, and cover decreased from 6% to near 0%.
- **2002 to 2007 - stable (0):** The perennial grass sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar, though cover increased to 21%. Cheatgrass and bulbous bluegrass increased significantly in nested frequency.
- **2007 to 2012 - stable (0):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar, though cover increased to 23%. Bulbous bluegrass increased significantly in nested frequency, and increased in cover from 1% to 2%.

#### Forb:

- **1983 to 1989 - slightly up (+1):** Perennial forb sum of nested frequency increased 13%, but forb species remain sparse and provided little forage value.
- **1989 to 1997 - slightly down (-1):** The sum of nested frequency of perennial forb species decreased, and perennial forbs remained sparse.
- **1997 to 2002 - down (-2):** The sum of nested frequency for both perennial and annual forbs decreased dramatically. No perennial forb species were sampled.
- **2002 to 2007 - stable (0):** Perennial forb species remain rare on the site. Annual forb sum of nested frequency increased markedly, and cover increased from near 0% to 6%.
- **2007 to 2012 - stable (0):** The sum of nested frequency and cover of perennial forb species remained similar. Annual forb sum of nested frequency decreased substantially, and cover decreased to 1%.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --  
Management unit 18A, study no: 29

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	10.8	14.6	13.6	30.0	-4.7	2.0	0.0	<b>66.2</b>	Good-Excellent
02	10.4	13.3	3.6	30.0	0.0	0.0	0.0	<b>57.2</b>	Good
07	8.3	2.3	0.0	30.0	-1.3	0.4	0.0	<b>39.7</b>	Fair
12	11.0	11.6	4.3	30.0	-1.3	0.4	0.0	<b>56.0</b>	Good

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 18A, Study no: 29

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	b <sub>50</sub>	c <sub>133</sub>	ab <sub>31</sub>	a <sub>2</sub>	a <sup>-</sup>	ab <sub>19</sub>	1.17	.03	-	.27
G	Agropyron intermedium	c <sub>98</sub>	a <sub>6</sub>	b <sub>50</sub>	a <sub>7</sub>	a <sub>3</sub>	a <sub>3</sub>	2.03	.41	.00	.03
G	Agropyron spicatum	a <sub>159</sub>	ab <sub>165</sub>	abc <sub>211</sub>	d <sub>253</sub>	cd <sub>239</sub>	bcd <sub>216</sub>	10.55	15.70	16.58	17.22
G	Bromus japonicus (a)	-	-	-	-	6	-	-	-	.01	-
G	Bromus tectorum (a)	-	-	c <sub>228</sub>	a <sub>20</sub>	b <sub>86</sub>	ab <sub>63</sub>	6.31	.04	1.70	1.73
G	Oryzopsis hymenoides	-	-	2	3	-	2	.03	.15	.00	.03
G	Poa bulbosa	a <sub>13</sub>	a <sup>-</sup>	a <sup>-</sup>	a <sub>2</sub>	b <sub>42</sub>	c <sub>78</sub>	-	.00	.61	2.42
G	Poa pratensis	-	-	-	-	-	4	-	-	-	.03
G	Poa secunda	ab <sub>122</sub>	a <sub>51</sub>	ab <sub>91</sub>	bc <sub>117</sub>	d <sub>173</sub>	cd <sub>162</sub>	1.72	1.67	3.85	5.30
G	Sitanion hystrix	b <sub>17</sub>	a <sub>1</sub>	ab <sub>8</sub>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.07	-	-	-
Total for Annual Grasses		0	0	228	20	92	63	6.31	0.04	1.71	1.73
Total for Perennial Grasses		459	356	393	384	457	484	15.59	17.98	21.06	25.32
Total for Grasses		459	356	621	404	549	547	21.90	18.02	22.78	27.06
F	Agoseris glauca	4	-	-	-	3	-	-	-	.03	-
F	Allium sp.	-	-	1	-	-	-	.03	-	-	-
F	Alyssum alyssoides (a)	-	-	b <sub>241</sub>	a <sub>17</sub>	c <sub>301</sub>	b <sub>204</sub>	1.79	.03	3.76	1.20
F	Antennaria rosea	3	-	-	-	-	-	-	-	-	-
F	Arabis sp.	a <sup>-</sup>	b <sub>14</sub>	b <sub>13</sub>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.08	-	-	-
F	Calochortus nuttallii	b <sub>19</sub>	a <sub>4</sub>	a <sub>3</sub>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.05	-	-	-
F	Chaenactis douglasii	7	-	-	-	-	-	-	-	-	-
F	Crepis acuminata	3	-	-	-	-	2	-	-	-	.00
F	Cruciferae	-	1	-	-	-	-	-	-	-	-
F	Erigeron pumilus	2	-	-	-	-	-	-	-	-	-
F	Erigeron sp.	2	-	-	-	-	-	-	-	-	-
F	Holosteum umbellatum (a)	-	-	-	2	-	3	-	.00	-	.00
F	Lactuca serriola (a)	-	-	1	-	-	-	.00	-	-	-
F	Lathyrus brachycalyx	c <sub>83</sub>	d <sub>133</sub>	b <sub>48</sub>	a <sup>-</sup>	a <sub>4</sub>	a <sub>6</sub>	.58	-	.15	.22
F	Petradoria pumila	b <sub>17</sub>	b <sub>12</sub>	ab <sub>5</sub>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.02	-	-	-
F	Phlox longifolia	8	3	8	-	2	-	.21	-	.03	-
F	Ranunculus testiculatus (a)	-	-	b <sub>107</sub>	a <sub>2</sub>	c <sub>195</sub>	a <sub>6</sub>	.39	.00	2.03	.01
F	Sisymbrium altissimum (a)	-	-	2	-	3	-	.03	-	.03	-

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
	Total for Annual Forbs	0	0	351	21	499	213	2.22	0.04	5.84	1.22
	Total for Perennial Forbs	148	167	78	0	9	8	0.98	0	0.21	0.22
	Total for Forbs	148	167	429	21	508	221	3.21	0.04	6.05	1.44

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

**BROWSE TRENDS--**

Management unit 18A, Study no: 29

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Artemisia tridentata wyomingensis</i>	27	21	24	25	3.38	5.01	3.45	4.63
B	<i>Cowania mexicana stansburiana</i>	9	6	7	5	4.37	2.73	2.63	3.49
B	<i>Gutierrezia sarothrae</i>	36	4	15	11	.77	-	.13	.04
B	<i>Juniperus osteosperma</i>	3	3	2	2	3.97	5.91	3.44	5.25
	Total for Browse	75	34	48	43	12.50	13.67	9.65	13.41

**CANOPY COVER, LINE INTERCEPT--**

Management unit 18A, Study no: 29

Species	Percent Cover		
	'02	'07	'12
<i>Artemisia tridentata wyomingensis</i>	5.21	6.36	5.71
<i>Cowania mexicana stansburiana</i>	4.96	5.56	6.16
<i>Gutierrezia sarothrae</i>	-	.81	.30
<i>Juniperus osteosperma</i>	6.15	7.76	5.86

**KEY BROWSE ANNUAL LEADER GROWTH--**

Management unit 18A, Study no: 29

Species	Average leader growth (in)		
	'02	'07	'12
<i>Artemisia tridentata wyomingensis</i>	1.2	1.2	0.9
<i>Cowania mexicana stansburiana</i>	1.4	2.7	1.2

**POINT-QUARTER TREE DATA--**

Management unit 18A, Study no: 29

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
<i>Juniperus osteosperma</i>	89	83	88	6.6	7.2	5.9

**BASIC COVER--**

Management unit 18A, Study no: 29

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	3.25	6.00	34.40	31.05	36.88	37.86
Rock	1.50	3.75	1.70	3.20	1.82	2.32
Pavement	3.25	17.00	7.44	11.06	10.84	8.19
Litter	73.50	57.25	51.37	50.00	34.09	49.39
Cryptogams	1.50	1.50	1.52	2.13	2.04	4.46
Bare Ground	17.00	14.50	7.66	20.22	22.73	17.03

**SOIL ANALYSIS DATA --**

Management unit 18A, Study no: 29, Deadman Canyon

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.6	7.3	42.7	28.7	28.6	3.7	6.8	198.4	0.6

**PELLET GROUP DATA--**

Management unit 18A, Study no: 29

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	47	55	69	25	-	-	-
Elk	-	-	-	1	-	1 (2)	-
Deer	29	22	1	6	58 (142)	14 (35)	5 (13)
Cattle	-	-	1	1	-	-	-

**BROWSE CHARACTERISTICS--**

Management unit 18A, Study no: 29

		Age class distribution					Utilization		
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata wyomingensis</b>									
83	<b>499</b>	47	53	0	66	33	0	0	38/45
89	<b>832</b>	56	40	4	-	84	4	0	30/45
97	<b>800</b>	48	50	3	40	8	0	0	24/33
02	<b>880</b>	2	89	9	-	36	0	0	27/39
07	<b>1000</b>	0	58	42	-	24	6	18	28/37
12	<b>740</b>	0	95	5	-	8	0	0	29/34
<b>Chrysothamnus viscidiflorus lanceolatus</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	19/22



		Age class distribution					Utilization		
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Cowania mexicana stansburiana</i>									
83	<b>199</b>	17	67	17	-	17	83	17	38/33
89	<b>165</b>	0	40	60	-	80	20	20	33/38
97	<b>180</b>	11	89	0	60	0	0	0	77/75
02	<b>120</b>	17	83	0	20	33	17	0	74/82
07	<b>140</b>	0	57	43	-	43	14	14	95/101
12	<b>100</b>	20	60	20	40	20	0	0	79/86
<i>Gutierrezia sarothrae</i>									
83	<b>632</b>	63	37	0	66	0	0	0	10/13
89	<b>33</b>	0	100	0	-	0	0	0	11/9
97	<b>1700</b>	22	66	12	-	0	0	7	9/10
02	<b>120</b>	0	67	33	-	0	0	17	5/9
07	<b>420</b>	0	100	0	-	5	0	0	7/7
12	<b>300</b>	7	80	13	20	0	0	7	7/10
<i>Juniperus osteosperma</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>33</b>	0	100	0	-	0	0	0	124/63
97	<b>60</b>	33	67	0	-	0	0	0	-/-
02	<b>60</b>	0	67	33	-	0	0	0	-/-
07	<b>40</b>	0	100	0	-	0	0	0	-/-
12	<b>40</b>	0	100	0	-	0	0	0	-/-

HATCH RANCH - TREND STUDY NO. 18A-30-12

Vegetation Type: Cliffrose

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: Semidesert Shallow Loam (Wyoming Big Sagebrush), R028AY243UT

Land Ownership: BLM

Elevation: 5,350 ft. (1,631 m)

Aspect: West

Slope: 17%

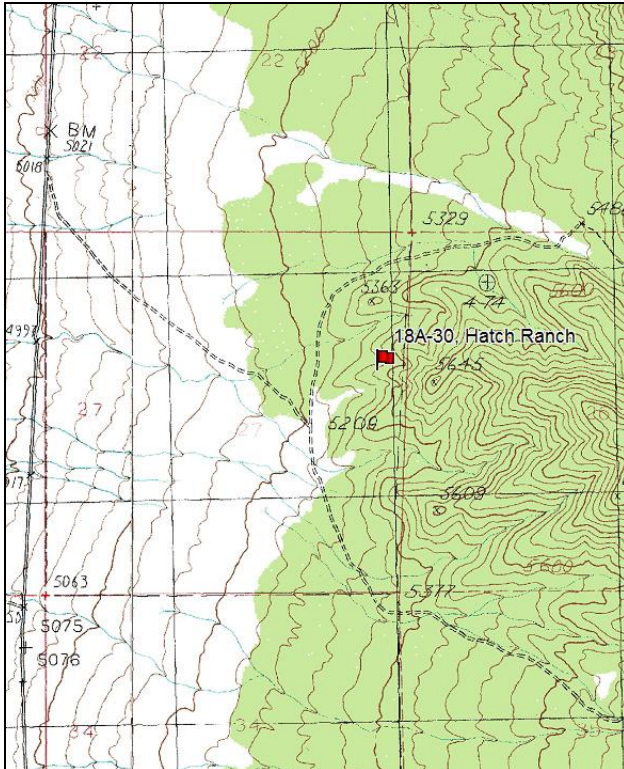
Transect bearing: 42° magnetic (line 1), 250° magnetic (line 2-4)

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

Note: No Rebar found on belt 2

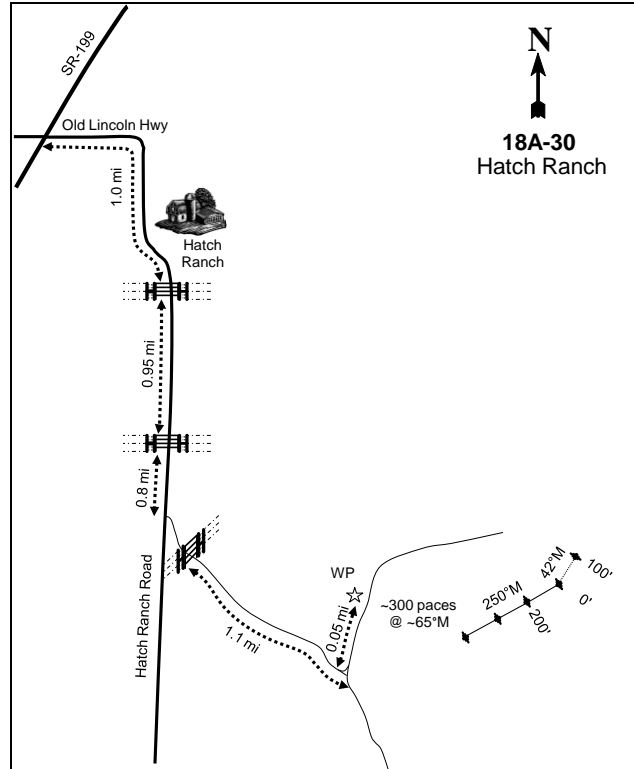
Directions: Across from the Old Lincoln Road, turn east off of SR-199 onto Hatch Ranch Road. Go east and south 1.0 mile to the Hatch Ranch. From the south gate, continue down the valley 0.95 miles to another gate. Continue 0.8 miles on the main road to a fork that angles southeast through a gate. Take this fork 1.1 miles to a fork at the base of the Onaqui Mountains. Bear left, going just 300 yards to the base of a ridge. From here, walk up the ridge at ~60°M about 400 yards to the 0-foot baseline stake on the ridge top. It is a short green fencepost marked with browse tag 9081.

Map Name: Johnson Pass



Township: 6S Range: 7W Section: 26

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 362868 E 4458765 N

## HATCH RANCH - TREND STUDY NO. 18A-30

### Site Information

Site Description: The study samples crucial deer winter range located at the base of the Onaqui Mountains, approximately three miles southeast of Hatch Ranch in Skull Valley. The area is administered by the Bureau of Land Management (BLM) as part of the Onaqui Mountain West allotment. The area is comprised of low hills and ridges occupied by scattered singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) woodlands and Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) mixed with Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). The entire area is rather depleted of herbaceous understory, especially forbs. Cheatgrass (*Bromus tectorum*) is widespread and found in dense patches. The area was treated as part of the Terra East Juniper Thinning-Phase 2, Bullhog Treatment ([WRI Project #1362](#)) in the winter of 2009-2010 (WRI Database 2013). The study was not part of the seeding treatment. Deer pellet groups were sampled in moderate abundance in 2002, but have been sampled in low abundance since 2007. Cattle sign has been sampled in low abundance since 2002. Rabbit pellet frequency has been moderate to high at times (Table - Pellet Group Data). There was also sign of wild horses in the area in 2002, but not on the study. Stud piles were found down slope from the study, and 10 wild horses were seen on the nearby sagebrush flat. In 1989, evidence of sheep use was noted.

Browse: Stansbury cliffrose and Wyoming big sagebrush provide nearly all of the browse cover on the site (Table - Browse Trends). The Wyoming big sagebrush stand is comprised of a scattered density of mostly mature plants. Recruitment of young sagebrush plants has been generally good throughout the course of the study. Decadence of sagebrush has been low to moderate, and poor vigor has been generally low over the sample years. Utilization of sagebrush has been mostly light to moderate, though with several years of heavier use. The cliffrose stand is comprised of a moderately dense population of mostly mature plants. Recruitment of young cliffrose plants has been good throughout the sample years. Decadence has been low and vigor has been good over the course of the study. Utilization of cliffrose has been moderate to heavy throughout the sample years (Table - Browse Characteristics). The bullhog treatment removed most of the mature Utah juniper (*Juniperus osteosperma*) from the site, but a number of young trees were sampled in 2012 (Table - Point-Quarter Tree Data).

Herbaceous Understory: The grass composition is poor on the site. The annual grasses cheatgrass (*Bromus tectorum*) and red brome (*B. rubens*) dominate the grass component in cover. The only common perennial grass is Sandberg bluegrass (*Poa secunda*), which provides limited forage. Perennial forb species are not common, and provide very limited forage (Table - Herbaceous Trends).

Soil: The soil is classified within the Lodar-Lundy series, likely as part of the Lodar component, which occur on mountainsides. These soils are formed from colluvium and/or residuum derived from limestone, and are characterized as shallow and well-drained (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral reaction (pH 7.1) (Table - Soil Analysis Data). Bare ground cover is low, with a high amount of vegetation, litter, and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2002 and 2012, but slight in 2007.

### Trend Assessments

#### Browse:

- **1983 to 1989 - stable (0):** The density of cliffrose decreased 11% from 598 plants/acre to 531 plants/acre. Recruitment of young plants remained similar at 12% of the population. Decadence of cliffrose increased from 6% to 37%, but poor vigor decreased from 11% to 0% of the population. The density of sagebrush increased 16% from 1,065 plants/acre to 1,231 plants/acre. Recruitment of young sagebrush plants increased from 31% to 41% of the population. Sagebrush decadence increased slightly from 9% to 11%, but poor vigor decreased from 16% to 5% of the population.

- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. Recruitment of young cliffrose plants increased to 21%. Decadence of cliffrose decreased to 13% of the population. Recruitment of young sagebrush plants decreased to 10% of the population. Decadence of sagebrush increased to 17%, and poor vigor increased to 33% of the population.
- **1997 to 2002 - up (+2):** Cliffrose density increased 47% from 780 plants/acre to 1,200 plants/acre, and cover increased from 9% to 12%. Recruitment of young plants decreased to 10% of the population. Sagebrush density increased 31% from 960 plants/acre to 1,260 plants/acre, but cover remained similar at 3%. Recruitment of young sagebrush plants increased to 19% of the population. Decadence of sagebrush increased to 22%, and poor vigor decreased to 8% of the population.
- **2002 to 2007 - down (-2):** Cliffrose density decreased 18% to 980 plants/acre, and cover decreased to 9%. Recruitment of young cliffrose plants decreased to 6%. The density of sagebrush decreased 32% to 860 plants/acre, but cover increased slightly to 4%. No young sagebrush plants were sampled. Decadence of sagebrush decreased to 19%, and poor vigor increased to 12% of the population.
- **2007 to 2012 - up (+2):** Cliffrose density remained similar at 940 plants/acre, and cover remained similar at 8%. Recruitment of young cliffrose plants increased to 15% of the population. The density of sagebrush increased 33% to 1,140 plants/acre, and cover increased to 7%. Recruitment of young sagebrush plants increased to 12% of the population. Decadence of sagebrush decreased to 12%, and poor vigor increased to 19% of the population.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequency of perennial grasses increased 49%.
- **1989 to 1997 - stable (0):** The sum of nested frequency of perennial grasses decreased 10%.
- **1997 to 2002 - slightly up (+1):** Perennial grass sum of nested frequency remained similar, and cover increased from 6% to 8%. Cheatgrass decreased significantly in nested frequency, and cover decreased from 8% to less than 1%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 10%, but cover increased to 9%. Cheatgrass increased significantly in nested frequency, and red brome was sampled for the first time since the study began. Cover of annual grasses increased from less than 1% to 4%.
- **2007 to 2012 - slightly down (-1):** The perennial grass sum of nested frequency decreased 11%, and cover decreased to 7%. Cheatgrass increased significantly in nested frequency, and cover increased to 15%.

Forb:

- **1983 to 1989 - stable (0):** Perennial forb species are rare on the site.
- **1989 to 1997 - stable (0):** Perennial forb species are rare on the site.
- **1997 to 2002 - stable (0):** Perennial forb species are rare on the site.
- **2002 to 2007 - stable (0):** Perennial forb species are rare on the site.
- **2007 to 2012 - stable (0):** Perennial forb species are rare on the site.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --  
Management unit 18A, study no: 30

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	17.9	10.8	9.1	12.2	-6.1	0.9	0.0	<b>44.8</b>	Fair-Good
02	22.2	11.9	6.0	15.2	-0.3	0.7	0.0	<b>55.6</b>	Good
07	18.7	9.9	2.0	17.5	-3.3	0.3	0.0	<b>45.1</b>	Fair-Good
12	17.8	11.0	6.8	14.3	-13.9	2.2	0.0	<b>38.1</b>	Fair

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 18A, Study no: 30

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	a17	b39	ab24	a15	a1	a13	.93	.58	.16	.77
G	Bromus rubens (a)	-	-	a-	a-	b109	b107	-	-	2.08	3.60
G	Bromus tectorum (a)	-	-	c285	a73	b158	c277	8.10	.46	2.25	14.83
G	Oryzopsis hymenoides	-	3	6	-	3	7	.07	-	.01	.18
G	Poa secunda	a192	b270	b252	b269	b253	a209	5.09	7.00	8.59	6.21
G	Secale cereale (a)	-	-	a-	a-	a-	b25	-	-	-	.10
Total for Annual Grasses		0	0	285	73	267	409	8.10	0.46	4.34	18.54
Total for Perennial Grasses		209	312	282	284	257	229	6.09	7.59	8.76	7.17
Total for Grasses		209	312	567	357	524	638	14.19	8.06	13.10	25.71
F	Agoseris glauca	-	-	3	-	-	3	.03	-	-	.15
F	Allium sp.	b10	ab6	b12	a-	a-	ab6	.06	-	-	.01
F	Alyssum alyssoides (a)	-	-	b10	a-	b10	b26	.02	-	.02	.07
F	Antennaria rosea	-	-	4	3	3	-	.01	.00	.00	-
F	Astragalus utahensis	-	1	3	-	-	-	.00	-	-	-
F	Calochortus nuttallii	3	7	1	-	-	3	.00	-	-	.00
F	Chaenactis douglasii	-	2	-	-	-	-	-	-	-	-
F	Cirsium sp.	-	-	1	-	-	-	.00	-	-	-
F	Cryptantha sp.	-	-	-	-	-	-	-	-	.00	-
F	Descurainia pinnata (a)	-	-	a-	a-	b21	a-	-	-	.07	-
F	Draba sp. (a)	-	-	a-	a-	b56	a4	-	-	.12	.01
F	Erigeron pumilus	a1	b10	ab6	a-	a-	a-	.03	-	-	-
F	Erodium cicutarium (a)	-	-	ab2	a-	b11	ab10	.01	-	.05	.04
F	Euphorbia sp.	-	-	5	-	-	-	.01	-	-	-
F	Haplopappus acaulis	-	6	-	-	-	-	-	-	-	-
F	Lactuca serriola (a)	a-	b27	a2	a-	a-	a1	.03	-	-	.00
F	Lappula occidentalis (a)	-	-	-	-	8	-	-	-	.01	-
F	Lomatium sp.	-	6	-	-	-	-	-	-	-	-
F	Microsteris gracilis (a)	-	-	2	-	11	-	.00	-	.02	-
F	Oenothera caespitosa	-	2	-	-	-	-	-	-	-	-
F	Phlox hoodii	-	-	9	9	3	8	.21	.36	.15	.91
F	Phlox longifolia	2	8	1	-	-	-	.00	-	-	-
F	Ranunculus testiculatus (a)	-	-	b149	a11	b189	a25	.74	.03	1.21	.09
F	Sisymbrium altissimum (a)	-	-	-	-	3	-	-	-	.03	-
F	Townsendia incana	a-	b37	a4	a-	a1	a5	.06	-	.00	.01
Total for Annual Forbs		0	27	165	11	309	66	0.80	0.03	1.56	0.22
Total for Perennial Forbs		16	85	49	12	7	25	0.44	0.36	0.16	1.09
Total for Forbs		16	112	214	23	316	91	1.25	0.39	1.72	1.32

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

BROWSE TRENDS--

Management unit 18A, Study no: 30

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata wyomingensis	34	36	29	34	3.10	3.30	4.43	6.48
B	Chrysothamnus viscidiflorus stenophyllus	13	0	1	2	.09	-	-	.03
B	Cowania mexicana stansburiana	32	38	38	37	9.34	12.03	8.75	8.26
B	Gutierrezia sarothrae	87	13	43	12	7.50	.30	.95	.38
B	Juniperus osteosperma	5	5	6	3	4.09	4.52	4.15	.84
B	Leptodactylon pungens	2	1	1	3	-	.03	.00	.03
B	Pinus monophylla	0	1	0	0	-	.00	-	-
B	Sclerocactus sp.	1	1	1	0	-	-	-	-
B	Tetradymia canescens	2	2	0	0	.15	-	-	-
B	Tetradymia nuttallii	18	11	4	4	.38	.09	.15	.15
Total for Browse		194	108	123	95	24.66	20.29	18.44	16.18

CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 30

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata wyomingensis	4.13	6.16	6.05
Chrysothamnus viscidiflorus stenophyllus	.03	-	-
Cowania mexicana stansburiana	14.66	17.16	13.51
Gutierrezia sarothrae	.01	1.20	.16
Juniperus osteosperma	6.21	7.30	.48
Leptodactylon pungens	-	-	.08
Tetradymia nuttallii	.13	-	.33

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 30

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata wyomingensis	1.4	0.8	1.0
Cowania mexicana stansburiana	1.7	0.6	1.5

POINT-QUARTER TREE DATA--

Management unit 18A, Study no: 30

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	63	89	71	5.3	5.9	2.5

BASIC COVER--

Management unit 18A, Study no: 30

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	2.00	3.25	34.68	27.06	28.81	41.46
Rock	22.75	23.00	16.75	19.56	19.92	15.81
Pavement	12.00	21.25	16.10	15.42	19.53	7.17
Litter	33.75	27.25	28.58	25.79	29.13	37.01
Cryptogams	15.50	16.00	17.79	22.27	13.17	6.61
Bare Ground	14.00	9.25	6.42	9.96	5.68	10.14

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 30, Hatch Ranch

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
6.1	7.1	35.1	32.7	32.2	2.5	9.5	233.6	0.7

PELLET GROUP DATA--

Management unit 18A, Study no: 30

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	45	12	64	3	-	-	-
Deer	40	8	9	3	31 (76)	3 (8)	5 (12)
Cattle	1	-	-	-	-	-	-

BROWSE CHARACTERISTICS--

Management unit 18A, Study no: 30

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Artemisia tridentata wyomingensis</i>										
83	<b>1065</b>	31	59	9	66	16	41	16	21/28	
89	<b>1231</b>	41	49	11	199	16	5	5	20/19	
97	<b>960</b>	10	73	17	320	4	0	33	19/28	
02	<b>1260</b>	19	59	22	-	5	3	8	21/30	
07	<b>860</b>	0	81	19	-	21	14	12	25/37	
12	<b>1140</b>	12	75	12	-	7	2	19	24/34	
<i>Chrysothamnus viscidiflorus stenophyllus</i>										
83	<b>1998</b>	2	93	5	-	0	0	3	12/17	
89	<b>1832</b>	4	51	45	-	55	4	2	7/7	
97	<b>380</b>	5	79	16	-	0	5	11	9/13	
02	<b>0</b>	0	0	0	-	0	0	0	9/13	
07	<b>20</b>	100	0	0	-	0	0	0	-/-	
12	<b>40</b>	0	100	0	-	0	0	50	8/14	

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Cowania mexicana stansburiana</i>									
83	<b>598</b>	11	83	6	-	78	22	11	50/41
89	<b>531</b>	12	50	37	66	25	44	0	37/24
97	<b>780</b>	21	67	13	80	5	3	3	51/54
02	<b>1200</b>	10	83	7	-	22	48	0	50/53
07	<b>980</b>	6	78	16	20	31	22	4	55/64
12	<b>940</b>	15	70	15	180	40	2	13	46/54
<i>Gutierrezia sarothrae</i>									
83	<b>2865</b>	17	83	0	133	0	0	0	11/9
89	<b>4732</b>	18	69	13	233	1	0	8	8/8
97	<b>12920</b>	14	83	3	-	0	0	1	9/10
02	<b>520</b>	4	81	15	-	4	0	15	5/5
07	<b>2720</b>	8	90	2	40	.73	0	7	7/8
12	<b>360</b>	11	78	11	160	0	0	6	6/8
<i>Juniperus osteosperma</i>									
83	<b>66</b>	0	100	-	-	0	0	0	56/42
89	<b>99</b>	0	100	-	133	0	0	0	79/45
97	<b>100</b>	40	60	-	20	0	0	0	-/-
02	<b>100</b>	20	80	-	-	0	0	0	-/-
07	<b>120</b>	33	67	-	20	0	0	0	-/-
12	<b>60</b>	100	0	-	-	0	0	0	-/-
<i>Leptodactylon pungens</i>									
83	<b>2132</b>	12	88	0	-	0	0	2	5/5
89	<b>2965</b>	6	92	2	99	0	0	0	5/6
97	<b>60</b>	33	67	0	-	0	0	0	10/26
02	<b>20</b>	0	0	100	-	0	0	100	-/-
07	<b>20</b>	0	100	0	-	0	0	0	11/11
12	<b>80</b>	0	100	0	-	0	0	0	9/8
<i>Pinus monophylla</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>20</b>	100	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<i>Sclerocactus</i> sp.									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>0</b>	0	0	0	-	0	0	0	-/-
97	<b>20</b>	0	100	0	-	0	0	0	5/10
02	<b>40</b>	0	50	50	-	0	0	0	7/12
07	<b>20</b>	0	100	0	-	0	0	0	2/12
12	<b>0</b>	0	0	0	-	0	0	0	5/12



		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Tetradymia canescens</i>										
83	<b>865</b>	0	46	54	-	0	0	23	18/19	
89	<b>598</b>	11	17	72	-	28	6	11	20/19	
97	<b>60</b>	0	100	0	-	0	0	100	20/25	
02	<b>40</b>	0	0	100	-	0	0	50	19/30	
07	<b>0</b>	0	0	0	-	0	0	0	-/-	
12	<b>0</b>	0	0	0	-	0	0	0	25/46	
<i>Tetradymia nuttallii</i>										
83	<b>0</b>	0	0	0	-	0	0	0	-/-	
89	<b>66</b>	50	50	0	-	50	0	0	9/10	
97	<b>580</b>	7	10	83	-	0	0	31	18/23	
02	<b>280</b>	0	29	71	-	0	0	57	24/36	
07	<b>80</b>	0	25	75	-	25	0	75	20/29	
12	<b>80</b>	0	100	0	-	0	0	50	18/26	

EAST HICKMAN CANYON - TREND STUDY NO. 18A-32-12

Vegetation Type: Perennial Grass

Range Type: Deer Winter

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

Land Ownership: SITLA

Elevation: 5,600 ft. (1,707 m)

Aspect: East

Slope: 5%

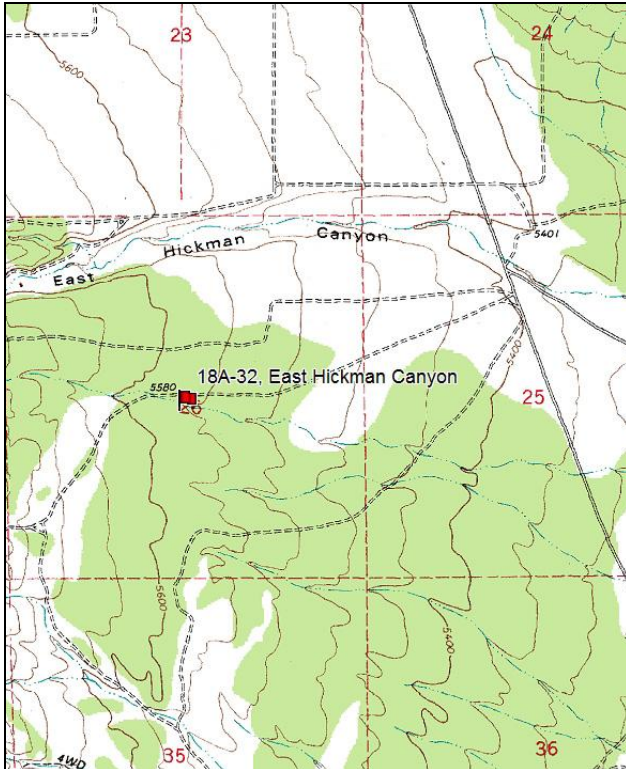
Transect bearing: 199° magnetic

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

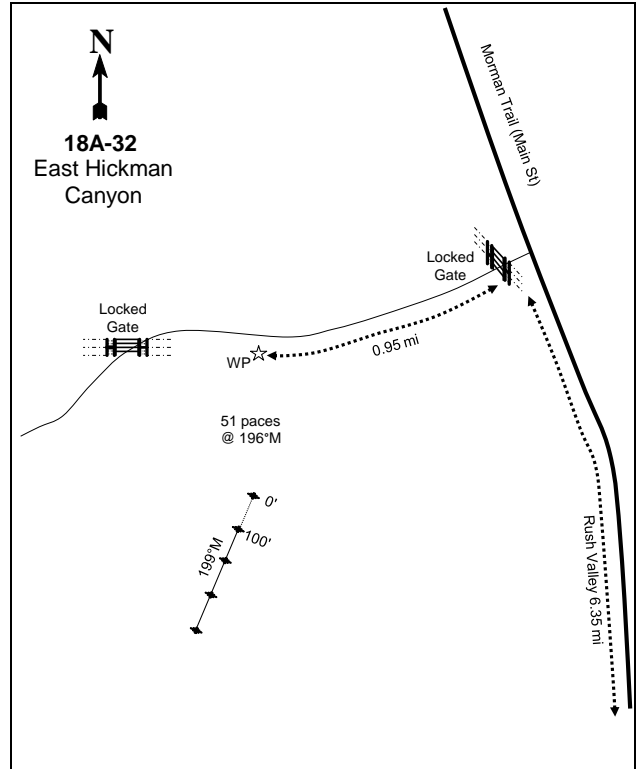
Note: Gates are locked, contact landowner.

Directions: From the intersection of Center and Main Streets in Rush Valley, drive north on Main Street/Mormon Trail 6.35 miles to a dirt road on the left (west). Turn left on this road and proceed a short distance to the locked gate. From the gate, continue 0.95 miles to the west to a witness post on the left side of the road. From the witness post walk 51 paces across the gully at 196 degrees magnetic to the 0-foot stake. The study is marked by green, steel fenceposts 12-18 inches in height. The 0-foot stake is marked by browse tag 440. In 2002 the site had to be reached by driving up East Hickman Canyon, crossing the creek and driving in from the west. That road is also blocked by a locked gate.

Map Name: South Mountain



Diagrammatic Sketch:



Township: 4S Range: 6W Section: 26

GPS: NAD 83, UTM 12S 373543 E 4477789 N

## EAST HICKMAN CANYON - TREND STUDY NO. 18A-32

### Site Information

Site Description: The study was established in 1997 to obtain pretreatment data for a Utah juniper (*Juniperus osteosperma*) chaining and seeding project completed in 1999. The site supported a thick juniper woodland with a poor understory. After the treatment there was a large response from the seeded grass species, which now provide the majority of cover on the site. Deer pellet groups have been sampled in low abundance since 2002, but pellet frequency was low in 1997 prior to the treatment. Cattle sign was sampled in low abundance in 2002 and 2012, but more moderate abundance in 2007. Rabbit pellet frequency was moderate to high from 1997 to 2007, but was low in 2012 (Table - Pellet Group Data).

Browse: Prior to the chaining, the site was dominated by a dense population of large, mature Utah juniper trees. The chaining removed most of the mature trees from the site, but a large number of young trees remained. These surviving trees have slowly increased in size since 2002 (Table - Point-Quarter Tree Data). Mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*) density has been low since the outset of the study. There was a large number of standing dead sagebrush plants sampled prior to the chaining. Any preferred browse species that may have been seeded in the treatment did not establish. Other shrub species, such as stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), rubber rabbitbrush (*Chrysothamnus nauseosus*), and broom snakeweed (*Gutierrezia sarothrae*) have been sampled in low densities (Table - Browse Characteristics).

Herbaceous Understory: Prior to the chaining, the abundant cover and density of juniper suppressed understory species. Grass species were rare and Sandberg bluegrass (*Poa secunda*) and mutton bluegrass (*P. fendleriana*) comprised nearly all of the grass cover, both of which provide poor forage value. Following the treatment, grass cover increased markedly due to increased from seeded grass species. Crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) were the most common seeded species sampled. A number of other native and introduced species have been sampled since the treatment. No seed mix was available for the treatment. Forb composition has been poor since the outset of the study. Perennial forb species are rare and annual forb species dominate the component (Table - Herbaceous Trends).

Soil: The soil is classified as a Borvant gravelly loam, which occurs on fan remnants. These soils are formed from alluvium derived from limestone, and are characterized as shallow and well-drained (Soil Survey Staff 2011). The soil has a fine clay loam texture, with a hardpan at a depth of about 13-15 inches. The soil reaction is neutral (pH 7.3) (Table - Soil Analysis Data). There are very few rocks on the surface or within the soil profile. Bare ground cover is high, with vegetation and litter providing the majority of the protective ground cover (Table - Soil Analysis Data). The soil erosion condition was classified as stable in 2002 and 2012, but slight in 2007.

### Trend Assessments

#### Browse:

- **1997 to 2002 - slightly up (+1):** Juniper canopy cover decreased from 31% to 8%, which opened up the understory for the establishment of other species. Mountain big sagebrush remained rare on the site at just 80 plant/acre. Decadence and poor vigor both decreased from 100% to 25% of the population.
- **2002 to 2007 - stable (0):** Browse continued to be a minor component on the site. Density of sagebrush remained at 80 plants/acre, and cover was less than 1%.
- **2007 to 2012 - stable (0):** Browse continued to be a minor component on the site. Density of sagebrush increased to 240 plants/acre, but cover remained less than 1%. Recruitment of young sagebrush plants comprised 50% of the population.

Grass:

- **1997 to 2002 - up (+2):** The sum of nested frequency of perennial grasses increased 20%, and cover increased from 8% to 21%. Seeded grasses established well following the seeding. Crested wheatgrass was the most prominent species, providing 69% of the grass cover.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 14%, but cover decreased to 17%.
- **2007 to 2012 - up (+2):** The perennial grass sum of nested frequency increased 20%, and cover increased to 23%.

Forb:

- **1997 to 2002 - stable (0):** The sum of nested frequency of perennial forbs increased, but perennial forbs remained rare on the site. Perennial forb cover remained less than 1%. Annual forb sum of nested frequency increased substantially, and cover increased from less than 1% to 5%.
- **2002 to 2007 - stable (0):** The sum of nested frequency of perennial forbs decreased, but were already rare on the site. Annual species continued to dominate the forb component of the understory, but cover decreased to 1%.
- **2007 to 2012 - stable (0):** There was little change in the forb component.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 18A, study no: 32

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	0.2	0.0	0.0	15.4	-0.1	1.2	0.0	<b>16.8</b>	Very Poor
02	0.0	0.0	0.0	30.0	-0.6	1.3	0.0	<b>30.8</b>	Very Poor
07	0.1	0.0	0.0	30.0	-0.3	0.7	0.0	<b>30.5</b>	Very Poor
12	0.1	0.0	0.0	30.0	0.0	0.7	0.0	<b>30.8</b>	Very Poor

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 18A, Study no: 32

Type	Species	Nested Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a-	b231	b260	b228	-	15.33	12.09	11.10
G	Agropyron intermedium	a-	b31	c72	d160	-	1.02	2.49	5.93
G	Agropyron spicatum	b50	ab37	ab52	a30	.43	1.60	.77	1.43
G	Aristida purpurea	a-	a2	a-	b19	-	.00	-	.57
G	Bromus inermis	a-	ab4	b16	a-	-	.03	.15	-
G	Bromus japonicus (a)	a-	b12	a-	a-	-	.03	-	-
G	Bromus tectorum (a)	a15	b90	b55	a5	.19	.79	.35	.01
G	Elymus cinereus	-	-	2	-	-	-	.15	-
G	Elymus junceus	a-	a-	b23	a3	-	.00	.41	.00
G	Oryzopsis hymenoides	-	-	10	-	-	-	.21	-
G	Poa bulbosa	a-	a-	a-	b14	-	.00	-	.07
G	Poa fendleriana	b48	a-	a-	a-	1.43	-	-	-
G	Poa secunda	c277	a140	a99	b184	5.67	2.36	.99	4.17
G	Sitanion hystrix	b17	b25	a2	a3	.16	.98	.03	.03

Type	Species	Nested Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
	Total for Annual Grasses	15	102	55	5	0.19	0.81	0.34	0.01
	Total for Perennial Grasses	392	470	536	641	7.72	21.36	17.32	23.33
	Total for Grasses	407	572	591	646	7.92	22.18	17.68	23.35
F	Allium sp.	4	5	1	3	.01	.04	.00	.00
F	Alyssum alyssoides (a)	<sub>a</sub> 1	<sub>b</sub> 84	<sub>c</sub> 227	<sub>d</sub> 314	.00	.66	.54	.84
F	Antennaria rosea	2	9	2	4	.00	.05	.00	.03
F	Arabis sp.	1	-	-	-	.00	-	-	-
F	Astragalus convallarius	16	10	11	14	.28	.07	.10	.05
F	Astragalus sp.	-	1	-	-	-	.00	-	-
F	Camelina microcarpa (a)	-	1	-	-	-	.00	-	-
F	Collinsia parviflora (a)	33	21	32	18	.15	.03	.05	.04
F	Crepis acuminata	1	1	-	-	.03	.00	-	-
F	Cryptantha sp.	-	3	7	-	-	.03	.09	.00
F	Descurainia pinnata (a)	-	-	1	-	-	-	.03	-
F	Draba sp. (a)	3	-	1	2	.00	-	.00	.01
F	Epilobium brachycarpum (a)	<sub>a</sub> -	<sub>b</sub> 14	<sub>a</sub> -	<sub>b</sub> 16	-	.18	-	.03
F	Gilia sp. (a)	-	3	-	-	-	.00	-	-
F	Heterotheca villosa	-	1	-	2	-	.00	-	.00
F	Holosteum umbellatum (a)	<sub>ab</sub> 1	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 8	.03	-	-	.02
F	Lactuca serriola (a)	2	1	-	5	.00	.00	-	.00
F	Lathyrus brachycalyx	<sub>ab</sub> 5	<sub>b</sub> 16	<sub>a</sub> 5	<sub>ab</sub> 12	.01	.13	.01	.05
F	Medicago sativa	<sub>a</sub> -	<sub>b</sub> 33	<sub>a</sub> -	<sub>a</sub> -	-	.23	-	-
F	Microsteris gracilis (a)	-	12	-	-	-	.02	-	-
F	Phlox hoodii	<sub>b</sub> 18	<sub>ab</sub> 3	<sub>a</sub> 5	<sub>a</sub> 2	.28	.06	.06	.18
F	Phlox longifolia	2	8	4	10	.00	.02	.03	.02
F	Polygonum douglasii (a)	-	2	-	-	-	.00	-	-
F	Ranunculus testiculatus (a)	<sub>a</sub> 50	<sub>c</sub> 231	<sub>b</sub> 124	<sub>ab</sub> 76	.13	4.04	.41	.18
F	Senecio multilobatus	-	-	2	-	-	-	.00	-
F	Sisymbrium altissimum (a)	-	2	-	3	-	.03	-	.01
F	Sphaeralcea coccinea	-	7	3	3	-	.01	.03	.00
F	Tragopogon dubius (a)	-	-	-	-	-	.00	-	-
	Total for Annual Forbs	90	371	385	442	0.32	5.00	1.04	1.14
	Total for Perennial Forbs	49	97	40	50	0.62	0.67	0.34	0.36
	Total for Forbs	139	468	425	492	0.95	5.68	1.38	1.51

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

**BROWSE TRENDS--**

Management unit 18A, Study no: 32

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	3	4	4	6	.18	.03	.06	.10
B	Chrysothamnus nauseosus	0	0	1	0	-	-	-	-
B	Gutierrezia sarothrae	1	5	10	11	-	.00	.10	.45
B	Juniperus osteosperma	24	14	13	18	16.54	5.28	4.84	6.27
Total for Browse		28	23	28	35	16.73	5.32	5.00	6.83

**CANOPY COVER, LINE INTERCEPT--**

Management unit 18A, Study no: 32

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	.21	.10	.78
Gutierrezia sarothrae	.05	.36	.36
Juniperus osteosperma	7.63	9.88	6.59

**KEY BROWSE ANNUAL LEADER GROWTH--**

Management unit 18A, Study no: 32

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	3.2	1.4	1.1

**POINT-QUARTER TREE DATA--**

Management unit 18A, Study no: 32

Species	Trees per Acre				Average diameter (in)			
	'97	'02	'07	'12	'97	'02	'07	'12
Juniperus osteosperma	295	146	240	184	5.0	3.2	4.1	2.4

**BASIC COVER--**

Management unit 18A, Study no: 32

Cover Type	Average Cover %			
	'97	'02	'07	'12
Vegetation	26.19	32.68	27.03	33.20
Rock	1.12	.17	.20	.10
Pavement	4.89	4.38	3.60	.70
Litter	30.51	47.92	45.02	49.01
Cryptogams	13.01	.09	.08	.80
Bare Ground	34.45	28.27	31.06	31.04

**SOIL ANALYSIS DATA --**

Management unit 18A, Study no: 32, East Hickman Canyon

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.1	7.3	36.7	34.7	28.6	2.0	6.5	134.2	0.4

PELLET GROUP DATA--

Management unit 18A, Study no: 32

Type	Quadrat Frequency			
	'97	'02	'07	'12
Rabbit	41	31	58	9
Deer	13	4	-	-
Cattle	-	-	3	1

Days use per acre (ha)		
'02	'07	'12
-	-	-
2 (5)	1 (2)	-
5 (13)	26 (65)	10 (25)

BROWSE CHARACTERISTICS--

Management unit 18A, Study no: 32

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Amelanchier utahensis</b>									
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	27/10
<b>Artemisia tridentata vaseyana</b>									
97	80	0	0	100	-	0	75	100	-/-
02	80	25	50	25	-	0	0	25	18/23
07	80	50	50	0	20	0	0	0	17/25
12	240	50	50	0	20	0	0	8	26/31
<b>Chrysothamnus nauseosus</b>									
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	20	0	100	-	-	0	0	0	17/15
12	0	0	0	-	-	0	0	0	11/14
<b>Chrysothamnus viscidiflorus viscidiflorus</b>									
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	10/22
07	0	0	0	-	-	0	0	0	7/16
12	0	0	0	-	-	0	0	0	7/12
<b>Cowania mexicana stansburiana</b>									
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	9/12
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<b>Gutierrezia sarothrae</b>									
97	20	0	100	0	-	0	0	0	-/-
02	120	0	83	17	-	0	0	0	8/15
07	440	9	77	14	60	0	5	9	9/11
12	540	7	85	7	-	0	0	11	10/10

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
Juniperus osteosperma										
97	<b>540</b>	11	89	0	60	0	0	0	-/-	
02	<b>300</b>	33	53	13	20	0	0	40	52/35	
07	<b>280</b>	7	93	0	20	7	0	64	-/-	
12	<b>440</b>	32	68	0	-	5	0	0	-/-	



CARR FORK 2 - TREND STUDY NO. 18A-34-12

Vegetation Type: Antelope Bitterbrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: UDWR

Elevation: 5,406 ft. (1,647 m)

Aspect: West

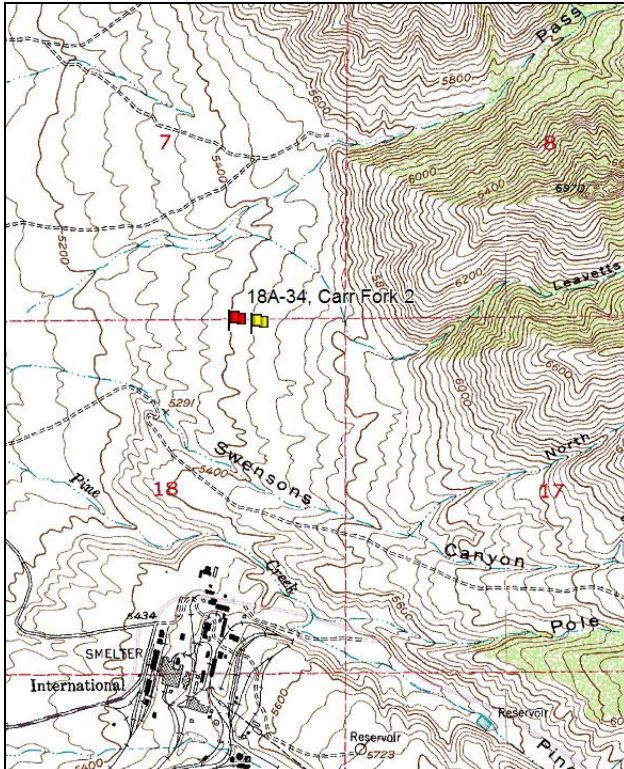
Slope: 8%

Transect bearing: 330° magnetic

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

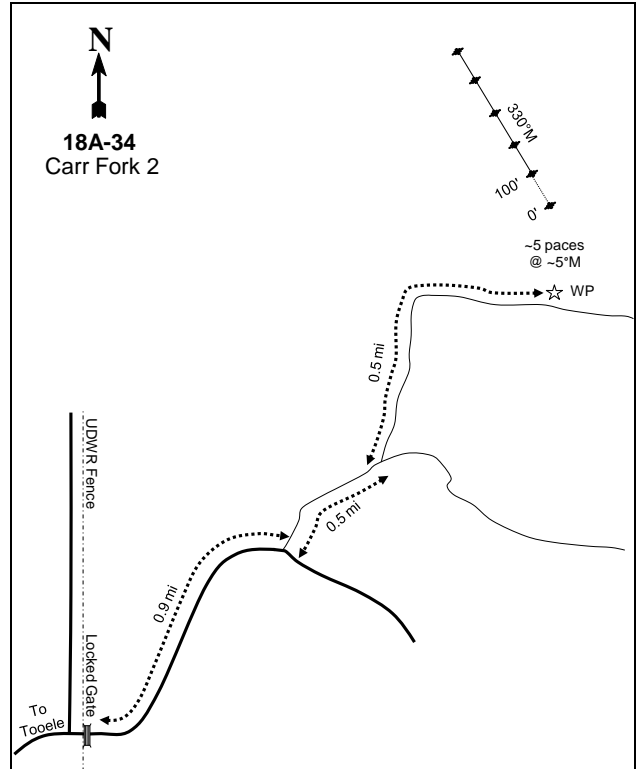
Directions: Go east on 4<sup>th</sup> north (Smelter Road) in Tooele for 1.5 miles to Ericson Road. Turn left; continue 0.8 miles to a fork in the road. Take the right fork for 0.1 miles to a locked gate (UDWR lock). Stay on “Old” road for 0.9 miles past a gate on the right. Go another 0.4 miles to a gate. Go 0.1 miles through a field of curly gum weed to a left fork. Take the left fork for 0.5 miles the witness post on the left side of the road. The 0-foot stake is 5 paces from the witness post at 5°M. The 0-foot stake is marked with browse tag 177.

Map Name: Bingham Canyon



Township: 3S Range: 3W Section: 7

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 396397 E 4491267 N

CARR FORK 2 - TREND STUDY NO. 18A-34

**Site Information**

Site Description: The study lies on property that originally belonged to Anaconda Mining Company and was transferred to the Utah Division of Wildlife Resources (UDWR) in 1994. The site is an old tailings area for a copper mine, and was mostly composed of weeds. In the fall of 1986 and spring of 1987, the area was disked deeply twice and drill seeded with a mixture of grasses and forbs. Antelope bitterbrush (*Purshia tridentata*) was transplanted in large strips through the area in 2002. The study was established in 2012 to replace the original Carr Fork study (18A-31) which monitored an area of annual grasses and weeds with a limited browse component. The new study was set up to monitor one of the strips of bitterbrush that are considered more valuable to big game. Pellet group data from the original Carr Fork study indicated moderate to high abundance of sampled deer pellet groups from 1997 to 2002. Deer pellet groups were sampled in low abundance on the new site in 2012 (Table - Pellet Group Data).

Browse: The browse component is comprised entirely of a moderately dense stand of very large, mature bitterbrush plants. Health of the population is good with low decadence and good vigor. Utilization was mostly light to moderate with some heavy use. Many of the plants are large enough that only portions of the plant are available to animals for use (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are fairly diverse and abundant, but the weedy species bulbous bluegrass (*Poa bulbosa*) dominates the grass component. Other prevalent perennial grass species include the seeded species tall wheatgrass (*Agropyron elongatum*), intermediate wheatgrass (*A. intermedium*), and orchardgrass (*Dactylis glomerata*). Forb composition is poor and dominated by annual or weedy species. The noxious weeds hoary crest (*Cardaria draba*), field bindweed (*Convolvulus arvensis*), and dalmation toadflax (*Linaria dalmatica*) were all sampled in high frequency and cover. Desirable forb species are rare (Table - Herbaceous Trends).

Soil: The soil is classified as a Kapod stony loam, which occurs on fan remnants. These soils are formed from alluvium derived from limestone and sandstone, and are characterized as deep and well drained (Soil Survey Staff 2011). The soil contains graded tailings from the Anaconda copper mines. Most sites containing tailings have mildly acidic soils, but this site has a strongly acidic soil reaction (pH 5.5) (Table - Soil Analysis Data). The low pH may be one of the reasons that the seeding was not successful. Bare ground cover is low, with a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as stable in 2012.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --  
Management unit 18A, study no: 34

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
12	26.8	12.9	3.5	30.0	0.0	10.0	-6.0	<b>77.2</b>	Good

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 18A, Study no: 34

T y p e	Species	Nested	Average
		Frequency	Cover %
		'12	'12
G	Agropyron elongatum	115	9.28
G	Agropyron intermedium	71	2.91
G	Dactylis glomerata	51	3.43
G	Poa bulbosa	324	24.60
G	Poa pratensis	11	.04
G	Poa secunda	7	.01
Total for Annual Grasses		0	0
Total for Perennial Grasses		579	40.28
Total for Grasses		579	40.28
F	Alyssum alyssoides (a)	7	.02
F	Ambrosia psilostachya	67	.62
F	Apocynum cannabinum	124	3.01
F	Asclepias sp.	4	.03
F	Aster sp.	51	.56
F	Camelina microcarpa (a)	12	.08
F	Cardaria draba	111	2.35
F	Chenopodium leptophyllum(a)	1	.00
F	Collinsia parviflora (a)	15	.03
F	Comandra pallida	71	.73
F	Convolvulus arvensis	204	3.89
F	Crepis acuminata	3	.00
F	Draba sp. (a)	16	.03
F	Epilobium brachycarpum (a)	123	.59
F	Grindelia squarrosa	33	.16
F	Holosteum umbellatum (a)	7	.02
F	Lactuca serriola (a)	12	.02
F	Linaria dalmatica	143	2.84
F	Lithospermum ruderales	8	.21
F	Onobrychis viciaefolia	4	.21
F	Phlox longifolia	9	.04
F	Polygonum douglasii (a)	8	.05
F	Ranunculus testiculatus (a)	3	.00
F	Sanguisorba minor	28	1.22
F	Tragopogon dubius (a)	18	.09
F	Verbascum blattaria	84	1.63
F	Veronica biloba (a)	6	.06
Total for Annual Forbs		228	1.01
Total for Perennial Forbs		944	17.56
Total for Forbs		1172	18.57

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

BROWSE TRENDS--

Management unit 18A, Study no: 34

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Purshia tridentata	14	17.86
Total for Browse		14	17.86

CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 34

Species	Percent Cover
	'12
Purshia tridentata	26.26

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 34

Species	Average leader growth (in)
	'12
Purshia tridentata	1.7

BASIC COVER--

Management unit 18A, Study no: 34

Cover Type	Average Cover %
	'12
Vegetation	74.61
Rock	.01
Pavement	.34
Litter	59.15
Cryptogams	2.37
Bare Ground	2.36

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 34, Carr Fork 2

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
12.1	5.5	32.0	41.4	26.6	2.2	51.0	275.2	0.4

PELLET GROUP DATA--

Management unit 18A, Study no: 34

Type	Quadrat Frequency	Days use per acre (ha)
	'12	'12
Deer	12	13 (31)

BROWSE CHARACTERISTICS--  
 Management unit 18A, Study no: 34

		Age class distribution				Utilization			
Y e a r	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Purshia tridentata									
12	<b>280</b>	7	86	7	40	36	7	7	74/114

MAGPIE CANYON - TREND STUDY NO. 18A-35-12

Vegetation Type: Antelope Bitterbrush

Range Type: Crucial Deer Spring/Fall

NRCS Ecological Site Description: Mountain Stony Loam (Antelope Bitterbrush), R028AY456UT

Land Ownership: USFS

Elevation: 6,201 ft. (1,890 m)

Aspect: Southeast

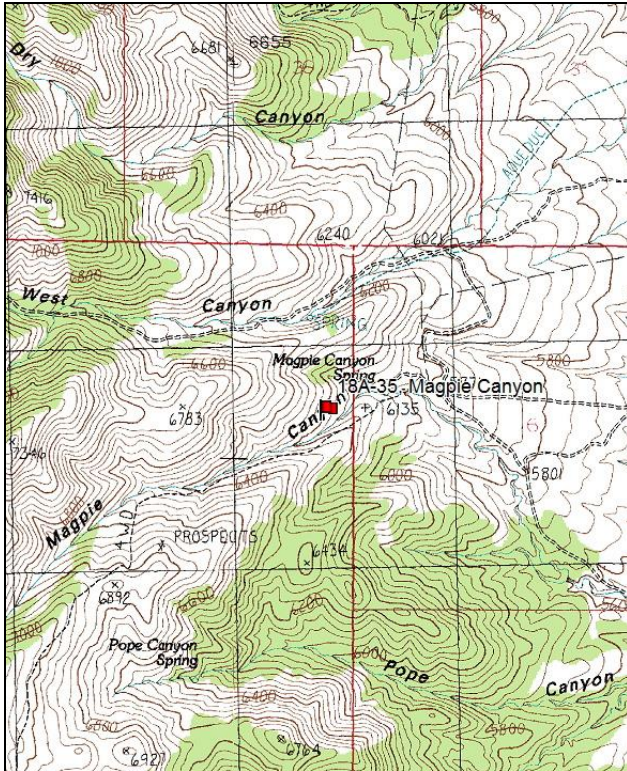
Slope: 37%

Transect bearing: 225° magnetic (Lines 1-4), 230° magnetic (Line 5)

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

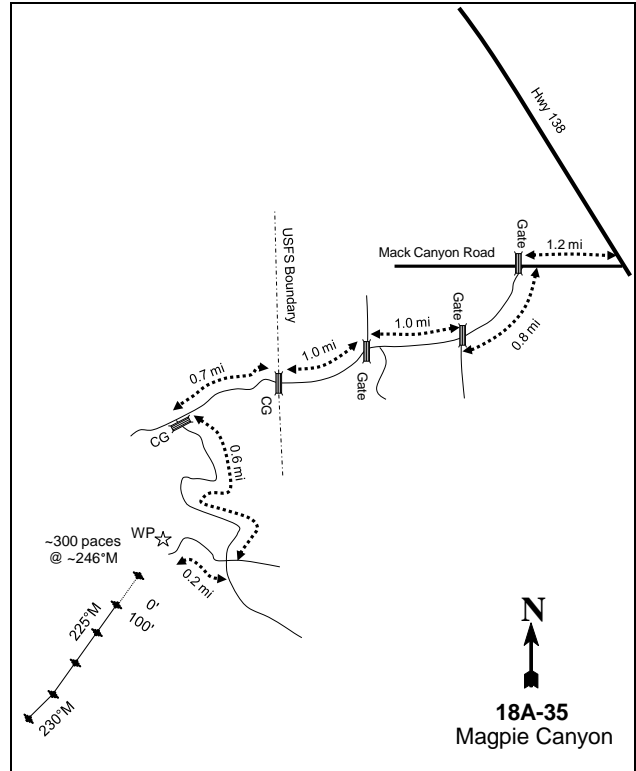
Directions: From Grantsville proceed west on Hwy 138 to Mack Canyon Road on the left side of the road just after Hwy 138 bends to the north. Turn left and travel 1.2 miles to a gate, keep right and travel for another 0.8 miles to another gate. Travel another 1.0 miles to another gate. Travel 1.0 miles to a cattle guard and continue to for another 0.7 miles and turn left. Travel for 0.6 miles and turn right. The witness post is 0.2 miles. The 0-foot stake is approximately 300 paces at 246°M. The 0-foot stake is marked with browse tag 161.

Map Name: North Willow Canyon



Township: 3S Range: 7W Section: 1

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 366332 E 4493865 N

MAGPIE CANYON - TREND STUDY NO. 18A-35

**Site Information**

Site Description: The study is located at the mouth of Magpie Canyon on land administered by the U.S. Forest Service (USFS) as part of the Grantsville North allotment. The study samples a steep, south facing sidehill with a mixture of antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and Utah serviceberry (*Amelanchier utahensis*) providing valuable browse for wildlife. Deer and elk pellet groups were sampled in low abundance in 2012. Cattle sign was minimal on the study site in 2012 (Table - Pellet Group Data).

Browse: Antelope bitterbrush provides the majority of the browse cover on the site (Table - Canopy Cover). The bitterbrush stand is comprised of a moderately dense population of mostly mature plants. Recruitment of young bitterbrush plants is low. Health of the bitterbrush population appears good, with low decadence and good vigor. Utilization of bitterbrush was mostly light to moderate. The sagebrush stand is comprised of a scattered population of mostly mature plants. Recruitment of young sagebrush plants is low. Decadence is low, but poor vigor is moderate. Utilization of sagebrush was mostly light, with some moderate use. Serviceberry occurs in low density on the site, but sampled plants displayed some heavy use (Table - Browse Characteristics).

Herbaceous Understory: Grasses on the site are fairly abundant, but composition is poor. The only common perennial grass species is bluebunch wheatgrass (*Agropyron spicatum*). The annual grass species cheatgrass (*Bromus tectorum*) and Japanese chess (*B. japonicus*) are prevalent and provide the majority of the grass cover on the site. The weedy perennial grass species bulbous bluegrass (*Poa bulbosa*) was sampled at low frequency and cover. The forb component is fairly diverse and abundant, but most species are not common. Arrowleaf balsamroot (*Balsamorhiza sagittata*) provides the majority of the perennial forb cover, but occurs in low frequency. Several annual and weedy forb species are common. The noxious weed houndstongue (*Cynoglossum officinale*) was sampled at low frequency and cover in 2012 (Table - Herbaceous Trends).

Soil: The soil is classified as part of the Lodar-Lundy series, likely as part of the Lundy component, which occur on mountainsides. The soils are formed from colluvium and/or residuum derived from limestone, and are characterized as shallow and well drained (Soil Survey Staff 2011). The soil texture is a clay loam with a neutral soil reaction (Table - Soil Analysis Data). Bare ground cover is moderate, but there is a high amount of vegetation, litter, and rock providing protective ground cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2012.

**Trend Assessments**

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 18A, 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
12	30.0	13.2	0.6	23.4	-9.9	7.1	-2.0	<b>62.3</b>	

## Trend Summary

### HERBACEOUS TRENDS--

Management unit 18A, Study no: 35

T y p e	Species	Nested Frequency	Average Cover %
		'12	'12
G	<i>Agropyron spicatum</i>	222	10.89
G	<i>Bromus japonicus</i> (a)	46	1.33
G	<i>Bromus tectorum</i> (a)	387	11.92
G	<i>Poa bulbosa</i>	36	.49
G	<i>Poa secunda</i>	50	.79
Total for Annual Grasses		433	13.26
Total for Perennial Grasses		308	12.18
Total for Grasses		741	25.44
F	<i>Allium</i> sp.	13	.08
F	<i>Alyssum alyssoides</i> (a)	288	.80
F	<i>Artemisia ludoviciana</i>	10	.48
F	<i>Astragalus</i> sp.	6	.06
F	<i>Astragalus utahensis</i>	4	.03
F	<i>Balsamorhiza sagittata</i>	14	1.75
F	<i>Calochortus nuttallii</i>	2	.00
F	<i>Cirsium</i> sp.	-	.00
F	<i>Collinsia parviflora</i> (a)	6	.01
F	<i>Comandra pallida</i>	10	.13
F	<i>Crepis acuminata</i>	3	.03
F	<i>Cynoglossum officinale</i>	1	.00
F	<i>Erodium cicutarium</i> (a)	145	2.05
F	<i>Galium aparine</i> (a)	15	.16
F	<i>Hackelia patens</i>	1	.01
F	<i>Holosteum umbellatum</i> (a)	31	.06
F	<i>Lactuca serriola</i> (a)	9	.02
F	<i>Lithospermum ruderae</i>	1	.21
F	<i>Lomatium</i> sp.	38	.58
F	<i>Phlox longifolia</i>	22	.15
F	<i>Ranunculus testiculatus</i> (a)	18	.03
F	<i>Tragopogon dubius</i> (a)	12	.13
Total for Annual Forbs		524	3.28
Total for Perennial Forbs		125	3.55
Total for Forbs		649	6.83

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



BROWSE TRENDS--

Management unit 18A, Study no: 35

Type	Species	Strip Frequency	Average Cover %
		'12	'12
B	Amelanchier utahensis	4	2.17
B	Artemisia tridentata vaseyana	23	2.29
B	Gutierrezia sarothrae	13	.01
B	Purshia tridentata	43	16.75
Total for Browse		83	21.23

CANOPY COVER, LINE INTERCEPT--

Management unit 18A, Study no: 35

Species	Percent Cover
	'12
Amelanchier utahensis	2.75
Artemisia tridentata vaseyana	4.51
Gutierrezia sarothrae	.16
Purshia tridentata	19.29

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18A, Study no: 35

Species	Average leader growth (in)
	'12
Artemisia tridentata vaseyana	1.7
Purshia tridentata	1.4

BASIC COVER--

Management unit 18A, Study no: 35

Cover Type	Average Cover %
	'12
Vegetation	47.84
Rock	20.29
Pavement	3.26
Litter	37.94
Cryptogams	.13
Bare Ground	16.38

SOIL ANALYSIS DATA --

Management unit 18A, Study no: 35, Magpie Canyon

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
-	6.7	28.4	40.1	31.5	2.6	10.4	157.0	1.0

PELLET GROUP DATA--

Management unit 18A, Study no: 35

Type	Quadrat Frequency	Days use per acre (ha)
	'12	'12
Elk	-	3 (7)
Deer	2	10 (25)
Cattle	-	1 (2)

BROWSE CHARACTERISTICS--

Management unit 18A, 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)
<i>Amelanchier utahensis</i>									
12	<b>80</b>	0	100	-	20	0	25	0	47/51
<i>Artemisia tridentata vaseyana</i>									
12	<b>560</b>	4	93	4	-	14	0	18	26/41
<i>Chrysothamnus nauseosus albicaulis</i>									
12	<b>0</b>	0	0	-	-	0	0	0	31/40
<i>Gutierrezia sarothrae</i>									
12	<b>480</b>	29	71	-	-	0	0	0	10/13
<i>Purshia tridentata</i>									
12	<b>1960</b>	1	92	7	-	29	4	4	26/47

SUMMARY  
WILDLIFE MANAGEMENT UNIT 18A - OQUIRRH-STANSBURY, NORTH

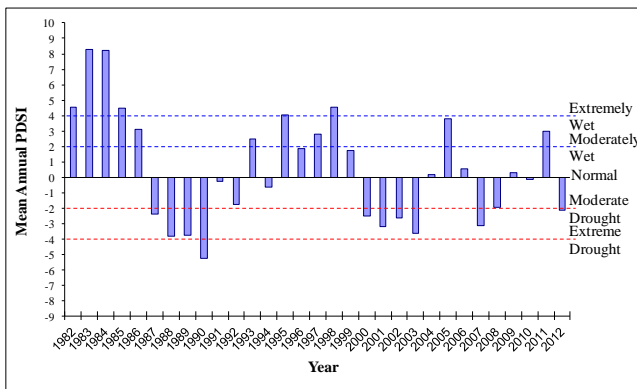
**Community Types**

Deer winter range within a unit is summarized into three categories based on ecological potentials which include **low potential**, **mid-level potential** and **high potential**. Low potential sites include desert shrub, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and cliffrose (*Cowania mexicana* ssp. *stansburiana*) communities. Mid-level potential sites include mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) communities. High potential sites include mountain brush communities. Low sagebrush (*A. arbuscula*), black sagebrush (*A. nova*), and basin big sagebrush (*A. tridentata* ssp. *tridentata*) communities are placed within the low potential or mid-level potential scales based on precipitation and elevation. Deer **summer range** is summarized separately from winter range as a fourth category and typically includes aspen (*Populus tremuloides*) and high elevation mountain brush communities. Ten interagency range trend studies were sampled in Unit 18A during the summer of 2012.

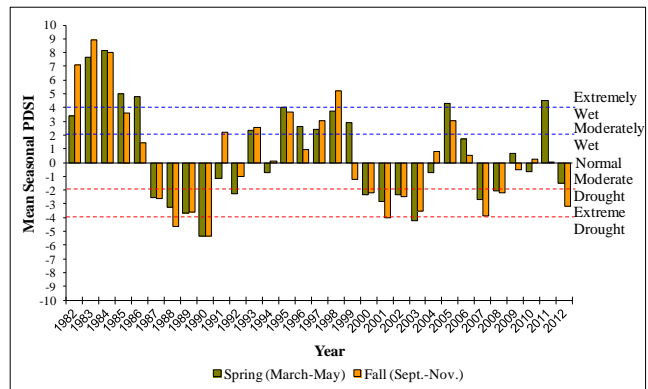
Five studies [Below Chokecherry Spring (18A-25), South of Broons Canyon (18A-27), East Hickman Canyon (18A-32), Carr Fork 2 (18A-34), and Magpie Canyon (18A-35)] are categorized as mid-level potential for deer winter range sites that sample mountain big sagebrush or bitterbrush communities. Five studies [South Palmer Point (18A-23), Salt Mountain Stock Pond (18A-24), Salt Mountain (18A-26), Deadman Canyon (18A-29), and Hatch Ranch (18A-30)] are categorized as low-level potential sites for deer winter range, and sample Wyoming big sagebrush or cliffrose communities.

**Precipitation**

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Precipitation and Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the North Central division (Division 3). The South Central division had a historic annual mean precipitation of 16.51 inches from 1895 to 2012. The mean annual PDSI of the North Central division displays a cycle of several wet years followed by several drought years over the course of study years (Figure 1 and Figure 2) (Time Series Data 2013).



**Figure 1.** The 31 year mean annual Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).



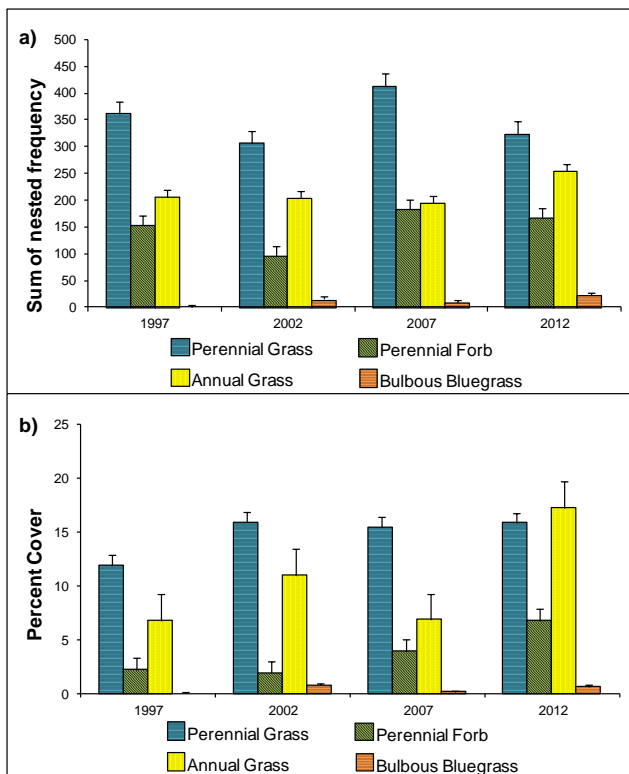
**Figure 2.** The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).

The 1961-1990 mean annual precipitation was 10-12 in. on the Hatch Ranch study; 12-14 in. on the Salt Mountain study; 14-16 in. on the South Palmer Point, Salt Mountain Stock Pond, Deadman Canyon, and East Hickman Canyon studies; 16-18 in. on the Below Chokeycherry Spring and South of Broons Canyon studies; and 18-20 in. on the Carr Fork 2 and Magpie Canyon studies (PRISM Climate Group 2011).

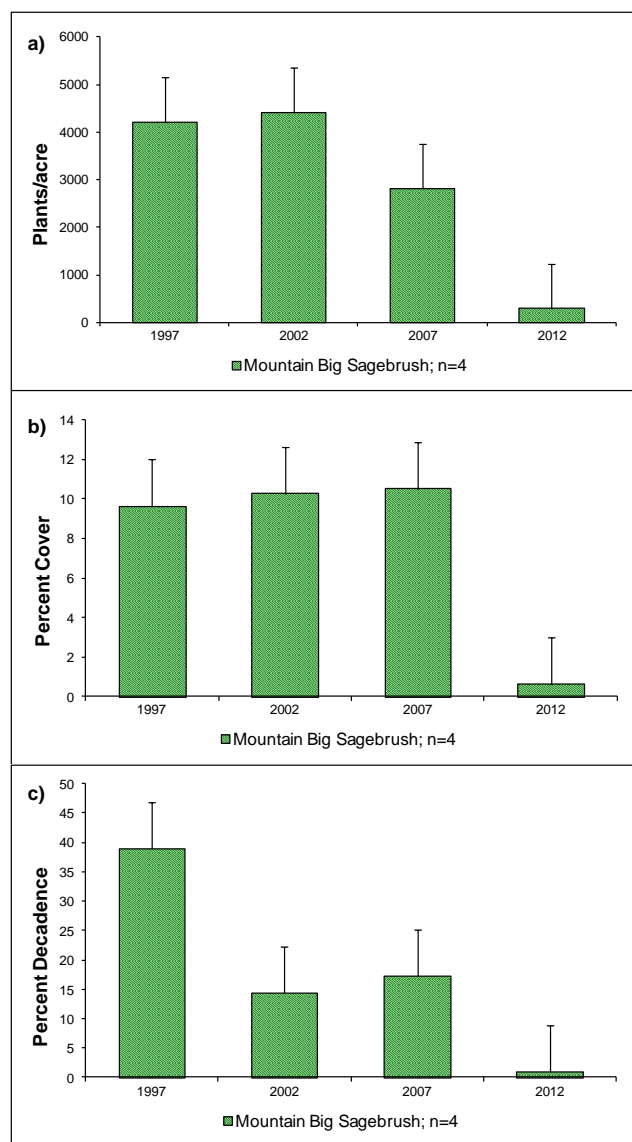
### Mid-Level Potential Deer Range

**Browse:** The mid-level potential site cumulative median browse trend initial increased from 1998 to 2002, but has since decreased in cumulative trend (Figure 7b). Mountain big sagebrush was a primary browse species on the Below Chokeycherry Spring and South of Broons Canyon studies, but was nearly eliminated from the studies by the Big Pole fire in 2009. The unit's mountain big sagebrush trend is driven by these two studies. Excluding the Carr Fork 2 study, mountain big sagebrush is found on the remaining studies, but is not prevalent. The mean density of mountain big sagebrush decreased slightly in 2002, but increased in mean cover. Mean density and cover decreased significantly in 2012 (Figure 4a and Figure 4b). A chaining and seeding treatment was done in 1999 on the East Hickman Canyon study to remove Utah juniper (*Juniperus osteosperma*) to improve the understory and increase sagebrush on the site, but sagebrush cover has remained low on the site.

**Herbaceous Understory:** The mid-level potential median cumulative grass trend has remained similar over the course of the sample years, but there was an increase in 2007 (Figure 7b). Annual grass species including cheatgrass (*Bromus tectorum*) are common



**Figure 3.** a) Mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass sum of nested frequency by year for WMU 18A, Oquirrh-Stansbury, North. b) Mid-level potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass cover by year for WMU 18A.



**Figure 4.** a) Mid-level potential sites mean density of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) by year for WMU 18A, Oquirrh-Stansbury, North. b) Mid-level potential sites mean cover of mountain big sagebrush by year for WMU 18A. c) Mid-level potential mean decadence of mountain big sagebrush by year for WMU 18A.

within the grass component on many of the sites. Mean sum of nested frequency and cover of annual grasses remained similar from 1997 to 2007, but increased significantly in 2012 (Figure 3a and Figure 3b). With the exception of the Carr Fork 2 study, the weedy perennial species bulbous bluegrass is not common on many of the mid-level potential study sites, but appears to be increasing within the unit. There was a significant increase in the mean nested frequency and cover of bulbous bluegrass in 2002 and 2012. The increase in 2012 is due to the addition of the Carr Fork 2 study (Figure 3a and Figure 3b). The mean sum of nested frequency of perennial grasses, excluding bulbous bluegrass, has varied significantly from sample year to sample year (Figure 3a); however, mean cover of perennial grass species increased significantly in 2002 and has since remained stable (Figure 3b).

The mid-level potential median cumulative forb trend has increased over the sample years, but did decrease in 2002 (Figure 7b). Perennial forb species are moderately common on most of the studies, but are rare on the East Hickman Canyon study. Weedy species are common on the Carr Fork 2 study. The mean sum of nested frequency of perennial forbs decreased significantly in 2002, but increased significantly in 2007 and remained near 1997 levels (Figure 3a). The mean cover of perennial forbs has steadily increased since 2002 (Figure 3b).

Occupancy: Pellet group transect data indicates that deer predominantly occupy these mid-level potential study areas, however, livestock was most prevalent in 2007. The mean abundance of deer pellet groups was moderate on most studies from 1998 to 2008, but was substantially lower in 2012. The decrease in pellet abundance is likely due to the mild winter of 2011-2012 which allowed animals to remain on higher elevation range. The mean abundance of elk and livestock sign has been generally low most sample years, but livestock abundance was high in 2007 (Figure 8a).

Deer Desirable Components Index (DCI): The mid-level potential deer DCI has remained poor each sample year. The poor score is primarily dictated by the low browse cover on these studies, as well as the high amount of annual grass cover (Table 1 and Figure 9).

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	12.5	6.9	4.4	15.5	-4.4	7.8	-1.5	<b>41.1</b>	Poor
02	13.4	6.4	3.6	17.8	-6.5	6.6	-1.5	<b>39.7</b>	Poor
07	14.7	4.8	0.5	21.3	-3.8	7.7	-1.0	<b>44.1</b>	Poor
12	11.4	5.2	0.8	24.0	-8.4	7.4	-1.6	<b>38.8</b>	Poor

**Table 1.** Mid-level potential scale mean deer DCI scores and rankings (n=5) by year for WMU 18A, Oquirrh-Stansbury, North. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

Discussion: Fire has had the most deleterious effects on mountain big sagebrush density and cover, especially on the Below Chokecherry Spring and South of Broons Canyon studies. The weedy species bulbous bluegrass is not a particular concern on these mid-level potential sites, but does have the potential to become a problem in the future. However, bulbous bluegrass is prevalent on the Carr Fork 2 study and has formed dense mats of cover that may compete with other more desirable species on the study, especially antelope bitterbrush. Annual grasses, especially cheatgrass, are common on most study sites and can pose an increased threat to winter range by increasing fuel loads and increasing the chance of a catastrophic fire event.

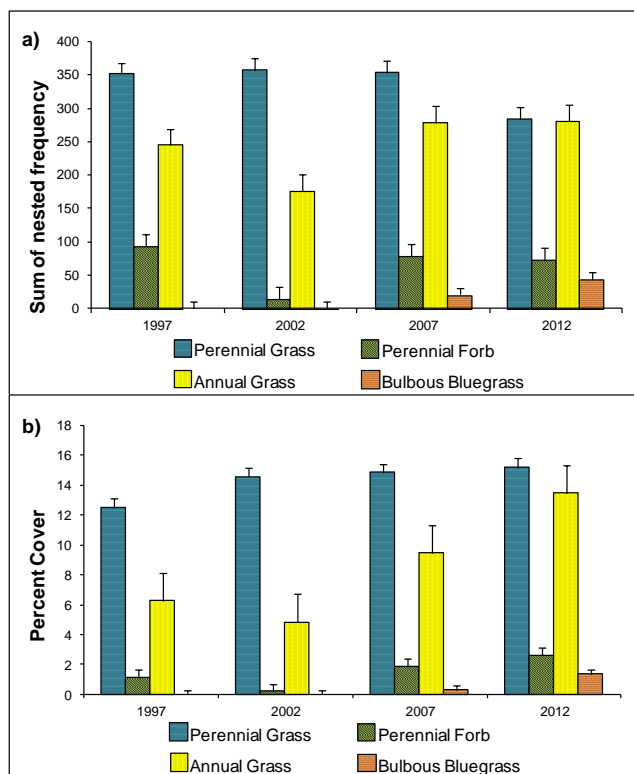
### Low Potential Deer Range

Browse: The low potential site cumulative median browse trend has varied over the duration of the study. There was a decrease in trend in 1989, an increase in 2002, but a decrease again in 2012 (Figure 7c). Wyoming big sagebrush was a primary browse species for all of the low-potential studies, but the Big Pole fire in 2009 eliminated Wyoming big sagebrush from the South Palmer Point, Salt Mountain Stock Pond, and Salt Mountain studies. The mean density of Wyoming big sagebrush steadily increased from 1997 to 2007, but

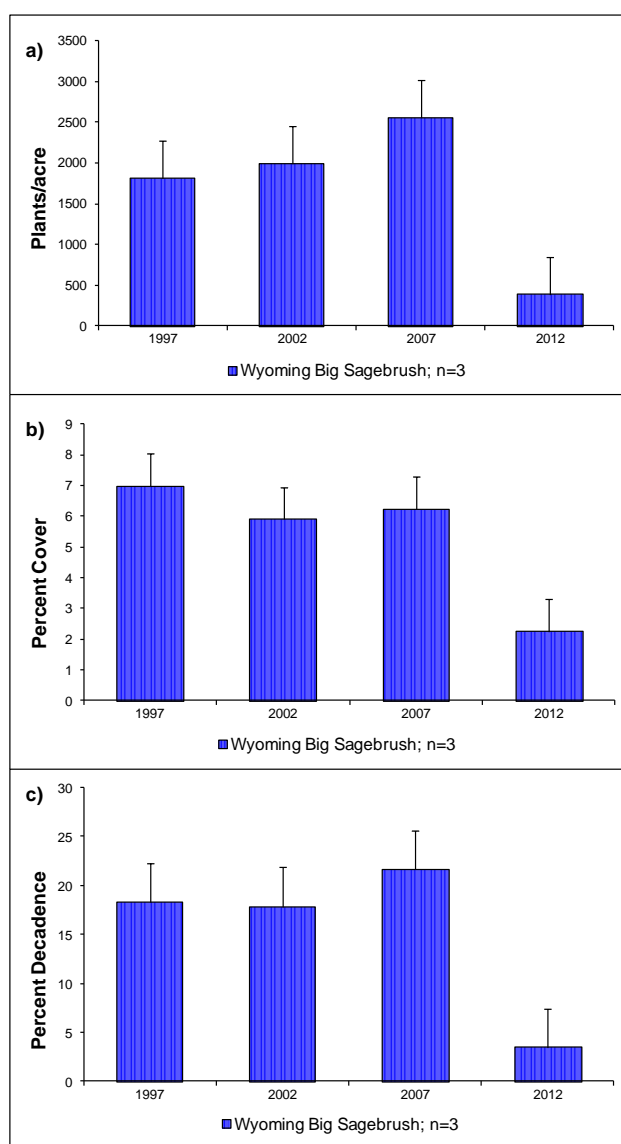
decreased significantly in 2012 (Figure 6a). The mean cover of Wyoming big sagebrush also decreased significantly in 2012 (Figure 6b). Decadence of Wyoming big sagebrush remained similar from 1997 to 2007, but decreased significantly in 2012, which is due to the unit's loss of sagebrush in the Big Pole fire (Figure 6c).

Stansbury cliffrose is common on the Deadman Canyon and Hatch Ranch studies, and has experienced some slight decreases in mean density and cover. For more information on this species refer to the discussion section for these studies.

**Herbaceous Understory:** The low potential median cumulative grass trend initially increased in 1989, and has remained stable over the course of the sample years (Figure 7c). Annual grass species including cheatgrass (*Bromus tectorum*) are common on the nearly all of the low-potential sites, but dominates the grass component on the Salt Mountain study. Mean sum of nested frequency of annual grasses decreased significantly in 2002, but increased significantly in 2007 and has remained near 1997 levels (Figure 5a). Additionally, the mean cover of annual grasses has increased significantly each sample year since 2002 (Figure 5b). The weedy perennial species bulbous bluegrass is also present in low abundance on a few of the low-level potential study sites, but appears to be increasing throughout the area. There was a significant increase in the mean nested frequency and cover of bulbous bluegrass in 2012 (Figure 5a and Figure 5b). The mean sum of nested frequency of perennial grasses, excluding bulbous bluegrass, has remained relatively stable most sample years, but mean sum of nested frequency



**Figure 5.** a) Low potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass sum of nested frequency by year for WMU 18A, Oquirrh-Stansbury, North. b) Low potential sites mean perennial grass (-POBU), perennial forb, annual grass, and bulbous bluegrass cover by year for WMU 18A.



**Figure 6.** a) Low potential sites mean density of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) by year for WMU 18A, Oquirrh-Stansbury, North. b) Low potential sites mean cover of Wyoming big sagebrush by year for WMU 18A. c) Low potential sites mean decadence of Wyoming big sagebrush and by year for WMU 18A.

decreased significantly in 2012 (Figure 5a). However, the mean cover of perennial grass species increased significantly in 2002 and has since remained similarly high (Figure 5b).

The low potential median cumulative forb trend decreased in 2002 and has remained lower in subsequent sample years (Figure 7c). Perennial forb species are rare on most of the studies. The mean sum of nested frequency of perennial forb species decreased significantly in 2002, but increased significantly in 2007, returning to 1997 levels (Figure 5a). The mean sum of perennial forb cover decreased significantly in 2002, but increased significantly in 2007 (Figure 5b)

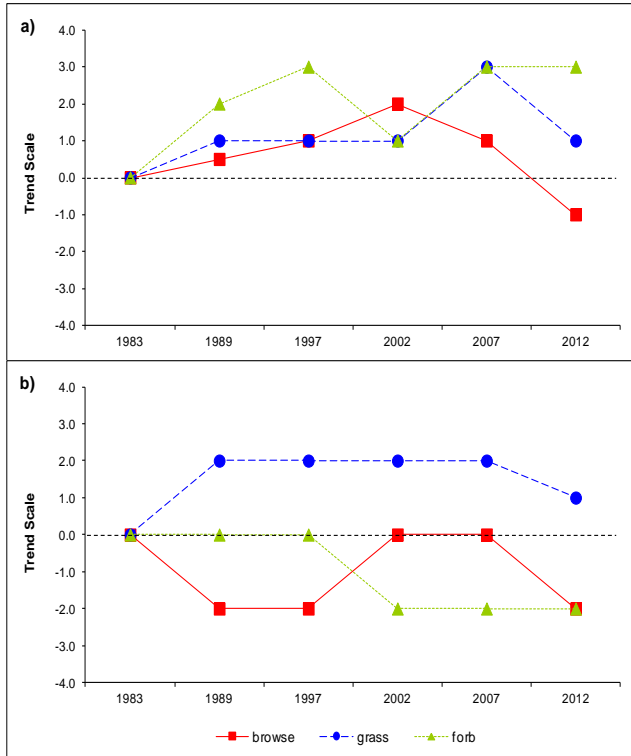
Occupancy: Pellet group transect data indicates that deer predominantly occupy these low potential study areas. The mean abundance of deer pellet groups was high in 2002, but was substantially lower in 2007 and 2012. The decrease in pellet abundance in 2012 is likely due to the mild winter of 2011-2012 which allowed animals to remain on higher elevation range. The mean abundance of elk and livestock sign has been very low since 2002 (Figure 8b).

Deer Desirable Components Index (DCI): The low potential deer DCI has steadily decreased from good to fair throughout the sample years. There has been a decrease in the preferred browse cover and young scores and an increase in the annual grass score (Table 2 and Figure 9).

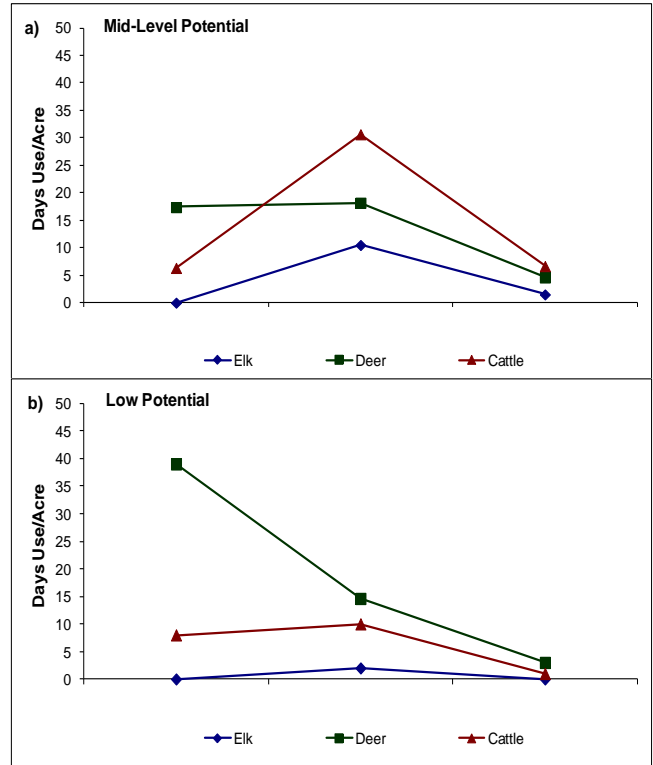
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	13.9	9.9	11.7	22.3	-4.7	2.2	0.0	<b>55.3</b>	Good
02	11.9	8.0	7.1	23.5	-3.6	0.4	0.0	<b>47.3</b>	Good
07	11.6	8.4	5.6	23.7	-7.1	3.7	0.0	<b>45.9</b>	Fair-Good
12	5.9	4.5	2.2	21.0	-10.1	4.1	-0.4	<b>27.3</b>	Fair

**Table 2.** Low potential scale mean deer DCI scores and rankings (n=5) by year for WMU 18A, Oquirrh-Stansbury, North. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

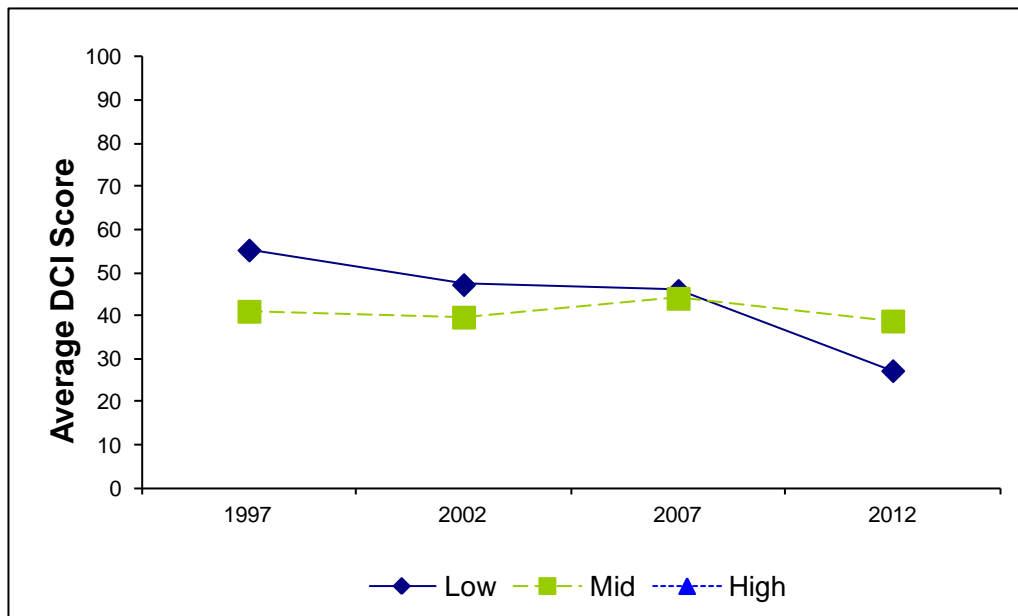
Discussion: Fire has had the most deleterious effects on Wyoming big sagebrush density and cover, especially on the South Palmer Point, Salt Mountain Stock Pond, and Salt Mountain studies. The abundance of weedy annual species and the increases of bulbous bluegrass is a particular concern on these low potential sites. These weedy species can form dense mats of cover that compete with other more desirable herbaceous species, and with seedlings and young shrubs which limits establishment of new plants into the population. Annual grass species can also increase fuel loads and increase the chance of a catastrophic fire event.



**Figure 7.** a) Deer mid-level potential sites cumulative median browse, grass, and forb trends by year for WMU 18A, Oquirrh-Stansbury, North. b) Low potential sites cumulative median browse, grass, and forb trends by year for WMU 18A.



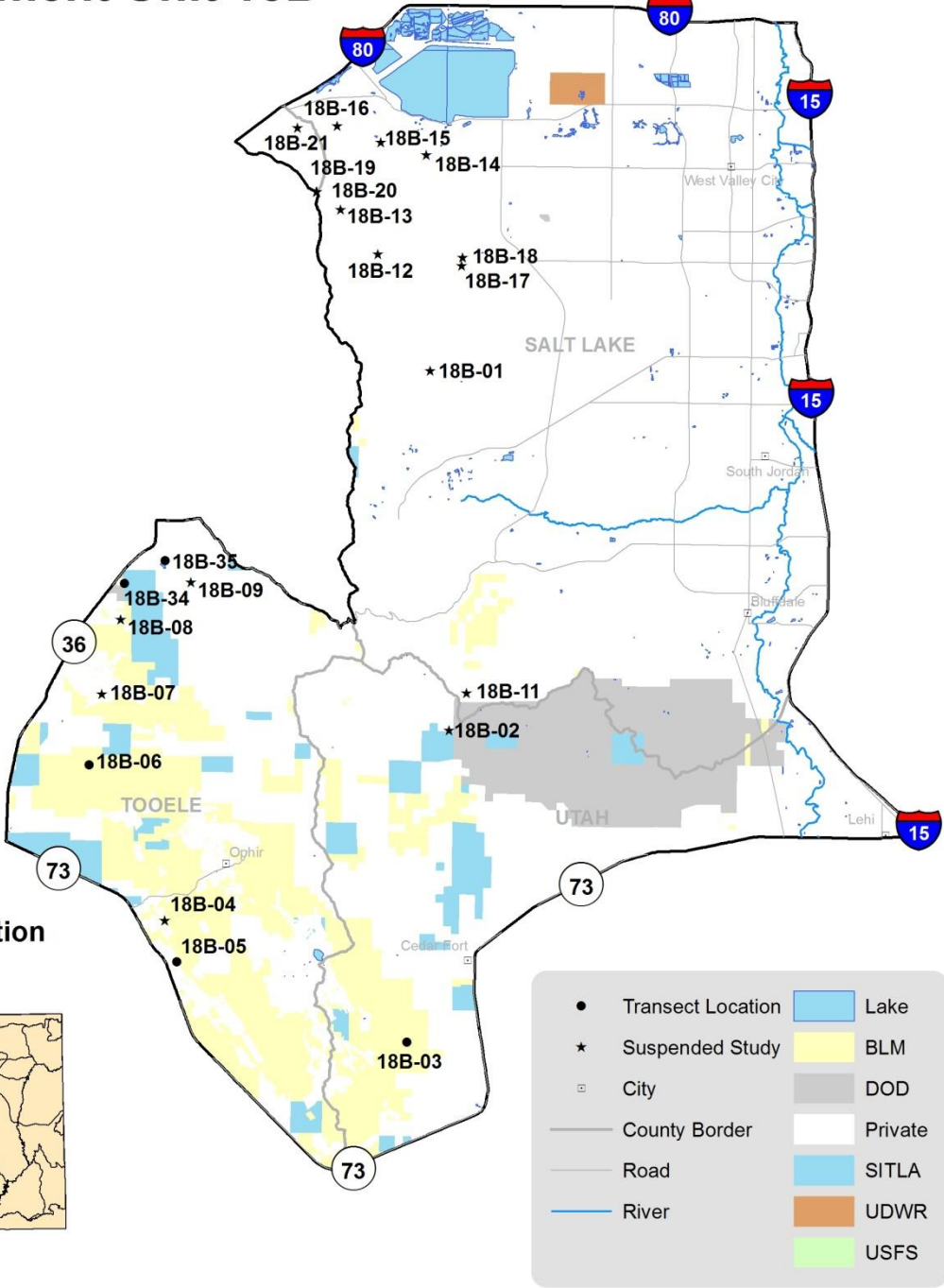
**Figure 8.** a) Deer mid-level potential sites mean animal days use/acre (n=5) by year for WMU 18A, Oquirrh-Stansbury, North. b) Low potential sites mean animal days use/acre (n=5) by year for WMU 18A.



**Figure 9.** Mean mid-level (n=5) and low (n=5) potential scale deer DCI scores by year for WMU 18A, Oquirrh-Stansbury, North. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.



# Management Unit 18B



Unit Location



## MANAGEMENT SUBUNIT 18B - OQUIRRH-STANSBURY, SOUTH

### Subunit Boundary Description

**Salt Lake, Utah, and Tooele counties** - Boundary begins at the junction of I-15 and I-80 in Salt Lake City; south on I-15 to SR-73; west on SR-73 to SR-36; north on SR-36 to Middle Canyon Road; east on Middle Canyon Road to the Tooele-Salt Lake County boundary; north along the Tooele-Salt Lake County boundary (Oquirrh Mountains ridge line) to Lake Point and I-80; east on I-80 to I-15 and beginning point.

### Range Trend Studies

Five interagency range trend studies were sampled in Subunit 18B during the summer of 2012. A total of twenty-two studies have been established within Subunit 18B since 1983. Eleven studies were established in 1983: Barney Canyon (18B-1), City Canyon (18B-2), Manning Canyon (18B-3), Silverado Canyon (18B-4), Big Dip Gulch (18B-5), South of Soldier Canyon (18B-6), Calumet Mine (18B-7), Silcox Canyon (18B-8), Left Fork Settlement Canyon (18B-9), Rose Canyon (18B-11), and Coon Canyon (18B-12); nine studies were established in 1990: Kessler Peak (18B-13), Little Valley (18B-14), Upper Kessler (18B-15), Smelter (18B-16), Deadman (18B-17), Hogback (18B-18), Black Rock West (18B-19), Black Rock East (18B-20), and Black Rock Canyon (18B-21); two studies were established in 2002: Three O'clock (18R-34) and Settlement Canyon Reservoir (18R-35).

In 1989, two studies (Barney Canyon and City Canyon) were suspended. In 1997, six studies (Silcox Canyon, Coon Canyon, Kessler Peak, Smelter, Deadman, and Hogback) were suspended. In 2002, six studies (Silverado Canyon, Calumet Mine, Left Fork Settlement Canyon, Little Valley, Black Rock West, and Black Rock Canyon) were suspended. In 2012, two studies (Upper Kessler and Black Rock East) were suspended. These studies were suspended for various reasons and if the need arises in the future these studies can be sampled again. To access maps, discussions, and data tables for suspended studies see: <http://www.wildlife.utah.gov/range>.

MANNING CANYON - TREND STUDY NO. 18B-3-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter/Spring, Substantial Elk Year-long

NRCS Ecological Site Description: Upland Shallow Hardpan (Mountain Big Sagebrush), R028AY322UT

Land Ownership: BLM

Elevation: 5,500 ft. (1,676 m)

Aspect: Southeast

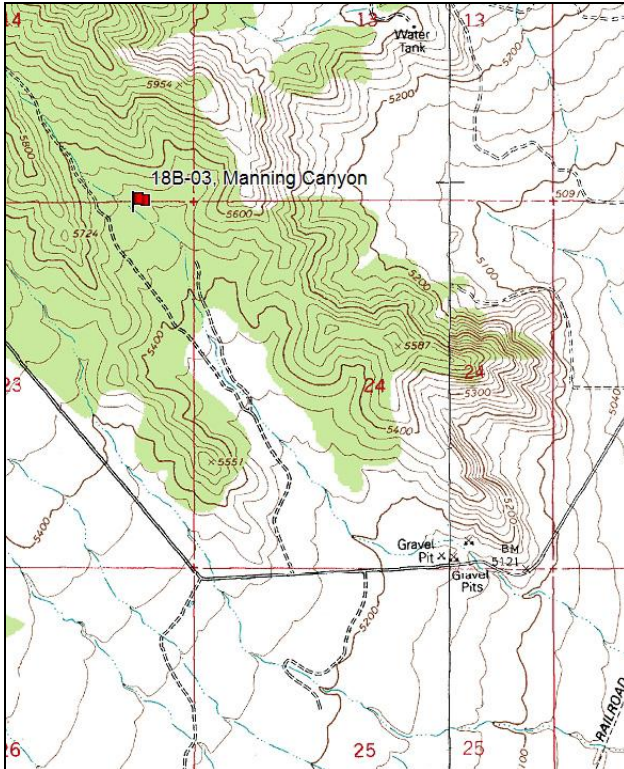
Slope: 7%

Transect bearing: 187° magnetic (Line 1), 113° magnetic (Line 2-4)

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

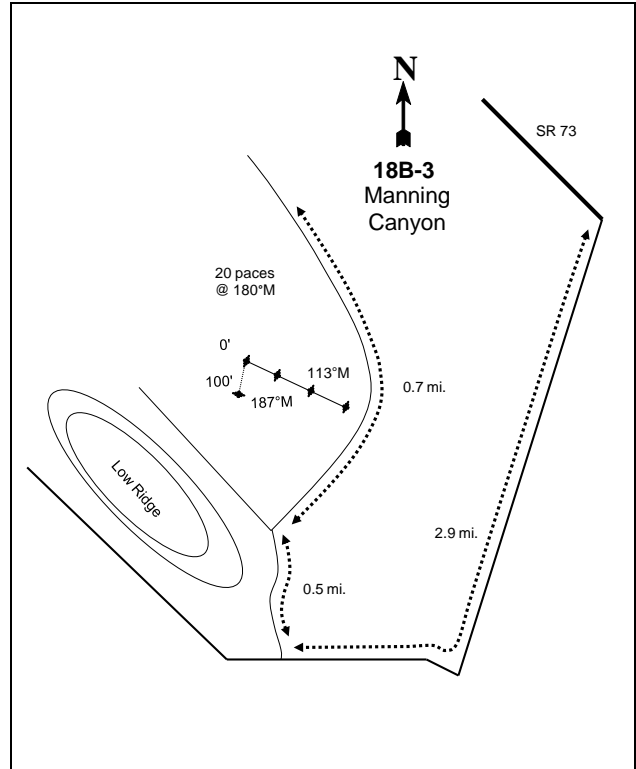
Directions: From the junction of SR-73 and Manning Canyon Road, between Cedar Fort and Fairfield, travel west on the Manning Canyon Road for 2.9 miles. Turn north (right) on a dirt road and travel 0.5 miles to a fork. Take the right fork (east) and travel an additional 0.7 miles. The 0-foot stake is 26 paces at 180°M and marked with a red browse tag number 3985.

Map Name: Mercur



Township: 6S Range: 3W Section: 14

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 402894 E 4460615 N

## MANNING CANYON - TREND STUDY NO. 18B-3

### Site Information

Site Description: This study is within crucial winter range at the extreme south end of the Oquirrh Mountains in a small valley surrounded with Utah juniper (*Juniperus osteosperma*) covered hills. The range type is a pinyon-juniper and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community on land administered by the Bureau of Land Management (BLM) within the Pole Canyon grazing allotment. Juniper trees on and around the study provide excellent thermal cover. Deer pellet groups were sampled in moderate abundance in 2002, but in low abundance in 2007 and 2012. Elk pellet groups were sampled in low abundance in 2002 and 2007. Rabbit pellets were extremely abundant in 2002 and 2007 (Table - Pellet Group Data). Domestic sheep and cattle sign has also been noted in past sample years.

Browse: The dominant preferred browse species mountain big sagebrush; however, there appears to be some hybridization occurring between mountain big sagebrush, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). All sagebrush was classified as mountain big sagebrush due to the difficulty of separating species. Some plants have the more upright growth forms characteristic of basin big sagebrush. Sagebrush is a moderately dense, mature population that has generally decreased in density since 1997. Sagebrush decadence has been high most sample years, and was at its highest in 1990. Poor vigor within the sagebrush population has generally been high throughout the duration of the study. Recruitment of young sagebrush has been minimal for each sampled year. The sagebrush defoliator moth (*Aroga websteri*) infested a moderate portion to the sagebrush population in 2007. Dead plants have been abundant since 1997. Utilization of sagebrush has been mostly light to moderate, though use was mostly heavy in 1983. Other browse species found on the site include green ephedra (*Ephedra viridis*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), pricklypear cactus (*Opuntia* sp.), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*), and black sagebrush (*Artemisia nova*). Cliffrose has not been sampled in density strips since 1990 (Table - Browse Characteristics). Utah juniper and singleleaf pinyon (*Pinus monophylla*) trees are scattered across the site in moderate density (Table - Point-Quarter Data). Most of the juniper trees are large and mature, while the singleleaf pinyon trees are a mixture of young and mature plants. The woodland succession stage is considered to be between Phase I and II (Tausch et al. 2009).

Herbaceous Understory: The herbaceous understory is dominated by bluebunch wheatgrass (*Agropyron spicatum*) and cheatgrass (*Bromus tectorum*). Indian ricegrass (*Oryzopsis hymenoides*) and needle-and-thread grass (*Stipa comata*) is also present, but in low abundance. The perennial grasses are unevenly distributed and tend to be in large clumps. The majority of forb cover is provided by annual species. Pale alyssum (*Alyssum alyssoides*) is the dominant forb and provides the most cover out of all the forbs (Table - Herbaceous Trends).

Soil: The soil is part of the Amtoft component, which is found on hills and ridges. The parent material consists of colluvium derived from sedimentary rock and/or residuum weathered from sedimentary rock (Soil Survey Staff 2011). The soil texture is a clay loam texture with a moderately alkaline soil reaction (pH 7.9) (Table - Soil Analysis Data). Ground cover is moderate with a moderate amount of cryptogams, and a high amount of vegetation and litter providing protective ground cover (Table - Basic Cover). Some sedimentation has been apparent and a number of small drainage channels traverse the area. The area is subject to flood damage from high intensity storms and runoff from higher up the slope. However, the soil erosion condition has been classified as stable since 2002.

### Trend Assessments

Browse:

- **1983 to 1990 - slightly down (-1):** The density of mountain big sagebrush decreased 10% from 1,598 plants/acre to 1,432 plants/acre. Decadence and poor vigor of sagebrush increased from 25% to 88%

and 21% to 28%, respectively. Recruitment of young sagebrush to the population decreased from 8% to 2%.

- **1990 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1997; therefore, trend was determined using other parameters. The health of the mountain big sagebrush population improved with decadence decreasing to 31%, and poor vigor decreasing to 12%. Recruitment of young sagebrush to the population remained minimal at 2%.
- **1997 to 2002 - stable (0):** The density of mountain big sagebrush decreased slightly from 2,160 plants/acre to 2,040 plants/acre, but cover remained similar at 8%. Decadence of sagebrush increased to 26%, and poor vigor increased to 25%. Recruitment of young sagebrush to the population remained poor at 3%.
- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 29% to 1,440 plants/acre, and cover decreased to 6%. Decadence of sagebrush increased to 51%, and poor vigor increased to 40%. The defoliator moth infested 20% of the sagebrush population. Recruitment of young sagebrush to the population was nominal at 1%.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush did not change at 1,440 plants/acre, but cover increased to 9%. Decadence of sagebrush decreased to 21%, and poor vigor decreased to 25%. Recruitment of young sagebrush to the population increased slightly to 8%.

Grass:

- **1983 to 1990 - stable (0):** The sum of nested frequencies of perennial grasses remained similar.
- **1990 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial grasses increased 11%. The invasive annual grass cheatgrass was included in the sample for the first time, and was the most common grass on the study.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial grasses remained similar, but cover decreased from 15% to 12%. The weedy species bulbous bluegrass (*Poa bulbosa*) was observed for the first time, but was not common. The invasive annual grass cheatgrass decreased in cover from 7% to 5%.
- **2002 to 2007 - slightly down (-1):** The sum of nested frequencies of perennial remained similar, and cover remained similar at 11%. The weedy species bulbous bluegrass was not observed. Cheatgrass increased significantly in nested frequency, and increased in cover to 9%.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequencies of perennial remained similar, but cover increased to 15%. Cheatgrass decreased significantly in nested frequency, but cover remained similar at 8%.

Forb:

- **1983 to 1990 - stable (0):** Perennial forb species are rare on the site.
- **1990 to 1997 - stable (0):** Perennial forb species are rare on the site.
- **1997 to 2002 - stable (0):** Perennial forb species are rare on the site.
- **2002 to 2007 - stable (0):** Perennial forb species are rare on the site.
- **2007 to 2012 - stable (0):** Perennial forb species are rare on the site.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --  
Management unit 18B, study no: 3

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	10.7	6.6	0.9	30.0	-5.0	3.5	0.0	<b>46.7</b>	Poor
02	11.1	1.1	1.3	23.5	-3.7	2.1	0.0	<b>35.4</b>	Very Poor-Poor
07	8.3	2.3	5.4	21.5	-6.8	0.8	0.0	<b>31.6</b>	Very Poor
12	12.4	9.5	8.7	29.5	-5.7	1.7	0.0	<b>56.2</b>	Fair

## Trend Summary

HERBACEOUS TRENDS--  
Management unit 18B, Study no: 3

Type	Species	Nested Frequency						Average Cover %			
		'83	'90	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron smithii	-	-	-	6	-	-	-	.03	-	-
G	Agropyron spicatum	a110	ab133	b162	ab151	ab160	ab133	9.96	6.05	8.17	8.51
G	Bromus japonicus (a)	-	-	-	2	-	-	-	.00	-	-
G	Bromus tectorum (a)	-	-	b282	ab251	c310	a224	6.69	4.89	9.03	7.56
G	Oryzopsis hymenoides	c77	bc64	ab41	ab45	a14	a17	1.82	1.13	.43	.54
G	Poa bulbosa	-	-	-	2	-	-	-	.03	-	-
G	Poa secunda	a1	ab15	b39	c75	c78	d114	.28	.80	.79	1.79
G	Sitanion hystrix	d89	c55	bc33	a3	ab10	a4	.53	.15	.40	.06
G	Stipa comata	a11	ab29	bc54	c64	bc56	c62	2.65	3.56	.97	3.81
G	Vulpia octoflora (a)	-	-	-	-	7	-	-	-	.01	-
Total for Annual Grasses		0	0	282	253	317	224	6.69	4.89	9.05	7.56
Total for Perennial Grasses		288	296	329	346	318	330	15.26	11.77	10.76	14.73
Total for Grasses		288	296	611	599	635	554	21.96	16.67	19.81	22.29
F	Agoseris glauca	-	-	-	4	-	-	-	.01	-	-
F	Alyssum alyssoides (a)	-	-	b315	a244	b300	a229	3.25	1.31	2.53	1.04
F	Arabis sp.	-	-	-	-	5	-	-	-	.01	-
F	Astragalus calycosus	a-	a-	a-	a-	b10	ab2	-	-	.05	.03
F	Astragalus eurekensis	-	-	-	-	2	-	-	-	.00	-
F	Astragalus sp.	6	-	1	-	-	-	.03	-	-	-
F	Calochortus nuttallii	b17	a-	b15	b10	a-	a-	.04	.03	-	-
F	Camelina microcarpa (a)	-	-	a-	a-	a-	b33	-	-	-	.16
F	Castilleja linariaefolia	-	-	7	2	4	-	.06	.03	.03	-
F	Castilleja sp.	-	-	4	-	-	-	.01	-	-	-
F	Cirsium sp.	-	-	1	-	-	-	.00	-	-	-
F	Descurainia pinnata (a)	-	-	3	-	3	-	.03	-	.03	-
F	Draba sp. (a)	-	-	a-	a-	b24	a-	-	-	.08	-
F	Eriogonum brevicaulis	-	-	-	-	-	9	-	-	-	.07
F	Eriogonum ovalifolium	-	-	4	10	3	-	.01	.01	.00	-
F	Erodium cicutarium (a)	-	-	a3	a9	b39	a-	.00	.01	1.41	-
F	Gilia sp. (a)	-	-	3	4	-	-	.00	.01	-	-
F	Holosteum umbellatum (a)	-	-	a-	a-	b21	a6	-	-	.03	.01
F	Lactuca serriola (a)	-	-	-	-	3	-	.00	-	.00	-
F	Lathyrus brachycalyx	3	2	7	7	1	9	.21	.31	.03	.06
F	Petradoria pumila	23	37	22	25	18	20	.94	.54	.16	.58
F	Phlox hoodii	-	-	4	-	3	3	.00	-	.00	.01
F	Phlox longifolia	2	-	-	3	3	-	-	.00	.00	-
F	Ranunculus testiculatus (a)	-	-	a3	a26	b106	a15	.00	.08	.46	.03
F	Sisymbrium altissimum (a)	-	-	-	-	2	-	-	-	.15	-
F	Sphaeralcea coccinea	20	21	24	9	18	12	.28	.06	.07	.11
F	Streptanthus cordatus	9	-	6	4	2	-	.16	.03	.03	-
Total for Annual Forbs		0	0	327	283	498	283	3.31	1.42	4.71	1.24

Type	Species	Nested Frequency					Average Cover %				
		'83	'90	'97	'02	'07	'12	'97	'02	'07	'12
	Total for Perennial Forbs	80	60	95	74	69	55	1.76	1.03	0.41	0.86
	Total for Forbs	80	60	422	357	567	338	5.07	2.46	5.13	2.11

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

#### BROWSE TRENDS--

Management unit 18B, Study no: 3

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Artemisia tridentata vaseyana</i>	61	62	52	45	7.70	7.89	5.53	8.61
B	<i>Chrysothamnus viscidiflorus stenophyllus</i>	0	0	7	6	-	-	.00	.21
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	11	13	2	2	.48	.09	.18	.03
B	<i>Ephedra viridis</i>	1	2	2	4	.85	.98	1.14	1.34
B	<i>Gutierrezia sarothrae</i>	7	11	3	4	.19	.03	.16	.18
B	<i>Juniperus osteosperma</i>	1	1	1	1	3.34	3.65	3.80	5.85
B	<i>Opuntia sp.</i>	2	6	5	3	-	-	.03	-
B	<i>Pinus monophylla</i>	0	0	0	0	-	.63	.15	.63
	Total for Browse	83	95	72	65	12.57	13.28	11.02	16.87

#### CANOPY COVER, LINE INTERCEPT--

Management unit 18B, Study no: 3

Species	Percent Cover	
	'07	'12
<i>Artemisia tridentata vaseyana</i>	8.21	7.73
<i>Chrysothamnus viscidiflorus stenophyllus</i>	-	.06
<i>Ephedra viridis</i>	1.76	3.34
<i>Gutierrezia sarothrae</i>	.16	.16
<i>Juniperus osteosperma</i>	6.06	9.81
<i>Opuntia sp.</i>	.06	.06
<i>Pinus monophylla</i>	-	.48

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18B, Study no: 3

Species	Average leader growth (in)		
	'02	'07	'12
<i>Artemisia tridentata vaseyana</i>	2.3	1.1	1.3

POINT-QUARTER TREE DATA--  
Management unit 18B, Study no: 3

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	37	31	34	10.1	9.2	8.6
Pinus monophylla	13	22	22	3.2	4.5	4.6

BASIC COVER--  
Management unit 18B, Study no: 3

Cover Type	Average Cover %					
	'83	'90	'97	'02	'07	'12
Vegetation	1.50	5.25	38.40	36.87	36.42	42.55
Rock	5.25	7.25	6.62	9.95	7.54	8.17
Pavement	4.25	25.75	13.51	7.94	8.03	8.36
Litter	59.25	41.00	39.88	35.18	33.36	41.68
Cryptogams	4.00	4.75	4.61	21.70	20.32	13.51
Bare Ground	25.75	16.00	8.93	7.19	11.62	12.19

SOIL ANALYSIS DATA --

Management unit 18B, Study no: 3, Manning Canyon

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
14.3	7.9	40.3	33.2	26.6	2.6	7.7	124.8	0.5

PELLET GROUP DATA--  
Management unit 18B, Study no: 3

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	10	45	91	39	-	-	-
Elk	2	-	8	-	1 (2)	1 (3)	-
Deer	52	21	18	4	31 (78)	18 (45)	7 (17)
Cattle	-	-	1	-	-	-	-



BROWSE CHARACTERISTICS--  
Management unit 18B, Study no: 3

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia nova</i>									
83	0	0	0	-	-	0	0	0	-/-
90	33	0	100	-	-	100	0	0	8/10
97	0	0	0	-	-	0	0	0	12/15
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	14/18
<i>Artemisia tridentata vaseyana</i>									
83	1598	8	67	25	-	2	92	21	13/18
90	1432	2	9	88	-	56	2	28	14/16
97	2160	2	67	31	-	17	5	12	31/43
02	2040	3	51	46	20	31	6	25	21/31
07	1440	1	47	51	-	35	11	40	29/40
12	1440	8	71	21	20	15	4	25	26/37
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
83	0	0	0	0	-	0	0	0	-/-
90	0	0	0	0	-	0	0	0	-/-
97	0	0	0	0	-	0	0	0	-/-
02	0	0	0	0	-	0	0	0	-/-
07	160	13	50	38	-	13	50	25	8/10
12	120	0	100	0	-	0	17	0	9/13
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
83	365	45	55	0	-	0	0	0	12/16
90	66	0	50	50	-	50	0	50	5/4
97	340	6	88	6	20	0	6	6	11/12
02	320	0	56	44	-	31	0	19	8/11
07	80	0	100	0	-	50	50	0	10/20
12	40	0	100	0	-	0	0	0	20/34
<i>Cowania mexicana stansburiana</i>									
83	66	50	50	-	-	50	50	0	33/28
90	99	67	33	-	33	0	100	0	35/26
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	91/100
12	0	0	0	-	-	0	0	0	-/-

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization			Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy	% poor vigor	
<i>Ephedra viridis</i>									
83	<b>199</b>	0	100	0	-	100	0	17	39/39
90	<b>232</b>	14	28	57	-	0	0	14	40/39
97	<b>20</b>	0	100	0	-	0	0	0	41/53
02	<b>40</b>	0	50	50	-	0	50	0	46/66
07	<b>40</b>	50	50	0	-	0	0	0	49/67
12	<b>180</b>	78	22	0	-	0	0	0	49/72
<i>Gutierrezia sarothrae</i>									
83	<b>432</b>	38	54	8	-	0	0	0	9/7
90	<b>1031</b>	19	71	10	-	0	0	3	5/6
97	<b>160</b>	13	88	0	-	0	0	0	10/10
02	<b>380</b>	11	53	37	-	0	0	26	5/7
07	<b>80</b>	50	25	25	-	0	0	25	6/6
12	<b>100</b>	0	100	0	60	0	0	0	8/9
<i>Juniperus osteosperma</i>									
83	<b>66</b>	100	0	-	-	0	0	0	-/-
90	<b>66</b>	50	50	-	-	0	0	0	91/69
97	<b>20</b>	0	100	-	-	0	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	-/-
07	<b>20</b>	0	100	-	20	0	0	0	-/-
12	<b>20</b>	0	100	-	-	0	0	0	78/67
<i>Opuntia sp.</i>									
83	<b>66</b>	0	100	0	-	0	0	0	7/5
90	<b>166</b>	20	80	0	33	0	0	0	6/7
97	<b>80</b>	0	100	0	-	0	0	0	8/14
02	<b>120</b>	0	100	0	-	0	0	0	5/13
07	<b>120</b>	0	100	0	-	17	0	0	6/15
12	<b>100</b>	0	80	20	-	0	0	20	5/12
<i>Purshia tridentata</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
90	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	-	0	0	0	76/96

**BIG DIP GULCH - TREND STUDY NO. 18B-5-12**

Vegetation Type: Black Sagebrush

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

NRCS Ecological Site Description: Upland Shallow Loam (Black Sagebrush), R028AY318UT

Land Ownership: BLM

Elevation: 5,700 ft. (1,737 m)

Aspect: West

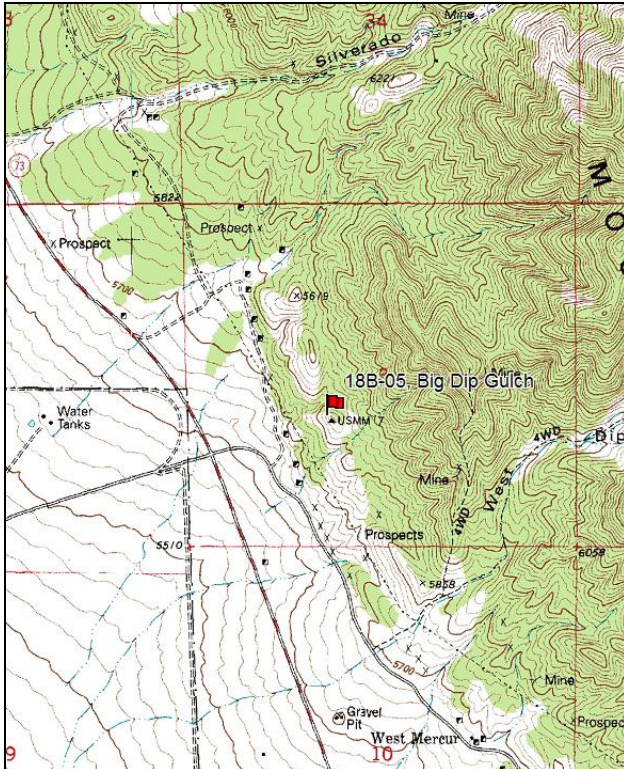
Slope: 12-25%

Transect bearing: 144° magnetic (Lines 1-2), 150° magnetic (Lines 3), 211° magnetic (Lines 4)

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

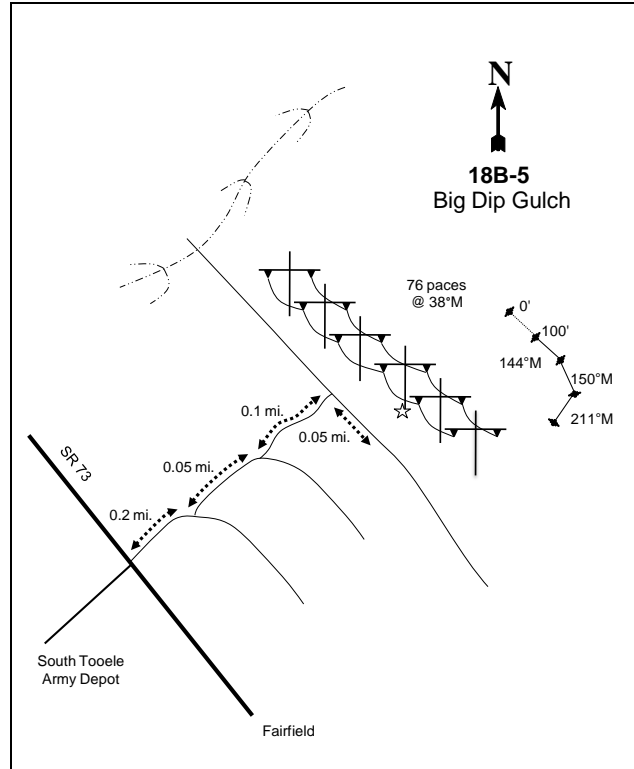
Directions: From the junction of SR-73 and east entrance of the South Army Depot, turn east on the dirt road directly across from the depot entrance towards West Dip Gulch and travel 0.2 miles to an intersection. Turn left and travel 0.05 miles to another intersection. Turn left again and travel 0.1 miles to another intersection. Turn right and proceed 0.05 miles along a power line until you come to two power poles. The 0-foot stake is marked by a green steel fencepost 15 inches in height and is marked with a red browse tag number 3969.

Map Name: Ophir



Township: 6S Range: 4W Section: 3

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 391082 E 4464749 N

## BIG DIP GULCH - TREND STUDY NO. 18B-5

### Site Information

Site Description: This study is located on a hillside between Silverado Canyon and West Dip Gulch. The study is on private land, but is found on the Murcur Canyon grazing allotment managed by the Bureau of Land Management (BLM). The sample vegetation is dominated by black sagebrush (*Artemisia nova*) with a limited understory, which transitions to Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) downslope. This crucial deer winter range was historically used by domestic sheep. Deer pellet groups were sampled in high abundance in 2002 and 2007, but more moderate abundance in 2012 (Table - Pellet Group Data).

Browse: The preferred browse species is black sagebrush which occurs in a dense, mature population that has gradually decreased in density over the course of the study. Black sagebrush decadence has fluctuated through the sample years. Decadence was at its lowest in 1997 and at its highest in 1989. Poor vigor has been low most sample years, but poor vigor was at its highest in 2007. Recruitment of young sagebrush to the population has steadily decreased over the course of the study. Utilization of black sagebrush has been mostly light to moderate, but heavy use was displayed in 1983 and 2012. Other browse species occurring rarely on the study include broom snakeweed (*Gutierrezia sarothrae*), narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*), littleleaf horsebrush (*Tetradymia glabra*), and a few widely scattered Utah juniper (*Juniperus osteosperma*) and Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) (Table - Browse Characteristics).

Herbaceous Understory: Grasses and forbs occur infrequently and account for minimal forage production. Bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*) are the dominant understory species. The invasive annual grass species cheatgrass has provided minimal cover each year sampled, but is common on the site. Forbs are mostly low growing native and weedy exotic species. They are neither diverse nor abundant. The weedy annual forb species storksbill (*Erodium cicutarium*) and bur buttercup (*Ranunculus testiculatus*) are the most abundant forb species (Table - Herbaceous Trends).

Soil: The soil is part of the Lodar and Lundy association, which is found on mountainsides. The parent material consists of colluvium derived from limestone and/or residuum weathered from limestone (Soil Survey Staff 2011). The soil texture is a clay loam with a mildly alkaline soil reaction (pH 7.5). Phosphorus may have a limited availability for plant growth and development at 4.9 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderately low with high amounts of pavement and rock, and a moderate amount of vegetation providing protective ground cover (Table - Basic Cover). Due to the shale rock armoring the surface the soil erosion condition was classified as stable in 2002 and 2007, but was moderate in 2012.

### Trend Assessments

Browse:

- **1983 to 1989 - stable (0):** The density of black sagebrush decreased slightly from 9,531 plants/acre to 9,065 plants/acre. Decadence of sagebrush increased from 11% to 57%, but poor vigor decreased from 8% to 0%. Recruitment of young sagebrush to the population decreased from 36% to 26%.
- **1989 to 1997 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined based on other parameters. Decadence of sagebrush decreased to 7%, and poor vigor increased slightly to 5%. Recruitment of young sagebrush to the population decreased to 16%.
- **1997 to 2002 - up (+2):** The density of black sagebrush increased 25% from 5,640 plants/acre to 7,040 plants/acre, and cover increased from 6% to 8%. Decadence of sagebrush increased to 22%, and poor vigor remained similar at 4%. Recruitment of young sagebrush to the population decreased further to 5%.

- **2002 to 2007 - stable (0):** The density of black sagebrush decreased slightly to 6,700 plants/acre, but cover increased to 9%. Decadence remained similar at 25%, but poor vigor increased to 17%. Recruitment of young sagebrush to the population remained low at 5%.
- **2007 to 2012 - stable (0):** The density of black sagebrush decreased slightly to 6,480 plants/acre, but cover increased to 10%. Decadence of sagebrush decreased to 8%, and poor vigor decreased to 3%. Recruitment of young sagebrush to the population remained low at 4%.

Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies of perennial grasses increased 63%. Bluebunch wheatgrass and Indian ricegrass (*Oryzopsis hymenoides*) increased significantly in nested frequency.
- **1989 to 1997 - down (-2):** The sum of nested frequencies of perennial grasses decreased 26%. The invasive annual cheatgrass was included in the sample for the first time, and is the most common grass on the site.
- **1997 to 2002 - slightly up (+1):** The sum of nested frequencies of perennial grasses increased 15%, and cover increased from 4% to 7%. Bottlebrush squirreltail (*Sitanion hystrix*) increased significantly in nested frequency. The invasive annual cheatgrass decreased significantly in nested frequency.
- **2002 to 2007 - up (+2):** The sum of nested frequencies of perennial grasses increased 23%, and cover increased to 11%. Sandberg bluegrass increased significantly in nested frequency. Cheatgrass increased significantly in nested frequency.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses remained similar, but cover decreased to 9%. Cheatgrass decreased significantly in nested frequency.

Forb:

- **1983 to 1989 - stable (0):** Perennial forb species are very rare on the site.
- **1989 to 1997 - stable (0):** Perennial forb species are very rare on the site.
- **1997 to 2002 - stable (0):** Perennial forb species are very rare on the site.
- **2002 to 2007 - stable (0):** Perennial forb species are very rare on the site.
- **2007 to 2012 - stable (0):** Perennial forb species are very rare on the site.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --

Management unit 18B, study no: 5

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	9.6	12.9	8.0	7.6	-0.4	0.1	0.0	<b>37.8</b>	Fair
02	12.2	8.4	2.5	14.0	-0.2	0.2	0.0	<b>37.1</b>	Fair
07	12.9	7.5	2.5	21.2	-0.5	0.0	0.0	<b>43.6</b>	Fair-Good
12	15.2	12.6	2.0	17.1	-0.1	0.0	0.0	<b>46.8</b>	Fair-Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 18B, Study no: 5

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron spicatum	<sub>a</sub> 49	<sub>c</sub> 119	<sub>bc</sub> 74	<sub>bc</sub> 100	<sub>c</sub> 121	<sub>c</sub> 131	2.37	4.19	6.51	6.76
G	Bromus tectorum (a)	-	-	<sub>c</sub> 192	<sub>a</sub> 77	<sub>b</sub> 156	<sub>a</sub> 57	.51	.21	.64	.14

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	<i>Oryzopsis hymenoides</i>	a <sup>3</sup>	b <sup>9</sup>	ab <sup>5</sup>	a <sup>3</sup>	a <sup>3</sup>	a <sup>-</sup>	.04	.03	.03	-
G	<i>Poa secunda</i>	a <sup>160</sup>	bc <sup>222</sup>	ab <sup>182</sup>	a <sup>185</sup>	c <sup>241</sup>	c <sup>237</sup>	1.37	2.66	4.02	1.79
G	<i>Sitanion hystrix</i>	ab <sup>4</sup>	ab <sup>1</sup>	a <sup>-</sup>	b <sup>11</sup>	ab <sup>3</sup>	ab <sup>4</sup>	.00	.10	.00	.01
Total for Annual Grasses		0	0	192	77	156	57	0.50	0.21	0.64	0.14
Total for Perennial Grasses		216	351	261	299	368	372	3.80	7.00	10.58	8.57
Total for Grasses		216	351	453	376	524	429	4.31	7.21	11.22	8.71
F	<i>Allium</i> sp.	a <sup>-</sup>	a <sup>-</sup>	ab <sup>2</sup>	b <sup>9</sup>	a <sup>-</sup>	a <sup>-</sup>	.00	.05	-	-
F	<i>Alyssum alyssoides</i> (a)	-	-	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>13</sup>	-	-	-	.03
F	<i>Antennaria rosea</i>	1	-	-	-	-	-	-	-	-	-
F	<i>Arabis</i> sp.	-	-	3	3	2	1	.00	.00	.00	.00
F	<i>Astragalus</i> sp.	-	-	3	-	-	-	.00	-	-	-
F	<i>Calochortus nuttallii</i>	-	-	-	5	-	-	-	.01	-	-
F	<i>Castilleja chromosa</i>	-	2	-	-	-	-	-	-	-	-
F	<i>Chaenactis douglasii</i>	ab <sup>11</sup>	b <sup>22</sup>	ab <sup>19</sup>	a <sup>2</sup>	a <sup>-</sup>	a <sup>-</sup>	.04	.00	-	-
F	<i>Cryptantha</i> sp.	2	3	-	-	-	3	-	-	-	.00
F	<i>Cymopterus</i> sp.	-	-	-	1	-	-	-	.00	-	-
F	<i>Draba</i> sp. (a)	-	-	-	-	1	-	-	-	.00	-
F	<i>Eriogonum</i> sp.	-	1	-	-	-	-	-	-	-	-
F	<i>Erodium cicutarium</i> (a)	-	-	a <sup>10</sup>	a <sup>9</sup>	b <sup>32</sup>	a <sup>-</sup>	.01	.02	.28	-
F	<i>Lactuca serriola</i> (a)	-	6	-	-	-	-	-	-	-	-
F	<i>Lygodesmia spinosa</i>	7	-	-	-	-	-	-	-	-	-
F	<i>Phlox hoodii</i>	-	7	-	-	-	-	-	-	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	-	b <sup>134</sup>	b <sup>172</sup>	c <sup>249</sup>	a <sup>36</sup>	.41	.51	1.08	.10
Total for Annual Forbs		0	6	144	181	282	49	0.42	0.53	1.37	0.13
Total for Perennial Forbs		21	35	27	20	2	4	0.05	0.08	0.00	0.00
Total for Forbs		21	41	171	201	284	53	0.47	0.61	1.37	0.14

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

#### BROWSE TRENDS--

Management unit 18B, Study no: 5

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	<i>Artemisia nova</i>	88	95	96	95	6.40	8.14	8.60	10.14
B	<i>Chrysothamnus viscidiflorus stenophyllus</i>	2	1	1	1	.01	.03	.15	.03
B	<i>Cowania mexicana stansburiana</i>	1	1	1	1	-	-	-	-
B	<i>Gutierrezia sarothrae</i>	50	21	31	6	2.73	.23	.45	.03
B	<i>Juniperus osteosperma</i>	1	1	1	1	-	.00	.06	.03
B	<i>Opuntia</i> sp.	1	1	0	0	-	-	-	-
B	<i>Pinus monophylla</i>	0	0	0	1	-	-	-	-
B	<i>Tetradymia glabrata</i>	1	1	1	0	-	-	-	-
Total for Browse		144	121	131	105	9.15	8.40	9.26	10.23

CANOPY COVER, LINE INTERCEPT--

Management unit 18B, Study no: 5

Species	Percent Cover	
	'07	'12
Artemisia nova	10.35	10.10
Gutierrezia sarothrae	.25	.36
Juniperus osteosperma	.01	.16

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18B, Study no: 5

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia nova	1.4	0.5	0.5

POINT-QUARTER TREE DATA--

Management unit 18B, Study no: 5

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	-	-	30	-	-	4.8

BASIC COVER--

Management unit 18B, Study no: 5

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	.75	10.00	13.81	15.10	20.44	18.90
Rock	16.25	33.00	25.22	32.12	31.87	26.43
Pavement	54.25	37.75	45.94	43.07	41.78	39.90
Litter	15.00	9.75	7.81	10.06	6.94	7.50
Cryptogams	0	.75	1.14	1.25	1.93	3.33
Bare Ground	13.75	8.75	2.12	9.68	8.63	8.73

SOIL ANALYSIS DATA --

Management unit 18B, Study no: 5, Big Dip Gulch

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		% sand	% silt	% clay				
5.9	7.5	28.0	39.4	32.6	2.8	4.9	195.2	0.5

PELLET GROUP DATA--

Management unit 18B, Study no: 5

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	9	15	85	15	-	-	-
Horse	1	-	-	-	-	-	-
Elk	-	-	4	-	-	-	-
Deer	42	22	24	21	44 (109)	62 (154)	25 (61)

BROWSE CHARACTERISTICS--  
Management unit 18B, Study no: 5

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia nova</i>									
83	<b>9531</b>	36	52	11	66	14	86	8	8/14
89	<b>9065</b>	26	18	57	1666	56	0	0	7/15
97	<b>5640</b>	16	78	7	340	48	0	5	20/21
02	<b>7040</b>	5	73	22	20	38	3	4	8/17
07	<b>6700</b>	5	70	25	620	13	1	17	8/22
12	<b>6480</b>	4	88	8	-	60	33	3	8/18
<i>Chrysothamnus viscidiflorus stenophyllus</i>									
83	<b>66</b>	100	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>40</b>	100	0	-	-	0	0	0	-/-
02	<b>20</b>	100	0	-	-	0	0	0	-/-
07	<b>40</b>	0	100	-	-	0	0	0	4/6
12	<b>20</b>	100	0	-	-	0	0	0	-/-
<i>Cowania mexicana stansburiana</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	100	0	-	-	100	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	56/128
07	<b>20</b>	0	100	-	-	0	0	0	50/61
12	<b>20</b>	0	100	-	-	0	100	0	35/49
<i>Ephedra viridis</i>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>0</b>	0	0	-	-	0	0	0	-/-
02	<b>0</b>	0	0	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	17/16
12	<b>0</b>	0	0	-	-	0	0	0	19/28
<i>Gutierrezia sarothrae</i>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>133</b>	100	0	0	-	0	0	0	-/-
97	<b>4300</b>	4	87	9	-	0	0	.93	7/9
02	<b>580</b>	17	31	52	-	0	0	38	5/8
07	<b>1280</b>	25	75	0	100	0	0	0	4/5
12	<b>200</b>	0	100	0	-	0	0	0	3/5



Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Juniperus osteosperma</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	20	100	0	-	-	0	0	0	-/-
02	20	0	100	-	-	0	0	0	-/-
07	20	100	0	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	31/38
<b>Opuntia sp.</b>									
83	66	0	100	-	-	0	0	0	6/6
89	66	100	0	-	-	0	0	0	-/-
97	20	0	100	-	-	0	0	0	8/14
02	20	0	100	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	4/9
12	0	0	0	-	-	0	0	0	5/13
<b>Pinus monophylla</b>									
83	0	0	0	-	-	0	0	0	-/-
89	0	0	0	-	-	0	0	0	-/-
97	0	0	0	-	-	0	0	0	-/-
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	20	100	0	-	-	0	0	0	54/58
<b>Tetradymia glabrata</b>									
83	0	0	0	0	-	0	0	0	-/-
89	0	0	0	0	-	0	0	0	-/-
97	20	0	100	0	-	0	0	0	4/5
02	20	0	100	0	-	0	0	0	10/11
07	20	0	0	100	-	0	0	100	20/33
12	0	0	0	0	-	0	0	0	21/30

SOUTH OF SOLDIER CREEK - TREND STUDY NO. 18B-6-12

Vegetation Type: Perennial Grass

Range Type: Crucial Deer Winter, Crucial Elk Winter

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

Land Ownership: BLM

Elevation: 5,600 ft. (1,707 m)

Aspect: Southwest

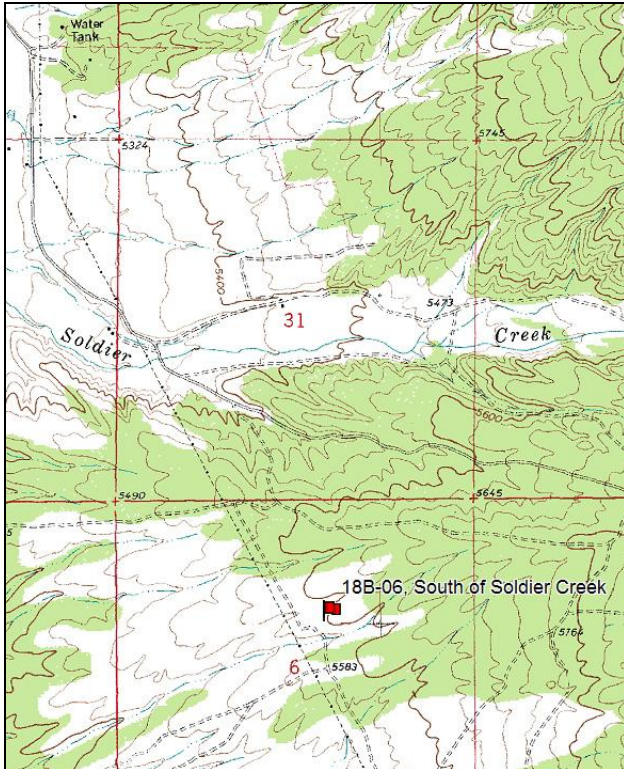
Slope: 6%

Transect bearing: 338° magnetic

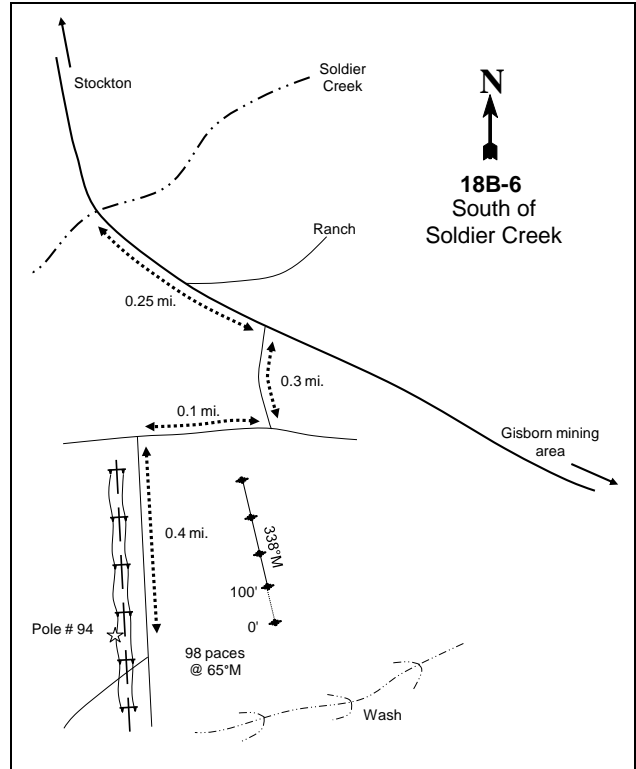
Belt placement: line 1 (11ft & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions: Heading north on SR-36 in Stockton, turn east on East Silver Avenue. Follow this road through town as it turns to the south and becomes Soldier Canyon Road. Proceed south on this road until it crosses over Soldier Creek. Go 0.25 miles from the creek and turn right (south) on a road that goes up on the bench to the south. Travel on this road for 0.3 miles to an intersection at the top of the hill. Turn right (west) and travel 0.1 miles to another intersection. Turn left (south) and travel 0.4 miles to where there is a double power pole on the west side of the road. From the power pole marked with #94, walk 98 paces at 65 degrees magnetic to the 0-foot stake.

Map Name: Stockton



Diagrammatic Sketch:



Township: 5S Range: 4W Section: 6

GPS: NAD 83, UTM 12S 386565 E 4474868 N

## SOUTH OF SOLDIER CREEK - TREND STUDY NO. 18B-6

### Site Information

Site Description: This study is located south of Soldier Creek on land administered by the Bureau of Land Management (BLM) as part of the Mercur Canyon grazing allotment. The study samples crucial deer winter range that was formerly populated by a dense stand of Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon pine (*Pinus monophylla*) trees. The study was established in 1983 on an old BLM chaining and seeding treatment. The Stockton Bullhog treatment ([WRI Project #1929](#)) was performed in 2012 to remove Utah juniper from the area and to better manage mountain big sagebrush habitat (*Artemisia tridentata* ssp. *vaseyana*). Additionally, 3,000 antelope bitterbrush seedling were planted within the treatment area (WRI Database 2013). Deer pellet groups were sampled in low abundance in 2002 and 2012, but in high abundance in 2007. Elk pellet groups were sampled in low abundance in 2002, but in moderate abundance in 2007. Cattle pats were sampled in low abundance in 2007 (Table - Pellet Group Data). Most pellet groups have been observed within the washes.

Browse: When the study was established in 1983, the seeded browse species appeared mature and well established. The preferred browse species found on the study is mountain big sagebrush; however, there appears to be some hybridization occurring between mountain big sagebrush and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). All of the sagebrush was classified as mountain big sagebrush in this study. Mountain big sage brush is a sparse, mature population that has varied in density over the course of the study. Decadence within the sagebrush population has been moderate most sample years, but was low in 1997. Poor vigor of sagebrush has been low over the duration of the study. Recruitment of young sagebrush to the population was high at the outset of the study, but has been poor since 2002. Utilization of sagebrush has been mostly light to moderate over the course of the study, but with some heavy use noted in 2002 (Table - Browse Characteristics). It was noted that the plants with more mountain big sagebrush characteristics display heavier use on the study. Prior to the bullhog treatment, Utah juniper was a moderately dense, mature population. Following the treatment in 2012, the remaining Utah juniper and singleleaf pinyon pine trees comprise a young, sparse community. Nearly all juniper and pinyon trees were removed by the bullhog treatment (Table - Point-Quarter Tree Data). Prior to treatment, the woodland succession stage was considered to be in Phase II, but is now considered to be in Phase I (Tausch et al. 2009).

Herbaceous Understory: The herbaceous understory is dominated by crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*A. spicatum*), and Sandberg bluegrass (*Poa secunda*). Indian ricegrass (*Oryzopsis hymenoides*) and bottlebrush squirreltail (*Sitanion hystrix*) also occur on the study but are found in low abundance. The invasive annual grass species cheatgrass (*Bromus tectorum*) is also abundant on the site. The forb composition is diverse, but is composed of species with relatively poor forage value. Common perennial forbs include rock goldenrod (*Petradoria pumila*), spiny phlox (*Phlox hoodii*), and Bonneville pea (*Lathyrus brachycalyx*). The forb community is not indicative of a past seeding (Table - Herbaceous Trends).

Soil: The soil is part of the Borvant component, which is found on fan remnants. The parent material consists of alluvium derived from limestone (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.5). Phosphorus may have limited availability for plant growth and development at 5.6 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is high, but with high amounts of litter and vegetation, and a moderate amount of pavement providing protective ground cover. The erosion condition class was determined to be stable since 2002.

## Trend Assessments

### Browse:

- **1983 to 1989 - stable (0):** The density of mountain big sagebrush did not change at 1,332 plants/acre. Decadence of sagebrush increased from 0% to 25%, and poor vigor increased from 0% to 8%. Recruitment of young sagebrush to the population increased from 22% to 35%.
- **1989 to 1997 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Decadence of sagebrush decreased to 9%, and poor vigor decreased to 3%. Recruitment of young sagebrush to the population decreased to 24%.
- **1997 to 2002 - slightly up (+1):** The density of mountain big sagebrush increased 29% from 680 plants/acre to 880 plants/acre, but cover remained similar at 2%. Decadence of sagebrush increased to 34%, and poor vigor increased to 18%. Recruitment of young sagebrush to the population decreased to 2%.
- **2002 to 2007 - stable (0):** The density of mountain big sagebrush increased slightly to 920 plants/acre, and cover increased to 3%. Decadence of sagebrush decreased to 20%, and poor vigor decreased to 7%. Recruitment of young sagebrush to the population remained similar at 4%. Approximately 7% of the sampled plants appeared to be infested by the sagebrush defoliator moth (*Aroga websteri*).
- **2007 to 2012 - down (-2):** The density of mountain big sagebrush decreased 39% from to 560 plants/acre, and cover decreased to 1%. Decadence of sagebrush increased to 29%, and poor vigor decreased to 0%. Recruitment of young sagebrush to the population increased to 11%.

### Grass:

- **1983 to 1989 - up (+2):** The sum of nested frequencies of perennial grasses increased 48%. Bluebunch wheatgrass increased and Sandberg bluegrass increased significantly in nested frequency.
- **1989 to 1997 - down (-2):** The sum of nested frequencies of perennial grasses decreased 27%. Crested wheatgrass increased significantly in nested frequency. The invasive annual species cheatgrass was included in the sample for the first time and was abundant on the study.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial grasses remained similar, but cover increased from 12% to 15%.
- **2002 to 2007 - slightly up (+1):** The sum of nested frequencies of perennial grasses increased 17%, and cover increased to 19%. Sandberg bluegrass increased significantly in nested frequency. Cheatgrass increased significantly in nested frequency, but cover remained near 2%.
- **2007 to 2012 - down (-2):** The sum of nested frequencies of perennial grasses decreased 21%, but cover remained similar at 18%. Sandberg bluegrass decreased significantly in nested frequency. Cheatgrass decreased significantly in nested frequency, and decreased in cover to less than 1%.

### Forb:

- **1983 to 1989 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 46%.
- **1989 to 1997 - slightly up (+1):** The sum of nested frequencies of perennial forbs increased 47%.
- **1997 to 2002 - stable (0):** The sum of nested frequencies of perennial forbs remained similar, and cover remained similar at 5%.
- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial forbs remained similar, but cover increased to 7%.
- **2007 to 2012 - slightly down (-1):** The sum of nested frequencies of perennial forbs decreased 30%, and cover decreased to 4%. The seeded perennial species small burnet was observed in low nested frequency and cover.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 18B, study no: 6

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
97	2.9	0.0	0.0	24.8	-2.4	9.8	0.0	<b>35.0</b>	Very Poor-Poor
02	2.4	0.0	0.0	29.4	-1.3	9.7	0.0	<b>40.2</b>	Poor
07	3.5	0.0	0.0	30.0	-1.2	10.0	0.0	<b>42.3</b>	Poor
12	1.2	0.0	0.0	30.0	-0.1	7.4	0.0	<b>38.5</b>	Poor

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 18B, Study no: 6

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
G	Agropyron cristatum	a106	a101	b159	ab141	ab120	ab113	6.64	7.07	5.61	8.72
G	Agropyron spicatum	c146	d210	ab74	a60	bc96	ab73	3.30	4.47	6.60	4.40
G	Bromus tectorum (a)	-	-	a82	a63	b117	a51	3.16	1.77	1.63	.18
G	Oryzopsis hymenoides	b22	ab14	ab8	ab13	a5	a3	.22	.33	.18	.03
G	Poa secunda	a60	bc177	b128	b143	c198	b144	2.21	2.82	6.12	4.35
G	Sitanion hystrix	7	4	-	-	-	-	-	-	-	-
Total for Annual Grasses		0	0	82	63	117	51	3.16	1.77	1.63	0.17
Total for Perennial Grasses		341	506	369	357	419	333	12.38	14.71	18.52	17.51
Total for Grasses		341	506	451	420	536	384	15.55	16.49	20.15	17.69
F	Allium sp.	-	-	-	1	-	-	-	.00	-	-
F	Alyssum alyssoides (a)	-	-	a-	b21	c66	c86	-	.20	1.36	.24
F	Antennaria rosea	-	1	1	-	-	1	.00	-	-	.00
F	Arabis sp.	-	-	4	-	2	3	.01	-	.03	.03
F	Astragalus beckwithii	a-	a-	b13	a-	b13	b9	.27	-	.08	.08
F	Astragalus sp.	1	4	6	3	-	1	.03	.04	-	.03
F	Astragalus tenellus	a-	a-	b13	a-	a-	ab2	.36	-	-	.00
F	Astragalus utahensis	-	-	-	3	-	2	-	.00	-	.00
F	Calochortus nuttallii	-	2	6	3	6	-	.02	.00	.01	-
F	Camelina microcarpa (a)	-	-	3	-	-	-	.00	-	-	-
F	Castilleja linariaefolia	-	-	-	-	1	-	-	-	.00	-
F	Cirsium sp.	-	-	-	1	-	-	-	.00	-	-
F	Cryptantha sp.	-	2	-	-	-	-	-	-	-	-
F	Erigeron pumilus	1	3	1	-	-	-	.03	-	-	-
F	Eriogonum ovalifolium	-	-	-	-	1	-	-	-	.00	-
F	Erodium cicutarium (a)	-	-	a6	a-	b22	a-	.01	-	.24	-
F	Gilia sp. (a)	-	-	-	1	1	-	-	.00	.00	-
F	Holosteum umbellatum (a)	-	-	a-	a-	b24	a-	-	-	.10	-
F	Lathyrus brachycalyx	-	-	a19	b53	b54	b66	1.04	2.10	2.74	2.51
F	Leucelene ericoides	-	-	-	-	1	-	-	-	.00	-
F	Petradoria pumila	ab19	ab26	b51	b51	b45	a2	2.09	1.72	2.26	.06
F	Phlox hoodii	ab69	b93	ab66	a62	a59	a41	.98	.93	1.67	.88

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'07	'12	'97	'02	'07	'12
F	Phlox longifolia	a-	a-	b <sup>13</sup>	b <sup>9</sup>	b <sup>13</sup>	b <sup>7</sup>	.02	.05	.06	.07
F	Ranunculus testiculatus (a)	-	-	b <sup>175</sup>	b <sup>157</sup>	c <sup>261</sup>	a <sup>12</sup>	1.40	.59	3.54	.02
F	Salsola iberica (a)	-	-	-	-	-	2	-	-	-	.15
F	Sanguisorba minor	-	-	-	-	-	3	-	-	-	.03
F	Sisymbrium altissimum (a)	-	-	3	-	6	-	.03	-	.06	-
Total for Annual Forbs		0	0	187	179	380	100	1.45	0.80	5.30	0.41
Total for Perennial Forbs		90	131	193	186	195	137	4.88	4.86	6.90	3.72
Total for Forbs		90	131	380	365	575	237	6.34	5.66	12.21	4.14

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

#### BROWSE TRENDS--

Management unit 18B, Study no: 6

Type	Species	Strip Frequency				Average Cover %			
		'97	'02	'07	'12	'97	'02	'07	'12
B	Artemisia tridentata vaseyana	24	31	27	20	2.31	1.92	2.78	.95
B	Chrysothamnus viscidiflorus stenophyllus	61	48	53	39	2.71	2.30	2.36	1.73
B	Gutierrezia sarothrae	14	16	4	19	.36	.40	.03	1.02
B	Juniperus osteosperma	5	7	7	0	3.76	6.07	6.34	-
B	Opuntia sp.	3	4	2	0	.15	.15	.00	-
B	Pinus monophylla	1	1	0	0	.38	.53	-	-
Total for Browse		108	107	93	78	9.69	11.39	11.52	3.71

#### CANOPY COVER, LINE INTERCEPT--

Management unit 18B, Study no: 6

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	2.13	1.38
Chrysothamnus viscidiflorus stenophyllus	1.66	2.13
Gutierrezia sarothrae	-	1.20
Juniperus osteosperma	7.23	-

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18B, Study no: 6

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.8	1.2	1.5

POINT-QUARTER TREE DATA--  
Management unit 18B, Study no: 6

Species	Trees per Acre			Average diameter (in)		
	'02	'07	'12	'02	'07	'12
Juniperus osteosperma	84	94	6	4.7	8.5	3.1
Pinus monophylla	-	-	6	-	-	1.5

BASIC COVER--  
Management unit 18B, Study no: 6

Cover Type	Average Cover %					
	'83	'89	'97	'02	'07	'12
Vegetation	5.50	10.00	29.22	34.22	37.81	23.00
Rock	1.25	2.25	1.96	2.78	1.78	2.14
Pavement	25.75	30.25	17.02	20.81	16.33	10.20
Litter	38.00	34.75	31.13	30.62	25.90	44.26
Cryptogams	3.00	8.50	7.60	13.11	10.40	4.25
Bare Ground	26.50	14.25	13.67	19.31	25.02	23.66

SOIL ANALYSIS DATA --

Management unit 18B, Study no: 6, South of Soldier Creek

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.0	7.5	36.0	34.4	29.6	3.2	5.6	284.8	0.6

PELLET GROUP DATA--  
Management unit 18B, Study no: 6

Type	Quadrat Frequency				Days use per acre (ha)		
	'97	'02	'07	'12	'02	'07	'12
Rabbit	29	29	54	10	-	-	-
Elk	1	4	6	-	5 (12)	29 (71)	-
Deer	19	8	6	2	4 (10)	52 (129)	2 (5)
Cattle	-	-	-	-	-	2 (4)	-

BROWSE CHARACTERISTICS--  
Management unit 18B, Study no: 6

		Age class distribution			Utilization				
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>									
83	<b>1332</b>	22	78	0	-	8	0	0	24/30
89	<b>1332</b>	35	40	25	-	38	0	8	30/31
97	<b>680</b>	24	68	9	-	18	3	3	21/30
02	<b>880</b>	2	64	34	-	30	27	18	19/30
07	<b>920</b>	4	76	20	-	52	2	7	18/26
12	<b>560</b>	11	61	29	-	46	11	0	17/27

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Chrysothamnus viscidiflorus stenophyllus</b>									
83	<b>2765</b>	22	77	1	-	0	0	1	11/18
89	<b>1931</b>	53	26	21	99	2	0	0	9/10
97	<b>3220</b>	6	73	20	-	0	0	16	9/15
02	<b>2660</b>	3	70	27	-	5	.75	10	7/12
07	<b>2540</b>	1	79	20	-	34	6	13	8/13
12	<b>1240</b>	0	85	15	-	2	0	3	8/12
<b>Gutierrezia sarothrae</b>									
83	<b>466</b>	7	93	0	-	0	0	0	8/12
89	<b>299</b>	78	11	11	-	11	0	0	8/13
97	<b>780</b>	18	82	0	200	0	0	0	6/8
02	<b>780</b>	0	79	21	-	0	0	0	4/7
07	<b>80</b>	0	100	0	-	0	0	0	6/9
12	<b>2220</b>	19	81	0	-	0	0	0	4/6
<b>Juniperus osteosperma</b>									
83	<b>166</b>	0	100	-	-	0	0	0	60/44
89	<b>199</b>	17	83	-	-	0	0	0	73/55
97	<b>100</b>	0	100	-	-	0	0	0	-/-
02	<b>180</b>	0	100	-	-	0	0	0	-/-
07	<b>140</b>	0	100	-	-	14	0	0	60/39
12	<b>0</b>	0	0	-	-	0	0	0	-/-
<b>Opuntia sp.</b>									
83	<b>0</b>	0	0	0	-	0	0	0	-/-
89	<b>66</b>	100	0	0	-	0	0	50	-/-
97	<b>120</b>	0	100	0	-	0	0	0	6/16
02	<b>100</b>	0	80	20	-	0	0	20	4/11
07	<b>40</b>	0	100	0	-	0	0	0	6/13
12	<b>0</b>	0	0	0	-	0	0	0	7/16
<b>Pinus monophylla</b>									
83	<b>0</b>	0	0	-	-	0	0	0	-/-
89	<b>0</b>	0	0	-	-	0	0	0	-/-
97	<b>20</b>	0	100	-	-	0	0	0	-/-
02	<b>20</b>	0	100	-	-	0	0	0	-/-
07	<b>0</b>	0	0	-	-	0	0	0	-/-
12	<b>0</b>	0	0	-	20	0	0	0	-/-



THREE O’CLOCK - TREND STUDY NO. 18B-34-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Elk Winter

NRCS Ecological Site Description: Upland Shallow Hardpan (Mountain Big Sagebrush), R028AY322UT

Land Ownership: SITLA

Elevation: 5,440 ft. (1,658 m)

Aspect: West

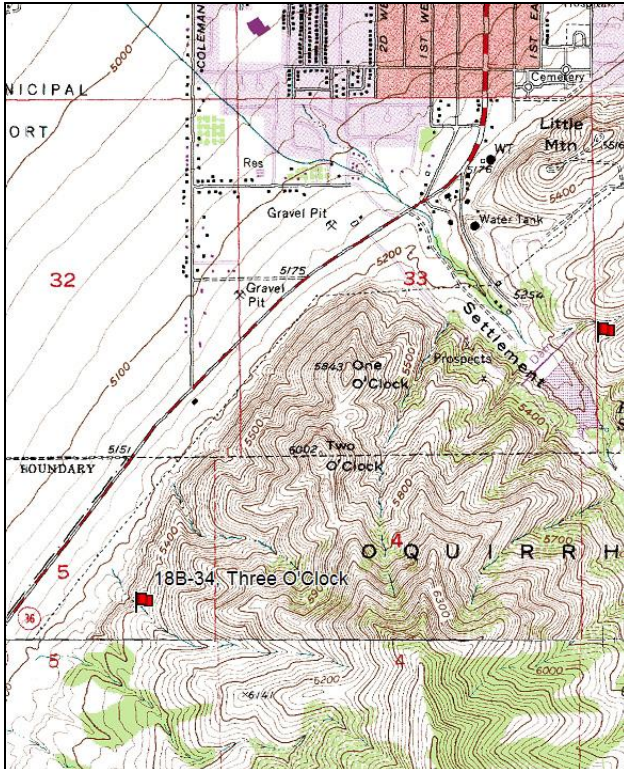
Slope: 20%

Transect bearing: 120° magnetic

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

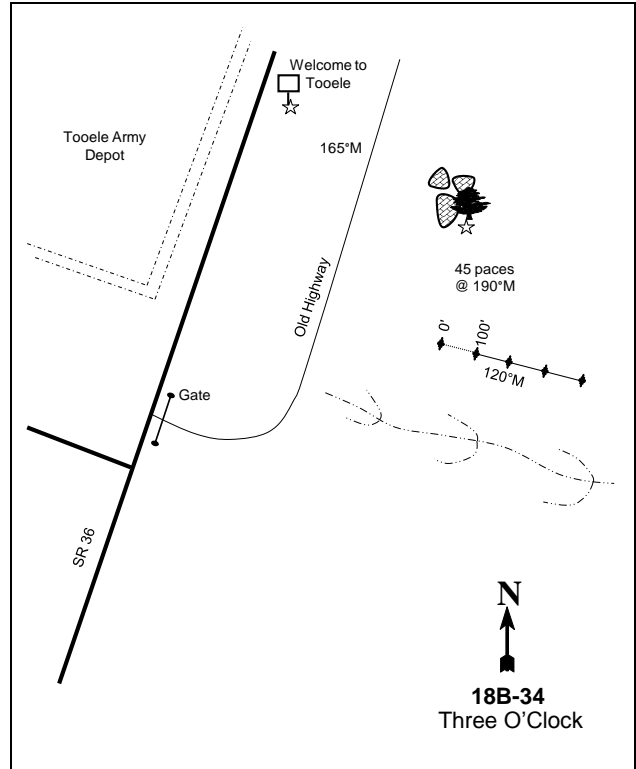
Directions: Park at the “Welcome to Tooele” sign south of Tooele. From the sign walk at 165 degrees magnetic to a rock outcrop with a lone juniper and from the lone juniper, walk 45 paces at 190 degrees magnetic to a rock cairn or the 0-foot stake.

Map Name: Tooele



Township: 3S Range: 4W Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 388379 E 4484199 N

## THREE O'CLOCK - TREND STUDY NO. 18B-34

### Site Information

Site Description: This study was established to monitor deer and elk winter range east of Highway 36 between Tooele and Stockton on land administered by School and Institutional Trust Lands Administration (SITLA). This study samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community on a terrace formed by ancient Lake Bonneville. The whole area burned in the late 1980's, but now has a healthy stand of mountain big sagebrush. The vicinity is occupied by deer and elk primarily in the winter and early spring. Deer/pronghorn pellet groups were sampled in moderate abundance in 2002 and 2007, but low abundance in 2012. Elk pellet groups were sampled in high abundance in 2002 and 2007, but in low abundance in 2012. Cattle pats were sampled in low abundance in 2002. Horse pellet groups were sampled in low abundance in 2007 and 2012 (Table - Pellet Group Data).

Browse: The common preferred browse species mountain big sagebrush is a moderately dense, mature population of with a low growing growth form. Decadence of sagebrush was low in 2002, but since 2007 has increased to moderate levels. Poor vigor within the sagebrush population has been generally low. Recruitment of young sagebrush to the population has remained low over the course of the study. Utilization of sagebrush has been moderate to heavy throughout the course of the study. This population of mountain big sagebrush is low growing, which may impede utilization during winters with heavy snow cover. The other common shrub species sampled is broom snakeweed (*Gutierrezia sarothrae*) which is a moderately dense, mature population. There were scattered, very heavily hedged antelope bitterbrush (*Purshia tridentata*) and serviceberry (*Amelanchier utahensis*) on the study, but none were sampled within density measurements (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is diverse and provides a high amount of cover. The weedy perennial grass bulbous bluegrass (*Poa bulbosa*) species is the dominant grass on the site. Bulbous bluegrass fills in the interspaces between browse species. The perennial grass species Sandberg bluegrass has increased significantly on the site over the course of the study. The other common grasses on the site include purple three-awn (*Aristida purpurea*) and cheatgrass (*Bromus tectorum*). Forbs are diverse and common on the study site. The most abundant species sampled were silky milkvetch (*Astragalus cibarius*), draba (*Draba* sp.), bur buttercup (*Ranunculus testiculatus*), and holosteum (*Holosteum umbellatum*) (Table - Herbaceous Trends)

Soil: The soil is in the Amtoft-Rock outcrop complex and is part of the Amtoft component, which is found on mountainsides and hillsides. The parent material consists of colluvium derived from limestone and/or residuum weathered from limestone (Soil Survey Staff 2011). The soil is shallow and very rocky on the surface and within the profile. The soil texture is a sandy clay loam with a slightly acidic soil reaction (pH 6.4) (Table - Soil Analysis Data). Bare ground cover is low with high amounts of vegetation and litter, and a moderate amount of rock providing protective ground cover. The erosion condition class was determined to be stable since 2002.

### Trend Assessments

#### Browse:

- **2002 to 2007 - down (-2):** The density of mountain big sagebrush decreased 29% from 6,480 plants/acre to 4,620 plants/acre, but cover increased from 14% to 17%. Decadence of sagebrush increased from 7% to 24%, and poor vigor increased from 2% to 16%. Recruitment of young sagebrush to the population remained minimal at 3%.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush changed little at 4,600 plants/acre, but cover decreased to 14%. Decadence of sagebrush changed little at 23%, but poor vigor decreased to 4%. Recruitment of young sagebrush to the population remains minimal at 4%.

Grass:

- **2002 to 2007 - up (+2):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased nearly three-fold, and cover increased from 2% to 11%. Sandberg bluegrass increased significantly in nested frequency, and was responsible for most of the increase in cover. The weedy species bulbous bluegrass decreased significantly in nested frequency, and decreased in cover from 36% to 19%. Cheatgrass decreased significantly in nested frequency, but cheatgrass cover remained at 1%.
- **2007 to 2012 - slightly up (+1):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 20%; moreover, cover increased to 14%. Sandberg bluegrass increased significantly in nested frequency, and increased in cover to 9%. The weedy species bulbous bluegrass increased slightly in cover to 22%. Cheatgrass increased significantly in nested frequency, and cover increased to 2%

Forb:

- **2002 to 2007 - up (+2):** The sum of nested frequencies of perennial forbs increased 26%, and cover increased from 4% to 5%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial forbs increased 35%, and cover increased to 7%.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 18B, study no: 34

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
02	18.1	12.9	0.5	4.2	-0.7	7.4	0.0	<b>42.3</b>	Poor
07	21.2	7.8	1.0	22.1	-0.7	9.7	0.0	<b>61.1</b>	Fair
12	17.8	8.1	2.0	27.4	-1.8	10.0	0.0	<b>63.5</b>	Fair-Good

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 18B, Study no: 34

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	Agropyron smithii	-	-	5	-	-	.63
G	Agropyron spicatum	4	-	2	.01	-	.03
G	Aristida purpurea	<sub>b</sub> 94	<sub>b</sub> 91	<sub>a</sub> 67	1.69	2.79	2.90
G	Bromus brizaeformis (a)	-	-	2	-	-	.00
G	Bromus tectorum (a)	<sub>c</sub> 227	<sub>a</sub> 98	<sub>b</sub> 163	.95	.93	1.98
G	Festuca myuros (a)	<sub>a</sub> -	<sub>a</sub> 2	<sub>b</sub> 24	-	.00	.38
G	Oryzopsis hymenoides	-	-	3	-	-	.03
G	Poa bulbosa	<sub>b</sub> 470	<sub>a</sub> 363	<sub>a</sub> 344	35.82	19.31	22.51
G	Poa secunda	<sub>a</sub> 29	<sub>b</sub> 264	<sub>c</sub> 349	.14	7.40	9.32
G	Sitanion hystrix	3	2	8	.18	.15	.09
G	Sporobolus cryptandrus	5	8	4	.07	.71	.68
G	Vulpia octoflora (a)	<sub>a</sub> 1	<sub>b</sub> 15	<sub>a</sub> -	.00	.05	-
Total for Annual Grasses		228	115	189	0.96	0.99	2.37
Total for Perennial Grasses		605	728	782	37.91	30.37	36.22

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
	Total for Grasses	833	843	971	38.87	31.36	38.59
F	Alyssum alyssoides (a)	a15	ab22	b38	.02	.05	.07
F	Antennaria rosea	2	6	4	.03	.04	.03
F	Asclepias sp.	1	2	6	.15	.38	.38
F	Astragalus cibarius	53	58	64	1.23	1.18	1.35
F	Astragalus utahensis	5	4	12	.09	.08	.26
F	Calochortus nuttallii	17	29	13	.06	.14	.03
F	Castilleja linariaefolia	a7	a15	b41	.41	.32	.29
F	Cerastium beeringianum	-	-	2	-	-	.00
F	Cirsium sp.	22	33	42	.50	.88	1.84
F	Crepis acuminata	21	27	45	.18	.20	.18
F	Draba sp. (a)	a-	c198	b159	-	.65	.30
F	Epilobium brachycarpum (a)	a3	a3	b57	.00	.00	.13
F	Eriogonum racemosum	40	47	59	.21	.59	.64
F	Erodium cicutarium (a)	ab25	a23	b49	.13	.31	.23
F	Gilia sp. (a)	1	-	-	.00	-	-
F	Grindelia squarrosa	a-	a-	b13	-	-	.16
F	Helianthus annuus (a)	b137	a2	a6	.33	.01	.03
F	Heterotheca villosa	a7	ab9	b17	.31	.35	.66
F	Holosteum umbellatum (a)	a1	b139	c204	.00	.32	.55
F	Lactuca serriola (a)	-	-	5	-	-	.01
F	Lomatium sp.	-	1	-	-	.00	-
F	Petradoria pumila	2	-	-	.00	-	.00
F	Phlox hoodii	3	3	-	.03	.03	-
F	Phlox longifolia	24	17	31	.08	.12	.06
F	Polygonum douglasii (a)	10	17	16	.02	.06	.04
F	Ranunculus testiculatus (a)	a-	b10	a-	-	.02	-
F	Sphaeralcea coccinea	-	2	4	-	.00	.03
F	Tragopogon dubius (a)	a21	a24	b68	.12	.13	.35
F	Zigadenus paniculatus	22	31	30	.39	.50	.55
	Total for Annual Forbs	213	438	602	0.65	1.56	1.73
	Total for Perennial Forbs	226	284	383	3.69	4.84	6.51
	Total for Forbs	439	722	985	4.34	6.41	8.25

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

BROWSE TRENDS--

Management unit 18B, Study no: 34

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	Amelanchier utahensis	0	0	1	-	-	-
B	Artemisia tridentata vaseyana	84	74	82	14.41	16.96	14.18
B	Chrysothamnus nauseosus albicaulis	3	4	5	.06	.00	.03
B	Gutierrezia sarothrae	66	47	31	.86	.79	.31
B	Opuntia sp.	3	4	1	.00	.03	-
B	Rhus trilobata	0	0	1	-	-	-
B	Sarcobatus vermiculatus	0	1	5	-	-	.03
B	Tetradymia canescens	5	6	3	.03	.53	.76
Total for Browse		161	136	129	15.37	18.32	15.31

CANOPY COVER, LINE INTERCEPT--

Management unit 18B, Study no: 34

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	18.10	15.83
Chrysothamnus nauseosus albicaulis	.20	.06
Gutierrezia sarothrae	.30	.60
Tetradymia canescens	4.21	-

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18B, Study no: 34

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	1.4	1.4	1.0

BASIC COVER--

Management unit 18B, Study no: 34

Cover Type	Average Cover %		
	'02	'07	'12
Vegetation	61.09	52.68	57.77
Rock	13.46	9.88	11.82
Pavement	9.80	8.60	8.47
Litter	24.87	19.83	31.98
Cryptogams	3.27	10.18	9.30
Bare Ground	6.83	5.73	4.51

SOIL ANALYSIS DATA --

Management unit 18B, Study no: 34, Three O'Clock

Effective rooting depth (in)	pH	Sandy Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
8.9	6.4	46.9	24.4	28.7	2.7	20.7	518.4	0.8

PELLET GROUP DATA--

Management unit 18B, Study no: 34

Type	Quadrat Frequency			Days use per acre (ha)		
	'02	'07	'12	'02	'07	'12
Rabbit	-	2	5	-	-	-
Horse	-	3	-	-	3 (7)	2 (4)
Elk	27	23	4	43 (116)	53 (131)	2 (5)
Deer	24	21	22	30 (74)	38 (94)	10 (25)
Cattle	2	1	-	13 (32)	-	-

BROWSE CHARACTERISTICS--

Management unit 18B, Study no: 34

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Amelanchier utahensis</i>									
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	33/44
12	20	100	0	-	-	100	0	0	36/32
<i>Artemisia tridentata vaseyana</i>									
02	6480	1	92	7	20	40	39	2	15/24
07	4620	2	74	24	460	36	33	16	17/32
12	4600	4	73	23	-	84	5	4	17/33
<i>Chrysothamnus nauseosus albicaulis</i>									
02	60	0	100	0	-	33	33	0	10/9
07	80	25	25	50	-	50	25	25	20/37
12	140	14	86	0	-	43	0	0	11/10
<i>Chrysothamnus viscidiflorus viscidiflorus</i>									
02	0	0	0	-	-	0	0	0	-/-
07	0	0	0	-	-	0	0	0	18/24
12	0	0	0	-	-	0	0	0	-/-
<i>Gutierrezia sarothrae</i>									
02	3320	3	88	9	40	0	0	3	6/7
07	1980	12	76	12	20	0	0	6	7/9
12	1180	8	92	0	40	0	0	0	7/9
<i>Opuntia sp.</i>									
02	60	33	67	-	-	0	0	0	5/12
07	80	25	75	-	-	0	0	0	5/12
12	20	0	100	-	-	0	0	0	4/7
<i>Purshia tridentata</i>									
02	0	0	0	-	20	0	0	0	22/57
07	0	0	0	-	-	0	0	0	39/74
12	0	0	0	-	-	0	0	0	49/100

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<b>Rhus trilobata</b>										
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>0</b>	0	0	-	20	0	0	0	32/50	
12	<b>20</b>	100	0	-	-	0	0	0	6/6	
<b>Sarcobatus vermiculatus</b>										
02	<b>0</b>	0	0	-	-	0	0	0	-/-	
07	<b>200</b>	0	100	-	-	0	100	0	-/-	
12	<b>100</b>	20	80	-	-	40	0	0	15/19	
<b>Tetradymia canescens</b>										
02	<b>100</b>	0	100	0	-	20	0	0	15/22	
07	<b>120</b>	17	67	17	-	17	0	0	12/29	
12	<b>60</b>	33	67	0	-	33	0	0	6/10	

SETTLEMENT CANYON RESERVOIR - TREND STUDY NO. 18B-35-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter, Crucial Deer Winter

NRCS Ecological Site Description: Upland Shallow Hardpan (Mountain Big Sagebrush), R028AY322UT

Land Ownership: Private

Elevation: 5,500 ft. (1,676 m)

Aspect: West

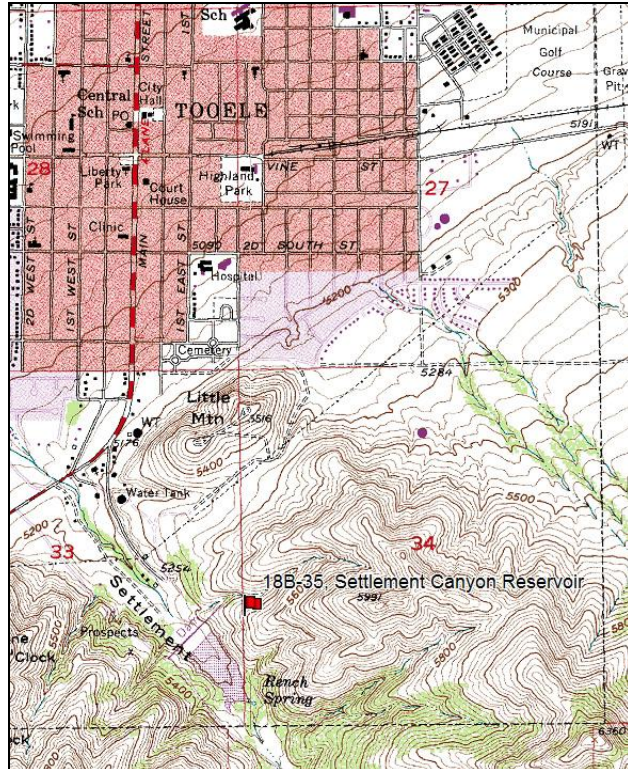
Slope: 22%

Transect bearing: 79° magnetic

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

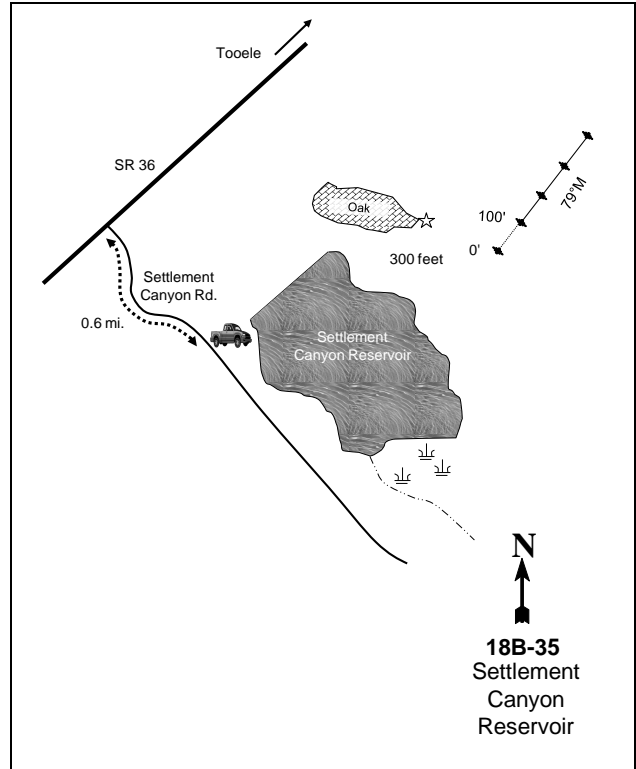
Directions: From the intersection of Hwy 36 and Settlement Canyon Road in Tooele, drive 0.6 miles to the parking lot at Settlement Canyon Reservoir. Walk across the dam and spillway. From the spillway, walk southeast up the ridge (there is a well worn trail) for 300 foot through an oak patch. Get above the oak and walk along the contour a short distance to the 0-foot stake marked by browse tag 246. There is a rock cairn next to the 0-foot stake.

Map Name: Tooele



Township: 3S Range: 4W Section: 33

Diagrammatic Sketch:



GPS: NAD 83, UTM 12S 390482 E 4485386 N



## SETTLEMENT CANYON RESERVOIR - TREND STUDY NO. 18B-35

### Site Information

Site Description: This study was established in 2002 to replace the Left Fork Settlement Canyon (18B-9) trend study. The new study is more representative of crucial winter range in the area and is frequented more by deer and elk. The study samples a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community located on private land that is on a mountain slope east of the Settlement Canyon Reservoir dam. Deer pellet groups were sampled in high abundance since 2002. It was noted in 2012 that many of the pellet groups were small and likely from fawns. Elk pellet groups were sampled in low abundance in 2012 (Table - Pellet Group Data).

Browse: The common preferred browse species found on the site is mountain big sagebrush which is a moderately dense, mature population that has steadily decreased in density over the course of the study. Decadence has been high each sample year, with a moderate amount of poor vigor also. Recruitment of young sagebrush to the population has been minimal throughout the duration of the study. Utilization of sagebrush has been moderate to heavy over the course of the study. Other shrubs sampled on the site are broom snakeweed (*Gutierrezia sarothrae*), creeping barberry (*Mahonia repens*), and pricklypear cactus (*Opuntia* sp.). The increaser species broom snakeweed is a moderately sparse, mature population that has decreased in density and cover over the course of the study (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is abundant and species composition is diverse. Perennial grass species that are common on the site include Bluebunch wheatgrass (*Agropyron spicatum*), Sandberg bluegrass (*Poa secunda*), and the weedy species bulbous bluegrass (*Poa bulbosa*), which is of poor forage value. Bulbous bluegrass is the dominant species on the site. The invasive annual species Japanese brome (*Bromus japonicus*) and cheatgrass (*Bromus tectorum*) are also common on the site, but have provided little cover over the course of the study. Other perennial grasses that have been found on site include purple-threawn (*Aristida purpurea*) and Kentucky bluegrass (*Poa pratensis*). The forb composition is diverse; however, the composition is weedy. In 2002, the dominant forb was the noxious weed dalmatian toadflax (*Linaria dalmatica*), but has since become less common. Other common forbs include hooker balsamroot (*Balsamorhiza hookeri*), rock goldenrod (*Petradoria pumila*), and mulesear (*Wyethia amplexicaulis*) (Table - Herbaceous Trends).

Soil: The soil is in the Amtoft-Rock outcrop complex and is part of the Amtoft component, which is found on mountainsides and hillsides. The parent material consists of colluvium derived from limestone and/or residuum weathered from limestone (Soil Survey Staff 2011). The soil is shallow and rocky with rocks common on the surface and throughout the profile. The soil texture is a clay loam with a neutral soil reaction (pH 6.6) (Table - Soil Analysis Data). Bare ground cover is low with high amounts of vegetation, litter, and rock providing protective ground cover (Table - Basic Cover). The erosion condition class was determined to be stable for each sampled year.

### Trend Assessments

Browse:

- **2002 to 2007 - slightly down (-1):** The density of mountain big sagebrush decreased 11% from 3,240 plants/acre to 2,880 plants/acre, but line intercept cover increased from 12% to 14%. Decadence increased slightly from 38% to 40%, and poor vigor increased from 13% to 21%. Recruitment of young sagebrush to the population remained minimal at 4%.
- **2007 to 2012 - slightly down (-1):** The density of mountain big sagebrush decreased to 19% to 2,340 plants/acre, but line-intercept cover decreased to 10%. Decadence of sagebrush decreased to 30%, and poor vigor decreased to 14%. Recruitment of young sagebrush to the population was nominal at 3%.

Grass:

- **2002 to 2007 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, increased 16%, and cover increased from 9% to 13%. However, bulbous bluegrass increased significantly in nested frequency, and increased in cover from 19% to 22%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial grasses, excluding bulbous bluegrass, remained similar, but cover decreased to 10%. The weedy species bulbous bluegrass slightly decreased in cover to 20%.

Forb:

- **2002 to 2007 - slightly up (+1):** The sum of nested frequency of perennial forbs remained similar, but cover increased from 10% to 11%. The noxious weed dalmation toadflax decreased significantly in nested frequency, and decreased in cover from 3% to 1%.
- **2007 to 2012 - stable (0):** The sum of nested frequencies of perennial forbs remained similar, but cover decreased to 10%. The noxious weed dalmation toadflax remains on the site at low frequency and cover.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --  
Management unit 18B, 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
02	15.4	3.6	1.5	17.3	-1.3	10.0	-2.0	<b>44.4</b>	Poor
07	12.6	3.0	2.0	25.4	-2.1	10.0	-2.0	<b>48.8</b>	Poor-Fair
12	10.7	6.0	1.5	19.5	-1.5	10.0	-2.0	<b>44.2</b>	Poor

**Trend Summary**

HERBACEOUS TRENDS--  
Management unit 18B, Study no: 35

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
G	Agropyron spicatum	280	267	260	8.05	10.43	7.67
G	Aristida purpurea	25	17	15	.39	.25	.19
G	Bromus japonicus (a)	<sub>a</sub> 102	<sub>b</sub> 134	<sub>b</sub> 132	.29	.47	.60
G	Bromus tectorum (a)	139	138	124	1.50	2.24	1.35
G	Festuca myuros (a)	<sub>a</sub> -	<sub>b</sub> 15	<sub>a</sub> -	-	.08	-
G	Poa bulbosa	<sub>a</sub> 389	<sub>b</sub> 416	<sub>ab</sub> 391	18.62	21.97	20.04
G	Poa pratensis	1	-	-	.03	-	-
G	Poa secunda	<sub>a</sub> 17	<sub>b</sub> 91	<sub>b</sub> 84	.14	1.99	1.87
G	Vulpia octoflora (a)	-	3	-	-	.00	-
Total for Annual Grasses		241	290	256	1.79	2.81	1.96
Total for Perennial Grasses		712	791	750	27.25	34.66	29.79
Total for Grasses		953	1081	1006	29.04	37.47	31.75
F	Agoseris glauca	9	10	7	.07	.05	.04
F	Allium sp.	10	3	-	.01	.00	-
F	Alyssum alyssoides (a)	27	23	26	.08	.04	.04
F	Ambrosia psilostachya	2	-	-	.00	-	-
F	Artemisia ludoviciana	4	6	3	.15	.03	.03

Type	Species	Nested Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
F	Asclepias sp.	-	-	2	-	.03	.03
F	Aster sp.	8	5	9	.19	.18	.36
F	Astragalus cibarius	24	17	21	.29	.21	.15
F	Astragalus utahensis	11	8	14	.07	.05	.25
F	Balsamorhiza hookeri	a44	ab54	b70	1.40	2.33	2.44
F	Calochortus nuttallii	b17	ab5	a-	.09	.02	.00
F	Cirsium sp.	10	15	7	.45	.27	.04
F	Collinsia parviflora (a)	a-	b33	b48	-	.42	.52
F	Collomia linearis (a)	1	-	-	.00	-	-
F	Comandra pallida	21	53	60	.29	.41	.41
F	Cordylanthus ramosus (a)	-	1	-	-	.00	-
F	Crepis acuminata	b35	ab20	a18	.17	.12	.07
F	Cryptantha sp.	-	3	-	-	.00	-
F	Cymopterus sp.	18	7	7	.14	.02	.01
F	Descurainia pinnata (a)	-	3	-	-	.03	-
F	Draba sp. (a)	a-	b171	a22	-	.29	.04
F	Eriogonum racemosum	b24	b35	a10	.22	.52	.06
F	Eriogonum umbellatum	-	-	5	-	-	.01
F	Erodium cicutarium (a)	-	-	1	-	-	.00
F	Heterotheca villosa	39	39	51	.89	2.17	1.83
F	Holosteum umbellatum (a)	a3	b98	b107	.01	.21	.22
F	Lactuca serriola (a)	-	-	3	-	-	.00
F	Linaria dalmatica	b122	a49	a45	2.45	.51	.56
F	Linum lewisii	-	1	-	-	.00	-
F	Lithospermum ruderales	-	-	2	-	-	.03
F	Petradoria pumila	42	51	51	1.54	1.97	1.99
F	Phlox longifolia	a45	b77	a48	.22	.49	.13
F	Polygonum douglasii (a)	2	8	-	.01	.01	-
F	Ranunculus testiculatus (a)	9	4	-	.01	.01	-
F	Tragopogon dubius (a)	a8	ab15	b30	.15	.04	.33
F	Viola sp.	1	-	-	.00	-	-
F	Wyethia amplexicaulis	23	30	25	1.01	1.18	1.52
F	Zigadenus paniculatus	6	11	7	.13	.11	.09
Total for Annual Forbs		50	356	237	0.27	1.06	1.18
Total for Perennial Forbs		515	499	462	9.87	10.74	10.09
Total for Forbs		565	855	699	10.14	11.81	11.28

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

#### BROWSE TRENDS--

Management unit 18B, Study no: 35

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	Artemisia tridentata vaseyana	77	73	68	12.28	10.05	8.57
B	Gutierrezia sarothrae	41	33	19	1.46	.57	.34

Type	Species	Strip Frequency			Average Cover %		
		'02	'07	'12	'02	'07	'12
B	Mahonia repens	2	1	2	.03	.01	-
B	Opuntia sp.	22	22	22	.33	.24	.52
Total for Browse		142	129	111	14.11	10.88	9.44

CANOPY COVER, LINE INTERCEPT--

Management unit 18B, Study no: 35

Species	Percent Cover		
	'02	'07	'12
Artemisia tridentata vaseyana	12.18	14.26	9.58
Gutierrezia sarothrae	.85	.30	.36
Opuntia sp.	.16	.03	.16

KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 18B, Study no: 35

Species	Average leader growth (in)		
	'02	'07	'12
Artemisia tridentata vaseyana	2.1	1.5	1.2

BASIC COVER--

Management unit 18B, Study no: 35

Cover Type	Average Cover %		
	'02	'07	'12
Vegetation	47.58	55.34	50.12
Rock	24.67	21.56	25.32
Pavement	6.13	4.69	3.26
Litter	30.61	23.81	40.73
Cryptogams	3.65	3.48	1.38
Bare Ground	4.59	4.68	2.09

SOIL ANALYSIS DATA --

Management unit 18B, Study no: 35, Settlement Canyon Reservoir

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
5.5	6.6	36.9	32.4	30.7	3.2	21.7	259.2	1.0

PELLET GROUP DATA--

Management unit 18B, Study no: 35

Type	Quadrat Frequency			Days use per acre (ha)		
	'02	'07	'12	'02	'07	'12
Rabbit	-	15	2	-	-	-
Elk	-	10	1	-	-	3 (8)
Deer	51	38	38	90 (223)	137 (337)	48 (120)

BROWSE CHARACTERISTICS--  
 Management unit 18B, Study no: 35

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<i>Artemisia tridentata vaseyana</i>									
02	<b>3240</b>	3	59	38	-	31	45	13	14/29
07	<b>2880</b>	4	56	40	20	32	34	21	15/33
12	<b>2340</b>	3	67	30	20	39	33	14	14/29
<i>Gutierrezia sarothrae</i>									
02	<b>1860</b>	6	80	14	20	0	0	13	7/9
07	<b>1300</b>	5	91	5	-	5	0	0	7/10
12	<b>680</b>	3	88	9	140	6	0	6	7/9
<i>Mahonia repens</i>									
02	<b>440</b>	0	100	-	-	0	0	0	1/4
07	<b>140</b>	0	100	-	-	0	0	0	-/-
12	<b>220</b>	0	100	-	-	0	0	0	3/5
<i>Opuntia sp.</i>									
02	<b>800</b>	25	63	13	-	0	0	8	5/10
07	<b>560</b>	7	93	0	20	0	0	0	5/11
12	<b>500</b>	0	100	0	20	0	0	0	5/14

SUMMARY  
WILDLIFE MANAGEMENT UNIT 18B - OQUIRRH-STANSBURY, SOUTH

**Community Types**

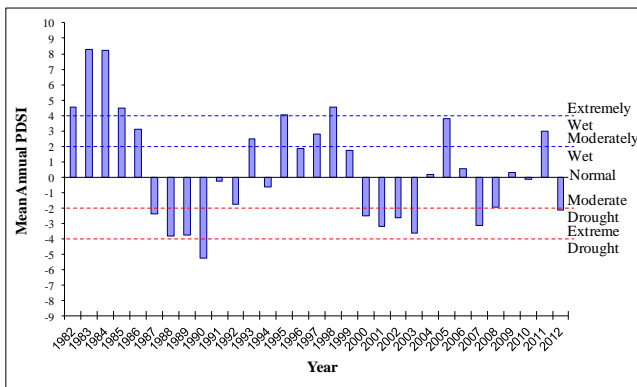
Deer winter range within a unit is summarized into three categories based on ecological potentials which include **low potential, mid-level potential** and **high potential**. Low potential sites include desert shrub, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and cliffrose (*Cowania mexicana* ssp. *stansburiana*) communities. Mid-level potential sites include mountain big sagebrush (*A. tridentata* ssp. *vaseyana*) communities. High potential sites include mountain brush communities. Low sagebrush (*A. arbuscula*), black sagebrush (*A. nova*), and basin big sagebrush (*A. tridentata* ssp. *tridentata*) communities are placed within the low potential or mid-level potential scales based on precipitation and elevation. Deer **summer range** is summarized separately from winter range as a fourth category and typically includes aspen (*Populus tremuloides*) and high elevation mountain brush communities. Five interagency range trend studies were sampled in Unit 18B during the summer of 2012.

Four studies [Manning Canyon (18B-3), South of Soldier Creek (18B-6), Three O'clock (18B-34), and Settlement Canyon Reservoir (18B-35)] are categorized as mid-level potential deer winter range, and sample mountain big sagebrush communities. One other study [Big Dip Gulch (18B-5)] is categorized as low-level potential site for deer winter range, and samples a black sagebrush community. For further information on the low potential study refer to the study discussion section.

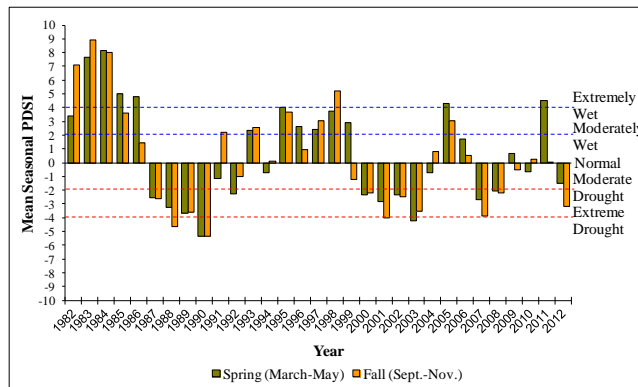
**Precipitation**

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Precipitation and Palmer Drought Severity Index (PDSI) data for the unit were compiled from the National Oceanic and Atmospheric Administration (NOAA) Physical Sciences Division (PSD) as part of the North Central division (Division 3). The North Central division had a historic annual mean precipitation of 16.51 inches from 1895 to 2012. The mean annual PDSI of the North Central division displays a cycle of wet and drought years over the course of study years in the unit (Figure 1 and Figure 2) (Time Series Data 2012).

The 1961-1990 mean annual precipitation was 12-14 in. on the South of Soldier Creek study; 14-16 in. on the



**Figure 1.** The 31 year mean annual Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).



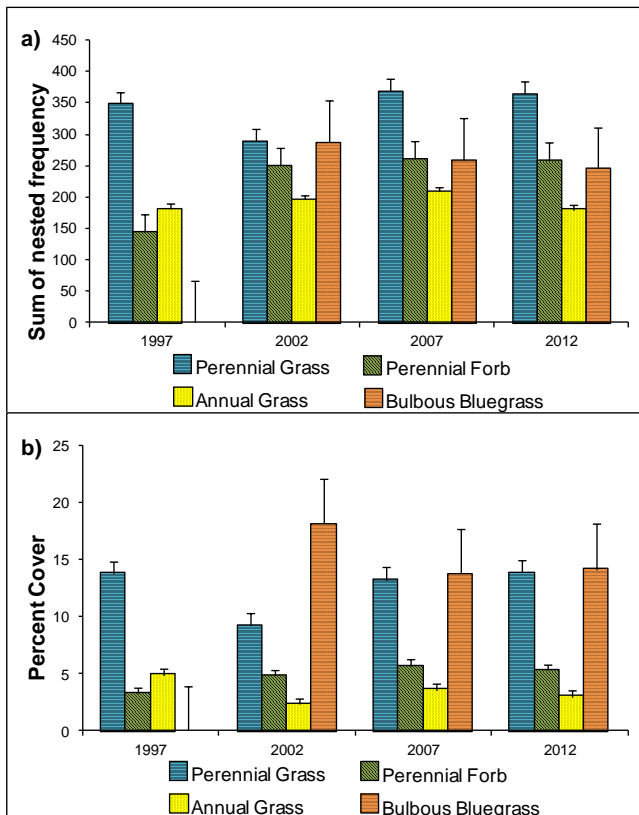
**Figure 2.** The 31 year mean spring (March-May) and fall (Sept.-Nov.) Palmer Drought Severity Index (PDSI) for the North Central division (Division 3). The PDSI is based on climate data gathered from 1895 to 2012. The PDSI uses a scale where 0 indicates normal, positive deviations indicate wet and negative deviations indicate drought. Classification of the scale is  $\geq 4.0$  = Extremely Wet, 3.0 to 3.9 = Very Wet, 2.0 to 2.9 = Moderately Wet, 1.0 to 1.9 = Slightly Wet, 0.5 to 0.9 = Incipient Wet Spell, 0.4 to -0.4 = Normal, -0.5 to -0.9 = Incipient Dry Spell, -1.0 to -1.9 = Mild Drought, -2.0 to -2.9 = Moderate Drought, -3.0 to -3.9 = Severe Drought and  $\leq -4.0$  = Extreme Drought (Time Series Data 2013).

Manning Canyon study; 16-18 in. on the Big Dip Gulch and 3 O'clock studies; and 18-20 in. on the Settlement Canyon Reservoir study (PRISM Climate Group 2011).

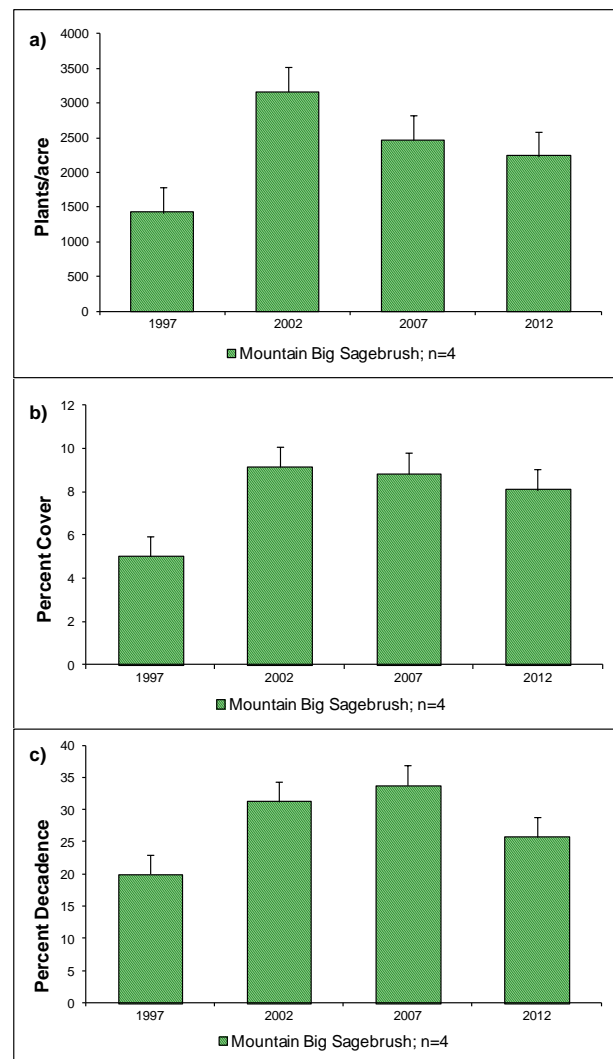
### Mid-Level Potential Deer Range

**Browse:** The mid-level potential site cumulative median browse trend has generally decreased over the duration of the study years. Most of the decrease occurred in the 2007 and 2012 sample years (Figure 5). Mountain big sagebrush is a primary browse species on the Manning Canyon, Three O'clock, and Settlement Canyon Reservoir studies, but is less prevalent on the South Soldier Creek study. The mean density of mountain big sagebrush increased significantly in 2002, decreased gradually in 2007 to 2012, but still remains above 1997 levels (Figure 4a). Mean cover of mountain big sagebrush also increased significantly in 2002. However, mean cover decreased gradually in 2012, but remains above 1997 levels (Figure 4b). The decrease in mountain big sagebrush is fairly consistent across the unit. Mean mountain big sagebrush decadence increased significantly in 2002, but decreased significantly in 2012 and remains just above 1997 levels (Figure 4c).

**Herbaceous Understory:** The mid-level potential median cumulative grass trend generally increased over the sample years, with slight increases in 1989/90, 2007, and 2012 (Figure 5). Perennial grasses comprise the majority of the herbaceous understory on these studies. Grasses within these communities are generally fairly diverse, but



**Figure 3.** a) Mid-level potential sites mean perennial grass (-POBU), perennial forb, and annual grass sum of nested frequency by year for WMU 18B, Oquirrh-Stansbury, South. b) Mid-level potential sites mean perennial grass (-POBU), perennial forb, and annual grass cover by year for WMU 18B.



**Figure 4.** a) Mid-level potential sites mean density of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and black sagebrush (*A. nova*) by year for WMU 18B, Oquirrh-Stansbury, South. b) Mid-level potential sites mean cover of mountain big sagebrush and black sagebrush by year for WMU 18B. c) Mid-level potential sites mean decadence of mountain big sagebrush by year for WMU 18B.

introduced species generally comprise a moderate portion of the herbaceous composition. The annual grass species cheatgrass (*Bromus tectorum*) occurs frequently within the unit. With the exception of Manning Canyon where cheatgrass cover is moderate, most studies within the unit are low in cheatgrass cover. The weedy perennial species bulbous bluegrass (*Poa bulbosa*) is prevalent on the Three O'clock and Settlement Canyon Reservoir studies, but is rare to absent on the remaining studies. The mean sum of nested frequency and cover of bulbous bluegrass increased significantly due to the addition of Three O'clock and Settlement Canyon Reservoir studies in 2002, but has decreased slightly since then (Figure 3a and Figure 3b). The mean sum of nested frequency and cover of perennial grasses decreased significantly in 2002, but increased significantly in 2007 and has since remained near 1997 levels (Figure 3a and Figure 3b). Mean sum of nested frequency and cover of annual grasses has fluctuated somewhat, but has remained relatively low since 1997 (Figure 3a and Figure 3b).

The mid-level potential median cumulative forb trend has increased over the course of the sample years (Figure 5). Perennial forb species are rare on most of the studies except for the Three O'clock and Settlement Canyon Reservoir studies, which are the main drivers of perennial forb trend. The perennial forb species sampled on the Three O'clock and Settlement Canyon Reservoir studies are generally diverse and provide moderate forage value to wildlife. The mean sum of nested frequency and cover of perennial forb species has been moderate to high since 2002 when these two studies were added (Figure 3a and Figure 3b).

Occupancy: Pellet group transect data indicates that deer predominantly occupy the majority of the study areas, but elk have been more prevalent on the Three O'clock study. The mean abundance of elk has generally been low since 2002. The mean abundance of deer pellet groups has ranged from low in 2012 to high in 2007. The mean abundance of livestock sign has been low on the studies since 2002 (Figure 6).

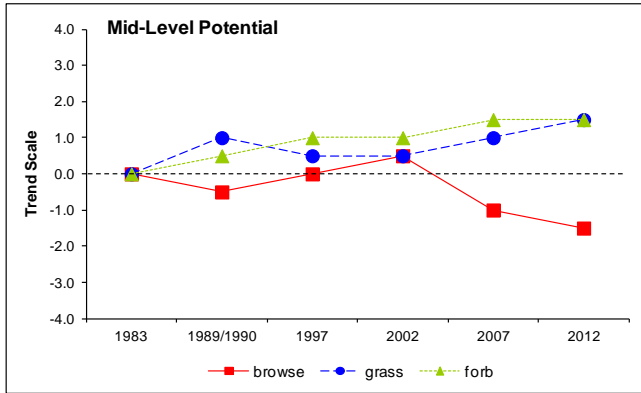
Deer Desirable Components Index (DCI): The mid-level potential deer DCI remained poor from 1997 to 2007, but increased to poor-fair in 2012. Most of the increase is due to the increases in scores for preferred browse young, preferred browse decadence (Table 1 and Figure 7).

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
1997	6.8	3.3	0.5	27.4	-3.7	6.6	0.0	<b>40.9</b>	Poor
2002	11.7	4.4	0.8	18.6	-1.8	7.3	-0.5	<b>40.6</b>	Poor
2007	11.4	3.3	2.1	24.8	-2.7	7.6	-0.5	<b>45.9</b>	Poor
2012	10.5	5.9	3.1	26.6	-2.3	7.3	-0.5	<b>50.6</b>	Poor-Fair

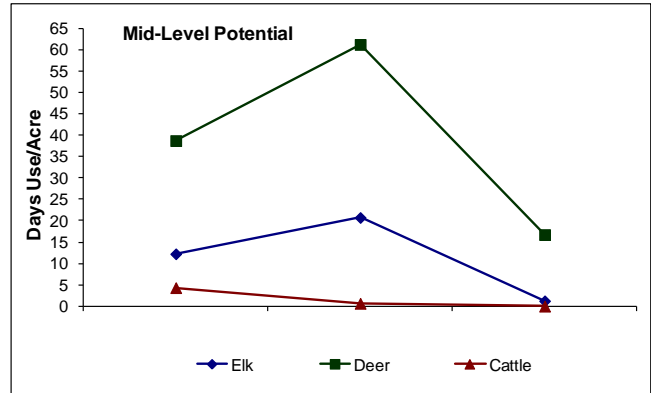
**Table 1.** Mid-level potential scale mean deer DCI scores and rankings (n=4) by year for WMU 18B, Oquirrh-Stansburry, South. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

Discussion: The increase of mountain big sagebrush in 2002 is likely related to the addition of the Three O'clock and Settlement Canyon Reservoir, but mountain big sagebrush appears to be decreasing on the unit as a whole. Some factors that may limit reestablishment of mountain big sagebrush include competition from invasive and weedy grass species, namely cheatgrass on the Manning Canyon study, and bulbous bluegrass on the Three O'clock and Settlement Canyon Reservoir Studies. Heavy utilization by deer, particularly on the Settlement Canyon Reservoir study, may have detrimental impacts on the herbaceous components of the site.

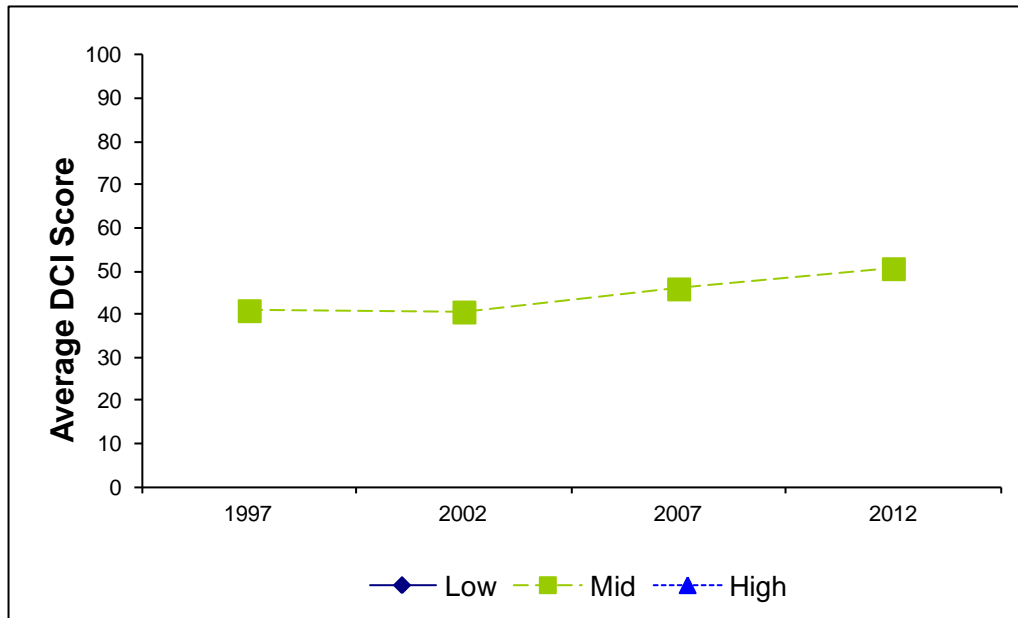




**Figure 5.** Deer mid-level potential sites cumulative median browse, grass and forb trends by year for WMU 18B, Oquirrh-Stansbury, South.



**Figure 6.** Deer mid-level potential sites mean animal days use/acre (n=4) by year for WMU 18B, Oquirrh-Stansbury, South.



**Figure 7.** Mean mid-level (n=4) potential scale deer DCI scores by year for WMU 18B, Oquirrh-Stansbury, South. The deer DCI rankings are divided into three categories based on ecological potentials which include low, mid-level and high.

PROVO RIVER CANYON - TREND STUDY NO. 7-7-12

Vegetation Type: Mountain Big Sagebrush

Range Type: Crucial Deer Winter/Spring

NRCS Ecological Site Description: [Mountain Loam \(Mountain Big Sagebrush\), R047XA430UT](#)

Land Ownership: Private

Elevation: 6,500 ft (1,981 m)

Aspect: South

Slope: 5-12%

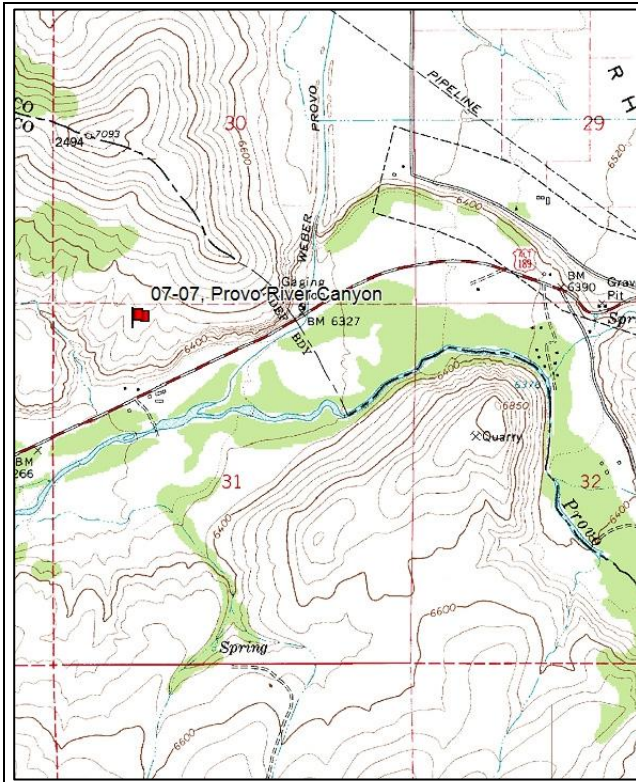
Transect bearing: 160° magnetic

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

Directions:

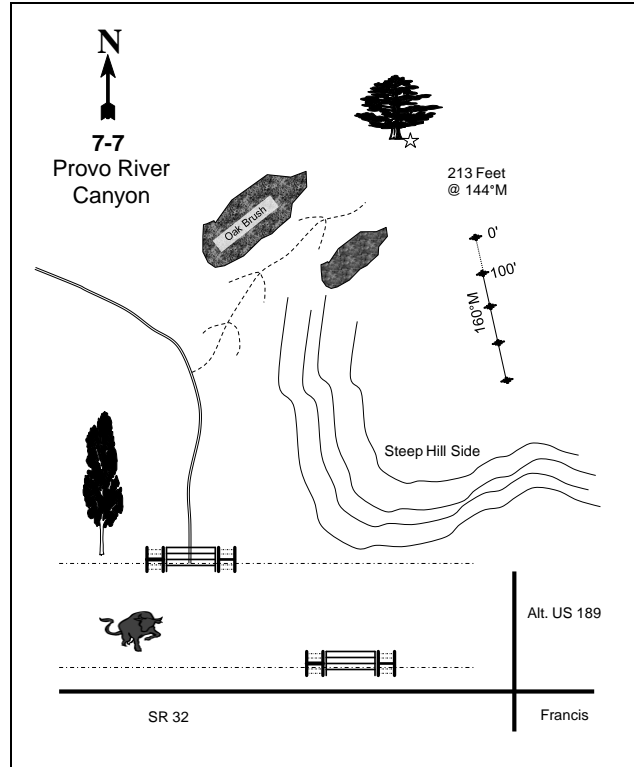
From the junction of SR-32 and Alt US-189 in Francis, proceed west on Hwy 32 for 1.7 miles and stop at an old corral in a marshy pasture on the right (north) opposite Victory Ranch Club (6480 E. Hwy 32). Walk to the large, narrow-leaf cottonwood northwest of the corral. The tree is at the mouth of a small canyon. Walk up the canyon approximately 500 feet until reaching the first drainage on the right. A drainage begins where the road crosses the creek for the second time. Walk up this drainage past the oak clumps to a point where the gully flattens out. To the right locate a 3-trunked, high-lined juniper. From the juniper, walk 213 feet at 144 degrees magnetic to the 0-foot stake of the baseline, marked with browse tag #7960. The baseline runs in a direction of 160 degrees magnetic.

Map Name: Francis



Township: 2S Range: 6E Section: 31

Diagrammatic Sketch:



GPS: NAD 83, UTM 12T 473377 E 4495437 N

## PROVO RIVER CANYON - TREND STUDY NO. 7-7

### Site Information

Site Description: This study samples a narrow band of crucial deer winter range located on private land that is located on a bluff north of the Provo River and west of Francis on SR-32. The nearest perennial source of water is a spring that is 950 feet to the south, near an abandoned house. Deer pellet groups have been sampled in moderate abundance since 2001. Elk pellet groups were sampled in low abundance in all sample years. Cattle pats were sampled in low abundance for all sample years. Several grouse pellet groups were sampled in 2012 (Table - Pellet Group Data).

Browse: Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant browse species. Mountain big sagebrush is a dense, mature population that has steadily decreased in density over the course of the study. Decadence of sagebrush has been moderate to high, and poor vigor has from low to high rates throughout the duration of the study. In 2012, a high proportion of the sagebrush plants were characterized as chlorotic. Recruitment of young sagebrush to the population was good at the outset of the study, but has been poor since 1996. Utilization has been mostly light to moderate, but with some heavy use in each sample year. Antelope bitterbrush (*Purshia tridentata*) is a sparse, mature population that has generally decreased in density over the course of the study. The health of the bitterbrush population has varied widely. Both decadence and poor vigor have ranged from absent to high over the course of the study. Recruitment of young bitterbrush has been nominal. Utilization has been mostly heavy throughout the study years (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by cheatgrass (*Bromus tectorum*). Japanese brome (*B. japonicus*) is also present, but is not abundant. Dominant perennial grass species include bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). Common forb species found on the study include silky milkvetch (*Astragalus cibarius*), and several small annual forbs that include slenderleaf collomia (*Collomia linearis*), blue-eyed Mary (*Collinsia parviflora*), owlclover (*Orthocarpus* spp.), and pale alyssum (*Alyssum alyssoides*) (Table - Herbaceous Trends).

Soil: The soil is part of the Little Pole component, which is found of mountainsides. The parent material consists of colluvium and/or slope alluvium over residuum weathered from andesite (Soil Survey Staff 2011). The soil has a clay loam texture and a neutral soil reaction (pH 6.6) (Table - Soil Analysis Data). Bare ground cover is low with high amounts of vegetation and litter providing protective ground cover (Table - Basic Cover). The erosion condition was classified as stable since 2007.

### Trend Assessments

#### Browse:

- **1984 to 1990 - slightly down (-1):** The density of mountain big sagebrush decreased slightly from 6,332 plants/acre to 6,065 plants/acre. Decadence of sagebrush increased from 33% to 57%, and poor vigor increased from 12% to 30%. Recruitment of young sagebrush to the population decreased from 14% to 10%. The density of antelope bitterbrush decreased 39% from 866 plants/acre to 532 plants/acre. Decadence of bitterbrush increased from 77% to 88%, and poor vigor increased from 38% to 75%. Recruitment of young bitterbrush to the population increased from 0% to 12%.
- **1990 to 1996 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined based on other parameters. Decadence of sagebrush decreased to 20%, and poor vigor decreased to 3%. Recruitment of young sagebrush to the population decreased to 4%. Decadence of bitterbrush decreased substantially to 11%, and poor vigor decreased to 0%. Recruitment of young bitterbrush to the population was absent.
- **1996 to 2001 - stable (0):** The density of mountain big sagebrush increased slightly from 4,120 plants/acre to 4,280 plants/acre, and cover decreased slightly from 32% to 31%. Decadence increased to 37%, and poor vigor increased to 22%. Recruitment of young sagebrush to the population was

minimal at 2%. The density of antelope bitterbrush increased 33% from 180 plants/acre to 240 plants/acre, and cover increased from 1% to 2%. Decadence and poor vigor of bitterbrush decreased to 0%. Recruitment of young bitterbrush to the population was not observed.

- **2001 to 2007 - down (-2):** The density of mountain big sagebrush decreased 38% to 2,660 plants/acre, and cover decreased to 15%. Decadence of sagebrush increased to 48%, and poor vigor increased to 32%. Recruitment of young sagebrush to the population remained nominal at 2%. The density of antelope bitterbrush decreased 17% to 200 plants/acre, and cover decreased to less than 1%. Decadence of bitterbrush increased to 40%, and poor vigor increased to 10%. Recruitment of young bitterbrush to the population was absent.
- **2007 to 2012 - stable (0):** The density of mountain big sagebrush decreased slightly to 2,600 plants/acre, but cover increased to 18%. Decadence of sagebrush decreased to 40%, but poor vigor increased to 49%. Recruitment of young sagebrush to the population was absent. The density of antelope bitterbrush did not change at 200 plants/acre, but cover decreased to near 0%. Decadence of bitterbrush decreased to 10%, and poor vigor increased to 30%. Recruitment of young bitterbrush to the population was absent.

#### Grass:

- **1984 to 1990 - up (+2):** The sum of nested frequencies of perennial grasses increased 71%. Bluebunch wheatgrass and Sandberg bluegrass increased significantly in nested frequency. Thickspike wheatgrass (*Agropyron dasystachyum*) decreased significantly in nested frequency.
- **1990 to 1996 - slightly down (-1):** The sum of nested frequencies of perennial grasses decreased 11%. Sandberg bluegrass and thickspike wheatgrass decreased significantly in nested frequency. The invasive annual species cheatgrass was the most abundant grass on the study, and had a cover of 8%.
- **1996 to 2001 - up (+2):** The sum of nested frequencies of perennial grasses increased 23%, and cover increased from 7% to 9%. Sandberg bluegrass increased significantly in nested frequency. The annual species cheatgrass decreased significantly in nested frequency, and decreased in cover to 2%.
- **2001 to 2007 - down (-2):** The sum of nested frequencies of perennial grasses decreased 23%, but cover remained similar at 8%. Sandberg bluegrass and bottlebrush squirreltail (*Sitanion hystrix*) decreased significantly in nested frequency. Cheatgrass increased significantly in nested frequency, and increased in cover to 18%.
- **2007 to 2012 - up (+2):** The sum of nested frequencies of perennial grasses increased 63%, and cover increased to 15%. Sandberg bluegrass increased significantly in nested frequency. Cheatgrass decreased significantly in nested frequency, and decreased in cover to 5%.

#### Forb:

- **1984 to 1990 - stable (0):** Perennial forb species are rare on the site.
- **1990 to 1996 - stable (0):** Perennial forb species are rare on the site.
- **1996 to 2001 - up (+2):** The sum of nested frequencies of perennial forbs increased nearly eight-fold, and cover increased from less than 1% to 4%. Most of the increase was due to a significant increase in the nested frequency of silky milkvetch.
- **2001 to 2007 - down (-2):** The sum of nested frequencies of perennial forbs decreased 78%, and cover decreased to less than 1%. Silvery lupine and silky milkvetch decreased significantly in nested frequency. Perennial forb species are rare on the site again.
- **2007 to 2012 - stable (0):** Perennial forb species are rare on the site.

DEER DESIRABLE COMPONENTS INDEX - MID POTENTIAL SCALE --

Management unit 7, study no: 7

Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	Total Score	Ranking
96	30.0	5.9	1.9	13.4	-5.6	0.5	0.0	<b>46.2</b>	Poor
01	30.0	5.7	0.9	18.0	-1.1	7.6	0.0	<b>61.1</b>	Fair
07	19.3	0.7	1.0	16.2	-13.4	1.3	0.0	<b>24.9</b>	Very Poor
12	22.2	3.0	0.0	30.0	-4.9	0.3	0.0	<b>50.6</b>	Poor-Fair

**Trend Summary**

HERBACEOUS TRENDS--

Management unit 07, Study no: 7

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'07	'12	'96	'01	'07	'12
G	Agropyron cristatum	8	13	10	19	20	16	.68	.48	.63	1.08
G	Agropyron dasystachyum	<sub>d</sub> 87	<sub>bc</sub> 34	<sub>a</sub> 3	<sub>ab</sub> 11	<sub>abc</sub> 17	<sub>c</sub> 54	.00	.08	.26	1.64
G	Agropyron spicatum	<sub>a</sub> 25	<sub>b</sub> 79	<sub>b</sub> 124	<sub>b</sub> 87	<sub>ab</sub> 70	<sub>b</sub> 116	2.71	2.32	2.90	5.75
G	Bromus japonicus (a)	-	-	<sub>a</sub> -	<sub>a</sub> 3	<sub>a</sub> 11	<sub>b</sub> 39	-	.00	.02	1.64
G	Bromus tectorum (a)	-	-	<sub>b</sub> 276	<sub>a</sub> 157	<sub>b</sub> 276	<sub>a</sub> 201	7.47	1.51	17.86	4.84
G	Elymus cinereus	-	-	7	-	3	4	.03	.00	.03	.03
G	Oryzopsis hymenoides	-	-	-	-	-	2	-	-	-	.00
G	Poa fendleriana	-	-	-	-	3	-	-	-	.00	-
G	Poa secunda	<sub>a</sub> 38	<sub>cd</sub> 141	<sub>ab</sub> 84	<sub>d</sub> 169	<sub>bc</sub> 125	<sub>d</sub> 185	2.37	5.51	4.14	6.34
G	Sitanion hystrix	<sub>a</sub> 13	<sub>ab</sub> 25	<sub>b</sub> 33	<sub>b</sub> 36	<sub>a</sub> 11	<sub>ab</sub> 29	.92	.60	.10	.53
Total for Annual Grasses		0	0	276	160	287	240	7.47	1.51	17.88	6.49
Total for Perennial Grasses		171	292	261	322	249	406	6.72	9.02	8.07	15.40
Total for Grasses		171	292	537	482	536	646	14.19	10.53	25.96	21.89
F	Agoseris glauca	-	9	2	-	1	-	.01	-	.00	-
F	Allium acuminatum	3	-	-	2	3	4	-	.00	.00	.03
F	Alyssum alyssoides (a)	-	-	<sub>a</sub> 18	<sub>a</sub> 20	<sub>b</sub> 156	<sub>c</sub> 215	.04	.07	2.14	1.86
F	Arabis sp.	-	1	-	6	4	3	-	.03	.03	.01
F	Astragalus cibarius	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 113	<sub>a</sub> 17	<sub>a</sub> 4	-	3.39	.25	.03
F	Astragalus convallarius	8	6	3	10	1	2	.00	.04	.03	.00
F	Astragalus sp.	2	-	5	-	-	-	.01	-	-	-
F	Calochortus nuttallii	1	-	-	-	-	2	-	-	-	.00
F	Collinsia parviflora (a)	-	-	<sub>a</sub> 15	<sub>b</sub> 103	<sub>b</sub> 65	<sub>a</sub> 14	.02	1.18	.29	.03
F	Collomia linearis (a)	-	-	<sub>ab</sub> 18	<sub>c</sub> 76	<sub>b</sub> 36	<sub>a</sub> 4	.09	.40	.07	.00
F	Crepis acuminata	<sub>ab</sub> 8	<sub>b</sub> 13	<sub>ab</sub> 7	<sub>ab</sub> 6	<sub>a</sub> 2	<sub>ab</sub> 6	.06	.06	.15	.01
F	Descurainia pinnata (a)	-	-	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 10	<sub>a</sub> -	-	-	.03	-
F	Draba sp. (a)	-	-	-	2	1	-	-	.03	.00	-
F	Epilobium brachycarpum (a)	-	-	1	-	-	-	.00	-	-	-
F	Erigeron pumilus	7	3	-	-	-	2	-	-	-	.00
F	Gayophytum ramosissimum(a)	-	-	-	4	-	-	-	.03	-	-
F	Holosteum umbellatum (a)	-	-	<sub>a</sub> -	<sub>b</sub> 11	<sub>a</sub> 3	<sub>a</sub> -	-	.08	.00	-
F	Lappula occidentalis (a)	-	-	-	-	4	-	-	-	.01	-

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'07	'12	'96	'01	'07	'12
F	Lomatium triternatum	-	-	3	1	-	1	.00	.00	-	.00
F	Lupinus argenteus	a <sup>-</sup>	a <sup>-</sup>	ab <sup>2</sup>	b <sup>19</sup>	a <sup>1</sup>	a <sup>3</sup>	.15	.14	.03	.01
F	Microsteris gracilis (a)	-	-	a <sup>-</sup>	b <sup>13</sup>	ab <sup>11</sup>	ab <sup>2</sup>	-	.03	.02	.00
F	Orthocarpus sp. (a)	-	-	a <sup>4</sup>	b <sup>36</sup>	a <sup>-</sup>	a <sup>-</sup>	.08	.42	-	-
F	Phlox longifolia	a <sup>-</sup>	c <sup>23</sup>	a <sup>2</sup>	bc <sup>23</sup>	ab <sup>6</sup>	ab <sup>7</sup>	.00	.07	.09	.01
F	Ranunculus testiculatus (a)	-	-	-	1	-	-	-	.00	-	-
F	Senecio integerrimus	-	-	-	2	-	-	-	.03	-	-
F	Taraxacum officinale	-	-	-	1	-	-	-	.03	-	-
F	Tragopogon dubius (a)	-	-	-	-	-	3	-	-	-	.00
F	Unknown forb-perennial	b <sup>16</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	-	-	-	-
F	Vicia americana	-	4	-	-	6	2	-	-	.03	.00
Total for Annual Forbs		0	0	56	266	286	238	0.23	2.26	2.57	1.91
Total for Perennial Forbs		45	59	24	183	41	36	0.25	3.81	0.64	0.14
Total for Forbs		45	59	80	449	327	274	0.50	6.08	3.21	2.05

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

#### BROWSE TRENDS--

Management unit 07, Study no: 7

Type	Species	Strip Frequency				Average Cover %			
		'96	'01	'07	'12	'96	'01	'07	'12
B	Artemisia tridentata vaseyana	94	92	65	82	32.32	31.06	14.80	17.68
B	Chrysothamnus viscidiflorus viscidiflorus	1	1	0	0	.00	.03	-	.01
B	Opuntia sp.	5	3	5	4	.03	.03	.03	.04
B	Purshia tridentata	9	9	10	9	1.14	1.87	.50	.04
Total for Browse		109	105	80	95	33.51	33.00	15.34	17.77

#### CANOPY COVER, LINE INTERCEPT--

Management unit 07, Study no: 7

Species	Percent Cover	
	'07	'12
Artemisia tridentata vaseyana	27.41	25.25
Opuntia sp.	.05	.05
Purshia tridentata	2.38	1.35

#### KEY BROWSE ANNUAL LEADER GROWTH--

Management unit 07, Study no: 7

Species	Average leader growth (in)	
	'07	'12
Artemisia tridentata vaseyana	1.5	2.2

BASIC COVER--

Management unit 07, Study no: 7

Cover Type	Average Cover %					
	'84	'90	'96	'01	'07	'12
Vegetation	2.00	6.50	50.12	50.18	47.82	50.22
Rock	.25	1.25	1.44	1.78	1.41	2.75
Pavement	1.75	3.75	.66	1.12	1.39	1.56
Litter	69.50	66.25	58.95	50.43	38.41	51.00
Cryptogams	13.25	14.00	4.69	7.43	1.18	3.23
Bare Ground	13.25	8.25	7.22	18.03	9.60	5.96

SOIL ANALYSIS DATA --

Management unit 07, Study no: 7, Study Name: Provo River Canyon

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
14.7	6.6	41.8	27.4	30.7	3.6	23.2	275.2	0.4

PELLET GROUP DATA--

Management unit 07, Study no: 7

Type	Quadrat Frequency				Days use per acre (ha)		
	'96	'01	'07	'12	'01	'07	'12
Rabbit	9	31	36	16	-	-	-
Elk	2	-	-	-	3 (7)	5 (13)	6 (15)
Deer	30	26	26	28	35 (86)	30 (74)	29 (71)
Cattle	-	-	3	1	1 (3)	11 (27)	3 (7)

BROWSE CHARACTERISTICS--

Management unit 07, Study no: 7

Year	Plants per Acre (excluding seedlings)	Age class distribution			Seedling (plants/acre)	Utilization		% poor vigor	Average Height Crown (in)
		% Young	% Mature	% Decadent		% moderate	% heavy		
<b>Amelanchier alnifolia</b>									
84	0	0	0	-	-	0	0	0	-/-
90	0	0	0	-	-	0	0	0	-/-
96	0	0	0	-	-	0	0	0	-/-
01	0	0	0	-	20	0	0	0	-/-
07	0	0	0	-	-	0	0	0	-/-
12	0	0	0	-	-	0	0	0	-/-
<b>Artemisia tridentata vaseyana</b>									
84	6332	5	62	33	199	40	36	12	33/28
90	6065	14	29	57	66	45	19	30	30/27
96	4120	3	77	20	20	37	5	3	34/51
01	4280	2	61	37	-	32	7	22	36/43
07	2660	2	50	48	20	32	12	32	37/45
12	2600	0	60	40	20	54	10	49	36/44

		Age class distribution					Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)	
<i>Chrysothamnus viscidiflorus viscidiflorus</i>										
84	<b>332</b>	20	40	40	-	0	0	0	11/10	
90	<b>265</b>	0	75	25	-	0	0	50	12/14	
96	<b>20</b>	100	0	0	-	0	0	0	-/-	
01	<b>20</b>	0	100	0	-	0	0	0	-/-	
07	<b>0</b>	0	0	0	-	0	0	0	10/13	
12	<b>0</b>	0	0	0	20	0	0	0	9/9	
<i>Opuntia sp.</i>										
84	<b>66</b>	0	100	-	-	0	0	0	6/21	
90	<b>133</b>	0	100	-	-	0	0	0	6/7	
96	<b>200</b>	0	100	-	-	10	0	0	6/22	
01	<b>60</b>	0	100	-	-	0	0	0	5/18	
07	<b>120</b>	17	83	-	-	0	0	0	5/9	
12	<b>100</b>	0	100	-	-	0	0	20	4/8	
<i>Purshia tridentata</i>										
84	<b>865</b>	0	23	77	-	0	92	38	33/34	
90	<b>532</b>	12	0	88	-	25	63	75	-/-	
96	<b>180</b>	0	89	11	-	11	67	0	25/47	
01	<b>240</b>	0	100	0	-	33	50	0	29/42	
07	<b>200</b>	0	60	40	-	10	80	10	32/37	
12	<b>200</b>	0	90	10	-	0	100	30	27/29	



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