UTAH BIG GAME RANGE TREND STUDIES

2007 Volume 2

Central Region

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REPORT FOR FEDERAL AID PROJECT W-82-R-52

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

UTAH BIG GAME
RANGE TREND STUDIES
2007 Volume 2

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* indicates study was not read in 2007, because it was suspended, replaced by another study, or was not accessible. Maps, discussions, and tables for these studies are available at http://www.wildlife.utah.gov/range/.

PROGRAM NARRATIVE

State: UTAH Project Number: W-82-R

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 Division's 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 BLM and 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 Division 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 2002 field season and reported in this publication involves the reading of interagency range trend studies in the DWR Central Region. Trend studies surveyed in these management units were established in 1983, 1989, 1990, 1997, 1998, and 2002, with rereads in 1989, 1990, 1997, 1998, 1999, and 2002.

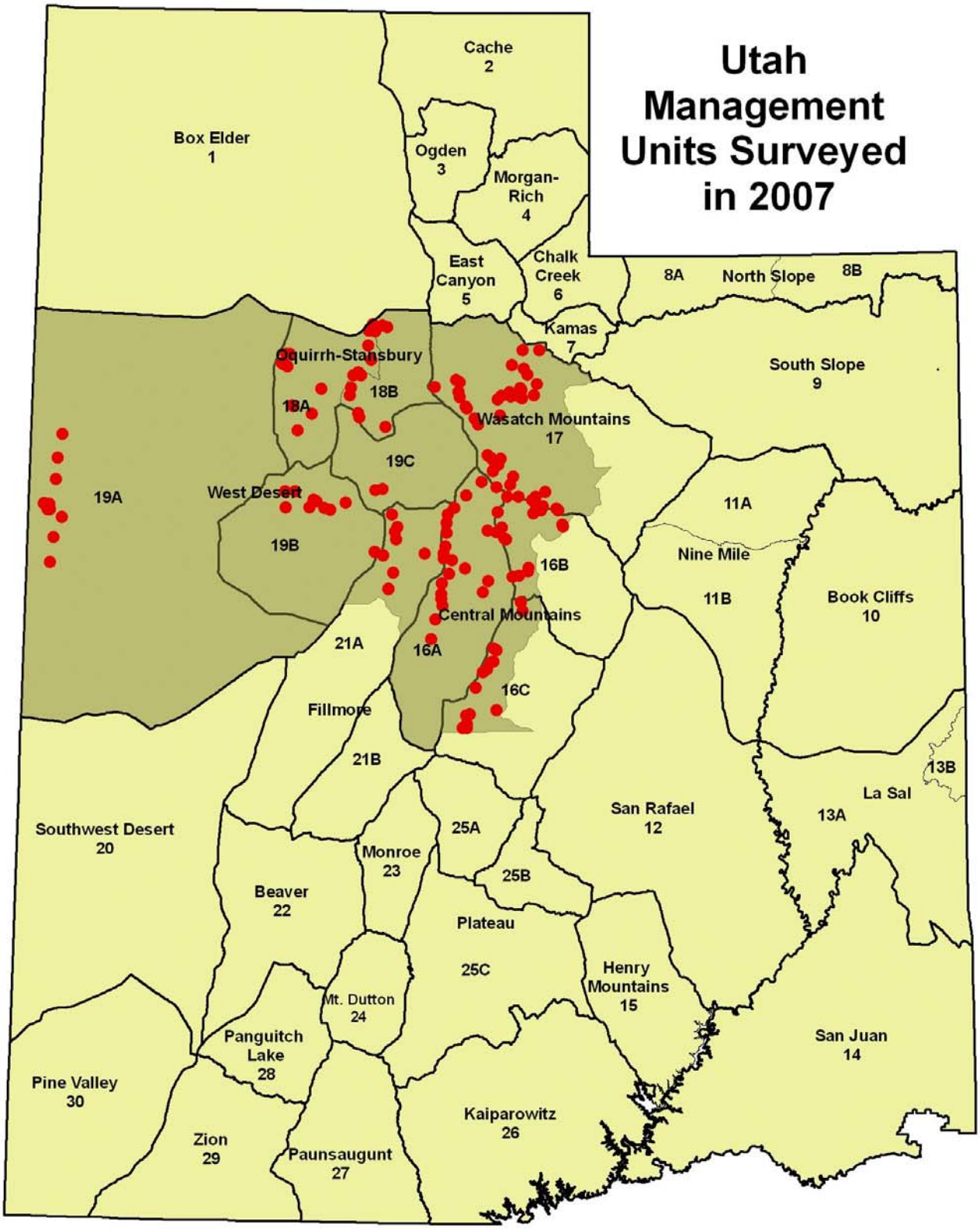
The following Bureau of Land Management and U.S. Forest Service offices provided information and/or assistance in completion of the trend studies which add to the value of this interagency report:

Bureau of Land Management Salt Lake Field Office

Bureau of Land Management Fillmore Field Office

Uinta National Forest
Spanish Fork Ranger District

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


Utah
Management
Units Surveyed
in 2007
Cache
2
Box Elder
1
Ogden
3
Morgan-
Rich
4
East
Canyon
5
Chalk
Creek
6
8A
North Slope
8B
Kamas
7
South Slope
9
Oquirrh-Stansbury
18B
18A
Wasatch Mountains
17
19C
19A
West Desert
19B
11A
Nine Mile
16B
11B
Book Cliffs
10
Central Mountains
21A
16A
16C
Fillmore
21B
13B
La Sal
13A
San Rafael
12
Southwest Desert
20
25A
Monroe
23
25B
Beaver
22
Plateau
25C
Henry
Mountains
15
Mt. Dutton
24
San Juan
14
Panguitch
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Pine Valley
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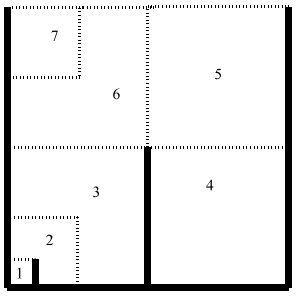
RANGE TREND STUDY METHODS

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 vegetative 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 have 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 critical 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 beginning baseline stake, is marked with a metal tag for proper identification of the transect.

Vegetative composition

Determining vegetational characteristics for each “key” area is determined by setting up 5 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^2 quadrat is centered every 5 feet along the same side of the belt, starting at the 5 foot mark. Cover and nested frequency values are determined for vegetation, litter, rock, pavement, cryptogams, and bare ground. Cover and nested frequency values are also estimated for all plant species occurring within a quadrat, including annual species.

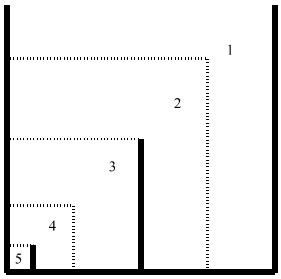
Cover is determined using an ocular cover estimation procedure using 7 cover classes (Bailey and Poulton, 1968, Daubenmire 1969). The seven cover classes are: 1) .01-1%, 2) 1.1-5%, 3) 5.1-25%, 4) 25.1-50%, 5) 50.1-75%, 6) 75.1-95%, and 7) 95.1-100%. For example, to estimate vegetative cover with this method, an observer would visualize which cover class all the vegetation would fit into if the plants were moved together until they were touching. To quantify percent cover for bare ground, litter, rock, pavement, and cryptogams, the observer would visually estimate which cover class could accommodate all of the specified cover type within the quadrat. These numbers are then recorded. To determine percent cover for each belt, the midpoint for each cover class value observed is summed and divided by the number of sampling quadrats (20). The mean for the five belts is the average for a given site.



Cover Classes
1/4 m^2 Quadrat

Total canopy cover of shrubs or trees is estimated using the line-intercept method. The distance along each belt covered by a particular species of tree or shrub is divided by the total length of the line to give percent canopy cover. Prior to 2002, only canopy cover above eye level was estimated.

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



Nested Frequency
1/4 m² 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 by themselves and do not necessarily indicate changes in composition and/or distribution of key plant species.

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

Shrub 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 placed in the following five classes. ([1]U.S. Department of Interior Bureau of Land Management 1996).

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 9 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.

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 4 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 at two hundred foot intervals along the baseline. Three hundred feet are added to the end of the transect so that five, 200 foot point-quarter centers can be read. This allows sampling trees on a much larger scale. The strip method that is used to estimate shrub density, can in most cases, effectively inventory seedling and young tree densities. However, the strip method is less effective at estimating densities of mature trees that are often widely disbursed.

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 larger sample will better reflect changing trends in shrub populations. 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. Particular attention is given to woody plants and their important role as indicators on critical 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 decadent plants, and the percentage of decadent plants that are classified as dying
3) biotic potential or proportion of seedlings to the population
4) proportion of young plants in population
5) proportion of individuals moderately or heavily browsed
6) proportion of plants in poor vigor
7) changes in height and crown diameter measurements for mature age class
8) changes in browse species composition
9) strip frequency values
10) proportion of cover contributed by key species

Trends in herbaceous plants as a group or as a single "key" species can be determined by comparing the sum of nested frequency values between readings. Attention is also given to changes in species composition of grasses and forbs through time. A non-parametric statistical test (Friedman test which is analogous to analysis of variance) (Conover 1980) is conducted on nested frequencies of each species to determine significant changes at alpha = .10. Ground cover parameters are analyzed and compared in the discussions of the reread studies. Trends for soil are determined by comparing basic ground cover measurements and cover composition (herbs vs shrubs) between years as well as comparing photos and observer observations between readings. A ratio of the nested frequency values of protective cover types (vegetation, litter, and cryptogams) to bare soil can also be used to help determine changes in soil trend. Beginning in 2002, an erosion condition class assessment adapted from the Bureau of Land Management is also completed on each study site to provide additional qualitative information on soil condition. On newly established studies, a more subjective or apparent assessment is made from qualitative comparisons.

The following tables and partial tables are taken from study number 23-1 to help illustrate some basic comparisons that can be made with the data. The "Herbaceous Trends" table summarizes average cover and

nested frequency data for individual grass and forb species. The table contains all the grass and forb species that have been sampled on study 23-1. Readings prior to mid-1992 include only nested frequency data for *perennial* species. Beginning in mid-1992, all trend studies have data for perennial and annual species as well as cover estimates for individual species.

In the following example, grasses had a combined total cover value of 11.39% in 1998 and 7.08% in 2003. In 1985 and 1991, bluebunch wheatgrass (*Agropyron spicatum*) had a nested frequency value of 227 out of a possible nested frequency score of 400. By 1998, nested frequency declined to 183. The subscript letters indicate that the nested frequency value for *A. spicatum* between 1991 and 1998 declined significantly. Nested frequency declined to 160 in 2003, but the subscript letters indicate that this was not a significant change. Cover was estimated at 7.78% for *A. spicatum* in 1998 declining to 5.59% in 2003. Trend for this grass is down over the life of the transect due to a significant decline in sum of nested frequency since 1991.

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

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

Values with different subscript letters are significantly different at alpha = .10 (annuals excluded)

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

The following "Browse Trends" table summarizes strip frequency and cover for all shrub species occurring on this site. All of the shrubs encountered at study number 23-1 are listed. For example, mountain big sagebrush (*Artemisia tridentata vaseyana)* had a strip frequency of 40 out of a possible 100 in 1998, declining to 26 in 2003. Average cover is determined using cover classes in conjunction with the $1/4m^2$ quadrat and estimating the percent of the quadrat covered. In this case, mountain big sagebrush cover was estimated to be 2.54% in 1998, declining to only 0.76% in 2003.

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

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

To more accurately estimate canopy cover of trees and shrubs, the line-intercept method is used along each 100 foot belt. This data is reported in the "Canopy Cover, Line Intercept" table. For example, Utah juniper (*Juniperus osteosperma*) had an estimated average cover of 23.31% in 2003. Prior to 2002, only trees species were sampled in the line-intercept transect. Beginning in 2002, all woody species are included in the line-intercept transect and a canopy cover value for each is determined. Live browse cover is measured along the belt transects and converted to percent cover. Gaps of six inches or more lacking live browse cover are excluded.

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

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

Beginning in 2002, annual leader growth of the key browse species is measured to get an idea of shrub production and vigor. This data is displayed in the "Key Browse Annual Leader Growth" table. For example, annual leaders on bitterbrush (*Purshia tridentata*) averaged 4 inches in length while mountain big sagebrush leaders averaged only 1.1 inches in 2003.

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

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

The following "Point-Quarter Tree Data" table displays tree density estimates using the point-center quarter method which better estimates density of widely disbursed trees than the shrub density strips. Average basal diameter is also listed in inches. Data from 2003 estimated 197 juniper and 119 pinyon trees/acre with average basal diameters of 7.0 inches and 5.3 inches respectively.

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

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

The "Basic Cover" table summarizes average cover of vegetation, rock, pavement, litter, cryptogams, and bare ground. Average cover prior to mid-1992 adds up to only 100%, while cover with the current method (post mid-1992) estimates several layers of plant and ground cover and will usually exceed 100%. For vegetation cover, the previous method only determined basal vegetative cover (2.0 and 5.75), while the new method estimates the vertical projection of the crown, or aerial cover (30.04 and 32.5%). Therefore, comparisons can be made for all cover measurements except for general vegetation cover.

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

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

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. Average soil temperature is taken from the deepest probe, one at each of the 5 baseline starting stakes. The temperature is listed in the table as the top measurement (e.g., 62.3°F), with the average depth (in inches) as the lower measurement (12.7). Average soil temperature is re-measured with each reading and the most current soil temperature and depth is listed in the soil analysis table. Chemical and textural characteristics are also listed and were determined by laboratory analysis of a composite soil sample taken near each of the 5 baseline starting stakes.

SOIL ANALYSIS DATA --
Management unit 23, Study # 01, Study Name: Bear Ridge

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
11.2	62.3 (12.7)	7.3	40.0	33.4	26.6	3.4	9.0	57.6	0.5

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

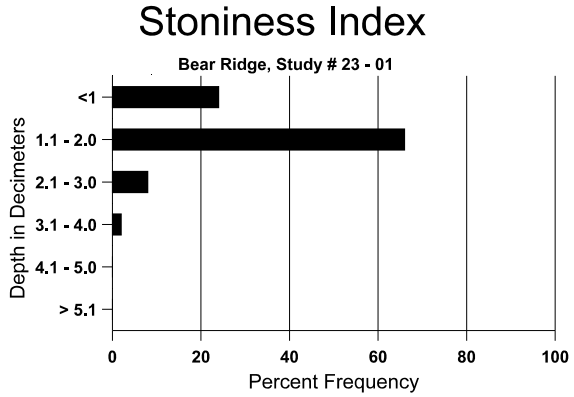
Ultra acid	< 3.5
Extremely acid	3.5-4.4
Very strongly acid	4.5-5.0
Strongly acid	5.1-5.5
Moderately acid	5.6-6.0
Slightly acid	6.1-6.5
Neutral	6.6-7.3
Slightly alkaline	7.4-7.8
Moderately alkaline	7.9-8.4
Strongly alkaline	8.5-9.0
Very strongly alkaline	> 9.1

Percent organic matter (% OM) refers to the amount of organic matter in the top 12 inches of the soil profile. Parts per million (ppm) of phosphorus (P) and potassium (K) are also included. Values for phosphorus and potassium less than 10 ppm and 70 ppm respectively may be limiting to plant growth and development (Tiedemann and Lopez 2004).

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

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

To determine how rock is distributed throughout the upper soil profile, a stoniness index is determined for each study site. Depth to the nearest rock is estimated on the first 10 feet (at one-foot intervals) along each of the 5 baselines, which allows 50 measurements. These data are then analyzed for each of the 5 incremental decimeter measurements, making it possible to visually determine the proportion (relative percent of rock at each depth) of rock from <1 decimeter to >5 decimeters. In the following example, most of the rock in the soil profile (~65%) was encountered in the 1 to 2 decimeter (4 to 8 inch) depth range. The distribution of rock in the soil profile can be an important factor for what is growing on the site.



The "Pellet Group Data" table summarizes the frequency of animal pellets sampled within the 100 quadrats placed along the sampling belts as well as data from a pellet group transect read parallel to the study site baseline. Quadrat frequency of wildlife and livestock droppings is included in reports done prior to mid-1992. For example in 1998, rabbit pellets were found in 25% of the quadrats placed on study 23-1, increasing to 32% in 2003. Quadrat frequency of rabbit or big game pellets indicate a relative amount of use by that particular animal. This data can help characterize changes in wildlife use patterns on the site.

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

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

It was determined that additional information on pellet groups was necessary. Therefore, a pellet group transect is now sampled in conjunction with the vegetative transects. The pellet group transect utilizes 50, 100ft^2 circular plots which are placed through the study area. These are usually two parallel transects of 25 plots on each side of the vegetative transect which runs 500 feet in length. The number of recent pellet groups for wildlife (usually deer and elk) and pats for cattle are recorded. That number is then converted to days use per acre. In the above example, deer days use/acre was estimated at 51 in 1998 increasing slightly to 54 in 2003. If a trend study needs to be read annually and more precision is required, the pellet group transect is marked permanently (rebar) and the pellet groups within the circular plots are removed or marked after being counted.

The “Browse Characteristics” table summarizes characteristics of the shrub community on study 23-1. Only mountain big sagebrush is included in this example. The sagebrush population is characterized by age class, vigor, utilization, and average height and crown for mature plants. Total density in plants/acre for mountain big sagebrush, excluding seedlings, was 1,400 in 1985, 1,065 in 1991, 1,100 in 1998, and 840 plants/acre in 2003. Seedlings are excluded from the population estimate because with summer drought, many will die by late fall causing great fluctuations in population estimates between sampling dates. Since mid-1992, a larger shrub sample (more than three times larger) is used to better characterize the shrub populations. Therefore, changes in density (before and after 1992) may not necessarily indicate changes in trend, especially shrub populations that characteristically are clumped and/or have discontinuous distributions. The earlier smaller sample could easily either overestimate or underestimate shrub populations. Other characteristics like percent of the population classified as dying, percent decadence, percent of the population displaying poor vigor, percent heavy hedging, young recruitment, etc. should be given more weight in determining shrub trend when comparing survey years where sample sizes are different.

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

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

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

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

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

Range trend data has been collected throughout Utah since 1982. In addition to determining trends on winter ranges, a system to determine the condition of these areas was needed. The desirable components index (DCI) was created by Range Trend Project personnel as a tool to address condition and/or value of winter ranges for mule deer. This subjective index is used primarily to determine if a particular site has the vegetation components necessary to be a good winter range for mule deer. Winter range condition is scored based upon several important vegetation components such as, preferred browse cover, shrub decadence and young recruitment, cover of perennial grasses, perennial forbs, and annual grasses (Clements and Young 1997; Olson 1992; Plummer et al. 1968; Stevens 2004; Wasley 2004). This index is used as one of many factors in deer herd management. It can also be used to identify areas where habitat restoration projects may be needed and assist land managers in determining possible rehabilitation options.

Ideal mule deer winter range provides 12-20% of preferred browse cover, shrub decadence is 20% or less, and has 10% or more of the shrub population that is young. The herbaceous understory contains 8-15% perennial grass cover, 5% perennial forb cover, and less than 5% annual grass cover. The DCI ratings are divided into three categories of winter range based different ecological potential, these include: Lower potential sites (Wyoming big sagebrush and desert shrubs), Mid-level potential (mountain big sagebrush), and High potential (mountain brush communities).

Desirable Components Index Ratings

Lower potential sites (Wyoming Big Sagebrush and Desert Shrub Communities)

> 65 points =	Excellent
45 – 64	Good
25 – 44	Fair
10 – 24	Poor
< 10	Very poor

Mid level potential sites (Mountain Big Sagebrush)

> 80 points =	Excellent
79 – 65	Good
64 – 50	Fair
49 – 35	Poor
< 35	Very poor

Higher potential sites (Mountain Brush Communities)

> 90 points =	Excellent
89 – 70	Good
69 – 55	Fair
54 – 40	Poor
< 39	Very poor

(Black sagebrush and Basin big sagebrush will be placed in Wyoming or Mountain big sagebrush scales based on precipitation and elevation).

Desirable Components Index Scoring

Preferred Browse (60 points)
(Preferred Browse species are favorable or critical to deer)

Preferred Browse Cover (30 pts. possible)
1.5 points for each 1% of preferred browse cover (maximum is 20% or 30 points)

Percent Decadence* (15 points possible)
-0.3 points for each 1% decadence (do not exceed 15 points)

Percent Young* (15 points possible)
0.5 points for each 1% of young

Herbaceous Understory (40 points)

Perennial Grass Cover (30 points possible)
2 points for each 1% cover

Perennial Forb Cover (10 points possible)
2 points for each 1% cover

Annual Grass Cover (-20 points possible)
-0.75 points for each 1% cover

Noxious Weeds (State List)
-2 points for each species present

*If the total preferred browse cover for the year is below 5%, then no points are awarded for percent young in population and percent decadence.

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

A discussion of the study site includes descriptions of the site's physical characteristics (elevation, slope, aspect), soil, ground cover, vegetative 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 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 (2,134 m) 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 (2,134 to 2,289 m) 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 have 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 pose a difficulty in this unit. Kennecott Copper Corporation, the largest single land owner, allows very limited hunting access for elk and deer hunting.

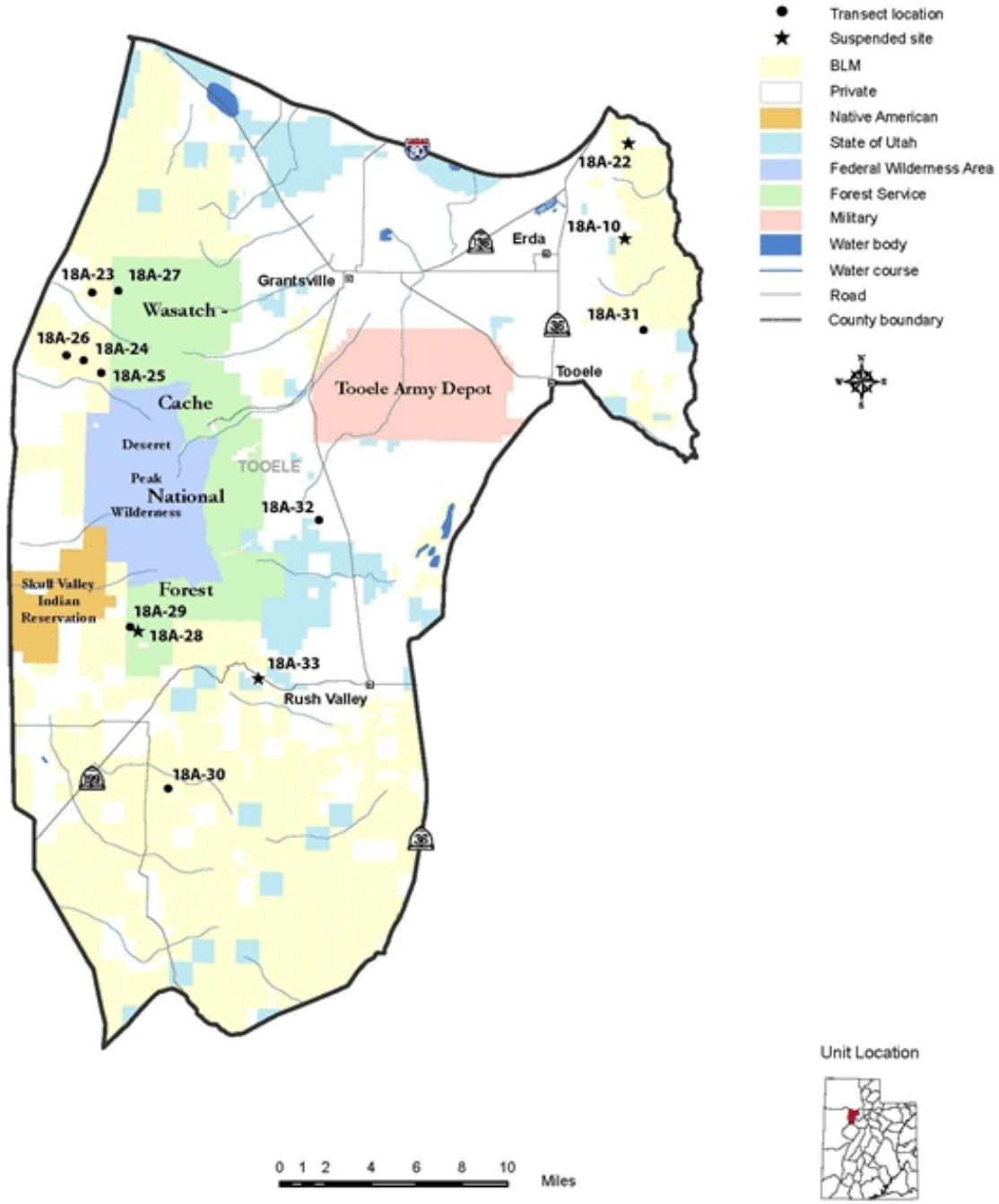
The Stansbury Mountains winter range is located below 6,800 feet (2,073 m) and makes up approximately 55% of the big game range. Summer range is limited to about 6,800 to 7,000 feet (2,073 to 2,134 m). The proportion of private lands on this big game habitat are 6% of the summer and 14% of the winter ranges. Although the overall winter range condition is generally more satisfactory than that of the Oquirrh Mountains, there is a high abundance invasive weeds restricting the reproduction and establishment of browse species.

Big Game Management Objectives

The estimated winter mule deer herd populations for the unit were 8,850 deer in 2002, 9,100 in 2003, 9,400 in 2004, and 10,250 in 2005 with an average of 12.3 bucks per 100 does from 2003 to 2005. The post-season fawn:doe ratio has averaged 61:100 since 1999. The current management objective for deer is a target herd winter population of 10,600 with a composition of 15 to 20 bucks per 100 does (Hersey and McLaughlin 2005).

The estimated winter elk herd populations in the entire unit from 2002 to 2004 were 700 elk and 740 in 2005. The current management objective for elk is a target herd winter population of 800 (Hersey and McLaughlin 2006).

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

Nine studies were originally established in the subunit in 1983. Since 1983, four studies were added for a total of 13, but four were suspended in 2002. In 2007, nine studies were sampled.

Trend Study 18A-23-07

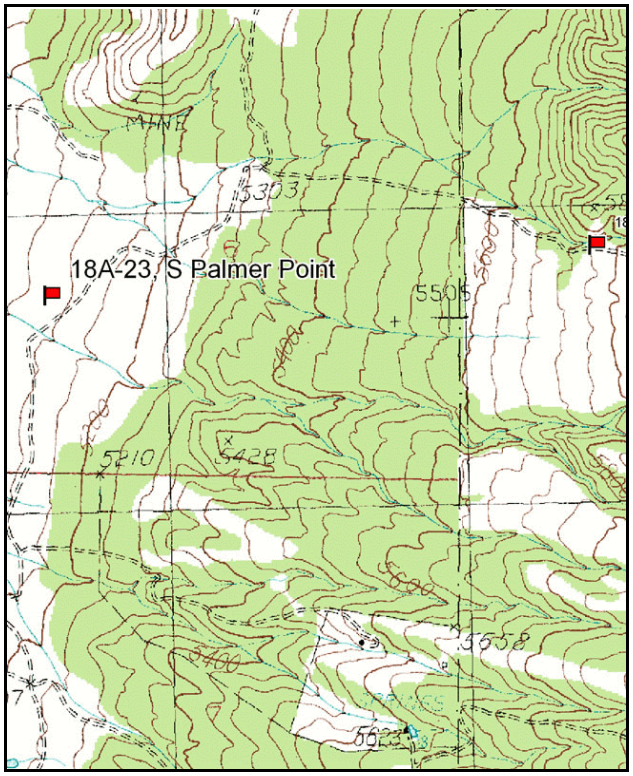
Study site name: South Palmer Point . Vegetation type: Big Sagebrush-Grass .

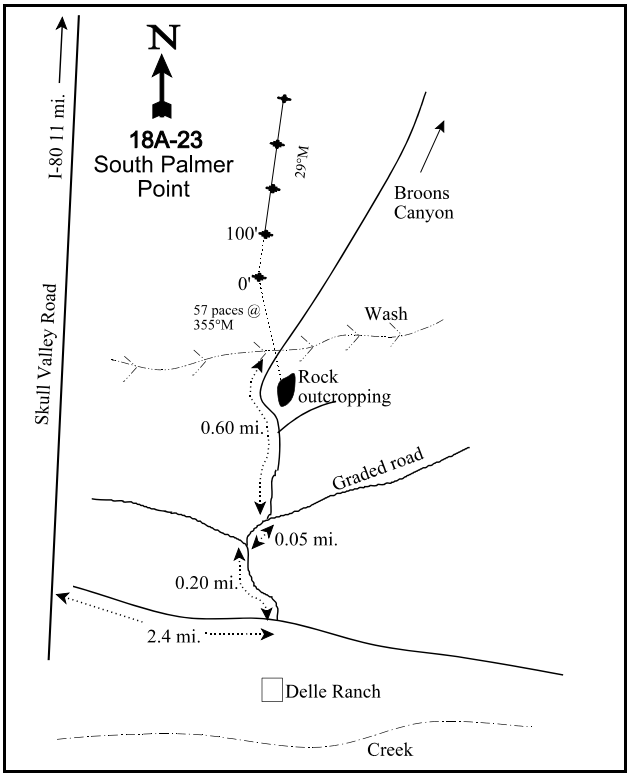
Compass bearing: frequency baseline 14 degrees magnetic.

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

LOCATION DESCRIPTION

From I-80, proceed south on Skull Valley Road for 11 miles. Turn east of a dirt road (between mile posts 24 and 25) 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 0.20 miles to an intersection. Go east for 0.05 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 355 degrees magnetic (across the road and a dry wash), to the 0-foot baseline stake. The baseline runs at an azimuth of 29 degrees magnetic, and is marked by green steel "T" fenceposts approximately 12 to 19 inches high. The 0-foot baseline stake has a red browse tag, number 3984, attached.





Map Name: Salt Mountain

Diagrammatic Sketch

Township 3S , Range 7W , Section 6

GPS: NAD 83, UTM 12T 357520 E 4493900 N

DISCUSSION

South Palmer Point - Trend Study No. 18A-23

Study Information

This study monitors deer winter range dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and Utah juniper (*Juniperus osteosperma*) [elevation: 5,100 feet (1,554 m), slope: 5%, aspect: west]. This land is administered by the Bureau of Land Management. The study was sampled in the summer of 2004 to assess pre-treatment conditions, and in November 2004, 780 acres (316 ha) surrounding the study were aerially seeded with sagebrush and perennial grasses and forbs as part of the Round Canyon treatment (Table 1). After the seeding, bullhogs were used to reduce the density of junipers. Deer use was light-moderate in 1997, with some light cattle use also evident. Pellet group data indicated 23 deer days use/acre (57 ddu/ha) in 2002, 13 days use/acre (31 ddu/ha) in 2004, and 14 days use/acre (35 ddu/ha) in 2007.

Soil

The soil is classified within the Abela series (USDA-NRCS 2007). Soils in this series are deep and well-drained. The parent material consists of a combination of limestone, sandstone, and quartzite, which were alluvially deposited from the canyon to the east. The soil texture is a loam with a moderately alkaline reaction (pH 7.9). The soil phosphorus is low at 3.4 ppm. Values less than 6 ppm may limit normal plant growth and development (Tiedemann and Lopez 2004). Relative bare ground cover has ranged from 9% to 17% since 1997. Protective ground cover is abundant enough to prevent most erosion. The erosion condition was stable in 2002 and 2007.

Browse

Wyoming big sagebrush is the primary browse species, and its cover has fluctuated between 10% and 12% since 1997. Previous to the bullhog treatment, density estimates ranged from 966 plants/acre (2,386 plants/ha) to 3,820 plants/acre (9,435 plants/ha). Density increased dramatically following the treatment, from 2,840 plants/acre (7,015 plants/ha) in 2004 to 7,200 plants/acre (17,791 plants/ha) in 2007. Decadence reached a peak of 83% in 1989, and declined to 8% by 2007. Recruitment was good in 1997, with 40% of the population consisting of young plants, but recruitment decreased to 7% by 2004. Following the bullhog treatment, young recruitment was high, constituting 65% of the population. Dead plants were abundant when they were first sampled in 1997, indicating that a die-off occurred in the past. Post-treatment data show a 57% decrease in dead plant abundance from 2004 to 2007. Vigor has been good on the majority of plants since 1997. Use was moderate-heavy in 1983, moderate in 1989, and light from 1997 to 2007. Annual leader growth averaged 3.4 inches (8.6 cm) in 2002 and 2004, but decreased to 1.4 inches (3.6 cm) in 2007.

Total canopy cover of Utah juniper increased from 5% in 1997 to 13% in 2004. Juniper cover decreased to 4% in 2007 following treatment. Density in 2002 and 2004 was 72 and 73 trees/acre (178 and 180 trees/ha), respectively, but the treatment only reduced the density to 68 trees/acre (168 trees/ha). Average tree diameter decreased from 12.3 inches (31.2 cm) in 2004 to 6.4 inches (16.3 cm) in 2007. The broom snakeweed (*Gutierrezia sarothrae*) population decreased from 2,600 plants/acre (6,425 plants/ha) in 2002 to 460 plants/acre (1,137 plants/ha) in 2004. This population increased to 860 plants/acre (2,125 plants/ha) in 2007.

Herbaceous Understory

The most common grasses are Sandberg bluegrass (*Poa secunda*) and cheatgrass (*Bromus tectorum*). Other grasses, such as bluebunch wheatgrass (*Agropyron spicatum*) and bottlebrush squirreltail (*Sitanion hystrix*) occur infrequently. Perennial grass cover has remained relatively stable at 7%-9% since 1997, while cheatgrass cover has increased from 9% in 1997 to 13% in 2002 and 18% in 2007. It comprised two-thirds of the total grass cover in 2007. This fine-fuel cover is high enough to create a potential fire hazard. The majority of forbs present are low growing species of rather poor forage value. However, western yarrow (*Achillea millefolium*), Lewis flax (*Linum lewisii*), and alfalfa (*Medicago sativa*) were seeded in 2004 and were

first sampled in 2007. These species provide excellent forage for wildlife and livestock.

1989 TREND ASSESSMENT
The trend for browse is down. Sagebrush density decreased from 2,399 plants/acre (5,928 plants/ha) to 966 plants/acre (2,387 plants/ha). The plants classified with poor vigor increased from 47% to 72% of the population. Decadence also increased from 47% to 83%. Browse use decreased from heavy to moderate. The trend for grass is up. Sandberg bluegrass increased significantly in nested frequency, and the sum of nested frequency of perennial grasses increased by 55%. The trend for forbs is slightly up. The sum of nested frequency of perennial forbs increased, but many of the species present are weedy.

browse - down (-2) grass - up (+2) forb - slightly up (+1)

1997 TREND ASSESSMENT
The trend for browse is up. The density of sagebrush increased from 966 plants/acre (2,387 plants/ha) to 2,420 plants/acre (5,980 plants/ha). Decadence decreased from 83% to 20%, and young recruitment increased from 7% to 40%. Plants classified as having poor vigor declined from 72% to 11% of the population. Moderately hedged plants decreased from 83% to 14%. The trend for grass is stable. There was no significant change in the nested frequencies of perennial grasses. Cheatgrass accounted for 50% of the total grass cover and 41% of the total herbaceous cover. The trend for forbs is stable. The majority of the forb cover is derived from annuals and weedy species. One of the most common forb species is bur buttercup (*Ranunculus testiculatus*), which is an allelopathic annual (Buchanan et al. 1978). The Desirable Components Index (DCI) was rated as good due to favorable browse cover and an understory composed of some perennial grasses, but low cover of perennial forbs.

winter range condition (DCI) - good (54) Low potential scale
browse - up (+2) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT
The trend for browse is up. Sagebrush density increased from 2,420 plants/acre (5,980 plants/ha) to 3,820 plants/acre (9,439 plants/ha). Percent decadence decreased, and young plants remained abundant at 24% of the population. Vigor was good, and utilization remained light. Juniper canopy cover increased from 5% to 11%, and may warrant treatment in the future. The trend for grass is stable. The nested frequencies of perennial grasses and cheatgrass did not change significantly. The trend for forbs is down. These species were fairly diverse, but produced less than 2% total cover. The sum of nested frequency of perennial forbs decreased by 62% since 1997. The DCI was rated as fair-good due to the decrease in forb cover.

winter range condition (DCI) - fair-good (43) Low potential scale
browse - up (+2) grass - stable (0) forb - down (-2)

2004 TREND ASSESSMENT
The trend for browse is down. Sagebrush density decreased 26%, and decadence increased from 19% to 26%. Young recruitment was high in 1997 and 2002, but decreased to 7% of the population in 2004. Utilization remained light, and only 11% of the plants displayed poor vigor. Juniper canopy cover continued to increase from 11% to 13%. The trend for grass is slightly down. Cheatgrass remained abundant, although its cover changed little since 2002. The sum of nested frequency for perennial grasses decreased 13%. Perennial grass cover also decreased from 9% to 7%. The trend for forbs is slightly down. The sum of nested frequency for annual forbs slightly increased, and storksbill nested frequency increased significantly. Storksbill has been shown to outcompete and prevent the establishment of native species (Kimball and Schiffman 2003). Forb cover remained less than 2% and provided very little forage. The DCI was rated as fair due to increased decadence and decreased recruitment of preferred browse, cheatgrass abundance, and low forb cover.

winter range condition (DCI) - fair (28) Low potential scale
browse - down (-2) grass - slightly down (-1) forb - slightly down (-1)

2007 TREND ASSESSMENT

The trend for browse is up. Sagebrush density increased from 2,640 plants/acre (6,523 plants/ha) to 7,200 plants/acre (17,790 plants/ha) following the 2004 seeding. The majority of this increase was attributed to young plants, which increased in density from 180 plants/acre (445 plants/ha) to 4,700 plants/acre (11,614 plants/ha). The proportion of young plants in the population increased from 7% to 65%. Seedlings were also sampled for the first time since 1997 at a density of 7,200 seedlings/acre (17,790 seedlings/ha). Decadence decreased from 28% of the population to 8%, and vigor improved. Due to the treatment, juniper canopy cover decreased from 13% to 4%. The trend for grass is stable. There was a significant increase in the nested frequency of cheatgrass, while the nested frequencies of perennial grasses did not change significantly. However, the sum of nested frequency for perennial grasses increased 12%. The trend for forbs is up. Perennial forbs such as western yarrow, Lewis flax, and alfalfa were established due to the seeding. The sum of nested frequency for perennial forbs increased dramatically. Total forb cover increased from 2% to 9%. The DCI was rated as good due to increases in preferred browse and perennial forb cover.

winter range condition (DCI) - good (55) Low potential scale
browse - up (+2) grass - stable (0) forb - up (+2)

Table 1. Seed mix applied to the South Palmer Point study in 2004.

Round Canyon Seed Mix	
Seeded Species	Approximate Bulk lbs/acre
Siberian Wheatgrass “Vavilov”	2.00
Russian Wildrye “Bozoski”	2.00
Western Wheatgrass “Arriba”	2.00
Lewis Flax	1.00
Western Yarrow	0.25
Alfalfa “Ladak”	0.50
Total	7.75

HERBACEOUS TRENDS --
Management unit 18A, Study no: 23

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'04	'07	'97	'02	'04	'07
G	Agropyron cristatum	-	-	-	-	-	7	-	-	-	.22
G	Agropyron spicatum	$_{ab}$12	$_{a}$6	$_{ab}$11	$_{ab}$21	$_{ab}$19	$_{b}$26	.61	.93	1.27	1.61
G	Aristida purpurea	-	-	-	3	-	-	-	.03	-	-
G	Bromus tectorum (a)	-	-	$_{a}$308	$_{a}$301	$_{a}$308	$_{b}$347	8.61	12.80	12.14	18.24
G	Poa secunda	$_{a}$160	$_{c}$244	$_{bc}$224	$_{bc}$236	$_{ab}$195	$_{abc}$200	7.65	7.92	4.84	6.17
G	Sitanion hystrix	$_{a}$9	$_{ab}$31	$_{ab}$21	$_{ab}$10	$_{ab}$21	$_{b}$30	.29	.39	.75	.80
G	Vulpia octoflora (a)	-	-	-	-	-	2	-	-	-	.00
Total for Annual Grasses		0	0	308	301	308	349	8.61	12.80	12.14	18.24
Total for Perennial Grasses		181	281	256	270	235	263	8.56	9.28	6.86	8.82
Total for Grasses		181	281	564	571	543	612	17.17	22.09	19.01	27.07
F	Achillea millefolium	-	-	-	-	-	15	-	-	-	.36
F	Agoseris glauca	-	-	-	$_{a}$1	-	$_{a}$3	-	.00	-	.00
F	Alyssum alyssoides (a)	-	-	-	-	-	27	-	-	-	.18
F	Allium sp.	-	-	-	-	-	3	-	-	-	.00
F	Antennaria rosea	$_{ab}$12	$_{ab}$18	$_{a}$5	$_{a}$6	-	$_{b}$27	.06	.19	-	.51
F	Astragalus cibarius	$_{a}$9	$_{a}$12	$_{b}$36	-	$_{a}$5	-	1.39	-	.01	-
F	Astragalus lentiginosus	-	-	-	-	-	23	-	-	-	.72
F	Astragalus utahensis	$_{a}$7	$_{a}$13	$_{a}$15	$_{a}$1	$_{a}$1	$_{a}$7	.23	.00	.00	.19
F	Castilleja chromosa	$_{a}$3	-	-	-	-	$_{a}$2	-	-	-	.03
F	Calochortus nuttallii	$_{ab}$11	$_{ab}$19	$_{ab}$10	$_{a}$4	$_{a}$6	$_{b}$27	.03	.01	.01	.10
F	Chaenactis douglasii	$_{a}$1	$_{a}$4	$_{a}$8	-	-	-	.02	-	-	-
F	Cirsium undulatum	$_{ab}$5	$_{ab}$2	$_{b}$10	-	-	$_{a}$1	.13	-	-	.00
F	Comandra pallida	-	-	$_{a}$3	$_{a}$6	$_{a}$4	$_{a}$4	.01	.03	.03	.03
F	Collinsia parviflora (a)	-	-	$_{a}$4	$_{a}$3	-	-	.01	.00	-	-
F	Cryptantha sp.	-	3	-	-	-	-	-	-	-	-
F	Delphinium nuttallianum	-	-	-	-	1	-	-	-	.00	-
F	Draba sp. (a)	-	-	-	4	-	-	-	.00	-	-
F	Erodium cicutarium (a)	-	-	$_{a}$1	$_{a}$11	$_{b}$28	$_{b}$30	.03	.25	.39	.70
F	Holosteum umbellatum (a)	-	-	$_{b}$34	$_{ab}$18	$_{a}$5	$_{c}$153	.31	.09	.01	2.01
F	Lathyrus brachycalyx	$_{a}$10	$_{a}$24	-	-	-	$_{a}$10	-	-	-	.25
F	Lactuca serriola	-	$_{a}$7	$_{a}$8	-	-	$_{a}$20	.04	-	-	.07
F	Linum lewisii	-	-	-	-	-	53	-	-	-	1.76
F	Lygodesmia sp.	-	-	3	-	-	-	.01	-	-	-
F	Melilotus officinalis	-	-	-	-	-	1	-	-	-	.03

Type	Species	Nested Frequency						Average Cover %			
		'83	'89	'97	'02	'04	'07	'97	'02	'04	'07
F	Medicago sativa	-	-	-	-	-	1	-	-	-	.00
F	Microsteris gracilis (a)	-	-	$_{a}$1	$_{a}$4	$_{a}$1	$_{a}$4	.00	.01	.00	.01
F	Phlox longifolia	$_{a}$10	$_{b}$32	$_{ab}$24	$_{ab}$29	$_{ab}$21	$_{b}$40	.25	.16	.17	.53
F	Ranunculus testiculatus (a)	-	-	$_{ab}$154	$_{a}$122	$_{ab}$148	$_{b}$185	1.09	.44	1.28	1.48
F	Tragopogon dubius	-	-	$_{a}$7	-	-	$_{a}$1	.04	-	-	.00
F	Zigadenus paniculatus	-	-	$_{a}$1	$_{a}$2	$_{a}$-	$_{a}$1	.03	.06	.00	.00
Total for Annual Forbs		0	0	194	162	182	399	1.45	0.80	1.69	4.39
Total for Perennial Forbs		68	134	130	49	38	239	2.28	0.47	0.25	4.64
Total for Forbs		68	134	324	211	220	638	3.73	1.27	1.94	9.04

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	'97	'02	'04	'07
B	Artemisia tridentata wyomingensis	64	77	65	76	11.78	9.55	9.73	11.48
B	Chrysothamnus nauseosus albicaulis	1	0	0	2	.03	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	0	0	0	.00	-	-	-
B	Gutierrezia sarothrae	38	45	12	20	.34	2.18	.36	.62
B	Juniperus osteosperma	6	9	9	8	7.68	8.89	8.79	1.09
B	Quercus gambelii	0	0	0	1	-	-	-	-
Total for Browse		110	131	86	107	19.85	20.63	18.88	13.20

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 23

Species	Percent Cover			
	'97	'02	'04	'07
Artemisia tridentata wyomingensis	-	9.63	10.21	12.44
Gutierrezia sarothrae	-	1.43	.48	.40
Juniperus osteosperma	5.19	10.93	13.10	3.71

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 23

Species	Average leader growth (in)		
	'02	'04	'07
Artemisia tridentata wyomingensis	3.4	1.6	1.4

POINT-QUARTER TREE DATA --
Management unit 18A, Study no: 23

Species	Trees per Acre		
	'02	'04	'07
Juniperus osteosperma	72	73	68

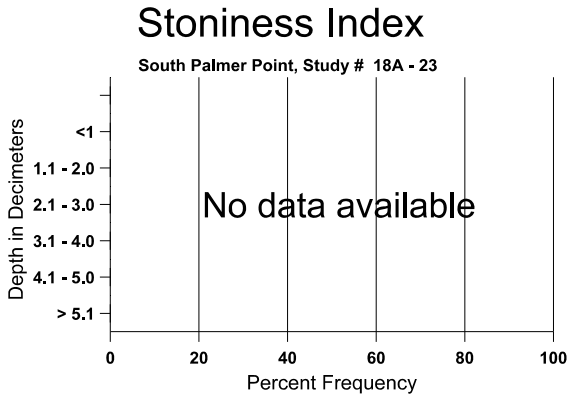
Average diameter (in)		
'02	'04	'07
7.1	12.3	6.4

BASIC COVER --
Management unit 18A, Study no: 23

Cover Type	Average Cover %					
	'83	'89	'97	'02	'04	'07
Vegetation	1.50	6.00	39.91	42.34	40.34	47.69
Rock	3.25	6.25	2.59	2.93	2.64	2.06
Pavement	1.25	10.00	5.13	5.51	5.60	4.85
Litter	63.50	53.75	43.77	37.09	42.76	39.32
Cryptogams	.25	3.75	10.16	12.06	6.88	2.56
Bare Ground	30.25	20.25	10.21	16.87	19.49	14.95

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 23, South Palmer Point

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
-	-	7.9	42.0	33.1	24.9	2.1	3.4	259.2	.5



PELLET GROUP DATA --
Management unit 18A, Study no: 23

Type	Quadrat Frequency			
	'97	'02	'04	'07
Rabbit	18	3	8	14
Elk	-	-	-	1
Deer	16	5	8	10
Cattle	2	-	-	-

Days use per acre (ha)		
'02	'04	'07
-	-	-
-	-	-
23 (56)	13 (31)	14 (35)
-	-	-

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 23

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**2399**	66	33	1233	1133	-	29	69	47	-	47	19/26
89	**966**	-	66	100	800	-	83	0	83	-	72	39/29
97	**2420**	940	960	980	480	2200	14	0	20	9	12	28/45
02	**3820**	-	900	2200	720	1560	5	0	19	7	7	21/31
04	**2820**	-	180	1900	740	1360	12	0	26	11	11	20/27
07	**7200**	7200	4700	1960	540	580	11	2	8	3	4	22/30
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	15/18
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
04	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**40**	-	20	20	-	-	0	0	-	-	0	26/33
Chrysothamnus viscidiflorus viscidiflorus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	0	0	-	-	0	6/5
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
04	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae												
83	**3199**	1966	1266	1933	-	-	0	0	0	-	0	9/11
89	**3732**	33	766	2933	33	-	0	0	1	-	3	13/14
97	**2520**	60	760	1760	-	60	3	0	0	-	0	7/6
02	**2600**	-	20	1840	740	800	0	0	28	6	6	8/11
04	**460**	-	-	380	80	480	0	0	17	13	13	8/11
07	**860**	80	180	660	20	20	0	0	2	2	2	7/9
Juniperus osteosperma												
83	**166**	66	33	133	-	-	0	0	0	-	0	62/44
89	**266**	-	200	66	-	-	0	0	0	-	0	335/118
97	**120**	40	20	100	-	-	0	0	0	-	0	-/-
02	**200**	20	60	140	-	-	0	0	0	-	0	-/-
04	**200**	-	80	120	-	-	0	0	0	-	0	-/-
07	**180**	40	140	-	40	20	0	0	22	11	11	-/-
Quercus gambelii												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
04	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	0	0	-	-	0	-/-
Rhus trilobata												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
04	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	20	-	-	-	-	0	0	-	-	0	-/-

Trend Study 18A-24-07

Study site name: Salt Mountain Stock Pond . Vegetation type: Chained, Seeded PJ .

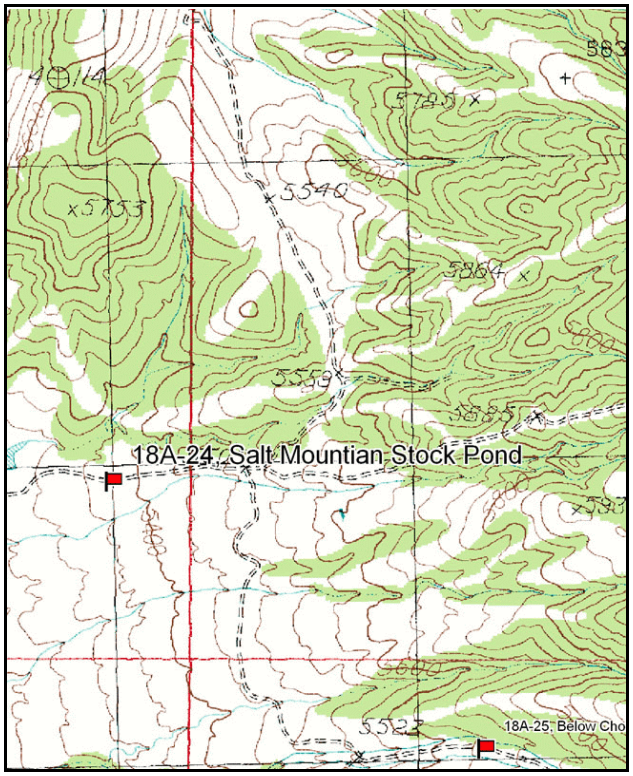
Compass bearing: frequency baseline 183 degrees magnetic.

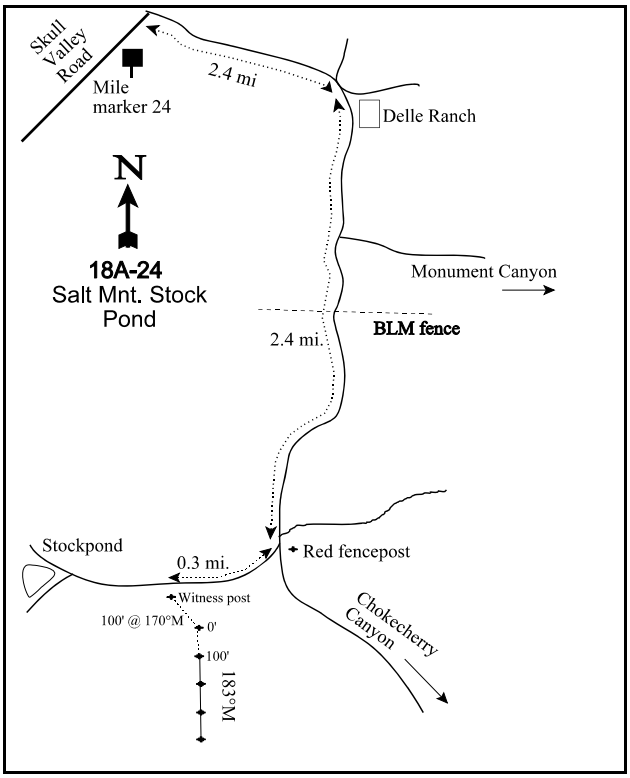
Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

Rebar: Belt 4 rebar is at 13 feet in a gully

LOCATI0N DESCRIPTI0N

Turn east off Skull Valley Road between mile mark 24 and 25. From the Skull Valley Road, 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 this intersection. Turn right and proceed 0.30 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" fenceposts 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 12T 356915 E 4489116 N

DISCUSSION

Salt Mountain Stock Pond - Trend Study No. 18A-24

Study Information

This study is located on a chained and seeded juniper woodland immediately east of Salt Mountain [elevation: 5,400 feet (1,646 m), slope: 8%, aspect: southwest]. The area was treated again between the 1983 and 1989 samplings to remove most of the remaining juniper (*Juniperus osteosperma*) trees. A stock pond lies approximately 1,000 feet (305 m) west of the study. In wet years, the pond could serve as a water source, however, it was dry in 2002 and 2007. 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 use was estimated at 27 deer days use/acre (74 ddu/ha) in 2002, which decreased to 4 deer days use/acre (10 ddu/ha) in 2007. There was also some elk use in 2007, estimated at 5 days use/acre (12 edu/ha). There was no cattle use in 2002, but use from the previous summer was estimated at 8 cattle days use/acre (22 cdu/ha). It increased slightly to 10 cattle days use/acre (25 cdu/ha) in 2007.

Soil

The soil is characterized within the Abela series (USDA-NRCS 2007). The soils in this series were alluvially deposited and are medium to fine textured. The soil is a sandy clay loam with a moderately alkaline soil reaction (pH 7.9). The soil phosphorus is low at only 4.8 ppm. Values less than 6 ppm may limit plant growth and development in rangeland ecosystems (Tiedemann and Lopez 2004). A few large rocks are present on the soil surface. The area initially showed evidence of moderate sheet erosion. This resulted largely from trampling by cattle and a general lack of good protective ground cover. Bare soil cover averaged 30% prior to 1997, and has remained stable at 16% since 1997. The soil erosion condition class was slight in 2002 and stable in 2007.

Browse

The vegetative composition is dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) interspersed with Utah juniper trees. Sagebrush cover declined slightly from 10% in 1997 to 8% in 2002 and 2007. From 1989 to 2004, sagebrush maintained a stable density of approximately 3,000 plants/acre (7,413 plants/ha). In 2007, it decreased by 11% to 2,720 plants/acre (6,721 plants/ha). Decadence has remained relatively high, ranging from 43% in 1989 to 31% in 2002. Young recruitment was good in 1997 and 2002, with 18% and 22% of the population consisting of young plants, respectively. In 2007, recruitment dropped to 7%, and the majority of the plants were mature or decadent. During the 1983 reading, 23% of the sagebrush plants showed poor vigor. Many plants had a yellow or chlorotic appearance, which may be indicative of a shallow hardpan, a serious iron deficiency, or an insect or disease problem. In subsequent sample years, plants with poor vigor have comprised 15%-20% of the population. Eighty-six percent of the plants were classified as having moderate-heavy use in 1983, but use has been light since. The average annual leader growth was 1.5 inches (3.8 cm) in 2002 and 1.6 inches (4.1 cm) in 2007. Antelope bitterbrush (*Purshia tridentata*) occurs infrequently, and the scattered plants were observed to be heavily hedged. Broom snakeweed (*Gutierrezia sarothrae*) was first sampled in 1989, and has fluctuated in density between 200 plants/acre (494 plants/ha) and 4,680 plants/acre (11,564 plants/ha).

Utah juniper trees continue to encroach upon the treatment, despite efforts to control them. The point-centered quarter data estimates for juniper were 51 trees/acre (126 trees/ha) in 2002 and 67 trees/acre (165 trees/ha) in 2007. The average tree trunk diameter was 1.9 inches (4.8 cm) in 2002 and 2.7 inches (6.9 cm) in 2007. The density of juniper is increasing, with established trees maturing. Ninety percent of the trees sampled in 2007 were between 1 (0.3 m) and 8 (2.4 m) feet tall.

Herbaceous Understory

Although the area was seeded with introduced perennial species, Sandberg bluegrass (*Poa secunda*), a native

species, was the most abundant perennial grass in 1983 and 1989. This species had a quadrat frequency of 89% in 1983 and 80% in 1989. Sandberg bluegrass has remained abundant, but has fluctuated with each reading since 1989. Crested wheatgrass (*Agropyron cristatum*) was the only seeded species sampled. It has been the most abundant perennial grass since 1997. Average crested wheatgrass cover increased from 16% in 1997 to 23% in 2002, then decreased to 18% in 2007. It has contributed an average 65% of the total herbaceous cover since 1997. Cheatgrass (*Bromus tectorum*) is present, and its average cover increased from 2% in 1997 and 2002 to 5% in 2007. Cheatgrass comprised 8% of the total grass cover in 1997 and 2002, and increased to 16% of the grass cover in 2007. Between 2002 and 2007, cheatgrass quadrat frequency increased from 55% to 91%. Forb composition is diverse, but most species occur infrequently. It is composed almost entirely of native species, but offers little forage value to wintering deer.

1989 TREND ASSESSMENT

Since 1983, portions of the old chaining were treated again for the removal of most of the young trees. The trend for browse is down. The density of sagebrush decreased 35%. There was a large number of seedlings, but no young plants were sampled. The number of plants classified as having poor vigor, however, decreased slightly from 23% to 15%. The trend for grass is stable. The sum of nested frequency for perennial grasses changed little. Most of the grasses were perennials and provided good forage value. The trend for forbs is down. The nested frequency of perennial forbs decreased by 58% between 1983 and 1989. Forbs were a very minor component of the understory.

browse - down (-2) grass - stable (0) forb - down (-2)

1997 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density did not change. Young plants increased from 0% of the population to 18%. The decadence of sagebrush decreased from 43% to 33%, however, plants classified as dying increased from 3% to 19%. The trend for grass is up. There was a significant increase in the nested frequency of crested wheatgrass, and the sum of the nested frequency of perennial grasses increased by 22%. Cheatgrass and Japanese brome (*Bromus japonicus*) were present, but provided less than 2% combined cover. The trend for forbs is up. There was a large increase in the nested frequency of perennial forbs, however, they still composed only 11% of the herbaceous understory, and less than 1% of the total ground cover. Sixty-one percent of the forb cover was bur buttercup (*Ranunculus testiculatus*), which is allelopathic and has no use for wildlife or cattle (Buchanan et al. 1978). The Desirable Components Index (DCI) was rated as good due to a favorable browse and perennial grass cover, and a lack of noxious weeds.

winter range condition (DCI) - good (57) Low potential scale
browse - stable (0) grass - up (+2) forb - up (+2)

2002 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density remained unchanged, use was mostly light, and decadence was similar to that in 1997 at 31%. Sixteen percent of the plants were classified as dying in 2002. Young recruitment remained good at 22% of the population. The trend for grass is stable. The sum of nested frequency for perennial grasses remained stable, and the nested frequency of crested wheatgrass increased significantly. Crested wheatgrass provided 82% of the total grass cover and 81% of the total herbaceous cover. The sum of nested frequency for annual grasses increased 13%, however, none of the individual species increased significantly in nested frequency. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 92%. Forbs contributed only 1% of the total vegetative cover, and provided little forage value. Bur buttercup decreased significantly, from 61% of the total forb cover to only 37%. Numerous species that were sampled in 1997 were not found in 2002. The DCI remained stable with a rating of good.

winter range condition (DCI) - good (55) Low potential scale
browse - stable (0) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is slightly down. The sagebrush density decreased from 3,060 plants/acre (7,561 plants/ha) to 2,720 plants/acre (6,721 plants/ha). Young recruitment decreased from 22% of the population to 7%. Decadent plants and those classified as dying slightly increased. Plants displaying poor vigor increased from 16% of the population to 20%, and the sagebrush defoliator moth (*Aroga websteri*) had infested 15% of the population. The trend for grass is stable. The sum of nested frequency for perennial grasses increased 12%. Sandberg bluegrass increased significantly in nested frequency, however, cheatgrass also increased. The trend for forbs is up. The sum of nested frequency for perennial forbs increased substantially, and perennial forb cover increased from near 0% to 4%. In 2007, forbs comprised 19% of the total vegetative cover, which increased from 1% in 2002. However, bur buttercup increased significantly, and forb composition remained poor in forage value. The DCI remained stable with a rating of good.

winter range condition (DCI) - good (53) Low potential scale
browse - slightly down (-1) grass - stable (0) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 24

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	$_{a}$102	$_{a}$145	$_{b}$267	$_{c}$283	$_{c}$277	16.01	23.15	18.07
G	Agropyron spicatum	$_{a}$10	$_{a}$3	-	$_{a}$12	$_{a}$13	-	.68	.83
G	Bromus japonicus (a)	-	-	$_{a}$25	$_{a}$27	$_{a}$37	.11	.09	.10
G	Bromus tectorum (a)	-	-	$_{a}$134	$_{a}$152	$_{b}$283	1.77	2.19	4.52
G	Poa secunda	$_{b}$239	$_{b}$221	$_{ab}$205	$_{a}$169	$_{b}$233	3.64	2.03	5.46
G	Sitanion hystrix	$_{a}$1	$_{b}$18	-	$_{a}$3	$_{a}$1	-	.15	.03
G	Vulpia octoflora (a)	-	-	-	1	-	-	.00	-
Total for Annual Grasses		0	0	159	180	320	1.88	2.28	4.62
Total for Perennial Grasses		352	387	472	467	524	19.65	26.02	24.41
Total for Grasses		352	387	631	647	844	21.54	28.30	29.03
F	Agoseris glauca	$_{a}$10	$_{a}$12	$_{a}$8	$_{a}$4	$_{a}$7	.02	.01	.04
F	Alyssum alyssoides (a)	-	-	$_{a}$5	$_{a}$2	$_{b}$26	.01	.01	.05
F	Antennaria rosea	$_{b}$25	$_{b}$24	$_{a}$6	$_{a}$2	-	.03	.00	-
F	Astragalus cibarius	$_{b}$36	-	$_{ab}$29	$_{a}$3	$_{c}$82	.35	.01	3.66
F	Astragalus sp.	-	-	1	-	-	.00	-	-
F	Astragalus utahensis	$_{a}$1	$_{a}$2	$_{a}$2	-	$_{a}$2	.07	-	.03
F	Castilleja linariaefolia	$_{a}$2	-	$_{a}$2	-	$_{a}$4	.00	-	.01
F	Camelina microcarpa (a)	-	-	$_{a}$12	$_{a}$2	$_{a}$1	.02	.00	.00
F	Calochortus nuttallii	$_{bc}$17	-	$_{ab}$17	$_{a}$1	$_{c}$29	.04	.00	.17
F	Castilleja sp.	-	-	3	-	-	.00	-	-
F	Chaenactis douglasii	$_{ab}$5	$_{a}$1	$_{b}$18	-	$_{ab}$8	.06	-	.22
F	Cirsium neomexicanum	$_{a}$6	$_{a}$5	$_{a}$5	-	-	.06	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Collinsia parviflora (a)	-	-	$_{a}$3	$_{a}$10	$_{a}$10	.00	.02	.02
F	Crepis acuminata	-	-	$_{a}$2	-	$_{a}$3	.00	-	.03
F	Cryptantha sp.	-	2	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	3	-	-	.00	-
F	Draba sp. (a)	-	-	$_{a}$5	-	$_{b}$18	.01	-	.03
F	Epilobium brachycarpum (a)	-	-	9	-	-	.07	-	-
F	Erodium cicutarium (a)	-	-	-	$_{a}$6	$_{a}$9	-	.03	.07
F	Eriogonum sp.	2	-	-	-	-	-	-	-
F	Helianthus annuus (a)	-	9	-	-	-	-	-	-
F	Heterotheca villosa	-	-	-	-	3	-	-	.03
F	Holosteum umbellatum (a)	-	-	$_{a}$5	$_{b}$42	$_{c}$270	.01	.12	4.19
F	Lactuca serriola	-	-	1	-	-	.00	-	-
F	Machaeranthera canescens	$_{a}$4	$_{a}$3	$_{b}$20	-	-	.06	-	-
F	Microsteris gracilis (a)	-	-	$_{a}$4	$_{a}$8	-	.00	.02	-
F	Oenothera sp.	2	-	-	-	-	-	-	-
F	Penstemon sp.	-	$_{a}$2	$_{a}$10	-	-	.08	-	-
F	Phlox longifolia	-	-	$_{ab}$8	$_{a}$1	$_{b}$18	.01	.00	.14
F	Ranunculus testiculatus (a)	-	-	$_{b}$167	$_{a}$48	$_{b}$120	1.67	.15	.36
F	Senecio multilobatus	$_{a}$6	-	-	$_{a}$1	-	-	.00	-
F	Tragopogon dubius	$_{a}$4	-	$_{a}$7	-	-	.07	-	-
F	Trifolium sp.	-	-	1	-	-	.00	-	-
F	Zigadenus paniculatus	-	-	2	-	-	.00	-	-
Total for Annual Forbs		0	9	210	121	454	1.81	0.37	4.74
Total for Perennial Forbs		120	51	142	12	156	0.92	0.04	4.35
Total for Forbs		120	60	352	133	610	2.74	0.41	9.10

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	'97	'02	'07
B	Artemisia tridentata wyomingensis	73	63	67	9.63	8.08	7.72
B	Atriplex canescens	0	1	0	-	-	-
B	Chrysothamnus nauseosus	1	0	0	.00	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	1	2	-	.15	-
B	Gutierrezia sarothrae	63	70	28	1.08	2.32	.47
B	Juniperus osteosperma	5	5	6	-	1.62	1.57
B	Opuntia sp.	2	2	1	-	-	-
Total for Browse		145	142	104	10.71	12.18	9.77

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 24

Species	Percent Cover	
	'02	'07
Artemisia tridentata wyomingensis	9.03	8.64
Gutierrezia sarothrae	2.76	.56
Juniperus osteosperma	1.31	1.50

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 24

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata wyomingensis	1.5	1.6

POINT-QUARTER TREE DATA --
Management unit 18A, Study no: 24

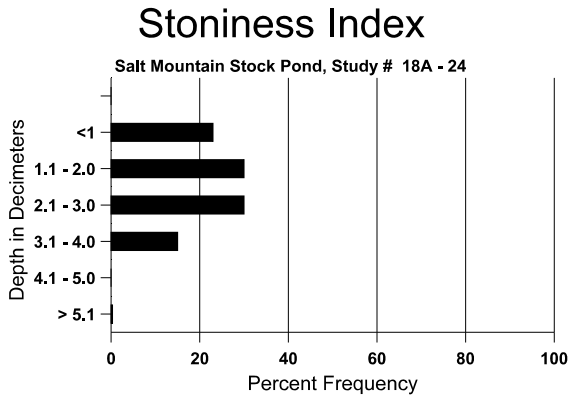
Species	Trees per Acre		Average diameter (in)	
	'02	'07	'02	'07
Juniperus osteosperma	51	67	1.9	2.7

BASIC COVER --
Management unit 18A, Study no: 24

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	2.25	15.00	36.75	41.09	49.45
Rock	.25	.50	.83	1.85	1.75
Pavement	10.00	7.25	7.19	4.97	6.96
Litter	52.00	49.50	45.63	48.98	40.97
Cryptogams	2.00	.50	3.69	2.94	2.01
Bare Ground	33.50	27.25	16.01	16.11	16.11

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 24, Salt Mountain Stock Pond

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.73	69.5 (12.8)	7.6	52.0	20.4	27.6	2.1	4.8	224.0	.5



PELLET GROUP DATA --
Management unit 18A, Study no: 24

Type	Quadrat Frequency		
	'97	'02	'07
Sheep	2	-	-
Rabbit	12	49	64
Elk	-	-	2
Deer	18	12	20
Cattle	2	4	3

Days use per acre (ha)	
'02	'07
-	-
-	-
-	5 (12)
27 (74)	4 (10)
8 (22)	10 (25)

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 24

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**4732**	-	66	2766	1900	-	42	44	40	.70	23	24/42
89	**3066**	1800	-	1733	1333	-	9	1	43	5	15	19/25
97	**3060**	520	560	1500	1000	360	29	8	33	19	20	20/36
02	**3060**	-	660	1460	940	580	14	0	31	16	16	19/28
07	**2720**	-	200	1560	960	460	25	15	35	18	20	22/32
Atriplex canescens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus nauseosus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	6/9
02	**20**	-	-	20	-	-	0	0	-	-	0	7/7
07	**60**	-	-	60	-	-	0	67	-	-	0	6/7
Gutierrezia sarothrae												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**200**	-	-	200	-	-	0	0	0	-	0	10/11
97	**4540**	320	1320	3140	80	-	.44	0	2	.88	.88	11/19
02	**4680**	-	20	4100	560	560	0	0	12	4	12	6/9
07	**1000**	140	100	620	280	-	8	2	28	10	20	7/10

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Juniperus osteosperma												
83	**300**	-	100	200	-	-	0	0	-	-	22	56/56
89	**100**	-	100	-	-	-	0	0	-	-	0	-/-
97	**100**	20	80	20	-	140	0	0	-	-	0	-/-
02	**100**	-	20	80	-	220	0	0	-	-	0	-/-
07	**120**	-	60	60	-	80	0	0	-	-	0	-/-
Opuntia sp.												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**40**	-	-	40	-	-	0	0	-	-	0	4/9
02	**40**	-	-	40	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	0	-	-	0	4/7
Purshia tridentata												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	8/28
02	**0**	-	-	-	-	-	0	0	-	-	0	10/54
07	**0**	-	-	-	-	-	0	0	-	-	0	22/64

Trend Study 18A-25-07

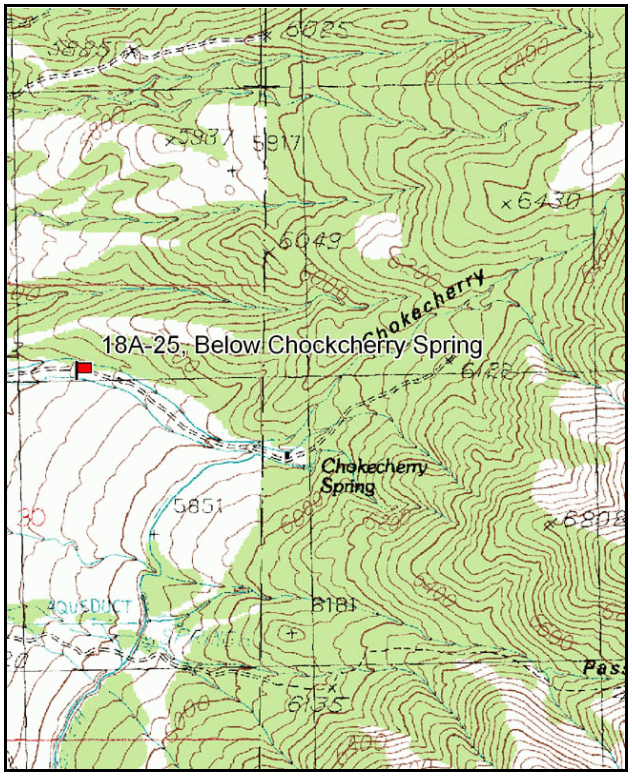
Study site name: Below Chokecherry Spring . Vegetation type: Big Sagebrush-Grass .

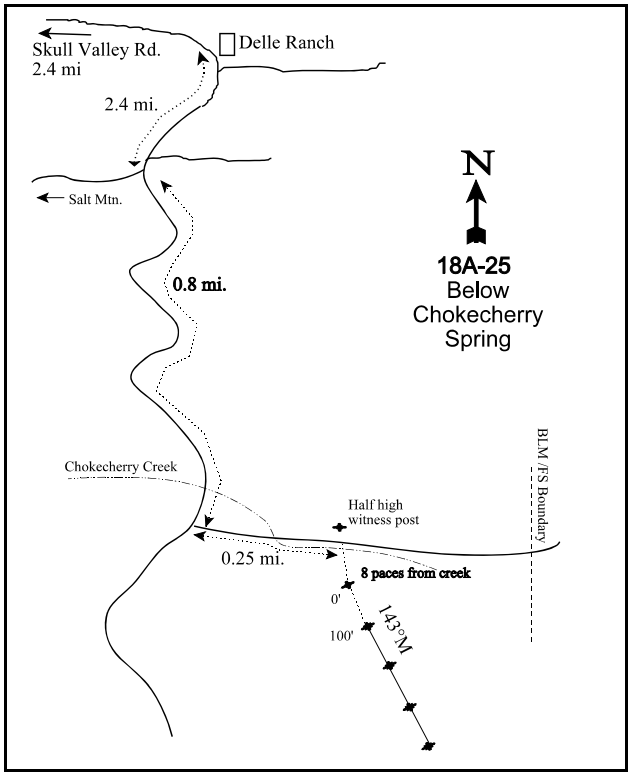
Compass bearing: frequency baseline 143 degrees magnetic.

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

LOCATION DESCRIPTION

Turn off the Skull Valley Road between mile mark 24 and 25 on a gravel road heading east. 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 this intersection. 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 the witness post at 141 degrees magnetic. Browse tag number 3924 is attached to the 0-foot marker of the baseline.





Map Name: Salt Mountain

Township 3S , Range 7W , Section 30

Diagrammatic Sketch

GPS: NAD 83, UTM 12T 358137 E 4488204 N

DISCUSSION

Below Chokecherry Spring - Trend Study No. 18A-25

Study Information

This study is located one-half mile (0.8 km) west of Chokecherry Spring on a low-lying alluvial site near an intermittent drainage channel [elevation: 5,600 feet (1,707 m), slope: 5-10%, aspect: west]. There is a moderately-incised perennial stream 40 feet (13 m) to the north of the study. The stream banks and corridor were being grazed by cattle while the study was sampled in 2007. The study monitors a large mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community surrounded by pinyon-juniper woodland. The woodland was apparently chained and seeded in the past, and some of the pinyon-juniper trees on the periphery of the study had been bullhogged just prior to the 2007 sampling. Summer cattle grazing was noted as heavy in 1983, although little succulent forage was available due to a dense understory of cheatgrass (*Bromus tectorum*). According to the local conservation officer in 1983, 400-500 deer customarily wintered in this area. However, in 1997, sagebrush had been lightly used, and deer pellet groups were only found in 11% of the quadrats. In 2002, grazing was less intense than in the past, and increased in 2007. Deer use was estimated at 29 deer days use/acre (73 ddu/ha) in 2002 and 11 deer days use/acre (26 ddu/ha) in 2007. Elk use was only noted in 2007, at an estimated 21 elk days use/acre (53 edu/ha). Additionally, cattle use was estimated at 14 cattle days use/acre (34 cdu/ha) in 2002 and 66 cattle days use/acre (163 cdu/ha) in 2007.

Soil

The soil is classified within the Kapod series (USDA-NRCS 2007). Soils in this series were alluvially deposited, derived mainly from sandstone and limestone. They are very deep and well-drained. The soil texture is a loam with a neutral to mildly alkaline reaction (pH 7.3). The soil phosphorus is relatively low at 6.3 ppm. Vegetation and litter cover are moderately high, and there is little exposed bare ground. Erosion is not a significant problem because of the gentle slope and protective herbaceous cover. The erosion condition class was determined as stable in 2002 and 2007.

Browse

Mountain big sagebrush density was relatively stable until 2007, when density declined 42%, from 10,920 plants/acre (26,972 plants/ha) to 6,320 plants/acre (15,617 plants/ha). This decrease correlates with the statewide sagebrush die-off that occurred through the winter and spring of 2002-2003. Average cover increased from 15% in 1997 to 20% in 2007. Over two-thirds of the plants were classified as mature in all sample years, except in 1997 when the population was mostly young. Decadence increased from 3% in 1997 to 17% in 2007. Utilization of sagebrush has been mostly light since 1983. The average annual leader growth was 2 inches (5 cm) in 2002 and 1.3 inches (3.3 cm) in 2007. In 2007, 34% of the plants sampled were infested with black insects.

Broom snakeweed (*Gutierrezia sarothrae*) was abundant in 1983, with a density of 15,556 plants/acre (38,438 plants/ha). The population decreased to only 2,900 plants/acre (7,166 plants/ha) by 1997, and was not sampled in 2007. Other browse that occur infrequently are white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), and antelope bitterbrush (*Purshia tridentata*).

Herbaceous Understory

There is a moderate-high abundance of perennial grasses, and forage production has increased since 1983. Vigor was somewhat suppressed as a result of heavy grazing use by cattle in early samplings. Crested wheatgrass (*Agropyron cristatum*), Sandberg bluegrass (*Poa secunda*), and cheatgrass are the most abundant grasses. Crested wheatgrass and Sandberg bluegrass cover have fluctuated since 1997, however, cheatgrass cover has steadily declined from 9% to 4%. Grasses constituted 55% of the vegetation cover in 1997, 51% in 2002, and 42% in 2007.

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 species are Bonneville pea (*Lathyrus brachycalyx*) and holosteum (*Holosteum umbellatum*), which provided 43% and 34% of the total forb cover in 2007, respectively. Forb cover increased from 18% of the total herbaceous cover in 2002 to 31% in 2007, due to substantial increases in annual forb cover.

1989 TREND ASSESSMENT

The trend for browse is up. The sagebrush density increased from 966 plants/acre (2,387 plants/ha) to 1,332 plants/acre (3,291 plants/ha). Seventy-three percent of the plants were classified as mature. There were a few young plants (10%), and although not sampled on the density plots, many large sagebrush were observed to have a high number of seedlings nearby. Decadence increased from 0% to 17%. Vigor was good, and use was light. The trend for grass is up. The sum of nested frequency for perennial grasses increased 67%, and there was a significant increase in the nested frequency of Sandberg bluegrass. The trend for forbs is up. The sum of nested frequency of perennial forbs increased by 44%. Several forb species significantly increased in nested frequency, and forb cover increased from 5% to approximately 7%.

browse - up (+2) grass - up (+2) forb - up (+2)

1997 TREND ASSESSMENT

The trend for browse is up. Sagebrush density increased from 1,332 plants/acre (3,290 plants/ha) to 10,840 plants/acre (26,785 plants/ha). However, this increase is most likely reflective of the larger area sampled in 1997. Decadence decreased from 17% to 3%, and young plants increased from 10% to 68% of the population. Additionally, there was an increase in sagebrush reproduction. The density of seedlings increased from 0 plants/acre to 2,420 plants/acre (5,990 plants/ha). Vigor remained good, and use was mostly light. The trend for grass is stable. Crested wheatgrass increased significantly in nested frequency and provided 44% of the total grass cover. Sandberg bluegrass and mutton bluegrass (*Poa fendleriana*) decreased significantly in nested frequency. Cheatgrass was still abundant and provided 9% cover, or 32% of the total grass cover. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little, and perennial forb cover was 5%. The Desirable Components Index (DCI) was rated as good-excellent due to an abundant young age class and good browse cover, as well as a diverse understory primarily composed of perennial grasses.

winter range condition (DCI) - good-excellent (82) Mid-level potential scale
browse - up (+2) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The trend for browse is stable. Density remained moderately high at 10,920 plants/acre (26,983 plants/ha), and cover increased from 15% to 18%. Decadence remained low at 4% of the population, but the percent of young plants in the population decreased from 68% in 1997 to 27% in 2002. It appears as though many of the plants classified as young in 1997 were classified as mature in 2002. Utilization remained light, and vigor was good. The trend for grass is stable. The nested frequency of Sandberg bluegrass decreased significantly, while the nested frequency of crested wheatgrass increased significantly. Crested wheatgrass provided 62% of the total grass cover, an increase from 44% in 1997. Cheatgrass was still abundant, and although its cover decreased from 9% to 7%, the nested frequency did not change significantly. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 36%. Forbs were diverse, but few were common. Twenty-three forb species were sampled in 1997, but due to drought conditions, only 11 species were sampled in 2002. The nested frequency of Bonneville pea did not change significantly, and this species provided 78% of the total forb cover. The DCI increased to excellent due to a slight increase in preferred browse cover.

winter range condition (DCI) - excellent (85) Mid-level potential scale
browse - stable (0) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is slightly down. The average quadrat cover of sagebrush increased from 18% to 20%, and average canopy cover increased from 19% to 22%. Average plant height and crown width increased 5 inches (12.7 cm) and 6 inches (15.2 cm), respectively. However, density decreased from 10,920 plants/acre (26,983 plants/ha) to 6,320 plants/acre (15,617 plants/ha). This decrease was most likely due to self-thinning, as young plants competed for more resources as they matured and increased in size. The young plants in the population decreased from 27% to 2%, while decadence increased from 4% to 17%. The number of plants showing moderate and heavy use also increased slightly, but vigor remained good. The trend for grass is up. The sum of nested frequency for perennial grasses increased 33%. There was a significant increase in the nested frequency of Sandberg bluegrass. The nested frequencies of cheatgrass and Japanese brome (*Bromus japonicus*) remained stable, but cheatgrass cover decreased from 7% to 4%. Grass cover accounted for 42% of the total herbaceous cover, a slight decrease from 51% in 2002. The trend for forbs is up. The sum of nested frequency for perennial forbs increased 44%. Four species increased significantly in nested frequency, including wild onion (*Allium* sp.). Forbs composed 19% of the total herbaceous cover, increasing from 12% in 2002. The DCI rating declined to good, due to an increase in sagebrush decadence and a decrease in young plants.

winter range condition (DCI) - good (72) Mid-level potential scale
browse - slightly down (-1) grass - up (+2) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 25

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	a57	a96	b169	c241	c225	12.91	20.81	13.88
G	Agropyron spicatum	a7	a4	a14	-	b37	.27	-	1.52
G	Bromus japonicus (a)	-	-	a3	ab9	b14	.00	.01	.05
G	Bromus tectorum (a)	-	-	b261	ab163	172	9.35	6.71	4.11
G	Poa bulbosa	-	-	-	a45	a28	-	2.37	.41
G	Poa fendleriana	-	b37	a2	-	-	.03	-	-
G	Poa secunda	b184	c281	b214	a131	b233	6.39	3.82	7.41
G	Sitanion hystrix	a7	a6	a2	-	a1	.03	-	.03
G	Sporobolus cryptandrus	-	a2	a1	-	-	.03	-	-
Total for Annual Grasses		0	0	264	172	186	9.36	6.72	4.17
Total for Perennial Grasses		255	426	402	417	524	19.69	27.00	23.26
Total for Grasses		255	426	666	589	710	29.05	33.73	27.43
F	Agoseris glauca	-	a4	a-	a3	a2	.00	.03	.03
F	Alyssum alyssoides (a)	-	-	-	a3	a4	-	.00	.03
F	Allium sp.	a8	b81	b73	a3	b71	.61	.01	.33
F	Antennaria rosea	-	3	-	-	-	-	-	-
F	Artemisia ludoviciana	a3	a1	-	-	-	-	-	-
F	Astragalus sp.	-	-	a7	-	a3	.04	-	.06
F	Astragalus utahensis	-	-	3	-	-	.03	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Calochortus nuttallii	$_{a}$7	$_{a}$6	$_{a}$6	-	$_{a}$12	.02	-	.03
F	Cirsium neomexicanum	$_{a}$3	-	$_{a}$7	-	-	.19	-	-
F	Collinsia parviflora (a)	-	-	$_{a}$85	$_{a}$97	$_{a}$82	.18	.52	.21
F	Crepis acuminata	-	2	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	-	8	-	-	.02
F	Descurainia sp. (a)	-	-	11	-	-	.02	-	-
F	Draba sp. (a)	-	-	$_{a}$22	$_{a}$3	$_{b}$173	.05	.00	1.35
F	Epilobium brachycarpum (a)	-	-	5	-	-	.01	-	-
F	Erodium cicutarium (a)	-	-	$_{a}$5	$_{a}$8	$_{a}$12	.01	.01	.05
F	Galium aparine (a)	-	-	-	-	1	-	-	.00
F	Hackelia patens	$_{a}$4	$_{a}$4	$_{a}$10	-	-	.35	-	-
F	Helianthus sp.	-	4	-	-	-	-	-	-
F	Holosteum umbellatum (a)	-	-	$_{a}$55	$_{a}$56	$_{b}$267	.13	.33	4.27
F	Lathyrus brachycalyx	$_{b}$207	$_{a}$149	$_{a}$139	$_{a}$150	$_{ab}$163	3.36	5.82	5.32
F	Lactuca serriola	-	$_{b}$26	-	-	$_{a}$5	-	-	.01
F	Lomatium sp.	-	-	$_{a}$-	$_{b}$31	$_{b}$15	.00	.57	.09
F	Lygodesmia sp.	-	-	2	-	-	.00	-	-
F	Microsteris gracilis (a)	-	-	$_{a}$2	$_{a}$3	$_{b}$19	.00	.01	.05
F	Montia perfoliata (a)	-	-	-	-	3	-	-	.03
F	Phlox longifolia	$_{a}$13	$_{b}$55	$_{b}$54	$_{ab}$37	$_{b}$52	.40	.14	.46
F	Polygonum douglasii (a)	-	-	3	-	-	.01	-	-
F	Ranunculus testiculatus (a)	-	-	$_{a}$19	-	$_{a}$27	.03	-	.08
F	Taraxacum officinale	$_{a}$3	$_{a}$4	$_{a}$14	-	-	.05	-	-
F	Tragopogon dubius	$_{a}$3	$_{b}$23	$_{b}$33	-	-	.17	-	-
F	Veronica biloba (a)	-	-	19	-	-	.05	-	-
Total for Annual Forbs		0	0	226	170	596	0.51	0.88	6.11
Total for Perennial Forbs		251	362	348	224	323	5.25	6.58	6.36
Total for Forbs		251	362	574	394	919	5.77	7.46	12.47

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	'97	'02	'07
B	Artemisia tridentata vaseyana	85	89	83	15.28	18.18	19.63
B	Chrysothamnus nauseosus albicaulis	10	8	4	.40	.36	-
B	Chrysothamnus viscidiflorus viscidiflorus	26	17	24	1.98	1.09	1.75
B	Gutierrezia sarothrae	50	41	0	.79	1.90	-
B	Juniperus osteosperma	2	0	2	-	.56	3.62
Total for Browse		173	155	113	18.47	22.11	25.02

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 25

Species	Percent Cover		
	'97	'02	'07
Artemisia tridentata vaseyana	-	18.56	22.38
Chrysothamnus nauseosus albicaulis	-	.30	-
Chrysothamnus viscidiflorus viscidiflorus	-	1.06	2.06
Gutierrezia sarothrae	-	1.89	-
Juniperus osteosperma	7.80	2.31	6.31

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 25

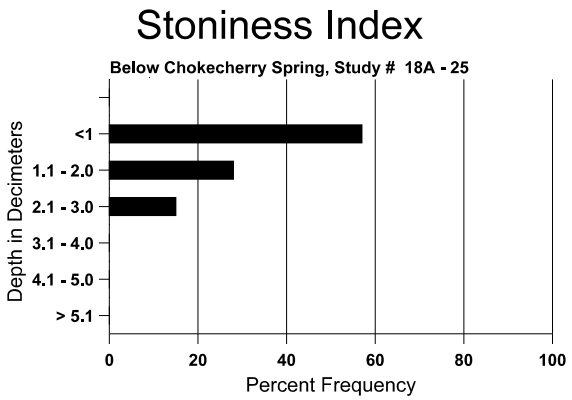
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.0	1.3

BASIC COVER --
Management unit 18A, Study no: 25

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	.25	10.25	53.84	60.31	67.05
Rock	1.75	3.00	2.17	3.63	3.26
Pavement	1.75	1.50	1.57	1.81	2.23
Litter	70.00	71.75	54.59	50.27	35.90
Cryptogams	0	3.25	6.73	2.73	.99
Bare Ground	26.25	10.25	2.66	2.91	8.03

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 25, Below Chokecherry Spring

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.5	60.5 (10.5)	7.3	44.0	31.4	24.6	3.2	6.3	236.8	.6



PELLET GROUP DATA --
Management unit 18A, Study no: 25

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	44	31	31
Elk	1	1	-
Deer	11	16	16
Cattle	11	4	10

Days use per acre (ha)	
'02	'07
-	-
-	21 (53)
29 (73)	11 (26)
14 (34)	66 (163)

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 25

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
83	**966**	-	333	633	-	-	0	0	0	-	0	29/37
89	**1332**	-	133	966	233	-	20	3	17	-	0	27/38
97	**10840**	2420	7340	3220	280	140	20	.36	3	.73	2	26/41
02	**10920**	-	2940	7560	420	420	8	.54	4	2	2	20/23
07	**6320**	-	140	5120	1060	280	23	13	17	8	9	25/29

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus albicaulis												
83	**66**	-	33	33	-	-	0	0	0	-	0	39/77
89	**133**	-	33	100	-	-	0	0	0	-	0	41/63
97	**460**	20	260	180	20	-	0	0	4	-	0	21/23
02	**160**	-	20	80	60	40	13	13	38	13	13	25/31
07	**80**	-	40	20	20	20	0	25	25	25	50	23/28
Chrysothamnus viscidiflorus viscidiflorus												
83	**66**	-	-	66	-	-	0	0	0	-	0	16/14
89	**166**	-	100	66	-	-	0	0	0	-	0	15/23
97	**1320**	-	160	1140	20	-	2	0	2	-	0	16/25
02	**840**	-	20	680	140	40	0	0	17	10	19	18/22
07	**1100**	40	20	880	200	-	5	0	18	2	18	15/21
Gutierrezia sarothrae												
83	**15566**	1733	13500	2066	-	-	0	0	0	-	0	13/13
89	**12999**	800	2333	7733	2933	-	0	0	23	10	11	13/11
97	**2900**	-	300	2520	80	20	0	0	3	-	0	10/10
02	**2120**	-	20	1440	660	280	.94	0	31	8	18	9/10
07	**0**	-	-	-	-	-	0	0	0	-	0	8/12
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**40**	-	20	20	-	80	0	0	-	-	50	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**40**	-	-	40	-	-	100	0	-	-	0	-/-
Purshia tridentata												
83	**66**	-	-	66	-	-	0	100	0	-	50	14/24
89	**33**	-	-	-	33	-	0	100	100	100	100	-/-
97	**0**	-	-	-	-	-	0	0	0	-	0	15/55
02	**0**	-	-	-	-	-	0	0	0	-	0	-/-
07	**0**	-	-	-	-	-	0	0	0	-	0	22/49

Trend Study 18A-26-07

Study site name: Salt Mountain . Vegetation type: Stansbury Cliffrose .

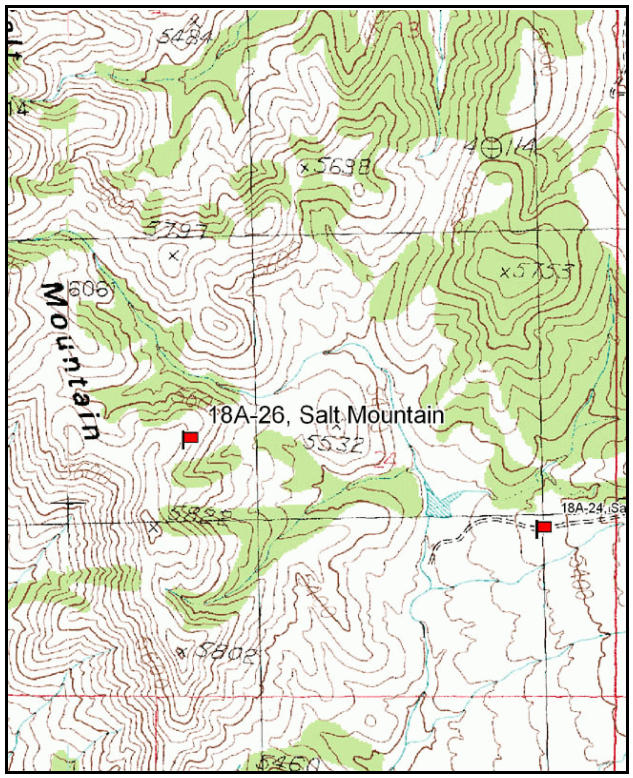
Compass bearing: frequency baseline 0 degrees magnetic (Line 1@ 360°M, line 2 @ 343°M and line 3 @ 205°M).

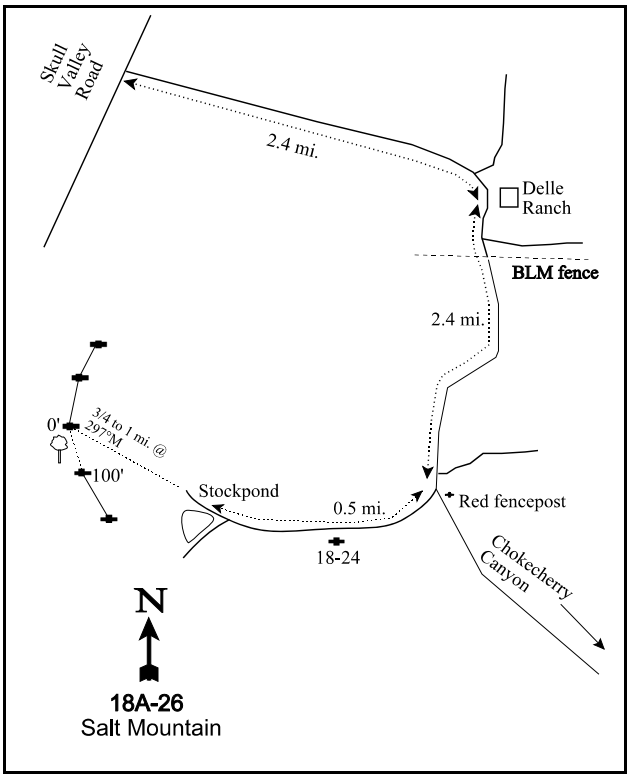
Frequency belt placement: line 1 (11 & 95), line 2 (59ft), line 3 (71ft), line 4 (34ft).

Rebar: Line 3 belt 4: rebar on 3 feet.

LOCATION DESCRIPTION

Turn east off Skull Valley Road between mile mark 24 and 25. From the Skull Valley Road, 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 this intersection. Turn right (west) and continue for 0.5 miles to a stock pond, passing study 18A-24. 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 stake is marked with browse tag #169.





Map Name: Salt Mountain

Diagrammatic Sketch

Township 3S , Range 8W , Section 24

GPS: NAD 83, UTM 12T 355675 E 4489457 N

DISCUSSION

Salt Mountain - Trend Study No. 18A-26

Study Information

This study, located on the east side of Salt Mountain, samples critical deer winter range within the Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) range type [elevation: 5,600 feet (1,707 m), slope: 55%, aspect: southeast]. 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 pellet groups present. Pellet group data from 2002 estimated 56 deer days use/acre (139 ddu/ha). In 2007, use decreased to 38 deer days use/acre (94 ddu/ha) and 3 elk days use/acre (8 edu/ha). All pellet groups appeared to be from winter use. A deer mandible was also noted on the site in 2007.

Soil

The soil is classified within the Amtoft series (USDA-NRCS 2007). Soils in this series were formed in material weathered from calcareous sedimentary rock. They are moderately shallow and well-drained. The soil has a sandy clay loam texture and a moderately alkaline soil reaction (pH 7.4). The surface is covered with dark-colored rock. The relative vegetative cover was 27% in 2002 and 34% in 2007. Combined relative vegetation and litter cover increased from 55% in 2002 to 60% in 2007. Erosion is not a significant problem, despite the steep slope. The erosion condition class was determined as stable in 2002 and 2007.

Browse

The browse composition consists 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*). Cliffrose plants vary in height from about 6 inches (15 cm) to individuals well above the reach of deer. However, the average cliffrose crown height has been slightly over 4 feet (1.2 m), and most of the foliage is available to wildlife. Cliffrose density was 600 plants/acre (1,483 plants/ha) in 1983, 133 plants/acre (329 plants/ha) in 1989 and approximately 100 plants/acre (247 plants/ha) in 2002 and 2007. This trend study is an example of the mid-1980s shrub die-off that affected different locations within the Great Basin. While age structure in 1983 was 78% mature plants, the entire cliffrose population was classified as decadent in 1989. No decadent individuals were sampled in 2002 and only 20% of the population was decadent in 2007. The density of dead plants decreased from 220 plants/acre (544 plants/ha) in 2002 to 60 plants/acre (148 plants/ha) in 2007. Vigor has remained good since 1983. Use was moderate-heavy in 1983, and in 1989, all of the cliffrose plants were moderately or heavily hedged. Utilization was mostly light in 2002, and 80% of the plants displayed moderate-heavy hedging in 2007. Annual leader growth averaged 4.3 inches (10.9 cm) in 2002 and 1.9 inches (4.9 cm) in 2007.

Sagebrush had a low density of approximately 200 plants/acre (494 plants/ha) in 1983 and 1989, 960 plants/acre (2,372 plants/ha) in 2002, and 1,000 plants/acre (2,471 plants/ha) in 2007. The increase in the estimated density appears to be reflective of the increased sample area used in 1997. In 1983 and 1989, 33% of the sagebrush population was classified as decadent, but decadence had declined to 4% by 2007. The majority of the plants have been mature every sample year. The density of dead plants increased from 180 plants/acre (448 plants/ha) in 2002 to 340 plants/acre (840 plants/ha) in 2007. Plants with poor vigor made up 33% of the population in 1983, but vigor has been good since. Use was heavy in 1983, light in 1989, and light-moderate in 2002 and 2007. Annual leader growth averaged 1.9 inches (4.8 cm) in 2002 and 1.7 inches (4.4 cm) in 2007. In 2007, the sagebrush defoliator moth (*Aroga websteri*) had infested 36% of the plants.

Utah juniper density has remained stable at approximately 40 trees/acre (99 trees/ha) since 2002, but individuals have grown larger. The average trunk diameter of juniper in 2002 was 8.5 inches (21.6 cm) and 12.1 inches (30.6 cm) in 2007.

Herbaceous Understory

Grasses comprise the majority of herbaceous cover. Cheatgrass *(Bromus tectorum*), although not reported in 1983 and 1989 because annuals were not recorded, was abundant and produced more cover than perennial grasses in 2002 and 2007. This species provided 9% cover in 2002 and 18% in 2007, with quadrat frequencies of 96% and 100%, respectively. Perennial grasses include bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). These species occur as scattered bunches within the uniform cover of cheatgrass. Grasses showed no evidence of use in 2002 and 2007. Forbs are sparse. The few perennial or biennial species that occur are rare and have little value for forage or erosion protection. Storksbill (*Erodium cicutarium*) has provided the majority of forb cover since 2002. It provided 1% of the total ground cover in 2002 and nearly 2% in 2007.

1989 TREND ASSESSMENT

The trend for browse is down. Cliffrose density decreased to 133 plants/acre (329 plants/ha), and all plants were classified as decadent. Utilization on the available cliffrose branches was moderate-heavy. 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 stable density of 199 plants/acre (492 plants/ha). The majority (67%) of the plants were classified as mature, while 33% of the population was classified as decadent. Some severely hedged plants were observed outside of the density strips that had a clubbed form, low growth, and no seed production. Smaller sagebrush, such as the few mature shrubs sampled within the density plots, displayed excellent growth and vigor. The trend for grass is up. Observations indicated less cheatgrass due to dry conditions. The sum of nested frequency for perennial grasses increased 63%. The nested frequencies of both bluebunch wheatgrass and Sandberg bluegrass increased significantly. The trend for forbs is stable. Four species of perennial forbs were sampled in 1989 that were not present in 1983, but none of the three species sampled in 1983 were sampled again in 1989. Forbs were rare and provided little forage.

browse - down (-2) grass - up (+2) forb - stable (0)

2002 TREND ASSESSMENT

The trend for browse is up. Preferred browse species provided approximately 7% canopy cover. Cliffrose density remained relatively stable at 120 plants/acre (297 plant/ha). However, the age distribution within the population improved from 100% decadent in 1989 to 33% young and 67% mature. These plants were vigorous, with many plants flowering and producing seeds. Use was mostly light. Sagebrush increased in density from 200 plants/acre (494 plants/ha) to 960 plants/acre (2,372 plants ha), although this increase may partially reflect the larger sampling area adopted since the previous sampling. The population was largely mature, with only 10% young and 8% decadent plants. Use was mostly light, and vigor was good. The trend for grass is stable. The sum of nested frequency for perennial grasses decreased 9%. Cheatgrass was still abundant, occurring in nearly every quadrat. It produced 42% of the grass cover and 9% of the total ground cover. Bluebunch wheatgrass decreased significantly in nested frequency. The trend for forbs is stable. These species continued to account for a very small percentage of the total vegetative cover, and the sum of nested frequency for perennial forbs changed little. The Desirable Components Index (DCI) was rated as poor, due to very low browse cover, the abundance of cheatgrass, and the lack of forbs.

winter range condition (DCI) - poor (22) Low potential scale
browse - up (+2) grass - stable (0) forb - stable (0)

2007 TREND ASSESSMENT

The trend for browse is stable. Cliffrose density remained relatively unchanged. Decadence increased from 0% of the population to 20%, however, young plants decreased to 20%, which is still considered sufficient to maintain the population. The majority of the population showed moderate-heavy use, but the plants were vigorous. The sagebrush density remained stable at 1,000 plants/acre (2,471 plants/ha). Young recruitment remained stable at 14% of the population, and decadence remained low at 4% of the population. Sagebrush

utilization was light-moderate, and only 4% of the population showed poor vigor. There were worm infestations on some cliffrose plants and a rust infestation on gray horsebrush. The sagebrush defoliator moth (*Aroga websteri*) had infested 36% of the population. The trend for grass is down. The sum of nested frequency for perennial grasses decreased 20%, and the nested frequency of cheatgrass increased significantly. This species comprised 61% of the total grass cover and 47% of the total vegetative cover. Sandberg bluegrass decreased significantly in nested frequency. The trend for forbs is stable. There was an increase in the number of forb species that were sampled in 2007. Several species that were present in 2002 increased significantly in nested frequency, however, all were annuals. One of these species was bur buttercup (*Ranunculus testiculatus*), which is allelopathic (Buchanan et al. 1978). Storksbill, which was shown by Kimball and Schiffman (2003) to outcompete and prevent the establishment of native rangeland species, also increased significantly in nested frequency. Although the total nested frequency for forbs increased since 2002, these species were very sparse and undesirable annuals. The DCI was rated as fair, due to a slight increase in preferred browse cover.

winter range condition (DCI) - fair (37) Low potential scale
browse - stable (0) grass - down (-2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 26

Type	Species	Nested Frequency				Average Cover %	
		'83	'89	'02	'07	'02	'07
G	Agropyron spicatum	a183	b222	a160	a135	6.60	7.88
G	Bromus tectorum (a)	-	-	a306	b366	8.57	18.28
G	Oryzopsis hymenoides	1	-	-	-	-	-
G	Poa secunda	a73	bc198	c224	b174	5.32	3.74
Total for Annual Grasses		0	0	306	366	8.57	18.28
Total for Perennial Grasses		257	420	384	309	11.93	11.62
Total for Grasses		257	420	690	675	20.51	29.91
F	Agoseris glauca	-	a4	-	a1	-	.00
F	Allium sp.	-	a4	a3	-	.02	-
F	Calochortus nuttallii	a1	-	-	a3	-	.00
F	Cirsium neomexicanum	b4	-	-	a-	-	.00
F	Delphinium nuttallianum	-	1	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	9	-	.04
F	Draba sp. (a)	-	-	-	67	-	.15
F	Erodium cicutarium (a)	-	-	a67	b114	1.22	1.61
F	Gilia sp. (a)	-	-	1	-	.00	-
F	Holosteum umbellatum (a)	-	-	-	17	-	.03
F	Lappula occidentalis (a)	-	-	a4	b24	.01	.07
F	Lactuca serriola	-	a8	a2	a3	.01	.00

Type	Species	Nested Frequency				Average Cover %	
		'83	'89	'02	'07	'02	'07
F	Ranunculus testiculatus (a)	-	-	$_{a}$10	$_{b}$68	.02	.21
F	Senecio sp.	2	-	-	-	-	-
Total for Annual Forbs		0	0	82	299	1.25	2.13
Total for Perennial Forbs		7	17	5	7	0.02	0.01
Total for Forbs		7	17	87	306	1.28	2.15

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	'02	'07
B	Artemisia tridentata wyomingensis	28	30	3.55	4.06
B	Cowania mexicana stansburiana	6	5	.21	1.21
B	Gutierrezia sarothrae	1	1	-	-
B	Juniperus osteosperma	2	2	2.23	1.42
B	Opuntia sp.	4	4	.15	.03
B	Tetradymia canescens	0	1	.18	.03
Total for Browse		41	43	6.32	6.76

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 26

Species	Percent Cover	
	'02	'07
Artemisia tridentata wyomingensis	4.38	5.01
Cowania mexicana stansburiana	2.41	2.83
Gutierrezia sarothrae	.08	.01
Juniperus osteosperma	2.59	3.03
Opuntia sp.	-	.15
Tetradymia canescens	.03	-

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 26

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata wyomingensis	1.9	1.7
Cowania mexicana stansburiana	4.3	1.9

POINT-QUARTER TREE DATA --
Management unit 18A, Study no: 26

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	42	40

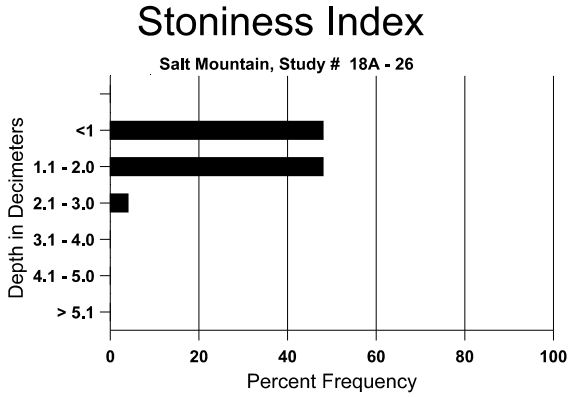
Average diameter (in)	
'02	'07
8.5	12.1

BASIC COVER --
Management unit 18A, Study no: 26

Cover Type	Average Cover %			
	'83	'89	'02	'07
Vegetation	.50	10.75	29.36	38.68
Rock	19.00	8.50	16.42	17.04
Pavement	15.50	33.25	7.93	9.13
Litter	41.75	34.50	30.76	29.57
Cryptogams	5.00	.50	5.21	7.20
Bare Ground	18.25	12.50	18.84	12.68

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 26, Salt Mountain

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
8.6	73.8 (9.6)	7.4	47.3	20.7	32.0	1.7	6.0	156.8	.7



PELLET GROUP DATA --
Management unit 18A, Study no: 26

Type	Quadrat Frequency		Days use per acre (ha)	
	'02	'07	'02	'07
Rabbit	19	52	-	-
Elk	-	2	-	3 (8)
Deer	17	18	56 (139)	38 (94)
Cattle	-	1	-	-

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 26

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**199**	-	-	133	66	-	0	100	33	-	33	12/17
89	**199**	-	-	133	66	-	0	0	33	-	0	15/16
02	**960**	20	100	780	80	180	33	0	8	-	0	22/31
07	**1000**	100	140	820	40	340	26	2	4	4	4	27/42
Cowania mexicana stansburiana												
83	**599**	-	100	466	33	-	50	33	6	-	11	56/47
89	**133**	-	-	-	133	-	75	25	100	-	0	-/-
02	**120**	-	40	80	-	220	17	17	0	-	0	50/57
07	**100**	-	20	60	20	60	40	40	20	-	0	48/48
Ephedra nevadensis												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	38/50
Gutierrezia sarothrae												
83	**1399**	-	666	733	-	-	0	0	-	-	2	14/16
89	**100**	-	-	100	-	-	0	0	-	-	0	8/12
02	**60**	-	-	60	-	20	0	0	-	-	0	13/19
07	**100**	40	-	100	-	-	0	0	-	-	0	6/8
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**40**	-	-	40	-	20	0	0	-	-	0	-/-
07	**40**	-	-	40	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Opuntia sp.												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**80**	-	-	80	-	-	0	0	-	-	0	4/11
07	**80**	-	-	80	-	-	0	0	-	-	0	6/7
Tetradymia canescens												
83	**100**	-	-	100	-	-	0	0	0	-	0	22/30
89	**99**	-	-	33	66	-	0	0	67	-	33	22/23
02	**0**	-	-	-	-	20	0	0	0	-	0	26/51
07	**20**	-	-	-	20	20	0	0	100	-	100	27/48

Trend Study 18A-27-07

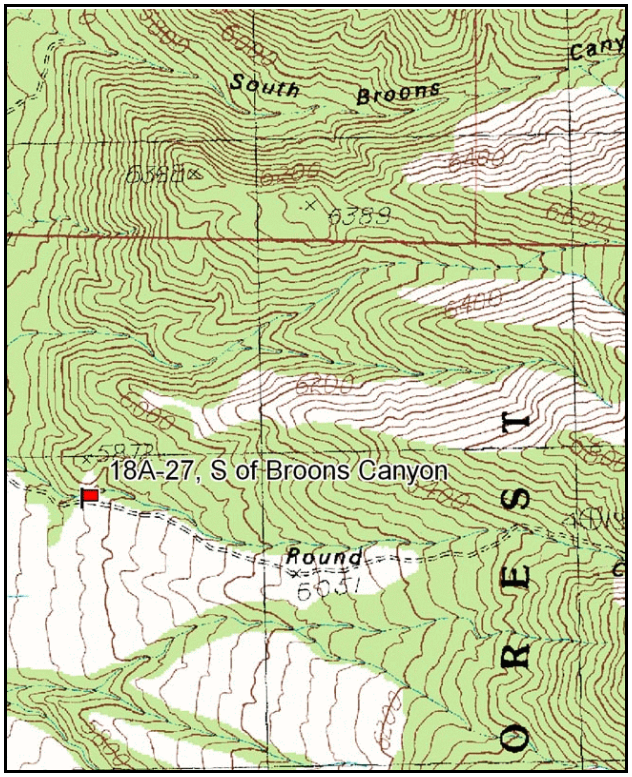
Study site name: South of Broons Canyon . Vegetation type: Antelope bitterbrush .

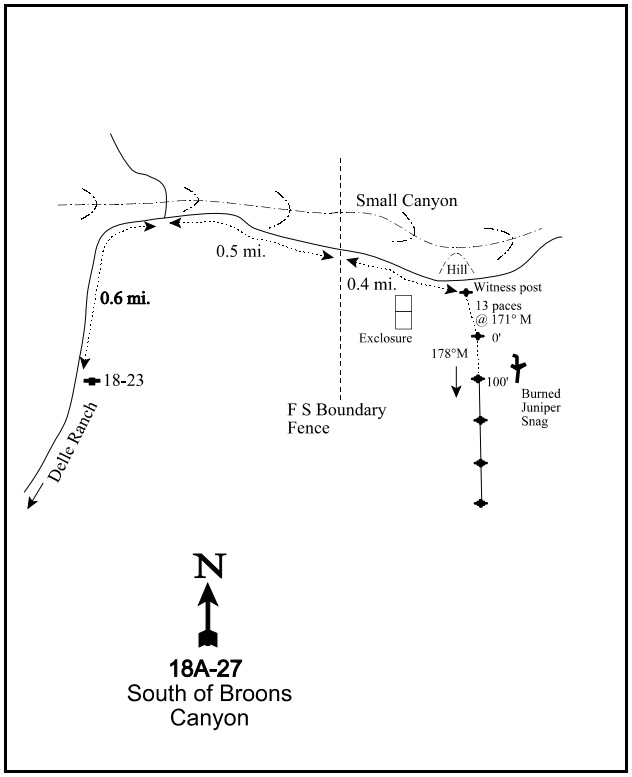
Compass bearing: frequency baseline 178 degrees magnetic.

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

LOCATION DESCRIPTION

From I-80, proceed south on Skull Valley Road for 11 miles. Turn east of a dirt road (between mile posts 24 and 25) 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 0.20 miles to an intersection. Go east for 0.05 miles to another intersection. Turn left, and go north 0.65 miles to the location of Study #18A-23. Continue 0.6 miles to a fork, go right (east). Continue approximately 0.5 miles to the Forest Service 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 12T 359357 E 4494036 N

DISCUSSION

South of Broons Canyon - Trend Study No. 18A-27

Study Information

This study lies just above the Forest Service exclosure located in Round Canyon. The range type is antelope bitterbrush (*Purshia tridentata*) with interspersed mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) [elevation: 5,800 feet (1,768 m), slope: 18%, aspect: west]. During the 1983 reading, deer pellet groups were abundant and there was moderate utilization of the key browse species. In 1997, deer pellet group quadrat frequency was moderately high at 27%. A pellet group transect read in 2002 estimated 56 deer days use/acre (139 ddu/ha), which increased to 79 deer days use/acre (195 ddu/ha) in 2007. Most of the deer pellet groups sampled in 2002 were from winter use, but about 5% were from spring use. Cattle also grazed the area and were observed at the time the study was established. Cattle use was considered light in 1997, but was not noted in 2002 or 2007.

Soil

The soil is classified within the Kapod series (USDA-NRCS 2007). These soils are derived from igneous alluvium and are gravelly to sandy in texture. Soil texture is a sand clay loam with a neutral reaction (pH 6.7). Large to medium sized rocks are common on the soil surface. The majority of the ground has been covered by vegetation and litter since the study was established. Approximately 5% of the ground is bare. The erosion condition class was stable in 2002 and 2007.

Browse

Since sampling began, this area has possessed an especially hardy and productive population of antelope bitterbrush. This ecotype exhibits a semi-erect growth form with some smaller shrubs growing under the canopies of the larger individuals. There appears to be some hybridization with Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*). This population has excellent seed production. It could be a potentially important seed collection site where seeds usually mature in the last half of July, depending upon local weather. Density of this thick layering stand has been difficult to estimate. It was estimated at 680 plants/acre (1,680 plants/ha) in 1997, 1,580 plants/acre (3,904 plants/ha) in 2002, and 900 plants/acre (2,224 plants/ha) in 2007. Total canopy cover was 39% in 2002 and 32% in 2007. Bitterbrush provided 70% of the total browse cover in 2002 and 60% in 2007. The population has been largely mature for the duration of the study. In 1983, the majority of the plants showed moderate use, but use has fluctuated from moderate-heavy to light since. Vigor remains good and there are few decadent plants. Annual leader growth averaged 4.6 inches (11.6 cm) in 2002 and 2 inches (5.1 cm) in 2007.

Sagebrush is present in moderate numbers and is of secondary importance. It made up 26% of the total browse cover in 2002 and 36% in 2007. Sagebrush density was 1,700 plants/acre (4,200 plants/ha) in 1997, 2,220 plants/acre (5,486 plants/ha) in 2002, and 2,000 plants/acre (4,942 plants/ha) in 2007. In 1983, 55% of the population was young plants, but the age structure has shifted to a mostly mature population. Decadence has increased from 14% in 1997 and 2002 to 35% in 2007. Utilization has been mostly light, and vigor is good. In 2007, 29% of the sampled sagebrush were infested with insects.

Broom snakeweed (*Gutierrezia sarothrae*), Utah juniper (*Juniperus osteosperma*), and stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* spp. *viscidiflorus*) are also present in low densities. Point-centered quarter data estimated juniper density at 62 trees/acre (153 trees/ha) in 2002 and 2007. The trunk diameter of the plants increased from 4.3 inches (10.9 cm) in 2002 to 6.8 inches (17.3 cm) in 2007.

Herbaceous Understory

The herbaceous understory composition consisted of mostly cheatgrass (*Bromus tectorum*) intermixed with perennial grasses in 1997 and 2002. Cheatgrass cover was 11% in 1997, 25% in 2002, and 16% in 2007. The

quadrat frequency of cheatgrass has been 97%-100% since 1997. Bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*) comprise the majority of the remaining grass cover.

Forbs increased from 10% of the herbaceous cover in 2002 to 55% in 2007. The site supports a diverse composition of forbs, but only a few species were sampled more than occasionally. However, a few good to moderately palatable species provide a small amount of forage. Some of these have shown evidence of utilization in the past. Most important are common stickseed (*Hackelia patens*), Indian paintbrush (*Castilleja linariaefolia*), gray lomatium (*Lomatium grayi*), arrowleaf balsamroot (*Balsamorhiza sagittata*), and redroot eriogonum (*Eriogonum racemosum*). Perennial forb cover was 6% in 1997, 3% in 2002, and 15% in 2007. Annual forb cover was 2% in 1997, less than 1% in 2002, and 12% in 2007.

1989 TREND ASSESSMENT

The trend for browse is slightly down. The density of bitterbrush decreased from 966 plants/acre (2,387 plants/ha) to 666 plants/acre (1,646 plants/ha). Decadence increased from 0% to 15%, while young recruitment decreased from 14% to 5%. Eighty-five percent of the plants showed moderate-heavy use, but vigor remained good. Sagebrush density also decreased, from 733 plants/acre (1,811 plants/ha) to 532 plants/acre (1,315 plants/ha). Decadence increased from 5% to 25%, and the percent of young plants in the population decreased from 55% to only 6%. Utilization of sagebrush was mostly light, with 38% of the plants displaying moderate use, and vigor was good. The trend for grass is stable. There were no significant changes in the nested frequencies of perennial grasses. The trend for forbs is up. The sum of nested frequency for perennial forbs increased by 54%. However, forbs were sampled infrequently.

browse - slightly down (-1) grass - stable (0) forb - up (+2)

1997 TREND ASSESSMENT

The trend for browse is up. The density of bitterbrush remained stable since 1989 at approximately 680 plants/acre (1,680 plants/ha), while the density of sagebrush increased from 532 plants/acre (1,315 plants/ha) to 1,700 plants/acre (4,201 plants/ha). However, a larger area was sampled in 1997 than in 1989. The percent decadence in both populations decreased. Recruitment for these two species was low, with young plants only comprising 8% of the sagebrush population and 3% of the bitterbrush population. Vigor was good, and use of both species was mostly light. The trend for grass is stable. There were no significant changes in the nested frequencies of the sampled grass species. Cheatgrass comprised 57% of the total grass cover and 40% of the total herbaceous cover. The trend for forbs is up. The sum of nested frequency for perennial forbs increased by almost 40%. Wild onion (*Allium* sp.) and stickseed increased significantly in nested frequency. The Desirable Components Index (DCI) was rated as fair-good due to good browse cover with low decadence, but a low percentage of young shrubs in the population. Annual grass cover was also high.

winter range condition (DCI) - fair-good (64) Mid-level potential scale
browse - up (+2) grass - stable (0) forb - up (+2)

2002 TREND ASSESSMENT

The trend for browse is up. The density of both bitterbrush and sagebrush increased, although the increase in bitterbrush is likely due to sampling error caused by the thickness of the stand and the difficulty discerning the layered individuals. Bitterbrush had a density of approximately 1,580 plants/acre (3,904 plants/ha), while sagebrush had a density of 2,220 plants/acre (5,486 plants/ha). The browse is mostly mature, with few young plants sampled. Only 9% of the bitterbrush and 14% of the sagebrush plants were classified as decadent, and vigor remained good. Utilization of bitterbrush increased to mostly moderate-heavy. The trend for grass is down. The total nested frequency for perennial grasses declined 73%. There was also a significant decline in the nested frequency of the primary perennial species, bluebunch wheatgrass and Sandberg bluegrass. Cheatgrass was abundant and remained stable in frequency. The percent cover for cheatgrass increased from 11% to 25%. Cheatgrass provided 94% of the total grass cover and 84% of the herbaceous cover in 2002. The

trend for forbs is down. Nested frequency for perennial forbs declined 62%, and the number of perennial species sampled decreased from 18 to 8. Forbs only accounted for 4% of the total vegetative cover. It is likely that the dense shrub cover is suppressing the understory. The DCI declined to a poor rating due to large decrease in perennial herbaceous cover, and an increase in cheatgrass cover.

winter range condition (DCI) - very poor (32) Mid-level potential scale
browse - up (+2) grass - down (-2) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is slightly down. The density of bitterbrush decreased from 1,580 plants/acre (3,904 plants/ha) to 900 plants/acre (2,224 plants/ha), likely an artifact of the slightly inflated sampling in 2002. Population decadence remained stable at 9%, and plants displayed good vigor. Forty-seven percent of the plants sampled displayed moderate-heavy use. The density of sagebrush slightly decreased from 2,220 plants/acre (5,486 plants/ha) to 2,000 plants/acre (4,942 plants/ha), a 10% decrease. Sagebrush decadence increased from 14% to 35%, and the plants classified with poor vigor also increased from 5% to 12%. Utilization for this species was low. The trend for grass is up. The sum of nested frequency for perennial grasses increased more than two-fold. There were significant increases in the nested frequencies of two perennial grass species: Sandberg bluegrass and oniongrass (*Melica bulbosa*). Perennial species comprised 28% of the grass cover, which was an increase from 6% in 2002. The average cover of cheatgrass decreased from 25% to 16%, and this species composed only 33% of the herbaceous understory, as opposed to 84% in 2002. However, cheatgrass remained stable in nested frequency, and was sampled in 100% of the quadrats. The trend for forbs is up. The nested frequencies of eight forb species increased significantly since 2002. However, one of these species was bur buttercup (*Ranunculus testiculatus*), which is allelopathic and of little value (Buchanan et al. 1978), and another was storksbill (*Erodium cicutarium*), which can outcompete and prevent the establishment of native species (Kimball and Shiffman 2003). Forbs accounted for 33% of the total vegetative cover. The DCI increased to a poor-fair rating, due to improvements in the herbaceous understory.

winter range condition (DCI) - poor-fair (51) Mid-level potential scale
browse - slightly down (-1) grass - up (+2) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 27

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	$_{b}$138	$_{b}$109	$_{b}$124	$_{a}$45	$_{a}$69	3.69	.96	3.38
G	Bromus tectorum (a)	-	-	$_{a}$338	$_{a}$339	$_{a}$342	10.86	25.41	16.01
G	Melica bulbosa	-	-	$_{ab}$20	$_{a}$7	$_{b}$20	.30	.36	.24
G	Poa fendleriana	-	$_{a}$5	$_{a}$4	$_{a}$4	$_{a}$1	.00	.15	.00
G	Poa secunda	$_{b}$138	$_{b}$159	$_{b}$141	$_{a}$21	$_{b}$116	4.19	.22	2.57
Total for Annual Grasses		0	0	338	339	342	10.86	25.41	16.01
Total for Perennial Grasses		276	273	289	77	206	8.20	1.70	6.19
Total for Grasses		276	273	627	416	548	19.07	27.11	22.20
F	Agoseris glauca	-	$_{b}$18	$_{a}$3	-	$_{ab}$9	.00	-	.51
F	Alyssum alyssoides (a)	-	-	$_{a}$41	$_{a}$26	$_{b}$63	.16	.12	.46
F	Allium sp.	$_{a}$3	$_{ab}$24	$_{c}$63	$_{ab}$27	$_{bc}$34	.53	.49	.16
F	Antennaria rosea	2	-	-	-	-	-	-	-
F	Astragalus sp.	$_{a}$2	$_{b}$17	$_{a}$1	-	$_{a}$4	.00	-	.06
F	Balsamorhiza sagittata	-	$_{a}$1	$_{a}$2	$_{a}$1	$_{a}$-	.21	.03	.00
F	Castilleja linariaefolia	-	-	5	-	-	.01	-	-
F	Calochortus nuttallii	$_{a}$3	$_{a}$3	$_{a}$5	-	$_{a}$2	.02	-	.00
F	Chenopodium sp. (a)	-	-	4	-	-	.00	-	-
F	Cirsium neomexicanum	$_{a}$6	$_{a}$12	$_{a}$5	-	$_{a}$1	.20	-	.03
F	Comandra pallida	-	-	$_{a}$-	-	$_{a}$5	.00	-	.03
F	Collinsia parviflora (a)	-	-	$_{a}$31	$_{a}$27	$_{b}$62	.11	.13	1.34
F	Crepis intermedia	$_{a}$5	$_{a}$7	$_{a}$4	$_{a}$11	$_{a}$11	.09	.15	.16
F	Descurainia sp. (a)	-	-	$_{a}$3	-	$_{b}$51	.00	-	.46
F	Draba sp. (a)	-	-	-	-	5	-	-	.01
F	Epilobium brachycarpum (a)	-	-	15	-	-	.06	-	-
F	Erodium cicutarium (a)	-	-	$_{b}$32	$_{a}$5	$_{c}$85	.31	.03	.89
F	Eriogonum racemosum	-	$_{a}$1	$_{a}$2	-	$_{a}$1	.03	-	.00
F	Galium boreale	-	$_{a}$33	$_{a}$17	-	$_{b}$152	.37	-	8.05
F	Hackelia patens	$_{a}$39	$_{a}$28	$_{b}$88	$_{a}$40	$_{a}$41	3.30	1.24	1.50
F	Holosteum umbellatum (a)	-	-	$_{b}$99	$_{a}$13	$_{c}$266	.66	.05	7.50
F	Lactuca serriola	-	-	$_{a}$11	-	$_{a}$5	.06	-	.04
F	Lithospermum ruderale	$_{a}$3	$_{a}$2	$_{a}$3	$_{a}$2	$_{a}$4	.56	.30	.53
F	Lomatium grayi	$_{a}$17	$_{a}$22	$_{a}$19	$_{a}$9	$_{b}$66	.38	.10	3.26
F	Lygodesmia sp.	-	-	13	-	-	.06	-	-
F	Machaeranthera canescens	-	-	14	-	-	.04	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Microsteris gracilis (a)	-	-	$_{a}$11	$_{a}$3	$_{b}$57	.18	.01	.38
F	Montia perfoliata (a)	-	-	-	-	36	-	-	.74
F	Phlox hoodii	-	-	-	-	2	-	-	.00
F	Phlox longifolia	$_{a}$23	$_{a}$56	$_{a}$56	$_{a}$31	$_{a}$35	.25	.22	.26
F	Polygonum douglasii (a)	-	-	2	-	-	.00	-	-
F	Ranunculus testiculatus (a)	-	-	$_{a}$5	$_{a}$7	$_{b}$48	.03	.01	.21
F	Sisymbrium altissimum (a)	-	-	-	$_{a}$2	$_{a}$6	-	.03	.03
F	Tragopogon dubius	$_{b}$48	$_{a}$4	$_{a}$11	$_{a}$3	-	.08	.03	-
F	Zigadenus paniculatus	-	4	-	-	-	-	-	-
Total for Annual Forbs		0	0	243	83	679	1.54	0.40	12.06
Total for Perennial Forbs		151	232	322	124	372	6.24	2.58	14.64
Total for Forbs		151	232	565	207	1051	7.79	2.99	26.71

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	'97	'02	'07
B	Artemisia tridentata vaseyana	50	54	59	13.35	12.59	11.84
B	Chrysothamnus nauseosus albicaulis	0	1	1	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	5	4	3	.06	.33	.00
B	Gutierrezia sarothrae	18	7	1	.70	.15	.38
B	Juniperus osteosperma	0	1	1	-	1.00	.76
B	Purshia tridentata	29	47	36	23.27	33.45	19.59
Total for Browse		102	114	101	37.38	47.53	32.58

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 27

Species	Percent Cover		
	'97	'02	'07
Artemisia tridentata vaseyana	-	15.14	16.66
Chrysothamnus viscidiflorus viscidiflorus	-	-	.03
Gutierrezia sarothrae	-	.33	-
Juniperus osteosperma	3.40	.23	1.78
Purshia tridentata	-	39.34	32.01

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 27

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	9.5	2.7
Purshia tridentata	11.6	2

POINT-QUARTER TREE DATA --
Management unit 18A, Study no: 27

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	62	62

Average diameter (in)	
'02	'07
4.3	6.8

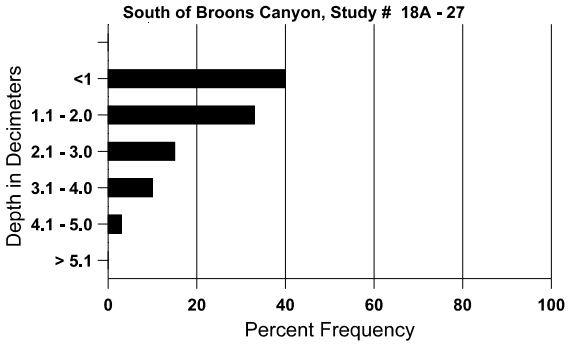
BASIC COVER --
Management unit 18A, Study no: 27

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	2.75	16.00	56.69	66.97	68.68
Rock	5.00	8.75	7.96	8.05	10.65
Pavement	.50	2.00	1.64	.60	1.18
Litter	84.25	65.50	62.09	49.21	35.11
Cryptogams	1.00	.75	1.17	1.01	1.39
Bare Ground	6.50	7.00	3.67	3.98	4.51

SOIL ANALYSIS DATA --
Herd Unit 18, Study no: 27, South of Broons Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.1	68.0 (15.2)	6.7	50.0	27.4	22.6	3.6	16.8	275.2	.4

Stoniness Index



PELLET GROUP DATA --
Management unit 18A, Study no: 27

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	35	36	32
Elk	1	-	8
Deer	27	24	17
Cattle	1	-	-

Days use per acre (ha)	
'02	'07
-	-
-	-
56 (137)	79 (195)
-	-

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 27

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	91/113
Artemisia tridentata vaseyana												
83	**733**	-	400	300	33	-	36	5	5	-	5	30/40
89	**532**	-	33	366	133	-	38	6	25	-	0	21/24
97	**1700**	140	140	1320	240	80	18	0	14	2	5	27/37
02	**2220**	-	100	1820	300	80	12	0	14	5	5	29/38
07	**2000**	240	20	1280	700	140	7	0	35	12	12	34/49

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**20**	-	-	20	-	-	100	0	0	-	0	15/20
07	**20**	-	-	-	20	-	0	0	100	100	100	-/-
Chrysothamnus viscidiflorus viscidiflorus												
83	**66**	-	33	33	-	-	50	0	0	-	0	20/31
89	**132**	100	66	66	-	-	25	0	0	-	0	12/12
97	**100**	-	20	80	-	-	0	0	0	-	0	16/29
02	**120**	-	-	120	-	-	0	0	0	-	0	15/23
07	**60**	-	-	40	20	-	0	0	33	-	0	14/22
Gutierrezia sarothrae												
83	**3200**	133	1600	1600	-	-	0	0	0	-	0	13/14
89	**1932**	-	366	933	633	-	2	0	33	10	17	8/10
97	**840**	40	100	740	-	-	0	0	0	-	0	12/12
02	**220**	-	-	180	40	120	0	0	18	-	0	10/12
07	**20**	-	-	20	-	-	0	0	0	-	0	10/16
Juniperus osteosperma												
83	**66**	-	-	33	33	-	0	0	50	-	0	67/51
89	**66**	-	-	33	33	-	50	0	50	-	0	89/94
97	**0**	-	-	-	-	20	0	0	0	-	0	-/-
02	**20**	-	-	20	-	-	0	0	0	-	0	-/-
07	**20**	-	-	20	-	-	0	0	0	-	0	-/-
Purshia tridentata												
83	**966**	33	133	833	-	-	83	10	0	-	0	45/41
89	**666**	-	33	533	100	-	70	15	15	-	0	46/86
97	**680**	20	20	660	-	20	15	0	0	-	0	52/91
02	**1580**	-	20	1420	140	-	56	29	9	3	3	54/94
07	**900**	40	20	800	80	40	27	22	9	-	0	56/89

Trend Study 18A-29-07

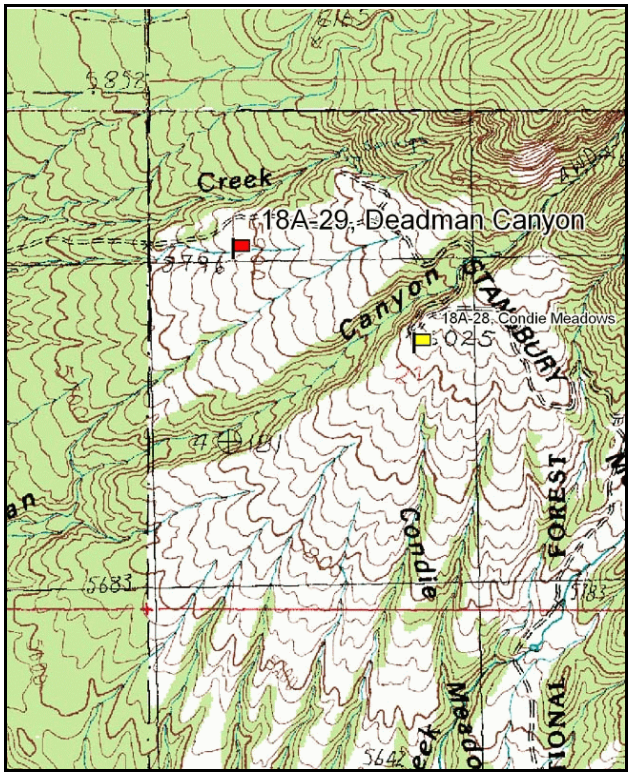
Study site name: Deadman Canyon . Vegetation type: Chained, Seeded PJ .

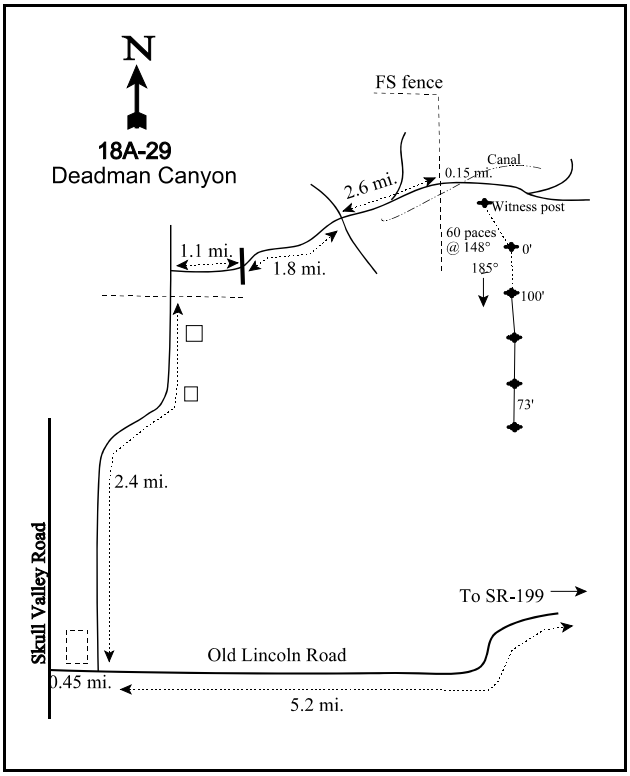
Compass bearing: frequency baseline 185 degrees magnetic.

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

LOCATION DESCRIPTION

From SR-l99, 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 Forest Service 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 degrees) to the 0-foot baseline stake. It is marked by a red browse tag, number 3927.





Map Name: Terra

Diagrammatic Sketch

Township 5S , Range 7W , Section 21

GPS: NAD 83, UTM 12T 360195 E 4470211 N

DISCUSSION

Deadman Canyon - Trend Study No. 18A-29

Study Information

This study, although located only a short distance from the suspended Condie Meadows (18A-28) study, samples a markedly different community [elevation 5,880 feet (1,792 m), slope: 10%, aspect: west]. This is a former pinyon-juniper woodland that has been chained and seeded with perennial grasses. Initially, there was no evidence that any shrub or forb species were included in the seed mixture, however, a fair browse stand remains. Deer use was moderate in 1997 with a quadrat frequency of 29%. Pellet group transect data estimated 58 deer days use/acre (142 ddu/ha) in 2002 and only 14 deer days/acre (35 ddu/ha) in 2007. Elk use was estimated at 1 elk day use/acre (2 edu/ha) in 2007. Rabbit pellet quadrat frequency was 55% in 2002 and 69% in 2007.

Soil

The soil is classified within the Abela series (USDA-NRCS 2007). Soils in this series are described as very gravelly loams. They are deep, well-drained, and formed in alluvium or lacustrine deposits derived from limestone, sandstone, and quartzite. The soil is rocky in the upper horizons with a clay loam texture. The soil reaction is neutral (pH 7.3). The soil phosphorus is relatively low at 6.8 ppm. Grasses, especially bluebunch wheatgrass (*Agropyron spicatum*), are well-established and provide valuable protection from erosion. Moderate erosion was thought to be occurring in 1983. Erosion has since been negligible and the soil erosion condition class was determined as slight in 2002 and 2007 due to some pedestalling and soil flow patterns.

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 (*Juniperus osteosperma*). Other shrub species, such as broom snakeweed (*Gutierrezia sarothrae*), occur infrequently. In 1983, sagebrush density was approximately 500 plants/acre (1,235 plants/ha). Density remained relatively stable from 1989 to 2002 between 800 plants/acre (1,977 plants/ha) and 880 plants/acre (2,174 plants/ha). In 2007, sagebrush density was 1,000 plants/acre (2,471 plants/ha). Average cover was 3% in 1997 and 2007, and 5% in 2002. The age structure of the sagebrush population has shifted, from a composition of only young and mature plants in 1983 to only mature and decadent plants in 2007. Decadent plants constituted only 10% of the population from 1983 to 2002, but made up 42% in 2007. Vigor has been good throughout the study, however, in 2007, 18% of the plants displayed poor vigor. Use has been mostly light-moderate. Average annual leader growth was 1.2 inches (3.2 cm) in 2002 and 2007.

Cliffrose density ranged between 199 plants/acre (492 plants/ha) in 1983 and 120 plants/acre (297 plants/ha) in 2002. Average cover has been 3%-4% since 1997. Decadence increased from 0% of the population in 1997 and 2002 to 43% in 2007. Young plants made up 11% of the population in 1997 and 17% in 2002, but no young plants were sampled in 2007. Vigor has been relatively good since 1983. Cliffrose utilization was moderate-heavy in 1983 and 1989, light in 1997, and light-moderate in 2002 and 2007. Average annual leader growth was 1.4 inches (3.6 cm) in 2002 and 2.7 inches (7 cm) in 2007.

The juniper population has remained at a relatively stable density since 1989. Juniper density was 89 trees/acre (220 plants/ha) in 2002 and 83 trees/acre (205 trees/ha) in 2007. The average trunk diameter was 6.6 inches (16.8 cm) in 2002 and 7.2 inches (18.3 cm) in 2007.

Herbaceous Understory

The herbaceous understory is composed mostly of perennial grasses, which increased in cover from 16% in 1997 to 21% in 2007. In 1983, common seeded species included crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Agropyron intermedium*). Natives, such as bluebunch wheatgrass (*Agropyron*

spicatum) and Sandberg bluegrass (*Poa secunda*), were dominant. Since 1983, the seeded species have steadily declined. The natives, particularly bluebunch wheatgrass, have provided the majority of the grass cover since 1997. Cheatgrass was abundant in 1997, but declined significantly in 2002, most likely due to drought conditions. Cheatgrass cover was 6% in 1997, almost 0% in 2002, and 2% in 2007. Bulbous bluegrass (*Poa bulbosa*) is present, and increased in nested frequency between 2002 and 2007.

Forb composition and abundance have been poor. Forage production from this component is low, and few desirable species have been sampled. The most common forb species include pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*). Due to drought conditions, forbs were essentially nonexistent in 2002, and recovered slightly by 2007.

1989 TREND ASSESSMENT

The trend for browse is slightly up. The density of sagebrush increased from 499 plants/acre (1,233 plants/ha) to 832 plants/acre (2,056 plants/ha). 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, and vigor remained good. The majority of the population (84%) showed moderate use. The density of cliffrose remained relatively stable. Decadence increased from 17% to 60%, and recruitment from young plants decreased from 17% of the population to 0%. These changes may reflect the mid-1980s shrub die-off that affected different locations within the Great Basin. Vigor remained good-moderate, and all of the plants sampled were moderately to heavily hedged. The trend for grass is slightly down. The sum of the nested frequency for perennial grasses decreased 20%. There were significant decreases in the nested frequencies of intermediate wheatgrass, Sandberg bluegrass, and bottlebrush squirreltail (*Sitanion hystrix*), while the nested frequency of crested wheatgrass increased significantly. Bluebunch wheatgrass and Sandberg bluegrass were the most abundant grasses. The trend for forbs is stable. Forb species were very sparse and provided little forage value. The number of forb species sampled decreased from 10 to six.

browse - slightly up (+1) grass - slightly down (-1) forb - stable (0)

1997 TREND ASSESSMENT

The trend for browse is stable. The density of sagebrush remained relatively stable at 800 plants/acre (1,977 plants/ha). Decadence remained low at 3% of the population, while recruitment remained high. Utilization was mostly light. Cliffrose density increased slightly, from 166 plants/acre (410 plants/ha) to 180 plants/acre (445 plants/ha). No plants were classified as decadent, which was an improvement from 60% in 1989. Young recruitment remained low at 11% of the population. Cliffrose utilization was light. The trend for grass is stable. There was a significant decrease in the nested frequency of crested wheatgrass, while two other perennial grasses significantly increased in nested frequency. The trend for forbs is slightly down. Five more forb species were sampled, but the total nested frequency for perennial forbs greatly decreased. The average cover of forbs was only 3%, and this was made up of annual species that did not provide significant forage. One of the most abundant forb species was bur buttercup, which inhibits the germination and growth of surrounding plants (Buchanan et al. 1978). The Desirable Components Index (DCI) was rated as good-excellent, due to good browse cover with low decadence and abundant young plants, and a favorable perennial grass understory.

winter range condition (DCI) - good-excellent (66) Low potential scale
browse - stable (0) grass - stable (0) forb - slightly down (-1)

2002 TREND ASSESSMENT

The trend for browse is stable. The sagebrush density increased slightly, from 800 plants/acre (1,977 plants/ha) to 880 plants/acre (2,174 plants/ha). Decadence remained low at 9% of the population, however, recruitment decreased from 48% of the population to 2%. Use was light-moderate, and vigor was good. The density of cliffrose decreased slightly, from 180 plants/acre (445 plants/ha) to 120 plants/acre (297 plants/ha).

The population remained largely mature, with no decadence and 17% composed of young plants. Fifty percent of the population displayed moderate-heavy use, but the plants were vigorous. The trend for grass is slightly up. The sum of nested frequency for perennial grasses remained similar to 1997, but drought conditions caused a significant decrease in the nested frequency of cheatgrass. Bluebunch wheatgrass accounted for 87% of the total herbaceous cover and 16% of the total ground cover. This species increased significantly in nested frequency. The trend for forbs is slightly down. The sum of nested frequency for both perennial and annual forbs decreased dramatically. Ten forb species were sampled in 1997, but only three annual species remained in 2002. Forbs were virtually nonexistent in 2002. The DCI declined from good-excellent to good, due to a decrease in sagebrush recruitment and the absence of forbs.

winter range condition (DCI) - good (57) Low potential scale
browse - stable (0) grass - slightly up (+1) forb - slightly down (-1)

2007 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density continued to increase from 880 plants/acre (2,174 plants/ha) to 1,000 plants/acre (2,471 plants/ha). However, there were no young plants sampled in 2007, and decadence increased from 9% to 42% of the population. Use was mostly light-moderate, but the percent of plants displaying poor vigor increased from 0% to 18%. The cliffrose population followed the same trends as sagebrush. Density increased slightly, from 120 plants/acre (297 plants/ha) to 140 plants/acre (346 plants/ha). No young plants were sampled, and decadence increased from 0% to 43% of the population. However, cliffrose height and crown width increased 21 inches (53 cm) and 19 inches (48 cm), respectively. Use remained moderate-heavy, and 14% of the plants sampled displayed poor vigor. The trend for grass is stable. Sandberg bluegrass increased significantly in nested frequency, however, cheatgrass and bulbous bluegrass also increased significantly. The trend for forbs is slightly down. Bur buttercup increased significantly, and forb diversity remained low. The species that were present are not very useful as forage. The DCI decreased to fair, due to an increase in browse decadence, the absence of browse recruitment, and an increase in annual grasses.

winter range condition (DCI) - fair (40) Low potential scale
browse - stable (0) grass - stable (0) forb - slightly down (-1)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 29

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	$_{b}$50	$_{c}$133	$_{ab}$31	$_{a}$2	-	1.17	.03	-
G	Agropyron intermedium	$_{c}$98	$_{a}$6	$_{b}$50	$_{a}$7	$_{a}$3	2.03	.41	.00
G	Agropyron spicatum	$_{a}$159	$_{a}$165	$_{ab}$211	$_{c}$253	$_{bc}$239	10.55	15.70	16.58
G	Bromus japonicus (a)	-	-	-	-	6	-	-	.01
G	Bromus tectorum (a)	-	-	$_{c}$228	$_{a}$20	$_{b}$86	6.31	.04	1.70
G	Oryzopsis hymenoides	-	-	$_{a}$2	$_{a}$3	$_{a}$-	.03	.15	.00
G	Poa bulbosa	$_{a}$13	-	-	$_{a}$2	$_{b}$42	-	.00	.61

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Poa secunda	$_{bc}$122	$_{a}$51	$_{b}$91	$_{b}$117	$_{c}$173	1.72	1.67	3.85
G	Sitanion hystrix	$_{b}$17	$_{a}$1	$_{ab}$8	-	-	.07	-	-
Total for Annual Grasses		0	0	228	20	92	6.31	0.04	1.71
Total for Perennial Grasses		459	356	393	384	457	15.59	17.98	21.06
Total for Grasses		459	356	621	404	549	21.90	18.02	22.78
F	Agoseris glauca	$_{a}$4	-	-	-	$_{a}$3	-	-	.03
F	Alyssum alyssoides (a)	-	-	$_{b}$241	$_{a}$17	$_{c}$301	1.79	.03	3.76
F	Allium sp.	-	-	1	-	-	.03	-	-
F	Antennaria rosea	3	-	-	-	-	-	-	-
F	Arabis sp.	-	$_{a}$14	$_{a}$13	-	-	.08	-	-
F	Calochortus nuttallii	$_{b}$19	$_{a}$4	$_{a}$3	-	-	.05	-	-
F	Chaenactis douglasii	7	-	-	-	-	-	-	-
F	Crepis acuminata	3	-	-	-	-	-	-	-
F	Cruciferae	-	1	-	-	-	-	-	-
F	Erigeron sp.	2	-	-	-	-	-	-	-
F	Erigeron pumilus	2	-	-	-	-	-	-	-
F	Holosteum umbellatum (a)	-	-	-	2	-	-	.00	-
F	Lathyrus brachycalyx	$_{c}$83	$_{d}$133	$_{b}$48	-	$_{a}$4	.58	-	.15
F	Lactuca serriola	-	-	1	-	-	.00	-	-
F	Petradoria pumila	$_{a}$17	$_{a}$12	$_{a}$5	-	-	.02	-	-
F	Phlox longifolia	$_{a}$8	$_{a}$3	$_{a}$8	-	$_{a}$2	.21	-	.03
F	Ranunculus testiculatus (a)	-	-	$_{b}$107	$_{a}$2	$_{c}$195	.39	.00	2.03
F	Sisymbrium altissimum (a)	-	-	$_{a}$2	-	$_{a}$3	.03	-	.03
Total for Annual Forbs		0	0	350	21	499	2.22	0.04	5.84
Total for Perennial Forbs		148	167	79	0	9	0.98	0	0.21
Total for Forbs		148	167	429	21	508	3.21	0.04	6.05

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	'97	'02	'07
B	Artemisia tridentata wyomingensis	27	21	24	3.38	5.01	3.45
B	Cowania mexicana stansburiana	9	6	7	4.37	2.73	2.63
B	Gutierrezia sarothrae	36	4	15	.77	-	.13
B	Juniperus osteosperma	3	3	2	3.97	5.91	3.44
Total for Browse		75	34	48	12.50	13.67	9.65

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 29

Species	Percent Cover		
	'97	'02	'07
Artemisia tridentata wyomingensis	-	5.21	6.36
Cowania mexicana stansburiana	2.79	4.96	5.56
Gutierrezia sarothrae	-	-	.81
Juniperus osteosperma	6.00	6.15	7.76

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 29

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata wyomingensis	1.2	1.2
Cowania mexicana stansburiana	1.4	2.7

POINT-QUARTER TREE DATA --
Management unit 18A, Study no: 29

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	89	83

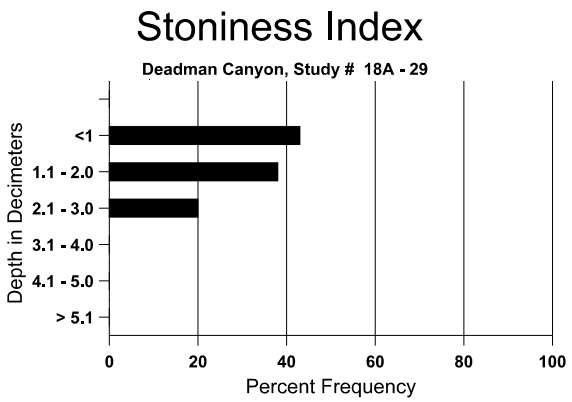
Average diameter (in)	
'02	'07
6.6	7.2

BASIC COVER --
Management unit 18A, Study no: 29

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	3.25	6.00	34.40	31.05	36.88
Rock	1.50	3.75	1.70	3.20	1.82
Pavement	3.25	17.00	7.44	11.06	10.84
Litter	73.50	57.25	51.37	50.00	34.09
Cryptogams	1.50	1.50	1.52	2.13	2.04
Bare Ground	17.00	14.50	7.66	20.22	22.73

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 29, Deadman Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
10.6	59.5	7.3	42.7	28.7	28.6	3.7	6.8	198.4	.6



PELLET GROUP DATA --
Management unit 18A, Study no: 29

Type	Quadrat Frequency			Days use per acre (ha)	
	'97	'02	'07	'02	'07
Rabbit	47	55	69	-	-
Elk	-	-	-	-	1 (2)
Deer	29	22	1	58 (142)	14 (35)
Cattle	-	-	1	-	-

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 29

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**499**	66	233	266	-	-	33	0	0	-	0	38/45
89	**832**	-	466	333	33	-	84	4	4	-	0	30/45
97	**800**	40	380	400	20	140	8	0	3	-	0	24/33
02	**880**	-	20	780	80	60	36	0	9	-	0	27/39
07	**1000**	-	-	580	420	140	24	6	42	10	18	28/37
Cowania mexicana stansburiana												
83	**199**	-	33	133	33	-	17	83	17	-	17	38/33
89	**166**	-	-	66	100	-	80	20	60	20	20	33/38
97	**180**	60	20	160	-	40	0	0	0	-	0	77/75
02	**120**	20	20	100	-	20	33	17	0	-	0	74/82
07	**140**	-	-	80	60	-	43	14	43	14	14	95/101
Gutierrezia sarothrae												
83	**633**	66	400	233	-	-	0	0	0	-	0	10/13
89	**33**	-	-	33	-	-	0	0	0	-	0	11/9
97	**1700**	-	380	1120	200	240	0	0	12	7	7	9/10
02	**120**	-	-	80	40	40	0	0	33	17	17	5/9
07	**420**	-	-	420	-	-	5	0	0	-	0	7/7
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**33**	-	-	33	-	-	0	0	0	-	0	124/63
97	**60**	-	20	40	-	60	0	0	0	-	0	-/-
02	**60**	-	-	40	20	40	0	0	33	-	0	-/-
07	**40**	-	-	40	-	20	0	0	0	-	0	-/-

Trend Study 18A-30-07

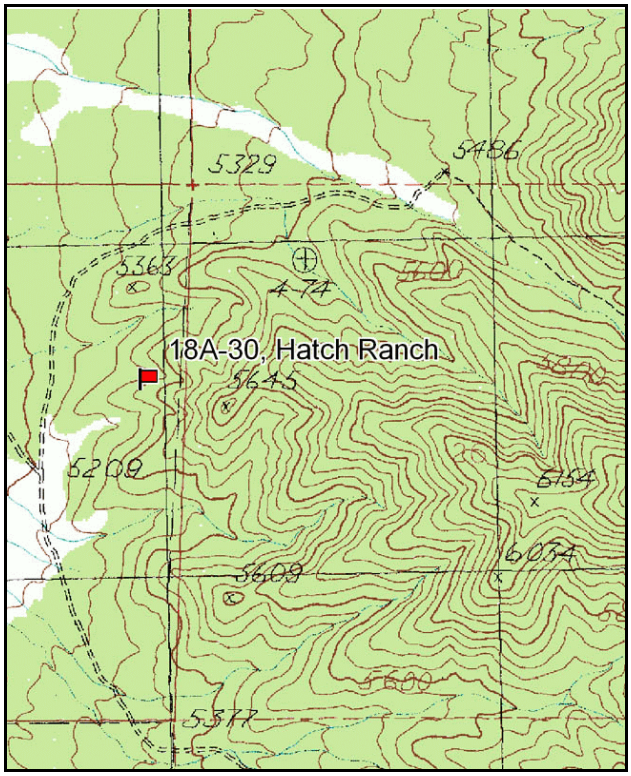
Study site name: Hatch Ranch . Vegetation type: Stansbury Cliffrose .

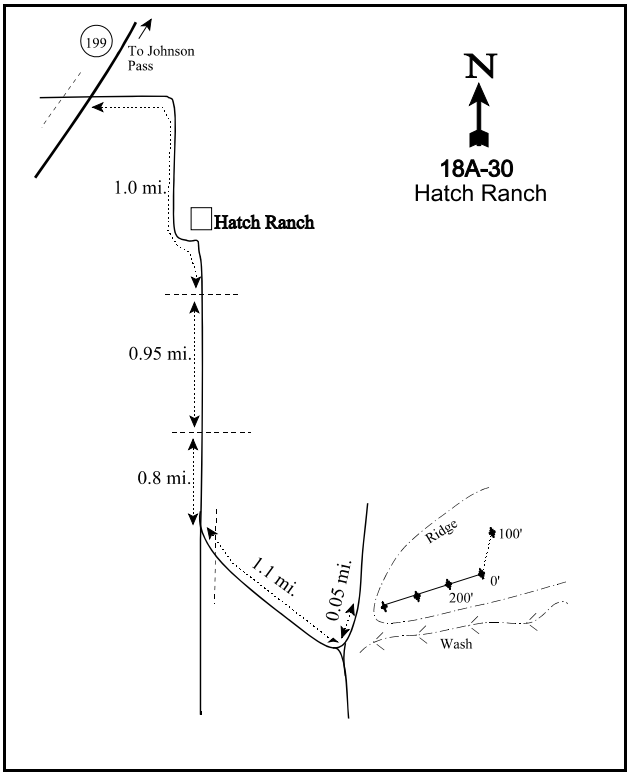
Compass bearing: frequency baseline 42 degrees magnetic (Lines 2-4 @ 250°M).

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

LOCATION DESCRIPTION

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 about 400 yards to the 0-foot baseline stake on the ridge top. It is a short green fencepost marked with browse tab #9081.





Map Name: Johnson Pass

Diagrammatic Sketch

Township 6S , Range 7W , Section 26

GPS: NAD 83, UTM 12T 362868 E 4458765 N

DISCUSSION

Hatch Ranch - Trend Study No. 18A-30

Study Information

This study samples critical winter range located at the base of the Onaqui Mountains, approximately 3 miles (4.8 km) south-southeast of Hatch Ranch [elevation: 5,350 feet (1,631 m), slope: 17%, aspect: west]. It is an area of low hills and ridges occupied by a scattered pinyon-juniper woodland 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 is administered by the BLM and is permitted for cattle grazing, which was underway at the time of study establishment in 1983. Little sign of cattle use was noted in 1997, 2002, or 2007. In 1989, evidence of sheep use was noted. Deer use has been moderate-light during sampling periods. Pellet group quadrat frequency was 40% in 1997, and decreased to 8% and 9% in 2002 and 2007, respectively. Deer pellet group transect data estimated 31 days use/acre (76 ddu/ha) in 2002 and 3 days use/acre (8 ddu/ha) in 2007. 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 sagebrush flat nearby.

Soil

The soil is classified within the Lodar-Lundy series (USDA-NRCS 2007). The soils in this series are shallow, well-drained, and moderately permeable. They are formed in residuum and colluvium from limestone, shale, and sandstone. Soil textural analysis shows a clay loam with a neutral reaction (pH 7.1). Approximately 42% of the ground surface is occupied by rock, pavement, or bare soil. Although the rate of soil erosion has been severe in the past, it was considered negligible or quite low in 1997 and 2002. The erosion condition class was determined as slight in 2007 due to some indication of soil movement.

Browse

Stansbury cliffrose and Wyoming big sagebrush combined have provided 51%-75% of the total browse cover since 1997. Sagebrush density has fluctuated between 860 plants/acre (2,125 plants/ha) and 1,260 plants/acre (3,113 plants/ha) since 1983. Average sagebrush cover has been 3%-4% since 1997. Decadence was low at 9% of the population in 1983, but steadily increased to 22% in 2002 and remained high in 2007. Young recruitment was high at 31% of the population in 1983 and 41% in 1989, but decreased to 10% in 1997, and increased to 19% in 2002. No young plants were sampled in 2007. Vigor was good in all years except 1997, when 26% of the mature sagebrush were classified as chlorotic and nearly all of the decadent shrubs were classified as dying. Utilization in 1983 was 43% light and 41% heavy, but has been mostly light since, with 35% moderate-heavy use in 2007. Average annual leader growth was 1.4 inches (3.5 cm) in 2002 and 0.8 inches (2 cm) in 2007.

Cliffrose density increased from just under 600 plants/acre (1,483 plants/ha) in 1983 and 1989 to 1,200 plants/acre (2,965 plants/ha) in 2002, then decreased to 980 plants/acre (2,422 plants/ha) in 2007. The cliffrose population has been mostly mature. Besides a moderately high percentage in 1989, decadence has remained relatively low. Young recruitment was good in 1997, but was low or moderate every other year. These plants have been moderately to heavily hedged during most years. Vigor has been good throughout the study. Annual leader growth averaged 1.7 inches (4.2 cm) in 2002 and 0.6 inches (1.5 cm) in 2007. Utah juniper (*Juniperus osteosperma*) is also present, and had a density of 63 trees/acre (156 trees/ha) in 2002 and 89 trees/acre (220 trees/ha) in 2007.

Herbaceous Understory

Total herbaceous cover was 15% in 1997 and 2007, but was only 8% in 2002, most likely due to drought conditions. Open areas and patches of cheatgrass occupied more ground area than any other class of

vegetation in 1997. Cheatgrass decreased from composing 57% of the total grass cover in 1997 to 6% of the grass cover in 2002 and 17% in 2007. Red brome (*Bromus rubens*) was also sampled in 2007, and made up 16% of the total grass cover. Sandberg bluegrass was the most abundant grass in 2002 and 2007, comprising 87% and 66% of the total grass cover, respectively. Several forb species are present, but only a few occur more than occasionally. Bur buttercup (*Ranunculus testiculatus*), an allelopathic species (Buchanan et al. 1978), was the most abundant forb in 1997 and 2007. Forbs only made up 3% of the total vegetative cover in 1997, 1% in 2002, and 5% in 2007.

1989 TREND ASSESSMENT

The trend for browse is stable. The density of cliffrose decreased slightly from 599 plants/acre (1,480 plants/ha) to 532 plants/acre (1,315 plants/ha). This species increased in decadence from 6% to 38%. Recruitment was low, with young plants comprising only 12% of the population. Cliffrose was the preferred species, and use by both deer and livestock was moderate-heavy. However, vigor remained good. The density of sagebrush increased from 1,066 plants/acre (2,634 plants/ha) to 1,233 plants/acre (3,047 plants/ha). Sagebrush decadence was low, and recruitment was excellent, with young plants making up 41% of the population. Use was light, and vigor was good. The trend for grass is up. The sum of nested frequency for perennial grasses increased 49%. The perennial grasses, Sandberg bluegrass and bluebunch wheatgrass (*Agropyron spicatum*), increased significantly in nested frequency. The trend for forbs is up. The sum of nested frequency for perennial forbs increased substantially. The number of forb species sampled increased from four to 10, and the total nested frequency of forbs greatly increased. However, forbs were still sampled infrequently and provided little forage value.

browse - stable (0) grass - up (+2) forb - up (+2)

1997 TREND ASSESSMENT

The trend for browse is stable. Cliffrose increased in density from 532 plants/acre (1,315 plants/ha) in 1989 to 780 plants/acre (1,927 plants/ha), and made up 38% of the total browse cover. The age class structure improved, with an increase in young plants from 12% of the population to 21%, and a decrease in decadence from 38% of the population to 13%. Vigor was good, and use was mostly light. Sagebrush density decreased from 1,233 plants/acre (3,047 plants/ha) to 960 plants/acre (2,372 plants/ha). The majority (73%) of the population was mature. Young plants in the population decreased from 41% in 1989 to 10% in 1997. Dead plants were noted for the first time in the study, with a density of 380 plants/acre (939 plants/ha). However, the density of sagebrush seedlings increased. Use was mostly light, and plants sampled with poor vigor increased from 5% to 33%. The trend for grass is stable. The sum of nested frequency for perennial grasses decreased 10%. Cheatgrass was the most abundant species, and its average cover was 8%. It comprised 57% of the total grass cover and 52% of the total herbaceous cover. Sandberg bluegrass was the most abundant perennial grass, and remained stable in nested frequency. The trend for forbs is slightly down. There was a significant decrease in the nested frequencies of two perennial forb species. Bur buttercup, which has poor forage value, was the most abundant forb. The Desirable Components Index (DCI) was rated as fair-good due to favorable browse cover, but also an abundance of cheatgrass and a lack of perennial grasses and forbs.

winter range condition (DCI) - fair-good (45) Low potential scale
browse - stable (0) grass - stable (0) forb - slightly down (-1)

2002 TREND ASSESSMENT

The trend for browse is up. Cliffrose density increased from 780 plants/acre (1,927 plants/ha) to 1,200 plants/acre (2,965 plants/ha). The cliffrose population was mainly mature, and the percentage of both young and decadent plants decreased. Use increased to moderate-heavy, and vigor remained good. Sagebrush density also increased, from 960 plants/acre (2,372 plants/ha) to 1,260 plants/acre (3,113 plants/ha). Sagebrush decadence slightly increased from 17% of the population to 22%, and young plants also increased from 10% of the population to 19%. Sagebrush use was mostly light, and vigor improved. The trend for grass

is slightly up. Cheatgrass decreased significantly in nested frequency, and had an average cover of less than 1%. Sandberg bluegrass remained stable in nested frequency. However, due to the decrease in cheatgrass, it increased to making up 87% of the grass cover and 83% of the herbaceous cover. The trend for forbs is down. Only three forb species were sampled in 2002, which decreased from 16 species in 1997. However, the nested frequency of bur buttercup decreased significantly. The DCI was rated as good due to an increase in preferred browse cover and a decrease in cheatgrass.

winter range condition (DCI) - good (56) Low potential scale
browse - up (+2) grass - slightly up (+1) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is down. Cliffrose density decreased from 1,200 plants/acre (2,965 plants/ha) to 980 plants/acre (2,422 plants/ha). It comprised 47% of the total browse cover, which is down from 59%. This population remained mature, with low recruitment and decadence. Thirty-one percent of the plants showed moderate use and 22% showed heavy use. Only 4% of the plants displayed poor vigor. The density of sagebrush decreased from 1,260 plants/acre (3,113 plants/ha) to 860 plants/acre (2,125 plants/ha). Sagebrush made up 24% of the total browse cover, which increased from 16% in 2002. This population was also mature. Young recruitment decreased from 19% of the population to 0%, and decadence slightly decreased from 22% of the population to 19%. Plants displaying poor vigor slightly increased from 8% of the population to 12%, and use increased from 8% of the plants showing moderate-heavy use to 35%. The trend for grass is slightly down. Cheatgrass increased significantly in nested frequency, and red brome was sampled for the first time since the study began. Sandberg bluegrass remained the dominant grass, but decreased from comprising 87% of the total grass cover to 66%. The trend for forbs is slightly down. Annual species dominated the forb component of the understory. Bur buttercup increased significantly in nested frequency. The DCI decreased to fair-good due to a decrease in browse cover and recruitment and an increase in annual grasses.

winter range condition (DCI) - fair-good (45) Low potential scale
browse - down (-2) grass - slightly down (-1) forb - slightly down (-1)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 30

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	a17	b39	ab24	a15	a1	.93	.58	.16
G	Bromus rubens (a)	-	-	-	-	109	-	-	2.08
G	Bromus tectorum (a)	-	-	c285	a73	b158	8.10	.46	2.25
G	Oryzopsis hymenoides	-	a3	a6	-	a3	.07	-	.01
G	Poa secunda	a192	b270	b252	b269	b253	5.09	7.00	8.59
Total for Annual Grasses		0	0	285	73	267	8.10	0.46	4.34
Total for Perennial Grasses		209	312	282	284	257	6.09	7.59	8.76
Total for Grasses		209	312	567	357	524	14.19	8.06	13.10
F	Agoseris glauca	-	-	3	-	-	.03	-	-
F	Alyssum alyssoides (a)	-	-	a10	-	a10	.02	-	.02
F	Allium sp.	a10	a6	a12	-	-	.06	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Antennaria rosea	-	-	$_{a}4$	$_{a}3$	$_{a}3$	.01	.00	.00
F	Astragalus utahensis	-	$_{a}1$	$_{a}3$	-	-	.00	-	-
F	Calochortus nuttallii	$_{a}3$	$_{a}7$	$_{a}1$	-	-	.00	-	-
F	Chaenactis douglasii	-	2	-	-	-	-	-	-
F	Cirsium sp.	-	-	1	-	-	.00	-	-
F	Cryptantha sp.	-	-	-	-	-	-	-	.00
F	Descurainia pinnata (a)	-	-	-	-	21_{a}	-	-	.07
F	Draba sp. (a)	-	-	-	-	56_{a}	-	-	.12
F	Erodium cicutarium (a)	-	-	$_{a}2$	-	$_{b}11$	.01	-	.05
F	Erigeron pumilus	$_{a}1$	$_{b}10$	$_{ab}6$	-	-	.03	-	-
F	Euphorbia sp.	-	-	5	-	-	.01	-	-
F	Haplopappus acaulis	-	6	-	-	-	-	-	-
F	Lappula occidentalis (a)	-	-	-	-	8_{a}	-	-	.01
F	Lactuca serriola	-	$_{b}27$	$_{a}2$	-	-	.03	-	-
F	Lomatium sp.	-	6	-	-	-	-	-	-
F	Microsteris gracilis (a)	-	-	$_{a}2$	-	$_{a}11$	.00	-	.02
F	Oenothera caespitosa	-	2	-	-	-	-	-	-
F	Phlox hoodii	-	-	$_{a}9$	$_{a}9$	$_{a}3$	.21	.36	.15
F	Phlox longifolia	$_{a}2$	$_{a}8$	$_{a}1$	-	-	.00	-	-
F	Ranunculus testiculatus (a)	-	-	$_{b}149$	$_{a}11$	$_{b}189$	.74	.03	1.21
F	Sisymbrium altissimum (a)	-	-	-	-	3	-	-	.03
F	Townsendia incana	-	$_{b}37$	$_{a}4$	-	$_{a}1$	.06	-	.00
Total for Annual Forbs		0	0	163	11	309	0.77	0.03	1.56
Total for Perennial Forbs		16	112	51	12	7	0.47	0.36	0.16
Total for Forbs		16	112	214	23	316	1.25	0.39	1.72

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	'97	'02	'07
B	Artemisia tridentata wyomingensis	34	36	29	3.10	3.30	4.43
B	Chrysothamnus viscidiflorus stenophyllus	13	0	1	.09	-	-
B	Cowania mexicana stansburiana	32	38	38	9.34	12.03	8.75
B	Gutierrezia sarothrae	87	13	43	7.50	.30	.95
B	Juniperus osteosperma	5	5	6	4.09	4.52	4.15
B	Leptodactylon pungens	2	1	1	-	.03	.00
B	Pinus monophylla	0	1	0	-	.00	-
B	Sclerocactus sp.	1	1	1	-	-	-
B	Tetradymia canescens	2	2	0	.15	-	-
B	Tetradymia nuttallii	18	11	4	.38	.09	.15
Total for Browse		194	108	123	24.66	20.29	18.44

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 30

Species	Percent Cover		
	'97	'02	'07
Artemisia tridentata wyomingensis	-	4.13	6.16
Chrysothamnus viscidiflorus stenophyllus	-	.03	-
Cowania mexicana stansburiana	-	14.66	17.16
Gutierrezia sarothrae	-	.01	1.20
Juniperus osteosperma	2.59	6.21	7.30
Tetradymia nuttallii	-	.13	-

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 30

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata wyomingensis	1.4	0.8
Cowania mexicana stansburiana	1.7	0.6

POINT-QUARTER TREE DATA --
Management unit 18A, Study no: 30

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	63	89

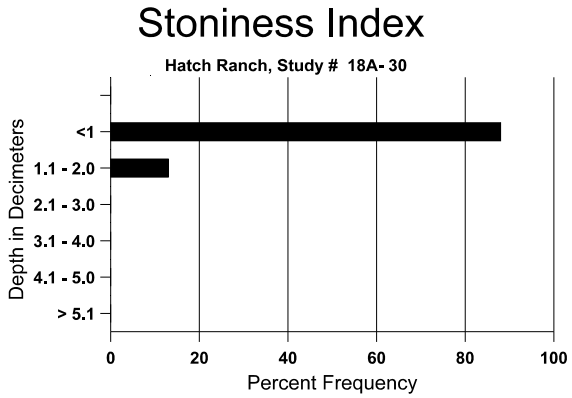
Average diameter (in)	
'02	'07
5.3	5.9

BASIC COVER --
Management unit 18A, Study no: 30

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	2.00	3.25	34.68	27.06	28.81
Rock	22.75	23.00	16.75	19.56	19.92
Pavement	12.00	21.25	16.10	15.42	19.53
Litter	33.75	27.25	28.58	25.79	29.13
Cryptogams	15.50	16.00	17.79	22.27	13.17
Bare Ground	14.00	9.25	6.42	9.96	5.68

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 30, Hatch Ranch

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
6.1	74.3 (8.4)	7.1	35.1	32.7	32.2	2.5	9.5	233.6	.7



PELLET GROUP DATA --
Management unit 18A, Study no: 30

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	45	12	64
Deer	40	8	9
Cattle	1	-	-

Days use per acre (ha)	
'02	'07
-	-
31 (76)	3 (8)
-	-

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 30

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**1066**	66	333	633	100	-	16	41	9	-	16	21/28
89	**1233**	200	500	600	133	-	16	5	11	5	5	20/19
97	**960**	320	100	700	160	380	4	0	17	15	33	19/28
02	**1260**	-	240	740	280	480	5	3	22	8	8	21/30
07	**860**	-	-	700	160	480	21	14	19	5	12	25/37
Chrysothamnus viscidiflorus stenophyllus												
83	**1999**	-	33	1866	100	-	0	0	5	-	3	12/17
89	**1832**	-	66	933	833	-	55	4	45	-	2	7/7
97	**380**	-	20	300	60	60	0	5	16	11	11	9/13
02	**0**	-	-	-	-	60	0	0	0	-	0	9/13
07	**20**	-	20	-	-	-	0	0	0	-	0	-/-
Cowania mexicana stansburiana												
83	**599**	-	66	500	33	-	78	22	6	-	11	50/41
89	**532**	66	66	266	200	-	25	44	38	-	0	37/24
97	**780**	80	160	520	100	100	5	3	13	3	3	51/54
02	**1200**	-	120	1000	80	140	22	48	7	-	0	50/53
07	**980**	20	60	760	160	60	31	22	16	4	4	55/64
Gutierrezia sarothrae												
83	**2866**	133	500	2366	-	-	0	0	0	-	0	11/9
89	**4732**	233	833	3266	633	-	1	0	13	3	8	8/8
97	**12920**	-	1860	10660	400	440	0	0	3	1	1	9/9
02	**520**	-	20	420	80	7500	4	0	15	15	15	5/5
07	**2720**	40	220	2440	60	60	.73	0	2	.73	7	7/8
Juniperus osteosperma												
83	**66**	-	-	66	-	-	0	0	-	-	0	56/42
89	**100**	133	-	100	-	-	0	0	-	-	0	79/45
97	**100**	20	40	60	-	-	0	0	-	-	0	-/-
02	**100**	-	20	80	-	20	0	0	-	-	0	-/-
07	**120**	20	40	80	-	20	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Leptodactylon pungens												
83	**2132**	-	266	1866	-	-	0	0	0	-	2	5/5
89	**2965**	100	166	2733	66	-	0	0	2	-	0	5/6
97	**60**	-	20	40	-	-	0	0	0	-	0	10/26
02	**20**	-	-	-	20	-	0	0	100	100	100	-/-
07	**20**	-	-	20	-	-	0	0	0	-	0	11/11
Pinus monophylla												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	20	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Sclerocactus sp.												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**20**	-	-	20	-	-	0	0	0	-	0	5/10
02	**40**	-	-	20	20	-	0	0	50	-	0	7/12
07	**20**	-	-	20	-	-	0	0	0	-	0	2/12
Tetradymia canescens												
83	**866**	-	-	400	466	-	0	0	54	-	23	18/19
89	**599**	-	66	100	433	-	28	6	72	6	11	20/19
97	**60**	-	-	60	-	40	0	0	0	-	100	20/25
02	**40**	-	-	-	40	20	0	0	100	50	50	19/30
07	**0**	-	-	-	-	20	0	0	0	-	0	-/-
Tetradymia nuttallii												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**66**	-	33	33	-	-	50	0	0	-	0	9/10
97	**580**	-	40	60	480	180	0	0	83	31	31	18/23
02	**280**	-	-	80	200	200	0	0	71	57	57	24/36
07	**80**	-	-	20	60	20	25	0	75	75	75	20/29

Trend Study 18A-31-07

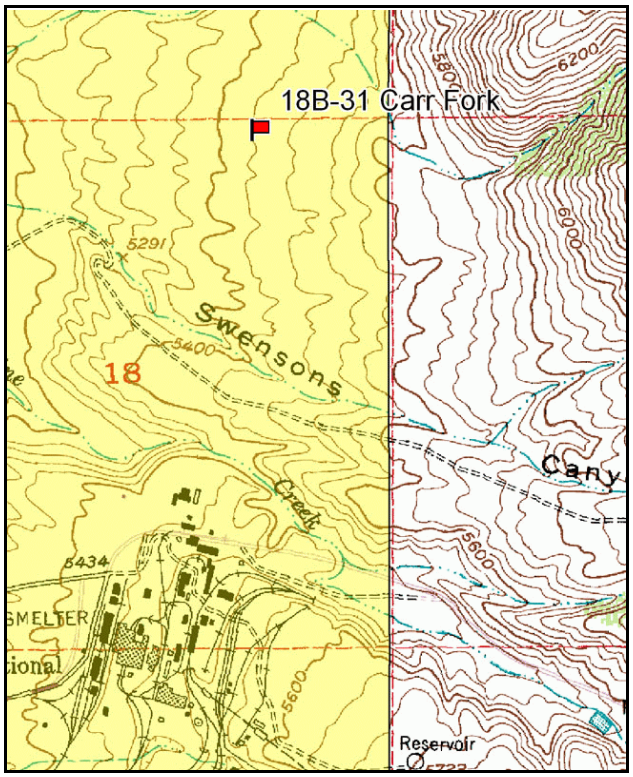
Study site name: Carr Fork . Vegetation type: Annual Grass-Forb .

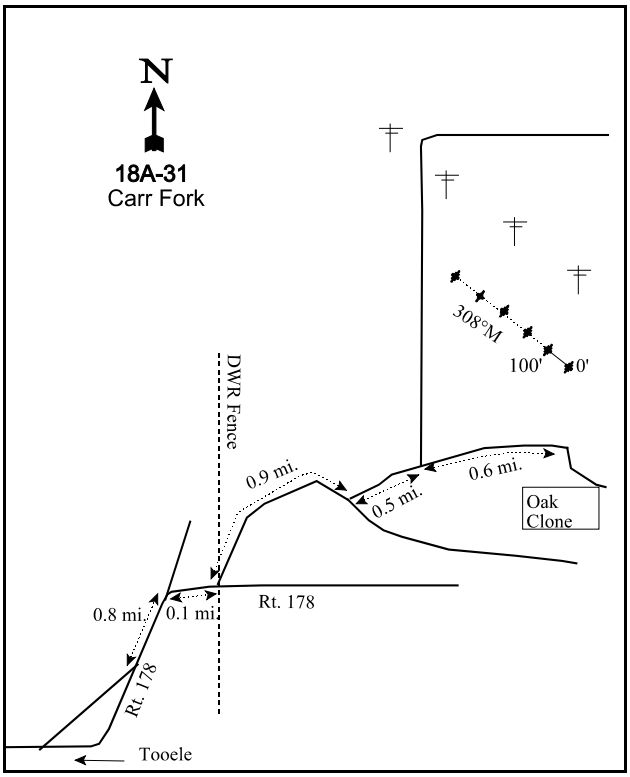
Compass bearing: frequency baseline 308 degrees magnetic.

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

LOCATION DESCRIPTION

Go east on 4th 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 (division 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 0.6 miles to a lone oak clone on the right. The 0-foot stake is on the left side of the road just before the power lines. The study is marked by green, steel fenceposts 12-18 inches in height. Roads were washed out in 2002 requiring walking about ½ mile to the site.





Map name: Bingham Canyon

Diagrammatic Sketch

Township 3S , Range 3W , Section 7

GPS: NAD 83, UTM 12T 396500 E 4491254 N

DISCUSSION

Carr Fork - Trend Study No. 18A-31

Study Information

This study was established in 1997 by request of the habitat manager in the Central Region. It lies on property that originally belonged to Anaconda Mining Company and was transferred to the Division of Wildlife Resources in 1994 [elevation: 5,400 feet (1,646 m), slope: 8%, aspect: west]. 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. The study was set up to monitor the results of the treatment. Deer use has been light. From the pellet group transect data, deer use was estimated at 36 deer days use/acre (89 ddu/ha) in 1997, 24 days use/acre (60 ddu/ha) in 2002, and 51 days use/acre (126 ddu/ha) in 2007. Use occurred during the fall and spring in 1997, and during the winter in 2002 and 2007. The nearby drainages provide good cover, mainly composed of Gambel oak (*Quercus gambelii*).

Soil

The soil is classified within the Kapod series (USDA-NRCS 2007). The soils in this series are stony loam and are derived from sandstone and limestone. They are deep and well-drained. The soil contains graded tailings from the Anaconda copper mines. Most sites containing tailings have mildly acidic soils, but this site is strongly acidic, with a pH of 5.5. The low pH may be one of the reasons that the seeding was not successful. The soil phosphorus is high at 51 ppm (Tiedemann and Lopez 2004). Relative bare ground cover was high in 1997 at 38%, but decreased to 5% and 4% in 2002 and 2007, respectively. Combined relative vegetation and litter cover increased from 60% in 1997 to approximately 90% in 2002 and 2007. The erosion condition class was determined as stable in 2002 and 2007.

Browse

The browse component is lacking with no browse species sampled in 1997. There was a small oak clone nearby, but it was not within the sample area. In 2002, a few transplanted bitterbrush (*Purshia tridentata*) plants were sampled at 80 plants/acre (198 plants/ha). Density increased slightly to 100 plants/acre (247 plants/ha) by 2007. These plants were all mature and vigorous. Annual leader growth averaged 3.4 inches (8.7 cm) in 2002 and 10 inches (25.3 cm) in 2007. There were also white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) plants sampled within the height-crown measurements in 2007.

Herbaceous Understory

The seeded grass and forb species did not establish well. In 1997, the only seeded species sampled were small burnet (*Sanguisorba minor*) and Lewis flax (*Linum lewisii*). The remaining species sampled were weeds. Cheatgrass (*Bromus tectorum*), bulbous bluegrass, ragweed (*Ambrosia psilostachya*), whitetop (*Cardaria draba*), bindweed (*Convolvulus arvensis*), curlycup gumweed (*Grindelia squarrosa*), and dalmatian toadflax (*Linaria dalmatica*) made up almost 70% of the herbaceous cover in 1997. By 2007, the site was still dominated by bulbous bluegrass and weedy forbs. Bulbous bluegrass increased significantly in nested frequency between 1997 and 2002, with a cover increase from 6% to 26%. By 2007, this species decreased to 16% cover. It accounted for 72% of the total grass cover and 27% of the total herbaceous cover in 2007. Intermediate wheatgrass (*Agropyron intermedium*), which was seeded, was sampled beginning in 2002 at 3% cover. It increased to 6% cover in 2007, comprising 26% of the total grass cover.

Total forb cover was high, and it increased from 30% in 1997 to 37% in 2007. However, the forb composition has been poor and dominated by weeds. Weedy forbs included toadflax, ragweed, bindweed, gumweed, spreading dogbane (*Apocynum cannabinum*), and sunflower (*Helianthus annuus*). Of these species, toadflax was the most abundant. Three noxious weeds, whitetop, bindweed, and toadflax, accounted for half of the forb cover in 1997 and increased to 63% in 2002. In 2007, no whitetop was sampled and noxious weeds decreased to 44% of the total forb cover. Seeded forb species, such as small burnet and common sainfoin (*Onobrychis*

viciaefolia), remained in trace amounts. This treatment was not very successful. The area should be retreated in the future and seeded with species that are better adapted to acidic soils.

2002 TREND ASSESSMENT

The trend for browse is slightly up. A few seeded bitterbrush plants were sampled. Density was low at only 80 plants/acre (198 plants/ha). The plants were all mature and moderately to heavily hedged, but maintained good vigor. The trend for grass is stable. There were some improvements in the grass component. Seeded intermediate wheatgrass was sampled, along with a few other perennial species. However, the grass composition was still poor. Cheatgrass and bulbous bluegrass were dominant, and the latter species increased in nested frequency. Together, these species provided 88% of the total grass cover. Bulbous bluegrass is a poor value perennial, and is similar to cheatgrass in phenology and ecological value (Stewart and Hull 1949). It dries out early in the season and provides intense competition. The trend for forbs is slightly down. Composition was poor and was dominated by weeds. Weedy species accounted for 77% of the total forb cover in 1997, and increased to 97% in 2002. The combined cover of the three noxious weeds, whitetop, bindweed, and dalmatian toadflax, increased from 15% to 20%. Whitetop declined significantly in nested frequency while dalmatian toadflax increased significantly. The Desirable Components Index (DCI) in 1997 was rated as very poor due to the lack of browse, the grass composition of bulbous bluegrass and cheatgrass, and the presence of noxious weeds. In 2002, the DCI score improved slightly to very poor-poor, due to the introduction of browse and a small increase in perennial grass cover, excluding bulbous bluegrass.

1997 winter range condition (DCI) - very poor (2) Low potential scale
2002 winter range condition (DCI) - very poor-poor (11) Low potential scale
browse - slightly up (+1) grass - stable (0) forb - slightly down (-1)

2007 TREND ASSESSMENT

The trend for browse is stable. Bitterbrush, the only browse species, slightly increased in density to 100 plants/acre (247 plants/ha). These plants remained vigorous, however, no seedlings or young plants were sampled. The average bitterbrush height and crown measurements increased 54 inches (137 cm) and 74 inches (188 cm), respectively. The trend for grass is up. Although bulbous bluegrass continued to dominate the site, it seemed that this species was outcompeting cheatgrass. Cheatgrass was not sampled in 2007. There were also significant increases in the nested frequencies of intermediate wheatgrass and orchardgrass (*Dactylis glomerata*), both of which are perennials. The trend for forbs is slightly up. Although the site was still dominated by weeds, these species decreased from composing 97% of the forb cover in 2002 to composing 74% in 2007. Of the three noxious weed species, toadflax was the only species that statistically increased between 2002 and 2007. Bindweed significantly decreased, and whitetop was not sampled. The DCI rating improved slightly to poor due to an increase in browse and desirable perennial grass cover, and a decrease in the number of noxious weeds sampled.

winter range condition (DCI) - poor (23) Low potential scale
browse - stable (0) grass - up (+2) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 31

Type	Species	Nested Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
G	Agropyron intermedium	-	a79	b157	-	3.49	5.76
G	Bromus japonicus (a)	-	9	-	-	.01	-
G	Bromus tectorum (a)	a245	a254	-	3.02	1.90	-
G	Dactylis glomerata	-	a4	b32	-	.15	.56
G	Poa bulbosa	a178	b433	b415	5.99	25.93	16.12
G	Poa pratensis	-	3	-	-	.15	-
G	Poa secunda	-	14	-	-	.05	-
Total for Annual Grasses		245	263	0	3.02	1.91	0
Total for Perennial Grasses		178	533	604	5.99	29.78	22.45
Total for Grasses		423	796	604	9.02	31.70	22.45
F	Alyssum alyssoides (a)	-	23	-	-	.07	-
F	Ambrosia psilostachya	a33	c172	b132	1.09	3.11	1.87
F	Apocynum cannabinum	-	a92	b206	-	3.20	5.94
F	Arabis sp.	-	-	7	-	-	.01
F	Asclepias sp.	a50	-	b95	2.62	-	4.20
F	Aster sp.	a4	a3	b129	.15	.00	.91
F	Astragalus sp.	a2	-	a2	.01	-	.03
F	Cardaria draba	b63	a33	-	.93	.60	-
F	Camelina microcarpa (a)	a1	a2	a1	.00	.00	.00
F	Convolvulus arvensis	ab287	b326	a247	11.16	13.76	5.92
F	Comandra pallida	a3	-	a12	.00	-	.07
F	Collinsia parviflora (a)	a1	b41	a3	.00	.13	.00
F	Draba sp. (a)	a4	a9	a3	.01	.01	.01
F	Epilobium brachycarpum (a)	a93	a75	b162	1.74	.15	1.21
F	Eriogonum brevicaule	-	10	-	-	.01	-
F	Gilia sp. (a)	-	a1	a2	-	.00	.00
F	Grindelia squarrosa	a104	a117	a129	1.48	1.07	3.29
F	Helianthus annuus (a)	c211	b31	a1	5.36	.07	.03
F	Lactuca serriola	b115	-	a3	1.89	-	.00
F	Linaria dalmatica	a52	b113	c277	2.96	6.12	10.41
F	Linum lewisii	26	-	-	.15	-	-
F	Lithospermum ruderale	-	-	1	-	-	.03
F	Onobrychis viciaefolia	-	a2	a3	-	.00	.15
F	Phlox longifolia	-	29	-	-	.11	-

Type	Species	Nested Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
F	Polygonum douglasii (a)	$_{a}$26	$_{a}$21	$_{b}$94	.17	.06	.73
F	Sanguisorba minor	$_{a}$1	$_{a}$7	$_{a}$18	.00	.18	.19
F	Tragopogon dubius	-	$_{a}$16	$_{b}$60	-	.16	.57
F	Veronica biloba (a)	$_{a}$15	-	$_{b}$61	.07	-	1.36
F	Verbascum blattaria	$_{a}$20	$_{b}$84	-	.50	3.70	-
Total for Annual Forbs		351	203	327	7.37	0.50	3.36
Total for Perennial Forbs		760	1004	1321	22.98	32.06	33.65
Total for Forbs		1111	1207	1648	30.36	32.57	37.02

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

BROWSE TRENDS --
Management unit 18A, Study no: 31

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Purshia tridentata	0	4	5	-	.18	2.88
Total for Browse		0	4	5	0	0.17	2.88

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 31

Species	Percent Cover	
	'02	'07
Purshia tridentata	-	5.80

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 31

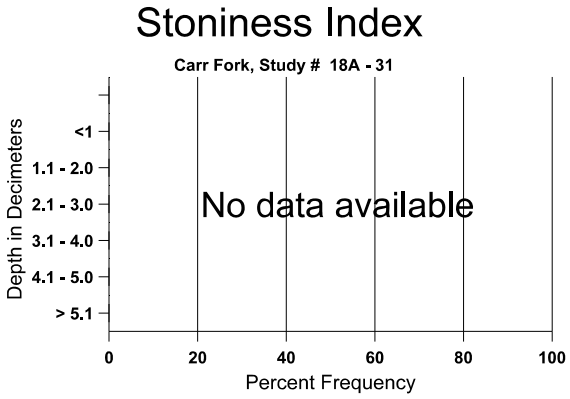
Species	Average leader growth (in)	
	'02	'07
Purshia tridentata	3.4	10

BASIC COVER --
Management unit 18A, Study no: 31

Cover Type	Average Cover %		
	'97	'02	'07
Vegetation	44.43	68.05	55.23
Rock	.78	.56	.16
Pavement	1.79	2.04	.91
Litter	18.82	37.32	36.50
Cryptogams	.16	4.01	6.65
Bare Ground	40.18	6.32	4.61

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 31, Carr Fork

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.1	58.4 (12.7)	5.5	32.0	41.4	26.6	2.2	51.0	275.2	.4



PELLET GROUP DATA --
Management unit 18A, Study no: 31

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	-	-	1
Elk	-	-	1
Deer	2	7	19

Days use per acre (ha)	
'02	'07
-	-
-	
24 (60)	51 (126)

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 31

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus albicaulis												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	23/61
Purshia tridentata												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**80**	-	-	80	-	-	50	50	-	-	0	15/28
07	**100**	-	-	100	-	-	0	0	-	-	0	69/102

Trend Study 18A-32-07

Study site name: East Hickman Canyon . Vegetation type: Chained, seeded P-J .

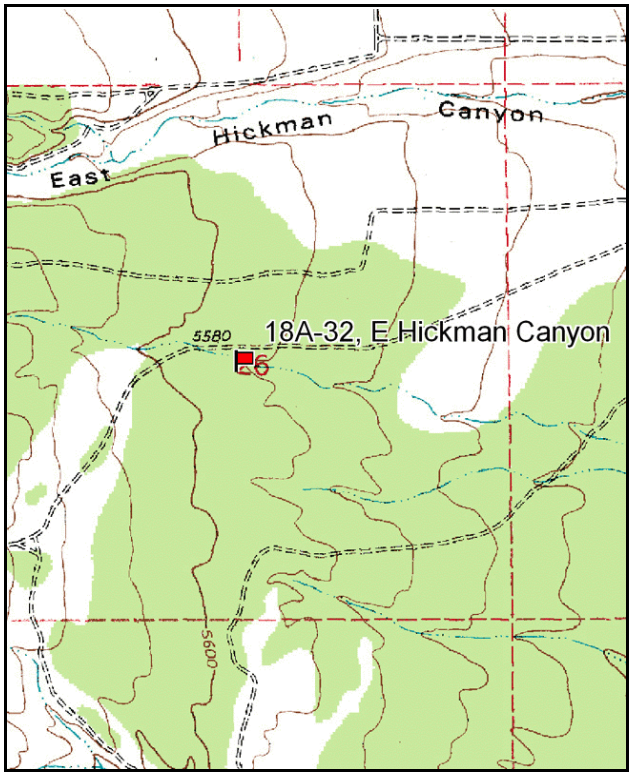
Compass bearing: frequency baseline 199 degrees magnetic.

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

LOCATION DESCRIPTION

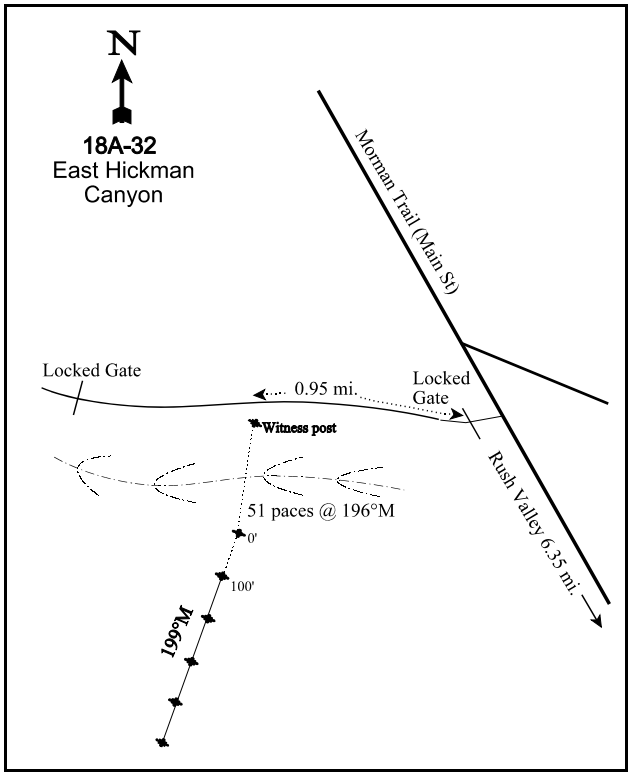
From the intersection of Center and Main Streets in Rush Valley, drive north on Main Street/Mormon Trail 6.35 miles to a dirt road on the left (west). Turn left on this road and proceed a short distance to the locked gate. From the gate, continue 0.95 miles to the west to a witness post on the left side 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.

Gates are locked. Contact land owner.



Map name: South Mountain

Township 4S , Range 6W , Section 26



Diagrammatic Sketch

GPS: NAD 83, UTM 12T 373543 E 4477789 N

DISCUSSION

East Hickman Canyon - Trend Study No. 18A-32

Study Information

This study was established in 1997 to obtain pretreatment data for a juniper (*Juniperus osteosperma*) chaining and seeding project completed in 1999. The site supported a thick juniper woodland with a poor understory, and while the chaining improved the understory, it also reduced wildlife cover [elevation: 5,600 feet (1,707 m), slope: 5%, aspect: east]. Deer use was very light in 1997, with a pellet group frequency of 13%, and rabbit use was much higher at 41%. Since the chaining project, wildlife use has been low, and cattle use has increased. Pellet group transect data estimated only 2 deer days use/acre (5 ddu/ha) in 2002 and 1 deer day use/acre (2 ddu/ha) in 2007. There were 5 cattle days use/acre (13 cdu/ha) in 2002 and 36 cattle days use/acre (65 cdu/ha) in 2007. Grasses were very heavily grazed in 2007.

Soil

The soil is classified within the Borvant series (USDA-NRCS 2007). The soils in this series are well-drained, and are formed in alluvium or colluvium derived from limestone and sandstone. Soil analysis showed a fine clay loam with a hardpan at a depth of about 13-15 inches (33-38 cm). There are very few rocks on the surface or within the soil profile. The soil reaction is neutral (pH 7.3), and phosphorus is moderately low at only 6.5 ppm. There is a high percentage of bare ground exposed, with 28% average relative bare ground cover since 1997. Erosion was apparent in 1997. The erosion condition class was stable in 2002 and slight in 2007, due to moderate pedestalling and slight surface litter movement and flow patterns.

Browse

Prior to the chaining, the site was dominated by juniper trees. In 1997, canopy cover for juniper averaged 31%, with a density of 295 trees/acre (729 trees/ha) and an average diameter of almost 5 inches (13 cm). Since the treatment, juniper canopy cover declined to approximately 10% in 2002 and 2007. Density had decreased to 146 trees/acre (361 trees/ha) by 2002, and increased to 240 trees/acre (593 trees/ha) in 2007. This area may need to be treated again due to the increasing juniper density. Average diameter of trees was 5 inches (12.7 cm) in 2002 and 4.1 inches (10.4 cm) in 2007.

In 1997, mountain big sagebrush (*Artemisia tridentata* spp. *vaseyana*) density was estimated at only 80 plants/acre (198 plants/ha), and these were all classified as decadent and dying. There were an estimated 1,220 dead plants/acre (3,015 plants/ha). Any preferred browse species that may have been seeded in the treatment did not establish. The density of mountain big sagebrush has remained stable at 80 plants/acre (198 plants/ha) since 1997, but vigor has improved dramatically and there is a more balanced age structure. Annual leader growth was 3.2 inches (8.2 cm) in 2002 and 1.4 inches (3.6 cm) in 2007. 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.

Herbaceous Understory

Prior to the chaining, the abundant cover and density of juniper suppressed understory species. Total herbaceous cover was less than 9%, with the total cover for forbs less than 1%. Sandberg bluegrass (*Poa secunda*) and mutton bluegrass (*Poa fendleriana*) made up 80% of the herbaceous cover, both of which provide poor forage value. Forbs provided less than 1% cover previous to the treatment. After the treatment, total herbaceous cover increased to 28% in 2002 and 19% in 2007, with the majority from seeded grasses. Crested wheatgrass (*Agropyron spicatum*) was the most abundant understory species, providing 15% cover in 2002 and 12% in 2007. Total forb cover increased to 6% in 2002 and decreased to 1% by 2007. The forb composition is diverse but dominated by annuals. Bur buttercup (*Ranunculus testiculatus*) and pale alyssum (*Alyssum alyssoides*) provided 83% of the total forb cover in 2002 and approximately 70% in 2007.

2002 TREND ASSESSMENT

The trend for key browse is slightly up. Juniper canopy cover decreased from 31% to 8%, which opened up the understory for the establishment of other species. The density of mountain big sagebrush remained stable at 80 plants/acre (198 plants/ha). However, the number of decadent plants decreased from 100% of the population to 25%. Use decreased, and vigor improved dramatically. The trend for grasses is slightly up. The sum of nested frequency for perennial grasses increased 20%, and average perennial grass cover increased from 8% to 21%. Seeded grasses established well. Crested wheatgrass was the most prominent species, providing 69% of the grass cover and 55% of the total herbaceous cover. However, Sandberg bluegrass decreased significantly in nested frequency, while cheatgrass (*Bromus tectorum*) increased significantly. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs increased 92%, and total forb cover increased from 1% to 6%. The forb composition was diverse, but dominated by annuals. Bur buttercup was the most abundant forb, and comprised 71% of the total forb cover. Seeded alfalfa established and should persist if not heavily grazed. The Desirable Components Index (DCI) was rated as very poor in 1997 due to a lack of browse cover and poor understory. Despite some improvements in 2002, the index remained very poor.

1997 winter range condition (DCI) - very poor (17) Low potential scale
2002 winter range condition (DCI) - very poor (31) Low potential scale
browse - slightly up (+1) grass - slightly up (+1) forb - slightly up (+1)

2007 TREND ASSESSMENT

The trend for browse is stable. The density of mountain big sagebrush did not change since 2002. However, the population consisted of only young and mature plants in 2007. Young plants in the population increased from 25% in 2002 to 50% in 2007. Sagebrush vigor was good, and use was light. The trend for grass is stable. The average grass cover decreased from 22% to 18%, which comprised 73% of the total vegetative cover. The sum of nested frequency for perennial grasses increased 14%. There was a significant increase in the nested frequency of intermediate wheatgrass, and a significant decrease in the nested frequency of bottlebrush squirreltail (*Sitanion hystrix*). The nested frequency of cheatgrass remained relatively stable. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs decreased substantially. Annual species continued to dominate the forb component of the understory. There was a significant increase in the nested frequency of pale alyssum and a significant decrease in the nested frequency of bur buttercup. Seeded alfalfa was not sampled in any quadrats. Eleven forb species that were present in 2002 were not noted in 2007. Forbs only provided an average of 6% cover. The DCI continued to be rated as very poor.

winter range condition (DCI) - very poor (31) Low potential scale
browse - stable (0) grass - stable (0) forb - slightly down (-1)

HERBACEOUS TRENDS --
Management unit 18A, Study no: 32

Type	Species	Nested Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	-	a231	a260	-	15.33	12.09
G	Agropyron intermedium	-	a31	b72	-	1.02	2.49
G	Agropyron spicatum	a50	a37	a52	.43	1.60	.77
G	Aristida purpurea	-	2	-	-	.00	-
G	Bromus inermis	-	a4	a16	-	.03	.15

Type	Species	Nested Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
G	Bromus japonicus (a)	-	12	-	-	.03	-
G	Bromus tectorum (a)	a15	b90	b55	.19	.79	.35
G	Elymus cinereus	-	-	2	-	-	.15
G	Elymus junceus	-	a-	b23	-	.00	.41
G	Oryzopsis hymenoides	-	-	10	-	-	.21
G	Poa bulbosa	-	-	-	-	.00	-
G	Poa fendleriana	48	-	-	1.43	-	-
G	Poa secunda	b277	a140	a99	5.67	2.36	.99
G	Sitanion hystrix	b17	b25	a2	.16	.98	.03
Total for Annual Grasses		15	102	55	0.19	0.81	0.34
Total for Perennial Grasses		392	470	536	7.72	21.36	17.32
Total for Grasses		407	572	591	7.92	22.18	17.68
F	Alyssum alyssoides (a)	a1	b84	c227	.00	.66	.54
F	Allium sp.	a4	a5	a1	.01	.04	.00
F	Antennaria rosea	a2	a9	a2	.00	.05	.00
F	Arabis sp.	1	-	-	.00	-	-
F	Astragalus convallarius	a16	a10	a11	.28	.07	.10
F	Astragalus sp.	-	1	-	-	.00	-
F	Camelina microcarpa (a)	-	1	-	-	.00	-
F	Collinsia parviflora (a)	a33	a21	a32	.15	.03	.05
F	Crepis acuminata	a1	a1	-	.03	.00	-
F	Cryptantha sp.	-	a3	a7	-	.03	.09
F	Descurainia pinnata (a)	-	-	1	-	-	.03
F	Draba sp. (a)	a3	-	a1	.00	-	.00
F	Epilobium brachycarpum (a)	-	14	-	-	.18	-
F	Gilia sp. (a)	-	3	-	-	.00	-
F	Heterotheca villosa	-	1	-	-	.00	-
F	Holosteum umbellatum (a)	1	-	-	.03	-	-
F	Lathyrus brachycalyx	a5	b16	a5	.01	.13	.01
F	Lactuca serriola	a2	a1	-	.00	.00	-
F	Medicago sativa	-	33	-	-	.23	-
F	Microsteris gracilis (a)	-	12	-	-	.02	-
F	Phlox hoodii	b18	a3	ab5	.28	.06	.06
F	Phlox longifolia	a2	b8	ab4	.00	.02	.03
F	Polygonum douglasii (a)	-	2	-	-	.00	-
F	Ranunculus testiculatus (a)	a50	c231	b124	.13	4.04	.41

Type	Species	Nested Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
F	Senecio multilobatus	-	-	2	-	-	.00
F	Sisymbrium altissimum (a)	-	2	-	-	.03	-
F	Sphaeralcea coccinea	-	$_{a}$7	$_{a}$3	-	.01	.03
F	Tragopogon dubius	-	-	-	-	.00	-
Total for Annual Forbs		88	370	385	0.32	4.99	1.04
Total for Perennial Forbs		51	98	40	0.63	0.69	0.34
Total for Forbs		139	468	425	0.95	5.68	1.38

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	'97	'02	'07
B	Artemisia tridentata vaseyana	3	4	4	.18	.03	.06
B	Chrysothamnus nauseosus	0	0	1	-	-	-
B	Gutierrezia sarothrae	1	5	10	-	.00	.10
B	Juniperus osteosperma	24	14	13	16.54	5.28	4.84
Total for Browse		28	23	28	16.73	5.32	5.00

CANOPY COVER, LINE INTERCEPT --
Management unit 18A, Study no: 32

Species	Percent Cover		
	'97	'02	'07
Artemisia tridentata vaseyana	-	.21	.10
Gutierrezia sarothrae	-	.05	.36
Juniperus osteosperma	31.20	7.63	9.88

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18A, Study no: 32

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	3.2	1.4

POINT-QUARTER TREE DATA --
Management unit 18A, Study no: 32

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	146	240

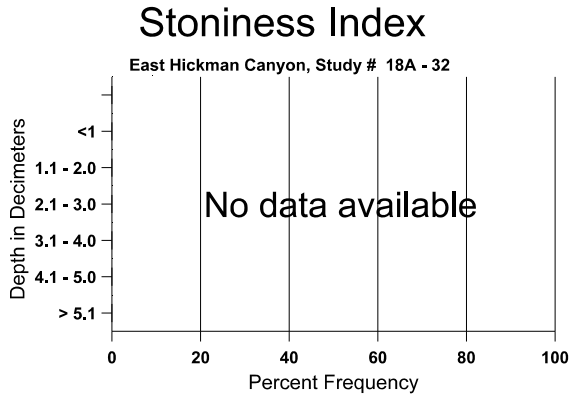
Average diameter (in)	
'02	'07
3.2	4.1

BASIC COVER --
Management unit 18A, Study no: 32

Cover Type	Average Cover %		
	'97	'02	'07
Vegetation	26.19	32.68	27.03
Rock	1.12	.17	.20
Pavement	4.89	4.38	3.60
Litter	30.51	47.92	45.02
Cryptogams	13.01	.09	.08
Bare Ground	34.45	28.27	31.06

SOIL ANALYSIS DATA --
Herd Unit 18A, Study no: 32, East Hickman Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
15.1	56.6 (15.3)	7.3	36.7	34.7	28.6	2.0	6.5	134.2	.4



PELLET GROUP DATA --
Management unit 18A, Study no: 32

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	41	31	58
Deer	13	4	-
Cattle	-	-	3

Days use per acre (ha)	
'02	'07
-	-
2 (5)	1 (2)
5 (13)	26 (65)

BROWSE CHARACTERISTICS --
Management unit 18A, Study no: 32

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
97	**80**	-	-	-	80	1220	0	75	100	100	100	-/-
02	**80**	-	20	40	20	-	0	0	25	25	25	18/23
07	**80**	20	40	40	-	-	0	0	0	-	0	17/25
Chrysothamnus nauseosus												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	0	-	-	0	17/15
Chrysothamnus viscidiflorus viscidiflorus												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	10/22
07	**0**	-	-	-	-	-	0	0	-	-	0	7/16
Cowania mexicana stansburiana												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	9/12
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Gutierrezia sarothrae												
97	**20**	-	-	20	-	-	0	0	0	-	0	-/-
02	**120**	-	-	100	20	-	0	0	17	-	0	8/15
07	**440**	60	40	340	60	20	0	5	14	9	9	9/11
Juniperus osteosperma												
97	**540**	60	60	480	-	-	0	0	0	-	0	-/-
02	**300**	20	100	160	40	240	0	0	13	-	40	52/35
07	**280**	20	20	260	-	-	7	0	0	-	64	-/-

SUMMARY

WILDLIFE MANAGEMENT SUBUNIT 18A - OQUIRRH-STANSBURY NORTH

Community Types

Nine trend studies were resampled in 2007. Three were dominated by Wyoming big sagebrush and Stansbury cliffrose, two by Wyoming big sagebrush, two by mountain big sagebrush, one by bitterbrush, and one by annual grasses and forbs.

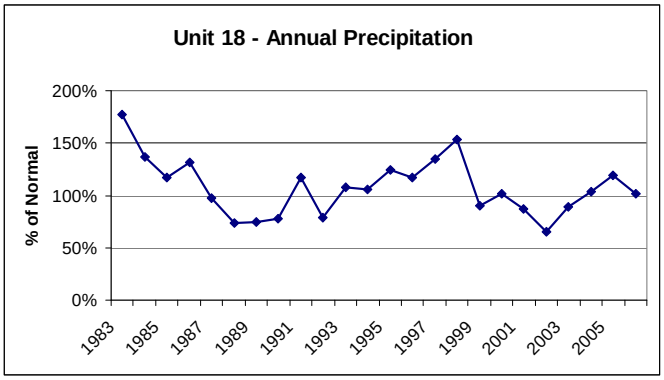


Figure 1. Annual precipitation for the entire unit 18. Precipitation data was collected at the Tooele, Johnson Pass, and Fairfield weather stations (Utah Climate Summaries 2007).

Precipitation

Vegetation trends are dependent upon annual and seasonal precipitation patterns. Precipitation data from this herd unit were compiled from the Tooele, Johnson Pass, and Fairfield weather stations (Figures 1 and 2). The unit annual precipitation average was below 75% of normal (drought conditions) in 1988, 1989, and 2002 and below normal in 1990, 1992, 1999, 2001, and 2003 (Figure 1). Spring precipitation was below 75% of normal in 1989, 1990, 1992, 2000, and 2007 and below normal in 1997, 2001, 2002, 2003, and 2004 (Figure 2). Fall precipitation was near or below 50% of normal in 1995, 1999, 2003, and 2005 (Figure 2). Spring precipitation is essential for the recruitment of browse seedlings and the establishment of native perennial grasses and forbs. Fall precipitation, however, benefits winter annual species, such as cheatgrass (Monsen 1994).

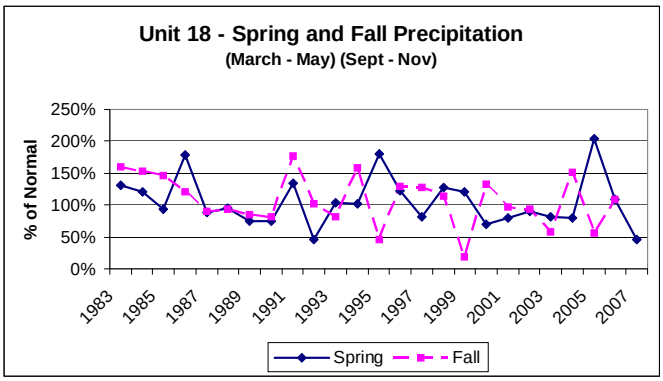


Figure 2. Spring and fall precipitation for unit 18. Precipitation data was collected at the Tooele, Johnson Pass, and Fairfield weather stations (Utah Climate Summaries 2007).

Browse

The average browse trend slightly decreased from 1983 to 1989, increased between 1989 and 2002, and slightly decreased from 2002 to 2007 (Figure 3). Mountain big sagebrush density declined from 2002 to 2007, but this decrease comes mostly from Below Chokecherry Spring (18A-25), where sagebrush density declined 42% (Figure 4). Figure 5 indicates a large decrease in mountain big sagebrush decadence between 1997 and 2002. However, this change is mainly a reflection of the results of the chaining treatment at East Hickman Canyon (18A-32), where juniper trees were removed and sagebrush decadence decreased from 100% of the population in 1997 to 25% in 2002. Average sagebrush cover has been stable since 1997 (Figure 6). Wyoming big sagebrush has slightly increased in both density and decadence since 1997 (Figures 4 and 5).

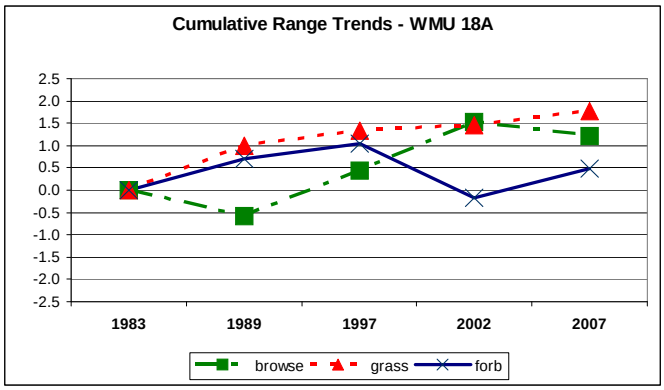


Figure 3. Cumulative range trends for subunit 18A, Oquirrh-Stansbury North.

Grass

The grass trend has increased steadily since 1983 (Figure 3). Perennial grass cover increased from 11% in 1997 to 14% in 2007, while cheatgrass cover only slightly increased from 6% to 7% (Figure 7). Bulbous bluegrass cover increased from 1% in 1997 to 3% in 2002, then decreased to 2% by 2007. This species was only sampled on three of the sites in this subunit, and the overall trend is mostly reflective of Carr Fork (18A-31), which had the highest bulbous bluegrass cover. The nested frequency of perennial grasses remained stable between 1997 and 2002, then increased in 2007. The nested frequency of cheatgrass slightly decreased from 1997 to 2002, and remained relatively stable between 2002 and 2007. The nested frequency of bulbous bluegrass increased between 1997 and 2002, and remained stable in 2007 (Figure 8).

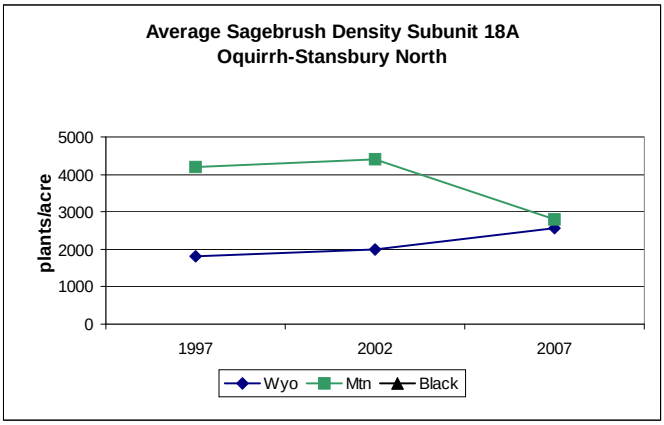


Figure 4. Average mountain big sagebrush and Wyoming big sagebrush density for subunit 18A.

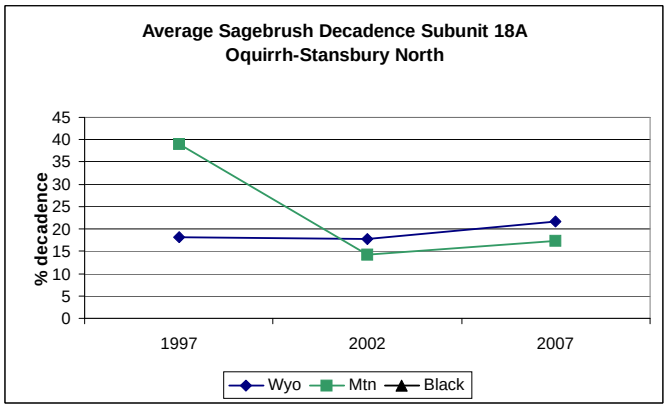


Figure 5. Average mountain big sagebrush and Wyoming big sagebrush decadence for subunit 18A.

Forbs

The forb trend steadily increased between 1983 and 1997, decreased in 2002, and increased in 2007 (Figure 3). The decline of forbs in 2002 may be due to drought conditions (Figure 1). The forb trend was down or slightly down on seven sites in 2002. Percent cover of perennial forbs was stable from 1997 to 2002, then increased from 3% in 2002 to 5% in 2007 (Figure 7). Nested frequency of perennial forbs decreased in 2002, and increased in 2007 (Figure 8). Bur buttercup, which is undesirable, and holosteum and pale alyssum, which provide little forage, were the dominant forb species on eight sites. Noxious weeds were only sampled at Carr Fork (18A-31).

Desirable Components Index

The subunit Desirable Components Index (DCI) average for low potential studies was fair-good in 1997, and decreased to fair in 2002 and 2007 (Figure 9). The DCI average for mid-level potential studies was fair in 1997, but dropped to a poor-fair rating in 2002, and remained stable in 2007 (Figure 9). The decrease in 2002 was due to a downward trend in grasses and forbs, mainly because of drought conditions. There was also a suppression of the understory at South of Broons Canyon (18A-27) by a dense bitterbrush canopy.

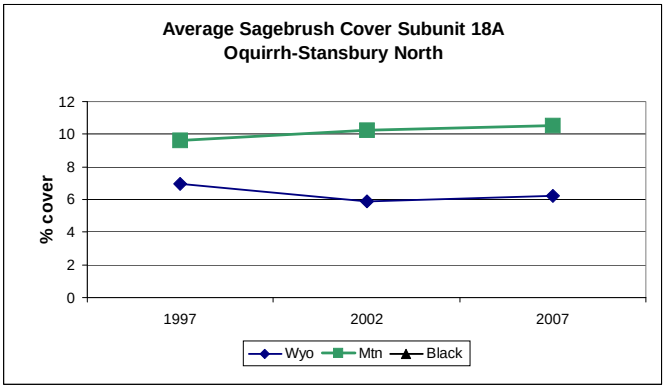


Figure 6. Average mountain big sagebrush and Wyoming big sagebrush cover for subunit 18A.

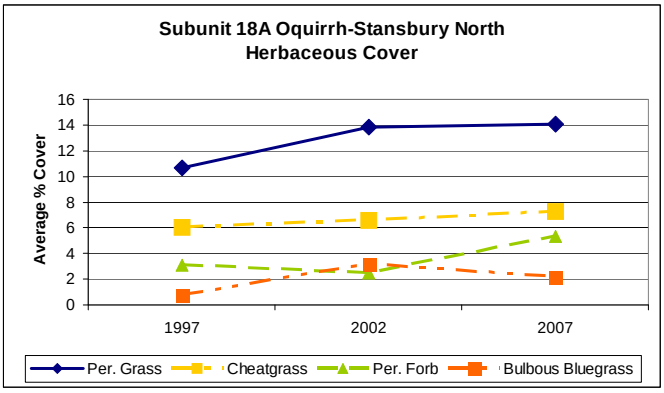


Figure 7. Average herbaceous cover for subunit 18A.

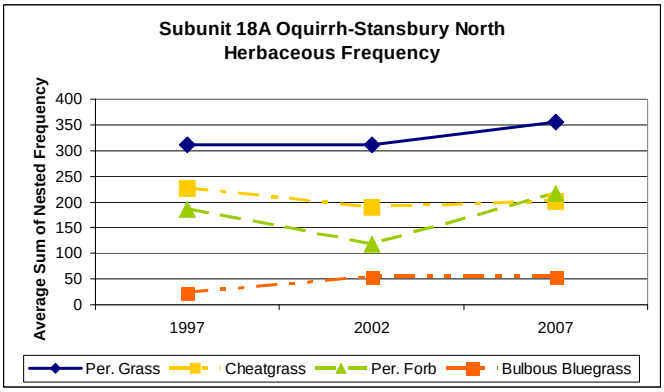


Figure 8. Average herbaceous nested frequency for subunit 18A.

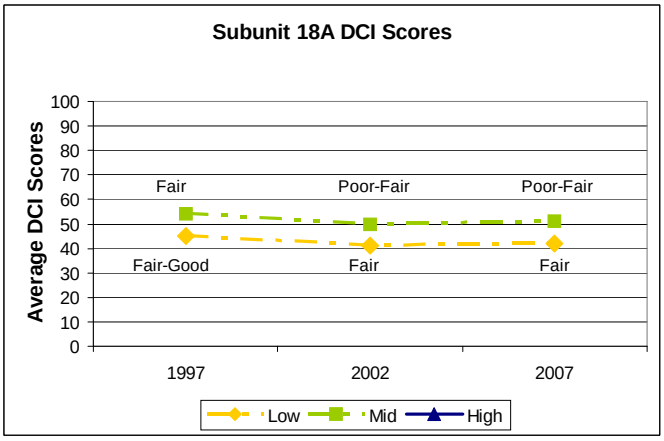
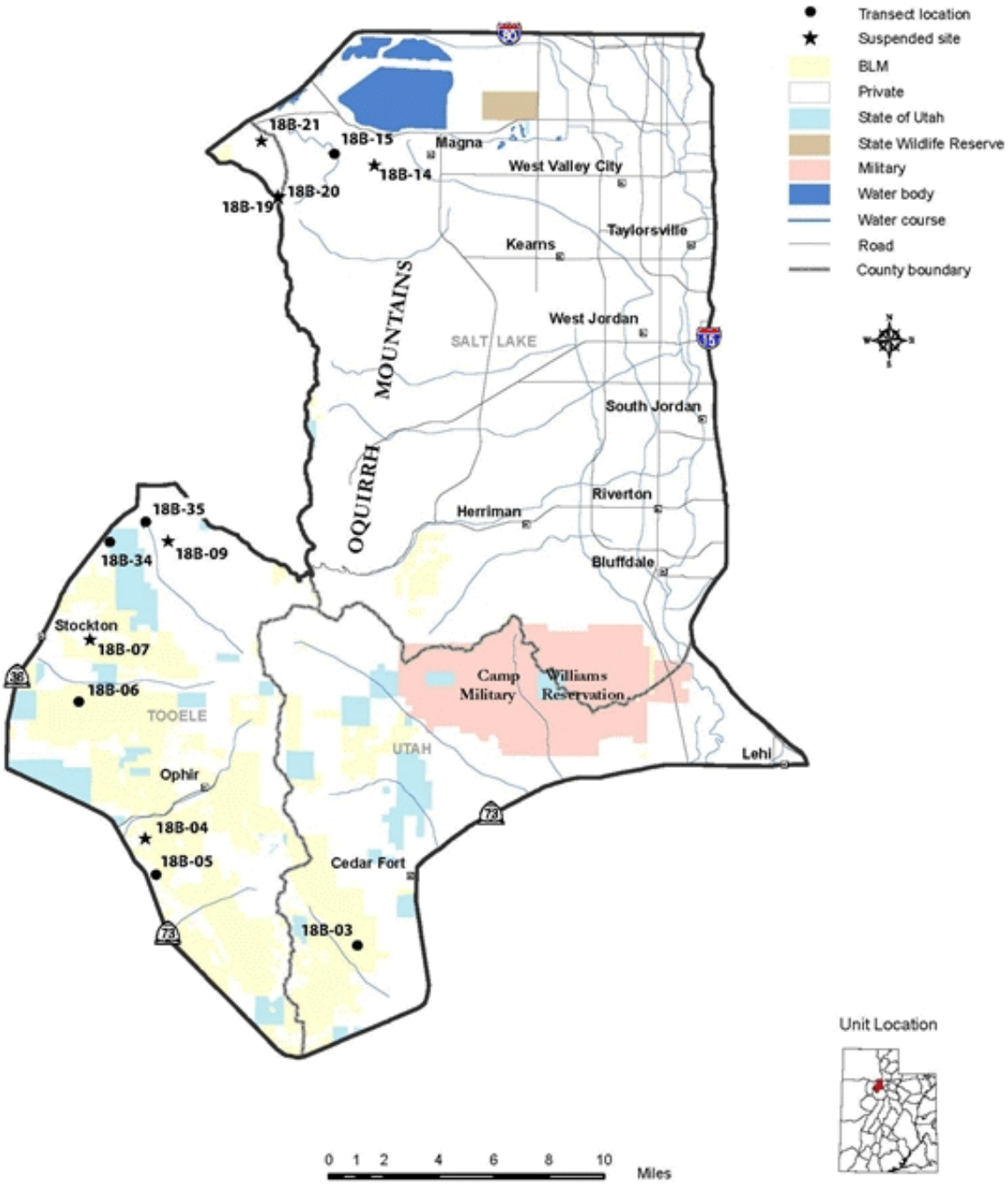


Figure 9. Subunit 18A average Desirable Components Index (DCI) scores by year. The DCI scores are divided into three categories based on ecological potentials, which include low, mid-level, and high.

Management Unit 18B



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 (Oquirh Mountains ridge line) to Lake Point and I-80; east on I-80 to I-15 and beginning point.

Range Trend Studies

Ten studies were originally established in the subunit in 1983. Since 1983, a total of 20 have been established, but 13 have been suspended over the years. In 2007, seven studies were read.

Trend Study 18B-3-07

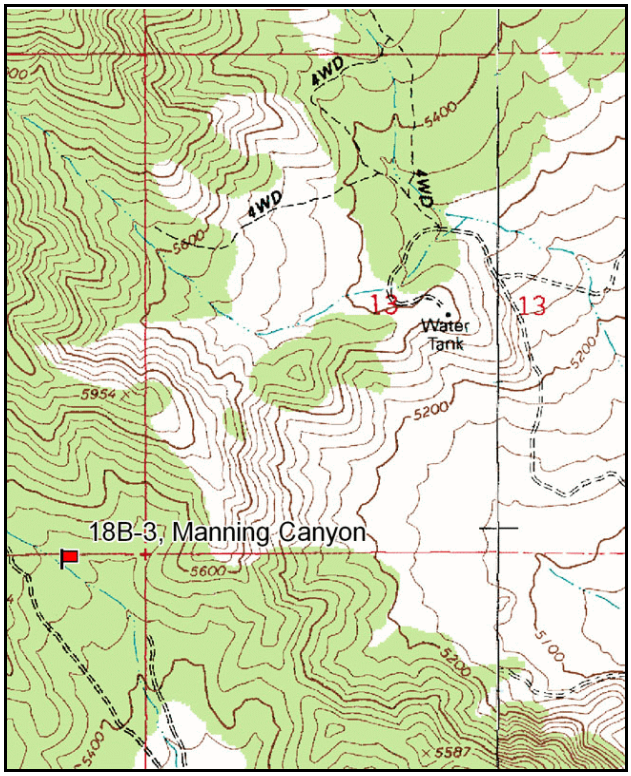
Study site name: Manning Canyon . Vegetation type: Pinyon-Juniper .

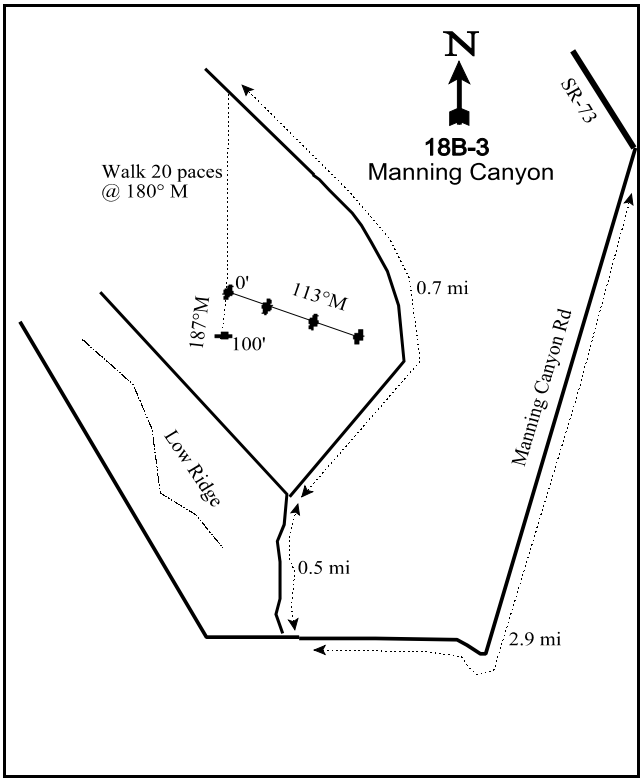
Compass bearing: frequency baseline 187 degrees magnetic (Line 2-4 @113°M).

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

LOCATION DESCRIPTION

From the junction of Highway SR-73 and the 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 mile to a fork. Take the right fork (east) and travel an additional 0.7 mile. Walk south on an azimuth of 180 degrees magnetic for 26 paces to the 0-foot mark of the frequency baseline, marked by a short fencepost with a red browse tag, number 3985.





Map Name: Mercur

Diagrammatic Sketch

Township 6S , Range 3W , Section 14

GPS: NAD 83, UTM 12T 402894 E 4460615 N

DISCUSSION

Manning Canyon - Trend Study No. 18B-3

Study Information

This study is within critical winter range at the extreme south end of the Oquirrh Mountains in a small valley surrounded with juniper-covered hills [elevation: 5,500 feet (1,676 m), slope: 7%, aspect: southeast]. The range type is essentially a pinyon-juniper/big sagebrush/grass ecotone on Bureau of Land Management-managed land. Juniper trees on and around the study provide excellent thermal cover. Deer use of the area has been moderate. Domestic sheep and cattle use have also been noted. The deer pellet group data estimates were 31 days use/acre in 2002 and 18 in 2007 (78 ddu/ha in 2002 and 45 in 2007). The elk pellet group transect data estimate in 2002 and 2007 were 1 day use/acre (3 edu/ha). Rabbit pellets were extremely abundant in 2002 and 2007 and were sampled in 45% of the quadrats in 2002 and 91% in 2007.

Soil

The soil is in the Amtoft series, which consists of a well to excessively drained, shallow soil that is formed from weathered calcareous sedimentary rock and are found on hills, mountains and ridges (USDA-NRCS 2007). It is somewhat gravelly and there appear to be no strongly developed horizons. It has a clay loam texture with a moderately alkaline reaction (pH of 7.9). Relative vegetation cover was 34% in 1997 and 31% in 2002 and 2007. Relative bare ground cover has been low at 6 to 10%. The soil erosion condition classification was determined as stable in 2002 and 2007. 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.

Browse

The dominant browse species is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*); it provided 8% cover in 1997 and 2002 and 6% cover in 2007. There appears to be some hybridizing occurring between mountain big sagebrush, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). Some plants have the more upright growth forms characteristic of basin big sagebrush. All sagebrush were classified as mountain big sagebrush due to the difficulty of separating species in such complex hybrid zones and positive fluorescence tests of several sagebrush samples. Sagebrush density decreased from 2,160 plants/acre (5,335/ha) in 1997 to 2,040 (5,039/ha) in 2002, and then 1,440 (3,557/ha) in 2007. Decadence has fluctuated from a low of 25% of the population in 1983, to 88% in 1990. Since, it has remained between 30 and 50%. The increase in decadence and slight decrease in density from 1983 to 1990 is likely a product of drought from 1988 to 1990 combined with very heavy use in 1983 (Utah Climate Summaries 2007). Plants classified as dying have steadily increased from 12% of the population in 1997 to 32% in 2007. Plants classified with poor vigor increased from 12% in 1997 to 43% in 2007. The sagebrush defoliator moth (*Aroga websteri*) infested 280 plants/acre in 2007. Dead plants have been abundant since 1997. Utilization on sagebrush was heavy in 1983, but has been light-moderate since.

Green ephedra (*Ephedra viridis*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), pricklypear cactus (*Opuntia* sp.), Utah juniper (*Juniperus osteosperma*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*), and black sagebrush (*Artemisia nova*) were also sampled. Ephedra density was 20 plants/acre (49 plants/ha) in 1997 and 40 plants/acre (99 plants/ha) in 2002 and 2007. Cliffrose has not been sampled since 1990. Both narrowleaf and stickyleaf low rabbitbrush received moderate-heavy use by rabbits in 2007.

Pinyon-juniper density is low. Point-quarter data estimates were 35 juniper (*Juniperus osteosperma*) (86/ha) and 8 single-leaf pinyon (*Pinus monophylla*) trees/acre (20 trees/ha) in 1997 and 2002. Juniper density estimates slightly decreased in 2007 to 31 trees/acre (77 trees/ha). Juniper trees were large mature individuals

averaged approximately 10 inches (25 cm) in diameter in 2002 and 2007. Single-leaf pinyon density increased to 22 trees/acre (54 trees/ha) in 2007 with an average trunk diameter of 4.5 inches (11 cm). Juniper line intercept canopy cover increased from less than 1% in 2002 to 6% in 2007.

Herbaceous Understory

The herbaceous understory is dominated by bluebunch wheatgrass (*Agropyron spicatum*) and cheatgrass (*Bromus tectorum*). Bluebunch cover was 10% in 1997, 6% in 2002, and 8% in 2007. Cheatgrass cover was 7% in 1997, 5% in 2002, and 9% in 2007. Indian ricegrass (*Oryzopsis hymenoides*) and needle-and-thread grass (*Stipa comata*) provided approximately 5% combined cover in 1997 and 2002. The grasses tend to be in large clumps, slightly pedestalled, and unevenly distributed.

The majority of forb cover is provided by annual species. Pale allyssum (*Alyssum alyssoides*) is the dominant forb; it provided 3% cover in 1997 and 2007 and 1% in 2002. Several increasers such as rock goldenrod (*Petradoria pumila*), are indicative of past grazing pressure.

1990 TREND ASSESSMENT

The browse trend is slightly down. The mountain big sagebrush component show signs of serious decline as evidenced by the sharp increase in percent decadence from 25% to 88%. Density has changed little. The sagebrush are generally moderately utilized. Cliffrose and ephedra densities changed little. The grass trend is stable. The sum of nested frequency remained unchanged. Bluebunch wheatgrass remained the dominant measured understory species. The forb trend is slightly down. The sum of the nested frequency of perennial forbs decreased slightly and forb diversity decreased from seven to three species.

browse - slightly down (-1) grass - stable (0) forb - slightly down (-1)

1997 TREND ASSESSMENT

Trend for browse is up. The density of sagebrush increased from 1,432 plants/acre (3,537 plants/ha) to 2,160 (5,335/ha). Part of this increase is due to an increase in sample area during this reading, but the density did increase. Percent decadence decreased from 88% to 31%. Plants classified with poor vigor also decreased from 28% to 12%. Plants classified as dying increased slightly. The improvement in sagebrush vigor is likely a product of the improvement in precipitation after 1990 (Utah Climate Summaries 2007). The grass trend is stable. The sum of the nested frequency of grasses increased slightly, but this may be due in part to the larger sample area used in 1997. None of the individual grass species nested frequencies changed significantly. Cheatgrass is abundant with nearly 7% cover. The forb trend is slightly up. The sum of the nested frequency of perennial forbs increased, but were not abundant. The diversity of perennial forbs increased from three to thirteen species, due in large part to the change in sample area. Pale alyssum was the dominant forb species at 3% cover. The Desirable Components Index (DCI) score was good due to moderate browse cover, high decadence, low recruitment, low forb cover, high perennial grass cover, and low annual grass cover.

winter range condition (DCI) - good (49) Low potential scale
browse - up (+2) grass - stable (0) forb - slightly up (+1)

2002 TREND ASSESSMENT

The browse trend is slightly down. The density of mountain big sagebrush remained relatively unchanged, but decadent individuals increased from 31% to 46% of the population. Plants classified as dying increased from 12% to 24% of the population and plants with poor vigor increased from 12% to 25%. Recruitment of young plants remained low at only 3% of the sagebrush population. The poor vigor of the sagebrush is likely due to below normal spring precipitation from 2000 through 2002. The other key browse species, cliffrose and ephedra, densities remained unchanged. The grass trend is slightly up. The sum of nested frequency for perennial grass increased by only 5% since the 1997 reading, which would correspond to a stable trend. However, the grass trend from 1990 to 1997 was on the threshold between stable and slightly up, and so the

trend was rated as slightly up in 2002 to reflect the cumulative improved trend (17% increase) since 1990. Bulbous bluegrass (*Poa bulbosa*), an aggressive invasive grass species with the potential to outcompete cheatgrass and perennial species (Stewart and Hull 1949), was sampled for the first time. The forb trend is slightly down. The nested frequency of perennial forbs decreased 22%, but was not abundant enough to justify a down trend. This slight decrease is likely a product of the below-average spring precipitation. The DCI score decreased to fair due to an increase in sagebrush decadence and a decrease in perennial grass cover.

winter range condition (DCI) - fair (38) Low potential scale
browse - slightly down (-1) grass - slightly up (+1) forb - slightly down (-1)

2007 TREND ASSESSMENT

The browse trend is down. The density of sagebrush decreased 29% from 2,040 plants/acre (5,039 plants/ha) to 1,440 plants/acre (3,557 plants/ha). Decadence increased from 46% to 51% and plants classified as dying increased from 24% to 32% of the population. Plants with poor vigor also increased from 25% to 43% of the population, due to the increase in dying individuals and those infested with the sagebrush defoliator moth. The grass trend is slightly down. The nested frequency of perennial grasses changed little, but that of cheatgrass increased significantly. The sum of the nested frequency of annual grasses increased 25% and cheatgrass cover increased from 5% to 9%, only 2% less than the combined cover of perennial grasses. The forb trend is slightly down. The nested frequencies of bur buttercup (*Ranunculus testiculatus*) and storksbill (*Erodium cicutarium*) both increased significantly and the combined cover of these species increased from one-tenth of one percent to 2%. Both of these species are strong competitors in rangelands and storksbill has been shown to out-compete and prevent the establishment of native species (Kimball and Schiffman 2003) and bur buttercup produces allelopathic chemicals that prevent seed germination of many native species (Buchanan et al. 1978). The nested frequency of perennial forbs remained low and unchanged. The DCI score remained fair.

winter range condition (DCI) - fair (33) Low potential scale
browse - down (-2) grass - slightly down (-1) forb - slightly down (-1)

HERBACEOUS TRENDS --
Management unit 18B, Study no: 3

Type	Species	Nested Frequency					Average Cover %		
		'83	'90	'97	'02	'07	'97	'02	'07
G	Agropyron smithii	-	-	-	6	-	-	.03	-
G	Agropyron spicatum	$_{a}$110	$_{ab}$133	$_{b}$162	$_{ab}$151	$_{ab}$160	9.96	6.05	8.17
G	Bromus japonicus (a)	-	-	-	2	-	-	.00	-
G	Bromus tectorum (a)	-	-	$_{a}$282	$_{a}$251	$_{b}$310	6.69	4.89	9.03
G	Oryzopsis hymenoides	$_{c}$77	$_{bc}$64	$_{ab}$41	$_{ab}$45	$_{a}$14	1.82	1.13	.43
G	Poa bulbosa	-	-	-	2	-	-	.03	-
G	Poa secunda	$_{a}$1	$_{ab}$15	$_{b}$39	$_{c}$75	$_{c}$78	.28	.80	.79
G	Sitanion hystrix	$_{d}$89	$_{c}$55	$_{bc}$33	$_{a}$3	$_{ab}$10	.53	.15	.40
G	Stipa comata	$_{a}$11	$_{ab}$29	$_{bc}$54	$_{c}$64	$_{bc}$56	2.65	3.56	.97
G	Vulpia octoflora (a)	-	-	-	-	7	-	-	.01

Type	Species	Nested Frequency					Average Cover %		
		'83	'90	'97	'02	'07	'97	'02	'07
Total for Annual Grasses		0	0	282	253	317	6.69	4.89	9.05
Total for Perennial Grasses		288	296	329	346	318	15.26	11.77	10.76
Total for Grasses		288	296	611	599	635	21.96	16.67	19.81
F	Agoseris glauca	-	-	-	4	-	-	.01	-
F	Alyssum alyssoides (a)	-	-	$_{b}$315	$_{a}$244	$_{b}$300	3.25	1.31	2.53
F	Arabis sp.	-	-	-	-	5	-	-	.01
F	Astragalus calycosus	-	-	-	-	10	-	-	.05
F	Astragalus eurekensis	-	-	-	-	2	-	-	.00
F	Astragalus sp.	$_{a}$6	-	$_{a}$1	-	-	.03	-	-
F	Castilleja linariaefolia	-	-	$_{a}$7	$_{a}$2	$_{a}$4	.06	.03	.03
F	Calochortus nuttallii	$_{a}$17	-	$_{a}$15	$_{a}$10	-	.04	.03	-
F	Castilleja sp.	-	-	4	-	-	.01	-	-
F	Cirsium sp.	-	-	1	-	-	.00	-	-
F	Descurainia pinnata (a)	-	-	$_{a}$3	-	$_{a}$3	.03	-	.03
F	Draba sp. (a)	-	-	-	-	24	-	-	.08
F	Erodium cicutarium (a)	-	-	$_{a}$3	$_{a}$9	$_{b}$39	.00	.01	1.41
F	Eriogonum ovalifolium	-	-	$_{a}$4	$_{a}$10	$_{a}$3	.01	.01	.00
F	Gilia sp. (a)	-	-	$_{a}$3	$_{a}$4	-	.00	.01	-
F	Holosteum umbellatum (a)	-	-	-	-	21	-	-	.03
F	Lathyrus brachycalyx	$_{a}$3	-	$_{a}$4	$_{a}$7	$_{a}$1	.06	.31	.03
F	Lactuca serriola	-	-	$_{a}$-	-	$_{a}$3	.00	-	.00
F	Petradoria pumila	$_{a}$23	$_{a}$37	$_{a}$22	$_{a}$25	$_{a}$18	.94	.54	.16
F	Phlox hoodii	-	-	$_{a}$4	-	$_{a}$3	.00	-	.00
F	Phlox longifolia	$_{a}$2	-	-	$_{a}$3	$_{a}$3	-	.00	.00
F	Ranunculus testiculatus (a)	-	-	$_{a}$3	$_{a}$26	$_{b}$106	.00	.08	.46
F	Sisymbrium altissimum (a)	-	-	-	-	2	-	-	.15
F	Sphaeralcea coccinea	$_{a}$20	$_{a}$21	$_{a}$24	$_{a}$9	$_{a}$18	.28	.06	.07
F	Streptanthus cordatus	$_{a}$9	-	$_{a}$6	$_{a}$4	$_{a}$2	.16	.03	.03
F	Vicia americana	-	$_{a}$2	$_{a}$3	-	-	.15	-	-
Total for Annual Forbs		0	0	327	283	495	3.31	1.42	4.71
Total for Perennial Forbs		80	60	95	74	72	1.76	1.03	0.41
Total for Forbs		80	60	422	357	567	5.07	2.46	5.13

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	'97	'02	'07
B	Artemisia nova	0	0	0	-	-	-
B	Artemisia tridentata vaseyana	61	62	52	7.70	7.89	5.53
B	Chrysothamnus viscidiflorus stenophyllus	0	0	7	-	-	.00
B	Chrysothamnus viscidiflorus viscidiflorus	11	13	2	.48	.09	.18
B	Ephedra viridis	1	2	2	.85	.98	1.14
B	Gutierrezia sarothrae	7	11	3	.19	.03	.16
B	Juniperus osteosperma	1	1	1	3.34	3.65	3.80
B	Opuntia sp.	2	6	5	-	-	.03
B	Pinus monophylla	0	0	0	-	.63	.15
Total for Browse		83	95	72	12.57	13.28	11.02

CANOPY COVER, LINE INTERCEPT --
Management unit 18B, Study no: 3

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	8.21
Ephedra viridis	-	1.76
Gutierrezia sarothrae	-	.16
Juniperus osteosperma	.41	6.06
Opuntia sp.	-	.06

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18B, Study no: 3

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.3	1.1

POINT-QUARTER TREE DATA --
Management unit 18B, Study no: 3

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	37	31
Pinus monophylla	13	22

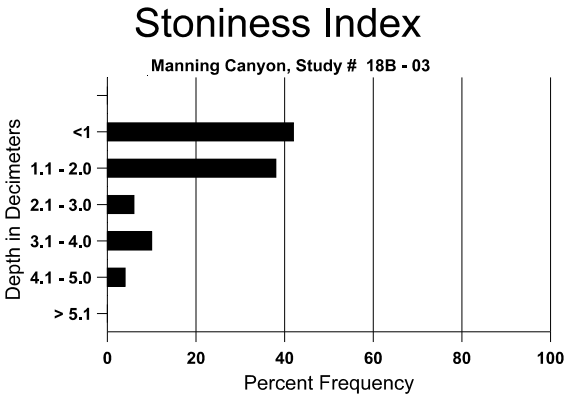
Average diameter (in)	
'02	'07
10.1	9.2
3.2	4.5

BASIC COVER --
Management unit 18B, Study no: 3

Cover Type	Average Cover %				
	'83	'90	'97	'02	'07
Vegetation	1.50	5.25	38.40	36.87	36.42
Rock	5.25	7.25	6.62	9.95	7.54
Pavement	4.25	25.75	13.51	7.94	8.03
Litter	59.25	41.00	39.88	35.18	33.36
Cryptogams	4.00	4.75	4.61	21.70	20.32
Bare Ground	25.75	16.00	8.93	7.19	11.62

SOIL ANALYSIS DATA --
Herd Unit 18B, Study no: 3, Manning Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
14.3	48.8 (16.8)	7.9	40.3	33.2	26.6	2.6	7.7	124.8	.5



PELLET GROUP DATA --
Management unit 18B, Study no: 3

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	10	45	91
Elk	2	-	8
Deer	52	21	18
Cattle	-	-	1

Days use per acre (ha)	
'02	'07
-	-
1 (2)	1 (3)
31 (78)	18 (45)
-	-

BROWSE CHARACTERISTICS --
Management unit 18B, Study no: 3

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**33**	-	-	33	-	-	100	0	-	-	0	8/10
97	**0**	-	-	-	-	-	0	0	-	-	0	12/15
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Artemisia tridentata vaseyana												
83	**1599**	-	133	1066	400	-	2	92	25	-	21	13/18
90	**1432**	-	33	133	1266	-	56	2	88	12	28	14/16
97	**2160**	-	40	1440	680	1580	17	5	31	12	12	31/43
02	**2040**	20	60	1040	940	1380	31	6	46	24	25	21/31
07	**1440**	-	20	680	740	920	35	11	51	32	40	29/40
Chrysothamnus viscidiflorus stenophyllus												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
90	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**0**	-	-	-	-	-	0	0	0	-	0	-/-
07	**160**	-	20	80	60	-	13	50	38	13	25	8/10
Chrysothamnus viscidiflorus viscidiflorus												
83	**366**	-	166	200	-	-	0	0	0	-	0	12/16
90	**66**	-	-	33	33	-	50	0	50	50	50	5/4
97	**340**	20	20	300	20	-	0	6	6	6	6	11/12
02	**320**	-	-	180	140	60	31	0	44	13	19	8/11
07	**80**	-	-	80	-	-	50	50	0	-	0	10/20
Cowania mexicana stansburiana												
83	**66**	-	33	33	-	-	50	50	-	-	0	33/28
90	**99**	33	66	33	-	-	0	100	-	-	0	35/26
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	91/100

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Ephedra viridis												
83	**200**	-	-	200	-	-	100	0	0	-	17	39/39
90	**232**	-	33	66	133	-	0	0	57	-	14	40/39
97	**20**	-	-	20	-	-	0	0	0	-	0	41/53
02	**40**	-	-	20	20	-	0	50	50	-	0	46/66
07	**40**	-	20	20	-	-	0	0	0	-	0	49/67
Gutierrezia sarothrae												
83	**432**	-	166	233	33	-	0	0	8	-	0	9/7
90	**1033**	-	200	733	100	-	0	0	10	-	3	5/6
97	**160**	-	20	140	-	20	0	0	0	-	0	10/10
02	**380**	-	40	200	140	40	0	0	37	26	26	5/7
07	**80**	-	40	20	20	20	0	0	25	25	25	6/6
Juniperus osteosperma												
83	**66**	-	66	-	-	-	0	0	-	-	0	-/-
90	**66**	-	33	33	-	-	0	0	-	-	0	91/69
97	**20**	-	-	20	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**20**	20	-	20	-	-	0	0	-	-	0	-/-
Opuntia sp.												
83	**66**	-	-	66	-	-	0	0	-	-	0	7/5
90	**166**	33	33	133	-	-	0	0	-	-	0	6/7
97	**80**	-	-	80	-	-	0	0	-	-	0	8/14
02	**120**	-	-	120	-	-	0	0	-	-	0	5/13
07	**120**	-	-	120	-	-	17	0	-	-	0	6/15

Trend Study 18B-5-07

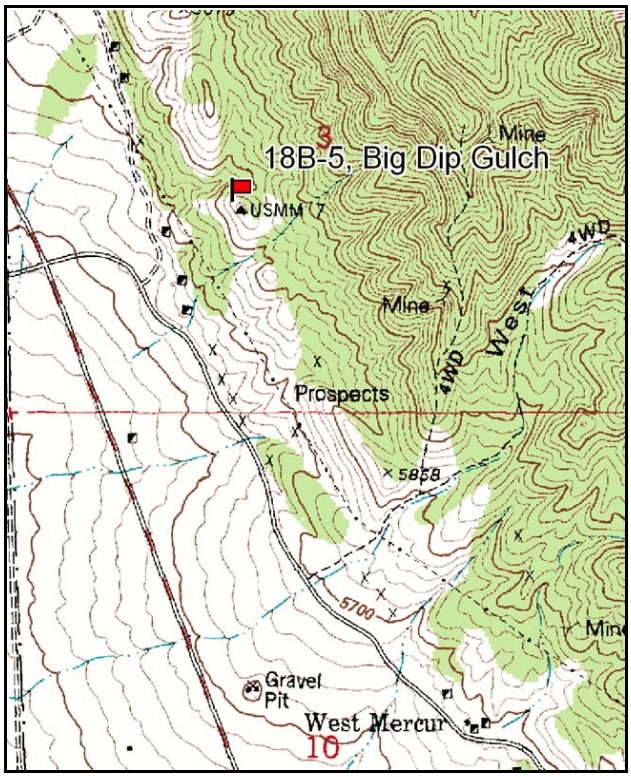
Study site name: Big Dip Gulch . Vegetation type: Black Sagebrush .

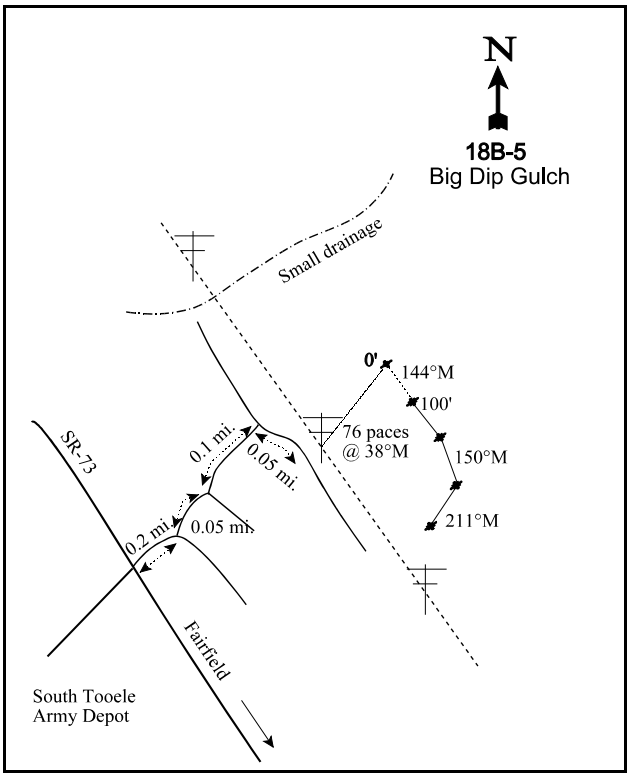
Compass bearing: frequency baseline 150 degrees magnetic. (Line 4 @ 211°M)

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

LOCATION DESCRIPTION

From the junction of SR-73 and the east entrance to the South Tooele Army Depot, turn east on the dirt road directly across from the depot entrance towards West Dip Gulch and travel 0.20 miles to an intersection. Turn left and travel 0.05 miles to another intersection. Turn left again and travel 0.10 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 mark of the frequency baseline is located 76 paces from the two power poles at an azimuth of 38 degrees magnetic. It is marked by a green steel fencepost 15 inches in height with a red browse tag, number 3969.





Map Name: Ophir

Diagrammatic Sketch

Township 6S , Range 4W , Section 3

GPS: NAD 83, UTM 12T 391082 E 4464749 N

DISCUSSION

Big Dip Gulch - Trend Study No. 18B-5

Study Information

This study is located on a black sagebrush hillside between Silverado Canyon and West Dip Gulch [elevation: 5,700 feet (1,737 m), slope: 12-25%, aspect: west]. It is managed by the Bureau of Land Management. The vegetation is dominated by black sagebrush with a sparse understory and transitions to Wyoming big sagebrush downslope. This critical deer winter range was historically used by domestic sheep. Deer use was moderately heavy in 1997 with a pellet group quadrat frequency of 42%. Deer use was lower in 2002 with a pellet group quadrat frequency 22%. The estimated deer pellet group transect data was 44 days use/acre in 2002 and 62 in 2007 (109 ddu/ha in 2002 and 154 in 2007).

Soil

The soil is in the Lodar and Lundy series, which is made up of shallow and well drained, moderately permeable soils on ridges, mountains, and hills. They form from residuum and colluvium from sandstone, shale, and/or limestone (USDA-NRCS 2007). The texture is a clay loam containing abundant shale fragments and with a mildly alkaline reaction (pH 7.5). The soil phosphorus level is 4.9 ppm; values less than 6 ppm may limit plant growth and development (Tiedemann and Lopez 2004). No significant litter or soil organic matter have accumulated. Relative vegetation cover has been 14% to 18%. The proportion of the cover contributed by rock and pavement has consistently been high (over 70%) since 1983. The soil erosion condition class was stable in 2002 and 2007, due largely to the shale rock armoring the surface.

Browse

The key browse species is black sagebrush (*Artemisia nova*). It comprises a relatively uniform, low growing, and evenly spaced shrub community that initially had an estimated density of 9,532 plants/acre (25,544 plants/ha) in 1983. Density decreased to 9,066 plants/acre (22,393 plants/ha) in 1989, 5,640 (13,931/ha) in 1997, increased to 7,040 (17,389/ha) in 2002, and decreased to 6,700 (16,549/ha) in 2007. The large decrease from 1989 to 1997 is due to the increase in sample area used beginning in 1997. Recruitment of young plants was high at 36% of the population in 1983, but has decreased to 5% of the population in 2002 and 2007. Decadent individuals have fluctuated from 7% (in 1997) of the population to 57% (in 1989). Plants classified as dying have slowly increased from 0% of the population in 1983 and 1989 to 16% in 2007. The average leader growth was 1.4 inches (3.5 cm) in 2002 and 0.5 (1.3 cm) inches in 2007. Utilization was classified as heavy in 1983, then decreased to moderate in 1989 and 1997, light-moderate in 2002, and light in 2007.

Other browse species occur rarely and 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* spp. *stansburiana*). Broom snakeweed density has fluctuated substantially, due to precipitation changes, from 133 (329/ha) in 1989 to 4,300 plants/acre (10,621 plants/ha) in 1997.

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. Bluebunch cover was 2% in 1997, 4% in 2002, and 7% in 2007. Sandberg bluegrass cover was 1% in 1997, 3% in 2002, and 4% in 2007. Cheatgrass has provided less than 1% cover every year since 1997. Forbs are mostly low growing native and weedy exotic species. They are neither diverse nor abundant. The undesirable annuals storksbill (*Erodium cicutarium*) and bur buttercup (*Ranunculus testiculatus*) are the most abundant forb species and both increased significantly in nested frequency in 2007 (Buchanan et al. 1978, Kimball and Schiffmann 2003).

1989 TREND ASSESSMENT
The browse trend is stable. The density of the key browse species, black sagebrush, changed little. Decadent individuals did increase from 11% to 57% of the population, a potential problem for the population. The grass trend is up. The nested frequency of perennial grasses increased 63% and the nested frequencies of Bluebunch wheatgrass, Sandberg bluegrass, and Indian ricegrass (*Oryzopsis hymenoides*) all increased significantly in nested frequency. The forb trend is stable. The nested frequency of perennial forbs changed little.

browse - stable (0) grass - up (+2) forb - stable (0)

1997 TREND ASSESSMENT
The browse trend is down. The black sagebrush density decreased 38% from 9,066 plants/acre (22,393 plants/ha) to 5,640 plants/acre (13,931plants/ha), some of which was due to the increase in sample area. Recruitment of young individuals decreased from 26% of the population to 16%. On the other hand, decadent plants decreased from 57% of the population to 7%. The grass trend is down. The sum of the nested frequency of perennial grasses decreased 26% and the nested frequencies of bluebunch wheatgrass and Sandberg bluegrass decreased significantly. The forb trend is stable. The nested frequency of perennial forbs changed little and forbs provided very little cover. The Desirable Components Index (DCI) score was fair due to low-moderate browse cover, low decadence, moderate recruitment, low perennial grass and forb cover, and low annual grass cover.

winter range condition (DCI) - fair (38) Low potential scale
browse - down (-2) grass - down (-2) forb - stable (0)

2002 TREND ASSESSMENT
The browse trend is slightly up. The sagebrush density increased 20% and the percentage of plants classified as dying changed little. Recruitment of young individuals decreased from 16% to 5% and decadence increased from 7% to 22% of the population. The grass trend is up. The sum of the nested frequency of perennial grasses increased 15% and that of annual grasses decreased 60%. The nested frequency of cheatgrass decreased significantly. The forb trend is stable. The sum of the nested frequencies of annual and perennial forbs changed remained low. The DCI score remained fair.

winter range condition (DCI) - fair (37) Low potential scale
browse - slightly up (+1) grass - up (+2) forb - stable (0)

2007 TREND ASSESSMENT
The browse trend is stable. The sagebrush density and decadence changed little. Plants classified as dying increased slightly from 4 to 16% of the population. Plants with poor vigor also increased from 4 to 17% of the population. The plants classified as dying and having poor vigor were not enough to justify a downward trend because the population is large and quite healthy. The grass trend is slightly up. The sum of the nested frequency of perennial grasses increased 23%, the majority of which was due to a significant increase in Sandberg bluegrass, but cheatgrass nested frequency increased significantly as well. The forb trend is down. The sum of the nested frequency of perennial forbs decreased to one forb in a single quadrat. Perennial forb species diversity decreased from five species to one. The nested frequencies of the undesirable annual forb species storksbill and bur buttercup increased significantly. The DCI score improved slightly from fair to fair-good due to an increase in browse and perennial grass cover.

winter range condition (DCI) - fair-good (44) Low potential scale
browse - stable (0) grass - slightly up (+1) forb - down (-2)

HERBACEOUS TRENDS --
Management unit 18B, Study no: 5

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	$_{a}$49	$_{c}$119	$_{ab}$74	$_{bc}$100	$_{c}$121	2.37	4.19	6.51
G	Bromus tectorum (a)	-	-	$_{c}$192	$_{a}$77	$_{b}$156	.51	.21	.64
G	Oryzopsis hymenoides	$_{a}$3	$_{b}$9	$_{ab}$5	$_{a}$3	$_{a}$3	.04	.03	.03
G	Poa secunda	$_{a}$160	$_{b}$222	$_{a}$182	$_{a}$185	$_{b}$241	1.37	2.66	4.02
G	Sitanion hystrix	$_{ab}$4	$_{ab}$1	$_{b}$-	$_{b}$11	$_{ab}$3	.00	.10	.00
Total for Annual Grasses		0	0	192	77	156	0.50	0.21	0.64
Total for Perennial Grasses		216	351	261	299	368	3.80	7.00	10.58
Total for Grasses		216	351	453	376	524	4.31	7.21	11.22
F	Allium sp.	-	-	$_{a}$2	$_{a}$9	-	.00	.05	-
F	Antennaria rosea	1	-	-	-	-	-	-	-
F	Arabis sp.	-	-	$_{a}$3	$_{a}$3	$_{a}$2	.00	.00	.00
F	Astragalus sp.	-	-	3	-	-	.00	-	-
F	Castilleja chromosa	-	2	-	-	-	-	-	-
F	Calochortus nuttallii	-	-	-	5	-	-	.01	-
F	Chaenactis douglasii	$_{ab}$11	$_{b}$22	$_{ab}$19	$_{a}$2	-	.04	.00	-
F	Cryptantha sp.	$_{a}$2	$_{a}$3	-	-	-	-	-	-
F	Cymopterus sp.	-	-	-	1	-	-	.00	-
F	Draba sp. (a)	-	-	-	-	1	-	-	.00
F	Erodium cicutarium (a)	-	-	$_{a}$10	$_{a}$9	$_{b}$32	.01	.02	.28
F	Eriogonum sp.	-	1	-	-	-	-	-	-
F	Lactuca serriola	-	6	-	-	-	-	-	-
F	Lygodesmia spinosa	7	-	-	-	-	-	-	-
F	Phlox hoodii	-	7	-	-	-	-	-	-
F	Ranunculus testiculatus (a)	-	-	$_{a}$134	$_{a}$172	$_{b}$249	.41	.51	1.08
Total for Annual Forbs		0	0	144	181	282	0.42	0.53	1.37
Total for Perennial Forbs		21	41	27	20	2	0.05	0.08	0.00
Total for Forbs		21	41	171	201	284	0.47	0.61	1.37

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	'97	'02	'07
B	Artemisia nova	88	95	96	6.40	8.14	8.60
B	Chrysothamnus viscidiflorus stenophyllus	2	1	1	.01	.03	.15
B	Cowania mexicana stansburiana	1	1	1	-	-	-
B	Gutierrezia sarothrae	50	21	31	2.73	.23	.45
B	Juniperus osteosperma	1	1	1	-	.00	.06
B	Opuntia sp.	1	1	0	-	-	-
B	Tetradymia glabrata	1	1	1	-	-	-
Total for Browse		144	121	131	9.15	8.40	9.26

CANOPY COVER, LINE INTERCEPT --
Management unit 18B, Study no: 5

Species	Percent Cover	
	'02	'07
Artemisia nova	-	10.35
Gutierrezia sarothrae	-	.25
Juniperus osteosperma	-	.01

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18B, Study no: 5

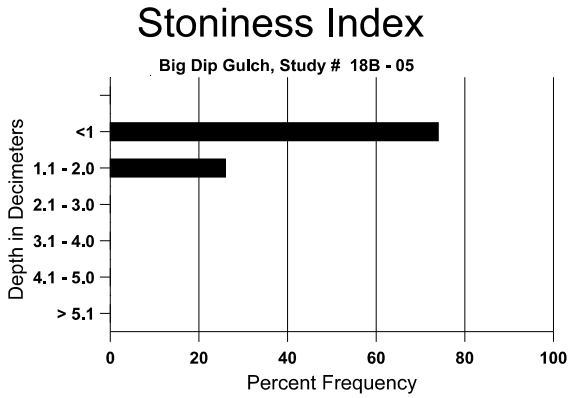
Species	Average leader growth (in)	
	'02	'07
Artemisia nova	1.4	0.5

BASIC COVER --
Management unit 18B, Study no: 5

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	.75	10.00	13.81	15.10	20.44
Rock	16.25	33.00	25.22	32.12	31.87
Pavement	54.25	37.75	45.94	43.07	41.78
Litter	15.00	9.75	7.81	10.06	6.94
Cryptogams	0	.75	1.14	1.25	1.93
Bare Ground	13.75	8.75	2.12	9.68	8.63

SOIL ANALYSIS DATA --
Herd Unit 18B, Study no: 5, Big Dip Gulch

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
5.9	46.8 (7.7)	7.5	28.0	39.4	32.6	2.8	4.9	195.2	.5



PELLET GROUP DATA --
Management unit 18B, Study no: 5

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	9	15	85
Horse	1	-	-
Elk	-	-	4
Deer	42	22	24

Days use per acre (ha)	
'02	'07
-	-
-	-
-	-
44 (109)	62 (154)

BROWSE CHARACTERISTICS --
Management unit 18B, Study no: 5

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
83	**9532**	66	3466	5000	1066	-	14	86	11	.70	8	8/14
89	**9066**	1666	2333	1600	5133	-	56	0	57	-	0	7/15
97	**5640**	340	880	4380	380	420	48	0	7	5	5	20/21
02	**7040**	20	320	5160	1560	520	38	3	22	4	4	8/17
07	**6700**	620	340	4680	1680	760	13	1	25	16	17	8/22

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus viscidiflorus stenophyllus												
83	**66**	-	66	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**40**	-	40	-	-	-	0	0	-	-	0	-/-
02	**20**	-	20	-	-	-	0	0	-	-	0	-/-
07	**40**	-	-	40	-	-	0	0	-	-	0	4/6
Cowania mexicana stansburiana												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	100	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	56/128
07	**20**	-	-	20	-	-	0	0	-	-	0	50/61
Ephedra viridis												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	17/16
Gutierrezia sarothrae												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**133**	-	133	-	-	-	0	0	0	-	0	-/-
97	**4300**	-	180	3720	400	200	0	0	9	.93	.93	7/9
02	**580**	-	100	180	300	3560	0	0	52	38	38	5/8
07	**1280**	100	320	960	-	20	0	0	0	-	0	4/5
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	0	0	-	-	0	-/-
Opuntia sp.												
83	**66**	-	-	66	-	-	0	0	-	-	0	6/6
89	**66**	-	66	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	8/14
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	100	0	0	-	-	0	4/9

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Tetradymia glabrata												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**20**	-	-	20	-	-	0	0	0	-	0	4/5
02	**20**	-	-	20	-	-	0	0	0	-	0	10/11
07	**20**	-	-	-	20	-	0	0	100	100	100	20/33

Trend Study 18B-6-07

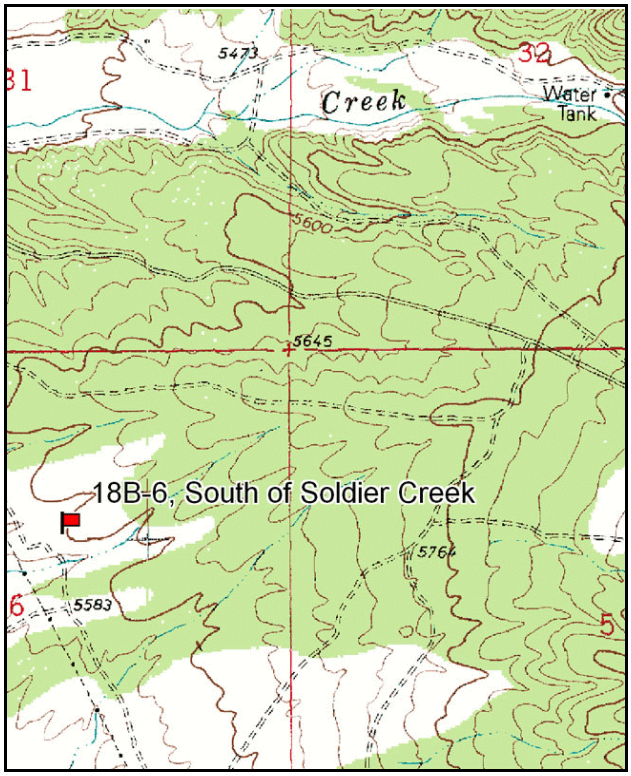
Study site name: South of Soldier Creek . Vegetation type: Chained, Seeded P-J .

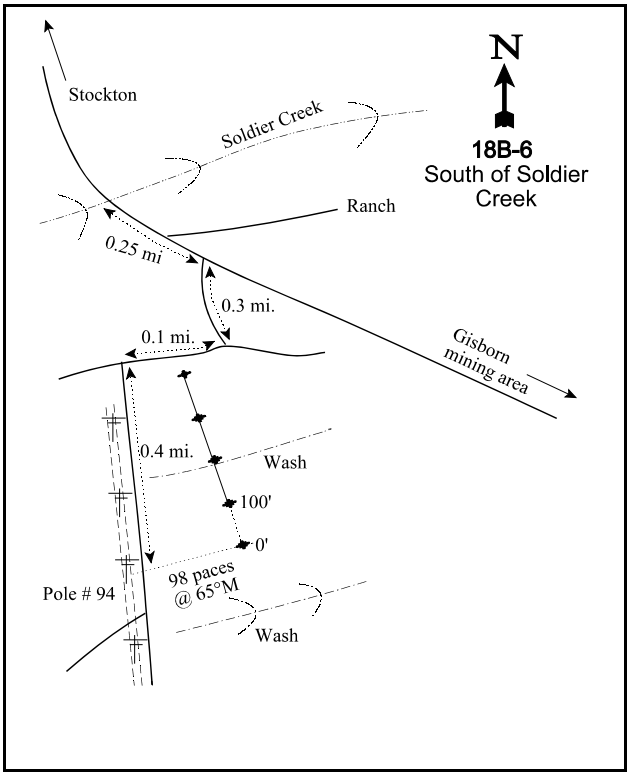
Compass bearing: frequency baseline 338 degrees magnetic.

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

LOCATION DESCRIPTION

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 the this road until the 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 0.30 miles to an intersection at the top of the hill. Turn right (west) and travel 0.10 miles to another intersection. Turn left (south) and travel 0.40 miles to where there is a double power pole on the west side of the road. From power pole #94, walk 98 paces at an azimuth of 65 degrees magnetic to the 0-foot mark of the frequency baseline, marked by a steel fencepost 15 inches in height.





Map Name: Stockton

Diagrammatic Sketch

Township 5S , Range 4W , Section 6

GPS: NAD 83, UTM 12T 386563 E 4474870 N

DISCUSSION

South of Soldier Canyon - Trend Study No. 18B-6

Study Information

This study was established in 1983 on an old Bureau of Land Management chaining and seeding treatment south of Soldier Creek [elevation: 5,600 feet (1,707 m), slope: 5%, aspect: west]. It is on a bench formerly populated by a dense stand of juniper and pinyon trees. The seeded area is within critical deer winter range. Judging by the low number of pellet groups and low forage utilization observed, relatively few deer occupy the area in a normal winter. Quadrat frequency of deer pellet groups was moderately low in 1997 at 19% and has decreased to 8% in 2002 and 6% in 2007. Most use has been observed through the washes. Deer pellet group transect data estimates were 4 days use/acre in 2002 and 52 in 2007 (10 ddu/ha in 2002 and 129 in 2007). Elk pellet group data estimates in 2002 were 5 days use/acre in 2002 and 29 in 2007 (12 edu/ha in 2002 and 71 in 2007). Cattle use was estimated at 2 days use/acre in 2007 (4 cdu/ha). Rabbit pellet quadrat frequency was 29% in 1997 and 2002 and 54% in 2007.

Soil

The soil is in the Borvant series, which consists of a shallow to a petrocalcic horizon that is well drained and formed from colluvium or alluvium and derived from a limestone and sandstone parent material on fan remnants, hills, or ridges (USDA-NRCS 2007). It is gravelly with a clay loam texture with a slightly alkaline reaction (pH 7.5). The soil phosphorus level is low at only 5.6 ppm; values less than 6 ppm may limit plant growth and development (Tiedemann and Lopez 2004). Relative bare ground cover was 14% in 1997, 16% in 2002, and 21% in 2007. Erosion is not significant due to the moderate vegetation cover and gentle slope; the erosion condition class determined the soil to be stable in 2002 and 2007.

Browse

Browse composition and density are low for a seeded area with the objective of improving big game habitat. When the study was established in 1983, the seeded species appeared mature and well-established. The key preferred browse species is a low elevation variety of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). This study was established within the ecotone of Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and mountain big sagebrush, where there appears to be some hybridization occurring between the two subspecies. Density estimates were 1,333 plants/acre (3,293 plants/ha) in 1983 and 1989. The larger sample area used beginning in 1997 estimated densities of 680 plants/acre (1,680 plants/ha) in 1997, 880 (2,174/ha) in 2002, and 920 (2,272/ha) in 2007. Decadence has been moderate and has averaged 26%, except in 1983 and 1997 when decadence was 0 and 9%, respectively. Recruitment of young plants was good in 1997 at 24%, but decreased to 2% in 2002 and 4% in 2007. Utilization was light from 1983 to 1997, but was moderate-heavy in 2002 and 2007. It appears that some sagebrush plants are more preferred than others based on differences in use. The plants with more mountain big sagebrush characteristics display heavier use. In 2007, 7% of the sampled plants appeared to be infested by an insect, likely the sagebrush defoliator moth (*Aroga websteri*).

Narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*) is the next most abundant browse species. This species is low in palatability and is mostly unutilized. Some of the use on this shrub appears to be from rabbits. Less abundant shrubs include broom snakeweed (*Gutierrezia sarothrae*) and pricklypear cactus (*Opuntia* sp.).

A few Utah juniper (*Juniperus osteosperma*) and single-leaf pinyon pine (*Pinus monophylla*) remain after the chaining treatment. Point-quarter density estimates from 2002 were 84 juniper trees/acre (207 trees/ha) with an average diameter of nearly 5 inches (12 cm). Trees were mostly mature and 10 to 12 feet (3.0 to 3.7 m) tall. In 2007, the point quarter density estimates for juniper were 94 trees/acre (232 trees/ha) with an average trunk diameter of 8.5 inches (22 cm). Young trees were uncommon in 2002, but trees under 4 feet (1.2 m) tall made

up 20% of those sampled in 2007.

Herbaceous Understory
The herbaceous understory is dominated by crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*Agropyron spicatum*), and Sandberg bluegrass (*Poa secunda*). Crested wheatgrass has provided 6% to 7% cover since 1997, bluebunch wheatgrass has increased from 3% cover in 1997 to nearly 7% in 2007, and Sandberg bluegrass has increased from 2% cover in 1997 to 6% in 2007. Indian ricegrass (*Oryzopsis hymenoides*) and bottlebrush squirreltail (*Sitanion hystrix*) also occur in lower abundances. Cheatgrass (*Bromus tectorum*) provided 3% cover in 1997 and nearly 2% in 2002 and 2007. Cheatgrass appears to be controlled by the dense understory and its influence on species composition is deminishing.

The forb composition is diverse, but is composed of species with relatively poor forage value and increasers. Abundance and productivity are significantly less than grasses. No evidence of commonly seeded forbs, such as alfalfa (*Medicago sativa*), small burnet (*Sanguisorba minor*), or yellow sweetclover (*Melilotus officinalis*) were observed anywhere on the chained and seeded area.

1989 TREND ASSESSMENT
The browse trend is stable. The sagebrush density remained unchanged, but decadence increased. This decadence increase is likely due to low precipitation in 1988 and 1989 (Utah Climate Summaries 2007). The grass trend is up. The sum of the nested frequency of perennial grasses increased 48% and the nested frequencies of bluebunch wheatgrass and Sandberg bluegrass increased significantly. The forb trend is slightly up. The sum of the nested frequency of perennial forbs increased and diversity increased from four species to seven.

browse - stable (0) grass - up (+2) forb - slightly up (+1)

1997 TREND ASSESSMENT
The browse trend is slightly down. The density of sagebrush, the key browse species, decreased substantially from 1989 to 1997. This is due mainly to an increase in the sample area in 1997, although there does appear to be some decrease in the sagebrush density. However, sagebrush decadence decreased. The grass trend is down. The sum of the nested frequency of perennial grasses decreased 27%, part of which is due to the change in sample area. The nested frequencies of bluebunch wheatgrass and Sandberg bluegrass decreased significantly. The forb trend is slightly up. The sum of the nested frequency of perennial forbs increased, although few species are beneficial to big game. Diversity increased, due in part to the increase in sample area, from seven perennial species to 11. The Desirable Components Index (DCI) score was fair due to low decadence, good recruitment, good perennial grass cover, and high perennial forb cover.

winter range condition (DCI) - fair (60) Mid-level potential scale
browse - slightly down (-1) grass - down (-2) forb - slightly up (+1)

2002 TREND ASSESSMENT
The browse trend is slightly up. The density of sagebrush increased 23%. Unfortunately, decadence increased from 9% to 34%, plants classified as dying increased from 3% of the population to 18%, and the percentage young plants in the population decreased. Utilization on the sagebrush was moderate-heavy. The grass trend is stable. The sum of the nested frequency of perennial grasses changed little and the nested frequency of cheatgrass did not change significantly. Perennial grass average cover increased from 12% to nearly 15%. The forb trend is stable. The sums of the nested frequencies of annual and perennial forbs changed little. The DCI score declined to poor due to an increase in the percent decadence and a decrease in the percent young.

winter range condition (DCI) - poor (46) Mid-level potential scale
browse - slightly up (+1) grass - stable (0) forb - stable (0)

2007 TREND ASSESSMENT

The browse trend is stable. The density of sagebrush changed little, decadent individuals decreased from 34% of the population to 20%, and plants classified as dying decreased from 18% of the population to 7%. Utilization remained moderate. The grass trend is slightly up. The sum of the nested frequency of perennial grasses increased 17% due to significant increases in the nested frequencies of bluebunch wheatgrass and Sandberg bluegrass. However, cheatgrass nested frequency also increased significantly and quadrat frequency increased from 24% to 40%, but cover did not change. The forb trend is stable. The nested frequency of perennial forbs changed little and perennial forb cover increased from 5% to 7%. Unfortunately, the nested frequency of bur buttercup (*Ranunculus testiculatus*) increased significantly and its cover increased from less than 1% to nearly 4%. The DCI score improved to fair due mainly to a decrease in sagebrush decadence.

winter range condition (DCI) - fair (54) Mid-level potential scale
browse - stable (0) grass - slightly up (+1) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 18B, Study no: 6

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	$_{a}$106	$_{a}$101	$_{b}$159	$_{ab}$141	$_{ab}$120	6.64	7.07	5.61
G	Agropyron spicatum	$_{c}$146	$_{d}$210	$_{ab}$74	$_{a}$60	$_{bc}$96	3.30	4.47	6.60
G	Bromus tectorum (a)	-	-	$_{a}$82	$_{a}$63	$_{b}$117	3.16	1.77	1.63
G	Oryzopsis hymenoides	$_{a}$22	$_{a}$14	$_{a}$8	$_{a}$13	$_{a}$5	.22	.33	.18
G	Poa secunda	$_{a}$60	$_{c}$177	$_{b}$128	$_{bc}$143	$_{d}$198	2.21	2.82	6.12
G	Sitanion hystrix	$_{a}$7	$_{a}$4	-	-	-	-	-	-
Total for Annual Grasses		0	0	82	63	117	3.16	1.77	1.63
Total for Perennial Grasses		341	506	369	357	419	12.38	14.71	18.52
Total for Grasses		341	506	451	420	536	15.55	16.49	20.15
F	Alyssum alyssoides (a)	-	-	-	$_{a}$21	$_{b}$66	-	.20	1.36
F	Allium sp.	-	-	-	1	-	-	.00	-
F	Antennaria rosea	-	$_{a}$1	$_{a}$1	-	-	.00	-	-
F	Arabis sp.	-	-	$_{a}$4	-	$_{a}$2	.01	-	.03
F	Astragalus beckwithii	-	-	$_{a}$13	-	$_{a}$13	.27	-	.08
F	Astragalus tenellus	-	-	13	-	-	.36	-	-
F	Astragalus sp.	$_{a}$1	$_{a}$4	$_{a}$6	$_{a}$3	-	.03	.04	-
F	Astragalus utahensis	-	-	-	3	-	-	.00	-
F	Castilleja linariaefolia	-	-	-	-	1	-	-	.00
F	Camelina microcarpa (a)	-	-	3	-	-	.00	-	-
F	Calochortus nuttallii	-	$_{a}$2	$_{a}$6	$_{a}$3	$_{a}$6	.02	.00	.01
F	Cirsium sp.	-	-	-	1	-	-	.00	-
F	Cryptantha sp.	-	2	-	-	-	-	-	-
F	Erodium cicutarium (a)	-	-	$_{a}$6	-	$_{b}$22	.01	-	.24

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Eriogonum ovalifolium	-	-	-	-	1	-	-	.00
F	Erigeron pumilus	$_{a}$1	$_{a}$3	$_{a}$1	-	-	.03	-	-
F	Gilia sp. (a)	-	-	-	$_{a}$1	$_{a}$1	-	.00	.00
F	Holosteum umbellatum (a)	-	-	-	-	24	-	-	.10
F	Lathyrus brachycalyx	-	-	$_{a}$19	$_{b}$53	$_{b}$54	1.04	2.10	2.74
F	Leucelene ericoides	-	-	-	-	1	-	-	.00
F	Petradoria pumila	$_{a}$19	$_{a}$26	$_{a}$51	$_{a}$51	$_{a}$45	2.09	1.72	2.26
F	Phlox hoodii	$_{ab}$69	$_{b}$93	$_{ab}$66	$_{a}$62	$_{a}$59	.98	.93	1.67
F	Phlox longifolia	-	-	$_{a}$13	$_{a}$9	$_{a}$13	.02	.05	.06
F	Ranunculus testiculatus (a)	-	-	$_{a}$175	$_{a}$157	$_{b}$261	1.40	.59	3.54
F	Sisymbrium altissimum (a)	-	-	$_{a}$3	-	$_{a}$6	.03	-	.06
Total for Annual Forbs		0	0	187	179	380	1.45	0.80	5.30
Total for Perennial Forbs		90	131	193	186	195	4.88	4.86	6.90
Total for Forbs		90	131	380	365	575	6.34	5.66	12.21

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	'97	'02	'07
B	Artemisia tridentata vaseyana	24	31	27	2.31	1.92	2.78
B	Chrysothamnus viscidiflorus stenophyllus	61	48	53	2.71	2.30	2.36
B	Gutierrezia sarothrae	14	16	4	.36	.40	.03
B	Juniperus osteosperma	5	7	7	3.76	6.07	6.34
B	Opuntia sp.	3	4	2	.15	.15	.00
B	Pinus monophylla	1	1	0	.38	.53	-
Total for Browse		108	107	93	9.69	11.39	11.52

CANOPY COVER, LINE INTERCEPT --
Management unit 18B, Study no: 6

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	2.13
Chrysothamnus viscidiflorus stenophyllus	-	1.66
Juniperus osteosperma	.48	7.23

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18B, Study no: 6

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.8	1.2

POINT-QUARTER TREE DATA --
Management unit 18B, Study no: 6

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	84	94

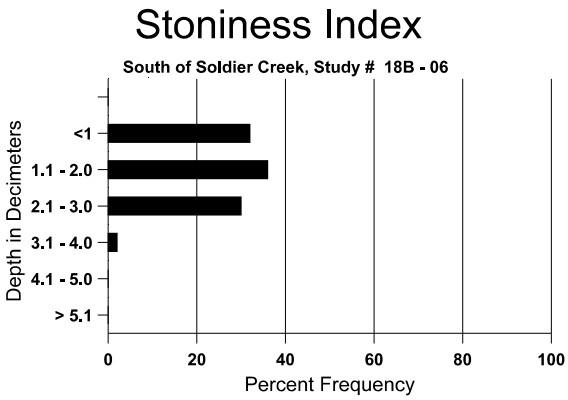
Average diameter (in)	
'02	'07
4.7	8.5

BASIC COVER --
Management unit 18B, Study no: 6

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	5.50	10.00	29.22	34.22	37.81
Rock	1.25	2.25	1.96	2.78	1.78
Pavement	25.75	30.25	17.02	20.81	16.33
Litter	38.00	34.75	31.13	30.62	25.90
Cryptogams	3.00	8.50	7.60	13.11	10.40
Bare Ground	26.50	14.25	13.67	19.31	25.02

SOIL ANALYSIS DATA --
Herd Unit 18B, Study no: 6, South of Soldier Creek

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.0	59.0 (12.0)	7.5	36.0	34.4	29.6	3.2	5.6	284.8	.6



PELLET GROUP DATA --
Management unit 18B, Study no: 6

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	29	29	54
Elk	1	4	6
Deer	19	8	6
Cattle	-	-	-

Days use per acre (ha)	
'02	'07
-	-
5 (12)	29 (71)
4 (10)	52 (129)
-	2 (4)

BROWSE CHARACTERISTICS --
Management unit 18B, Study no: 6

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
83	**1333**	-	300	1033	-	-	8	0	0	-	0	24/30
89	**1332**	-	466	533	333	-	38	0	25	3	8	30/31
97	**680**	-	160	460	60	160	18	3	9	3	3	21/30
02	**880**	-	20	560	300	140	30	27	34	18	18	19/30
07	**920**	-	40	700	180	220	52	2	20	7	7	18/26
Chrysothamnus viscidiflorus stenophyllus												
83	**2766**	-	600	2133	33	-	0	0	1	1	1	11/18
89	**1933**	100	1033	500	400	-	2	0	21	-	0	9/10
97	**3220**	-	200	2360	660	220	0	0	20	14	16	9/15
02	**2660**	-	80	1860	720	220	5	.75	27	10	10	7/12
07	**2540**	-	20	2000	520	80	34	6	20	12	13	8/13

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae												
83	**466**	-	33	433	-	-	0	0	0	-	0	8/12
89	**299**	-	233	33	33	-	11	0	11	-	0	8/13
97	**780**	200	140	640	-	40	0	0	0	-	0	6/8
02	**780**	-	-	620	160	240	0	0	21	-	0	4/7
07	**80**	-	-	80	-	20	0	0	0	-	0	6/9
Juniperus osteosperma												
83	**166**	-	-	166	-	-	0	0	-	-	0	60/44
89	**199**	-	33	166	-	-	0	0	-	-	0	73/55
97	**100**	-	-	100	-	40	0	0	-	-	0	-/-
02	**180**	-	-	180	-	20	0	0	-	-	0	-/-
07	**140**	-	-	140	-	20	14	0	-	-	0	60/39
Opuntia sp.												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**66**	-	66	-	-	-	0	0	0	-	50	-/-
97	**120**	-	-	120	-	-	0	0	0	-	0	6/16
02	**100**	-	-	80	20	-	0	0	20	20	20	4/11
07	**40**	-	-	40	-	-	0	0	0	-	0	6/13
Pinus monophylla												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 18B-15-07

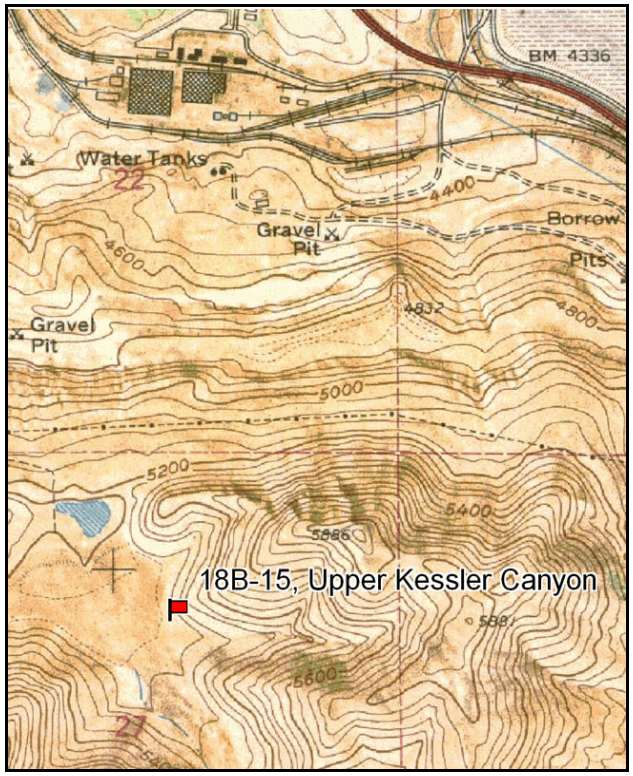
Study site name: Upper Kessler Canyon . Vegetation type: Perennial Grass .

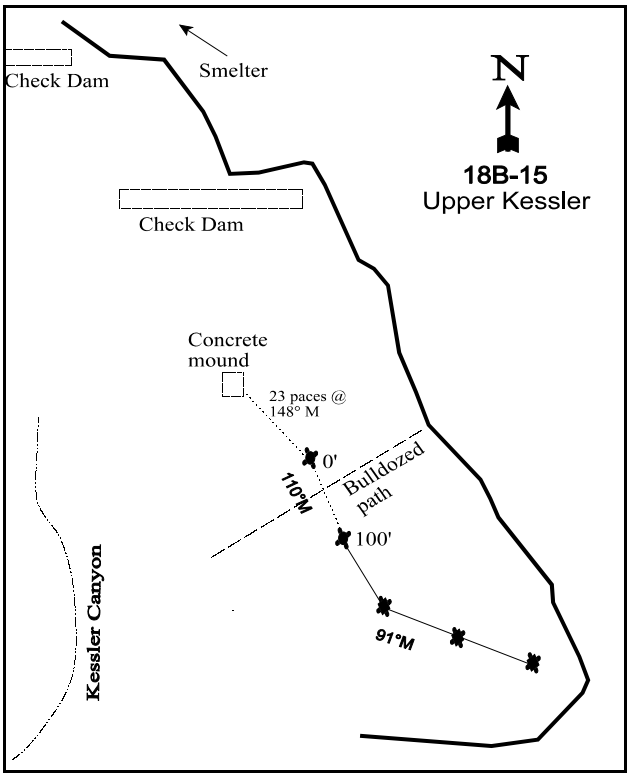
Compass bearing: frequency baseline 110 degrees magnetic (Lines 3-4 @ 91°M).

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

LOCATION DESCRIPTION

Contact the Kennecott Environmental Office (569-7120) before reading the site. From Highway 201 turn left (south) at 11600 West to North Warehouse, Gate #24 of Kennecott. Travel to security shack and get permission and an escort to proceed up Kessler Canyon. From the check dam in upper Kessler Canyon (Smelter Canyon) continue on into the valley for approximately 0.25 miles to a concrete mound. From the concrete mound, walk 23 paces bearing 148 degrees magnetic to the 0-foot baseline stake. The 0-foot stake is a short fencepost with a white top.





Map Name: Farnsworth Peak

Diagrammatic Sketch

Township 1S , Range 3W , Section 27

GPS: NAD 83, UTM 12T 398277 E 4504336 N

DISCUSSION

Upper Kessler Canyon - Trend Study No. 18B-15

Study Information

This study is located in the canyon owned by Kennecott, just south of the smelter [elevation: 5,200 feet (1,585 m), slope: 3-5%, aspect: northwest]. Decades of pollution from the smelter, previous to current environmental regulations, denuded the vegetation on the surrounding hills, which cause the soil to erode into the bottom of the canyon (personal communication with Ann Neville, Kennecott biologist resource specialist, 2007). The study is located in an area where sediment has collected during the period of high pollution and heavy erosion. It was disked and seeded mainly with perennial grass species. Wildlife use is mostly from elk, but there is also some deer. Deer pellet group transect data estimates were 9 days use/acre in 2002 and 2 in 2007 (22 ddu/ha in 2002 and 5 in 2007). Elk pellet group estimates were 22 days use/acre in 2002 and 27 in 2007 (54 edu/ha in 2002 and 68 in 2007).

Soil

The soil surface is hard-packed sandy clay loam with a relatively large percentage of rock and gravel on the surface and throughout the shallow profile. It is categorized as a stony alluvial land by the NRCS (USDA-NRCS 2007). The soil pH is 6.6. This unusually low pH is likely influenced by past pollution. The original shrub community was removed from the area during the years of heavy pollution and denudation and have not recovered. The shallow soil depth slows the establishment of shrubs, as illustrated by the low success rate of shrub seedings in this area. There is little erosion occurring because of the protective cover from herbaceous species, litter, and lack of significant slope.

Browse

No browse species were sampled within the sample area other than a Russian olive (*Elaeagnus angustifolia*) in 2002. If shrubs are thought to be necessary to improve the value of the reclamation area a winter range, interseeding or planting browse species is necessary.

Herbaceous Understory

In a 1978 line-intercept study, the area was devoid of perennial vegetation and dominated by bare soil, rock, and annual species. By 1990, the study area had been disked, terraced, and seeded with perennial species. The dominant species in the canyon bottom in 1990 was the large and very robust bunchgrass tall wheatgrass (*Agropyron elongatum*), which is often used in reclamation. The tall wheatgrass provides good forage for elk in the winter, but is not used by deer in winter. It has been the dominant species and has provided 28-29% cover every year. In 2007, cheatgrass (*Bromus tectorum*), dalmatian toadflax (*Linaria dalmatica*), and western ragweed (*Ambrosia psilostachya*) had increased significantly in nested frequency, despite the competition from elongated wheatgrass. Those three species also increased substantially in cover. Weedy species have established and become a large component of the understory. Dalmatian toadflax is a noxious weed and should be controlled before it displaces more desirable species.

1997 TREND ASSESSMENT

The browse trend is stable because there were no browse species sampled. The grass trend is stable. The sum of the nested frequency of perennial grasses did not change and tall wheatgrass continued to dominate. However, there continued to be little diversity. The forb trend is stable. The sum of the nested frequency of perennial forbs changed little and the forb composition remained weedy. Western ragweed was sampled for the first time. The Desirable Components Index (DCI) score was fair due to high perennial grass cover.

winter range condition (DCI) - fair (37) Low potential scale
browse - stable (0) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The browse trend is stable. No browse species were sampled. The grass trend is stable. The tall wheatgrass continued to dominate the understory and prevent other grass species, including cheatgrass, from spreading. The forb trend is slightly down. The nested frequency of perennial forbs increased, as did that of annual forbs, but the majority of the forbs sampled were weedy. The noxious weed dalamtian toadflax was also sampled for the first time. The increase in the noxious weed and worsening of the species composition are the reason for the downward trend. The DCI score remained fair.

winter range condition (DCI) - fair (33) Low potential scale
browse - stable (0) grass - stable (0) forb - slightly down (-1)

2007 TREND ASSESSMENT

The browse trend is stable. No browse species were sampled. The grass trend is slightly down. The nested frequency and cover of perennial grasses changed little, but the nested frequency of cheatgrass increased significantly. The forb trend is slightly down. The sum of the nested frequency of perennial forbs increased, but most of the increases were by weedy species. The nested frequencies of dalmatian toadflax and western ragweed increased significantly. The nested frequency of prickly lettuce (*Lactuca serriola*) and white sweetclover (*Melilotus alba*), both of which are preferred forage for big game, increased. The DCI score remained fair.

winter range condition (DCI) - fair (37) Low potential scale
browse - stable (0) grass - slightly down (-1) forb - slightly down (-1)

HERBACEOUS TRENDS --
Management unit 18B, Study no: 15

Type	Species	Nested Frequency				Average Cover %		
		'90	'97	'02	'07	'97	'02	'07
G	Agropyron elongatum	a286	b306	b307	ab303	27.99	29.17	27.73
G	Bromus japonicus (a)	-	-	-	1	-	-	.00
G	Bromus tectorum (a)	-	a67	a51	b94	.39	.35	.97
G	Poa bulbosa	-	-	a5	a4	-	.04	.06
G	Poa fendleriana	a3	a5	-	a3	.04	-	.00
G	Poa pratensis	a23	a10	-	a8	.09	-	.21
Total for Annual Grasses		0	67	51	95	0.39	0.35	0.98
Total for Perennial Grasses		312	321	312	318	28.13	29.21	28.01
Total for Grasses		312	388	363	413	28.52	29.56	28.99
F	Achillea millefolium	-	-	-	1	-	-	.15
F	Ambrosia psilostachya	-	a70	a62	b96	3.25	1.36	5.09
F	Aster chilensis	b25	a2	-	a6	.00	-	.19
F	Cardaria draba	-	-	-	4	-	-	.06
F	Cirsium sp.	-	a2	3	-	.00	.04	-
F	Compositae	-	-	-	47	-	-	.50
F	Comandra pallida	-	-	1	-	-	.00	-

Type	Species	Nested Frequency				Average Cover %		
		'90	'97	'02	'07	'97	'02	'07
F	Epilobium brachycarpum (a)	-	$_{a}$34	$_{b}$76	$_{c}$161	.28	.85	1.24
F	Equisetum hyemale	-	-	2	-	-	.00	-
F	Eriogonum brevicaule	-	-	28	-	-	.26	-
F	Grindelia squarrosa	$_{ab}$27	$_{a}$4	$_{ab}$15	$_{b}$31	.22	.38	1.12
F	Helianthus annuus (a)	-	-	$_{b}$20	$_{a}$3	-	.82	.03
F	Lactuca serriola	$_{a}$2	$_{a}$14	$_{a}$9	$_{b}$48	.06	.02	.46
F	Linaria dalmatica	-	-	$_{a}$36	$_{b}$148	-	.63	3.01
F	Melilotus alba	-	-	-	17	-	-	.91
F	Mentzelia sp.	-	-	1	-	-	.38	-
F	Medicago sativa	$_{a}$11	-	$_{a}$3	-	-	.06	-
F	Phlox longifolia	-	-	-	3	-	-	.00
F	Solidago sp.	18	-	-	-	-	-	-
F	Tragopogon dubius	-	-	-	2	-	-	.06
F	Verbascum thapsus	-	-	$_{a}$7	$_{a}$1	-	.04	.15
Total for Annual Forbs		0	34	96	164	0.28	1.68	1.27
Total for Perennial Forbs		83	92	167	404	3.55	3.19	11.76
Total for Forbs		83	126	263	568	3.84	4.87	13.03

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

BROWSE TRENDS --
Management unit 18B, Study no: 15

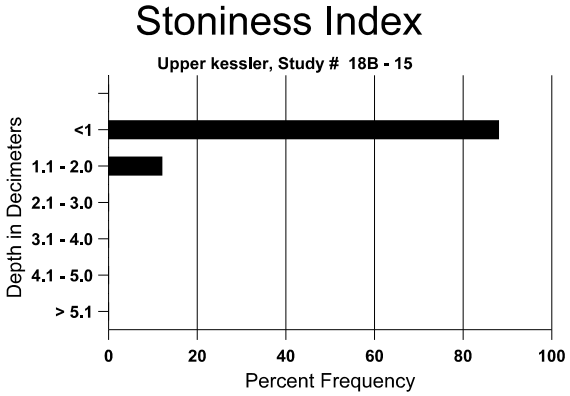
Type	Species	Average Cover %		
		'97	'02	'07
B	Elaeagnus angustifolia	-	.15	-
Total for Browse		0	0.15	0

BASIC COVER --
Management unit 18B, Study no: 15

Cover Type	Average Cover %			
	'90	'97	'02	'07
Vegetation	0	33.99	33.88	39.78
Rock	0	23.40	21.96	15.90
Pavement	0	2.83	3.69	2.22
Litter	0	44.82	34.93	45.27
Cryptogams	0	2.83	4.77	5.06
Bare Ground	7.50	8.89	14.36	3.29

SOIL ANALYSIS DATA --
Herd Unit 18B, Study no: 15, Upper Kessler

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
5.0	79.0 (5.9)	6.6	52.3	26.2	21.6	1.0	28.4	134.4	.7



PELLET GROUP DATA --
Management unit 18B, Study no: 15

Type	Quadrat Frequency			
	'90	'97	'02	'07
Elk	-	32	4	18
Deer	-	-	2	-

Days use per acre (ha)	
'02	'07
9 (22)	27 (68)
22 (54)	2 (5)

Trend Study 18B-20-07

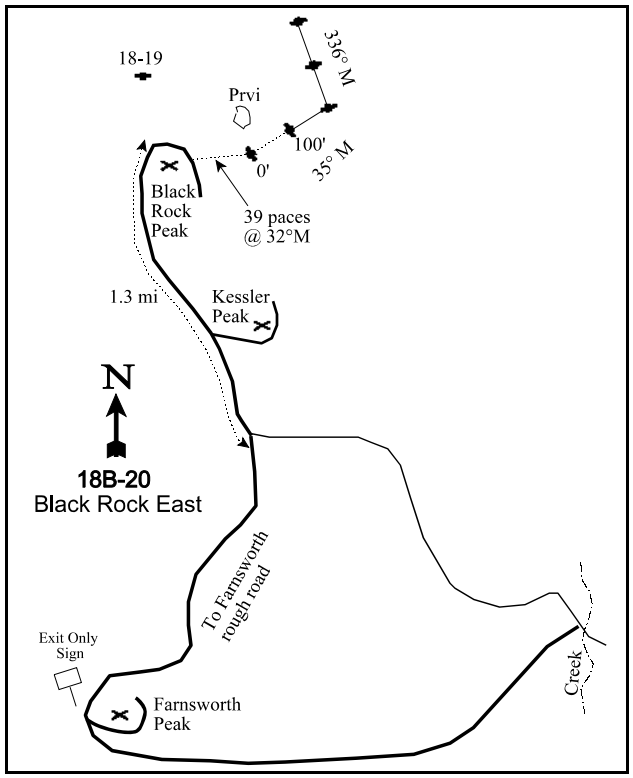
Study site name: Black Rock East . Vegetation type: Perennial Grass .

Compass bearing: frequency baseline 35 degrees magnetic (Line 3-4 @ 336°M).

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

LOCATION DESCRIPTION

Traveling north on Highway #111 turn left (West) (just before the Baccus west gate sign and overpass) on a dirt road which goes up Coon Canyon. Travel west for 0.2 miles to a gate. This gate (#39E) is controlled by Kennecott and you must get permission to have it opened. From the gate continue up Coon Canyon for 3.9 miles to a fork. Turn left at the fork and cross the bridge. Follow the road up the left fork of Coon Canyon to Farnsworth Peak. Just below the KSL radio tower at the peak, take a left at a road marked exit only (road is very steep and rocky). Drive this road for about 0.6 miles to a fork. Stay left and continue 1.3 miles up a steep road around the west side of Kessler Peak to last switchback west of Black Rock Peak. Park here and walk onto the knoll to the east. From the knoll, walk 39 paces north (bearing approximately 32 degrees magnetic) to the 0-foot baseline stake. The study is marked by short fenceposts. The 100-foot end of the baseline is marked by rebar.



Map Name: Farnsworth Peak

Diagrammatic Sketch

Township 1S , Range 3W , Section 32

GPS: NAD 83, UTM 12T 401552 E 4506870 N

DISCUSSION

Black Rock East - Trend Study No. 18B-20

Study Information

This study is located on the northern ridge of Kessler Peak in elk summer range on Kennecott land [elevation: 8,600 feet (2,621 m), slope: 35%, aspect: northeast]. In 1997, it was noted that the study had been poorly located; it was placed on the ecotone between a thick stand of spike fescue on the northern aspect and the noticeably drier eastern aspect dominated by needlegrass and slender wheatgrass. It was suggested that it should be moved further to the north where elk pellet groups indicated that elk preferred the spike fescue, not the drier eastern aspect, but the study was never moved. The northern aspect is similar in vegetation composition to the Black Rock West (18B-19) study. The elk pellet group transect data estimates were 48 days use/acre in 1997, 64 in 2002, and 44 in 2007 (119 edu/ha in 1997, 159 in 2002, and 107 in 2007). In 2007, 2/3 of elk pellet groups counted were on the northern aspect of the study. Deer pellet group estimates were 3 days use/acre in 2002 and 2007 (7 ddu/ha in 2002 and 2007). No deer pellets were sampled in 2007. Grasshoppers were common in 1997, 2002, and 2007.

Soil

The soil is moderately deep with an effective rooting depth of almost 16 inches (40.6 cm). The soil texture is a loam with a slightly acidic soil reaction (pH of 6.4). It has good protective herbaceous and litter cover, with little occurrence of erosion. The erosion condition class was determined as stable in 2002 and 2007.

Browse

Chokecherry (*Prunus virginiana*) is the most abundant browse species, but is only in a single clump and density measurements are dependent upon the number of young branches that emerge during the sample year. There are also a few stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and snowberry (*Symphoricarpos oreophilus*) individuals on the slope. Total shrub cover was 4% in 1997, 6% in 2002, and 5% in 2007. Because the area is used by elk in spring and summer, utilization on the browse species is minimal.

Herbaceous Understory

The herbaceous understory is abundant and very diverse. Spike fescue (*Leucopoa kingii*) provided 17% cover in 1997, 21% in 2002, and 23% in 2007. Several other perennial grasses are present of which Letterman needlegrass (*Stipa lettermani*) and subalpine needlegrass (*Stipa columbiana*) are the most abundant. Annual grasses have not been sampled. Bulbous bluegrass (*Poa bulbosa*), an undesirable grass species, was sampled in one quadrat 1997 and 19 quadrats in 2007.

The forb composition is very diverse with 23-25 species sampled since 1997. The more common perennial species include western yarrow (*Achillea millefolium*), rose pussytoes (*Antennaria rosea*), aster (*Aster* sp.), silvery lupine (*Lupinus argenteus*), and showy goldeneye (*Viguiera multiflora*). The noxious weed dalmatian toadflax (*Linaria dalmatica*) was sampled in a single quadrat in 2002 and 2007.

1997 TREND ASSESSMENT

The browse trend is stable. Browse species are sparse and utilized very little in this summer range. The grass trend is stable. The sum of the nested frequency of perennial grasses changed little. With the change in sample area, the dominant species sampled changed. More spike fescue and less slender wheatgrass (*Agropyron trachycaulum*) and mountain brome (*Bromus carinatus*) were sampled. The forb trend is stable. The sum of the nested frequency of perennial forbs was unchanged.

winter range condition (DCI) - Not applicable, summer range
browse - stable (0) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The browse trend remained stable for this summer range. The density of chokecherry increased, but all of the increase was in young rhizomatous stems. Chokecherry cover increased less than 2%. The grass trend is stable. The sum of the nested frequency of perennial grasses changed little. Perennial grass cover increased from 23% to 26% and diversity remained high. Spike fescue remains the dominant grass species. The forb trend is slightly down. The sum of the nested frequency of perennial forbs changed little, but dalmatian toadflax, a noxious weed, and cluster tarweed (*Madia glomerata*), an undesirable species, were sampled for the first time.

winter range condition (DCI) - Not applicable, summer range
browse - stable (0) grass - stable (0) forb - slightly down (-1)

2007 TREND ASSESSMENT

The browse trend is stable for this summer range. The density of chokecherry decreased, but again the change in density is related to the number of rhizomatous stems that were sampled. Chokecherry cover did not change substantially. The grass trend is slightly up. The sum of the nested frequency of perennial grasses, excluding that of bulbous bluegrass, increased 11%. Bulbous bluegrass nested frequency increased significantly. The forb trend is up. The nested frequency of perennial forbs increased 33% and the nested frequencies of dalmatian toadflax and cluster tarweed remained unchanged.

winter range condition (DCI) - Not applicable, summer range
browse - stable (0) grass - up slightly (+1) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 18B, Study no: 20

Type	Species	Nested Frequency				Average Cover %		
		'90	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	$_{a}$3	$_{a}$10	$_{a}$4	-	.19	.03	-
G	Agropyron trachycaulum	$_{c}$157	$_{b}$91	$_{a}$26	$_{a}$43	.90	.24	1.04
G	Bromus carinatus	$_{b}$102	$_{a}$8	$_{a}$22	$_{a}$23	.22	.66	1.33
G	Leucopoa kingii	$_{a}$21	$_{b}$153	$_{bc}$163	$_{c}$178	17.10	20.87	22.97
G	Melica bulbosa	$_{a}$4	$_{a}$1	-	$_{a}$5	.00	-	.06
G	Poa bulbosa	-	$_{a}$1	-	$_{b}$47	.00	-	.76
G	Poa fendleriana	-	$_{a}$1	$_{a}$11	$_{a}$3	.03	.04	.03
G	Poa pratensis	$_{a}$2	$_{a}$5	$_{a}$3	$_{b}$17	.01	.03	.90
G	Poa secunda	-	$_{a}$1	$_{b}$15	$_{ab}$12	.00	.13	.05
G	Stipa columbiana	$_{a}$16	$_{ab}$36	$_{b}$43	$_{ab}$36	1.09	.53	.48
G	Stipa lettermani	$_{a}$121	$_{a}$128	$_{a}$111	$_{a}$126	3.22	3.17	5.02
Total for Annual Grasses		0	0	0	0	0	0	0
Total for Perennial Grasses		426	435	398	490	22.79	25.74	32.67
Total for Grasses		426	435	398	490	22.79	25.74	32.67

Type	Species	Nested Frequency				Average Cover %		
		'90	'97	'02	'07	'97	'02	'07
F	Achillea millefolium	a97	a109	ab132	b149	2.79	1.88	4.18
F	Agoseris glauca	b26	ab11	a5	ab12	.02	.01	.10
F	Agastache urticifolia	-	a7	b22	a8	.04	.25	.44
F	Antennaria rosea	-	a51	a45	a52	4.00	3.40	5.22
F	Arabis sp.	a13	a9	a8	-	.02	.02	-
F	Aster sp.	-	a18	b44	ab25	.43	.93	.86
F	Chaenactis douglasii	b21	a1	-	-	.00	-	-
F	Chenopodium fremontii (a)	-	-	-	3	-	-	.15
F	Cirsium sp.	-	b7	a-	ab3	.36	.00	.03
F	Comandra pallida	-	-	a-	a3	-	.00	.03
F	Collinsia parviflora (a)	-	-	b10	a3	-	.03	.00
F	Crepis acuminata	b19	-	-	a3	-	-	.03
F	Delphinium nuttallianum	a5	a3	a1	-	.06	.03	-
F	Delphinium occidentale	-	-	-	2	-	-	.30
F	Epilobium brachycarpum (a)	-	a10	a7	b33	.07	.01	.17
F	Eriogonum umbellatum	-	a6	a6	a5	.15	.03	.04
F	Erysimum sp.	9	-	-	-	-	-	-
F	Gayophytum ramosissimum(a)	-	b95	a1	-	2.12	.01	-
F	Helianthus annuus (a)	1	-	-	-	-	-	-
F	Helianthella uniflora	16	-	-	-	-	-	-
F	Lathyrus brachycalyx	a9	ab17	a14	b32	1.24	.60	1.81
F	Lactuca serriola	4	-	-	-	-	-	-
F	Linaria dalmatica	-	-	a1	a2	-	.16	.00
F	Lupinus argenteus	b68	a31	ab49	b60	2.46	3.95	3.83
F	Lychnis drummondii	-	-	-	14	-	-	.36
F	Machaeranthera canescens	a1	a7	a7	a3	.07	.04	.03
F	Madia glomerata (a)	-	-	5	6	-	.04	.04
F	Osmorhiza occidentalis	a12	-	-	a1	-	-	.06
F	Penstemon sp.	-	13	-	-	.11	-	-
F	Polygonum douglasii (a)	-	b209	a159	a178	5.67	1.72	3.62
F	Potentilla sp.	-	a4	-	a2	.03	-	.00
F	Stellaria jamesiana	-	b121	a25	c181	1.61	.07	1.68
F	Taraxacum officinale	-	5	-	-	.15	-	-
F	Thalictrum fendleri	a8	a3	a7	a7	.15	.18	.59
F	Tragopogon dubius	b13	a1	ab2	-	.00	.01	-
F	Unknown forb-perennial	-	5	-	-	.09	-	-

Type	Species	Nested Frequency				Average Cover %		
		'90	'97	'02	'07	'97	'02	'07
F	Viguiera multiflora	$_{b}$197	$_{a}$80	$_{b}$176	$_{b}$158	1.33	5.66	6.34
F	Viola sp.	-	2	-	-	.03	-	-
Total for Annual Forbs		1	314	182	223	7.87	1.81	3.98
Total for Perennial Forbs		518	511	544	722	15.23	17.27	25.97
Total for Forbs		519	825	726	945	23.11	19.09	29.95

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

BROWSE TRENDS --
Management unit 18B, Study no: 20

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Chrysothamnus viscidiflorus viscidiflorus	0	2	1	-	.03	-
B	Prunus virginiana	12	13	12	4.06	5.65	5.28
B	Sambucus racemosa	0	0	1	-	-	.15
B	Symphoricarpos oreophilus	1	1	0	.15	-	-
Total for Browse		13	16	14	4.21	5.69	5.44

CANOPY COVER, LINE INTERCEPT --
Management unit 18B, Study no: 20

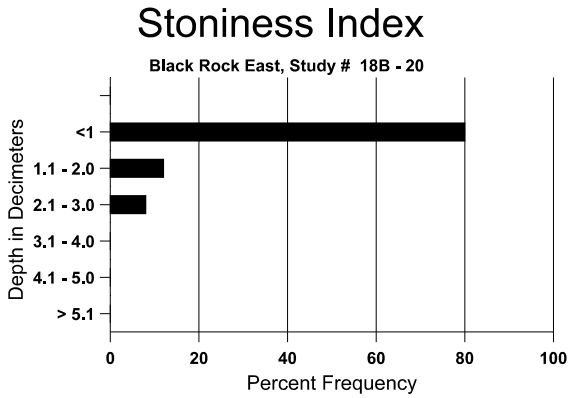
Species	Percent Cover	
	'02	'07
Chrysothamnus viscidiflorus viscidiflorus	-	.11
Prunus virginiana	5.80	6.71

BASIC COVER --
Management unit 18B, Study no: 20

Cover Type	Average Cover %			
	'90	'97	'02	'07
Vegetation	7.75	55.12	54.47	66.22
Rock	11.75	6.25	8.47	3.91
Pavement	16.00	14.37	8.39	10.07
Litter	51.50	42.15	36.38	18.06
Cryptogams	.25	0	.01	.15
Bare Ground	12.75	5.88	9.26	10.61

SOIL ANALYSIS DATA --
Herd Unit 18B, Study no: 20, Black Rock East

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
15.7	50.0 (17.4)	6.4	36.4	46.1	17.5	8.9	43.9	252.8	.4



PELLET GROUP DATA --
Management unit 18B, Study no: 20

Type	Quadrat Frequency			
	'90	'97	'02	'07
Elk	-	21	25	26
Deer	-	-	2	-

Days use per acre (ha)	
'02	'07
64 (159)	44 (107)
3 (7)	3 (7)

BROWSE CHARACTERISTICS --
Management unit 18B, Study no: 20

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus viscidiflorus viscidiflorus												
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**40**	-	-	40	-	-	0	0	-	-	0	9/12
07	**20**	-	-	20	-	-	0	0	-	-	0	9/12
Prunus virginiana												
90	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**2120**	-	1040	1060	20	140	3	0	1	.94	.94	30/14
02	**9960**	-	9240	480	240	160	.20	0	2	2	2	34/19
07	**5680**	-	1160	4480	40	100	6	.70	1	-	0	30/15

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Sambucus racemosa												
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**40**	-	-	40	-	-	0	0	-	-	0	-/-
Symphoricarpos oreophilus												
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	7/5
02	**20**	-	20	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 18B-34-07

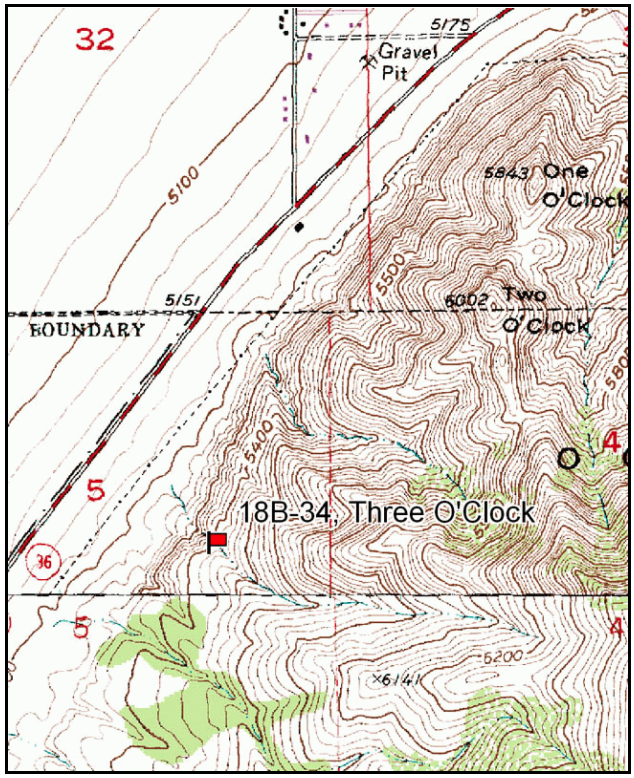
Study site name: Three O'Clock . Vegetation type: Mountain Big Sagebrush .

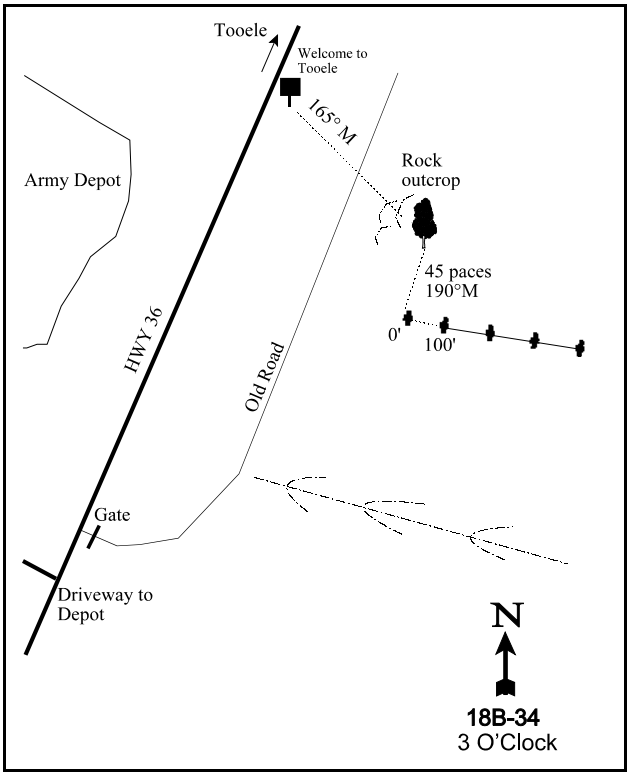
Compass bearing: frequency belt ~120 degrees magnetic.

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

LOCATION DESCRIPTION

Park at the "Welcome to Tooele" sign south of Tooele. From the sign walk at 165 degrees magnetic to a rock out crop with a lone juniper. From the lone juniper, go 45 paces at 190 degrees magnetic to a rock cairn or the 0-foot stake.





Map name: Tooele

Diagrammatic Sketch

Township 3S , Range 4W , Section 33

GPS: NAD 83, UTM 12T 388377 E 4484202 N

DISCUSSION

Three O'Clock - Trend Study No. 18B-34

Study Information

This study was established to monitor deer and elk winter range east of highway 36 between Tooele and Stockton [elevation: 5,400 feet (1,646 m), slope: 20%, aspect: west]. This mountain big sagebrush study is located on the Bonneville lake terrace. The whole area burned in the late 1980's, but now has a healthy stand of mountain big sagebrush. The vicinity is used heavily by deer and elk primarily in the winter and early spring. Deer pellet group transect data estimates were 30 days use/acre in 2002 and 38 in 2007 (74 ddu/ha in 2002 and 94 in 2007). Some of the deer pellet groups may be from antelope which also use the area. Elk pellet group estimates were 43 days use/acre in 2002 and 53 in 2007 (106 edu/ha in 2002 and 131 in 2007). Cattle estimates were 13 days use/acre in 2002 (32 cdu/ha). Horse use was estimated at 3 days use/acre (7 hdu/ha) in 2007.

Soil

The soil is in the Broad-Reywat outcrop association, which consists of shallow to moderately deep, well drained, moderately to slowly permeable soils that formed in residuum and colluvium from quartzite, sandstone, andesite, or basalt parent materials on hills, plateaus, and mountainsides (USDA-NRCS 2007). The soil is shallow and very rocky on the surface and within the profile. The texture is a sandy clay loam with a slightly acidic reaction (pH of 6.4). There is little exposed bare ground on the site primarily due to the abundance of bulbous bluegrass (*Poa bulbosa*). Relative bare ground cover was only 6% in 2002 and 5% in 2007. The erosion condition class was determined as stable in 2002 and 2007.

Browse

The key browse species is mature mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). The density was 6,480 plants/acre (16,006 plants/ha) in 2002 and 4,620 (11,411/ha) in 2007. The majority of sagebrush individuals are in the mature age classification. Decadence increased from 7% of the population in 2002 to 24% in 2007. This population of mountain big sagebrush is low growing, averaging only 16 inches in height. The individuals displayed moderate-heavy use and good vigor both years. Average annual leader growth estimates were 1.4 inches (3.6 cm) in 2002 and 2007. The only other common shrub sampled was broom snakeweed (*Gutierrezia sarothrae*) which had a density of 3,320 plants/acre (8,200 plants/ha) in 2002 and 1,980 plants/acre (4,891 plants/ha) in 2007. There were scattered, very heavily hedged antelope bitterbrush (*Purshia tridentata*) and serviceberry (*Amalanchier utahensis*) on the study, but none were sampled.

Herbaceous Understory

The herbaceous understory is diverse and provides high cover. The low forage and ecological value bulbous bluegrass is the dominant species; it provided 36% cover in 2002 and 19% in 2007. Bulbous bluegrass provides little forage and dries out completely by early summer. The only other common grasses include purple threeawn (*Aristida purpurea*) and cheatgrass (*Bromus tectorum*). Cheatgrass provided 1% cover in 2002 and 2007. Sandberg bluegrass also provided a substantial amount of cover in 2007 (7%).

Forbs are diverse with 22 species sampled in 2002 and 24 species in 2007. The most abundant species sampled were silky milkvetch (*Astragalus cibarius*), draba (*Draba* sp.), and holosteum (*Holosteum umbellatum*). Bur buttercup (*Ranunculus testiculatus*) was sampled for the first time in 2007.

2007 TREND ASSESSMENT

The browse trend is down. The density of sagebrush, the key browse species, decreased 29% from 6,480 plants/acre (16,006 plants/ha) to 4,620 (11,411/ha), but sagebrush cover increased from 14% to 17%. It is quite possible that population is thinning itself as it matures. Plants classified as decadent increased from 7% of the population to 24% and those classified as dying increased from 2% of the population to 12%. Five

percent of the plants sampled were infested with insects. The grass trend is up. The sum of the nested frequency of perennial grasses, excluding bulbous bluegrass, increased nearly three-fold and the nested frequency of cheatgrass decreased significantly. The forb trend is up. The sum of the nested frequency of perennial forbs increased 25%. Several species are utilized by big game. The Desirable Components Index (DCI) score in 2002 was poor due to a low percentage of young individuals and low perennial grass cover (excluding bulbous bluegrass). The 2007 DCI score increased to good-fair due to an increase in preferred browse and perennial grass cover.

2002 winter range condition (DCI) - poor (46) Mid-level potential scale
2007 winter range condition (DCI) - good-fair (66) Mid-level potential scale
browse - down (-2) grass - up (+2) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 18B, Study no: 34

Type	Species	Nested Frequency		Average Cover %	
		'02	'07	'02	'07
G	Agropyron spicatum	4	-	.01	-
G	Aristida purpurea	a94	a91	1.69	2.79
G	Bromus tectorum (a)	b227	a98	.95	.93
G	Festuca myuros (a)	-	2	-	.00
G	Poa bulbosa	b470	a363	35.82	19.31
G	Poa secunda	a29	b264	.14	7.40
G	Sitanion hystrix	a3	a2	.18	.15
G	Sporobolus cryptandrus	a5	a8	.07	.71
G	Vulpia octoflora (a)	a1	b15	.00	.05
Total for Annual Grasses		228	115	0.96	0.99
Total for Perennial Grasses		605	728	37.91	30.37
Total for Grasses		833	843	38.87	31.36
F	Alyssum alyssoides (a)	a15	a22	.02	.05
F	Antennaria rosea	a2	a6	.03	.04
F	Astragalus cibarius	a53	a58	1.23	1.18
F	Asclepias sp.	a1	a2	.15	.38
F	Astragalus utahensis	a5	a4	.09	.08
F	Castilleja linariaefolia	a7	a15	.41	.32
F	Calochortus nuttallii	a17	a29	.06	.14
F	Cirsium sp.	a22	b33	.50	.88
F	Crepis acuminata	a21	a27	.18	.20
F	Draba sp. (a)	-	198	-	.65
F	Epilobium brachycarpum (a)	a3	a3	.00	.00
F	Erodium cicutarium (a)	a25	a23	.13	.31
F	Eriogonum racemosum	a40	a47	.21	.59

Type	Species	Nested Frequency '02	Nested Frequency '07	Average Cover % '02	Average Cover % '07
F	Gilia sp. (a)	1	-	.00	-
F	Helianthus annuus (a)	$_{b}$137	$_{a}$2	.33	.01
F	Heterotheca villosa	$_{a}$7	$_{a}$9	.31	.35
F	Holosteum umbellatum (a)	$_{a}$1	$_{b}$139	.00	.32
F	Lomatium sp.	-	1	-	.00
F	Petradoria pumila	2	-	.00	-
F	Phlox hoodii	$_{a}$3	$_{a}$3	.03	.03
F	Phlox longifolia	$_{a}$24	$_{a}$17	.08	.12
F	Polygonum douglasii (a)	$_{a}$10	$_{a}$17	.02	.06
F	Ranunculus testiculatus (a)	-	10	-	.02
F	Sphaeralcea coccinea	-	2	-	.00
F	Tragopogon dubius	$_{a}$21	$_{a}$24	.12	.13
F	Zigadenus paniculatus	$_{a}$22	$_{b}$31	.39	.50
Total for Annual Forbs		192	414	0.53	1.43
Total for Perennial Forbs		247	308	3.81	4.97
Total for Forbs		439	722	4.34	6.41

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

BROWSE TRENDS --
Management unit 18B, Study no: 34

Type	Species	Strip Frequency '02	Strip Frequency '07	Average Cover % '02	Average Cover % '07
B	Artemisia tridentata vaseyana	84	74	14.41	16.96
B	Chrysothamnus nauseosus albicaulis	3	4	.06	.00
B	Gutierrezia sarothrae	66	47	.86	.79
B	Opuntia sp.	3	4	.00	.03
B	Sarcobatus vermiculatus	0	1	-	-
B	Tetradymia canescens	5	6	.03	.53
Total for Browse		161	136	15.37	18.32

CANOPY COVER, LINE INTERCEPT --
Management unit 18B, Study no: 34

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	18.10
Chrysothamnus nauseosus albicaulis	-	.20
Gutierrezia sarothrae	-	.30
Tetradymia canescens	-	4.21

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18B, Study no: 34

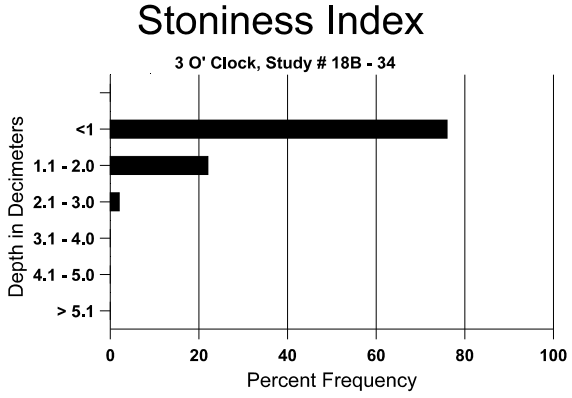
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.4	1.4

BASIC COVER --
Management unit 18B, Study no: 34

Cover Type	Average Cover %	
	'02	'07
Vegetation	61.09	52.68
Rock	13.46	9.88
Pavement	9.80	8.60
Litter	24.87	19.83
Cryptogams	3.27	10.18
Bare Ground	6.83	5.73

SOIL ANALYSIS DATA --
Herd Unit 18B, Study no: 34, Three O'Clock

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	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	.8



PELLET GROUP DATA --
Management unit 18B, Study no: 34

Type	Quadrat Frequency	
	'02	'07
Rabbit	-	2
Horse	-	3
Elk	27	23
Deer	24	21
Cattle	2	1

Days use per acre (ha)	
'02	'07
-	-
-	3 (7)
43 (116)	53 (131)
30 (74)	38 (94)
13 (32)	-

BROWSE CHARACTERISTICS --
Management unit 18B, Study no: 34

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	33/44
Artemisia tridentata vaseyana												
02	**6480**	20	80	5940	460	520	40	39	7	2	2	15/24
07	**4620**	460	80	3420	1120	240	36	33	24	12	16	17/32
Chrysothamnus nauseosus albicaulis												
02	**60**	-	-	60	-	-	33	33	0	-	0	10/9
07	**80**	-	20	20	40	-	50	25	50	25	25	20/37
Chrysothamnus viscidiflorus viscidiflorus												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	18/24
Gutierrezia sarothrae												
02	**3320**	40	100	2920	300	320	0	0	9	3	3	6/7
07	**1980**	20	240	1500	240	140	0	0	12	6	6	7/9
Opuntia sp.												
02	**60**	-	20	40	-	-	0	0	-	-	0	5/12
07	**80**	-	20	60	-	-	0	0	-	-	0	5/12
Purshia tridentata												
02	**0**	20	-	-	-	20	0	0	-	-	0	22/57
07	**0**	-	-	-	-	-	0	0	-	-	0	39/74
Rhus trilobata												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	20	-	-	-	-	0	0	-	-	0	32/50

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Sarcobatus vermiculatus												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**200**	-	-	200	-	-	0	100	-	-	0	-/-
Tetradymia canescens												
02	**100**	-	-	100	-	60	20	0	0	-	0	15/22
07	**120**	-	20	80	20	-	17	0	17	-	0	12/29

Trend Study 18B-35-07

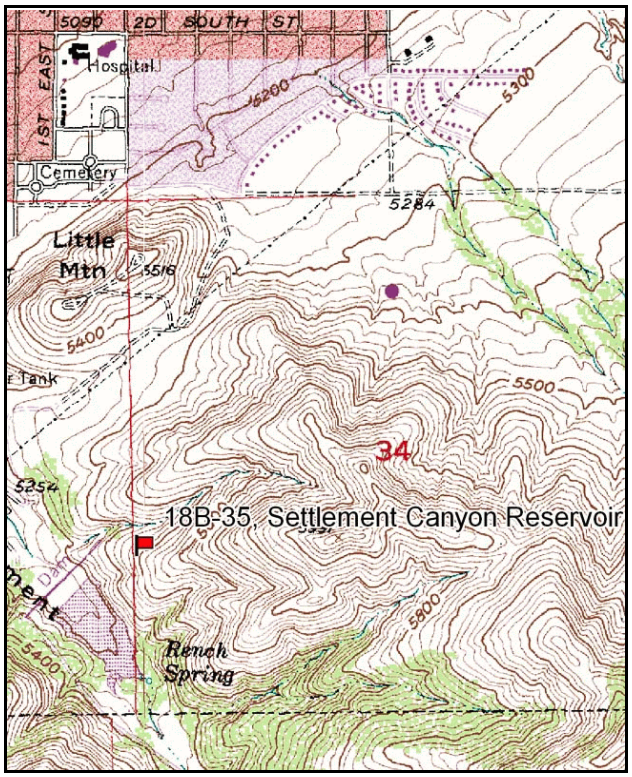
Study site name: Settlement Canyon Reservoir . Vegetation type: Mountain Big Sagebrush .

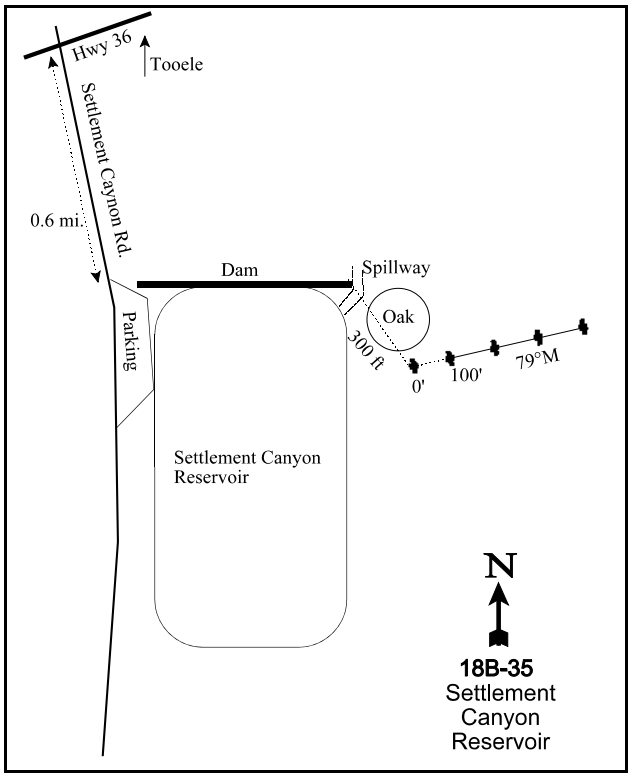
Compass bearing: frequency belt 79 degrees magnetic.

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

LOCATION DESCRIPTION

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

Diagrammatic Sketch

Township 3S , Range 4W , Section 33

GPS: NAD 83, UTM 12T 390482 E 4485386 N

DISCUSSION

Settlement Canyon Reservoir - Trend Study No. 18B-35

Study Information

This study was established in 2002 to replace the Left Fork Settlement Canyon (18B-9) trend study [elevation: 5,500 feet (1,676 m), slope: 22%, aspect: west]. The new study is more representative of critical winter range in the area and is more heavily used by deer and elk. It samples a mountain big sagebrush slope located east of the Settlement Canyon Reservoir dam. Deer use the area heavily and pellet group transect data estimates were 90 days use/acre in 2002 and 137 in 2007 (223 ddu/ha in 2002 and 337 in 2007). Most pellet groups were from winter use, but some were from spring and early summer.

Soil

The soil is in the Broad-Reywat outcrop association, which consists of shallow to moderately deep, well drained, moderately to slowly permeable soils that formed in residuum and colluvium from quartzite, sandstone, andesite, or basalt parent materials on hills, plateaus, and mountainsides (USDA-NRCS 2007). It is shallow and rocky. Rocks are common on the surface and within the profile. The texture is a clay loam with a neutral reaction (pH of 6.6). Protective ground cover is abundant. Relative bare ground cover was only 4% in 2002 and 2007. The erosion condition class was stable in 2002 and 2007.

Browse

This is a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community with an estimated density of 3,240 plants/acre (8,002 plants/ha) in 2002 and 2,880 (7,114/ha) in 2007. Utilization was moderate-heavy in 2002 and 2007. Decadence was moderately high in 2002 (38%) and 2007 (40%). Plants classified as dying made up 13% of the population in 2002 and 20% in 2007. Most mature plants were vigorous with an annual leader growth average of 2.1 inches (5.2 cm) in 2002 and 1.5 inches (3.8 cm) in 2007. Young recruitment was only 3% of the population in 2002 and 4% in 2007, which is not enough to compensate for the overall density loss. No seedling sagebrush were sampled in 2002, but 20 seedlings/acre were sampled in 2007. The only other shrubs sampled were broom snakeweed (*Gutierrezia sarothrae*), creeping barberry (*Mahonia repens*), and pricklypear cactus (*Opuntia* sp.).

Herbaceous Understory

The herbaceous understory is abundant; it provided nearly 40% cover in 2002 and nearly 50% in 2007. However, species composition is poor. Bulbous bluegrass (*Poa bulbosa*), a poor value perennial, is the dominant species. It provided 19% cover in 2002 and 22% in 2007 and had a quadrat frequency of 96% both years. Bluebunch wheatgrass (*Agropyron spicatum*) provided 8% cover in 2002 and 10% in 2007. Japanese brome (*Bromus japonicus*) and cheatgrass (*Bromus tectorum*), both winter annuals, were also relatively abundant, but provided little cover in 2002 and 2007. Other perennial grasses include purple-threeawn (*Aristida purpurea*), Kentucky bluegrass (*Poa pratensis*), and Sandberg bluegrass (*Poa secunda*).

The forb composition is diverse with 27 species sampled in 2002 and 30 species in 2007. The composition is weedy. In 2002, the dominant forb was the noxious weed dalmatian toadflax (*Linaria dalmatica*), it provided 2% cover. In 2007, it had decreased to less than 1% cover and the quadrat frequency decreased by 60%. Other common forbs include hooker balsamroot (*Balsamorhiza hookeri*), rock goldenrod (*Petradoria pumila*), and mulesear (*Wyethia amplexicaulis*).

2007 TREND ASSESSMENT

The browse trend is slightly down. The density of sagebrush, the key browse species, decreased 11%. This decrease may be due to the lack of young plants and seedlings to recruit into the population. The decadence changed little, but plants classified as dying increased from 13% of the population to 20%. Sagebrush utilization remained moderate-high. The grass trend is stable. The sum of the nested frequency of perennial

grasses, excluding bulbous bluegrass, increased 16%, but the nested frequency of bulbous bluegrass increased significantly. The sum of nested frequency of annual grasses increased 20% and the nested frequency of Japanese brome increased significantly. The forb trend is slightly up. The sum of the nested frequency of perennial forbs, excluding dalmatian toadflax, increased 16% and the nested frequency of dalmatian toadflax decreased significantly. Toadflax cover decreased substantially as well. The Desirable Components Index (DCI) score in 2002 was poor due to moderate browse cover, low percentage of young plants, moderate perennial grass cover, and excellent perennial forb cover. The DCI score in 2007 increased to fair-good due to an increase in perennial grass cover.

2002 winter range condition (DCI) - poor (46) Mid-level potential scale
2007 winter range condition (DCI) - fair-good (51) Mid-level potential scale
browse - slightly down (-1) grass - stable (0) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 18B, Study no: 35

Type	Species	Nested Frequency '02	Nested Frequency '07	Average Cover % '02	Average Cover % '07
G	Agropyron spicatum	a280	a267	8.05	10.43
G	Aristida purpurea	a25	a17	.39	.25
G	Bromus japonicus (a)	a102	b134	.29	.47
G	Bromus tectorum (a)	a139	a138	1.50	2.24
G	Festuca myuros (a)	-	15	-	.08
G	Poa bulbosa	a389	b416	18.62	21.97
G	Poa pratensis	1	-	.03	-
G	Poa secunda	a17	b91	.14	1.99
G	Vulpia octoflora (a)	-	3	-	.00
Total for Annual Grasses		241	290	1.79	2.81
Total for Perennial Grasses		712	791	27.25	34.66
Total for Grasses		953	1081	29.04	37.47
F	Agoseris glauca	a9	a10	.07	.05
F	Alyssum alyssoides (a)	a27	a23	.08	.04
F	Allium sp.	a10	a3	.01	.00
F	Ambrosia psilostachya	2	-	.00	-
F	Artemisia ludoviciana	a4	a6	.15	.03
F	Astragalus cibarius	a24	a17	.29	.21
F	Asclepias sp.	-	-	-	.03
F	Aster sp.	a8	a5	.19	.18
F	Astragalus utahensis	a11	a8	.07	.05
F	Balsamorhiza hookeri	a44	b54	1.40	2.33
F	Calochortus nuttallii	a17	a5	.09	.02
F	Cirsium sp.	a10	a15	.45	.27

Type	Species	Nested Frequency		Average Cover %	
		'02	'07	'02	'07
F	Collomia linearis (a)	1	-	.00	-
F	Comandra pallida	$_{a}$21	$_{b}$53	.29	.41
F	Collinsia parviflora (a)	-	33	-	.42
F	Cordylanthus ramosus (a)	-	1	-	.00
F	Crepis acuminata	$_{b}$35	$_{a}$20	.17	.12
F	Cryptantha sp.	-	3	-	.00
F	Cymopterus sp.	$_{a}$18	$_{a}$7	.14	.02
F	Descurainia pinnata (a)	-	3	-	.03
F	Draba sp. (a)	-	171	-	.29
F	Eriogonum racemosum	$_{a}$24	$_{a}$35	.22	.52
F	Heterotheca villosa	$_{a}$39	$_{a}$39	.89	2.17
F	Holosteum umbellatum (a)	$_{a}$3	$_{b}$98	.01	.21
F	Linaria dalmatica	$_{b}$122	$_{a}$49	2.45	.51
F	Linum lewisii	-	1	-	.00
F	Petradoria pumila	$_{a}$42	$_{a}$51	1.54	1.97
F	Phlox longifolia	$_{a}$45	$_{b}$77	.22	.49
F	Polygonum douglasii (a)	$_{a}$2	$_{a}$8	.01	.01
F	Ranunculus testiculatus (a)	$_{a}$9	$_{a}$4	.01	.01
F	Tragopogon dubius	$_{a}$8	$_{a}$15	.15	.04
F	Viola sp.	1	-	.00	-
F	Wyethia amplexicaulis	$_{a}$23	$_{a}$30	1.01	1.18
F	Zigadenus paniculatus	$_{a}$6	$_{a}$11	.13	.11
Total for Annual Forbs		42	341	0.11	1.02
Total for Perennial Forbs		523	514	10.02	10.78
Total for Forbs		565	855	10.14	11.81

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	'02	'07
B	Artemisia tridentata vaseyana	77	73	12.28	10.05
B	Gutierrezia sarothrae	41	33	1.46	.57
B	Mahonia repens	2	1	.03	.01
B	Opuntia sp.	22	22	.33	.24
Total for Browse		142	129	14.11	10.88

CANOPY COVER, LINE INTERCEPT --
Management unit 18B, Study no: 35

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	12.18	14.26
Gutierrezia sarothrae	.85	.30
Opuntia sp.	.16	.03

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 18B, Study no: 35

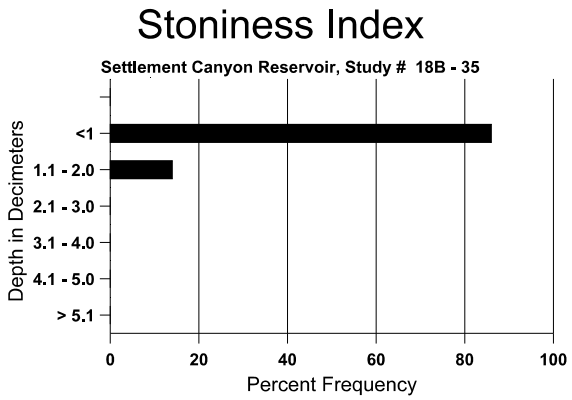
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.1	1.5

BASIC COVER --
Management unit 18B, Study no: 35

Cover Type	Average Cover %	
	'02	'07
Vegetation	47.58	55.34
Rock	24.67	21.56
Pavement	6.13	4.69
Litter	30.61	23.81
Cryptogams	3.65	3.48
Bare Ground	4.59	4.68

SOIL ANALYSIS DATA --
Herd Unit 18B, Study no: 35, Settlement Canyon Reservoir

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
5.5	55.6 (8.1)	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	
	'02	'07
Rabbit	-	15
Elk	-	10
Deer	51	38

Days use per acre (ha)	
'02	'07
-	-
-	-
90 (223)	137 (337)

BROWSE CHARACTERISTICS --
Management unit 18B, Study no: 35

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
02	**3240**	-	100	1920	1220	540	31	45	38	13	13	14/29
07	**2880**	20	120	1600	1160	180	32	34	40	20	21	15/33
Gutierrezia sarothrae												
02	**1860**	20	120	1480	260	160	0	0	14	13	13	7/9
07	**1300**	-	60	1180	60	-	5	0	5	-	0	7/10
Mahonia repens												
02	**440**	-	-	440	-	-	0	0	-	-	0	1/4
07	**140**	-	-	140	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Opuntia sp.												
02	**800**	-	200	500	100	40	0	0	13	8	8	5/10
07	**560**	20	40	520	-	-	0	0	0	-	0	5/11

SUMMARY

WILDLIFE MANAGEMENT SUBUNIT 18B - OQUIRRH-STANSBURY SOUTH

Community Types

Seven trend studies were resampled in the summer of 2007, two were dominated by mountain big sagebrush, two by a hybrid of mountain big sagebrush and Wyoming big sagebrush (classified as mountain big sagebrush), one by black sagebrush, one by perennial exotic grasses, and one by perennial native grasses (summer range).

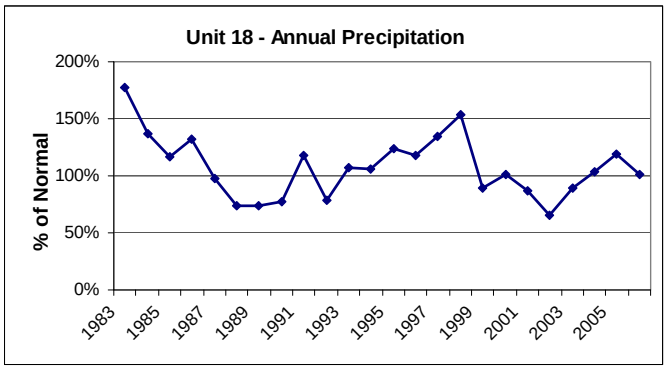


Figure 1. Annual precipitation for the entire unit 18. Precipitation data was collected at the Tooele, Johnson Pass, and Fairfield weather stations (Utah Climate Summaries 2007).

Precipitation

Vegetation trends are dependent upon annual and spring precipitation patterns. Precipitation data from this herd unit was compiled from the Tooele, Johnson Pass, and Fairfield weather stations (Figures 1 and 2). The unit annual precipitation average was below 75% of normal (drought conditions) in 1988, 1989, and 2002 and below normal in 1990, 1992, 1999, 2001, and 2003 (Figure 1). Spring precipitation was below 75% of normal 1989, 1990, 1992, 2000, and 2007 and was below normal in 1997, 2001, 2002, 2003, and 2004 (Figure 2). Fall precipitation was near or below 50% of normal in 1995, 1999, 2003, and 2005 (Figure 2). Spring precipitation is essential for the recruitment of browse seedlings and the establishment of native cool season perennial grasses and forbs.

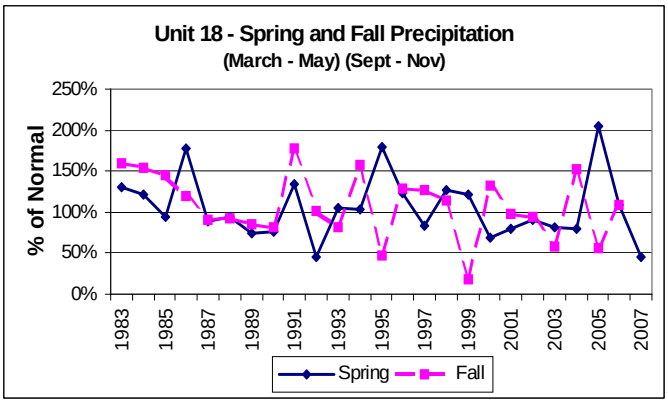


Figure 2. Spring and fall precipitation for unit 18. Precipitation data was collected at the Tooele, Johnson Pass, and Fairfield weather stations (Utah Climate Summaries 2007).

Browse

The average browse trend had changed little until 2002, but decreased substantially from 2002 to 2007 (Figure 3). Black sagebrush changes were only a reflection of the changes of Big Dip Gulch (18B-5), which was the only black sagebrush study sampled in 2007. The average density of mountain big sagebrush decreased 22% from 2002 to 2007 (Figure 4). Sagebrush decadence increased from 20% of the population in 1997 to approximately 31% in 2002 and 2007 (Figure 5). Mountain big sagebrush average cover for the subunit increased from 5% in 1997 to 9% in 2002 and 2007 (Figure 6). The browse trends of Manning Canyon (18B-3) and Three O'Clock (18B-34) were down and slightly down for Settlement Canyon Reservoir (18B-3). These studies, with the exception of South of Soldier Canyon (18B-6) which remained stable, constituted all of the mountain big sagebrush studies in the herd unit. The sagebrush defoliator moth was sampled at Manning Canyon and South of Soldier Canyon. It infested 7% of the sagebrush population at South of Soldier Canyon and 19% of the Manning Canyon population. Insects infested the sagebrush of Three O'Clock, but

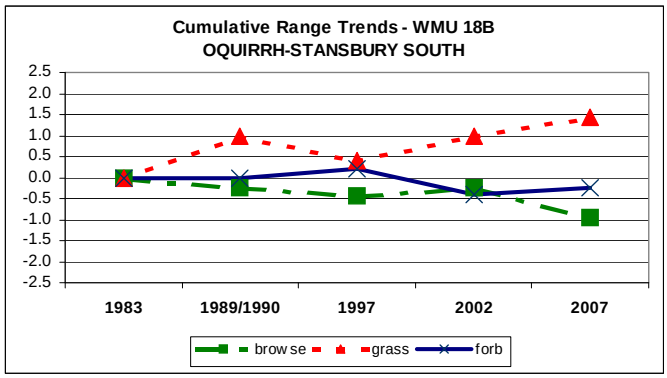


Figure 3. Cumulative range trends for subunit 18B, Oquirhh-Stansbury South.

the species of insect was not noted. No browse trends improved from 2002 to 2007.

Grass

Grass trends have increased steadily since 1997 (Figure 3). Perennial grass cover and nested frequency increased from 2002 to 2007 and cheatgrass cover and nested frequency changed little (Figures 7 and 8). Perennial grass cover increased from 14% to 18% and cheatgrass cover only increased from 1% to 2%. Bulbous bluegrass was only sampled in one study in 1997, but was sampled in four studies in 2002 and 2007. The subunit average of bulbous bluegrass cover decreased from 8% to 6%, although the nested frequency changed little (Figures 7 and 8). It increased in nested frequency and cover (from 19% to 22%) at Settlement Canyon Reservoir (18B-35), but decreased in both nested frequency and cover (from 36% to 19%) at Three O'Clock (18B-34). Both of these studies have low cheatgrass cover and nested frequencies, as though the bulbous bluegrass is controlling the cheatgrass. Stewart and Hull (1949) reported that bulbous bluegrass seed and bulbils distributed in established cheatgrass stands could reduce cheatgrass densities.

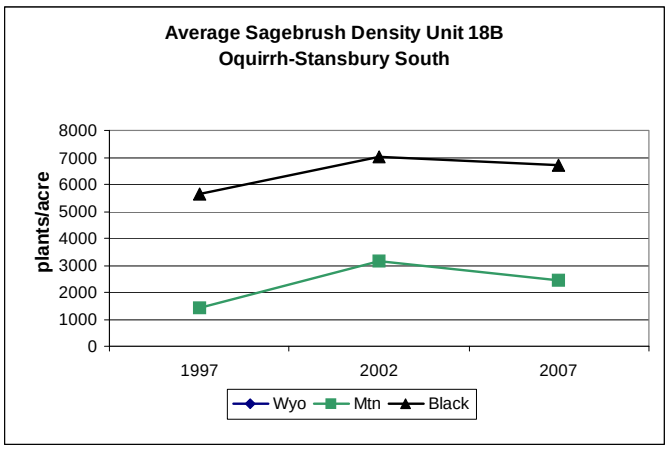


Figure 4. Average mountain big sagebrush and black sagebrush density for subunit 18B.

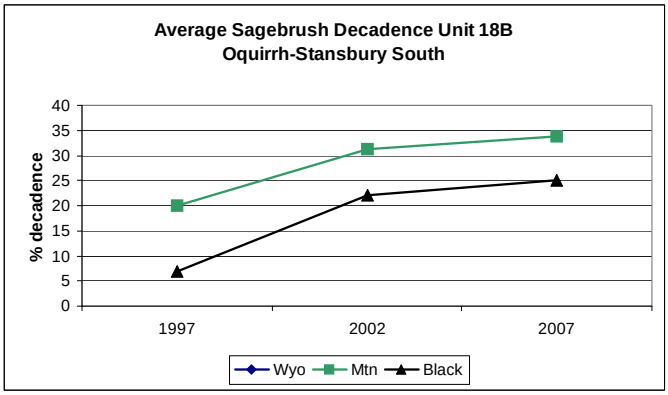


Figure 5. Average mountain big sagebrush and black sagebrush decadence for subunit 18B.

Forbs

The forb trends declined from 1997 to 2002 and slightly increased from 2002 to 2007 (Figure 3). The perennial forb average cover of the subunit did not change from 1997 to 2002, but increased from 5% in 2002 to 8% in 2007 (Figure 7). The nested frequency of perennial forbs has increased steadily since 1997 (Figure 8). Storksbill (*Erodium cicutarium*) and bur buttercup (*Ranunculus testiculatus*) showed significant increases in nested frequency in 2007 at the lower elevation studies Manning Canyon (18B-3), Big Dip Gulch (18B-5), and South of Soldier Canyon (18B-6). Both of these undesirable species have been shown to outcompete native species in rangelands (Buchanan et al. 1978; Kimball and Schiffman 2003; Young et al. 1992).

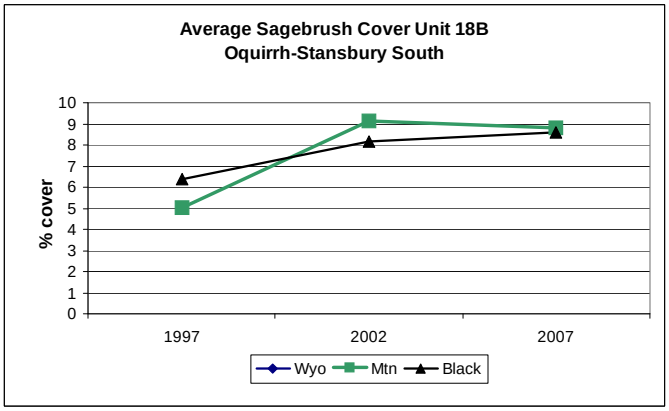


Figure 6. Average mountain big sagebrush and black sagebrush cover for subunit 18B.

Desirable Components Index

The subunit Desirable Components Index (DCI) average for low potential studies have remained fair (Figure 9). The mid-level potential studies decreased from fair in 1997 to poor in 2002, and back to fair in 2007 (Figure 9). The decrease in the DCI was due to a decrease in perennial grass cover in 2002, a product of the drought in 2001 and 2002. The good perennial grass cover across the unit buffers the DCI scores from larger changes.

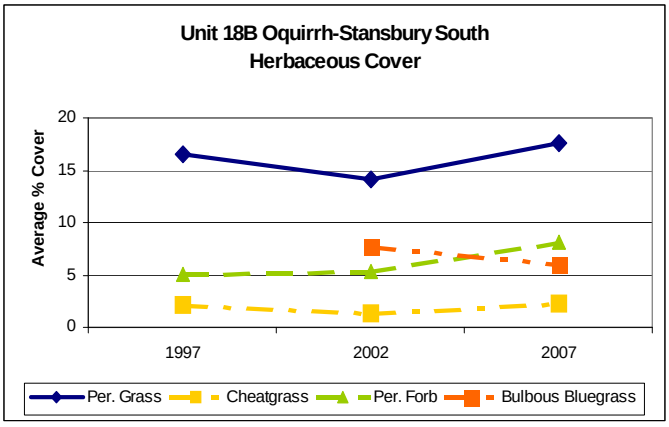


Figure 7. Average herbaceous cover for subunit 18B.

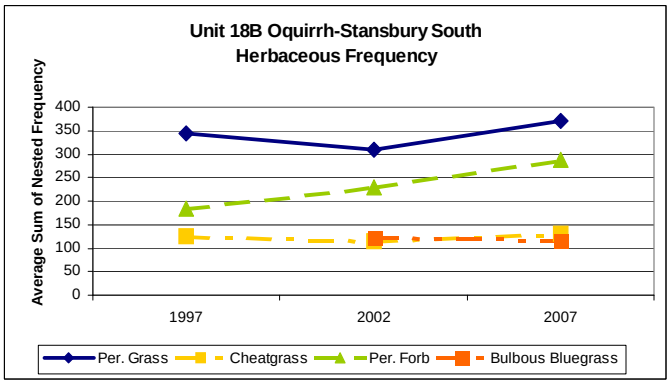


Figure 8. Average nested frequency for subunit 18B.

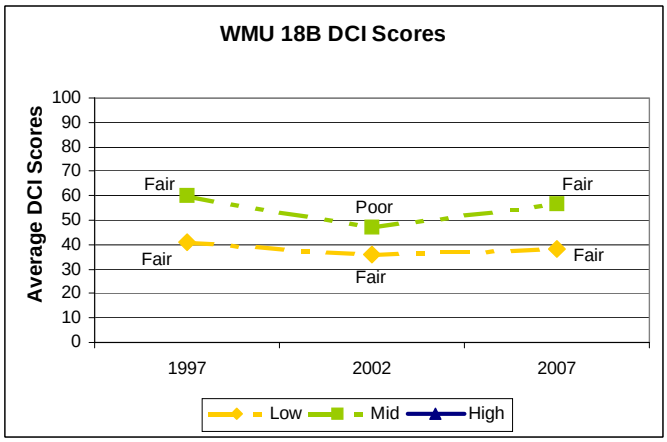


Figure 9. Subunit 18B average Desirable Components Index (DCI) scores by year. The DCI scores are divided into three categories based on ecological potentials, which include: low, mid-level, and high.

WILDLIFE MANAGEMENT UNIT 19 - WEST DESERT

Boundary Description

Tooele, Utah, Juab, and Millard counties - Boundary begins at the Utah-Nevada state line and I-80 in Wendover; east on I-80 to the Dugway road at Rowley Junction; south on this road to the Pony Express Road: east on this road to SR-36; north on SR-36 to SR-73; east on SR-73 to I-15; south on I-15 to US-6 at Santaquin, west and southwest on US-6 to its junction with US-50 near Delta; west on US-50 and 6 to the Utah-Nevada state line; north along this state line to I-80 at Wendover.

Management Unit Description

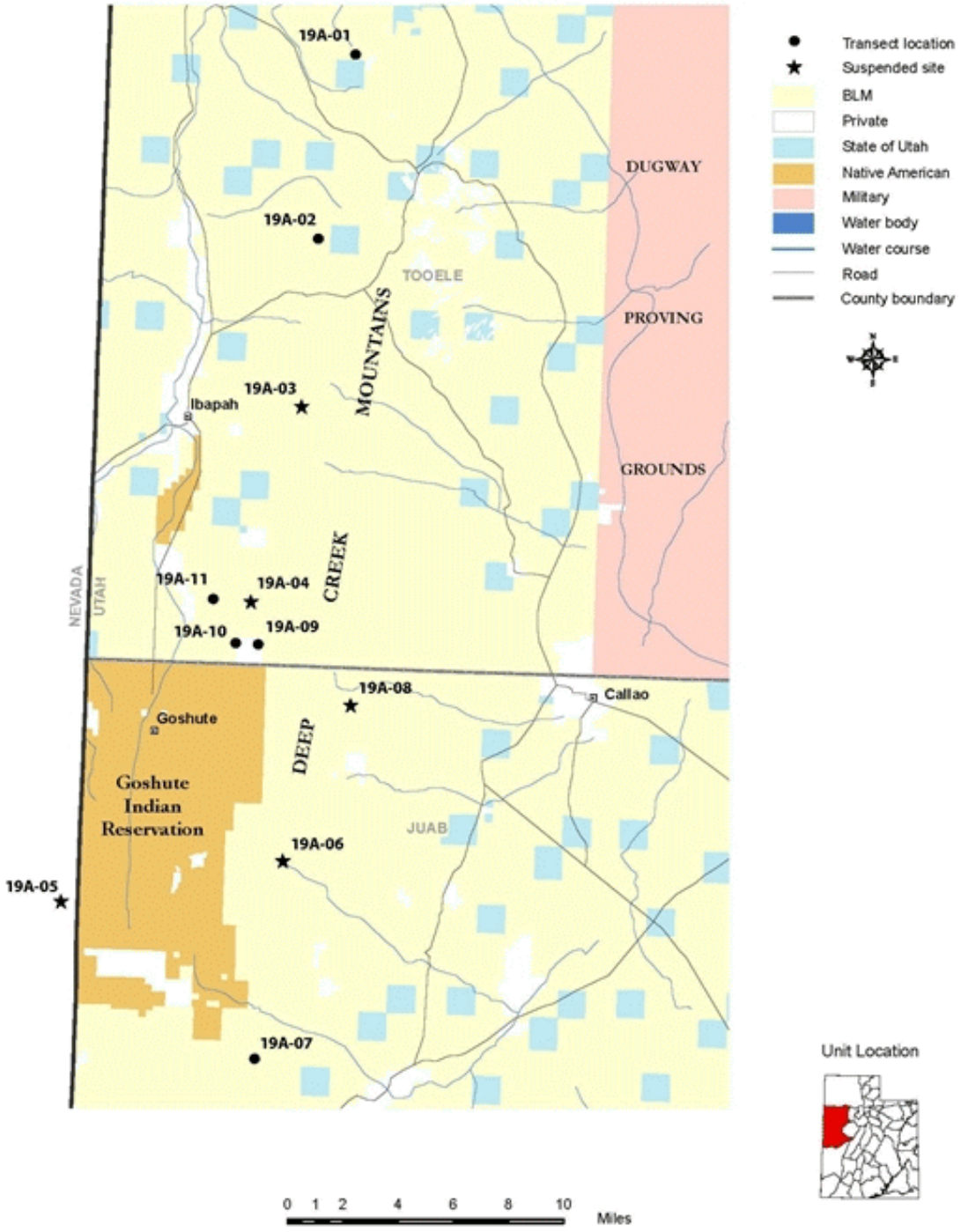
Management unit 19 is subdivided into three smaller subunits, Deep Creek (19A), Vernon (19B), and Tintic (19C). Of the total land area within unit 19, the majority is categorized as either transitional or winter range. Winter, transitional, and summer ranges make up 61%, 23%, and 16% of the area, respectively. The vast majority of the land within unit 19 is managed by the Bureau of Land Management.

As with nearly all of the management units within the state, the deer herds are managed to achieve a buck to doe ratio of 15:100, with 30% of the bucks being 3-point or better. The estimated winter herd size was 7,650 in 2002, 6,200 in 2003, 6,900 in 2004, and 7,000 in 2005. The management plan calls for a wintering population of 11,200 deer (Hersey and McLaughlin 2005). The management plan objectives for elk in this unit are 200 wintering animals. This objective was reached from 2002 to 2005 (Hersey and McLaughlin 2005). Most of the elk in this unit are found on the Deep Creek (subunit 19A).

Population and Habitat Management Strategies

The Vernon subunit (19B) is currently managed under the limited entry hunting status. Other portions of unit 19 are open to general season hunting for deer. Some factors that may limit success in reaching management objectives include drought conditions, crop depredation, habitat loss, and predation by cougars. To minimize these limiting factors, the following habitat management strategies will be used: 1) monitor the permanent range trend studies throughout the unit, 2) maintain and/or enhance forage production through direct range improvements throughout the unit, and 3) work with private and federal agencies to maintain and protect critical summer ranges from future losses and degradation (Deer Herd Unit Management Plan 2001).

Management Unit 19A



WILDLIFE MANAGEMENT UNIT - 19A - WEST DESERT, DESERT MOUNTAIN RANGES

Boundary Description

Tooele, Utah, Juab, and Millard counties - Boundary begins at the Utah-Nevada state line and I-80 in Wendover; east on I-80 to the Dugway Road at Rowley Junction; south on this road to the Pony Express Road; southwest on this road to the Dugway Valley Road; south on this road to SR-174; southeast on SR-174 to US-6 to its junction with Highway US-50; west on US-50 and 6 to the Utah-Nevada state line; north along the Utah-Nevada state line to I-80 at Wendover and beginning point.

Management Unit Description

With few exceptions, deer summer range on the Deep Creek Mountains is generally above 7,500 feet (2,286 m) in elevation. Quality summer range and water distribution are the limiting factors for the deer population. There are approximately 65,654 acres (26,569 ha) of winter range in the unit. A majority of the winter range (72%) is located on Bureau of Land Management (BLM) administered land. Very little winter range is located on private land or on the Goshute Indian Reservation. Some winter range is also located on Division of Wildlife Resources and State Trust Lands. Winter range surrounds the Deep Creek Mountains and ranges in elevation from 7,500 feet (2286 m) down to 5,800 feet (1,768 m). Some transitional range exists, most of which is located on BLM lands.

Range Trend Studies

In 1983, six key areas were identified, on which trend studies were established. Two additional studies were added in 1989. All studies within the unit were reread in 1997. In 2002, five studies were suspended and two new studies were established. Suspended studies included Sevy Canyon (19A-3), Chokecherry Spring (19A-5), Granite Creek (19A-6), and The Basin (19A-8). Sevy Canyon, Granite Creek, and The Basin all lie within BLM wilderness study areas and were not accessible. The study at Chokecherry Spring is located on Indian lands within Nevada. It is not critical range for big game and was not read after consultation with the biologist. Two new studies, Rocky Canyon (19A-9) and Rocky Spring (19A-10) were established in 2002 to monitor big game use on west-facing slopes that border privately owned lands near Rocky Canyon. In 2007, after consultation with the area habitat biologist, Durse Canyon (19A-4) was also suspended. A new study, Ibapah Harrow (19A-11) was established on the west side of the Deep Creek Mountains to monitor the effects of a Dixie harrow on a population of Wyoming big sagebrush and big game use.

Trend Study 19A-1-07

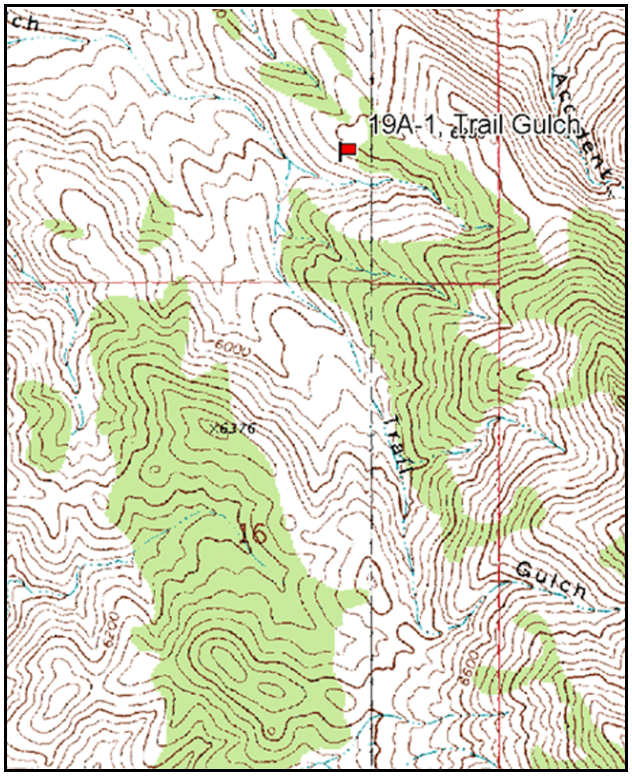
Study site name: Trail Gulch . Vegetation type: Stansbury Cliffrose .

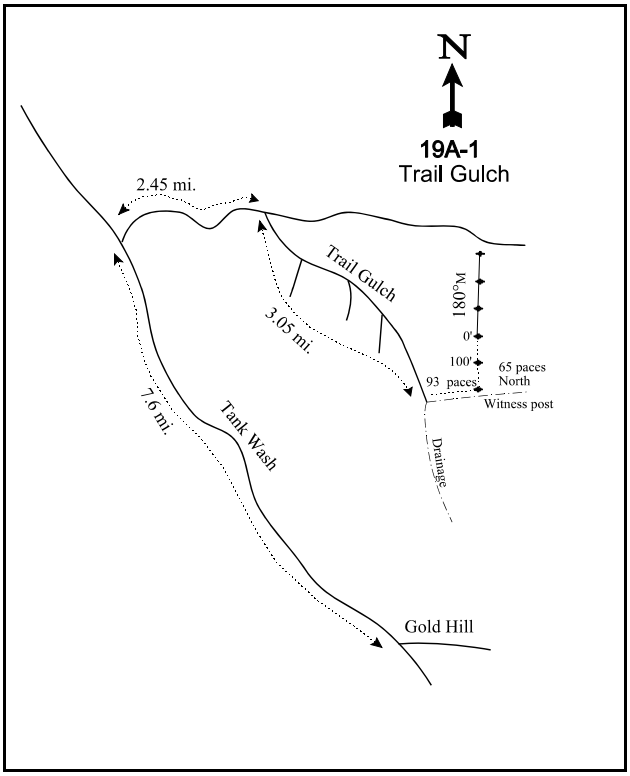
Compass bearing: frequency baseline 180 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: none on site, too rocky.

LOCATION DESCRIPTION

Beginning at Gold Hill, proceed northwesterly toward Gold Hill Pass and Tank Wash for 7.60 miles to a road to the north. Turn right and proceed northerly for 2.45 miles to a dirt road to the southeast up Trail Gulch. Proceed up Trail Gulch for 3.05 miles staying to the left (straight) at all intersections. Stop where the road ends and two drainages come together. From the intersection of the streambeds, walk 93 paces easternly, along the left drainage to a green steel "T" fencepost on the north side of the streambed. From the fencepost, walk 65 paces north to the 0-foot baseline stake. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height. The 0-foot baseline stake has a red browse tag, number 3970, attached.





Map Name: Ochre Mountain

Diagrammatic Sketch

Township 7S , Range 18W , Section 9

GPS: NAD 83, UTM 12T 255223 E 4457093 N

DISCUSSION

Trail Gulch - Trend Study No. 19A-1

Study Information

This study monitors winter range on the north end of the Deep Creek Mountains. It is dry, rocky, and occupied by a sparse stand of Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) and black sagebrush (*Artemisia nova*) in association with scattered Utah juniper (*Juniperus osteosperma*) [elevation: 5,900 feet (1,790 m), slope: 30-45%, aspect: south]. In 1983, utilization was reportedly intense, although relatively few deer pellet groups were observed. Several broods of chukars were observed in the area in 1983. In 1989 and 1997, utilization by livestock and wildlife was noted as infrequent. From the pellet group transect, deer use was estimated at 22 days use/acre (55 ddu/ha) in 2002 and 5 days use/acre (13 ddu/ha) in 2007. Elk use was estimated at 1 elk day use/acre (3 edu/ha) in 2007.

Soil

The soil is in the Amtoft series. These soils are shallow and well-drained, and formed in material weathered from calcareous sedimentary rocks (USDA-NRCS 2007). Rocks are angular shaped and uniformly dark grey in color. The soil texture is clay loam with a neutral reaction (pH 7.1). Relative bare ground cover has been low to moderately low at 3%-11% in all years, and combined vegetation and litter cover has been high at 46%-57%. The combined relative rock and pavement cover have also been high at 38%-45%. The erosion condition was classified as slight in 2002 and 2007. The soil showed recent surface litter and soil movement as well as flow patterns.

Browse

The key browse species are Stansbury cliffrose, Nevada ephedra (*Ephedra nevadensis*), and black sagebrush. On average, black sagebrush has provided more cover than any other preferred browse. Stansbury cliffrose density was estimated at 340 plants/acre (840 plants/ha) in 1997, 380 plants/acre (939 plants/ha) in 2002, and 360 plants/acre (642 plants/ha) in 2007. The population has been composed predominantly of mature plants and few young. Decadence has ranged from 0%-40% of the population. Vigor has been generally good. Utilization of cliffrose was moderate-heavy in 2002, but lighter in other sample years. Even with drought in 2002, cliffrose had an abundance of flowers and annual leaders. The average annual growth was 1.8 inches (4.6 cm) in 2002, and increased to 2.3 inches (5.8 cm) in 2007.

Nevada ephedra had an estimated density of 820 plants/acre (2,025 plants/ha) in 1997, 660 plants/acre (1,630 plants/ha) in 2002, and 720 plants/acre (1,778 plants/ha) in 2007. Decadence has ranged from 7-69%. Vigor was good in 1989 and 1997, but poor in 1983, 2002, and 2007. Use was heavy in 1983, light-moderate in 1989 and 1997, and moderate-heavy in 2002 and 2007.

The population of black sagebrush was estimated at 840 plants/acre (2,075 plants/ha) in 1997, 1,400 plants/acre (3,458 plants/ha) in 2002, and 980 plants/acre (2,421 plants/ha) in 2007. Decadence has ranged from 11%-53%. Use on black sagebrush has been moderate overall and vigor has generally been good. Annual leaders averaged less than 1 inch (2.5 cm) of growth in 2002 and 2007.

Other browse sampled include shadscale (*Atriplex confertifolia*), California brickellia (*Brickellia californica*), broom snakeweed (*Gutierrizia sarothrae*), narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*), and littleleaf horsebrush (*Tetradymia glabrata*). Broom snakeweed was the most abundant in 1983 and 1989, but decreased to 20 plants/acre (49 plants/ha) by 2007. Single-leaf pinyon (*Pinus monophylla)* and Utah juniper are scattered across the landscape. Point-center quarter data estimates were 14 pinyon/acre (35 pinyon/ha) in 1997 and 34 pinyon/acre (84 pinyon/ha) in 2007. Juniper estimates were 53 juniper/acre (131 juniper/ha) in 1997, and 76 juniper/acre (188 juniper/ha) in 2007. The average trunk diameter for juniper was 8.7 inches (22.1 cm) in 1997 and 7.7 inches (19.6 cm) in 2007. The average trunk diameter for pinyon

was 4.1 inches (10.4 cm) in 1997 and 3 inches (7.6 cm) in 2007.

Herbaceous Understory

The dominant grass is cheatgrass (*Bromus tectorum*). It provided 64% of the grass cover in 1997, 52% in 2002, and 48% in 2007. Cheatgrass nested frequency significantly decreased in 2002, and remained stable in 2007. Its cover decreased from 7% in 1997, to 4% in 2007. Bluebunch wheatgrass (*Agropyron spicatum*) is the most abundant perennial grass. It has maintained a stable nested frequency and cover since 1997. Other less abundant grasses that have been sampled include galleta (*Hilaria jamesii*), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and sand dropseed (*Sporobolus cryptandrus*).

The forb component, including annual species, is neither abundant nor diverse. Longleaf phlox (*Phlox longifolia*) is the most abundant species but was sampled in less than five quadrats every year. No annual species were sampled in 1997, but five were sampled in 2002 and 2007.

1989 TREND ASSESSMENT

The browse trend is up. The key species, black sagebrush, Stansbury cliffrose, and Nevada ephedra, increased in density. The recruitment of young was stable at 0%for black sagebrush, increased to 50% for Stansbury cliffrose, and increased to 31% for Nevada ephedra. However, they also have increased in percent decadence, which may be due to drought conditions. The grass trend is slightly up. The sum of nested frequency of perennial grasses increased, mostly due to the first sampling of sand dropseed. The forb trend is stable. There was very little change in perennial forbs.

browse - up (+2) grass - slightly up - (+1) forb - stable - (0)

1997 TREND ASSESSMENT

The trend for browse is stable. Stansbury cliffrose density was changed little. The recruitment of young decreased to 18% of the population and decadence also decreased from 40% to 18%. The density of black sagebrush increased 68%. The recruitment of young increased slightly to 2% of the population and decadence decreased from 53% to 19%. The density of Nevada ephedra increased 54%. The recruitment of young decreased to 20% of the population, and decadence decreased from 44% to 7%. Browse utilization was lower than reported in past years, which coincided with the lack of pellet groups sampled. The grass trend is stable. Bluebunch wheatgrass nested frequency significantly increased while galleta grass was not sampled. Annual grasses were measured in the study for the first time. Cheatgrass was the dominant grass, with an average cover of 7%. The forb trend is stable. Very little change occurred in perennial forbs. The Desirable Components Index (DCI) rated this study as fair due to moderate browse cover with relatively low decadence, and a low perennial grass and forb cover.

winter range condition (DCI) - fair (31) Low potential scale
browse - stable (0) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The browse trend is slightly up, but the key species showed obvious negative signs of drought, specifically minimal annual leader growth and increased decadence. Black sagebrush density increased 67%. The recruitment of young changed little to 1% of the population and decadence increased to 29%. Utilization also increased. Cliffrose density increased 12%. The recruitment of young decreased to 5% of the population and decadence decreased slightly to 16%. Browse use increased to mostly moderate and heavy. The density of nevada ephedra decreased 20%. The recruitment of young decreased to 3%, and decadence increased to 42%. Browse use increased from mostly light to moderate-heavy. The grass trend is slightly up due to a significant decrease in the nested frequency of cheatgrass. Trend for forbs is stable. The nested frequency of perennial forbs changed little. Storksbill (*Erodium cicutarium*) and stickseed (*Lappula occidentalis*) were sampled for

the first time. The DCI rating remained fair, though there was a slight decrease in the recruitment of young browse.

winter range condition (DCI) - fair (27) Low potential scale
browse - slightly up (+1) grass - slightly up (+1) forb - stable (0)

2007 TREND ASSESSMENT

The trend for browse is slightly down. Black sagebrush density declined 30% The recruitment of young increased slightly to 2% of the population, and decadence remained stable. Browse use increased, with 57% of the population showing heavy use. Cliffrose density decreased 5%. The recruitment of young decreased to 0% of the population and decadence increased to 33%. The Nevada ephedra population decreased 9%. The recruitment of young decreased to 0% of the population and decadence increased to 69%. Browse use increased to mostly heavy, with 75% of the population showing heavy use. The trend for grasses is stable. The nested frequencies for perennial and annual grasses changed little. The trend for forbs is stable. The nested frequencies of perennial and annual forbs changed little. However, the nested frequency of storksbill increased slightly. The DCI rating declined to poor-fair due to relatively high decadence and nearly no recruitment of young browse.

winter range condition (DCI) - poor-fair (22) Low potential scale
browse - slightly down (-1) grass - stable (0) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 19A, Study no: 1

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	a43	a47	b97	b82	b112	3.09	4.33	3.88
G	Bromus tectorum (a)	-	-	b248	a196	a195	7.17	5.39	3.75
G	Hilaria jamesii	c37	bc33	ab13	a5	a2	.36	.09	.06
G	Oryzopsis hymenoides	a5	a6	a6	a1	a2	.21	.15	.06
G	Poa secunda	a3	a14	a15	a19	a13	.40	.29	.08
G	Sitanion hystrix	-	-	a6	a7	-	.03	.07	-
G	Sporobolus cryptandrus	-	b20	-	a4	-	-	.00	-
Total for Annual Grasses		0	0	248	196	195	7.17	5.39	3.75
Total for Perennial Grasses		88	120	137	118	129	4.11	4.95	4.08
Total for Grasses		88	120	385	314	324	11.29	10.35	7.83
F	Astragalus utahensis	-	-	3	-	-	.00	-	-
F	Cirsium neomexicanum	a6	b19	a1	a1	a2	.00	.00	.15
F	Collinsia parviflora (a)	-	-	-	-	4	-	-	.01
F	Cymopterus sp.	-	-	-	-	1	-	-	.03
F	Descurainia pinnata (a)	-	-	-	a4	a5	-	.01	.01
F	Draba sp. (a)	-	-	-	1	-	-	.00	-
F	Erodium cicutarium (a)	-	-	-	a3	b18	-	.00	.16
F	Lappula occidentalis (a)	-	-	-	a1	a3	-	.00	.01

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Lomatium sp.	-	-	$_{a}$1	$_{a}$3	-	.00	.00	-
F	Lygodesmia grandiflora	3	-	-	-	-	-	-	-
F	Machaeranthera spp	1	-	-	-	-	-	-	-
F	Phlox longifolia	-	$_{a}$3	$_{a}$10	$_{a}$6	$_{a}$6	.04	.01	.01
F	Sphaeralcea coccinea	$_{a}$2	$_{a}$10	-	$_{a}$3	$_{a}$5	-	.00	.06
F	Streptanthus cordatus	-	-	-	2	-	-	.00	-
F	Unknown forb-perennial	-	-	$_{a}$8	-	$_{a}$3	.06	-	.00
F	Zigadenus paniculatus	-	-	-	4	-	-	.01	-
Total for Annual Forbs		0	0	0	9	30	0	0.02	0.19
Total for Perennial Forbs		12	32	23	19	17	0.12	0.04	0.25
Total for Forbs		12	32	23	28	47	0.12	0.06	0.44

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

BROWSE TRENDS --
Management unit 19A, Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia nova	21	25	21	5.40	3.59	3.61
B	Atriplex confertifolia	5	3	4	.53	.03	.21
B	Brickellia californica	5	2	4	.03	-	.00
B	Chrysothamnus viscidiflorus stenophyllus	10	5	6	.15	.38	.38
B	Cowania mexicana stansburiana	15	15	14	2.54	4.02	3.59
B	Echinocereus sp.	0	1	0	-	-	-
B	Ephedra nevadensis	12	17	12	1.78	.97	.59
B	Gutierrezia sarothrae	19	7	1	.60	.00	-
B	Juniperus osteosperma	8	5	8	11.46	10.00	8.23
B	Opuntia sp.	2	3	1	-	.00	-
B	Pinus monophylla	1	3	2	-	.15	.56
B	Tetradymia glabrata	12	4	9	1.09	-	.30
Total for Browse		110	90	82	23.60	19.16	17.50

CANOPY COVER, LINE INTERCEPT --
Management unit 19A, Study no: 1

Species	Percent Cover		
	'97	'02	'07
Artemisia nova	-	4.16	3.33
Brickellia californica	-	.08	.21
Chrysothamnus viscidiflorus stenophyllus	-	.65	.08
Cowania mexicana stansburiana	-	7.38	7.76
Ephedra nevadensis	-	2.26	.56
Juniperus osteosperma	14.60	13.10	15.23
Pinus monophylla	-	2.11	2.04
Tetradymia glabrata	-	.10	.75

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19A, Study no: 1

Species	Average leader growth (in)	
	'02	'07
Artemisia nova	0.9	1.0
Cowania mexicana stansburiana	1.8	2.3

POINT-QUARTER TREE DATA --
Management unit 19A, Study no: 1

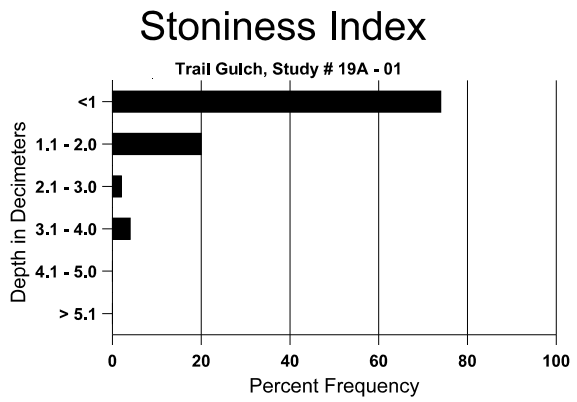
Species	Trees per Acre		Average diameter (in)	
	'97	'07	'97	'07
Juniperus osteosperma	53	76	8.7	7.7
Pinus monophylla	14	34	4.1	3.0

BASIC COVER --
Management unit 19A, Study no: 1

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	.25	4.00	35.30	28.60	25.70
Rock	27.00	30.00	27.53	32.42	31.78
Pavement	20.25	21.50	16.47	18.55	19.24
Litter	39.50	33.50	30.37	27.46	30.22
Cryptogams	.25	1.50	1.66	2.11	.71
Bare Ground	12.75	9.50	3.34	13.38	6.87

SOIL ANALYSIS DATA --
Herd Unit 19A, Study no: 1, Trail Gulch

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
8.9	64.4 (12.6)	7.1	38.0	32.4	29.6	2.4	7.7	76.8	.7



PELLET GROUP DATA --
Management unit 19A, Study no: 1

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	8	9	25
Elk	-	-	-
Deer	-	2	6

Days use per acre (ha)	
'02	'07
-	-
-	1 (3)
22 (55)	5 (13)

BROWSE CHARACTERISTICS --
Management unit 19A, Study no: 1

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
83	**332**	-	33	266	33	-	60	30	10	-	20	13/25
89	**499**	33	-	233	266	-	53	0	53	-	0	12/29
97	**840**	-	20	660	160	140	19	0	19	7	7	13/29
02	**1400**	-	20	980	400	140	51	13	29	6	6	10/21
07	**980**	-	20	680	280	160	29	57	29	22	22	14/28

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Atriplex confertifolia												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**120**	20	-	80	40	-	0	0	33	-	0	8/11
02	**60**	-	-	20	40	-	0	0	67	33	33	6/12
07	**80**	-	-	60	20	-	0	25	25	25	25	12/22
Brickellia californica												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**160**	60	20	140	-	-	0	0	-	-	0	12/14
02	**40**	-	-	40	-	-	0	0	-	-	0	10/15
07	**160**	-	-	160	-	-	38	0	-	-	0	9/19
Chrysothamnus viscidiflorus stenophyllus												
83	**133**	-	-	133	-	-	0	0	0	-	0	8/10
89	**166**	-	-	66	100	-	0	0	60	-	0	4/6
97	**220**	-	-	180	40	-	0	0	18	9	9	10/16
02	**100**	-	-	80	20	-	0	0	20	-	0	11/24
07	**120**	-	-	120	-	-	0	0	0	-	0	13/21
Cowania mexicana stansburiana												
83	**199**	-	33	166	-	-	33	17	0	-	0	44/67
89	**332**	-	166	33	133	-	10	0	40	-	0	55/71
97	**340**	20	60	220	60	-	12	0	18	6	6	38/60
02	**380**	-	20	300	60	-	42	37	16	11	11	44/63
07	**360**	-	-	240	120	20	17	28	33	17	17	45/64
Echinocereus sp.												
83	**33**	-	-	33	-	-	0	0	-	-	0	3/5
89	**33**	-	33	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	4/5
07	**0**	-	-	-	-	-	0	0	-	-	0	3/8
Ephedra nevadensis												
83	**300**	-	-	200	100	-	0	100	33	-	100	18/33
89	**532**	-	166	133	233	-	56	0	44	-	0	15/24
97	**820**	-	160	600	60	20	34	0	7	-	0	20/29
02	**660**	-	20	360	280	80	27	39	42	27	45	18/32
07	**720**	-	-	220	500	60	11	75	69	39	39	17/33

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae												
83	**2533**	-	200	2333	-	-	0	0	0	-	0	8/8
89	**2699**	166	300	1566	833	-	0	0	31	-	0	5/7
97	**640**	20	40	600	-	20	0	0	0	-	0	7/12
02	**180**	-	-	40	140	100	0	0	78	67	67	8/12
07	**20**	-	-	20	-	-	0	0	0	-	0	6/12
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**99**	-	66	33	-	-	0	0	0	-	0	118/197
97	**160**	-	40	100	20	-	0	0	13	-	0	-/-
02	**100**	-	-	100	-	20	0	0	0	-	0	-/-
07	**160**	20	60	80	20	20	0	0	13	-	0	-/-
Opuntia sp.												
83	**33**	-	-	33	-	-	0	0	0	-	100	4/18
89	**66**	-	33	-	33	-	0	0	50	-	50	-/-
97	**40**	-	-	40	-	-	0	0	0	-	0	7/13
02	**80**	-	-	80	-	-	0	0	0	-	0	4/12
07	**20**	-	-	-	20	-	0	0	100	100	100	4/8
Pinus monophylla												
83	**33**	-	33	-	-	-	0	0	-	-	0	-/-
89	**66**	-	66	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	-/-
02	**60**	20	40	20	-	-	0	0	-	-	0	-/-
07	**40**	20	20	20	-	-	0	0	-	-	0	-/-
Tetradymia glabrata												
83	**66**	-	-	66	-	-	0	0	0	-	0	26/38
89	**199**	-	66	-	133	-	0	0	67	-	33	-/-
97	**340**	-	20	180	140	80	0	0	41	12	12	23/21
02	**120**	-	-	-	120	220	0	0	100	83	100	22/14
07	**220**	-	-	60	160	100	18	9	73	45	73	11/20

Trend Study 19A-2-07

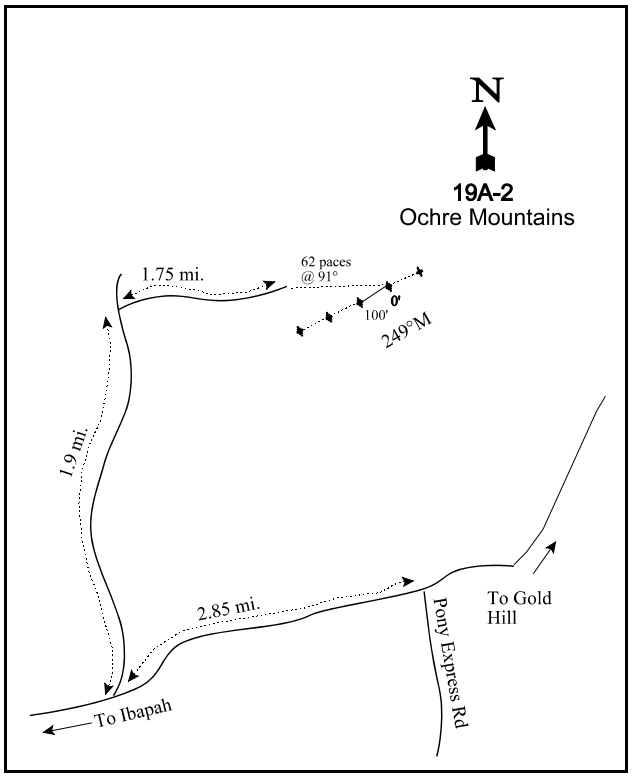
Study site name: Ochre Mountain . Vegetation type: Big Sagebrush-Grass .

Compass bearing: frequency baseline 249 degrees magnetic.

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

LOCATION DESCRIPTION

From Gold Hill, proceed southwest toward Pony Express Road. From the intersection at Pony Express Rd, continue on main road (east) towards Ibapah for another 2.85 miles to an intersection going north (right). Take the road going north for 1.91 miles to a road going east (right). Turn right and go 1.75 miles to a small box canyon. Stop and walk 62 paces at an azimuth of 91 degrees true to a green steel “T" fencepost with a red browse tag, number 3931, attached. This marks the 0-foot stake of the baseline. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height.



Map Name: Ochre Mountain

Diagrammatic Sketch

Township 8S , Range 18W , Section 17

GPS: NAD 83, UTM 12T 253042 E 4446321 N

DISCUSSION

Ochre Mountain - Trend Study No. 19A-2

Study Information

This study samples deer winter range on the west side of Ochre Mountain [elevation: 6,400 feet (1,940 m), slope: 15%-20%, aspect: west]. It samples a basin big sagebrush-grass community. The area is surrounded by steep, rocky pinyon-juniper hillsides which contain some Stansbury cliffrose. This transect is in the Ochre Mountain BLM grazing allotment, permitted for cattle use in winter and spring. From the pellet group transect, deer use was estimated at 44 days use/acre (107 ddu/ha) in 2002 and 1 day use/acre (3 ddu/ha) in 2007. The elk estimates were 15 days use/acre (36 edu/ha) in 2002 and 29 days use/acre (73 edu/ha) in 2007. The cattle estimates were 4 days use/acre (10 cdu/ha) in 2002 and 2007. The horse estimates were 5 days use/acre (12 hdu/ha) in 2007. In 2002, there was sign of wild horses and several rub trees severely damaged by big game. The deer and elk pellets sampled in 2002 and 2007 appeared to be primarily from winter or spring and the sampled cattle and horse appeared to be from the previous year. Previous to 2002, big game, wild horse and livestock use was reported light-moderate.

Soil

The soil is in the Spager series. These soils consists of shallow over a calcium carbonate cemented hardpan, somewhat excessively drained, and moderately-rapidly permeable. They formed in alluvium weathered mainly from limestone. Spager soils are on alluvial plains, fan remnants and hillslopes (USDA-NRCS 2007). The soil texture is loam with a neutral pH (7.1). Past soil erosion is evident by exposed rock, pavement, and the presence of pedestalled plants. Relative bare ground cover has been low (2%-4%) in all years, while the sum of vegetation and litter cover has been very high, an estimated 78%-88%. In 2002, the erosion condition was classified as stable. In 2007, the erosion codition was classified as slight due to some pedestalling, rills, flow patterns, and light litter and soil movement.

Browse

Browse composition consists almost entirely of basin big sagebrush (*Artemisia tridentata* spp. *tridentata*). Density was estimated at 2,720 plants/acre (6,718 plants/ha) in 1997, 1,820 plants/acre (4,495 plants/ha) in 2002, and 1,100 plants/acre (2,717 plants/ha) in 2007. The decrease in density may be due to self-thinning as evidenced by a 12 inch (30.5 cm) increase in the average crown width that occurred from 1997 to 2007. The population has consisted predominantly of mature and decadent plants. Percent decadency has been moderate-high all years, especially during drought periods in 1989 and 2002 (Utah Climate Summaries 2007). Plants classified as dying have increased from 3% of the population in 1989 to 27% in 2007. In all years recruitment has been very low. There has been a high proportion of plants in the population with poor vigor, and the highest levels occurred in 1989, 2002, and 2007. Many of the sagebrush plants showed insect damage in 2002 and some showed it in 2007. The population showed sagebrush defoliator moth (*Aroga websteri*) damage in 2007, and were infested by aphids and ants. Plant use has been light-moderate every year. Average annual leader growth was 1.7 inches (4.3 cm) in 2002 and 1 inch (2.5 cm) in 2007. Other shrubs sampled include narrowleaf low rabbitbrush (*Chrysothamnus viscidiforus* ssp *stenophyllus*) and black sagebrush (*Artemisia nova*).

Herbaceous Understory

Cheatgrass (*Bromus tectorum*) cover has fluctuated between 8% and 13%. It is likely a fire hazard due to its abundance and distribution in the area. Although frequency and cover were not measured before 1997, it was noted from 1989 photographs that cheatgrass was less abundant prior to 1983. Average cover of perennial grasses increased from 9% in 1997 to 14% in 2007. Bluebunch wheatgrass (*Agropyron spicatum*), the dominant perennial grass, provided 8% cover in 1997, 11% in 2002, and 12% in 2007. Sandberg bluegrass (*Poa secunda*) is also moderately abundant, but has declined from a quadrat frequency of 56% in 1983 to 34% in 2007.

With one exception, forbs occur infrequently. Bonneville pea (*Lathyrus brachycalyx*) is moderately abundant with an average cover of 6% in 1997, 8% in 2002, and 12% in 2007. Other forbs sampled include false dandelion (*Agoseris glauca*), longleaf phlox (*Phlox longifolia*), low fleabane (*Erigeron pumilus*), rockcress (*Arabis* sp.), desert Indian paintbrush (*Castilleja chromosa*), and tumble mustard (*Sisymbrium altissimum*).

1989 TREND ASSESSMENT

The browse trend is slightly down. The density of basin big sagebrush remained stable. The recruitment of young increased from 0% of the population to 10%, and decadence increased from 30% to 70%. and plants exhibiting poor vigor increased from 10% of the population to 55%. Browse use was mostly light-moderate. The grass trend is slightly down. The sum of nested frequency for perennial grasses decreased 13%. The forbs trend is up. The sum of nested frequency for perennial forbs increased 60%, and there were significant increases in the nested frequencies of peavine and longleaf phlox. Diversity also increased from three to seven species.

browse - slightly down (-1) grass - slightly down (-1) forb - up (+2)

1997 TREND ASSESSMENT

The browse trend is up. Density of mature basin big sagebrush increased over two-fold. The recruitment of young decreased to 6% of the population, and decadence decreased to 33%. Plants classified as showing poor vigor decreased to 18% of the population. Although the percentage of plants with poor vigor decreased, almost all of those plants were classified as dying. There were no dead plants sampled in 1989, but there were 1,060 dead plants/acre (2,624 plants/ha) in 1997. The population appeared to be self-thinning, which could prove advantageous to its overall health. Browse use decreased to mostly light. The grass trend is slightly up. The sum of nested frequency for perennial grasses increased 16%. The nested frequency of bluebunch wheatgrass increased. This site exhibits low diversity, so an increase in any perennial species is beneficial. Because the sample area changed between these two readings, it is possible that the change in nested frequencies was slightly inflated. Annual grasses were included in the study for the first time. Cheatgrass was abundant, with 11% average cover. The forb trend is slightly down. The sum of the nested frequency of perennial forbs decreased 14%. Forbs, with the exception of peavine, were rare. The Desirable Components Index (DCI) score was fair due to the high browse cover, and high perennial grass and perennial forb cover. However, the high browse decadence, low recruitment of young browse, and moderate annual grass cover decreased the score.

winter range condition (DCI) - fair (50) Mid-level potential scale
browse - up (+2) grass - slightly up (+1) forb - slightly down (-1)

2002 TREND ASSESSMENT

The browse trend is down. Density of basin big sagebrush declined 33%. The recruitment of young decreased to 0% of the population and decadence increased to 51%. Plants classified as showing poor vigor increased to 26% of the population. Plants classified as dying remained high, indicating further losses in density could occur in the future. The density of dead plants increased to 1,580 plants/acre (3,911 plants/ha). Browse use remained mostly light. A high proportion of the population showed insect damage. Drought conditions and high densities of cheatgrass in the understory contributed to the poor sagebrush condition. The grass trend is stable. The sum of nested frequency for perennial grasses decreased 17%, though none of the species decreased at a significant level. However, cheatgrass decreased in nested frequency with the existing drought conditions, and this decrease contributed to the stable trend. The forb trend is up. The sum of the nested frequency for perennial forbs increased 22%. The DCI score remained fair.

winter range condition (DCI) - fair (49) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - up (+2)

2007 TREND ASSESSMENT

The browse trend is down. Density of basin big sagebrush declined 40%. The recruitment of young increased to 9% of the population and decadence decreased to 42%. Plants classified with poor vigor increased to 36% of the population, and browse use remained mostly light Insect use was evident; many of the plants had use by ants and aphids, with some noticeable use by the sagebrush defoliator moth. The trend for grasses is stable. The sum of nested frequency of perennial grassed increased 3%. The sum of nested frequency for cheatgrass significantly increased. The forb trend is stable with no significant change. The DCI score remained fair.

winter range condition (DCI) - fair (53) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - stable (0)

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

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	-	-	4	-	-	.18	-	-
G	Agropyron spicatum	$_{a}$119	$_{ab}$117	$_{c}$189	$_{bc}$159	$_{c}$177	7.63	11.31	12.28
G	Bromus tectorum (a)	-	-	$_{b}$329	$_{a}$270	$_{b}$311	10.92	7.61	12.58
G	Poa fendleriana	$_{b}$37	$_{a}$14	-	$_{a}$3	$_{a}$9	-	.00	.18
G	Poa secunda	$_{b}$153	$_{ab}$138	$_{ab}$121	$_{a}$98	$_{a}$83	1.63	.91	1.34
Total for Annual Grasses		0	0	329	270	311	10.92	7.61	12.58
Total for Perennial Grasses		309	269	314	260	269	9.44	12.23	13.81
Total for Grasses		309	269	643	530	580	20.36	19.85	26.40
F	Agoseris glauca	-	-	-	$_{a}$19	$_{a}$7	-	.14	.04
F	Arabis sp.	-	$_{a}$6	$_{a}$5	$_{a}$1	$_{a}$3	.01	.00	.03
F	Astragalus sp.	-	-	-	-	3	-	-	.03
F	Castilleja chromosa	-	$_{a}$2	$_{a}$1	-	-	.03	-	-
F	Cirsium sp.	-	-	-	-	-	.03	-	-
F	Crepis acuminata	-	-	$_{a}$3	$_{a}$2	$_{a}$8	.03	.01	.36
F	Delphinium nuttallianum	-	-	-	3	-	-	.00	-
F	Descurainia pinnata (a)	-	-	$_{a}$7	$_{a}$4	$_{a}$10	.02	.03	.05
F	Erigeron pumilus	-	$_{a}$8	$_{a}$3	-	-	.00	-	-
F	Hackelia patens	-	-	2	-	-	.00	-	-
F	Lathyrus brachycalyx	$_{a}$145	$_{b}$193	$_{ab}$182	$_{b}$196	$_{b}$206	5.74	8.05	11.60
F	Lappula occidentalis (a)	-	-	-	$_{a}$41	$_{a}$56	-	.79	.28
F	Lactuca serriola	-	-	-	4	-	-	.03	-
F	Lomatium sp.	-	-	-	3	-	-	.00	-
F	Machaeranthera canescens	-	$_{a}$1	$_{a}$1	-	-	.03	-	-
F	Oenothera sp.	-	8	-	-	-	-	-	-
F	Phlox longifolia	$_{a}$4	$_{b}$25	$_{ab}$13	$_{b}$28	$_{ab}$15	.06	.14	.11
F	Sisymbrium altissimum (a)	-	-	$_{a}$12	$_{a}$14	$_{b}$32	.08	.35	.89

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Unknown forb-perennial	3	-	-	-	-	-	-	-
Total for Annual Forbs		0	0	19	59	98	0.10	1.17	1.23
Total for Perennial Forbs		152	243	210	256	242	5.96	8.40	12.17
Total for Forbs		152	243	229	315	340	6.06	9.57	13.40

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

BROWSE TRENDS --
Management unit 19A, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia nova	5	6	7	.33	.36	.46
B	Artemisia tridentata tridentata	64	50	38	16.40	16.31	14.03
B	Chrysothamnus viscidiflorus stenophyllus	18	14	14	.30	.71	1.28
B	Chrysothamnus viscidiflorus viscidiflorus	0	0	1	-	-	-
Total for Browse		87	70	60	17.04	17.38	15.78

CANOPY COVER, LINE INTERCEPT --
Management unit 19A, Study no: 2

Species	Percent Cover	
	'02	'07
Artemisia nova	.33	.38
Artemisia tridentata tridentata	13.25	17.56
Chrysothamnus viscidiflorus stenophyllus	.31	1.43

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19A, Study no: 2

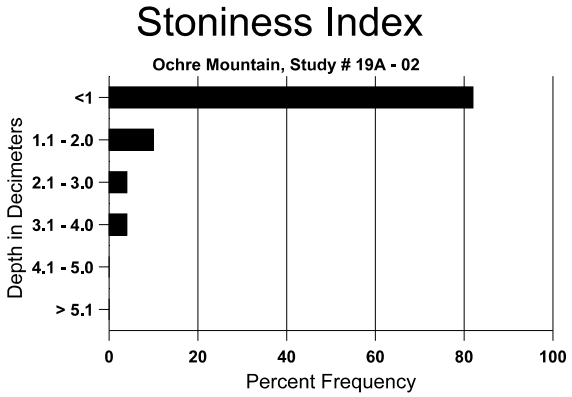
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata tridentata	1.7	1.0

BASIC COVER --
Management unit 19A, Study no: 2

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	2.00	12.00	39.64	45.36	51.31
Rock	6.75	11.50	5.11	8.21	3.76
Pavement	14.50	11.00	8.30	12.71	6.20
Litter	69.75	62.00	53.55	49.91	40.81
Cryptogams	1.75	1.25	1.38	1.75	.13
Bare Ground	5.25	2.25	2.58	4.92	2.32

SOIL ANALYSIS DATA --
Herd Unit 19A, Study no: 2, Ochre Mountain

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
15.2	61.0 (16.5)	7.1	50.0	32.4	17.6	3.4	7.6	150.4	1.0



PELLET GROUP DATA --
Management unit 19A, Study no: 2

Type	Quadrat Frequency			Days use per acre (ha)	
	'97	'02	'07	'02	'07
Rabbit	1	2	5	-	-
Horse	1	1	1	-	5 (12)
Elk	-	5	10	15 (36)	29 (73)
Deer	5	18	5	44 (107)	1 (3)
Cattle	5	3	1	3 (9)	4 (11)

BROWSE CHARACTERISTICS --
Management unit 19A, Study no: 2

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**220**	-	-	180	40	40	0	0	18	18	18	9/17
02	**260**	-	-	140	120	220	54	15	46	-	0	14/23
07	**360**	-	40	120	200	280	0	0	56	22	22	12/25
Artemisia tridentata tridentata												
83	**1333**	-	-	933	400	-	45	5	30	-	10	43/45
89	**1332**	-	133	266	933	-	50	5	70	10	55	35/39
97	**2720**	20	160	1660	900	1060	15	4	33	18	18	34/47
02	**1820**	-	-	900	920	1580	15	12	51	26	26	36/46
07	**1100**	20	100	540	460	900	16	0	42	27	27	39/59
Chrysothamnus viscidiflorus stenophyllus												
83	**400**	-	-	400	-	-	0	0	0	-	0	19/20
89	**133**	-	-	-	133	-	0	0	100	-	50	-/-
97	**460**	-	-	420	40	40	0	0	9	9	9	18/24
02	**340**	-	-	320	20	20	0	0	6	-	0	15/23
07	**300**	-	40	240	20	-	0	0	7	-	0	16/29
Chrysothamnus viscidiflorus viscidiflorus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	0	-	-	0	14/28

Trend Study 19A-7-07

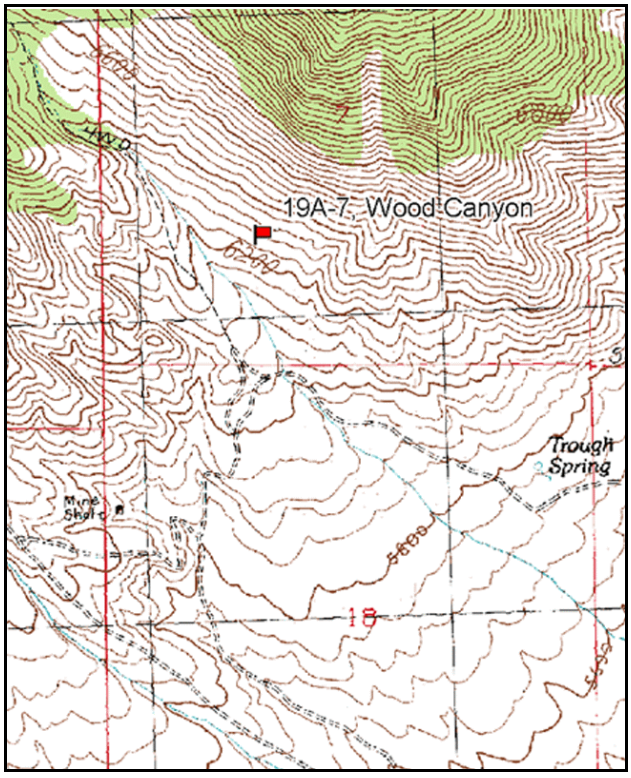
Study site name: Wood Canyon . Vegetation type: Desert Shrub .

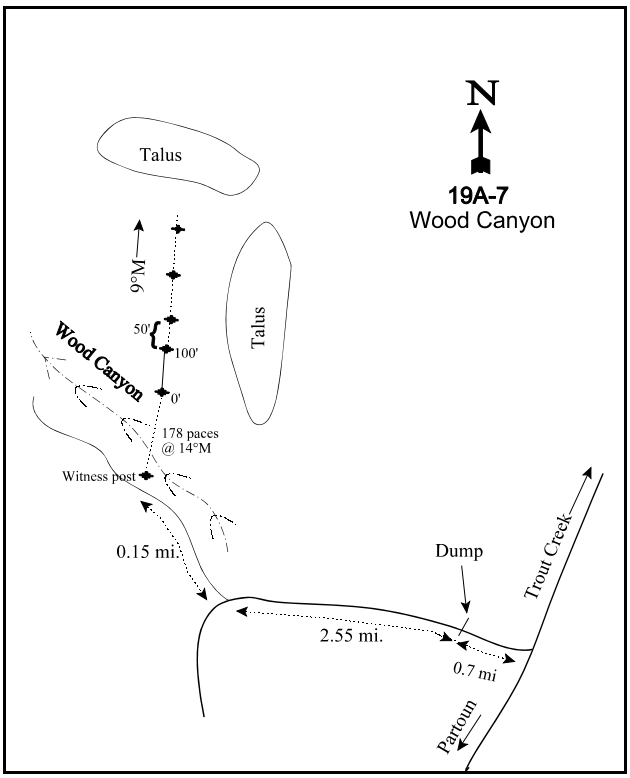
Compass bearing: frequency baseline 9 degrees magnetic.

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

LOCATION DESCRIPTION

From Trout Creek on the Gandy Road through Snake Valley, go south to the old Partoun dump (Now covered over). Turn west and continue 0.7 miles to the Trough Springs turnoff. Take this road west for 3.25 miles to the turn-off to Wood Canyon. Turn right and go 0.15 miles to a witness post on the right side of the road. From the witness post, walk 178 paces north (14°M) to the 0 foot baseline stake which is behind a large rock. The baseline runs uphill at 9 degrees magnetic.





Map Name: Partoun

Diagrammatic Sketch

Township 13S , Range 18W , Section 7

GPS: NAD 83, UTM 12S 249326 E 4398446 N

DISCUSSION

Wood Canyon - Trend Study No. 19A-7

Study Information

This study is located on the southeast end of the Deep Creek Mountains [elevation: 6,200 feet (1,880 m) slope: 32-35%, aspect: south]. Rugged cliffs cap the ridge north of the study, and it is surrounded by miles of vast open desert to the south and east. It was established in 1989 primarily to monitor bighorn sheep habitat, but it mainly receives winter use by deer. Chukars were heard on the nearby ledges in both 1989 and 1997. In 2007, pronghorn were spotted a half mile east of the study. A stock pond 1 mile (1.6 km) to the east is the closest apparent water source. From the pellet group transect, deer use was estimated at 10 days use/acre (25 ddu/ha) in 2002 and 2 days use/acre (5 ddu/ha) in 2007. Elk use estimates were 1 day use/acre (2 edu/ha) in 2002 and 3 days use/acre (8 edu/ha) in 2007. Pronghorn use estimates were 4 days use/acre (10 pdu/ha) in 2002 and 11 days use/acre (28 pdu/ha) in 2007. Cattle use estimates were 8 days use/acre (20 cdu/ha) in 2007 and 6 days use/acre (14 cdu/ha) in 2007. Horse use estimates were 3 days use/acre (7 hdu/ha) in 2002 and 1 day use/acre (1 hdu/ha) in 2007. There were 17 sage-grouse pellet groups/acre (42 groups/ha) in 2002. Because of the difficulty distinguishing between deer and pronghorn pellets, it is quite possible there could be overlap in the estimates between the two.

Soil

The soil is a very gravelly loam with a mildly alkaline reaction (pH 7.4). Relative vegetation cover was 27% in 1997, 13% in 2002, and 25% in 2007. Relative bare ground cover was 6% in 1997, 13% in 2002, and 4% in 2007. Erosion has been negligible in spite of only fair vegetation and litter cover because boulders, rocks and pavement are very abundant and armor the soil. The erosion condition was classified as stable in 2002 and 2007.

Browse

The browse component consists of a variety of species. Shadscale (*Atriplex confertifolia*) had an estimated density of 1,400 plants/acre (3,458 plants/ha) in 1997, 1,140 plants/acre (2,816 plants/ha) in 2002, and 800 plants/acre (1,976 plants/ha) in 2007. The recruitment of young in the population was 10% in 1997, 30% in 2002, and 0% in 2007. Percent decadence was 23% in 1997, 44% in 2002, and 38% in 2007. The proportion of decadent plants classified as dying has been high at 75% or greater in 1997, 2002, and 2007. Plants classified as having poor vigor increased from 20% of the population in 1997 to 48% in 2007. Utilization has been light all years.

Nevada ephedra (*Ephedra nevadensis*) had an estimated density of 160 plants/acre (395 plants/ha) in 1997 and 320 plants/acre (790 plants/ha) in 2002 and 2007. Young plants increased from 0% of the population in 1997, to 25% in 2002, and 31% in 2007. The proportion of the population exhibiting poor vigor significantly increased from 0% in 1997, to 75% in 2002, and 50% in 2007. Utilization has been mostly light-moderate in all samples.

Broom snakeweed (*Gutierrezia sarothrae*) is the dominant browse with an estimated density of 5,200 plants/acre (12,844 plants/ha) in 1997, 3,320 plants/acre (8,200 plants/ha) in 2002, and 4,040 plants/acre (9,979 plants/ha) in 2007. This is a mature population that fluctuates with precipitation changes. Percent decadence and poor vigor seem to vary as well with environmental conditions. Recruitment of young into the population was low in all years.

Other low density browse species that were sampled include winterfat (*Ceratoides lanata*), summer cypress (*Kochia americana*), black sagebrush (*Artemisia nova*), cottonthorn horsebrush (*Tetradymia spinosa*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*), and pricklypear cactus (*Opuntia* sp.).

Herbaceous Understory

Cheatgrass (*Bromus tectorum*) is the most abundant grass. It provided 6% of the total ground cover in 1997, decreased to 2% in 2002, and increased to 9% in 2007. Galleta (*Hilaria jamesii*) is the most abundant perennial grass. It provided 4% of the total ground cover in 1997 and 1% in 2002 and 2007. Other perennials sampled include Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), sand dropseed (*Sporobolus cryptandrus*), and needle-and-thread grass (*Stipa comata*). Average cover for perennial grasses was 8% in 1997, 3% in 2002, and 5% in 2007. Incidentally, the decrease in the average cover for perennial and annual grasses in 2002 coincided with drought conditions (Utah Climate Summaries 2007).

The forb component is sparse, especially perennial species. Four perennial species were sampled in 1989, three in 1997, none in 2002, and one in 2007. Storksbill (*Erodium cicutarium)*, a winter annual, was moderately abundant in 2002 and 2007 and provided nearly all forb cover both years. It increased in cover and nested frequency every sample year from 1997 to 2007. Storksbill has been shown to outcompete and prevent the establishment of native species (Kimball and Schiffman 2003).

1997 TREND ASSESSMENT

The browse trend is stable, with little utilization on any browse species. Shadscale density increased 24%. However this increase may be due in part to the increased sample area. The recruitment of young increased from 0% of the population to 10%, and decadence increased from 18% to 23%. Plants classified as having poor vigor increased from 0% of the population to 20%. Browse use was mostly light. Nevada ephedra density declined 52%. The recruitment of young decreased from 40% of the population to 0%., and decadence decreased from 20% to zero. Plant vigor was excellent, and browse use was mostly ight. The grass trend is up. The sum of the nested frequency of perennial grasses increased 68%, and the nested frequency of galleta and needle-and-thread grass increased significantly. The forb trend is stable. The nested frequency for perennial forbs changed little. Annual forbs were measured for the first time. The Desirable Components Index (DCI) score was poor due to the overall lack of browse species, moderate annual grass cover, and lack of perennial forb cover.

winter range condition (DCI) - poor (15) Low potential scale
browse - stable (0) grass - up (+2) forb - stable (0)

2002 TREND ASSESSMENT

The browse trend is slightly down. Shadscale density declined 19%. The recruitment of young increased to 30% of the population and decadence increased to 44%. The number of dead plants sampled increased to 1,060 plants/acre (2,618 plants/ha). Plants classified as having poor vigor increased to 35% of the population, and browse use remained mostly light. Nevada ephedra density doubled. The recruitment of young increased to 25% of the population, and decadence increased to 13%. Plants classified with poor vigor increased from 0% of the population to 75%,and browse use increased to mostly moderate. The grass trend is slightly down. Perennial grasses decreased 23% in the sum of nested frequency. Cheatgrass nested frequency also decreased significantly, though not as greatly as that of perennial grasses. The forb trend is stable. No perennial forbs were sampled in 2002. However, storksbill nested frequency significantly increased. The DCI rating was very poor due to low browse cover, low perennial grass and forb cover, and moderate annual grass.

winter range condition (DCI) - very poor (7) Low potential scale
browse - slightly down (-1) grass - slightly down (-1) forb - stable (0)

2007 TREND ASSESSMENT

The browse trend is down. The shadscale density decreased 30%. The recruitment of young decreased to 0% of the population, and decadence decreased to 38%. Plants with poor vigor increased to 48% of the population, and use remained mostly light. The density of Nevada ephedra did not change. The recruitment of young

increased to 31% of the population, and decadence increased to 19%. Plants classified as having poor vigor declined to 50%, and browse use decreased to mostly light. The density of winterfat increased from 40 plants/acre (99 plants/ha) to 260 plants/acre (644 plants/ha). The grass trend is slightly up. The nested frequency of perennial grasses increased 25%, with significant increases in the nested frequencies of Sandberg bluegrass and bottlebrush squirreltail. However, cheatgrass nested frequency also increased significantly. The forb trend is stable. The perennial forb component consisted of two longleaf phlox (*Phlox lonifolia*) plants. Storksbill nested frequency increased significantly, and cover increased from 2% to 5%. The DCI score remained very poor.

winter range condition (DCI) - very poor (6) Low potential scale
browse - down (-2) grass - slightly up (+1) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 19A, Study no: 7

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
G	Bromus tectorum (a)	-	$_{b}$351	$_{a}$304	$_{b}$342	6.15	2.00	8.62
G	Hilaria jamesii	$_{a}$59	$_{b}$119	$_{ab}$78	$_{ab}$84	4.03	.97	1.47
G	Oryzopsis hymenoides	$_{b}$63	$_{ab}$47	$_{a}$27	$_{a}$25	1.81	.60	.39
G	Poa secunda	-	$_{a}$5	$_{a}$6	$_{b}$24	.06	.04	.23
G	Sitanion hystrix	$_{ab}$15	$_{ab}$17	$_{a}$2	$_{b}$28	.34	.03	1.06
G	Sporobolus cryptandrus	-	$_{a}$3	$_{b}$24	$_{b}$37	.06	.20	.66
G	Stipa comata	$_{a}$8	$_{b}$52	$_{b}$50	$_{ab}$36	1.50	1.16	.92
Total for Annual Grasses		0	351	304	342	6.15	2.00	8.62
Total for Perennial Grasses		145	243	187	234	7.82	3.01	4.75
Total for Grasses		145	594	491	576	13.98	5.01	13.37
F	Alyssum alyssoides (a)	-	$_{a}$11	$_{a}$5	$_{b}$69	.02	.01	.33
F	Astragalus sp.	$_{a}$3	$_{a}$1	-	-	.03	-	-
F	Erodium cicutarium (a)	-	$_{a}$83	$_{b}$239	$_{c}$296	1.17	1.92	4.83
F	Erigeron sp.	-	7	-	-	.03	-	-
F	Gilia sp. (a)	-	-	-	3	-	-	.00
F	Halogeton glomeratus (a)	$_{a}$13	$_{a}$3	-	$_{a}$1	.00	-	.03
F	Lappula occidentalis (a)	-	-	-	6	-	-	.01
F	Phlox longifolia	-	-	-	2	-	-	.00
F	Sphaeralcea grossulariifolia	$_{a}$9	$_{a}$2	-	-	.03	-	-
F	Unknown forb-perennial	2	-	-	-	-	-	-
Total for Annual Forbs		13	97	244	375	1.20	1.93	5.21
Total for Perennial Forbs		14	10	0	2	0.09	0	0.00
Total for Forbs		27	107	244	377	1.29	1.93	5.22

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

BROWSE TRENDS --
Management unit 19A, Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Atriplex confertifolia	42	33	26	2.31	.72	.52
B	Ceratoides lanata	3	2	4	-	-	.15
B	Chrysothamnus viscidiflorus stenophyllus	5	4	6	.53	.30	.33
B	Echinocereus sp.	0	9	8	-	.01	.04
B	Ephedra nevadensis	6	10	10	.78	1.25	1.86
B	Gutierrezia sarothrae	87	72	81	4.98	2.21	3.49
B	Kochia americana	0	5	1	.03	.03	-
B	Opuntia sp.	18	24	23	1.03	.82	.67
B	Tetradymia spinosa	5	5	6	1.34	.21	.42
Total for Browse		166	164	165	11.01	5.58	7.49

CANOPY COVER, LINE INTERCEPT --
Management unit 19A, Study no: 7

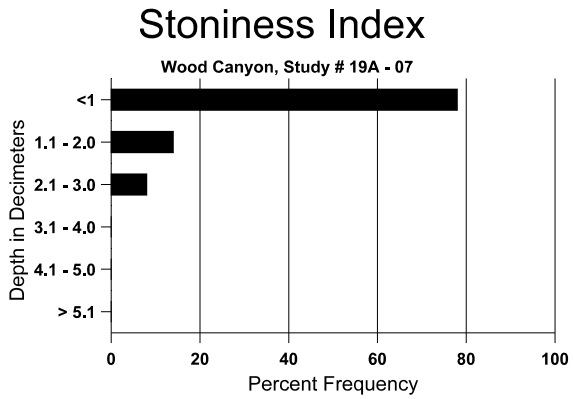
Species	Percent Cover	
	'02	'07
Atriplex confertifolia	.81	.68
Ceratoides lanata	-	.01
Chrysothamnus viscidiflorus stenophyllus	.16	.30
Ephedra nevadensis	1.75	1.29
Gutierrezia sarothrae	2.29	4.15
Kochia americana	.43	-
Opuntia sp.	.80	.31
Tetradymia spinosa	-	1.14

BASIC COVER --
Management unit 19A, Study no: 7

Cover Type	Average Cover %			
	'89	'97	'02	'07
Vegetation	7.25	29.85	13.73	27.17
Rock	23.25	29.92	34.00	31.52
Pavement	38.75	23.06	27.17	23.67
Litter	23.50	21.44	18.53	23.85
Cryptogams	0	.31	.44	.01
Bare Ground	7.25	6.78	13.98	3.96

SOIL ANALYSIS DATA --
Herd Unit 19A, Study no: 7, Wood Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
10.4	71.0 (11.3)	7.4	50.0	31.4	18.6	1.5	9.2	233.6	.8



PELLET GROUP DATA --
Management unit 19A, Study no: 7

Type	Quadrat Frequency			Days use per acre (ha)	
	'97	'02	'07	'02	'07
Rabbit	4	4	8	-	-
Horse	-	1	1	-	1 (1)
Elk	2	-	-	1 (2)	3 (8)
Deer	9	10	-	10 (25)	2 (5)
Cattle	-	-	1	8 (20)	6 (14)
Antelope	-	-	6	4 (10)	11 (28)

BROWSE CHARACTERISTICS --
Management unit 19A, Study no: 7

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	13/20
02	**0**	-	-	-	-	60	0	0	-	-	0	8/17
07	**0**	-	-	-	-	180	0	0	-	-	0	11/27

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Atriplex confertifolia												
89	**1133**	-	-	933	200	-	0	0	18	-	0	10/17
97	**1400**	20	140	940	320	500	14	7	23	17	20	10/23
02	**1140**	-	340	300	500	1060	4	4	44	33	35	6/15
07	**800**	-	-	500	300	220	3	0	38	28	48	7/19
Ceratoides lanata												
89	**99**	-	-	66	33	-	0	0	33	-	0	11/15
97	**60**	-	-	60	-	-	33	0	0	-	0	9/10
02	**40**	-	-	20	20	-	0	100	50	50	50	5/10
07	**260**	-	-	260	-	-	0	8	0	-	0	6/10
Chrysothamnus viscidiflorus stenophyllus												
89	**100**	-	-	100	-	-	0	0	0	-	0	8/10
97	**100**	-	-	80	20	-	0	0	20	20	20	48/16
02	**80**	-	-	40	40	40	0	25	50	25	25	7/17
07	**120**	-	-	100	20	-	17	0	17	-	17	8/17
Echinocereus sp.												
89	**66**	-	66	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**200**	-	40	160	-	-	0	0	-	-	0	3/6
07	**160**	20	20	140	-	20	0	0	-	-	0	3/6
Ephedra nevadensis												
89	**332**	-	133	133	66	-	0	0	20	-	0	11/21
97	**160**	-	-	160	-	-	13	0	0	-	0	17/35
02	**320**	-	80	200	40	-	56	6	13	13	75	18/46
07	**320**	-	100	160	60	-	13	19	19	-	50	18/48
Gutierrezia sarothrae												
89	**4533**	-	800	2700	1033	-	0	0	23	2	12	7/6
97	**5200**	60	360	4160	680	860	0	0	13	10	11	8/12
02	**3320**	-	140	2240	940	900	0	.60	28	14	33	5/9
07	**4040**	-	120	3360	560	80	.49	0	14	5	5	8/14
Kochia americana												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**240**	-	140	100	-	-	0	8	-	-	0	5/8
07	**40**	-	-	40	-	-	100	0	-	-	0	9/15

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Opuntia sp.												
89	**599**	-	333	233	33	-	0	0	6	6	6	5/12
97	**460**	-	40	400	20	-	0	0	4	4	4	10/17
02	**500**	-	80	340	80	40	0	0	16	8	20	4/13
07	**520**	-	-	440	80	80	4	0	15	8	12	5/15
Tetradymia glabrata												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	10/23
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Tetradymia spinosa												
89	**66**	-	-	-	66	-	0	0	100	-	0	-/-
97	**100**	-	-	60	40	-	20	0	40	20	20	16/29
02	**100**	-	-	-	100	20	0	0	100	60	100	18/32
07	**120**	-	-	-	120	20	0	0	100	100	100	17/47
Yucca sp.												
89	**33**	-	-	33	-	-	0	0	-	-	0	18/37
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	21/23

Trend Study 19A-9-07

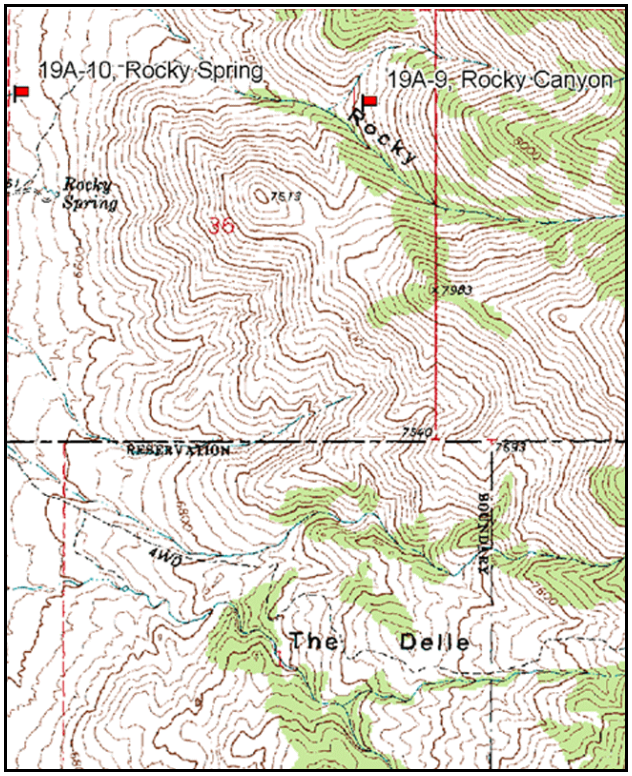
Study site name: Rocky Canyon Vegetation type: Mountain Big Sagebrush

Compass bearing: frequency baseline 110 degrees magnetic.

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

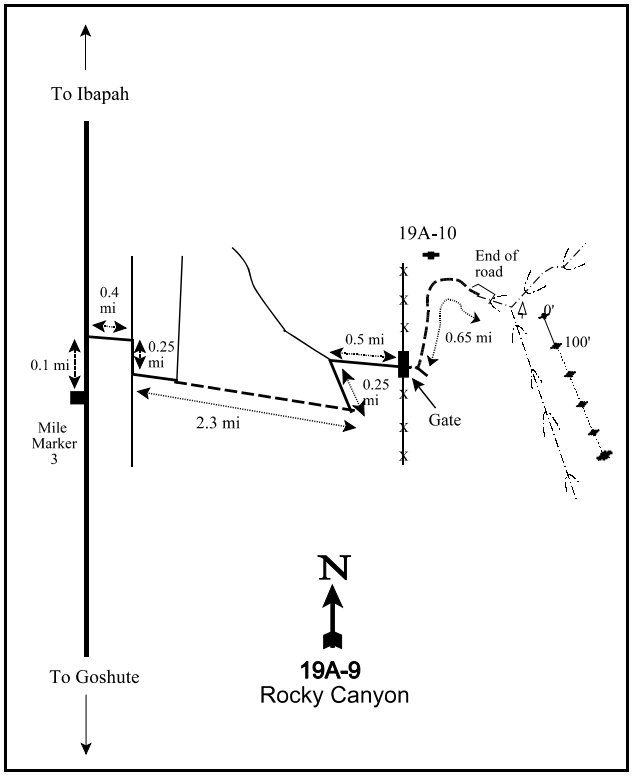
LOCATION DESCRIPTION

From the main road between Ibapah and Goshute, turn east onto a road that is 0.1 mile north of mile marker 3. Go for 0.4 mile to an intersection. Turn right and go 0.25 mile to another intersection. Turn left and go 2.3 miles on a 4WD road that is faint in places to another intersection. Turn right and go 0.25 miles to another intersection. Turn right and go 0.50 to a gate. Drive through the gate and follow the road to the left for 0.65 miles, passing a witness post on your way on the left side of the road. This witness post is for 19A-10. At 0.65 mile (0.4 miles after the witness post) the road comes to an end. Park here and walk easterly in the drainage. The drainage will split, from here walk 200 feet eastward out of the drainage toward a lone juniper. The 0-foot stake is 20ft east of the juniper. The 0-foot stake is marked by browse tag #413.



Map Name: Goshute

Township 10S , Range 19W , Section 36



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 249542 E 4422646 N

DISCUSSION

Rocky Canyon - Trend Study No. 19A-9

Study Information

This study was established in 2002 to monitor elk use on the west side of the Deep Creek Mountains. It is located within a natural travel corridor for elk that move down onto the lower flats during winter months, and monitors a mountain big sagebrush-grass community [elevation: 7,200 feet (2,187 m), slope: 34%, aspect: southwest]. From the pellet group transect, elk use was estimated at 25 days use/acre (63 edu/ha) in 2002 and 2007. Deer use was estimated at 16 days use/acre (40 ddu/ha) in 2002 and 21 days use/acre (51 ddu/ha) in 2007. Cattle use was estimated at 4 days use/acre (9 cdu/ha) in 2002 and 1 day use/acre (2 cdu/ha) in 2007. Cattle were grazing the area heavily in 2002, especially within the canyon bottom leading up to the site. Most of the deer and elk pellets were from winter and spring. An elk carcass was noted in 2007.

Soil

The soil is in the Podmor series, which consists of moderately deep, well-drained, moderately permeable soils that formed in colluvium and residuum, and are derived dominantly from quartzite (USDA-NRCS 2007). The soil is dark brown/gray in color, loam in texture, and slightly acidic in reactivity (pH 6.4). It is very rocky both on the surface and throughout the profile. The abundant vegetation, litter, and rock cover aid in minimizing erosion on this steep slope. Relative bare ground cover was low at 8% in 2002 and 10% in 2007. The erosion condition was classified as stable in 2002. In 2007, the erosion condition was classified as slight due to pedestalling around vegetation, flow patterns, and slight transportation of surface rock fragments.

Browse

The browse component is dominated by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Mountain big sagebrush had an estimated density of 5,340 plants/acre (13,190 plants/ha) in 2002 and 3,100 plants/acre (7,657 plants/ha) in 2007. Recruitment has been low, ranging from 6%-8%. Percent decadence was 21% in 2002, and 35% in 2007. Plants classified as having poor vigor has ranged from 13%-28% of the population. In 2007, the sagebrush defoliator moth (*Aroga websteri*) was sampled on 11% of the population. Utilization has been light-moderate. Annual leader growth averaged just under 2 inches (5 cm) in 2002 and just over 1 inch (3 cm) in 2007.

Black sagebrush (*Artemisia nova*) had an estimated density of 440 plants/acre (1,087 plants/ha) in 2002 and 1,260 plant/acre (3,112 plants/ha) in 2007. Decadence was moderate at 18% of the population in 2002 and 27% in 2007. Plants classified with poor vigor made up 5% of the population in 2002 and 17% in 2007. With the fluctuation in sagebrush densities from 2002 to 2007 it may be possible that there was some hybridization between the two species or miss identification.

Other browse sampled include Myrtle pachistima (*Pachistima myrsinites*), gray rabbitbrush (*Chrysothamnus nauseosus* ssp. *hololeucus*), slenderbush eriogonum (*Eriogonum microthecum)*, broom snakeweed (*Gutierrezia sarothrae*), Oregon grape (*Mahonia repens*), and pediocactus (*Pediocactus simpsonii*).

Herbaceous Understory

The herbaceous understory has fair diversity. Bluebunch wheatgrass (*Agropyrom spicatum*), Sandberg bluegrass (*Poa secunda*), and mutton bluegrass (*Poa fendleriana*) are the dominant perennial grasses. Bluebunch wheatgrass is the dominant grass species. It provided approximately 7% cover in 2002 and 2007. Sandberg bluegrass increased from 5% cover in 2002 to 7% in 2007. Bulbous bluegrass was also sampled at less than 1% cover in both 2002 and 2007. Cheatgrass (*Bromus tectorum*) was sampled in 33% of the quadrats in 2002 and only 5% in 2007. It provided 1% cover in 2002 and nearly no cover in 2007.

Silvery lupine (*Lupinus argenteus*) dominates the forb component. It contributed 77% of the forb cover in 2002 and 70% in 2007. In both years much of the sampled lupine was dessicated. Utilization of the lupine by crickets was noted in 2002.

2007 TREND ASSESSMENT

The browse trend is down. The density of mountain big sagebrush decreased 42%. Percent decadence increased from to 35% of the population. The recruitment of young increased from 6% of the population to 8%, and decadence increased from 21% to 35%. Plants classified as having poor vigor increased from 13% of the population to 28%, and browse use remained mostly light. Black sagebrush density increased nearly three-fold. However, the increase in black sagebrush density was not enough to replace the loss of mountain big sagebrush. The recruitment of young remained stable at 5% of the population, but decadence increased from 18% to 27%. Plants classified as showing poor vigor increased from 5% of the population to 17%, and browse use remained light. With the fluctuation in sagebrush densities from 2002 to 2007 it may be possible that there was some hybridization between the two species or miss identification. However, overall the density of sagebrush species decreased. The grass trend is up. The sum of the nested frequency of perennial grasses increased 20% and the nested frequency of Sandberg bluegrass increased significantly. Cheatgrass decreased significantly in nested frequency, and its cover also decreased. The forb trend is up. Nested frequencies of both annual and perennial forbs increased substantially. Silvery lupine, longleaf phlox (*Phlox longifolia*), false dandelion (*Agoseris glauca*) and bastard toadflax (*Comandra pallida*) nested frequencies increased significantly. In 2002, the Desirable Components Index (DCI) score was good-excellent due to the very good browse cover, excellent perennial grass and forb cover, and minimal annual grass cover. In 2007 the DCI score decreased to good due to a large decrease in preferred browse cover.

2002 winter range condition (DCI) - good-excellent (76) Mid-level potential scale
2007 winter range condition (DCI) - good (67) Mid-level potential scale
browse - down (-2) grass - up (+2) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 19A, Study no: 9

Type	Species	Nested Frequency '02	Nested Frequency '07	Average Cover % '02	Average Cover % '07
G	Agropyron spicatum	$_{a}$108	$_{a}$124	6.46	7.21
G	Bromus tectorum (a)	$_{b}$84	$_{a}$10	1.27	.06
G	Poa bulbosa	$_{a}$9	$_{a}$17	.17	.42
G	Poa fendleriana	$_{a}$99	$_{a}$115	2.75	2.75
G	Poa secunda	$_{a}$214	$_{b}$261	4.73	7.22
Total for Annual Grasses		84	10	1.27	0.06
Total for Perennial Grasses		430	517	14.11	17.62
Total for Grasses		514	527	15.39	17.68
F	Agoseris glauca	$_{a}$3	$_{b}$20	.00	.08
F	Balsamorhiza hookeri	-	-	.00	-
F	Calochortus nuttallii	-	3	-	.01
F	Chaenactis douglasii	$_{a}$3	$_{a}$1	.03	.00
F	Comandra pallida	$_{a}$12	$_{b}$34	.07	.57

Type	Species	Nested Frequency '02	Nested Frequency '07	Average Cover % '02	Average Cover % '07
F	Collinsia parviflora (a)	$_{a}$91	$_{b}$166	.37	.39
F	Cystopteris fragilis	-	16	-	.18
F	Epilobium brachycarpum (a)	$_{a}$4	$_{a}$9	.01	.04
F	Eriogonum brevicaule	2	-	.01	-
F	Hackelia patens	$_{a}$7	$_{a}$2	.05	.03
F	Heterotheca villosa	-	2	-	.00
F	Holosteum umbellatum (a)	-	13	-	.02
F	Ipomopsis aggregata	-	4	-	.03
F	Lappula occidentalis (a)	-	5	-	.06
F	Lupinus argenteus	$_{a}$94	$_{b}$137	4.01	4.74
F	Machaeranthera canescens	$_{a}$3	$_{a}$9	.06	.04
F	Microsteris gracilis (a)	$_{a}$2	$_{a}$3	.00	.01
F	Petradoria pumila	$_{a}$3	$_{a}$5	.38	.15
F	Phlox longifolia	$_{a}$15	$_{b}$29	.06	.24
F	Senecio multilobatus	-	8	-	.17
F	Unknown forb-perennial	15	-	.14	-
Total for Annual Forbs		97	196	0.38	0.53
Total for Perennial Forbs		157	270	4.83	6.28
Total for Forbs		254	466	5.22	6.82

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

BROWSE TRENDS --
Management unit 19A, Study no: 9

Type	Species	Strip Frequency		Average Cover %	
		'02	'07	'02	'07
B	Artemisia nova	5	19	.74	1.58
B	Artemisia tridentata vaseyana	90	80	20.95	12.99
B	Chrysothamnus nauseosus hololeucus	1	1	.03	.00
B	Eriogonum microthecum	4	3	.00	.06
B	Gutierrezia sarothrae	15	18	.63	.30
B	Juniperus osteosperma	2	1	-	.18
B	Mahonia repens	39	37	.87	1.12
B	Pachistima myrsinites	8	9	1.36	.63
B	Pediocactus simpsonii	1	0	.03	.03
B	Pinus monophylla	1	1	-	.03
Total for Browse		166	169	24.62	16.94

CANOPY COVER, LINE INTERCEPT --
Management unit 19A, Study no: 9

Species	Percent Cover	
	'02	'07
Artemisia nova	2.70	1.86
Artemisia tridentata vaseyana	24.56	16.88
Chrysothamnus nauseosus hololeucus	-	.05
Eriogonum microthecum	-	.33
Gutierrezia sarothrae	1.04	.63
Juniperus osteosperma	-	1.16
Mahonia repens	.73	1.56
Pachistima myrsinites	1.66	.66

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19A, Study no: 9

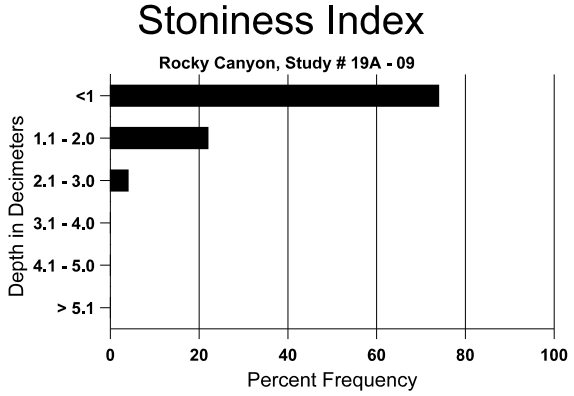
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.9	1.3

BASIC COVER --
Management unit 19A, Study no: 9

Cover Type	Average Cover %	
	'02	'07
Vegetation	42.00	37.12
Rock	27.06	33.02
Pavement	4.01	4.00
Litter	33.46	24.81
Cryptogams	.33	.20
Bare Ground	9.78	11.03

SOIL ANALYSIS DATA --
Herd Unit 19A, Study no: 9, Rocky Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
9.7	63.6 (11.5)	6.4	41.3	34.7	24.0	4.7	19.0	361.6	.7



PELLET GROUP DATA --
Management unit 19A, Study no: 9

Type	Quadrat Frequency	
	'02	'07
Rabbit	3	3
Elk	15	12
Deer	6	4
Cattle	-	2

Days use per acre (ha)	
'02	'07
-	-
25 (63)	25 (63)
16 (40)	21 (51)
4 (9)	1 (2)

BROWSE CHARACTERISTICS --
Management unit 19A, Study no: 9

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
02	**440**	-	20	340	80	-	0	0	18	5	5	8/18
07	**1260**	220	60	860	340	80	0	0	27	17	17	9/24
Artemisia tridentata vaseyana												
02	**5340**	-	340	3860	1140	700	8	3	21	12	13	21/31
07	**3100**	940	240	1780	1080	280	34	9	35	19	19	23/38
Cercocarpus montanus												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	32/51
Chrysothamnus nauseosus hololeucus												
02	**20**	-	-	20	-	-	0	0	-	-	0	17/4
07	**20**	-	-	20	-	-	0	0	-	-	100	28/30
Chrysothamnus viscidiflorus viscidiflorus												
02	**0**	-	-	-	-	-	0	0	-	-	0	16/16
07	**0**	-	-	-	-	-	0	0	-	-	0	14/18
Eriogonum microthecum												
02	**120**	-	20	100	-	-	0	0	-	-	0	7/13
07	**80**	-	-	80	-	-	0	0	-	-	0	9/14
Gutierrezia sarothrae												
02	**640**	-	-	600	40	-	0	0	6	3	6	8/12
07	**600**	20	20	560	20	-	0	0	3	-	0	7/10
Juniperus osteosperma												
02	**40**	-	20	20	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	0	0	-	-	0	-/-
Mahonia repens												
02	**6000**	-	180	5380	440	140	0	0	7	7	19	3/4
07	**6300**	-	60	6140	100	20	0	0	2	-	2	3/4
Pachistima myrsinites												
02	**2400**	20	40	2300	60	-	0	0	3	2	2	3/8
07	**1440**	-	-	1440	-	-	0	0	0	-	0	6/9
Pediocactus simpsonii												
02	**20**	-	-	20	-	-	0	0	-	-	0	2/2
07	**0**	-	-	-	-	-	0	0	-	-	0	2/3

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Pinus monophylla												
02	**20**	40	20	-	-	-	0	0	-	-	0	-/-
07	**40**	-	40	-	-	-	0	0	-	-	0	-/-
Purshia tridentata												
02	**0**	-	-	-	-	-	0	0	-	-	0	29/90
07	**0**	-	-	-	-	-	0	0	-	-	0	29/78
Rosa woodsii												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	14/23
Sambucus racemosa												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	52/61

Trend Study 19A-10-07

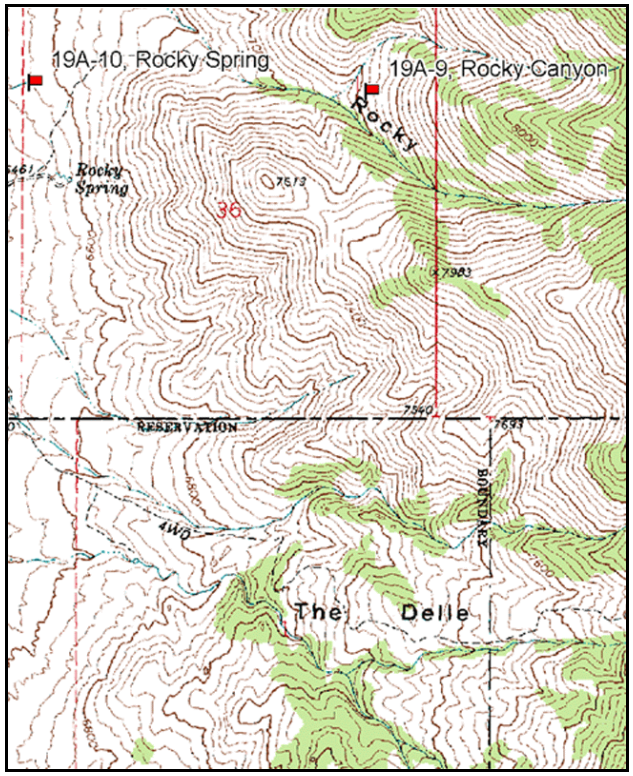
Study site name: Rocky Spring . Vegetation type: Mountain Big Sagebrush .

Compass bearing: frequency baseline 326 degrees magnetic.

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

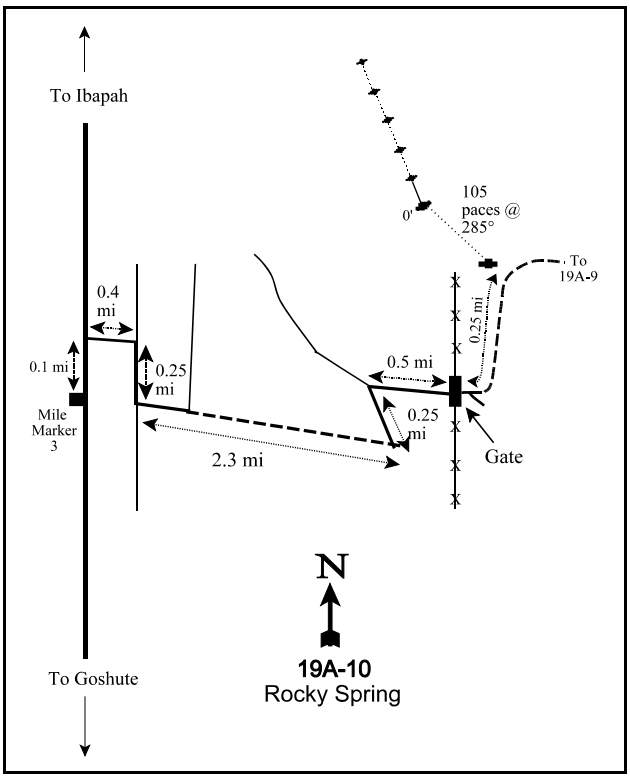
LOCATION DESCRIPTION

From the main road between Ibapah and Goshute, turn east onto a road that is 0.1 mile north of mile marker 3. Go for 0.4 mile to an intersection. Turn right and go 0.25 mile to another intersection. Turn left and go 2.3 miles on a 4WD road that is faint in places to another intersection. Turn right and go 0.25 miles to another intersection. Turn right and go 0.50 to a gate. Drive through the gate and follow the road to the left for 0.65 miles, passing a witness post on your way on the left side of the road. From the witness post, walk 105 paces at 285 degrees magnetic to the 0-foot stake.



Map Name: Goshute

Township 10S , Range 19W , Section 36



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 248241 E 4422727 N

DISCUSSION

Rocky Spring - Trend Study No. 19A-10

Study Information

This study was established in 2002 to monitor winter big game use, primarily by elk, on the west side of the Deep Creek Mountains. It lies on an alluvial fan at the mouth of Rocky Canyon [elevation: 6,500 feet (1,974 m), slope: 11%, aspect: southwest]. The study samples a mountain big sagebrush flat that receives moderate to heavy deer and elk use during the winter. From the pellet group transect, elk use was estimated at 33 elk days use/acre (83 edu/ha) in 2002 and 35 elk days use/acre (86 edu/ha) in 2007. Deer use was estimated at 67 deer days use/acre (165 ddu/ha) in 2002 and 58 deer days use/acre (144 ddu/ha) in 2007. Cattle use was estimated at 3 cattle days use/acre (9 cdu/ha) in 2002 and 2 cattle days use/acre (5 cdu/ha) in 2007. In both readings, most deer and elk pellet groups were from winter and spring use. Cattle were present in 2007 when the study was sampled.

Soil

The soil is in the Holmes series, which consists of very deep, well-drained, moderately permeable soils that formed in mixed alluvium (USDA-NRCS 2007). It is dark brown/gray in color and very rocky, both on the surface and throughout the profile. The soil has a loam texture and is slightly acidic in reactivity (pH of 6.5). Combined relative vegetation and litter cover has been high, averaging 74% in 2002 and 61% in 2007. Relative bare ground cover was 9% in 2002 and 16% in 2007. The erosion condition was classified as stable in 2002, and increased to slight in 2007 due to the formation of a small gully, and pedestalling.

Browse

The dominant browse is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Sagebrush density was 2,840 plants/acre (7,015 plants/ha) in 2002 and 2,220 plants/acre (5,483 plants/ha) in 2007. It accounted for 97% of the browse cover and 55% of the total vegetation cover in 2002. In 2007, these values had decreased slightly to 95% and 44%. Young plants made up 2% of the population in 2002 and 13% in 2007. Decadent plants decreased from 42% of the population in 2002 to 36% in 2007. Plants classified as dying made up 19% of the population in 2002 and 2007. Plants with poor vigor increased from 19% of the population in 2002 to 27% in 2007. Utilization has been mostly light-moderate. Annual leaders averaged about 1.5 inches (3.8 cm) of growth in 2002 and about 2 inches (5 cm) in 2007.

Other browse sampled include broom snakeweed (*Gutierrezia sarothrae*), pricklypear cactus (*Opuntia* spp.), pediocactus (*Pediocatus simpsonii*), and wild rose (*Rosa woodsii*). Utah juniper (*Juniperus osteosperma*) and singleleaf pinyon (*Pinus monophylla*) are scattered throughout the area. A point-centered quarter estimate of tree density in 2007 estimated Utah juniper at 28 trees/acre (69 plants/ha) and singleleaf pinyon pine at 32 tress/acre (79 plants/ha). In 2007, the average trunk diameter for juniper was 6.9 inches (17.5 cm) and that for pinyon was 3.4 inches (8.6 cm).

Herbaceous Understory

The understory has poor diversity with few forage species. Eight species of grasses and 11 species of forbs have been sampled, but four species dominate the understory. Cheatgrass (*Bromus tectorum*) made up 44% of the total grass cover in 2002 and 24% in 2007. Bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*) are the only abundant perennial grass species. Both species had a patchy distribution, but increased in cover from 2002 to 2007.

Silvery lupine (*Lupinus argenteus*) was the most abundant forb in 2002 and 2007. It provided 3% cover in 2002 and 4% cover in 2007. Other forbs sampled include aster (*Aster* spp.), milkweed (*Asclepias* spp.), bastard toadflax (*Comandra pallida*), and skeleton weed (*Lygodesmia* spp.). Forbs provided 5%-6% of the total ground cover both years.

2007 TREND ASSESSMENT

The browse trend is down. Mountain big sagebrush, the dominant key browse species, decreased in density by 22%. The population was comprised mostly of mature and decadent plants. Plants classified as dying did not change and fewer decadent plants were sampled. The recruitment of young increased from 2% of the population to 13%, and decadence decreased from 42% to 36%. Plants classified with poor vigor increased from 19% of the population to 27, and browse use remained mostly light. The grass trend was up. The sum of the nested frequency of perennial grasses with the exception of bulbous bluegrass increased 22%, and perennial grass cover increased from 6% to 10%. Cheatgrass nested frequency significantly decreased. The forb trend is stable with no significant change in the nested frequencies of individual species. Silvery lupine continued to be the dominate forb species. In 2002, the Desirable Components Index (DCI) score was poor-fair due to high browse cover, low annual grass cover, and good perennial grass and forb cover. In 2007, the DCI score increased to fair due to improved recruitment of young browse into the population, increased perennial grass cover, and decreased cheatgrass cover.

2002 winter range condition (DCI) - poor-fair (47) Mid-level potential scale
2007 winter range condition (DCI) - fair (59) Mid-level potential scale
browse - down (-2) grass - up (+2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 19A, Study no: 10

Type	Species	Nested Frequency '02	Nested Frequency '07	Average Cover % '02	Average Cover % '07
G	Agropyron spicatum	a83	a90	3.09	3.94
G	Bromus tectorum (a)	b250	a173	5.00	3.75
G	Poa bulbosa	-	8	-	.18
G	Poa fendleriana	a28	a26	.34	.59
G	Poa pratensis	-	26	-	.96
G	Poa secunda	a162	a173	2.84	4.04
G	Sitanion hystrix	a1	b19	.15	.42
G	Vulpia octoflora (a)	a3	b20	.01	.04
Total for Annual Grasses		253	193	5.01	3.79
Total for Perennial Grasses		274	342	6.43	10.15
Total for Grasses		527	535	11.45	13.96
F	Agoseris glauca	-	2	-	.03
F	Asclepias sp.	a8	a4	.15	.15
F	Aster sp.	a21	a20	.54	.51
F	Comandra pallida	a18	a15	.29	.31
F	Cryptantha sp.	-	1	-	.00
F	Eriogonum brevicaule	a3	a2	.00	.00
F	Gayophytum ramosissimum(a)	-	1	-	.00
F	Lupinus argenteus	a59	a68	2.92	3.87
F	Lygodesmia sp.	a20	a13	.72	.72

Type	Species	Nested Frequency '02	Nested Frequency '07	Average Cover % '02	Average Cover % '07
F	Senecio multilobatus	-	5	-	.08
F	Zigadenus paniculatus	-	3	-	.06
Total for Annual Forbs		0	1	0	0.00
Total for Perennial Forbs		129	133	4.64	5.75
Total for Forbs		129	134	4.64	5.76

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

BROWSE TRENDS --
Management unit 19A, Study no: 10

Type	Species	Strip Frequency '02	Strip Frequency '07	Average Cover % '02	Average Cover % '07
B	Artemisia nova	3	3	-	.06
B	Artemisia tridentata vaseyana	75	71	20.21	15.91
B	Cercocarpus montanus	1	0	-	-
B	Gutierrezia sarothrae	14	8	.51	.09
B	Juniperus osteosperma	1	1	-	-
B	Leptodactylon pungens	1	0	-	-
B	Opuntia sp.	12	9	.07	.09
B	Pediocactus simpsonii	2	3	.06	.03
B	Pinus monophylla	3	2	-	.03
B	Rosa woodsii	4	5	.06	.48
Total for Browse		116	102	20.92	16.71

CANOPY COVER, LINE INTERCEPT --
Management unit 19A, Study no: 10

Species	Percent Cover '02	Percent Cover '07
Artemisia nova	1.00	.06
Artemisia tridentata vaseyana	18.60	18.83
Cercocarpus ledifolius	-	.80
Gutierrezia sarothrae	.25	.21
Opuntia sp.	-	.03
Pinus monophylla	.46	.85
Rosa woodsii	.20	.66

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19A, Study no: 10

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.6	1.9

POINT-QUARTER TREE DATA --
Management unit 19A, Study no: 10

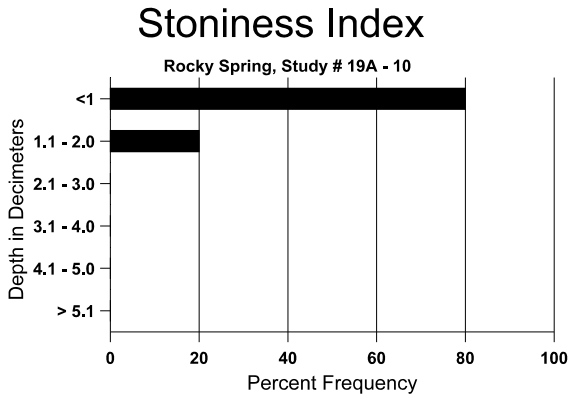
Species	Trees per Acre		Average diameter (in)	
	'02	'07	'02	'07
Juniperus osteosperma	-	28	-	6.9
Pinus monophylla	-	32	-	3.4

BASIC COVER --
Management unit 19A, Study no: 10

Cover Type	Average Cover %	
	'02	'07
Vegetation	34.56	33.98
Rock	16.34	21.75
Pavement	2.91	4.01
Litter	52.09	35.54
Cryptogams	.35	.04
Bare Ground	10.96	18.00

SOIL ANALYSIS DATA --
Herd Unit 19A, Study no: 10, Rocky Spring

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
7.0	69.0 (8.3)	6.5	45.3	36.7	18.0	4.6	20.4	233.6	.8



PELLET GROUP DATA --
Management unit 19A, Study no: 10

Type	Quadrat Frequency		Days use per acre (ha)	
	'02	'07	'02	'07
Rabbit	6	26	-	-
Elk	26	19	33 (83)	35 (86)
Deer	15	13	67 (165)	58 (144)
Cattle	2	-	4 (9)	2 (5)

BROWSE CHARACTERISTICS --
Management unit 19A, Study no: 10

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
02	**120**	-	-	100	20	-	0	0	17	-	0	-/-
07	**80**	-	-	80	-	20	0	0	0	-	0	8/15
Artemisia tridentata vaseyana												
02	**2840**	20	60	1600	1180	1040	18	3	42	19	19	22/38
07	**2220**	1300	280	1140	800	640	33	3	36	19	27	23/45
Ceratoides lanata												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	4/23
Cercocarpus montanus												
02	**20**	-	-	20	-	-	100	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	8/19
Gutierrezia sarothrae												
02	**640**	-	-	560	80	40	16	0	13	6	6	9/14
07	**200**	-	-	200	-	100	0	0	0	-	0	9/11
Juniperus osteosperma												
02	**20**	-	20	-	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	0	0	-	-	0	-/-
Leptodactylon pungens												
02	**120**	-	-	120	-	-	0	0	-	-	0	7/11
07	**0**	-	-	-	-	20	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Opuntia sp.												
02	**260**	-	40	220	-	-	0	0	-	-	0	5/9
07	**220**	-	20	200	-	-	18	0	-	-	18	4/12
Pediocactus simpsonii												
02	**40**	-	-	40	-	-	0	0	-	-	0	2/4
07	**100**	-	-	100	-	-	0	0	-	-	0	2/7
Pinus monophylla												
02	**60**	-	60	-	-	-	0	0	-	-	0	-/-
07	**40**	-	20	20	-	-	0	0	-	-	0	-/-
Rosa woodsii												
02	**640**	-	-	640	-	-	0	0	0	-	0	10/12
07	**360**	-	40	300	20	-	0	0	6	-	0	12/17

Trend Study 19A-11-07

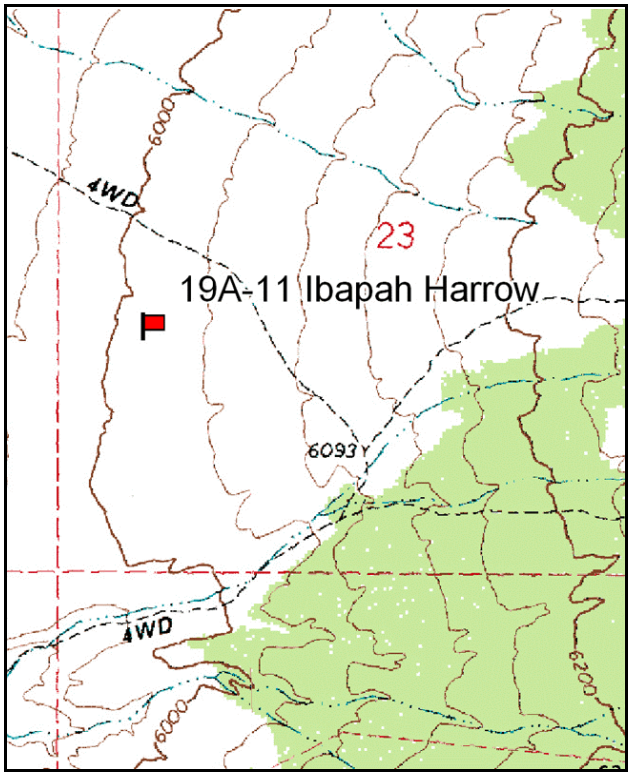
Study site name: Ibapah Harrow . Vegetation type: Wyoming Sagebrush .

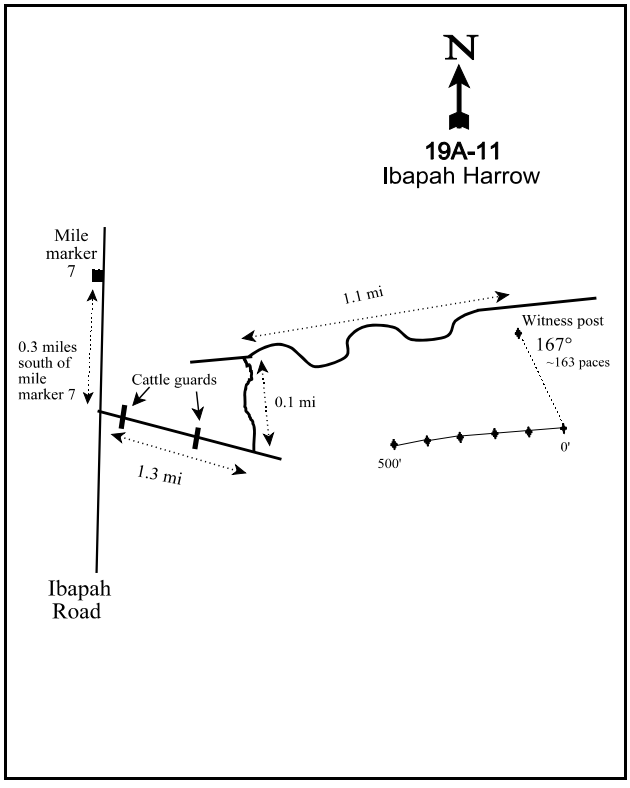
Compass bearing: frequency baseline 269 degrees magnetic.

Frequency belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), and line 5 (95ft). Rebar: none

LOCATION DESCRIPTION

From Ibapah, proceed south just past mile marker 6; turn right onto a road 0.3 miles south of mile marker 7. Drive east for 1.3 miles, crossing two cattle guards along the way. Turn left and go for 0.1 miles. Turn right and go for 1.1 miles to the witness post on the right side of the road. From the witness post, walk approximately 163 paces at 167 degrees magnetic to the 0-foot stake.





Map Name: Goshute

Diagrammatic Sketch

Township 10S , Range 19W , Section 23

GPS: NAD 83, UTM 12S 246911 E 4425299 N

DISCUSSION

Ibapah Harrow - Trend Study No. 19A-11

Study Information

This study was established in 2007 to monitor the effects of a Dixie harrow on Wyoming big sagebrush community, and is located on the west side of the Deep Creek Mountains [elevation: 6,020 feet (1,835 m), slope: 4%, aspect: west]. It receives winter big game use, primarily by elk. From the pellet group transect elk use was estimated at 17 days use/acre (41 edu/ha) in 2007. Deer use was estimated at 1 day use/acre (2 ddu/ha) in 2007. Elk and deer pellets were from winter and spring. Though not sampled, cattle pats from the previous summer were noted.

Soils

The soil is of the Hiko Peak series, which consist of very deep, well-drained soils that formed in alluvium and colluvium derived dominantly from igneous rocks, limestone, and quartzite (USDA-NRCS 2007). The soil has a loam texture and is mildly alkaline in reactivity (pH 7.5). The soil is light tan in color, with moderately abundant white rock on the surface and throughout the profile. The erosion condition was classified as slight in 2007. The soil showed moderate pedestalling and light soil and litter movement. Relative bare ground cover was moderate-high at 37% in 2007.

Browse

The dominant browse is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). It made up 68% of the total vegetative cover in 2007. Sagebrush density was estimated at 6,220 plants/acre (15,363 plants/ha), 55% of which were decadent and 41% were mature. Recruitment was low with only 4% being classified as young. Plants classified as dying made up 20% of the population, and those with poor vigor made up 28%. Annual leaders averaged approximately 1 inch (2.5 cm). Use was mostly light-moderate. Other sampled browse species were narrowleaf low rabbitbrush (*Chrysothamnus viscidflorus* ssp. *stenophyllus*) and broom snakeweed (*Gutierrezia sarothrae*).

Herbaceous Understory

The understory diversity is poor with few forage species. The dominant grass is Sandberg bluegrass (*Poa secunda*), which was in 95% of the quadrats sampled and accounted for 79% of the total grass cover. Other perennial grasses sampled include Indian ricegrass (*Oryzopsis hymenoides*) and crested wheatgrass (*Agropyron cristatum*). Nested frequency for cheatgrass (*Bromus tectorum*) was also very high and was sampled in 81% of the quadrats. Due to its small stature, cheatgrass made up only 15% of the total grass cover.

The forb component is sparse. It provided 2% of the total vegetation cover. Hoods phlox (*Phlox hoodii*) was the most abundant forb in 2007.

2007 PRE-TREATMENT ASSESSMENT

The winter range condition determined by the Desirable Components Index (DCI) score was fair. Browse cover was high. Wyoming big sagebrush provided 23% line-intercept cover. Fifty five percent of the population was decadent and the recruitment of young to the population was low at 4%. Plant use was light-moderate. The perennial grasses provided 7% average cover, and annual grass cover was 1%. Grasses provided 30 % of the total vegetation cover. Perennial forb cover was poor, providing less than 1% cover.

2007 winter range condition (DCI) - fair (41) Low potential scale

HERBACEOUS TRENDS --
Management unit 19A, Study no: 11

Type	Species	Nested Frequency '07	Average Cover % '07
G	Agropyron cristatum	8	.40
G	Agropyron spicatum	5	.00
G	Bromus tectorum (a)	267	1.31
G	Oryzopsis hymenoides	3	.03
G	Poa fendleriana	5	.03
G	Poa secunda	303	6.94
Total for Annual Grasses		267	1.31
Total for Perennial Grasses		324	7.41
Total for Grasses		591	8.73
F	Arabis sp.	3	.00
F	Castilleja flava	16	.16
F	Castilleja linariaefolia	1	.03
F	Calochortus nuttallii	4	.02
F	Cymopterus sp.	2	.00
F	Erigeron pumilus	6	.07
F	Phlox hoodii	21	.21
F	Phlox longifolia	34	.09
F	Ranunculus testiculatus (a)	27	.06
F	Tragopogon dubius	1	.03
F	Zigadenus paniculatus	1	.03
Total for Annual Forbs		27	0.06
Total for Perennial Forbs		89	0.66
Total for Forbs		116	0.72

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

BROWSE TRENDS --
Management unit 19A, Study no: 11

Type	Species	Strip Frequency '07	Average Cover % '07
B	Artemisia tridentata wyomingensis	92	19.94
B	Chrysothamnus viscidiflorus stenophyllus	37	1.93
B	Gutierrezia sarothrae	0	.03
Total for Browse		129	21.91

CANOPY COVER, LINE INTERCEPT --
Management unit 19A, Study no: 11

Species	Percent Cover '07
Artemisia tridentata wyomingensis	22.91
Chrysothamnus viscidiflorus stenophyllus	2.18

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19A, Study no: 11

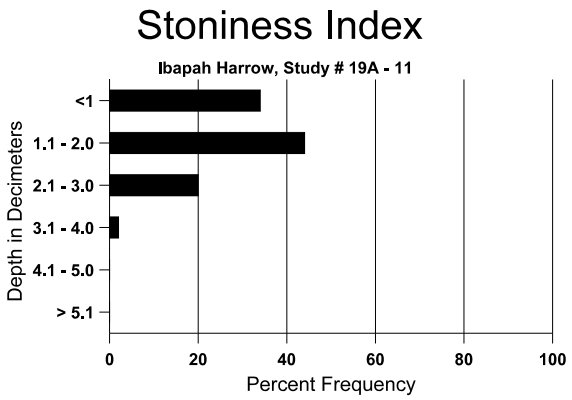
Species	Average leader growth (in) '07
Artemisia tridentata wyomingensis	0.8

BASIC COVER --
Management unit 19A, Study no: 11

Cover Type	Average Cover % '07
Vegetation	32.28
Rock	.88
Pavement	2.48
Litter	26.07
Cryptogams	6.70
Bare Ground	40.35

SOIL ANALYSIS DATA --
Herd Unit 19A, Study no: 11, Ibapah Harrow

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
-	-	7.5	27.4	26.6	46.0	1.5	9.2	249.6	.5



PELLET GROUP DATA --
Management unit 19A, Study no: 11

Type	Quadrat Frequency '07	Days use per acre (ha) '07
Rabbit	18	-
Elk	5	17 (41)
Deer	4	1 (2)

BROWSE CHARACTERISTICS --
Management unit 19A, Study no: 11

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
07	**6220**	380	260	2560	3400	1240	36	0	55	20	28	19/31
Cercocarpus ledifolius												
07	**0**	-	-	-	-	-	0	0	-	-	0	39/54
Chrysothamnus viscidiflorus stenophyllus												
07	**1160**	-	20	620	520	40	2	0	45	14	19	11/16
Gutierrezia sarothrae												
07	**0**	-	-	-	-	-	0	0	-	-	0	7/6

SUMMARY

WILDLIFE MANAGEMENT UNIT - 19A - WEST DESERT, DESERT MOUNTAIN RANGES

Community types

Studies for management subunit 19A are in and around the Deep Creek mountain range of the west desert, on the Utah-Nevada border. Six trend studies were monitored in 2007. Two were dominated by mountain big sagebrush, one by basin big sagebrush, one by Wyoming big sagebrush, one by Stansbury cliffrose and black sagebrush, and one by desert shrub.

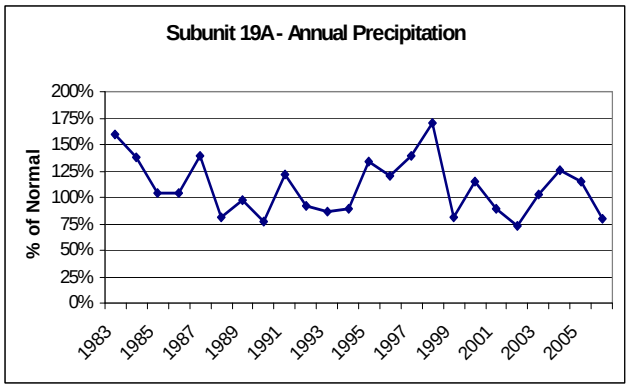


Figure 1. Percent of total annual precipitation for West Desert unit 19A from weather stations at Ibapah, Callao and Partoun (Utah Climate Summaries 2007).

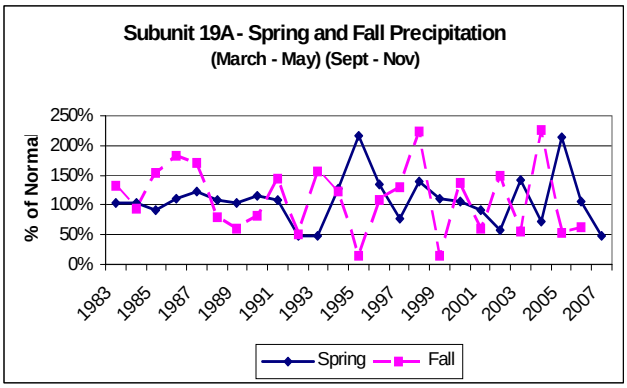


Figure 2. Percent for spring and fall precipitation for West Desert unit 19A from weather stations at Ibapah, Callao, and Partoun (Utah Climate Summaries 2007).

Precipitation

Precipitation data collected at weather stations in Ibapah, Callao and Partoun show alternating wet and dry cycles from 1983 to 2007 (Figures 1 and 2). Precipitation is the single most important factor determining the type and productivity of vegetation in and area (Holechek, 2004). The average annual precipitation for the subunit was near or below 75% of normal (drought conditions) in 1990 and 2002 (Figure 1). Spring precipitation was less than 75% of normal in 1992, 1993, 2002, 2004 and 2007 (Figure 2). Spring precipitation is important for shrub, perennial grass and forb recruitment. Fall precipitation was less than 75% of normal in 1989, 1992, 1995, 1999, 2001, 2003, 2005, and 2006 (Figure 2). Fall precipitation is important for the germination of many weedy winter annuals like cheatgrass. Two or more consecutive years of drought have far more impact on vegetation than 1 year of drought followed by normal or above-normal precipitation (Holecheck, 2004).

Browse

The cumulative browse trend shows improving browse conditions from 1983 to 1997, and declining conditions from 1997 to 2007 (Figure 3). This decline was attributed to high decadence and lack of recruitment of key species associated with drought conditions (Utah Climate Summaries 2007). Ochre Mountain (19A-2) was the only basin big sagebrush study sampled in the subunit. Average basin big sagebrush density decreased 33% in 2002 and increased 100% in 2007 (Figure 4), while average cover remained stable at 16%-17% (Figure 5). Average basin big sagebrush decadence increased 55% in 2002 and decreased 18% in 2007 (Figure 6). Mountain big sagebrush was

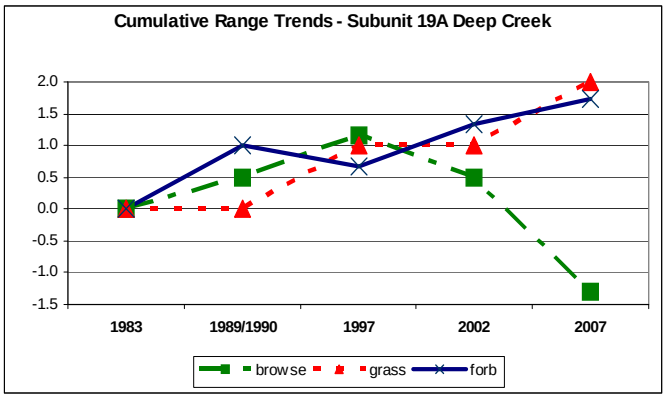


Figure 3. Cumulative range trends for subunit 19A.

sampled at Rocky Canyon (19A-9) and Rocky Spring (19A-10) beginning in 2002. Average density decreased 35% from 2002 to 2007 (Figure 4). Changes in average cover (Figure 5) of mountain big sagebrush coincided with changes in plant density (Figure 4). Mountain big sagebrush decadence increased 13% in 2007 (Figure 6). Black sagebrush was sampled at Trail Gulch (19A-1), Ochre Mountain (19A-2), and Rocky Canyon (19A-9). Average black sagebrush density increased 32% in 2002 and 24% in 2007 (Figure 4). Average cover remained stable at 2%-3% (Figure 5). Decadence increased 63% in 2002 and 19% in 2007 (Figure 6).

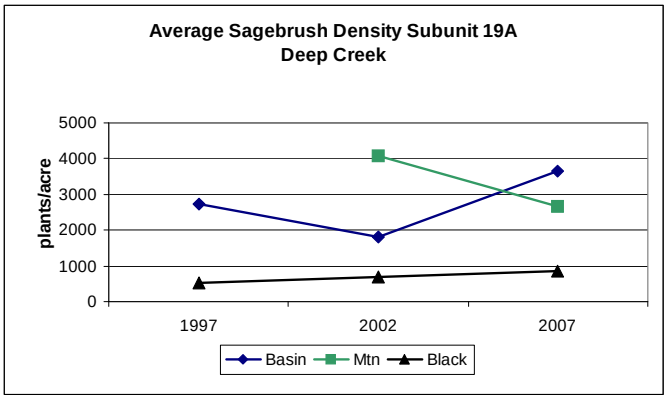


Figure 4 Average density of mountain, basin, and black sagebrush for subunit 19A.

Grass

The cumulative grass trend was stable from 1983 to 1989, increased from 1989 to 1997, remained stable from 1997 to 2002, then increased again from 2002 to 2007 (Figure 3). Perennial grasses improved in nested frequency and cover from 1997 to 2007 (Figures 7 and 8). Cheatgrass nested frequency declined in 2002, and increased slightly in 2007 (Figure 7), while its average cover decreased in 2002 and remained stable in 2007 (Figure 8). Drought conditions, particularly recent multiple years of fall drought conditions (Figure 2) seem to correlate with a decline in cheatgrass densities. Bulbous bluegrass was sampled at only Rocky Canyon (19A-9) in 2002, and at Rocky Canyon and Rocky Springs (19A-10) in 2007.

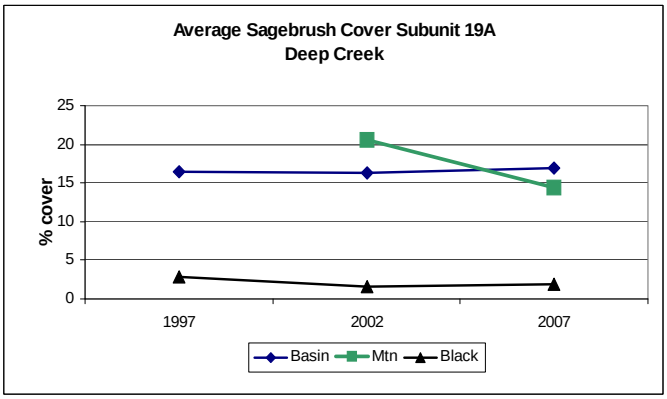


Figure 5. Average cover of mountain, basin, and black sagebrush for subunit 19A.

Forb

The cumulative perennial forb trend improved in 1989, declined slightly in 1997, remained stable and increased in 2002 and 2007 (Figure 3). Perennial forbs increased steadily in nested frequency and cover between 1997 and 2007 (Figures 7 and 8).

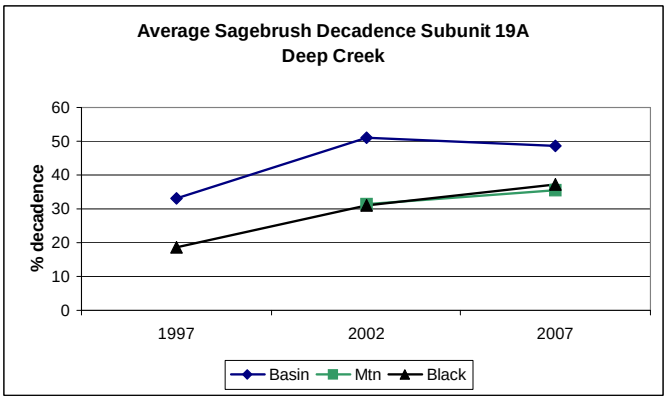


Figure 6. Average decadence of mountain, basin, and black sagebrush for subunit 19A.

Desirable Components Index

The DCI scores are divided into three categories based on ecological potentials, which include low, mid-level, and high. The average Desirable Components Index (DCI) rating remained fair from 1997 to 2007 for the mid-level potential scale studies (Figure 9). For the low potential scale studies, the DCI rating decreased slightly, from poor-fair in 1997 to poor in 2002, and increased slightly to fair-poor in 2007. The decrease in the DCI was due to a slight decrease in perennial grass and browse cover in 2002, and may be a product of the drought in 2002.

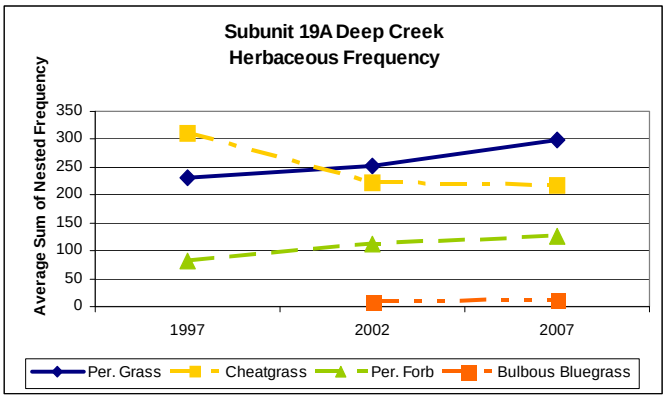


Figure 7. Average herbaceous nested frequency for subunit 19A.

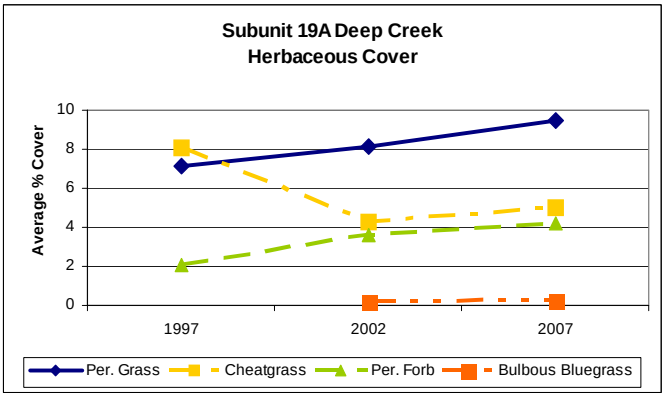


Figure 8. Average herbaceous cover for subunit 19A.

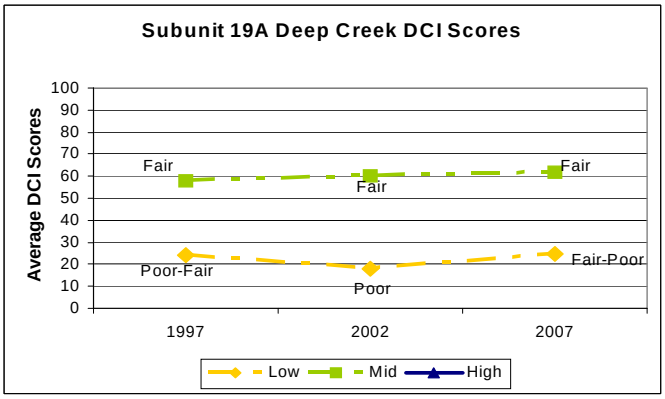
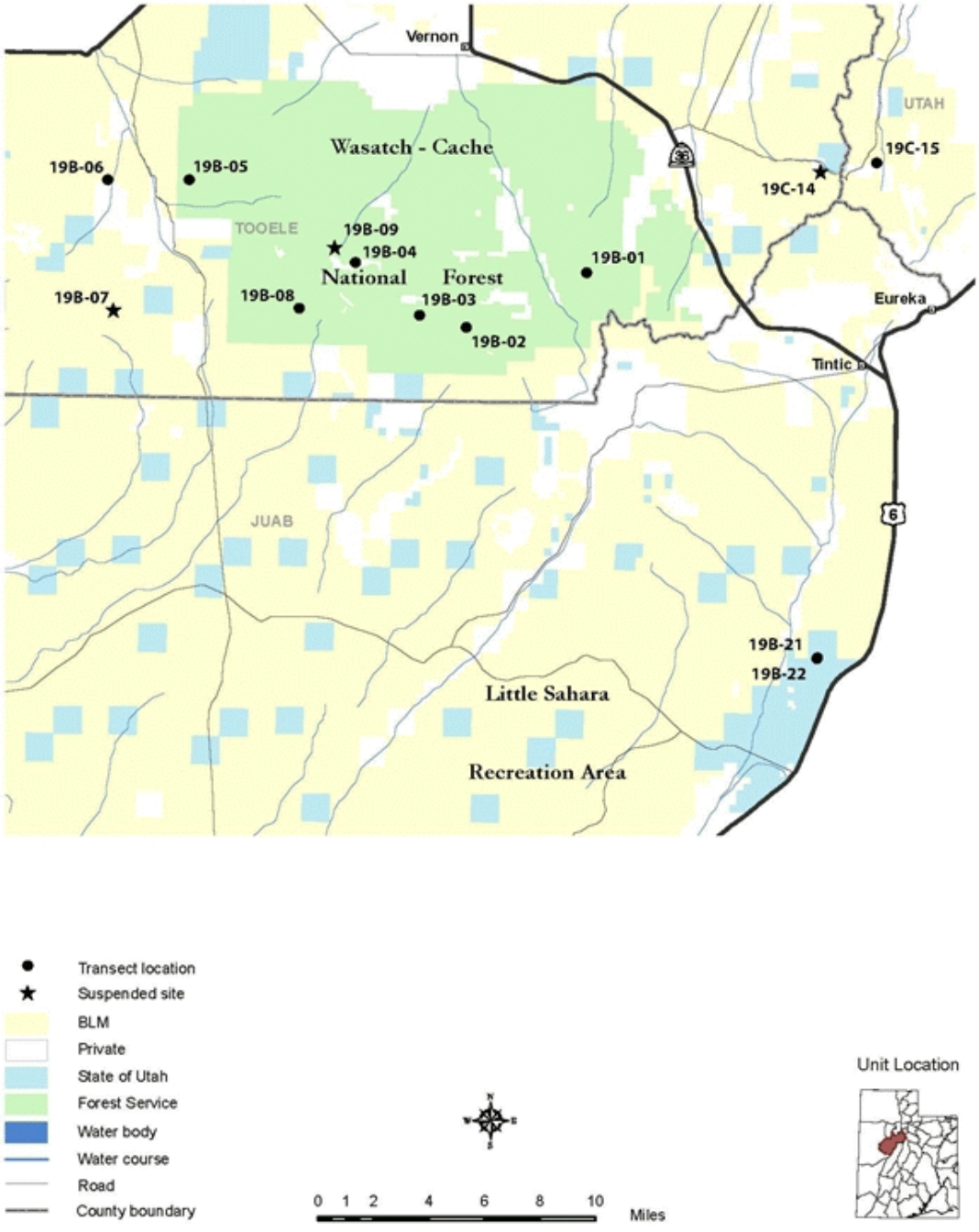


Figure 9. Average Desirable Components Index (DCI) for subunit 19A.

Management Units 19B and 19C



WILDLIFE MANAGEMENT UNIT 19 - WEST DESERT
SUBUNIT 19B - WEST DESERT, VERNON

Subunit 19B Boundary Description

Tooele and Juab Counties - Boundary begins at the junction of SR-36 and the Pony Express Road; north on SR-36 to SR-73; east on SR-73 to I-15; south on I-15 to US-6 at Santaquin; west on US-6 to SR-174; northwest on SR-174 to the Dugway Valley Road; north on this road to the Pony Express Road; northeast on this road to SR-36 returning to the beginning point.

Subunit Description

The 19B Vernon subunit encompasses the Simpson, Sheeprock, and West Tintic Mountains. Trend studies are concentrated primarily in the East Tintic and Sheeprock Mountains. Predation on fawns has been a major problem on the Vernon subunit. In 1996, a predator management plan was implemented and several coyote dens were destroyed in the immediate vicinity of prime deer fawning areas. Two other issues that affect big game in the subunit are the availability of summer range, and wildfires. Due to the relatively low elevation of these desert mountain ranges, there is a lack of quality summer range. Large wildfires burned large areas of this unit between 1996 and 2002. Much of the burned areas have been seeded in restoration projects. The success of these projects in restoring deer winter habitat is in question, as browse re-establishment has been limited. However, the projects have been successful in establishing stands of perennial grasses.

Big Game Management Objectives

According to the 2005 Utah Annual Big Game Report, the current management objective is to maintain a herd of 11,200 wintering deer for the entire management unit. The estimated herd size decreased from 7,650 deer in 2002 to 6,200 deer in 2003, then increased to 7,000 deer by 2005. The buck:doe ratio has averaged 13:100 from 2003 to 2005, and is slightly below the objective of 15-20 bucks per 100 does. From 1999 to 2005 the fawn:doe ratio has averaged 68:100 (Hersey and McLaughlin 2006). The Vernon subunit was closed to all hunting in 1997, and reopened as a limited entry hunting unit in 2000. In 2002, 149 limited entry deer tags were permitted. In 2007, 76 buck-only, limited entry tags were permitted.

The current elk management objective is to maintain a winter herd population of 200 for the entire management unit (Hersey and McLaughlin 2006). However, only the elk population in the Deep Creek Mountains (subunit 19A) are actively managed.

Trend Study Description

The number of studies in subunit 19B has fluctuated as existing studies were suspended, new studies were added, and as the subunit boundaries were realigned. Eighteen studies were originally established in the Vernon subunit in 1983. Eight studies were located on winter range and the other 10 studies were located on summer range. All 18 studies were re-sampled in the summer of 1989. In 1997, all but two studies were re-sampled, South Pine Canyon (19B-8) and Old Canyon (19B-17). At South Pine Canyon, sampling was postponed because a fire removed all browse species from the site in 1996. Old Canyon was not sampled due to a lack of wildlife use, and the study was suspended. Four studies were added to the subunit in 1998 to monitor post-fire restoration efforts: Paul Bunyon Burn (19B-19), Paul Bunyon Burn and Chain (91B-20), Jericho State Section (19B-21) and Jericho BLM (19B-22). In 2002, all but three of the studies were re-sampled, North Oak Brush Canyon (19B-9), Water Canyon (19B-11), and Black Rock Canyon (19B-14). These three studies were suspended in 2002 after consulting with the regional biologist, as they no longer represent key areas or are not representative of critical deer range.

In 2007, the subunit boundaries had been realigned and seven of the 18 studies from 19B were moved to subunit 21A. The 11 remaining studies were sampled in 2007. Although it was sampled in 2007, it has been recommended that Judd Creek (19B-7) be suspended from further sampling because of access problems.

Trend Study 19B-1-07

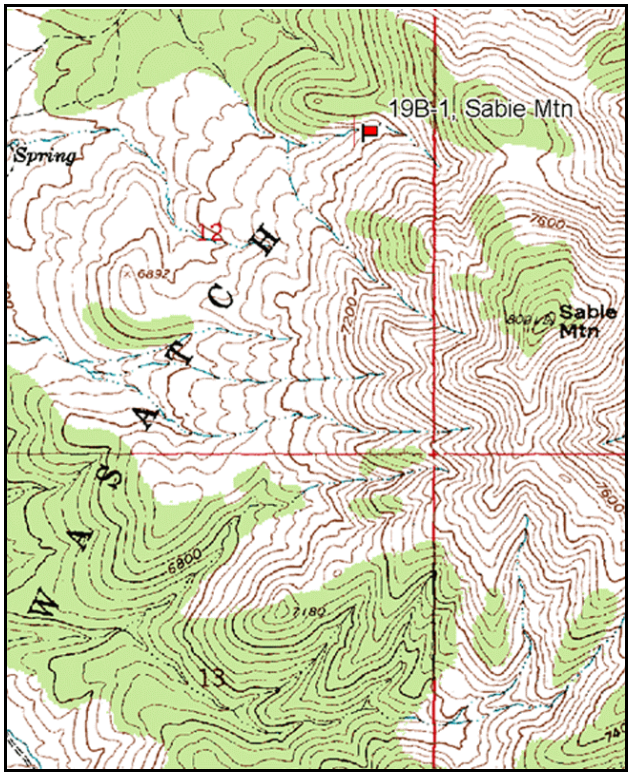
Study site name: Sabie Mountain . Vegetation type: Big Sagebrush-Grass .

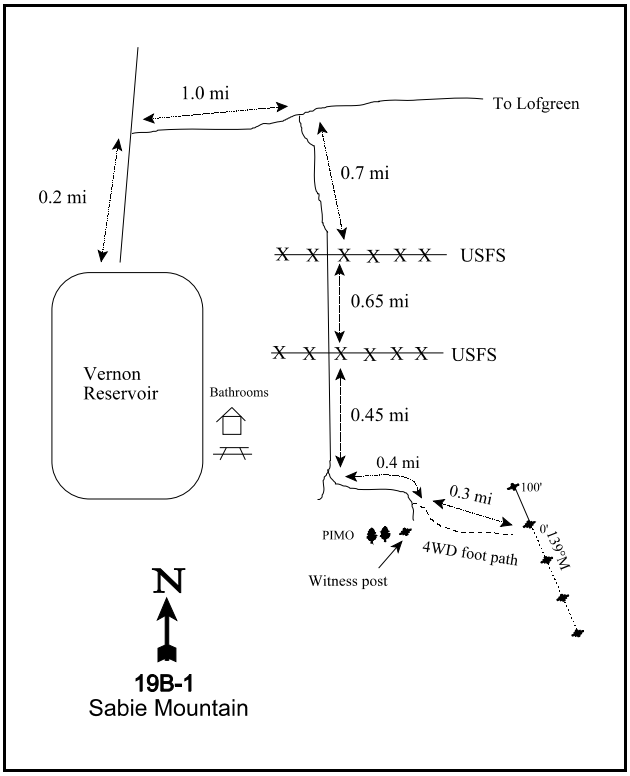
Compass bearing: frequency baseline 319 degrees magnetic. (Lines 2-4 @ 139°M)

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

LOCATION DESCRIPTION

From the North end of Vernon Reservoir, go 0.2 miles north until you reach an intersection. Turn right and go 1 mile on an eastbound road that eventually goes to Lofgreen. At 1 mile turn right onto a southbound road. Go 0.7 miles and cross a USFS fence. Go 0.65 miles and cross another USFS fence. Go 0.45 miles to a "Y" intersection; take the left fork and go 0.4 miles to an intersection of a 4WD footpath going off to the left. The witness post is on the right side of the road between some PIMOs and is ~12" tall. Walk 0.3 miles on the footpath to the 0-foot stake.





Map Name: Sabie Mountain

Diagrammatic Sketch

Township 10S , Range 5W ,Section 12

GPS: NAD 83, UTM 12S 384770 E 4425573 N

DISCUSSION

Sabie Mountain - Trend Study No. 19B-1

Study Information

This transitional range study is located on the northwest slope of Sabie Mountain on land administered by the Uinta National Forest [elevation: 7,000 feet (2,134 m), slope: 35%, aspect: northwest]. The nearest water sources are Vernon Creek 1.4 miles (2.3 km) to the west, and Vernon Reservoir 2.3 miles (3.7 km) to the northwest. The range type is mountain big sagebrush-grass, with a mixture of other shrubs. The area had a diverse and productive herbaceous understory, which decreased in 2002 and recovered somewhat in 2007. From the pellet group transect, there were an estimated 7 deer days use/acre (17 ddu/ha) in 1997, 19 deer days use/acre (46 ddu/ha) in 2002, and 22 deer days use/acre (55 ddu/ha) in 2007. Deer use in 2002 was from late spring and early summer, and from winter and early spring in 2007. Cattle use in 1997 was estimated at 14 cattle days use/acre (35 cdu/ha), 5 cattle days use/acre (13 cdu/ha) in 2002, and 11 cattle days use/acre (27 cdu/ha) in 2007. In 2002 and 2007 the cattle pats were approximately one year old, suggesting that the study is likely grazed in the late summer or fall. In 2007, there were an estimated 14 elk days use/acre (35 edu/ha), and the groupings appeared to be from spring and early summer.

Soil

The study lies within the Reywat-Broad-Rock outcrop soil association, and generally consists of shallow to moderately deep, well-drained soil. Depth to bedrock is 20-40 inches (51-102 cm). The soils in this series formed in colluvium and residuum derived from sandstone and quartzite, or basalt and andesite on hillsides, mountains, or plateaus (USDA-NRCS 2007). At the study, soil color is medium dark and has an estimated organic matter content of 4.7%. The soil has a loam to clay loam texture, and it is slightly acidic in reactivity (pH of 6.3). In 1983, some past erosion was apparent, evidenced by a few gullies in the vicinity. Relative bare ground cover increased from 4% in 1997 to 16% by 2007. The abundance of vegetation and litter cover prevents accelerated erosion in most places. Pocket gophers were reportedly active throughout the area and were a source of significant soil disturbance in 1983. This activity has not been reported in any other year. The erosion condition was classified as stable in 2002 and 2007.

Browse

The dominant browse species is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), though Saskatoon serviceberry (*Amelanchier alnifolia*) and mountain snowberry (*Symphoricarpos oreophilus*) are also present. In 1997, an increased sample area was used to more accurately represent the browse populations. Canopy cover of mountain big sagebrush increased from 23% in 2002 to 26% in 2007. The density of sagebrush increased from 1,799 plants/acre (4,453 plants/ha) in 1983 to 4,580 plants/acre (11,337 plants/ha) by 2002, and decreased to 3,220 plants/acre (7,970 plants/ha) in 2007. The age structure has been relatively similar since 1989. Reproduction and recruitment have been low in all sample years. Decadency has steadily increased in each sample year from 15% in 1983 to 29% by 2007. Dying plants have comprised 0%-14% of the population and were most common in 1997 and 2007. Vigor has been normal, except in 1989 when about one-third of the population showed poor vigor. Annual leader growth averaged 1.2 inches (3 cm) in 2002 and 2007. Browse use on mountain big sagebrush has been light-moderate. Crickets were abundant on the study in 2002 and had noticeably eaten many sagebrush leaves.

The canopy cover of Saskatoon serviceberry was less than 1% in 2002 and 2007. The estimated population density increased from 133 plants/acre (329 plants/ha) in 1983 to 280 plants/acre (693 plants/ha) by 1997, and decreased to 80 plants/acre (198 plants/ha) by 2007. Seedlings have not been sampled in any year. There no young plants sampled in 1983, but they comprised 67% of the population in 1989. Young plants steadily decreased in subsequent sample years, until no young plants were sampled by 2007. Serviceberry decadence has oscillated between increasing and decreasing each sample year and was lowest in 1983 (0% of the population) and highest in 2002 (58% of the population). The serviceberry population has had normal vigor,

except in 1983 when the entire population displayed poor vigor. Browse use on Saskatoon serviceberry has been moderate-high and has resulted in stunted growth form.

Snowberry canopy cover increased from 11% in 2002 to 26% in 2007. Mountain snowberry has the highest density of the shrub species present. The density has ranged from a low of 5,060 plants/acre (12,525 plants/ha) in 1997 to a high of 8,866 plants/acre (21,946 plants/ha) in 1989. In 2007, there were an estimated 6,600 plants/acre (16,337 plants/ha). The population consists primarily of mature plants, and there have been few young since 1997. Browse use has been mostly light on snowberry, and was highest in 1989 when 37% of the population was moderately browsed. Crickets were observed eating snowberry leaves in 2002. Other sampled browse include stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), Oregon grape (*Mahonia repens*), and Woods' rose (*Rosa woodsii*). Singleleaf pinyon (*Pinus monophylla*) had an estimated density of 51 trees/acre (126 trees/ha) in 2002 and 44 trees/acre (109 trees/ha) in 2007. Utah juniper (*Juniperus osteosperma*) had an estimated density of 22 trees/acre (54 trees/ha) in 2002 and 24 trees/acre (59 trees/ha) in 2007.

Herbaceous Understory

Total grass cover declined from 11% in 1997, to 5% in 2002, and slightly increased to 6% in 2007. Mutton bluegrass (*Poa fendleriana*) has been the most abundant grass on the study and has provided 65%-81% of the total grass cover since 1997. Bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*) have been sampled at lower frequencies. Other grasses scattered throughout the study include: oniongrass (*Melica bulbosa*), spike fescue (*Leucopoa kingii*), bottlebrush squirreltail (*Sitanion hystrix*), Great Basin wildrye (*Elymus cinereus*), and bulbous bluegrass (*Poa bulbosa*). Cheatgrass (*Bromus tectorum*) is the only annual grass measured and was found in one quadrat in 2007.

Forbs are important to wildlife on this summer/transitional range. Perennial forb cover was 13% in 1997, 3% in 2002, and 5% in 2007. The number of forb species was high between 1983 and 1997, numbering between 25 and 30 species. In 2002, there were only 10 species measured. Although the weather station in herd subunit 19B did not report any precipitation data for 2002, there was a region-wide drought that year (Utah Climate Summaries 2007). The drought is suspected to have caused the decrease in the number of species. The number of forb species recovered somewhat in 2007 to 23 species. Species composition and abundance have also shifted with time. The 23 species present in 2007 included some species not present in 1983 and vice-versa. Interestingly, 1988 and 1989 were drought years, yet the sum of nested frequency for grasses and forbs was highest in 1989 than in any other sample year. The most abundant species have included bastard toadflax (*Comandra pallida*), tapertip hawksbeard (*Crepis acuminata*), one-flower helianthella (*Helianthella uniflora*), silvery lupine (*Lupinus argenteus*), American vetch (*Vicia americana*) and mulesears wyethia (*Wyethia amplexicaulis*).

1989 TREND ASSESSMENT

The browse trend is stable. The density of Saskatoon serviceberry increased by 50%, but the mountain big sagebrush density increased by only 4%. Decadence and young plants increased for both species. The proportion of serviceberry plants exhibiting poor vigor decreased from 100% of the population to 0%, but increased for sagebrush from 0% to 32%. The grass trend is stable. The sum of nested frequency increased by 8%, including a significant increase in nested frequency of mutton bluegrass. The forb trend is slightly up. The sum of nested frequency of perennial forbs increased by 20%. There was a significant increase in tapertip hawksbeard and five additional species were present.

browse - stable (0) grass - stable (0) forb - slightly up (+1)

1997 TREND ASSESSMENT

The browse trend is stable. The density of Saskatoon serviceberry increased by 41% and mountain big sagebrush had more than a two-fold increase. The increase in density is partly attributed to the larger sample

area used in 1997, and therefore, the trend was determined from other parameters. Mountain big sagebrush decadence increased from 21% of the population to 25%, and 14% of the population was dying. In addition, there were 720 dead plants/acre (1,782 plants/ha), whereas there hadn't been any previously. The percentages of decadent/dying/dead were greatly in excess of seedlings and young plants. The proportion of sagebrush plants exhibiting poor vigor decreased from 32% of the population to 14%, and browse use remained light-moderate. The trend for grass is stable. The sum of nested frequency of perennial grasses decreased 4%. The forb trend is down. The sum of nested frequency of perennial forbs decreased by 45% and there were significant decreases in the nested frequencies of nine species. The Desirable Components Index (DCI) score is good due to high browse and perennial forb cover and moderate perennial grass cover.

winter range condition (DCI) - good (71) Mid-level potential scale
browse - stable (0) grass - stable (0) forb - down (-2)

2002 TREND ASSESSMENT

The browse trend is stable. Saskatoon serviceberry density decreased from 280 plants/acre (693 plants/ha) to 240 plants/acre (594 plants/ha). Decadence increased from 14% of the population to 58%. Mountain big sagebrush density increased 9% to 4,580 plants/acre (11,337 plants/ha) and decadence changed little, increasing from 25% of the population to 26%. Recruitment remained low, but dying plants decreased from 14% of the population to only 2%. Dead plants decreased to 660 plants/acre (1,633 plants/ha). Browse use remained light, but 24% of the population had been heavily browsed. The grass trend is down. The sum of nested frequency for perennial grasses decreased by 24%, including a significant decrease in the nested frequency of mutton bluegrass. The number of grass species measured declined from eight to four. The forb trend is down. The sum of nested frequency of perennial grasses decreased 75%, and there were no annual forbs measured. Forb cover decreased from 13% to 3%. Drought conditions are suspected to have caused the decline in forb abundance and cover. Cricket use on forbs was noted to be heavy. The DCI score declined to fair due to the decrease in perennial grass and forb cover.

winter range condition (DCI) - fair (55) Mid-level potential scale
browse - stable(0) grass - down (-2) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is down. The density of mountain big sagebrush and Saskatoon serviceberry decreased by 30% and 67%, respectively. Sagebrush decadency increased to 29% of the population and 10% of the population was classified as dying. There were no seedlings or young plants measured. However, the density of dead plants decreased to 240 plants/acre (594 plants/ha). The decrease in dead plants may be due to the decomposition of previously sampled dead plants. Browse use was light-moderate on sagebrush, but serviceberry was heavily hedged. The grass trend is stable. The sum of nested frequency of perennial grasses decreased by 1% and cheatgrass was sampled for the first time in one quadrat. The forb trend is up. The sum of nested frequency of perennial forbs increased more than two-fold. There were significant increases in the nested frequencies of three forb species. The DCI score decreased to poor-fair due to a decrease in browse cover. The score would have been poor were it not for an increase in perennial forb cover.

winter range condition (DCI) - fair (50) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 1

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	ab59	b93	ab53	a38	a30	1.65	.47	.50
G	Agropyron trachycaulum	a9	a5	-	-	-	-	-	-
G	Bromus carinatus	a4	-	-	-	a4	-	-	.06
G	Bromus tectorum (a)	-	-	-	-	3	-	-	.00
G	Elymus cinereus	-	-	3	-	-	.41	.03	-
G	Leucopoa kingii	-	a3	ab7	ab4	b16	.18	.15	.16
G	Melica bulbosa	a11	a18	a9	-	a11	.08	-	.04
G	Poa bulbosa	-	-	3	-	-	.03	-	-
G	Poa fendleriana	a200	bc241	c240	ab196	a173	7.65	4.25	3.72
G	Poa secunda	b58	a23	ab53	ab47	ab47	1.13	.37	1.21
G	Sitanion hystrix	b19	ab6	a5	-	a1	.01	-	.03
Total for Annual Grasses		0	0	0	0	3	0	0	0.00
Total for Perennial Grasses		360	389	373	285	282	11.17	5.27	5.72
Total for Grasses		360	389	373	285	285	11.17	5.27	5.73
F	Agoseris glauca	b29	-	a11	-	a7	.08	-	.12
F	Allium sp.	b32	ab10	a5	-	c102	.01	-	.58
F	Arabis sp.	a2	a9	a6	-	-	.01	-	-
F	Astragalus cibarius	ab20	b28	a2	-	-	.01	-	-
F	Astragalus convallarius	b58	b70	b70	-	a5	2.25	-	.01
F	Balsamorhiza hookeri	a3	a2	b19	ab16	ab6	.66	.42	.22
F	Balsamorhiza sagittata	bc30	c44	a12	ab13	bc34	.66	.45	1.34
F	Castilleja linariaefolia	a1	a4	-	-	-	-	-	-
F	Calochortus nuttallii	a1	a3	-	-	-	-	-	-
F	Cirsium neomexicanum	ab14	b14	a2	-	-	.03	-	-
F	Comandra pallida	a46	a42	a66	a51	a71	.90	1.02	.71
F	Collinsia parviflora (a)	-	-	a22	-	b175	.07	-	.85
F	Crepis acuminata	c155	d222	b59	-	a12	.74	-	.19
F	Delphinium nuttallianum	-	a3	a9	-	a2	.02	-	.00
F	Erigeron eatonii	-	b29	a4	-	a3	.01	-	.00
F	Eriogonum racemosum	bc20	c27	c21	ab6	a2	.28	.03	.03
F	Eriogonum umbellatum	a4	a3	a10	a4	-	.29	.03	-
F	Fritillaria atropurpurea	-	a3	a1	-	-	.00	-	-
F	Helianthella uniflora	b92	b114	a63	a37	a38	2.52	.59	.25
F	Hydrophyllum capitatum	-	a4	-	-	a9	-	-	.10

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Lithospermum ruderale	$_{a}$4	$_{a}$2	$_{a}$4	$_{a}$10	$_{a}$3	.03	.21	.00
F	Lomatium grayi	$_{ab}$8	$_{b}$17	$_{a}$4	-	$_{a}$3	.04	-	.01
F	Lupinus argenteus	$_{a}$5	$_{a}$2	$_{b}$69	-	$_{a}$5	2.37	-	.10
F	Machaeranthera canescens	$_{b}$26	$_{b}$33	$_{a}$7	-	-	.02	-	-
F	Mertensia oblongifolia	-	$_{a}$15	-	-	$_{a}$12	-	-	.15
F	Microsteris gracilis (a)	-	-	$_{a}$3	-	$_{a}$4	.00	-	.01
F	Orobanche fasciculata	-	1	-	-	-	-	-	-
F	Penstemon subglaber	$_{a}$10	$_{a}$5	$_{a}$5	-	$_{a}$4	.01	-	.01
F	Phlox longifolia	$_{b}$80	$_{c}$124	$_{b}$72	$_{a}$2	$_{a}$3	.37	.00	.06
F	Polygonum douglasii (a)	-	-	6	-	-	.01	-	-
F	Senecio integerrimus	-	$_{a}$3	$_{a}$14	-	$_{b}$35	.22	-	.50
F	Senecio multilobatus	-	-	6	-	-	.06	-	-
F	Taraxacum officinale	-	-	$_{a}$1	$_{a}$1	-	.00	.03	-
F	Tragopogon dubius	4	-	-	-	-	-	-	-
F	Vicia americana	$_{b}$199	$_{b}$191	$_{a}$17	-	$_{a}$1	.13	-	.00
F	Wyethia amplexicaulis	$_{b}$28	$_{b}$28	$_{b}$23	$_{a}$5	$_{ab}$21	1.06	.21	.87
F	Zigadenus paniculatus	$_{b}$10	$_{a}$1	-	-	-	-	-	-
Total for Annual Forbs		0	0	31	0	179	0.09	0	0.86
Total for Perennial Forbs		881	1053	582	145	378	12.88	3.02	5.31
Total for Forbs		881	1053	613	145	557	12.97	3.02	6.17

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

BROWSE TRENDS --
Management unit 19B, Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier alnifolia	11	11	3	.15	.06	.15
B	Artemisia tridentata vaseyana	91	93	82	22.50	25.46	16.18
B	Chrysothamnus viscidiflorus viscidiflorus	55	25	25	1.48	.37	.44
B	Juniperus osteosperma	3	3	3	.53	.63	.78
B	Mahonia repens	22	8	23	1.11	.06	.17
B	Pinus monophylla	1	1	1	-	1.48	1.82
B	Rosa woodsii	22	26	18	.98	1.35	.70
B	Symphoricarpos oreophilus	82	75	81	9.67	11.79	13.41
Total for Browse		287	242	236	36.43	41.22	33.67

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 1

Species	Percent Cover	
	'02	'07
Amelanchier alnifolia	.21	-
Artemisia tridentata vaseyana	23.06	25.95
Chrysothamnus viscidiflorus viscidiflorus	.35	.48
Juniperus osteosperma	.56	1.21
Mahonia repens	.06	.16
Pinus monophylla	1.03	1.60
Rosa woodsii	.33	1.03
Symphoricarpos oreophilus	11.36	25.89

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 1

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.2	1.3

POINT-QUARTER TREE DATA --
Management unit 19B, Study no: 1

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	22	24
Pinus monophylla	51	44

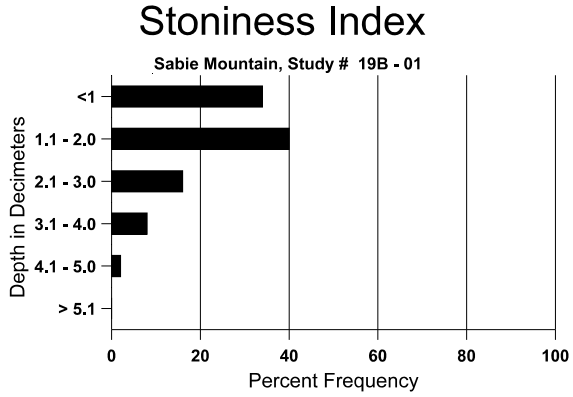
Average diameter (in)	
'02	'07
1.4	2.6
1.6	3.1

BASIC COVER --
Management unit 19B, Study no: 1

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	3.50	9.75	52.32	47.79	45.73
Rock	12.50	8.75	5.75	7.86	6.12
Pavement	5.00	11.50	5.65	6.34	8.35
Litter	51.75	58.50	57.13	44.81	31.95
Cryptogams	.25	.25	.04	.10	.00
Bare Ground	27.00	11.25	5.33	16.31	17.39

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 1, Sabie Mountain

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
13.0	52.8 (15.3)	6.3	30.6	41.8	27.6	4.7	10.1	275.2	1.0



PELLET GROUP DATA --
Management unit 19B, Study no: 1

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	6	1	31
Elk	1	-	2
Deer	8	8	17
Cattle	-	1	4

Days use per acre (ha)	
'02	'07
-	-
-	14 (35)
19 (46)	22 (55)
5 (13)	11 (27)

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 1

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier alnifolia												
83	**133**	-	-	133	-	-	50	50	0	-	100	20/3
89	**199**	-	133	-	66	-	33	67	33	-	0	-/-
97	**280**	-	120	120	40	-	29	7	14	-	7	19/18
02	**240**	-	20	80	140	-	33	58	58	-	0	14/22
07	**80**	-	-	60	20	-	0	100	25	-	0	18/21
Artemisia tridentata vaseyana												
83	**1799**	-	-	1533	266	-	30	0	15	-	0	22/20
89	**1866**	-	133	1333	400	-	21	0	21	-	32	26/30
97	**4220**	80	60	3100	1060	720	20	.94	25	14	14	26/32
02	**4580**	-	40	3340	1200	660	4	24	26	2	2	25/35
07	**3220**	-	-	2280	940	240	37	17	29	10	12	26/40
Chrysothamnus viscidiflorus viscidiflorus												
83	**3666**	-	-	3666	-	-	0	0	0	-	0	8/8
89	**4332**	-	1533	2133	666	-	3	0	15	-	5	18/18
97	**2640**	-	200	2300	140	20	0	0	5	4	4	13/12
02	**800**	-	20	200	580	80	5	13	73	25	25	5/7
07	**820**	60	20	580	220	-	5	5	27	2	22	9/13
Eriogonum microthecum												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**200**	-	200	-	-	-	33	0	-	-	67	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**60**	-	60	-	-	-	0	0	-	-	0	-/-
02	**80**	-	40	40	-	-	0	0	-	-	0	-/-
07	**80**	-	40	40	-	-	0	0	-	-	0	-/-
Mahonia repens												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**2820**	-	220	2600	-	-	0	0	0	-	0	3/5
02	**420**	-	-	380	40	-	0	0	10	-	0	4/5
07	**2400**	-	160	2240	-	-	0	0	0	-	0	2/3
Pinus monophylla												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	20	20	-	-	-	0	0	-	-	0	-/-
02	**20**	20	-	20	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	0	-	-	0	-/-
Rosa woodsii												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**1820**	-	840	980	-	-	0	0	0	-	0	8/10
02	**1540**	-	320	1060	160	-	0	0	10	1	1	9/9
07	**1500**	-	200	1300	-	40	7	0	0	-	0	13/9
Symphoricarpos oreophilus												
83	**6600**	-	-	6600	-	-	0	0	0	-	0	22/14
89	**8866**	200	3466	5000	400	-	32	2	5	-	2	18/17
97	**5060**	40	260	4720	80	-	0	0	2	-	0	13/20
02	**8360**	-	40	7340	980	40	0	1	12	.23	.23	12/17
07	**6600**	-	200	6300	100	-	3	0	2	-	2	13/26

Trend Study 19B-2-07

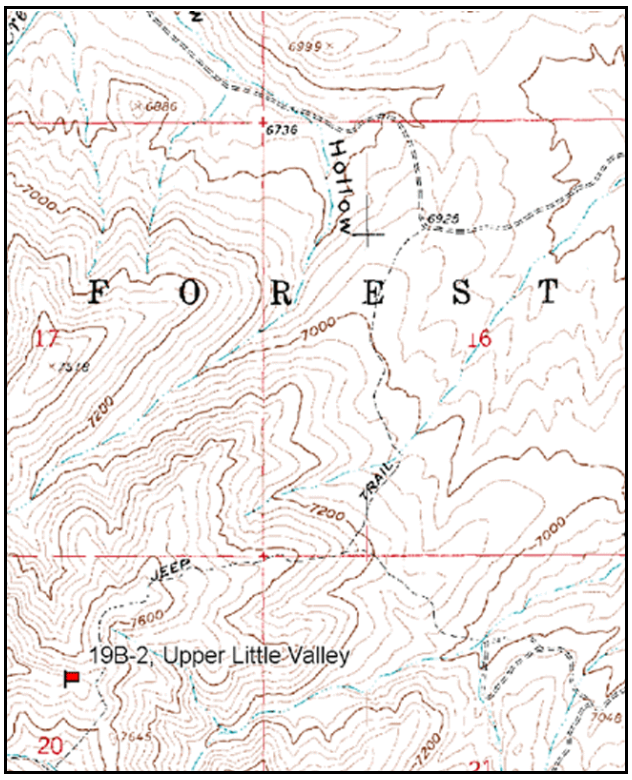
Study site name: Upper Little Valley . Vegetation type: Mountain Brush .

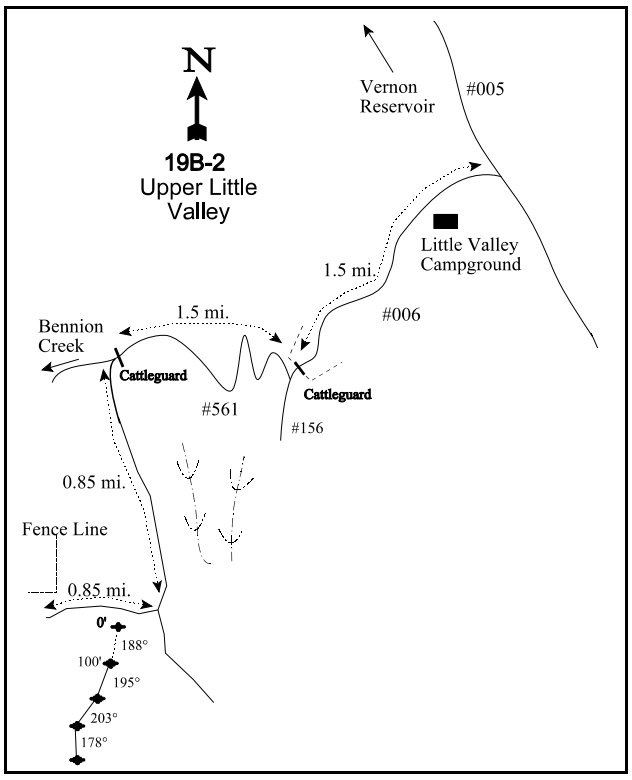
Compass bearing: frequency baseline 188 degrees magnetic (Line 2 @ 195°M, line 3 @ 203°M, line 4 178°M).

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

LOCATION DESCRIPTION

The steep, rocky road leading to this study site can be reached on the Little Valley road either by traveling east 2.5 miles from Bennion Creek or west 2.6 miles from the Little Valley Campground. Turn south, and go 0.85 to an intersection. Bear right and continue southerly up the ridge for 0.85 miles to a fence corner on the ridge line. Continue up along the fence to the l9th fencepost. From this fencepost, the 0-foot baseline stake is 33 paces away at an azimuth of 169 degrees. This stake is marked by a red tag, #3928.





Map Name: Dutch Peak

Diagrammatic Sketch

Township 10S , Range 5W , Section 20

GPS: NAD 83, UTM 12S 377780 E 4422418 N

DISCUSSION

Upper Little Valley - Trend Study No. 19B-2

Study Information

This study samples deer summer range near the head of Little Valley on land administered by the U.S. Forest Service [elevation: 7,700 feet (2,347 m), slope: 25%-30%, aspect: south]. Numerous intermittent and perennial streams in the area provide good distribution of water. However, thermal and escape cover is inadequate as most of the surrounding area is occupied by low-growing shrubs. Only in the canyon bottoms does vegetation exceed 5 feet (1.5 m) in height. The study is moderately used by deer, with elk and cattle use being light. From the pellet group transect, there were an estimated 42 deer days use/acre (104 ddu/ha) in 2002 and 38 deer days use/acre (93 ddu/ha) in 2007. Elk use was estimated at 2 days use/acre (5 edu/ha) in 2002 and increased to 15 days use/acre (36 edu/ha) in 2007. Cattle use was estimated at 9 days use/acre (21 cdu/ha) in 2002 and 2 days use/acre (4 cdu/ha) in 2007. Most of the deer and elk pellets appeared to be from winter/early spring use. The cattle pats appeared to be at least one year old. Thirteen deer were observed near the study in 2002.

Soil

The study lies within the Podmor-Onaqui-Rock outcrop association, and generally consists of shallow to moderately deep, well-drained soil. Soil depths were 10-23 inches (25-58 cm). Soils in this series formed in colluvium and residuum derived predominantly from quartzite, and are found on mountainsides and ridges (USDA-NRCS 2007). On the study, the soil is relatively shallow and rocky with numerous basalt rocks and outcrops noticeable in the immediate area. The soil has a sandy clay loam and has a slightly acidic reactivity (pH of 6.2). Relative bare ground cover has fluctuated between 7% and 15%, except in 2002 when bare ground cover was 27%. Although the weather station in herd subunit 19B did not report any precipitation data for 2002, there was a region-wide drought that year (Utah Climate Summaries 2007). The drought is expected to have caused the increase of bare ground cover. Litter cover was the dominant cover type until 2007, when vegetation was dominant. The erosion condition was classified as slight in 2002 and 2007. A moderate level of surface rock movement and soil pedestalling provided the most evidence of erosion.

Browse

The most abundant preferred browse is Saskatoon serviceberry (*Amelanchier alnifolia*), which increased in canopy cover from 8% in 2002 to 11% in 2007. The estimated density increased from 733 plants/acre (1,814 plants/ha) in 1983 to 1,199 plants/acre (2,968 plants/ha) in 1989, and decreased to 640 plants/acre (1,584 plants/ha) in 1997. In 2002, there were an estimated 700 plants/acre (1,733 plants/ha), and in 2007 the density decreased to 480 plants/acre (1,188 plants/ha). No seedlings have been sampled in any sample year. Young plants comprised 44% of the population in 1989 and 6% in 1997, but have not been sampled otherwise. Prior to 1997, approximately 20% of the population was decadent. In subsequent sample years, 0%-3% of the population has been decadent. There have been few dead or dying plants. Nearly half of the plants had poor vigor in 2002; otherwise between 0% and 9% of the population has exhibited poor vigor. It was reported in 2002 that serviceberry plants were not producing flowers or annual leader growth, and were losing many leaves due to the extremely dry conditions. Although there were some chlorotic plants observed in 2007, average annual leader growth was 2.6 inches (6.6 cm). Browse use has been mostly moderate-heavy in all sample years. Tent caterpillars (*Malacosoma* sp.) were present on most serviceberry plants in 1983.

Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) provides additional preferred browse. Sagebrush canopy cover was 3% in 2002 and 5% in 2007. The estimated density increased from 800 plants/acre (1,980 plants/ha) in 1983 to 1,198 plants/acre (2,965 plants/ha) in 1989, and decreased to 340 plants/acre (842 plants/ha) in 1997. By 2007, the estimated density had increased to 620 plants/acre (1,535 plants/ha). The population consists of mostly mature plants. There had been no seedlings measured until 2007, when there were approximately 140 seedlings/acre (347 seedlings/ha). Young plants comprised 35% of the sagebrush

population in 2007, but recruitment has been low in other sample years. Decadence has ranged from a low of 0% of the population to a high of 22%. Dying plants have comprised 10% or less of the population, and the density of dead plants has been decreasing since 1997. Plants exhibiting poor vigor accounted for 56% of the population in 1989, but vigor has been good otherwise. Sagebrush annual leader growth averaged 1.6 inches (4.1 cm) in 2002 and 2007. Browse use has been light-moderate.

Although mountain snowberry (*Symphoricarpos oreophilus*) has a lower forage value than Saskatoon serviceberry or mountain big sagebrush, and is not usually considered a key browse species, there has been some browse use at this study. Wildlife may use this species because it is more abundant than the two preferred browse species. Snowberry canopy cover was 18% in both 2002 and 2007. The estimated density increased from 1,132 plants/acre (2,802 plants/ha) in 1983 to 3,000 plants/acre (7,426 plants/ha) by 1997, and decreased to 2,200 plants/acre (5,446 plants/ha) by 2007. Few or no seedlings have been measured in any sample year. Young plants comprised 41% of the population in 1983 and 23% in 1997, but have not been abundant in other years. Decadence has ranged from 0% of the population in 1983 to 33% in 1989. In 2007, 24% of the population was decadent. There have been few dead or dying plants. The proportion of the population displaying poor vigor peaked in 2002 at 35%, and was likely a result of drought. Browse use has been consistently light-moderate. Other browse sampled on the site include Oregon grape (*Mahonia repens*), Martin ceanothus (*Ceanothus martinii*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), and pricklypear cactus (*Opuntia* sp.).

Herbaceous Understory

The herbaceous understory was abundant and diverse prior to 2002. The drought in 2002 is suspected to have caused a decline in cover and frequency of both grasses and forbs. With the exception of 2007, perennial grasses were more abundant than annual grasses. Perennial grass cover was 8% in 1997, 6% in 2002, and 4% in 2007. The common perennial grasses include bluebunch wheatgrass (*Agropyron spicatum*), mutton bluegrass (*Poa fendleriana*), mountain brome (*Bromus carinatus*), and bottlebrush squirreltail (*Sitanion hystrix*). Cheatgrass (*Bromus tectorum*) frequency and cover have fluctuated since 1997. Cheatgrass cover was 2% in 1997, 0% in 2002, and 14% in 2007. It appears from photographic comparisons that cheatgrass was much more abundant prior to 1997, but since annuals were not sampled in 1983 or 1989, no comparisons can be made.

The forb component was abundant and diverse in 1983-1997. During sampling in 2002, it was observed that most forbs were dessicated and unrecognizable. Perennial forb cover decreased from 14% in 1997 to 1% in 2002, then increased to 8% in 2007. Prior to the drought in 2002, the most abundant perennial forbs included wild onion (*Allium* sp.), longleaf phlox (*Phlox longifolia*), tapertip hawksbeard (*Crepis acuminata*), gray lomatium (*Lomatium grayi*), and tailcup lupine (*Lupinus caudatus*). Annual forb cover also decreased from 5% in 1997 to nearly 0% in 2002, then increased to 10% in 2007. The most common annual forb species were pale alyssum (*Alyssum alyssoides*), slenderleaf collomia (*Collomia linearis*), and blue-eyed Mary (*Collinsia parviflora*).

1989 TREND ASSESSMENT

The browse trend is up. The density of serviceberry and sagebrush increased by 64% and 50%, respectively. Decadency increased for both browse species, but none of the browse population was classified as dying. There was an increase in the number of young serviceberry and sagebrush. Plants exhibiting poor vigor remained low for serviceberry but increased to 56% of the sagebrush population. The grass trend was slightly up. The sum of nested frequency for perennial grasses increased 12%. However, there was a significant decrease in nested frequency of bottlebrush squirreltail. The forb trend is down. The sum of nested frequency of perennial grasses decreased 39%, and the number of species decreased from 23 to 16.

browse - up (+2) grass - slightly up (+1) forb - down (-2)

1997 TREND ASSESSMENT

The browse trend is slightly down. Densities of serviceberry and sagebrush, decreased by 47% and 72%, respectively. Some of the change in browse density is attributed to the larger sample area that was measured beginning in 1997. The number of young plants also decreased for serviceberry and sagebrush. Decadence declined for both browse species. The density of dead sagebrush plants was higher than the density of live plants. Fewer key browse plants exhibited poor vigor. Browse use on sagebrush improved to light and remained light-moderate for serviceberry. The grass trend is stable. The sum of nested frequency of perennial grasses changed little, decreasing 9%. There was a significant increase in the nested frequency of Sandberg bluegrass (*Poa secunda*). The forb trend is slightly up. The sum of nested frequency of perennial forbs increased 17% and the number of species increased to 29. There was a significant increase in the nested frequency of wild onion, and a significant decrease in that of dandelion (*Taraxacum officinale*). The Desirable Components Index (DCI) score was not calculated for this summer range site.

winter range condition (DCI) - Not applicable, summer range
browse - slightly down (-1) grass - stable (0) forb - slightly up (+1)

2002 TREND ASSESSMENT

The browse trend is stable. The density of serviceberry and sagebrush increased 9% and 53%, respectively. Even though the density of these species increased, the density and cover remained low. Decadence was stable for serviceberry, but increased from 12% of the population to 19% for sagebrush. There were no seedlings or young plants of preferred browse species. In addition, it was noted that seed and flower production was low on serviceberry and sagebrush. The proportion of serviceberry plants exhibiting poor vigor increased to 49%, but remained stable for sagebrush. Browse use on serviceberry shifted from light-moderate to heavy, and was mostly light on sagebrush. The grass trend is stable. Although the sum of nested frequency for perennial grasses decreased by another 8%, there was a 97% decrease in cheatgrass frequency. Bluebunch wheatgrass was the only perennial grass to increase in either frequency or cover, and the increase was significant. The nested frequency of Mutton bluegrass and Sandberg bluegrass decreased significantly. Grasses had been heavily grazed. The forb trend is down. The sum of nested frequency of perennial forbs decreased 89% and cover decreased from 14% to 1%. The number of forb species decreased from 29 to 11. The DCI score was not calculated for this summer range site.

winter range condition (DCI) - Not applicable, summer range
browse - stable (0) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is stable. The density of serviceberry decreased 31%, but the density of sagebrush increased 19%. There were no seedling or young serviceberry plants. Conversely, there were 140 sagebrush seedlings/acre (347 seedlings/ha) and 220 young sagebrush/acre (545 young/ha). The increase of sagebrush reproduction and recruitment buffered against a down or slightly down browse trend. Decadence decreased for serviceberry and sagebrush. Vigor was good for both species. Browse use remained light-moderate for sagebrush and decreased from heavy to moderate-heavy for serviceberry. The grass trend is down. The sum of nested frequency of perennial grasses decreased 32%, which included a significant decrease in bluebunch wheatgrass. There was a significant increase in the nested frequency of cheatgrass. Cheatgrass cover increased from 0% to 14% of the total ground cover. The forb trend is up. There was a four-fold increase in the sum of nested frequency of perennial forbs. Bur buttercup (*Ranunculus testiculatus*), an allelopathic annual (Buchanan et al. 1978), was measured for the first time in one quadrat. The DCI score was not calculated for this summer range site.

winter range condition (DCI) - Not applicable, summer range
browse - stable (0) grass - down (-2) forb - up (+2)

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

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	a31	a49	a60	b144	a55	1.86	4.98	1.95
G	Agropyron trachycaulum	a3	a9	-	-	a1	-	-	.15
G	Bromus carinatus	ab41	b72	ab49	a32	a23	1.17	.66	.20
G	Bromus tectorum (a)	-	-	b187	a5	c246	1.71	.01	13.76
G	Festuca myuros (a)	-	-	-	-	3	-	-	.03
G	Melica bulbosa	a3	-	a8	-	a2	.26	-	.01
G	Poa fendleriana	c78	c78	bc50	a17	ab38	2.99	.53	1.30
G	Poa secunda	-	a9	b28	a5	ab17	.66	.03	.22
G	Sitanion hystrix	c58	b27	ab25	ab7	a3	.65	.04	.03
G	Stipa lettermani	a3	-	a3	a-	-	.03	.00	-
Total for Annual Grasses		0	0	187	5	249	1.71	0.01	13.79
Total for Perennial Grasses		217	244	223	205	139	7.62	6.26	3.88
Total for Grasses		217	244	410	210	388	9.33	6.28	17.67
F	Achillea millefolium	1	-	-	-	-	-	-	-
F	Agoseris glauca	ab12	-	b26	ab5	a3	.47	.03	.03
F	Alyssum alyssoides (a)	-	a21	b249	a3	b236	4.31	.01	2.94
F	Allium sp.	d182	b70	c100	-	a4	.45	-	.04
F	Aster sp.	-	a1	a4	-	-	.36	-	-
F	Astragalus sp.	-	-	7	-	-	.06	-	-
F	Astragalus utahensis	3	-	-	-	-	-	-	-
F	Balsamorhiza sagittata	a10	a17	a10	a11	a8	.82	.54	.43
F	Camelina microcarpa (a)	-	-	11	-	-	.02	-	-
F	Chaenactis douglasii	3	-	-	-	-	-	-	-
F	Cirsium neomexicanum	a9	a8	a3	a2	a3	.21	.03	.00
F	Collomia linearis (a)	-	-	b88	-	a8	.38	-	.04
F	Comandra pallida	c81	b43	ab29	ab24	a13	.35	.18	.13
F	Collinsia parviflora (a)	-	-	b32	a1	c227	.06	.00	2.99
F	Crepis acuminata	b63	b59	b50	a3	a5	1.20	.03	.06
F	Cryptantha sp.	4	-	-	-	-	-	-	-
F	Delphinium nuttallianum	a12	-	a21	-	-	.15	-	-
F	Descurainia pinnata (a)	-	-	-	-	25	-	-	.70
F	Epilobium brachycarpum (a)	-	-	ab15	b22	a4	.06	.12	.03
F	Epilobium sp.	-	-	-	-	7	-	-	.18
F	Eriogonum racemosum	b17	ab9	a3	-	-	.15	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Hackelia patens	$_{a}$11	$_{a}$10	-	-	$_{a}$9	-	-	.06
F	Heuchera parvifolia	1	-	-	-	-	-	-	-
F	Helianthella uniflora	3	-	-	-	-	-	-	-
F	Hymenoxys acaulis	-	-	45	-	-	4.65	-	-
F	Hydrophyllum capitatum	$_{a}$87	-	-	-	$_{a}$79	-	-	5.13
F	Lathyrus brachycalyx	$_{a}$8	-	-	$_{a}$3	-	-	.00	-
F	Lappula occidentalis (a)	-	-	-	-	16	-	-	.09
F	Lactuca serriola	-	-	-	-	1	-	-	.03
F	Lithospermum ruderale	$_{b}$9	$_{a}$1	$_{ab}$3	$_{ab}$4	$_{ab}$6	.15	.18	.68
F	Lomatium grayi	$_{b}$52	$_{b}$30	$_{b}$49	-	$_{a}$7	1.50	-	.12
F	Lupinus caudatus	$_{b}$78	$_{b}$72	$_{ab}$44	-	$_{a}$37	1.74	-	.89
F	Machaeranthera canescens	$_{a}$1	-	$_{a}$1	-	-	.03	-	-
F	Microsteris gracilis (a)	-	-	$_{a}$24	-	$_{b}$177	.14	-	3.23
F	Penstemon sp.	-	-	5	-	-	.01	-	-
F	Phlox longifolia	$_{a}$29	$_{a}$43	$_{a}$56	-	$_{a}$29	.63	-	.38
F	Polygonum douglasii (a)	-	-	$_{b}$21	-	$_{a}$2	.10	-	.00
F	Ranunculus testiculatus (a)	-	-	-	-	2	-	-	.00
F	Senecio integerrimus	-	$_{a}$9	$_{a}$5	-	$_{a}$1	.18	-	.00
F	Taraxacum officinale	-	$_{b}$21	$_{a}$5	-	$_{a}$5	.12	-	.06
F	Tragopogon dubius	$_{b}$20	$_{b}$30	$_{ab}$17	-	$_{a}$1	.07	-	.00
F	Unknown forb-perennial	-	-	-	1	-	-	.00	-
F	Wyethia amplexicaulis	-	-	5	-	-	.15	-	-
F	Zigadenus paniculatus	-	-	8	-	-	.02	-	-
Total for Annual Forbs		0	21	440	26	697	5.08	0.14	10.06
Total for Perennial Forbs		696	423	496	53	218	13.54	1.01	8.27
Total for Forbs		696	444	936	79	915	18.62	1.15	18.33

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

BROWSE TRENDS --
Management unit 19B, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier alnifolia	22	24	20	5.56	4.55	4.51
B	Artemisia tridentata vaseyana	13	19	22	2.57	3.16	3.76
B	Ceanothus martinii	7	10	1	.33	.56	-
B	Chrysothamnus viscidiflorus viscidiflorus	5	5	4	.93	.33	.15
B	Juniperus osteosperma	1	0	0	-	-	-
B	Mahonia repens	25	18	23	2.66	.51	1.50
B	Opuntia sp.	6	5	1	.15	.15	-
B	Symphoricarpos oreophilus	66	66	53	15.70	14.43	10.87
Total for Browse		145	147	124	27.91	23.71	20.80

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 2

Species	Percent Cover	
	'02	'07
Amelanchier alnifolia	8.03	10.81
Artemisia tridentata vaseyana	3.31	5.16
Ceanothus martinii	.41	-
Chrysothamnus viscidiflorus viscidiflorus	.30	.36
Mahonia repens	.66	1.14
Symphoricarpos oreophilus	18.39	18.18

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 2

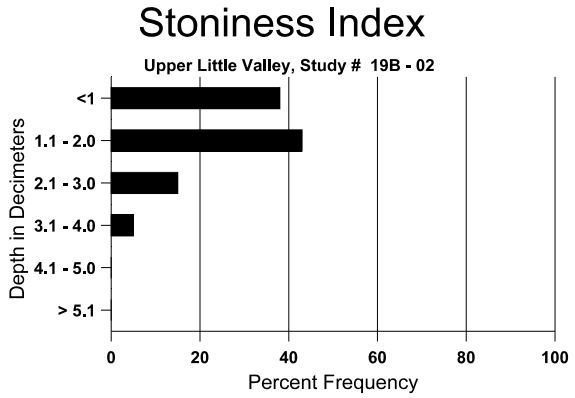
Species	Average leader growth (in)	
	'02	'07
Amelanchier alnifolia	-	2.6
Artemisia tridentata vaseyana	1.6	1.7

BASIC COVER --
Management unit 19B, Study no: 2

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	4.75	10.25	50.93	27.84	57.93
Rock	5.50	9.25	6.74	10.16	9.20
Pavement	3.25	3.25	1.85	10.75	9.21
Litter	71.50	63.50	53.03	38.76	18.77
Cryptogams	0	0	.03	0	0
Bare Ground	15.00	13.75	8.91	32.10	13.53

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 2, Upper Little Valley

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.8	59.5 (13.8)	6.2	49.3	27.2	23.6	4.6	13.7	211.2	.6



PELLET GROUP DATA --
Management unit 19B, Study no: 2

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	3	-	1
Elk	2	-	10
Deer	26	21	18
Cattle	-	1	-

Days use per acre (ha)	
'02	'07
-	-
2 (5)	15 (36)
42 (104)	38 (93)
9 (21)	2 (4)

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 2

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier alnifolia												
83	**733**	-	-	600	133	-	64	36	18	9	9	27/27
89	**1199**	-	533	400	266	-	28	22	22	-	6	32/30
97	**640**	-	40	580	20	20	50	13	3	3	3	53/55
02	**700**	-	-	700	-	40	0	97	0	-	49	42/42
07	**480**	-	-	480	-	20	46	50	0	-	0	51/59
Artemisia tridentata vaseyana												
83	**800**	-	-	800	-	-	42	8	0	-	0	21/31
89	**1198**	-	66	866	266	-	22	0	22	-	56	20/25
97	**340**	-	-	300	40	380	0	0	12	6	6	26/43
02	**520**	-	-	420	100	220	15	8	19	4	4	22/40
07	**620**	140	220	340	60	100	13	13	10	10	10	23/44
Ceanothus martinii												
83	**732**	-	466	266	-	-	100	0	-	-	0	7/11
89	**733**	-	-	733	-	-	27	0	-	-	0	8/11
97	**300**	40	80	220	-	-	33	0	-	-	0	8/27
02	**340**	-	20	320	-	40	0	88	-	-	0	4/11
07	**40**	-	-	40	-	-	0	100	-	-	0	5/7
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	24/39
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
83	**199**	-	66	133	-	-	0	0	0	-	0	11/13
89	**333**	-	133	200	-	-	0	0	0	-	0	13/19
97	**180**	-	-	180	-	-	0	0	0	-	0	15/32
02	**180**	-	-	20	160	-	0	11	89	44	44	9/18
07	**180**	-	-	160	20	-	0	0	11	11	11	11/20

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**40**	-	-	40	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Mahonia repens												
83	**533**	-	-	533	-	-	0	0	0	-	0	5/7
89	**1265**	-	133	1066	66	-	0	0	5	-	0	2/5
97	**7560**	-	1640	5920	-	-	0	0	0	-	0	5/7
02	**1560**	-	-	840	720	160	0	0	46	46	46	4/5
07	**8700**	-	-	8700	-	-	.22	0	0	-	0	3/5
Opuntia sp.												
83	**600**	-	-	600	-	-	0	0	0	-	0	6/13
89	**732**	-	133	533	66	-	0	0	9	-	0	8/22
97	**180**	-	40	140	-	20	0	0	0	-	22	6/11
02	**100**	-	-	100	-	-	0	0	0	-	0	5/13
07	**20**	-	-	20	-	-	0	0	0	-	0	6/13
Pachistima myrsinites												
83	**532**	-	66	466	-	-	0	0	-	-	0	5/4
89	**799**	-	333	466	-	-	0	25	-	-	0	2/2
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Symphoricarpos oreophilus												
83	**1132**	-	466	666	-	-	12	0	0	-	0	19/15
89	**1599**	-	133	933	533	-	29	0	33	-	13	19/22
97	**3000**	40	700	1840	460	100	25	7	15	9	11	25/45
02	**2880**	-	-	2480	400	40	0	.69	14	3	35	21/36
07	**2200**	-	60	1620	520	40	21	3	24	5	8	19/33
Tetradymia canescens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	19/38
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 19B-3-07

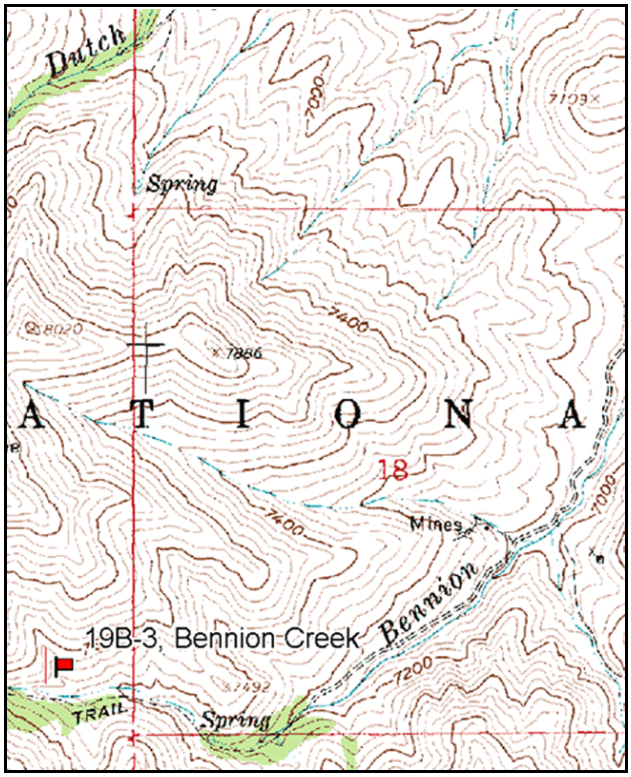
Study site name: Bennion Creek . Vegetation type: Mountain Brush .

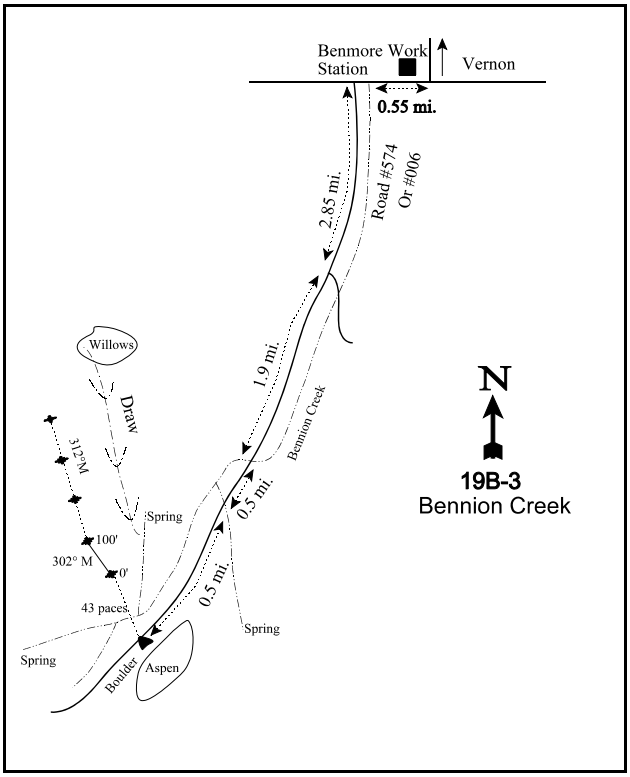
Compass bearing: frequency baseline 302 degrees magnetic (Lines 2-4 @ 312°M).

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

LOCATION DESCRIPTION

From the Benmore Work Station south of Vernon, travel west 0.55 miles to the intersection with the Forest Service road #574 (may have been changed to road #006). Turn left and go south 2.85 miles to a fork. Bear right and go 1.7 miles to where Bennion Creek crosses the road. Proceed 0.5 miles to where a small drainage from a spring crosses the road. Continue up Bennion Creek 0.5 miles to the study site. Vehicle travel may be restricted in this last 0.5 mile. The site is located on a ridge above the point where two springs come together. From the road, the 0-foot baseline stake is 43 paces northwest. A red browse tag, number 3979, is attached to the 0-foot baseline stake.





Map Name: Dutch Peak Diagrammatic Sketch

Township 10S , Range 6W , Section 13 GPS: NAD 83, UTM 12S 375082 E 4423122 N

DISCUSSION

Bennion Creek - Trend Study No. 19B-3

Study Information

This study is typical of deer summer range found on the Sheeprock Mountains [elevation: 7,500 feet (2,286 m), slope: 15%-30%, aspect: east]. The study samples a low-growing, mountain brush community. Bennion Creek, a perennial stream, is located 200 yards (182 m) down the slope to the south. A moderately large aspen stand and dense thickets of chokecherry and serviceberry provide cover nearby. Several deer were observed in the immediate area in 1983 and 2007. In 1997, several cows were observed grazing along Bennion Creek. Wildlife use has been light on the immediate study. From the pellet group tansect, there were an estimated 11 deer days use/acre (28 ddu/ha) in 2002 and 13 deer days use/acre (33 ddu/ha) in 2007. Elk use was estimated at 1 day use/acre (2 edu/ha) in 2002 and 5 days use/acre (12 edu/ha) in 2007. Cattle use was estimated at 21 days use/acre (52 cdu/ha) in 2002 and 9 days use/acre (22 cdu/ha) in 2007. The deer and elk sign appeared to be mostly from spring and early summer. Cattle pats have been one year old, suggesting that the site may be grazed in the fall.

Soil

The study lies within the Podmor-Onaqui-Rock outcrop association, and generally consists of shallow to moderately deep, well-drained soil. Soil depths were 10-23 inches (25-58 cm). Soils in this series formed in colluvium and residuum derived predominantly from quartzite, and are found on mountainsides and ridges (USDA-NRCS 2007). Specifically on the study, the soil has a loam texture and a slightly acidic reactivity (pH of 6.5). It is relatively shallow with angular quartzite rocks on the surface. Some soil movement is apparent, but appears minimal. Abundant vegetation and litter cover are likely to have prevented excessive runoff and soil loss in the past. Vegetation and litter cover both declined and exposed more bare soil and pavement in 2002, then vegetation recovered in 2007. Rock and pavement are abundant and armor the surface, which also helps minimize erosive events. The erosion condition was at the upper limit of stable in 2002, and increased to slight in 2007.

Browse

Utah serviceberry (*Amelanchier utahensis*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) are the key browse species, and together have comprised an average 12% canopy cover since 2002. Serviceberry density increased from 732 plants/acre (1,812 plants/ha) in 1983 to 866 plants/acre (2,144 plants/ha) in 1989, and steadily decreased to 460 plants/acre (1,139 plants/ha) by 2007. Seedlings were measured in 1989, but have not been measured since. However, seedlings were probably present but were not sampled in the transect. This is evidenced by the presence of young plants in all sample years. The density of young plants has declined with each sampling. Decadence increased from 9% in 1983 to a high of 37% in 1997, and then decreased to 0% in 2007. Plants exhibiting poor vigor peaked at 17% of the population in 1997 and decreased to 10% and 4% in 2002 and 2007, respectively. Serviceberry leader growth was not measurable in 2002 or 2007. Browse use was light-moderate in 1983 and 1989, and increased to moderate-heavy in 1997, 2002, and 2007.

The mountain big sagebrush density increased from 532 plants/acre (1,317 plants/ha) in 1983 to 940 plants/acre (2,327 plants/ha) in 1997. The population decreased to 860 plants/acre (2,130 plants/ha) in 2002 and increased to 1,080 plants/acre (2,673 plants/ha) in 2007. Prior to 2007, this was largely a mature and decadent population with few seedling and young plants. However, in 2007 the density of seedlings was estimated at 800 seedlings/acre (1,980 seedlings/ha), and young plants comprised 30% of the population. Sagebrush decadence has ranged from 25% of the population to30%, except in 1989, when no decadent plants were sampled. Plants classified as dying were first sampled in 1997 at 17% of the population, then declined to 6% by 2007. The proportion of the population exhibiting poor vigor peaked in 1997 at 21% of the population, then decreased to 7% in 2007. Annual leader growth averaged 1.1 inches (2.8 cm) in 2002 and 1.5 inches (3.8

cm) in 2007. Crickets were abundant in 2002 and had defoliated many of the sagebrush and low rabbitbrush plants. Browse use has been light-moderate in all sample years.

Mountain snowberry (*Symphoricarpos oreophilus*), although having a lower wildlife preference, is the most abundant browse sampled. It has averaged 9% canopy cover since 2002. Snowberry density increased from 2,466 plants/acre (6,104 plants/ha) in 1983 to approximately 6,000 plants/acre (14,850 plants/ha) in 1989. Since 1989, the population has steadily decreased, and was estimated at 1,980 plants/acre (4,900 plants/ha) in 2007. The decline in density is likely the result of the decrease in young plants that began in 1997. In 1989, young plants comprised 66% of the population. Young plants decreased to 21% in 1997, and 2% in 2002 and 2007. There have been few decadent or dying plants in all sample years. Browse use on snowberry has been mostly light.

There is also a fairly abundant population of mountain lover (*Pachistima myrsinites*). Since 1997, density has ranged from an estimated 600 plants/acre (1,485) to 1,740 plants/acre (4,307 plants/ha). The population is mostly mature and is comprised of short plants that average 4 inches (10.2 cm) in height. Black sagebrush (*Artemisia nova*) has also been sampled at low densities. Other shrubs sampled include: stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), whorled buckwheat (*Eriogonum heracleoides*), Oregon grape (*Mahonia repens*), and pricklypear cactus (*Opuntia* sp.).

Herbaceous Understory

Perennial grass cover was 16% in 1997, 9% in 2002, and 5% in 2007. Grasses are dominated by a variety of perennial species. These include spike fescue (*Leucopoa kingii*), mutton bluegrass (*Poa fendleriana*), oniongrass (*Melica bulbosa)*, and bluebunch wheatgrass (*Agropyron spicatum*). Cheatgrass (*Bromus tectorum*) was measured in 1997 and 2007, but cover has been less than 1% every sample year. Bulbous bluegrass (*Poa bulbosa*), which has a phenology similar to annual grasses (Stewart and Hull 1949) was sampled in 4% of the quadrats in 2007. Grasses had been heavily grazed by insects in 2002.

Forbs were very diverse and abundant in 1983. From 1989 to 2002, the nested and quadrat frequencies of perennial forbs decreased, and the number of perennial species sampled decreased from 28 to 13. In 2007, there was an increase in nested and quadrat frequencies. Perennial cover decreased from 10% in 1997 to 2% in 2002, then increased to 9% in 2007. The most abundant perennial forb species included wild onion (*Allium* sp.), aster (*Aster* sp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), tapertip hawksbeard (*Crepis acuminata*), and lomatium (*Lomatium* sp.). Annual forb cover increased from less than 1% in 1997 and 2002 to 10% in 2007. Blue-eyed Mary (*Collinsia parviflora*), slenderleaf collomia (*Collomia linearis*), and pale alyssum (*Alyssum alyssoides*) have been the most abundant. Houndstongue (*Cynoglossum officinale*), a noxious weed, was sampled in one quadrat in 2002, but was not sampled in 2007.

1989 TREND ASSESSMENT

The browse trend is slightly up. The density of serviceberry and sagebrush increased 18% and 25%, respectively. Decadence increased for serviceberry and decreased for sagebrush, though there were no dead key browse plants sampled. Browse use remained light-moderate for serviceberry and light for sagebrush. The trend for grass is stable. The sum of nested frequency for perennial grasses increased 4%. The forb trend is stable. The sum of nested frequency of perennial forbs decreased 8%, and there were five fewer species measured. There were significant increases in three forb species and significant decreases in three forb species.

browse - slightly up (+1) grass - stable (0) forb - stable (0)

1997 TREND ASSESSMENT

The browse trend is slightly down. Serviceberry density decreased 19% and sagebrush density increased 41%. Some of the change in density is attributed to the larger area sampled beginning in 1997. However, the

population decadency increased from 15% to 37% for serviceberry and from 0% to 30% for sagebrush. Young plants comprised less of the population for both browse species. The proportion of browse plants exhibiting poor vigor increased and most of those plants were actually classified as dying. Browse use on serviceberry shifted from light-moderate to moderate-heavy. The grass trend is slightly up. The sum of nested frequency of perennial grasses increased 19%. There were significant increases in the nested frequencies of oniongrass and spike fescue. Cheatgrass was sampled in two quadrats. Since annual grasses were not measured in 1983 or 1989, it is not clear if cheatgrass had been present prior to 1997. The forb trend is down. The sum of nested frequency of perennial forbs decreased 36%, including significant decreases in the nested frequencies of eight perennial species. The Desirable Components Index (DCI) score was not calculated for this summer range site.

winter range condition (DCI) - Not applicable, summer range
browse - slightly down (-1) grass - slightly up (+1) forb - down (-2)

2002 TREND ASSESSMENT

The browse trend is stable. Serviceberry density decreased by 11% and sagebrush density decreased by 9%. However, serviceberry and sagebrush decadence decreased to 16% and 28%, respectively. The grass trend is slightly down. The sum of nested frequency of perennial grasses decreased 21%. There were significant decreases in the nested frequencies of mountain brome, oniongrass, and Sandberg bluegrass. Conversely, the nested frequency of bluebunch wheatgrass increased significantly and cheatgrass was not measured. The forb trend is down. The sum of nested frequency of perennial forbs decreased 83%, and that of annual forbs decreased 98%. The number of forb species decreased from 34 to 14, and forb cover decreased from 11% to 2%. Additionally, a noxious weed, common houndstongue, was measured in one quadrat. The DCI score was not calculated for this summer range site.

winter range condition (DCI) - Not applicable, summer range
browse - stable (0) grass - slightly down (-1) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is slightly up. The density of serviceberry decreased 26%, but sagebrush density increased 26%. Decadence decreased to 0% of the serviceberry population and 9% of the sagebrush population. While there was little to no serviceberry reproduction or recruitment, there were 800 sagebrush seedlings/acre (1,980 seedlings/ha) and young plants comprised 30% of the population. Sagebrush reproduction and recruitment have not been this high in any sample year. In addition, the percentage of plants exhibiting poor vigor decreased for both browse species. The grass trend is down. The sum of nested frequency of perennial grasses decreased 27%, including significant decreases in the nested frequencies of bluebunch wheatgrass, spike fescue, and mutton bluegrass. Cheatgrass was measured again, and bulbous bluegrass (*Poa bulbosa*) was measured for the first time. Both of these cool season grasses are active early in the year and are likely to decrease the available soil moisture for germination and growth of desired species. The trend for forbs is up. The sum of nested frequency of perennial forbs increased more than three-fold and the number of forb species returned to 34. Annual forbs also increased and, for the first time, had a higher nested frequency and cover than perennial forbs. Tapertip hawksbeard increased significantly and common houndstongue was not measured. The DCI score was not calculated for this summer range site.

winter range condition (DCI) - Not applicable, summer range
browse - slightly up (+1) grass - down (-2) forb - up (+2)

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

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	a49	a48	a70	b147	a51	1.90	2.64	1.00
G	Agropyron trachycaulum	ab13	b14	a1	-	-	.00	-	-
G	Bromus carinatus	bc57	bc53	b33	a3	c86	.36	.03	1.87
G	Bromus tectorum (a)	-	-	a4	-	a8	.03	-	.07
G	Carex sp.	ab11	b26	-	a6	a4	-	.18	.03
G	Elymus junceus	-	-	-	-	3	-	-	.15
G	Leucopoa kingii	b87	b84	c137	bc124	a31	6.78	4.69	.85
G	Melica bulbosa	a26	a26	b109	a22	a54	2.29	.27	.57
G	Phleum pratense	-	-	3	-	-	.03	-	-
G	Poa bulbosa	-	-	-	-	10	-	-	.19
G	Poa fendleriana	b147	b140	b120	b106	a38	3.48	1.40	.43
G	Poa pratensis	a14	a13	a13	-	a1	.36	-	.01
G	Poa secunda	ab13	b29	b31	a6	ab21	.57	.01	.31
G	Stipa lettermani	a5	a7	a5	a1	a3	.06	.00	.01
Total for Annual Grasses		0	0	4	0	8	0.03	0	0.07
Total for Perennial Grasses		422	440	522	415	302	15.86	9.25	5.45
Total for Grasses		422	440	526	415	310	15.90	9.25	5.52
F	Achillea millefolium	a3	-	a3	-	a1	.03	-	.00
F	Agoseris glauca	a5	c69	b23	ab8	a3	.07	.04	.03
F	Alyssum alyssoides (a)	-	-	a79	-	a76	.15	-	1.05
F	Allium sp.	d202	b121	c160	-	a54	.79	-	.27
F	Arabis sp.	-	a6	a1	-	-	.01	-	-
F	Artemisia ludoviciana	a4	a1	a10	a9	a5	.60	.21	.18
F	Astragalus cibarius	b60	b59	a17	-	-	.26	-	-
F	Aster sp.	ab91	c115	b72	a38	a34	1.04	.43	.81
F	Balsamorhiza sagittata	ab18	b26	a5	a3	ab8	.66	.28	1.95
F	Castilleja linariaefolia	a7	a3	a10	-	a2	.05	-	.00
F	Camelina microcarpa (a)	-	-	-	-	2	-	-	.03
F	Calochortus nuttallii	a2	a3	a8	-	-	.02	-	-
F	Chaenactis douglasii	a1	-	a1	-	-	.00	-	-
F	Cirsium sp.	b29	a5	a7	-	a10	.34	-	.10
F	Collomia linearis (a)	-	-	a79	-	a106	.24	-	.46
F	Comandra pallida	ab35	b35	-	ab18	a11	-	.16	.22
F	Collinsia parviflora (a)	-	-	a83	-	b297	.16	-	7.29

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Crepis acuminata	$_{c}$138	$_{c}$140	$_{b}$86	$_{a}$1	$_{b}$59	2.53	.00	1.80
F	Cruciferae	-	-	-	-	4	-	-	.03
F	Cynoglossum officinale	-	-	-	3	-	-	.00	-
F	Delphinium nuttallianum	$_{b}$31	-	$_{a}$13	-	$_{a}$2	.04	-	.00
F	Epilobium brachycarpum (a)	-	-	$_{a}$25	$_{a}$8	$_{b}$39	.07	.04	.28
F	Erysimum asperum	15	-	-	-	-	-	-	-
F	Eriogonum brevicaule	-	-	-	-	3	-	-	.00
F	Erigeron divergens	$_{a}$4	$_{a}$1	$_{a}$8	-	$_{a}$3	.09	-	.03
F	Eriogonum racemosum	$_{b}$49	$_{b}$42	$_{a}$6	$_{a}$12	$_{a}$6	.04	.25	.09
F	Eriogonum umbellatum	$_{b}$40	$_{b}$38	$_{a}$13	$_{a}$3	$_{a}$-	.17	.00	-
F	Fritillaria pudica	2	-	-	-	-	-	-	-
F	Gayophytum ramosissimum(a)	-	-	-	-	7	-	-	.03
F	Hackelia patens	$_{a}$2	-	$_{a}$2	-	-	.00	-	-
F	Holosteum umbellatum (a)	-	-	$_{a}$5	-	$_{a}$2	.01	-	.00
F	Hydrophyllum capitatum	$_{a}$28	-	-	-	$_{b}$56	-	-	1.69
F	Lappula occidentalis (a)	-	-	-	-	5	-	-	.03
F	Lactuca serriola	-	-	$_{a}$2	-	$_{b}$29	.00	-	.25
F	Lithospermum sp.	-	-	$_{a}$-	$_{a}$2	-	.00	.03	-
F	Lomatium sp.	$_{c}$149	$_{c}$163	$_{b}$59	-	$_{a}$24	.91	-	1.06
F	Lupinus caudatus	$_{b}$59	$_{a}$23	-	-	$_{a}$6	-	-	.18
F	Lupinus sericeus	$_{c}$29	$_{bc}$19	$_{ab}$11	$_{ab}$2	$_{a}$-	.33	.15	.01
F	Machaeranthera canescens	$_{a}$6	$_{a}$1	$_{a}$11	-	$_{a}$3	.03	-	.15
F	Microsteris gracilis (a)	-	-	$_{a}$20	-	$_{a}$18	.05	-	.13
F	Orobanche uniflora	$_{a}$2	-	-	-	$_{a}$7	-	-	.04
F	Phlox longifolia	$_{a}$17	$_{a}$32	$_{a}$18	-	$_{a}$20	.21	-	.17
F	Polygonum douglasii (a)	-	-	$_{a}$67	-	$_{a}$49	.22	-	.31
F	Senecio integerrimus	$_{a}$7	$_{b}$43	$_{b}$44	$_{a}$3	$_{a}$6	.54	.03	.07
F	Tragopogon dubius	-	$_{a}$1	$_{a}$1	-	-	.03	-	-
F	Veronica biloba (a)	-	-	$_{a}$8	-	$_{a}$3	.01	-	.00
F	Wyethia amplexicaulis	-	$_{ab}$3	$_{b}$21	$_{a}$1	$_{a}$-	.91	.15	.03
Total for Annual Forbs		0	0	366	8	604	0.92	0.04	9.64
Total for Perennial Forbs		1035	949	612	103	356	9.78	1.75	9.23
Total for Forbs		1035	949	978	111	960	10.72	1.79	18.88

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

BROWSE TRENDS --
Management unit 19B, Study no: 3

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier utahensis	32	28	20	3.65	3.19	3.10
B	Artemisia nova	8	1	1	.44	-	.03
B	Artemisia tridentata vaseyana	40	34	39	4.48	3.56	3.44
B	Chrysothamnus viscidiflorus viscidiflorus	4	3	5	.38	.03	1.00
B	Eriogonum heracleoides	18	27	21	.27	1.31	.51
B	Juniperus osteosperma	1	0	0	-	-	-
B	Mahonia repens	16	3	14	.75	.04	.42
B	Opuntia sp.	3	5	6	.15	.54	.38
B	Pachistima myrsinites	21	26	13	.70	.87	.23
B	Rosa woodsii	21	7	7	1.88	.21	.39
B	Salix bebbiana perrostrata	0	0	0	-	-	.85
B	Symphoricarpos oreophilus	68	61	56	9.90	6.23	8.05
B	Tetradymia canescens	0	1	0	-	-	-
Total for Browse		232	196	182	22.63	16.02	18.44

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 3

Species	Percent Cover	
	'02	'07
Amelanchier utahensis	5.16	6.84
Artemisia tridentata vaseyana	5.08	7.91
Chrysothamnus viscidiflorus viscidiflorus	.13	.45
Eriogonum heracleoides	1.00	1.21
Mahonia repens	.01	.20
Opuntia sp.	.45	.75
Pachistima myrsinites	.25	.43
Rosa woodsii	.21	.95
Salix bebbiana perrostrata	-	.16
Symphoricarpos oreophilus	8.03	9.71

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 3

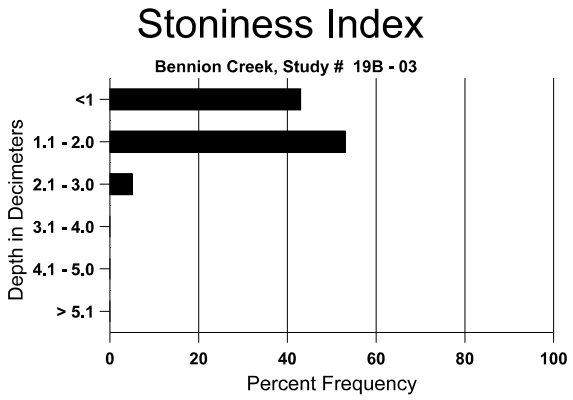
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.1	1.5

BASIC COVER --
Management unit 19B, Study no: 3

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	3.50	8.50	49.18	26.78	43.98
Rock	12.00	10.25	12.07	15.73	12.13
Pavement	2.50	13.75	5.51	15.27	13.27
Litter	55.50	52.75	50.44	32.01	18.13
Cryptogams	0	0	.17	0	.00
Bare Ground	26.50	14.75	7.03	27.78	20.61

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 3, Bennion Creek

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.2	56.8 (13.2)	6.5	43.3	30.7	26.0	4.5	12.3	307.2	.6



PELLET GROUP DATA --
Management unit 19B, Study no: 3

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	1	-	-
Elk	1	-	-
Deer	8	5	1
Cattle	5	10	5

Days use per acre (ha)	
'02	'07
-	-
1 (2)	5 (12)
11 (28)	13 (33)
21 (52)	9 (22)

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 3

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
83	**732**	-	400	266	66	-	45	0	9	-	0	33/21
89	**866**	66	400	333	133	-	46	0	15	-	0	34/19
97	**700**	-	60	380	260	80	49	43	37	17	17	33/35
02	**620**	-	40	480	100	20	32	65	16	10	10	34/35
07	**460**	-	20	440	-	80	26	52	0	-	4	42/42
Artemisia nova												
83	**132**	-	66	66	-	-	0	0	0	-	0	14/23
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**240**	-	-	180	60	-	17	0	25	17	25	12/22
02	**60**	-	-	60	-	-	0	0	0	-	0	8/26
07	**100**	-	-	100	-	20	0	0	0	-	0	10/26
Artemisia tridentata vaseyana												
83	**532**	-	133	266	133	-	38	0	25	-	0	21/51
89	**666**	-	66	600	-	-	10	10	0	-	10	21/35
97	**940**	-	20	640	280	360	21	0	30	17	21	24/39
02	**860**	-	80	540	240	240	28	14	28	16	16	19/35
07	**1080**	800	320	660	100	120	41	6	9	6	7	22/38
Chrysothamnus viscidiflorus viscidiflorus												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**133**	-	-	133	-	-	0	0	0	-	0	16/10
97	**80**	-	-	60	20	-	0	0	25	25	25	16/28
02	**60**	-	-	60	-	-	0	0	0	-	33	10/15
07	**100**	-	-	100	-	-	0	0	0	-	0	11/19
Eriogonum heracleoides												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**680**	60	140	520	20	-	0	0	3	3	3	12/13
02	**980**	-	-	920	60	40	12	8	6	-	2	6/13
07	**660**	20	40	620	-	-	18	3	0	-	0	6/14

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**40**	-	-	40	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Mahonia repens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**1920**	-	640	1280	-	-	0	0	-	-	0	4/6
02	**120**	-	-	120	-	-	0	0	-	-	0	2/3
07	**1900**	-	80	1820	-	-	11	0	-	-	0	4/5
Opuntia sp.												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**140**	-	-	140	-	-	0	0	-	-	0	8/32
02	**120**	-	-	120	-	-	0	0	-	-	0	6/33
07	**160**	-	-	160	-	-	0	0	-	-	0	5/17
Pachistima myrsinites												
83	**733**	-	-	733	-	-	0	0	-	-	0	5/4
89	**133**	533	133	-	-	-	0	0	-	-	0	-/-
97	**1560**	40	380	1180	-	-	0	0	-	-	0	5/12
02	**1740**	-	-	1740	-	-	14	10	-	-	0	4/7
07	**600**	60	60	540	-	-	13	3	-	-	0	4/11
Rosa woodsii												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**1140**	260	740	340	60	-	0	0	5	2	2	12/17
02	**820**	-	100	720	-	-	27	0	0	-	0	5/6
07	**660**	-	-	660	-	-	9	0	0	-	0	13/10
Symphoricarpos oreophilus												
83	**2466**	-	1066	1400	-	-	0	0	0	-	0	24/21
89	**5999**	133	3933	1533	533	-	3	0	9	-	2	30/31
97	**3620**	20	760	2580	280	-	16	1	8	4	8	16/29
02	**2980**	-	60	2720	200	-	0	0	7	2	17	14/22
07	**1980**	-	40	1920	20	-	5	1	1	-	10	15/32

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Tetradymia canescens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 19B-4-07

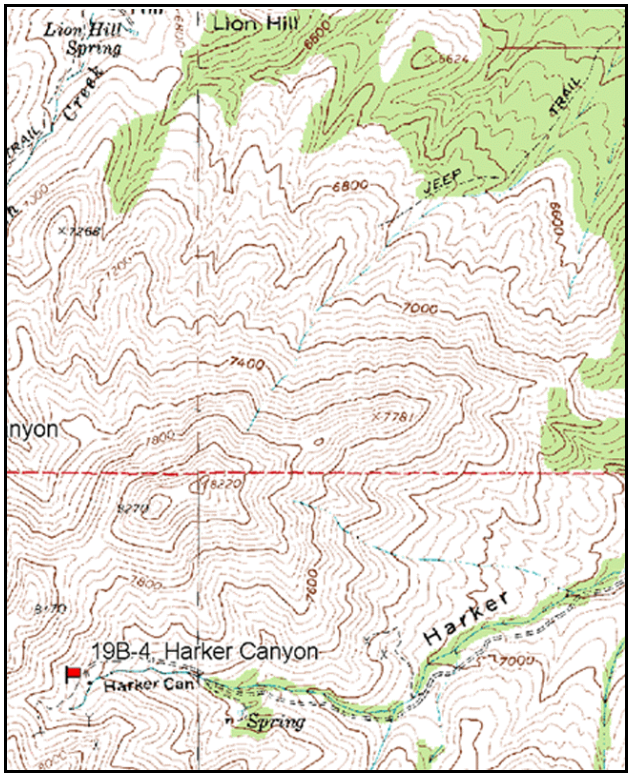
Study site name: Harker Canyon . Vegetation type: Snowberry .

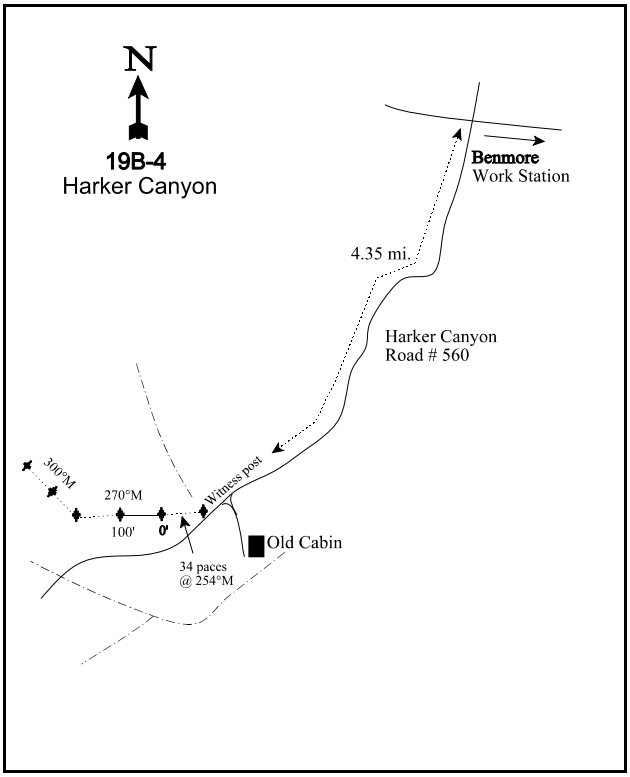
Compass bearing: frequency baseline 270 degrees magnetic (Line 3-4 @ 300°M).

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 3 on 7ft, belt 4 on 1ft, and belt 5 on 1ft.

LOCATION DESCRIPTION

From the Forest Service's Benmore Work Station, proceed south 0.10 miles to a “T” intersection. Turn right at the intersection (west) for 2.0 miles to an intersection and a sign for "Harker Canyon." Turn left, heading southwest towards Harker Canyon for 4.35 miles. Just after passing an old cabin on the lefthand side of the road, look for a half high green steel "T" fencepost with a white top on the right side of the road (northeast). From the fencepost the 0-foot stake of the baseline is 34 paces away at an azimuth of 245 degrees magnetic. The study is marked by green steel “T" fenceposts approximately 12-18 inches in height.





Map Name: Erickson Knoll Diagrammatic Sketch

Township 10S , Range 6W , Section Unsurveyed (3) GPS: NAD 83, UTM 12S 371356 E 4426183 N

DISCUSSION

Harker Canyon - Trend Study No. 19B-4

Study Information

This study samples deer summer range located near the upper end of Harker Canyon on Forest Service land [elevation: 7,700 feet (2,347 m), slope: 35%, aspect: east]. The vegetation is dominated by mountain brush and there is a perennial water source about 150 yards (137 m) to the south. Nearby, in Harker Canyon, scattered aspen and tall brush thickets provide resting and escape cover during the summer. In 1983, two mature bucks and one doe were observed, and there was a moderate number of deer pellet groups and cattle pats. Only a few deer and elk pellet groups were observed in 1997. During 2002 and 2007, several deer were seen nearby, including a couple of small bucks. From the pellet group transect there were an estimated 40 deer days use/acre (99 ddu/ha) in 2002 and 25 deer days use/acre (63 ddu/ha) in 2007. Elk use was estimated at 1 day use/acre (2 edu/ha) in 2002 and 2007. Cattle use was estimated at 10 days use/acre (25 cdu/ha) in 2002 and 5 days use/acre (13 cdu/ha) in 2007. The majority of deer and elk pellets sampled appeared to be from spring and early summer, and cattle pats were from late summer. Additionally, there were off-road vehicle tracks traversing the study in 2007.

Soil

The study lies within the Podmor-Onaqui-Rock outcrop association, and generally consists of shallow to moderately deep, well-drained soil. Soil depths were 10-23 inches (25-58 cm). Soils in this series formed in colluvium and residuum derived predominantly from quartzite, and are found on mountainsides and ridges (USDA-NRCS 2007). Specifically at the study, soil is coarse and rocky. The soil has a loam texture and a moderately acidic reactivity (pH of 6.0). Relative vegetation cover was 45% in 1997, decreased to 35% in 2002, and increased to 46% in 2007. Relative bare ground soil increased from 2% in 1997 to 20% in 2002, and decreased to 16% in 2007. The decrease in vegetation cover and the increase in bare ground cover in 2002 is likely the result of a region-wide drought (Utah Climate Surveys 2007). It was reported in the past that erosion was negligible as there was little bare ground and abundant vegetation and litter cover. Most signs of erosion occurred on animal trails that zig-zag through the area. Both surface litter and soil movement were noted in 2002. The erosion condition has been on the threshold between stable and slight since 2002.

Browse

The vegetative community is dominated by the browse component. The three most abundant browse species are mountain snowberry (*Symphoricarpos oreophilus*), Saskatoon serviceberry (*Amelanchier alnifolia*), and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Snowberry canopy cover was 26% in 2002 and increased to 33% in 2007. The estimated snowberry density increased from 1,000 plants/acre (2,475 plants/ha) in 1983 to 3,000 plants/acre (7,426 plants/ha) in 2002, then decreased to 2,480 plants/acre (6,140 plants/ha) in 2007. Nearly 90% of the sampled plants have been classified as mature since 1997. Decadence has increased from 2% of the population in 1997 to 12% in 2007. In 2002 and 2007, few seedling or young plants were sampled, and plants with poor vigor comprised 24% and 16% of the population, respectively. The majority of plants with poor vigor were chlorotic and dropping leaves. Browse use has been light, though in 2002 crickets were observed feeding on snowberry leaves.

Serviceberry canopy cover was 6% in 2002 and increased to 8% in 2007. The serviceberry density has oscillated between increasing and decreasing in alternate sample years. The estimated density has fluctuated between a low of 333 plants/acre (824 plants/ha) in 1983 to a high of 1,266 plants/acre (3,137 plants/ha) in 1989. In 2007, there were an estimated 500 plants/acre (1,238 plants/ha). No serviceberry seedlings have been measured in any year. Young plants comprised 11% of the population in 1989 and 1997, 5% in 2002, and 16% in 2007. Decadence was highest in 1989 at 26% and has been from 0% to 12% all other sample years. Vigor was good all sample years except for 2002, when 38% of the population displayed poor vigor. The increase in poor vigor was likely the result of the region-wide drought (Utah Climate Summaries 2007).

As with mountain snowberry, a combination of leaf drop due to drought and browsing by crickets resulted in plants being categorized as having reduced vigor. Annual leader growth on serviceberry averaged 1.9 inches (4.8 cm) in 2002 and 4.1 inches (10.5 cm) in 2007. Browse use on this species was light in 1983 and 1989, light-moderate in 1997, and moderate-heavy in 2002. In 2007, browse use was split between light and heavy.

The canopy cover of mountain big sagebrush has been approximately 3% since 2002. Sagebrush density has also oscillated between increasing and decreasing in alternate sample years. The lowest mountain big sagebrush density was 560 plants/acre (1,386 plants/ha) in 2002, and the highest was 1,540 plants/acre (3,812 plants/ha) in 1997. In 2007, the density was estimated at 580 plants/acre (1,435 plants/ha). Seedlings were not measured until 2007 and had a density of 160 plants/acre (396 plants/ha). Young plants increased from 6% of the population in 1983 to 57% in 1997, decreased to 0% in 2002, and increased to 34% in 2007. Decadence was high in 1983 (19%), 1989 (50%), and in 2002 (21%), but was 10% or less in 1997 and 2007. There were no dead plants measured prior to 1997, but since then dead plant density has ranged from 140 plants/acre (347 plants/ha) to 300 plants/acre (743 plants/ha). The proportion of plants exhibiting poor vigor increased from 13% in 1983 to 17% in 1989, then decreased to 3% by 2007. In 2002 and 2007, all of the plants with poor vigor were classified as dying. Annual sagebrush leader growth averaged 1.8 inches (4.6 cm) in 2002 and 2007. Browse use was moderate in 1983 and has been light all other sample years.

Curl-leaf mountain mahogany (*Cercocarpus ledifolius*) and true mountain mahogany (*Cercocarpus montanus*) are also present, but have low abundance. Curl-leaf mahogany occurs as large, scattered plants on the hillslope above the transect and canopy cover has averaged 7% since 2002. The site supports many other less preferred browse, including: Martin ceanothus (*Ceanothus martinii*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), whorled buckwheat (*Eriogonum heracloides*), Oregon grape (*Mahonia repens*), mountain lover (*Pachistima myrsinites*), and Woods' rose (*Rosa woodsii*). Some of these species have seen drastic oscillations in density, due in part to the increased sample area used since 1997. In 2002, many of the browse species had been defoliated by a combination of drought and crickets.

Herbaceous Understory

The grass understory has been diverse and abundant. Between seven and 12 grass species have been measured throughout all sample years. Nested frequency data indicate that perennial grasses have been in decline since 1997. Cover data reflect the same decline from 1997 through 2007. Perennial grass cover was 17% in 1997 and decreased to 7% in 2007. The most abundant perennial species are oniongrass (*Melica bulbosa*), spike fescue (*Leucopoa kingii*), mutton bluegrass (*Poa fendleriana*), and mountain brome (*Bromus carinatus*). Cheatgrass (*Bromus tectorum*) was sampled in 1% of quadrats in 1997, and 3% in 2007.

As this is summer range, forbs are especially important to deer, so forb density and composition quality are crucial. Perennial forb cover was 7% in 1997, 2% in 2002, and 13% in 2007. The most abundant perennial species have been wild onion (*Allium* sp.), tapertip hawksbeard (*Crepis acuminata*), ballhead waterleaf (*Hydrophyllum capitatum*), silky lupine (*Lupinus sericeus*), longleaf phlox (*Phlox longifolia*), and mulesear wyethia (*Wyethia amplexicaulis*). The number of perennial forb species measured has been fairly stable, except in 2002. Between 20 and 24 species were sampled in 1983, 1989, 1997, and 2007, and only nine species were measured in 2002. The decrease in 2002 was likely the result of drought conditions.

1989 TREND ASSESSMENT

The browse trend is slightly up. The density of serviceberry increased nearly three-fold, but sagebrush density decreased 25%. Decadence in both species increased; from 0% to 26% for serviceberry, and from 19% to 50% for sagebrush. None of the decadent plants were classified as dying and there was an increase in young plants for both species. The proportion of plants exhibiting poor vigor remained 0% for serviceberry and increased from 13% to 17% for sagebrush. Serviceberry use remained light and that of sagebrush changed from moderate to light. The grass trend is up. The sum of nested frequency of perennial grasses increased 51%, including significant increases in the nested frequencies of five species. The forb trend is up. The sum of

nested frequency of perennial forbs increased 45%. There was a significant increase in the nested frequencies of five forb species, and a significant decreases in the nested frequency of three.

browse - slightly up (+1) grass - up (+2) forb - up (+2)

1997 TREND ASSESSMENT

The browse trend is slightly up. Serviceberry density decreased 56%, but sagebrush density increased 93%. Some of the change in shrub density is attributed to the larger area sampled beginning in 1997. Therefore, the trend assessment was based more heavily on other parameters. For example, the young age class remained constant for serviceberry at 11%, and increased more than three-fold for sagebrush (from 17% to 57%). The density of young sagebrush was much higher than the densities of decadent and dead plants. Serviceberry decadency decreased from 26% to 4% and sagebrush decadence decreased from 50% to 8% of the population. The proportion of plants exhibiting poor vigor remained constant for serviceberry and decreased from 17% to 13% for sagebrush. Browse use was light-moderate for both species. The grass trend is stable. The sum of nested frequency of perennial grasses decreased 9%, including a significant decrease in the nested frequency of slender wheatgrass (*Agropyron trachycaulum*). The forb trend is down. The sum of nested frequency of perennial forbs decreased 57%, including significant decreases in the nested frequencies of seven species. The Desirable Components Index (DCI) score was not computed for this summer range study.

winter range condition (DCI) - Not applicable, summer range
browse - slightly up (+1) grass - stable (0) forb - down (-2)

2002 TREND ASSESSMENT

The browse trend is down. The density of serviceberry increased 43% and sagebrush density decreased 64%. There were no seedlings of either species and the young plant component of both populations decreased. The high number of young sagebrush plants that were sampled in 1997 did not reach maturity. All of the decrease in sagebrush density was from the young and mature age classes. The serviceberry population had no decadent plants, but sagebrush decadence increased from 8% to 21% of the population. The proportion of serviceberry plants exhibiting poor vigor increased from 0% to 38% and remained nearly constant for sagebrush. Browse use on serviceberry shifted to moderate-heavy and remained light for sagebrush. The grass trend is slightly down. The sum of nested frequency of perennial grasses decreased 9% for the second consecutive sample year. Additionally, the number of species decreased from 12 to seven. The forb trend is down. The sum of nested frequency of perennial forbs decreased 89%, and the total number of species decreased from 26 to nine. The DCI score was not computed for this summer range study.

winter range condition (DCI) - Not applicable, summer range
browse - down (-2) grass - slightly down (-1) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is slightly down. The density of serviceberry decreased 38%, while sagebrush density increased only 4%. The loss of serviceberry plants was largely from the mature age class. Decadence increased from 0% to 12% for serviceberry, and decreased from 21% to 10% for sagebrush. Seedling sagebrush plants were measured for the first time and the young age class increased from 0% to 34% of the population. Young serviceberry plants also increased. For both browse species, the proportion of plants exhibiting poor vigor returned to low levels. Browse use on serviceberry was almost evenly divided between light and heavy, and remained light on sagebrush. The grass trend is down. The sum of nested frequency of perennial grasses decreased 38%, including significant decreases in the nested frequencies of spike fescue, oniongrass, and mutton bluegrass. The number of sampled grass species slightly increased from seven to eight. The forb trend is up. The sum of nested frequency increased nearly nine-fold and the number of

species increased from nine to 27. Perennial forb cover increased from 2% to 16%. The DCI score was not computed for this summer range study.

winter range condition (DCI) - Not applicable, summer range
browse - slightly down (-1) grass - down (-2) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 4

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	a1	b29	ab16	ab13	b29	.49	.40	.43
G	Agropyron trachycaulum	a8	b61	a6	-	-	.06	-	-
G	Bromus carinatus	a44	b81	b103	ab61	ab71	3.81	1.21	3.04
G	Bromus tectorum (a)	-	-	a2	-	a5	.00	-	.06
G	Carex sp.	-	-	-	4	-	-	.38	-
G	Festuca ovina	-	-	3	-	-	.03	-	-
G	Leucopoa kingii	a41	a61	b114	b107	a33	5.06	4.92	.91
G	Melica bulbosa	b243	b224	b179	b197	a112	6.02	5.75	2.07
G	Poa fendleriana	a16	ab28	bc46	c75	ab27	1.27	1.32	.68
G	Poa pratensis	a6	b26	ab20	a2	-	.26	.03	-
G	Poa secunda	a2	b26	ab13	-	a6	.24	-	.06
G	Stipa columbiana	a1	a11	a1	-	-	.00	-	-
G	Stipa lettermani	a4	a6	a1	-	a8	.00	-	.01
Total for Annual Grasses		0	0	2	0	5	0.00	0	0.06
Total for Perennial Grasses		366	553	502	459	286	17.27	14.03	7.22
Total for Grasses		366	553	504	459	291	17.28	14.03	7.29
F	Agoseris glauca	b15	a2	-	-	ab5	-	-	.01
F	Alyssum alyssoides (a)	-	-	a19	-	a20	.07	-	.23
F	Allium sp.	a87	b124	ab118	-	ab115	.52	-	1.17
F	Arabis sp.	-	-	2	-	-	.01	-	-
F	Aster chilensis	a20	b84	a7	-	a5	.03	-	.06
F	Astragalus cibarius	a10	a5	a1	-	-	.00	-	-
F	Balsamorhiza hookeri	3	-	-	-	-	-	-	-
F	Balsamorhiza sagittata	-	-	-	a1	a4	-	.18	.53
F	Castilleja linariaefolia	-	-	-	-	1	-	-	.00
F	Calochortus nuttallii	-	a3	a7	-	a3	.02	-	.00
F	Chaenactis douglasii	-	-	1	-	-	.00	-	-
F	Cirsium sp.	-	a12	a1	-	-	.23	-	-
F	Collomia linearis (a)	-	-	a38	-	a54	.09	-	.45
F	Collinsia parviflora (a)	-	-	a31	-	b164	.08	-	1.21

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Crepis acuminata	$_{b}$65	$_{c}$143	$_{b}$46	-	$_{a}$3	.56	-	.01
F	Cruciferae	-	30	-	-	-	-	-	-
F	Delphinium nuttallianum	-	-	$_{a}$4	$_{a}$3	-	.01	.03	-
F	Epilobium brachycarpum (a)	-	-	-	-	18	-	-	.21
F	Erigeron eatonii	$_{b}$22	$_{ab}$16	-	-	3	-	-	.00
F	Eriogonum racemosum	$_{ab}$14	$_{b}$17	$_{ab}$20	$_{a}$3	$_{ab}$6	.55	.06	.07
F	Eriogonum umbellatum	$_{c}$53	$_{b}$32	$_{a}$3	$_{a}$2	$_{a}$2	.00	.00	.00
F	Fritillaria pudica	$_{a}$5	$_{a}$7	-	-	-	-	-	-
F	Hackelia patens	$_{a}$5	-	$_{a}$2	-	$_{a}$3	.00	-	.03
F	Helianthella uniflora	$_{a}$9	$_{a}$9	-	$_{a}$2	-	-	.15	-
F	Hydrophyllum capitatum	$_{b}$35	$_{a}$3	-	-	$_{c}$99	-	-	5.08
F	Lomatium sp.	$_{a}$15	$_{a}$30	$_{a}$27	-	$_{a}$14	.18	-	.15
F	Lupinus sericeus	$_{b}$155	$_{b}$160	$_{a}$68	-	$_{a}$25	1.45	-	.79
F	Machaeranthera canescens	$_{a}$1	$_{a}$8	$_{a}$3	-	$_{a}$3	.00	-	.03
F	Microsteris gracilis (a)	-	-	$_{a}$10	-	$_{a}$5	.05	-	.01
F	Penstemon caespitosus	-	$_{a}$2	$_{a}$3	-	-	.00	-	-
F	Penstemon humilis	-	-	-	-	9	-	-	.09
F	Petradoria pumila	-	-	-	-	-	-	.00	-
F	Phlox longifolia	$_{a}$47	$_{b}$87	$_{a}$37	-	$_{a}$26	.22	-	.20
F	Polygonum douglasii (a)	-	-	$_{b}$85	$_{a}$2	$_{b}$61	.41	.00	.42
F	Senecio integerrimus	-	$_{b}$26	-	$_{a}$3	$_{a}$4	-	.03	.05
F	Taraxacum officinale	-	$_{b}$19	$_{a}$3	-	-	.03	-	-
F	Veronica biloba (a)	-	-	$_{a}$1	-	$_{a}$3	.00	-	.03
F	Viola sp.	$_{a}$2	$_{a}$3	-	$_{a}$1	$_{a}$3	-	.00	.03
F	Wyethia amplexicaulis	$_{b}$49	$_{c}$74	$_{ab}$35	$_{a}$27	$_{ab}$35	2.80	1.05	4.80
F	Zigadenus paniculatus	$_{a}$7	$_{a}$1	$_{a}$2	-	-	.03	-	-
Total for Annual Forbs		0	0	184	2	325	0.72	0.00	2.59
Total for Perennial Forbs		619	897	390	42	368	6.71	1.52	13.15
Total for Forbs		619	897	574	44	693	7.43	1.52	15.75

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

BROWSE TRENDS --
Management unit 19B, Study no: 4

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier alnifolia	21	27	20	3.65	4.08	3.48
B	Artemisia tridentata vaseyana	30	22	18	1.87	3.67	2.00
B	Cercocarpus ledifolius	0	1	1	.45	-	.53
B	Ceanothus martinii	9	0	0	.60	-	-
B	Cercocarpus montanus	0	1	1	-	-	.03
B	Chrysothamnus nauseosus albicaulis	3	0	0	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	20	11	6	1.19	.13	.06
B	Eriogonum heracleoides	22	33	23	1.49	1.08	1.53
B	Mahonia repens	16	13	17	.78	.45	.33
B	Pachistima myrsinites	0	9	9	-	.64	.39
B	Rosa woodsii	10	7	12	.06	.09	.40
B	Symphoricarpos oreophilus	55	71	65	22.89	19.06	20.27
Total for Browse		186	195	172	32.99	29.23	29.04

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 4

Species	Percent Cover		
	'97	'02	'07
Amelanchier alnifolia	-	6.25	7.88
Artemisia tridentata vaseyana	-	3.48	2.01
Cercocarpus ledifolius	1.00	6.36	7.33
Cercocarpus montanus	-	-	.18
Chrysothamnus viscidiflorus viscidiflorus	-	.18	.05
Eriogonum heracleoides	-	2.56	.61
Mahonia repens	-	.41	.61
Pachistima myrsinites	-	.76	.38
Rosa woodsii	-	.36	.85
Symphoricarpos oreophilus	-	25.54	33.18

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 4

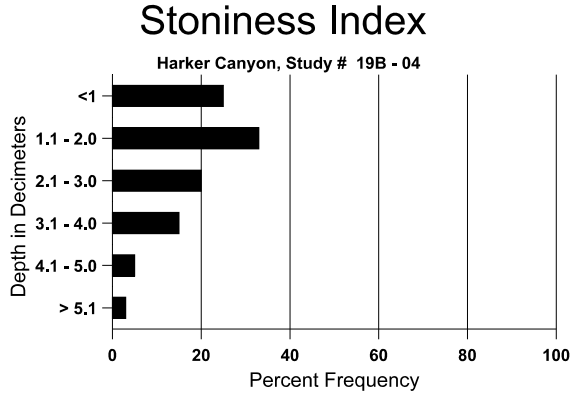
Species	Average leader growth (in)	
	'02	'07
Amelanchier alnifolia	1.9	4.1
Artemisia tridentata vaseyana	1.8	1.8
Cercocarpus ledifolius	2.5	1.7

BASIC COVER --
Management unit 19B, Study no: 4

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	1.75	18.50	61.45	41.98	49.82
Rock	3.50	5.50	4.61	9.05	6.51
Pavement	3.00	4.50	2.66	9.95	7.61
Litter	72.25	61.50	65.00	36.07	27.82
Cryptogams	.25	0	.01	.38	0
Bare Ground	19.25	10.00	2.91	23.61	17.22

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 4, Harker Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
13.1	54.0 (14.3)	6.0	46.3	31.1	22.6	5.4	21.2	342.4	.6



PELLET GROUP DATA --
Management unit 19B, Study no: 4

Type	Quadrat Frequency		
	'97	'02	'07
Elk	2	-	3
Deer	6	11	4
Cattle	-	5	3

Days use per acre (ha)	
'02	'07
1 (3)	1 (2)
40 (99)	25 (63)
10 (25)	5 (13)

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 4

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier alnifolia												
83	**333**	-	-	333	-	-	0	0	0	-	0	39/35
89	**1266**	-	133	800	333	-	0	0	26	-	0	55/31
97	**560**	-	60	480	20	-	25	4	4	-	0	55/51
02	**800**	-	40	760	-	-	25	45	0	-	38	47/43
07	**500**	-	80	360	60	-	8	44	12	4	4	51/48
Artemisia tridentata vaseyana												
83	**1066**	-	66	800	200	-	69	0	19	-	13	26/30
89	**799**	-	133	266	400	-	0	0	50	-	17	24/39
97	**1540**	-	880	540	120	240	3	1	8	3	13	26/33
02	**560**	-	-	440	120	300	0	0	21	11	11	22/35
07	**580**	160	200	320	60	140	17	3	10	3	3	22/40
Cercocarpus ledifolius												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	157/177
02	**20**	-	-	20	-	-	0	0	-	-	0	161/236
07	**20**	-	-	20	-	-	0	0	-	-	0	143/223
Ceanothus martinii												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**580**	-	260	320	-	-	3	0	-	-	0	8/18
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Cercocarpus montanus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	100	51/70
07	**20**	-	-	20	-	-	0	0	-	-	0	61/76
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**80**	-	80	-	-	-	25	50	-	-	25	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
83	**666**	-	-	666	-	-	0	0	0	-	0	12/10
89	**666**	-	133	533	-	-	0	0	0	-	0	16/14
97	**760**	-	160	600	-	-	0	0	0	-	0	16/17
02	**260**	-	-	120	140	20	0	0	54	31	38	10/12
07	**160**	-	-	160	-	-	50	0	0	-	0	11/19
Cowania mexicana stansburiana												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	11/70
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Eriogonum heracleoides												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**920**	-	-	920	-	20	0	0	0	-	0	15/14
02	**1560**	-	-	1380	180	20	21	5	12	4	10	7/14
07	**780**	80	-	760	20	-	0	21	3	-	3	5/12
Mahonia repens												
83	**666**	-	-	666	-	-	0	0	0	-	0	8/7
89	**532**	-	-	466	66	-	0	0	12	-	13	3/3
97	**2180**	-	300	1880	-	-	0	0	0	-	0	4/6
02	**1040**	-	-	1040	-	-	0	0	0	-	0	3/4
07	**3600**	-	140	3460	-	-	0	0	0	-	0	3/4

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Opuntia sp.												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	4/18
Pachistima myrsinites												
83	**400**	-	-	400	-	-	0	0	0	-	0	16/49
89	**14732**	1066	6466	7000	1266	-	16	6	9	.45	1	10/9
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**880**	-	180	700	-	-	7	0	0	-	0	3/6
07	**880**	-	240	640	-	-	23	14	0	-	0	4/9
Purshia tridentata												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	35/61
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Rosa woodsii												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**880**	20	480	400	-	-	0	0	0	-	0	9/8
02	**420**	20	100	320	-	-	0	0	0	-	0	9/8
07	**880**	-	-	860	20	-	0	7	2	-	2	10/10
Symphoricarpos oreophilus												
83	**1000**	-	-	1000	-	-	0	0	0	-	0	32/31
89	**2132**	200	533	866	733	-	0	0	34	-	3	27/35
97	**2620**	-	200	2360	60	-	0	0	2	2	2	33/64
02	**3000**	-	20	2720	260	-	.66	0	9	-	24	27/45
07	**2480**	-	20	2160	300	20	3	0	12	.80	16	30/52

Trend Study 19B-5-07

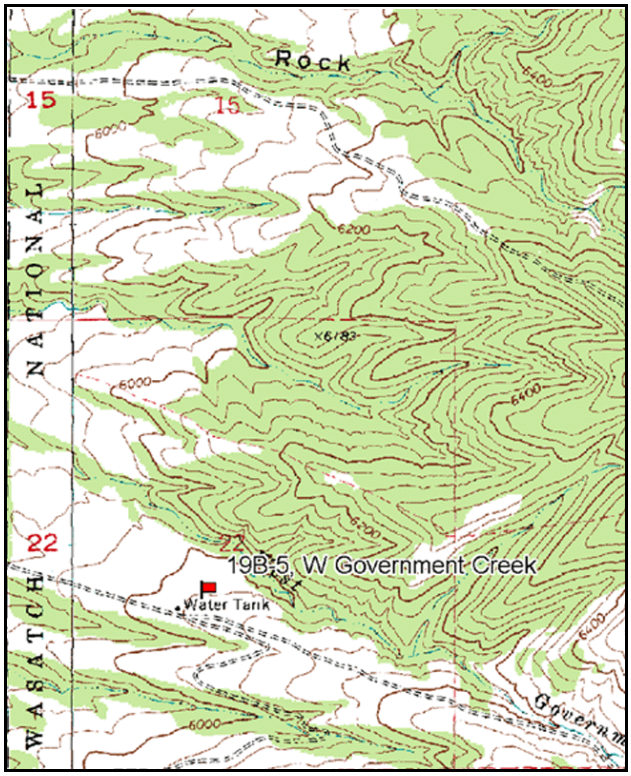
Study site name: West Government Creek . Vegetation type: Big Sagebrush-Grass .

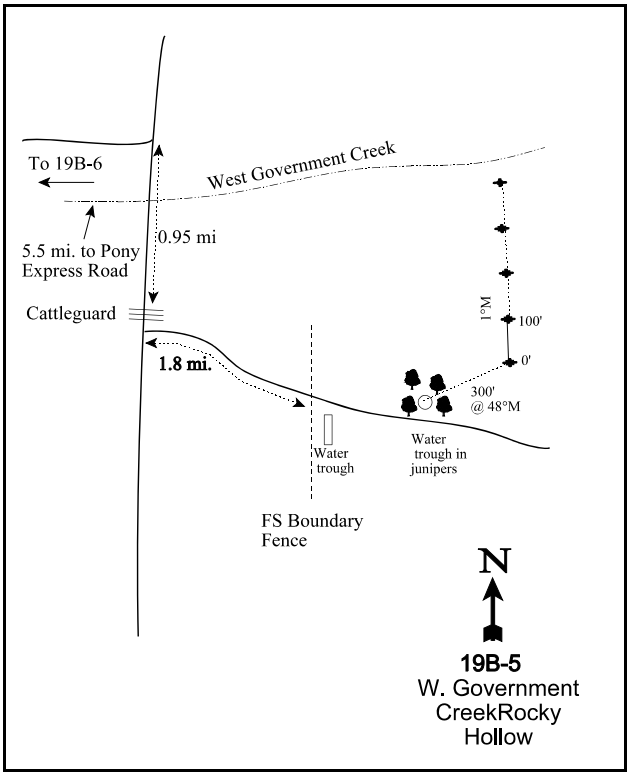
Compass bearing: frequency baseline 357 degrees magnetic.

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

LOCATION DESCRIPTION

Turn south off the Pony Express Road onto the Erickson Pass Road. Go 4.6 miles to the turnoff to study 19B-6. Continue 0.95 miles to a cattleguard. Turn left 60 yards past the cattleguard. Go 1.8 miles to a water trough. From the northeast side of the circular trough, the 0-foot baseline stake is 300 feet away at an azimuth of 48 degrees. This stake is marked by browse tag #3975.





Map Name: Lookout Pass

Diagrammatic Sketch

Township 9S , Range 7W , Section 22

GPS: NAD 83, UTM 12S 361722 E 4430996 N

DISCUSSION

West Government Creek - Trend Study No. 19B-5

Study Information

This study samples deer winter range on Forest Service-administered land [elevation: 6,060 feet (1,847 m), slope: 7%-10%, aspect: west-northwest]. This area was formerly occupied by juniper-pinyon woodland. In the late 1960s, the trees were chained and windrowed. The area was then seeded using a rangeland drill. In 1983, it was noted that heavy cattle use was depressing grass vigor. Past intense cattle grazing has partly contributed to the high shrub canopy cover. There is a steel water trough 300 feet (91 m) to the southwest, which may explain the localized, intense grazing. The trough had no water in 2007. Use of the site by big game is very light. From the pellet group tansect, there were an estimated 14 deer days use/acre (35 ddu/ha) in 2002 and 25 deer days use/acre (63 ddu/ha) in 2007. Elk pellets were only present in the transect in 2007 and use was estimated at 1 elk day use/acre (3 edu/ha). Cattle use was estimated at 33 days use/acre (82 cdu/ha) in 2002 and 3 days use/acre (7 cdu/ha) in 2007. Rabbit pellet groups were also moderately abundant in 2007, quadrat frequency was 52%.

Soil

The study lies within the Abela soil series, which generally consists of very deep, well-drained soils that formed in alluvium or lacustrine deposits. Soils in this series are derived mainly from limestone, sandstone, and quartzite and are found on fan remnants with 2%-25% slopes (USDA-NRCS 2007). Specifically at the study, the soil texture is a gravelly loam with a slightly alkaline reactivity (pH of 7.6). Surface soil movement and pedestalling around plants has been apparent. Relative bare ground cover was very high in 1983 at 51%. It declined to 26% in 1989 and 15% in 1997, but increased to 34% with drought in 2002. In 2007, relative bare ground cover decreased to 23%. The erosion condition was classified as slight in 2002 and 2007.

Browse

Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) dominates the overstory, and canopy cover has averaged 30% since 2002. The density has oscillated between increasing and decreasing with alternate sample years. The lowest density was estimated at 2,300 plants/acre (5,693 plants/ha) in 1997, and the highest density was estimated at 5,298 plants/acre (13,114 plants/ha) in 1989. In 2007, the density was estimated at 2,320 plants/acre (5,743 plants/ha). In 1983, there were 1,166 seedlings/acre (2,886 seedlings/ha), but there have been few or no seedlings sampled since. The young age class has steadily decreased from 31% in 1983 to 1% of the population in 2007. Sagebrush decadence was low from 1983 through 1997 (1%-9%) and increased dramatically in both 2002 (24%) and 2007 (39%). In 2007, 19% of the population was dying, but few dying plants had been sampled previously. Annual leader growth averaged 1.2 inches (3 cm) in 2002 and 2007. Browse use been predominantly light-moderate in all sample years.

Antelope bitterbrush (*Purshia tridentata*) provides additional, but limited, forage. Although there has been a small amount of variability, the estimated density has averaged 100 plants/acre (248 plants/ha) since 1983. These plants have a prostrate growth form due to heavy browsing over the years. Height and crown measurements have increased each sample year. Even with heavy use, bitterbrush plants have had normal vigor, and no decadent plants have been sampled since 1997.

Scattered pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) trees are present, and the re-establishment of the tree canopy has occurred at a slow rate. Juniper density estimates, using the point-centered quarter method were only 30 trees/acre in 2002 and in 2007. Pinyon density has been too low to measure.

Herbaceous Understory

Perennial grasses dominate the understory. Perennial grass cover was 16% in 1997, 12% in 2002, and 21% in

2007. Although cover has been variable, the sum of nested frequency for perennial grasses has remained similar between sample years. The grass component is composed primarily of crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Agropyron intermedium*), and Sandberg bluegrass (*Poa secunda*). Crested wheatgrass has been the most abundant grass, providing nearly one-half of the grass cover in 1997 and 2002. Intermediate wheatgrass is more common in depressions. Cheatgrass (*Bromus tectorum*) is present but has been sampled in only a few quadrats.

Forb diversity and abundance has been fair. Perennial forb cover was 5% in 1997, less than 1% in 2002, and 3% in 2007. Between three and 20 perennial species have been sampled, and the most abundant species include silky milkvetch (*Astragalus cibarius*), tapertip hawksbeard (*Crepis acuminata*), alfalfa (*Medicago sativa*), American vetch (*Vicia americana*), and longleaf phlox (*Phlox longifolia*). In 2002, forbs were only sampled in 12% of the quadrats, and the only forb species sampled were pale agoseris (*Agoseris glauca*), rock goldenrod (*Petradoria pumila*), and American vetch. Common annual species include pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*), which is an allelopathic plant (Buchanan et al. 1978).

1989 TREND ASSESSMENT

The browse trend is up. Wyoming big sagebrush density increased 71%. Young plants decreased from 31% to 26%, and decadence increased from 1% of the population to 9%. The average crown width decreased 12 inches (30 cm). Browse use improved from light-moderate to light. The grass trend is stable. The sum of nested frequency of perennial grasses increased 6%. Bottlebrush squirreltail (*Sitanion hystrix*) and Indian ricegrass (*Oryzopsis hymenoides*) were each sampled in one quadrat in 1983, but were not sampled at all in 1989. The forb trend is up. The sum of nested frequency of perennial forbs increased 67%, including significant increases in the nested frequencies of silky milkvetch, longstalk springparsely (*Cymopterus longipes*), and alfalfa.

browse - up (+2) grass - stable (0) forb - up (+2)

1997 TREND ASSESSMENT

The browse trend is stable. The density of Wyoming big sagebrush decreased 57%. Most of the decrease in density was attributed to the larger sample area that was measured beginning in 1997. If there had been a large number of dead sagebrush plants measured, then the decrease in density may have been attributed to shrub die-off. Thus, trend was determined from other parameters. Young plants decreased to 16% of the population, but decadence remained constant at 9%. The proportion of plants exhibiting poor vigor was stable, and browse use shifted from light to light-moderate. The grass trend is stable. The sum of nested frequency of perennial grasses increased 7%. There was a significant decrease in the nested frequency of intermediate wheatgrass and a significant increase in that of Sandberg bluegrass, however, Sandberg bluegrass offers less forage than intermediate wheatgrass. The forb trend is stable. The sum of nested frequency for perennial forbs decreased 4%, including significant decreases in the nested frequencies of four species. The Desirable Components Index (DCI) score was excellent due to the high browse cover, low browse decadence, and high perennial grass and forb cover.

winter range condition (DCI) - excellent (84) Low potential scale
browse - stable (0) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The browse trend is up. Wyoming big sagebrush density increased 37%. The change in density was attributed to increases in both the mature and decadent age classes. Decadency increased to 24% of the population, while young plants decreased from 16% to 3%. The increase in decadency was likely the result of the region-wide drought (Utah Climate Summaries 2007). The proportion of plants exhibiting poor vigor remained constant. Browse use remained light-moderate. The grass trend is stable. The sum of nested frequency for perennial grasses decreased 8%. The forb trend is down. The sum of nested frequency of perennial forbs

decreased 92%, and the number of measured species decreased from 24 to three. No annual forbs were sampled. Crickets and competition from sagebrush were also suspected to have suppressed the forb species. The DCI score decreased to good due to the decrease in recruitment, perennial grass cover and perennial forb cover.

winter range condition (DCI) - good (61) Low potential scale
browse - up (+2) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is down. Wyoming big sagebrush density decreased 27%. No sagebrush seedlings were sampled, and the young component of the population decreased to 1%. The decadent age class increased to 39% of the population, and 19% of the population was classified as dying. Because of the high number of dying plants, vigor also declined. Many of the sagebrush looked drought-stressed. Browse use remained predominantly light-moderate, though heavily browsed plants increased from 3% of the population to 21%. The grass trend is stable. The sum of nested frequency of perennial grasses increased 7%, including a significant increase in the nested frequency of Sandberg bluegrass. Although the increase in nested frequency was small, perennial grass cover increased from 12% to 21%. Grasses had good seed production, but had not been grazed at the time of sampling. The forb trend is up. The sum of nested frequency of perennial forbs increased nine-fold, and the number of species increased from three to 19. Annual forbs had a higher abundance, but lower cover, than perennial forbs. The DCI score remained good.

winter range condition (DCI) - good (61) Low potential scale
browse - down (-2) grass - stable (0) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 5

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	$_{c}$279	$_{bc}$263	$_{ab}$231	$_{a}$176	$_{a}$196	8.53	5.74	8.01
G	Agropyron intermedium	$_{ab}$154	$_{a}$192	$_{bc}$136	$_{c}$132	$_{bc}$109	3.59	3.02	3.58
G	Agropyron spicatum	-	-	$_{a}$7	$_{a}$9	$_{a}$12	.18	.39	.51
G	Bromus tectorum (a)	-	-	$_{a}$12	$_{a}$3	$_{a}$10	.02	.00	.05
G	Oryzopsis hymenoides	1	-	-	-	-	-	-	-
G	Poa secunda	$_{a}$39	$_{a}$50	$_{b}$168	$_{b}$176	$_{c}$216	3.95	2.73	9.18
G	Sitanion hystrix	$_{a}$3	-	-	$_{a}$4	-	-	.03	-
Total for Annual Grasses		0	0	12	3	10	0.02	0.00	0.05
Total for Perennial Grasses		476	505	542	497	533	16.26	11.93	21.29
Total for Grasses		476	505	554	500	543	16.29	11.93	21.35
F	Agoseris glauca	-	-	$_{a}$2	$_{a}$3	$_{a}$4	.00	.00	.06
F	Alyssum alyssoides (a)	-	-	$_{b}$249	-	$_{a}$76	.63	-	.20
F	Antennaria rosea	-	$_{a}$8	$_{a}$3	-	-	.00	-	-
F	Arabis sp.	-	-	6	-	-	.01	-	-
F	Astragalus cibarius	$_{a}$25	$_{b}$74	$_{a}$25	-	$_{b}$47	1.14	-	1.69

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Astragalus convallarius	$_{a}$3	$_{a}$6	$_{a}$3	-	$_{a}$2	.04	-	.03
F	Castilleja chromosa	-	$_{a}$2	$_{a}$1	-	-	.03	-	-
F	Calochortus nuttallii	$_{a}$1	-	$_{a}$1	-	$_{a}$6	.00	-	.01
F	Chaenactis douglasii	$_{a}$16	$_{a}$9	$_{a}$3	-	-	.00	-	-
F	Cirsium neomexicanum	$_{a}$1	$_{a}$6	$_{a}$2	-	-	.03	-	-
F	Comandra pallida	-	-	$_{a}$3	-	$_{a}$2	.03	-	.00
F	Collinsia parviflora (a)	-	-	$_{a}$45	-	$_{a}$65	.11	-	.20
F	Crepis acuminata	$_{a}$14	$_{a}$26	$_{a}$15	-	$_{a}$15	.16	-	.14
F	Cymopterus longipes	$_{a}$11	$_{b}$31	$_{a}$10	-	$_{a}$3	.04	-	.01
F	Draba sp. (a)	-	-	-	-	4	-	-	.00
F	Eriogonum sp.	-	-	1	-	-	.03	-	-
F	Erigeron pumilus	$_{a}$16	$_{a}$16	$_{a}$9	-	-	.02	-	-
F	Galium boreale	-	-	$_{a}$4	-	$_{a}$5	.18	-	.01
F	Holosteum umbellatum (a)	-	-	-	-	5	-	-	.01
F	Lathyrus brachycalyx	-	-	34	-	-	.37	-	-
F	Medicago sativa	$_{a}$18	$_{b}$38	$_{a}$13	-	-	1.72	-	-
F	Microsteris gracilis (a)	-	-	$_{a}$23	-	$_{a}$10	.04	-	.02
F	Petradoria pumila	$_{bc}$30	$_{c}$37	$_{ab}$18	$_{a}$12	$_{a}$10	.34	.28	.22
F	Phlox longifolia	$_{a}$55	$_{a}$69	$_{a}$68	-	$_{a}$53	.66	-	.35
F	Ranunculus testiculatus (a)	-	-	$_{b}$200	-	$_{a}$158	1.00	-	.56
F	Tragopogon dubius	-	$_{a}$2	-	-	$_{a}$2	-	-	.01
F	Vicia americana	$_{a}$4	-	$_{b}$89	$_{a}$10	$_{b}$75	.57	.04	.42
F	Zigadenus paniculatus	-	-	-	-	1	-	-	.01
Total for Annual Forbs		0	0	517	0	318	1.78	0	0.99
Total for Perennial Forbs		194	324	310	25	225	5.43	0.33	2.99
Total for Forbs		194	324	827	25	543	7.21	0.33	3.99

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

BROWSE TRENDS --
Management unit 19B, Study no: 5

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata wyomingensis	73	76	74	17.67	20.67	16.40
B	Atriplex canescens	0	0	0	-	.38	-
B	Gutierrezia sarothrae	10	10	5	.03	.12	.03
B	Juniperus osteosperma	1	3	2	.85	1.37	1.50
B	Purshia tridentata	5	4	4	.71	.38	.33
Total for Browse		89	93	85	19.27	22.94	18.28

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 5

Species	Percent Cover	
	'02	'07
Artemisia tridentata wyomingensis	31.35	28.64
Gutierrezia sarothrae	.06	-
Juniperus osteosperma	2.21	3.23
Purshia tridentata	.05	.25

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 5

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata wyomingensis	1.2	1.2

POINT-QUARTER TREE DATA --
Management unit 19B, Study no: 5

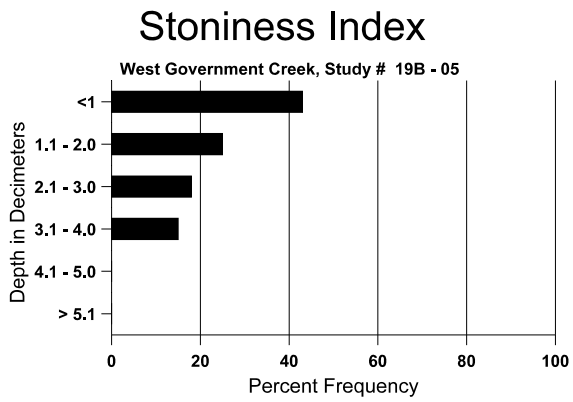
Species	Trees per Acre		Average diameter (in)	
	'02	'07	'02	'07
Juniperus osteosperma	30	20	4.1	3.9

BASIC COVER --
Management unit 19B, Study no: 5

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	5.25	10.00	42.08	35.67	42.98
Rock	2.75	2.75	.76	1.08	.40
Pavement	8.75	22.50	6.08	5.15	5.71
Litter	32.25	38.75	42.22	37.11	39.62
Cryptogams	0	0	4.57	1.06	.53
Bare Ground	51.00	26.00	16.29	40.34	26.13

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 5, West Government Creek

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.2	58.5 (14.0)	7.6	40.4	35.1	24.6	3.4	23.8	336.0	.2



PELLET GROUP DATA --
Management unit 19B, Study no: 5

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	21	12	54
Elk	-	-	1
Deer	3	3	8
Cattle	10	10	6

Days use per acre (ha)	
'02	'07
-	-
-	1 (3)
14 (35)	25 (63)
33 (82)	3 (7)

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 5

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**3099**	1166	966	2100	33	-	55	0	1	-	1	25/36
89	**5298**	33	1366	3466	466	-	17	0	9	1	7	21/24
97	**2300**	20	360	1740	200	-	40	0	9	2	6	31/51
02	**3160**	-	100	2300	760	20	30	3	24	6	6	30/47
07	**2320**	-	20	1400	900	60	30	21	39	19	21	31/49
Gutierrezia sarothrae												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**33**	-	-	33	-	-	0	0	0	-	0	7/4
97	**240**	20	60	180	-	-	0	0	0	-	0	12/11
02	**440**	-	20	400	20	-	0	0	5	-	0	7/9
07	**140**	-	-	80	60	20	0	0	43	43	43	6/7
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	0	0	-	-	0	-/-
02	**60**	-	20	40	-	-	0	0	-	-	0	-/-
07	**40**	-	-	40	-	-	0	0	-	-	0	-/-
Purshia tridentata												
83	**66**	-	-	66	-	-	0	100	0	-	0	9/28
89	**132**	-	-	66	66	-	25	75	50	-	0	12/22
97	**100**	-	20	80	-	-	20	40	0	-	0	15/38
02	**120**	-	20	100	-	-	0	83	0	-	0	17/51
07	**80**	-	-	80	-	-	0	75	0	-	0	23/59

Trend Study 19B-6-07

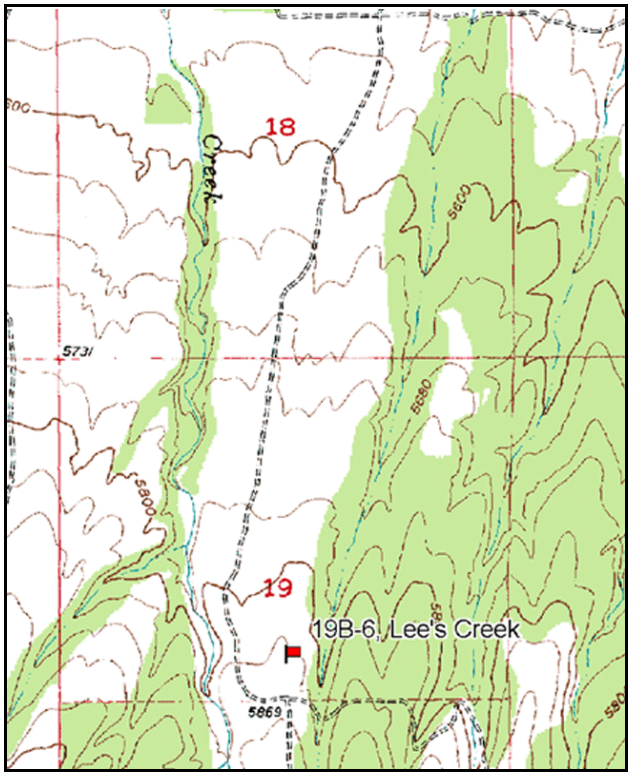
Study site name: Lee's Creek . Vegetation type: Chained, Seeded PJ .

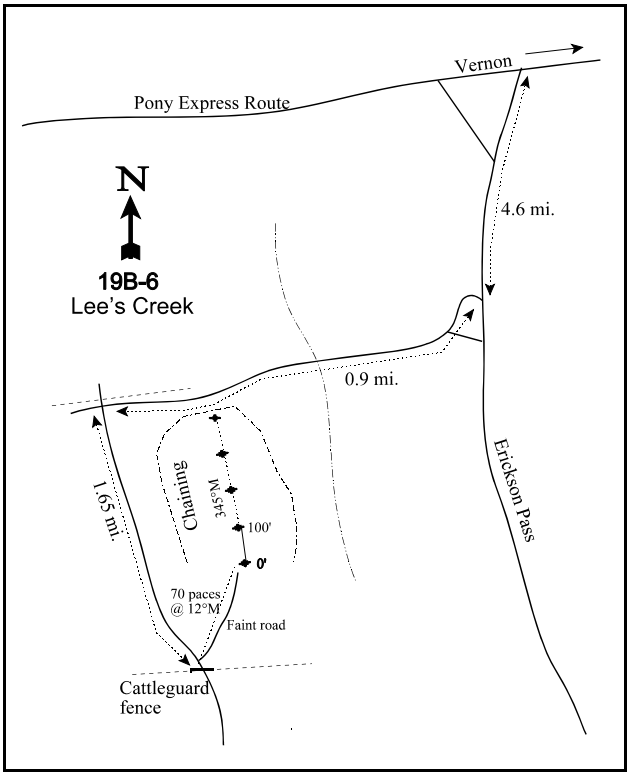
Compass bearing: frequency baseline 345 degrees magnetic.

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

LOCATION DESCRIPTION

Starting at the intersection of the Erickson Pass and Pony Express Roads, proceed south on the Erickson Pass Road for 4.60 miles to an intersection. Turn right at the intersection and proceed west for 0.9 miles to another intersection. Turn left at the intersection and proceed south for 1.65 miles to a cattle guard and gate. From the cattle guard, the 0-foot stake of the baseline, is 70 paces away at an azimuth of 12 degrees magnetic. The study runs at an azimuth of 345 degrees true. The study is located just inside the chaining that is adjacent to the burn. A red browse tag, number 3973, is attached to the 0-foot marker of the baseline.





Map Name: Indian Peaks

Diagrammatic Sketch

Township 9S , Range 7W , Section 19

GPS: NAD 83, UTM 12T 357007 E 4430991 N

DISCUSSION

Lee's Creek - Trend Study No. 19B-6

Study Information

This winter range study is located in the lower portion of the Lee's Creek drainage on an old Bureau of Land Management juniper chaining. It is situated on a ridge that runs north-south [elevation: 5,850 feet (1,783 m), slope: 5%, aspect: north]. Lee's Creek, a perennial stream, is located 900 feet (274 m) to the west. The study is located on a fairly narrow corridor of intact pinyon-juniper woodland surrounded by large areas that had been burned before 1997.. Although the juniper canopy is good thermal and visual cover, wildlife use has been low. From the pellet group transect, deer use was estimated at less than 1 day use/acre (2 ddu/ha) in 2002 and 7 days use/acre (17 ddu/ha) in 2007. Elk use was estimated at 1 day use/acre (3 edu/ha) in 2007, and rabbit use has been abundant since 1997. Use by domestic animals has been moderate. In 1997, cattle were grazing a burned area west of the study. Cattle use was estimated at 21 days use/acre (52 cdu/ha) in 2002 and 15 days use/acre (38 cdu/ha) in 2007. Nearly all of the cattle pats sampled in 2002 were from the previous grazing season. There were 2 sheep days use/acre (5 sdu/ha) in 2007.

Soil

The study lies within the Abela soil series, which generally consists of very deep, well-drained soils that formed in alluvium or lacustrine deposits. Soils in this series are derived mainly from limestone, sandstone, and quartzite, and are found on fan remnants and lake terraces with 2%-25% slopes (USDA-NRCS 2007). Specifically at the study, the soil texture is loam and it has a neutral reactivity (pH of 7.0). Soil phosphorous is 6.3 ppm, which is slightly above the minimum threshold (6 ppm) considered necessary for normal plant growth and development (Tiedemann and Lopez 2004). Erosion is minimal due to minimal slope and moderate vegetation and litter cover. The erosion condition was classified as stable in 2002 and 2007.

Browse

Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the dominant browse species. Canopy cover was 7% in 2002 and increased to 11% in 2007. Sagebrush density was estimated at approximately 700 plants/acre (1,733 plants/ha) in 1983 and 1989. Beginning in 1997, a larger area was sampled to improve density estimates. The density was estimated at 2,260 plants/acre (5,594 plants/ha) in 1997, 3,260 plants/acre (8,069 plants/ha) in 2002, and 2,200 plants/acre (5,445 plants/ha) in 2007. There were 1,760 seedlings/acre (4,356 seedlings/ha) sampled in 1997, otherwise few seedlings have been sampled. Young plants were also most abundant in 1997, and comprised 72% of the population. In other sample years, young plants have comprised from 19% to 48% of the population. Decadence was highest in 1983 (14%) and in 2007 (19%), and has been less than 10% otherwise. There have been few dead or dying plants in all sample years. The proportion of plants exhibiting poor vigor has ranged from 0% to 14% of the population. In 2007, 54% of the population was infested by the sagebrush defoliator moth (*Aroga websteri*). Annual leader growth on sagebrush was 1.1 inches (2.8 cm) in 2002 and 1.9 inches (4.9 cm) in 2007. Browse use was light in 1983, 1997, and 2002, and light-moderate in 1989 and 2007.

Antelope bitterbrush (*Purshia tridentata*) is present in low numbers. The estimated density has decreased from 166 plants/acre (411 plants/ha) in 1989 to 0 plants/acre in 2007. The majority of the sampled plants were in the young and mature age class. The few bitterbrush present have a prostrate growth form. Average height measurements have been 16 inches (41 cm) or less, while average crown width has been 51 inches (130 cm) or less. Browse use was heavy from 1983 through 1997 and light in 2002 and 2007.

Point-centered quarter data indicates little change in Utah juniper (*Juniperus osteosperma*) density. Estimated juniper density has been 87-97 trees/acre (215-240 trees/ha) since 1989. However, canopy cover increased from 14% in 2002 to 17% in 2007. Other species scattered around the site include white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), pricklypear cactus (*Opuntia* sp.), and broom snakeweed

(*Gutierrezia sarothrae*). Since 2002, canopy cover of these species has been 1% or less.

Herbaceous Understory

The herbaceous understory is dominated by perennial grasses. Since 1997, the cover of perennial grasses has averaged 14%. Crested wheatgrass (*Agropyron cristatum*) and Sandberg bluegrass (*Poa secunda*) are the dominant species, accounting for 98% of the grass cover since 1997. Crested wheatgrass individuals are short and small. It was noted in 2002 that crested wheatgrass plants in the adjacent burned areas had better vigor, stature, and provided more cover compared to the plants sampled by this transect. Other perennial grasses sampled in very low frequencies are bluebunch wheatgrass (*Agropyron spicatum*), bottlebrush squirreltail (*Sitanion hystrix*), and Letterman needlegrass (*Stipa lettermani*). Cheatgrass (*Bromus tectorum*) has been measured, but in low frequencies.

Perennial forb cover decreased from 2% in 1997 to less than 1% by 2007. The few forb species present have poor forage values. The most abundant perennial forbs are rock goldenrod (*Petradoria pumila*) and Hood's phlox (*Phlox hoodii*). Pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*) have been the most abundant annual species. In years when these species are present, they occur at higher nested and quadrat frequencies than the perennial species. Bur buttercup is allelopathic (Buchanan et al. 1978) and may be limiting the establishment of other species.

1989 TREND ASSESSMENT

The browse trend is stable. The density of Wyoming big sagebrush remained constant. The age class distribution shifted from predominantly young to mature plants, though seedling and young plants still comprised a substantial portion of the population. Decadence decreased from 14% of the population to 9%, but the proportion of plants exhibiting poor vigor increased from 0% to 14%. Browse use shifted from light to light-moderate. The grass trend is stable. The sum of nested frequency of perennial grasses increased 8%. There was a significant increase in the nested frequency of Sandberg bluegrass and a significant decrease in bottlebrush squirreltail. The forb trend is slightly up. Even though the sum of nested frequency of perennial forbs increased 70%, they are still a small part of the vegetative component.

browse - stable (0) grass - stable (0) forb - slightly up (+1)

1997 TREND ASSESSMENT

The browse trend is up. The Wyoming big sagebrush density increased more than three-fold. This increase is due to an increase in young and mature plants included in the larger sample area. There was also a very large increase in the number of sagebrush seedlings measured. No decadent plants were sampled, and the proportion of plants exhibiting poor vigor decreased from 14% to 5%. Browse use shifted from light-moderate to light. The grass trend is stable. The sum of nested frequency of perennial grasses increased 3%. The nested frequency of Sandberg bluegrass increased significantly, but that of crested wheatgrass decreased significantly. The forb trend is slightly up. The sum of nested frequency of perennial forbs increased 37%, but forbs remained a small part of the vegetative component. The Desirable Components Index (DCI) score was fair due to the low preferred browse cover (less than 5%). The DCI score would have been lower were it not for the high perennial grass cover.

winter range condition (DCI) - fair (39) Low potential scale
browse - up (+2) grass - stable (0) forb - slightly up (+1)

2002 TREND ASSESSMENT

The browse trend is up. The Wyoming big sagebrush density increased 44%, which was due to an increase in the number of mature plants. There was a decrease in both seedling and young plant density, though young plants are still dense enough to yield good recruitment. Decadence increased from 0% of the population to 7%, and 6% of the population was classified as dying. The proportion of plants exhibiting poor vigor and

browse use both remained constant. The grass trend is stable. The sum of nested frequency of perennial grasses decreased 8%. Cheatgrass was not measured. The forb trend is slightly down. The sum of nested frequency of perennial forbs decreased 29% and only four species were measured. The decrease in the nested frequency of grasses and forbs was likely the result of a region-wide drought (Utah Climate Summaries 2007). The DCI score increased to good because sagebrush cover increased beyond a minimum threshold set at 5%.

winter range condition (DCI) - good (57) Low potential scale
browse - up (+2) grass - stable (0) forb - slightly down (-1)

2007 TREND ASSESSMENT

The browse trend is down. The density of Wyoming big sagebrush decreased 33%. Seedling density remained low, and there was a decrease in young and mature plants. Decadence increased from 7% of the population to 19%, but plants classified as dying decreased from 6% of the population to 2%. The sagebrush defoliator moth had infested 54% of the plants. Browse use shifted from light to light-moderate. The grass trend is stable. The sum of nested frequency of perennial grasses increased 7%. Grasses had already been heavily grazed before the vegetation was sampled. The forb trend is slightly down. The sum of nested frequency of perennial forbs increased 4%, which would normally result in a stable trend. However, there was a significant increase in bur buttercup, quadrat frequency was 78%. The DCI score decreased to fair due to the low preferred-browse cover (less than 5%). The DCI score would have been lower, were it not for the high perennial grass cover.

winter range condition (DCI) - fair (35) Low potential scale
browse - down (-2) grass - stable (0) forb - slightly down (-1)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 6

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	b298	b308	a277	a238	a245	10.01	8.93	8.02
G	Agropyron spicatum	b25	-	-	a3	a5	-	.03	.07
G	Bromus tectorum (a)	-	-	a21	-	a12	.21	-	.03
G	Oryzopsis hymenoides	a1	-	a-	-	-	.00	-	-
G	Poa secunda	a94	b165	c215	c213	c241	4.44	3.03	6.14
G	Sitanion hystrix	b28	a8	a2	a4	a-	.03	.18	.01
G	Stipa lettermani	-	-	1	-	-	.03	-	-
Total for Annual Grasses		0	0	21	0	12	0.20	0	0.03
Total for Perennial Grasses		446	481	495	458	491	14.53	12.17	14.24
Total for Grasses		446	481	516	458	503	14.74	12.17	14.28
F	Alyssum alyssoides (a)	-	-	b116	-	a41	.25	-	.11
F	Antennaria rosea	-	-	-	a1	b9	-	.00	.01
F	Astragalus cibarius	-	-	-	-	7	-	-	.07
F	Astragalus sp.	-	a1	a8	-	a2	.20	-	.01
F	Astragalus utahensis	-	-	-	-	-	.00	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Chaenactis douglasii	$_{a}$1	-	$_{a}$5	$_{a}$2	-	.01	.00	-
F	Crepis acuminata	-	$_{a}$3	$_{a}$4	-	-	.01	-	-
F	Descurainia pinnata (a)	-	-	-	-	1	-	-	.00
F	Hymenoxys acaulis	-	4	-	-	-	-	-	-
F	Lactuca serriola	-	-	-	-	5	-	-	.01
F	Microsteris gracilis (a)	-	-	1	-	-	.00	-	-
F	Petradoria pumila	$_{a}$4	$_{ab}$11	$_{bc}$28	$_{c}$30	$_{abc}$14	1.33	.76	.40
F	Phlox hoodii	$_{ab}$25	$_{b}$29	$_{ab}$23	$_{ab}$17	$_{a}$8	.31	.09	.02
F	Phlox longifolia	-	$_{a}$1	$_{a}$2	-	$_{a}$6	.01	-	.04
F	Ranunculus testiculatus (a)	-	-	$_{a}$98	-	$_{b}$221	.31	-	.84
F	Townsendia incana	-	2	-	-	-	-	-	-
F	Zigadenus paniculatus	-	-	$_{a}$-	-	$_{a}$1	.03	-	.00
Total for Annual Forbs		0	0	215	0	263	0.57	0	0.95
Total for Perennial Forbs		30	51	70	50	52	1.92	0.86	0.57
Total for Forbs		30	51	285	50	315	2.49	0.86	1.53

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

BROWSE TRENDS --
Management unit 19B, Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata wyomingensis	42	52	47	4.61	5.14	4.62
B	Atriplex canescens	0	1	0	-	-	-
B	Chrysothamnus nauseosus albicaulis	5	1	0	.01	-	-
B	Cowania mexicana stansburiana	0	0	1	-	-	-
B	Gutierrezia sarothrae	4	4	4	.30	1.23	.03
B	Juniperus osteosperma	6	7	8	9.64	9.37	12.67
B	Purshia tridentata	1	1	0	-	-	-
Total for Browse		58	66	60	14.57	15.75	17.32

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 6

Species	Percent Cover		
	'97	'02	'07
Artemisia tridentata wyomingensis	-	6.94	10.63
Chrysothamnus nauseosus albicaulis	-	.10	-
Gutierrezia sarothrae	-	.48	.05
Juniperus osteosperma	6.00	14.38	16.75

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 6

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata wyomingensis	1.1	1.9

POINT-QUARTER TREE DATA --
Management unit 19B, Study no: 6

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	97	87

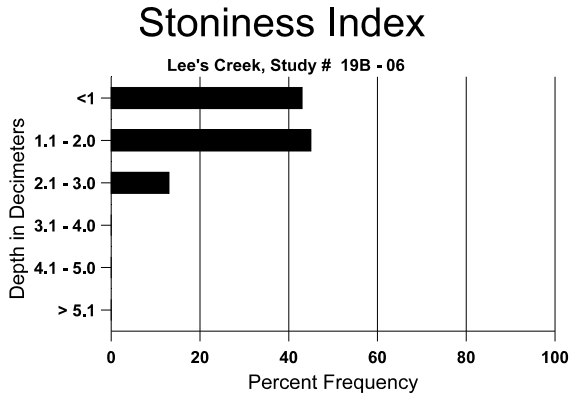
Average diameter (in)	
'02	'07
5.1	7.7

BASIC COVER --
Management unit 19B, Study no: 6

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	3.25	7.75	26.29	27.71	33.07
Rock	0	5.00	1.88	2.55	1.35
Pavement	4.50	11.50	11.55	23.43	14.53
Litter	59.75	36.75	32.06	31.87	33.57
Cryptogams	0	0	5.19	.58	.35
Bare Ground	32.50	39.00	24.19	25.08	34.04

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 6, Lee's Creek

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
10.2	62.5 (12.7)	7.0	38.0	36.1	25.9	3.0	6.3	182.4	.7



PELLET GROUP DATA --
Management unit 19B, Study no: 6

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	27	8	60
Elk	-	-	1
Deer	14	3	10
Cattle	22	14	7
Sheep	-	-	-

Days use per acre (ha)	
'02	'07
-	-
-	1 (3)
1 (2)	7 (17)
21 (52)	15 (38)
-	2 (5)

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 6

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**699**	133	333	266	100	-	5	0	14	-	0	35/36
89	**698**	100	266	366	66	-	38	0	9	-	14	25/27
97	**2260**	1760	1620	640	-	40	6	.88	0	-	5	25/38
02	**3260**	20	760	2260	240	40	7	0	7	6	7	21/30
07	**2200**	20	420	1360	420	40	46	5	19	2	3	24/32
Atriplex canescens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**40**	-	-	40	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**140**	60	140	-	-	-	14	29	0	-	14	-/-
02	**20**	-	-	-	20	20	0	100	100	-	0	11/16
07	**0**	-	-	-	-	-	0	0	0	-	0	9/14
Cowania mexicana stansburiana												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	100	0	-	-	0	-/-
Gutierrezia sarothrae												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**240**	-	40	200	-	-	0	0	0	-	0	7/10
02	**480**	-	20	280	180	40	0	0	38	13	13	7/11
07	**140**	-	-	60	80	-	0	0	57	29	29	8/10
Juniperus osteosperma												
83	**66**	-	-	66	-	-	0	0	-	-	0	67/41
89	**100**	-	-	100	-	-	0	0	-	-	0	87/52
97	**120**	-	-	120	-	20	0	0	-	-	0	-/-
02	**160**	-	-	160	-	-	0	0	-	-	0	-/-
07	**180**	-	-	180	-	20	0	0	-	-	0	-/-
Leptodactylon pungens												
83	**100**	-	-	100	-	-	0	0	0	-	0	8/15
89	**198**	-	66	66	66	-	0	0	33	33	33	6/7
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**0**	-	-	-	-	-	0	0	0	-	0	-/-
07	**0**	-	-	-	-	-	0	0	0	-	0	-/-
Opuntia sp.												
83	**33**	-	-	33	-	-	0	0	-	-	0	6/15
89	**33**	-	-	33	-	-	0	0	-	-	0	6/15
97	**0**	-	-	-	-	-	0	0	-	-	0	6/21
02	**0**	-	-	-	-	-	0	0	-	-	0	5/18
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Purshia tridentata												
83	**133**	-	-	133	-	-	0	100	0	-	0	13/31
89	**166**	-	-	133	33	-	0	80	20	20	20	10/19
97	**20**	-	20	-	-	-	0	100	0	-	0	9/24
02	**40**	-	40	-	-	-	0	0	0	-	0	12/51
07	**0**	-	-	-	-	-	0	0	0	-	0	16/49

Trend Study 19B-7-07

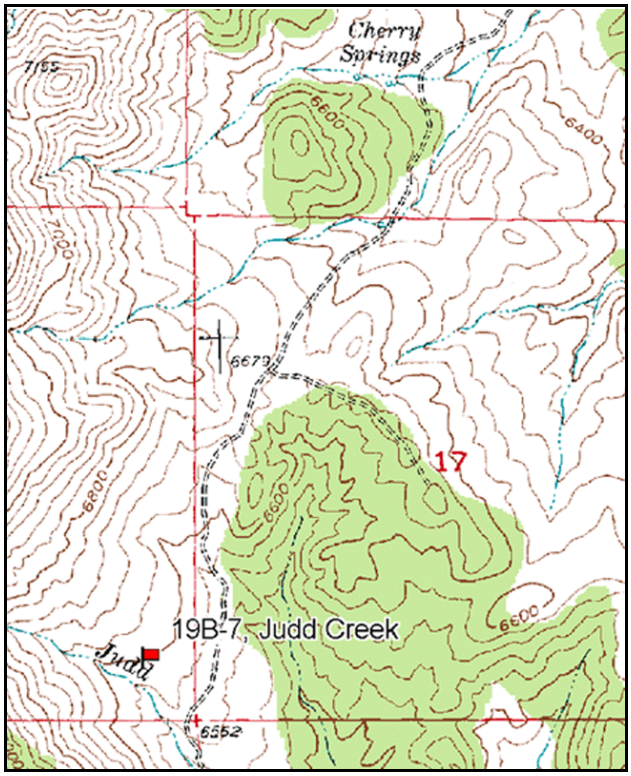
Study site name: Judd Creek . Vegetation type: Mountain Brush .

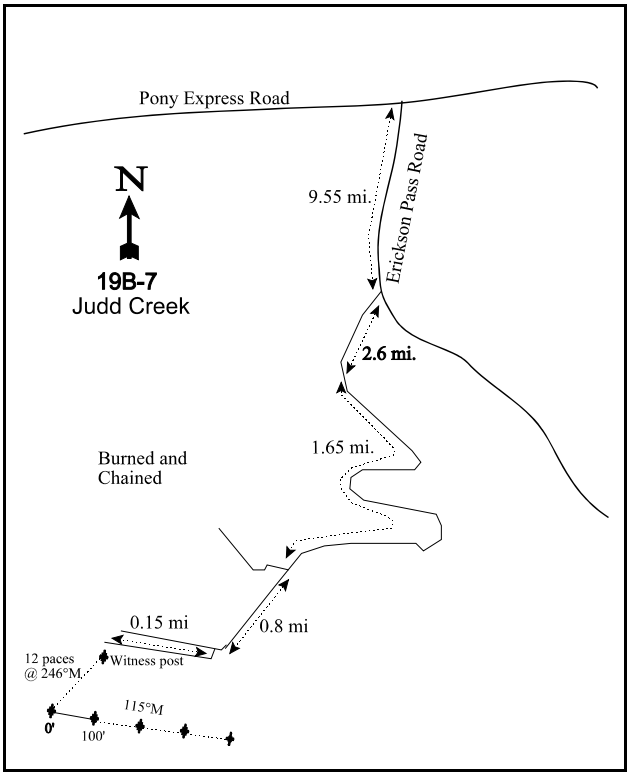
Compass bearing: frequency baseline 115 degrees magnetic.

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

LOCATION DESCRIPTION

Starting at the intersection of the Pony Express and Erickson Pass Roads, proceed south the on Erickson Pass Road for 9.55 miles to an intersection just before where the road crosses Government Creek. Turn right (i.e., southwest) at the intersection and proceed 2.5 miles to an intersection. Stay to the right (i.e., southerly) and proceed 1.9 miles to a green steel "T" fencepost on the west side of the road (next to a Rhus trilobata). From the fencepost, the 0-foot stake of the baseline is 12 paces away at an azimuth of 246 degrees magnetic. The baseline runs at 115 degrees magnetic. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height.





Map Name: Indian Springs Diagrammatic Sketch

Township 10S , Range 7W , Section 18 GPS: NAD 83, UTM 12S 357317 E 4423422 N

DISCUSSION

Judd Creek - Trend Study No. 19B-7

Study Information

This study is located within a small parcel of private property surrounded by Bureau of Land Management land. The area is categorized as deer winter range, and has been used by cattle during the spring, summer, and fall [elevation: 6,600 feet (2,012 m), slope: 10%, aspect: south]. Portions of the site were burned in 1996 and apparently seeded. Lines 2 and 3 of the baseline sample an area that was not burned and the remaining lines are within burned areas. Judd Creek, an intermittent stream, is found 200 feet (61 m) south of the baseline. It has a willow community associated with it. Wildlife use is light, while livestock use is moderate. From the pellet group tansect, there were an estimated 9 deer days use/acre (23 ddu/ha) in 2002, and 21 deer days use/acre (53 ddu/ha) in 2007. Elk use was estimated at 3 days use/acre (7 edu/ha) in 2007. There were an estimated 49 cattle days use/acre (120 cdu/ha) in 2002 and 56 cattle days use/acre (138 cdu/ha) in 2007. In 2007, all pellets and pats appeared to be from spring and summer. In 2007, salt licks were found within the area. The proximity of Judd Creek, the presence of the salt licks, and heavily grazed grasses suggest that the study is located in an area of high grazing pressure.

Soil

The study lies within the Abela soil series, which generally consists of very deep, well-drained soils that formed in alluvium or lacustrine deposits. Soils in this series are derived mainly from limestone, sandstone, and quartzite, and are found on fan remnants and lake terraces with 2%-25% slopes (USDA-NRCS 2007). Specifically at the study, the soil has a clay loam texture and is neutral in reactivity (pH of 6.7). The soil is rocky and very shallow. Additionally, there has been high soil disturbance beneath the few Utah juniper (*Juniperus osteosperma*) trees that are clustered along the baseline. Litter cover prior to the fire was high at approximately 60% in 1983 and 1989, but has averaged 28% since the fire. In 2002, relative bare ground cover was high (34%) and the erosion condition was classified as moderate. It improved to stable in 2007 due to decreases in pedestalling, rills, and soil and litter movement. Relative bare ground cover in 2007 was also lower (20%) in 2007.

Browse

The key browse species that are present include: Utah serviceberry (*Amelanchier utahensis*), Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) and antelope bitterbrush (*Purshia tridentata*), most of which are found in the unburned portion of the transect. Canopy cover of sagebrush was 1% in 2002 and 2% in 2007. Prior to the fire, the estimated density for sagebrush was 1,466 plants/acre (3,629 plants/ha). The density decreased to 340 plants/acre (842 plants/ha) in 1997, and was stable at 260 plants/acre (644 plants/ha) in 2002 and 2007. Reproduction and recruitment have been low in all sample years. Decadence has been high; greater than 20% of the population has been decadent in all sample years, and greater than 60% in 1989 and 2002. In 1997 and 2002, the density of dead plants was almost as high as the density of living plants. The proportion of plants exhibiting poor vigor has been widely variable and has ranged from 3%-86%. The proportion was highest in 1989 (86%) and 2002 (54%), which coincides to drought periods (Utah Climate Summaries 2007). Additionally, 12% of the population was classified as dying in 1997, 54% in 2002, and 23% in 2007. Sagebrush annual leader growth averaged 2.2 inches (5.6 cm) in 2002 and 1.4 inches (3.6 cm) in 2007. Browse use was light-moderate in 1983 and 1989, and has been light since 1997.

The canopy cover of antelope bitterbrush increased from 2% in 2002 to 4% in 2007. Bitterbrush density increased from 766 plants/acre (1,896 plants/ha) in 1983 to 2,166 plants/acre (5,361 plants/ha) in 1989. Following the wildfire, the density has been fairly stable at approximately 380 plants/acre (940 plants/ha). The population has been comprised mostly of mature plants. Seedling bitterbrush have not been sampled in any year. The density of young plants peaked in 1989 at 200 plants/acre (495 plants/ha) and decreased to 0 plants/acre in 2007. Decadent plants have accounted for 0% to 28% of the population. Bitterbrush plants

exhibiting poor vigor have been a small proportion of the population in all sample years. The average annual leader growth was 3.9 inches (9.9 cm) in 2002 and decreased to 2.4 inches (6.1 cm) in 2007. Browse use has ranged from light to heavy.

A few Utah serviceberry plants are also scattered throughout the site. Canopy cover was less than 1% in 2002 and 2007, and the density has been approximately 60 plants/acre (149 plants/ha) since 1989. Serviceberry has had moderate-heavy use, with one-third of the population classified with poor vigor since 1997.

Less preferred and/or palatable browse species sampled include: Oregon grape (*Mahonia repens*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), broom snakeweed (*Gutierrezia sarothrae*), Woods' rose (*Rosa woodsii*), pricklypear cactus (*Opuntia* sp.), and mountain snowberry (*Symphoricarpos oreophilus*). With the exception of broom snakeweed, these species occur in relatively low densities. The snakeweed density has ranged from 1,160 plants/acre (2,871 plants/ha) in 1997 to 7,232 plants/acre (17,900 plants/ha) in 1989. There were an estimated 1,300 plants/acre (3,218 plants/ha) in 2007. Juniper tree density has been too low to use the point-centered quarter method. However, juniper canopy cover increased from 4% in 2002 to 6% in 2007.

Herbaceous Understory

Perennial grass cover increased from 6% in 1997 to 17% in 2007. The number of grass species that have been sampled since 1983 has ranged from five to 13. The dominant perennial grasses include crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*Agropyron spicatum*), and to a lesser extent, mutton bluegrass (*Poa fendleriana*), and Sandberg bluegrass (*Poa secunda*). Two less desirable species, cheatgrass (*Bromus tectorum*) and bulbous bluegrass (*Poa bulbosa*) have been sampled. Cheatgrass cover was 3% in 1997 and less than 1% in 2007. Although bulbous bluegrass is a perennial, it has a phenology that is similar to annual grasses (Stewart and Hull 1949).

Perennial forb cover decreased from 9% in 1997 to 4% in 2002, then increased to 6% in 2007. The dominant perennial species include wild onion (*Allium* sp.), bastard toadflax (*Comandra pallida*), stoneseed (*Lithospermum ruderale*), longleaf phlox (*Phlox longifolia*), and American vetch (*Vicia americana*). When it was sampled in 1997 and 2007, pale alyssum (*Alyssum alyssoides*) was the dominant forb species. The forb component has been diverse, and the number of species has ranged from 17 to 38. Diversity was highest in 1997 when precipitation was above normal, and lowest in 2002 during a region-wide drought. No annual forbs were sampled in 2002.

1989 TREND ASSESSMENT

The browse trend is up. The density of Wyoming big sagebrush and antelope bitterbrush increased 16% and 183%, respectively. The increase in density was given more weight than other parameters when determining trend. For example, the increase in density offset the increase in sagebrush decadence (from 21% to 61%) and the number of plants exhibiting poor vigor (86%). Bitterbrush decadence increased from 0% to 28%. The increase in decadence and poor vigor were attributed to drought conditions. The grass trend is up. The sum of nested frequency of perennial grasses increased 61%. There were significant increases in the nested frequencies of mutton bluegrass and Sandberg bluegrass. The forb trend is stable. The sum of nested frequency of perennial forbs decreased 4%. The nested frequencies of wild onion and pale stickseed (*Hackelia patens*) decreased significantly, but those of longleaf phlox and tapertip hawksbeard (*Crepis acuminata*) increased significantly.

browse - up (+2) grass - up (+2) forb - stable (0)

1997 TREND ASSESSMENT

The browse trend is down. The 1996 fire greatly reduced the density of Wyoming big sagebrush and antelope bitterbrush. Sagebrush does not re-sprout after a fire, and bitterbrush re-sprouting success following fire is

variable. Sagebrush density decreased 77% and bitterbrush density decreased 83%. The density of dead sagebrush was nearly as high as the density of the live population. Sagebrush decadence decreased from 61% to 29%, and plants with poor vigor decreased to 18% of the population. Bitterbrush decadency decreased from 28% to 11%. Browse use on sagebrush shifted from light-moderate to light, and use shifted on bitterbrush from moderate-heavy to light. Increaser or invader species, primarily broom snakeweed, low rabbitbrush, and Woods' rose, were in low abundance but could increase under favorable climatic conditions. The grass trend is down. The sum of nested frequency of perennial grasses decreased 26%. Indian ricegrass (*Oryzopsis hymenoides*) and mutton bluegrass decreased significantly in nested frequency. Cheatgrass cover was second only to bluebunch wheatgrass. The forb trend is slightly down. The sum of nested frequency of perennial forbs decreased 11%. Although the number of forb species increased from 21 to 38, the increase did not include species with high forage values. The Desirable Components Index (DCI) score was fair-good due to the low preferred-browse cover, high decadence, and low perennial grass cover.

winter range condition (DCI) - fair-good (45) Low potential scale
browse - down (-2) grass - down (-2) forb - slightly down (-1)

2002 TREND ASSESSMENT

The browse trend is slightly down. The density of Wyoming big sagebrush decreased 24%, but the density of antelope bitterbrush increased 17%. Sagebrush decadence increased to 69% of the population and the majority of the decadent plants were classified as dying. Furthermore, the density of dead plants remained nearly as large as live plants and plants with poor vigor comprised 54% of the population. Bitterbrush decadence increased from 11% to 14%, and plants with poor vigor accounted for an additional 14% of the population. Browse use remained light on sagebrush and shifted from light to heavy on bitterbrush. The grass trend is up. The sum of nested frequency of perennial grasses increased 21%, including a significant increase in the nested frequency of crested wheatgrass. Cheatgrass was not sampled. Grasses had been moderately to heavily utilized in 2002. The forb trend is down. The sum of nested frequency of perennial forbs decreased 70%, and the number of species decreased to 17. There were significant decreases in the nested frequencies of longleaf phlox and timber poisonvetch (*Astragalus convallarius*). The change in vegetative composition towards more grass and less forbs is attributed to the drought. The DCI score declined to fair due to the low preferred-browse cover (less than 5%).

winter range condition (DCI) - fair (42) Low potential scale
browse - slightly down (-1) grass - up (+2) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is stable. The density of Wyoming big sagebrush was constant, but antelope bitterbrush density decreased 14%. No seedlings were sampled for either species, and while young no bitterbrush were sampled, the density of young sagebrush doubled. Sagebrush decadence decreased from 69% to 23%, but all of the decadent plants were classified as dying. There were no decadent bitterbrush plants sampled. Seed production on sagebrush was good, but bitterbrush had poor seed production. Browse use remained light for sagebrush and heavy for bitterbrush. The Wood's rose population was moderately browsed. The grass trend is up. The sum of nested frequency of perennial grasses increased 60%, including significant increases in the nested frequencies of bluebunch wheatgrass and Sandberg bluegrass. Cheatgrass was sampled again, though at a lower frequency than in 1997. All wheatgrass species were moderately to heavily grazed. The forb trend is up. The sum of nested frequency of perennial forbs increased more than two-fold, and the number of species increased to 30. Perennial forb richness was higher than pre-fire levels, but abundance of each species was lower. Stoneseed plants had been heavily grazed. The DCI score improved to good-excellent due to the increases in preferred-browse and perennial grass cover.

winter range condition (DCI) - good-excellent (65) Low potential scale
browse - stable (0) grass - up (+2) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 7

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	-	-	a1	b131	b108	.15	4.61	5.82
G	Agropyron intermedium	-	-	a7	ab13	b19	.09	.12	.50
G	Agropyron smithii	-	-	a3	a4	a1	.03	.03	.15
G	Agropyron spicatum	a59	a72	a85	a73	b144	3.92	2.80	7.30
G	Bromus tectorum (a)	-	-	b186	-	a36	3.39	-	.32
G	Melica bulbosa	-	-	2	-	-	.00	-	-
G	Oryzopsis hymenoides	b62	b62	a19	a8	a17	.12	.09	.45
G	Phleum pratense	-	-	1	-	-	.00	-	-
G	Poa bulbosa	-	-	-	-	20	-	-	.29
G	Poa fendleriana	b38	c95	a13	a3	ab25	.28	.03	1.00
G	Poa pratensis	-	-	a19	a10	a12	.16	.04	.37
G	Poa secunda	a12	b47	b57	a13	b63	.98	.08	1.14
G	Sitanion hystrix	a6	a9	a1	-	-	.00	-	-
G	Stipa lettermani	-	-	2	-	-	.03	-	-
Total for Annual Grasses		0	0	186	0	36	3.39	0	0.31
Total for Perennial Grasses		177	285	210	255	409	5.79	7.83	17.05
Total for Grasses		177	285	396	255	445	9.18	7.83	17.37
F	Agoseris glauca	ab14	-	a3	-	b24	.06	-	.25
F	Alyssum alyssoides (a)	-	-	a189	-	b236	3.73	-	3.83
F	Allium sp.	b122	a28	b105	-	a18	1.12	-	.06
F	Antennaria rosea	-	-	3	-	-	.15	-	-
F	Arabis sp.	-	a4	-	-	a1	-	-	.00
F	Artemisia ludoviciana	b32	b23	a3	ab19	ab20	.30	.37	.81
F	Aster chilensis	b50	b52	-	a2	-	-	.03	-
F	Astragalus convallarius	ab5	ab6	b15	a1	ab5	.23	.00	.02
F	Astragalus sp.	-	a3	b25	-	a1	.16	-	.01
F	Astragalus utahensis	-	2	-	-	-	-	-	-
F	Balsamorhiza sagittata	a5	a4	a9	a3	a3	.56	.15	.18
F	Castilleja linariaefolia	-	-	1	-	-	.00	-	-
F	Camelina microcarpa (a)	-	-	b21	-	a2	.63	-	.01
F	Calochortus nuttallii	a12	a8	a8	-	a8	.04	-	.02
F	Cirsium sp.	b33	ab25	a10	ab16	a5	.29	.27	.04
F	Collomia linearis (a)	-	-	a17	-	a9	.06	-	.03
F	Comandra pallida	a33	a27	ab59	b71	ab50	.99	1.39	.54

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Collinsia parviflora (a)	-	-	$_{a}$47	-	$_{b}$71	.21	-	.28
F	Crepis acuminata	$_{a}$18	$_{b}$38	$_{a}$11	-	$_{a}$16	.46	-	.27
F	Cryptantha sp.	$_{a}$13	$_{a}$9	$_{a}$9	$_{a}$20	$_{a}$8	.07	.14	.07
F	Delphinium nuttallianum	2	-	-	-	-	-	-	-
F	Descurainia sp. (a)	-	-	$_{a}$3	-	$_{a}$6	.18	-	.02
F	Epilobium brachycarpum (a)	-	-	-	-	6	-	-	.10
F	Eriogonum brevicaule	-	-	-	1	-	-	.00	-
F	Erodium cicutarium (a)	-	-	1	-	-	.00	-	-
F	Erigeron sp.	-	-	$_{a}$3	$_{a}$2	-	.03	.00	-
F	Eriogonum racemosum	-	-	$_{a}$3	-	$_{a}$1	.00	-	.03
F	Galium boreale	-	-	5	-	-	.18	-	-
F	Gayophytum ramosissimum(a)	-	-	-	-	1	-	-	.00
F	Hackelia patens	$_{c}$61	$_{b}$22	$_{a}$5	$_{a}$3	$_{a}$4	.01	.04	.03
F	Lathyrus brachycalyx	-	-	25	-	-	.37	-	-
F	Lactuca serriola	-	-	-	$_{a}$4	$_{b}$23	-	.03	.12
F	Linum lewisii	$_{b}$13	-	$_{a}$3	-	-	.01	-	-
F	Lithospermum ruderale	$_{a}$17	$_{a}$30	$_{a}$16	$_{a}$18	$_{a}$12	1.32	1.35	.63
F	Lomatium grayi	$_{a}$4	$_{a}$5	$_{a}$11	-	$_{a}$3	.05	-	.16
F	Microsteris gracilis (a)	-	-	$_{a}$26	-	$_{a}$22	.08	-	.05
F	Monolepis nuttalliana (a)	3	-	-	-	-	-	-	-
F	Oenothera sp.	1	-	-	-	-	-	-	-
F	Penstemon sp.	-	$_{a}$3	-	$_{a}$1	-	-	.00	-
F	Petradoria pumila	-	$_{a}$2	$_{a}$8	$_{a}$8	$_{a}$5	.24	.24	.33
F	Phlox hoodii	-	-	-	1	-	-	.00	-
F	Phlox longifolia	$_{b}$54	$_{c}$172	$_{c}$167	$_{a}$1	$_{c}$175	1.27	.00	2.50
F	Polygonum douglasii (a)	-	-	$_{b}$14	$_{a}$3	-	.18	.00	-
F	Ranunculus testiculatus (a)	-	-	$_{a}$36	-	$_{a}$20	.51	-	.09
F	Taraxacum officinale	-	-	7	-	-	.05	-	-
F	Tragopogon dubius	$_{a}$21	-	$_{a}$19	-	-	.47	-	-
F	Trifolium sp.	-	-	1	-	-	.00	-	-
F	Unknown forb-perennial	-	1	-	-	-	-	-	-
F	Veronica biloba (a)	-	-	$_{b}$54	-	$_{a}$15	.21	-	.06
F	Vicia americana	$_{b}$168	$_{b}$188	$_{a}$43	-	$_{a}$32	.59	-	.11
F	Viguiera multiflora	-	-	1	-	-	.00	-	-
Total for Annual Forbs		3	0	408	3	388	5.82	0.00	4.48
Total for Perennial Forbs		678	652	578	171	414	9.09	4.07	6.24

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
Total for Forbs		681	652	986	174	802	14.92	4.07	10.72

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

BROWSE TRENDS --
Management unit 19B, Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier utahensis	3	3	3	.63	.38	.38
B	Artemisia tridentata wyomingensis	10	9	9	3.13	1.91	2.15
B	Cercocarpus montanus	1	0	0	-	-	-
B	Chrysothamnus nauseosus albicaulis	0	6	0	-	.30	-
B	Chrysothamnus viscidiflorus viscidiflorus	5	12	15	.18	.78	.51
B	Gutierrezia sarothrae	16	30	29	.19	.82	.84
B	Juniperus osteosperma	2	5	4	2.92	4.84	1.61
B	Mahonia repens	20	9	16	.41	.07	.07
B	Opuntia sp.	9	10	6	.33	.68	.03
B	Purshia tridentata	13	14	13	2.36	2.50	3.17
B	Rosa woodsii	9	11	11	.26	.42	.72
B	Symphoricarpos oreophilus	3	1	0	.15	.00	-
B	Tetradymia canescens	5	6	5	.03	.04	.16
Total for Browse		96	116	111	10.61	12.78	9.65

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 7

Species	Percent Cover		
	'97	'02	'07
Amelanchier utahensis	-	.48	.33
Artemisia tridentata wyomingensis	-	.71	2.36
Chrysothamnus nauseosus albicaulis	-	.05	-
Chrysothamnus viscidiflorus viscidiflorus	-	.83	.66
Gutierrezia sarothrae	-	.76	1.20
Juniperus osteosperma	1.79	3.59	6.44
Mahonia repens	-	-	.08
Opuntia sp.	-	.38	.23
Purshia tridentata	-	1.64	3.83
Rosa woodsii	-	.30	.48
Tetradymia canescens	-	.66	.23

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 7

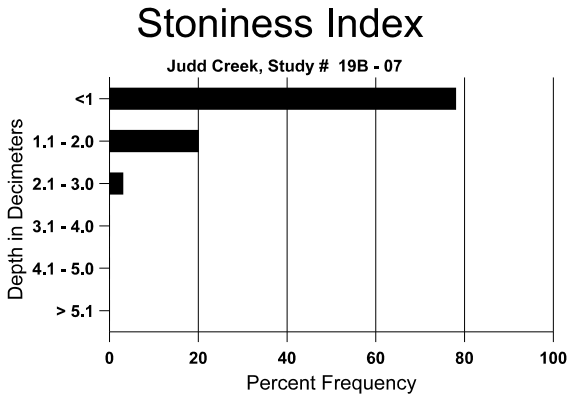
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata wyomingensis	2.2	1.4
Purshia tridentata	3.9	2.4

BASIC COVER --
Management unit 19B, Study no: 7

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	2.25	4.75	34.89	26.16	36.63
Rock	12.50	8.50	8.64	10.54	7.15
Pavement	7.00	9.50	14.81	9.06	10.11
Litter	59.00	60.75	28.76	26.81	34.71
Cryptogams	0	0	.87	.00	0
Bare Ground	19.25	16.50	15.31	37.90	22.27

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 7, Judd Creek

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
9.1	66.8 (11.9)	6.7	40.4	25.1	34.6	4.9	27.5	611.2	.8



PELLET GROUP DATA --
Management unit 19B, Study no: 7

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	5	3	3
Elk	-	-	-
Deer	11	10	3
Cattle	5	15	13

Days use per acre (ha)	
'02	'07
-	-
-	3 (7)
9 (23)	21 (53)
49 (120)	56 (138)

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 7

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
83	**33**	-	-	33	-	-	0	100	0	-	100	35/35
89	**66**	-	-	-	66	-	0	100	100	-	0	-/-
97	**60**	-	20	20	20	20	0	0	33	33	33	27/35
02	**60**	-	-	40	20	-	33	67	33	33	33	30/36
07	**60**	-	-	40	20	-	33	67	33	33	33	36/40

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
83	**1265**	-	66	933	266	-	58	3	21	-	3	25/29
89	**1466**	-	66	500	900	-	55	2	61	-	86	18/25
97	**340**	20	20	220	100	260	6	0	29	12	18	28/41
02	**260**	-	20	60	180	220	8	0	69	54	54	20/33
07	**260**	-	40	160	60	40	0	0	23	23	23	23/35
Cercocarpus montanus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	20	100	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	72/74
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus nauseosus albicaulis												
83	**66**	-	-	-	66	-	0	0	100	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**160**	-	-	160	-	-	0	13	0	-	13	12/16
07	**0**	-	-	-	-	-	0	0	0	-	0	22/39
Chrysothamnus viscidiflorus viscidiflorus												
83	**33**	-	-	33	-	-	0	0	0	-	0	13/28
89	**33**	-	-	33	-	-	0	0	0	-	0	11/13
97	**160**	-	-	160	-	-	0	0	0	-	0	14/19
02	**420**	-	80	300	40	40	10	5	10	-	14	11/21
07	**400**	-	-	400	-	20	10	5	0	-	0	14/24
Gutierrezia sarothrae												
83	**2333**	-	400	1933	-	-	0	0	0	-	0	9/7
89	**7232**	66	466	5900	866	-	0	0	12	-	.46	8/8
97	**1160**	220	360	780	20	-	0	0	2	-	0	9/5
02	**2000**	40	-	2000	-	40	0	0	0	-	1	11/16
07	**1300**	280	120	1160	20	20	2	3	2	2	2	9/11
Juniperus osteosperma												
83	**66**	-	33	33	-	-	0	0	-	-	0	67/79
89	**133**	33	100	33	-	-	0	0	-	-	0	138/118
97	**40**	-	20	20	-	20	0	0	-	-	0	-/-
02	**100**	20	40	60	-	-	0	0	-	-	0	-/-
07	**80**	-	60	20	-	20	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Mahonia repens												
83	**10966**	-	800	10166	-	-	0	0	0	-	0	4/6
89	**20099**	566	3533	16566	-	-	0	0	0	-	0	3/3
97	**1480**	340	420	1060	-	-	0	0	0	-	0	2/4
02	**420**	-	60	360	-	-	0	0	0	-	0	2/2
07	**2400**	-	-	2380	20	-	0	0	1	-	0	3/4
Opuntia sp.												
83	**133**	-	100	33	-	-	0	0	0	-	0	4/16
89	**333**	-	33	300	-	-	0	0	0	-	10	6/8
97	**280**	-	20	240	20	-	0	0	7	-	0	6/14
02	**280**	-	-	260	20	-	0	0	7	-	0	8/20
07	**140**	-	-	140	-	-	0	0	0	-	0	6/19
Purshia tridentata												
83	**766**	-	33	733	-	-	17	83	0	-	0	14/36
89	**2166**	-	200	1366	600	-	65	29	28	-	2	15/33
97	**360**	-	80	240	40	100	0	0	11	-	0	18/54
02	**420**	-	20	340	60	-	19	71	14	-	14	15/45
07	**360**	-	-	360	-	-	6	89	0	-	0	18/50
Rhus trilobata												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	30/48
02	**0**	-	-	-	-	-	0	0	-	-	0	42/60
07	**0**	-	-	-	-	-	0	0	-	-	0	47/79
Rosa woodsii												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**660**	120	640	20	-	-	0	0	0	-	0	10/5
02	**2400**	-	1620	580	200	-	0	0	8	5	5	8/9
07	**1680**	-	440	1240	-	40	49	15	0	-	0	8/8
Symphoricarpos oreophilus												
83	**33**	-	-	33	-	-	0	0	0	-	0	11/18
89	**66**	-	33	33	-	-	0	0	0	-	50	13/15
97	**140**	-	60	-	80	-	0	0	57	-	0	19/32
02	**20**	-	-	-	20	-	0	0	100	100	100	-/-
07	**0**	-	-	-	-	-	0	0	0	-	0	14/25

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Tetradymia canescens												
83	**266**	-	33	133	100	-	0	0	38	-	0	5/10
89	**232**	-	66	133	33	-	14	0	14	-	43	7/10
97	**160**	-	40	120	-	-	0	0	0	-	0	10/7
02	**140**	-	-	100	40	-	0	0	29	-	29	10/21
07	**120**	-	20	80	20	-	0	0	17	-	0	11/18

Trend Study 19B-8-07

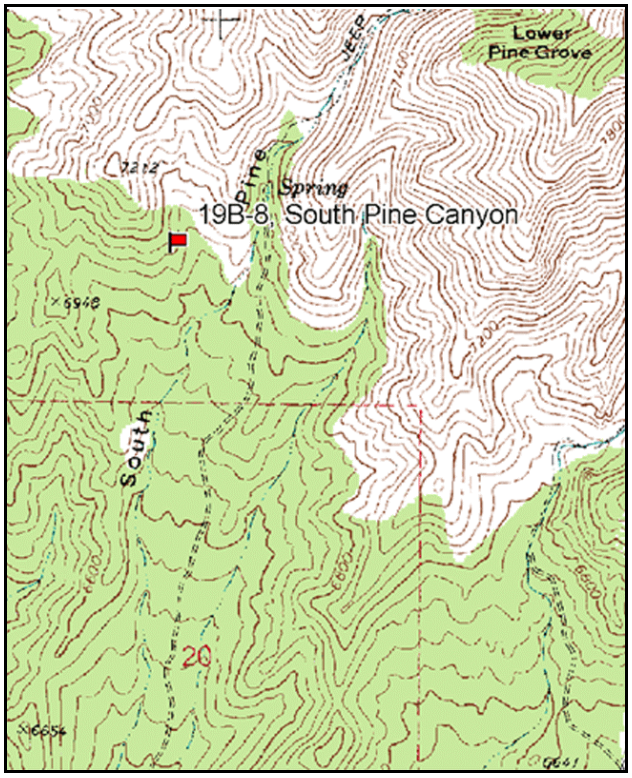
Study site name: South Pine Canyon . Vegetation type: Mountain Brush .

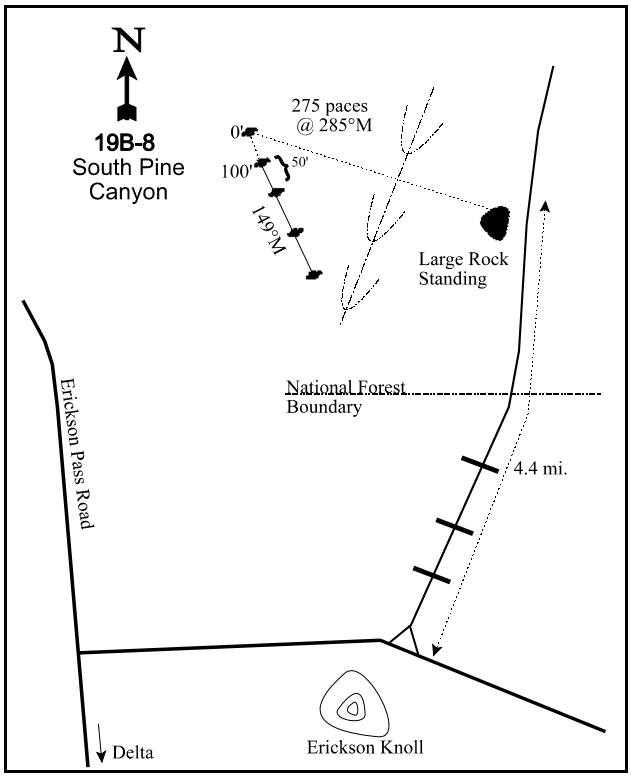
Compass bearing: frequency baseline 149 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft) and line 4 (71ft).

LOCATION DESCRIPTION

Starting on the road north of Erickson Knoll (road #564), take the South Pine Canyon Rd north for 4.4 Miles. In route, you will pass through a series of four gates and the National Forest Service boundary. Stop next to a huge rock on the west side of the road. From the west side of the road, the 0-foot baseline stake is 250 paces away at 285 degrees magnetic (across South Pine wash). The 0-foot baseline is marked by browse tag #3976.





Map Name: Erickson Knoll

Diagrammatic Sketch

Township 10S , Range 6W , Section 17

GPS: NAD 83, UTM 12S 368087 E 4423525 N

DISCUSSION

South Pine Canyon - Trend Study No. 19B-8

Study Information

This study is located on Forest Service administered land and samples important deer winter range [elevation: 6,900 feet (2,103 m), slope: 22%, aspect: south]. An ephemeral stream is located 750 feet to the east (229 m). This study was not sampled during the 1997 rotation because a wildfire had eliminated all of the browse. Before the wildfire, the vegetation consisted of a mountain brush community with a sparse herbaceous understory. Although no wildlife use information was available from that time, deer use was moderate following the fire. From the pellet group tansect, there were an estimated 55 deer days use/acre (136 ddu/ha) in 2002, and 27 deer days use/acre (68 ddu/ha) in 2007. Elk use was estimated at 3 days use/acre (7 edu/ha) in 2007. Most of the wildlife use appeared to be from late winter and spring use. Cattle use was estimated at 6 days use/acre (14 cdu/ha) in 2002. Cattle were grazing in the vicinity while the study was sampled in 2002. There were no cattle pats in 2007.

Soil

The study lies within the Reywat-Broad-Rock outcrop soil association, which generally consists of shallow to moderately deep, well-drained soil. Depth to bedrock is 20-40 inches (51-102 cm). The soils in this series formed in colluvium and residuum derived from sandstone and quartzite, or basalt and andesite, and are found on hillsides, mountains, or plateaus (USDA-NRCS 2007). At the study, the soil has a sandy loam texture and a neutral reactivity (pH of 7.1). Rock and pavement have accounted for approximately one-third of the total ground cover since 2002. The profile is also very rocky throughout. Prior to 2002, there were signs of significant pedestalling, as well as sheet and gully erosion. In 2002 and 2007, the erosion condition was classified as stable. Litter and vegetation cover are lacking, but the abundance of rock and pavement armor the surface.

Browse

The key browse species are Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and antelope bitterbrush (*Purshia tridentata*). Canopy cover of sagebrush increased from 1% in 2002 to 13% in 2007. Sagebrush density ranged from 100 plants/acre (248 plants/ha) to 533 plants/acre (1,319 plants/ha) between 1983 and 2002. In 2007, the density increased dramatically to 10,620 plants/acre (26,287 plants/ha). Seedling sagebrush plants were not sampled prior to 2007, but there were 4,060 seedlings/acre (10,050 seedlings/ha) in 2007. A similar pattern exists for young plants. Decadent sagebrush were also first sampled in 2007, but at a very low density. The proportion of plants exhibiting poor vigor has been low in each sample year. The average annual leader growth was 2.1 inches (5.3 cm) in 2002 and 1.5 inches (3.8 cm) in 2007. Browse use was light-moderate through 2002 and was light in 2007.

Canopy cover of Utah serviceberry increased from 3% in 2002 to 5% in 2007. The estimated density increased from 800 plants/acre (1,980 plants/ha) in 1983 to 932 plants/acre (2,307 plants/ha) in 1989, but decreased to 200 plants/acre (495 plants/ha) by 2007. No serviceberry seedlings have been measured in any sample year, and young plants were only sampled in 1989. Decadent plants comprised 14% of the population in 1989 and 31% in 2002, but there were no decadent plants in 1983 or 2007. Vigor has been good all sample years except 2002, when 38% of the population had poor vigor. The annual leader growth averaged 1.3 inches (3.3 cm) in 2002 and 1.4 inches (3.6 cm) in 2007. Browse use on serviceberry has oscillated between heavy and moderate with each sampling.

Antelope bitterbrush density has ranged from 60 plants/acre (149 plants/ha) to 1,666 plants/acre (4,124 plants/ha). Only mature and decadent plants have been sampled. Decadence was low, except in 2007 when 33% of the population was classified as such. The bitterbrush are healthy and none have been classified as having poor vigor, despite heavy browse use in each sample year. The average annual leader growth was 2.5

inches (6.4 cm) in 2002 and 1.2 inches (3.0 cm) in 2007.

Herbaceous Understory

The perennial understory was rather sparse before the fire, and was even more so afterwards. Perennial grasses comprised 2% cover in 2002 and 1% in 2007. Bluebunch wheatgrass (*Agropyron spicatum*) has been the dominant perennial grass every sample year, but the nested frequency was significantly lower following the fire. Other perennial grasses include: mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*Poa secunda*), and sand dropseed (*Sporobolus cryptandrus*). The composition of the grasses before the fire may have been different than that sampled after the fire. For example, cheatgrass (*Bromus tectorum*) was measured in 94% of the quadrats following the fire, but since annual species were not measured before the fire, it is difficult to determine if cheatgrass increased following the fire. As a result, there is no certainty regarding any changes in composition from perennial to annual grass following the fire. Cheatgrass cover has been approximately 10% since 2002. Cattle were reported to have heavily grazed the limited wheatgrass plants previous to 2007.

Forbs were diverse in 1983 and 1989, but provided little forage. The most common species were American vetch (*Vicia americana*), wild onion (*Allium* sp.), longstalk springparsley (*Cymopterus longipes*), longleaf phlox (*Phlox longifolia*), and thistle (*Cirsium* sp.). More desirable species such as redroot eriogonum (*Eriogonum racemosum*), tapertip hawksbeard (*Crepis acuminata*), and gray lomatium (*Lomatium grayi*) have been sampled infrequently. Perennial forb frequency was much lower in 2002 and 2007 than in previous sample years. Perennials comprised 1% cover in 2002 and 2% in 2007, while annuals comprised less than 1% in 2002 and 3% in 2007. Pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*) were the dominant forb species, and bur buttercup (*Ranunculus testiculatus*), an allelopathic annual (Buchanan et al. 1978), was sampled for the first time in 2007.

1989 TREND ASSESSMENT

The browse trend is stable. The density of Utah serviceberry and mountain big sagebrush increased 17% and 33%, respectively. Conversely, the density of antelope bitterbrush decreased 28%. No preferred browse seedlings were sampled, though the proportion of the serviceberry plants in the young age class increased from 0% to 14% of the population. Serviceberry and bitterbrush decadence increased, but remained stable for sagebrush. Plants with poor vigor increased from 0% to 13% of the sagebrush population, but all of the sampled serviceberry and bitterbrush plants had good vigor. The grass trend is stable. The sum of nested frequency of perennial grasses increased 10%. Grasses remained a minor component of vegetation. The forb trend is up. The sum of nested frequency increased 31%. Gray lomatium, Douglas chaenactis (*Chaenactis douglasii*), and longleaf phlox all significantly increased in nested frequency, but wild onion decreased.

browse - stable (0) grass - stable (0) forb - up (+2)

2002 TREND ASSESSMENT

The browse trend is down. Densities of all the key species declined sharply. The decrease in density was partly attributed to a wildfire that burned through the area, and partly to the larger area sampled beginning in 2002. There were no decadent sagebrush or bitterbrush, but 31% of the serviceberry population was classified as decadent. Browse use shifted to heavy on serviceberry and changed little on sagebrush and bitterbrush. The grass trend is down. The sum of nested frequency of perennial grasses decreased 66%. The nested frequency of bluebunch wheatgrass and Sandberg bluegrass decreased significantly. Cheatgrass was found in 94% of the quadrats and accounted for 10% cover. The forb trend is down. The sum of nested frequency of perennial forbs decreased 93%. The number of forb species decreased from 19 to eight and the nested frequency of three species decreased significantly. The Desirable Components Index (DCI) score was very poor due to the low preferred-browse cover (less than 5%), low perennial grass and forb cover, and high annual grass cover.

winter range condition (DCI) - very poor (1) Mid-level potential scale
browse - down (-2) grass - down (-2) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is up. Utah serviceberry and antelope bitterbrush densities remained low, but the density of mountain big sagebrush increased dramatically. Sagebrush density increased from 100 plants/acre (248 plants/ha) to 10,620 plants/acre (26,287 plants/ha). The sagebrush population is approximately half young and half mature plants. There were no decadent serviceberry or sagebrush plants, and only 20 bitterbrush plants/acre (50 plants/ha) were decadent. The proportion of plants with poor vigor decreased for serviceberry and remained low for sagebrush and bitterbrush. Browse use remained high on bitterbrush, shifted to moderate on serviceberry, and shifted to light on sagebrush. The grass trend is down. The sum of nested frequency of perennial grasses decreased 59%. The nested frequency of cheatgrass significantly increased and it was measured in all but one quadrat. The forb trend is up. The sum of nested frequency of perennial forbs increased four-fold. The number of species increased from one to eight for annual species and from seven to 13 for perennial species. The DCI score improved to poor due to the increase in preferred-browse cover and recruitment, and a decrease in browse decadence.

winter range condition (DCI) - poor (46) Mid-level potential scale
browse - up (+2) grass - down (-2) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 8

Type	Species	Nested Frequency				Average Cover %	
		'83	'89	'02	'07	'02	'07
G	Agropyron spicatum	bc90	c90	ab33	a13	1.70	.78
G	Bromus tectorum (a)	-	-	a290	b315	9.86	10.13
G	Poa fendleriana	a1	a9	a3	-	.03	-
G	Poa secunda	b13	b15	a1	a-	.01	.01
G	Sporobolus cryptandrus	-	-	a2	a3	.03	.15
Total for Annual Grasses		0	0	290	315	9.86	10.13
Total for Perennial Grasses		104	114	39	16	1.77	0.94
Total for Grasses		104	114	329	331	11.63	11.07
F	Agoseris glauca	5	-	-	-	-	-
F	Alyssum alyssoides (a)	-	-	-	179	-	.93
F	Allium sp.	b54	a29	-	-	-	-
F	Arabis sp.	-	11	-	-	-	-
F	Arenaria sp.	-	3	-	-	-	-
F	Artemisia ludoviciana	a11	a7	-	a1	-	.03
F	Astragalus sp.	a3	a2	-	-	-	-
F	Calochortus nuttallii	-	2	-	-	-	-
F	Chaenactis douglasii	a1	b21	a1	b30	.00	.22
F	Cirsium sp.	a13	a7	a9	a2	.45	.25
F	Collomia linearis (a)	-	-	-	4	-	.01

Type	Species	Nested Frequency				Average Cover %	
		'83	'89	'02	'07	'02	'07
F	Comandra pallida	$_{a}$7	$_{a}$11	-	-	-	-
F	Collinsia parviflora (a)	-	-	-	87	-	.29
F	Crepis acuminata	$_{a}$18	$_{a}$24	-	-	-	-
F	Cryptantha sp.	$_{ab}$18	$_{b}$20	$_{a}$2	$_{ab}$4	.03	.01
F	Cymopterus longipes	$_{b}$29	-	-	$_{a}$10	-	.02
F	Descurainia pinnata (a)	-	$_{a}$3	-	$_{b}$69	-	.68
F	Epilobium brachycarpum (a)	-	-	-	3	-	.01
F	Erodium cicutarium (a)	-	-	$_{a}$14	$_{b}$71	.21	.84
F	Eriogonum racemosum	$_{a}$2	-	-	$_{b}$12	-	.22
F	Hackelia patens	$_{a}$12	$_{a}$12	-	$_{a}$3	-	.03
F	Lappula occidentalis (a)	-	-	-	52	-	.33
F	Lactuca serriola	-	-	$_{a}$10	$_{a}$2	.13	.01
F	Lithospermum ruderale	$_{a}$5	$_{a}$5	$_{a}$5	$_{a}$8	.24	.45
F	Lomatium grayi	$_{a}$11	$_{b}$77	-	$_{a}$7	-	.02
F	Machaeranthera canescens	$_{a}$2	$_{a}$3	-	$_{a}$8	-	.05
F	Microsteris gracilis (a)	-	-	-	4	-	.01
F	Phlox longifolia	$_{a}$2	$_{b}$45	$_{a}$3	$_{b}$43	.00	.30
F	Ranunculus testiculatus (a)	-	-	-	3	-	.00
F	Sanguisorba minor	-	-	2	-	.03	-
F	Tragopogon dubius	-	4	-	-	-	-
F	Vicia americana	$_{b}$140	$_{b}$155	-	$_{a}$2	-	.00
F	Viola sp.	1	-	-	-	-	-
Total for Annual Forbs		0	3	14	472	0.21	3.13
Total for Perennial Forbs		334	438	32	132	0.90	1.64
Total for Forbs		334	441	46	604	1.11	4.77

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

BROWSE TRENDS --
Management unit 19B, Study no: 8

Type	Species	Strip Frequency		Average Cover %	
		'02	'07	'02	'07
B	Amelanchier utahensis	13	9	1.45	3.56
B	Artemisia tridentata vaseyana	5	76	.33	12.03
B	Chrysothamnus nauseosus	0	19	-	.85
B	Chrysothamnus viscidiflorus viscidiflorus	7	58	.56	3.41
B	Juniperus osteosperma	0	0	-	-
B	Mahonia repens	2	2	.06	.30
B	Opuntia sp.	1	3	-	-
B	Purshia tridentata	3	3	.38	1.31
B	Tetradymia canescens	1	0	-	-
Total for Browse		32	170	2.78	21.47

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 8

Species	Percent Cover	
	'02	'07
Amelanchier utahensis	2.71	5.08
Artemisia tridentata vaseyana	1.11	12.91
Chrysothamnus nauseosus	-	.95
Chrysothamnus viscidiflorus viscidiflorus	.86	3.95
Mahonia repens	-	.25
Purshia tridentata	.40	2.21

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19B, Study no: 8

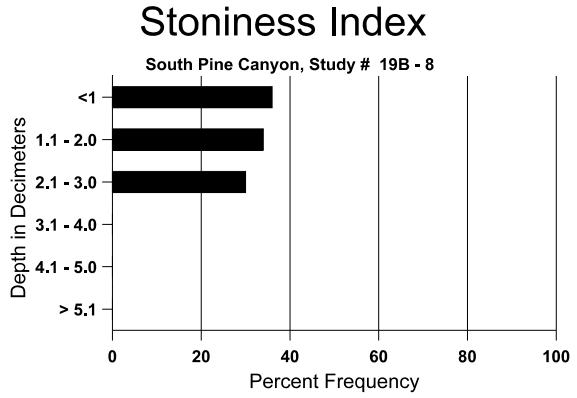
Species	Average leader growth (in)	
	'02	'07
Amelanchier utahensis	-	1.4
Artemisia tridentata vaseyana	2.1	1.5
Purshia tridentata	2.5	1.2

BASIC COVER --
Management unit 19B, Study no: 8

Cover Type	Average Cover %			
	'83	'89	'02	'07
Vegetation	2.75	6.25	15.07	35.24
Rock	6.75	9.50	13.52	13.41
Pavement	1.75	2.75	24.91	21.13
Litter	65.25	62.75	27.26	16.01
Cryptogams	.25	.25	0	.00
Bare Ground	23.25	18.50	26.89	22.06

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 8, South Pine Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.4	67.0 (11.7)	7.1	69.3	16.7	14.0	2.5	13.8	227.2	.6



PELLET GROUP DATA --
Management unit 19B, Study no: 8

Type	Quadrat Frequency	
	'02	'07
Rabbit	1	6
Elk	-	5
Deer	20	17
Cattle	5	1

Days use per acre (ha)	
'02	'07
-	-
-	3 (7)
55 (136)	27 (68)
6 (14)	-

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 8

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
83	**800**	-	-	800	-	-	0	100	0	-	0	45/53
89	**932**	-	133	666	133	-	79	0	14	-	0	45/48
02	**320**	-	-	220	100	-	0	88	31	31	38	21/44
07	**200**	-	-	200	-	-	70	10	0	-	10	33/59
Artemisia tridentata vaseyana												
83	**400**	-	-	400	-	-	50	0	0	-	0	28/36
89	**533**	-	-	533	-	-	63	0	0	-	13	11/13
02	**100**	-	40	60	-	200	40	0	0	-	0	20/34
07	**10620**	4060	5900	4700	20	60	9	2	0	.18	.18	15/25
Atriplex canescens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	10/22
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus nauseosus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**540**	-	40	500	-	20	26	4	-	-	4	16/20
Chrysothamnus viscidiflorus viscidiflorus												
83	**332**	-	66	200	66	-	0	0	20	-	0	14/10
89	**266**	-	-	266	-	-	0	0	0	-	0	9/9
02	**220**	-	-	220	-	-	9	0	0	-	0	15/33
07	**4980**	240	1440	3180	360	-	16	0	7	4	11	14/29
Gutierrezia sarothrae												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	20	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Juniperus osteosperma												
83	**66**	-	-	66	-	-	0	0	-	-	0	67/173
89	**66**	-	-	66	-	-	0	0	-	-	0	197/157
02	**0**	-	-	-	-	20	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Mahonia repens												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**200**	-	20	180	-	-	0	0	0	-	80	2/6
07	**960**	-	-	740	220	100	0	0	23	-	88	5/7
Opuntia sp.												
83	**866**	-	-	866	-	-	0	0	0	-	0	10/17
89	**866**	-	200	600	66	-	0	0	8	8	54	7/28
02	**20**	-	-	20	-	-	0	0	0	-	0	6/18
07	**60**	-	-	60	-	-	0	0	0	-	33	5/25
Purshia tridentata												
83	**1666**	-	-	1600	66	-	4	96	4	-	0	17/25
89	**1199**	-	-	1066	133	-	33	67	11	-	0	14/31
02	**60**	-	-	60	-	-	0	100	0	-	0	8/24
07	**60**	-	-	40	20	-	0	100	33	-	0	15/61
Symphoricarpos oreophilus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	21/40
Tetradymia canescens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	20	-	-	-	100	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	17/69

Trend Study 19C-15-07

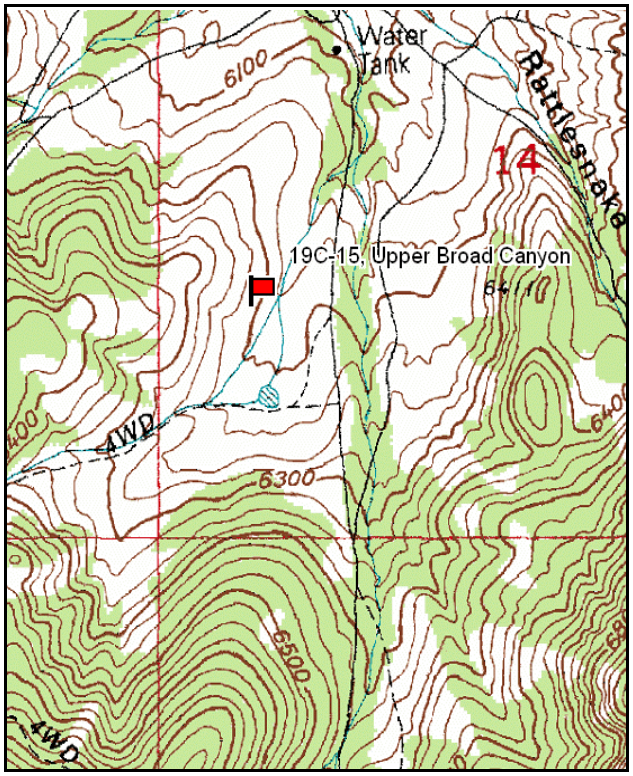
Study site name: Upper Broad Canyon . Vegetation type: Big Sagebrush-Grass .

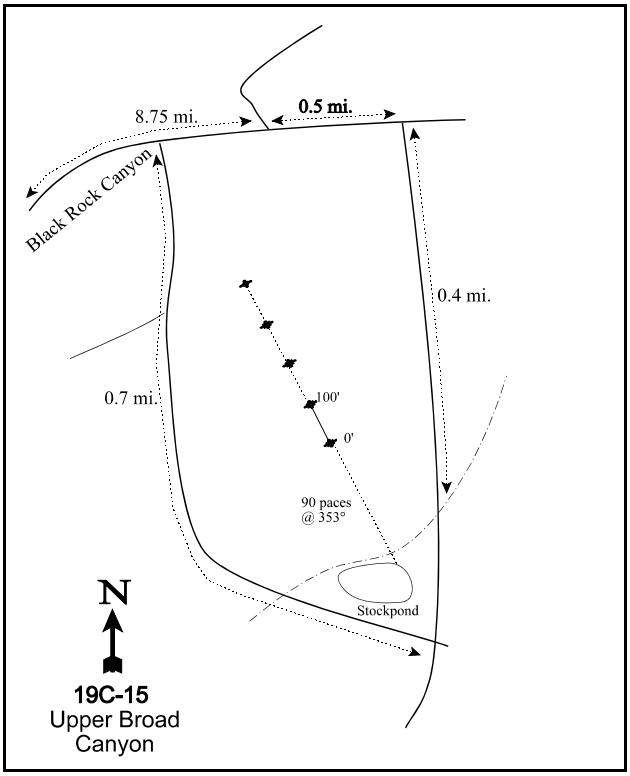
Compass bearing: frequency baseline 319 degrees magnetic.

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

LOCATION DESCRIPTION

From Highway U-36 between Vernon and Tintic Junction, proceed east on the Black Rock Canyon Road for 8.75 miles, to the road junction in Broad Canyon within Utah County. At this point, take the right fork (east) and travel an additional 0.50 miles to another fork. Turn right and travel 0.40 miles to another fork. Turn left and travel approximately 0.10 miles to where there is a stock pond surrounded by a fence on the west side of the road. From the northwest corner of the stock pond, walk 90 paces at 353 degrees magnetic toward a large juniper at the base of the hill. At this point, there will be a green steel fencepost, 15 inches high with a red browse tag, number 3935, attached, which marks the 0-foot end of the frequency baseline.





Map Name: Boulder Peak Diagrammatic Sketch

Township 9S , Range 3W , Section 14 GPS: NAD 83, UTM 12T 401604 E 4431971 N

DISCUSSION

Upper Broad Canyon - Trend Study No. 19C-15

Study Information

This transitional deer range study is located on a sheep allotment that is administered by the Bureau of Land Management [elevation: 6,250 feet (1,905 m), slope: 15%-20%, aspect: southeast]. The range type is mountain big sagebrush-grass and is intermixed with smaller densities of antelope bitterbrush. A wildfire burned through the surrounding area in either 2000 or 2001, leaving the study intact. There are obvious signs of livestock trailing to a stock pond located 600 feet (183 m) to the south. Wildlife pellet groups are frequent, especially deer. Two antler sheds were found within the transect in 1983, and in 2002 four bucks and a couple of does were seen just north of the study. From the pellet group tansect, there were an estimated 22 deer days use/acre (55 ddu/ha) in 2002 and 30 deer days use/acre (74 ddu/ha) in 2007. Sheep use was estimated at 19 days use/acre (48 sdu/ha) in 2002 and 3 days use/acre (8 sdu/ha) in 2007.

Soil

The study lies within the Lodar-Rock outcrop complex. Soils in this series formed in residuum and colluvium from limestone and sandstone. The soils are well or somewhat excessively-drained, moderately permeable soils on ridges, mountains, and hills. Soil depths are 10-20 inches (25-51 cm) (USDA-NRCS 2007). At the study, the soil has a clay loam texture and a neutral reactivity (pH of 7.1). There is an abundance of rocks and pavement, both on and below the soil surface. Relative rock cover has averaged 16%, and pavement cover has averaged 12% since 1997. The erosion condition was classified as stable in 2002 and declined to slight in 2007, due to decreases in surface rock and soil movement, flow patterns, and pedestalling.

Browse

The dominant key browse species are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and, to a lesser extent, antelope bitterbrush (*Purshia tridentata*). Canopy cover of sagebrush was 6% in 2002 and increased to 8% in 2007. The density of sagebrush increased from an estimated 2,232 plants/acre (5,525 plants/ha) in 1983 to 2,432 plants/acre (6,020 plants/ha) in 1989. The density was approximately 2,080 plants/acre (5,149 plants/ha) in 1997 and 2002, and decreased to 1,560 plants/acre (3,861 plants/ha) in 2007. Reproduction and recruitment have been low since 1989. In addition, decadence has been high every sample year, and has ranged from 27% of the population to 47%. Decadent sagebrush were most abundant in 1989, 2002, and 2007. Since 1997, a high percentage of the plants have been classified as dying and the density of dead plants has averaged 873 plants/acre (2,162 plants/ha). The proportion of plants exhibiting poor vigor has varied from 18% to 93%. The mean annual sagebrush leader growth was 1.8 inches (4.6 cm) in 2002 and 1.4 inches (3.5 cm) in 2007. Browse use has been characterized as light, light-moderate, and heavy.

The canopy cover of antelope bitterbrush has been approximately 3% since 2002. The estimated density increased from 299 plants/acre (740 plants/ha) in 1983 to 380 plants/acre (941 plants/ha) in 1997, and decreased to 220 plants/acre (545 plants/ha) by 2007. The bitterbrush population has maintained generally good vigor and low decadence in spite of moderate-heavy browse use every sample year. Individual plants have acquired a prostrate growth form due to many years of elevated browse use. Annual bitterbrush leader growth averaged 2.7 inches (6.9 cm) in 2002 and 2.2 inches (5.7 cm) in 2007.

Singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) are scattered across the study in moderate densities. Juniper trees were not sampled in the canopy cover transect, but pinyon pine canopy cover has been less than 1% since 2002. From point-centered quarter data, there were an estimated 73 pinyon trees/acre (181 trees/ha) in 2002 and 49 trees/acre (121 trees/ha) in 2007. There were an estimated 32 juniper trees/acre (79 trees/ha) in 2002 and 25 trees/acre (62 trees/ha) in 2007. The mean diameter of both species increased considerably in 2007. These data suggest that the tree community is comprised of fewer, larger trees.

Herbaceous Understory

Grasses are the dominant component of the understory and have accounted for 59% to 73% of the vegetative cover since 1997. Perennial grass cover was 20% in 1997, 18% in 2002, and 27% in 2007. The dominant grasses are bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). Even though Sandberg bluegrass has a higher frequency, average bluebunch wheatgrass cover is greater. Less abundant perennials include crested wheatgrass (*Agropyron cristatum*) and bottlebrush squirreltail (*Sitanion hystrix*). Cheatgrass (*Bromus tectorum*) is present, but has accounted for a small proportion of grass cover.

Perennial forb cover has been less than 1% since 1997. The few perennial forbs that are present occur in low frequencies and offer little forage. The most common perennial species are rose pussytoes (*Antennaria rosea*) and desert parsley (*Lomatium* sp.). Annual forbs are dominated by pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*). Annual forb cover was 2% in 1997, 0% in 2002, and 1% in 2007.

1989 TREND ASSESSMENT

The browse trend is slightly down. The density of mountain big sagebrush increased 9%. However, decadence increased from 27% to 44% of the sagebrush population, and the proportion of plants exhibiting poor vigor increased from 25% to 93%. Thus, the small increase in sagebrush density was offset by a decline in population health. Browse use on sagebrush shifted from heavy to light-moderate. Bitterbrush density increased 11%, decadence remained stable, and plants in poor vigor decreased from 11% to 0% of the population. The grass trend is stable. The sum of nested frequency of perennial grasses increased 8%. Two species increased significantly in nested frequency and two species decreased significantly. The forb trend is stable. The sum of nested frequency of perennial forbs increased 11%. Perennial forbs are a very insignificant part of the vegetation component.

browse - slightly down (-1) grass - stable (0) forb - stable (0)

1997 TREND ASSESSMENT

The browse trend is stable. The density of mountain big sagebrush decreased 15%. Some of the changes in sagebrush density are due to the larger area sampled beginning in 1997. Sagebrush recruitment changed little; young plants increased from 5% of the population to 8%. Decadence decreased to 29% of the population, and plants with poor vigor decreased to 34%. Plants that were classified as dying comprised 20% of the population. The density of dead plants increased from 0 plants/acre to 920 plants/acre (2,277 plants/ha), but again, this increase may be the result of the larger area sampled. The bitterbrush density increased 15%, and both decadence and vigor remained constant. The grass trend is stable. The sum of nested frequency of perennial grasses decreased only 1%. There was a significant increase in the nested frequency of bluebunch wheatgrass, and a significant decrease in that of crested wheatgrass. The forb trend is slightly down. Although the sum of nested frequency of perennial forbs decreased 29%, forbs have such a low abundance that the decrease is muted. The Desirable Components Index (DCI) score is fair due to the moderate browse cover, and high perennial grass cover.

winter range condition (DCI) - fair (54) Mid-level potential scale
browse - stable (0) grass - stable (0) forb - slightly down (-1)

2002 TREND ASSESSMENT

The browse trend is stable. The density of mountain big sagebrush remained stable even though there was no improvement in reproduction. Decadence increased to 47% of the population, and 17% of the population was classified as dying. However, plants with poor vigor decreased to 18%, and browse use shifted from light-moderate to light. Bitterbrush density also remained stable, but decadence increased from 11% to 22% of the population. Browse use on bitterbrush shifted from heavy to moderate-heavy. The grass trend is slightly up. The sum of nested frequency of perennial grasses decreased only 1%, but there was a significant decrease in the nested frequency of cheatgrass. Cheatgrass quadrat frequency decreased from 76% to 10%. Grazing use

on grasses was minimal. The forb trend is stable. Even though the sum of nested frequency of perennial forbs decreased again by 29%, perennial forb abundance was already low. However, there was a significant decrease in the nested frequency of bur buttercup. This allelopathic annual may inhibit germination and growth of other herbaceous species (Buchanan et al. 1978). The DCI score declined to poor due to the increase in browse decadence and decrease in young, preferred browse plants.

winter range condition (DCI) - poor (46) Mid-level potential scale
browse - stable (0) grass - slightly up (+1) forb - stable (0)

2007 TREND ASSESSMENT

The browse trend is down. The density of mountain big sagebrush decreased 26%. Sagebrush decadence remained stable at 47%, but dying plants increased to 33% of the population. Plants exhibiting poor vigor increased from 18% to 45% of the population, and many of the plants were chlorotic. Browse use on sagebrush shifted from light to light-moderate. Bitterbrush density decreased 39%, though none of the plants were decadent or had poor vigor. The grass trend is stable. The sum of nested frequency of perennial grasses did not change, although average cover increased from 18% to 27%. Cheatgrass increased significantly in nested frequency, but did not return to the frequency or cover values measured in 1997. The forb trend is stable. The nested frequency of perennial forbs increased two-fold, but perennial forbs are still an insignificant vegetative component. Bur buttercup significantly increased in nested frequency. The DCI score remained poor.

winter range condition (DCI) - poor (46) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 19C, Study no: 15

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	a12	b83	a40	a16	a14	.79	1.12	.68
G	Agropyron spicatum	ab189	a147	b202	b204	ab195	14.03	12.96	15.57
G	Bromus carinatus	-	-	-	-	3	-	-	.15
G	Bromus tectorum (a)	-	-	c212	a17	b94	1.23	.05	.47
G	Oryzopsis hymenoides	b30	a10	a1	-	a2	.00	-	.30
G	Poa fendleriana	-	-	4	-	-	.01	-	-
G	Poa secunda	a212	b259	b261	b282	b287	5.13	4.10	10.05
G	Sitanion hystrix	b34	a17	a3	a3	a3	.03	.00	.03
Total for Annual Grasses		0	0	212	17	94	1.23	0.05	0.47
Total for Perennial Grasses		477	516	511	505	504	19.99	18.20	26.79
Total for Grasses		477	516	723	522	598	21.23	18.25	27.26
F	Agoseris glauca	-	-	a2	a1	a3	.00	.00	.00
F	Alyssum alyssoides (a)	-	-	b328	a11	c234	1.34	.02	.78
F	Antennaria rosea	a13	a33	a19	a29	a18	.12	.31	.15
F	Arabis sp.	a4	a3	a5	-	-	.01	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Calochortus nuttallii	$_{a}$11	$_{a}$7	-	-	$_{a}$12	-	-	.03
F	Chaenactis douglasii	$_{a}$12	$_{a}$6	-	-	-	-	-	-
F	Cirsium sp.	-	-	1	-	-	.00	-	-
F	Collinsia parviflora (a)	-	-	$_{a}$16	-	$_{a}$25	.03	-	.06
F	Delphinium nuttallianum	4	-	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	-	10	-	-	.05
F	Draba sp. (a)	-	-	-	-	11	-	-	.05
F	Epilobium brachycarpum (a)	-	-	14	-	-	.03	-	-
F	Holosteum umbellatum (a)	-	-	-	$_{a}$1	$_{a}$5	-	.00	.01
F	Lomatium sp.	-	-	$_{a}$12	-	$_{b}$30	.03	-	.21
F	Microsteris gracilis (a)	-	-	$_{b}$59	-	$_{a}$8	.12	-	.01
F	Phlox longifolia	-	-	-	1	-	-	.00	-
F	Ranunculus testiculatus (a)	-	-	$_{b}$135	$_{a}$12	$_{b}$114	.70	.02	.31
F	Tragopogon dubius	$_{a}$6	$_{a}$1	-	-	-	-	-	-
F	Unknown forb-perennial	4	-	-	-	-	-	-	-
F	Zigadenus paniculatus	$_{a}$3	$_{a}$13	$_{a}$6	$_{a}$1	$_{a}$2	.01	.03	.01
Total for Annual Forbs		0	0	552	24	407	2.24	0.05	1.29
Total for Perennial Forbs		57	63	45	32	65	0.18	0.35	0.40
Total for Forbs		57	63	597	56	472	2.42	0.40	1.70

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

BROWSE TRENDS --
Management unit 19C, Study no: 15

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier utahensis	2	2	2	-	-	-
B	Artemisia tridentata vaseyana	69	68	59	8.61	7.26	5.50
B	Eriogonum microthecum	1	1	1	-	-	-
B	Gutierrezia sarothrae	86	57	43	1.20	.68	.78
B	Juniperus osteosperma	0	1	1	.00	-	-
B	Pinus monophylla	0	0	0	.85	.00	.03
B	Purshia tridentata	12	11	9	1.91	1.92	2.01
Total for Browse		170	140	115	12.58	9.88	8.34

CANOPY COVER, LINE INTERCEPT --
Management unit 19C, Study no: 15

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	6.18	7.93
Eriogonum microthecum	-	.08
Gutierrezia sarothrae	.83	.91
Pinus monophylla	.83	.90
Purshia tridentata	2.54	2.46

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 19C, Study no: 15

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.8	1.4
Purshia tridentata	2.7	2.2

POINT-QUARTER TREE DATA --
Management unit 19C, Study no: 15

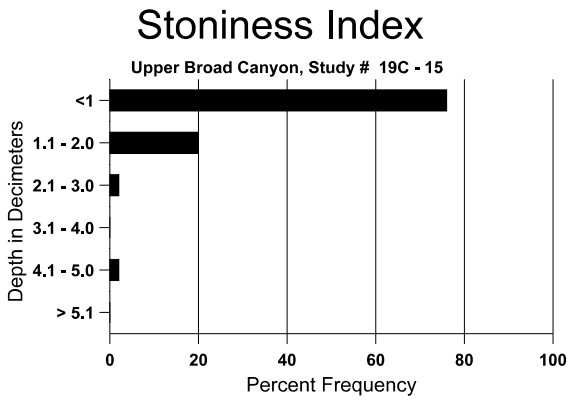
Species	Trees per Acre		Average diameter (in)	
	'02	'07	'02	'07
Juniperus osteosperma	32	25	1.8	5.1
Pinus monophylla	73	49	1.8	3.4

BASIC COVER --
Management unit 19C, Study no: 15

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	0	5.25	34.31	27.71	35.45
Rock	11.75	17.25	19.31	19.66	17.38
Pavement	28.00	24.75	12.09	13.53	13.80
Litter	49.50	38.50	28.56	28.13	21.09
Cryptogams	.50	2.50	3.05	4.07	4.90
Bare Ground	10.25	11.75	14.59	16.81	16.55

SOIL ANALYSIS DATA --
Herd Unit 19C, Study no: 15, Upper Broad Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
9.6	64.2 (11.3)	7.1	42.4	29.1	28.6	3.0	7.1	166.4	.6



PELLET GROUP DATA --
Management unit 19C, Study no: 15

Type	Quadrat Frequency		
	'97	'02	'07
Sheep	12	3	-
Rabbit	7	3	9
Elk	-	3	-
Deer	17	15	7
Cattle	-	3	-

Days use per acre (ha)	
'02	'07
19 (48)	-
-	-
-	3 (8)
22 (55)	30 (74)
-	-

BROWSE CHARACTERISTICS --
Management unit 19C, Study no: 15

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**40**	-	-	40	-	-	50	0	-	-	0	12/12
02	**40**	-	-	40	-	-	100	0	-	-	0	11/16
07	**40**	-	-	40	-	-	50	0	-	-	0	22/23
Artemisia tridentata vaseyana												
83	**2232**	-	266	1366	600	-	10	69	27	-	25	24/23
89	**2432**	100	133	1233	1066	-	38	26	44	-	93	16/23
97	**2060**	20	160	1300	600	920	42	9	29	20	34	22/35
02	**2100**	-	60	1060	980	900	17	0	47	17	18	21/34
07	**1560**	-	40	780	740	800	35	24	47	33	45	22/39

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Eriogonum microthecum												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**20**	-	-	20	-	-	0	0	0	-	0	5/8
02	**20**	-	-	20	-	-	0	0	0	-	0	4/5
07	**20**	-	-	-	20	-	0	0	100	100	100	7/9
Gutierrezia sarothrae												
83	**5166**	2066	1233	3933	-	-	0	0	0	-	0	8/8
89	**7999**	800	2200	5566	233	-	0	0	3	-	0	8/12
97	**6760**	20	1340	5380	40	-	0	0	1	-	0	7/7
02	**2500**	-	40	1860	600	2520	.80	0	24	9	10	5/8
07	**1360**	40	60	1300	-	60	0	0	0	-	0	7/10
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	0	0	-	-	0	-/-
Pinus monophylla												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	80	-	-	-	-	0	0	-	-	0	-/-
07	**0**	40	-	-	-	-	0	0	-	-	0	-/-
Purshia tridentata												
83	**299**	-	-	266	33	-	0	100	11	-	11	11/29
89	**332**	-	133	166	33	-	20	60	10	-	0	10/18
97	**380**	-	20	320	40	40	16	68	11	-	0	18/34
02	**360**	-	-	280	80	20	28	39	22	11	11	20/46
07	**220**	-	-	220	-	-	36	45	0	-	0	24/56
Ribes sp.												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	14/33
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Symphoricarpos oreophilus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	14/65
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

SUMMARY

WILDLIFE MANAGEMENT SUBUNIT 19B - WEST DESERT, VERNON

Eight of the trend studies in this management unit were established in 1983 and re-sampled in 1989, 1997, 2002, and 2007. One study, South of Pine Canyon (19B-8) was not re-sampled in 1997 because of a wildfire.

Community Types

The studies in this unit primarily monitor sagebrush, mountain brush, and salt desert shrub/grass communities. Specifically, two monitor Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) communities, two monitor mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) communities, and five monitor mountain brush communities.

Precipitation

Both annual and seasonal precipitation play important roles in vegetation trends. The only weather station located within the boundaries of unit 19B is in Vernon. Data from this weather station were summarized for precipitation patterns over the past two decades. The average annual precipitation during that time was 10.7 inches (27.2 cm). Precipitation data were not complete in 1990, 2002, 2005, 2006. Drought conditions (less than 75% of annual precipitation) occurred in 1988 and 1989. Precipitation was below normal in 1992, 1999, 2000, 2001, and 2003 (Figure 1).

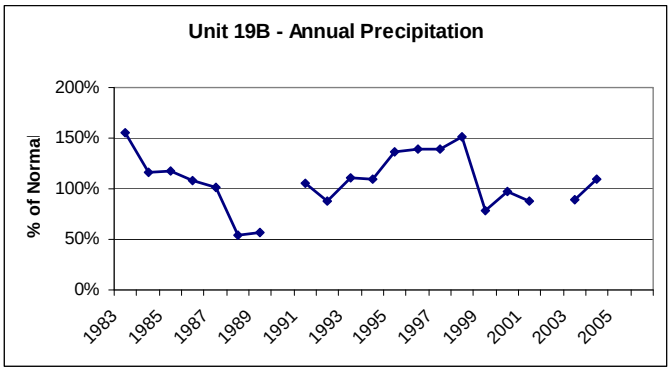


Figure 1. Annual precipitation for subunit 19B. Precipitation data was collected at a weather station in Vernon, Utah (Utah Climate Summaries 2007).

Spring and fall precipitation may be as critical as total precipitation for cool and warm season plant germination and growth. Precipitation data was partitioned into the amount that accumulated in the spring and fall. Spring precipitation was below 75% of normal in 1988, 1989, and 1992 (Figure 2). Spring precipitation was below normal in 1983, 1997, 2000, 2001, and 2003. Fall precipitation was below 75% of normal in 1988, 1989, 1995, 1999, and 2003. Fall precipitation was below normal in 1986, 1987, 1993, and 2001.

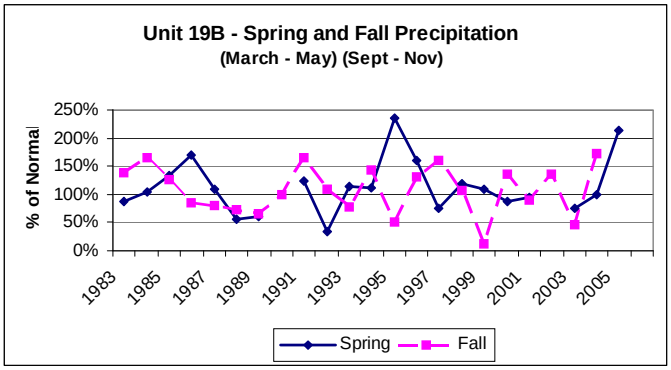


Figure 2. Spring and fall precipitation for subunit 19B. Precipitation data was collected at a weather station in Vernon, Utah (Utah Climate Summaries 2007).

Browse

The cumulative browse trend slightly decreased since 2002 (Figure 3). The browse trend was down at five studies: Sabie Mountain (19B-1), Harker Canyon (19B-4), West Government Creek (19B-5), Lee's Creek (19B-6), and Upper Broad Creek (19C-15). The browse trend was stable at two studies:Upper Little Valley (19B-2) and Judd Creek (19B-7). The browse trend was slightly up at Bennion Creek (19B-3), and was up at South Pine Canyon (19B-8). By community types, the browse trend was up at one of the mountain brush studies,

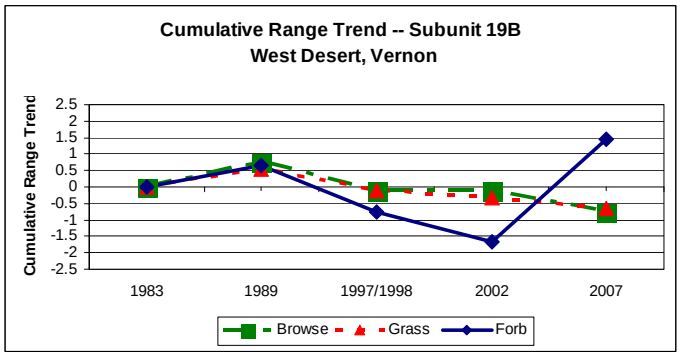


Figure 3. The cumulative range trend for the browse, grass, and forb components from 1983 to 2007 in subunit 19B.

slightly up at another, stable at two studies, and down at one study. The browse trend was down at both of the mountain big sagebrush studies, as well as both of the Wyoming big sagebrush studies.

The subunit average density of Wyoming big sagebrush decreased from 2,227 plants/acre (5,512 plants/ha) in 2002 to 1,593 plants/acre (3,943 plants/ha) in 2007, which is similar to the average density that was sampled in 1997 (Figure 4). The average density of mountain big sagebrush populations increased from 1,453 plants/acre (3,713 plants/ha) to 2,947 plants/acre (7,294 plants/ha). The largest increase in density was measured at South Pine Canyon. Black sagebrush (*Artemisia nova*) was only present at one study, Bennion Creek, and the density remained stable.

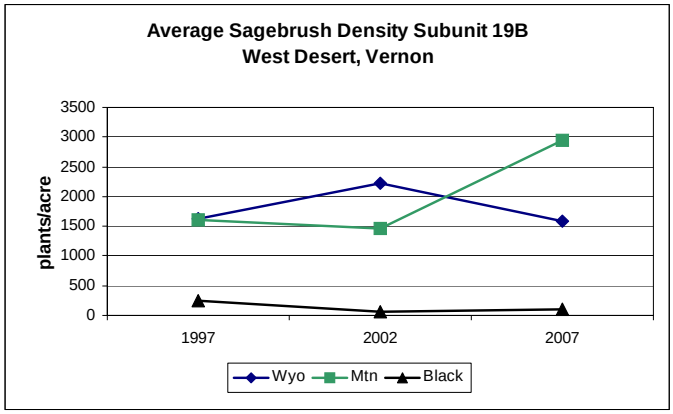


Figure 4.. Average density among Wyoming big sagebrush, mountain big sagebrush, and black sagebrush populations in subunit 19B.

The subunit average percent decadence of Wyoming big sagebrush decreased from 33% of the population in 2002 to 27% in 2007, but was still higher than the 1997 estimate of 13% (Figure 5). The subunit decrease in decadence was largely attributed to a decrease at Judd Creek, a mountain brush site. Decadence increased at the two remaining Wyoming big sagebrush studies. The average decadence of mountain big sagebrush decreased from increased from 17% of the population in 1997 to 24% in 2002, then decreased to 18% in 2007. Decadence levels of black sagebrush remained stable at the one study where it was sampled.

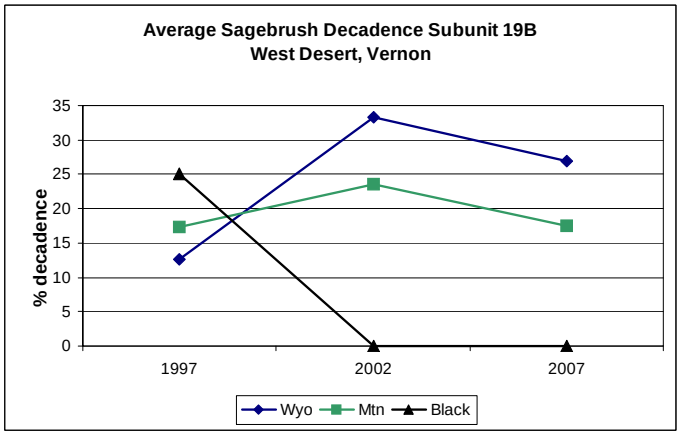


Figure 5. Average percent decadence among Wyoming big sagebrush, mountain big sagebrush, and black sagebrush populations in subunit 19B.

The subunit average percent cover of Wyoming big sagebrush, mountain big sagebrush, and black sagebrush remained stable (Figure 6). The largest change in cover occurred at South Pine Canyon; mountain big sagebrush cover increased from less than 1% to 12%.

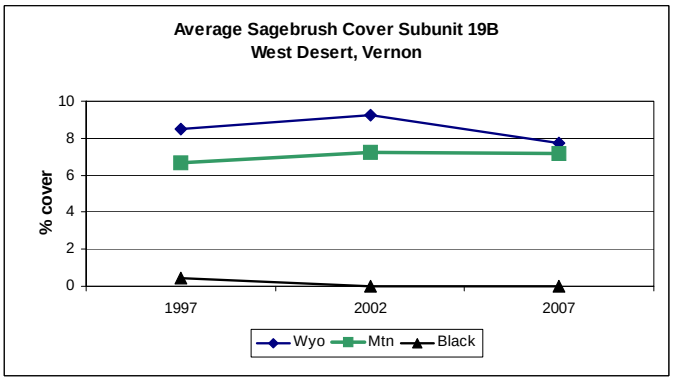


Figure 6. Average percent cover of Wyoming big sagebrush, mountain big sagebrush, and black sagebrush in subunit 19B.

<u>Grass</u>

Since 2002, the subunit grass trend decreased slightly (Figure 3). The grass trend was down at four studies: Upper Little Valley, Bennion Creek, Harker Canyon, and South Pine Canyon. The grass trend was stable at four studies: Sabie Mountain, West Government Creek, Lee's Creek, and Upper Broad Canyon. The grass trend was up at Judd Creek..

The subunit average sum of nested frequency of perennial grasses decreased slightly in 2007 (Figure 7). The average percent cover occupied by perennial grasses slightly increased in 2007 (Figure 8). Cheatgrass nested frequency and cover decreased from 1997 to 2002, then increased in 2007. It was most abundant at Upper Little Valley and South Pine Canyon. Cheatgrass was sampled for the first time at Sabie Mountain in 2007.

Bulbous bluegrass was measured for the first time at two studies in 2007, Bennion Creek and Judd Creek, but nested frequency and percent cover were low.

Forb

The subunit average forb trend increased substantially since 2002 (Figure 3). The forb trend was slightly down at Lee's Creek and was stable at Upper Broad Canyon. The forb trend was up at the remaining seven studies: Sabie Mountain, Upper Little Valley, Bennion Creek, Harker Valley, West Government Creek, Judd Creek, and South Pine Canyon. All but one of these studies, Judd Creek, are located in the Sheeprock Mountains.

The subunit average sum of nested frequency of perennial forbs increased more than three-fold in 2007, but was still less than 1997 (Figure 7). The average percent cover of perennial forbs increased from 2% to 5% in 2007, but was still below the 1997 percent cover (Figure 8). The decrease in forb cover and nested frequency in 2002 was attributed to a region-wide drought (Utah Climate Summaries 2007). Houndstongue, a noxious weed, was sampled at Bennion Creek in 2002.

Desirable Components Index

The winter range Desirable Components Index (DCI) was calculated for six of the nine studies in subunit 19B. Three of these studies are in the low potential category and three are in the mid-level potential category. The three studies not calculated were excluded because they are classified as summer range. The average DCI score of the mid-level potential studies decreased from fair in 1997 to very poor-poor in 2002, then increased to poor in 2007 (Figure 9). The changes have resulted largely from fluctuations in browse cover and decadence, and perennial grass cover. At the low potential studies, the average DCI score has consistently been good.

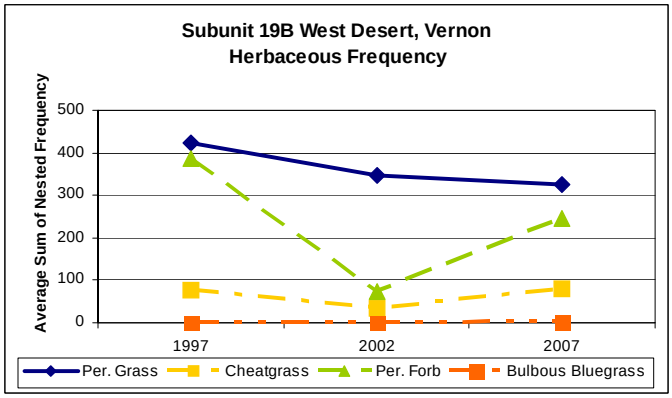


Figure 7. Average sum of nested frequency for the herbaceous understory in subunit 19B.

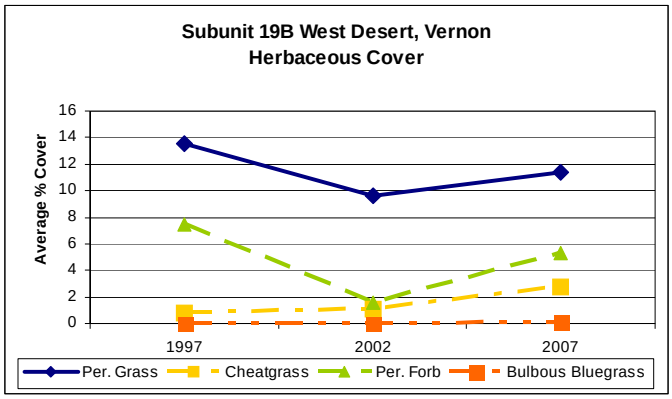


Figure 8. Average percent cover for the herbaceous understory in subunit 19B.

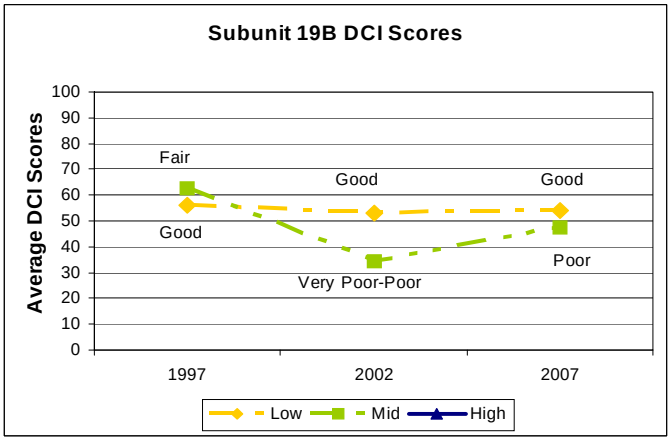
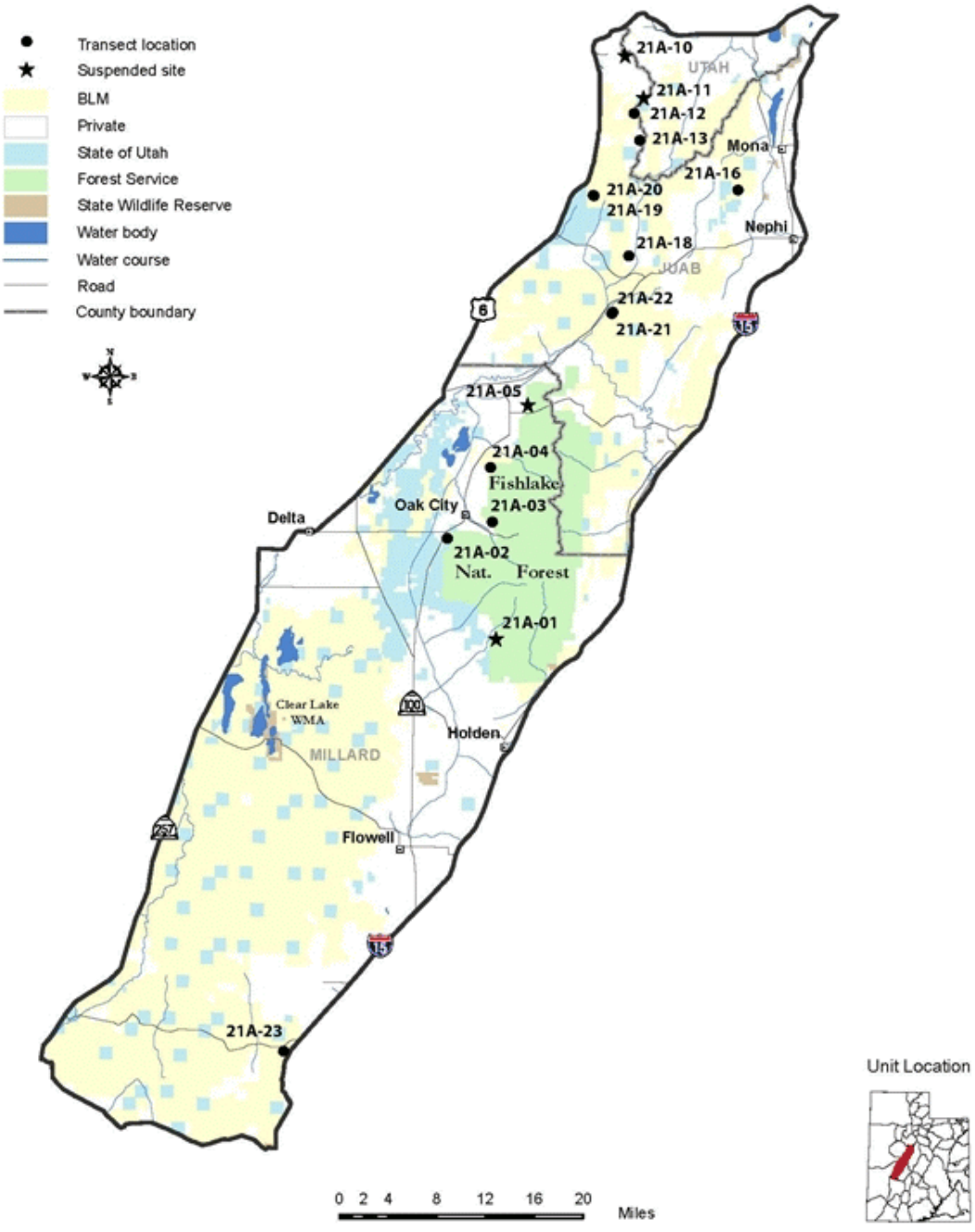


Figure 9. Average DCI score for subunit 19B. The scores are divided into categories based on ecological potential and include: high, mid-level, and low.

Management Unit 21A



MANAGEMENT SUBUNIT 21A - OAK CREEK

Management Unit Description

The Fillmore unit includes the area encompassed by the Oak Creek (21A) and Pahvant (21B) subunits. Total usable mule deer range is estimated at about 1,126,800 acres (456,016 ha). Year-long deer range only makes up 1% of the area. Summer deer ranges are usually confined to elevations above 7,000 feet (2,134 m) and are limiting, as they only make up 30% of the range. The majority (69%) of mule deer range within the Fillmore unit is classified as winter range. Total useable elk range is estimated at 505,047 acres (204,393 ha). Year-long, summer, and winter elk ranges represent 22%, 38%, and 40% of the total elk range, respectively. The majority of deer and elk ranges lie on public lands administered by the BLM and U.S. Forest Service. The Fillmore unit includes the Canyon Mountains northeast of Scipio, the Valley Mountains east of Scipio, and the Pahvant Range east of Fillmore. Elevation is highly variable from approximately 5,000 feet (1,524 m) near Fillmore, 10,129 feet (3,087 m) on Pioneer Peak, 9,711 feet (2,960 m) at Fool Creek Peak in the Canyon Mountains, and 8,240 feet (2,512 m) in the Valley Mountains. The Valley Mountains are relatively dry and have no continuous flowing drainages. The Canyon Mountains drain mostly to the west by way of Oak Creek and Fools Creek, and to the east down Little Oak Creek. The major Pahvant drainages are Chalk Creek, Pioneer Creek, Maple Hollow, and Wild Goose Creek on the west side, and Maple Creek on the east side.

The major vegetation types that make up the summer range are mountain brush, conifer, aspen, and dry meadow. A history of severe overgrazing of these steep mountain ranges has resulted in poor ground cover and related soil disturbances. These issues caused problems of periodic flash flooding and soil erosion, which necessitated a great deal of costly watershed and soil stabilization work by the U.S. Forest Service. Contour trenching, seeding, grazing reductions, and other management practices have largely eliminated the flash flooding problems. However, the land is still in the recovery process. Meanwhile, production rates of desirable forage, especially forbs, remains relatively low.

A number of events have resulted in changes in the character of the winter range, especially for the Valley Mountains. In 1981, two large wildfires burned approximately 60,000 acres (24,282 m) of mostly pinyon-juniper areas of the winter range, resulting in a significant reduction of important escape and thermal cover. Portions of these burns have been seeded, resulting in increased production of forbs and grasses in some areas. However, browse species in some of the burned areas remain limited. In addition to these burns, approximately 6% of the winter range was chained and seeded. Also, a deer-proof fence built along I-15 has severely limited the movement of deer between the Oak Creek and Pahvant subunits, which was common before the construction. The three underpasses built near Scipio Pass are receiving little use and apparently deer have yet to learn to use these structures. The unit is also receiving an increase in recreational use, especially in the Oak Creek area.

Poor quality of both summer and winter ranges and depredation on private lands are the major problems within the Oak Creek subunit. Additional revegetation projects are needed on the winter ranges. Emphasis should be placed on seeding and/or planting nursery stock of browse species for winter use and forbs for spring forage. Reductions in livestock grazing in the oakbrush, and cutting or burning mature stands to encourage resprouting could improve fawning and summer habitat. The driest portions of the summer range could also be improved by developing water sources and fencing existing water sources to protect them from livestock. These range improvements should also lessen depredation problems by providing alternate food sources to deer which feed in the orchards and fields near Oak Creek.

The Pahvant subunit is divided in half by I-15. The eastern half includes the southern two-thirds of the Pahvant Mountain range, which provides virtually all of the unit's deer summer range and most of the winter range. The western half is in the Black Rock Desert and contains only 40,000 acres (16,188 ha) of deer winter range. Deer habitat spans a range in elevation from above 10,000 feet (3,048 m) on the summer range of the Pahvant Mountains down to 5,000 feet (1,524 m) on the winter range in the Black Rock desert. The

topography is steep and rugged at elevations of 6,000-8,000 feet (1,829-2,438 m), but more gentle with rolling slopes, hills, and flats above and below these contours. Meadow and Corn Creeks on the west side and Clear Creek along the southern boundary are the most important drainages. Other springs and intermittent streams are common throughout the summer range.

The majority of the deer range is on public land under BLM and U.S. Forest Service management. Recreation, wood-cutting, geothermal, gas, oil and mineral exploration, and livestock grazing are the most important land uses. Cattle and sheep are grazed under rest-rotation and deferred-use programs. Stocking rates have been reduced in most allotments due to problems in the past with overgrazing, but it is still an issue in some local areas. Concentrations of deer on the winter range have also over-utilized key browse species in several areas where these species had already been browsed by livestock due to poor range conditions.

With these localized exceptions, both the summer and winter range are generally in good condition. Pinyon-juniper covers approximately 67% of the normal winter range. Dense pinyon-juniper stands at elevations of 5,000-6,000 feet (1,524-1,829 m) have sparse understories and relatively low forage production rates. The browse-shrub type, which is generally found above the pinyon-juniper zone and above the upper limits of severe winter range, usually has the highest rates of forage production. The treated sagebrush and seeded types are most abundant in the lower portions of the severe wintering areas. These are critically important to deer during severe winters. While forage production is still good in most areas, a growing percentage of increasers and undesirable plants, especially cheatgrass, indicates overuse in many places and creates high fire hazards. Wildfires burned the Dog Valley (21B-11) and Smiths Ridge (21B-8) studies in 1996 and 2000, respectively, which was partly due to dense cheatgrass.

Herd Unit Management Objectives

Current management objectives for deer are to achieve a target population of 12,500 wintering animals (Hersey and Auode 2007). The winter population estimate was 8,200 deer in 2002, 7,400 deer in 2003, 9,700 deer in 2004, and approximately 8,000 deer in 2005 and 2006. The postseason buck:doe ratio objectives are 25-35:100 for the Oak Creek subunit and 15-20:100 for the Pahvant subunit. Thirty percent of these bucks are to be 3 point or better. The 3-year average (2004-2006) postseason buck:doe ratio was 24:100 for Oak Creek and 13:100 for Pahvant. The 3-year average fawn:doe ratio was 60:100 for Oak Creek and 54:100 for Pahvant.

The target winter herd size for elk is 1,425 animals (Hersey and Auode 2007). The winter population estimate was 1,400 elk in 2002 and 2003, 1,250 elk in 2004, 1,150 elk in 2005, and 1,350 elk in 2006. As of 2001, the postseason bull:cow ratio objective was 20:100 (DeBloois 2001). Half of the bulls are to be 2.5 years of age or older. The average total bull harvest from 1999 to 2006 was 30 animals (range 8-70) for Oak Creek and 34 animals (range 21-63) for Pahvant. The average antlerless harvest for the same years was 18 animals (range 3-36) for Oak Creek and 69 animals (range 31-127) for Pahvant. The total harvest for the unit in 2006 was 118 bulls and 70 antlerless.

Subunit Boundary Description

Utah, Juab, and Millard Counties - Boundary begins at the junction of I-15 and US-6 in Santaquin, south on I-15 to US-50, northwest on US-50 to US-6, northeast on US-6 to I-15 and beginning point.

Range Trend Studies

The boundary for subunit 21A was altered between 2002 and 2007 to include 15 studies previously in subunit 19B and unit 21. Five studies have been suspended since 1989. In 2007, 10 were sampled, including four special studies established to monitor differences in fire rehabilitation techniques.

Trend Study 21A-3-07

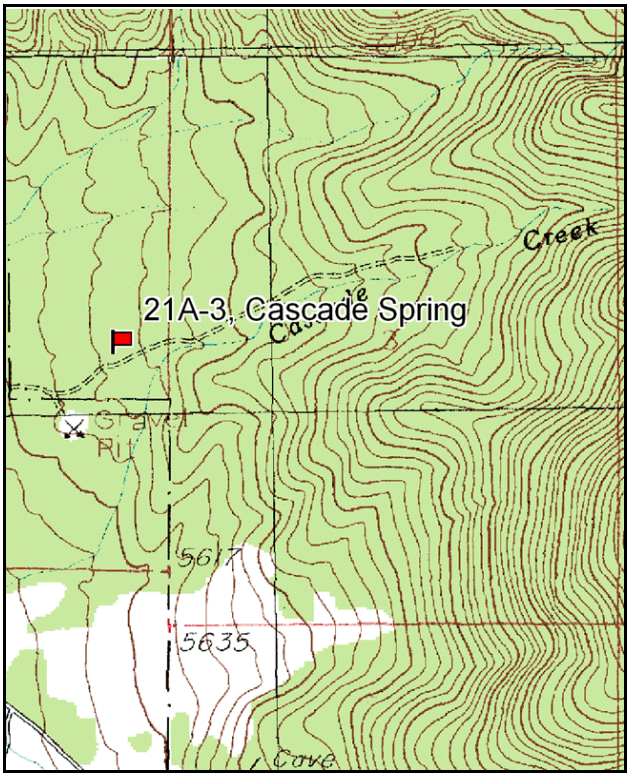
Study site name: Cascade Spring . Vegetation type: Burn-perennial grass .

Compass bearing: frequency baseline 180 degrees magnetic.

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

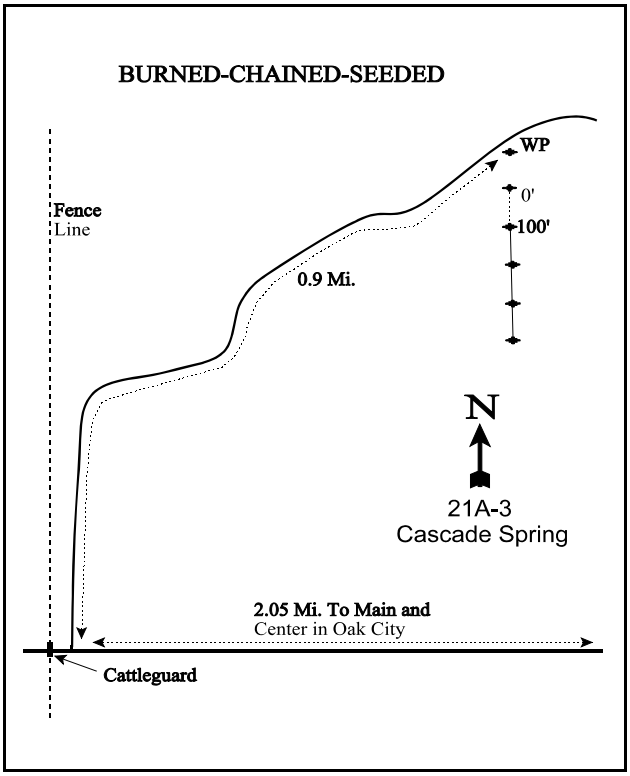
LOCATION DESCRIPTION

From Main Street and Center in Oak City, go east on Center 0.35 miles around an "S" bend to an intersection. Stay left and continue 1.7 miles to a cattleguard. Just beyond the cattleguard, turn left up the road to Cascade Spring. Follow this road around several bends for 0.9 miles to a 5/8" rebar 10 feet off the right side of the road. The baseline starts 55 feet true south of this witness post. The 0-foot baseline stake is tagged #7114. The 100-foot end of the baseline is marked by a rebar that is actually only 99 feet south of the 0-foot baseline stake.



Map Name: Oak City South

Township 17S , Range 4W , Section 4



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 388500 E 4358370 N

DISCUSSION

Cascade Spring - Trend Study No. 21A-3

Study Information

This study is located near the Cascade Spring pellet group transect, 2 miles (3.2 km) east of Oak City [elevation: 5,700 feet (1,737 m), slope: 13%, aspect: west]. It was burned by wildfire in 1981, and the lower slopes were seeded and chained the following year. The vegetative composition has been dominated by annuals and seeded grasses since the treatment. The U.S. Forest Service considered the project successful in establishing range suitable for cattle grazing, however, the area has limited value for wintering deer due to the lack of browse and thermal cover. The study burned again in 2006 in a wildfire. Pellet group transect data were estimated at 12 deer days use/acre (30 ddu/ha) in 1998, 3 deer days use/acre (8 ddu/ha) in 2003, and 15 deer days use/acre (38 ddu/ha) in 2007. A deer was observed during the 2007 sampling. A few elk pellets were also sampled in 2003. Cattle use was estimated at 62 days use/acre (153 cdu/ha) in 1998, 13 days use/acre (32 cdu/ha) in 2003, and 38 days use/acre (95 cdu/ha) in 2007. It was noted that the cattle pats sampled in 2007 were from the previous summer.

Soil

The nearest identified soil series is the Kapod-Collard complex, which lies approximately 300 feet (91 m) from the study (USDA-NRCS 2007). The soils in the Kapod series are very deep and well-drained, and formed in alluvium derived dominantly from sandstone and limestone. The soils in the Collard series are very deep and somewhat excessively drained. They formed in alluvium derived dominantly from quartzite, sandstone, and quartzite conglomerate. The soil on the study is very rocky on the surface and throughout the profile. The texture is a loam and the pH is neutral (6.8). Relative vegetation cover has increased from 32% in 1998 to 49% in 2007, while relative litter cover has decreased from 37% in 1998 to 29% in 2007. A large gully, which is currently covered with vegetation, is evidence that erosion was a concern on the study previous to establishment. The soil erosion condition was classified as stable in 2003 and 2007.

Browse

No browse was sampled when the study was established in 1985. The only browse species that have been sampled are broom snakeweed (*Gutierrezia sarothrae*) and very low densities of echinocereus (*Echinocereus* sp.) and pricklypear (*Opuntia* sp.). The snakeweed density increased from 200 plants/acre (494 plants/ha) in 1991 to 740 plants/acre (1,829 plants/ha) in 1998, decreased to 280 plants/acre (692 plants/ha) in 2003, then increased to 1,860 plants/acre (4,596 plants/ha) by 2007. The plants have been mostly mature, except in 2007 when approximately half of the sampled plants were young. According to the 1981 Forest Service revegetation report, bitterbrush (*Purshia tridentata*) and fourwing saltbush (*Atriplex canescens*) were included in the seed mix, but there are still no preferred browse species present.

Herbaceous Understory

Grasses have comprised over 90% of the total vegetative cover since 1998. Identification of grass species was difficult in 1998 due to intense livestock grazing. Intermediate wheatgrass (*Agropyron intermedium*) is the dominant seeded grass and has maintained a stable cover of 12% between 1998 and 2007. Other perennial species, such as Sandberg bluegrass (*Poa secunda*) and crested wheatgrass (*Agropyron cristatum*) are relatively abundant. Bulbous bluegrass (*Poa bulbosa*) has increased significantly in nested frequency every year since 1991, and increased from 4% cover in 1998 to 13% in 2007. Cheatgrass (*Bromus tectorum*) has also increased substantially. It provided 15% of the total grass cover in 2003, and 45% in 2007. Cheatgrass cover increased from 5% in 2003 to 24% in 2007, and it was the dominant grass in 2007.

Forbs are sparse, and diversity is poor. Alfalfa (*Medicago sativa*) was seeded, and was the most abundant forb in 1985. However, most of the sampled plants were small and almost entirely eaten by insects. The nested frequency of alfalfa declined significantly in subsequent years, and only a few plants were sampled in 1991

and 2007. Forbs provided less than 1% cover in 1998 and 2003. Total forb cover increased to 4% in 2007, however, this increase was mostly attributed to a significant increase in storksbill (*Erodium cicutarium*) cover. Storksbill has been shown to outcompete and prevent the establishment of native species (Kimball and Schiffman 2003), and it largely dominated the forb component in 2003 and 2007. Additionally, field bindweed (*Convolvulus arvensis*), a noxious weed, was sampled in 2003 and 2007.

1991 TREND ASSESSMENT

The trend for browse is stable, due to the continuing lack of browse. The trend for grass is up. The sum of nested frequency for perennial grasses increased almost 30%. Intermediate wheatgrass and Sandberg bluegrass increased significantly in nested frequency. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased almost 80%, and alfalfa decreased significantly in nested frequency.

browse - stable (0) grass - up (+2) forb - down (-2)

1998 TREND ASSESSMENT

The trend for browse is stable. No key browse species were sampled. The trend for grass is up. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, increased 62%. Intermediate wheatgrass continued to increase significantly in nested frequency. However, bulbous bluegrass also increased significantly in nested frequency. The trend for forbs is stable. The sum of nested frequency for perennial forbs remained very low. The number of forb species sampled decreased from five to one. The Desirable Components Index (DCI) was rated as poor-fair due to the lack of browse and perennial forb cover, but perennial grass cover was high.

winter range condition (DCI) - poor-fair (26) Low potential scale
browse - stable (0) grass - up (+2) forb - stable (0)

2003 TREND ASSESSMENT

The trend for browse is stable, due to the lack of key browse. The trend for grass is stable. The sum of nested frequency for perennial grasses, with the exception of bulbous bluegrass, changed very little. Sandberg bluegrass increased significantly in nested frequency, while crested wheatgrass decreased significantly in nested frequency. However, bulbous bluegrass nested frequency also significantly increased, and its average cover increased from 4% to 9%. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs remained low. Bindweed was also sampled, but at a very low frequency. The DCI rating remained poor-fair.

winter range condition (DCI) - poor-fair (24) Low potential scale
browse - stable (0) grass - stable (0) forb - slightly down (-1)

2007 TREND ASSESSMENT

The trend for browse continued to be stable with the lack of key browse. The trend for grass is down. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, decreased 17%. Sandberg bluegrass decreased significantly in nested frequency, while bulbous bluegrass and cheatgrass increased significantly in nested frequency. The average cover of bulbous bluegrass continued to increase from 9% to 13%, and cheatgrass cover increased from 5% to 24%. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs, excluding bindweed, increased substantially, and the number of perennial species sampled doubled from two to four. Bindweed was sampled again, but did not change in nested frequency. However, storksbill increased substantially in nested frequency. The DCI rating decreased to very poor-poor due to the increase in annual grass cover.

winter range condition (DCI) - very poor-poor (11) Low potential scale
browse - stable (0) grass - down (-2) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 3

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'98	'03	'07	'98	'03	'07
G	Agropyron cristatum	$_{b}$111	$_{b}$76	$_{b}$88	$_{a}$36	$_{a}$31	4.55	1.60	1.09
G	Agropyron intermedium	$_{a}$33	$_{b}$73	$_{c}$202	$_{c}$205	$_{c}$218	11.82	11.61	12.27
G	Agropyron spicatum	$_{a}$1	$_{a}$4	-	$_{a}$6	$_{a}$9	-	.78	1.17
G	Bromus inermis	$_{b}$34	$_{ab}$32	$_{ab}$26	-	$_{a}$8	.73	-	.24
G	Bromus tectorum (a)	-	-	$_{a}$191	$_{a}$184	$_{b}$334	5.32	5.44	24.35
G	Poa bulbosa	-	$_{a}$8	$_{b}$77	$_{c}$119	$_{d}$177	4.05	9.20	13.41
G	Poa secunda	$_{a}$31	$_{b}$86	$_{b}$122	$_{c}$182	$_{b}$91	4.02	7.24	2.11
G	Vulpia octoflora (a)	-	-	$_{a}$1	-	$_{a}$6	.00	-	.01
Total for Annual Grasses		0	0	192	184	340	5.32	5.44	24.36
Total for Perennial Grasses		210	279	515	548	534	25.18	30.45	30.31
Total for Grasses		210	279	707	732	874	30.51	35.89	54.68
F	Artemisia ludoviciana	-	-	4	-	-	.06	-	-
F	Astragalus eurekensis	-	-	-	-	6	-	-	.06
F	Calochortus nuttallii	-	-	-	-	9	-	-	.05
F	Convolvulus arvensis	-	-	-	$_{a}$5	$_{a}$5	-	.06	.19
F	Cymopterus sp.	-	-	-	$_{a}$1	$_{b}$8	-	.00	.09
F	Draba sp. (a)	-	-	-	-	1	-	-	.00
F	Erodium cicutarium (a)	$_{b}$54	-	-	$_{a}$-	$_{c}$134	-	.38	3.39
F	Erigeron sp.	13	-	-	-	-	-	-	-
F	Lactuca serriola	-	$_{a}$10	$_{a}$-	-	$_{b}$88	.03	-	.51
F	Medicago sativa	$_{b}$76	$_{a}$4	-	-	$_{a}$3	-	-	.01
F	Ranunculus testiculatus (a)	-	-	-	-	22	-	-	.09
F	Stephanomeria exigua (a)	11	-	-	-	-	-	-	-
F	Taraxacum officinale	-	-	-	2	-	-	.00	-
F	Tragopogon dubius	-	$_{a}$1	-	-	$_{a}$3	-	-	.03
F	Unknown forb-annual (a)	-	3	-	-	-	-	-	-
F	Unknown forb-perennial	-	4	-	-	-	-	-	-
Total for Annual Forbs		65	3	0	0	157	0	0.37	3.49
Total for Perennial Forbs		89	19	4	8	122	0.09	0.07	0.96
Total for Forbs		154	22	4	8	279	0.09	0.45	4.45

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

BROWSE TRENDS --
Management unit 21A, Study no: 3

Type	Species	Strip Frequency			Average Cover %		
		'98	'03	'07	'98	'03	'07
B	Echinocereus sp.	1	1	1	-	-	-
B	Gutierrezia sarothrae	11	6	15	.69	.15	.51
B	Opuntia sp.	0	1	1	-	.03	.15
Total for Browse		12	8	17	0.69	0.18	0.66

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 3

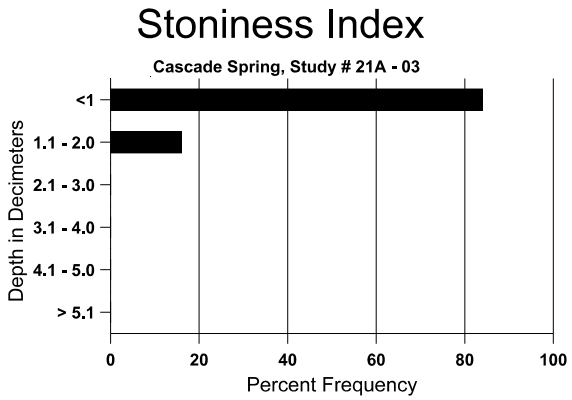
Species	Percent Cover	
	'03	'07
Echinocereus sp.	.05	-
Gutierrezia sarothrae	-	.91
Opuntia sp.	-	.16

BASIC COVER --
Management unit 21A, Study no: 3

Cover Type	Average Cover %				
	'85	'91	'98	'03	'07
Vegetation	7.25	10.75	35.95	38.94	56.18
Rock	24.25	22.00	14.15	21.33	20.97
Pavement	9.00	6.25	3.32	5.62	3.34
Litter	40.75	44.00	41.01	29.78	32.97
Cryptogams	.75	1.00	.14	.02	.45
Bare Ground	18.00	16.00	16.66	17.68	1.42

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 3, Cascade Spring

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
10.5	57.2 (13.1)	6.8	50.9	29.8	19.3	2.2	13.8	140.8	0.7



PELLET GROUP DATA --
Management unit 21A, Study no: 3

Type	Quadrat Frequency		
	'98	'03	'07
Rabbit	5	4	3
Deer	7	3	3
Cattle	26	-	9

Days use per acre (ha)		
'98	'03	'07
-	-	-
12 (30)	3 (8)	15 (38)
62 (153	13 (32)	38 (95)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 3

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Echinocereus sp.												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**20**	-	-	20	-	-	0	0	0	-	0	-/-
03	**20**	-	-	-	20	-	0	0	100	100	100	-/-
07	**20**	-	-	20	-	-	0	0	0	-	0	6/9
Gutierrezia sarothrae												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**200**	-	-	200	-	-	0	0	0	-	0	10/15
98	**740**	-	-	740	-	100	0	0	0	-	0	8/15
03	**280**	-	20	180	80	20	0	0	29	29	29	4/9
07	**1860**	100	980	840	40	-	0	0	2	2	2	7/7

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Opuntia sp.												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**20**	-	-	20	-	-	0	0	-	-	0	4/5
07	**20**	-	-	20	-	-	0	0	-	-	0	6/16

Trend Study 21A-4-07

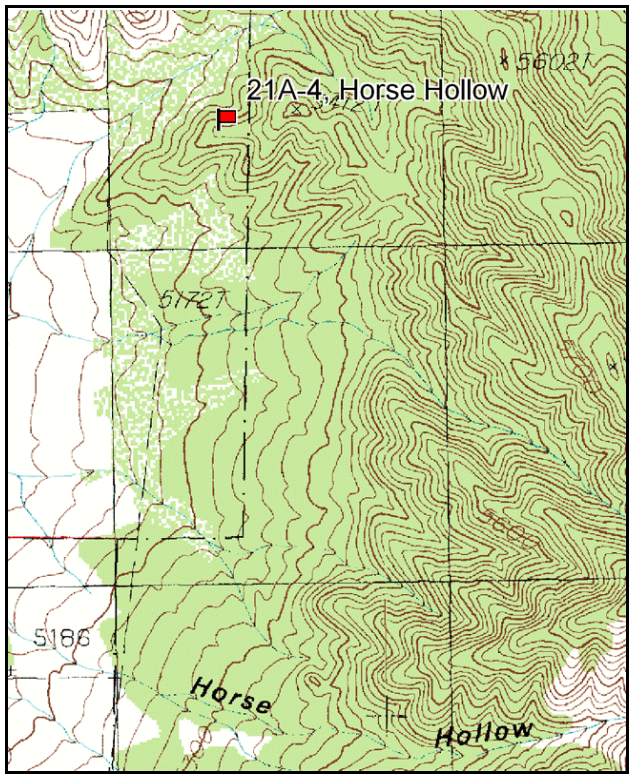
Study site name: Horse Hollow . Vegetation type: Juniper .

Compass bearing: frequency baseline 180 degrees magnetic.

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

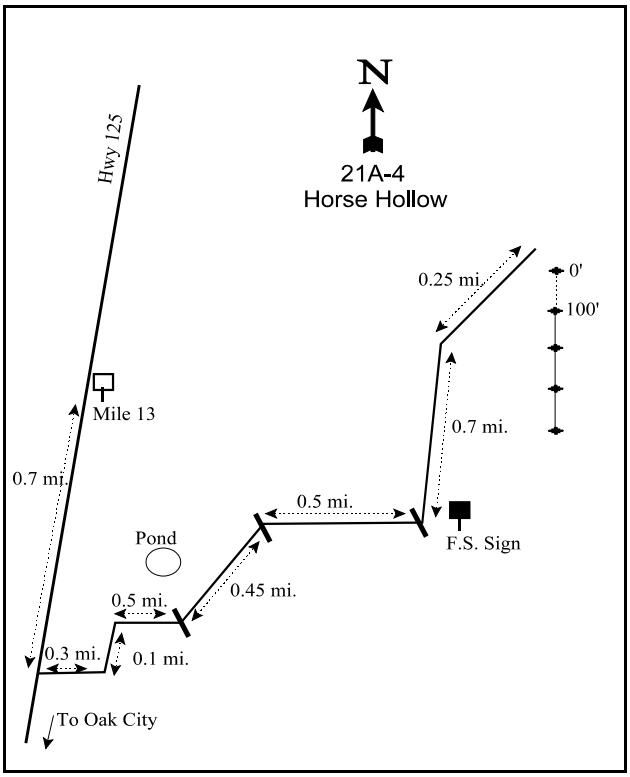
LOCATION DESCRIPTION

Proceed north from Oak City on SR 125. At 0.7 miles south of mile marker 13, turn left (east). Drive 0.3 miles, turn left, and drive 0.1 miles parallel to a fence. Turn right and drive 0.5 miles to a gate. Stay left at the gate and drive 0.45 miles to another gate. Go through the gate and drive 0.5 miles to another gate. On the other side of the gate is a Forest Service sign. The road will turn left (north), drive 0.7 miles up the hill to a ridge. At the top of the hill turn right and drive 0.25 miles on a faint road up the ridge line. Look for a green and white fencepost 18 feet off the right side of the road. The fencepost marks the 0-foot end of the frequency baseline. All stakes are full high fence post.



Map Name: Oak City

Township 16S , Range 4W , Section Unsurveyed



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 388271 E 4365558 N

DISCUSSION

Horse Hollow - Trend Study No. 21A-4

Study Information

This study is located on winter range dominated by Utah juniper (*Juniperus osteosperma*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and is located in the foothills above privately owned wheatfields. The transect runs down the south side of a rocky ridge and across a small wash [elevation: 5,300 feet (1,615 m), slope: 15%-20%, aspect: south]. Adjacent areas to the north and south were burned, seeded, then chained prior to study establishment in 1985. The area was also chained and seeded following a wildfire in 2006. Three of the sampling belts were located in burned and chained areas in 2007, while two were outside of the treatment. The land is managed by the Forest Service and is grazed by cattle. Pellet group transect data were estimated at 7 deer days use/acre (17 ddu/ha) in 1998, 3 deer days use/acre (7 ddu/ha) in 2003, and 4 deer days use/acre (10 ddu/ha) in 2007. Cattle use was estimated at only 2 days use/acre (5 cdu/ha) in 1998, with no cattle pats sampled in 2003 and 2007. Although not recorded in the pellet group transect data, rabbit pellet quadrat frequency steadily increased from 25% in 1998 to 43% in 2007. In 1998, grasshoppers were numerous and Mormon crickets (*Anabrus simplex*) had been on the site earlier in the season. Coyote scat was noted in the same year that contained numerous cricket remains.

Soil

The soil is classified as an Amtoft-Spager complex (USDA-NRCS 2007). The soils in the Amtoft series are shallow and well-drained, and formed in material weathered from calcareous sedimentary rocks. The Spager series consists of shallow soils over calcium carbonate cemented hardpan. They are somewhat excessively drained, and formed in alluvium weathered mainly from limestone. The soil texture is a sandy loam, and the pH is neutral (7.1). Soil phosphorus is low at 3.3 ppm. Values less than 6 ppm may limit normal plant growth and development (Tiedemann and Lopez 2004). The soil is moderately shallow and very rocky, both on the surface and throughout the profile. A thin hardpan is located at a depth of 6-8 inches (15-20 cm). Erosion is not a serious problem, although a small wash at the bottom of the hill shows some sedimentation. The erosion condition was classified as stable in 2003 and 2007.

Browse

Wyoming big sagebrush has been the dominant preferred browse since 1985. Sagebrush density increased from approximately 800 plants/acre (1,977 plants/ha) in 1985 and 1991 to 920 plants/acre (2,273 plants/ha) in 1998, then decreased to 640 plants/acre (1,581 plants/ha) in 2003. The wildfire and chaining treatment in 2006 eliminated the sagebrush population by the 2007 sampling. Decadence was high between 1985 and 2003, ranging from 39% to 50% of the population. Recruitment was low, with young plants comprising 8% of the population in 1985 and 4% in 1998, and no young plants sampled in 1991, 2003, and 2007. Vigor was good on over 80% of the plants in all sample years except 1991, when one-third of the population displayed poor vigor. Use was moderate in 1985, mostly light in 1991 and 2003, and light-moderate in 1998. Annual leader growth averaged 1.6 inches (4.1 cm) in 2003.

Nevada ephedra (*Ephedra nevadensis*) has also been sampled since 1998. Ephedra density increased from 100 plants/acre (247 plants/ha) in 1998 to 420 plants/acre (1,037 plants/ha) in 2003, and decadence increased from 0% to 71% of the population. After the fire and chaining treatment, young ephedra plants were sampled at a density of 40 plants/acre (99 plants/ha). All of the plants were vigorous in 1998 and 2007, and 19% of the population showed poor vigor in 2003. Use was moderate in 1998, moderate-heavy in 2003, and light in 2007. Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*) was also sampled at a low density in 1998 and 2003, and showed moderate-heavy use in 2003. It was not sampled in 2007.

Before the burn and chaining, the overstory was dominated by large juniper trees. One patch of trees remained unburned in 2007. Juniper canopy cover averaged 14% in 1998, 7% in 2003, and only 1% in 2007 after the

treatment. Point-centered quarter data estimated juniper density at 82 trees/acre (203 trees/ha) in 1998 and 2003, and 29 trees/acre (72 trees/ha) in 2007. Nearly half of the sampled trees were greater than 12 feet (3.7 m) in height in 2003, while most trees in 2007 were 8-12 feet (2.4-3.7 m) tall.

Herbaceous Understory

The herbaceous understory has been sparse in all sample years, providing 16% cover in 1998, 9% in 2003, and 17% in 2007. It is composed of mostly grass. Cheatgrass (*Bromus tectorum*) dominated the understory in 1998 and 2007, providing 80% and 83% of the total herbaceous cover, respectively. Cheatgrass cover was most abundant in areas that remained unburned in 2007. In 2003, cheatgrass, bluebunch wheatgrass (*Agropyron spicatum*), and Sandberg bluegrass (*Poa secunda*) combined provided 92% of the herbaceous cover. Other perennial grasses, such as galleta (*Hilaria jamesii*) and Indian ricegrass (*Oryzopsis hymenoides*) are present in small frequencies. Forbs have provided very little cover since 1998, and annual species were dominant in 2007. The most abundant forbs were draba (*Draba* sp.), nodding eriogonum (*Eriogonum cernuum*), and tansymustard (*Descurainia pinnata*).

1991 TREND ASSESSMENT

The trend for browse is slightly down. Sagebrush density remained stable at 800 plants/acre (1,977 plants/ha). However, decadence increased from 42% of the population to 50%, while young recruitment decreased from 8% of the population to 0%. Plants displaying poor vigor increased from 17% of the population to 33%. Use decreased from moderate to light. The trend for grass is slightly up. The sum of nested frequency for perennial grasses increased 18%, and galleta increased significantly in nested frequency. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs decreased slightly.

browse - slightly down (-1) grass - slightly up (+1) forb - slightly down (-1)

1998 TREND ASSESSMENT

The trend for browse is slightly up. Sagebrush density increased from 800 plants/acre (1,977 plants/ha) to 920 plants/acre (2,273 plants/ha), although this increase may be attributed to the increase in sample area. Decadence decreased from 50% of the population to 39%, and young recruitment slightly increased from 0% to 4% of the population. Dead plants were sampled for the first time, at a density of 800 plants/acre (1,977 plants/ha). Plants displaying poor vigor decreased from 33% of the population to 13%, and use increased to moderate. Ephedra and cliffrose were sampled for the first time at 100 plants/acre (247 plants/ha) and 20 plants/acre (49 plants/ha), respectively. Use on ephedra was moderate, and use on cliffrose was light. The trend for grass is down. The sum of nested frequency for perennial grasses decreased 41%. Bluebunch wheatgrass, galleta, and Indian ricegrass decreased significantly in nested frequency. The trend for forbs is stable. The sum of nested frequency for perennial forbs remained low. The Desirable Components Index (DCI) was rated as very poor due to low browse and perennial herbaceous cover, and high annual grass cover.

winter range condition (DCI) - very poor (0) Low potential scale
browse - slightly up (+1) grass - down (-2) forb - stable (0)

2003 TREND ASSESSMENT

The trend for browse is down. Sagebrush density declined 30% to 640 plants/acre (1,581 plants/ha). Decadence increased from 39% to 47% of the population, and no young plants were sampled. The density of dead plants decreased to 500 plants/acre (1,235 plants/ha). Plants displaying poor vigor increased from 13% of the population to 19%, and use decreased to mostly light. Ephedra density increased from 100 plants/acre (247 plants/ha) to 420 plants/acre (1,038 plants/ha), however, decadence increased substantially, from 0% to 71% of the population. Nineteen percent of the plants showed poor vigor. Cliffrose density doubled to 40 plants/acre (99 plants/ha), but half of the sampled plants were decadent. Use of both ephedra and cliffrose was moderate-heavy. The trend for grass is up. The sum of nested frequency for perennial grasses increased 45% and cheatgrass decreased significantly in nested frequency. Perennial grass cover increased from 3% to 5%,

while cheatgrass cover decreased from 13% to only 3%. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little, and the number of perennial species sampled increased from three to eight. Cover remained stable and was almost nonexistent. The DCI rating increased to poor due to increases in browse and perennial grass cover, and a decrease in annual grass cover.

winter range condition (DCI) - poor (14) Low potential scale
browse - down (-2) grass - up (+2) forb - stable (0)

2007 TREND ASSESSMENT

The trend for browse is down. The study burned and was chained in 2006, and the only sagebrush sampled in 2007 were two dead plants. No cliffrose plants were sampled. Ephedra was noted as resprouting and young plants were sampled at a density of 40 plants/acre (99 plants/ha). The trend for grass is down. The sum of nested frequency for perennial grasses decreased 46% and Sandberg bluegrass decreased significantly in nested frequency. Average perennial grass cover decreased from 5% to 2%. Cheatgrass increased significantly in nested frequency and its average cover increased from 3% to 14%. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little, while that for annual forbs increased substantially. Total forb cover increased to 1%, however, this increase was mostly attributed to annuals such as draba and tansymustard. The DCI rating declined to very poor due to the lack of browse cover, the decrease in perennial grass cover, and the increase in annual grass cover.

winter range condition (DCI) - very poor (-6) Low potential scale
browse - down (-2) grass - down (-2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 4

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'98	'03	'07	'98	'03	'07
G	Agropyron spicatum	$_{b}$73	$_{b}$77	$_{a}$19	$_{a}$35	$_{a}$31	.65	1.21	1.11
G	Bromus tectorum (a)	-	-	$_{b}$337	$_{a}$239	$_{b}$317	12.65	3.47	13.86
G	Hilaria jamesii	$_{a}$8	$_{b}$34	$_{a}$6	$_{a}$9	$_{a}$9	.10	.04	.25
G	Oryzopsis hymenoides	$_{ab}$29	$_{b}$31	$_{a}$12	$_{ab}$20	$_{ab}$11	.12	.56	.11
G	Poa secunda	$_{a}$54	$_{a}$47	$_{ab}$75	$_{b}$101	$_{a}$39	2.06	3.41	.31
G	Secale cereale (a)	-	-	5	-	-	.02	-	-
G	Sitanion hystrix	-	$_{a}$5	$_{a}$2	-	-	.06	-	-
Total for Annual Grasses		0	0	342	239	317	12.67	3.47	13.86
Total for Perennial Grasses		164	194	114	165	90	3.00	5.24	1.78
Total for Grasses		164	194	456	404	407	15.67	8.71	15.65
F	Alyssum alyssoides (a)	-	-	-	-	3	-	-	.00
F	Arabis drummondi	$_{a}$1	-	-	$_{a}$2	-	-	.00	-
F	Astragalus sp.	$_{b}$19	$_{ab}$8	$_{a}$4	-	-	.01	-	-
F	Astragalus utahensis	-	-	-	3	-	-	.00	-
F	Calochortus nuttallii	-	-	-	$_{a}$3	$_{a}$3	-	.00	.00
F	Cirsium sp.	-	-	$_{a}$7	$_{a}$1	$_{a}$5	.04	.00	.01

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'98	'03	'07	'98	'03	'07
F	Cryptantha sp.	$_{a}$5	$_{a}$1	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	$_{a}$2	$_{a}$2	-	.00	.38
F	Draba sp. (a)	-	-	-	-	11	-	-	.64
F	Eriogonum cernuum (a)	-	-	-	$_{a}$5	$_{b}$28	-	.01	.06
F	Erodium cicutarium (a)	-	-	-	-	4	-	-	.01
F	Erigeron eatonii	-	4	-	-	-	-	-	-
F	Eriogonum ovalifolium	-	2	-	-	-	-	-	-
F	Gilia sp. (a)	-	-	-	$_{a}$5	$_{a}$2	-	.01	.01
F	Hymenopappus filifolius	-	-	-	5	-	-	.01	-
F	Lomatium sp.	-	-	-	1	-	-	.00	-
F	Phlox austromontana	15	-	-	-	-	-	-	-
F	Phlox longifolia	$_{a}$2	-	$_{a}$3	$_{a}$3	$_{a}$2	.00	.00	.00
F	Sisymbrium altissimum (a)	-	-	-	-	3	-	-	.00
F	Unknown forb-perennial	3	-	-	-	-	-	-	-
F	Zigadenus paniculatus	-	$_{a}$1	-	$_{a}$1	$_{a}$1	-	.01	.00
Total for Annual Forbs		0	0	0	12	53	0	0.03	1.12
Total for Perennial Forbs		45	16	14	19	11	0.05	0.05	0.03
Total for Forbs		45	16	14	31	64	0.05	0.09	1.15

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

BROWSE TRENDS --
Management unit 21A, Study no: 4

Type	Species	Strip Frequency			Average Cover %		
		'98	'03	'07	'98	'03	'07
B	Artemisia tridentata wyomingensis	34	26	0	2.07	3.79	-
B	Chrysothamnus viscidiflorus stenophyllus	22	9	2	.21	.30	.03
B	Cowania mexicana stansburiana	1	2	0	-	.53	-
B	Ephedra nevadensis	3	4	2	.94	.68	.36
B	Gutierrezia sarothrae	41	18	4	1.49	.58	.16
B	Juniperus osteosperma	4	5	2	6.22	8.57	4.71
B	Opuntia sp.	1	1	0	-	-	-
Total for Browse		106	65	10	10.94	14.46	5.26

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 4

Species	Percent Cover		
	'98	'03	'07
Artemisia tridentata wyomingensis	-	3.86	-
Chrysothamnus viscidiflorus stenophyllus	-	.23	.01
Cowania mexicana stansburiana	-	.76	-
Ephedra nevadensis	-	.71	.95
Gutierrezia sarothrae	-	.06	.03
Juniperus osteosperma	13.80	7.46	1.35

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21A, Study no: 4

Species	Average leader growth (in)	
	'03	'07
Artemisia tridentata wyomingensis	1.6	-

POINT-QUARTER TREE DATA --
Management unit 21A, Study no: 4

Species	Trees per Acre		
	'98	'03	'07
Juniperus osteosperma	81	82	29

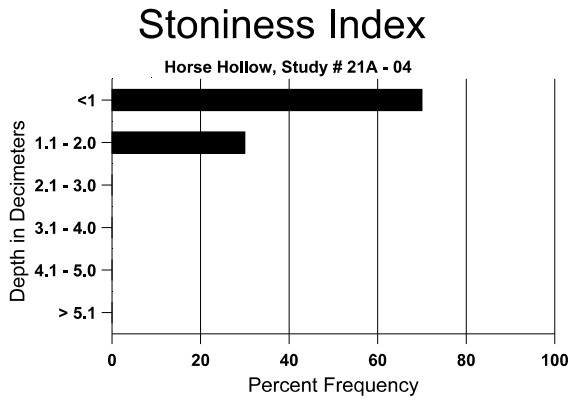
Average diameter (in)		
'98	'03	'07
8.3	7.8	15.1

BASIC COVER --
Management unit 21A, Study no: 4

Cover Type	Average Cover %				
	'85	'91	'98	'03	'07
Vegetation	3.25	1.00	25.25	22.73	21.28
Rock	7.00	18.00	12.65	14.71	17.14
Pavement	37.50	31.00	30.39	26.12	25.35
Litter	33.25	30.50	34.54	28.22	24.11
Cryptogams	2.75	3.25	3.94	6.81	3.88
Bare Ground	16.25	16.25	14.71	20.10	21.90

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 4, Horse Hollow

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.4	74.0 (12.6)	7.1	54.9	25.8	19.3	1.3	3.3	105.6	0.5



PELLET GROUP DATA --
Management unit 21A, Study no: 4

Type	Quadrat Frequency		
	'98	'03	'07
Rabbit	25	34	43
Deer	19	6	8

Days use per acre (ha)		
'98	'03	'07
-	-	-
7 (17)	3 (7)	4 (10)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 4

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
85	**799**	66	66	400	333	-	58	0	42	-	17	15/18
91	**800**	-	-	400	400	-	0	0	50	-	33	15/28
98	**920**	-	40	520	360	800	43	4	39	13	13	22/35
03	**640**	-	-	340	300	500	3	3	47	19	19	24/38
07	**0**	-	-	-	-	40	0	0	0	-	0	23/26
Chrysothamnus nauseosus												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	18/33
03	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus viscidiflorus stenophyllus												
85	**333**	-	-	-	333	-	0	0	100	20	100	-/-
91	**266**	-	-	266	-	-	0	0	0	-	0	9/14
98	**560**	-	-	500	60	140	25	75	11	-	29	10/17
03	**280**	-	-	160	120	260	0	0	43	14	14	7/12
07	**40**	-	-	-	40	20	0	0	100	50	100	4/6
Cowania mexicana stansburiana												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**20**	-	-	20	-	-	0	0	0	-	0	17/20
03	**40**	-	-	20	20	-	50	50	50	-	0	22/20
07	**0**	-	-	-	-	-	0	0	0	-	0	-/-
Ephedra nevadensis												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**100**	-	-	100	-	-	100	0	0	-	0	17/41
03	**420**	-	-	120	300	20	29	19	71	19	19	14/20
07	**40**	-	40	-	-	-	0	0	0	-	0	13/49
Gutierrezia sarothrae												
85	**1266**	-	400	733	133	-	0	0	11	-	21	6/9
91	**1398**	-	66	1266	66	-	0	0	5	5	5	9/13
98	**2500**	-	80	2320	100	200	7	3	4	-	98	8/10
03	**600**	-	20	540	40	340	0	0	7	7	7	6/9
07	**100**	700	40	60	-	-	0	0	0	-	20	7/8
Juniperus osteosperma												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**80**	40	40	40	-	-	0	0	0	-	0	-/-
03	**120**	-	20	100	-	-	0	0	0	-	0	-/-
07	**40**	-	-	20	20	60	0	0	50	-	50	-/-
Opuntia sp.												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	-	20	-	-	0	0	-	-	0	11/26
03	**20**	-	-	20	-	-	0	0	-	-	0	4/19
07	**0**	-	-	-	-	-	0	0	-	-	0	2/4

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Tetradymia spinosa												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	18/37
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 21A-12-07

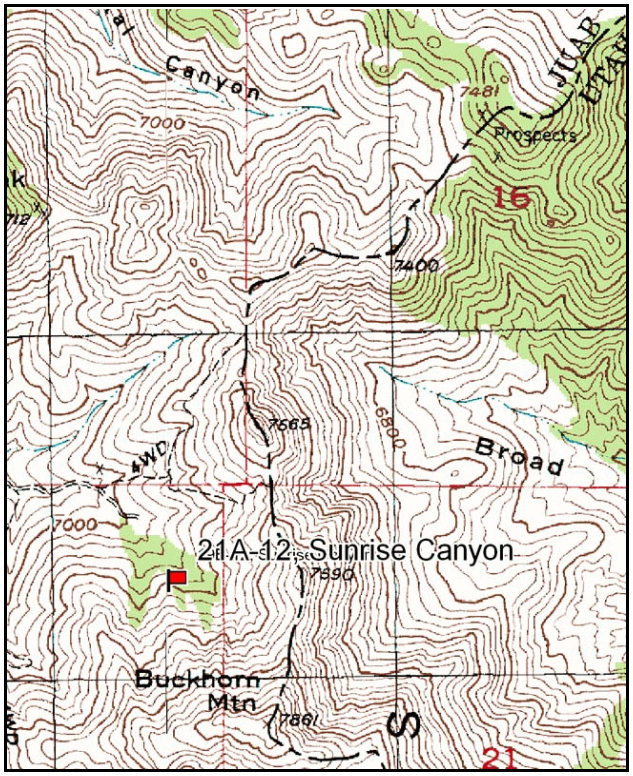
Study site name: Sunrise Canyon Vegetation type: Big Sagebrush-Grass

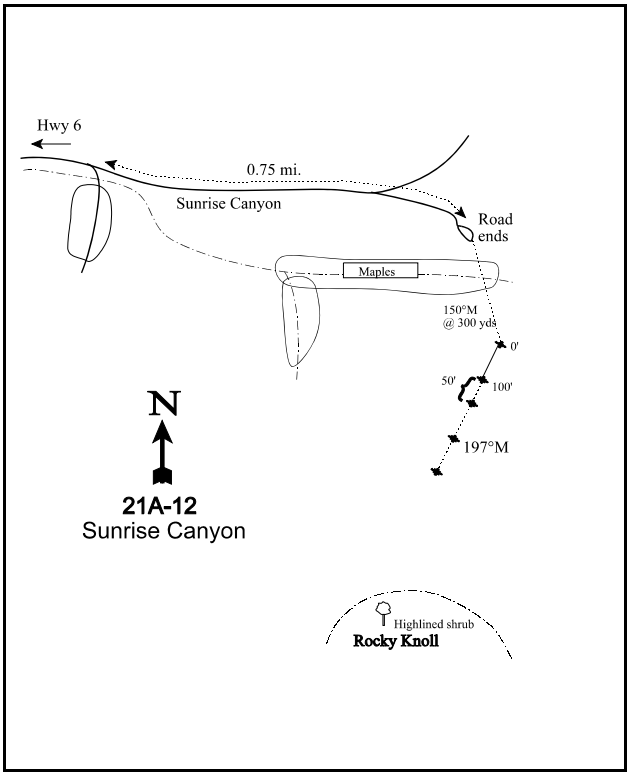
Compass bearing: frequency baseline 197 degrees magnetic.

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

LOCATION DESCRIPTION

From the junction of Highway U.S. 6 and U-36, proceed south on U.S. 6 for 6.30 miles to where the Sunrise Seeding road leads off to the east at mile marker 132. Proceed east on this road for 0.70 miles to a fork. Keep left for an additional 0.90 miles to an intersection. Turn right (east) up Sunrise Canyon for 0.85 miles to another fork. Stay left and go 0.75 miles to the end of the road in the bottom of Sunrise Canyon. From this point, the 0-foot mark of the baseline is located on a small ridge on an azimuth of 171 degrees on the opposite side of a maple clogged draw. Walk on the designated azimuth through the draw to the sagebrush grass ridge. The 0-foot mark, marked by a green steel fencepost with a red browse tag #437, is located approximately midway up the slope and in the middle of the ridge.





Map Name: Tintic Mountain Diagrammatic Sketch

Township 11S , Range 2W , Section 20 GPS: NAD 83, UTM 12S 407278 E 4412453 N

DISCUSSION

Sunrise Canyon - Trend Study No. 21A-12

Study Information

This study is located on big game summer range, and is typical of the higher ridges and slopes in this portion of the East Tintic Mountains [elevation: 7,250 feet (2,210 m), slope: 44%, aspect: northwest]. The area is occupied by a sagebrush-grass community. Escape cover is limited to narrow fingers of chokecherry (*Prunus virginiana*) and bigtooth maple (*Acer grandidentatum*) trees in the drainage bottoms. In 1983, numerous does with fawns, as well as a sage-grouse brood, were flushed from the draw immediately below the study. It was further noted that livestock grazing was especially intense in the draws, but much less on the slopes and ridges. In 1989, the shrub interspaces were nearly devoid of cover after spring sheep use. A herd of sheep was grazing during the 2002 sampling. In 2007, three deer and a deer carcass were observed near the study, and deer pellet groups seem to be concentrated more in the chokecherry and maple bottoms. Deer use was estimated at 7 days use/acre (17 ddu/ha) in 2002 and 12 days use/acre (30 ddu/ha) in 2007. Domestic sheep use was estimated at 41 days use/acre (102 sdu/ha) in 2002 and 71 days use/acre (175 sdu/ha) in 2007. Horse use was estimated at 5 days use/acre (12 hdu/ha) in 2007.

Soil

The soil is classified in the Wallsburg series (USDA-NRCS 2007). The soils in this series are shallow and well-drained, and formed in residuum and colluvium from limestone, sandstone, and shale. The soil texture is a sandy clay loam with a slightly acidic reaction (pH 6.1). It is very shallow and rocky. Rock has provided 17%-20% relative ground cover since 1997, while combined relative vegetation and litter cover has averaged 59%-66%. The slope is terraced by a network of livestock and game trails. The erosion condition was classified as slight in 2002 and 2007 due to pedestalling, flow patterns, and soil movement.

Browse

The browse composition is diverse, but it is composed mostly of low-growing species due to the shallow, rocky soil. Low sagebrush *(Artemisia arbuscula*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) are present, and it is a possibility that these species are hybridizing (McArthur et al. 1979). Low sagebrush is the most abundant shrub, and has steadily declined in density from 6,700 plants/acre (16,555 plants/ha) in 1997 to 3,580 plants/acre (8,846 plants/ha) in 2007. Its average cover decreased from 14% in 1997 to 7% in 2007. The population has been mostly mature, although decadence has increased from 13% of the population in 1997 to 31% in 2007. Young plants have comprised 5% or less of the population since 1997. Vigor has been good on most plants except in 1989, when 60% of the sampled plants displayed poor vigor. Use was mostly light in 1983, 1997, and 2002, light-moderate in 1989, and moderate-heavy in 2007. Annual leader growth averaged 1.1 inches (2.8 cm) in 2007.

Mountain big sagebrush density has fluctuated between 1,720 plants/acre (4,250 plants/ha) and 3,020 plants/acre (7,462 plants/ha) since 1997, while average cover has ranged from 7% to 15%. The population has been mostly mature, and decadence has decreased from 30% of the population to 21% since 1997. Young recruitment increased from 7% of the population in 1997 to 15% in 2002, then remained stable in 2007. The density of dead plants has ranged between 480 plants/acre (1,186 plants/ha) and 840 plants/acre (2,076 plants/ha), and approximately one-fifth of the plants have displayed poor vigor since 1997. Use was mostly light in 1983, 1997, and 2002, light-moderate in 1989, and moderate-heavy in 2007. Annual leader growth averaged 0.7 inches (1.8 cm) in 2002 and 1.4 inches (3.5 cm) in 2007.

The study supports smaller populations of other browse species, including serviceberry (*Amelanchier alnifolia*), true mountain mahogany (*Cercocarpus montanus*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), slenderbush eriogonum (*Eriogonum microthecum*), Oregon grape (*Mahonia repens*), pricklypear (*Opuntia* sp.), Myrtle pachistima (*Pachistima myrsinites*), snowberry (*Symphoricarpos*

oreophilus), and gray horsebrush (*Tetradymia canescens*).

Herbaceous Understory
The herbaceous understory has been moderately low, due to the high cover provided by sagebrush and consistent spring sheep grazing. Bluebunch wheatgrass (*Agropyron spicatum*) and mutton bluegrass (*Poa fendleriana*) have provided 89%-95% of the total grass cover since 1997. Both species were grazed heavily in 2002 and 2007. Average perennial grass cover was 6% in 1997, 7% in 2002, and 3% in 2007. Cheatgrass (*Bromus tectorum*) is present at a very low frequency, and has not increased in nested frequency or cover in the past 10 years.

Forb cover was high at 11% and 20% in 1997 and 2002, respectively, then decreased to 5% in 2007. The most common species are perennials, and include silvery lupine (*Lupinus argenteus*), sandwort (*Arenaria fendleri*), and Hood's phlox (*Phlox hoodii*). Common houndstongue (*Cynoglossum officinale*), a noxious weed, was sampled at a quadrat frequency of 20% and 16% in 1997 and 2002, respectively.

1989 TREND ASSESSMENT
The trend for browse is slightly up. Low sagebrush density increased from 7,066 plants/acre (17,460 plants/ha) to 8,465 plants/acre (20,917 plants/ha). Decadence increased from 0% to 10% of the population, and young recruitment also increased from 0% to 9% of the population. Mountain big sagebrush density increased from 1,665 plants/acre (4,114 plants/ha) to 1,865 plants/acre (4,608 plants/ha). Decadence slightly decreased from 16% of the population to 14%, and young recruitment also decreased from 16% of the population to 7%. Low sagebrush and big sagebrush plants displaying poor vigor greatly increased from 0% of both populations to 60% and 46%, respectively. Use of both species increased to light-moderate. The trend for grass is stable. The sum of nested frequency for perennial grasses did not change substantially. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs decreased 16%. Hood's phlox and rock goldenrod (*Petradoria pumila*) both decreased significantly in nested frequency, while fleabane (*Erigeron* sp.) increased significantly in nested frequency. Houndstongue was sampled in one quadrat in 1983, but was not sampled in 1989.

browse - slightly up (+1) grass - stable (0) forb - slightly down (-1)

1997 TREND ASSESSMENT
The trend for browse is slightly down. Low sagebrush density decreased from 8,465 plants/acre (20,917 plants/ha) to 6,700 plants/acre (16,555 plants/ha), although this decrease may be partly attributed to the increase in sampling area during this year. Decadence increased slightly from 10% to 13% of the population, and young recruitment decreased slightly from 9% to 5% of the population. Plants showing poor vigor decreased from 60% of the population to 9%. Mountain big sagebrush density also decreased, from 1,865 plants/acre (4,608 plants/ha) to 1,720 plants/acre (4,250 plants/ha). Decadence more than doubled to 30% of the population, while recruitment remained stable with 7% of the population composed of young plants. Plants displaying poor vigor decreased to 20% of the population. Use of both species decreased to mostly light. The trend for grass is slightly down. The sum of nested frequency for perennial species decreased 13% since 1983. Bluebunch wheatgrass increased significantly in nested frequency. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs continued to decrease 15%. Sandwort and milkvetch (*Astragalus* sp.) decreased significantly in nested frequency, while lupine and Hood's phlox increased significantly in nested frequency. Houndstongue was sampled again and provided 2% cover. The Desirable Components Index (DCI) was not calculated for this study because it is on summer range.

winter range condition (DCI) - Not applicable, summer range
browse - slightly down (-1) grass - slightly down (-1) forb - slightly down (-1)

2002 TREND ASSESSMENT

The trend for browse is up. Low sagebrush density remained relatively stable at 6,440 plants/acre (15,913 plants/ha). Decadence slightly increased from 13% of the population to 16%, and young recruitment remained low at 3%. The majority of the plants continued to be vigorous. Mountain big sagebrush density increased 76%, from 1,720 plants/acre (4,250 plants/ha) to 3,020 plants/acre (7,462 plants/ha). Decadence slightly decreased from 30% of the population to 25%, and young recruitment increased from 7% of the population to 15%. Plants displaying poor vigor slightly decreased from 20% to 17% of the population. Use on both sagebrush species remained mostly light. The trend for grass is slightly down. The sum of nested frequency for perennial grasses decreased nearly 20%, while average cover increased slightly from 6% to 7%. The trend for forbs is stable. The sum of nested frequency for perennial forbs increased 9%. Houndstongue quadrat frequency declined from 20% to 16%, and its average cover decreased from 2% to less than 1%.

winter range condition (DCI) - Not applicable, summer range
browse - up (+2) grass - slightly down (-1) forb - stable (0)

2007 TREND ASSESSMENT

The trend for browse is down. Low sagebrush density decreased from 6,440 plants/acre (15,913 plants/ha) to 3,580 plants/acre (8,846 plants/ha). Decadence increased from 16% of the population to 31%, while young recruitment remained relatively stable at 2% of the population. Mountain big sagebrush density decreased from 3,020 plants/acre (7,462 plants/ha) to 2,140 plants/acre (5,288 plants/ha). Decadence and young recruitment slightly decreased to 21% and 14% of the population, respectively. Sagebrush plants displaying poor vigor remained stable at 8% of the low sagebrush population and 18% of the big sagebrush population. Use of both species increased to moderate-heavy. The trend for grass is down. The sum of nested frequency for perennial grasses decreased 23% and average cover decreased from 7% to 3%. Mutton bluegrass decreased significantly in nested frequency. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 44% and average perennial forb cover decreased from 20% to 5%. Sandwort, lupine, and Hood's phlox decreased significantly in nested frequency. Houndstongue was not sampled.

winter range condition (DCI) - Not applicable, summer range
browse - down (-2) grass - down (-2) forb - down (-2)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 12

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	$_{ab}$103	$_{a}$64	$_{b}$138	$_{b}$116	$_{ab}$96	2.02	2.60	1.50
G	Bromus tectorum (a)	-	-	$_{a}$15	$_{a}$7	$_{a}$5	.04	.01	.01
G	Carex sp.	$_{a}$1	-	-	$_{a}$4	-	-	.06	-
G	Koeleria cristata	$_{a}$3	-	-	-	$_{b}$19	-	-	.09
G	Melica bulbosa	$_{b}$29	-	-	$_{a}$3	-	-	.15	-
G	Poa fendleriana	$_{b}$237	$_{b}$254	$_{b}$157	$_{b}$131	$_{a}$67	3.25	4.26	.93
G	Poa secunda	$_{a}$7	$_{ab}$23	$_{b}$29	$_{ab}$15	$_{ab}$23	.20	.13	.16

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Stipa columbiana	$_{a}$3	$_{a}$8	$_{a}$8	-	$_{a}$3	.44	-	.03
Total for Annual Grasses		0	0	15	7	5	0.04	0.01	0.00
Total for Perennial Grasses		383	349	332	269	208	5.92	7.22	2.72
Total for Grasses		383	349	347	276	213	5.97	7.23	2.73
F	Antennaria rosea	-	-	$_{a}$10	$_{a}$3	$_{a}$1	.04	.03	.00
F	Arabis sp.	$_{a}$13	$_{a}$9	$_{a}$3	-	-	.01	-	-
F	Arenaria fendleri	$_{c}$174	$_{c}$153	$_{b}$91	$_{b}$67	$_{a}$33	1.93	1.70	.30
F	Astragalus sp.	-	$_{b}$11	$_{a}$3	$_{ab}$4	-	.01	.03	-
F	Castilleja chromosa	4	-	-	-	-	-	-	-
F	Calochortus nuttallii	6	-	-	-	-	-	-	-
F	Chenopodium album (a)	-	-	-	-	9	-	-	.04
F	Chaenactis douglasii	$_{a}$2	$_{a}$2	-	-	-	-	-	-
F	Chenopodium sp. (a)	-	-	1	-	-	.00	-	-
F	Chenopodium leptophyllum(a)	-	-	-	-	8	-	-	.04
F	Collomia linearis (a)	-	-	$_{a}$2	$_{a}$2	$_{a}$3	.00	.00	.00
F	Comandra pallida	-	-	-	3	-	-	.00	-
F	Collinsia parviflora (a)	-	-	$_{a}$27	$_{a}$20	$_{a}$12	.06	.08	.04
F	Cynoglossum officinale	$_{a}$1	-	$_{b}$37	$_{b}$34	-	1.76	.23	-
F	Epilobium brachycarpum (a)	-	-	-	$_{b}$21	$_{a}$2	-	.04	.03
F	Erigeron sp.	$_{a}$12	$_{b}$28	-	$_{a}$3	-	-	.01	-
F	Eriogonum racemosum	-	-	-	-	1	-	-	.00
F	Eriogonum umbellatum	$_{a}$1	$_{a}$4	-	-	-	-	-	-
F	Galium sp.	-	-	-	3	-	-	.00	-
F	Heuchera parvifolia	3	-	-	-	-	-	-	-
F	Lactuca serriola	-	-	$_{a}$7	-	$_{a}$2	.02	-	.01
F	Lithospermum ruderale	$_{a}$3	$_{a}$5	$_{a}$1	-	-	.00	-	-
F	Lomatium sp.	-	2	-	-	-	-	-	-
F	Lupinus argenteus	$_{a}$55	$_{ab}$84	$_{cd}$120	$_{d}$154	$_{bc}$105	6.30	16.26	4.03
F	Machaeranthera canescens	$_{a}$7	$_{a}$7	$_{a}$3	$_{a}$3	$_{a}$1	.00	.01	.00
F	Petradoria pumila	$_{b}$25	$_{a}$4	-	-	-	-	-	-
F	Phlox hoodii	$_{c}$91	$_{a}$16	$_{b}$47	$_{b}$55	$_{a}$19	.82	1.17	.16
F	Phlox longifolia	-	-	-	$_{a}$4	$_{a}$6	-	.01	.01
F	Polygonum douglasii (a)	-	-	$_{b}$21	$_{a}$4	$_{ab}$9	.07	.01	.04
F	Senecio integerrimus	-	$_{a}$11	-	$_{a}$5	$_{a}$3	-	.04	.04
F	Senecio multilobatus	-	-	$_{a}$2	-	$_{a}$6	.00	-	.03
F	Taraxacum officinale	-	-	-	3	-	-	.01	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Unknown forb-perennial	$_{a}$10	-	-	$_{a}$10	-	-	.24	-
F	Zigadenus paniculatus	$_{a}$3	$_{a}$8	$_{a}$5	-	-	.01	-	-
Total for Annual Forbs		0	0	51	47	43	0.14	0.14	0.20
Total for Perennial Forbs		410	344	329	351	177	10.93	19.78	4.61
Total for Forbs		410	344	380	398	220	11.08	19.93	4.82

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

BROWSE TRENDS --
Management unit 21A, Study no: 12

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Acer grandidentatum	1	4	3	-	.21	.01
B	Amelanchier alnifolia	1	0	1	-	-	-
B	Artemisia arbuscula	61	57	44	14.27	12.99	7.06
B	Artemisia tridentata vaseyana	48	53	56	10.08	15.05	7.37
B	Cercocarpus montanus	1	0	0	-	-	-
B	Chrysothamnus nauseosus albicaulis	1	2	1	-	-	.15
B	Chrysothamnus viscidiflorus viscidiflorus	36	38	38	1.12	2.57	1.61
B	Ephedra nevadensis	0	0	0	-	-	.38
B	Eriogonum microthecum	27	21	19	.49	.47	.40
B	Mahonia repens	8	8	10	.48	.73	.26
B	Opuntia sp.	2	4	3	.63	.63	.15
B	Pachistima myrsinites	1	0	12	-	-	1.29
B	Symphoricarpos oreophilus	10	9	6	.06	.52	.48
B	Tetradymia canescens	2	2	1	.03	.15	.03
Total for Browse		199	198	194	27.18	33.35	19.22

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 12

Species	Percent Cover	
	'02	'07
Acer grandidentatum	-	.06
Artemisia arbuscula	21.98	11.06
Artemisia tridentata vaseyana	21.38	12.81
Chrysothamnus nauseosus albicaulis	.70	.43
Chrysothamnus viscidiflorus viscidiflorus	3.53	1.85
Eriogonum microthecum	.01	.18
Mahonia repens	1.96	.35
Opuntia sp.	.61	-
Pachistima myrsinites	-	2.33
Symphoricarpos oreophilus	.36	.01

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21A, Study no: 12

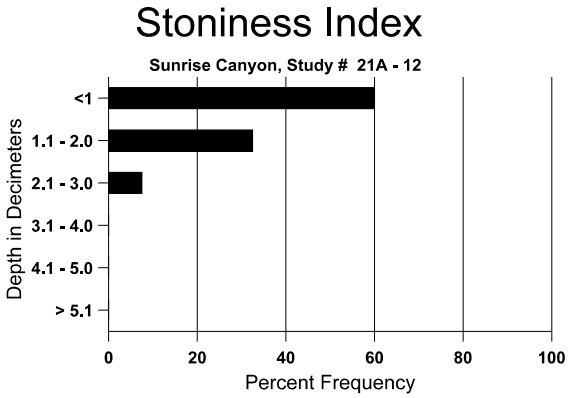
Species	Average leader growth (in)	
	'02	'07
Artemisia arbuscula	-	1.1
Artemisia tridentata vaseyana	0.7	1.4

BASIC COVER --
Management unit 21A, Study no: 12

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	2.75	9.25	39.82	52.60	29.46
Rock	28.50	24.75	20.16	21.08	21.32
Pavement	4.75	7.25	7.75	7.15	7.24
Litter	48.00	40.50	39.36	24.07	35.20
Cryptogams	0	0	.16	.18	.01
Bare Ground	16.00	18.25	13.54	14.30	15.21

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 12, Sunrise Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
7.5	55.0 (13.0)	6.1	54.4	23.1	22.6	4.7	23.1	358.4	.6



PELLET GROUP DATA --
Management unit 21A, Study no: 12

Type	Quadrat Frequency		
	'97	'02	'07
Sheep	6	13	13
Horse	-	-	-
Elk	-	-	7
Deer	10	4	2

Days use per acre (ha)	
'02	'07
41 (102)	71 (175)
-	5 (12)
-	6 (15)
7 (17)	6 (15)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 12

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Acer grandidentatum												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	0	0	-	-	0	-/-
02	**120**	20	100	20	-	-	0	0	-	-	0	-/-
07	**140**	-	20	120	-	-	86	0	-	-	14	20/17
Amelanchier alnifolia												
83	**66**	-	66	-	-	-	0	0	-	-	0	-/-
89	**66**	-	66	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	25/11
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia arbuscula												
83	**7066**	-	-	7066	-	-	0	0	0	-	0	10/18
89	**8465**	333	733	6866	866	-	50	0	10	-	60	15/21
97	**6700**	200	340	5520	840	360	20	1	13	5	9	12/22
02	**6440**	40	180	5200	1060	300	4	9	16	8	8	11/22
07	**3580**	280	80	2400	1100	380	45	13	31	6	8	10/21
Artemisia tridentata vaseyana												
83	**1665**	-	266	1133	266	-	4	0	16	-	0	24/34
89	**1865**	66	133	1466	266	-	32	4	14	7	46	22/32
97	**1720**	220	120	1080	520	840	8	5	30	15	20	26/38
02	**3020**	120	460	1800	760	480	5	13	25	7	17	26/39
07	**2140**	860	300	1380	460	680	46	9	21	13	18	25/40
Cercocarpus montanus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	0	0	-	-	0	14/2
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	79/87
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**20**	-	-	20	-	-	0	0	0	-	0	38/26
02	**60**	-	-	60	-	-	0	0	0	-	0	21/20
07	**20**	-	-	-	20	-	0	0	100	100	100	56/62
Chrysothamnus viscidiflorus viscidiflorus												
83	**1333**	-	-	1333	-	-	0	0	0	-	0	11/9
89	**1533**	-	733	800	-	-	4	0	0	-	9	5/7
97	**2900**	-	460	2400	40	-	10	3	1	-	0	11/11
02	**2040**	20	40	1940	60	20	7	0	3	.98	.98	11/15
07	**1620**	20	140	1480	-	20	48	12	0	-	0	12/14
Eriogonum microthecum												
83	**2066**	-	-	2066	-	-	0	0	0	-	0	9/8
89	**1866**	66	866	1000	-	-	4	0	0	-	0	7/5
97	**1020**	40	100	920	-	-	2	0	0	-	0	5/7
02	**460**	-	60	400	-	-	4	13	0	-	0	4/8
07	**500**	40	100	380	20	-	20	8	4	-	0	6/9

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Mahonia repens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**660**	-	60	600	-	-	0	0	-	-	0	5/7
02	**780**	-	-	780	-	-	0	0	-	-	0	5/8
07	**1720**	20	260	1460	-	-	0	0	-	-	1	4/5
Opuntia sp.												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**60**	-	40	20	-	-	0	0	0	-	0	9/52
02	**680**	-	-	680	-	-	0	0	0	-	0	6/13
07	**100**	-	20	60	20	-	0	0	20	20	20	7/11
Pachistima myrsinites												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**20**	-	-	20	-	-	0	0	0	-	0	-/-
02	**0**	-	-	-	-	-	0	0	0	-	0	-/-
07	**680**	140	-	560	120	220	18	0	18	15	15	7/22
Symphoricarpos oreophilus												
83	**200**	-	200	-	-	-	33	33	0	-	0	-/-
89	**66**	-	-	66	-	-	0	0	0	-	0	6/2
97	**280**	40	-	280	-	-	7	7	0	-	7	9/11
02	**200**	40	40	140	20	-	0	0	10	-	10	18/26
07	**140**	-	20	120	-	-	14	14	0	-	29	13/36
Tetradymia canescens												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**60**	-	-	60	-	-	0	0	0	-	0	9/9
02	**60**	-	-	40	20	-	0	0	33	-	33	10/11
07	**60**	20	-	-	60	-	0	0	100	-	0	14/10

Trend Study 21A-13-07

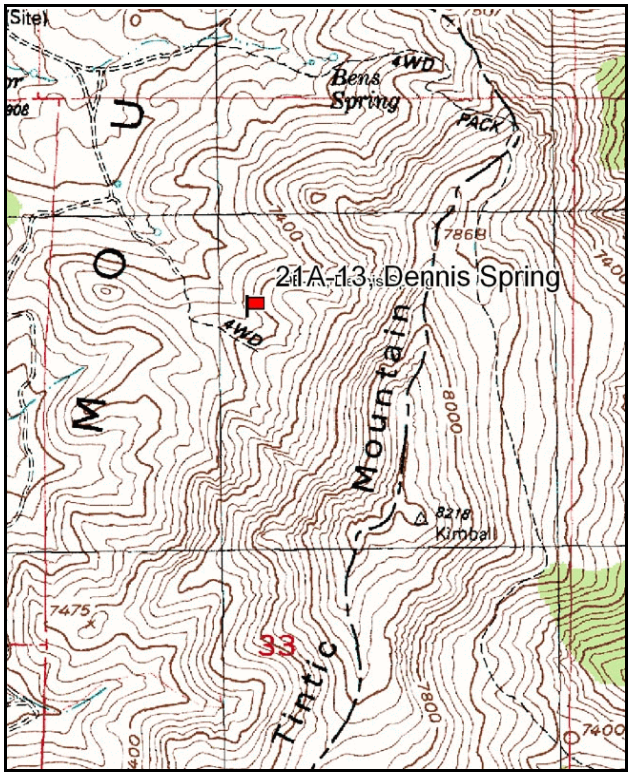
Study site name: Dennis Spring . Vegetation type: Big Sagebrush-Grass .

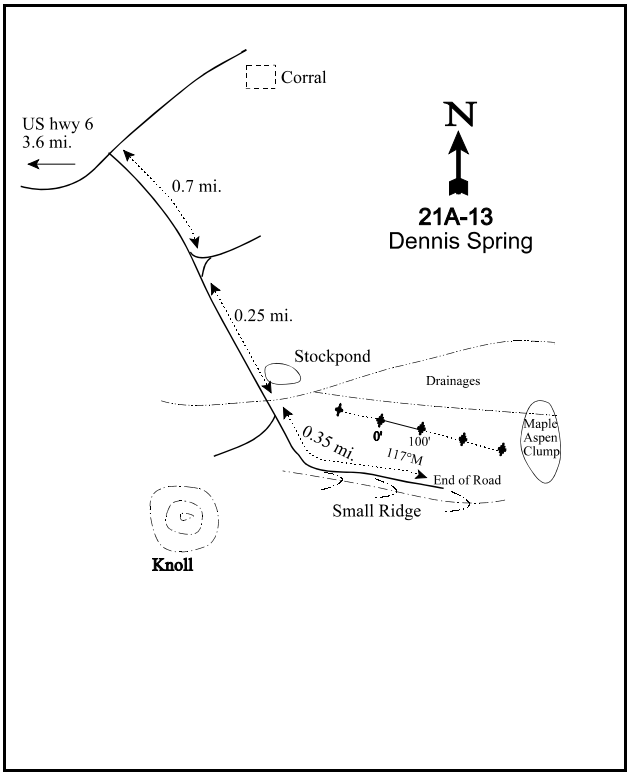
Compass bearing: frequency baseline 117 degrees magnetic.

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

LOCATION DESCRIPTION

From mile marker 130 on Highway U.S. 6, proceed east for 1.6 miles to a fork and go left. Proceed 2.0 miles on the "Dennis Road" up Copperpolis Creek to a fork. Turn right (to the southeast) and travel uphill for 0.70 miles to another fork. Turn right again for 0.25 miles to where there is a fork turning off sharply to the right and a stockpond on the left. Continue straight ahead (on the left fork) for an additional 0.35 miles to where the road ends on top of a small ridge. At this point, there will be an aspen-maple stand to your immediate left-front at the head of a small drainage. Just behind you, there should be a knoll. From the front-rightmost maple tree of the clump to your front, walk 13 paces on an azimuth of 8 degrees to the number 300-foot stake. The 0-foot marker of the baseline is marked by a red browse tag, number 3945, is located in the approximate middle of a triangle formed by three boulders. All plot markers consists of steel fenceposts 15" to 20" in height.





Map Name: Tintic Mountain Diagrammatic Sketch

Township 11S , Range 2W , Section 33 GPS: NAD 83, UTM 12S 408019 E 4408894 N

DISCUSSION

Dennis Spring - Trend Study No. 21A-13

Study Information

This study samples summer range near the bottom of a swale, approximately one-quarter mile (0.4 km) from Dennis Spring [elevation: 7,390 feet (2,252 m), slope: 25%, aspect: northwest]. Prior to 2001, the plant community was dominated by a moderately tall mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) population interspersed with lower growing shrubs. Except for a few isolated aspen (*Populus tremuloides*) clones and patches of bigtooth maple (*Acer grandidentatum*), the area is devoid of tree cover. A wildfire burned through the area in 2001, greatly reducing the browse component. There was a very slight decrease in pellet group quadrat frequencies following the fire. Deer use was estimated at 7 days use/acre (18 ddu/ha) in 2002 and 1 day use/acre (3 ddu/ha) in 2007. Elk use was estimated at 7 days use/acre (17 edu/ha) in 2007. Sheep use was estimated at 13 days use/acre (33 sdu/ha) in 2002 and 20 days use/acre (50 sdu/ha) in 2007. Mormon crickets (*Anabrus simplex*) were also abundant in 2002 and appeared to have utilized many of the herbaceous plants.

Soil

The soil is classified as a Wallsburg-Yeates Hollow complex (USDA-NRCS 2007). The soils in the Wallsburg series are shallow and well-drained, and formed in residuum and colluvium from limestone, sandstone, and shale. The soils in the Yeates Hollow series are deep and well-drained or moderately well-drained, and formed in alluvium, colluvium, and residuum from conglomerate, sandstone, and quartzite. The soil texture is a sandy clay loam, and the pH is moderately acidic (5.9). Relative vegetation cover decreased from 39% in 1997 to 25% in 2002 following the fire, then increased to 39% in 2007. Relative bare ground cover increased from 14% in 1997 to 45% in 2002, then decreased to 25% in 2007. The soil erosion condition was classified as stable in 2002 and moderate in 2007 due to indications of surface litter, rock, and soil movement, as well as pedestalling, flow patterns, and gullies.

Browse

Mountain big sagebrush is the preferred browse species, and provided 79% of the total browse cover in 1997, 23% in 2002, and 77% in 2007. Its density has steadily increased from 4,920 plants/acre (12,157 plants/ha) in 1997 to 9,500 plants/acre (23,474 plants/ha) in 2007. The population was largely mature in 1997 before the burn, and in 2002 only young plants were sampled. By 2007, approximately half of the population was young and half was mature. Vigor has been good on most plants in every sample year, and use has been mostly light. Annual leader growth averaged 1.8 inches (4.5 cm) in 2007.

Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) is also present, and its density has declined from 5,560 plants/acre (13,739 plants/ha) in 1997 to 2,700 plants/acre (6,672 plants/ha) in 2007. Rabbitbrush provided most shrub cover in 2002. Snowberry (*Symphoricarpos oreophilus*), Oregon grape (*Mahonia repens*), Myrtle pachistima (*Pachistima myrsinites*), Woods' rose (*Rosa woodsii*), and gray horsebrush (*Tetradymia canescens*) have also been sampled at lower densities.

Herbaceous Understory

Average perennial grass cover has remained low, but stable, at 3%-4% since 1997. Subalpine needlegrass (*Stipa columbiana*) was the most abundant grass in 1997 and 2002, providing 48% and 51% of the total grass cover, respectively. Cheatgrass (*Bromus tectorum*) became the most abundant grass in 2007. It increased from 15% of the total grass cover in 2002 to 51% in 2007. Average cheatgrass cover increased from 1% in 2002 to 4% in 2007. Other grasses present include bluebunch wheatgrass (*Agropyron spicatum*), bottlebrush squirreltail (*Sitanion hystrix*), slender wheatgrass (*Agropyron trachycaulum*), and crested wheatgrass (*Agropyron cristatum*).

Average perennial forb cover remained stable at 10% in 1997 and 2002, then decreased to 2% by 2007. The most abundant perennial species include silvery lupine (*Lupinus argenteus*), ballhead waterleaf (*Hydrophyllum capitatum*), longleaf phlox (*Phlox longifolia*), and prickly lettuce (*Lactuca serriola*). Lupine provided 65% of the total forb cover in 1997, then declined significantly to only 10% in 2002. Waterleaf was the most abundant forb in 2002 and 2007; it comprised 28% and 42% of the total forb cover, respectively. Common houndstongue (*Cynoglossum officinale*), a noxious weed, was sampled in 1983-2002, but in low frequencies. Annual forbs have provided 15%-22% of the total forb cover since 1997. The most abundant annual species include lambsquarters (*Chenopodium album*), Douglas knotweed (*Polygonum douglasii*), and blue-eyed Mary (*Collinsia parviflora*).

1989 TREND ASSESSMENT

The trend for browse is up. Sagebrush density increased from 1,199 plants/acre (2,963 plants/ha) to 8,532 plants/acre (21,082 plants/ha). Young plants increased from 6% of the population to 61%, and seedlings were also sampled at a density of 1,533 seedlings/acre (3,788 seedlings/ha). Decadence decreased from 17% of the population to only 1%. Vigor was good on all sampled plants, and use decreased to light. The trend for grass is up. The sum of nested frequency for perennial grasses increased 22%. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little. Lupine decreased significantly in nested frequency, while tapertip hawksbeard (*Crepis acuminata*) and aster (*Aster* sp.) increased significantly in nested frequency.

browse - up (+2) grass - up (+2) forb - stable (0)

1997 TREND ASSESSMENT

The trend for browse is slightly down. Sagebrush density decreased from 8,532 plants/acre (21,082 plants/ha) to 4,920 plants/acre (12,157 plants/ha), however, this change can be attributed to the increase in sampling area in 1997. The population was largely mature. Decadence increased from 1% of the population to 11%, while young recruitment decreased from 61% of the population to 1%. Plants displaying poor vigor increased slightly to 8% of the population. Use remained light. The trend for grass is up. The sum of nested frequency for perennial grasses increased 38%. Subalpine needlegrass (*Stipa columbiana*) increased significantly in nested frequency, while bluebunch wheatgrass and Sandberg bluegrass (*Poa secunda*) decreased significantly in nested frequency. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 21%. Hawksbeard decreased significantly in nested frequency. Houndstongue quadrat frequency increased slightly from 16% to 23%. The Desirable Components Index (DCI) was not calculated for this study since it is on summer range.

winter range condition (DCI) - Not applicable, summer range
browse - slightly down (-1) grass - up (+2) forb - down (-2)

2002 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density increased 45% following the fire, from 4,920 plants/acre (12,157 plants/ha) to 7,120 plants/acre (17,593 plants/ha). However, average sagebrush cover decreased from 32% to 1%. The population has been converted from a mature, dense-canopied population to one with an open canopy composed completely of young, vigorous plants. The density of young sagebrush plants is high, so the sagebrush component should develop rather quickly. The trend for grass is down. The sum of nested frequency for perennial grasses decreased 45%. Squirreltail decreased significantly in nested frequency. Cheatgrass increased significantly in nested frequency, however, its average cover changed very little. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs increased 17%. Longleaf phlox and prickly lettuce increased significantly in nested frequency, while lupine and houndstongue decreased significantly in nested frequency. Total forb cover increased from 11% to 13%.

winter range condition (DCI) - Not applicable, summer range
browse - stable (0) grass - down (-2) forb - slightly up (+1)

2007 TREND ASSESSMENT

The trend for browse is up. Sagebrush density increased from 7,120 plants/acre (17,593 plants/ha) to 9,500 plants/acre (23,474 plants/ha), and its average cover increased from 1% to 23%. Fifty-two percent of the plants were young, while 48% were mature. Seedling density was extremely high at 26,420 plants/acre (65,283 plants/ha). Vigor remained excellent and use was mostly light, with 4% of the sampled plants showing moderate use. The trend for grass is up. The sum of nested frequency for perennial grasses increased substantially. Crested wheatgrass, squirreltail, and smooth brome (*Bromus inermis*) increased significantly in nested frequency. Cheatgrass did not change significantly in nested frequency, although its cover increased from 1% to 4%. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 61%. Five perennials, including waterleaf, lupine, phlox, lambstongue groundsel (*Senecio integerrimus*), and clover (*Trifolium* sp.) decreased significantly in nested frequency. Houndstongue was not sampled.

winter range condition (DCI) - Not applicable, summer range
browse - up (+2) grass - up (+2) forb - down (-2)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 13

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	-	-	$_{a}$4	$_{a}$1	$_{b}$16	.00	.15	.21
G	Agropyron spicatum	$_{bc}$72	$_{c}$80	$_{a}$47	$_{a}$31	$_{ab}$45	.32	.54	1.08
G	Agropyron trachycaulum	-	-	-	$_{a}$8	$_{a}$12	-	.21	.28
G	Bromus inermis	-	-	$_{a}$3	$_{a}$2	$_{b}$15	.00	.15	.14
G	Bromus japonicus (a)	-	-	-	-	-	.00	-	-
G	Bromus tectorum (a)	-	-	$_{a}$26	$_{b}$129	$_{b}$148	.41	.71	3.86
G	Oryzopsis hymenoides	-	-	-	-	1	-	-	.03
G	Poa fendleriana	-	$_{a}$3	$_{a}$9	$_{a}$8	$_{a}$9	.21	.27	.19
G	Poa secunda	$_{b}$45	$_{b}$32	$_{a}$6	$_{a}$1	-	.04	.00	-
G	Sitanion hystrix	$_{a}$12	$_{ab}$23	$_{bc}$43	$_{a}$3	$_{c}$51	.59	.20	.78
G	Stipa columbiana	-	$_{a}$19	$_{b}$105	$_{b}$64	$_{b}$52	1.50	2.38	.97
G	Stipa lettermani	-	-	-	$_{a}$2	$_{a}$6	-	.01	.04
Total for Annual Grasses		0	0	26	129	148	0.42	0.70	3.86
Total for Perennial Grasses		129	157	217	120	207	2.69	3.94	3.73
Total for Grasses		129	157	243	249	355	3.11	4.65	7.60

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Agoseris glauca	$_{a}$5	-	$_{a}$2	$_{a}$3	$_{a}$4	.00	.04	.01
F	Arabis sp.	$_{a}$7	$_{a}$9	-	-	-	-	-	-
F	Arenaria fendleri	$_{a}$2	$_{a}$1	-	-	-	-	-	-
F	Artemisia ludoviciana	-	-	-	-	1	-	-	.03
F	Astragalus convallarius	$_{b}$18	$_{ab}$7	$_{a}$3	$_{ab}$12	$_{ab}$6	.01	.31	.04
F	Aster sp.	$_{a}$2	$_{b}$33	-	$_{a}$1	$_{a}$1	-	.00	.00
F	Astragalus sp.	-	-	3	-	-	.00	-	-
F	Calochortus nuttallii	$_{a}$1	-	$_{a}$1	$_{a}$1	-	.00	.00	-
F	Chenopodium album (a)	-	-	$_{b}$83	$_{c}$142	$_{a}$6	.40	1.41	.02
F	Chenopodium leptophyllum(a)	-	-	-	-	6	-	-	.01
F	Cirsium sp.	$_{a}$3	$_{a}$3	$_{a}$2	$_{a}$2	-	.00	.03	-
F	Collomia linearis (a)	-	-	$_{a}$5	-	$_{a}$1	.01	-	.00
F	Comandra pallida	-	$_{a}$2	$_{a}$2	-	-	.00	-	-
F	Collinsia parviflora (a)	-	-	$_{b}$190	$_{a}$19	$_{a}$41	1.08	.06	.14
F	Crepis acuminata	$_{b}$23	$_{a}$142	$_{b}$33	$_{a}$-	$_{a}$1	.25	.00	.03
F	Cymopterus sp.	-	-	2	-	-	.00	-	-
F	Cynoglossum officinale	$_{b}$34	$_{b}$32	$_{b}$39	$_{a}$10	-	.76	.19	-
F	Epilobium brachycarpum (a)	-	-	-	3	-	-	.00	-
F	Erigeron sp.	-	-	$_{a}$3	$_{a}$3	-	.03	.00	-
F	Eriogonum racemosum	$_{b}$14	$_{ab}$10	-	$_{a}$2	-	-	.00	-
F	Gayophytum ramosissimum(a)	-	-	-	$_{b}$28	$_{a}$7	-	.25	.01
F	Geranium sp.	$_{a}$3	$_{a}$3	-	-	-	-	-	-
F	Hackelia patens	$_{a}$7	-	-	-	$_{a}$3	-	-	.00
F	Hydrophyllum capitatum	-	-	-	$_{b}$62	$_{a}$40	-	3.67	1.21
F	Lathyrus brachycalyx	$_{a}$18	$_{a}$15	$_{a}$18	$_{a}$17	$_{a}$2	.25	.46	.15
F	Lactuca serriola	-	-	$_{a}$4	$_{b}$122	-	.01	1.11	-
F	Lupinus argenteus	$_{d}$208	$_{c}$147	$_{c}$140	$_{b}$47	$_{a}$8	7.32	1.29	.11
F	Machaeranthera canescens	-	$_{a}$2	$_{a}$2	-	$_{a}$9	.00	-	.04
F	Microsteris gracilis (a)	-	-	$_{a}$32	$_{a}$14	$_{a}$20	.09	.22	.04
F	Penstemon sp.	-	-	-	$_{a}$3	$_{a}$3	-	.01	.03
F	Phlox longifolia	$_{a}$79	$_{ab}$96	$_{a}$76	$_{b}$133	$_{a}$81	.22	2.54	.47
F	Polygonum douglasii (a)	-	-	$_{a}$20	$_{b}$83	$_{c}$123	.06	.81	.40
F	Senecio integerrimus	-	-	-	$_{b}$29	$_{a}$15	-	.32	.08
F	Senecio multilobatus	-	-	$_{b}$44	-	$_{a}$1	.45	-	.00
F	Solidago sp.	56	-	-	-	-	-	-	-
F	Streptanthus cordatus	-	-	5	-	-	.03	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Taraxacum officinale	$_{a}$3	$_{a}$6	$_{a}$15	$_{a}$2	-	.05	.03	-
F	Trifolium sp.	$_{ab}$14	$_{bc}$23	$_{c}$37	$_{bc}$22	$_{a}$3	.10	.22	.01
F	Viguiera multiflora	-	-	1	-	-	.00	-	-
F	Viola sp.	-	1	-	-	-	-	-	-
Total for Annual Forbs		0	0	330	289	204	1.65	2.76	0.64
Total for Perennial Forbs		497	532	432	471	178	9.56	10.28	2.23
Total for Forbs		497	532	762	760	382	11.21	13.05	2.88

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

BROWSE TRENDS --
Management unit 21A, Study no: 13

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Acer grandidentatum	1	0	0	-	-	-
B	Amelanchier alnifolia	2	0	0	-	-	-
B	Artemisia tridentata vaseyana	91	70	93	32.23	1.43	22.61
B	Chrysothamnus nauseosus albicaulis	7	1	0	.69	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	80	83	70	2.67	2.71	3.39
B	Hydrophyllum capitatum	0	0	0	-	-	.15
B	Juniperus osteosperma	2	0	0	1.12	-	-
B	Mahonia repens	29	28	28	1.33	.86	1.43
B	Pachistima myrsinites	0	0	3	-	.03	-
B	Purshia tridentata	0	0	0	.03	-	-
B	Rosa woodsii	5	8	7	.06	.09	.33
B	Symphoricarpos oreophilus	55	29	18	2.23	.43	1.24
B	Tetradymia canescens	6	11	6	.21	.53	.18
B	Unknown browse	1	0	0	-	-	-
Total for Browse		279	230	225	40.60	6.10	29.33

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 13

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	1.41	35.98
Chrysothamnus viscidiflorus viscidiflorus	2.46	5.25
Mahonia repens	.53	2.58
Pachistima myrsinites	-	.08
Rosa woodsii	.03	.11
Symphoricarpos oreophilus	1.13	1.61
Tetradymia canescens	.20	.33

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21A, Study no: 13

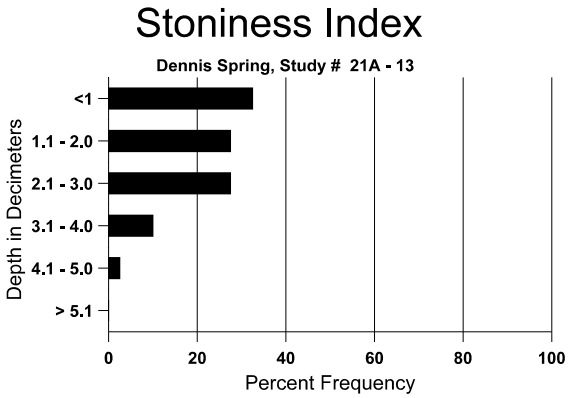
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	-	1.8

BASIC COVER --
Management unit 21A, Study no: 13

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	1.00	10.75	47.86	28.06	43.91
Rock	6.00	7.25	3.45	6.38	4.96
Pavement	.50	0	1.26	3.86	2.77
Litter	68.50	57.50	54.12	22.89	32.51
Cryptogams	0	0	.04	.85	0
Bare Ground	24.00	24.50	17.09	50.06	28.49

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 13, Dennis Spring

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.5	52.3 (13.7)	5.9	48.4	27.1	24.6	5.2	52.0	553.6	.5



PELLET GROUP DATA --
Management unit 21A, Study no: 13

Type	Quadrat Frequency		
	'97	'02	'07
Sheep	8	6	8
Rabbit	3	1	1
Horse	-	-	1
Elk	4	-	8
Deer	14	4	4
Cattle	1	-	-

Days use per acre (ha)	
'02	'07
13 (33)	20 (50)
-	-
-	-
-	7 (17)
7 (18)	1 (3)
-	-

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 13

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Acer grandidentatum												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**200**	-	200	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Amelanchier alnifolia												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**66**	-	-	-	66	-	0	100	100	-	0	-/-
97	**40**	-	40	-	-	-	0	0	0	-	0	-/-
02	**0**	-	-	-	-	-	0	0	0	-	0	-/-
07	**0**	-	-	-	-	-	0	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
83	**1199**	-	66	933	200	-	28	0	17	-	0	32/29
89	**8532**	1533	5200	3266	66	-	0	0	1	-	0	17/20
97	**4920**	40	60	4320	540	380	.81	0	11	4	8	34/36
02	**7120**	1020	7120	-	-	100	0	0	0	-	0	8/11
07	**9500**	26420	4880	4580	40	60	4	0	0	.21	.21	25/33
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**200**	-	20	100	80	-	70	0	40	30	30	44/38
02	**20**	-	20	-	-	-	0	100	0	-	0	-/-
07	**0**	-	-	-	-	-	0	0	0	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
83	**15266**	-	1800	13466	-	-	0	0	0	-	0	15/13
89	**9533**	133	1600	2533	5400	-	31	45	57	.20	.69	12/8
97	**5560**	100	820	4700	40	20	12	1	1	.71	.71	10/10
02	**4700**	-	960	3720	20	-	6	.85	0	.42	.42	8/10
07	**2700**	500	280	2200	220	-	25	2	8	2	11	14/18
Juniperus osteosperma												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**40**	-	40	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Mahonia repens												
83	**333**	-	-	333	-	-	0	0	0	-	0	4/6
89	**533**	-	400	133	-	-	25	0	0	-	0	5/3
97	**4540**	20	340	4200	-	-	0	0	0	-	0	4/5
02	**6340**	-	20	6240	80	100	0	0	1	.94	5	3/5
07	**8320**	-	-	8320	-	-	0	0	0	-	0	4/6
Pachistima myrsinites												
83	**133**	-	133	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**60**	-	20	40	-	-	33	0	-	-	33	5/9

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Rosa woodsii												
83	**533**	-	-	533	-	-	0	0	0	-	0	12/3
89	**399**	-	266	-	133	-	17	17	33	-	0	-/-
97	**180**	20	140	40	-	-	0	0	0	-	0	-/-
02	**260**	-	260	-	-	-	0	0	0	-	8	-/-
07	**240**	-	60	180	-	-	8	0	0	-	0	12/15
Symphoricarpos oreophilus												
83	**799**	-	66	733	-	-	25	17	0	-	8	23/21
89	**1265**	-	133	66	1066	-	16	84	84	-	0	17/14
97	**2540**	20	320	2200	20	-	5	.78	1	-	.78	12/20
02	**1160**	20	800	360	-	-	2	2	0	-	0	11/24
07	**420**	-	40	380	-	-	24	0	0	-	10	13/27
Tetradymia canescens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**220**	-	40	180	-	-	0	0	-	-	0	15/16
02	**400**	-	100	300	-	-	0	0	-	-	0	9/14
07	**240**	-	80	160	-	-	8	0	-	-	0	12/26
Unknown browse												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 21A-16-07

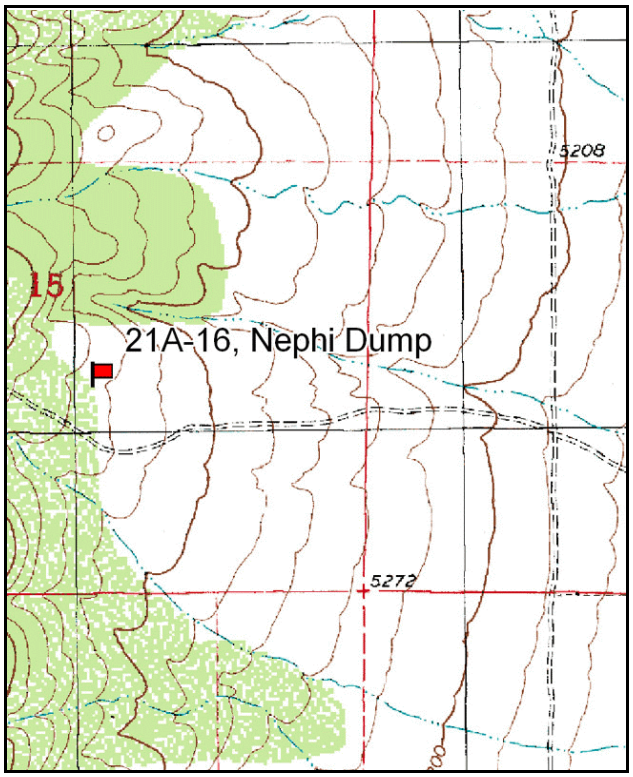
Study site name: Nephi Dump . Vegetation type: Stansbury Cliffrose .

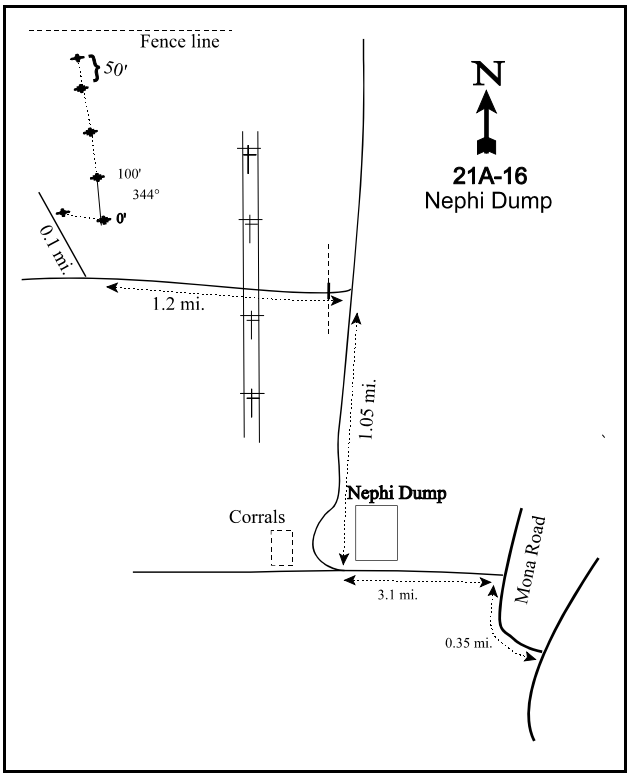
Compass bearing: frequency baseline 344 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (29ft).

LOCATION DESCRIPTION

From the Nephi City Dump, travel north on a gravel road for 1.05 miles and then turn left (west) just after passing through a cattle guard. Travel west for 1.25 miles and turn right (north) onto a faint road and go 0.1mile. At this point, there is a small stockpile and a short red steel stake. From here, walk east a short distance to the 0-foot mark of the frequency baseline, marked by a steel fencepost with a red browse tag, number 3942, attached.





Map Name: Slate Jack Canyon

Diagrammatic Sketch

Township 12S , Range 1W , Section 15

GPS: NAD 83, UTM 12S 420980 E 4402330 N

DISCUSSION

Nephi Dump - Trend Study No. 21A-16

Study Information

This study samples deer winter range located northwest of Nephi on the east side of Long Ridge [elevation: 5,500 feet (1,676 m), slope: 5%-10%, aspect: east]. It supports a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) community interspersed with Utah juniper (*Juniperus osteosperma*) and Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*). The study is located within an area of approximately 40 acres (16 ha) that was not burned by the extensive fires of 1996, however, much of the surrounding vegetation was burned in 1986 and 1996. Deer use was estimated at 31 days use/acre (76 ddu/ha) in 2002 and 18 days use/acre (45 ddu/ha) in 2007. Cattle also graze the area, and use was estimated at 7 days use/acre (16 cdu/ha) in 2002 and 24 days use/acre (59 cdu/ha) in 2007.

Soil

The soil is classified within the Pibler series (USDA-NRCS 2007). The soils in this series are shallow over petrocalcic, well-drained soils that formed in alluvium mainly from sedimentary rocks. The soil texture is a clay loam with a neutral reaction (pH 6.9). Relative combined rock and pavement cover has averaged 18%-23% since 1997, and combined vegetation and litter cover has averaged 57%-69%. The soil erosion condition was classified as stable in 2002 and 2007.

Browse

The preferred browse species is mountain big sagebrush, which has provided 50%-60% of the total browse cover since 1997. Identification of this species has been problematic due to differing growth forms. It is likely that a minor component of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) is also present. Sagebrush density steadily declined from 3,400 plants/acre (8,401 plants/ha) in 1983 to 1,920 plants/acre (4,744 plants/ha) in 1997, increased to 2,220 plants/acre (5,486 plants/ha) in 2002, then decreased to 1,740 plants/acre (4,299 plants/ha) in 2007. Average cover decreased from 11% in 1997 to 6% by 2007. Decadence has ranged from 20% to 47% of the population since 1983, while young plants have comprised less than 10% of the population. Plants displaying poor vigor have fluctuated from 8% to 28% of the population since 1983. Use has been light-moderate in all years, with some heavy use in 1989, 2002, and 2007. Annual leader growth averaged 2.2 inches (5.6 cm) in 2002 and 1.9 inches (4.9 cm) in 2007.

Stansbury cliffrose also provides some browse, but occurs infrequently. Cliffrose density decreased from 166 plants/acre (410 plants/ha) in 1983 to 40 plants/acre (99 plants/ha) in 1997, and was not sampled within the density strips in 2002 and 2007. Use was light-moderate in 1983 and heavy in all other sample years. Annual leader growth averaged 3 inches (7.6 cm) in 2007.

Point-centered quarter data estimates of juniper density were 52 trees/acre (128 trees/ha) in 2002 and 43 trees/acre (106 trees/ha) in 2007. Although juniper density estimates decreased, tree size increased. Average trunk diameter was 3.9 inches (9.9 cm) in 2002 and 7.5 inches (19 cm) in 2007. The majority of the trees sampled in 2007 were over 4 feet (1.2 m) in height.

Herbaceous Understory

Perennial herbaceous species have steadily increased in nested frequency since 1983. The dominant perennial grasses include crested wheatgrass (*Agropyron cristatum*), Sandberg bluegrass (*Poa secunda*), and bluebunch wheatgrass (*Agropyron spicatum*). Average perennial grass cover has been 15%-18% since 1997. Average cheatgrass (*Bromus tectorum*) cover increased from 3% in 2002 to 10% in 2007. This species provided 15% of the total grass cover in 2002 and 37% in 2007.

The forb component is dominated by annual species. Average forb cover has increased from 5% in 1997 and 2002 to 7% in 2007. Pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*) are the dominant forbs, and have provided over 60% of the total forb cover since 1997. Bur buttercup cover increased from 1% in 1997 to 3% in 2002 and 4% in 2007. Bur buttercup is an undesirable, allelopathic annual (Buchanan et al. 1978).

1989 TREND ASSESSMENT

The trend for browse is down. Sagebrush density decreased from 3,400 plants/acre (8,401 plants/ha) to 2,766 plants/acre (6,835 plants/ha). Decadence increased from 26% to 39% of the population, and young recruitment decreased from 9% to 0% of the population. Plants displaying poor vigor increased from 8% of the population to 18%. Use increased, with approximately half of the sampled plants showing moderate-heavy use. Cliffrose density also decreased from 166 plants/acre (410 plants/ha) to 133 plants/acre (329 plants/ha). Decadence increased to 25% of the population, and use also increased to heavy. The trend for grass is up. The sum of nested frequency for perennial grasses increased 57%. Sandberg bluegrass increased significantly in nested frequency. The trend for forbs is up. The sum of nested frequency for perennial forbs increased substantially, and the number of perennial species sampled increased from three to 11.

browse - down (-2) grass - up (+2) forb - up (+2)

1997 TREND ASSESSMENT

The trend for browse is slightly down. Sagebrush density continued to decline from 2,766 plants/acre (6,835 plants/ha) to 1,920 plants/acre (4,744 plants/ha), although some of this change can be attributed to the increase in sampling area. Young recruitment increased to 5% of the population, and seedlings were sampled for the first time at a density of 60 seedlings/acre (148 seedlings/ha). Plants displaying poor vigor continued to increase from 18% to 28% of the population. Use slightly decreased to light-moderate. Cliffrose density decreased substantially, from 133 plants/acre (329 plants/ha) to 40 plants/acre (99 plants/ha). Decadence increased from 25% to 50% of the population and use remained heavy. The trend for grass is up. The sum of nested frequency for perennial grasses increased 65%. Crested wheatgrass increased significantly in nested frequency. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs doubled. Sego lily (*Calochortus nuttallii*) increased significantly in nested frequency. The Desirable Components Index (DCI) was rated as fair due to moderate browse cover with low young recruitment and low perennial forb cover, but high perennial grass cover.

winter range condition (DCI) - fair (52) Mid-level potential scale
browse - slightly down (-1) grass - up (+2) forb - slightly up (+1)

2002 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density increased from 1,920 plants/acre (4,744 plants/ha) to 2,220 plants/acre (5,486 plants/ha) and average cover slightly decreased from 11% to 9%. Decadence increased from 20% of the population to 44%, and reproduction and recruitment declined to almost nothing. Plants classified as dying increased from 8% of the population to 14%. Vigor improved from 28% of the plants displaying poor vigor to only 15%. Use slightly increased, with 9% of the sampled plants showing heavy hedging. No cliffrose plants were sampled. The trend for grass is stable. The sum of nested frequency for perennial grasses changed little. Cheatgrass changed little in nested frequency and its average cover slightly decreased from 4% to 3%. The trend for forbs is stable. The sum of nested frequency for perennial forbs increased 17% and average cover increased from less than 1% to 2%. However, the number of perennial species sampled decreased from 11 to eight. Longleaf phlox (*Phlox longifolia*) increased significantly in nested frequency, while pale alyssum and sego lily decreased significantly in nested frequency. The DCI rating decreased to poor, mainly due to an increase in decadence and decrease in recruitment of browse.

winter range condition (DCI) - poor (45) Mid-level potential scale
browse - stable (0) grass - stable (0) forb - stable (0)

2007 TREND ASSESSMENT

The trend for browse is down. Sagebrush density declined from 2,220 plants/acre (5,486 plants/ha) to 1,740 plants/acre (4,299 plants/ha) and average cover decreased from 9% to 6%. Decadence continued to increase to 47%, and reproduction and recruitment remained very low. Almost 25% of the sampled plants were classified as dying. Plants displaying poor vigor increased from 15% of the population to 28% and use remained mostly light-moderate, with some heavy hedging. The trend for grass is stable. The sum of nested frequency for perennial forbs increased 14%, and bluebunch wheatgrass increased significantly in nested frequency. However, the nested frequency of cheatgrass almost doubled, and quadrat frequency increased from 63% to 96%. Average cheatgrass cover increased from 3% to 10%. The trend for forbs is stable. The sum of nested frequency for perennial forbs increased 16%. However, bur buttercup increased significantly in nested frequency. The DCI rating declined slightly to very poor-poor, due to decreases in browse cover and recruitment, as well as increases in browse decadence and annual grass cover.

winter range condition (DCI) - very poor-poor (34) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 16

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	a7	a17	b143	b133	b118	9.05	8.84	5.11
G	Agropyron intermedium	-	-	-	2	-	-	.03	-
G	Agropyron spicatum	a10	ab30	ab33	b38	c80	1.42	1.89	3.52
G	Bromus japonicus (a)	-	-	a22	a15	a31	.12	.05	.16
G	Bromus tectorum (a)	-	-	a183	a163	b309	4.46	2.77	10.37
G	Oryzopsis hymenoides	a1	a5	-	a4	a-	-	.03	.00
G	Poa bulbosa	-	-	-	-	5	-	-	.01
G	Poa pratensis	3	-	-	-	-	-	-	-
G	Poa secunda	a103	bc149	b161	bc182	c204	4.20	5.09	8.74
G	Sitanion hystrix	a9	a8	a8	a4	a11	.07	.21	.24
Total for Annual Grasses		0	0	205	178	340	4.58	2.83	10.53
Total for Perennial Grasses		133	209	345	363	418	14.75	16.11	17.65
Total for Grasses		133	209	550	541	758	19.34	18.94	28.18
F	Agoseris glauca	-	-	-	1	-	-	.00	-
F	Alyssum alyssoides (a)	-	-	b264	a151	b215	3.04	.37	.88
F	Astragalus calycosus	-	3	-	-	-	-	-	-
F	Astragalus cibarius	-	-	-	-	11	-	-	.69
F	Astragalus eurekensis	-	a2	a10	b31	a7	.07	1.23	.04
F	Castilleja linariaefolia	-	a1	a1	a1	-	.01	.00	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Camelina microcarpa (a)	-	-	$_{a}$10	-	$_{a}$7	.02	-	.02
F	Calochortus nuttallii	$_{a}$2	$_{a}$6	$_{b}$18	$_{a}$1	$_{a}$4	.10	.00	.02
F	Chorispora tenella (a)	-	-	$_{a}$4	$_{a}$6	-	.03	.30	-
F	Comandra pallida	$_{a}$2	$_{a}$1	-	-	-	-	-	-
F	Collinsia parviflora (a)	-	-	-	$_{a}$6	$_{a}$4	-	.01	.01
F	Cymopterus sp.	-	-	-	$_{a}$6	$_{a}$2	-	.03	.03
F	Holosteum umbellatum (a)	-	-	-	-	40	-	-	.11
F	Lactuca serriola	-	$_{a}$2	$_{a}$9	-	-	.02	-	-
F	Microsteris gracilis (a)	-	-	$_{a}$3	$_{a}$2	$_{a}$5	.00	.01	.01
F	Phlox austromontana	-	$_{a}$2	$_{a}$1	$_{a}$1	$_{a}$2	.00	.03	.00
F	Phlox longifolia	-	$_{a}$13	$_{a}$17	$_{b}$40	$_{b}$58	.04	.27	.33
F	Ranunculus testiculatus (a)	-	-	$_{a}$189	$_{a}$199	$_{b}$278	1.19	2.71	4.44
F	Senecio multilobatus	-	-	$_{a}$5	$_{a}$1	-	.01	.00	-
F	Sisymbrium altissimum (a)	-	-	-	$_{a}$1	$_{a}$2	-	.00	.03
F	Sphaeralcea coccinea	-	$_{a}$1	$_{a}$1	-	-	.00	-	-
F	Tragopogon dubius	-	$_{a}$3	$_{a}$2	-	-	.03	-	-
F	Unknown forb-annual (a)	-	-	4	-	-	.01	-	-
F	Unknown forb-perennial	2	-	-	-	-	-	-	-
F	Vicia americana	-	-	$_{a}$2	-	$_{a}$11	.03	-	.33
F	Zigadenus paniculatus	-	$_{a}$1	$_{a}$4	-	-	.01	-	-
Total for Annual Forbs		0	0	474	365	551	4.30	3.41	5.50
Total for Perennial Forbs		6	35	70	82	95	0.34	1.59	1.46
Total for Forbs		6	35	544	447	646	4.65	5.01	6.96

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

BROWSE TRENDS --
Management unit 21A, Study no: 16

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata vaseyana	65	71	64	10.92	9.01	6.35
B	Cercocarpus montanus	0	1	0	-	-	-
B	Chrysothamnus nauseosus	2	1	1	.79	.98	.63
B	Chrysothamnus viscidiflorus stenophyllus	40	46	39	5.49	4.12	3.50
B	Cowania mexicana stansburiana	2	0	0	.78	-	-
B	Gutierrezia sarothrae	34	19	7	.69	.15	.04
B	Juniperus osteosperma	1	1	1	3.40	.68	2.25
Total for Browse		144	139	112	22.08	14.94	12.78

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 16

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	7.59
Chrysothamnus nauseosus	-	.31
Chrysothamnus viscidiflorus stenophyllus	-	5.44
Juniperus osteosperma	.60	6.58

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21A, Study no: 16

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.2	1.9
Cercocarpus montanus	-	3.0

POINT-QUARTER TREE DATA --
Management unit 21A, Study no: 16

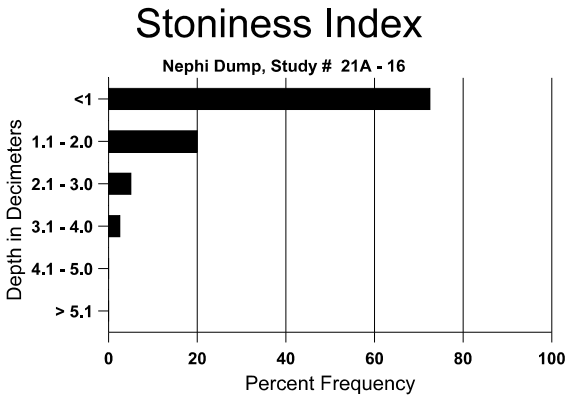
Species	Trees per Acre		Average diameter (in)	
	'02	'07	'02	'07
Juniperus osteosperma	52	43	3.9	7.5

BASIC COVER --
Management unit 21A, Study no: 16

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	.25	5.00	38.75	41.17	47.71
Rock	13.25	13.00	9.50	10.58	8.03
Pavement	10.00	16.75	18.19	12.17	12.38
Litter	59.00	50.75	39.46	30.07	31.27
Cryptogams	4.00	4.50	3.96	14.77	4.36
Bare Ground	13.50	10.00	7.75	16.69	11.03

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 16, Nephi Dump

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
9.1	71.0 (10.7)	6.9	42.0	27.4	30.6	2.9	7.7	284.8	.7



PELLET GROUP DATA --
Management unit 21A, Study no: 16

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	22	5	51
Elk	-	-	1
Deer	17	12	8
Cattle	8	1	9

Days use per acre (ha)	
'02	'07
-	-
-	-
31 (76)	18 (45)
7 (16)	24 (59)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 16

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
83	**3400**	-	300	2200	900	-	36	0	26	-	8	22/24
89	**2766**	-	-	1700	1066	-	35	14	39	4	18	34/30
97	**1920**	60	100	1440	380	540	38	0	20	8	28	24/33
02	**2220**	-	20	1220	980	420	32	9	44	14	15	24/31
07	**1740**	20	-	920	820	520	24	14	47	24	28	30/36
Cercocarpus montanus												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**20**	-	-	-	20	-	0	0	100	100	100	-/-
07	**0**	-	-	-	-	-	0	0	0	-	0	-/-
Chrysothamnus nauseosus												
83	**100**	-	-	100	-	-	0	0	0	-	0	26/27
89	**100**	-	-	100	-	-	33	0	0	-	0	19/22
97	**40**	-	-	-	40	-	0	0	100	-	0	-/-
02	**20**	-	-	-	20	-	0	0	100	-	0	42/74
07	**20**	-	-	-	20	-	0	0	100	-	100	23/66
Chrysothamnus viscidiflorus stenophyllus												
83	**399**	-	33	300	66	-	0	0	17	-	0	18/20
89	**733**	-	-	700	33	-	0	0	5	-	5	13/14
97	**1780**	-	40	1580	160	20	0	0	9	1	2	17/18
02	**2380**	-	60	1780	540	100	0	0	23	7	7	16/22
07	**1820**	20	-	800	1020	20	2	0	56	13	14	16/24
Cowania mexicana stansburiana												
83	**166**	-	-	166	-	-	40	0	0	-	0	27/25
89	**133**	-	-	100	33	-	0	100	25	25	25	22/25
97	**40**	-	-	20	20	-	0	100	50	-	0	64/66
02	**0**	-	-	-	-	-	0	0	0	-	0	58/37
07	**0**	-	-	-	-	-	0	0	0	-	0	53/58

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae												
83	**1166**	-	333	833	-	-	0	0	0	-	0	15/15
89	**2532**	-	133	2266	133	-	0	0	5	3	3	10/9
97	**1920**	120	400	1500	20	40	0	0	1	1	1	11/11
02	**680**	-	20	400	260	660	0	0	38	38	38	7/8
07	**140**	20	-	140	-	-	0	0	0	-	0	9/10
Juniperus osteosperma												
83	**33**	-	33	-	-	-	0	0	-	-	0	-/-
89	**66**	-	66	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	0	-	-	0	-/-
Leptodactylon pungens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	10/18
Purshia tridentata												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	11/16
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 21A-18-07

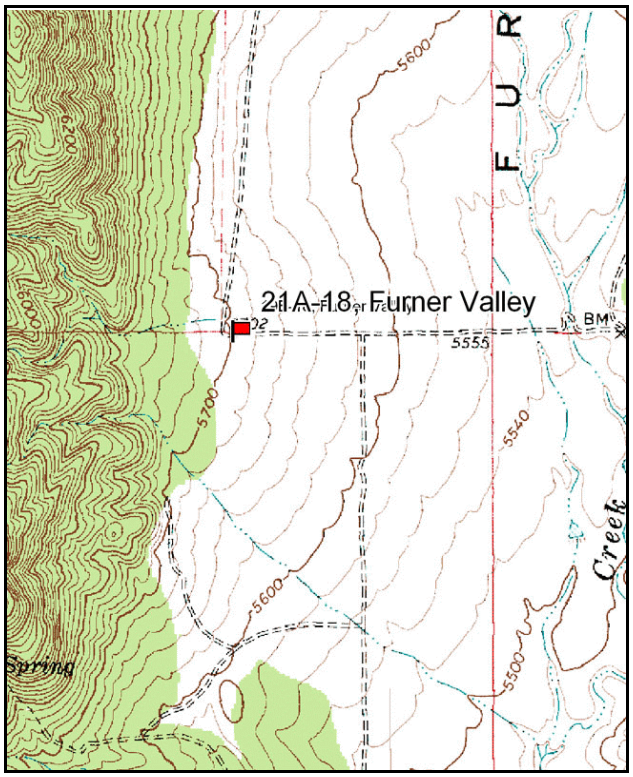
Study site name: Furner Valley . Vegetation type: Big Sagebrush-Grass .

Compass bearing: frequency baseline 188 degrees magnetic.

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

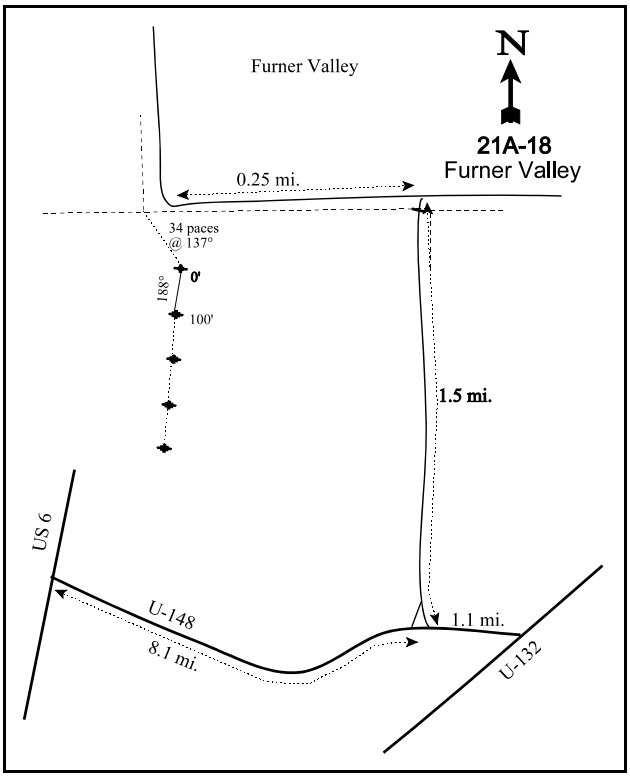
LOCATION DESCRIPTION

From a point on Highway U-148, located 8.1 miles east of the junction of Highway U-148 and U.S. 6, proceed north on the dirt road to Furner Valley for 1.50 miles. At this point, there is a "T" intersection with cropland immediately to the north. Turn left (west) for 0.25 miles, to where the road turns north again at a right angle. Stop! From the corner of the fence, walk 34 paces at an azimuth of 137 degrees M to the 0-foot marker of the frequency baseline, a green steel fencepost 15 inches high with a red browse tag, number 3936, attached.



Map Name: Furner Ridge

Township 13S , Range 2W , Section 18



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 406477 E 4393624 N

DISCUSSION

Furner Valley - Trend Study No. 21A-18

Study Information

This study samples deer winter range on the west side of Furner Valley. The vegetation type is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and grass, with antelope bitterbrush (*Purshia tridentata*) as a sub-dominant shrub [elevation: 5,700 feet (1,737 m), slope: 8%, aspect: east]. Immediately west of the study is a mature stand of pinyon-juniper, which provides escape and thermal cover. The study was mowed or aerated between the 2002 and 2007 readings, thinning the browse cover substantially. Deer use has been moderate-heavy in the past, and there has also been evidence of cattle and sheep use. In 1989, when conditions were dry, it was observed that cattle had made considerable use of the annual bitterbrush growth by 20 July. The area is in close proximity to a large dryland farm, which may attract deer in the spring. A pellet group transect estimated 36 deer days use/acre (89 ddu/ha) in 2002 and only 1 day use/acre (3 ddu/ha) in 2007. Cattle use was estimated at 6 days use/acre (14 cdu/ha) in 2002 and 10 days use/acre (25 cdu/ha) in 2007. Horse use was estimated at 5 days use/acre (13 hdu/ha) in 2002 and 20 days use/acre (50 hdu/ha) in 2007. Sheep use was estimated at 4 days use/acre (10 sdu/ha) in 2002.

Soil

The soil is classified within the Borvant series (USDA-NRCS 2007). The soils within this series are shallow above a petrocalcic horizon, and are well-drained. They formed in alluvium or colluvium derived from limestone and sandstone. The soil is light in color with rock scattered across the soil surface and throughout the profile. The texture is a sandy clay loam with a neutral reaction (pH 7.1). Relative bare ground cover has steadily decreased from 21% in 1997 to 14% in 2007, while relative pavement cover has ranged from 6% to 9%. Combined relative vegetation and litter cover has ranged from 66% to 75% between 1997 and 2007. The erosion condition class was determined as stable in 2002 and slight in 2007, due to apparent soil and surface rock movement, pedestalling, flow patterns.

Browse

Mountain big sagebrush and antelope bitterbrush are the preferred browse species. Together they comprised approximately 50% of the total vegetative cover in 1997 and 2002, and only 27% in 2007 after being mowed. Sagebrush density declined from 2,799 plants/acre (6,916 plants/ha) in 1983 to 1,980 plants/acre (4,893 plants/ha) in 2002, then 940 plants/acre (2,323 plants/ha) in 2007 after the treatment. Average cover decreased from 11% in 1997 to only 1% in 2007. Sagebrush decadence was moderate-high at approximately 25% in 1997 and 2002, 50% in 1983 and 2007, and 75% in 1989. Young recruitment was low at 4% of the population in 1983 and 1989, but has improved to 11%-24% since 1997. The density of dead plants increased from 380 plants/acre (939 plants/ha) in 1997 to 780 plants/acre (1,927 plants/ha) in 2002 and 1,760 plants/acre (4,349 plants/ha) in 2007 following the treatment. Plants displaying poor vigor decreased from 52% of the population in 1989 to 10% in 2002, then increased after the treatment to 55% in 2007. Many of the plants with poor vigor in 2007 had been mowed. Use was moderate-heavy in 1983, but has been mostly light in subsequent samples, with some heavy hedging in 2002 and 2007. Annual leader growth averaged 2.6 inches (6.6 cm) in 2002 and 2.5 inches (6.4 cm) in 2007.

Bitterbrush density decreased from 399 plants/acre (986 plants/ha) in 1983 to 299 plants/acre (739 plants/ha) in 1989, increased to 580 plants/acre (1,433 plants/ha) in 1997, then decreased after the treatment to 460 plants/acre (1,137 plants/ha) in 2007. Its average cover increased from 5% in 1997 to 9% in 2002, then declined to 4% in 2007 following the treatment. The population has been mostly mature in all sampling years, with low recruitment. Decadence has decreased significantly from 33% of the population in 1989 to only 4% in 2007. Vigor was excellent until 2007, when 30% of the sampled plants showed poor vigor because they had been mowed. Use was light-moderate in 1983, moderate in 1989-2002, and light in 2007. Annual leader growth averaged 1.4 inches (3.6 cm) in 2002 and 3 inches (7.6 cm) in 2007.

Utah juniper (*Juniperus osteosperma*) trees are also scattered throughout the study. Point-centered quarter data estimated a relatively stable juniper density of 29 trees/acre (72 trees/ha) in 1997, 35 trees/acre (86 trees/ha) in 2002, and 36 trees/acre (89 trees/ha) in 2007. Average trunk diameter was 4.3 inches (10.9 cm) in 1997, 3.3 inches (8.4 cm) in 2002 and 5 inches (12.7 cm) in 2007. The majority of the trees sampled in 2007 were either in the 1-4 foot (0.3-1.2 m) or 8-12 foot (2.4-3.7 m) height class.

Herbaceous Understory

Perennial grasses are common in the understory, and have provided 53%-85% of the total grass cover since 1997. Needle-and-thread (*Stipa comata*) is the most abundant perennial grass, and bottlebrush squirreltail (*Sitanion hystrix*), Sandberg bluegrass (*Poa secunda*), and Indian ricegrass (*Oryzopsis hymenoides*) are also relatively common. In 2007, it was noted that the perennial grasses were very heavily grazed by 28 August. Average cheatgrass (*Bromus tectorum*) cover decreased from 5% in 1997 to 2% in 2002, then increased dramatically to 10% in 2007. Cheatgrass comprised 15% of the total grass cover in 2002 and almost 50% in 2007.

Forbs are relatively diverse and have increased in average cover from 4% in 1997 to 8% in 2007. However, the majority of the forb cover has been provided by annual species since 1997. The most abundant forb is pale alyssum (*Alyssum alyssoides*), which comprised 87% of the total forb cover in 2002 and 93% in 2007. Musk thistle (*Carduus nutans*), a noxious annual, was sampled in one quadrat in 1997. The most abundant perennials have included Torrey milkvetch (*Astragalus calycosus*), Lewis flax (*Linum lewisii*), longleaf phlox (*Phlox longifolia*), and lobeleaf groundsel (*Senecio multilobatus*).

1989 TREND ASSESSMENT

The trend for browse is down. Sagebrush density decreased slightly, from 2,799 plants/acre (6,916 plants/ha) to 2,566 plants/acre (6,340 plants/ha), however, decadence increased from 48% of the population to 75%. Young recruitment remained low at 4% of the population. Plants displaying poor vigor increased from 6% of the population to 52% and use decreased to mostly light. Bitterbrush density decreased 25%, from 399 plants/acre (986 plants/ha) to 299 plants/acre (739 plants/ha), and decadence increased to one-third of the population. Recruitment slightly increased, with 11% of the population consisting of young plants. Vigor remained excellent, and use increased to moderate. The trend for grass is slightly up. The sum of nested frequency for perennial grasses increased 19%. Needle-and-thread increased significantly in nested frequency, while squirreltail decreased significantly in nested frequency. The trend for forbs is up. The sum of nested frequency for perennial forbs increased 64%. Both longleaf and desert phlox (*Phlox austromontana*) increased significantly in nested frequency.

browse - down (-2) grass - slightly up (+1) forb - up (+2)

1997 TREND ASSESSMENT

The trend for browse is slightly down, however, many of the changes in browse may be attributed to the increase in sampling area. Sagebrush density continued to decrease from 2,566 plants/acre (6,340 plants/ha) to 2,100 plants/acre (5,189 plants/ha). Young recruitment increased from 4% of the population to 16%, and decadence decreased from 75% of the population to 27%. However, plants classified as dying increased from 12% to 16% of the population. Dead plants were sampled for the first time at a density of 380 plants/acre (939 plants/ha). Vigor improved from 52% of the population showing poor vigor to 24%, and use remained light. Bitterbrush density increased from 299 plants/acre (739 plants/ha) to 580 plants/acre (1,433 plants/ha). Decadence decreased from 33% of the population to 10%, and recruitment also decreased from 11% of the population to 3%. Vigor remained good on most plants, and use remained moderate. The trend for grass is stable. The sum of nested frequency for perennial grasses changed little. Sandberg bluegrass increased significantly in nested frequency, while Indian ricegrass decreased significantly in nested frequency. The trend for forbs is stable. The sum of nested frequency for perennial forbs decreased 7%. Lobeleaf groundsel and Torrey milkvetch increased significantly in nested frequency, and desert phlox decreased significantly in

nested frequency. Musk thistle was sampled for the first time. The Desirable Components Index (DCI) was rated as poor-fair due to good browse and perennial grass cover, but low browse recruitment and the presence of a noxious weed.

winter range condition (DCI) - poor-fair (52) Mid-level potential scale
browse - slightly down (-1) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density declined slightly from 2,100 plants/acre (5,189 plants/ha) to 1,980 plants/acre (4,893 plants/ha). Young recruitment continued to increase from 16% of the population to 24%, while decadence remained relatively stable at 25% of the population. Plants classified as dying decreased from 16% of the population to 8%. Vigor continued to improve, and use remained mostly light. Bitterbrush density also decreased slightly from 580 plants/acre (1,433 plants/ha) to 520 plants/acre (1,285 plants/ha). However, average cover increased from 5% to 9%. No young plants were sampled and decadence decreased slightly from 10% of the population to 8%. Vigor remained good and use remained moderate. The trend for grass is stable. The sum of nested frequency for perennial grasses changed little, however, average perennial cover increased from 9% to 14%. Squirreltail decreased significantly in nested frequency. Cheatgrass did not change significantly in nested frequency, but its quadrat frequency increased from 69% to 81%. Average cheatgrass cover decreased from 5% to 2%. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased almost 60%. Lobeleaf groundsel and Lewis flax decreased significantly in nested frequency, while pale alyssum increased significantly. Musk thistle was not sampled. The DCI rating improved to good due to increases in browse and perennial grass cover, a decrease in annual grass cover, and the absence of noxious weeds.

winter range condition (DCI) - good (69) Mid-level potential scale
browse - stable (0) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is down. Due to the mowing treatment, sagebrush density decreased from 1,980 plants/acre (4,893 plants/ha) to 940 plants/acre (2,323 plants/ha). Decadence doubled to 51% of the population and the density of dead plants increased to 1,760 plants/acre (4,349 plants/ha). Recruitment declined, with 11% of the population consisting of young plants. Plants displaying poor vigor increased from 10% to 55% of the population and use remained mostly light. Bitterbrush density decreased from 520 plants/acre (1,285 plants/ha) to 460 plants/acre (1,137 plants/ha), and decadence continued to decline to 4% of the population. Young recruitment did not increase. Plants displaying poor vigor increased from 4% of the population to 30% and use decreased to mostly light. The trend for grass is stable. The sum of nested frequency for perennial grasses increased 18%, mostly due to a significant increase in squirreltail. However, cheatgrass also increased significantly in nested frequency and its quadrat frequency increased from 81% to 94%. Average cheatgrass cover increased from 2% to 10%. Perennial grass cover decreased from 14% to 12%. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs continued to decrease 44%. Annual forb cover increased from 6% to 8%. The DCI rating declined to very poor-poor due to decreases in browse cover and recruitment, and an increase in annual grass cover.

winter range condition (DCI) - very poor-poor (35) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - slightly down (-1)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 18

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	-	-	a2	a1	-	.15	.03	-
G	Agropyron smithii	-	-	-	a8	a7	-	.04	.07
G	Agropyron spicatum	a10	a12	a4	a19	a10	.06	1.00	.54
G	Bromus japonicus (a)	-	-	-	4	-	-	.01	-
G	Bromus tectorum (a)	-	-	a219	a241	b303	5.28	2.36	10.33
G	Oryzopsis hymenoides	ab40	b58	a20	ab38	a23	.82	1.77	.73
G	Poa fendleriana	-	2	-	-	-	-	-	-
G	Poa pratensis	a3	a4	-	-	-	-	-	-
G	Poa secunda	a7	a6	b37	b41	b60	.47	1.11	1.58
G	Sitanion hystrix	c107	b70	bc82	a25	bc76	1.28	.49	2.21
G	Sporobolus cryptandrus	-	-	a4	a2	a3	.15	.00	.03
G	Stipa comata	a111	bc178	ab172	bc180	c192	5.96	9.34	6.40
G	Unknown grass - perennial	-	-	3	-	-	.15	-	-
Total for Annual Grasses		0	0	219	245	303	5.28	2.37	10.33
Total for Perennial Grasses		278	330	324	314	371	9.06	13.80	11.58
Total for Grasses		278	330	543	559	674	14.34	16.18	21.92
F	Alyssum alyssoides (a)	-	-	a305	b333	b351	2.28	5.83	7.39
F	Antennaria rosea	-	-	2	-	-	.00	-	-
F	Arabis sp.	5	-	-	-	-	-	-	-
F	Astragalus calycosus	a5	ab13	c30	bc23	abc14	.40	.30	.09
F	Astragalus sp.	-	-	a7	a4	-	.09	.03	-
F	Astragalus utahensis	-	-	-	-	-	-	-	.00
F	Caulanthus crassicaulis	a34	a20	-	-	-	-	-	-
F	Carduus nutans (a)	-	-	2	-	-	.00	-	-
F	Calochortus nuttallii	a6	-	a3	a3	-	.04	.00	-
F	Castilleja sp.	-	-	b9	a1	-	.17	.03	-
F	Chaenactis douglasii	a2	a4	a10	-	-	.04	-	-
F	Crepis acuminata	-	-	2	-	-	.03	-	-
F	Erodium cicutarium (a)	-	-	-	-	11	-	-	.24
F	Ipomopsis aggregata	2	-	-	-	-	-	-	-
F	Lithospermum incisum	a11	a8	a1	a2	-	.01	.00	-
F	Linum lewisii	c33	c52	bc31	a3	ab11	.16	.04	.08
F	Lygodesmia grandiflora	a5	a8	-	a8	a2	-	.04	.00
F	Machaeranthera canescens	-	1	-	-	-	-	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Microsteris gracilis (a)	-	-	-	-	3	-	-	.00
F	Oenothera sp.	$_{a}$1	$_{a}$5	$_{a}$6	$_{a}$3	-	.01	.03	-
F	Phlox austromontana	$_{a}$3	$_{b}$19	$_{a}$6	$_{a}$6	$_{a}$3	.19	.18	.00
F	Phlox longifolia	$_{a}$10	$_{b}$36	$_{ab}$36	$_{ab}$25	$_{a}$7	.13	.10	.01
F	Ranunculus testiculatus (a)	-	-	-	-	3	-	-	.03
F	Senecio multilobatus	$_{a}$4	$_{a}$16	$_{b}$44	$_{a}$1	$_{a}$2	.39	.00	.03
F	Sphaeralcea coccinea	-	-	-	$_{a}$3	$_{a}$6	-	.00	.01
F	Streptanthus cordatus	-	$_{a}$13	$_{a}$14	$_{a}$1	$_{a}$1	.11	.00	.00
F	Tragopogon dubius	$_{a}$17	$_{a}$7	$_{a}$7	$_{a}$6	$_{a}$4	.09	.05	.01
F	Unknown forb-perennial	-	3	-	-	-	-	-	-
F	Zigadenus paniculatus	-	$_{b}$21	$_{a}$3	$_{a}$2	$_{a}$1	.00	.01	.00
Total for Annual Forbs		0	0	307	333	368	2.29	5.83	7.67
Total for Perennial Forbs		138	226	211	91	51	1.89	0.85	0.27
Total for Forbs		138	226	518	424	419	4.18	6.69	7.94

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

BROWSE TRENDS --
Management unit 21A, Study no: 18

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata vaseyana	66	60	32	11.05	9.38	1.44
B	Chrysothamnus viscidiflorus viscidiflorus	1	2	1	-	-	-
B	Gutierrezia sarothrae	59	55	45	1.29	.96	.96
B	Juniperus osteosperma	4	5	4	2.74	4.59	4.90
B	Leptodactylon pungens	0	1	1	-	.00	.03
B	Opuntia sp.	1	1	1	.00	.03	-
B	Purshia tridentata	25	23	19	4.83	8.89	3.70
Total for Browse		156	147	103	19.93	23.88	11.04

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 18

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	2.58
Gutierrezia sarothrae	-	.85
Juniperus osteosperma	.20	7.55
Purshia tridentata	-	6.43

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21A, Study no: 18

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.6	2.5
Purshia tridentata	1.4	3.0

POINT-QUARTER TREE DATA --
Management unit 21A, Study no: 18

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	35	36

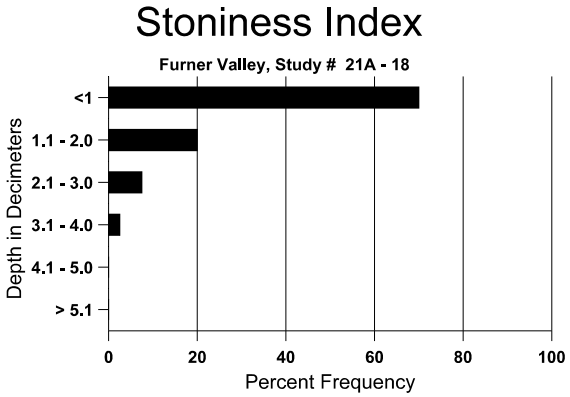
Average diameter (in)	
'02	'07
3.4	5

BASIC COVER --
Management unit 21A, Study no: 18

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	2.00	7.25	34.52	46.75	37.59
Rock	1.75	1.50	1.52	2.01	1.04
Pavement	1.00	20.50	8.73	7.61	9.66
Litter	52.25	41.25	40.31	36.43	44.8
Cryptogams	0	3.75	1.25	11.40	1.11
Bare Ground	43.00	25.75	22.77	20.70	15.25

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 18, Furner Valley

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
10.7	66.8 (13.8)	7.1	54.4	23.1	22.6	2.4	10.5	160.0	.6



PELLET GROUP DATA --
Management unit 21A, Study no: 18

Type	Quadrat Frequency			Days use per acre (ha)	
	'97	'02	'07	'02	'07
Sheep	2	2	-	4 (10)	-
Rabbit	12	21	85	-	-
Horse	-	2	10	-	20 (50)
Elk	1	-	1	-	-
Deer	11	12	1	36 (89)	1 (3)
Cattle	2	2	5	6 (14)	10 (25)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 18

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
83	**2799**	-	100	1366	1333	-	38	56	48	-	6	24/31
89	**2566**	333	100	533	1933	-	21	0	75	12	52	24/28
97	**2100**	60	340	1200	560	380	10	0	27	15	24	33/48
02	**1980**	120	480	1000	500	780	14	4	25	8	10	31/43
07	**940**	100	100	360	480	1760	9	11	51	19	55	19/27
Chrysothamnus viscidiflorus viscidiflorus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	16/26
02	**40**	-	-	40	-	-	0	0	-	-	0	7/14
07	**40**	-	20	20	-	-	0	0	-	-	0	9/21

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae												
83	**699**	-	-	633	66	-	10	10	9	-	52	7/6
89	**1565**	66	166	1266	133	-	0	0	8	-	2	9/8
97	**5000**	40	1220	3780	-	-	0	0	0	-	0	10/10
02	**3820**	-	100	3200	520	1420	0	0	14	9	9	7/10
07	**2160**	400	280	1760	120	60	0	0	6	3	6	8/13
Juniperus osteosperma												
83	**33**	-	33	-	-	-	0	0	-	-	0	-/-
89	**33**	-	33	-	-	-	0	0	-	-	0	-/-
97	**80**	-	20	60	-	-	0	0	-	-	0	-/-
02	**100**	20	-	100	-	-	0	0	-	-	0	-/-
07	**100**	-	-	100	-	-	0	0	-	-	0	-/-
Leptodactylon pungens												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	9/16
07	**60**	-	20	40	-	-	0	0	-	-	0	4/12
Opuntia sp.												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	3/3
02	**20**	-	-	20	-	-	0	0	-	-	0	5/7
07	**20**	-	-	20	-	-	0	0	-	-	0	4/10
Purshia tridentata												
83	**399**	-	33	366	-	-	50	0	0	-	0	29/42
89	**299**	-	33	166	100	-	67	22	33	-	0	23/37
97	**580**	-	20	500	60	40	59	17	10	3	3	34/58
02	**520**	-	-	480	40	80	58	15	8	4	4	46/81
07	**460**	-	-	440	20	-	13	17	4	-	30	33/63

SUMMARY

WILDLIFE MANAGEMENT SUBUNIT 21A - FILLMORE, OAK CREEK

Community Types

Six trend studies were resampled in 2007; two on summer range and four on winter range. Four were dominated by mountain big sagebrush, one by juniper, and one by perennial grasses.

Precipitation

Vegetation trends are dependent on annual, spring, and fall precipitation. Precipitation data for this subunit were gathered from the Oak City, Nephi, and Scipio weather stations (Figures 1 and 2). The average annual precipitation for the subunit was below normal in 1987-1992, 2001, and 2002, and below 75% of normal (drought conditions) in 1989 (Figure 1). Spring precipitation was below normal in 1987, 1990, 1993, 1994, 1997, 1998, 2000, and 2001, and near or below 75% of normal (drought conditions) in 1989, 1992, 2004, and 2007 (Figure 2). Spring precipitation is crucial for the recruitment of browse seedlings and the establishment of native perennial grasses and forbs. Fall precipitation was below 50% of normal in 1995 and 1999 (Figure 2).

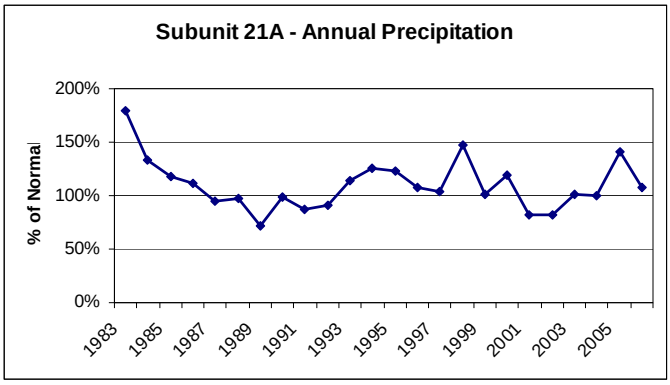


Figure 1. Annual precipitation for subunit 21A. Precipitation data were collected at the Oak City, Nephi, and Scipio weather stations (Utah Climate Summaries 2007).

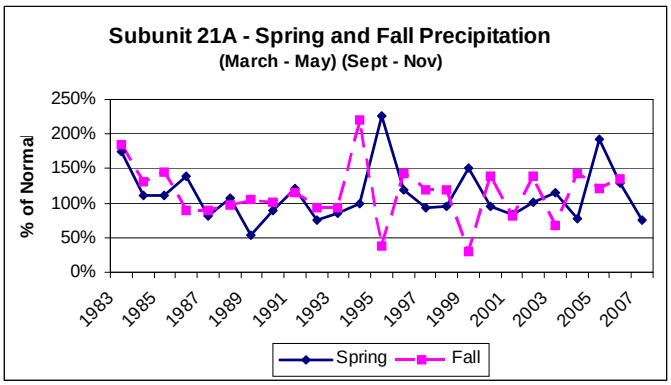


Figure 2. Spring and fall precipitation for subunit 21A. Precipitation data were collected at the Oak City, Nephi, and Scipio weather stations (Utah Climate Summaries).

Browse

The average browse trend steadily decreased from 1983 to 1998, remained stable between 1998 and 2002, and declined from 2002 to 2007 (Figure 3). Mountain big sagebrush cover decreased drastically between 1997 and 2002, then slightly increased by 2007 (Figure 4). The decrease in cover was mainly due to the wildfire that burned the Dennis Spring study (21A-13) in 2001. This fire reduced the mature sagebrush canopy, however, an abundance of seedlings caused the average mountain big sagebrush density to increase between 1997 and 2002 (Figure 5). The density remained stable between 2002 and 2007. Mountain big sagebrush decadence remained relatively stable from 1997 to 2002, and increased from 2002 to 2007 (Figure 6). Wyoming big sagebrush was only sampled at the Horse Hollow study (21A-4), before it burned and was chained in 2006. Sagebrush cover and decadence both increased slightly from 1998 to 2003 (Figures 4 and 6), while density declined (Figure 5). Low sagebrush was only sampled at Sunrise Canyon (21A-12). Cover and density remained relatively stable between 1997 and 2002, then drastically decreased by 2007 (Figures 4 and 5). Low sagebrush decadence also remained rather stable from 1997 to 2002, and increased in 2007 (Figure 6).

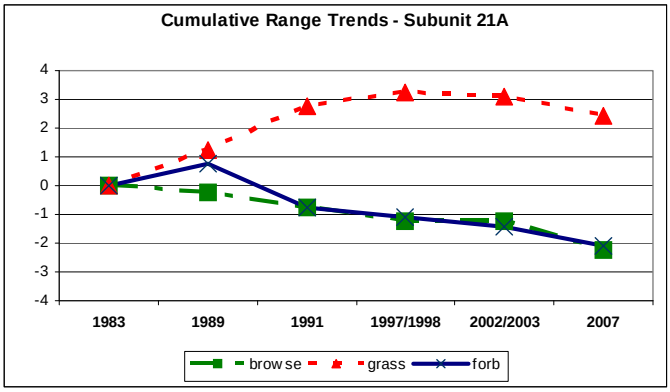


Figure 3. Cumulative range trends for subunit 21A, Fillmore, Oak Creek.

Grass

The average grass trend increased from 1983 to 1998, then declined in 2002 and 2007 (Figure 3). Average perennial grass cover fluctuated between 9% and 11% between 1997 and 2007, while average cheatgrass cover declined from 5% to 3% between 1997 and 2003, then increased to 11% by 2007 (Figure 7). The changes in cheatgrass cover may be attributed to precipitation patterns. Cheatgrass is a winter annual, and thrives on fall precipitation (Monsen 1994). Fall precipitation was below normal in 1999, 2001, and 2003 (Figure 3), which may have inhibited the spread of cheatgrass before the 2002/2003 readings. However, fall precipitation was above normal in 2004-2006. Several of the studies were also in areas that burned or were mechanically treated between 2002 and 2007, opening a niche in which cheatgrass could establish and spread. The sum of nested frequency for perennial grasses decreased slightly from 1997 to 2007, while the nested frequency of cheatgrass remained stable from 1997 to 2003, then increased by 2007 (Figure 8). Bulbous bluegrass was only sampled at Cascade Spring (21A-3) and Nephi Dump (21A-16), where it steadily increased in cover and nested frequency between 1997 and 2007 (Figures 7 and 8).

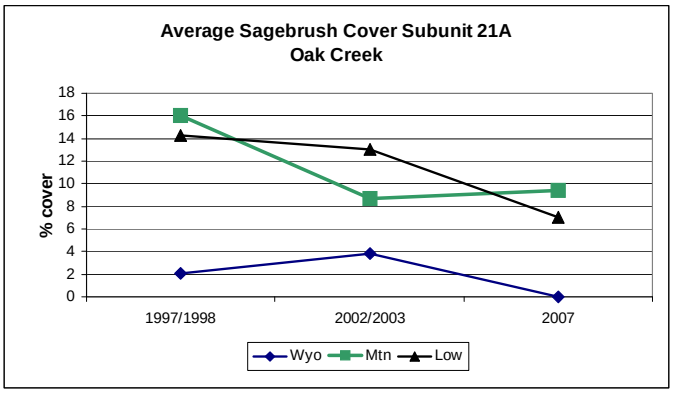


Figure 4. Average Wyoming big, mountain big, and low sagebrush cover for subunit 21A.

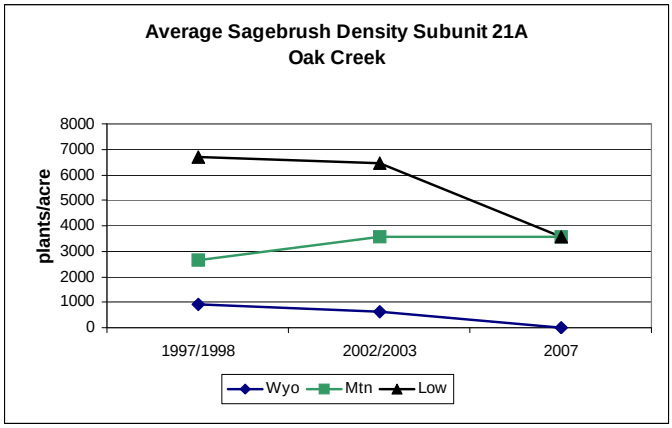


Figure 5. Average Wyoming big, mountain big, and low sagebrush density for subunit 21A.

Forbs

The average forb trend increased between 1983 and 1989, then declined from 1989 to 2007 (Figure 3). Average perennial forb cover increased slightly between 1997 and 2003, then decreased by 2007 (Figure 7). The sum of nested frequency for perennial forbs remained stable from 1997 to 2003, and declined from 2003 to 2007 (Figure 8). The forb components at Sunrise Canyon (21A-12) and Dennis Spring (21A-13) were dominated by perennial species such as silvery lupine, ballhead waterleaf, phlox, and sandwort. However, the most abundant forbs on the other studies included alyssum, storksbill, draba, and bur buttercup. Several noxious weeds, including houndstongue, bindweed, and musk thistle, have been sampled in this subunit.

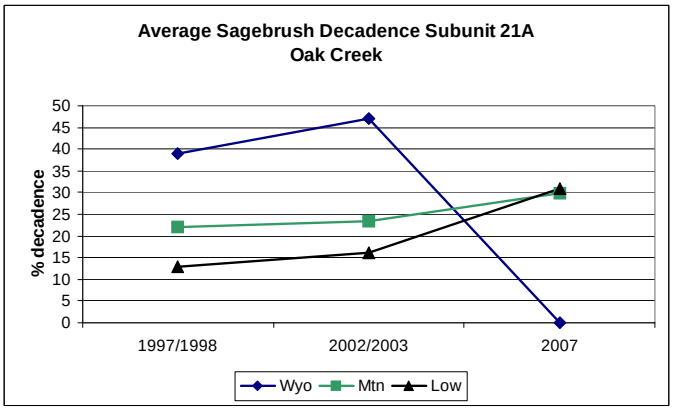


Figure 6. Average Wyoming big, mountain big, and low sagebrush decadence for subunit 21A.

Desirable Components Index

The average Desirable Components Index (DCI) score for low potential studies was rated as very poor-poor in 1998 and 2003, and declined to very poor by 2007 (Figure 9). These studies had very low preferred browse and perennial herbaceous cover, and high cheatgrass cover. The average DCI score for mid-level potential studies was rated as poor-fair in 1997, fair in 2002, and very poor-poor in 2007 (Figure 9). These studies

displayed low cover and poor recruitment of browse species, and increasing cheatgrass cover.

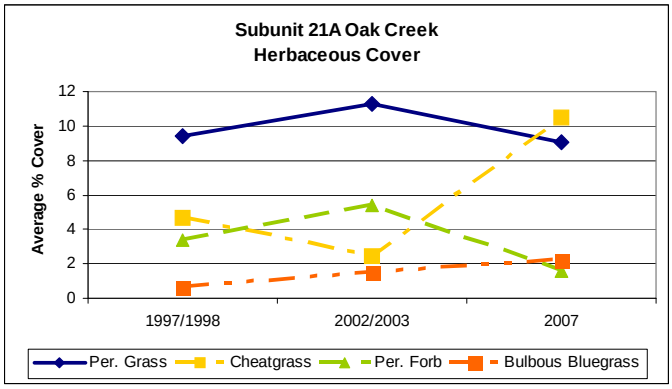


Figure 7. Average herbaceous cover for subunit 21A.

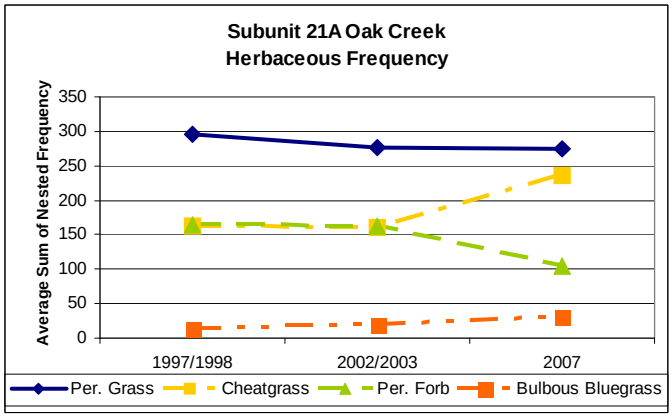


Figure 8. Average herbaceous nested frequency for subunit 21A.

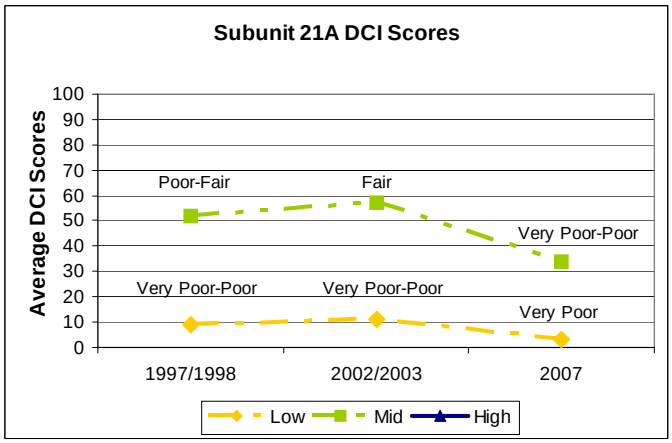


Figure 9. Subunit 21A average Desirable Components Index (DCI) scores by year. The DCI scores are divided into three categories based on ecological potentials, which include low, mid-level and high.

2007 Special Projects

2007 SPECIAL PROJECTS - MANAGEMENT UNITS 19B, 21A

Special projects are carried out by project personnel to address immediate range monitoring needs throughout the state. These are projects that are deemed high priority and cannot wait for the regular rotation schedule. The location and number of special studies conducted depend upon funding and need, but usually occur on an annual basis. Range trend personnel work with DWR biologists and federal land managers to prioritize special studies within each DWR administrative region. Special projects are established for a variety of reasons including, but not limited to the following: to monitor habitat restoration projects; to monitor high use areas by wildlife, livestock, or both (conflict areas); and to gather baseline data for anticipated habitat treatments in the future.

In 2007, special studies were reread in management units 19B (West Desert, Vernon) and 21A (Fillmore, Oak Creek). These studies were reread to monitor habitat restoration projects that resulted from the large wildfires that occurred in 1996 west of Nephi. Maps, data tables, and a narrative of these projects follow.

LEAMINGTON BURN COMPLEX SPECIAL STUDIES

Introduction

In 1996, Utah experienced one of its most active, extensive, and devastating fire seasons in history. In Millard and Juab Counties alone, some 250,000 acres (101,171 ha) burned. The Leamington complex was the largest burned area, covering approximately 138,340 acres (55,984 ha) of mostly pinyon-juniper woodland. Rehabilitation efforts began in the fall of 1996, which included drilling the more accessible low-lying areas, with the remainder being aerially seeded and one-way chained to cover the seed. On the Leamington complex, about 6,100 acres (2,469 ha) were treated with a rangeland drill, 10,736 acres (4,345 ha) were aerially seeded and one-way chained, and 8,308 acres (3,362 ha) were aerially seeded only. Aerially seeding and then chaining is an effective method of breaking up burned trees, which provide valuable surface litter to help protect the soil from erosion. Chaining also enhances seed establishment by covering the seed with soil and litter. This practice was stopped temporarily because of concerns voiced by environmental and Native American groups with regard to archeological resources in the burned areas, even though an archeological survey had been completed. In 1997, two studies named Leamington Burn and Chain (21A-21) and Leamington Burn (21A-22) were established. One was placed in a burned and seeded area, and the other in an area that had been burned, seeded, then chained one-way. Additional pairs of studies were established in 1998; two near Jericho (19B-21 and 19B-22), and two near Paul Bunyan (21A-19 and 21A-20) to monitor the effects of treatments to those at the Leamington sites. The purpose of these studies was to monitor and compare the recovery of these areas following rehabilitation using seeding alone and seeding and chaining.

Seed Lists

Jericho State Section (19B-21)

Aerial Seed Mix

Species	Pounds per acre	Kg per ha
High Crest (*Agropyron cristatum*)	5	5.6
Intermediate Wheatgrass (*Agropyron intermedium*)	3	3.4
Alfalfa (*Medicago sativa*)	1	1.1
Yellow Sweet Clover (*Melilotus officinalis*)	0.5	0.6

Jericho BLM Section (19B-22)

Aerial Seed Mix

Species	Pounds per acre	Kg per ha
High Crest (*Agropyron cristatum*)	3.1	3.5
Rye (*Elymus junceus*)	2.1	2.4
Tall wheatgrass (*Agropyron elongatum*)	2.0	2.3
Smooth Brome (*Bromus inermis*)	1.9	2.1

Dribbler Seed Mix

Fourwing saltbush (*Atriplex canescens*)	1.0	1.1

Paul Bunyan Burn (21A-19) and Paul Bunyan Burn and Chain (21A-20)

Aerial Mix

Species	Pounds of Seed	Pounds per acre
Hycrest crested wheatgrass (*Agropyron cristatum*)	15,100	4.0
Russian wildrye (*Elymus junceus*)	11,350	3.0
Elongated wheatgrass (*Agropyron elongatum*)	7,500	2.0

Dribbler Mix

Fourwing saltbush (*Atriplex canescens*)	3,800	1.0

Leamington Burn (21A-22) and Leamington Burn and Chain (21A-21)

Aerial Mix

Species	Pounds of seed	Pounds per acre
Hycrest crested wheatgrass (*Agropyron cristatum*)	12,450	3.3
Russian wildrye (*Elymus junceus*)	12,450	3.3
Elongated wheatgrass (*Agropyron elongatum*)	8,300	2.2
Great Basin wildrye (*Elymus cinereus*)	2,000	0.53
Smooth brome (*Bromus inermis*)	600	0.16
Alfalfa (*Medicago sativa*)	1,200	0.32
Small burnet (*Sanguisorba minor*)	500	0.13

Dribbler Mix

Fourwing saltbush (*Atriplex canescens*)	3,700	1.0

Trend Study 19B-21-07

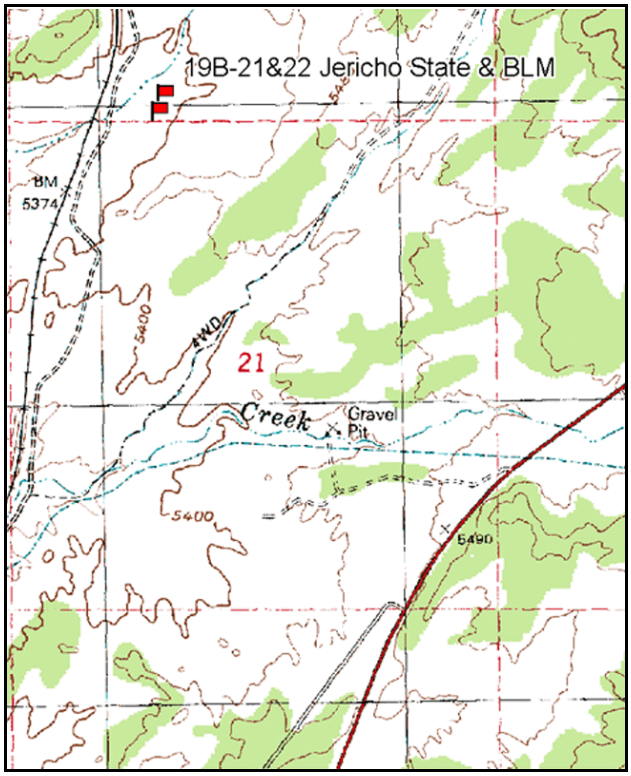
Study site name: Jericho State Section . Vegetation type: Burn .

Compass bearing: frequency baseline 0 degrees magnetic.

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

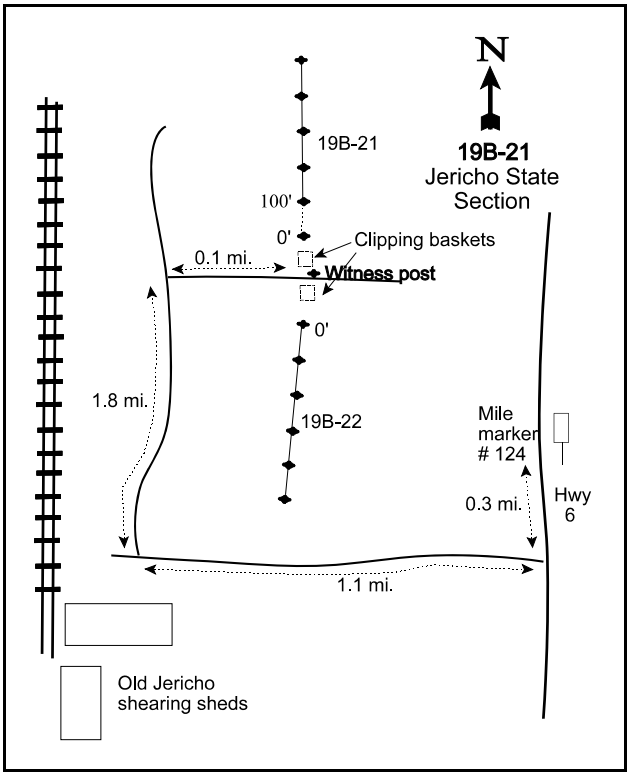
LOCATION DESCRIPTION

From mile marker 124 on Hwy 6, drive 0.1 miles south to a road heading west. Take this road for 1.1 miles to the old Jericho shearing sheds on the left and an intersection before the railroad tracks. Turn right and follow the road on the east side of the tracks for 1.8 miles. At this point is the border of state land and BLM land. Park here and walk for 0.1 miles to a witness post and some clipping baskets. The 0-foot stake is 100 feet directly north of the witness post.



Map Name: McIntyre

Township 12S , Range 3W , Section 16



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 398135 E 4403208 N

DISCUSSION

Jericho State Section - Trend Study No. 19B-21

Study Information

This study is located in Tintic Valley west of U.S. Highway 6, and north of the old Jericho sheep shearing sheds [elevation: 5,400 feet (1,646 m), slope: 5%, aspect: southwest]. The area was part of the extensive Leamington burn complex of 1996. The fire eliminated the dense sagebrush stand that had been present. This study samples a section of land owned by the State of Utah that was aerially seeded after the fire. The study was not chained to cover the seed. In 1998, pellet group data suggested that there was little rabbit use and sign of only a few trespass cattle. From the pellet group transect, sheep use was estimated at 64 days use/acre (159 sdu/ha) in 2002 and 39 days use/acre (96 sdu/ha) in 2007. No wildlife droppings were sampled in the pellet group transect, though deer pellets were sampled in quadrats in 2002 and 2007.

Soil

The study lies within the Wales loam soil series and consists of very deep, well-drained, moderate to moderately-slowly permeable soils. Soils in this series formed in alluvium derived from sandstone, shale, limestone, and igneous rocks, and are found on alluvial fans and plains. Soil depths are typically in excess of 4 feet (1.2 m) and have been disturbed by cultivation (USDA-NRCS 2007). At the study, the soil has a loam texture, and there is very little rock or pavement either on the surface or in the profile. The soil has a neutral reactivity with a pH of 7.1. The phosphorus concentration is 3.8 ppm, which is below the 6 ppm threshold that may limit normal plant growth and development (Tiedemann and Lopez 2004). Relative bare ground cover was high (52%) in 1998 and 2002, and slightly decreased in 2007 (47%). The presence of shallow gullies indicate that erosion occurred in the past, but these channels are now filled with grasses and forbs. The erosion condition was classified as stable in 2002 and increased to slight in 2007 due mainly to moderate pedestalling and light soil movement, gully and rill erosion, and flow patterns..

Browse

Before the 1996 fire consumed all of the basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), the estimated sagebrush density was 5,600 plants/acre (13,861 plants/ha). This estimate was made from the number of burned sagebrush stems measured in 1998. Following the wildfire, no surviving shrubs have been sampled, and none were included in the seed mix.

Herbaceous Understory

The herbaceous understory accounts for all of the vegetation cover, and perennial grasses are the most abundant of the herbaceous species. Perennial grass cover has been constant at 17% since 1998. Crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*Agropyron intermedium*) were seeded after the fire and have been two of the dominant grasses. Western wheatgrass *(Agropyron smithii*) was not included in the seed mix, but was first sampled in 2002 and has increased in frequency and cover. Other perennial grasses that are present, but infrequent, include Russian wildrye (*Elymus junceus*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*). Cheatgrass (*Bromus tectorum*) has been present in all sample years. Cheatgrass cover has fluctuated from less than 1% to 6%.

Perennial forb cover has decreased from 21% in 1998 to less than 1% in 2007. The diversity of the forb component has been low. Two seeded species, yellow sweet clover (*Melilotus officinalis*) and alfalfa (*Medicago sativa*), dominated the forb component in 1998 and provided 94% of the forb cover. Both species were large and vigorous. The frequency and cover of both species decreased dramatically in 2002 and 2007. Grasshoppers and Mormon crickets heavily utilized the yellow sweetclover in 1997 and alfalfa in 2002. Annual forbs accounted for 97% of forb cover in 2007, and desert alyssum (*Alyssum desertorum*) was the dominant species.

2002 TREND ASSESSMENT

Browse species are absent and so the trend is considered to be stable. The grass trend is stable. The sum of nested frequency of perennial grasses decreased 10%; much of the decrease was attributed to the significant decrease in intermediate wheatgrass. However, there was also a significant decrease in cheatgrass. The forb trend is down. The sum of nested frequency of perennial forbs decreased 41%, and the number of forb species decreased from 11 to three. Quadrat frequency of yellow sweet clover decreased from 40% to 0%. Alfalfa vigor was much reduced and plants were being defoliated by Mormon crickets (*Anabrus simplex*). The 1998 Desirable Components Index (DCI) score was fair due to the non-existent browse cover, but high perennial grass and forb cover. In 2002, the DCI score remained fair.

1998 winter range condition (DCI) - fair (36) Low potential scale
2002 winter range condition (DCI) - fair (40) Low potential scale
browse - stable (0) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend continues to be stable. The grass trend is stable. The sum of nested frequency of perennial grasses increased 11%, but there was a significant increase in the nested frequency of cheatgrass. The forb trend is down. The sum of nested frequency of perennial forbs decreased 86%, which was attributed to the significant decrease in alfalfa. The DCI score remained fair.

winter range condition (DCI) - fair (29) Low potential scale
browse - stable (0) grass - stable (0) forb - down (-2)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 21

Type	Species	Nested Frequency			Average Cover %		
		'98	'02	'07	'98	'02	'07
G	Agropyron cristatum	$_{a}$250	$_{ab}$292	$_{b}$315	9.84	15.13	13.07
G	Agropyron intermedium	$_{b}$159	$_{a}$41	$_{a}$54	6.69	1.22	1.75
G	Agropyron smithii	-	$_{a}$45	$_{a}$59	-	.27	2.25
G	Bromus tectorum (a)	$_{c}$247	$_{a}$37	$_{b}$168	5.99	.47	1.01
G	Elymus junceus	-	5	-	-	.30	-
G	Oryzopsis hymenoides	$_{a}$4	$_{a}$6	-	.03	.33	-
G	Sitanion hystrix	$_{b}$18	-	$_{a}$6	.79	-	.18
Total for Annual Grasses		247	37	168	5.99	0.47	1.01
Total for Perennial Grasses		431	389	434	17.36	17.26	17.27
Total for Grasses		678	426	602	23.35	17.74	18.28
F	Alyssum desertorum (a)	$_{a}$13	$_{a}$10	$_{b}$297	.19	.02	2.28
F	Astragalus sp.	3	-	-	.03	-	-
F	Descurainia pinnata (a)	$_{a}$3	-	$_{a}$2	.00	-	.03
F	Draba sp. (a)	-	-	5	-	-	.01
F	Erigeron sp.	2	-	-	.15	-	-
F	Melilotus officinalis	93	-	-	8.05	-	-

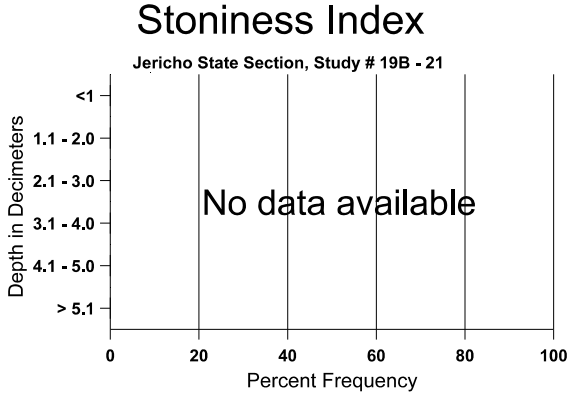
Type	Species	Nested Frequency			Average Cover %		
		'98	'02	'07	'98	'02	'07
F	Medicago sativa	$_{b}$175	$_{b}$164	$_{a}$20	12.24	6.72	.03
F	Phlox hoodii	2	-	-	.15	-	-
F	Phlox longifolia	$_{a}$2	-	$_{a}$1	.03	-	.03
F	Potentilla gracilis	1	-	-	.15	-	-
F	Sisymbrium altissimum (a)	$_{a}$10	-	$_{a}$21	.49	-	.33
F	Sphaeralcea coccinea	$_{a}$2	$_{a}$2	$_{a}$2	.03	.01	.00
Total for Annual Forbs		26	10	325	0.68	0.02	2.66
Total for Perennial Forbs		280	166	23	20.84	6.73	0.07
Total for Forbs		306	176	348	21.53	6.75	2.73

BASIC COVER --
Management unit 19B, Study no: 21

Cover Type	Average Cover %		
	'98	'02	'07
Vegetation	41.50	26.00	24.68
Rock	.13	.06	.09
Pavement	.80	.84	.39
Litter	10.19	27.91	34.09
Cryptogams	0	.31	.36
Bare Ground	56.47	59.64	52.12

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 21, Jericho State Section

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
16.1	67.0 (17.5)	7.1	44.0	31.1	24.9	.9	3.8	278.4	.6



PELLET GROUP DATA --
Management unit 19B, Study no: 21

Type	Quadrat Frequency		
	'98	'02	'07
Sheep	-	16	6
Rabbit	2	2	35
Elk	-	-	1
Deer	-	3	6
Cattle	-	-	1

Days use per acre (ha)	
'02	'07
64 (159)	39 (96)
-	-
-	-
-	-
-	-

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 21

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata tridentata												
98	**0**	-	-	-	-	5600	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Opuntia sp.												
98	**0**	-	-	-	-	40	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 19B-22-07

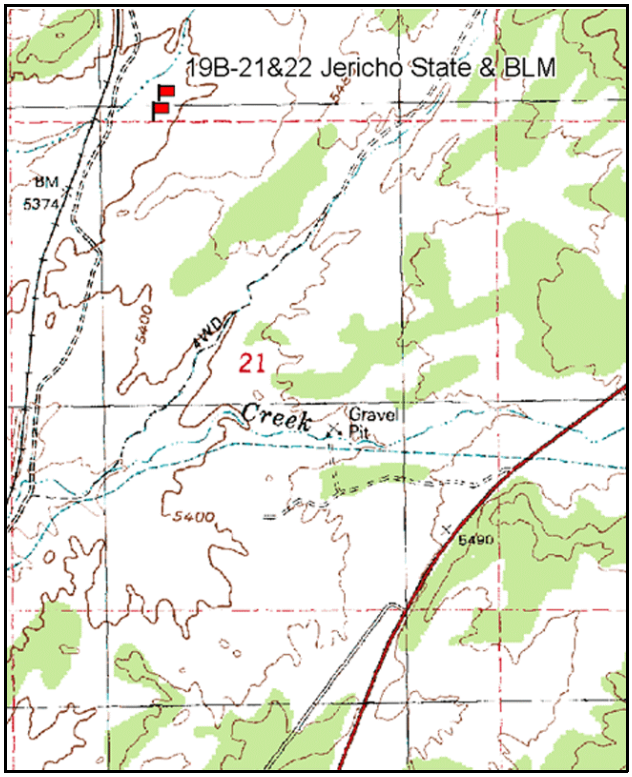
Study site name: Jericho BLM . Vegetation type: Burn .

Compass bearing: frequency baseline 0 degrees magnetic.

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

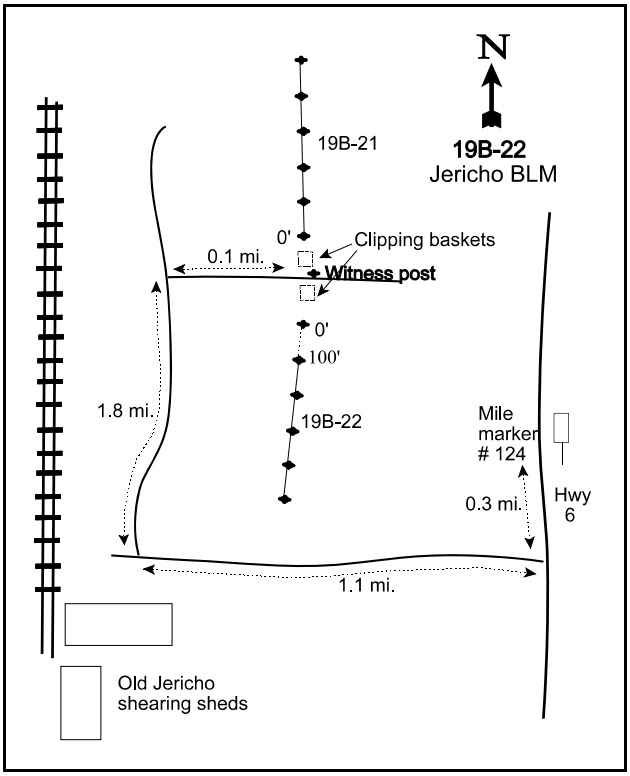
LOCATION DESCRIPTION

From mile marker 124 on Hwy 6, drive 0.1 miles south to a road heading west. Take this road for 1.1 miles to the old Jericho shearing sheds on the left and an intersection before the railroad tracks. Turn right and follow the road on the east side of the tracks for 1.8 miles. At this point is the border of state land and BLM land. Turn right and follow the faint road along the border for 0.1 miles to a witness post and some clipping baskets. The 0-foot stake is 100 feet at 192 degrees magnetic from the witness post. The 0-foot stake has browse tag #475.



Map Name: McIntyre

Township 12S , Range 3W , Section 16



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 398115 E 4403152 N

DISCUSSION

Jericho BLM - Trend Study No. 19B-22

Study Information

This study is located in Tintic Valley west of U.S. Highway 6, and north of the old Jericho sheep shearing sheds and is adjacent to the Jericho State Section study (19B-21) [elevation: 5,400 feet (1,646 m), slope: 5%, aspect: southwest]. The area was part of the extensive Leamington burn complex of 1996. The fire eliminated the dense sagebrush stand that had been present. This study samples a section of land managed by the Bureau of Land Management that was aerially seeded and then one-way chained with an Ely chain after the fire. Fourwing saltbush (*Atriplex canescens*) seed was applied using a dribbler during the chaining. The 1998 pellet group transect sampled only one deer pellet group and a few trespass cattle pats. From the pellet group transect, sheep use was estimated at 36 days use/acre (88 sdu/ha) in 2002 and 40 days use/acre (99 sdu/ha) in 2007. Deer pellets were sampled in only three quadrats in 2002 and in one in 2007.

Soil

The study lies within the Wales loam soil series and consists of very deep, well-drained, moderate to moderately-slowly permeable soils. The soils in this series formed in alluvium derived from sandstone, shale, limestone, and igneous rocks, and are found on alluvial fans and plains. Soil depths are typically in excess of 4 feet (1.2 m) and have been disturbed by cultivation (USDA-NRCS 2007). At the study, the soil has a loam texture, with very little rock or pavement either on the surface or in the profile. The pH is neutral (7.3). Percent organic matter is 2.5 times higher than the adjacent, unchained study. The phosphorus concentration is 3.8 ppm, which is below the 6 ppm threshold that may limit normal plant growth and development (Tiedemann and Lopez 2004). Relative bare ground cover is abundant and was 47% in 1998, 51% in 2002, and 39% in 2007. The erosion condition was classified as stable-slight in 2002 and stable in 2007. Severe pedestalling around the base of bunchgrasses provides most of the evidence of past erosion.

Browse

Before the 1996 fire consumed all of the basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), the estimated sagebrush density was 2,640 plants/acre (6,535 plants/ha), only about half as many plants as on the adjacent study. This estimate was made from the number of burned sagebrush stems measured in 1998 and may be skewed due to the disturbance of burned stems that occurred during the chaining. No living sagebrush plants have been sampled since the burn.

Fourwing saltbush is the only key browse species sampled since the fire. The density of fourwing saltbush has decreased from 400 plants/acre (990 plants/ha) in 1998 to 180 plants/acre (446 plants/ha) in 2007. No seedling saltbush have ever been sampled, and young plants were only sampled in 1998. There were no decadent plants in 1998, but decadent plants comprised about 80% of the population in successive samplings. The proportion of plants exhibiting poor vigor has ranged from 0% to 80%, and all plants with poor vigor were classified as dying. The average height and crown measurements have steadily increased. Together, the density and height and crown data suggest that the population is composed of fewer, but larger plants. Browse use on fourwing saltbush has been light to light-moderate.

Herbaceous Understory

The vegetative component is dominated by the herbaceous understory, in particular by seeded perennial grasses. Perennial grass cover was 24% in 1998, 22% in 2002, and 17% in 2007. The dominant perennial grasses are crested wheatgrass (*Agropyron cristatum*) and tall wheatgrass (*Agropyron elongatum*), which together have comprised 53% to 78% of the total vegetative cover. Two other seeded species, Russian wildrye (*Elymus junceus*) and smooth brome (*Bromus inermis*), are present at lower frequencies. Western wheatgrass (*Agropyron smithii*), bluebunch wheatgrass (*Agropyron spicatum*), and bottlebrush squirreltail (*Sitanion hystrix*) have also been measured at low frequencies. Cheatgrass (*Bromus tectorum*) cover decreased from

10% in 1998 to less than 1% in 2002, then increased to 2% in 2007. Japanese brome (Bromus japonicus) was sampled for the first time in 2007, but only in two quadrats.

In contrast to the seed mix at the adjacent study (19B-21), no forbs were included in the BLM seed mix. Perennial forb cover has been 0% since 1998, and annual cover has averaged 2% since 1998. The dominant forbs have been desert alyssum (*Alyssum desertorum*) and tumblemustard (*Sisymbrium altissimum*).

2002 TREND ASSESSMENT

The browse trend is down. The density of fourwing saltbush decreased 50%. There were no seedling or young plants measured. Decadence increased from 0% of the population to 80%, and all of the decadent shrubs were classified as dying. The density of dead plants increased from 0 plants/acre to 60 plants/acre (149 plants/ha). The decrease in fourwing saltbush was attributed to a region-wide drought (Utah Climate Summaries 2007) and sheep browsing. The grass trend is up. The sum of nested frequency of perennial grasses increased 15%, and two previously-absent native grasses were sampled: western wheatgrass and bluebunch wheatgrass. There was a significant decrease in the nested frequency of cheatgrass; quadrat frequency decreased from 94% to 7%. The forb trend is stable. The sum of nested frequency of perennial forbs decreased 83%, but perennial forbs already existed at extremely low frequencies. Annual forbs also decreased so that there were few forbs present. Again, the decrease in forbs was attributed to drought conditions. The 1998 Desirable Components Index (DCI) score was poor-fair due to the low browse and perennial forb cover, high annual grass cover, but high perennial grass cover. In 2002, the DCI score increased to fair due to the decrease in annual grass cover.

1998 winter range condition (DCI) - poor-fair (23) Low potential scale
2002 winter range condition (DCI) - fair (31) Low potential scale
browse - down (-2) grass - up (+2) forb - stable (0)

2007 TREND ASSESSMENT

The browse trend is stable. The density of fourwing saltbush decreased 10%, and there were still no seedling or young plants measured. Decadence remained high at 78% of the population but only 43% of the decadent plants were classified as dying. The density of dead plants did not change. Browse use shifted to light-moderate. The grass trend is slightly down. The sum of nested frequency of perennial grasses decreased 12%, including significant decreases in the nested frequencies of smooth brome and western wheatgrass. Cheatgrass significantly increased in nested frequency, and was measured in 78% of the quadrats. The forb trend is stable. The sum of nested frequency of perennial grasses did not change. Although there was a marked increase in annual forbs, the species have low forage value. The DCI score remained fair.

winter range condition (DCI) - fair (29) Low potential scale
browse - stable (0) grass - slightly down (-1) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 19B, Study no: 22

Type	Species	Nested Frequency			Average Cover %		
		'98	'02	'07	'98	'02	'07
G	Agropyron cristatum	$_{a}$133	$_{b}$193	$_{b}$224	5.14	10.33	9.42
G	Agropyron elongatum	$_{b}$198	$_{a}$108	$_{a}$93	14.29	7.15	4.66
G	Agropyron smithii	-	$_{b}$87	$_{a}$40	-	1.35	.75

Type	Species	Nested Frequency			Average Cover %		
		'98	'02	'07	'98	'02	'07
G	Agropyron spicatum	-	5	-	-	.15	-
G	Bromus inermis	$_{b}$35	$_{b}$46	$_{a}$21	1.29	.51	.30
G	Bromus japonicus (a)	-	-	3	-	-	.01
G	Bromus tectorum (a)	$_{c}$334	$_{a}$14	$_{b}$244	9.84	.06	1.72
G	Elymus junceus	$_{a}$35	$_{a}$35	$_{a}$57	1.79	1.83	1.99
G	Oryzopsis hymenoides	-	-	-	.00	-	-
G	Sitanion hystrix	$_{b}$31	$_{ab}$21	$_{a}$2	1.79	.48	.03
G	Vulpia octoflora (a)	-	-	2	-	-	.03
Total for Annual Grasses		334	14	249	9.84	0.06	1.75
Total for Perennial Grasses		432	495	437	24.32	21.83	17.16
Total for Grasses		766	509	686	34.17	21.89	18.92
F	Agoseris glauca	3	-	-	.00	-	-
F	Alyssum desertorum (a)	$_{b}$87	$_{a}$13	$_{c}$392	.62	.03	2.46
F	Calochortus nuttallii	2	-	-	.00	-	-
F	Collinsia parviflora (a)	-	-	3	-	-	.00
F	Descurainia pinnata (a)	$_{a}$4	-	$_{a}$1	.01	-	.00
F	Draba sp. (a)	-	-	3	-	-	.00
F	Helianthus annuus (a)	-	-	3	-	-	.03
F	Lactuca serriola	-	-	1	-	-	.00
F	Senecio multilobatus	1	-	-	.00	-	-
F	Sisymbrium altissimum (a)	$_{b}$33	$_{a}$2	$_{a}$7	1.91	.00	.07
F	Sphaeralcea grossulariifolia	$_{a}$-	$_{a}$1	-	.00	.00	-
Total for Annual Forbs		124	15	409	2.54	0.03	2.58
Total for Perennial Forbs		6	1	1	0.01	0.00	0.00
Total for Forbs		130	16	410	2.56	0.03	2.59

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

BROWSE TRENDS --
Management unit 19B, Study no: 22

Type	Species	Strip Frequency			Average Cover %		
		'98	'02	'07	'98	'02	'07
B	Atriplex canescens	16	9	8	.33	.58	.59
B	Opuntia sp.	0	1	1	-	-	-
Total for Browse		16	10	9	0.32	0.58	0.59

CANOPY COVER, LINE INTERCEPT --
Management unit 19B, Study no: 22

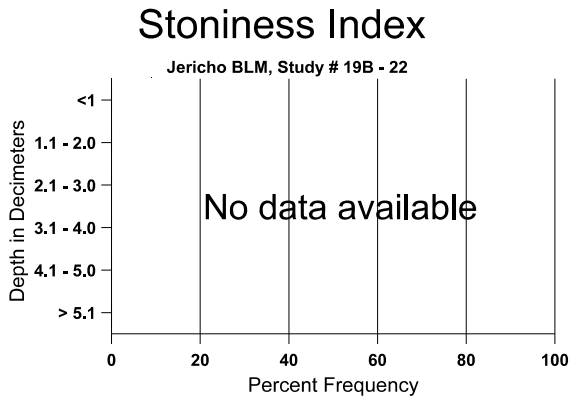
Species	Percent Cover	
	'02	'07
Atriplex canescens	-	1.39

BASIC COVER --
Management unit 19B, Study no: 22

Cover Type	Average Cover %		
	'98	'02	'07
Vegetation	39.77	24.76	25.07
Rock	.11	.12	.22
Pavement	2.41	2.14	1.58
Litter	14.53	26.26	36.72
Cryptogams	0	.04	2.11
Bare Ground	49.61	56.15	42.34

SOIL ANALYSIS DATA --
Herd Unit 19B, Study no: 22, Jericho BLM

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
17.5	67.4 (17.7)	7.3	44.0	30.1	25.9	2.5	4.0	364.8	.7



PELLET GROUP DATA --
Management unit 19B, Study no: 22

Type	Quadrat Frequency		
	'98	'02	'07
Sheep	-	17	7
Rabbit	1	4	20
Deer	-	3	1

Days use per acre (ha)	
'02	'07
35 (88)	40 (99)
-	-
-	-

BROWSE CHARACTERISTICS --
Management unit 19B, Study no: 22

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata tridentata												
98	**0**	-	-	-	-	2640	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Atriplex canescens												
98	**400**	-	300	100	-	-	0	0	0	-	0	17/17
02	**200**	-	-	40	160	60	10	30	80	80	80	26/37
07	**180**	-	-	40	140	60	33	11	78	33	33	40/56
Opuntia sp.												
98	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**20**	-	-	-	20	-	0	0	100	100	100	2/3
07	**20**	-	-	20	-	-	0	0	0	-	0	-/-

Summary and Comparison of Jericho State Section (19B-21) and Jericho BLM (19B-22)

These studies were established in 1998 to monitor the effect of chaining on vegetation recovery following the Leamington wildfire complex that burned through the area in 1996. The Jericho State Section study was seeded only, while the Jericho BLM study was seeded and then one-way chained. The purpose of the chaining was to cover the seed and to prepare the seedbed. Both processes enhance the establishment of the seeded species.

In addition to the type of treatment, these two studies had different seed mixes. Yellow sweet clover (*Melilotus officinalis*) and alfalfa (*Medicago sativa*) were included in the Jericho State Section seed mix, whereas there were no forbs in the Jericho BLM seed mix. Additionally, fourwing saltbush (*Atriplex canescens*) was included only in the Jericho BLM seed mix. The grass and forb seeds were aerially broadcast, and fourwing saltbush seeds were applied with a dribbler during the chaining. A total of 8 pounds of grass seed/acre (9 kg/ha) were seeded on the state section, while 9.1 pounds of grass seed/acre (10.7 kg/ha) were seeded onto the BLM study. It is difficult to determine if the difference in seeding rates accounted for some of the difference in vegetation recovery, or if the difference resulted from the chaining alone. However, since the difference between the seeding rates is relatively small, the difference in the vegetation recovery between the two studies is likely the result of the chaining.

After the wildfire and the treatment, perennial grasses were the key component in the vegetation community on both Jericho studies. In 1998, the average percent cover of perennial grasses was higher on the seeded and chained study (BLM; Figure 1). However, the sum of nested frequency of perennial grasses was nearly identical at both studies (Figure 2). In 2002, both the sum of nested frequency and percent cover of perennial grasses were higher on the seeded and chained study than on the seeded only study. When the studies were re-sampled in 2007, there was no difference in nested frequency or average cover of perennial grasses between the two studies.

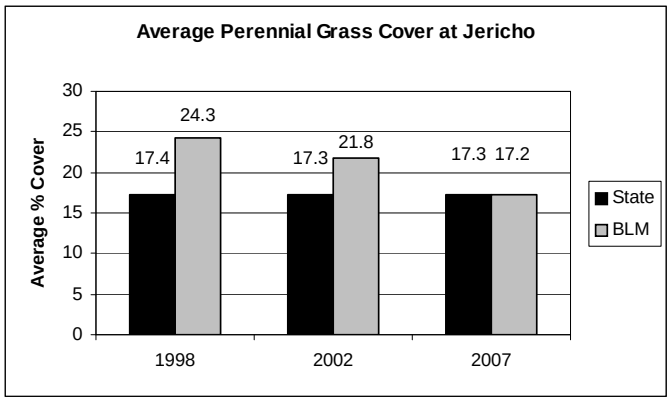


Figure 1. Average perennial grass cover from 1998 to 2007 at the Jericho rehabilitation studies.

Cheatgrass (*Bromus tectorum*) was very abundant at both Jericho studies in 1998 (Figures 3 and 4). Interestingly, cheatgrass had higher percent cover and nested frequency values on the seeded and chained study (BLM) than on the seeded only study. However in 2002, nested frequency and percent cover of cheatgrass were slightly higher on the state section, although both parameters were greatly reduced on both studies due to drought conditions. In 2007, cheatgrass nested frequency and average percent cover were higher on the seeded and chained study than on the seeded only study.

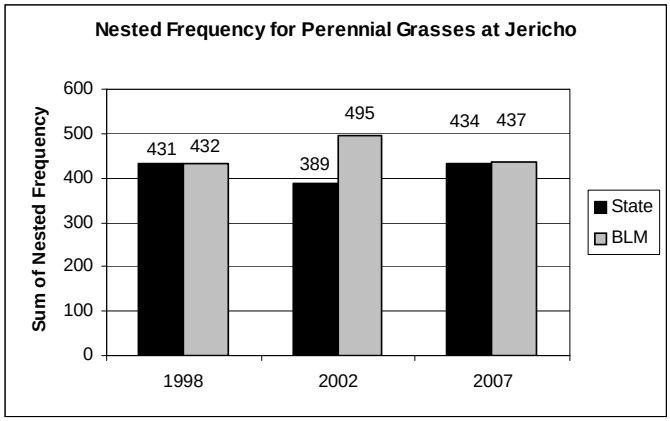


Figure 2. The sum of nested frequency of perennial grasses from 1998 to 2007 at the Jericho rehabilitation studies.

The seeded-only study initially had a very high cover of perennial forbs due to the abundance of two seeded species, alfalfa and yellow sweet clover. In 2002, alfalfa was still moderately abundant but yellow sweet clover was not sampled. Yellow sweet clover is a short-lived species, so this change is not surprising.

Drought conditions and Mormon crickets (*Anabrus simplex*) in 2002 resulted in poor vigor of most alfalfa plants. In 2007, alfalfa was sampled in only 7% of the quadrats, and cover decreased to less than one-tenth of a percent. Very few forbs occur on the seeded and chained study, but no forbs were seeded on this treatment. In 2007, the forb cover and composition were similar on both studies, dominated by the small annual forb desert alyssum (*Alyssum desertorum*).

As mentioned, fourwing saltbush was applied with a dribbler when the Jericho BLM study was chained, but no shrubs were seeded on the state section. The fourwing saltbush population was noted as vigorous and increasing in 1998, but the population decreased in 2002, and most of the population was classified as decadent and having poor vigor. In 2007, there were no young plants and decadence was nearly constant. However, vigor had improved and the average crown and width measurement had increased 14 inches (36 cm) and 19 inches (48 cm), respectively. No shrubs have been sampled on the state section, and due to the distance of any native seed source, it will likely remain so in the future.

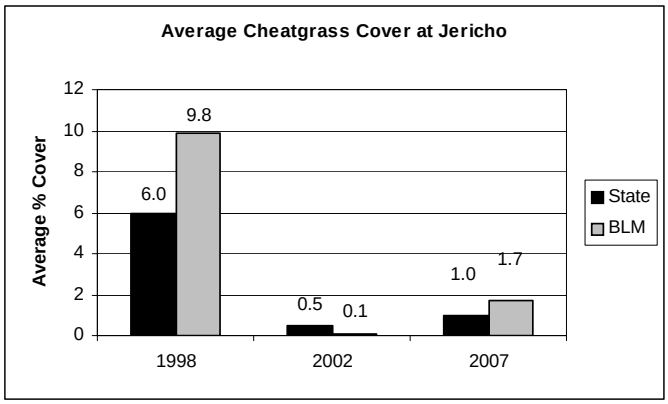


Figure 3. Average percent cover of cheatgrass from 1998 to 2007 at the Jericho rehabilitation studies.

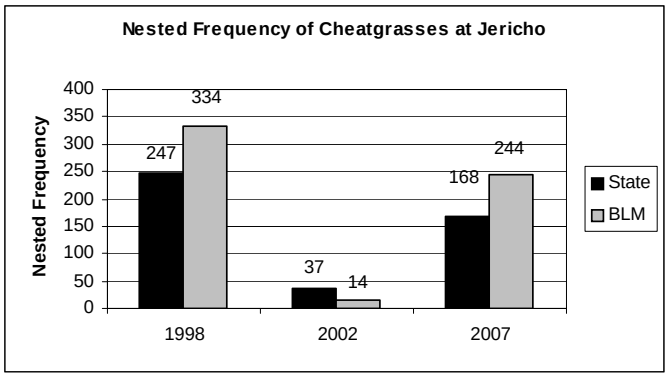


Figure 4. Nested frequency of cheatgrass from 1998 to 2007 at the Jericho rehabilitation studies.

Trend Study 21A-19-07

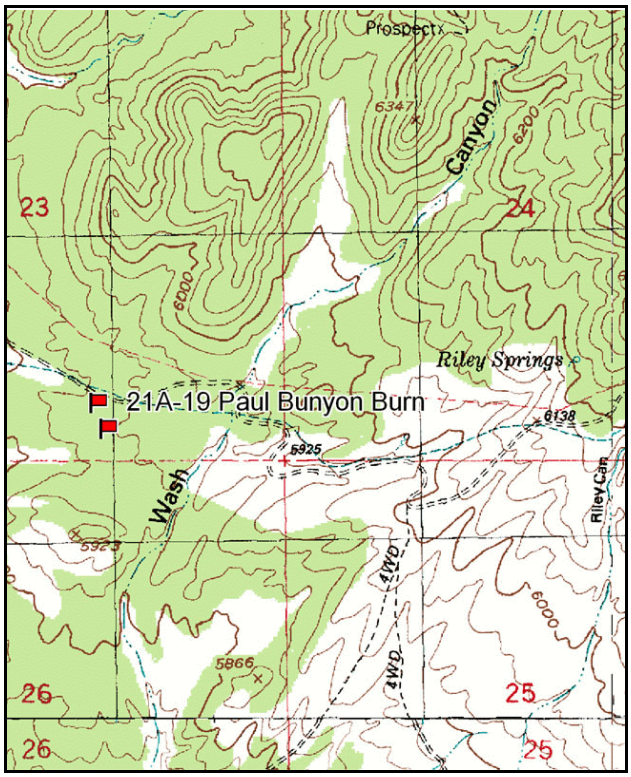
Study site name: Paul Bunyan Burn . Vegetation type: Burn and Seeded .

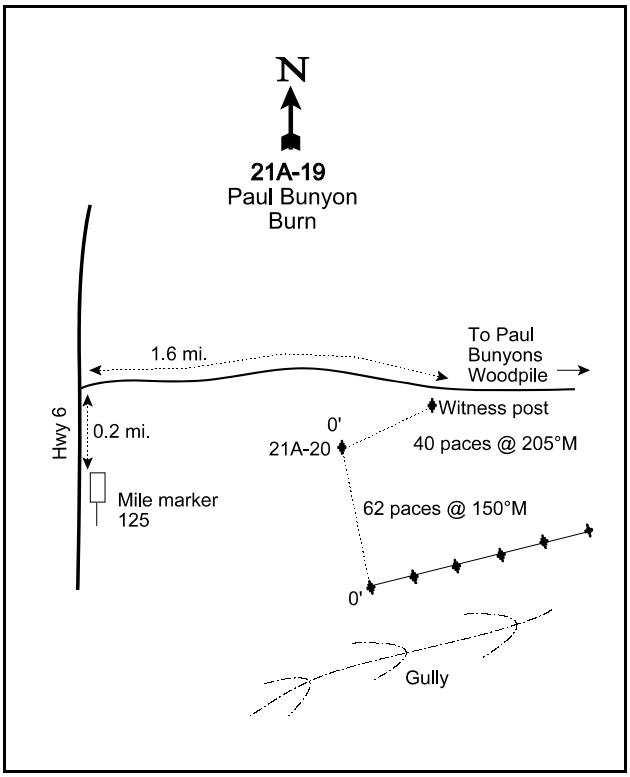
Compass bearing: frequency baseline 68 degrees magnetic.

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

LOCATION DESCRIPTION

From Hwy 6 go 0.2 miles north of mile marker 125. Turn right (east) heading toward the Paul Bunyan Woodpile. Drive 1.6 miles to a four foot tall witness post on the right side of the road. The 0-foot stake for study 19B-20 is 40 paces at 205degrees magnetic. The 0-foot stake for 19B-19 is 62 paces at 150 degrees magnetic from the other sites' 0-foot stake. The site is marked by short green fenceposts. The 0-foot stake is marked by browse tag # 66.





Map Name: McIntyre

Diagrammatic Sketch

Township 12S , Range 3W , Section 23

GPS: NAD 83, UTM 12S 401897 E 4401539 N

DISCUSSION

Paul Bunyan Burn - Trend Study No. 21A-19

Study Information

This study was established in 1998 to monitor a burned and seeded pinyon-juniper woodland [elevation: 5,900 feet (1,798 m), slope: 8%-10%, aspect: southwest]. This study and the adjacent Paul Bunyan Burn and Chain study (21A-20) were part of the extensive Leamington burn complex which affected approximately 138,340 acres (55,986 ha) of mostly pinyon-juniper rangelands. Rehabilitation efforts were started during the fall of 1996, and included drilling, chaining, and seeding. This study samples an area that was aerially seeded, but was not chained. It is the comparison to study 21A-20, which was chained. Wildlife use this area sparingly and deer and elk pellets have been infrequent in all readings. Deer use was estimated at 7 days use/acre (18 ddu/ha) in 2002. Rabbit pellet quadrat frequency has increased from 11% in 1998 to 80% in 2007. Cattle pats had a 2% quadrat frequency in 2007, but grazing appeared to be light.

Soil

The soil is classified within the Jericho series (USDA-NRCS 2007). The soils in this series are shallow over a duripan layer and are well-drained. They formed in alluvium derived mainly from igneous rocks. The soil texture is a sandy clay loam and the pH is neutral (7.0). Relative combined rock and pavement cover was high in 1998 at 32%, then decreased to 16% by 1999 and has remained relatively stable at less than 20%. The soil is rocky at soil depths greater than 4 inches (10.2 cm). Relative bare ground cover decreased from 35% in 1998 to 20% in 2002, then increased to 26% by 2007. Relative combined vegetation and litter cover was 33% in 1998 and approximately 60% in 1999-2007. Some erosion is evident in the form of pedestalling and soil movement, but the soil erosion condition was classified as stable in 2002 and 2007.

Browse

Prior to the fire in 1996, the study was dominated by Utah juniper (*Juniperus osteosperma*). Point-centered quarter data collected on dead trees estimated a density of 331 trees/acre (818 trees/ha) in 1998. Following the fire, the browse component was reduced to almost nothing. White rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) was the most abundant shrub in 2007, with a density of 180 plants/acre (445 plants/ha). These plants were heavily browsed by rabbits. Fourwing saltbush (*Atriplex canescens*), Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), green ephedra (*Ephedra viridis*), and bitterbrush (*Purshia tridentata*) are also scattered throughout the study in very low densities. In 2007, fourwing saltbush canopy cover was approximately the same as that for rabbitbrush.

Herbaceous Understory

Perennial grasses are the key vegetative component in the community. Because the study was seeded but not chained, perennial grasses have been slow to establish. Average perennial grass cover was 4% in 1998 and 5% in 1999, then increased substantially to 12% in 2002 and 2007. Seeded species, such as crested wheatgrass (*Agropyron cristatum*) and Russian wildrye (*Elymus junceus*), are the most abundant perennial species. Crested wheatgrass provided 48% of the total grass cover in 2002 and 61% in 2007. Native species occur less frequently, and include bottlebrush squirreltail (*Sitanion hystrix*), Indian ricegrass (*Oryzopsis hymenoides*), and bluebunch wheatgrass (*Agropyron spicatum*). Cheatgrass (*Bromus tectorum*) was the most abundant grass in 1998 and 1999, providing 76% and 82% of the total grass cover, respectively. Average cheatgrass cover declined from 21% in 1999 to 4% in 2002 and 2% in 2007. Grasses have been vigorous, with some of the seeded species growing to 3 feet (0.9 m) in height.

No forbs were included in the seed mix due to a plan to spray herbicide in the future for noxious weed control. Average forb cover increased from 3%-4% in 1998 and 1999 to 18% in 2007. However, annual species provided 98% of the total forb cover in 2002 and 2007. As annual forb cover increased, perennial forb cover decreased from 3% in 1998 to less than 1% in 2007. Prickly lettuce (*Lactuca serriola*) was the most abundant

forb in 1998 and 1999, while desert alyssum (*Alyssum desertorum*) provided 60% of the total forb cover in 2002 and 77% in 2007. Tumblemustard (*Sisymbrium altissimum*) is also common. Musk thistle (*Carduus nutans*), a noxious weed, was sampled in one quadrat in 1998. Mormon crickets (*Anabrus simplex*) were noted to have utilized forbs in 2002.

1999 TREND ASSESSMENT

The trend for browse is stable. No key browse species were sampled within the density strips, which was a decreased from 40 fourwing saltbush plants/acre (99 plants/ha) in 1998. The trend for grass is stable. The sum of nested frequency for perennial grasses increased 11%. Average perennial grass cover increased from 4% to 5%, however, average cheatgrass cover increased dramatically from 13% to 21%. Cheatgrass also increased significantly in nested frequency, and its quadrat frequency increased from 79% to 96%. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs changed little. Musk thistle was sampled in 1998, but was not sampled in 1999. The Desirable Components Index (DCI) rating in 1998 was very poor due to the lack of browse, low perennial grass cover, high annual grass cover, and the presence of a noxious weed. The DCI rating remained very poor in 1999.

1998 winter range condition (DCI) - very poor (3) Low potential scale
1999 winter range condition (DCI) - very poor (-4) Low potential scale
browse - stable (0) grass - stable (0) forb - slightly up (+1)

2002 TREND ASSESSMENT

The trend for browse is stable. No key browse species were sampled. The trend for grass is up. The sum of nested frequency for perennial grasses increased 31%. Average perennial grass cover increased from 5% to 12%, while average cheatgrass cover declined from 21% to 4%. Cheatgrass also decreased significantly in nested frequency, and its quadrat frequency decreased to 66%. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 66%, and perennial forb cover was almost nonexistent. Annual forb cover increased from 1% to 8%, mainly due to significant increases in the nested frequencies of alyssum, tumblemustard, and Russian thistle (*Salsola iberica*). The DCI rating increased to poor due to the increase in perennial grass cover and the decrease in annual grass cover.

winter range condition (DCI) - poor (21) Low potential scale
browse - stable (0) grass - up (+2) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is stable. No key browse species were sampled within the density strips. The trend for grass is up. The sum of nested frequency for perennial grasses increased almost 100%. Crested wheatgrass and squirreltail increased significantly in nested frequency. Cheatgrass remained stable in nested frequency and quadrat frequency, and cover continued to decrease from 4% to 2%. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little and average cover remained below 1%. Annual forb cover increased from 8% to 17%. Alyssum increased significantly in nested frequency. The DCI rating increased to poor-fair due to the decrease in cheatgrass cover.

winter range condition (DCI) - poor-fair (24) Low potential scale
browse - stable (0) grass - up (+2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 19

Type	Species	Nested Frequency				Average Cover %			
		'98	'99	'02	'07	'98	'99	'02	'07
G	Agropyron cristatum	a58	ab74	b93	c199	1.64	2.61	7.23	8.44
G	Agropyron dasystachyum	-	-	-	2	-	-	-	.00
G	Agropyron elongatum	a7	a7	a9	a7	.33	.19	.61	.59
G	Agropyron spicatum	-	a3	-	a2	-	.00	-	.15
G	Bromus inermis	-	-	-	16	.00	.03	-	.22
G	Bromus japonicus (a)	-	-	a4	a1	-	-	.03	.00
G	Bromus tectorum (a)	a268	b395	a227	a210	12.52	20.85	3.51	1.86
G	Elymus junceus	a27	a22	a26	a29	1.49	1.32	2.77	1.75
G	Oryzopsis hymenoides	a4	a3	a6	a4	.21	.45	.74	.24
G	Sitanion hystrix	a2	a-	a9	b26	.38	.00	.23	.54
Total for Annual Grasses		268	395	231	211	12.52	20.85	3.54	1.87
Total for Perennial Grasses		98	109	143	285	4.06	4.62	11.60	11.95
Total for Grasses		366	504	374	496	16.58	25.48	15.14	13.82
F	Alyssum alyssoides (a)	-	-	-	7	-	-	-	.03
F	Alyssum desertorum (a)	a45	a65	b290	c364	.26	.20	4.65	13.47
F	Argemone munita	a-	a-	-	-	.30	.03	-	-
F	Astragalus calycosus	-	-	-	4	-	-	-	.19
F	Astragalus eurekensis	-	-	-	2	-	-	-	.00
F	Astragalus sp.	a3	-	a6	-	.01	-	.04	-
F	Camelina microcarpa (a)	-	a8	-	a12	-	.30	-	.03
F	Carduus nutans (a)	2	-	-	-	.00	-	-	-
F	Chaenactis douglasii	a11	-	a3	a4	.24	-	.00	.01
F	Chenopodium sp. (a)	-	-	1	-	-	-	.00	-
F	Cruciferae	10	-	-	-	.24	-	-	-
F	Cryptantha sp.	-	-	5	-	-	-	.03	-
F	Descurainia pinnata (a)	a8	-	-	b32	.18	-	-	.13
F	Eriogonum cernuum (a)	a16	a8	-	-	.23	.06	-	-
F	Gilia sp. (a)	-	a2	a1	a6	-	.00	.00	.01
F	Helianthus annuus (a)	-	2	-	-	-	.00	-	-
F	Lactuca serriola	b68	b86	-	a20	2.51	1.20	-	.14
F	Lesquerella sp.	a-	-	a3	a2	.00	-	.00	.03
F	Machaeranthera canescens	-	-	1	-	-	-	.00	-
F	Nicotiana attenuata (a)	-	-	-	-	.00	-	-	-
F	Phlox hoodii	-	-	3	-	-	-	.00	-

Type	Species	Nested Frequency				Average Cover %			
		'98	'99	'02	'07	'98	'99	'02	'07
F	Phlox longifolia	-	-	3	-	-	-	.01	-
F	Salsola iberica (a)	$_{a}$1	$_{a}$10	$_{b}$43	-	.01	.33	.78	-
F	Senecio multilobatus	-	-	5	-	-	-	.04	-
F	Sisymbrium altissimum (a)	$_{a}$4	$_{a}$22	$_{b}$86	$_{b}$100	.31	.49	2.20	3.42
F	Tragopogon dubius	-	-	-	2	-	-	-	.01
F	Zigadenus paniculatus	-	-	-	2	-	-	-	.00
Total for Annual Forbs		76	117	421	521	1.02	1.40	7.65	17.10
Total for Perennial Forbs		92	86	29	36	3.32	1.23	0.14	0.39
Total for Forbs		168	203	450	557	4.34	2.64	7.80	17.50

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

BROWSE TRENDS --
Management unit 21A, Study no: 19

Type	Species	Strip Frequency				Average Cover %			
		'98	'99	'02	'07	'98	'99	'02	'07
B	Atriplex canescens	2	0	0	1	.03	-	-	-
B	Chrysothamnus nauseosus albicaulis	0	0	0	8	-	-	-	.30
Total for Browse		2	0	0	9	0.03	0	0	0.30

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 19

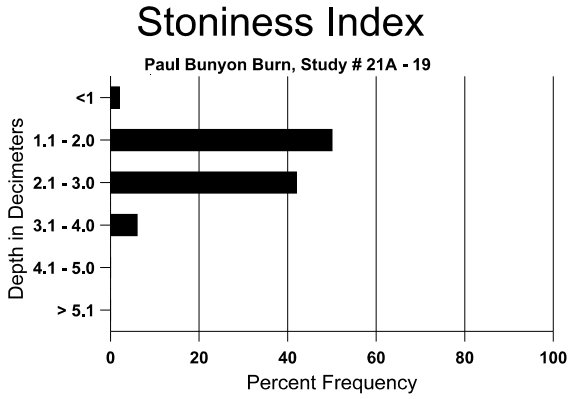
Species	Percent Cover	
	'02	'07
Atriplex canescens	-	.20
Chrysothamnus nauseosus albicaulis	-	.28

BASIC COVER --
Management unit 21A, Study no: 19

Cover Type	Average Cover %			
	'98	'99	'02	'07
Vegetation	21.67	30.56	24.22	31.54
Rock	3.33	3.46	2.35	2.05
Pavement	32.45	14.92	19.34	16.32
Litter	15.95	35.60	45.85	34.27
Cryptogams	0	0	.38	.14
Bare Ground	39.84	28.43	23.67	29.82

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 19, Paul Bunyan Burn

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
14.0	70.0 (15.5)	7.0	48.7	24.7	26.6	2.7	11.6	115.2	0.6



PELLET GROUP DATA --
Management unit 21A, Study no: 19

Type	Quadrat Frequency			
	'98	'99	'02	'07
Rabbit	11	13	22	80
Elk	-	4	-	-
Deer	1	3	6	-
Cattle	-	-	-	2

Days use per acre (ha)	
'02	'07
-	-
-	-
7 (18)	-
1 (2)	-

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 19

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
98	**0**	-	-	-	-	20	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Atriplex canescens												
98	**40**	-	20	20	-	-	0	50	-	-	0	-/-
99	**0**	-	-	-	-	20	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	44/62
07	**20**	-	-	20	-	-	0	0	-	-	0	66/84
Chrysothamnus nauseosus albicaulis												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	42/66
07	**180**	40	60	120	-	-	78	22	-	-	0	19/26
Cowania mexicana stansburiana												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	16/18
07	**0**	-	-	-	-	-	0	0	-	-	0	38/55
Ephedra viridis												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	27/44
07	**0**	-	-	-	-	-	0	0	-	-	0	37/55
Juniperus osteosperma												
98	**0**	-	-	-	-	380	0	0	-	-	0	-/-
99	**0**	-	-	-	-	340	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	100	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Purshia tridentata												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	13/22
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Trend Study 21A-20-07

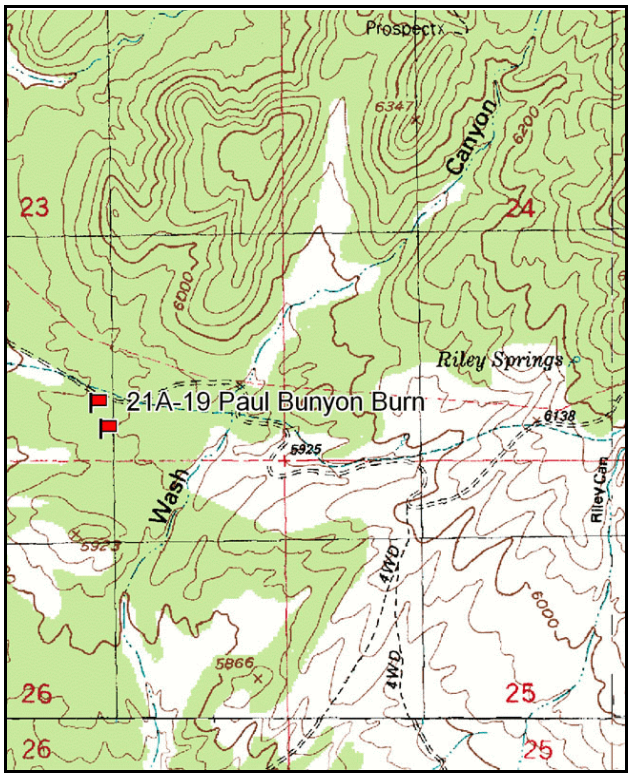
Study site name: Paul Bunyan Burn and Chain . Vegetation type: Burn and Seeded .

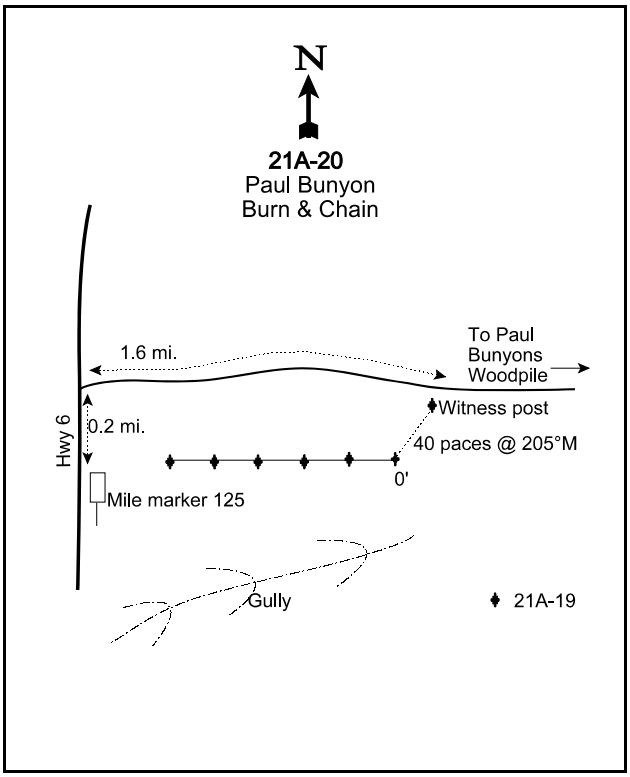
Compass bearing: frequency baseline 268 degrees magnetic.

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

LOCATION DESCRIPTION

From Hwy 6 go 0.2 miles north of mile marker 125. Turn right heading toward the Paul Bunyan Woodpile. Drive 1.6 miles to a four foot tall witness post on the right side of the road. The 0-foot stake for this study is 40 paces at 205 degrees magnetic from the witness post. The site is marked by short green fenceposts. The 0-foot stake is marked by browse tag #74.





Map Name: McIntyre

Diagrammatic Sketch

Township 12S , Range 3W , Section 23

GPS: NAD 83, UTM 12S 401867 E 4401625 N

DISCUSSION

Paul Bunyan Burn and Chain - Trend Study No. 21A-20

Study Information

This study was placed northwest of the Paul Bunyan Burn study (21A-19) [elevation: 5,900 feet (1,798 m), slope: 5%, aspect: west]. Seed was applied aerially and the area was chained one-way with an Ely chain to help cover the seed and enhance establishment of the seeded species. A seed dribbler was used to apply fourwing saltbush (*Atriplex canescens*) seed during the chaining. Due to low browse cover, the area is of very little use for wintering big game. Elk pellet quadrat frequency was 8% in 1999. Deer pellet quadrat frequency was 3% in 2002 and 2% in 2007. No deer or elk pellets were sampled along the pellet group transect in 2002 or 2007. Rabbit pellet quadrat frequency has increased from 3% in 1998 to 76% in 2007.

Soil

The soil is classified within the Jericho series (USDA-NRCS 2007). The soils in this series are shallow over a duripan layer and are well-drained. They formed in alluvium derived mainly from igneous rocks. The soil texture is a sandy clay loam, and the pH is neutral (7.0). Soil phosphorus is marginal at 8.9 ppm (Tiedemann and Lopez 2004). Relative combined rock and pavement cover has remained relatively stable at 17%-21% in all sample years. Relative bare ground cover has decreased from 47% in 1998 to 31% in 1999 and 26% in 2002 and 2007. Relative combined vegetation and litter cover has steadily increased from 33% in 1998 to 56% in 2007. Some erosion is evident in the form of pedestalling and soil movement, but the soil erosion condition was classified as stable in 2002 and 2007.

Browse

Seeded fourwing saltbush provides the majority of the preferred browse. Its density has declined since the seeding, from 280 plants/acre (692 plants/ha) in 1998 to 40 plants/acre (99 plants/ha) in 2007. Average cover has been less than 1% in all sample years and, like density, has steadily decreased. Young recruitment was high at 50% of the population in 1998, but decreased to 25% in 1999, and no young plants were sampled in 2002 or 2007. Decadence has increased from 8% of the population in 1999 to 63% in 2002 and 50% in 2007. The density of dead plants increased from 40 plants/acre (99 plants/ha) in 2002 to 180 plants/acre (445 plants/ha) in 2007. All of the plants were vigorous in 1998 and 1999, but all of the decadent plants in 2002 and 2007 displayed poor vigor and were classified as dying. Use was light-moderate in 2002 and heavy in 2007.

Other palatable browse species are present at low densities. These include Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*), antelope bitterbrush (*Purshia tridentata*), green ephedra (*Ephedra viridis*), and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*).

Herbaceous Understory

Perennial grasses dominate the understory. The most abundant species are seeded perennials, including crested wheatgrass (*Agropyron cristatum*), Russian wildrye (*Elymus junceus*), and elongated wheatgrass (*Agropyron elongatum*). These species have provided 64%-86% of the total grass cover since 1998. Native perennial species, such as bluebunch wheatgrass (*Agropyron spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), and bottlebrush squirreltail (*Sitanion hystrix*), have been rare. Perennial grass cover was 15% in 1998, 12% in 1999, 20% in 2002, and 19% in 2007. Average cheatgrass (*Bromus tectorum*) cover declined from 5% in 1999 to 2% in 2002 and 2007. Cheatgrass provided 23% of the total grass cover in 1998, 31% in 1999, and approximately 10% in 2002 and 2007.

Average forb cover was approximately 1% in all sample years until 2007, when cover increased to 8%. However, this increase was due to a significant increase in desert alyssum (*Alyssum desertorum*) cover. Alyssum provided 37% of the total forb cover in 2002 and 94% in 2007. Other abundant forb species have

included prickly lettuce (*Lactuca serriola*) and tumblemustard (*Sisymbrium altissimum*). Musk thistle (*Carduus nutans*), a noxious weed, was present in 2007, but was not abundant and was not sampled in any quadrats.

1999 TREND ASSESSMENT

The trend for browse is slightly down. Fourwing saltbush density decreased from 280 plants/acre (692 plants/ha) to 240 plants/acre (593 plants/ha). Young recruitment decreased from 50% of the population to 25%, and decadence increased from 0% to 8% of the population. Vigor remained excellent, and use remained light. The trend for grass is slightly down. The sum of nested frequency for perennial grasses decreased 16%. Russian wildrye decreased significantly in nested frequency. Average perennial grass cover decreased from 15% to 12%, while average cheatgrass cover increased slightly from 4% to 5%. Cheatgrass nested frequency did not change significantly, and its quadrat frequency decreased from 84% to 76%. The trend for forbs is stable. The sum of nested frequency for perennial forbs decreased 10% and total forb cover remained below 1%. Tumblemustard decreased significantly in nested frequency. The Desirable Components Index (DCI) was rated as fair in 1998 due to very low browse and perennial forb cover, but high perennial grass cover. The DCI rating decreased to poor in 1999 due to the decrease in perennial grass cover.

1998 winter range condition (DCI) - fair (28) Low potential scale
1999 winter range condition (DCI) - poor (21) Low potential scale
browse - slightly down (-1) grass - slightly down (-1) forb - stable (0)

2002 TREND ASSESSMENT

The trend for browse is down. Fourwing saltbush density decreased from 240 plants/acre (593 plants/ha) to 160 plants/acre (395 plants/ha). Decadence increased from 8% of the population to 63% and no young plants were sampled. All of the decadent plants displayed poor vigor and were classified as dying. Use increased slightly, with 13% of the sampled plants showing moderate hedging. The trend for grass is slightly up. The sum of nested frequency for perennial grasses increased 10% and cover increased from 12% to 20%. Cheatgrass decreased significantly in nested frequency, and quadrat frequency decreased from 76% to 43%. Average cheatgrass cover decreased from 5% to 2%. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs decreased slightly. Alyssum increased significantly in nested frequency and prickly lettuce decreased significantly in nested frequency. The DCI rating improved to fair due to the increase in perennial grass cover and the decrease in annual grass cover.

winter range condition (DCI) - fair (30) Low potential scale
browse - down (-2) grass - slightly up (+1) forb - slightly down (-1)

2007 TREND ASSESSMENT

The trend for browse is down. Fourwing saltbush density decreased 75%, from 160 plants/acre (395 plants/ha) to 40 plants/acre (99 plants/ha). Decadence decreased slightly, but was still high at 50% of the population. The density of dead plants increased from 40 plants/acre (99 plants/ha) to 180 plants/acre (445 plants/ha). No seedling or young plants were sampled. Vigor was poor on half of the sampled plants. Use increased from mostly light to heavy. The trend for grass is up. The sum of nested frequency for perennial grasses increased 36%. Russian wildrye increased significantly in nested frequency. Cheatgrass nested frequency and cover remained stable, while quadrat frequency increased from 43% to 60%. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little. Alyssum increased significantly in nested frequency and increased in cover from less than 1% to 7%. The DCI rating remained fair.

winter range condition (DCI) - fair (29) Low potential scale
browse - down (-2) grass - up (+2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 20

Type	Species	Nested Frequency				Average Cover %			
		'98	'99	'02	'07	'98	'99	'02	'07
G	Agropyron cristatum	a133	a139	ab158	b193	7.22	8.46	12.64	10.59
G	Agropyron elongatum	a52	a44	a47	a36	2.69	2.12	2.34	2.20
G	Agropyron spicatum	a9	a13	a14	a17	.56	.78	1.44	.66
G	Bromus japonicus (a)	-	-	-	1	-	-	-	.00
G	Bromus tectorum (a)	b270	b265	a124	a166	4.39	5.38	2.13	2.21
G	Elymus junceus	b78	a24	a33	b78	3.87	.45	3.65	5.00
G	Oryzopsis hymenoides	-	-	a2	a6	-	-	.06	.01
G	Poa secunda	-	7	-	-	-	.02	-	-
G	Sitanion hystrix	a4	a4	-	b15	.21	.01	.00	.13
Total for Annual Grasses		270	265	124	167	4.39	5.38	2.13	2.22
Total for Perennial Grasses		276	231	254	345	14.56	11.86	20.16	18.61
Total for Grasses		546	496	378	512	18.95	17.24	22.29	20.82
F	Alyssum desertorum (a)	a13	a27	b122	c308	.19	.10	.38	7.09
F	Antennaria rosea	-	-	3	-	-	-	.00	-
F	Astragalus calycosus	a10	a6	a7	a1	.09	.04	.04	.15
F	Calochortus nuttallii	2	-	-	-	.00	-	-	.00
F	Chaenactis douglasii	a4	-	a1	a2	.03	-	.00	.03
F	Cryptantha sp.	a3	a7	-	a1	.00	.01	-	.00
F	Descurainia pinnata (a)	-	-	-	28	-	-	-	.13
F	Gilia sp. (a)	a3	a1	-	a5	.00	.00	-	.01
F	Lactuca serriola	b35	b49	a11	a12	.58	.36	.19	.03
F	Lesquerella sp.	a1	-	a1	-	.01	-	.00	-
F	Lomatium sp.	a3	-	-	a1	.03	-	-	.00
F	Phlox hoodii	a2	-	a2	-	.00	-	.15	-
F	Phlox longifolia	-	-	a11	a4	-	-	.02	.01
F	Ranunculus testiculatus (a)	-	-	-	8	-	-	-	.01
F	Salsola iberica (a)	a1	ab14	b21	-	.03	.09	.22	-
F	Senecio multilobatus	-	-	-	1	-	-	-	.00
F	Sisymbrium altissimum (a)	b20	a2	-	b22	.32	.07	-	.07
F	Streptanthus cordatus	a9	-	a1	-	.06	-	.01	-
F	Tragopogon dubius	-	-	-	1	-	-	-	.00
F	Zigadenus paniculatus	-	-	-	1	-	-	-	.00
Total for Annual Forbs		37	44	143	371	0.55	0.27	0.60	7.32
Total for Perennial Forbs		69	62	37	24	0.83	0.41	0.42	0.25

Type	Species	Nested Frequency				Average Cover %			
		'98	'99	'02	'07	'98	'99	'02	'07
Total for Forbs		106	106	180	395	1.38	0.68	1.03	7.58

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

BROWSE TRENDS --
Management unit 21A, Study no: 20

Type	Species	Strip Frequency				Average Cover %			
		'98	'99	'02	'07	'98	'99	'02	'07
B	Atriplex canescens	14	11	8	2	.63	.73	.48	.15
B	Chrysothamnus nauseosus albicaulis	0	0	0	1	-	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	1	0	1	1	-	-	-	-
B	Ephedra viridis	0	1	0	0	-	-	-	-
Total for Browse		15	12	9	4	0.63	0.73	0.48	0.15

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 20

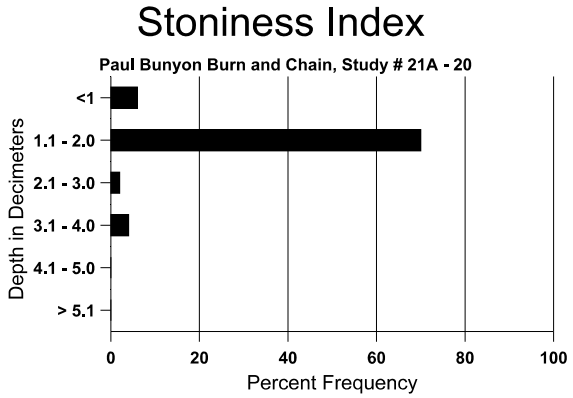
Species	Percent Cover	
	'02	'07
Atriplex canescens	-	.21

BASIC COVER --
Management unit 21A, Study no: 20

Cover Type	Average Cover %			
	'98	'99	'02	'07
Vegetation	21.46	24.41	24.92	27.09
Rock	4.19	4.36	3.43	2.34
Pavement	17.03	16.23	20.65	16.91
Litter	13.75	26.82	37.07	35.23
Cryptogams	0	0	0	.31
Bare Ground	49.65	32.64	30.29	29.33

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 20, Paul Bunyan Burn and Chain

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
13.9	69.0 (14.5)	7.0	48.4	25.1	26.6	2.7	8.9	134.4	.6



PELLET GROUP DATA --
Management unit 21A, Study no: 20

Type	Quadrat Frequency			
	'98	'99	'02	'07
Rabbit	3	8	13	76
Horse	-	-	1	-
Elk	-	8	-	-
Deer	-	-	3	2

Days use per acre (ha)	
'02	'07
-	-
-	-
-	-
-	-

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 20

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis												
98	**0**	-	-	-	-	120	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Atriplex canescens												
98	**280**	20	140	140	-	-	0	0	0	-	0	31/35
99	**240**	20	60	160	20	-	0	0	8	-	0	28/31
02	**160**	-	-	60	100	40	13	0	63	63	63	36/43
07	**40**	-	-	20	20	180	0	100	50	50	50	54/66
Chrysothamnus nauseosus albicaulis												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	33/60
07	**20**	-	-	20	-	-	0	0	-	-	0	20/39
Chrysothamnus viscidiflorus viscidiflorus												
98	**20**	-	-	20	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	16/31
07	**20**	-	-	20	-	-	0	0	-	-	0	20/36
Cowania mexicana stansburiana												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	30/33
07	**0**	-	-	-	-	-	0	0	-	-	0	36/42
Ephedra viridis												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**20**	-	20	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	22/30
07	**0**	-	-	-	-	-	0	0	-	-	0	30/42
Juniperus osteosperma												
98	**0**	-	-	-	-	360	0	0	-	-	0	-/-
99	**0**	-	-	-	-	220	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	60	0	0	-	-	0	-/-
Purshia tridentata												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	17/25
02	**0**	-	-	-	-	-	0	0	-	-	0	21/28
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

Summary and Comparison of Paul Bunyan Burn (21A-19) and Paul Bunyan Burn and Chain (21A-20)

Studies 21A-19 and 21A-20 were established in 1998 to monitor the recovery of the vegetation community on two treatments following a wildfire. Both of these studies were aerially seeded, with study 21A-20 being chained one way with an Ely chain following the seeding. These studies were paired to compare differences in restoration efforts between seeding only (21A-19) and seeding followed by one-way chaining (21A-20) to cover the seed and enhance establishment of the seeded species. Both studies were seeded with the same mix.

The most important comparisons that can be made between these studies involve the establishment and persistence of the herbaceous species since the treatments. Grasses have developed into the major component of the vegetation community on both of these studies. During the initial reading in 1998 and in every sample year, perennial grasses were more abundant in average cover and sum of nested frequency on the chained study compared to the unchained study (Figures 1 and 2).

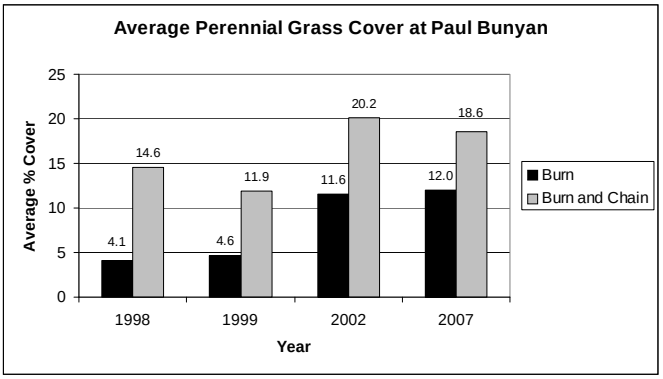


Figure 1. Average perennial grass cover on the Paul Bunyan fire rehabilitation studies, 1998-2007.

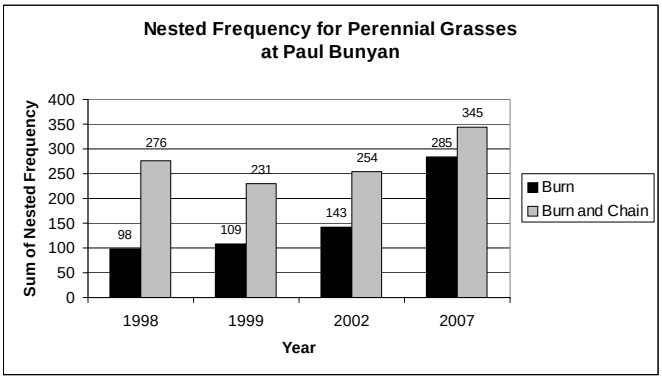


Figure 2. Nested frequency for perennial grasses on the Paul Bunyan fire rehabilitation studies, 1998-2007.

In the first sample year, perennial grasses provided more than three times the amount of cover on the study that was chained. Sum of nested frequency for all perennial grasses combined was nearly three times higher on the chained study as well. In 2007, 10 years after the treatments were conducted, perennial grasses still provided more cover and a higher sum of nested frequency on the study that was seeded and chained than the study that was only seeded.

Cheatgrass (*Bromus tectorum*) provided more cover on the unchained study in 1998, although nested frequency was nearly identical between the two treatments (Figures 3 and 4). In 1999 and 2002, cheatgrass

cover and nested frequency were higher on the unchained study. By 2007, average cover was similar between the two studies, although nested frequency remained higher on the unchained study.

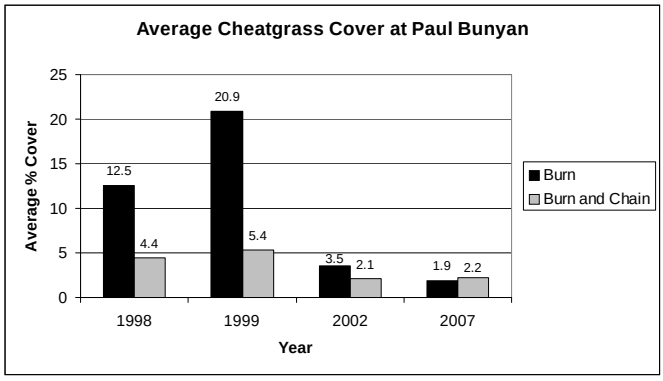


Figure 3. Average cheatgrass cover on the Paul Bunyan fire rehabilitation studies, 1998-2007.

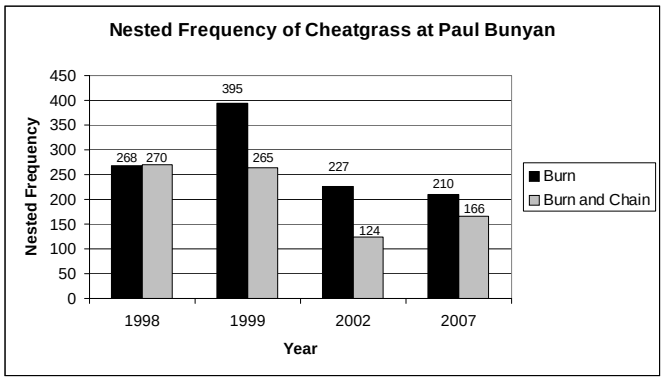


Figure 4. Nested frequency of cheatgrass on the Paul Bunyan fire rehabilitation studies, 1998-2007.

The best way to control cheatgrass competition is to establish a healthy and abundant perennial understory (Monsen 1994). The data from these studies are consistent with this concept. Perennial grasses, particularly seeded species, were more successful on the chained study, where the seedbed was prepared. On average, seeded grasses had higher quadrat frequency and cover values on the chained study each sample year after the treatment. Consequently, cheatgrass cover and nested frequency were lower on this study than on the unchained study in most sample years. Furthermore, on the unchained study, crested wheatgrass comprised 61% of the total grass cover by 2007, while the remaining seeded species, combined, comprised 17%. By the same year on the chained study, crested wheatgrass comprised 51% of the total grass cover, while the remaining seeded species comprised 35%. The higher seeding success on the chained study will increase the resilience of the community in the future.

Both the forb and browse components are sparse and relatively unimportant on these studies. Forbs were not included in the seed mix, due to the threat of noxious weed invasion and the possibility of herbicide application following treatment. The browse component was dominated by juniper (*Juniperus osteosperma*) prior to the burn, resulting in a depleted native seedbank of herbaceous and shrub species. Fourwing saltbush (*Atriplex canescens*) was seeded, but provided less than 1% cover on both studies in all sample years. Most of the vegetative community in 2007 continued to be composed of non-native seeded species. These studies have very little use for big game due to the minimal cover of palatable browse for winter forage.

Trend Study 21A-21-07

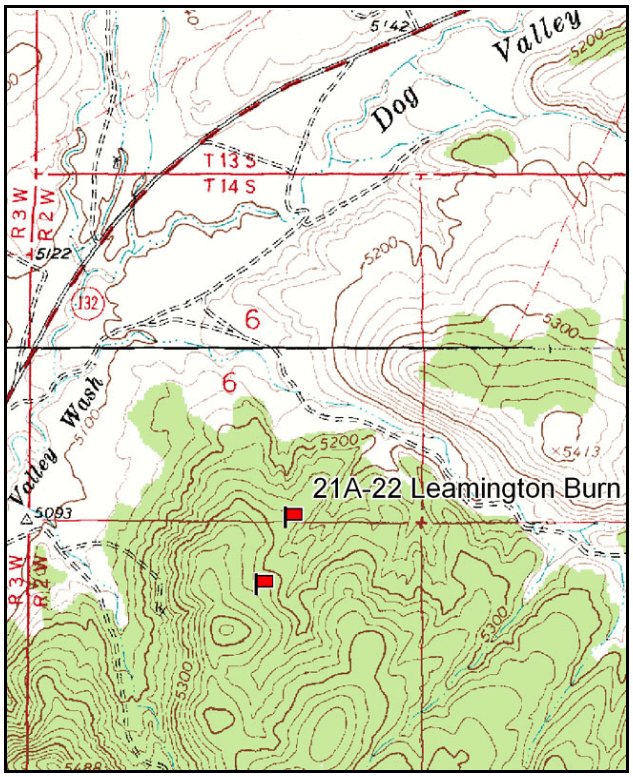
Study site name: Leamington Burn and Chain . Vegetation type: Chained and Burned P-J .

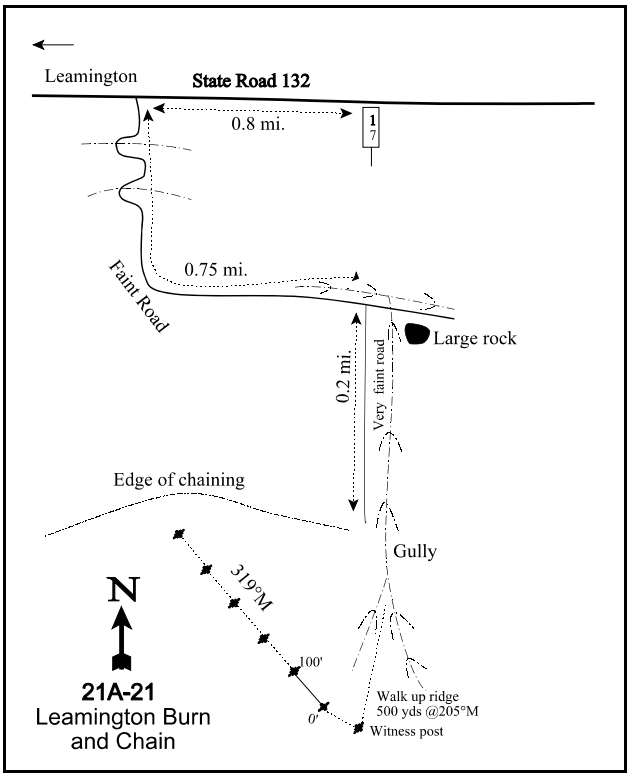
Compass bearing: frequency baseline 322 degrees magnetic.

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

LOCATION DESCRIPTION

From Nephi, drive about 17.1 miles on State Road 132. Drive west 0.8 miles past mile marker 17 to a faint road on the left. Drive 0.75 miles past a water trough to a gully with a large boulder by the road. Go up the gully 0.2 miles to where it forks. Park here. From where the drainage divides in two, walk up the middle ridge about 500 yards at a bearing of 205 degrees magnetic to a witness post. The 0-foot stake is 20 feet from the witness post at about 319 degrees magnetic. The study is marked by 12-18 inch, green, steel fenceposts.





Map name: Sage Valley

Diagrammatic Sketch

Township 14S Range 2W Section 6

GPS: NAD 83, UTM 12S 404313 E 4385970 N

DISCUSSION

Leamington Burn and Chain - Trend Study No. 21A-21

Study Information

This study was established in 1997 to sample a burned, seeded, and chained area west of the Leamington Burn study (21A-22) [elevation: 5,300 feet (1,615 m), slope: 13%, aspect: northeast]. It is on BLM land approximately 17 miles (27.4 km) west of Nephi and 1 mile (1.6 km) south of SR-132. It was established to contrast secondary succession and establishment of seeded grasses and forbs with the nearby burned and seeded treatment that made no attempt to cover the seed. The area burned during the summer of 1996 and is part of the Leamington burn complex. Seed was applied aerially and the study was chained one-way with an Ely chain to cover the seed and enhance establishment of seeded species. Fourwing saltbush (*Atriplex canescens*) seed was also applied with a seed dribbler. Wildlife use has been limited in all sample years. Pellet group transect data indicated less than 1 deer day use/acre (2 ddu/ha) in 1997 and 2002, and 2 days use/acre (5 ddu/ha) in 2007. Elk use was estimated at 1 day use/acre (2 edu/ha) in 1997, 8 days use/acre (20 edu/ha) in 1998, 3 days use/acre (8 edu/ha) in 2002, and 2 days use/acre (5 edu/ha) in 2007. Cattle were grazing during the 2002 reading, and use was estimated at 9 days use/acre (21 cdu/ha) in 2002 and 14 days use/acre (34 cdu/ha) in 2007. Cattle use was much higher in the bottoms below the study.

Soil

The soil is classified as a Borvant-Reywat complex (USDA-NRCS 2007). Soils in the Borvant series are shallow over a petrocalcic horizon, and are well-drained. They formed in alluvium or colluvium derived from limestone and sandstone. Soils in the Reywat series are also shallow and well-drained, and formed in residuum and colluvium derived dominantly from andesite and basalt. The soil texture is a loam with a neutral reaction (pH 7.0). Rocks and pavement are abundant on the surface, and are also common throughout the soil profile. Relative combined rock and pavement cover decreased from 33% in 1997 to 23% in 2002 and 2007. Relative bare ground cover has decreased substantially, from 43% in 1997 to 27% in 2002 and 16% in 2007. Relative combined vegetation and litter cover increased from 21% in 1997 to 60% in 2007. The erosion condition was classified as stable in 2002 and 2007.

Browse

Browse is limited, with fourwing saltbush, Nevada ephedra (*Ephedra nevadensis*), antelope bitterbrush (*Purshia tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) occurring in low densities. Broom snakeweed (*Gutierrezia sarothrae*) is the most abundant browse species. Its density has ranged between 400 plants/acre (988 plants/ha) and 820 plants/acre (2,026 plants/ha) since 1997.

Herbaceous Understory

Herbaceous species, especially grasses, are dominant. Average perennial grass cover, which is composed mostly of seeded species, increased from 7% in 1997 to 19% in 1998, and ranged from 13% to 17% between 1999 and 2007. Crested wheatgrass (*Agropyron spicatum*) is the most abundant perennial grass, and has provided 24%-43% of the total grass cover since 1997. Other perennials include elongated wheatgrass (*Agropyron elongatum*), bluebunch wheatgrass (*Agropyron spicatum*), smooth brome (*Bromus inermis*), Russian wildrye (*Elymus junceus*), Indian ricegrass (*Oryzopsis hymenoides*), and Sandberg bluegrass (*Poa secunda*), although seeded species are more abundant than native species. In 1998, perennial grasses were noted as being vigorous and robust, with some reaching 3-4 feet (0.9-1.2 m) in height. In 2002, perennial grasses had been moderately utilized, with some of the large bunchgrasses used heavily. Use was light on grasses in 2007. Cheatgrass (*Bromus tectorum*) is also present. Its average cover increased from 1% in 1997 to 9%-10% in 1998 and 1999, then decreased to 5% in 2002 and 2007. Cheatgrass comprised 16% of the total grass cover in 1997, 42% in 1999, and 22% in 2007.

Forbs have been fairly diverse, but few species are abundant. Perennial forbs are rare. Alfalfa (*Medicago sativa*) and small burnet (*Sanguisorba minor*) were seeded, but quadrat frequency for each species has been less than 4% since 1997, and neither species was sampled in 2007. The sum of nested frequency for annual forbs increased substantially in 2007 and average cover increased from less than 1% in 2002 to 3% in 2007. The most abundant forbs in 2007 were desert alyssum (*Alyssum desertorum*), tansymustard (*Descurainia pinnata*), and bur buttercup (*Ranunculus testiculatus*), which is allelopathic (Buchanan et al. 1978). Musk thistle (*Carduus nutans*), a noxious weed, was sampled in 1997.

1998 TREND ASSESSMENT

The trend for browse is slightly up. No key browse species were sampled in 1997, but fourwing saltbush, ephedra, and bitterbrush were sampled in 1998 in very low densities. These plants were all young or mature and vigorous, and use was light. The trend for grass is up. The sum of nested frequency for perennial grasses increased 56% and average cover increased from 7% to 19%. Elongated wheatgrass increased significantly in nested frequency. However, cheatgrass also increased significantly in nested frequency and its average cover increased from 1% to 10%. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs changed little, but average cover increased from 1% to 2%. The sum of nested frequency for annual forbs decreased almost 90%. Musk thistle was sampled in eight quadrats in 1997, but was not sampled in 1998. The Desirable Components Index (DCI) was rated as poor in 1997 due to low browse and perennial forb cover, and the presence of a noxious weed. The DCI rating improved to poor-fair in 1998 due to increased perennial grass and forb cover, and the lack of noxious weeds.

1997 winter range condition (DCI) - poor (14) Low potential scale
1998 winter range condition (DCI) - poor-fair (26) Low potential scale
browse - slightly up (+1) grass - up (+2) forb - slightly up (+1)

1999 TREND ASSESSMENT

The trend for browse is stable. Preferred browse densities remained very low. Fourwing saltbush displayed heavy use, while use on other species was light. The trend for grass is down. The sum of nested frequency for perennial grasses decreased 28%, while cover decreased from 19% to 13%. Cheatgrass did not change significantly in nested frequency or cover. The trend for forbs is stable. The sum of nested frequency for perennial forbs increased 12% and that for annual forbs increased 17%. However, total forb cover decreased from 2% to less than 1%. The DCI rating declined to poor due to decreases in perennial grass and forb cover.

winter range condition (DCI) - poor (20) Low potential scale
browse - stable (0) grass - down (-2) forb - stable (0)

2002 TREND ASSESSMENT

The trend for browse is stable. The preferred browse component remained very limited, and use on all species was light. The trend for grass is up. The sum of nested frequency for perennial grasses increased 38% and cover increased from 13% to 16%. Elongated wheatgrass, Russian wildrye, and Sandberg bluegrass increased significantly in nested frequency. Cheatgrass decreased significantly in nested frequency, and average cover decreased from 9% to 5%. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 81%, and total forb cover remained below 1%. The number of species sampled decreased from 12 to six. Small burnet was not sampled for the first time. The DCI rating improved to fair due to the increase in perennial grass cover and the decrease in cheatgrass cover.

winter range condition (DCI) - fair (27) Low potential scale
browse - stable (0) grass - up (+2) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is stable. The preferred browse component remained unchanged. Bitterbrush showed

heavy hedging, while use was light on the other browse species. The trend for grass is stable. The sum of nested frequency for perennial grasses changed little. Elongated wheatgrass decreased significantly in nested frequency, while western wheatgrass (*Agropyron smithii*) increased significantly in nested frequency. The trend for forbs is stable. The number of forb species sampled increased from six to 11. The sum of nested frequency for perennial forbs changed little and cover remained below 1%. The sum of nested frequency for annual forbs increased significantly, and average annual cover increased from less than 1% to 3%. Alyssum and bur buttercup increased significantly in nested frequency. The DCI rating remained fair.

winter range condition (DCI) - fair (27) Low potential scale
browse - stable (0) grass - stable (0) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 21

Type	Species	Nested Frequency					Average Cover %				
		'97	'98	'99	'02	'07	'97	'98	'99	'02	'07
G	Agropyron cristatum	a144	a152	a130	a132	a165	3.69	6.94	5.96	5.63	7.93
G	Agropyron elongatum	a39	bc96	ab74	c113	ab58	.98	4.71	2.33	4.30	2.62
G	Agropyron smithii	-	-	-	a5	b20	-	-	-	.03	.13
G	Agropyron spicatum	a27	a47	a31	a47	a47	1.25	3.46	2.72	3.67	3.35
G	Bromus inermis	a9	ab30	ab20	b39	ab16	.22	.73	.65	.24	.15
G	Bromus japonicus (a)	-	-	-	3	-	-	-	-	.03	-
G	Bromus tectorum (a)	a98	bc318	c351	b294	bc326	1.35	9.86	9.38	4.69	4.65
G	Dactylis glomerata	a18	a28	a10	-	-	.70	.65	.09	-	-
G	Elymus junceus	-	ab22	a3	b27	b36	-	.91	.15	.67	.69
G	Oryzopsis hymenoides	a26	a28	a25	a17	a21	.37	1.47	.95	.35	1.02
G	Poa fendleriana	a4	-	-	-	a1	.01	-	-	-	.03
G	Poa secunda	a4	ab19	a11	bc38	c46	.06	.58	.05	.61	.58
G	Stipa comata	-	-	-	-	3	-	-	-	-	.03
G	Vulpia octoflora (a)	-	-	-	-	1	-	-	-	-	.00
Total for Annual Grasses		98	318	351	297	327	1.35	9.86	9.38	4.73	4.66
Total for Perennial Grasses		271	422	304	418	413	7.30	19.46	12.91	15.55	16.56
Total for Grasses		369	740	655	715	740	8.66	29.33	22.29	20.28	21.22
F	Alyssum desertorum (a)	-	a2	a4	a10	b253	-	.00	.00	.03	1.39
F	Astragalus beckwithii	a3	-	-	a5	-	.00	-	-	.04	-
F	Astragalus calycosus	a12	a7	a14	a1	-	.12	.09	.07	.00	-
F	Astragalus sp.	a6	a6	a3	-	a8	.18	.19	.03	-	.07
F	Camelina microcarpa (a)	-	a2	-	-	a1	-	.03	-	-	.00
F	Carduus nutans (a)	16	-	-	-	-	.04	-	-	-	-
F	Calochortus nuttallii	a-	-	-	-	a1	.00	-	-	-	.00
F	Chaenactis douglasii	a10	a10	-	-	-	.32	.24	-	-	-
F	Cryptantha sp.	a1	-	-	-	a1	.00	-	-	-	.00

Type	Species	Nested Frequency					Average Cover %				
		'97	'98	'99	'02	'07	'97	'98	'99	'02	'07
F	Descurainia pinnata (a)	$_{ab}$15	$_{a}$1	-	-	$_{b}$32	.10	.02	-	-	1.00
F	Draba sp. (a)	-	$_{a}$1	$_{a}$1	-	$_{a}$5	-	.00	.00	-	.01
F	Gilia sp. (a)	23	-	-	-	-	.92	-	-	-	-
F	Lactuca serriola	-	$_{a}$15	$_{a}$30	-	-	-	.38	.53	-	-
F	Lesquerella sp.	$_{a}$5	$_{a}$4	-	-	-	.01	.16	-	-	-
F	Medicago sativa	$_{a}$1	$_{a}$4	$_{a}$1	$_{a}$1	-	.11	.29	.01	.03	-
F	Nicotiana attenuata (a)	1	-	-	-	-	.00	-	-	-	-
F	Phlox hoodii	-	$_{a}$1	$_{a}$1	$_{a}$4	$_{a}$3	-	.00	.00	.18	.15
F	Phlox longifolia	$_{a}$4	-	$_{a}$3	-	-	.01	-	.00	-	-
F	Ranunculus testiculatus (a)	$_{a}$7	-	-	$_{b}$52	$_{c}$196	.02	-	-	.24	.84
F	Salsola iberica (a)	-	-	1	-	-	-	-	.00	-	-
F	Sanguisorba minor	$_{a}$2	$_{a}$3	$_{a}$2	-	-	.15	.18	.03	-	-
F	Senecio multilobatus	-	2	-	-	-	-	.03	-	-	-
F	Sisymbrium altissimum (a)	-	-	$_{a}$1	-	$_{a}$5	-	-	.03	-	.06
F	Streptanthus cordatus	$_{a}$8	-	-	-	$_{a}$7	.02	-	-	-	.01
F	Tragopogon dubius	-	-	4	-	-	-	-	.00	-	-
Total for Annual Forbs		62	6	7	62	492	1.09	0.05	0.04	0.27	3.31
Total for Perennial Forbs		52	52	58	11	20	0.95	1.57	0.69	0.25	0.24
Total for Forbs		114	58	65	73	512	2.05	1.63	0.74	0.52	3.55

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

BROWSE TRENDS --
Management unit 21A, Study no: 21

Type	Species	Strip Frequency					Average Cover %				
		'97	'98	'99	'02	'07	'97	'98	'99	'02	'07
B	Atriplex canescens	0	1	1	1	1	.03	-	-	.15	.00
B	Chrysothamnus nauseosus albicaulis	0	0	0	0	1	-	-	-	-	.15
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	0	0	0	-	-	-	-	-
B	Ephedra nevadensis	0	1	0	1	0	-	-	-	.00	-
B	Gutierrezia sarothrae	16	11	22	19	13	.07	.59	.52	.31	.19
B	Purshia tridentata	0	1	1	0	1	-	-	-	-	-
Total for Browse		16	15	24	21	16	0.10	0.59	0.52	0.46	0.35

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

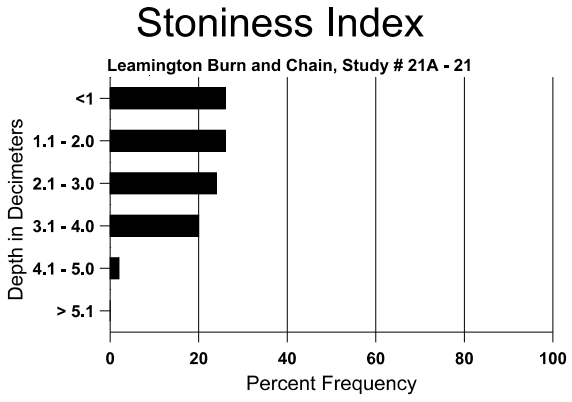
Species	Percent Cover	
	'02	'07
Atriplex canescens	-	.06
Gutierrezia sarothrae	-	.11

BASIC COVER --
Management unit 21A, Study no: 21

Cover Type	Average Cover %				
	'97	'98	'99	'02	'07
Vegetation	10.43	34.11	25.44	24.21	27.25
Rock	16.54	20.72	15.36	20.31	17.49
Pavement	13.43	10.18	3.30	5.80	7.74
Litter	9.42	27.58	21.86	30.73	36.31
Cryptogams	1.96	0	0	.01	.19
Bare Ground	39.39	27.02	21.77	29.36	17.11

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 21, Leamington Burn and Chain

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
13.8	62.8 (14.4)	7.0	46.0	33.1	20.9	3.0	12.3	195.2	.9



PELLET GROUP DATA --
Management unit 21A, Study no: 21

Type	Quadrat Frequency				
	'97	'98	'99	'02	'07
Rabbit	2	3	11	5	66
Elk	1	4	2	-	3
Deer	3	-	1	2	2
Cattle	-	-	4	2	1

Days use per acre (ha)	
'02	'07
-	-
3 (8)	2 (5)
1 (2)	2 (5)
9 (21)	14 (34)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 21

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	17/24
07	**0**	-	-	-	-	-	0	0	-	-	0	36/45
Atriplex canescens												
97	**0**	20	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	-	20	-	-	0	0	-	-	0	34/41
99	**20**	-	-	20	-	-	0	100	-	-	0	31/28
02	**20**	-	-	20	-	-	0	0	-	-	0	26/30
07	**20**	-	-	20	-	-	0	0	-	-	0	56/67
Chrysothamnus nauseosus albicaulis												
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	0	-	0	23/20
99	**0**	-	-	-	-	-	0	0	0	-	0	27/26
02	**0**	-	-	-	-	-	0	0	0	-	0	12/12
07	**20**	-	-	-	20	-	0	0	100	-	0	36/50
Chrysothamnus viscidiflorus viscidiflorus												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	20	-	-	-	0	0	-	-	100	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	18/31
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	10/17

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Ephedra nevadensis												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	20	-	-	-	0	0	-	-	0	16/22
99	**0**	-	-	-	-	-	0	0	-	-	0	11/28
02	**20**	-	-	20	-	-	0	0	-	-	0	19/28
07	**0**	-	-	-	-	-	0	0	-	-	0	20/35
Gutierrezia sarothrae												
97	**500**	-	-	500	-	-	0	0	0	-	0	-/-
98	**400**	20	-	400	-	-	0	0	0	-	0	12/18
99	**820**	20	100	720	-	-	0	0	0	-	0	11/16
02	**680**	-	40	540	100	40	0	0	15	12	12	6/10
07	**480**	160	100	280	100	40	0	0	21	13	17	10/16
Juniperus osteosperma												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	60	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Leptodactylon pungens												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	7/12
Purshia tridentata												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	20	-	-	-	0	0	-	-	0	-/-
99	**20**	-	20	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	100	-	-	0	12/24

Trend Study 21A-22-07

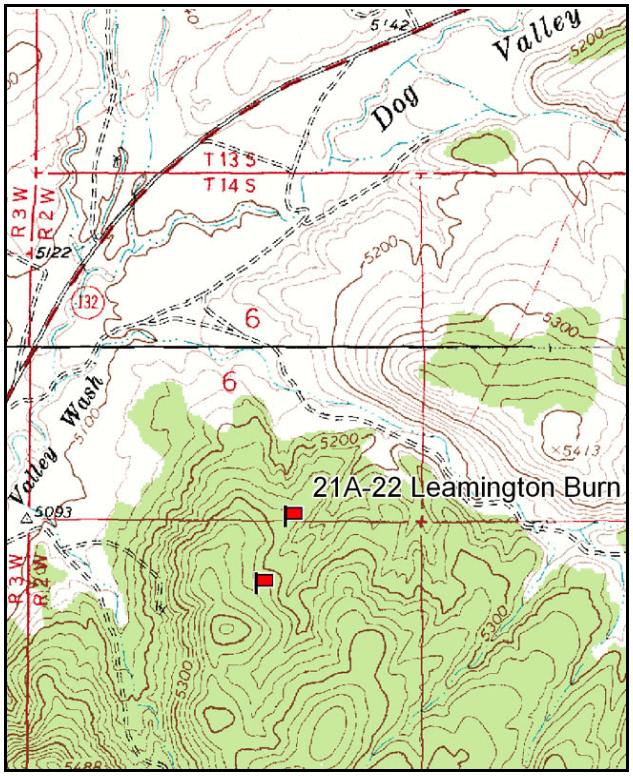
Study site name: Leamington Burn . Vegetation type: Burned Pinyon-Juniper .

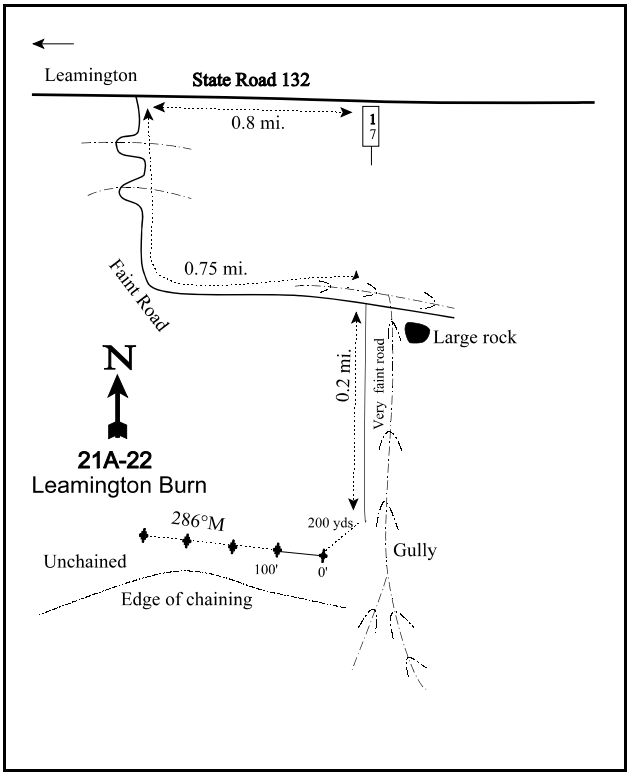
Compass bearing: frequency baseline 286 degrees magnetic.

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

LOCATION DESCRIPTION

From Nephi, drive about 17.1 miles on State Road 132. Drive west 0.8 miles past mile marker 17 to a faint road on the left. Drive 0.75 miles past a water trough to a gully with a large boulder by the road. Go up the gully 0.2 miles to where it forks. Park here. The study is located on the ridge west of the gully. From the fork, the study is 200 yards away by the edge of the chaining. The study is marked by 12-18 inch, green, steel fenceposts.





Map Name: Sage Valley . Diagrammatic Sketch

Township 14S Range 2W Section 6 GPS: NAD 83, UTM 12S 404409 E 4386173 N

DISCUSSION

Leamington Burn - Trend Study No. 21A-22

Study Information

This study was established in 1997 on a burned and seeded pinyon-juniper woodland [elevation: 5,300 feet (1,615 m), slope: 8%, aspect: northeast]. It is on BLM land approximately 17 miles (27.4 km) west of Nephi and 1 mile (1.6 km) south of SR-132. It is part of the extensive Leamington burn complex that took place during the summer of 1996. The area was aerially seeded, but not chained. The paired site, Leamington Burn and Chain (Study 21A-21), samples a burned area that was aerially seeded, then chained. The purpose of these paired studies is to contrast the difference in seeded species establishment and recovery between the treatments. Wildlife use has been very light. Deer use was estimated at less than 1 day use/acre (2 ddu/ha) in 2002 and 3 days use/acre (8 ddu/ha) in 2007. Elk use was estimated at 5 days use/acre (12 edu/ha) in 1998 and 1 day use/acre (3 edu/ha) in 2002 and 2007. Livestock were present during the 2002 reading. Cattle use was estimated at 13 days use/acre (32 cdu/ha) in 2002 and 16 days use/acre (39 cdu ha) in 2007. The cattle pats in 2007 were from the previous year.

Soil

The soil is classified as a Borvant-Reywat complex (USDA-NRCS 2007). Soils in the Borvant series are shallow over a petrocalcic horizon, and are well-drained. They formed in alluvium or colluvium derived from limestone and sandstone. Soils in the Reywat series are also shallow and well-drained, and formed in residuum and colluvium derived dominantly from andesite and basalt. The soil texture is a loam with a neutral reaction (pH 7.0). Soil phosphorus is marginal at 8 ppm (Tiedemann and Lopez 2004). Rocks are common on the surface and within the profile, and some of the rocks beneath the soil surface have calcium carbonate deposits. The soil surface was described as hard in 2007. Relative bare ground cover increased from 16% in 1999 to 41% in 2002, then decreased to 25% by 2007. Although there is a considerable percentage of bare soil cover, erosion is minimal. The erosion condition was classified as stable in 2002 and 2007.

Browse

Prior to the fire, the dominant vegetation consisted of Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*). Shrubs have been rare since the study burned. A group of unburned juniper trees intermixed with Wyoming big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) remains at the end of the baseline, where the majority of the pellet groups were sampled. The sagebrush population was tall and unused in 2007, and density is very low at only 20 plants/acre (49 plants/ha). Nevada ephedra (*Ephedra nevadensis*) and fourwing saltbush (*Atriplex canescens*) also occur in low densities. Sprouting species, such as white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*), and broom snakeweed (*Gutierrezia sarothrae*) have been sampled at higher densities.

Herbaceous Understory

The majority of vegetative cover is provided by the herbaceous understory, mainly grasses. Total grass cover increased dramatically from 7% in 1997 to 37% in 1998, decreased to 16% in 2002, and increased to 21% in 2007. However, cheatgrass (*Bromus tectorum*) provided the large majority of the grass cover in 1998 and 1999 at 26% and 20% cover, respectively. Average cheatgrass cover declined to 5% in 2002 and 4% in 2007, while seeded and native perennial grasses steadily increased in cover. Average perennial grass cover was 5% in 1997, 11% in 1998, 10% in 1999, 11% in 2002, and 17% in 2007. Common species include crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*Agropyron spicatum*), Sandberg bluegrass (*Poa secunda*), and Indian ricegrass (*Oryzopsis hymenoides*). Elongated wheatgrass (*Agropyron elongatum*), Russian wildrye (*Elymus junceus*), smooth brome (*Bromus inermis*), and bottlebrush squirreltail (*Sitanion hystrix*) are also present in low frequencies.

The forb component was diverse in 1997 and 1998 with 16 and 15 species sampled, respectively, but declined to nine species sampled in 2002 and 11 species sampled in 2007. In 1997, approximately half of the total forb cover was provided by perennial species, but annuals were largely dominant in 2002 and 2007. The most common species were bur buttercup (*Ranunculus testiculatus*), an allelopathic annual (Buchanan et al. 1978), and desert alyssum (*Alyssum desertorum*). Additionally, knapweed (*Centaurea* sp.) and musk thistle (*Carduus nutans*), both noxious species, were sampled in 1998 and 2002, respectively.

1998 TREND ASSESSMENT

The trend for browse is stable. No preferred browse species were sampled, which is a slight decrease from three ephedra plants being sampled in 1997. The trend for grass is slightly down. The sum of nested frequency for perennial grasses remained stable, while cheatgrass increased significantly in nested frequency. Cheatgrass quadrat frequency increased from 54% to 99%, and average cover increased from 2% to 26%. Crested wheatgrass also increased significantly in nested frequency, however, the increase was not as substantial as that of cheatgrass. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased almost 50%. Longleaf phlox (*Phlox longifolia*) decreased significantly in nested frequency. Knapweed was sampled at a quadrat frequency of 5%. The Desirable Components Index (DCI) was rated as poor in 1997 due to the lack of browse and relatively low perennial grass and forb cover. The DCI rating decreased to very poor in 1998 due to the increase in cheatgrass cover and the presence of a noxious weed.

1997 winter range condition (DCI) - poor (13) Low potential scale
1998 winter range condition (DCI) - very poor (4) Low potential scale
browse - stable (0) grass - slightly down (-1) forb - down (-2)

1999 TREND ASSESSMENT

The trend for browse is stable. The shrub component remained depleted, although ephedra density increased from 0 plants/acre to 40 plants/acre (99 plants/ha). The trend for grass is down. The sum of nested frequency for perennial grasses decreased 28%, while that for cheatgrass increased 6%. Cheatgrass quadrat frequency remained high at 97%, while its cover declined from 26% to 20%. Sandberg bluegrass decreased significantly in nested frequency. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs decreased 32%. Douglas chaenactis (*Chaenactis douglasii*) decreased significantly in nested frequency, while prickly lettuce (*Lactuca serriola*) increased significantly in nested frequency. Knapweed was not sampled. The DCI rating remained very poor.

winter range condition (DCI) - very poor (6) Low potential scale
browse - stable (0) grass - down (-2) forb - slightly down (-1)

2002 TREND ASSESSMENT

The trend for browse is stable. Ephedra density increased from 40 plants/acre (99 plants/ha) to 60 plants/acre (148 plants/ha), and was moderately hedged. Sagebrush was also sampled at a density of 20 plants/acre (49 plants/ha). The trend for grass is up. The sum of nested frequency for perennial grasses increased two-fold. Crested wheatgrass and Sandberg bluegrass increased significantly in nested frequency. Cheatgrass decreased significantly in nested frequency, and its average cover decreased from 20% to 5%. However, cheatgrass quadrat frequency remained high at 96%. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 47%, while that for annuals increased substantially. Bur buttercup and alyssum both increased significantly in nested frequency. Annual forb cover increased from less than 1% to 3%. Musk thistle was sampled, but only in one quadrat. The DCI rating increased to poor due to the increase in perennial grass cover and the decrease in annual grass cover.

winter range condition (DCI) - poor (18) Low potential scale
browse - stable (0) grass - up (+2) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density remained stable, and ephedra density declined slightly from 60 plants/acre (148 plants/ha) to 20 plants/acre (49 plants/ha). The trend for grass is up. The sum of nested frequency for perennial grasses increased almost 30% and cover increased from 11% to 17%. Sandberg bluegrass increased significantly in nested frequency. Average cheatgrass cover continued to decrease from 5% to 4%. However, cheatgrass nested frequency and quadrat frequency remained stable. The trend for forbs is stable. The sum of nested frequency for perennial forbs did not change, however, bur buttercup, which may inhibit the germination of other species (Buchanan et al. 1978), increased significantly in nested frequency. Alyssum also increased significantly in nested frequency. No noxious weeds were sampled. The DCI rating improved to fair due to the increase in perennial grass cover and the absence of noxious weeds.

winter range condition (DCI) - fair (27) Low potential scale
browse - stable (0) grass - up (+2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 21A, Study no: 22

Type	Species	Nested Frequency					Average Cover %				
		'97	'98	'99	'02	'07	'97	'98	'99	'02	'07
G	Agropyron cristatum	a6	b35	b36	c82	c108	.27	1.50	1.63	3.56	6.34
G	Agropyron elongatum	-	a3	a4	a11	a15	-	.04	.18	.36	.42
G	Agropyron spicatum	a60	a41	a46	a65	a59	2.20	3.90	5.94	4.08	4.28
G	Bromus inermis	-	-	a1	a4	a3	-	-	.03	.01	.06
G	Bromus japonicus (a)	-	-	-	a4	a14	-	-	-	.03	.02
G	Bromus tectorum (a)	a153	c430	c454	b340	b345	2.34	26.01	20.14	4.54	4.30
G	Elymus junceus	-	ab4	a1	ab6	b11	-	.03	.03	.16	.37
G	Oryzopsis hymenoides	a68	a58	a49	a39	a45	1.26	3.06	1.54	1.44	1.57
G	Poa secunda	b63	b54	a7	c110	d183	.87	1.22	.04	1.51	3.80
G	Sitanion hystrix	b16	ab22	ab12	ab7	a2	.17	.78	.18	.04	.00
G	Stipa comata	-	-	-	7	-	-	-	-	.03	-
Total for Annual Grasses		153	430	454	344	359	2.34	26.01	20.14	4.57	4.32
Total for Perennial Grasses		213	217	156	331	426	4.78	10.55	9.60	11.22	16.86
Total for Grasses		366	647	610	675	785	7.13	36.57	29.75	15.80	21.19
F	Alyssum desertorum (a)	a1	a2	a3	b81	c272	.00	.00	.00	.14	1.24
F	Arabis sp.	a3	-	a3	-	-	.00	-	.07	-	-
F	Astragalus beckwithii	a4	a-	-	-	-	.06	.00	-	-	-
F	Camelina microcarpa (a)	-	a6	a3	a16	a3	-	.06	.03	.22	.03
F	Carduus nutans (a)	-	-	-	2	-	-	-	-	.00	-
F	Calochortus nuttallii	a3	-	a-	a1	a1	.01	-	.00	.00	.00
F	Centaurea sp.	-	7	-	-	-	-	.05	-	-	-
F	Chaenactis douglasii	b52	b42	a2	a8	-	.97	1.20	.00	.01	-
F	Chorispora tenella (a)	-	-	-	-	5	-	-	-	-	.03

Type	Species	Nested Frequency					Average Cover %				
		'97	'98	'99	'02	'07	'97	'98	'99	'02	'07
F	Crepis acuminata	-	-	-	-	-	-	.03	-	-	-
F	Descurainia pinnata (a)	$_{b}$14	-	$_{ab}$6	$_{a}$4	$_{ab}$16	.13	-	.18	.00	.03
F	Draba sp. (a)	-	$_{a}$14	-	-	$_{a}$14	-	.02	-	-	.02
F	Eriogonum cernuum (a)	$_{a}$6	$_{a}$3	-	-	-	.30	.03	-	-	-
F	Erigeron sp.	-	3	-	-	-	-	.03	-	-	-
F	Gilia sp. (a)	77	-	-	-	-	1.64	-	-	-	-
F	Holosteum umbellatum (a)	-	-	-	-	15	-	-	-	-	.09
F	Lactuca serriola	$_{a}$6	$_{a}$17	$_{b}$45	-	-	.61	.49	.37	-	-
F	Lesquerella sp.	38	-	-	-	-	.19	-	-	-	-
F	Medicago sativa	$_{a}$1	$_{a}$4	$_{a}$3	-	-	.00	.18	.04	-	-
F	Nicotiana attenuata (a)	-	2	-	-	-	-	.00	-	-	-
F	Phlox longifolia	$_{b}$46	$_{a}$13	-	$_{a}$17	$_{a}$28	.36	.03	-	.06	.06
F	Ranunculus testiculatus (a)	$_{b}$112	$_{a}$3	$_{a}$5	$_{c}$271	$_{d}$371	.76	.03	.01	2.91	2.11
F	Salsola iberica (a)	-	$_{a}$-	$_{a}$5	$_{a}$-	-	-	.15	.18	.00	-
F	Sanguisorba minor	$_{a}$1	$_{a}$2	-	-	-	.15	.15	-	-	-
F	Sisymbrium altissimum (a)	-	$_{a}$1	$_{a}$8	-	$_{b}$21	-	.15	.18	-	.55
F	Streptanthus cordatus	7	-	-	-	-	.04	-	-	-	-
F	Tragopogon dubius	$_{a}$3	$_{a}$3	$_{a}$4	$_{a}$4	$_{a}$1	.03	.10	.05	.00	.00
Total for Annual Forbs		210	31	30	374	717	2.84	0.46	0.60	3.29	4.12
Total for Perennial Forbs		164	91	57	30	30	2.44	2.28	0.53	0.09	0.07
Total for Forbs		374	122	87	404	747	5.28	2.74	1.13	3.38	4.19

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

BROWSE TRENDS --
Management unit 21A, Study no: 22

Type	Species	Strip Frequency					Average Cover %				
		'97	'98	'99	'02	'07	'97	'98	'99	'02	'07
B	Artemisia tridentata vaseyana	0	0	0	1	1	-	-	-	.15	.00
B	Chrysothamnus nauseosus	0	0	0	0	16	-	-	-	-	1.20
B	Chrysothamnus nauseosus albicaulis	0	1	3	4	8	.00	-	.38	.38	.03
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	1	1	2	.03	.15	.00	-	.15
B	Ephedra nevadensis	1	0	1	1	1	-	-	-	.00	.15
B	Gutierrezia sarothrae	2	8	15	13	14	.18	.86	1.03	.65	.61
B	Leptodactylon pungens	0	0	4	9	8	.00	-	-	.06	-
Total for Browse		3	10	24	29	50	0.22	1.00	1.42	1.25	2.15

CANOPY COVER, LINE INTERCEPT --
Management unit 21A, Study no: 22

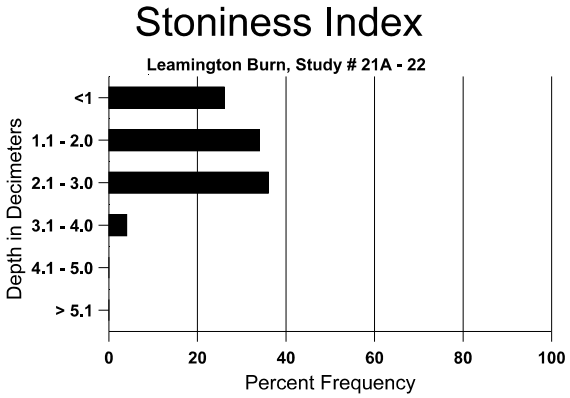
Species	Percent Cover	
	'02	'07
Chrysothamnus nauseosus	-	2.33
Ephedra nevadensis	-	.55
Gutierrezia sarothrae	-	.30

BASIC COVER --
Management unit 21A, Study no: 22

Cover Type	Average Cover %				
	'97	'98	'99	'02	'07
Vegetation	13.11	39.16	35.04	22.46	30.36
Rock	11.08	9.00	6.96	7.53	7.05
Pavement	20.50	12.50	5.31	6.49	10.67
Litter	7.05	28.25	39.20	27.58	33.95
Cryptogams	2.08	.19	.06	.22	.24
Bare Ground	32.10	28.43	16.73	44.74	26.81

SOIL ANALYSIS DATA --
Herd Unit 21A, Study no: 22, Leamington Burn

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
13.7	62.0 (13.5)	7.0	46.7	28.4	24.8	2.4	8.0	214.4	.6



PELLET GROUP DATA --
Management unit 21A, Study no: 22

Type	Quadrat Frequency				
	'97	'98	'99	'02	'07
Rabbit	15	1	24	14	70
Elk	-	1	4	-	1
Deer	1	1	1	1	2
Cattle	1	-	2	5	7

Days use per acre (ha)	
'02	'07
-	-
1 (3)	1 (3)
1 (2)	3 (8)
13 (32)	16 (40)

BROWSE CHARACTERISTICS --
Management unit 21A, Study no: 22

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
97	**0**	-	-	-	-	80	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	80	0	0	-	-	0	11/9
02	**20**	-	-	20	-	-	0	0	-	-	0	9/11
07	**20**	-	-	20	-	-	0	0	-	-	0	23/32
Atriplex canescens												
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	-	-	-	-	-	0	0	-	-	0	46/33
02	**0**	-	-	-	-	-	0	0	-	-	0	24/32
07	**0**	-	-	-	-	-	0	0	-	-	0	42/46

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus												
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	0	-	0	-/-
99	**0**	-	-	-	-	-	0	0	0	-	0	-/-
02	**0**	-	-	-	-	-	0	0	0	-	0	-/-
07	**940**	60	100	800	40	20	6	0	4	-	2	24/29
Chrysothamnus nauseosus albicaulis												
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**20**	-	20	-	-	-	0	0	0	-	0	-/-
99	**60**	-	-	60	-	-	0	0	0	-	0	27/27
02	**100**	-	20	80	-	-	20	20	0	-	0	30/38
07	**380**	-	20	340	20	-	5	0	5	-	0	12/11
Chrysothamnus viscidiflorus viscidiflorus												
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**20**	-	-	20	-	-	0	0	0	-	0	-/-
99	**40**	-	-	40	-	-	0	0	0	-	0	13/18
02	**40**	-	-	40	-	-	0	0	0	-	0	13/18
07	**40**	-	-	20	20	-	0	0	50	50	50	13/31
Ephedra nevadensis												
97	**60**	-	60	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**40**	-	-	40	-	-	0	0	-	-	0	19/34
02	**60**	-	-	60	-	-	100	0	-	-	0	21/38
07	**20**	-	-	20	-	-	0	0	-	-	0	27/47
Gutierrezia sarothrae												
97	**80**	-	20	60	-	-	0	0	0	-	0	7/3
98	**240**	20	-	240	-	-	0	0	0	-	0	12/20
99	**520**	-	20	500	-	-	0	0	0	-	0	12/20
02	**360**	-	-	280	80	80	0	0	22	11	11	7/13
07	**320**	260	60	260	-	-	6	0	0	-	6	10/16
Juniperus osteosperma												
97	**0**	-	-	-	-	40	0	0	-	-	0	-/-
98	**0**	-	-	-	-	20	0	0	-	-	0	-/-
99	**0**	-	-	-	-	80	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Leptodactylon pungens												
97	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	0	-	0	-/-
99	**80**	-	40	40	-	-	0	0	0	-	0	3/6
02	**260**	-	-	260	-	-	0	0	0	-	0	5/10
07	**180**	-	-	160	20	-	0	0	11	-	0	6/14

Summary and Comparison between Leamington Burn and Chain (21A-21)
and Leamington Burn (21A-22)

Studies 21A-21 and 21A-22 were established in 1997 to monitor the recovery of the vegetation community on two treatments following the Leamington wildfire complex that burned in 1996. These studies were paired to compare differences in restoration efforts between seeding only (21A-22) and seeding followed by one-way chaining (21A-21) to cover the seed and enhance establishment of the seeded species. Both of these studies were seeded with the same mix.

As with the previous fire rehabilitation studies, the herbaceous understory, primarily the grass component, dominates the vegetation community at the Leamington sites. Perennial grasses established more quickly on the chained study, and were higher in average cover and nested frequency from 1997-2002 (Figures 1 and 2). In 1998, perennial grass cover and nested frequency on the chained study were almost double that on the unchained study. By 2007, average cover and nested frequency were similar for the two studies.

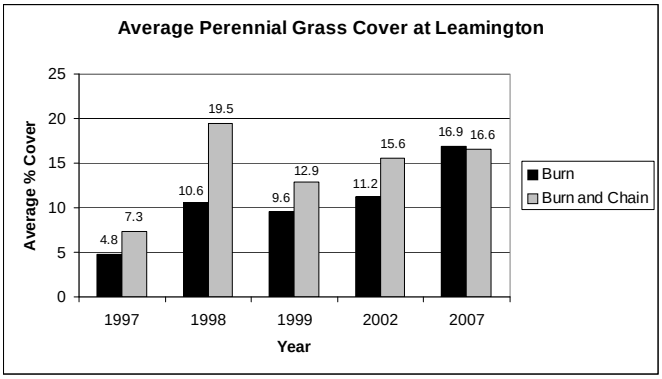


Figure 1. Average perennial grass cover on the Leamington fire rehabilitation studies, 1997-2007.

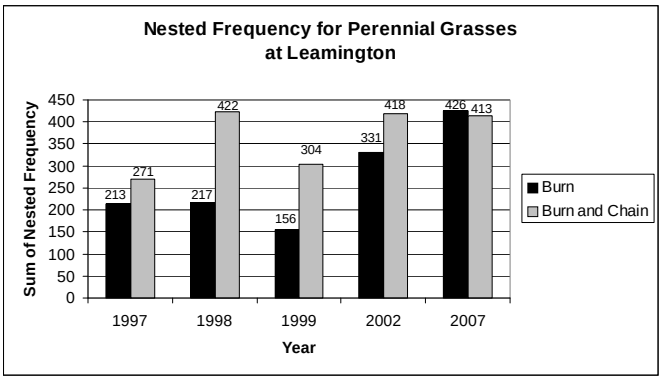


Figure 2. Nested frequency for perennial grasses on the Leamington fire rehabilitation studies, 1997-2007.

Average cheatgrass (*Bromus tectorum*) cover was lower on the chained study in 1997-1999, but was similar to the unchained study in 2002 and 2007 (Figures 3 and 4). Cheatgrass cover on the unchained study was more than double that on the chained study in 1998 and 1999. The nested frequency of cheatgrass was greater on the unchained study in all sample years.

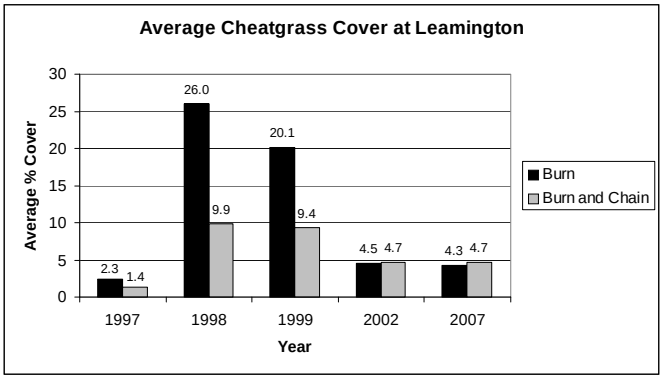


Figure 3. Average cheatgrass cover on the Leamington fire rehabilitation studies, 1997-2007.

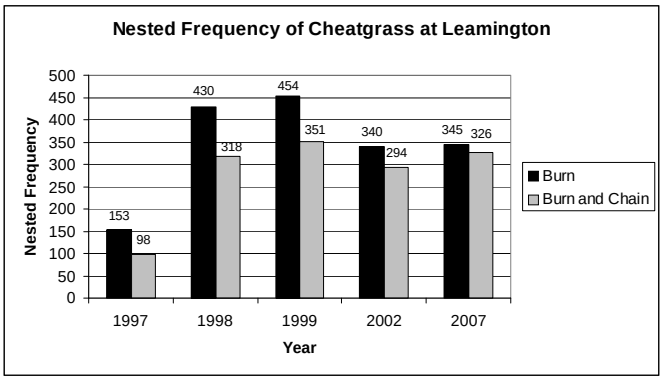


Figure 4. Nested frequency of cheatgrass on the Leamington fire rehabilitation studies, 1997-2007.

Although both studies have a limited and poor forb component, average cover and sum of nested frequency for perennial forbs were slightly greater on the unchained study in 1997 and 1998, and were similar for both studies in 1999, 2002, and 2007. Alfalfa (*Medicago sativa*) and small burnet (*Sanguisorba minor*) were seeded on both studies, but quadrat frequencies were less than 4% for each species in 1997-2002, and neither species was sampled in 2007. The browse component is also very sparse. Fourwing saltbush (*Atriplex canescens*) was seeded, but provided little cover.

The best way to control cheatgrass competition is to establish a healthy and abundant perennial understory (Monsen 1994). Chaining following a seeding provides cover for germinating seeds, and allows them to establish more readily. The comparison between the Leamington studies illustrates this point. Preparation of the seedbed allowed perennial grasses to establish quickly, which minimized the spread of cheatgrass. On average, seeded grass species also had higher quadrat frequencies and cover values on the chained study, indicating that the seedbed preparation allowed more widespread establishment.

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