

# UTAH BIG GAME RANGE TREND STUDIES 2003 Volume 2 Southern Region



**PUBLICATION NUMBER 04-18  
REPORT FOR FEDERAL AID PROJECT W-82-R-48**

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

**UTAH BIG GAME  
RANGE TREND STUDIES  
2003 Volume 2**

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## 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 2003 field season and reported in this publication involves the reading of interagency range trend studies in the DWR Southern Region. Most trend studies surveyed in these management units were established in the 1980's with rereads at 5 year intervals.

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

### Bureau of Land Management

- Cedar City Field Office
- Grand Staircase-Escalante National Monument
- Kanab Field Office
- Fillmore Field Office
- Richfield Field Office
- St. George Field Office

### Dixie National Forest

- Cedar City Ranger District
- Escalante Ranger District
- Pine Valley Ranger District
- Powell Ranger District
- Teasdale Ranger District

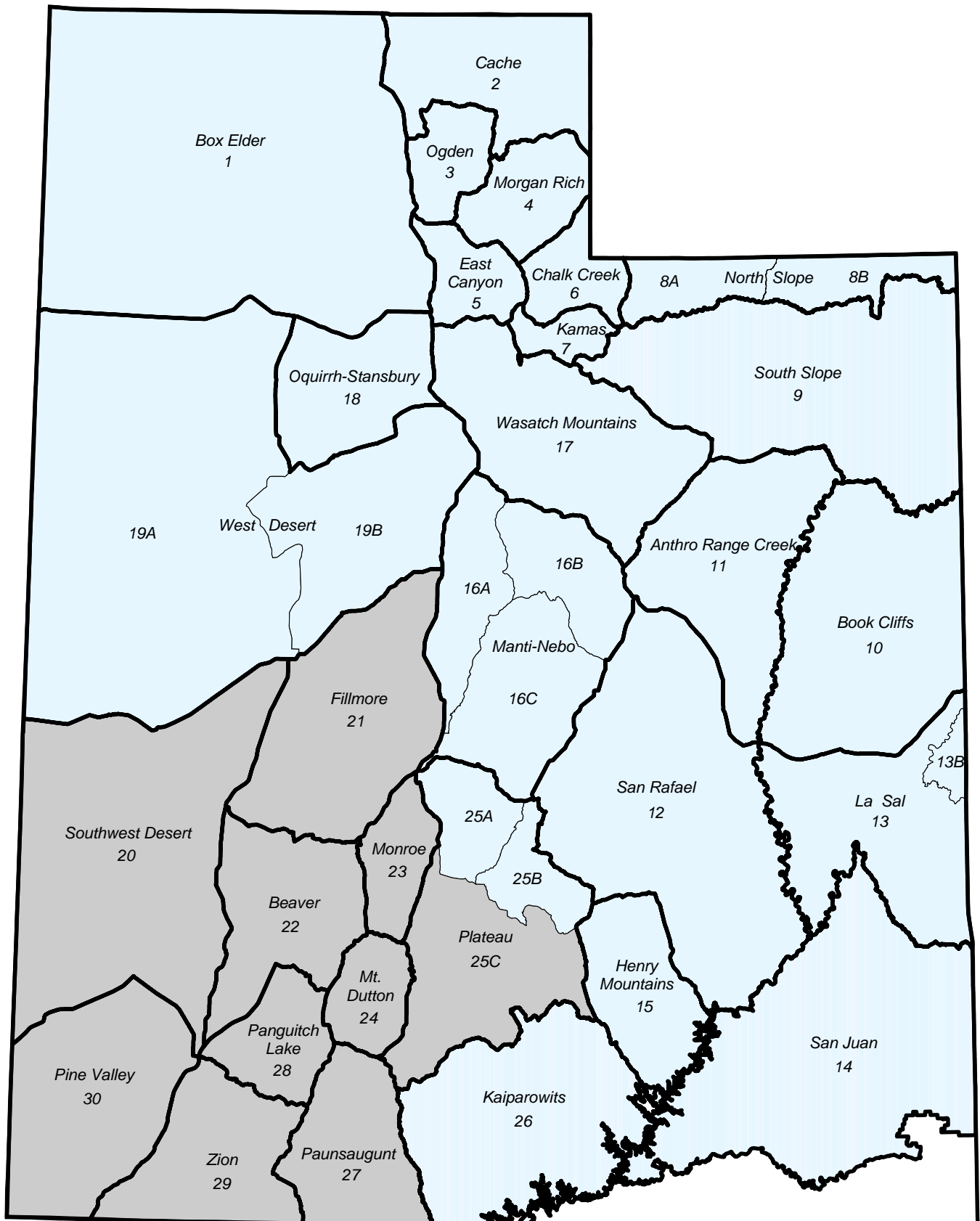
### Fishlake National Forest

- Beaver Ranger District
- Fillmore Ranger District
- Richfield Ranger District

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



# Utah Management Units Surveyed in 2003



## RANGE TREND STUDY METHODS

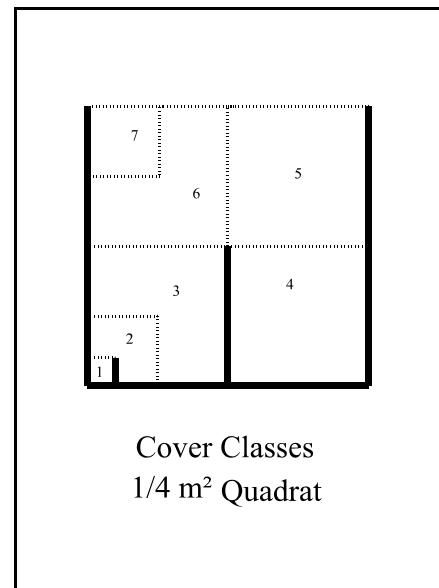
Studies monitoring range trend depend greatly on site selection, especially when dealing with large geographic areas such as wildlife management units. Since it is impossible to intensively monitor all vegetative or habitat types within a unit, it is necessary to concentrate on specific sites and/or “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

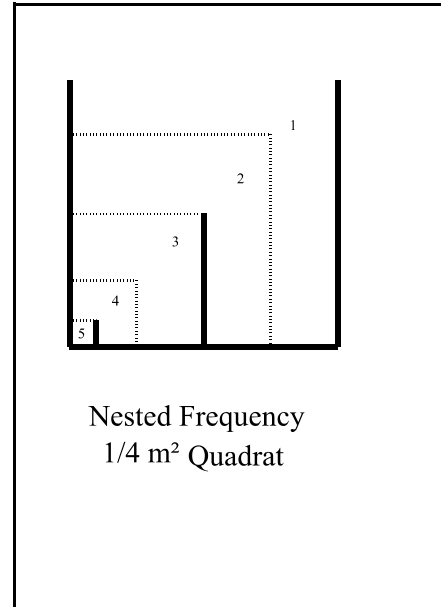
Determining vegetational characteristics for each “key” area is determined by setting up 5 consecutive 100 foot baseline transects in the area of interest. This 500 foot line is the baseline and one, 100 foot belt is placed perpendicular to each 100 foot section of the baseline at random foot marks and 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<sup>2</sup> quadrat is centered every 5 feet along the same side of the belt, starting at the 5 foot mark. Cover and nested frequency values are determined for vegetation, litter, rock, pavement, cryptogams, and bare ground. Cover and nested frequency values are also estimated for all plant species occurring within a quadrat, including annual species.

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.

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



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



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

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

Shrub 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. (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 1/5-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	<i>Agropyron spicatum</i>	<sub>b</sub> 227	<sub>b</sub> 227	<sub>a</sub> 183	<sub>a</sub> 160	7.78	5.59
G	<i>Bromus tectorum</i> (a)	-	-	<sub>b</sub> 42	<sub>a</sub> 15	.43	.03
G	<i>Oryzopsis hymenoides</i>	4	12	12	5	.17	.04
G	<i>Poa fendleriana</i>	<sub>a</sub> 6	<sub>bc</sub> 36	<sub>c</sub> 49	<sub>ab</sub> 24	.98	.46
G	<i>Poa secunda</i>	<sub>a</sub> 3	<sub>a</sub> 18	<sub>b</sub> 94	<sub>b</sub> 80	2.00	.94
G	<i>Sitanion hystrix</i>	<sub>c</sub> 25	<sub>bc</sub> 20	<sub>ab</sub> 6	<sub>a</sub> 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	<i>Agoseris glauca</i>	<sub>a</sub> -	<sub>a</sub> 10	<sub>ab</sub> 1	<sub>a</sub> -	.00	-
F	<i>Arabis</i> spp.	<sub>a</sub> -	<sub>b</sub> 18	<sub>a</sub> 1	<sub>a</sub> 1	.00	.00
F	<i>Astragalus convallarius</i>	2	4	6	6	.15	.10
F	<i>Calochortus nuttallii</i>	4	8	-	-	-	-
F	<i>Crepis acuminata</i>	-	6	7	-	.06	-
F	<i>Eriogonum racemosum</i>	-	-	4	-	.03	-
F	<i>Eriogonum umbellatum</i>	<sub>a</sub> -	<sub>a</sub> 1	<sub>b</sub> 9	<sub>ab</sub> 5	.16	.07
F	<i>Phlox austromontana</i>	-	6	4	6	.16	.15
F	<i>Physaria chambersii</i>	1	4	-	-	-	-
F	<i>Phlox longifolia</i>	<sub>a</sub> 8	<sub>b</sub> 27	<sub>a</sub> 16	<sub>a</sub> 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 than 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<sup>2</sup> 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	<i>Artemisia nova</i>	35	26	2.24	2.41
B	<i>Artemisia tridentata vaseyana</i>	40	26	2.54	.76
B	<i>Gutierrezia sarothrae</i>	2	0	-	-
B	<i>Juniperus osteosperma</i>	4	5	5.51	9.29
B	<i>Opuntia</i> spp.	1	2	.15	-
B	<i>Pinus edulis</i>	4	6	5.99	8.81
B	<i>Purshia tridentata</i>	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.

CANOPY COVER, LINE INTERCEPT --

Management unit 23 , Study no: 1

Species	Percent Cover	
	'98	'03
<i>Artemisia nova</i>	-	1.85
<i>Artemisia tridentata vaseyana</i>	-	.55
<i>Juniperus osteosperma</i>	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
<i>Artemisia tridentata vaseyana</i>	1.1
<i>Purshia tridentata</i>	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
<i>Juniperus osteosperma</i>	213	197	8.8	7.0
<i>Pinus edulis</i>	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

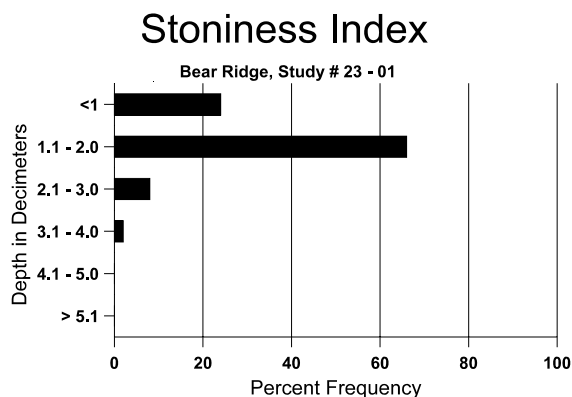
Percent organic matter (% OM) refers to the amount of organic matter in the top 12 inches of the soil profile. Parts per million (ppm) of phosphorus (P) and potassium (K) are also included. Values for phosphorus and potassium less than 10 ppm and 70 ppm respectively may be limiting to plant growth and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

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<sup>2</sup> circular plots which are placed through the study area. These are usually two parallel transects of 25 plots on each side of the 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.

On the following page is a section of a “Browse Characteristics” table which 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 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	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>											
85	<b>1400</b>	266	200	400	800	-	67	24	57	14	13/15
91	<b>1065</b>	333	333	66	666	-	19	6	63	38	12/13
98	<b>1100</b>	-	100	260	740	2300	56	2	67	40	15/23
03	<b>840</b>	-	120	140	580	1740	29	0	69	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. 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 and increased percent decadence. Also, the number of dead plants encountered is more than double the number of live plants inventoried. 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. 1987). In some cases, most notably *Agropyron* and *Purshia*, the species names used by the Range Trend Study Plant Species List (Giunta 1983) and the Intermountain Flora (Cronquist et al. 1977) are retained to maintain continuity and alleviate confusion with earlier published reports.

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- <sup>1</sup>U.S. Department of Interior Bureau of Land Management. 1996. Utilization Studies and Residual Measurements, Interagency Technical Reference, BLM/RS/ST-96/004+1730.
- <sup>2</sup>U.S. Department of Interior Bureau of Land Management. 1996. Sampling vegetation attributes, Interagency Technical Reference, BLM/RS/ST-96/002+1730.
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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).

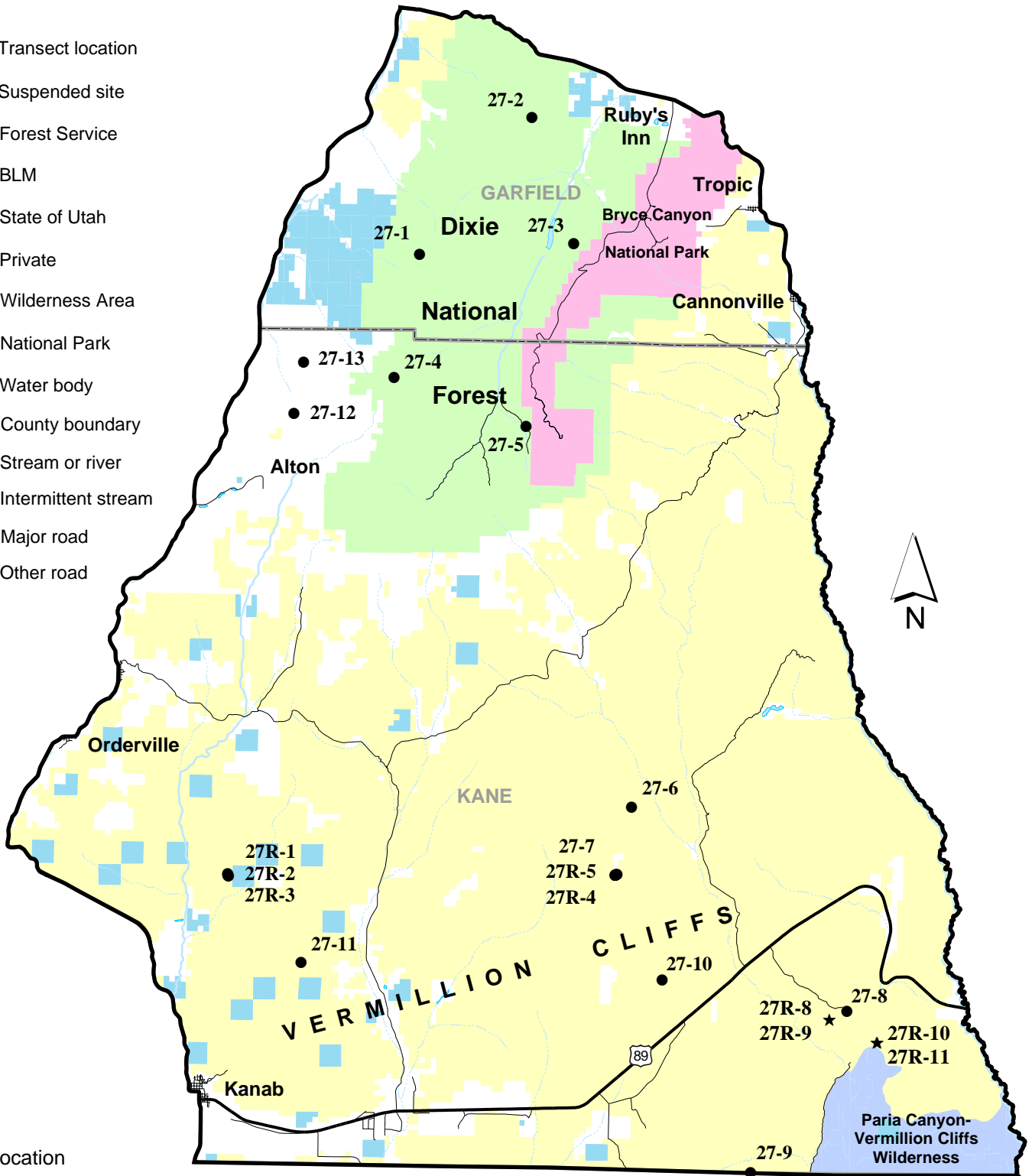
A discussion of the study site includes descriptions of the site's physical characteristics (elevation, slope, aspect), soil, ground cover, vegetative community, and species composition. The trend assessment is based upon the comparison of the recent year and the previous years data. Additional assessment 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.

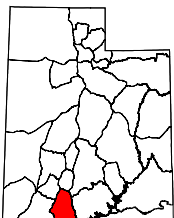
Summaries and evaluations at the end of each management unit address range trends in these key areas. This report will serve to identify and verify changes that are occurring on key areas for big game.

# Management Unit 27

- Transect location
- ★ Suspended site
- Forest Service
- BLM
- State of Utah
- Private
- Wilderness Area
- National Park
- Water body
- County boundary
- Stream or river
- Intermittent stream
- Major road
- Other road



Unit Location



0 2.5 5 10 15 Miles

## WILDLIFE MANAGEMENT UNIT 27 - PAUNSAUGUNT

### Boundary Description

**Kane and Garfield counties** - Boundary begins at highway US-89A and the Utah-Arizona state line; then north on US-89A to Highway US-89; then north on US-89 to Highway SR-12; then east on SR-12 to the Paria River; then south along the Paria River to the Arizona-Utah state line; then west along this state line to US-89A and beginning point.

### Winter Range Description

The Paunsaugunt wildlife management unit encompasses approximately 280,471 acres of summer range and 205,284 acres of winter range for deer, of which only 26% and 7% respectively occurs on private land. The vast majority of the winter range in the unit (85%) is managed by the Bureau of Land Management, while most of the summer range falls under Forest Service administration (40%), private land holdings (26%), and the Bureau of Land Management (25%). The Paunsaugunt Plateau provides the bulk of the summer range in the unit with an average elevation of 9,000 feet. The southern rim of the plateau is delineated by the Pink Cliffs of Bryce Canyon National Park and the Sunset Cliffs to the west. Terrain of the transitional and/or winter range is characterized by gently sloping terraces interspersed by extensive cliff formations. The Skutumpah Terrace lies between the Pink Cliffs and White Cliffs; the Wygaret Terrace, Nephi Pasture, and No Man's Mesa lie between the White and Vermillion Cliffs. The bulk of the winter range is found on the Wygaret Terrace.

### Key Areas

The key areas that have been identified on the summer range are the mixed mountain brush community in the upper reaches of Proctor Canyon, a high elevation black sagebrush-grass community between Ahlstrom Hollow and Johnson Bench, the ponderosa pine type on Whiteman Bench, the conifer clear-cut with its associated aspen resurgence below the Sunset Cliffs near Sand Pass, and the grass meadow type in Podunk Creek. Three studies were established in 1987 on deer winter range which are all on BLM land. Sagebrush is the dominant vegetation type on the two Nephi Pasture sites, and black sagebrush predominates on the Five Mile Mountain study site. An additional 5 study sites were established in 1997 to include important areas previously missed by trend studies. These include critical winter ranges on the south end of the unit on Buckskin Mountain, Telegraph Flat, and Crocodile. Two additional sites at Moon's Landing and Heaton, on the west side of the unit, sample mountain brush and sagebrush/bitterbrush transitional ranges at around 8,000 feet. In 1998, trend studies were established at several exclosures in the unit to determine differences in grazing treatments. These studies are found at the exclosure complexes in Nephi Pasture and John R. Flat. Both of these areas are important deer wintering areas.

### Livestock Grazing

**Grazing information from the 1997 report has been retained here. This information was current in 1997 but specific dates and AUM's may have changed since.**

Trend studies on Whiteman Bench and Podunk Creek lie within the East Fork C & H allotment which is managed by the Powell Ranger District, Dixie National Forest. This allotment has been grazed by domestic livestock since Panguitch Valley was settled in 1866. Use was extremely heavy by both cattle and sheep. The East Fork bottom land was the most productive and consequently received the most use. Streams were degraded and riparian vegetation was eliminated. In 1960, the permittees and Forest Service signed a Range Improvement Agreement which called for a 25% reduction in AUMs and a Forest Service commitment to

perform watershed improvement and range revegetation work. The present grazing system was implemented in 1975 and involves a seven pasture combination deferred rotation system. A total of 443 cows, owned by 12 permittees, use the allotment from about June 16 to about October 5. The Whiteman Bench site is located in the Tropic Reservoir Unit which is grazed for only 5 days in late September. The Podunk Creek site is located in the Upper East Fork Unit which is grazed annually between the end of July to the end of August, depending on the rotation, with 443 head of cattle.

The Proctor Canyon site is located in the Hatch Cattle Allotment. Very heavy sheep use occurred in this area around 1900. By the 1920's, the range was seriously overgrazed causing the depletion of vegetation and soils. Grazing pressure was reduced in the 1930's. By 1943, all the sheep were removed and cattle numbers were reduced. Although range studies showed that the allotment was still over utilized during the 1950's, cattle numbers remained the same through 1964. Allotment boundary changes and reductions have resulted in a total of 45 head using the allotment for the June 16 to September 15 season. The allotment is split into two units, and a deferred- rotation system is in place. Proctor Canyon is grazed early one year (6/16 - 8/15) and then later the next year (7/16 - 9/15) to effect two grazing treatments; grazing at range readiness one year and at late plant flowering through seed ripe the second year. Although 9,648 acres are included in this allotment, only 571 are considered suitable range for livestock. The steeper slopes provide an abundance of browse forage for mule deer; and consequently, winter range does not appear to limit deer numbers on this portion of the unit. Concentrated use by livestock on the small more productive portions of the unit will limit their value as summer range habitat for wildlife, especially in periods of drought.

The Ahlstrom Hollow study site is located in the Blue Fly Allotment which is currently assigned for 190 cattle between June 10th to October 10th. This allotment has a similar grazing history to that of the previous two. Excessive use by sheep was followed by reductions, and then in 1962, cattle replaced the sheep. A 5 pasture deferred rotation system was in place from 1930 to 1962, then a 2 pasture rest rotation system was initiated. The trend study is located in the south pasture of this allotment.

The Sand Pass trend study is located in the Kanab Creek C & H Allotment. This allotment experienced similar patterns of use since the late 1800's. Sheep use was followed by cattle in the 1950's. A series of allotment boundary changes and livestock reductions have taken place. The current allotment boundary was established in 1962. A three-pasture deferred rotation system is currently in place which is grazed by 60 head of cattle annually from June 11 to October 10. The Sand Pass trend study is located in the upper Unit 1 which is grazed with a deferred rest rotation grazing plan.

The two Nephi Pasture study sites are located in the Vermillion-Nephi Pasture BLM Allotment. Prior to 1970, 210 cattle used the unit from mid-April to mid-September. Since 1970, the numbers have been reduced to 190 and the starting date delayed to June 1. No earlier records are available. However, as was the case for the entire herd unit, excessive use by sheep occurred. This lower elevation range was used as winter sheep range prior to 1950. The Nephi Pasture study sites currently are part of a 9 pasture deferred rotation grazing system that is grazed in the winter. The new study site at Telegraph Flat is also part of the Vermillion allotment. The Five Mile Mountain study site is also on BLM land and is grazed by cattle during the winter from November 1<sup>st</sup> to April 30<sup>th</sup> as part of a single pasture unit. The new site at Crocodile is within the Oak Springs allotment which receives summer use on a deferred rotation system. The Buckskin Mountain site, on the Arizona border, is part of the Mollies Nipple allotment which receives winter use.

### Herd Unit Management Objectives

This unit was previously combined with the adjacent Kaiparowits unit. Together they made up herd unit 60 A&B. In 1992, herd unit boundaries were reevaluated with the Paunsaugunt unit being changed to unit 52. In 1996, unit boundaries were again reevaluated and elk and deer herd units combined. The current boundary

is unchanged from 1992, but the unit number was changed to 27. The most current management objectives are to achieve a target population size of 6,500 wintering deer with a post season buck to doe ratio of 35:100. Buck deer harvest is managed for a 5 year old average age. Management objectives for elk are to a target winter herd size of 200 elk with a post season bull cow ratio of 16 bulls to 100 cows with at least 8 of these bulls being 2 ½ years or older. Bull harvest is managed for an average age of 5-6 year old animals.

Fawn production was low on the unit prior to 1992 and had declined steadily since 1987. Low fawn numbers are a factor which limited deer numbers in the past on the unit (Gardiner 1983). Inadequate summer range seems to be the key factor limiting fawn production. This has been exacerbated by years of drought. The long period of heavy use by sheep during the early part of this century, has reduced the forb component on the summer ranges and consequently, the productivity of these ranges as fawning habitat. Another factor is the gradual domination of seral aspen stands by conifers. This has greatly impacted deer summer range. Habitat improvement efforts should be directed towards converting areas that have shown good potential for aspen and reestablish them to productive seral stage plant communities again and seeding these areas with herbaceous species. Grazing systems in place on summer ranges, i.e. deferred-rotation and rest-rotation with cattle only, will tend to favor the production of forbs which should constitute a habitat improvement in most areas. Since a low of 51 fawns/100 does was estimated in 1992, fawn production had increased to 74 fawns/100 does by the next season (1992-93). Over the next four seasons, the average fawn/doe ratio was 71 fawns/100 does. Additional information on deer and elk management objectives and trend information for big game can be found in the Division's Big Game annual reports and management plans.

#### Study Site Description

Eight study sites were originally established in 1987 and reread in 1992. These include five summer range study sites which occur on Forest Service land on the Paunsaugunt plateau. Three sites sample winter range on BLM administered land. During the 1997 season, 3 additional winter range sites were established at Buckskin Mountain (27-9), Telegraph Flat (27-10) and Crocodile (27-11). Two new study sites were also placed on transitional range on the west site of the unit at Moons Landing (27-12) and Heaton (27-13). In 1998, studies were placed in the enclosure complexes at Nephi Pasture and John R. Flat to study differences in grazing treatments in these areas.



Trend Study 27-1-03

Study site name: Proctor Canyon.

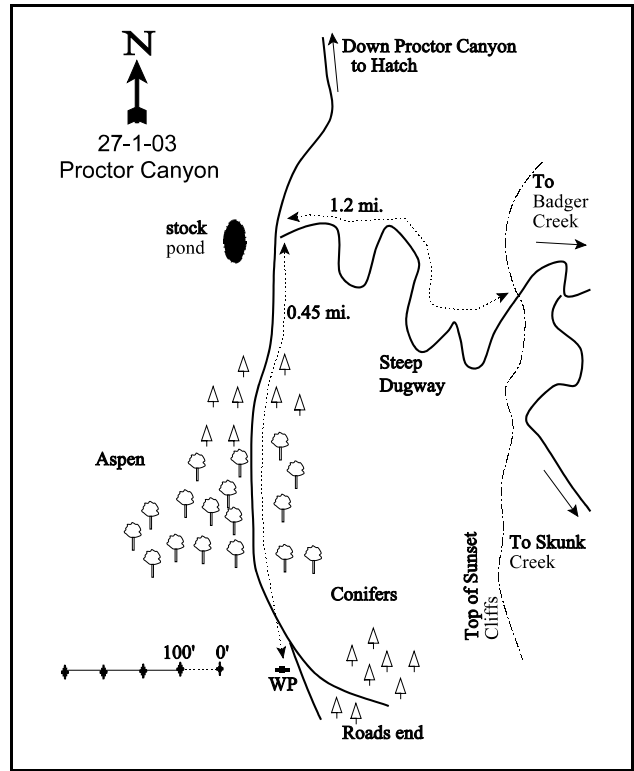
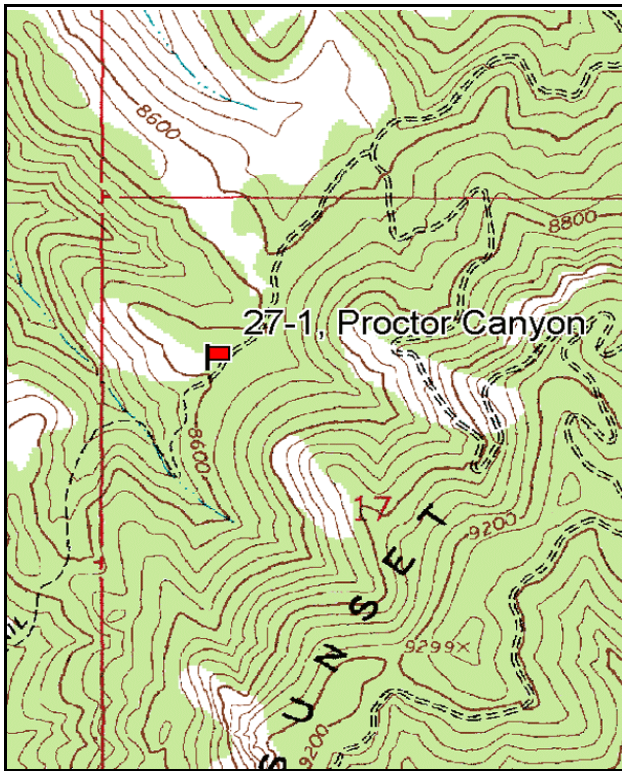
Vegetation type: Mountain Brush.

Compass bearing: frequency baseline 297 degrees magnetic.

Frequency belt placement: line 1 (11 & 71ft), line 2 (95ft), line 3 (59ft), line 4 (34ft). No rebar.

LOCATION DESCRIPTION

At the south end of Tropic Reservoir, turn west off the East Fork Sevier Road and proceed up Badger Creek 2.45 miles. Keep left at the fork and continue towards Proctor Canyon 3.5 miles to a fork at the top of the mountain. Go right towards Hatch for 1.2 miles, down a narrow, rocky dugway, to a fork in the aspens. Turn hard left towards Big Hollow/Camp Eli, and go 0.45 miles to a clearing and the witness post. The frequency baseline starts near the top of the hill and runs west-northwest. The trend study is marked by 2 foot tall green fence posts. The 0-foot baseline stake is 50 west of the witness post and is marked with a red browse tag #7161.



Map Name: Tropic Reservoir

Diagrammatic Sketch

Township 37S, Range 4 1/2W, Section 17

GPS: NAD 27, UTM 12S 4161084 N, 380141 E

## DISCUSSION

### Proctor Canyon - Trend Study No. 27-1

This study is located on big game summer range on the west side of the Paunsaugunt Plateau below the Sunset Cliffs. The small open ridge top where the study is located is a mixed mountain brush community surrounded by dense conifer forest and aspen stands. It is representative of larger, but more inaccessible, open, sagebrush ridges to the northwest. Elevation of the site is approximately 8,600 feet with a northwest aspect and slope that varies from 1-3%. One-half mile to the north, in the same cattle allotment, is a seeded area and stock pond. Deer sign, consisting of pellet groups and antler drops, was noted in 1992, along with a few elk pellet groups. Quadrat frequency of deer pellet groups increased by nearly 2-fold in 1997, while elk pellet group frequency remained at similar but low levels. Recent livestock use was also noted in 1997. Pellet group transect data from 2003 estimated 49 deer, 2 elk, and 8 cow days use/acre (121 ddu/ha, 5 edu/ha, and 20 cdu/ha) on the site.

The soil on the ridge is fairly deep with an effective rooting depth estimated at 14 inches. It is a light colored loamy sand with a neutral pH (7.1). Phosphorus may be limiting to plant growth at only 8 ppm, where 10 ppm is considered the minimum necessary for normal plant growth and development. Percent organic matter is also relatively low at 1.5%. Vegetation cover is good on the site, confining erosion to the bare interspaces. Bare ground has been moderate in all readings ranging from 17-23%. The road and steeper side hills show evidence of gullying and other surface erosion features. An erosion condition class assessment rated soils as stable in 2003.

The browse composition is diverse with 14 shrub species being sampled on the site. The most abundant key browse species are bitterbrush and black sagebrush which account for over ½ of the total browse cover. Serviceberry and currant are also prominent due to their larger size. At the edge of the aspen and conifer stands, young ponderosa pine and Rocky Mountain juniper are abundant. Of the 14 browse species encountered on the transect, serviceberry and bitterbrush provide the bulk of the forage utilized by big game. Both bitterbrush and serviceberry have been moderate to heavily hedged in all readings, with black sagebrush showing moderate to heavy use in 1987 only. In 1987 and 1992, the serviceberry population consisted of a high proportion of plants having poor vigor at 43% and 94% respectively. The shrubs were apparently suffering from Cedar-apple rust. During the 1997 and 2003 surveys, serviceberry vigor was normal on most plants. Bitterbrush and black sagebrush have maintained normal vigor in all readings. Serviceberry and black sagebrush have had moderate to high recruitment by young plants in all surveys. Bitterbrush recruitment was moderately high in 1987 and 1992, fair in 1997, and low in 2003. All 3 of these key species have had low decadence rates in all surveys, except for black sagebrush in 1987 when decadence was estimated at 36%. Serviceberry and bitterbrush leaders had averaged 3.6 and 2.5 inches of annual growth respectively when the site was read in mid-July of 2003.

It appears that during the 1987 reading there was trouble identifying the different rabbitbrush species. In 1992, the majority of the rabbitbrush was classified as stickleaf low rabbitbrush (*Chrysothamnus viscidiflorus viscidiflorus*) and dwarf rabbitbrush (*Chrysothamnus depressus*), with lesser amounts of Parry rabbitbrush (*Chrysothamnus parryi attenuatus*). These 3 species combined for an estimated density of 8,520 plants/acre in 1992, 59% of which was stickleaf low rabbitbrush. In 1997, all of the rabbitbrush species showed population declines. In 2003, dwarf rabbitbrush had a 64% density increase with Parry and low rabbitbrush's slightly increasing.

Complementing the diverse shrub overstory is a wide variety of herbaceous species. Eleven perennial grass species have been sampled on the transect with the most common being Kentucky bluegrass, mutton bluegrass, prairie junegrass, Letterman needlegrass, needle-and-thread grass, and slender wheatgrass. Total

grass production was poor in 1997 and 2003 with average cover values of only 8% and 9% respectively. Total grass cover was much higher in 1992 at nearly 19%. Nearly 50 species of forbs have been sampled at least once on the transect. Redroot eriogonum, dusty penstemon, Pacific aster, cinquefoil, and skyrocket gilia seem to be the preferred forb species. Although highly diverse, most of the forb species are infrequent. Grasses accounted for 30% of the total vegetation cover on the site in 1992, but only about 15% in 1997 and 2003. Average forb cover has steadily declined with each sampling as well.

### 1992 TREND ASSESSMENT

Percent cover of bare ground has increased slightly (17% to 20%) while litter cover declined by 37% (65% to 41%). Several open sandy areas on the site show that erosion is occurring, as do a few active gullies nearby. Some soil pedestalling is also evident. Overall, erosion is not a major problem on the site with trend for soil being slightly down. Heavy utilization of the key browse species has declined significantly since 1987. Vigor is good on all species except serviceberry which is suffering from Cedar-apple rust. Percent decadence of black sagebrush has declined to 11%. Age class analysis indicates that the key species serviceberry, black sagebrush, and bitterbrush have healthy populations. The abundance of the less desirable dwarf, Parry, and stickyleaf low rabbitbrush is a concern on this site. Continued increases in these shrubs could come at the expense of the more desirable shrub species. Overall, the browse trend is slightly up. Trend for the herbaceous understory is stable with a slight increase in the sum of nested frequency of grasses and a slight decrease in the sum of nested frequency of forbs.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly up (4)

herbaceous understory - stable (3)

### 1997 TREND ASSESSMENT

Percent bare ground has steadily increased on this site since 1987. Currently, nearly 22% of the ground surface is exposed and erosion is occurring in localized areas. Litter cover has increased since 1992 but vegetative cover has declined from 63% to 53%. More importantly from a watershed standpoint, sum of nested frequency for grasses and forbs has declined by 22%. Trend for soil is considered slightly down. Trend for the key browse species, serviceberry, black sagebrush and bitterbrush is also slightly down. Utilization is similar to 1992 with moderate to heavy use on serviceberry and bitterbrush, and mostly light use on black sagebrush. Density of serviceberry has declined by 52% since 1992. The number of mature plants increased slightly while the proportion of young plants declined from 62% to 17%. Black sagebrush declined 16% in population density since 1992 with a similar decline in young plants and an increase in percent decadence. Bitterbrush density has declined 51% since 1992 and young plants dropped from 740 plants/acre to 140 by 1997. Percent decadence is still low however, and the current number of seedlings and young appear to be adequate to maintain the population. On the beneficial side, the combined density of the less desirable dwarf, Parry and stickyleaf low rabbitbrush declined from 8,520 plants/acre in 1992 to 4,720 in 1997. Age class analysis of these species indicates mostly mature populations with few seedlings or young. Trend for the herbaceous understory is slightly down with the sum of nested frequency of grasses and forbs both declining. Average cover of grasses has declined from almost 19% in 1992 to only about 8% in 1997. Forb cover has also declined considerably (11% to 6%). Composition of the grasses is also changing on the site. Needle-and-thread grass along with Kentucky bluegrass have increased significantly in nested frequency since 1992. Currently, these 2 species account for 65% of the total grass cover. Slender wheatgrass, Prairie Junegrass, and Letterman needlegrass have all declined significantly. Common forb species on the site including thistle, Pacific aster, redroot eriogonum, longleaf phlox, and silverweed cinquefoil, are all weedy increasers.

TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - slightly down (2)

2003 TREND ASSESSMENT

Trend for soil is stable. Bare soil continues to slightly increase, but the combination of vegetation and litter cover remain stable since 1997. Signs of erosion are minimal and soils were rated stable from an erosion condition class assessment done in 2003. Trend for browse is stable. The key species have low decadence, generally good vigor, and stable (serviceberry) or increasing (black sagebrush and bitterbrush) population densities. Recruitment was stable for serviceberry and increased in the black sagebrush population. Bitterbrush had lower recruitment in 2003, and both serviceberry and bitterbrush displayed heavier hedging compared to 1997. Dwarf rabbitbrush increased by nearly 3-fold in total density, but the other 2 rabbitbrush species remained stable. Trend for the herbaceous understory is down. Sum of nested frequency values of perennial grasses and forbs show large declines since 1997. Drier conditions since 1997, coupled with the high canopy cover of browse species are negatively effecting the herbaceous component. This site should be considered for treatment in the near future. A decline in browse cover would favor herbaceous species and be beneficial in this area as shrubs are of less importance on this summer range.

TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - down (1)

HERBACEOUS TRENDS --  
Management unit 27 , Study no: 1

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
G	Agropyron spicatum	ab6	b25	b27	a-	.16	.07	-
G	Agropyron trachycaulum	c185	b112	a40	a49	1.71	.13	.62
G	Bouteloua gracilis	b34	a15	ab13	a3	.36	.15	.03
G	Bromus anomalus	a8	b39	a1	a-	.75	.00	.00
G	Carex spp.	c64	b24	ab11	a6	.87	.10	.09
G	Koeleria cristata	a54	b144	a78	a72	2.99	.61	1.11
G	Poa fendleriana	b88	b78	a45	b72	2.52	.54	1.14
G	Poa pratensis	a-	b39	c101	b39	2.99	2.25	1.68
G	Stipa columbiana	a-	ab1	b14	ab8	.03	.08	.04
G	Stipa comata	a17	b96	b124	b97	3.22	3.13	3.26
G	Stipa lettermani	b133	ab115	a83	a91	2.85	1.20	1.12
Total for Annual Grasses		0	0	0	0	0	0	0
Total for Perennial Grasses		589	688	537	437	18.50	8.28	9.11
Total for Grasses		589	688	537	437	18.50	8.28	9.11
F	Achillea millefolium	b74	ab40	b55	a20	.82	.58	.07
F	Agoseris glauca	-	-	-	5	-	-	.04
F	Alyssum alyssoides (a)	-	-	-	6	-	-	.01
F	Antennaria rosea	-	3	3	-	.15	.15	-
F	Androsace septentrionalis (a)	-	8	2	5	.02	.00	.03
F	Arabis spp.	-	1	2	-	.00	.00	-
F	Artemisia dracunculus	b40	b33	ab23	a4	1.12	.66	.09
F	Artemisia ludoviciana	b15	ab7	ab6	a-	.06	.06	-
F	Aster chilensis	c95	bc64	b43	a13	.67	.21	.04
F	Astragalus humistratus	ab16	b29	b28	a1	.42	.22	.00
F	Astragalus tenellus	b27	a5	a8	a3	.06	.01	.04
F	Aster spp.	-	-	-	3	-	-	.03
F	Castilleja linariaefolia	-	2	11	3	.00	.05	.01
F	Calochortus nuttallii	-	7	4	8	.01	.01	.04
F	Chaenactis douglasii	7	1	-	-	.00	-	-
F	Chenopodium fremontii (a)	-	-	1	-	-	.00	-
F	Chenopodium leptophyllum(a)	-	-	3	1	-	.00	.00
F	Cirsium arizonicum	b37	b40	ab35	a11	1.17	.43	.08
F	Collinsia parviflora (a)	-	a-	a-	b11	-	-	.02
F	Crepis acuminata	-	-	2	3	-	.00	.06

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
F	Cruciferae	5	-	-	-	-	-	-
F	Erigeron eatonii	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 11	<sub>ab</sub> 1	-	.12	.00
F	Erigeron flagellaris	<sub>c</sub> 148	<sub>b</sub> 63	<sub>a</sub> 6	<sub>a</sub> 10	.52	.01	.05
F	Erigeron pumilus	1	5	10	12	.15	.03	.13
F	Eriogonum racemosum	36	44	48	34	1.02	.34	.37
F	Eriogonum umbellatum	23	44	28	28	1.06	1.16	.57
F	Fritillaria atropurpurea	-	-	4	-	-	.01	-
F	Gayophytum ramosissimum(a)	-	-	3	11	-	.00	.05
F	Hymenoxys richardsonii	<sub>b</sub> 13	<sub>b</sub> 21	<sub>a</sub> -	<sub>b</sub> 10	.23	-	.22
F	Ipomopsis aggregata	<sub>ab</sub> 6	<sub>bc</sub> 15	<sub>c</sub> 6	<sub>a</sub> -	.08	.01	-
F	Linum lewisii	4	20	18	-	.26	.05	-
F	Lotus utahensis	4	-	-	-	-	-	-
F	Lychnis drummondii	-	10	1	6	.02	.00	.01
F	Machaeranthera canescens	12	16	13	22	.06	.12	.28
F	Microsteris gracilis (a)	-	-	-	8	-	-	.04
F	Oenothera caespitosa	-	2	-	-	.03	-	-
F	Oenothera pallida	-	3	-	11	.00	-	.19
F	Orthocarpus luteus (a)	<sub>a</sub> 6	<sub>b</sub> 56	<sub>a</sub> 13	<sub>b</sub> 45	1.53	.16	.41
F	Penstemon comarrhenus	<sub>b</sub> 50	<sub>ab</sub> 41	<sub>a</sub> 37	<sub>a</sub> 24	.15	.21	.13
F	Penstemon humilis	-	-	-	3	-	-	.00
F	Phlox longifolia	<sub>ab</sub> 37	<sub>c</sub> 65	<sub>bc</sub> 56	<sub>a</sub> 17	.45	.27	.04
F	Potentilla concinna	<sub>b</sub> 65	<sub>a</sub> 23	<sub>a</sub> 30	<sub>a</sub> 24	.87	.65	.46
F	Polygonum douglasii (a)	-	<sub>b</sub> 78	<sub>b</sub> 58	<sub>a</sub> 2	.28	.12	.01
F	Senecio douglasii	6	-	-	-	-	-	-
F	Taraxacum officinale	<sub>b</sub> 42	<sub>a</sub> 1	<sub>a</sub> 4	<sub>a</sub> -	.00	.01	-
F	Tragopogon dubius	<sub>c</sub> 31	<sub>bc</sub> 15	<sub>ab</sub> 9	<sub>a</sub> -	.08	.02	-
Total for Annual Forbs		6	142	80	89	1.84	0.30	0.60
Total for Perennial Forbs		794	620	501	276	9.54	5.46	3.00
Total for Forbs		800	762	581	365	11.38	5.77	3.60

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

BROWSE TRENDS --

Management unit 27 , Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'92	'97	'03	'92	'97	'03
B	Amelanchier utahensis	22	21	16	3.45	2.30	4.71
B	Artemisia nova	33	28	44	4.94	5.62	7.39
B	Chrysothamnus depressus	22	14	26	1.22	1.36	1.04
B	Chrysothamnus parryi attenuatus	11	8	6	.24	.01	.04
B	Chrysothamnus viscidiflorus viscidiflorus	73	60	67	4.99	4.16	5.74
B	Gutierrezia sarothrae	10	3	2	.33	.03	.03
B	Juniperus scopulorum	0	0	0	4.28	3.40	2.78
B	Mahonia repens	1	1	0	-	.00	-
B	Opuntia spp.	3	0	0	-	-	-
B	Pinus ponderosa	1	1	0	.00	-	-
B	Purshia tridentata	60	52	53	22.88	22.12	19.85
B	Ribes cereum inebrians	6	3	4	1.74	1.78	1.86
B	Rosa woodsii	14	10	11	.85	.78	.45
B	Symphoricarpos oreophilus	21	18	27	2.37	3.02	3.40
B	Tetradymia canescens	26	17	25	1.06	.21	.69
Total for Browse		303	236	281	48.40	44.83	48.04

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 1

Species	Percent Cover '03
Amelanchier utahensis	3.84
Artemisia nova	6.15
Chrysothamnus depressus	1.61
Chrysothamnus parryi attenuatus	.23
Chrysothamnus viscidiflorus viscidiflorus	5.26
Juniperus scopulorum	7.59
Purshia tridentata	25.61
Ribes cereum inebrians	1.39
Rosa woodsii	.66
Symphoricarpos oreophilus	4.25
Tetradymia canescens	1.16

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 27 , Study no: 1

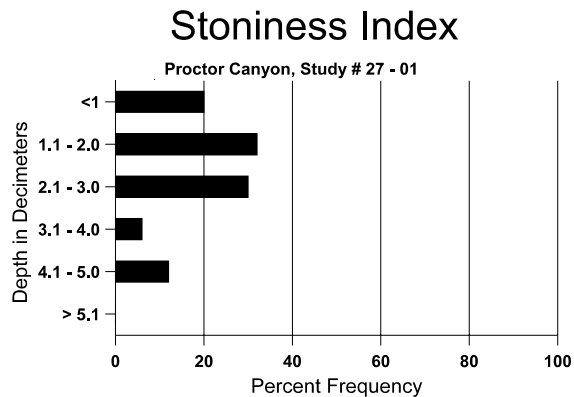
Species	Average leader growth (in)
	'03
Amelanchier utahensis	3.6
Purshia tridentata	2.5

BASIC COVER --  
 Management unit 27 , Study no: 1

Cover Type	Average Cover %			
	'87	'92	'97	'03
Vegetation	11.00	63.12	53.09	57.47
Rock	2.25	2.82	.37	.77
Pavement	5.25	0	1.62	.67
Litter	64.50	40.95	50.03	48.00
Cryptogams	0	.16	.83	.42
Bare Ground	17.00	20.06	21.83	23.27

SOIL ANALYSIS DATA --  
 Management unit 27, Study no: 1, Study Name: Proctor Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	%OM	PPM P	PPM K	dS/m
14.4	63.0 (14.3)	7.1	80.0	7.1	12.9	1.5	8.0	54.4	0.4





PELLET GROUP DATA --

Management unit 27 , Study no: 1

Type	Quadrat Frequency			Days use per acre (ha)
	'92	'97	'03	
Rabbit	6	1	6	-
Elk	3	2	5	2 (5)
Deer	12	22	19	49 (121)
Cattle	-	2	4	8 (20)

BROWSE CHARACTERISTICS --

Management unit 27 , Study no: 1

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
87	<b>466</b>	66	266	200	-	-	0	86	0	43	52/49
92	<b>1000</b>	-	620	280	100	-	66	8	10	94	-/-
97	<b>480</b>	-	80	400	-	-	58	8	0	0	44/41
03	<b>440</b>	-	60	320	60	-	23	32	14	5	42/40
<b>Artemisia nova</b>											
87	<b>3532</b>	-	466	1800	1266	-	38	45	36	4	14/19
92	<b>1840</b>	60	500	1140	200	-	12	3	11	0	-/-
97	<b>1540</b>	20	180	1020	340	140	10	0	22	6	14/27
03	<b>2720</b>	-	520	1940	260	60	10	0	10	.73	19/27
<b>Chrysothamnus depressus</b>											
87	<b>133</b>	-	-	133	-	-	50	50	0	0	4/7
92	<b>2880</b>	-	440	2440	-	-	0	0	0	1	-/-
97	<b>900</b>	-	100	780	20	-	0	7	2	2	4/12
03	<b>2480</b>	-	-	2480	-	-	6	15	0	0	4/9
<b>Chrysothamnus parryi attenuatus</b>											
87	<b>3732</b>	200	533	2666	533	-	14	2	14	0	17/16
92	<b>580</b>	-	180	400	-	-	0	3	0	0	-/-
97	<b>320</b>	-	140	180	-	-	0	0	0	0	12/7
03	<b>420</b>	-	-	420	-	-	0	0	0	0	6/8
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>5060</b>	80	1760	2900	400	-	2	0	8	2	-/-
97	<b>3500</b>	-	100	3380	20	-	0	0	1	0	16/21
03	<b>3640</b>	-	-	3420	220	-	0	1	6	.54	14/17

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Gutierrezia sarothrae</b>											
87	<b>333</b>	-	-	333	-	-	0	0	-	0	7/6
92	<b>580</b>	-	60	520	-	-	0	0	-	0	-/-
97	<b>200</b>	-	-	200	-	-	0	0	-	0	7/3
03	<b>100</b>	-	80	20	-	-	0	0	-	0	9/5
<b>Mahonia repens</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
97	<b>20</b>	-	-	20	-	-	0	0	-	0	3/5
03	<b>0</b>	-	-	-	-	-	0	0	-	0	3/5
<b>Opuntia spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>60</b>	-	60	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Pinus ponderosa</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	20	-	-	-	100	0	-	0	-/-
97	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
87	<b>2732</b>	333	533	2133	66	-	24	68	2	0	22/35
92	<b>3460</b>	180	740	2600	120	-	50	31	3	0	-/-
97	<b>1680</b>	140	140	1460	80	20	54	33	5	1	27/56
03	<b>2340</b>	-	80	2160	100	20	9	80	4	0	24/48
<b>Ribes cereum inebrians</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>280</b>	40	160	100	20	-	0	0	7	7	-/-
97	<b>80</b>	-	-	80	-	-	0	0	0	0	61/72
03	<b>80</b>	-	-	60	20	-	0	0	25	0	54/48
<b>Rosa woodsii</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>1880</b>	-	1820	60	-	-	0	0	-	0	-/-
97	<b>1200</b>	60	580	620	-	-	0	0	-	0	14/15
03	<b>1140</b>	120	800	340	-	-	0	0	-	0	8/8

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Symphoricarpos oreophilus</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>1260</b>	-	740	500	20	-	2	0	2	2	-/-
97	<b>480</b>	-	80	380	20	-	8	0	4	4	17/42
03	<b>1200</b>	-	40	1140	20	-	2	10	2	2	14/20
<b>Tetradymia canescens</b>											
87	<b>1266</b>	200	400	866	-	-	37	16	0	0	9/10
92	<b>820</b>	-	460	300	60	-	0	0	7	0	-/-
97	<b>400</b>	-	40	300	60	-	0	0	15	0	15/14
03	<b>940</b>	-	160	720	60	-	0	0	6	0	12/12

Trend Study 27-2-03

Study site name: Ahlstrom Hollow.

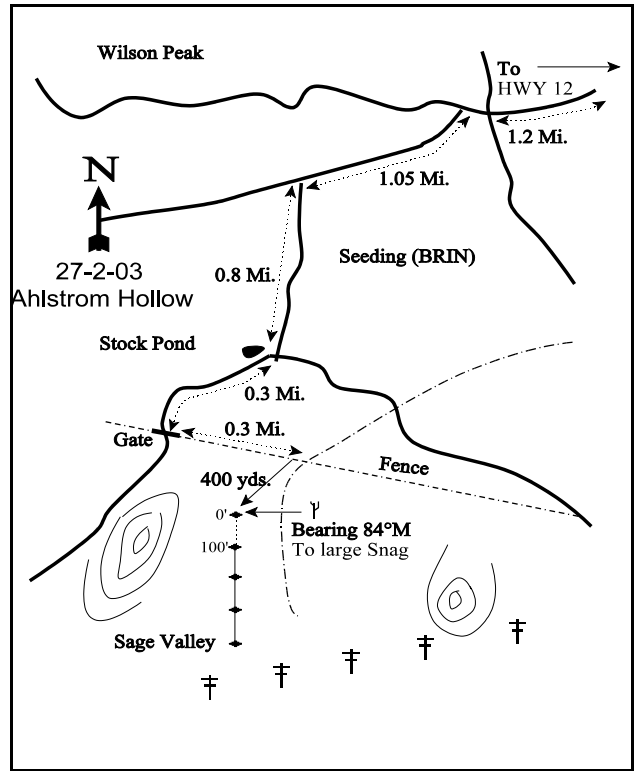
Vegetation type: Black Sagebrush.

Compass bearing: frequency baseline 190 degrees magnetic.

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

LOCATION DESCRIPTION

From the Bryce Canyon area, take SR 12 west towards Red Canyon. From the Forest Service boundary sign and mile marker 9, go 0.6 miles further west. Turn left onto Wilson Peak Rd #111, cross a cattleguard and go 1.2 miles to the Ahlstrom Hollow road intersection. Pass this 90° intersection and continue 0.05 miles on the Wilson Peak Road to a dirt road going off to the left at a 45° angle. Go down this road 1.05 miles to a fork. Bear left and continue 0.8 miles to a fork by a stock pond. Turn right and go 0.3 miles to a fence. Park here. Walk east along the fenceline up and over a ridge and down to the middle of the next valley. At the bottom of this valley, turn and walk up (south) along the bottom for about 400 yards to the 0-foot baseline, a 2-foot fencepost tagged #7150.



Map Name: Wilson Peak

Diagrammatic Sketch

Township 36S, Range 4W, Section 18

GPS: NAD 27, UTM 12S 4170896 N, 388205 E

## DISCUSSION

### Ahlstrom Hollow - Trend Study No. 27-2

Although named Ahlstrom Hollow, this study is actually situated in a drainage north of the wide, open, revegetated valley that is Ahlstrom Hollow. The small valley sampled by this trend study is above Johnson Bench, an area seeded mainly with smooth brome and other grasses. This particular black sagebrush-rabbitbrush valley shows little evidence of the seeding treatments done in the early 1950's. Surrounded by pinyon-juniper woodland and mountain mahogany ridges, the valley supports a mixture of black sagebrush, rabbitbrush, and grasses with a scattered population of bitterbrush. The valley drains to the northeast via an intermittent wash. Located on the west side of the valley at 8,000 feet in elevation, the transect has an east-southeast aspect and a slope that varies from 8-10%. The area is used by deer, elk, and cattle. Pellet group transect data collected in 2003 estimated 31 elk, 7 deer, and 32 cow days use/acre (76 edu/ha, 18 ddu/ha, and 79 cdu/ha) on the site. Cattle pats were fairly fresh indicating recent grazing, while deer and elk pellets appeared to be from spring and early summer.

The presence of black sagebrush throughout the whole valley would normally indicate shallow soils in the 8-10 inch range. However, the soil on the site is relatively deep with an average effective rooting depth of almost 18 inches. Texture analysis indicates it to be a sandy loam with a mildly alkaline pH (7.4). There is a high percentage of gravel in the profile, but the soil surface has very little rock or pavement cover. At this relatively high elevation and moderately deep soils, one would expect to find mountain big sagebrush. It may be that the gravelly nature of the soil or some subsurface physical or physiological barrier makes this a marginal site for mountain big sagebrush. The soil appears to be more shallow around the edges of the valley. There is evidence of past erosion and serious gully formation, especially on the surrounding hillsides. An erosion condition class assessment completed in 2003 resulted in a stable rating for soils. Bare ground has been moderate to high since 1992, and the ratio of protective cover (vegetation, litter, and cryptogams) to bare soil has steadily decreased with each reading since 1992, being estimated at 2.0 in 2003.

Black sagebrush is the dominant shrub over most of the valley, although rabbitbrush is prevalent in the bottoms. Black sagebrush density was estimated at 9,680 plants/acre in 1997 and 8,120 in 2003. A fire burned through a portion of the site between the 1997 and 2003 surveys, and accounts for some of the loss in density. The number of young plants in the population also declined in 2003. The black sagebrush population has maintained a healthy condition over all years with a decent proportion of young, moderately low decadence, and normal vigor. Utilization of black sagebrush has been mostly light to moderate in all readings. Annual leaders on black sagebrush had averaged 1.6 inches of growth when the site was read in mid-July of 2003. A few bitterbrush were encountered on the frequency belts even though it appears to be more common in the lower part of the valley. Bitterbrush is a preferred forage species, and displays moderate to heavy hedging in all years. Bitterbrush plants are large, spreading, and vigorous with annual leaders averaging 3 inches of growth in 2003.

Low and dwarf rabbitbrush are also common on the site. In 2003, all rabbitbrush on the site was classified as low rabbitbrush while the species were split in previous readings. Combined rabbitbrush density has totaled from about 3,000-4000 plants/acre over all surveys.

As this area is transitional/summer range for big game, and also grazed by livestock, grasses are an important component of this site. Eight perennial grass species have been sampled on the site in at least 1 year, with mutton bluegrass, needle-and-thread grass, and prairie junegrass being the most abundant. Only a few remnant individual smooth brome plants were found in 1987, but none were encountered in any other survey. Much of the biomass provided by grasses had been utilized in 2003 and some cattle trampling was evident. Sum of nested frequency of grasses declined between 1987 and 1992, remained nearly stable in 1997, and again decreased in 2003. Forbs are diverse but not particularly abundant. Many of the more palatable forb

species had been utilized by big game during the 1987 reading. They selected lupine, penstemon, and buckwheat. Utilization of forbs was not evident in 2003. Average cover of forbs was 6% in 1992, declining to 3% in 1997 and 2003. Most forbs are found only rarely with the more common species including owlclover, pussytoes, and longleaf phlox.

### 1992 TREND ASSESSMENT

Trend for soil is considered slightly down. Small areas throughout the site show signs of detectible soil movement, broken soil cover, and active gulying, especially on the surrounding hillsides. Percent bare ground has increased from 14% to 31%, while litter cover declined from 66% to 32%. The health and vigor of black sagebrush is good with a relatively high density. Trend for browse is up. Trend for the herbaceous understory is slightly down with sum of nested frequency values for grasses decreasing substantially. The forbs had a slight increase in their nested frequency value, but not enough to compensate for the loss to the grasses.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - up (5)

herbaceous understory - slightly down (2)

### 1997 TREND ASSESSMENT

Trend for soil is up slightly due to a 26% increase in litter cover and a 29% decline in percent bare ground. Trend for black sagebrush is considered stable even though density has declined 40% since 1992. Density of black sagebrush was extremely high in 1992 at 16,200 plants/acre. The current estimated population density is similar to 1987 levels at 9,680 plants/acre. This is a more manageable density for a black sagebrush site and reduces intraspecific competition. Recruitment is adequate with 11% of the population consisting of young plants and a reproductive potential (percentage of seedlings to the population) of 12%. Percent decadence has also declined from 23% to 14%. Utilization is mostly light and vigor is normal on most plants. Trend for the herbaceous understory is stable. Sum of nested frequency of grasses has remained similar even though percent cover (effected by the timing of precipitation) of grasses has declined sharply. Frequency of forbs increased slightly but cover was also lower compared to 1992. Nested frequency of prairie junegrass (dependant on early season precipitation) declined significantly while frequency of needle-and-thread increased significantly.

#### TREND ASSESSMENT

soil - up slightly (4)

browse - stable (3)

herbaceous understory - stable (3)

### 2003 TREND ASSESSMENT

Trend for soil is slightly down. Bare soil increased from 22% to 38%, and litter cover declined from 43% to 34%. These changes translate into less protective cover on the soil surface, thus increasing the erosion potential of the site. Erosion remains low at the present time. Trend for browse is slightly down. Black sagebrush has a lower population density in 2003 due to plant mortality caused by a fire that burned a portion of the site. Recruitment declined in 2003 and percent decadence slightly increased. Overall, the population remains healthy. Trend for the herbaceous understory is slightly down. Sum of nested frequency of perennial grasses declined by 15% while that of perennial forbs declined by 41%. These changes are drought related and should improve with better precipitation.

TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --

Management unit 27 , Study no: 2

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
G	<i>Agropyron dasystachyum</i>	-	-	-	2	-	-	.00
G	<i>Agropyron trachycaulum</i>	<sub>a</sub> 8	<sub>a</sub> 12	<sub>ab</sub> 21	<sub>b</sub> 46	.42	.11	.62
G	<i>Bouteloua gracilis</i>	<sub>c</sub> 96	<sub>b</sub> 69	<sub>b</sub> 64	<sub>a</sub> 27	2.23	.72	.29
G	<i>Bromus inermis</i>	2	-	-	-	-	-	-
G	<i>Bromus tectorum</i> (a)	-	-	3	-	-	.00	-
G	<i>Koeleria cristata</i>	<sub>b</sub> 148	<sub>b</sub> 134	<sub>a</sub> 89	<sub>a</sub> 71	3.09	.98	.92
G	<i>Oryzopsis hymenoides</i>	-	-	-	-	.00	-	-
G	<i>Poa fendleriana</i>	<sub>a</sub> 129	<sub>b</sub> 232	<sub>b</sub> 201	<sub>b</sub> 187	7.53	2.88	4.38
G	<i>Poa secunda</i>	<sub>c</sub> 229	<sub>a</sub> 5	<sub>b</sub> 36	<sub>ab</sub> 23	.01	.81	.24
G	<i>Stipa comata</i>	<sub>b</sub> 130	<sub>a</sub> 80	<sub>ab</sub> 111	<sub>ab</sub> 107	1.95	1.31	2.99
G	<i>Stipa lettermani</i>	<sub>a</sub> -	<sub>bc</sub> 29	<sub>c</sub> 34	<sub>ab</sub> 9	.68	.58	.21
G	<i>Vulpia octoflora</i> (a)	-	-	-	3	-	-	.00
Total for Annual Grasses		0	0	3	3	0	0.00	0.00
Total for Perennial Grasses		742	561	556	472	15.94	7.42	9.67
Total for Grasses		742	561	559	475	15.94	7.42	9.68
F	<i>Agoseris glauca</i>	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> 1	<sub>b</sub> 36	-	.00	.23
F	<i>Alyssum alyssoides</i> (a)	-	-	-	-	-	-	.01
F	<i>Ambrosia</i> spp.	-	3	-	-	.06	-	-
F	<i>Antennaria rosea</i>	7	6	8	-	.04	.33	-
F	<i>Androsace septentrionalis</i> (a)	-	5	3	-	.04	.00	-
F	<i>Arabis</i> spp.	<sub>a</sub> -	<sub>b</sub> 6	<sub>b</sub> 12	<sub>a</sub> -	.02	.03	-
F	<i>Aster chilensis</i>	-	-	7	-	-	.01	-
F	<i>Castilleja linariaefolia</i>	-	-	-	8	-	-	.02
F	<i>Calochortus nuttallii</i>	-	-	-	2	-	-	.00
F	<i>Castilleja</i> spp.	-	-	-	-	-	-	.00
F	<i>Chenopodium leptophyllum</i> (a)	-	-	-	2	-	-	.00
F	<i>Comandra pallida</i>	-	-	1	-	-	.00	-
F	<i>Collinsia parviflora</i> (a)	-	-	-	8	-	-	.02
F	<i>Crepis acuminata</i>	-	-	-	3	-	-	.00
F	<i>Cryptantha bakeri</i>	<sub>c</sub> 60	<sub>b</sub> 12	<sub>b</sub> 20	<sub>a</sub> -	.06	.05	-
F	Cruciferae	6	3	-	-	.00	-	-

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
F	Cymopterus spp.	-	-	1	-	-	.00	-
F	Descurainia pinnata (a)	-	-	a-	b <sup>35</sup>	-	-	.68
F	Draba spp. (a)	-	-	-	2	-	-	.01
F	Erigeron eatonii	ab <sup>14</sup>	b <sup>27</sup>	a <sup>2</sup>	ab <sup>11</sup>	.33	.01	.02
F	Erigeron pumilus	ab <sup>11</sup>	a <sup>1</sup>	b <sup>22</sup>	ab <sup>11</sup>	.15	.20	.05
F	Eriogonum racemosum	6	13	14	8	.18	.16	.02
F	Eriogonum umbellatum	20	12	18	15	.11	.20	.26
F	Euphorbia robusta	b <sup>11</sup>	a <sup>3</sup>	a <sup>4</sup>	a-	.18	.06	-
F	Gayophytum ramosissimum(a)	-	-	14	1	-	.03	.01
F	Heterotheca villosa	b <sup>15</sup>	a <sup>3</sup>	a <sup>2</sup>	ab <sup>5</sup>	.15	.03	.06
F	Holosteum umbellatum (a)	-	-	3	-	-	.00	-
F	Lappula occidentalis (a)	-	-	a <sup>5</sup>	b <sup>53</sup>	-	.01	1.39
F	Lotus utahensis	b <sup>34</sup>	ab <sup>21</sup>	a <sup>13</sup>	a <sup>11</sup>	.33	.25	.05
F	Lupinus argenteus	-	-	-	2	-	-	.00
F	Microsteris gracilis (a)	-	-	b <sup>61</sup>	a <sup>2</sup>	-	.17	.00
F	Oenothera pallida	-	-	3	7	-	.00	.07
F	Orthocarpus luteus (a)	a <sup>21</sup>	b <sup>121</sup>	b <sup>111</sup>	a <sup>33</sup>	2.70	1.43	.19
F	Penstemon comarrhenus	c <sup>36</sup>	ab <sup>14</sup>	b <sup>12</sup>	a-	1.01	.05	-
F	Penstemon spp.	-	-	8	1	-	.07	.00
F	Phlox longifolia	a <sup>29</sup>	b <sup>66</sup>	b <sup>72</sup>	a <sup>21</sup>	.30	.35	.07
F	Polygonum douglasii (a)	-	b <sup>25</sup>	b <sup>26</sup>	a-	.06	.07	-
F	Taraxacum officinale	a-	ab <sup>7</sup>	b <sup>8</sup>	ab <sup>2</sup>	.39	.05	.00
F	Tragopogon dubius	2	-	5	-	-	.01	-
F	Trifolium kingii	a-	ab <sup>6</sup>	b <sup>9</sup>	ab <sup>1</sup>	.01	.02	.00
F	Unknown forb-perennial	1	-	-	-	-	-	-
Total for Annual Forbs		21	151	223	136	2.81	1.73	2.33
Total for Perennial Forbs		252	203	242	144	3.37	1.92	0.91
Total for Forbs		273	354	465	280	6.18	3.65	3.24

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



BROWSE TRENDS --

Management unit 27 , Study no: 2

Type	Species	Average Cover %		
		'92	'97	'03
B	Artemisia nova	24.25	21.39	15.10
B	Chrysothamnus depressus	.67	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	4.70	1.90	6.95
B	Juniperus osteosperma	.15	.85	.85
B	Leptodactylon pungens	2.34	.64	.67
B	Opuntia spp.	.03	.00	.00
B	Purshia tridentata	.38	.03	-
B	Tetradymia canescens	.09	.24	.06
Total for Browse		32.63	25.07	23.64

BROWSE TRENDS--

Management unit 27 , Study no: 2

Species	Strip Frequency		
	'92	'97	'03
Artemisia nova	98	98	57
Chrysothamnus depressus	33	31	0
Chrysothamnus viscidiflorus viscidiflorus	52	27	62
Juniperus osteosperma	1	2	1
Leptodactylon pungens	49	42	31
Opuntia spp.	2	1	1
Purshia tridentata	5	2	1
Tetradymia canescens	14	11	12

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 2

Species	Percent Cover	
	'97	'03
Artemisia nova	-	15.88
Chrysothamnus viscidiflorus viscidiflorus	-	6.90
Juniperus osteosperma	1.60	1.96
Leptodactylon pungens	-	.23
Purshia tridentata	-	.50
Tetradymia canescens	-	.08

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 27 , Study no: 2

Species	Average leader growth (in)
	'03
Artemisia nova	1.6
Purshia tridentata	3.0

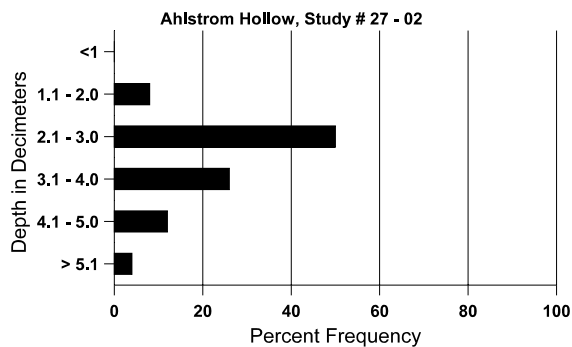
BASIC COVER --  
Management unit 27 , Study no: 2

Cover Type	Average Cover %			
	'87	'92	'97	'03
Vegetation	5.50	47.05	38.87	38.60
Rock	1.25	7.93	.07	.54
Pavement	12.75	0	7.14	4.17
Litter	66.25	31.65	42.92	33.63
Cryptogams	0	.41	.46	.04
Bare Ground	14.25	31.40	22.36	37.97

SOIL ANALYSIS DATA --  
Management unit 27, Study no: 2, Study Name: Ahlstrom Hollow

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	%OM	PPM P	PPM K	dS/m
17.6	65.3 (14.8)	7.4	66.4	19.1	14.6	2.5	15.9	86.4	0.5

### Stoniness Index



PELLET GROUP DATA --

Management unit 27 , Study no: 2

Type	Quadrat Frequency		
	'92	'97	'03
Rabbit	30	11	13
Elk	22	7	12
Deer	6	14	8
Cattle	3	6	8

Days use per acre (ha)
'03
-
31 (76)
7 (18)
32 (79)

BROWSE CHARACTERISTICS --

Management unit 27 , Study no: 2

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia nova</i>											
87	<b>9532</b>	2600	2333	6133	1066	-	33	13	11	0	16/20
92	<b>16200</b>	1020	3400	9020	3780	-	22	2	23	4	-/-
97	<b>9680</b>	1140	1100	7220	1360	420	5	0	14	4	16/27
03	<b>8120</b>	-	480	6000	1640	2580	9	0	20	4	15/23
<i>Chrysothamnus depressus</i>											
87	<b>3132</b>	800	266	2733	133	-	17	15	4	0	4/10
92	<b>1920</b>	-	1000	920	-	-	5	1	0	0	-/-
97	<b>1900</b>	-	40	1860	-	-	0	0	0	0	10/10
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
87	<b>3332</b>	733	466	2533	333	-	32	4	10	0	16/18
92	<b>4080</b>	20	1600	2360	120	-	4	.49	3	.98	-/-
97	<b>900</b>	-	20	780	100	-	0	0	11	2	14/20
03	<b>4300</b>	-	20	4120	160	-	0	0	4	.46	12/18
<i>Juniperus osteosperma</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	20	-	-	-	100	0	-	0	-/-
97	<b>40</b>	-	20	20	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<i>Leptodactylon pungens</i>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>5040</b>	-	420	4540	80	-	0	0	2	2	-/-
97	<b>2780</b>	60	220	2520	40	80	0	0	1	1	6/6
03	<b>1720</b>	-	40	1580	100	-	0	0	6	5	5/7

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Opuntia spp.</b>											
87	<b>133</b>	-	-	133	-	-	0	0	0	0	3/8
92	<b>120</b>	-	100	-	20	-	0	0	17	0	-/-
97	<b>20</b>	-	20	-	-	-	0	0	0	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	0	0	-/-
<b>Purshia tridentata</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>100</b>	-	80	20	-	-	0	60	0	0	-/-
97	<b>40</b>	-	-	40	-	-	50	50	0	0	21/43
03	<b>20</b>	-	-	-	20	40	0	100	100	0	19/59
<b>Tetradymia canescens</b>											
87	<b>266</b>	-	-	266	-	-	75	0	0	0	9/9
92	<b>420</b>	-	200	200	20	-	14	5	5	0	-/-
97	<b>400</b>	60	160	240	-	-	0	0	0	0	9/11
03	<b>300</b>	-	20	260	20	-	0	0	7	7	9/12

Trend Study 27-3-03

Study site name: Whiteman Bench.

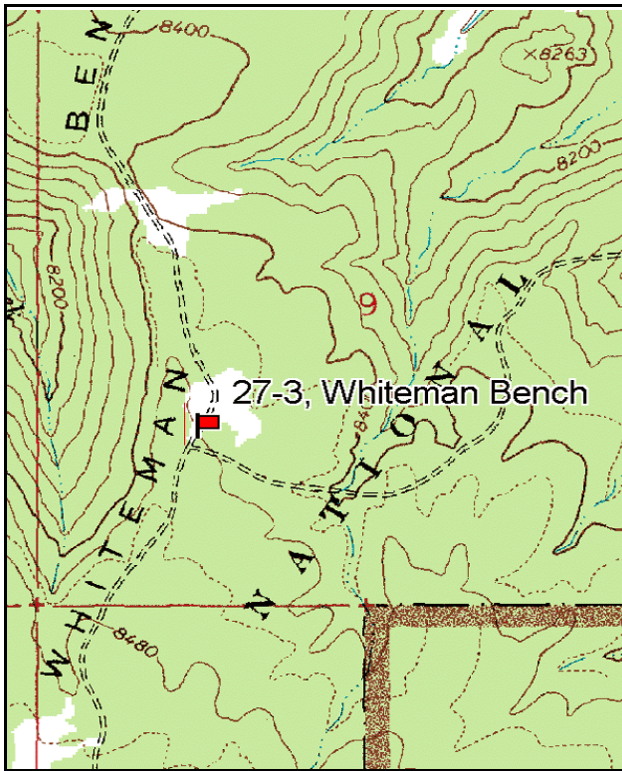
Vegetation type: Selective Logged-Ponderosa.

Compass bearing: frequency baseline 60 degrees magnetic.

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

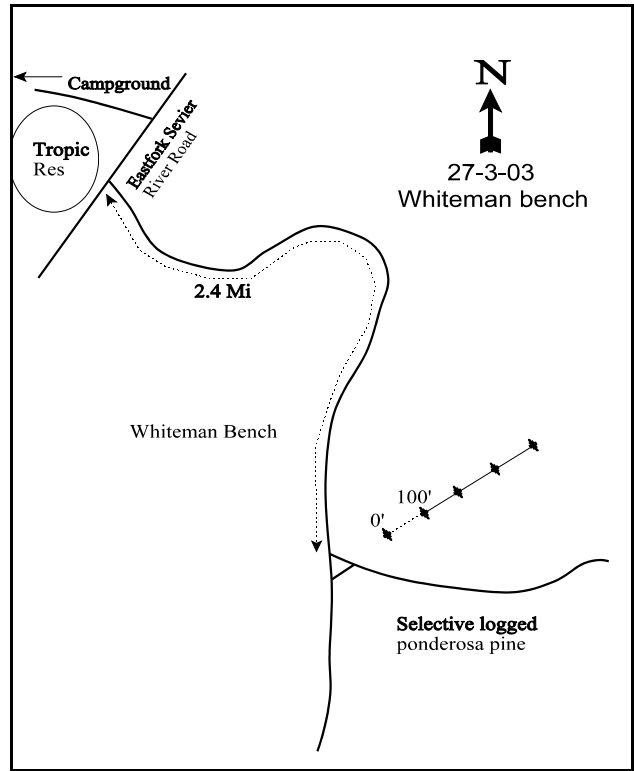
LOCATION DESCRIPTION

East of the Tropic Reservoir Dam on the E. Fork Sevier River Road, take the Whiteman Bench road east for 2.40 miles to a fork in the road. Stop here. Walk east 18 paces to the first stake, a red-painted fencepost 18" high marked with browse tag #7153. The frequency baseline runs NE from here.



Map Name: Bryce Point

Township 37S, Range 4W, Section 9



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4161825 N 391200 E

## DISCUSSION

### Whiteman Bench - Trend Study No. 27-3

Whiteman Bench is a large, level bench area east of Tropic Reservoir. Most of the bench is covered with ponderosa pine in varying stages of growth due to logging activities. The study samples a moderate aged stand of ponderosa that was clear cut more than 20 years ago. The understory is a mixture of shrubs and grasses. The site is nearly level with a slope of 2-3% and an elevation of 8,400 feet. The area is utilized as summer range by deer and elk. There is little livestock use occurs in the timbered areas of the East Fork allotment. Pellet group transect data collected in 2003 estimated 12 elk and 24 deer days use/acre (30 edu/ha and 60 ddu/ha) on the site. In 2003, elk pellets were from the current summer while deer pellets were older.

Due to the flat terrain, erosion is not deleterious. There was some soil movement but little net soil loss observed in 1987. In 1992, erosion was thought to have increased with vegetational pedestalling, especially in the open meadows. There is adequate litter cover associated with the trees and shrubs, especially the buildup of needles beneath the ponderosa pine. There are spots where erosion pavement and rocks are frequent on the surface. There is a high concentration of rocks 4 to 6 inches below the surface. The soil has moderate depth with an effective rooting depth estimated at 13 inches. Soil texture is a clay loam with a considerable amount of cobble rock in the profile. Soils are neutral in reactivity with a pH of 6.9. Phosphorus may be limiting to plant growth at 7.6 ppm, where 10 ppm is considered minimum for normal plant development. An erosion condition class assessment completed in 2003 resulted in a stable rating for soils.

The ponderosa canopy is fairly open, although the trees appear to have increased in size since the site was first photographed in 1981. Overhead canopy cover was estimated at 17% in 2003. The open ponderosa forest is at a relatively low density estimated at 50-60 mature trees/acre in 1997 and 2003, and appears to have little effect on the shrub understory. The most abundant and important browse species are black sagebrush, bitterbrush, and dwarf rabbitbrush. Dwarf rabbitbrush accounted for half of the total browse cover in 1997 and 37% in 2003. Density estimates for dwarf rabbitbrush have been very high ranging from about 14,000-22,000 plants/acre since 1992. These plants are very small averaging only 5 inches in height, show mostly light use, and vigor has been good in all surveys. Bitterbrush provides less than 1/4 of the total browse cover, but provides the most preferred forage. Density of bitterbrush was estimated at 720 plants/acre in 2003, a slight increase from 620 plants/acre in 1997. Seedling and young bitterbrush were few in 1997 and 2003. Percent decadence was low from 1987-1997, increasing to 39% in 2003. Bitterbrush shows moderate to heavy utilization in all surveys, but has maintained good vigor. Annual bitterbrush leaders had averaged 3 inches of growth by mid-July 2003 when the site was read.

The black sagebrush population has stabilized at around 1,400 plants/acre in 1997 and 2003. Earlier readings recorded a higher density, but poor vigor and decadence were also moderately high. This population has fairly low decadence at less than 20% in 1997 and 2003 and showed improving vigor in both years as well. Utilization of black sagebrush was light to moderate in 1992, but mostly light in all other sampling years. Annual leaders averaged 1.5 inches of growth in 2003. Other browse sampled on the site include Parry rabbitbrush, currant, snowberry, and gray horsebrush.

The herbaceous understory is not particularly abundant on this site. Grasses and forbs combined to produce 16% total cover in 1992, 8% in 1997, and 11% in 2003. The most abundant herbaceous species is by far rock goldenrod. This species provided 28% of the total herbaceous cover in 1992, increasing to 46% and 61% of the total in 1997 and 2003 respectively. Mutton bluegrass was very abundant in 1987, but has steadily declined with each sampling since. Other grasses include needle-and-thread grass, Letterman needlegrass, and *Carex*. Other forbs sampled on the site include fendler sandwort, pacific aster, and redroot eriogonum.

### 1992 TREND ASSESSMENT

Percent bare ground is 21%, a substantial increase since 1987. There was also more evidence of soil pedestalling around plants, especially in the meadows. This all points to a slightly downward trend for soils for this site. The browse trend is slightly up with good densities and vigor for most species. Only black sagebrush has a high rate of decadence, but biotic potential is very high at 52% and the young age class makes up 26% of the population. This should compensate for any possible losses in the future. Trend for browse is slightly up. Trend for the herbaceous understory is mixed. Sum of nested frequency of perennial grasses has declined while frequency of perennial forbs has increased. Since forbs account for 57% of the herbaceous cover, the overall herbaceous understory trend is considered stable.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly up (4)

herbaceous understory - stable (3)

### 1997 TREND ASSESSMENT

Trend for soil is considered slightly down. Percent bare ground cover declined slightly but vegetative cover also declined by 30%. More importantly, from a watershed standpoint, is the fact that nested frequency of perennial grasses and forbs declined by 34%. This is also shown by the ratio of protective cover to bare soil, which clearly illustrates that there is less protection for the soils at this time. Trend for browse is down slightly. The 3 key species on this site, black sagebrush, dwarf rabbitbrush, and bitterbrush, have all declined substantially in population density. However, moderate to heavy utilization of black sagebrush and dwarf rabbitbrush has declined, vigor is generally good, and percent decadence is low. Bitterbrush however, still shows similar amounts of moderate and heavy use between years. Trend for the herbaceous understory is down. Sum of nested frequency for grasses and forbs has declined substantially since 1992. The only grass species to show an increase in nested frequency since 1992 is western wheatgrass. All others declined. In addition, all forb species showed a decline in nested frequency since 1992.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - down (1)

### 2003 TREND ASSESSMENT

Trend for soil is stable. Ground cover characteristics are similar to 1997 estimates, and erosion is low. Trend for browse is stable. Dwarf rabbitbrush, black sagebrush, and bitterbrush all show stable densities. Bitterbrush decadence increased to 39% and use remains moderate to heavy, but decadence for the other species is low and utilization is mostly light. As this is summer range for big game, the browse component is less important than the herbaceous understory. The herbaceous understory has a slightly downward trend as the sum of nested frequency of perennial grasses continues to decline. Perennial forbs remained stable in 2003, but are dominated by rock goldenrod which is not highly preferred for forage. The understory is likely suffering the effects of drought, but the abundance of dwarf rabbitbrush and heavy litter accumulations underneath the ponderosa pine are probably also having a negative effect on understory production.

#### 2003 TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --  
Management unit 27 , Study no: 3

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
G	Agropyron dasystachyum	a-	b36	c72	b21	.25	.33	.21
G	Carex spp.	57	47	35	30	.64	.74	.37
G	Koeleria cristata	12	31	26	13	.42	.22	.12
G	Oryzopsis hymenoides	b21	a3	a-	a-	.01	-	-
G	Poa fendleriana	c209	b148	a75	a67	3.20	.93	.70
G	Poa secunda	-	-	3	-	-	.00	-
G	Sitanion hystrix	b87	a30	a9	a22	.14	.05	.13
G	Stipa comata	a19	b57	b53	b53	1.04	.61	.49
G	Stipa spp.	3	4	-	-	.03	-	-
G	Stipa lettermani	b93	b88	a51	a50	.93	.50	.40
Total for Annual Grasses		0	0	0	0	0	0	0
Total for Perennial Grasses		501	444	324	256	6.68	3.42	2.43
Total for Grasses		501	444	324	256	6.68	3.42	2.43
F	Agoseris glauca	-	2	-	7	.01	-	.07
F	Antennaria rosea	2	7	3	5	.03	.00	.01
F	Androsace septentrionalis (a)	-	a2	a-	b17	.00	-	.03
F	Arabis demissa	10	15	11	7	.04	.02	.02
F	Arenaria fendleri	a33	c93	bc64	ab40	2.65	.48	.54
F	Artemisia ludoviciana	5	3	-	3	.03	-	.15
F	Arabis pulchra	-	11	-	-	.02	-	-
F	Aster chilensis	a25	b71	a29	a14	.51	.10	.11
F	Astragalus humistratus	b11	ab6	a-	a-	.05	.00	-
F	Balsamorhiza hookeri	-	-	-	8	-	-	.07
F	Calochortus nuttallii	a-	ab1	a-	b7	.00	-	.02
F	Cirsium spp.	-	1	1	1	.03	.03	.00
F	Crepis acuminata	-	3	4	3	.03	.01	.03
F	Cruciferae	8	-	-	-	-	-	-
F	Cryptantha spp.	-	1	-	3	.00	-	.00
F	Descurainia pinnata (a)	-	-	-	3	-	-	.00
F	Erysimum asperum	b18	a-	a-	a-	-	-	-
F	Erigeron flagellaris	a7	b19	a1	a3	.34	.00	.00
F	Erigeron spp.	5	-	-	-	-	-	-
F	Erigeron pumilus	5	-	3	-	-	.00	-
F	Eriogonum racemosum	ab24	b38	ab29	a17	.29	.15	.11
F	Eriogonum umbellatum	-	3	-	-	.03	-	-



Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
F	<i>Hymenoxys richardsonii</i>	-	-	-	-	.03	-	-
F	<i>Ipomopsis aggregata</i>	6	4	5	-	.01	.01	-
F	<i>Lappula occidentalis</i> (a)	-	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 16	-	-	.49
F	<i>Lychnis drummondii</i>	-	1	-	-	.00	-	-
F	<i>Orthocarpus luteus</i> (a)	<sub>a</sub> 5	<sub>b</sub> 21	<sub>a</sub> 4	<sub>a</sub> 2	.09	.01	.01
F	<i>Penstemon caespitosus</i>	-	7	3	-	.09	.00	.00
F	<i>Penstemon</i> spp.	5	6	3	3	.05	.03	.03
F	<i>Petroradia pumila</i>	<sub>a</sub> 88	<sub>ab</sub> 112	<sub>a</sub> 95	<sub>b</sub> 135	4.47	3.85	6.59
F	<i>Phlox longifolia</i>	<sub>a</sub> -	<sub>b</sub> 15	<sub>a</sub> -	<sub>a</sub> -	.04	-	-
F	<i>Potentilla crinita</i>	<sub>a</sub> -	<sub>b</sub> 15	<sub>a</sub> -	<sub>a</sub> 1	.19	-	.00
F	<i>Polygonum douglasii</i> (a)	<sub>a</sub> -	<sub>b</sub> 31	<sub>b</sub> 29	<sub>a</sub> 8	.07	.11	.02
F	<i>Senecio multilobatus</i>	-	-	-	1	-	-	.00
F	<i>Taraxacum officinale</i>	-	-	1	-	-	.00	-
F	<i>Tragopogon dubius</i>	4	-	-	-	-	-	-
F	Unknown forb-perennial	1	-	-	1	-	-	.00
Total for Annual Forbs		5	54	33	46	0.17	0.12	0.56
Total for Perennial Forbs		257	434	252	259	8.98	4.74	7.80
Total for Forbs		262	488	285	305	9.16	4.86	8.37

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

BROWSE TRENDS --

Management unit 27 , Study no: 3

Type	Species	Strip Frequency			Average Cover %		
		'92	'97	'03	'92	'97	'03
B	Artemisia nova	35	32	31	2.03	1.16	1.49
B	Ceanothus fendleri	0	0	1	-	-	-
B	Chrysothamnus depressus	98	89	87	8.31	7.23	7.58
B	Chrysothamnus parryi attenuatus	36	3	33	.41	.03	.64
B	Gutierrezia sarothrae	12	1	7	.04	-	.01
B	Mahonia repens	3	0	0	.04	.00	-
B	Pinus ponderosa	6	4	4	11.14	2.20	6.71
B	Purshia tridentata	39	24	22	5.21	2.91	2.89
B	Ribes cereum inebrians	4	1	1	-	-	.15
B	Symphoricarpos oreophilus	8	9	5	.85	.81	.63
B	Tetradymia canescens	20	8	15	.24	.06	.24
Total for Browse		261	171	206	28.30	14.41	20.36

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 3

Species	Percent Cover	
	'97	'03
Artemisia nova	-	1.96
Chrysothamnus depressus	-	6.94
Chrysothamnus parryi attenuatus	-	.38
Gutierrezia sarothrae	-	.03
Pinus ponderosa	4.40	16.96
Purshia tridentata	-	3.21
Ribes cereum inebrians	-	.68
Symphoricarpos oreophilus	-	.16
Tetradymia canescens	-	.10

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27 , Study no: 3

Species	Average leader growth (in)
	'03
Artemisia nova	1.5
Purshia tridentata	3.0

POINT-QUARTER TREE DATA --  
Management unit 27 , Study no: 3

Species	Trees per Acre		Average diameter (in)	
	'03		'03	
Pinus ponderosa	50		9.6	

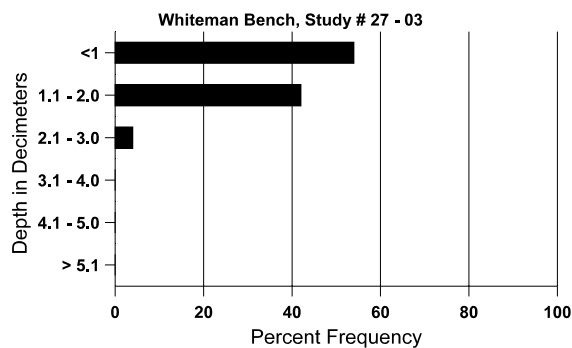
BASIC COVER --  
Management unit 27 , Study no: 3

Cover Type	Average Cover %			
	'87	'92	'97	'03
Vegetation	2.00	42.34	29.83	28.45
Rock	8.75	12.57	8.37	10.07
Pavement	4.25	0	4.80	.56
Litter	75.75	49.28	47.95	51.08
Cryptogams	.25	.99	1.81	.03
Bare Ground	9.00	20.97	17.22	21.93

SOIL ANALYSIS DATA --  
Management unit 27, Study no: 3, Study Name: Whiteman Bench

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
13.0	69.7 (6.0)	6.9	36.4	32.1	31.6	3.6	7.6	163.2	0.6

### Stoniness Index



PELLET GROUP DATA --  
Management unit 27 , Study no: 3

Type	Quadrat Frequency			Days use per acre (ha)	
	'92	'97	'03	'03	
Rabbit	6	-	3	-	
Elk	3	8	9	12 (30)	
Deer	6	7	7	24 (60)	

BROWSE CHARACTERISTICS --  
Management unit 27 , Study no: 3

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia nova</b>											
87	<b>2399</b>	133	300	2033	66	-	3	0	3	22	11/9
92	<b>2020</b>	1060	520	720	780	-	44	3	39	19	-/-
97	<b>1380</b>	-	140	980	260	300	0	0	19	13	13/25
03	<b>1340</b>	-	100	1020	220	200	1	0	16	7	14/18
<b>Ceanothus fendleri</b>											
87	<b>433</b>	-	200	233	-	-	0	0	-	0	4/14
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	10/48
03	<b>20</b>	-	-	20	-	-	0	0	-	0	7/24
<b>Chrysothamnus depressus</b>											
87	<b>8199</b>	133	800	7366	33	-	1	0	0	.81	4/7
92	<b>21840</b>	780	3340	16960	1540	-	15	2	7	4	-/-
97	<b>13380</b>	40	780	12320	280	40	.14	0	2	1	5/13
03	<b>14980</b>	-	420	13680	880	680	10	10	6	2	5/9
<b>Chrysothamnus parryi attenuatus</b>											
87	<b>1132</b>	-	166	966	-	-	0	0	0	0	6/5
92	<b>1460</b>	40	500	440	520	-	29	15	36	8	-/-
97	<b>80</b>	-	20	40	20	-	0	0	25	0	7/10
03	<b>1220</b>	-	40	1120	60	-	8	10	5	5	7/11
<b>Gutierrezia sarothrae</b>											
87	<b>500</b>	-	-	500	-	-	0	0	-	0	6/5
92	<b>380</b>	40	20	360	-	-	5	0	-	5	-/-
97	<b>60</b>	-	40	20	-	-	0	0	-	0	-/-
03	<b>400</b>	-	320	80	-	-	0	0	-	0	5/5
<b>Mahonia repens</b>											
87	<b>2099</b>	33	2033	66	-	-	0	0	-	0	5/9
92	<b>280</b>	140	260	20	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	4/5
<b>Pinus ponderosa</b>											
87	<b>166</b>	-	66	100	-	-	0	0	-	20	367/144
92	<b>120</b>	20	40	80	-	-	0	0	-	0	-/-
97	<b>80</b>	-	20	60	-	-	0	0	-	0	-/-
03	<b>80</b>	-	20	60	-	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	% poor vigor	Average Height Crown (in)
<b>Purshia tridentata</b>											
87	<b>1132</b>	233	433	633	66	-	68	6	6	6	15/23
92	<b>1820</b>	140	820	820	180	-	38	19	10	4	-/-
97	<b>620</b>	40	80	440	100	-	52	6	16	0	14/41
03	<b>720</b>	-	20	420	280	-	36	61	39	0	16/38
<b>Ribes cereum inebrians</b>											
87	<b>100</b>	-	-	100	-	-	0	0	0	0	26/29
92	<b>160</b>	20	100	40	20	-	75	0	13	0	-/-
97	<b>20</b>	-	-	20	-	-	0	0	0	0	39/57
03	<b>20</b>	-	-	20	-	-	100	0	0	0	45/58
<b>Symphoricarpos oreophilus</b>											
87	<b>100</b>	-	-	100	-	-	0	100	0	0	15/20
92	<b>300</b>	20	160	120	20	-	13	40	7	0	-/-
97	<b>240</b>	-	60	180	-	-	8	0	0	0	17/41
03	<b>300</b>	-	60	240	-	-	33	27	0	0	13/25
<b>Tetradymia canescens</b>											
87	<b>66</b>	-	33	33	-	-	0	0	0	50	8/6
92	<b>540</b>	20	240	180	120	-	22	4	22	0	-/-
97	<b>200</b>	-	60	140	-	-	0	0	0	0	7/8
03	<b>420</b>	-	80	340	-	-	0	0	0	0	9/11

Trend Study 27-4-03

Study site name: Sand Pass.

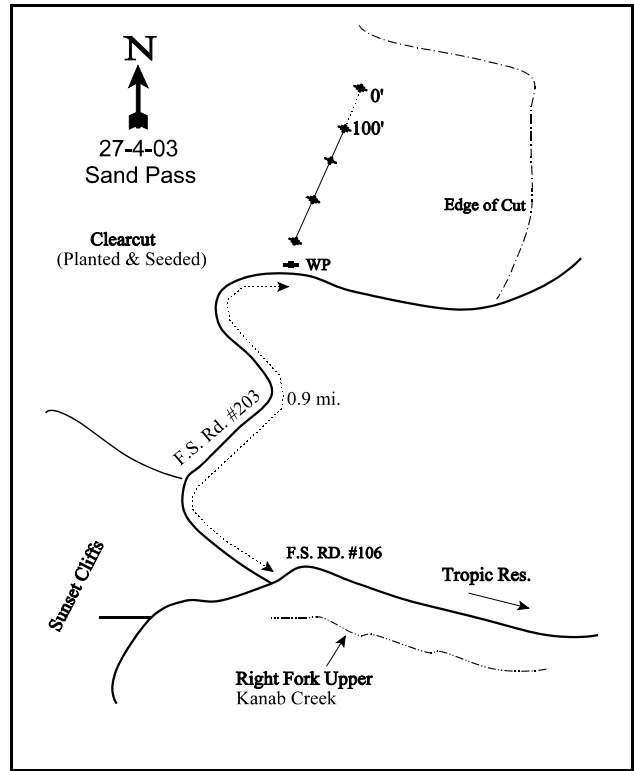
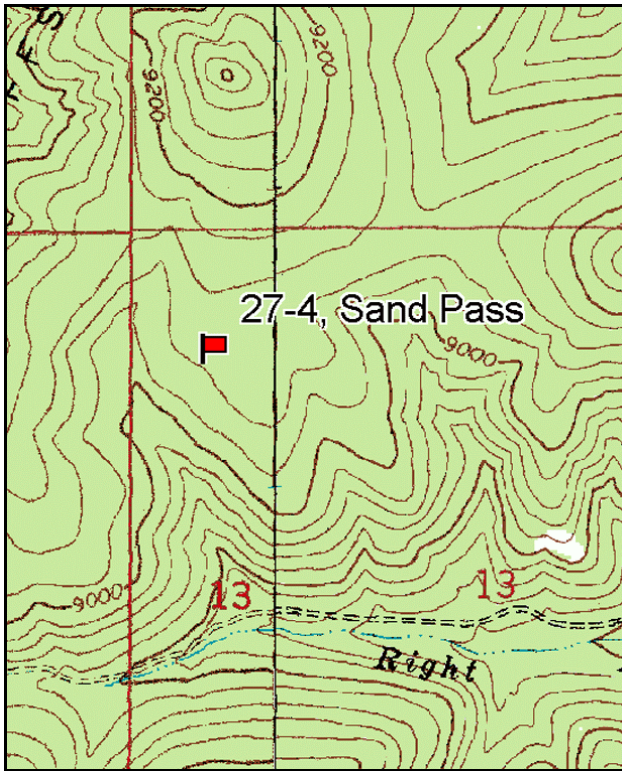
Vegetation type: Clearcut-Mixed Conifer.

Compass bearing: frequency baseline 225 degrees magnetic.

Frequency belt placement: line 1 (11 & 71ft), line 2 (34ft), line 3 (59ft), line 4 (95ft). No rebar.

LOCATION DESCRIPTION

From Badger Creek turnoff on the south end of Tropic Reservoir, travel south on the East Fork of the Sevier River Road (F.S. road 105) for about 4.35 miles to Kanab Creek. Turn right onto the Kanab Creek Road and go 4.5 miles to a fork. Bear right towards North Fork Kanab Creek and travel 2.6 miles to another fork. Bear right up a hill and drive 0.9 miles through a clearcut to the witness post (4' green fencepost) on the left side of the road. If you go too far, the road curves around the ridge at the edge of the clearcut. The transect is in the clearcut above the road. The 400-foot stake is 6 feet north of the witness post. The 0-foot stake is marked by a browse tag #7156.



Map Name: George Mountain

Diagrammatic Sketch

Township 38S, Range 5W, Section 13

GPS: NAD 27, UTM 12S 4152274 N, 378317 E

## DISCUSSION

### Sand Pass - Trend Study No. 27-4

This study samples a conifer forest clear cut and seeding project completed in 1972 on the slopes below Sand Pass and the Sunset Cliffs. Remnants of the mixed conifer type exist on top and in the nearby drainages. Scattered clumps of aspen are an important component of the area. Ponderosa pine and Douglas fir were transplanted, but neither species has been particularly abundant since the treatment. This study lies in the Kanab Creek allotment, although few cattle make it this far out of the drainages. The area is also used as summer range by deer and elk. The study area is typical of the high, previously heavily timbered areas of the Paunsaugunt Plateau. The transect has a southwest exposure and a moderate slope of 15% at an elevation of 9,000 feet. Pellet group transect data collected in 2003 estimated 3 elk and 25 deer days use/acre (8 edu/ha and 61 ddu/ha). Pellets were fresh and from the current summer.

Initially, there appeared to have been some soil erosion following the clear cut. Since then, vegetation and litter cover have stabilized the soil over most of the slope. The seeding of perennial grasses on the road cuts and bare areas have helped minimize excessive soil loss, although a few problem areas remain. An erosion condition class assessment rated soils as stable in 2003. Soils are derived from Wasatch limestone parent material and have moderate depth. Soil texture is a clay with a slightly acidic pH (6.5). A large concentration of rock and fragments are found throughout the profile and on the surface. Phosphorus may be limiting to plant growth at only 6.4 ppm, where 10 ppm is considered minimal for normal plant development.

The young conifers that were planted following the clear cut average 8 to 12 feet in height. Point-center quarter data from 2003 estimated 32 ponderosa pine trees/acre with an average diameter of 6.1 inches, and 90 Douglas fir trees/acre with an average diameter of 3.6 inches. A few aspen also occur on the site.

The dominant vegetation on the site is a mixture of shrubs. Total canopy cover of woody species was estimated at nearly 48% in 2003. The prevalent shrub species in order of average cover provided are currant, manzanita, snowberry, Oregon grape, Fendler ceanothus, and Wood's rose. Most of the browse on the site shows little use except for ceanothus which was moderate to heavily hedged in 1997 and 2003. Of the prevalent species, currant provides the most shrub cover with a total line intercept average cover value of 20%. Currant leaders averaged 3.7 inches of annual growth when the site was read in early August of 2003. Percent decadence was low and vigor good on all of the browse species sampled in 1997 and 2003. The moderately to heavily browsed Fendler ceanothus has a small population of 900 plants/acre estimated in 2003. They show good vigor and no decadent plants were sampled in 1997 or 2003.

The abundance of conifer and mountain browse in the area limits the productivity of herbaceous species. Although 11 species of perennial grasses have been sampled on the site, they have combined to produce 5% or less total cover since 1992. The most common native species are bottlebrush squirreltail, a *Carex*, fringed brome, subalpine needlegrass, and Letterman needlegrass. Of these, Letterman needlegrass and *Carex* significantly declined in nested frequency in 2003, while subalpine needlegrass significantly increased. The seeded species are restricted mainly to road cuts and include Kentucky bluegrass, crested wheatgrass, intermediate wheatgrass, and timothy. Forbs are moderately diverse and provide more cover on the site than grasses. Although not sampled on the transect, elkweed is common on the more open rocky openings and has been heavily used by wildlife in the past. Penstemon, Oregon fleabane, redroot buckwheat, and groundsel are often utilized when available. Wheeler's thistle has been the most abundant forb on the site in all surveys.

### 1992 TREND ASSESSMENT

Of the total vegetation cover on the site, the majority is provided by browse (66%). Shrub cover does not protect soils as well as herbaceous cover, especially from the effects of high intensity summer storms. Because the forb and grass nested frequency values are both declining, and percent bare ground and percent rock-pavement both increased, trend for soils is slightly down. Browse trend for this site is slightly up. Percent decadence for key species is low with good biotic potentials and good percentages of young plants indicating a healthy increasing population of shrubs. The trend for the herbaceous understory of grasses and forbs is downward. Nested frequency values for both show significant decreases, especially for the forbs.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly up (4)

herbaceous understory - down (1)

### 1997 TREND ASSESSMENT

The soil trend continues to be slightly down. Percent bare ground declined slightly, but this is due mainly to an increase in rock and pavement cover. Vegetative cover declined slightly and sum of nested frequency of grasses and forbs declined by 32%. In addition, litter cover has declined in consecutive readings. Trend for browse appears stable for the key species. Use remains mostly light to moderate and vigor good. Trend for the herbaceous understory is down due to a decline in the sum of nested frequency for both grasses and forbs. This will likely be a continuing trend as shrubs and trees become more dominant on the site.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - stable (3)

herbaceous understory - down (1)

### 2003 TREND ASSESSMENT

Trend for soil is stable. Vegetation and litter cover are stable and bare ground remains at 21%. Erosion is not severe, and soils were given a stable rating in 2003 from an erosion condition class assessment. Trend for browse is stable. The prevalent species show mostly light use, low decadence, and average cover either increased or remained stable. Total shrub cover increased from 25% in 1997 to 38% in 2003. Due to the fact that this site represents summer range, browse are of less importance here compared to lower elevational sites. In addition, the high cover value for shrubs is inhibiting herbaceous production. Trend for the herbaceous understory is slightly down as perennial grasses continue to decline in sum of nested frequency. Forbs remained nearly stable in frequency in 2003. Tree and shrub cover is high which greatly limits the productivity of the herbaceous component. Because this is summer range for big game and also grazed by livestock, a greater emphasis should be placed on grasses and forbs. This area would be a good candidate for a prescribed burn to decrease browse cover and stimulate herbaceous species and aspen regrowth.

#### TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - slightly down (2)



HERBACEOUS TRENDS --  
Management unit 27 , Study no: 4

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
G	Agropyron intermedium	a-	c52	c20	b18	.66	.12	.33
G	Agropyron trachycaulum	-	5	9	3	.06	.01	.15
G	Bromus ciliatus	b58	ab55	a35	ab40	1.02	.44	.99
G	Bromus inermis	-	5	1	-	.06	.00	-
G	Carex spp.	c67	bc44	ab42	a16	.69	.75	.58
G	Oryzopsis hymenoides	1	2	3	-	.03	.03	-
G	Phleum pratense	-	-	6	1	-	.06	.00
G	Poa fendleriana	32	30	23	21	.57	.40	.44
G	Sitanion hystrix	c202	b119	a26	a27	1.22	.25	.24
G	Stipa columbiana	a-	a6	a12	b32	.18	.02	.64
G	Stipa lettermani	b47	ab35	b39	a10	.61	.84	.22
Total for Annual Grasses		0	0	0	0	0	0	0
Total for Perennial Grasses		407	353	216	168	5.11	2.95	3.62
Total for Grasses		407	353	216	168	5.11	2.95	3.62
F	Achillea millefolium	-	1	2	-	.00	.00	-
F	Antennaria rosea	-	-	1	1	-	.00	.03
F	Androsace septentrionalis (a)	-	a-	b9	a-	-	.02	-
F	Arabis spp.	b11	a-	a-	a-	-	-	-
F	Aster spp.	a-	a-	b46	b75	-	.80	.95
F	Astragalus spp.	5	7	9	1	.06	.10	.00
F	Calochortus nuttallii	-	-	-	3	-	-	.01
F	Cirsium wheeleri	137	110	131	116	3.85	2.95	3.68
F	Draba subalpina	a-	c72	b21	a-	.16	.04	-
F	Erigeron speciosus	c73	b55	a-	a-	1.07	.03	-
F	Frasera speciosa	c45	cd25	ab9	a1	.42	.38	.30
F	Geranium caespitosum	3	6	-	5	.04	-	.15
F	Gentiana spp.	b11	ab1	ab2	a-	.03	.03	-
F	Lithophragma	-	-	2	-	-	.03	-
F	Lomatium spp.	59	36	28	28	.18	.10	.45
F	Penstemon caespitosus	-	-	2	1	-	.03	.03
F	Penstemon spp.	ab40	b41	ab34	a16	.48	.25	.31
F	Polygonum douglasii (a)	-	-	2	-	-	.00	-
F	Senecio multilobatus	c78	b39	a-	a7	1.13	-	.07
F	Solidago sparsiflora	a11	b54	a13	b52	.63	.49	1.79
F	Taraxacum officinale	b42	a17	a23	a10	.09	.12	.24

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
F	Thlaspi spp.	<sub>b</sub> 100	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	-	-	-
F	Tragopogon dubius	9	3	-	-	.00	-	-
F	Viguiera multiflora	-	-	8	1	-	.36	.15
Total for Annual Forbs		0	0	11	0	0	0.03	0
Total for Perennial Forbs		624	467	331	317	8.20	5.74	8.18
Total for Forbs		624	467	342	317	8.20	5.77	8.18

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

#### BROWSE TRENDS --

Management unit 27 , Study no: 4

Type	Species	Strip Frequency			Average Cover %		
		'92	'97	'03	'92	'97	'03
B	Amelanchier alnifolia	4	2	1	.06	.03	.18
B	Arctostaphylos patula	10	15	11	1.00	3.34	5.15
B	Ceanothus fendleri	11	7	10	.73	2.52	2.85
B	Chrysothamnus parryi attenuatus	0	0	0	-	.03	-
B	Clematis columbiana	3	8	6	1.45	.48	.27
B	Gutierrezia sarothrae	0	0	1	-	-	-
B	Haplopappus zionis	10	0	0	.21	-	-
B	Juniperus communis	3	3	3	.33	.15	1.25
B	Mahonia repens	90	89	86	4.41	3.72	4.15
B	Pachistima myrsinites	36	30	23	1.03	1.10	.93
B	Pinus flexilis	1	0	0	-	-	-
B	Pinus ponderosa	3	0	1	1.61	-	.78
B	Populus tremuloides	1	4	1	-	-	-
B	Pseudotsuga menziesii	12	10	8	.37	-	4.52
B	Ribes cereum inebrians	44	40	37	7.78	7.13	10.85
B	Rosa woodsii	63	44	45	3.30	2.21	2.07
B	Symphoricarpos oreophilus	45	37	41	4.01	4.21	5.03
Total for Browse		336	289	274	26.34	24.95	38.09

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 4

Species	ercent Cover	
	'97	'03
Arctostaphylos patula	-	6.81
Ceanothus fendleri	-	1.14
Clematis columbiana	-	.11
Juniperus communis	-	1.31
Mahonia repens	-	2.66
Pachistima myrsinites	-	2.06
Pinus ponderosa	-	.20
Populus tremuloides	3.20	2.00
Pseudotsuga menziesii	1.79	5.53
Ribes cereum inebrians	1.60	20.10
Rosa woodsii	-	1.73
Symphoricarpos oreophilus	-	4.00

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27 , Study no: 4

Species	Average leader growth (in)
	'03
Ribes cereum inebrians	3.7

POINT-QUARTER TREE DATA --

Management unit 27 , Study no: 4

Species	Trees per Acre	Average diameter (in)
	'03	
Pinus ponderosa	32	6.1
Pseudotsuga menziesii	90	3.6

BASIC COVER --

Management unit 27 , Study no: 4

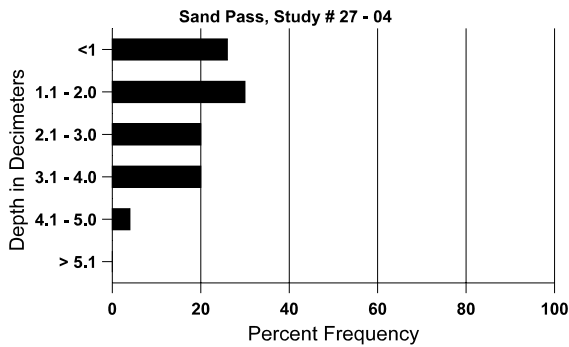
Cover Type	Average Cover %			
	'87	'92	'97	'03
Vegetation	6.00	36.34	34.04	44.14
Rock	4.50	8.79	8.46	10.17
Pavement	1.25	0	3.47	.93
Litter	66.75	53.79	47.12	49.04
Cryptogams	.50	0	.45	0
Bare Ground	21.00	23.40	20.55	20.86

SOIL ANALYSIS DATA --

Management unit 27, Study no: 4, Study Name: Sand Pass

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
12.6	50.7 (16.0)	6.5	31.0	27.2	41.8	3.4	6.4	115.2	0.6

Stoniness Index



PELLET GROUP DATA --

Management unit 27, Study no: 4

Type	Quadrat Frequency			Days use per acre (ha)
	'92	'97	'03	
Rabbit	8	5	-	-
Elk	2	1	1	3 (8)
Deer	16	20	8	25 (61)

BROWSE CHARACTERISTICS --

Management unit 27, Study no: 4

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier alnifolia</b>											
87	0	-	-	-	-	-	0	0	0	0	-/-
92	120	-	80	-	40	-	0	0	33	0	-/-
97	120	-	100	20	-	-	0	17	0	0	14/8
03	40	-	40	-	-	-	0	100	0	0	7/11
<b>Arctostaphylos patula</b>											
87	133	-	-	133	-	-	0	0	0	0	23/71
92	220	40	20	200	-	-	0	0	0	0	-/-
97	680	80	20	640	20	-	0	0	3	3	22/55
03	280	-	-	240	40	20	0	0	14	14	23/70

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Ceanothus fendleri</b>											
87	<b>66</b>	-	-	66	-	-	0	100	0	0	17/65
92	<b>4260</b>	300	1880	2260	120	-	56	33	3	1	-/-
97	<b>400</b>	-	-	400	-	-	0	40	0	0	9/47
03	<b>900</b>	-	-	900	-	-	69	0	0	0	11/36
<b>Clematis columbiana</b>											
87	<b>466</b>	133	400	66	-	-	0	0	-	0	29/4
92	<b>200</b>	40	180	20	-	-	0	0	-	0	-/-
97	<b>240</b>	-	100	140	-	-	0	0	-	0	18/25
03	<b>180</b>	-	-	180	-	-	0	0	-	0	11/10
<b>Gutierrezia sarothrae</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<b>Haplopappus zionis</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>2220</b>	1180	1440	760	20	-	58	22	1	3	-/-
97	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<b>Juniperus communis</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>60</b>	80	-	60	-	-	0	0	-	33	-/-
97	<b>120</b>	-	20	100	-	-	0	0	-	0	16/37
03	<b>60</b>	-	20	40	-	-	0	0	-	0	19/50
<b>Mahonia repens</b>											
87	<b>36799</b>	6266	36133	666	-	-	0	0	0	0	4/4
92	<b>35440</b>	6060	23220	12040	180	-	2	.05	1	0	-/-
97	<b>13300</b>	40	3380	9920	-	-	0	0	0	.75	4/5
03	<b>16440</b>	-	360	16080	-	-	0	0	0	0	4/5
<b>Pachistima myrsinites</b>											
87	<b>1933</b>	600	1933	-	-	-	0	0	0	0	-/-
92	<b>6300</b>	660	5640	640	20	-	6	4	0	0	-/-
97	<b>2500</b>	60	860	1640	-	-	0	0	0	0	5/6
03	<b>1560</b>	-	40	1520	-	-	5	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	% poor vigor	Average Height Crown (in)
<b>Pinus flexilis</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Pinus ponderosa</b>											
87	<b>266</b>	-	266	-	-	-	0	0	-	0	-/-
92	<b>60</b>	20	60	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<b>Populus tremuloides</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	20	-	20	-	-	0	0	-	0	-/-
97	<b>180</b>	-	80	100	-	-	22	0	-	33	-/-
03	<b>100</b>	-	-	100	-	-	0	0	-	0	-/-
<b>Pseudotsuga menziesii</b>											
87	<b>66</b>	-	66	-	-	-	0	0	-	0	-/-
92	<b>240</b>	-	240	-	-	-	17	0	-	0	-/-
97	<b>220</b>	-	160	60	-	-	0	0	-	9	-/-
03	<b>160</b>	-	80	80	-	-	0	0	-	0	-/-
<b>Ribes cereum inebrians</b>											
87	<b>1733</b>	-	533	1200	-	-	4	0	0	4	35/27
92	<b>1660</b>	760	440	1140	80	-	33	12	5	1	-/-
97	<b>1620</b>	20	60	1500	60	-	12	0	4	1	53/67
03	<b>1140</b>	-	40	1060	40	20	7	0	4	2	51/57
<b>Rosa woodsii</b>											
87	<b>1932</b>	66	1266	666	-	-	41	3	0	0	9/6
92	<b>15020</b>	1400	13540	1320	160	-	25	3	1	.66	-/-
97	<b>5900</b>	80	4280	1620	-	80	1	0	0	0	11/9
03	<b>4280</b>	-	420	3780	80	-	6	0	2	0	8/8
<b>Symphoricarpos oreophilus</b>											
87	<b>1066</b>	66	200	733	133	-	50	38	12	19	15/27
92	<b>3080</b>	1100	1380	1420	280	-	26	15	9	4	-/-
97	<b>2120</b>	40	320	1780	20	-	9	0	1	0	18/33
03	<b>1500</b>	-	280	1180	40	-	3	4	3	0	15/32

Trend Study 27-5-03

Study site name: Podunk Creek.

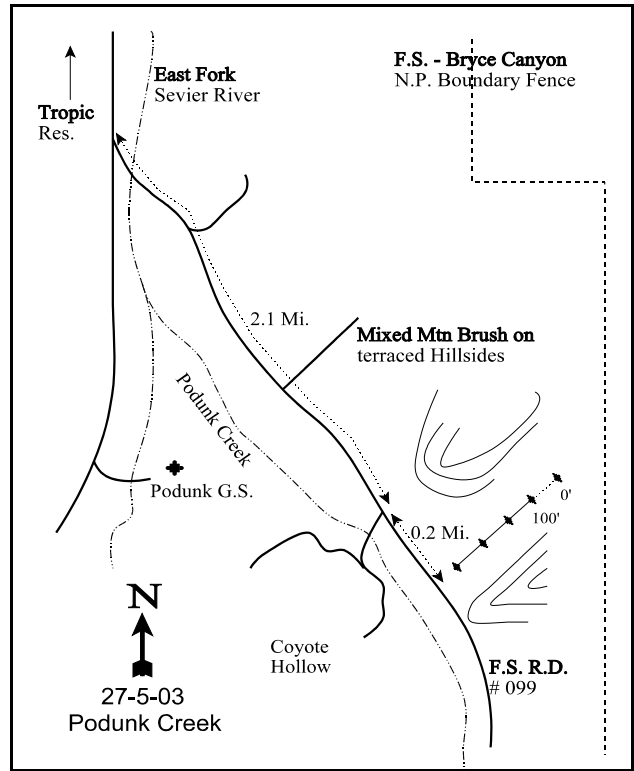
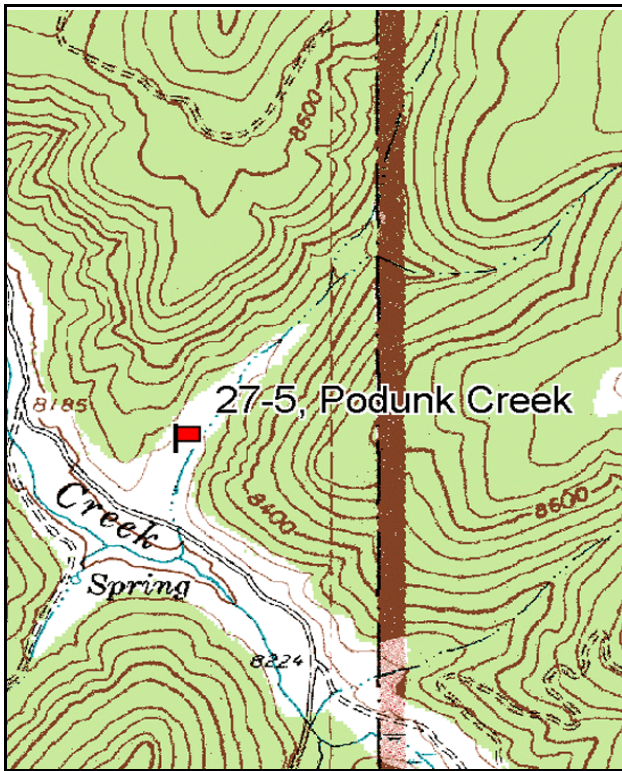
Vegetation type: Dry Meadow.

Compass bearing: frequency baseline 185 degrees magnetic.

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

LOCATION DESCRIPTION

Travel about 7.0 miles south from Tropic Reservoir on the East Fork of the Sevier River Road to a major fork. Turn left towards Podunk Creek and the park boundary. Travel 2.1 miles SE on the main road up Podunk Creek to a fork at Coyote Hollow. Stay left on USFS road #099 and continue about 0.2 miles to a point in the middle of the valley to the north. The transect is in the bottom of this seeded meadow valley. The end of the baseline can be found 125 feet north of the road. The study is marked by short fenceposts. The 0-foot baseline stake is 375 feet north of the end stake as the study runs from there back to the southwest.



Map Name: Podunk Creek

Diagrammatic Sketch

Township 38S, Range 4W, Section 19

GPS: NAD 27, UTM 12S 4148754 N, 387799 E

## DISCUSSION

### Podunk Creek - Trend Study No. 27-5

This study is located in a narrow valley off of Podunk Creek. It samples a contour-trenched and seeded dry meadow. Due to serious erosion and gully formation caused by overgrazing in the early part of the areas grazing history, watershed rehabilitation treatments were undertaken in the 1960's all along the East Fork of the Sevier River drainage. The treatment here successfully established a dense stand of perennial grasses, stopped overland flows and erosion, and helped heal the adjacent gully. Erosion is now almost non-existent due to the contoured trenching treatment and the dense grass and litter cover. The valley slopes gently to the south into Podunk Creek. Elevation at the site is 8,200 feet. The site showed very little big game use in 2003. Elk use was estimated at 4 days use/acre (10 edu/ha), and no deer pellets were sampled in the pellet transect in 2003. This upper part of the East Fork watershed is grazed by cattle in late summer. Cattle use was estimated at 72 days use/acre (177 cdu/ha) in 2003. Most of the cattle use appeared to be from the previous grazing season. Use has been moderate to heavy over the years due to the close proximity of the site to water.

The soil is deep with an effective rooting depth of almost 19 inches. Soil texture analysis indicates it to be a clay loam with a neutral pH (7.2). Percent organic matter is relatively high at 4.1%, the highest amount on the unit. Very little evidence of erosion was present on the site in 1997 and 2003. Soils were rated as stable from an erosion condition class assessment in 2003. Vegetation and litter cover are moderately high on the site, although bare ground has ranged from 22%-34% since 1987.

Browse is not a significant component of this community. The surrounding hills are dominated by mixed conifer and aspen with no evidence of forest invading into the meadow. The larger sampling method used beginning in 1992 picked up a small number of shrubs. The only fairly common species found are several species of rabbitbrush. These shrubs show occasional moderate or heavy use, but most are unutilized.

A very dense stand of grasses characterizes the meadow. Smooth brome is the most abundant species having been sampled in nearly every quadrat in all surveys, and providing 87% and 95% of the total grass cover in 1997 and 2003 respectively. Smooth brome is a vigorous, rhizomatous species which is a sod former and provides excellent ground cover. Smooth brome also is an excellent forage plant for livestock and wildlife. Letterman needlegrass, Kentucky bluegrass, and mountain muhly were all common prior to the 2003 reading, but all 3 of these species declined in nested frequency with dry conditions in 2003. Due to heavy livestock use in 1987, little seed production was observed that summer. Use was moderate in 1992 and 1997 with grasses showing good seed production. Grass production was only fair in 2003 with the drought, and grasshopper use was noted as being high. Forbs provide a fair forage source on the site as well. The most numerous species have included western aster, trailing fleabane, redroot eriogonum, and northwest cinquefoil. Most of these species are low growing increasers. Trailing fleabane significantly increased in nested frequency between 1997 and 2003 and western aster was not sampled.

### 1992 TREND ASSESSMENT

The trend for soil is stable even with an average cover value of 27% for bare ground. With most other communities, this high of a value for bare ground could indicate possible future problems. Because herbaceous species make up 96% of the total cover, soils have excellent protection from high intensity summer storms. The trend for browse is not important on this summer range as it only makes up 4% of the total vegetative cover. However, trend for browse for this site appears stable, but almost non-existent. The herbaceous understory is very vigorous and is dominated by 1 species (smooth brome). Trend for grasses and forbs is slightly up for both with regard to their sum of nested frequency values.



#### TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - slightly up (4)

#### 1997 TREND ASSESSMENT

Trend for soil is stable even though percent cover of vegetation declined somewhat. Litter cover increased substantially which helps offset the decline in vegetation. Percent bare ground is still relatively low at 22% and there does not appear to be an erosion problem. Trend for the small browse component appears up slightly although not an important aspect on this summer range. Trend for the herbaceous understory is down slightly. Sum of nested frequency of grasses and forbs has declined by 31%. However, nested frequency of the dominant species, smooth brome has not changed significantly since 1987. The most obvious change is the significant decline in the nested frequency of Kentucky bluegrass. Quadrat frequency was 77% with an average cover value of over 7% in 1992. Currently, it has a quadrat frequency of only 19% and an average cover value of less than one percent.

#### TREND ASSESSMENT

soil - stable (3)

browse - up slightly (4)

herbaceous understory - down slightly (2)

#### 2003 TREND ASSESSMENT

Trend for soil is slightly down. Bare ground increased from 22% to 34%, vegetation and litter cover both show slight declines, and the sum of nested frequency of perennial grasses and forbs decreased by over 15%. These changes are primarily the result of drought conditions prior to and including the 2003 sampling period, and should improve with normal precipitation patterns. Erosion remains low on the site. Trend for browse is down as the combined density of the rabbitbrush species declined significantly in 2003. However as stated previous, the browse component is relatively unimportant on this meadow. Trend for the herbaceous understory is slightly down overall. Smooth brome remains the dominant species and remained stable in 2003. However, mountain muhly, Kentucky bluegrass, and Letterman needlegrass all declined in nested frequency in 2003 with drought. Perennial forbs actually increased in sum of nested frequency which is somewhat surprising with the dry conditions. All of the increase in forb frequency can be attributed to the low growing increaser trailing fleabane which has little forage value.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - down (1)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --  
Management unit 27 , Study no: 5

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
G	Agropyron intermedium	b18	a-	a-	a-	-	-	-
G	Bromus inermis	356	348	357	343	31.07	22.11	21.77
G	Koeleria cristata	ab10	b15	a-	a-	.27	-	-
G	Muhlenbergia montana	b60	b75	b85	a6	1.50	1.56	.06
G	Poa fendleriana	1	2	-	5	.15	-	.03
G	Poa pratensis	b227	b248	a44	a13	7.19	.22	.07
G	Poa secunda	4	-	-	1	-	-	.00
G	Stipa columbiana	-	3	3	-	.03	.00	-
G	Stipa lettermani	b152	b178	b167	a79	4.14	1.66	1.06
Total for Annual Grasses		0	0	0	0	0	0	0
Total for Perennial Grasses		828	869	656	447	44.36	25.55	23.01
Total for Grasses		828	869	656	447	44.36	25.55	23.01
F	Antennaria rosea	-	8	6	4	.56	.30	.18
F	Androsace septentrionalis (a)	-	b24	a-	b32	.11	-	.10
F	Artemisia dracuncululus	-	-	8	-	-	.36	-
F	Arenaria fendleri	10	-	-	-	-	-	-
F	Astragalus convallarius	a-	b164	a1	a-	3.01	.00	-
F	Aster occidentalis	b40	a-	c124	a39	-	1.39	.21
F	Astragalus spp.	2	-	-	6	.00	-	.06
F	Castilleja linariaefolia	-	-	3	-	-	.00	-
F	Cruciferae	5	-	-	-	-	-	-
F	Equisetum spp.	2	-	-	-	-	-	-
F	Erigeron flagellaris	c298	b194	a53	b227	4.52	.65	5.21
F	Erigeron spp.	A-	a-	b18	a-	-	.11	-
F	Eriogonum racemosum	ab17	ab18	b29	a10	.75	.64	.22
F	Hymenoxys richardsonii	4	6	-	-	.09	-	-
F	Potentilla concinna	a-	a-	a-	b44	-	-	1.24
F	Polygonum douglasii (a)	-	-	5	-	-	.02	-
F	Potentilla gracilis	ab36	c82	b51	a15	6.46	2.15	.46
F	Polygonum spp.	-	14	-	-	.03	-	-
F	Senecio spartioides	9	4	-	-	.01	-	-
F	Taraxacum officinale	3	-	-	-	-	-	-
F	Tragopogon dubius	3	7	-	10	.09	-	.02
F	Unknown forb-perennial	2	-	-	-	-	-	-
F	Vicia americana	-	2	-	-	.00	-	-

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
	Total for Annual Forbs	0	24	5	32	0.10	0.01	0.10
	Total for Perennial Forbs	431	499	293	355	15.56	5.63	7.62
	Total for Forbs	431	523	298	387	15.67	5.65	7.72

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

#### BROWSE TRENDS --

Management unit 27 , Study no: 5

Type	Species	Strip Frequency			Average Cover %		
		'92	'97	'03	'92	'97	'03
B	Chrysothamnus nauseosus hololeucus	0	12	0	-	1.09	-
B	Chrysothamnus parryi	5	0	6	.78	.15	-
B	Chrysothamnus vaseyi	34	44	4	1.75	3.19	.03
B	Chrysothamnus viscidiflorus lanceolatus	6	2	26	.18	.30	.78
B	Gutierrezia sarothrae	1	1	2	-	.15	-
	Total for Browse	46	59	38	2.71	4.88	0.81

#### CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 5

Species	Percent Cover
	'03
Chrysothamnus vaseyi	.33
Chrysothamnus viscidiflorus lanceolatus	1.20

#### BASIC COVER --

Management unit 27 , Study no: 5

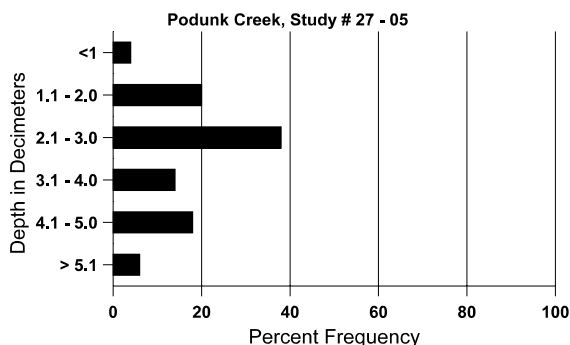
Cover Type	Average Cover %			
	'87	'92	'97	'03
Vegetation	19.75	53.47	39.04	32.59
Rock	1.25	5.67	.96	3.80
Pavement	3.50	0	4.96	5.92
Litter	52.00	28.00	39.34	34.06
Cryptogams	0	.00	0	0
Bare Ground	23.50	27.11	22.03	33.68

SOIL ANALYSIS DATA --

Management unit 27, Study no: 5, Study Name: Podunk Creek

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
18.5	60.0 (18.1)	7.2	31.7	37.7	30.6	4.1	24.5	332.8	0.7

Stoniness Index



PELLET GROUP DATA --

Management unit 27, Study no: 5

Type	Quadrat Frequency			Days use per acre (ha)
	'92	'97	'03	
Elk	-	3	-	4 (10)
Deer	3	4	-	-
Cattle	6	23	32	72 (177)

BROWSE CHARACTERISTICS --

Management unit 27, Study no: 5

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus nauseosus hololeucus</b>											
87	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
97	480	-	280	200	-	-	0	0	-	0	16/19
03	0	-	-	-	-	-	0	0	-	0	-/-
<b>Chrysothamnus parryi</b>											
87	0	-	-	-	-	-	0	0	0	0	-/-
92	120	-	40	40	40	-	33	0	33	0	-/-
97	0	-	-	-	-	-	0	0	0	0	19/21
03	200	-	-	160	40	-	40	0	20	20	14/18

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus vaseyi</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>2860</b>	-	440	2180	240	-	0	0	8	3	-/-
97	<b>4060</b>	-	20	4040	-	-	0	0	0	0	6/13
03	<b>100</b>	-	-	100	-	-	0	40	0	0	13/17
<b>Chrysothamnus viscidiflorus lanceolatus</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>340</b>	-	40	180	120	-	18	0	35	0	-/-
97	<b>80</b>	-	40	40	-	-	0	0	0	0	10/11
03	<b>1180</b>	-	-	900	280	-	0	0	24	0	9/14
<b>Eriogonum microthecum</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	17/18
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Gutierrezia sarothrae</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>20</b>	-	-	20	-	-	0	0	0	0	-/-
97	<b>20</b>	-	-	20	-	-	0	0	0	0	15/20
03	<b>60</b>	-	-	20	40	-	0	0	67	0	4/4

Trend Study 27-6-03

Study site name: Nephi Pasture I.

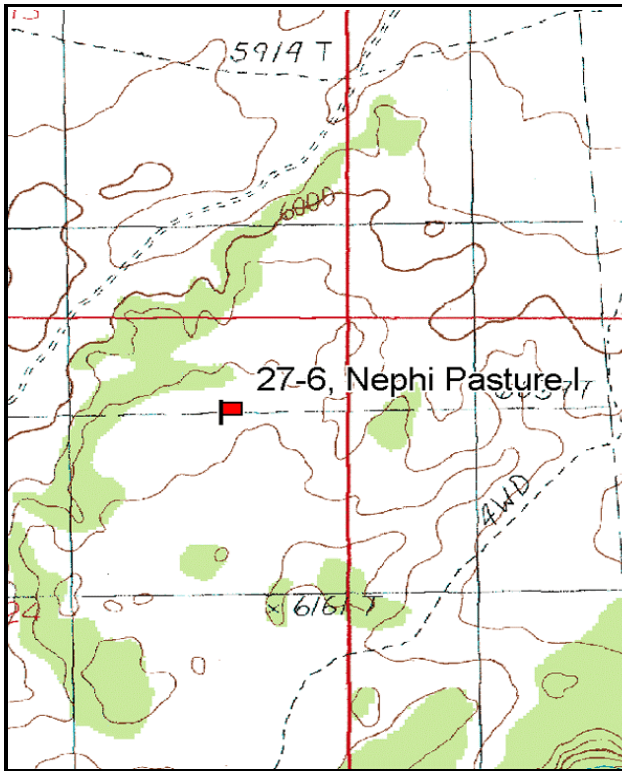
Vegetation type: Basin Big Sagebrush.

Compass bearing: frequency baseline 165 degrees magnetic.

Frequency belt placement: line 1 (11 & 71ft), line 2 (34ft), line 3 (59ft), line 4 (95ft). No rebar.

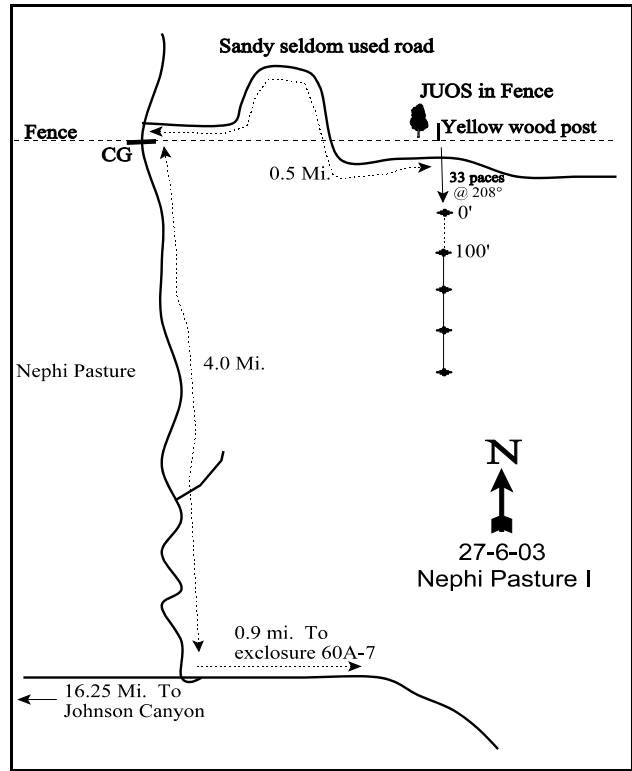
LOCATION DESCRIPTION

From Kanab, take US 89 east for 9.4 miles to the Johnson Canyon turnoff. Turn left and travel up Johnson Canyon 9.75 miles to the Lock Ridge-Nephi Pasture road. Turn right. Go 3.6 miles to a cattleguard. Go 0.8 miles to a fork, bear right (There are lots of forks, stay on main Nephi Pasture road). Go 1.25 miles to a fork, keep right. Go 0.85 miles to a fork by a cattleguard, continue straight. Continue 1.2 miles to a cattleguard. Continue 4.7 miles to a fork, bear right. Go 0.7 miles to a cattleguard, and continue 2.8 miles to an intersection. Turn left (straight goes to Nephi Point and the Nephi Pasture enclosure) and follow this road 4.0 miles to a cattleguard. Turn right and follow the road up the fence 0.5 miles to a yellow-painted wood post marking the pellet group transect and range trend study. The 0-foot baseline stake is 33 paces at 208 degrees magnetic south of the yellow post. The trend study is marked by short fenceposts, and runs south along the pellet group transect.



Map Name: Buckskin Mountain

Township 41S, Range 4W, Section 24



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4121457 N, 395377 E

## DISCUSSION

### Nephi Pasture I - Trend Study No. 27-6

This study samples an important spring-fall range for deer, but also receives use in light winters. Most of the area below the White Cliffs consists of either sagebrush/grass or pinyon-juniper woodland communities. The study samples a basin big sagebrush community with scattered mixed browse associated with a sparse herbaceous understory. Although cattle were present in the lower end of Nephi Pasture in 1987, there was little sign or forage on the site. Water is limited in this area in the summer. Elevation at the study site is approximately 6,000 feet. The slope is 5-8% with a northwest exposure. Quadrat frequency of deer pellets was moderate in 1992 and 2003 at 30% and 21% respectively, and high in 1997 at 49%. Pellet group transect data collected in 2003 estimated 72 deer days use/acre (177 ddu/ha) and 9 cow days use/acre (22 cdu/ha) on the site. Cattle pats were from the previous grazing season while deer pellets were from winter and spring.

There is some snow cover in winter, but most of the annual precipitation comes during the summer monsoons as high intensity thunderstorms. Consequently, the loose, excessively drained sandy soil is susceptible to soil movement as evidenced by gullies in the drainages. Soils are also susceptible to wind erosion. Bare ground has been high in all readings, but particularly so in 2003 at 43%. The high proportion of bare ground is the result of the minimal herbaceous understory. Soil depth on the stabilized dunes is moderately deep with an effective rooting depth of nearly 16 inches. There are some areas with sandstone occurring at a depth of 10 to 12 inches. Organic matter is very low at less than 1%. Shrubs and grasses either have exposed roots or a buildup of soil, but cover appears adequate to help minimize soil loss from the site. An erosion condition class assessment rated soils as stable in 2003.

Due to competition for moisture in the sandy soils, basin big sagebrush is somewhat limited in its density. Basin big sagebrush density was estimated at 3,000 plants/acre in 1992, but has steadily declined with each survey. Density was estimated at 1,620 plants/acre in 2003, about half of the 1992 estimate. Basin big sagebrush has provided nearly 70% of the total browse cover on the transect since 1992. Along with the steady decline in population density, basin big sagebrush also has increased poor vigor and declining reproduction since 1992. The most alarming parameter is percent decadence which was high from 1987-1997 at 40-50%, but extreme in 2003 at 91%. Additionally, 71% and 51% of the decadent plants were classified as dying in 1997 and 2003 respectively. This population will almost undoubtedly continue to decline in the future. Use on basin big sagebrush has been light to moderate with few plants showing heavy use in any year. Annual sagebrush leaders had averaged 2.1 inches of growth when the site was read on July 30, 2003.

The most preferred browse on the site is antelope bitterbrush which is present on the site in low densities. These scattered plants are moderately to heavily used, but have maintained good vigor and moderate to low decadence even during cyclic drought periods during the late 1980's and early 2000's. Bitterbrush density has averaged about 500 plants/acre between 1992-2003. The large serviceberry are more scattered, less common and loosely aggregated. With the increased sample size, serviceberry density was estimated at 500 plants/acre in 1992, 300 in 1997, and 100 in 2003. The decline in the serviceberry population is due to the constant decline of young in the population since 1992. The available portions of the serviceberry plants were heavily browsed in 1987, but use has since become mostly light. Bitterbrush and serviceberry leaders averaged 6.0 and 5.6 inches of annual growth respectively in 2003. Other woody species sampled on the site include the increaser, broom snakeweed, green ephedra, and Utah juniper.

The most common grass, Sandhill muhly, forms large rings in the open areas. It is of low forage quality and an increaser with heavy grazing. Sandhill muhly accounted for 69% of the grass cover in 1997 increasing to 87% in 2003. However, this species significantly declined in nested frequency and average cover in 2003 which illustrates the limited herbaceous understory on the site. Other grasses sampled on the site include sand dropseed, bottlebrush squirreltail, blue grama, and Indian ricegrass, but these species occur infrequently.

Sixweeks fescue, an annual, had the highest nested frequency value of any grass in 1997 but was not sampled in 2003 with the dry conditions. Forbs are also limited on the site. The most common species are peavine and toadflax. Sum of nested frequency values of all perennial herbaceous species declined by more than half from 1997 and 2003.

### 1992 TREND ASSESSMENT

Soil trend for this site would have to be considered down and in poor condition because of the relatively high percentage of bare ground (40%). Total vegetative cover is relatively low at only 34%, and only 18% of that comes from the herbaceous understory. Herbaceous species are the most protective portion of the vegetative community against high intensity summer storms. The browse trend is slightly down for basin big sagebrush with a slight decrease in density, and an increase in percent decadence to 51%. Also, biotic potential (percentage of seedlings to the population) and percentage of the population in the young age class has decreased substantially since 1987. The herbaceous understory is almost nonexistent. Grasses and forbs both showed decreased nested frequency values for perennial species.

#### TREND ASSESSMENT

soil - down (1)

browse - slightly down (2)

herbaceous understory - down (1)

### 1997 TREND ASSESSMENT

Trend for soil is considered stable but still in poor condition. Percent bare ground declined slightly; however, vegetation and litter cover also declined. Erosion is not currently a serious problem on the site. Overall trend for browse would be down. Trend for browse is slightly down for bitterbrush and down for basin big sagebrush (which makes up 67% of the browse cover). Bitterbrush has declined slightly in density. Utilization remains at 1992 levels but a larger proportion of the shrubs display poor vigor. Percent decadence has increased from 33% to 39% and recruitment is poor. Basin big sagebrush shows these same trends. Even though percent decadence has declined due to a die-off of decadent plants, 71% of the decadent plants are classified as dying. This translates into an additional 600 plants/acre that could be lost from the population. Trend for the herbaceous understory is stable yet depleted. The increase in sum of nested frequency for grasses comes from the a significant increase in the nested frequency of the small annual, sixweeks fescue. Unlike other sites on the unit, grass and forb cover values are similar compared to 1992 estimates.

#### TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - stable (3)

### 2003 TREND ASSESSMENT

Trend for soil is slightly down. A decline in vegetation cover and corresponding increase in bare ground elevates the erosion potential on the site. The high infiltration rate of this sandy soil helps keep erosion below excessive levels. Trend for browse is down. Basin big sagebrush has a lower density estimate and decreased reproduction. This species also shows alarming increases in poor vigor (32% to 47%) and percent decadence (40% to 91%). As was the case in 1997, a large proportion of the decadent age class is classified as dying in 2003 (51%). This translates into an additional ~750 plants/acre that could die-off in the near future. Serviceberry continues to decline in density with no young in the population in 2003. These plants are large, and mostly unavailable to browsing deer during winter months. Bitterbrush increased in density in 2003 and shows improved decadence and vigor. However, density is still low at about 600 plants/acre. The herbaceous



understory remains limited and has a downward trend. The most abundant species, Sandhill muhly declined significantly in nested frequency and cover. Perennial grasses and forbs both had lower sum of nested frequency values in 2003 compared to 1997 estimates. Herbaceous production remains poor with total grass and forb cover estimated at only about 3%.

TREND ASSESSMENT

soil - slightly down (2)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 27 , Study no: 6

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
G	Agropyron spp.	9	-	-	-	-	-	-
G	Bouteloua gracilis	3	-	3	-	-	.03	-
G	Muhlenbergia pungens	c122	b85	b97	a30	3.97	3.78	.59
G	Oryzopsis hymenoides	1	10	9	-	.15	.10	-
G	Poa secunda	6	2	-	-	.03	-	-
G	Sitanion hystrix	b15	b17	b20	a3	.63	.16	.03
G	Sporobolus cryptandrus	b19	ab9	ab9	a6	.42	.07	.06
G	Vulpia octoflora (a)	-	a12	b168	a-	.02	1.29	-
Total for Annual Grasses		0	12	168	0	0.01	1.29	0
Total for Perennial Grasses		175	123	138	39	5.20	4.15	0.68
Total for Grasses		175	135	306	39	5.22	5.45	0.68
F	Astragalus spp.	3	-	-	-	-	-	-
F	Calochortus nuttallii	3	-	6	-	-	.01	-
F	Comandra pallida	b49	a18	ab44	b41	.16	.85	.84
F	Delphinium nuttallianum	-	-	2	-	-	.03	-
F	Descurainia pinnata (a)	-	a5	b47	a-	.01	.35	-
F	Eriogonum cernuum (a)	ab6	c70	b15	a-	.23	.03	-
F	Gilia spp. (a)	-	-	9	-	-	.02	-
F	Lathyrus brachycalyx	ab65	b74	ab58	a39	.38	.47	1.50
F	Lappula occidentalis (a)	-	-	3	-	-	.03	-
F	Penstemon spp.	1	-	-	-	-	-	-
F	Sphaeralcea parvifolia	1	3	-	-	.01	-	-
F	Townsendia spp.	-	1	-	-	.00	-	-
Total for Annual Forbs		6	75	74	0	0.24	0.43	0
Total for Perennial Forbs		122	96	110	80	0.55	1.37	2.34
Total for Forbs		128	171	184	80	0.79	1.81	2.34

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

BROWSE TRENDS --

Management unit 27 , Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'92	'97	'03	'92	'97	'03
B	Amelanchier utahensis	8	7	4	3.50	2.25	2.64
B	Artemisia tridentata tridentata	68	59	58	19.74	14.50	13.35
B	Gutierrezia sarothrae	27	45	13	1.37	1.79	.09
B	Juniperus osteosperma	2	2	2	.98	.63	.82
B	Opuntia spp.	0	2	0	-	-	-
B	Purshia tridentata	17	17	19	2.87	2.33	2.65
Total for Browse		122	132	96	28.48	21.52	19.56

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 6

Species	Percent Cover
	'03
Amelanchier utahensis	7.98
Artemisia tridentata tridentata	7.31
Gutierrezia sarothrae	.13
Juniperus osteosperma	1.36
Purshia tridentata	5.75

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27 , Study no: 6

Species	Average leader growth (in)
	'03
Amelanchier utahensis	5.6
Artemisia tridentata tridentata	2.1
Purshia tridentata	6.0

**BASIC COVER --**

Management unit 27 , Study no: 6

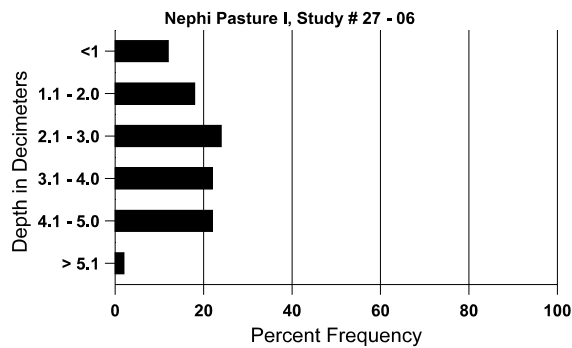
Cover Type	Average Cover %			
	'87	'92	'97	'03
Vegetation	8.00	33.87	29.81	21.84
Rock	.50	1.13	.27	.59
Pavement	2.00	0	.73	.88
Litter	60.50	48.39	43.54	47.32
Cryptogams	1.00	1.53	1.53	.18
Bare Ground	28.00	39.89	34.83	43.46

**SOIL ANALYSIS DATA --**

Management unit 27, Study no: 6, Study Name: Nephi Pasture I

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
15.8	66.3 (14.6)	6.5	88.4	4.1	7.56	0.6	13.0	57.6	0.3

**Stoniness Index**



**PELLET GROUP DATA --**

Management unit 27 , Study no: 6

Type	Quadrat Frequency		
	'92	'97	'03
Rabbit	48	27	17
Deer	30	49	21
Cattle	-	1	2

Days use per acre (ha)
'03
-
72 (177)
9 (22)

BROWSE CHARACTERISTICS --  
Management unit 27 , Study no: 6

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
87	<b>66</b>	-	-	66	-	-	0	100	0	0	55/59
92	<b>500</b>	40	440	40	20	-	8	0	4	36	-/-
97	<b>300</b>	-	200	100	-	-	7	0	0	0	95/111
03	<b>100</b>	-	-	100	-	20	0	20	0	0	86/80
<b>Artemisia tridentata tridentata</b>											
87	<b>3466</b>	1066	466	1400	1600	-	27	10	46	25	44/32
92	<b>3000</b>	20	240	1220	1540	-	31	.66	51	8	-/-
97	<b>2100</b>	40	60	1200	840	1180	18	7	40	32	39/47
03	<b>1620</b>	-	-	140	1480	1180	15	2	91	47	36/39
<b>Ceratoides lanata</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	13/13
<b>Ephedra viridis</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	40/46
<b>Gutierrezia sarothrae</b>											
87	<b>1399</b>	66	266	1133	-	-	0	0	0	0	8/10
92	<b>1480</b>	340	220	1220	40	-	3	1	3	0	-/-
97	<b>3500</b>	-	120	3380	-	40	0	0	0	0	11/10
03	<b>320</b>	-	-	320	-	20	0	0	0	0	7/9
<b>Juniperus osteosperma</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>40</b>	-	20	20	-	-	0	0	-	0	-/-
97	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
03	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>40</b>	-	20	20	-	-	0	0	-	0	3/7
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Purshia tridentata</b>											
87	<b>199</b>	-	66	133	-	-	100	0	0	0	31/22
92	<b>540</b>	340	60	300	180	-	52	19	33	4	-/-
97	<b>460</b>	-	20	260	180	-	52	26	39	17	30/49
03	<b>620</b>	-	-	500	120	60	32	68	19	6	33/49
<b>Yucca spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	59/74

Trend Study 27-8-03

Study site name: Fivemile Mountain.

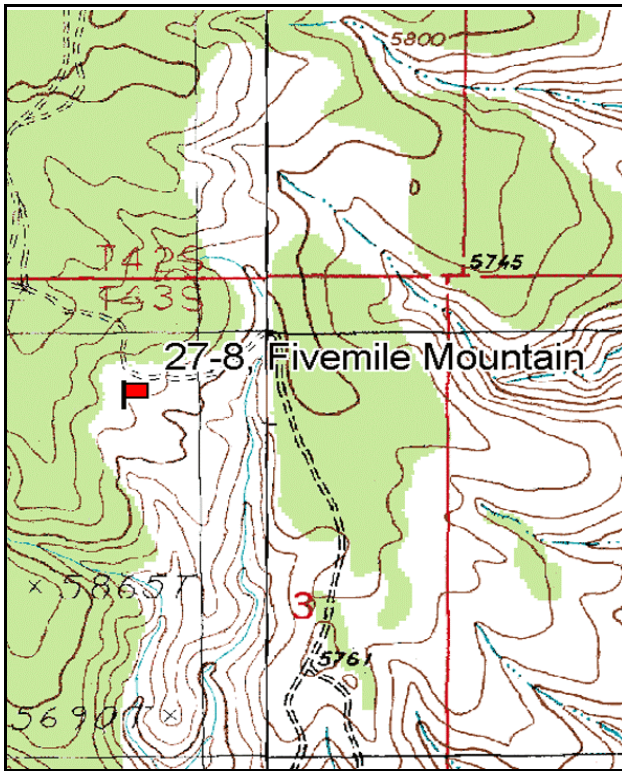
Vegetation type: Black Sagebrush.

Compass bearing: frequency baseline 125 degrees magnetic.

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

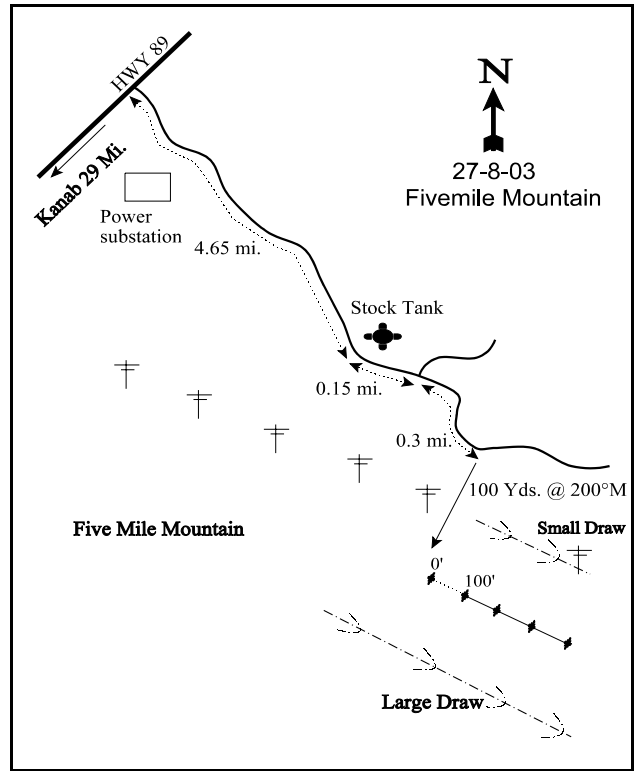
LOCATION DESCRIPTION

From the 90° turn in US 89 in the center of Kanab, go 29.0 miles south on US 89 to the turnoff to Fivemile Mountain. Turn right (southeast) and travel 4.6 miles on the graded road (BLM Rd #710) to a stock tank. Continue on a dirt road 0.15 miles to a fork, bear right. Continue up and over the mountain for 0.3 miles to a bend in the road. Stop here and walk about 100 yards south to the crest of a small ridge and the 0-foot baseline stake. The study runs E-SE down the ridge.



Map Name: Buckskin Mountain

Township 43S, Range 2W, Section 3



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4106822 N, 410840 E

## DISCUSSION

### Fivemile Mountain - Trend Study No. 27-8

This study is located on the south slope of Fivemile Mountain, a low plateau that is important for mule deer during severe winters when they drop off of the Vermillion Cliffs. The range type is black sagebrush interspersed with juniper. The transect runs down an east-southeast facing ridge with a slope of approximately 7%. Elevation at the site is 5,850 feet. Moderate numbers of deer pellet groups are usually encountered as indicated by quadrat frequency values for deer in 1997 (28%) and 2003 (26%). Pellet group transect data was also collected on site in 2003 and estimated 27 deer and 5 cow days use/acre (66 ddu/ha and 13 cdu/ha).

Besides low precipitation, the limiting factor for vegetation on this site is the shallow rocky soils. Effective rooting depth was estimated at almost 11 inches, but there is a high percentage of rock fragments in all horizons. Soil texture is a sandy clay loam with a neutral pH (7.2). Due to the rocky nature of the soil, average soil temperature was high in 1997 and 2003 at nearly 75°F (8 inches in depth). Past soil loss has left a layer of erosion pavement over most of the exposed surface, but erosion is minimal at the present time. An erosion condition class assessment resulted in a stable rating for soils in 2003. Vegetation and litter cover are fairly abundant, and bare ground has been moderately low (8%-12%) in all surveys.

The dominant browse species is black sagebrush which has accounted for more than 3/4 of the browse cover since 1992. Density estimates increased between 1987 and 1992, primarily due to the much larger sample used beginning in the 1992 field season. The black sagebrush population was estimated at 5,980 plants/acre in 1992, decreasing to 4,420 in 1997 and 5,260 in 2003. Utilization was moderate to heavy on 48% of the sagebrush sampled in 1987, but more light to moderate in all other samples. From 1987-1997, black sagebrush displayed generally good vigor and percent decadence was stable at around 30%. In 2003, poor vigor increased to 30% of the population, and percent decadence was estimated at 61%. A high number of dead plants were counted in both 1997 and 2003, suggesting a rather rapid turnover of black sagebrush. A further concern is that a high proportion of the decadent age class was classified as dying in 1997 (43%) and 2003 (49%), which is often considered an irreversible condition. With low recruitment from young plants in both 1997 and 2003 (2%), it appears that black sagebrush will decline on this site in the future. Increases in decadence and poor vigor as well as low reproduction can be attributed primarily to the dry conditions experienced prior to and including the 2003 survey. Annual leaders averaged less than 1 inch of new growth when the site was read in early August of 2003.

If it was more common, Stansbury cliffrose could be a key browse species. Scattered large plants are found west of the study site. These shrubs average 10 feet in height and have been hedged, but not severely. There are occasional seedling and young plants along the ridge. Junipers on the site exhibit the harshness of the growing conditions by their stunted, twisted forms. Some individuals are highlined. Point-center quarter data collected in 2003 estimated 42 juniper trees/acre on the site. There are a few young pinyon scattered around as well. The other most common shrubs are the increasers broom snakeweed and low rabbitbrush. Both species showed decreased densities in 2003.

The herbaceous understory is poor and dominated by cheatgrass which has significantly increased in nested frequency since 1992. Cheatgrass accounted for 49% of the grass cover in 1997, increasing to 66% in 2003. Even with dry conditions in 2003, cheatgrass cover nearly tripled from 2.4% to 6.6%. Perennial species are infrequent and have a lower combined sum of nested frequency value than cheatgrass. Perennial grasses that have been sampled include blue grama, needle-and-thread, Sandberg bluegrass, Indian ricegrass, and bottlebrush squirreltail. Perennial forbs are very rare in all surveys. Storksbill, an annual, was the most abundant forb species sampled in 2003.

## 1992 TREND ASSESSMENT

The soils on this site are shallow and very rocky. Surface rock-pavement is very common with a high cover value of 45%. Percent bare soil is now estimated at 8%. Trend for soil appears stable but in very poor condition. The trend for browse is stable. Black sagebrush has a moderately large population with a fairly good biotic potential and young age class of plants. Percent decadence has also decreased somewhat for this population. The trend for the herbaceous understory is slightly up. There was a slight increase in nested frequency values for the perennial grasses and forbs, but it is still in very poor condition.

### TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - slightly up (4)

## 1997 TREND ASSESSMENT

Trend for soil is slightly down due to an increase in percent bare soil and a decline in vegetation cover. Percent pavement and rock cover declined from 45% to 37% which would suggest some overland soil movement. On the positive side from a watershed standpoint, sum of nested frequency of grasses increased. However, this improvement comes primarily from a significant increase in the nested frequency value for cheatgrass. Trend for black sagebrush is down. Population density has declined 26% since 1992, along with a slight increase in moderate to heavy use, an increase in plants showing poor vigor, and an increase in percent decadence from 24% to 31%. The percentage of decadent plants classified as dying has steadily increased since 1987 when it was 25%. It is currently up to 43%, meaning that an additional 584 plants/acre could soon be classified with the dead plants, raising the percentage of dead plants from 19% to 27%. Recruitment is currently not adequate to replace the decadent/dying plants, indicating a continued decline in density unless more favorable conditions for seedling establishment return to the area. Trend for the herbaceous understory is mixed. Sum of nested frequency of perennial grasses has remained similar to 1992 levels, while sum of nested frequency of forbs has declined. Since forbs are rare, trend is considered stable for the herbaceous understory. However, composition and abundance is poor.

### TREND ASSESSMENT

soil - down slightly (2)

browse - down (1)

herbaceous understory - stable (3)

## 2003 TREND ASSESSMENT

Trend for soil is stable. Soil surface characteristics are similar to 1997 estimates including stable bare ground and litter cover estimates. Vegetation cover slightly increased in 2003 with most coming from the increase in cheatgrass cover. Erosion remains low. Trend for browse is down. Although the population density estimate for black sagebrush is slightly higher than in 1997, most of the key population parameters show negative changes. The most notable changes are the increase in percent decadence (31% to 61%), increase in the proportion of the population showing poor vigor (13% to 30%), and the proportion of the decadent age class classified as dying (49%, ~1,560 plants/acre). Recruitment from young plants remains very low at 2%, and far below the level needed to replace the decadent and dying individuals in the population. The number of dead sagebrush plants also increased in 2003. Trend for the herbaceous understory is also down. Sum of nested frequency values for perennial grasses and forbs have declined by nearly 50% since 1997. Cheatgrass continues to dominate the site and shows increases in both frequency and cover in 2003. The negative trends for black sagebrush and declining number of perennial grasses and forbs can be attributed to drier precipitation patterns prior to and including the 2003 survey.



TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 27 , Study no: 8

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
G	<i>Bouteloua gracilis</i>	<sub>a</sub> 15	<sub>b</sub> 42	<sub>b</sub> 42	<sub>b</sub> 40	1.25	.91	1.39
G	<i>Bromus tectorum</i> (a)	-	<sub>a</sub> 18	<sub>b</sub> 180	<sub>b</sub> 202	.07	2.44	6.59
G	<i>Hilaria jamesii</i>	-	3	-	3	.03	-	.15
G	<i>Oryzopsis hymenoides</i>	<sub>ab</sub> 12	<sub>c</sub> 38	<sub>bc</sub> 31	<sub>a</sub> 10	.51	.21	.16
G	<i>Poa fendleriana</i>	-	3	3	3	.03	.00	.00
G	<i>Poa secunda</i>	<sub>a</sub> -	<sub>b</sub> 14	<sub>c</sub> 35	<sub>ab</sub> 6	.08	.40	.06
G	<i>Sitanion hystrix</i>	<sub>b</sub> 51	<sub>a</sub> 22	<sub>a</sub> 15	<sub>a</sub> 2	.15	.41	.03
G	<i>Stipa comata</i>	48	25	40	32	.39	.28	.47
G	<i>Stipa speciosa</i>	-	1	4	5	.00	.15	.15
G	<i>Vulpia octoflora</i> (a)	-	<sub>b</sub> 107	<sub>a</sub> 58	<sub>b</sub> 104	.34	.12	.96
Total for Annual Grasses		0	125	238	306	0.41	2.56	7.55
Total for Perennial Grasses		126	148	170	101	2.46	2.38	2.42
Total for Grasses		126	273	408	407	2.87	4.95	9.98
F	<i>Alyssum alyssoides</i> (a)	-	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 15	-	-	.06
F	<i>Astragalus</i> spp.	<sub>b</sub> 13	<sub>c</sub> 40	<sub>b</sub> 20	<sub>a</sub> -	.12	.07	-
F	<i>Calochortus nuttallii</i>	-	9	3	1	.02	.01	.00
F	<i>Collinsia parviflora</i> (a)	-	-	2	5	-	.00	.01
F	Cruciferae	-	6	-	-	.04	-	-
F	<i>Descurainia pinnata</i> (a)	-	8	4	10	.02	.01	.05
F	<i>Draba cuneifolia</i> (a)	-	<sub>b</sub> 19	<sub>a</sub> -	<sub>ab</sub> 8	.09	-	.02
F	<i>Eriogonum cernuum</i> (a)	-	2	1	-	.03	.00	-
F	<i>Erodium cicutarium</i> (a)	-	<sub>a</sub> -	<sub>a</sub> 12	<sub>b</sub> 31	-	.19	1.74
F	<i>Erigeron pumilus</i>	<sub>c</sub> 23	<sub>ab</sub> 2	<sub>bc</sub> 13	<sub>a</sub> -	.03	.02	-
F	<i>Gilia inconspicua</i> (a)	-	<sub>c</sub> 139	<sub>a</sub> 16	<sub>b</sub> 57	.48	.03	1.11
F	<i>Lappula occidentalis</i> (a)	-	<sub>b</sub> 146	<sub>a</sub> 6	<sub>a</sub> -	.48	.01	-
F	<i>Lomatium</i> spp.	-	5	1	-	.03	.03	-
F	<i>Mentzelia</i> spp.	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 14	-	-	1.01
F	<i>Penstemon thompsoniae</i>	-	1	1	-	.03	.00	-
F	<i>Phlox longifolia</i>	<sub>a</sub> 3	<sub>b</sub> 25	<sub>ab</sub> 15	<sub>a</sub> 5	.25	.06	.06
F	<i>Sphaeralcea grossulariaefolia</i>	-	3	-	-	.00	-	.01
F	Unknown forb-annual (a)	-	5	-	-	.01	-	-

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'97	'03	'92	'97	'03
F	Zigadenus paniculatus	-	1	-	-	.00	-	-
Total for Annual Forbs		0	319	41	126	1.11	0.25	3.00
Total for Perennial Forbs		39	92	53	20	0.54	0.21	1.09
Total for Forbs		39	411	94	146	1.65	0.46	4.09

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

BROWSE TRENDS --

Management unit 27 , Study no: 8

Type	Species	Strip Frequency			Average Cover %		
		'92	'97	'03	'92	'97	'03
B	Artemisia nova	86	79	80	22.60	13.00	12.19
B	Ceratoides lanata	1	2	2	-	-	-
B	Chrysothamnus viscidiflorus stenophyllus	25	20	21	2.09	1.18	.72
B	Gutierrezia sarothrae	4	8	6	.19	.01	.33
B	Juniperus osteosperma	2	2	2	2.49	-	1.92
B	Opuntia spp.	1	2	5	-	.38	.38
B	Sclerocactus	5	3	5	.18	.15	.06
Total for Browse		124	116	121	27.55	14.72	15.61

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 8

Species	Percent Cover	
	'97	'03
Artemisia nova	-	14.50
Chrysothamnus viscidiflorus stenophyllus	-	.63
Juniperus osteosperma	3.00	2.56
Opuntia spp.	-	.03
Sclerocactus	-	.05

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 27 , Study no: 8

Species	Average leader growth (in)
	'03
Artemisia nova	0.9

POINT-QUARTER TREE DATA --  
Management unit 27 , Study no: 8

Species	Trees per Acre	Average diameter (in)
	'03	'03
Juniperus osteosperma	42	9.0

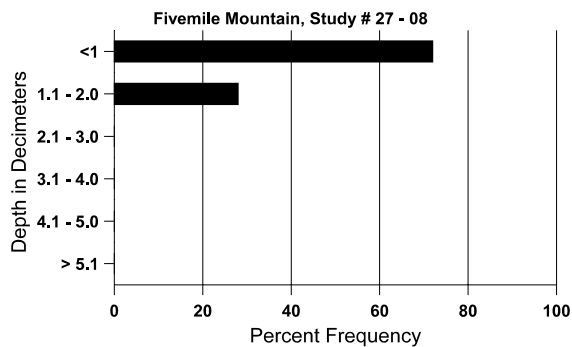
BASIC COVER --  
Management unit 27 , Study no: 8

Cover Type	Average Cover %			
	'87	'92	'97	'03
Vegetation	2.75	30.85	23.60	30.53
Rock	19.50	44.86	18.30	21.68
Pavement	28.00	0	18.18	21.40
Litter	36.00	29.56	28.00	26.07
Cryptogams	5.25	1.31	2.51	.76
Bare Ground	8.50	8.08	12.39	11.49

SOIL ANALYSIS DATA --  
Management unit 27, Study no: 8, Study Name: Fivemile Mountain

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
10.7	74.0 (10.0)	7.2	58.4	19.1	22.6	2.1	16.0	115.2	0.7

### Stoniness Index



PELLET GROUP DATA --

Management unit 27 , Study no: 8

Type	Quadrat Frequency		
	'92	'97	'03
Rabbit	8	9	8
Deer	16	28	26
Cattle	-	2	2

Days use per acre (ha)
'03
-
27 (66)
5 (13)

BROWSE CHARACTERISTICS --

Management unit 27 , Study no: 8

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia nova</i>											
87	<b>2532</b>	133	66	1666	800	-	37	11	32	16	12/20
92	<b>5980</b>	160	740	3800	1440	-	22	0	24	9	-/-
97	<b>4420</b>	100	80	2980	1360	1040	32	2	31	13	16/28
03	<b>5260</b>	-	80	1980	3200	1480	6	0	61	30	13/23
<i>Ceratoides lanata</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	20	-	20	-	-	0	0	-	0	-/-
97	<b>40</b>	-	-	40	-	-	0	0	-	0	9/7
03	<b>40</b>	-	-	40	-	-	50	0	-	0	11/8
<i>Chrysothamnus viscidiflorus stenophyllus</i>											
87	<b>933</b>	-	-	533	400	-	0	0	43	43	10/9
92	<b>780</b>	-	40	640	100	-	0	0	13	10	-/-
97	<b>660</b>	-	20	420	220	40	0	0	33	9	11/21
03	<b>560</b>	-	-	300	260	-	0	0	46	29	12/22
<i>Cowania mexicana stansburiana</i>											
87	<b>0</b>	66	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	78/101
<i>Gutierrezia sarothrae</i>											
87	<b>1198</b>	400	66	1066	66	-	0	0	6	6	7/7
92	<b>100</b>	80	-	100	-	-	0	0	0	0	-/-
97	<b>220</b>	-	-	180	40	80	0	0	18	0	7/7
03	<b>140</b>	-	-	140	-	20	0	0	0	0	7/7

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Juniperus osteosperma</b>											
87	<b>66</b>	-	-	-	66	-	0	0	100	0	-/-
92	<b>40</b>	-	20	20	-	-	0	0	0	0	-/-
97	<b>40</b>	-	20	20	-	20	0	0	0	0	-/-
03	<b>40</b>	-	-	40	-	20	0	0	0	0	-/-
<b>Opuntia spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
97	<b>60</b>	-	-	60	-	-	0	0	-	0	9/27
03	<b>100</b>	-	20	80	-	-	0	0	-	0	10/23
<b>Sclerocactus</b>											
87	<b>0</b>	66	-	-	-	-	0	0	0	0	-/-
92	<b>100</b>	-	40	40	20	-	0	0	20	20	-/-
97	<b>60</b>	-	20	40	-	-	0	0	0	0	5/8
03	<b>100</b>	-	20	40	40	-	0	0	40	40	4/5
<b>Yucca spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	19/25

Trend Study 27-9-03

Study site name: Buckskin Mountain.

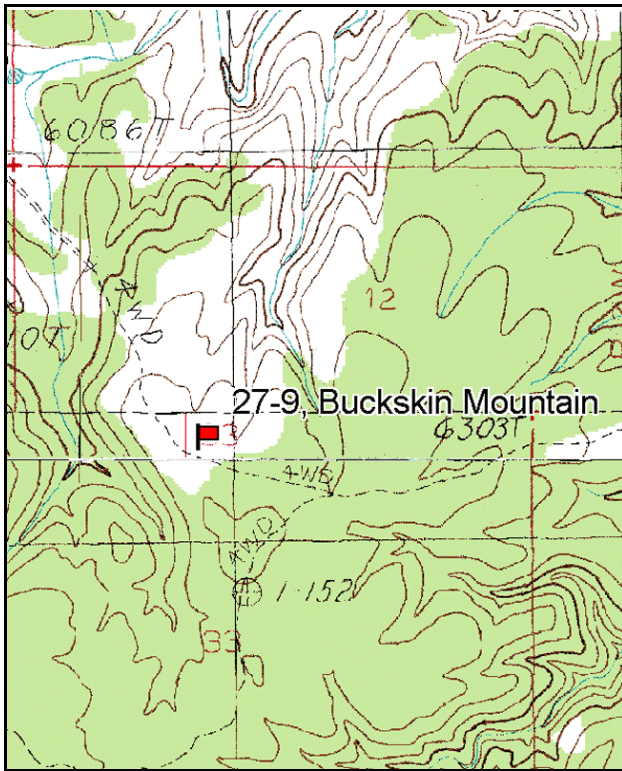
Vegetation type: Basin Big Sagebrush.

Compass bearing: frequency baseline 21 degrees magnetic. (Line 5 357°M).

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

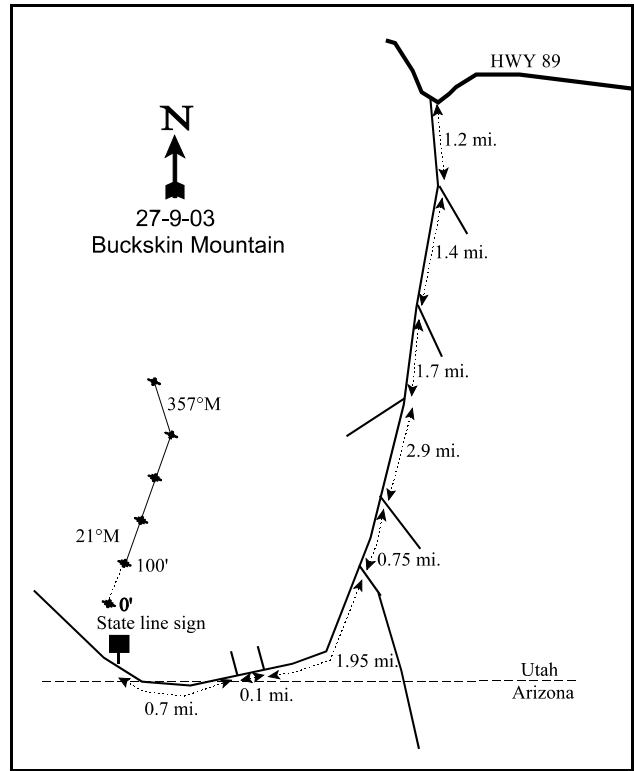
LOCATION DESCRIPTION

From Kanab, head east on U.S. 89 to mile marker 44. Go 0.6 miles south of the mile marker to a road on the right (BLM Rd. #730). Drive 1.2 miles to a fork on the right. Go right (main road) for 1.4 miles to a left turn (BLM Rd. #723). Go 1.7 miles to another fork and go straight (left). Drive 2.9 miles to another fork. Stay on the main road (right) for 0.75 miles to a fork. Go straight at the fork for 1.95 miles to another right fork. Go 0.1 miles to a right fork. Continue 0.7 miles to the Arizona\Utah border sign. From this sign, walk 50 feet at 326 degrees magnetic to the 0-foot stake. The study is marked by steel, green fenceposts approximately 12-18 inches in height.



Map name: Telegraph Flat

Township 44S, Range 3W, Section 12



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4095235 N, 403910 E

## DISCUSSION

### Buckskin Mountain - Trend Study No. 27-9

This study was established in 1997 and is located south of U.S. 89, west of Kaibab Gulch, and just south of Pine Hollow Canyon on the Utah-Arizona border. This site was established to better sample critical winter range south of the Vermillion Cliffs. It samples a low flat ridge which supports a cliffrose/juniper overstory with a basin big sagebrush/grass understory. The site slopes gently in a northerly direction at an elevation of about 6,300 feet. Deer frequent the site as evidenced by the high quadrat frequency of deer pellet groups in 1997 (49%) and 2003 (31%). Pellet group transect data was collected on site in 2003 and estimated 98 deer and 4 cow days use/acre (243 ddu/ha and 11 cdu/ha). A single elk pellet group was also sampled in 2003.

Soils at this site are very similar to those at Fivemile Mountain. Average effective rooting depth is estimated at almost 10 inches. Pavement and rock are abundant in the un-vegetated areas of the surface and throughout the soil profile. There is obviously no subsurface rooting barrier as evidenced by the dense stand of basin big sagebrush. Soil texture is a loam with a moderately alkaline pH (7.4). Soil temperature was high at 70°F in 2003 at a depth of 11 inches. Some erosion was noted in the isolated open areas, but vegetation and litter cover are adequate to prevent serious erosion. Bare ground was very low on the site at less than 10% in both readings.

The key browse on the site are basin big sagebrush and Stansbury cliffrose. Sagebrush accounted for 52% and 56% of the shrub cover in 1997 and 2003 respectively. Basin big sagebrush density was estimated at 2,920 plants/acre in 1997 decreasing to 2,180 in 2003. A slight increase in the number of dead sagebrush as well as a decrease in young plants accounted for the population decline. Although the number of young declined in 2003, recruitment would still be considered fair with 10% of the population consisting of young plants. Percent decadence was moderate in both 1997 and 2003 at 34% and 44% respectively. The number of decadent plants classified as dying declined from 45% (440 plants/acre) in 1997 to 27% (260 plants/acre) in 2003 which was an improvement. Most of the sagebrush displayed normal vigor in both surveys. Utilization was light to moderate with a few individuals receiving heavy use in 1997, but very little utilization was evident in 2003. Annual leaders on basin big sagebrush averaged 1.5 inches of growth in 2003.

Cliffrose density was estimated at 240 plants/acre and 360 plants/acre in 1997 and 2003 respectively. The available portions of cliffrose plants provided 28% and 18% of the browse cover in 1997 and 2003. These percentages are higher if the unavailable portions of cliffrose sampled by the line-intercept transect are factored in. This population is mostly mature with moderately low decadence. About half of the mature plants were partially unavailable to browsing in both surveys, resulting in mostly light to moderate use overall. Mature cliffrose average nearly 8 feet in height with overhead canopy cover averaging about 10% over the whole site in 1997 and 2003. Vigor has remained mostly normal throughout the cliffrose population, and reproduction is low. Cliffrose leaders had averaged 3.6 inches of annual growth when the site was read in early August of 2003. Broom snakeweed is present on the site with an average density of about 1,000 plants/acre, and pinyon and juniper trees had a combined density of about 140 trees/acre in 2003.

The herbaceous understory is very poor, and a discussion of perennial species is futile. A total of 9 perennial grasses and forbs were sampled on the transect during the 1997 and 2003 surveys, which provided less than ½ of 1% total cover during either reading. Cheatgrass dominates the understory as it provided 99% of the grass cover and half of the total vegetation cover in 1997 and 2003. With an average cover value of over 20% in both readings, the fire hazard created by cheatgrass is very high. A wildfire would be devastating to this important winter range as both basin big sagebrush and cliffrose are fire intolerant species. The abundance of cheatgrass also presents a severe competition problem for seedling and young shrubs, as well as perennial grasses and forbs, that will have a difficult time with establishment and survival in this system.

1997 APPARENT TREND ASSESSMENT

The soil trend appears stable with percent bare soil at only 6%. Vegetation and litter cover combined with the gentle terrain limit erosion. The browse trend appears down, primarily for sagebrush, however it provides the majority of the key browse forage (67%). The population of big sagebrush will likely decline due to the high percentage of decadent plants classified as dying at 45%. Another way to look at it is that another 440 plants/acre will be dead in the future. This will raise the percentage of dead plants in the population from 32% to 38%. However, seedlings and young could help to maintain the current population, but nothing is certain with these harsh conditions. The herbaceous understory is in extremely poor condition due to the lack of perennial grasses and the dominance of cheatgrass. In addition, forbs are rare in their occurrence on this site.

2003 TREND ASSESSMENT

Trend for soil is stable. Vegetation and litter cover are high, although the source for most of the surface vegetation and litter is cheatgrass. Bare ground remains low at 9% and erosion is minimal. Trend for browse is slightly down. Basin big sagebrush has a lower density estimate, increased decadence, and less young in the population. However, use is lighter compared to 1997 levels, and the proportion of the decadent age class classified as dying declined from 45% to 27%. Cliffrose showed a slight density increase, decadence remains quite low (17%), and the entire population had normal vigor in 2003. Although cliffrose reproduction is low, these plants are long lived and appear to be maintaining themselves at the present time. The herbaceous understory trend is slightly down and in very poor condition. Cheatgrass continues to dominate the understory although it significantly declined in nested frequency. Cheatgrass cover averaged over 20% in 2003 which creates a serious fire hazard to the key browse on the site. Perennial grasses and forbs are very rare and declined in sum of nested frequency.

TREND ASSESSMENT

soil - stable (3)

browse - slightly down (2)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --

Management unit 27 , Study no: 9

Type	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
G	Bouteloua gracilis	1	-	.00	-
G	Bromus tectorum (a)	<sub>b</sub> 453	<sub>a</sub> 368	25.61	20.39
G	Festuca ovina	7	1	.03	.00
G	Poa fendleriana	6	-	.21	-
G	Poa secunda	10	5	.01	.03
G	Sitanion hystrix	<sub>b</sub> 26	<sub>a</sub> 1	.10	.00
G	Vulpia octoflora (a)	<sub>a</sub> -	<sub>b</sub> 38	-	.16
Total for Annual Grasses		453	406	25.61	20.55
Total for Perennial Grasses		50	7	0.35	0.03
Total for Grasses		503	413	25.96	20.59



T y p e	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
F	Calochortus nuttallii	6	-	.01	-
F	Descurainia pinnata (a)	-	5	-	.02
F	Draba spp. (a)	<sub>a</sub> -	<sub>b</sub> 46	-	.27
F	Erodium cicutarium (a)	<sub>a</sub> -	<sub>b</sub> 25	-	1.04
F	Erigeron spp.	6	-	.01	-
F	Gilia spp. (a)	<sub>a</sub> 11	<sub>b</sub> 138	.01	2.66
F	Holosteum umbellatum (a)	-	2	-	.00
F	Lappula occidentalis (a)	<sub>a</sub> -	<sub>b</sub> 23	-	.11
F	Microsteris gracilis (a)	<sub>a</sub> 2	<sub>b</sub> 16	.00	.06
F	Phlox longifolia	5	-	.01	-
F	Plantago patagonica (a)	-	2	-	.00
F	Ranunculus testiculatus (a)	<sub>a</sub> 1	<sub>b</sub> 28	.00	.12
F	Sphaeralcea grossulariaefolia	1	10	.00	.01
F	Unknown forb-annual (a)	-	6	-	.04
Total for Annual Forbs		14	291	0.02	4.35
Total for Perennial Forbs		18	10	0.03	0.01
Total for Forbs		32	301	0.06	4.36

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

#### BROWSE TRENDS --

Management unit 27 , Study no: 9

T y p e	Species	Strip Frequency		Average Cover %	
		'97	'03	'97	'03
B	Artemisia tridentata tridentata	76	65	12.19	8.77
B	Cowania mexicana stansburiana	9	10	6.55	2.82
B	Ephedra viridis	3	0	.06	.38
B	Gutierrezia sarothrae	27	15	1.08	.11
B	Juniperus osteosperma	7	5	3.57	3.43
B	Opuntia spp.	3	2	.00	.03
Total for Browse		125	97	23.48	15.56

CANOPY COVER, LINE INTERCEPT --  
 Management unit 27 , Study no: 9

Species	Percent Cover	
	'97	'03
Artemisia tridentata tridentata	-	7.31
Cowania mexicana stansburiana	10.80	8.36
Gutierrezia sarothrae	-	.06
Juniperus osteosperma	5.19	7.19

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 27 , Study no: 9

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	1.5
Cowania mexicana stansburiana	3.6

POINT-QUARTER TREE DATA --  
 Management unit 27 , Study no: 9

Species	Trees per Acre	Average diameter (in)
	'03	
Cowania mexicana stansburiana	61	10.2
Juniperus osteosperma	78	6.8

BASIC COVER --  
 Management unit 27 , Study no: 9

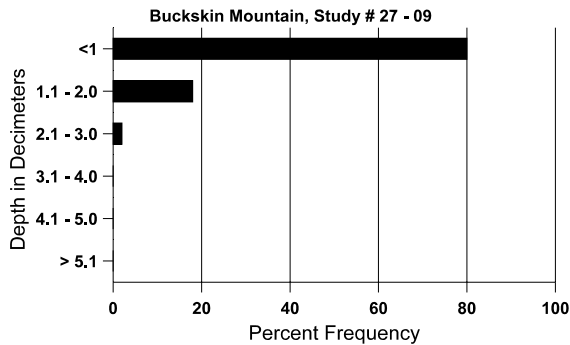
Cover Type	Average Cover %	
	'97	'03
Vegetation	38.47	37.72
Rock	4.40	5.34
Pavement	19.59	21.29
Litter	48.10	43.54
Cryptogams	.61	.04
Bare Ground	5.84	8.61

SOIL ANALYSIS DATA --

Management unit 27, Study no: 9, Study Name: Buckskin Mountain

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
9.8	70.0 (10.6)	7.4	41.7	32.7	25.6	2.6	25.7	121.6	0.4

Stoniness Index



PELLET GROUP DATA --

Management unit 27, Study no: 9

Type	Quadrat Frequency		Days use per acre (ha)
	'97	'03	
Rabbit	24	14	-
Elk	5	1	1 (2)
Deer	49	31	98 (243)
Cattle	1	3	4 (11)

BROWSE CHARACTERISTICS --

Management unit 27, Study no: 9

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata tridentata</b>											
97	<b>2920</b>	640	740	1200	980	1360	30	9	34	15	29/37
03	<b>2180</b>	-	220	1000	960	1480	4	0	44	12	27/29
<b>Cowania mexicana stansburiana</b>											
97	<b>240</b>	20	20	180	40	-	17	0	17	8	94/95
03	<b>360</b>	-	20	280	60	-	6	17	17	0	93/97
<b>Ephedra viridis</b>											
97	<b>60</b>	-	-	60	-	-	0	0	-	0	28/30
03	<b>0</b>	-	-	-	-	-	0	0	-	0	35/47

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Gutierrezia sarothrae</i>											
97	<b>1120</b>	-	60	960	100	520	0	0	9	9	8/11
03	<b>860</b>	400	440	420	-	40	0	0	0	0	6/7
<i>Juniperus osteosperma</i>											
97	<b>140</b>	-	20	120	-	-	0	0	-	0	-/-
03	<b>100</b>	-	-	100	-	-	0	0	-	0	-/-
<i>Opuntia spp.</i>											
97	<b>80</b>	-	40	40	-	20	0	0	-	0	6/15
03	<b>40</b>	-	-	40	-	-	0	0	-	0	6/18
<i>Opuntia whipplei</i>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	15/23
<i>Pediocactus simpsonii</i>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	7/24
<i>Yucca spp.</i>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	24/34
03	<b>0</b>	-	-	-	-	-	0	0	-	0	30/40

Trend Study 27-10-03

Study site name: Telegraph Flat.

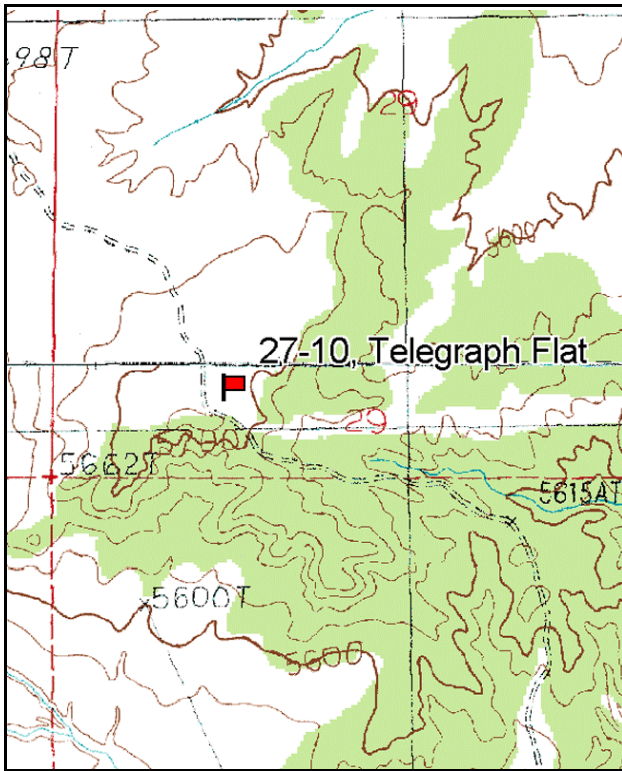
Vegetation type: Cliffrose, Pinyon-Juniper.

Compass bearing: frequency baseline 358 degrees magnetic.

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

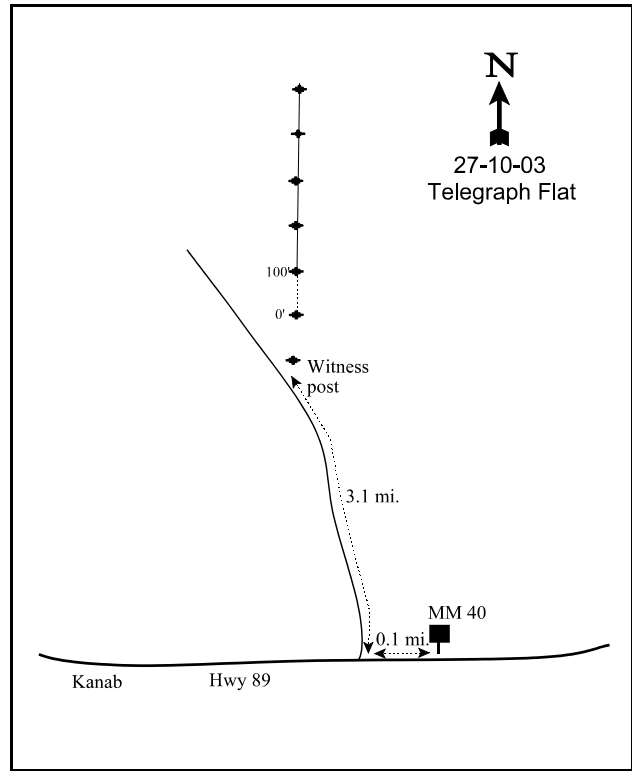
LOCATION DESCRIPTION

From mile marker #40 on Highway 89 east of Kanab, go 0.1 mile west to a road on the north. Go north 2.7 miles to a witness post on the right side of the road. From the witness post walk 14 paces at 0 degrees magnetic to the 0' stake. The study runs north and is marked by green, steel fenceposts approximately 12-18 inches in height.



Map name: Telegraph Flat

Township 42S, Range 3W, Section 29



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4109067 N, 397554 N

## DISCUSSION

### Telegraph Flat - Trend Study No. 27-10

This study was established in 1997 and is located east of Telegraph Wash and west of Clay Hole Wash. The site samples a Wyoming big sagebrush community with a cliffrose and pinyon/juniper overstory on a nearly level bench. This area was chained and seeded in 1963. Elevation is approximately 5,700 feet. Pellet group transect data collected in 2003 estimated 28 deer and 17 cow days use/acre (69 ddu/ha and 41 cdu/ha) on the site. A few elk pellets were found in the quadrat sampling in 1997, and rabbit pellets were moderately abundant in 1997 and 2003.

Soil on the site has a sandy loam texture with a neutral pH (7.2). Soil depth is moderate with an effective rooting depth estimated at over 14 inches. There is no rock and little pavement on the surface or in the profile. Soil temperature was moderately high averaging 60°F at an average depth of 16 inches in 1997. There was a considerable amount of bare ground exposed in both 1997 and 2003 (nearly 50%), but erosion is minimal on the site due to the lack of significant slope and the high infiltration rate of the sandy soils. There are numerous gullies near the site which have been caused by high intensity summer storms. An erosion condition class assessment completed in 2003 resulted in a stable soils rating on the immediate site.

The key browse species is Wyoming big sagebrush which accounted for 2/3 of the total browse cover in 1997 and 2003. Population density was estimated at 12,760 plants/acre in 1997, declining to 8,340 plants/acre in 2003. Half of the population consisted of young plants in 1997 with the remainder being mostly mature. In 2003, young plants accounted for a very small portion of the total population (1%), and decadence increased from 10% to 42%. Nearly half of the decadent age class in 2003 was classified as dying which translates into ~1,700 plants/acre that could die-off in the near future. With drought conditions prior to and including the 2003 survey, it appears that this highly dense sagebrush population is in a period of thinning, but should stabilize at a lower density level once precipitation patterns return to normal. Two-thirds of the sagebrush showed moderate or heavy use in 1997, declining to 43% in 2003. Twenty-one percent of the population displayed poor vigor in 2003, an increase from only 4% in 1997. Annual sagebrush leaders had averaged 1.7 inches of annual growth when the site was read in early August 2003.

Cliffrose density was estimated at 400 plants/acre in 1997 and 320 in 2003. Mature plants are large averaging nearly 5 feet in height, resulting in a portion of the cliffrose forage being unavailable to browsing. As with Wyoming big sagebrush, young cliffrose were abundant in 1997, accounting for 55% of the population. The proportion of young plants declined to a more moderate level of 25% in 2003. Utilization on cliffrose was moderate to heavy in both 1997 and 2003, but vigor was normal in both surveys and decadence low at 5% and 19% respectively. Cliffrose leaders averaged 3.8 inches of growth in August 2003. Pinyon and juniper had a combined density of 64 trees/acre on the site in 2003.

The herbaceous understory is poor. Five perennial and 2 annual grass species were sampled on the site in 1997. Crested wheatgrass was the only common species as it provided 90% of the herbaceous cover and was sampled in 83% of the quadrats. In 2003, crested wheatgrass was not sampled at all. The only plausible explanation is that crested wheatgrass was "droughted out", which was surprising to project personnel as this species is typically thought of as drought tolerant. Forbs were rare in both surveys and provide very little to the site.

### 1997 APPARENT TREND ASSESSMENT

A considerable amount of bare soil is exposed on the site (50%) with some soil pedestalling evident. Herbaceous cover is lacking and nearly 3/4 of the vegetative cover consists of shrub crowns. However, due to the gentle terrain, erosion is not currently a serious problem on the site. The key browse, Wyoming big

sagebrush, displays a dynamic population with half of the plants being young. Mature plants are quite dense at an estimated 5,060 plants/acre. Utilization is moderate to heavy but vigor is good and decadence relatively low at 10%. There are some indications that the population may start to decline in numbers in the future. Cliffrose are moderately hedged with good recruitment, normal vigor, and low percent decadence. This population appears stable. The herbaceous understory is lacking. The only fairly common species is crested wheatgrass which makes up 90% of the herbaceous cover.

2003 TREND ASSESSMENT

Trend for soil is stable but poor. Bare ground remains high at nearly 50%, but erosion is minimal on the immediate site. Vegetation and litter cover remain similar to 1997 estimates. Several gullies are present in the vicinity which are caused by high intensity thunderstorms. Trend for browse is down. Wyoming big sagebrush showed a drastic decline in total density as the number of young decreased from 50% of the population to only 1%. Percent decadence increased from 10% to 42%, and nearly half of the decadent age class was classified as dying which equates to ~1,700 plants/acre that could be lost from the population in the near future. This dense population appears to be in a period of thinning due to the current drought cycle as well as high intraspecific competition between plants. Cliffrose remains healthy overall with a nearly stable density, good vigor, and low decadence. Trend for the herbaceous understory is down. Crested wheatgrass was the only abundant herbaceous species in 1997, but was not sampled on the site in 2003. The only plausible explanation is that crested wheatgrass was “droughted out”. Cattle grazing may also be a factor but cow use was not very high in either sampling year and overgrazing is unlikely. Rabbit pellets were moderately abundant on the site in both 1997 and 2003 and use by rabbits may also be a cause for the decline. Crested wheatgrass is typically quite drought and grazing tolerant and it’s absence from the site in 2003 was surprising. This trend has been seen in other areas of the region where crested wheatgrass has been seeded on sandy soils and declined significantly during drought.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 27 , Study no: 10

Type	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
G	Agropyron cristatum	<sub>b</sub> 252	<sub>a</sub> -	5.83	-
G	Aristida purpurea	<sub>a</sub> 8	<sub>b</sub> 21	.20	.24
G	Bromus tectorum (a)	2	-	.00	-
G	Festuca ovina	8	-	.01	-
G	Oryzopsis hymenoides	8	6	.06	.03
G	Sitanion hystrix	3	6	.03	.01
G	Vulpia octoflora (a)	10	-	.04	-
Total for Annual Grasses		12	0	0.05	0
Total for Perennial Grasses		279	33	6.15	0.29
Total for Grasses		291	33	6.20	0.29

T y p e	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
F	<i>Agoseris glauca</i>	1	-	.00	-
F	<i>Astragalus</i> spp.	5	-	.03	-
F	<i>Calochortus nuttallii</i>	-	3	.00	.01
F	<i>Castilleja</i> spp.	1	-	.00	-
F	<i>Eriogonum umbellatum</i>	-	1	-	.00
F	<i>Gilia</i> spp. (a)	<sub>a</sub> 2	<sub>b</sub> 29	.00	1.01
F	<i>Holosteum umbellatum</i> (a)	3	-	.00	-
F	<i>Machaeranthera canescens</i>	-	1	-	.00
F	<i>Microsteris gracilis</i> (a)	3	-	.00	-
F	<i>Navarretia intertexta</i> (a)	<sub>a</sub> -	<sub>b</sub> 89	-	2.49
F	<i>Phlox austromontana</i>	3	7	.15	.06
F	<i>Phlox hoodii</i>	5	-	.03	-
F	<i>Sphaeralcea grossulariaefolia</i>	-	1	-	.00
F	<i>Stephanomeria exigua</i> (a)	-	2	-	.03
F	Unknown forb-annual (a)	3	-	.03	-
Total for Annual Forbs		11	120	0.04	3.53
Total for Perennial Forbs		15	13	0.23	0.08
Total for Forbs		26	133	0.28	3.62

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

#### BROWSE TRENDS --

Management unit 27 , Study no: 10

T y p e	Species	Strip Frequency		Average Cover %	
		'97	'03	'97	'03
B	<i>Amelanchier utahensis</i>	0	0	.03	-
B	<i>Artemisia tridentata</i> <i>wyomingensis</i>	85	89	11.60	13.33
B	<i>Chrysothamnus nauseosus</i>	1	0	-	-
B	<i>Cowania mexicana</i> <i>stansburiana</i>	15	14	1.90	2.35
B	<i>Ephedra viridis</i>	0	1	-	-
B	<i>Gutierrezia sarothrae</i>	3	8	-	.19
B	<i>Juniperus osteosperma</i>	4	3	1.26	2.00
B	<i>Pinus edulis</i>	2	2	1.66	2.62
B	<i>Yucca</i> spp.	0	0	.38	-
Total for Browse		110	117	16.84	20.52



CANOPY COVER, LINE INTERCEPT --  
 Management unit 27 , Study no: 10

Species	Percent Cover	
	'97	'03
Artemisia tridentata wyomingensis	-	13.56
Cowania mexicana stansburiana	2.20	3.90
Juniperus osteosperma	3.59	2.59
Pinus edulis	1.79	4.00

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 27 , Study no: 10

Species	Average leader growth (in)
	'03
Artemisia tridentata wyomingensis	1.7
Cowania mexicana stansburiana	3.8

POINT-QUARTER TREE DATA --  
 Management unit 27 , Study no: 10

Species	Trees per Acre	Average diameter (in)
	'03	
Juniperus osteosperma	36	2.7
Pinus edulis	28	5.4

BASIC COVER --  
 Management unit 27 , Study no: 10

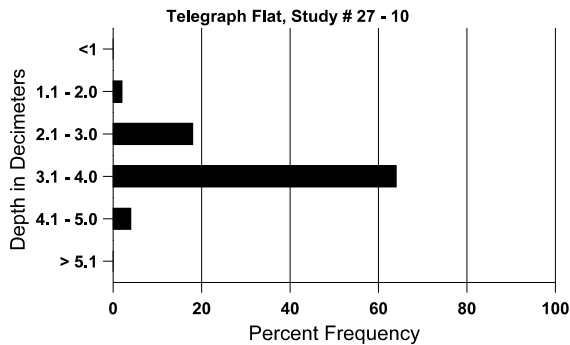
Cover Type	Average Cover %	
	'97	'03
Vegetation	22.68	24.62
Pavement	.06	.05
Litter	28.17	34.32
Cryptogams	4.69	6.74
Bare Ground	49.65	48.52

SOIL ANALYSIS DATA --

Management unit 27, Study no: 10, Study Name: Telegraph Flat

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
14.4	73.3 (13.9)	7.2	62.4	19.1	18.6	1.3	20.2	124.8	0.6

Stoniness Index



PELLET GROUP DATA --

Management unit 27, Study no: 10

Type	Quadrat Frequency		Days use per acre (ha)
	'97	'03	
Sheep	1	-	-
Rabbit	18	19	-
Elk	3	-	-
Deer	19	24	28 (69)
Cattle	-	7	17 (41)

BROWSE CHARACTERISTICS --

Management unit 27, Study no: 10

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>											
97	<b>12760</b>	140	6400	5060	1300	180	55	12	10	4	20/31
03	<b>8340</b>	-	80	4740	3520	520	13	30	42	21	17/23
<i>Chrysothamnus nauseosus</i>											
97	<b>80</b>	-	80	-	-	-	100	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Cowania mexicana stansburiana</i>											
97	<b>400</b>	-	220	160	20	20	60	0	5	0	59/68
03	<b>320</b>	-	80	180	60	80	13	69	19	0	54/66
<i>Ephedra viridis</i>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	22/16
<i>Gutierrezia sarothrae</i>											
97	<b>100</b>	-	-	80	20	-	0	0	20	0	9/10
03	<b>280</b>	-	20	260	-	40	0	0	0	0	9/12
<i>Juniperus osteosperma</i>											
97	<b>80</b>	-	20	60	-	40	0	0	-	0	-/-
03	<b>60</b>	-	-	60	-	-	0	0	-	0	-/-
<i>Opuntia spp.</i>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	4/9
<i>Pinus edulis</i>											
97	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
03	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
<i>Yucca spp.</i>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	19/24

Trend Study 27-11-03

Study site name: Crocodile.

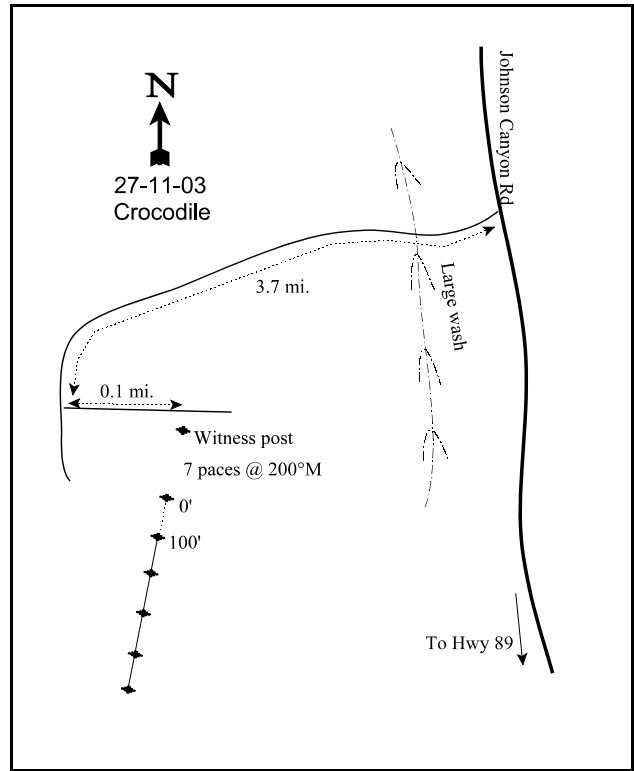
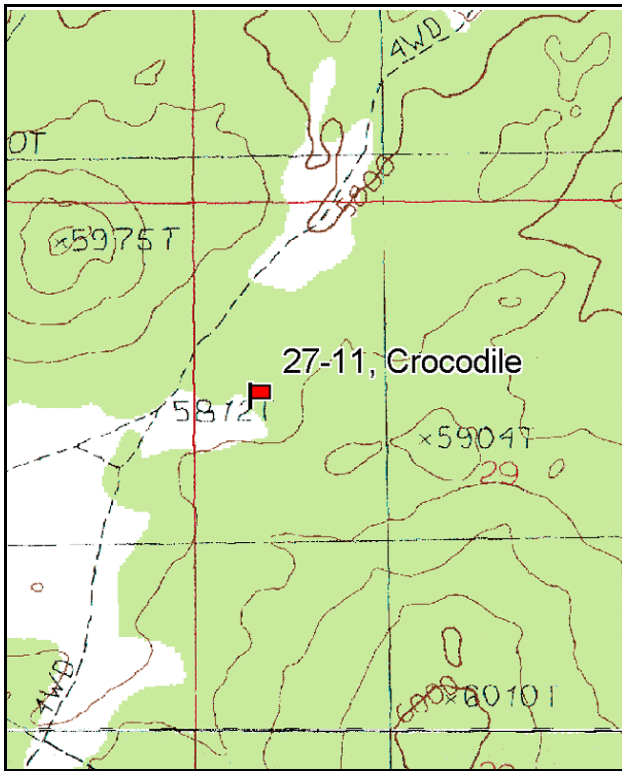
Vegetation type: Basin Big Sagebrush.

Compass bearing: frequency baseline 192 degrees magnetic.

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

LOCATION DESCRIPTION

From the LDS church in Alton, travel south 10.8 miles. At this intersection turn left and head towards Kanab. Continue 6.8 miles to another intersection. Turn south on the pavement and go 9.8 miles to another intersection. Turn right (west) and go 0.1 miles to a left fork. Take this fork and go 3.7 miles across a large wash to a two track on the left. Go 0.1 miles to a witness post on the right (south) side of the road. From the witness post, walk 7 paces at 200 degrees magnetic to the 0-foot stake.



Map name: Cutler Point

Diagrammatic Sketch

Township 42S, Range 5W, Section 29

GPS: NAD 27, UTM 12S 4110325 N, 371620 E

## DISCUSSION

### Crocodile - Trend Study No. 27-11

This study was established in 1997 to sample critical winter range on the Paunsaugunt unit. It is located west of the Johnson Valley Road along the Wygaret Terrace about 1½ miles north of the head of Dairy Canyon. It samples a big sagebrush type with a scattered juniper overstory that was seeded with crested wheatgrass in the mid-1960's. Slope on the site varies from 3% to 10% with a slight north aspect. Elevation is approximately 5,800 feet. The vicinity is a concentration area for wintering deer. A pellet group transect read along the baseline estimated heavy deer use in 1997 and 2003 at 128 deer days use/acre (316 ddu/ha) and 88 deer days use/acre (218 ddu/ha) respectively. A few elk also utilize the area. Twenty-eight cow use days/acre (69 cdu/ha) were also estimated in 1997, declining to 12 days use/acre (30 cdu/ha) in 2003. Most of the herbaceous vegetation was heavily utilized at the time the transect was established on August 19, 1997, and a watering trough was found about 1/4 of a mile to the west of the study area.

Soils at the study site are very deep with an effective rooting depth estimated at nearly 35 inches. Soil texture is a fine sand, and pH is moderately acidic (5.8). Rock and pavement are rare on the surface or in the profile. Erosion is not a serious problem on the site due to the high infiltration capacity of the sandy soil combined with the gentle terrain. However, an erosion condition class assessment completed on site in 2003 rated soils to be slightly eroding due to high pedestalling and surface soil/litter movement. Soil temperature averaged 65°F and 71°F in 1997 and 2003 respectively at a depth of about 18 inches. This would suggest a dry soil profile. Herbaceous vegetation is limited, and bare ground is high at about 55% in both 1997 and 2003.

Basin big sagebrush and antelope bitterbrush represent the key browse on the site. Big sagebrush accounted for just over ½ of the total shrub cover in 1997 and 2003, while bitterbrush provided just under 40% of the browse cover in the same years. Basin big sagebrush had an estimated population density of 2,860 plants/acre in 1997 and 2,340 in 2003. Along with the slight decline in density, a major age class shift also occurred in the basin big sagebrush population in 2003. Young plants declined by more than half, and decadent plants increased from 12% to 57%. Nearly half (46%) of the decadent age class was classified as dying in 2003 which equates to ~620 plants/acre that could be lost from the population in the near future. Utilization has been mostly moderate, with poor vigor being found on 8% and 26% of the population in 1997 and 2003 respectively. Bitterbrush density was estimated at 900 plants/acre in 1997, increasing to 1,160 in 2003. This population consists of mostly heavily hedged, mature plants that have both upright and prostrate growth forms. Percent decadence was low in 1997 at 2%, increasing to 28% in 2003. Both basin big sagebrush and bitterbrush had good seed production in 2003, and annual leaders averaged 2.5 inches for sagebrush and 4.5 inches for bitterbrush. Other browse species that have been sampled on the site include broom snakeweed, rubber rabbitbrush, prickly phlox, sand sagebrush, and yucca.

The herbaceous understory is lacking. Grasses and forbs provide fair diversity but low production. Eight perennial grasses and 1 annual grass have been sampled on the site with needle-and-thread, sandhill muhly, Indian ricegrass, and blue grama being the most abundant. The area was seeded with crested wheatgrass in the 1960's, and this species was sampled in 20 quadrats in 1997. As with the Telegraph Flat study, crested wheatgrass was not sampled at all in 2003, and may have been "droughted out". Most of the cool season grasses had been heavily utilized by livestock prior to sampling in 1997, but there was no noticeable use on grasses in 2003. Forbs are nearly nonexistent with 4 annual and 6 perennial species being sampled between both surveys. Forbs combined to produce about 1% average cover in 2003.

### 1997 APPARENT TREND ASSESSMENT

The soil on the site is extremely sandy and well drained. Over half (55%) of the ground surface is bare soil, and less than 20% of the ground surface is covered by vegetation. Litter cover is moderate at 34%. Seventy-

four percent of the vegetation cover comes from shrub crowns. However, due to the lack of significant slope and the high infiltration capacity of the sandy soil, erosion is not currently a problem on this site. Trends for the key browse species, basin big sagebrush appears slightly down and bitterbrush appears stable, but current use is extremely heavy. The herbaceous understory is very poor.

2003 TREND ASSESSMENT

Trend for soil is stable, but protective cover is poor. Bare ground remains high at over 55%. Signs of erosion were evident in 2003 including severe pedestalling around bunchgrasses and shrubs, and moderate soil/litter surface movement. Due to the high infiltration rate of this sandy soil, erosion is low except during high intensity summer thunderstorms. Trend for browse is down. The most abundant browse, basin big sagebrush, declined in density and reproduction, and showed increased decadence and poor vigor. Nearly half of the decadent age class was classified as dying which translates into ~620 plants/acre that could be lost from the population in the near future. Bitterbrush density slightly increased, but reproduction is poor. Decadence increased from 2% to 28%, and nearly the entire population of sampled plants displayed heavy use in 2003. Vigor remains mostly normal for bitterbrush. Trend for the herbaceous understory is down and in very poor condition. Perennial grasses significantly declined in sum of nested frequency. Crested wheatgrass was not sampled in 2003 and sandhill muhly, needle-and-thread, and sand dropseed all declined individually in nested frequency. Forbs are rare and provide little forage or diversity on this site.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 27 , Study no: 11

Type	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
G	Agropyron cristatum	b43	a-	.30	-
G	Aristida purpurea	-	2	-	.03
G	Bouteloua gracilis	19	15	.11	.26
G	Muhlenbergia pungens	b49	a26	1.64	.43
G	Oryzopsis hymenoides	a-	b31	.00	.40
G	Sitanion hystrix	10	2	.12	.06
G	Sporobolus cryptandrus	b60	a8	.43	.01
G	Stipa comata	106	73	1.47	1.31
G	Vulpia octoflora (a)	b54	a-	.15	-
Total for Annual Grasses		54	0	0.15	0
Total for Perennial Grasses		287	157	4.10	2.51
Total for Grasses		341	157	4.25	2.51
F	Astragalus convallarius	-	3	-	.03
F	Astragalus spp.	b14	a-	.02	-
F	Comandra pallida	6	10	.06	.34

T y p e	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
F	Eriogonum cernuum (a)	3	-	.00	-
F	Gilia spp. (a)	-	12	-	.09
F	Lappula occidentalis (a)	3	-	.01	-
F	Lotus utahensis	4	6	.01	.01
F	Oenothera pallida	<sub>a</sub> -	<sub>b</sub> 10	-	.21
F	Plantago patagonica (a)	<sub>a</sub> 5	<sub>b</sub> 27	.01	.32
F	Sphaeralcea grossulariaefolia	<sub>a</sub> 3	<sub>b</sub> 19	.03	.10
Total for Annual Forbs		11	39	0.02	0.41
Total for Perennial Forbs		27	48	0.12	0.70
Total for Forbs		38	87	0.15	1.12

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

#### BROWSE TRENDS --

Management unit 27 , Study no: 11

T y p e	Species	Strip Frequency		Average Cover %	
		'97	'03	'97	'03
B	Artemisia filifolia	2	4	.15	.85
B	Artemisia tridentata tridentata	65	60	7.94	8.96
B	Chrysothamnus nauseosus hololeucus	15	10	.28	.15
B	Gutierrezia sarothrae	33	25	1.04	.11
B	Leptodactylon pungens	3	5	.04	.06
B	Opuntia spp.	3	0	.03	-
B	Purshia tridentata	28	33	6.02	5.97
B	Yucca spp.	1	1	.15	.15
Total for Browse		150	138	15.66	16.25

CANOPY COVER, LINE INTERCEPT --  
Management unit 27 , Study no: 11

Species	Percent Cover
	'03
Artemisia filifolia	.56
Artemisia tridentata tridentata	11.61
Chrysothamnus nauseosus hololeucus	.71
Chrysothamnus viscidiflorus	.43
Leptodactylon pungens	.01
Purshia tridentata	10.00
Yucca spp.	.66

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 27 , Study no: 11

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	2.5
Purshia tridentata	4.5

POINT-QUARTER TREE DATA --  
Management unit 27 , Study no: 11

Species	Trees per Acre	
	'97	'03
Juniper osteosperma	10	N/A

Average diameter (in)	
'97	'03
13.4	N/A

BASIC COVER --  
Management unit 27 , Study no: 11

Cover Type	Average Cover %	
	'97	'03
Vegetation	18.82	20.57
Rock	.02	.06
Pavement	.08	.04
Litter	34.13	39.60
Cryptogams	.28	1.09
Bare Ground	54.99	55.61

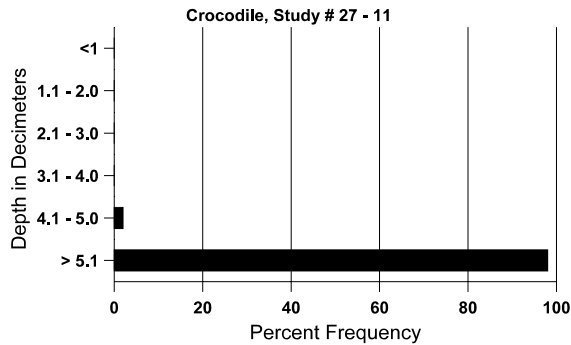


SOIL ANALYSIS DATA --

Management unit 27, Study no: 11, Study Name: Crocodile

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
34.8	70.7 (18.1)	5.8	91.6	2.4	5.9	0.3	9.6	19.2	0.2

Stoniness Index



PELLET GROUP DATA --

Management unit 27, Study no: 11

Type	Quadrat Frequency		Days use per acre (ha)	
	'97	'03	'97	'03
Rabbit	29	16	-	-
Elk	8	-	1 (2)	-
Deer	44	37	86 (212)	88 (218)
Cattle	6	2	20 (49)	12 (30)

BROWSE CHARACTERISTICS --

Management unit 27, Study no: 11

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia filifolia</b>											
97	<b>60</b>	-	-	60	-	-	0	0	0	0	20/19
03	<b>120</b>	-	-	80	40	-	0	0	33	0	23/18
<b>Artemisia tridentata tridentata</b>											
97	<b>2860</b>	280	800	1720	340	420	32	7	12	8	46/49
03	<b>2340</b>	-	300	700	1340	680	53	.85	57	26	33/35

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus nauseosus hololeucus</b>											
97	<b>400</b>	-	60	280	60	40	0	0	15	5	23/27
03	<b>280</b>	-	-	160	120	-	0	0	43	7	28/31
<b>Chrysothamnus viscidiflorus</b>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	22/23
<b>Ephedra viridis</b>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	44/46
<b>Gutierrezia sarothrae</b>											
97	<b>1620</b>	-	140	1380	100	260	0	0	6	6	8/11
03	<b>1020</b>	-	740	240	40	-	0	0	4	0	9/10
<b>Leptodactylon pungens</b>											
97	<b>120</b>	-	-	120	-	-	0	0	-	0	6/3
03	<b>340</b>	-	-	340	-	-	0	0	-	0	5/6
<b>Opuntia spp.</b>											
97	<b>60</b>	-	-	60	-	-	0	0	-	0	3/6
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
97	<b>900</b>	-	80	800	20	20	36	56	2	2	71/81
03	<b>1160</b>	-	20	820	320	20	10	86	28	10	35/52
<b>Yucca spp.</b>											
97	<b>20</b>	-	-	20	-	-	0	0	-	0	20/37
03	<b>20</b>	-	-	20	-	-	0	0	-	0	39/57

Trend Study 27-12-03

Study site name: Moons Landing.

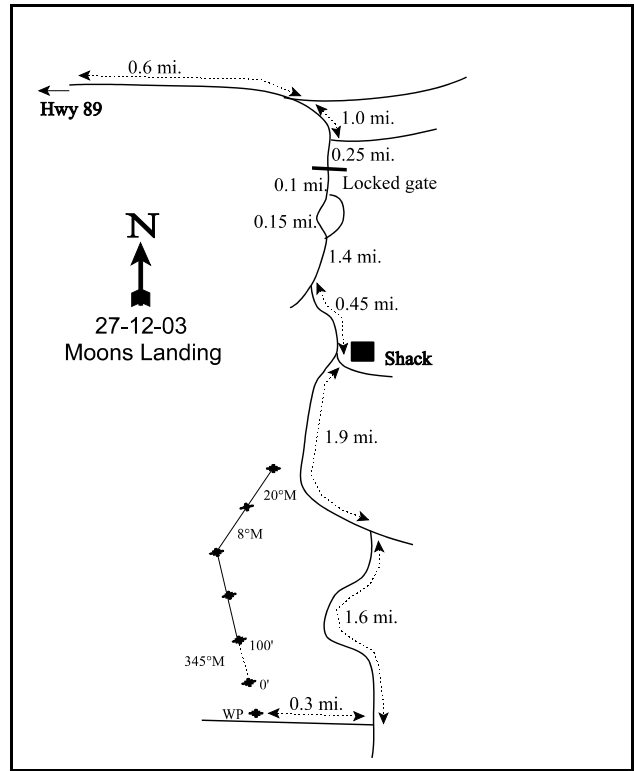
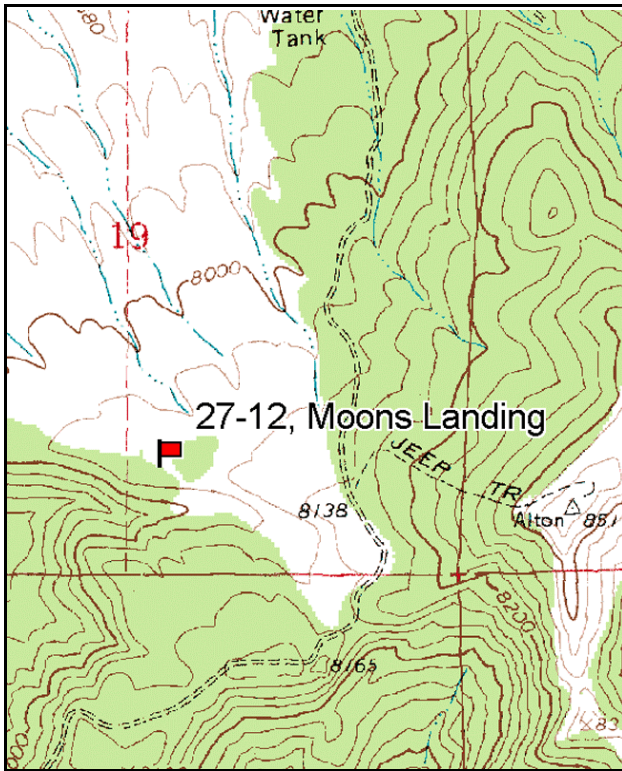
Vegetation type: Mountain Brush.

Compass bearing: frequency baseline 345 degrees magnetic. (Line 4-8°M, line 5-20°M).

Frequency belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft). Rebar: belt 2 on 6ft, belt 3 on 4ft, belt 4 on 1ft, belt 5 on 2ft.

LOCATION DESCRIPTION

From U. S. 89, go approximately 0.4 miles south of mile marker #111 to a road on the left. Go 0.6 miles to a fork. Stay on Bryce Road (right) and go 1.0 mile to a fork. Stay left and go 0.25 to a locked gate (get combination). Go through the gate and go 1.65 miles, staying on the main road, to a fork. Go right 0.45 miles to another fork with a shack on the left. Go right for 1.9 miles to a fork. Turn right and go 1.6 miles to a two track road on the right. Go 0.3 miles on the two track to a witness post on the right (north). The 0-foot stake is 15 feet north of the witness post. The study is marked by green, steel fenceposts approximately 12-18 inches in height.



Map name: Alton

Diagrammatic Sketch

Township 38S, Range 5W, Section 19

GPS: NAD 27, UTM 12S 4149689 N, 371112 E

## DISCUSSION

### Moons Landing - Trend Study No. 27-12

This site was established in 1997 to monitor transitional/summer range on the west side of the Paunsaugunt wildlife management area. It samples a mountain brush type 2 miles east of U.S. 89 and about 4 miles north of Alton. The land is privately owned and part of the Heaton private hunting unit. The transect was placed on a gently sloping ridge with a northwest aspect at an elevation of about 8,100 feet. Pellet group transect data showed heavy deer use on the area with an estimated 192 deer days use/acre (474 ddu/ha) in 1997. Several deer were seen in the area during study establishment. Deer use declined but remained high at an estimated 96 days use/acre (238 ddu/ha) in 2003. Elk also use the area but to a much lesser extent. Elk use was estimated at 14 days use/acre (35 edu/ha) in 1997, with no elk pellets being sampled in 2003. Cattle had been on the site during both readings with use estimated at 43 days use/acre (106 cdu/ha) in 1997 and 15 days use/acre (36 cdu/ha) in 2003. A deer fawn and a sage grouse were seen on the site in 2003.

The soil is moderately deep with an average effective rooting depth of about 15 inches. Texture is a sandy clay loam with a moderately acidic pH (5.9). Rocks and pavement are not abundant on the surface or in the profile. The presence of both black sagebrush (often found in shallow soils) and mountain big sagebrush (deep rooted species) suggest some sort of rooting barrier, either physical or physiological, not discovered by the soil penetrometer. Erosion on the ridge is minimal due to the abundant vegetation and litter cover combined with the gentle terrain. Between 1997 and 2003, vegetation and litter cover declined and bare ground increased from 7% to 22%. An erosion condition class assessment completed on site in 2003 resulted in a stable soil rating.

The site supports a variety of useful browse species including serviceberry, black sagebrush, mountain big sagebrush, and bitterbrush. There are also some oak clones nearby which provide cover and additional forage. The most important shrub on the site is bitterbrush which provided over 40% of the browse cover in 1997 and 2003. Bitterbrush density was estimated at 1,860 plants/acre in 1997, increasing to 2,160 plants/acre in 2003. Eighty percent or more of the population was classified as mature in 1997 and 2003, and decadence was low in both years at 6% and 11% respectively. These shrubs have been severely hedged to the point where many are partly or totally unavailable due to hedging. Most plants still have good leader growth and seed production, and vigor was normal in both surveys. Black sagebrush and mountain big sagebrush are both found on the site in moderate numbers. Many of the sagebrush plants on the site are likely hybrids between the 2 species, but were split according to growth form. Black sagebrush density numbered 980 plants/acre in 1997 and 1,540 plants/acre in 2003. Mountain big sagebrush density was estimated at 560 plants/acre in 1997 and 880 plants/acre in 2003. Both sagebrush populations showed mostly light use, good vigor, and low decadence in both 1997 and 2003. Snowberry provides about 1/4 of the browse cover on the site. Mature plants are fairly large averaging about 2 feet in height with a crown diameter of just over 3 feet in 2003. Snowberry usually receives little use on most areas, but here, some plants displayed moderate to heavy utilization. Serviceberry are rare but heavily hedged.

Stickyleaf low rabbitbrush, an increaser, is widespread on the site with an estimated density of over 2,000 plants/acre. The population appears stable with a majority of the plants being mature in both 1997 and 2003. A small number of dwarf rabbitbrush and white rubber rabbitbrush also persist on the site.

The herbaceous understory is diverse with a fairly abundant perennial grass component. Letterman needlegrass was the most common grass in 1997 and 2003 although it significantly decreased between the 2 surveys. Other fairly common species include mutton bluegrass, Sandberg bluegrass, and needle-and-thread. Of these, needle-and-thread grass and mutton bluegrass increased significantly in nested frequency in 2003, while Sandberg bluegrass significantly declined. Cattle had utilized most of the grasses in the open areas in 1997. Less abundant grasses include slender wheatgrass, blue grama, prairie junegrass, and bottlebrush

squirreltail. Forbs are also diverse with 30 species being sampled between the 2 surveys. Perennial forbs are more abundant than annual varieties with redroot eriogonum, longleaf phlox, Louisiana sagebrush, and pale agoseris being the most abundant. Total forb cover was about 4% in both 1997 and 2003.

#### 1997 APPARENT TREND ASSESSMENT

The soil is well protected by vegetation and litter cover. This, combined with the gentle terrain, limit erosion to localized areas. The key browse on the site, bitterbrush, appears to have a stable population but current use is extremely heavy. If this degree of use continues over several years, it could cause a downward trend. The other important browse species, black sagebrush, mountain big sagebrush and snowberry, appear to have healthy, stable populations with good vigor and low decadence. The herbaceous understory is diverse but not particularly abundant especially for forbs which make only 4% total cover. The dense shrub cover combined with livestock use will prohibit any major improvements for grasses and forbs.

#### 2003 TREND ASSESSMENT

Trend for soil is slightly down. Bare ground increased while vegetation and litter both declined. However, erosion remains minimal and soils were given a stable rating from an erosion condition class assessment in 2003. Trend for browse is slightly up. All of the preferred species show increases in density, and maintain normal vigor and low decadence. Bitterbrush, the most preferred, still displays very heavy use, but most of the population continues to produce good leader growth and seed production. Trend for the herbaceous understory is stable overall. Trend for grasses is slightly down as the sum of nested frequency of all species has declined since 1997. Trend for forbs is slightly up as perennial species increased in sum of nested frequency since 1997. The increase in forb frequency is somewhat surprising with drought conditions experienced prior to and including the 2003 survey.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly up (4)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --  
Management unit 27 , Study no: 12

Type	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
G	Agropyron dasystachyum	50	42	.77	.24
G	Agropyron trachycaulum	7	7	.18	.09
G	Bouteloua gracilis	31	25	.91	.16
G	Bromus carinatus	2	2	.00	.03
G	Carex spp.	<sub>b</sub> 19	<sub>a</sub> 3	.06	.03
G	Koeleria cristata	24	29	.24	.30
G	Poa fendleriana	<sub>a</sub> 47	<sub>b</sub> 114	1.34	1.34
G	Poa pratensis	-	3	-	.01
G	Poa secunda	<sub>b</sub> 133	<sub>a</sub> 80	1.30	1.40
G	Sitanion hystrix	32	20	.30	.32
G	Stipa comata	<sub>a</sub> 95	<sub>b</sub> 133	1.57	2.22
G	Stipa lettermani	<sub>b</sub> 305	<sub>a</sub> 157	11.75	3.38
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		745	615	18.45	9.55
Total for Grasses		745	615	18.45	9.55
F	Agoseris glauca	<sub>a</sub> 3	<sub>b</sub> 31	.00	.29
F	Alyssum alyssoides (a)	-	6	-	.09
F	Allium spp.	4	1	.01	.00
F	Antennaria rosea	1	3	.00	.18
F	Androsace septentrionalis (a)	<sub>a</sub> -	<sub>b</sub> 33	-	.41
F	Arabis spp.	-	2	-	.00
F	Artemisia dracunculus	3	5	.03	.19
F	Artemisia ludoviciana	88	76	1.41	.63
F	Balsamorhiza sagittata	1	2	.15	.15
F	Calochortus nuttallii	-	4	-	.01
F	Cirsium spp.	4	4	.03	.06
F	Crepis acuminata	<sub>a</sub> -	<sub>b</sub> 9	-	.05
F	Descurainia pinnata (a)	-	-	-	.00
F	Epilobium brachycarpum (a)	<sub>a</sub> 1	<sub>b</sub> 23	.00	.03
F	Erigeron eatonii	-	-	-	.00
F	Erigeron flagellaris	15	7	.36	.06
F	Eriogonum racemosum	<sub>b</sub> 118	<sub>a</sub> 80	1.52	1.19
F	Eriogonum umbellatum	<sub>a</sub> 6	<sub>b</sub> 17	.18	.23
F	Lappula occidentalis (a)	-	1	-	.00
F	Lomatium spp.	5	8	.01	.01

T y p e	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
F	<i>Lychnis drummondii</i>	4	2	.03	.01
F	<i>Microsteris gracilis</i> (a)	-	4	-	.01
F	<i>Orthocarpus luteus</i> (a)	-	3	-	.03
F	<i>Phlox longifolia</i>	<sub>a</sub> 33	<sub>b</sub> 80	.10	.17
F	<i>Polygonum douglasii</i> (a)	<sub>b</sub> 62	<sub>a</sub> 4	.18	.01
F	<i>Potentilla gracilis</i>	1	2	.03	.03
F	<i>Senecio</i> spp.	-	-	-	.00
F	<i>Stellaria jamesiana</i>	-	2	-	.00
F	<i>Taraxacum officinale</i>	5	-	.06	-
F	<i>Tragopogon dubius</i>	6	9	.02	.04
Total for Annual Forbs		63	74	0.18	0.61
Total for Perennial Forbs		297	344	3.97	3.35
Total for Forbs		360	418	4.16	3.96

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

#### BROWSE TRENDS --

Management unit 27 , Study no: 12

T y p e	Species	Strip Frequency		Average Cover %	
		'97	'03	'97	'03
B	<i>Amelanchier utahensis</i>	0	2	-	.15
B	<i>Artemisia nova</i>	14	20	2.55	2.40
B	<i>Artemisia tridentata vaseyana</i>	15	25	2.17	2.33
B	<i>Chrysothamnus depressus</i>	12	8	.73	1.28
B	<i>Chrysothamnus nauseosus hololeucus</i>	10	3	.51	.18
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	53	47	5.56	4.54
B	<i>Gutierrezia sarothrae</i>	0	10	-	.10
B	<i>Mahonia repens</i>	4	3	.00	-
B	<i>Purshia tridentata</i>	58	60	17.35	15.26
B	<i>Quercus gambelii</i>	4	4	1.16	1.16
B	<i>Ribes</i> spp.	2	2	.15	.15
B	<i>Rosa woodsii</i>	0	2	.15	.03
B	<i>Symphoricarpos oreophilus</i>	30	32	10.24	7.28
B	<i>Tetradymia canescens</i>	2	4	-	.03
Total for Browse		204	222	40.59	34.93

CANOPY COVER, LINE INTERCEPT --  
 Management unit 27 , Study no: 12

Species	Percent Cover	
	'97	'03
Amelanchier utahensis	-	.06
Artemisia nova	-	5.25
Artemisia tridentata vaseyana	-	2.90
Chrysothamnus depressus	-	.56
Chrysothamnus nauseosus hololeucus	-	.18
Chrysothamnus viscidiflorus viscidiflorus	-	7.71
Gutierrezia sarothrae	-	.21
Purshia tridentata	-	17.45
Quercus gambelii	2.20	2.79
Ribes spp.	-	.66
Symphoricarpos oreophilus	-	8.19
Tetradymia canescens	-	.16

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 27 , Study no: 12

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.3
Purshia tridentata	2.8

BASIC COVER --  
 Management unit 27 , Study no: 12

Cover Type	Average Cover %	
	'97	'03
Vegetation	62.22	49.17
Rock	1.33	2.29
Pavement	1.18	.93
Litter	55.81	42.33
Cryptogams	.49	.03
Bare Ground	7.05	21.55

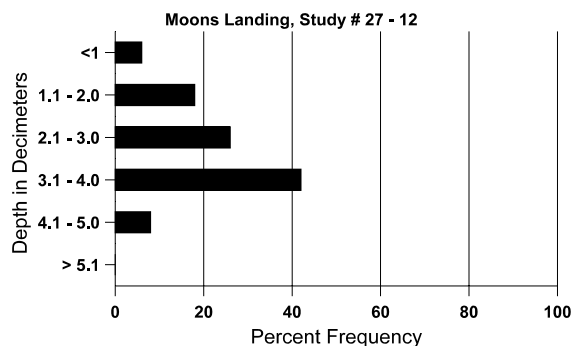


SOIL ANALYSIS DATA --

Management unit 27, Study no: 12, Study Name: Moons Landing

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
15.4	64.0 (9.5)	5.9	64.0	16.1	19.9	2.7	19.1	134.4	0.4

Stoniness Index



PELLET GROUP DATA --

Management unit 27, Study no: 12

Type	Quadrat Frequency		Days use per acre (ha) '03
	'97	'03	
Rabbit	3	11	-
Elk	8	-	-
Deer	45	34	96 (238)
Cattle	14	4	15 (36)

BROWSE CHARACTERISTICS --

Management unit 27, Study no: 12

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	93/78
03	<b>40</b>	-	20	20	-	-	0	50	-	0	4/17
<b>Artemisia nova</b>											
97	<b>980</b>	420	460	440	80	80	14	4	8	6	18/36
03	<b>1540</b>	-	500	960	80	20	1	1	5	0	22/26
<b>Artemisia tridentata vaseyana</b>											
97	<b>560</b>	100	280	240	40	60	14	0	7	4	26/38
03	<b>880</b>	40	380	400	100	40	14	5	11	5	25/29

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus depressus</b>											
97	<b>760</b>	-	180	580	-	-	0	0	-	0	4/8
03	<b>380</b>	-	-	380	-	-	47	53	-	0	6/10
<b>Chrysothamnus nauseosus hololeucus</b>											
97	<b>360</b>	-	20	340	-	-	0	0	-	0	12/16
03	<b>60</b>	-	-	60	-	-	0	0	-	0	12/17
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
97	<b>2080</b>	-	260	1820	-	40	0	0	0	0	19/27
03	<b>2220</b>	-	80	2120	20	20	0	0	1	0	19/26
<b>Gutierrezia sarothrae</b>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>460</b>	-	-	460	-	-	0	0	-	0	6/7
<b>Mahonia repens</b>											
97	<b>200</b>	-	-	200	-	-	0	0	-	0	3/6
03	<b>140</b>	-	-	140	-	-	0	0	-	0	3/6
<b>Purshia tridentata</b>											
97	<b>1860</b>	20	260	1480	120	100	25	70	6	1	23/70
03	<b>2160</b>	-	80	1840	240	40	16	78	11	2	20/46
<b>Quercus gambelii</b>											
97	<b>500</b>	80	360	120	20	-	32	0	4	4	98/32
03	<b>480</b>	-	100	380	-	-	8	54	0	0	70/29
<b>Ribes spp.</b>											
97	<b>40</b>	-	-	40	-	-	50	0	0	0	46/61
03	<b>40</b>	-	-	20	20	-	50	50	50	0	53/52
<b>Rosa woodsii</b>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>40</b>	-	20	20	-	-	0	0	-	0	16/9
<b>Symphoricarpos oreophilus</b>											
97	<b>880</b>	-	60	820	-	-	59	9	0	0	25/57
03	<b>1280</b>	-	80	1140	60	-	11	9	5	2	20/40
<b>Tetradymia canescens</b>											
97	<b>80</b>	20	60	20	-	-	0	0	-	0	10/13
03	<b>160</b>	-	60	100	-	-	0	0	-	0	15/16

Trend Study 27-13-03

Study site name: Heaton .

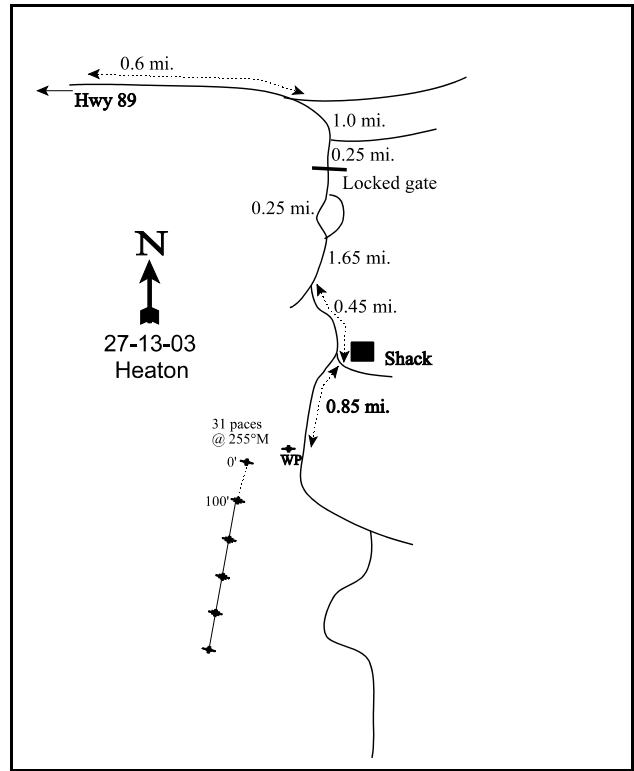
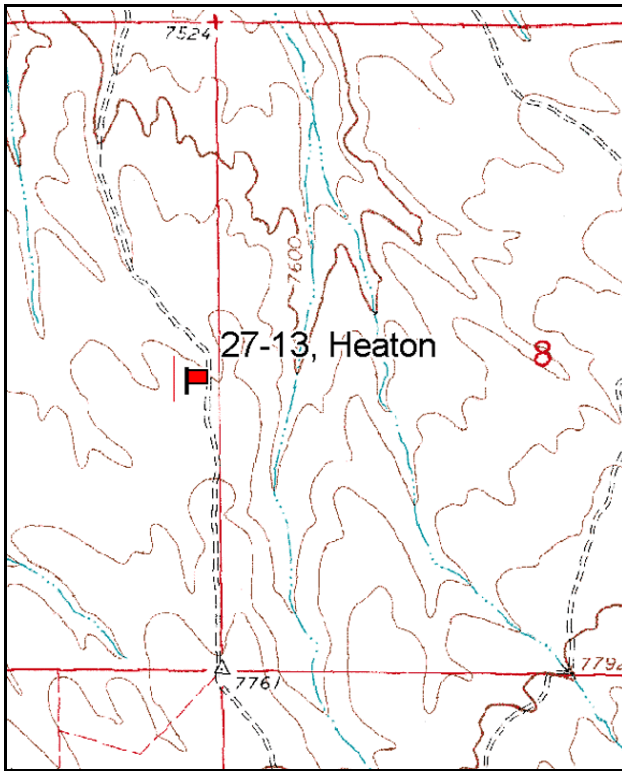
Vegetation type: Black Sagebrush .

Compass bearing: frequency baseline 195 degrees magnetic.

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

LOCATION DESCRIPTION

From U. S. 89 go approximately 0.4 miles south of mile marker 111 to a road on the left. Go 0.6 miles to a fork. Stay on Bryce Road (right) and go 1 mile to a fork. Continue straight and go 0.25 to a locked gate (get combination). Go through the gate and go 1.65 miles, staying on the main road, to a fork. Go left 0.45 miles to another fork with a shack on the left. Go right for 0.85 miles to a witness post on the right (west). From the witness post walk 31 paces at 255 degrees magnetic to the 0-foot stake. The 0-foot stake is marked by browse tag #289. The study is marked by green, steel fenceposts approximately 12-18 inches in height.



Map name: George Mountain

Diagrammatic Sketch

Township 38S, Range 5W, Section 7

GPS: NAD 27, UTM 12S 4153324 N, 371811 E

## DISCUSSION

### Heaton - Trend Study No. 27-13

This study was established in 1997 in conjunction with the previous one to monitor transitional range on the west side of the Paunsaugunt Plateau. It is found east of U.S. 89 about 2 miles north of the Moons Landing study site. The study area is on private land owned by the Heaton family and is part of the Heaton private hunting unit. It samples a sagebrush/bitterbrush flat with a northerly aspect and a gentle slope of 3%. Elevation is approximately 7,700 feet. Deer use was also heavy here with a total of 113 days use/acre (279 ddu/ha) being estimated in 1997. Deer use was much lower in 2003 at 45 days use/acre (111 ddu/ha). Elk use was estimated at 5 days use/acre (12 edu/ha) in 1997 and 2 days use/acre (5 edu/ha) in 2003. Cattle grazing on the site resulted in 79 cow days use/acre (195 cdu/ha) being estimated in 1997 and 25 cow days use/acre (61 cdu/ha) in 2003. This site was aerated between the initial reading in 1997 and the 2003 survey, with the last 4 belts on the transect being effected.

Soil at the site is moderately deep with an effective rooting depth of almost 17 inches. There is little rock on the surface or in the profile. Texture is a sandy loam with a slightly acidic pH (6.1). This site supports a black sagebrush/mountain big sagebrush hybrid population which suggests some sort of physical and/or physiological rooting barrier not discovered by the soil penetrometer. Erosion is not a problem locally due to the gentle terrain and adequate vegetation and litter cover. Ground cover characteristics changed somewhat in 2003 with bare ground increasing, and vegetation and litter cover both decreasing. The aerator treatment, coupled with drought, likely accounts for most of these changes. An erosion condition class assessment rated soils as stable in 2003.

Shrubs, particularly sagebrush, dominate the vegetational aspect of the site. Sagebrush on the site is a hybrid between black sagebrush and mountain big sagebrush as determined by a florescence test under a black light. Sagebrush provided 69% and 75% of the total browse cover in 1997 and 2003 respectively. Total browse cover, including sagebrush cover, declined between 1997 and 2003 due to the aerator treatment. However, the most abundant browse species either increased or remained stable in overall density. Sagebrush density was estimated at 8,800 plants/acre in 1997 and 11,140 plants/acre in 2003. Decadence was low in both sampling years at 12% and 9%, although poor vigor increased in 2003 as some of the plants that had been aerated were in poor condition. Use was light on sagebrush in both years. Bitterbrush has a stable population at nearly 1,300 plants/acre. Use on bitterbrush was moderate to heavy in 1997 and 2003, but decadence was low. Poor vigor increased to 53% in 2003 with the aerator treatment effecting a lot of the bitterbrush on the site. As this site is more transitional range for big game, and is also grazed by livestock, a more aggressive treatment would have yielded better results as far as decreasing the browse component. Although total browse cover declined from 35% to 21%, shrub density remained stable or slightly increased and this site will likely show very little herbaceous understory improvement in the long term.

The herbaceous understory accounted for 28% of the total vegetation cover on the site in 1997 and 33% in 2003. Nine species of perennial grasses have been sampled between the 2 surveys, with mutton bluegrass, prairie Junegrass, and needle-and-thread being the most common. As a group, perennial grasses showed a large decline in sum of nested frequency between 1997 and 2003. Forbs are diverse on the site but not abundant. Twenty-four species were sampled on the site between 1997 and 2003. Perennial forbs also declined in sum of nested frequency in 2003. The loss of herbaceous species abundance could be attributed to several factors including a temporary decline due to the aerator treatment, drought, and grazing.

### 1997 APPARENT TREND ASSESSMENT

The soil is relatively well protected on the site by the abundant vegetation and litter cover combined with the gentle terrain. Unfortunately, 72% of the vegetation cover comes from shrubs which are not as effective at protecting the soil from high intensity summer storm events as herbaceous cover is. The herbaceous cover is

lacking, especially forbs. Browse are abundant. The age class distribution of black sagebrush appears to be capable of maintaining itself on this site, however the proportion of dead plants in the population should be monitored closely. The population is already moderately dense and an increase will only further suppress the herbaceous understory. The more preferred bitterbrush is receiving some very heavy use but the population is healthy with good recruitment, normal vigor, and low percent decadence. The few serviceberry plants on the site are very severely hedged. The herbaceous understory is lacking on this site perhaps due to a long history of livestock grazing. The herbaceous understory will likely further decline if the already dense population of black sage continues to increase.

2003 TREND ASSESSMENT

Trend for soil is slightly down. Bare ground increased to 29%, and vegetation and litter cover both declined due to drought and the aerator treatment. Soils show minimal erosion, and trend should improve as the site has time to recover from the aerator treatment and with better precipitation. Trend for browse is stable. Black sagebrush increased in density even with the aerator treatment that was done on the site. Bitterbrush density remained stable. Decadence is low for both species, although vigor was reduced in both populations with the treatment. Black sagebrush is still very abundant, and this site will recover quickly. A more aggressive treatment would yield better results to decrease the browse component and favor the herbaceous species. Trend for the herbaceous understory is down. Perennial grasses and forbs both showed declined sum of nested frequency values in 2003. A combination of the mechanical treatment and drought account for this loss. It appears that the herbaceous understory may not gain any long term benefits from the treatment.

TREND ASSESSMENT

soil - slightly down (2)

browse - stable (3)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 27 , Study no: 13

T y p e	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
G	Agropyron cristatum	4	6	.53	.30
G	Agropyron smithii	23	26	.07	.45
G	Bouteloua gracilis	35	15	.28	.11
G	Koeleria cristata	<sub>b</sub> 155	<sub>a</sub> 92	2.65	1.73
G	Poa fendleriana	<sub>b</sub> 273	<sub>a</sub> 194	6.67	4.59
G	Poa secunda	6	4	.15	.00
G	Sitanion hystrix	-	2	-	.06
G	Stipa comata	90	103	1.12	1.64
G	Stipa lettermani	<sub>b</sub> 29	<sub>a</sub> -	.59	-
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		615	442	12.09	8.90
Total for Grasses		615	442	12.09	8.90

T y p e	Species	Nested Frequency		Average Cover %	
		'97	'03	'97	'03
F	<i>Agoseris glauca</i>	a-	b13	-	.03
F	<i>Alyssum alyssoides</i> (a)	-	9	-	.01
F	<i>Allium</i> spp.	1	-	.00	-
F	<i>Antennaria rosea</i>	13	1	.21	.00
F	<i>Arabis</i> spp.	2	-	.00	-
F	<i>Astragalus</i> spp.	b41	a-	.37	-
F	<i>Calochortus nuttallii</i>	1	-	.00	-
F	<i>Castilleja</i> spp.	2	1	.00	.00
F	<i>Cirsium</i> spp.	5	-	.00	-
F	<i>Collinsia parviflora</i> (a)	a12	b123	.05	.52
F	<i>Crepis acuminata</i>	-	2	-	.00
F	<i>Eriogonum racemosum</i>	b31	a20	.37	.29
F	<i>Eriogonum umbellatum</i>	7	13	.03	.08
F	<i>Gayophytum ramosissimum</i> (a)	-	5	-	.04
F	<i>Gilia</i> spp. (a)	8	-	.04	-
F	<i>Lomatium</i> spp.	3	-	.03	-
F	<i>Lotus utahensis</i>	b45	a6	.22	.01
F	<i>Lychnis drummondii</i>	-	2	-	.00
F	<i>Microsteris gracilis</i> (a)	-	14	-	.09
F	<i>Oenothera</i> spp.	1	-	.00	-
F	<i>Orthocarpus luteus</i> (a)	3	7	.01	.06
F	<i>Penstemon</i> spp.	b22	a2	.09	.01
F	<i>Phlox longifolia</i>	43	51	.14	.09
F	<i>Polygonum douglasii</i> (a)	b44	a9	.08	.01
Total for Annual Forbs		67	167	0.19	0.75
Total for Perennial Forbs		217	111	1.51	0.54
Total for Forbs		284	278	1.70	1.29

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

BROWSE TRENDS --

Management unit 27 , Study no: 13

Type	Species	Strip Frequency		Average Cover %	
		'97	'03	'97	'03
B	Amelanchier utahensis	1	2	.03	-
B	Artemisia nova	96	98	24.60	15.75
B	Chrysothamnus depressus	8	1	.24	.03
B	Chrysothamnus nauseosus hololeucus	1	0	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	22	29	.55	.66
B	Gutierrezia sarothrae	1	12	-	.39
B	Opuntia spp.	6	3	.18	.00
B	Purshia tridentata	43	44	10.25	4.25
B	Rosa woodsii	1	0	-	-
B	Symphoricarpos oreophilus	0	1	-	-
B	Tetradymia canescens	1	2	-	.06
Total for Browse		180	192	35.86	21.14

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 13

Species	Percent Cover
	'03
Artemisia nova	17.88
Chrysothamnus depressus	.23
Chrysothamnus viscidiflorus viscidiflorus	.85
Purshia tridentata	3.76
Tetradymia canescens	.11

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27 , Study no: 13

Species	Average leader growth (in)
	'03
Artemisia nova	1.1
Purshia tridentata	2.7

BASIC COVER --

Management unit 27 , Study no: 13

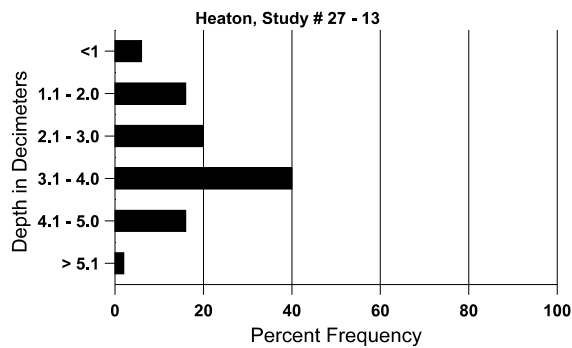
Cover Type	Average Cover %	
	'97	'03
Vegetation	49.70	32.78
Rock	.14	.22
Pavement	3.04	3.96
Litter	53.33	42.73
Cryptogams	.06	.03
Bare Ground	20.90	28.71

SOIL ANALYSIS DATA --

Management unit 27, Study no: 13, Study Name: Heaton

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
16.5	65.3 (10.6)	6.1	65.0	19.2	15.8	2.1	13.4	131.2	0.4

### Stoniness Index



PELLET GROUP DATA --

Management unit 27 , Study no: 13

Type	Quadrat Frequency		Days use per acre (ha)
	'97	'03	
Rabbit	3	2	-
Elk	8	2	2 (5)
Deer	51	19	45 (111)
Cattle	13	5	25 (61)



BROWSE CHARACTERISTICS --  
Management unit 27 , Study no: 13

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
97	<b>20</b>	20	-	20	-	-	0	100	-	0	-/-
03	<b>40</b>	-	20	20	-	-	0	50	-	50	26/33
<b>Artemisia nova</b>											
97	<b>8800</b>	2180	2820	4940	1040	700	10	2	12	7	15/28
03	<b>11140</b>	20	2820	7360	960	300	4	2	9	29	15/21
<b>Chrysothamnus depressus</b>											
97	<b>240</b>	-	20	220	-	-	0	0	-	0	6/10
03	<b>60</b>	-	-	60	-	-	0	100	-	0	6/8
<b>Chrysothamnus nauseosus hololeucus</b>											
97	<b>20</b>	-	-	20	-	-	0	0	-	0	24/30
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
97	<b>1060</b>	-	120	940	-	-	0	0	0	0	6/11
03	<b>1440</b>	-	80	1320	40	-	0	0	3	14	7/12
<b>Gutierrezia sarothrae</b>											
97	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>360</b>	-	-	360	-	-	0	0	-	6	5/10
<b>Opuntia spp.</b>											
97	<b>160</b>	-	40	100	20	-	0	0	13	13	4/13
03	<b>60</b>	-	-	60	-	-	0	0	0	0	3/8
<b>Purshia tridentata</b>											
97	<b>1220</b>	180	140	1000	80	-	61	21	7	3	22/51
03	<b>1280</b>	-	60	1080	140	-	36	61	11	53	16/32
<b>Rosa woodsii</b>											
97	<b>20</b>	-	-	-	20	-	0	0	100	100	-/-
03	<b>0</b>	-	-	-	-	-	0	0	0	0	8/6
<b>Symphoricarpos oreophilus</b>											
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	100	-	0	12/17
<b>Tetradymia canescens</b>											
97	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>40</b>	-	-	40	-	-	0	0	-	0	7/10

Trend Study 27R-1-03

Study site name: John R. Flat Total Exclusion .

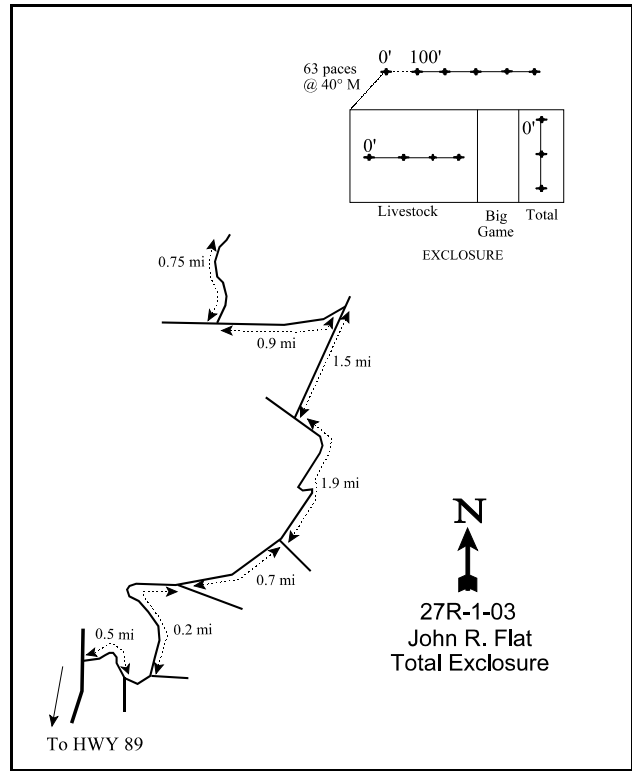
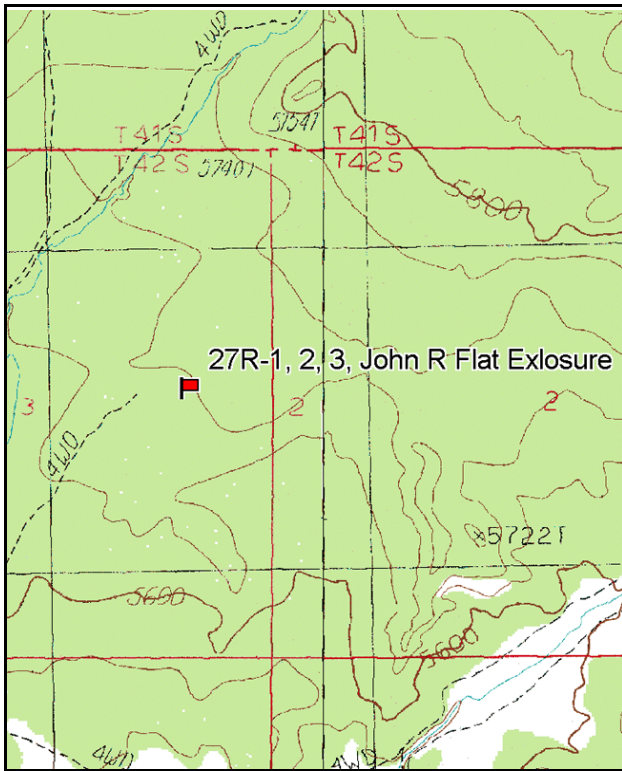
Vegetation type: P-J/ Big Sagebrush .

Compass bearing: frequency baseline 351 degrees magnetic.

Frequency belt placement: line 1 (34ft, 59ft, & 95 ft), line 2 (34ft & 71 ft). Rebar: belt 5 on 2ft.

LOCATION DESCRIPTION

From Kanab, travel north on Highway 89 to the Kanab Creek turnoff. Turn right and go 2.9 miles to another turnoff (you will pass the Best Friends Animal Sanctuary). Turn right, crossing Kanab Creek, and go 0.5 miles to a fork. Stay left and continue approximately 100 feet to another fork. Stay left again and continue 0.2 miles to the next fork. Stay left and continue 0.7 miles to the next fork. Stay left again and travel 1.9 miles to another fork. Go right at this fork and go 1.5 miles to another fork. At this fork, turn left, cross the drainage, and go 0.9 miles to a fork. Go right at the fork for 0.75 miles to the enclosure. The total enclosure is the section farthest to the east. The baseline runs north through the enclosure and has browse tag #114 attached to the 0-foot stake.



Map Name: White Tower

Diagrammatic Sketch

Township 42S, Range 6W, Section 3

GPS: NAD 27, UTM 12S 4116535 N, 366418 E

## DISCUSSION

### John R. Flat Total Exclosure - Trend Study No. 27R-1

The John R. Flat big game/livestock exclosure is located on BLM administered land 10 miles north of Kanab, and about 1-2 miles south of the White Cliffs. In 1998, a 3-way comparison was established to compare the vegetative community between the different exclosure treatments; total exclosure, livestock exclosure, and outside or open to all grazing animals. This study samples the interior of the total exclosure at John R. Flat. The total exclosure was built to exclude both livestock and big game and is almost half an acre in size. Aspect is to the west with a 3-5% slope, and elevation is about 5,700 feet. The exclosure at John R. Flat was built in the 1960's, but has not been fully maintained. Fence line repairs were made in the summer of 1998, in addition to debris removal on or near the fence line. There were no big game or livestock pellet groups sampled inside the total exclosure in 1998, but a dead deer carcass as well as a few deer pellets were found in 2003. Rabbit pellets were abundant in both 1998 and 2003.

Soils are very deep with an effective rooting depth of 33 inches. Soil texture is a sand which is strongly acidic (pH of 5.4). Average soil temperature was high in both surveys at 71°F (measured at a depth of 18 inches). Both potassium and phosphorous measurements were low, 3.2 ppm and 6.8 ppm respectively, and may limit plant development. No rocks or pavement were encountered on the soil surface or within the soil profile. Much of the protective ground cover on this sites comes from litter and cryptogams, and only 2% of the vegetation cover is contributed by herbaceous species. Percent bare ground cover was very high at over 40% in 1997 and 2003. Some soil pedestalling was noted around shrubs, but there is little erosion apparent at this time due to the soil texture and the levelness of the site. An erosion condition class assessment completed on site in 2003 resulted in a stable soil rating.

Browse species provided 98% of the vegetation cover within the total exclosure in 1998 and 2003. Antelope bitterbrush, basin big sagebrush, and sand sagebrush are the most abundant browse species. Bitterbrush density numbered 940 plants/acre in both surveys. Mature plants dominated the population in 1998 at 89%. No decadent plants were sampled in 1998, but 43% of the population was classified as decadent in 2003. As expected within a total exclosure, no use was noted on bitterbrush in 1998. In 2003 however, some plants showed moderate to heavy use as several deer were able to find their way into the exclosure. Recruitment by young plants was moderate in 1997 at 11%, but no young were sampled in 2003. The densities of basin big sagebrush and sand sagebrush were estimated at 920 plants/acre and 840 plants/acre respectively in 1998. Both species showed lower densities in 2003 by 200 plants/acre. Both species had decadence rates of about 20% in 1998, increasing to the mid-40% range in 2003. Basin big sagebrush had moderate recruitment in 1998 at 13%, with no young being sampled for either species in 2003. Bitterbrush and basin big sagebrush leaders averaged 3.6 and 1.1 inches of annual growth in 2003.

The herbaceous understory is very sparse in diversity and production. Total cover provided by grasses and forbs was less than 1% in both surveys. Perennial grasses and forbs maintained stable sum of nested frequency values in 2003, but with very little to begin with, this is not encouraging.

### 1998 APPARENT TREND ASSESSMENT

Although some shrubs showed pedestalling, current erosion is not readily apparent. The antelope bitterbrush population appears to be stable and healthy with no decadent or dead plants sampled. However, the basin big sagebrush population exhibits many decadent, dying, and dead plants. As there is no browsing inside the exclosure, this condition is primarily due to the climatic variables of extended drought and/or winter injury. The herbaceous understory is nearly non-existent with only 1 grass and 6 forb species encountered in 1998.

2003 TREND ASSESSMENT

Trend for soil is stable. Ground cover characteristics remain similar to 1998 estimates, and erosion is low. Trend for browse is down. Bitterbrush density is stable, with basin big sagebrush and sand sagebrush declining. All 3 species show large increases in percent decadence. Recruitment also declined for bitterbrush and basin big sagebrush. Although some deer found their way into the enclosure prior to the 2003 survey, use played a minor role, if any, to the declining health of the browse populations. Climatic variables, primarily drought, would have the biggest effect on browse populations within the total enclosure. Trend for herbaceous species is stable, but the understory is in very poor condition with very little to compare between years. A primrose was the most abundant herbaceous species in 2003, but it was sampled in only 7 of the 100 quadrats.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --

Management unit 27R, Study no: 1

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Bouteloua gracilis</i>	11	8	.08	.04
G	<i>Muhlenbergia pungens</i>	-	3	-	.03
G	<i>Sporobolus cryptandrus</i>	-	5	-	.18
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		11	16	0.07	0.25
Total for Grasses		11	16	0.07	0.25
F	<i>Artemisia dracunculus</i>	-	3	-	.01
F	<i>Chaenactis douglasii</i>	2	-	.00	-
F	<i>Descurainia</i> spp. (a)	<sub>b</sub> 28	<sub>a</sub> 6	.32	.04
F	<i>Draba</i> spp. (a)	-	1	-	.00
F	<i>Eriogonum cernuum</i> (a)	2	-	.00	-
F	<i>Euphorbia parryi</i>	1	-	.00	-
F	<i>Oenothera</i> spp.	<sub>a</sub> 8	<sub>b</sub> 16	.18	.22
F	<i>Sphaeralcea coccinea</i>	6	-	.01	-
F	<i>Stephanomeria exigua</i> (a)	-	1	-	.03
Total for Annual Forbs		30	8	0.32	0.07
Total for Perennial Forbs		17	19	0.20	0.23
Total for Forbs		47	27	0.53	0.31

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

BROWSE TRENDS --

Management unit 27R, Study no: 1

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia filifolia	31	28	5.39	6.22
B	Artemisia tridentata tridentata	38	29	6.66	5.30
B	Chrysothamnus nauseosus	0	8	-	1.60
B	Chrysothamnus viscidiflorus	5	0	1.42	-
B	Eriogonum nummulare	2	0	.03	-
B	Juniperus osteosperma	0	0	.03	-
B	Purshia tridentata	38	36	12.23	9.10
B	Rhus trilobata	0	1	.03	.03
Total for Browse		114	102	25.80	22.26

CANOPY COVER, LINE INTERCEPT --

Management unit 27R, Study no: 1

Species	Percent Cover
	'03
Artemisia filifolia	5.86
Artemisia tridentata tridentata	4.66
Chrysothamnus nauseosus	1.76
Purshia tridentata	10.05
Rhus trilobata	.23

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27R, Study no: 1

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	1.1
Purshia tridentata	3.6

BASIC COVER --

Management unit 27R, Study no: 1

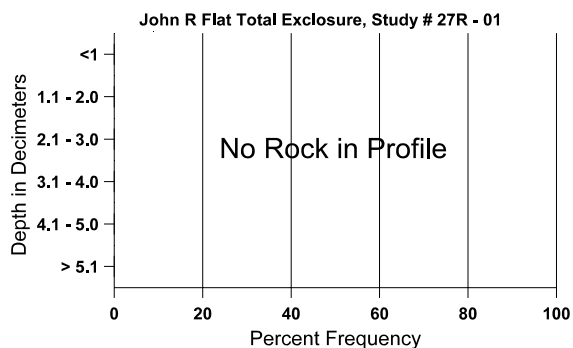
Cover Type	Average Cover %	
	'98	'03
Vegetation	28.59	23.22
Litter	41.92	48.09
Cryptogams	7.93	1.79
Bare Ground	41.73	43.27

SOIL ANALYSIS DATA --

Management unit 27R, Study no: 1, Study Name: John R. Flat Total Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
32.7	71.0 (17.7)	5.5	90.2	4.0	5.8	0.4	6.8	3.2	0.3

### Stoniness Index



PELLET GROUP DATA --

Management unit 27R, Study no: 1

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	8	27	N/A	N/A
Deer	-	24	N/A	N/A

BROWSE CHARACTERISTICS --

Management unit 27R, Study no: 1

		Age class distribution (plants per acre)					Utilization				Average Height Crown (in)
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	
<b>Artemisia filifolia</b>											
98	<b>840</b>	500	20	640	180	60	0	0	21	14	36/47
03	<b>640</b>	-	20	340	280	20	0	0	44	3	36/40
<b>Artemisia tridentata tridentata</b>											
98	<b>920</b>	20	120	600	200	540	0	0	22	13	44/54
03	<b>720</b>	-	-	380	340	580	11	0	47	22	38/44
<b>Chrysothamnus nauseosus</b>											
98	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
03	<b>200</b>	-	-	80	120	60	0	0	60	20	38/47

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Chrysothamnus viscidiflorus</i>											
98	<b>160</b>	-	-	120	40	20	0	0	25	0	41/56
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<i>Ephedra viridis</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	56/84
<i>Eriogonum nummularre</i>											
98	<b>40</b>	-	-	40	-	-	0	0	-	0	24/41
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Purshia tridentata</i>											
98	<b>940</b>	-	100	840	-	-	0	0	0	0	32/59
03	<b>940</b>	-	-	540	400	20	49	4	43	9	42/62
<i>Rhus trilobata</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	28/27
03	<b>20</b>	-	-	20	-	-	0	0	-	0	19/22
<i>Yucca spp.</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	20/29
03	<b>0</b>	-	-	-	-	-	0	0	-	0	30/44

Trend Study 27R-2-03

Study site name: John R. Flat Livestock Exclosure .

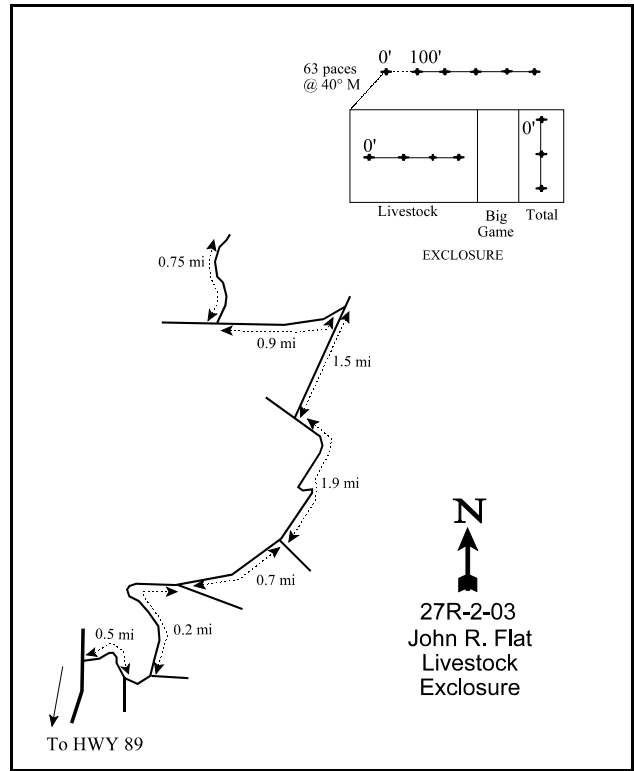
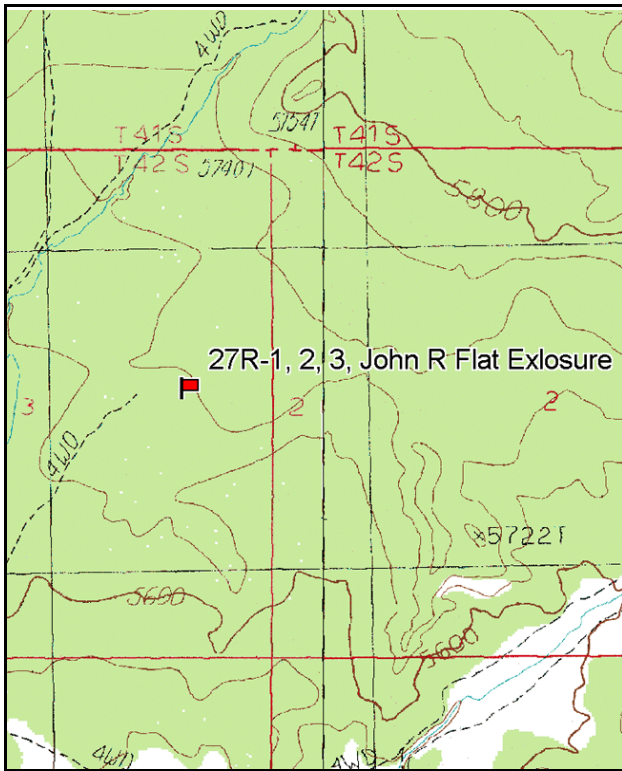
Vegetation type: P-J/ Big Sagebrush .

Compass bearing: frequency baseline 0 degrees magnetic.

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

LOCATION DESCRIPTION

From Kanab, travel north on Highway 89 to the Kanab Creek turnoff. Turn right and go 2.9 miles to another turnoff (you will pass the Best Friends Animal Sanctuary). Turn right, crossing Kanab Creek, and go 0.5 miles to a fork. Stay left and continue approximately 100 feet to another fork. Stay left again and continue 0.2 miles to the next fork. Stay left and continue 0.7 miles to the next fork. Stay left again and travel 1.9 miles to another fork. Go right at this fork and go 1.5 miles to another fork. At this fork, turn left, cross the drainage, and go 0.9 miles to a fork. Go right at the fork for 0.75 miles to the exclosure. The livestock exclosure is nearest the road (lower fence), and the baseline runs down the middle of the exclosure starting at the east side near the taller fence marking the big game exclosure. Count down to the 11<sup>th</sup> post in from either side to the 0 foot stake. The 0-foot stake is on the east side and marked by browse tag #166.



Map Name: White Tower

Diagrammatic Sketch

Township 42S, Range 6W, Section 3

GPS: NAD 27, UTM 12S 4116569 N, 366376 E



## DISCUSSION

### John R. Flat Livestock Exclosure - Trend Study No. 27R-2

The John R. Flat exclosure is located on BLM administered land 10 miles north of Kanab, and about 1-2 miles south of the White Cliffs. In 1998, a 3-way comparison was established to compare the vegetative community between the different exclosure treatments (for additional information on the exclosure complex, refer to the discussion for study 27R-1). This study samples the interior of the livestock exclosure which was built to exclude livestock but not big game. The area within the livestock exclosure is almost 1.4 acres (approximately 60,000 ft<sup>2</sup>). Aspect is to the south at a gentle 1-3% slope. Elevation is 5,700 feet. A pellet group transect showed abundant deer sign within the livestock exclosure with an estimated 114 days use/acre (282 ddu/ha) being estimated in 1998. Deer use was almost identical within the livestock exclosure in 2003 at an estimated 112 days use/acre (278 ddu/ha). Additionally, some rabbit pellet groups were observed in both surveys.

Soils are sandy, very deep (effective rooting depth of 27 inches), and strongly acidic (pH of 5.4). Average soil temperature was 72°F at 18 inches in depth in 1998. Both potassium and phosphorous measurements were low, 6.4 ppm and 7.7 ppm respectively, and may limit plant development. Rock and pavement are very limited on the surface and in the profile. The soil appeared to be more compacted underneath the shrubs than in the bare interspaces. Much of the protective ground cover on this site comes from litter and cryptogams. Only 6% of the vegetation cover is contributed by herbaceous species. Although percent bare ground cover is high, erosion is low due to the sandy texture and lack of slope. An erosion condition class assessment rated soils as stable in 2003.

Browse species provided 94% and 99% of the vegetation cover within the livestock exclosure in 1998 and 2003 respectively. Antelope bitterbrush, basin big sagebrush, and sand sagebrush are the most abundant browse species. Basin big sagebrush had an estimated density of 4,420 plants/acre in 1998, declining to 2,520 in 2003. The number of dead in the population more than doubled in 2003, and no young plants were sampled. The young age class made up 43% of the population in 1998. Percent decadence was low in 1998 at 14%, increasing to 93% in 2003. In addition, 67% (~1,560 plants/acre) of the decadent age class was classified as dying in 2003, an increase from 33% (~200 plants/acre) in 1998. Sixty-two percent of the population was also classified as having poor vigor in 2003. Use on basin big sagebrush was mostly light in both surveys. The effects of the current drought are obvious on big sagebrush. In addition to drought, heavy deer use and high intraspecific competition likely contribute to the declining health of big sagebrush within the livestock exclosure.

Antelope bitterbrush density numbers just under 1,000 plants/acre. Several different growth forms are present in the bitterbrush population including tall, upright plants that are partially unavailable to browsing as well as prostrate plants that receive very heavy use. The bitterbrush population had very good recruitment in 1998 at 37%, and decadence was very low at only 2%. With drought conditions in 2003, decadence increased to 46% and no young plants were sampled. Utilization was light to moderate in 1998, but much heavier in 2003. Bitterbrush has exhibited good vigor and exceptional leader growth in both surveys. The sand sagebrush population numbers about 400 plants/acre, has low reproduction, and shows mostly light use. Decadence for this species also increased in 2003 from 21% to 50%. Point-center quarter data estimated 27 juniper trees/acre in 1998. Other species scattered throughout the livestock exclosure include rubber rabbitbrush, skunkbush sumac, green ephedra, and yucca.

The herbaceous understory is sparse, diversity is low, and composition is poor. Total herbaceous cover was just over 1% in 1998 and only about 1/10 of one percent in 2003. The most abundant herbaceous species in 1998 was the annual, nodding eriogonum. In 2003, a total of 5 herbaceous species were sampled. Nodding eriogonum was not sampled in 2003 due to the very dry conditions. Blue grama was the most abundant grass on the site in 1998, but it declined in 2003. Total sum of nested frequency of all perennial grasses and forbs was 28 in 1998 and 12 in 2003.

1998 APPARENT TREND ASSESSMENT

Although there is little protective ground cover provided by herbaceous species at this time, there is currently little erosion apparent on the site. The basin big sagebrush population appears to be stable at this time with many healthy, young plants encountered. The antelope bitterbrush population also appears to be stable and healthy with only one decadent plant sampled and no dead plants found. Utilization of basin big sagebrush and bitterbrush is light with few plants exhibiting poor vigor. The herbaceous understory is nearly non-existent with only 2 grass and 7 forb species encountered.

2003 TREND ASSESSMENT

Trend for soil is slightly down as there is less protective cover on the surface. Vegetation and cryptogamic cover both declined, and bare soil increased. The ratio of protective cover (vegetation, litter, and cryptogams) to bare soil is poor at 1.5:1. Erosion is not severe due primarily to the high infiltration rate of the sandy soils and the gentle slope. Trend for browse is down. Basin big sagebrush is in very poor condition with a 43% decline in density, no recruitment, extreme decadence, and a large increase in the number of dead. This population will likely continue to decline because 67% of the decadent age class was classified as dying. Bitterbrush maintained a nearly stable population but use is heavy and decadence moderately high at 46%. The effect of the current drought on shrubs is obvious, and this is exacerbated by heavy deer use and high intraspecific competition for resources. Trend for the herbaceous understory is stable but in continued poor condition. Determining trend for the herbaceous species on this site is difficult as there is very little to compare between years. Perennial species are almost nonexistent and slightly declined in sum of nested frequency between 1998 and 2003.

TREND ASSESSMENT

soil - slightly down (2)

browse - down (1)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --  
Management unit 27R, Study no: 2

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Aristida purpurea	3	4	.18	.03
G	Bouteloua gracilis	<sub>b</sub> 11	<sub>a</sub> 2	.33	.03
G	Hilaria jamesii	-	5	-	.03
G	Vulpia octoflora (a)	2	-	.00	-
Total for Annual Grasses		2	0	0.00	0
Total for Perennial Grasses		14	11	0.51	0.10
Total for Grasses		16	11	0.51	0.10
F	Artemisia dracunculul	2	-	.03	-
F	Draba spp. (a)	2	-	.00	-
F	Eriogonum cernuum (a)	<sub>b</sub> 132	<sub>a</sub> -	.66	-
F	Euphorbia albomarginata	10	-	.02	-

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
F	Gilia spp. (a)	1	-	.00	-
F	Oenothera spp.	1	1	.00	.00
F	Sphaeralcea grossulariaefolia	1	-	.03	-
F	Unknown forb-annual (a)	-	2	-	.03
Total for Annual Forbs		135	2	0.67	0.03
Total for Perennial Forbs		14	1	0.08	0.00
Total for Forbs		149	3	0.75	0.03

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

#### BROWSE TRENDS --

Management unit 27R, Study no: 2

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia filifolia	18	14	1.50	1.10
B	Artemisia tridentata tridentata	75	63	10.03	5.81
B	Chrysothamnus nauseosus	3	1	.15	.15
B	Eriogonum nummulare	0	1	-	.03
B	Juniperus osteosperma	1	1	3.12	2.87
B	Purshia tridentata	38	35	5.48	3.70
B	Rhus trilobata	0	0	-	.03
B	Yucca spp.	1	2	.38	.63
Total for Browse		136	117	20.67	14.32

#### CANOPY COVER, LINE INTERCEPT --

Management unit 27R, Study no: 2

Species	Percent Cover	
	'98	'03
Artemisia filifolia	-	1.66
Artemisia tridentata tridentata	-	5.08
Chrysothamnus nauseosus	-	.16
Juniperus osteosperma	5.00	6.00
Purshia tridentata	1.00	5.46
Rhus trilobata	-	.10
Yucca spp.	-	.30

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 27R, Study no: 2

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	2.6
Purshia tridentata	5.9

POINT-QUARTER TREE DATA --  
Management unit 27R, Study no: 2

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	27	N/A

Average diameter (in)	
'98	'03
6.4	N/A

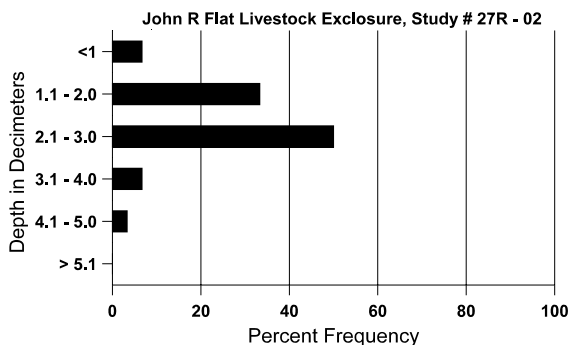
BASIC COVER --  
Management unit 27R, Study no: 2

Cover Type	Average Cover %	
	'98	'03
Vegetation	22.86	15.37
Pavement	0	2.61
Litter	47.95	49.73
Cryptogams	4.34	1.34
Bare Ground	42.29	48.85

SOIL ANALYSIS DATA --  
Management unit 27R, Study no: 2, Study Name: John R. Flat Livestock Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
26.8	71.0 (17.7)	5.4	90.2	4.0	5.8	0.6	7.7	6.4	0.3

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 27R, Study no: 2

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	9	10	-	-
Elk	5	-	-	-
Deer	46	43	114 (282)	112 (277)

BROWSE CHARACTERISTICS --  
 Management unit 27R, Study no: 2

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia filifolia</i>											
98	<b>480</b>	100	20	360	100	60	4	0	21	4	27/29
03	<b>360</b>	-	-	180	180	80	0	0	50	17	25/24
<i>Artemisia tridentata tridentata</i>											
98	<b>4420</b>	180	1920	1900	600	1180	25	2	14	5	33/37
03	<b>2520</b>	-	-	180	2340	2480	19	5	93	62	20/21
<i>Chrysothamnus nauseosus</i>											
98	<b>80</b>	-	-	20	60	-	0	0	75	50	32/45
03	<b>20</b>	-	-	-	20	-	0	0	100	100	31/41
<i>Ephedra viridis</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	45/83
03	<b>0</b>	-	-	-	-	-	0	0	-	0	45/60
<i>Eriogonum nummularre</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	100	0	-	0	11/13
<i>Gutierrezia sarothrae</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	11/10
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Juniperus osteosperma</i>											
98	<b>20</b>	-	-	20	-	20	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<i>Purshia tridentata</i>											
98	<b>980</b>	-	360	600	20	-	27	0	2	2	36/50
03	<b>920</b>	-	-	500	420	60	4	78	46	9	29/41

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Rhus trilobata</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	87/132
03	<b>0</b>	-	-	-	-	-	0	0	-	0	72/173
<b>Yucca spp.</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	46/41
03	<b>60</b>	-	-	60	-	-	0	0	-	0	26/42

Trend Study 27R-3-03

Study site name: John R. Flat Exclosure Outside .

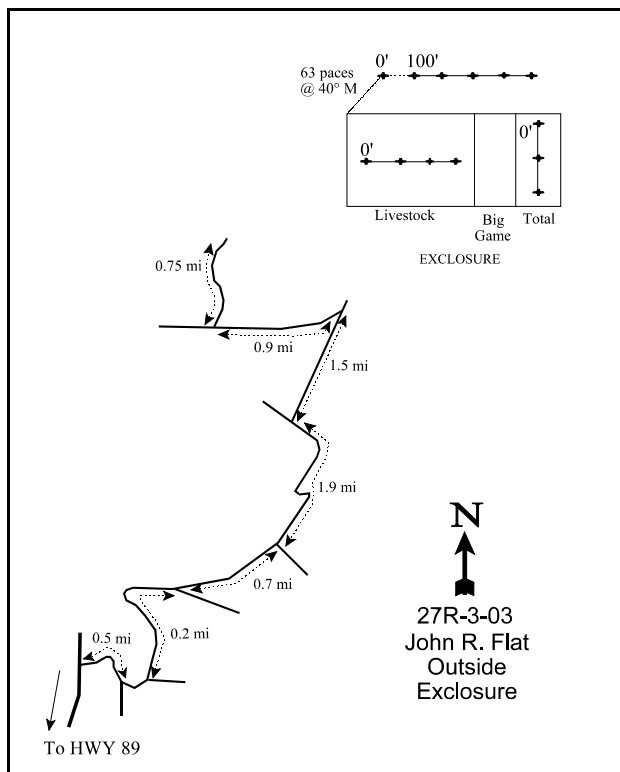
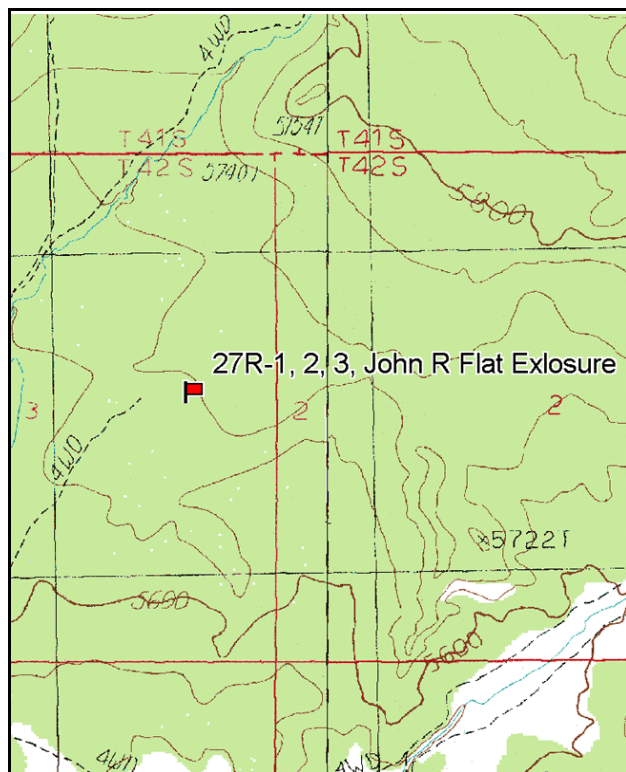
Vegetation type: P-J/ Big Sagebrush .

Compass bearing: frequency baseline 100 degrees magnetic.

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

LOCATION DESCRIPTION

From Kanab, travel north on Highway 89 to the Kanab Creek turnoff. Turn right and go 2.9 miles to another turnoff (you will pass the Best Friends Animal Sanctuary). Turn right, crossing Kanab Creek, and go 0.5 miles to a fork. Stay left and continue approximately 100 feet to another fork. Stay left again and continue 0.2 miles to the next fork. Stay left and continue 0.7 miles to the next fork. Stay left again and travel 1.9 miles to another fork. Go right at this fork and go 1.5 miles to another fork. At this fork, turn left, cross the drainage, and go 0.9 miles to a fork. Go right at the fork for 0.75 miles to the exclosure. From the northwest corner of the exclosure, walk 63 paces at 40 degrees magnetic to the 0-foot stake of the baseline. The baseline runs at 100 degrees magnetic.



Map Name: White Tower

Diagrammatic Sketch

Township 42S , Range 6W , Section 3

GPS: NAD 27, UTM 12S 4116670 N, 366350 E

## DISCUSSION

### John R. Flat Exclosure Outside - Trend Study No. 27R-3

The John R. Flat exclosure is located on BLM administered land 10 miles north of Kanab, and about 1-2 miles south of the White Cliffs. In 1998, a 3-way comparison was established to compare the vegetative community between the different exclosure treatments (for additional information on the exclosure complex, refer to the discussion for study 27R-1). This study samples the vegetative community outside the exclosure complex. Aspect is to the west at 3-5%, and elevation is about 5,700 feet. A pellet group transect estimated 34 deer days use/acre (84 ddu/ha) in 1998 and 22 deer days use/acre (55 ddu/ha) in 2003.

Soils are sandy in texture and moderately acidic (pH of 5.6). Average effective rooting depth was estimated at 29 inches with an average soil temperature of 73°F at 18 inches in depth. Both potassium and phosphorous measurements were low, 3.2 ppm and 5.1 ppm respectively, and may limit plant development. Rocks and pavement are rarely encountered on the soil surface and were not encountered within the soil profile. Percent bare ground cover is high (61% in 1998 and 67% in 2003) and some soil pedestalling was noted around shrubs. The sandy soil texture and levelness of the site help minimize erosion.

Browse species provided 62% and 74% of the vegetative cover on the site in 1998 and 2003. Basin big sagebrush, sand sagebrush, and antelope bitterbrush are the most abundant browse species. Basin big sagebrush density was estimated at 1,540 plants/acre in 1998, declining to 900 in 2003. This population is highly decadent with no recruitment. Nearly 3/4 of the population had poor vigor in 2003, and dead plants were more abundant than live ones. Sand sagebrush numbered 380 plants/acre in 1998 and 460 in 2003. Most of the population was classified as mature, use was light, and decadence low at 22% in 2003. Antelope bitterbrush has an estimated density of about 250 plants/acre. The population was ½ young and ½ mature in 1998 with no decadence, light to moderate use, and normal vigor. In 2003, decadence increased to 23%, use was more heavy, and the young plants made up only 8% of the population. Point-center quarter data estimated 27 juniper trees/acre on the site in both 1998 and 2003. Other species scattered throughout the site include rubber rabbitbrush, skunkbush sumac, green ephedra, buckwheat, broom snakeweed, prickly pear cactus, and yucca.

The herbaceous understory is more abundant outside the exclosure complex compared to the livestock and total exclosures. Herbaceous species provided 5% cover on the site in 1998 and 2.5% in 2003. Grasses have low diversity with blue grama and sandhill muhly being the most common. Forbs are less abundant than grasses with nodding eriogonum having the highest frequency in 1998. With drought in 2003, nodding eriogonum was not sampled. Tarragon is the most abundant perennial forb on the site. Other perennial grasses include sand dropseed, Indian ricegrass, and purple three-awn.

### 1998 APPARENT TREND ASSESSMENT

Although some pedestalling was noted around shrubs, there is currently no serious erosion apparent on the site. The basin big sagebrush population appears to be declining at this time with 53% of the population classified as decadent, a dead to live ratio of 1:1, and no seedling plants encountered. The antelope bitterbrush population appears to be stable and healthy with no decadent or dead plants encountered. Utilization of antelope bitterbrush is light with all exhibiting good vigor. Herbaceous understory cover is poor and provides little protective ground cover.

### 2003 TREND ASSESSMENT

Trend for soil is slightly down with less protective cover on the surface. Vegetation and cryptogamic cover both declined and bare ground increased to 67%. The ratio of protective cover (vegetation, litter, and cryptogams) to bare soil is very low at 1.3:1. Trend for browse is down. Basin big sagebrush shows declines in density and reproduction, and increases in decadence and poor vigor. This population is in very poor



condition. Bitterbrush has a low but stable density, low decadence, and mostly good vigor. Use increased to a heavier level, but the population appears to be maintaining itself. Trend for the herbaceous understory is stable but in poor condition. Sum of nested frequency for perennial grasses and forbs slightly declined between 1998 and 2003, but with such low abundance to begin with, trend is still considered stable.

TREND ASSESSMENT

soil - slightly down (2)

browse - down (1)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --  
Management unit 27R, Study no: 3

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Aristida purpurea	-	5	-	.01
G	Bouteloua gracilis	37	29	1.95	.76
G	Muhlenbergia pungens	<sub>a</sub> 8	<sub>b</sub> 25	.78	1.27
G	Oryzopsis hymenoides	6	-	.06	.15
G	Sporobolus cryptandrus	20	4	.40	.01
G	Vulpia octoflora (a)	<sub>b</sub> 25	<sub>a</sub> -	.05	-
Total for Annual Grasses		25	0	0.05	0
Total for Perennial Grasses		71	63	3.21	2.22
Total for Grasses		96	63	3.25	2.22
F	Artemisia dracunculus	17	12	.77	.25
F	Chaenactis douglasii	<sub>b</sub> 13	<sub>a</sub> -	.36	-
F	Eriogonum cernuum (a)	<sub>b</sub> 115	<sub>a</sub> -	.53	-
F	Euphorbia parryi	6	-	.04	-
F	Gilia spp. (a)	5	-	.04	-
F	Machaeranthera canescens	-	-	.00	-
F	Oenothera albicaulis (a)	-	3	-	.01
F	Oenothera pallida	4	3	.04	.00
F	Sphaeralcea parvifolia	1	2	.00	.00
F	Unknown forb-annual (a)	-	5	-	.00
Total for Annual Forbs		120	8	0.57	0.01
Total for Perennial Forbs		41	17	1.22	0.25
Total for Forbs		161	25	1.79	0.27

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

BROWSE TRENDS --

Management unit 27R, Study no: 3

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia filifolia	15	19	.75	.65
B	Artemisia tridentata tridentata	54	32	3.83	3.05
B	Chrysothamnus nauseosus	9	8	.73	.58
B	Ephedra viridis	5	3	.58	.44
B	Eriogonum nummulare	2	4	.03	.00
B	Gutierrezia sarothrae	1	0	-	-
B	Juniperus osteosperma	0	1	.15	.38
B	Opuntia spp.	1	2	-	-
B	Purshia tridentata	11	10	2.19	1.91
Total for Browse		98	79	8.29	7.03

CANOPY COVER, LINE INTERCEPT --

Management unit 27R, Study no: 3

Species	Percent Cover	
	'98	'03
Artemisia filifolia	-	.91
Artemisia tridentata tridentata	-	1.61
Chrysothamnus nauseosus	-	.20
Ephedra viridis	-	.93
Juniperus osteosperma	2.40	3.40
Purshia tridentata	-	2.61

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27R, Study no: 3

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	2.2
Purshia tridentata	3.4

POINT-QUARTER TREE DATA --

Management unit 27R, Study no: 3

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	27	27

Average diameter (in)	
'98	'03
10.4	13.2

BASIC COVER --

Management unit 27R, Study no: 3

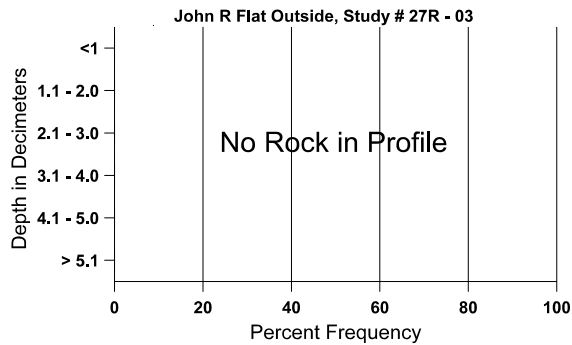
Cover Type	Average Cover %	
	'98	'03
Vegetation	14.82	9.83
Rock	.00	0
Pavement	.00	.03
Litter	28.68	27.57
Cryptogams	6.28	1.74
Bare Ground	60.68	66.54

SOIL ANALYSIS DATA --

Management unit 27R, Study no: 3, Study Name: John R. Flat Outside

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
29.4	72.6 (17.7)	5.6	92.2	2.0	5.8	0.5	5.1	3.2	0.2

Stoniness Index



PELLET GROUP DATA --

Management unit 27R, Study no: 3

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	17	15	-	-
Cow	-	-	-	1 (4)
Elk	1	-	-	-
Deer	33	23	33 (82)	22 (55)

BROWSE CHARACTERISTICS --  
Management unit 27R, Study no: 3

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia filifolia</i>											
98	<b>380</b>	40	40	300	40	20	0	0	11	5	22/22
03	<b>460</b>	-	40	320	100	80	0	0	22	4	22/26
<i>Artemisia tridentata tridentata</i>											
98	<b>1540</b>	-	160	560	820	1480	45	9	53	19	27/35
03	<b>900</b>	-	-	100	800	1100	9	0	89	73	19/24
<i>Chrysothamnus nauseosus</i>											
98	<b>200</b>	-	20	140	40	80	0	0	20	0	29/41
03	<b>180</b>	-	20	100	60	40	0	0	33	0	29/36
<i>Ephedra viridis</i>											
98	<b>160</b>	40	100	60	-	-	75	0	0	0	44/63
03	<b>240</b>	-	40	180	20	-	17	0	8	8	31/37
<i>Eriogonum nummulare</i>											
98	<b>60</b>	-	20	40	-	-	0	0	-	0	13/22
03	<b>80</b>	-	40	40	-	-	0	50	-	0	11/14
<i>Gutierrezia sarothrae</i>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	6/8
03	<b>0</b>	-	-	-	-	20	0	0	-	0	9/18
<i>Juniperus osteosperma</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
<i>Opuntia spp.</i>											
98	<b>20</b>	-	-	20	-	-	0	0	0	0	5/13
03	<b>40</b>	-	-	-	40	-	0	0	100	50	-/-
<i>Purshia tridentata</i>											
98	<b>240</b>	-	120	120	-	-	25	0	0	0	40/65
03	<b>260</b>	-	20	180	60	-	8	54	23	8	27/46
<i>Rhus trilobata</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	18/30
03	<b>0</b>	-	-	-	-	-	0	0	-	0	13/29
<i>Ribes spp.</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	22/59
<i>Yucca spp.</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	30/25
03	<b>0</b>	-	-	-	-	-	0	0	-	0	17/36

## John R. Flat Exclosure Comparison Summary

Ground cover characteristics differ considerably outside and within the exclosures. Bare ground cover was highest outside of the exclosure in both 1998 and 2003 at 61% and 67% respectively, compared to the livestock and total exclosures where bare ground was estimated between 42% and 49%. Vegetation cover was nearly twice as high inside the exclosures compared to outside in both 1998 and 2003. Litter cover was lowest outside the exclosures in both 1998 and 2003 at just under 30%, while the livestock and total exclosures had litter values ranging between 42%-50%.

As was reported in 1998, soil characteristics are very similar between all treatments. Soils are moderately deep with very sandy textures and understandably low organic matter content. Soils are moderate to strongly acidic across all exclosure types. Very little erosion is occurring on any of the sites due to the high infiltration rates of these very sandy soils and the levelness of the site. Phosphorous and potassium levels are low for all sites and may limit plant development.

The browse component is critical at John R. Flat as this area is critical winter range for the deer herds that inhabit the Paunsaugunt unit. Basin big sagebrush and antelope bitterbrush are the key species in the area. In 1998, the density of basin big sagebrush was highest in the livestock exclosure (4,420 plants/acre), intermediate outside the exclosure (1,540 plants/acre), and lowest in the total exclosure (920 plants/acre). Sagebrush density declined in all 3 treatments in 2003. Much of the decline was due to the loss of a moderate to high proportion of young in 1998 which virtually disappeared in 2003 with drought conditions. In 2003, the number of dead sagebrush was almost as numerous as the live plants in all 3 exclosures. Percent decadence was high outside the exclosure in 1998 at 53%, but much lower in the total (22%) and livestock exclosures (14%). All 3 treatments showed large increases in decadence for sagebrush in 2003 with the livestock and outside treatments having extreme levels of 93% and 89% respectively. The total exclosure had moderately high decadence at 47%. The proportion of sagebrush exhibiting poor vigor characteristics showed the same pattern as decadence with the highest levels being found in the livestock exclosure and outside, and the lowest level occurring in the total exclosure. Bitterbrush density remained relatively stable between 1998 and 2003 in all 3 treatments. However, the key browse parameters of young recruitment and decadence showed important changes. As with basin big sagebrush, young bitterbrush plants declined in all 3 treatments, and percent decadence increased. The decadence levels for bitterbrush were not as extreme as with basin big sagebrush, but still too high at over 40% in the total and livestock exclosures. Bitterbrush vigor was generally good in 1998 and 2003 on all sites.

It was noted in the 1998 summary comparison that sagebrush are more susceptible to winter injury than any other shrub species occurring on the site. This injury is presumably caused by freezing due to a lack of sufficient cold hardiness and/or winter drought or dessication (Nelson and Tiernan 1983). During mild winters, sagebrush can break dormancy during the middle of the winter and begin growth too early in the year. By doing so, sagebrush plants become susceptible to dessication and crown death if temperatures become very cold for any substantial length of time or there is little moisture within the soil profile especially within these deep sandy soils. This effect could be aggravated by use on the outside of the exclosure as well as inside the livestock exclosure, causing even higher death rates and higher rates of decadency.

The drought cycle that included the 2003 sampling year probably has the biggest effect on overall browse conditions. There is some evidence in 2003 that utilization may be having an additive negative effect inside the livestock exclosure as well as outside the exclosures, as the highest levels of poor vigor and decadence occurred on these 2 treatments. However, use is most likely not the primary driving force behind deteriorating sagebrush health as utilization of sagebrush was mostly light to moderate in 1998 and 2003.

Herbaceous vegetation at John R. Flat is depleted. The understories on these sites have very low production and diversity. Interestingly, the highest cover and frequency values for herbaceous species occurred outside the exclosures in both 1998 and 2003. But even on this treatment, herbaceous species were low providing only 5% and 2.5% average cover in 1998 and 2003 respectively. Total sum of nested frequency of perennial

grasses and forbs was 112 in 1998 and 80 in 2003. The understory communities inside the livestock and total exclosures were almost nonexistent in both surveys, and a discussion here is futile. With so few herbaceous species, livestock will naturally turn to browsing on shrubs during the grazing season, and an increase in herbaceous species is highly unlikely unless restoration is an option.

Trend Study 27R-4-03

Study site name: Nephi Pasture Total Enclosure .

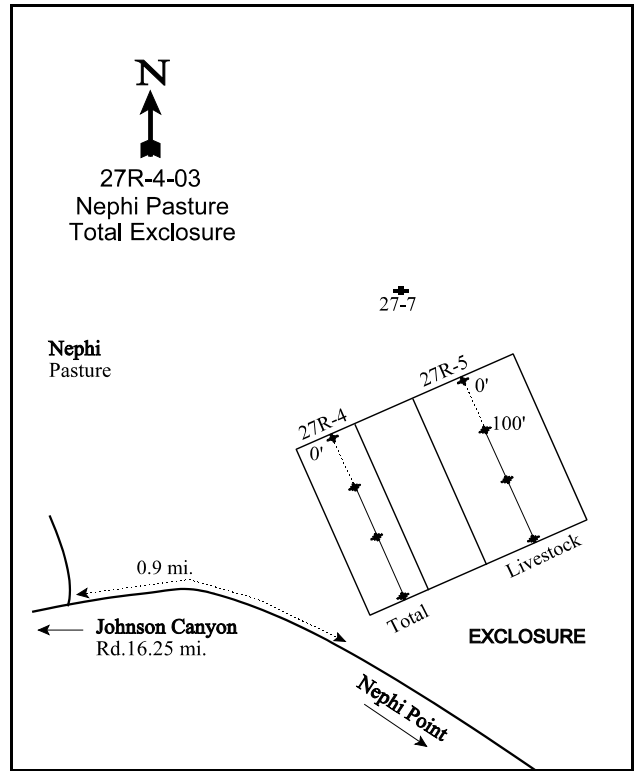
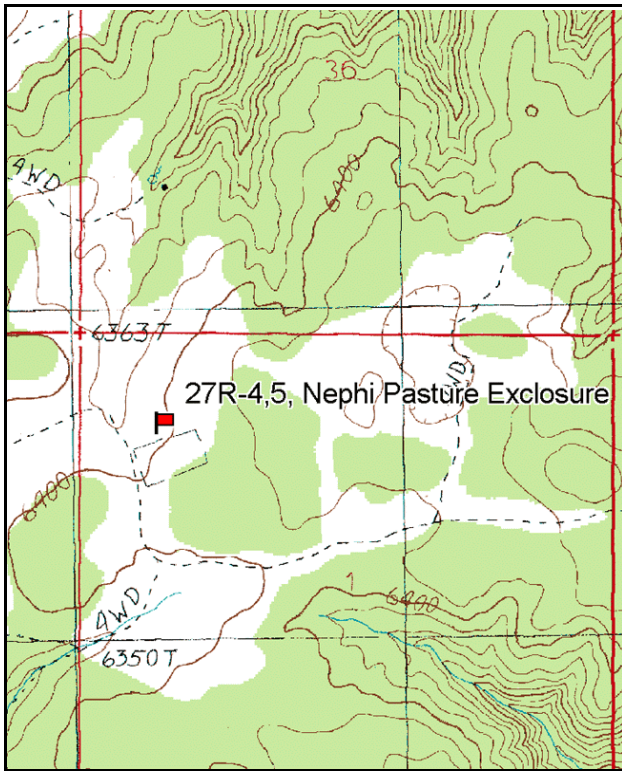
Vegetation type: P-J/ Big Sagebrush .

Compass bearing: frequency baseline 142 degrees magnetic.

Frequency belt placement: line 1 (11ft & 95 ft), line 2 (59ft), line 3 (34 ft & 71 ft). No rebar.

LOCATION DESCRIPTION

From Kanab, take US 89 east for 9.4 miles to Johnson Canyon. Travel north up Johnson Canyon 9.75 miles to the Lock Ridge-Nephi Pasture road. Turn right and go 16.25 miles (see 27-6-03 for more detail) on the main road to a major intersection in Nephi Pasture. Continue straight towards Nephi Point, going 0.9 miles to an enclosure. From the northwest corner of the enclosure, count up five posts to the 0 foot baseline on the inside of the enclosure. The baseline runs at 142 degrees magnetic.



Map Name: Nephi Point

Diagrammatic Sketch

Township 42S , Range 4W , Section 1

GPS: NAD 27, UTM 12S 4116576 N, 394199 E

## DISCUSSION

### Nephi Pasture Total Exclosure - Trend Study No. 27R-4

The Nephi Pasture exclosure complex was built in the 1960's and is found approximately 20 miles northeast of Kanab. This transect was established inside the total exclosure in 1998 as part of a 3-way comparison between the different exclosure grazing treatments; no grazing in the total exclosure, wildlife use in the livestock exclosure, and open to all grazing animals outside the exclosure. The area supports a mixed shrub community with a scattered overstory of pinyon and juniper trees. Slope is 13% with a northwest aspect, and elevation is approximately 6,400 feet. Deer generally utilize the area at high levels during the winter. The total exclosure is supposed to exclude all animals, but due to a hole in the fence, some deer had gotten into the exclosure prior to both the 1998 and 2003 surveys, and had moderately hedged many of the preferred shrubs.

Soils inside the exclosure are very deep, sandy loam in texture, and moderately acidic (pH of 5.9). Effective rooting depth was estimated at almost 23 inches in 1998. Phosphorus and potassium may be limiting to plant growth at just 8.2 ppm and 25.6 ppm respectively. Values higher than 10 ppm for phosphorus and 70 ppm for potassium are considered minimal for normal plant development. There is virtually no rock or pavement on the surface or within the soil profile. Some soil pedestalling is evident, but there is very little erosion occurring inside of the exclosure. Vegetation and litter combined to provide 83% and 78% total cover in 1998 and 2003 respectively. Bare ground has been moderately high inside the total exclosure at 23% and 35% in 1998 and 2003. An erosion condition class assessment completed on site in 2003 gave soils a stable rating.

The total exclosure supports a moderately dense stand of basin big sagebrush with a population that numbered 2,820 plants/acre in 1998. An increase in the number of dead individuals as well as a decline in young recruitment resulted in a population decrease in 2003 to 1,780 plants/acre. Percent decadence and poor vigor were both high in 1998 at 64% and 46% respectively. The proportion of the decadent age class that was classified as dying was very high in 1998 at 72%. Many of these plants died prior to the 2003 survey as evidenced by the large increase in dead plants. As a result, total decadence as well as the proportion of decadent sagebrush classified as dying declined in 2003. Vigor improved considerably in 2003 with only 18% of the population displaying poor vigor. Antelope bitterbrush density was estimated at 920 plants/acre in 1998 and 740 in 2003. Young bitterbrush made up 20% of the population in 1998, but none were sampled in 2003. The number of dead plants increased from 60 to 320 from 1998 to 2003, and percent decadence went from 2% to 30% over the same time period. Vigor was normal throughout the population in both surveys. A few large serviceberry are present inside the total exclosure, but in far lower numbers compared to the livestock exclosure and outside. Annual leader growth on these species was good in 2003 at 5.5 inches for serviceberry, 4 inches for bitterbrush, and 2 inches for basin big sagebrush.

The herbaceous understory was moderately productive in 1998 providing 17% cover. Diversity is only fair however, and cheatgrass accounted for over half of the total. With drought in 2003, the grass component virtually disappeared and produced less than 1% cover. Cheatgrass was not sampled in 2003, and the 3 most abundant perennial grasses all had lower nested frequency values including western wheatgrass, Sandberg bluegrass, and needle-and-thread. The forb component was dominated by toadflax in 1998 and 2003.

### 1998 APPARENT TREND ASSESSMENT

The soil appears to be stable with limited erosion occurring. Ground cover characteristics differ slightly compared to the livestock exclosure. Percent vegetative cover is 41% compared to 47% in the livestock exclosure. Litter cover is much lower at 42% in the total exclosure compared to 67% in the livestock exclosure. However, percent bare ground is similar at 23%. Trend for the key browse species, basin big sagebrush, appears to be declining. Percent decadence is high at 64% with 72% (1,300 plants/acre) of the decadent sagebrush classified as dying. Reproduction is poor with no seedlings found and only 12% (340



plants/acre) of the population consisting of young plants. Even though this is supposed to be a total enclosure, the fence is not well maintained. The deer were able to browse some of the sagebrush and bitterbrush. This use does not appear to be the cause for the poor condition of sagebrush however. Use is higher in the livestock enclosure, but the sagebrush there are much healthier. Trend for bitterbrush and serviceberry in the total enclosure appear stable. The herbaceous understory is similar in composition and abundance to the livestock enclosure, although annual grasses are more abundant providing 72% of the grass cover. The only fairly common perennial grass is needle-and-thread, which is found in low numbers in the livestock enclosure and outside. Forb composition is similar to the livestock enclosure with toadflax and wooly plantain being the most abundant.

2003 TREND ASSESSMENT

Trend for soil is down. Vegetation cover declined substantially and bare ground increased to 35%. Litter cover actually increased, but this is due partly to the increase of dead sagebrush plants which is more aerial litter cover than surface litter. The ratio of protective cover (vegetation, litter, and cryptogams) to bare soil declined from over 4:1 to 2.5:1. Erosion remains low however. Trend for browse is down. Basin big sagebrush has a lower density, decreased reproduction, and a large increase in the number of dead plants in the population. Although decadence improved, it still remains high at 54%. Bitterbrush also showed a population decline due to the increase in dead plants and less young in 2003. Bitterbrush decadence increased to 30% in 2003, but vigor remains mostly normal. Trend for the herbaceous understory is down. With drought conditions in 2003, grasses virtually disappeared. Cheatgrass was by far the most abundant herbaceous species in 1998, but was not sampled at all in 2003. Western wheatgrass, Sandberg bluegrass, and needle-and-thread all had lower nested frequency values in 2003. Toadflax was the only abundant forb in either 1998 or 2003 and it also declined significantly in 2003. All of these downward trends are due primarily to the dry precipitation cycle that southern Utah was in prior to and including the 2003 survey.

TREND ASSESSMENT

soil - down (1)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 27R, Study no: 4

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Agropyron smithii	56	29	.76	.26
G	Agropyron spicatum	2	-	.03	-
G	Bromus tectorum (a)	<sub>b</sub> 321	<sub>a</sub> -	7.44	-
G	Oryzopsis hymenoides	3	6	.18	.23
G	Poa secunda	<sub>b</sub> 37	<sub>a</sub> 8	.43	.05
G	Sitanion hystrix	8	-	.04	-
G	Sporobolus cryptandrus	3	5	.06	.03
G	Stipa comata	<sub>b</sub> 60	<sub>a</sub> 12	1.92	.27
G	Vulpia octoflora (a)	<sub>b</sub> 144	<sub>a</sub> -	1.41	-
Total for Annual Grasses		465	0	8.85	0
Total for Perennial Grasses		169	60	3.44	0.85

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
	Total for Grasses	634	60	12.29	0.85
F	Calochortus nuttallii	a-	b11	-	.05
F	Comandra pallida	b167	a132	3.32	2.77
F	Descurainia pinnata (a)	11	-	.07	-
F	Eriogonum cernuum (a)	5	-	.03	-
F	Erigeron spp.	6	-	.06	-
F	Eriogonum racemosum	-	8	-	.04
F	Gilia spp. (a)	a-	b42	-	1.23
F	Lupinus spp.	5	-	.18	.15
F	Microsteris gracilis (a)	6	6	.03	.04
F	Phlox austromontana	4	5	.03	.04
F	Plantago patagonica (a)	b66	a1	.76	.00
F	Polygonum douglasii (a)	3	-	.00	-
F	Sphaeralcea coccinea	1	-	.00	-
	Total for Annual Forbs	91	49	0.90	1.27
	Total for Perennial Forbs	183	156	3.60	3.06
	Total for Forbs	274	205	4.51	4.34

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

#### BROWSE TRENDS --

Management unit 27R, Study no: 4

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	4	3	1.03	3.75
B	Artemisia tridentata tridentata	73	54	10.35	7.36
B	Gutierrezia sarothrae	35	2	1.42	.15
B	Juniperus osteosperma	2	3	-	.63
B	Opuntia spp.	1	0	.03	-
B	Purshia tridentata	30	27	7.90	6.50
	Total for Browse	145	89	20.73	18.40

CANOPY COVER, LINE INTERCEPT --  
 Management unit 27R, Study no: 4

Species	Percent Cover
	'03
Amelanchier utahensis	5.36
Artemisia tridentata tridentata	8.63
Gutierrezia sarothrae	.06
Juniperus osteosperma	.98
Purshia tridentata	5.80

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 27R, Study no: 4

Species	Average leader growth (in)
	'03
Amelanchier utahensis	5.5
Artemisia tridentata tridentata	2.0
Purshia tridentata	4.0

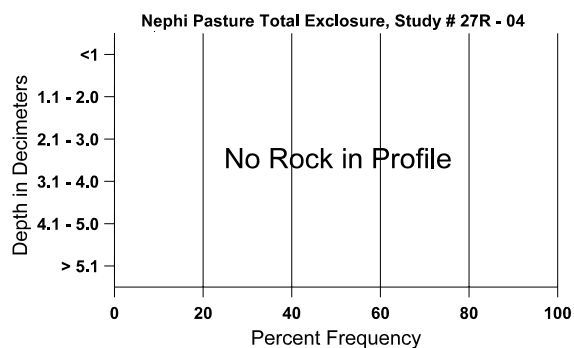
BASIC COVER --  
 Management unit 27R, Study no: 4

Cover Type	Average Cover %	
	'98	'03
Vegetation	41.18	23.88
Pavement	.01	0
Litter	41.79	54.27
Cryptogams	11.46	2.98
Bare Ground	23.23	34.92

SOIL ANALYSIS DATA --  
 Management unit 27R, Study no: 4, Study Name: Nephi Pasture Total Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
22.7	68.8 (17.7)	5.9	74.2	18.0	7.8	0.7	8.2	25.6	0.4

## Stoniness Index



### PELLET GROUP DATA --

Management unit 27R, Study no: 4

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	14	31	-	-
Elk	1	-	N/A	N/A
Deer	22	14	N/A	N/A

### BROWSE CHARACTERISTICS --

Management unit 27R, Study no: 4

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Amelanchier utahensis</i>											
98	<b>80</b>	-	20	40	20	-	0	0	25	0	88/103
03	<b>60</b>	-	-	40	20	20	33	0	33	0	84/90
<i>Artemisia tridentata tridentata</i>											
98	<b>2820</b>	-	340	680	1800	2020	32	0	64	46	32/37
03	<b>1780</b>	-	-	820	960	3680	2	0	54	18	35/37
<i>Cercocarpus montanus</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	39/49
03	<b>0</b>	-	-	-	-	-	0	0	-	0	52/41
<i>Gutierrezia sarothrae</i>											
98	<b>1580</b>	-	80	1460	40	20	0	0	3	3	10/11
03	<b>60</b>	-	-	60	-	-	0	0	0	0	11/12
<i>Juniperus osteosperma</i>											
98	<b>40</b>	-	40	-	-	-	0	0	-	0	-/-
03	<b>60</b>	-	20	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	% poor vigor	Average Height Crown (in)
<i>Opuntia</i> spp.											
98	<b>20</b>	-	-	-	20	-	0	0	100	100	-/-
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<i>Purshia tridentata</i>											
98	<b>920</b>	-	180	720	20	60	28	0	2	2	35/51
03	<b>740</b>	-	-	520	220	320	14	5	30	3	33/53

Trend Study 27R-5-03

Study site name: Nephi Pasture Livestock Enclosure.

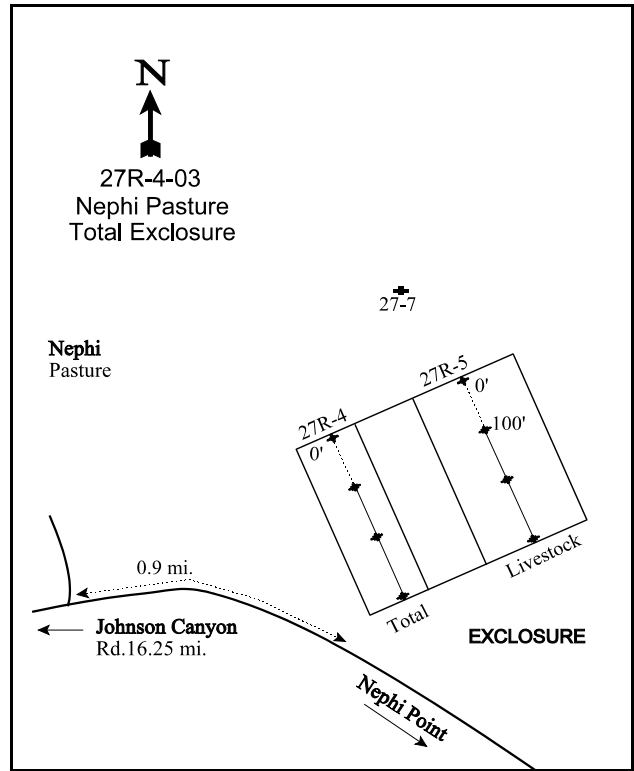
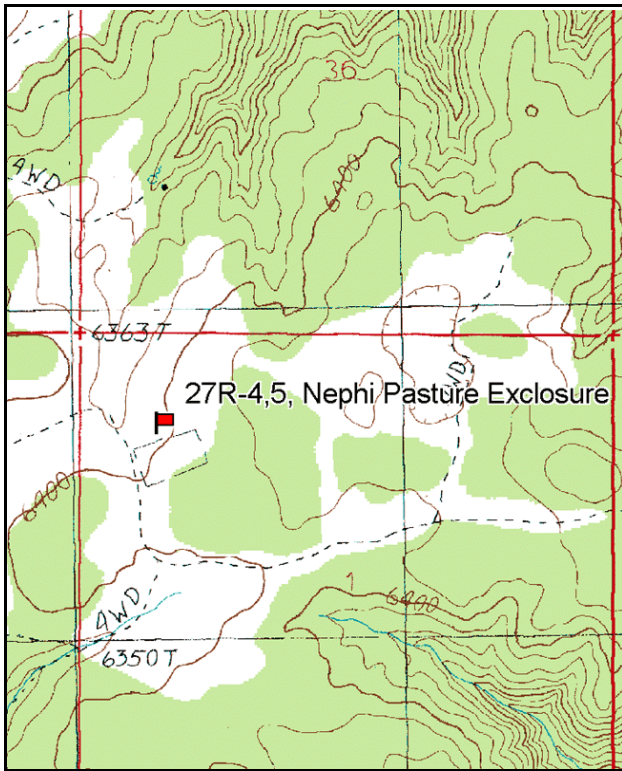
Vegetation type: P-J/ Big Sagebrush .

Compass bearing: frequency baseline 147 degrees magnetic.

Frequency belt placement: line 1 (11ft & 95 ft), line 2 (59ft), line 3 (34ft & 71 ft). No rebar.

LOCATION DESCRIPTION

From Kanab, take US 89 east for 9.4 miles to Johnson Canyon. Travel north up Johnson Canyon 9.75 miles to the Lock Ridge-Nephi Pasture road. Turn right and go 16.25 miles (see 27-6-03 for more detail) on the main road to a major intersection in Nephi Pasture. Continue straight towards Nephi Point, going 0.9 miles to an enclosure. Walk east along the fence on the north side of the enclosure to the beginning of the livestock enclosure (lower fence). From here, walk down to the midpoint of the fenceposts. The baseline starts on the inside of the livestock enclosure at the midpoint, and runs at an azimuth of 147 degrees magnetic.



Map Name: Nephi Point

Diagrammatic Sketch

Township 42S, Range 4W, Section 1

GPS: NAD 27, UTM 12S 4116620 N, 394319 E

## DISCUSSION

### Nephi Pasture Livestock Exclosure - Trend Study No. 27R-5

The Nephi Pasture exclosure complex was built in the 1960's and is found approximately 20 miles northeast of Kanab. This transect was established inside the livestock exclosure in 1998 as part of a 3-way comparison between the different exclosure grazing treatments. This transect is within 300 feet of the original Nephi Pasture study that samples outside the exclosure complex (27-7). The livestock exclosure is approximately 200 feet by 300 ft in size, about 1.4 acres. Slope varies from 5% to 10% with a northwest aspect at an elevation of nearly 6,400 feet. Deer utilize this exclosure heavily with use estimated at 111 days use/acre (274 ddu/ha) in 1998 and 169 days use/acre (418 ddu/ha) in 2003. Pellet groups in both surveys were primarily from the winter preceding sampling.

Soils inside the livestock exclosure are deep, sand in texture, and moderately acidic (pH of 5.8). Effective rooting depth was estimated at just over 20 inches with a compacted layer encountered at that depth. Phosphorus and potassium may be limiting to plant development and growth at 6.9 ppm and 12.8 ppm respectively. Minimum values for phosphorus are 10 ppm and 70 ppm for potassium. Rock and pavement are rare on the surface and within the profile. Erosion was minimal in 1998, but slight in 2003. Severe pedestalling around the base of shrubs as well as surface soil and litter movement provided evidence of erosion in 2003. Pellet group translocation also provided evidence of surface flows from recent rainstorms. Bare ground is moderate, but vegetation and litter have been adequate to limit erosion.

The livestock exclosure supports more shrub cover than either the total exclosure or outside the exclosure complex. The key species are basin big sagebrush, Utah serviceberry, and antelope bitterbrush. Sagebrush is the most abundant of the 3 species, but has the lowest preference for deer. Density of sagebrush was estimated at 3,340 plants/acre in 1998 and 2,420 plants/acre in 2003. In 1998, the young age class was abundant making up 22% of the population, and mature and decadent plants provided 44% and 34% of the age class respectively. As was the case inside the total exclosure, total sagebrush density declined in 2003, the number of dead plants increased, and the number of young declined. Sagebrush decadence nearly doubled inside the livestock exclosure in 2003 to 66%. The proportion of decadent sagebrush classified as dying was high in 1998 at 51% (~580 plants/acre), increasing in 2003 to 78% (~1,240 plants/acre). With this in mind, additional sagebrush die-off is likely. Utilization on sagebrush was light to moderate with 13% of the plants displaying heavy use in 1998. Use was much lighter on sagebrush inside the livestock exclosure in 2003. The proportion of the sagebrush population displaying poor vigor in 1998 was estimated at 18%, increasing to 51% in 2003.

Serviceberry numbered 740 plants/acre in 1998, declining to 540 in 2003. This population shows good recruitment in both 1998 and 2003 at 27% and 22% respectively, low decadence, and normal vigor. These plants are large averaging over 5 feet in height in 2003. Because of their size, a lot of the mature plants are partly unavailable to browsing which explains the relatively light use overall on serviceberry. Bitterbrush has a stable density of about 800 plants/acre. These plants showed light to moderate use in 1998, suggesting that the extremely heavy use outside the exclosure was due to dual cow/deer utilization. In 2003, use was heavy on 69% of the sampled plants inside the livestock exclosure. Bitterbrush vigor was mostly normal in both surveys, and decadence was low. In 2003, annual leader growth on shrubs was 5.2 inches for bitterbrush, 2.6 inches for serviceberry, and 2.3 inches for basin big sagebrush.

The only other common shrub in the livestock exclosure in 1998 was broom snakeweed which had an estimated density of 1,780 mostly mature plants/acre. Snakeweed density numbered only 120 plants/acre with drought in 2003. Point quarter data estimated 20 pinyon and 27 juniper trees/acre in 1998. Average basal diameter is 7.4 inches for pinyon and 6.8 inches for juniper. Most of these trees are in the 12 to 20 foot tall range.

The herbaceous understory inside the livestock enclosure provided 18% cover to the site in 1998. Several desirable perennial grasses were sampled including western wheatgrass, bluebunch wheatgrass, Indian ricegrass, mutton bluegrass, bottlebrush squirreltail, and needle-and-thread. Cheatgrass was the single most abundant species on the site in 1998 being sampled in just over half of the quadrats and providing 35% of the total grass cover. Sixweeks fescue was also abundant in 1998. With drought prior to and including the 2003 sampling year, all 6 of the perennial species listed above significantly decreased in nested frequency, and cheatgrass and sixweeks fescue were not sampled. Toadflax was the most abundant forb in 1998 and 2003, but did show a significant decline in frequency between years. Combined sum of nested frequency for perennial herbaceous species totaled 411 in 1998 but only 72 in 2003.

### 1998 APPARENT TREND ASSESSMENT

Trend for soil appears stable. Vegetation and litter cover are higher in the livestock enclosure compared to the total enclosure or outside. Percent bare ground is similar to the total enclosure at 23% but lower than outside (23% vs 31%). Erosion does not appear to be a problem. Trend for the key browse species, basin big sagebrush, serviceberry, and bitterbrush appear stable with higher densities compared to outside the enclosure. Serviceberry and bitterbrush display moderate use, good vigor and low decadence. Reproduction appears adequate to maintain the population. Sagebrush density is nearly two times higher in the livestock enclosure compared to outside. Forty percent of the population shows moderate or heavy use, although vigor is good on most plants and percent decadence is moderate at 34%. There are a large number of dead plants and half of the decadent sagebrush were classified as dying (~580 plants/acre). However, reproduction is currently appears adequate to maintain the stand. The herbaceous understory is more abundant in the livestock enclosure compared to outside. Total herbaceous cover is 18%. Annual grasses, cheatgrass and six weeks fescue, are abundant and provide half of the grass cover. Perennial grasses are also fairly abundant however. Forb diversity is similar compared to the total enclosure and outside. In addition, perennial forbs are more abundant in the livestock enclosure compared to outside. The most common species include bastard toadflax, silvery lupine, and woolly plantain.

### 2003 TREND ASSESSMENT

Trend for soil is down. An erosion condition class assessment rated soils as slightly eroding. Severe pedestalling and surface soil/litter movement provided evidence of erosion in 2003. Bare ground increased while vegetation cover declined considerably. Bitterbrush remained stable in density, and maintains good vigor and low decadence. The proportion of young bitterbrush declined from 28% to 7%. Serviceberry density declined from 740 plants/acre to 540 plants/acre in 2003, but young recruitment remains good at 22%, and vigor is normal on most plants. Changes in the sagebrush population are much worse than either serviceberry or bitterbrush. Sagebrush density declined by 28% in 2003, decadence increased to 66%, and the proportion of the decadent age class classified as dying increased to 78% (~1,240 plants/acre). The number of dead in the population nearly doubled in 2003, and young recruitment declined from 22% to 2%. Half of the sagebrush sampled in 2003 also displayed poor vigor. Individually, bitterbrush and serviceberry have stable trends while basin big sagebrush is down. Collectively, browse trend is slightly downward overall. Trend for the herbaceous understory is down. Perennial herbaceous sum of nested frequency declined 6 fold. The 6 most abundant perennial grasses sampled in 1998 all significantly declined in 2003 with drought. The one positive change for the understory that often accompanies drought was that cheatgrass was not sampled in 2003.

#### TREND ASSESSMENT

soil - down (1)

browse - slightly down (2)

herbaceous understory - down (1)



HERBACEOUS TRENDS --  
 Management unit 27R, Study no: 5

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Agropyron smithii</i>	<sub>b</sub> 99	<sub>a</sub> 9	2.82	.04
G	<i>Agropyron spicatum</i>	<sub>b</sub> 20	<sub>a</sub> -	.60	-
G	<i>Bromus tectorum</i> (a)	<sub>b</sub> 177	<sub>a</sub> -	4.69	-
G	<i>Oryzopsis hymenoides</i>	<sub>b</sub> 28	<sub>a</sub> 2	.59	.15
G	<i>Poa fendleriana</i>	<sub>b</sub> 41	<sub>a</sub> 8	2.07	.48
G	<i>Sitanion hystrix</i>	<sub>b</sub> 23	<sub>a</sub> 1	.69	.00
G	<i>Sporobolus cryptandrus</i>	1	-	.00	.00
G	<i>Stipa comata</i>	<sub>b</sub> 14	<sub>a</sub> -	.07	.03
G	<i>Vulpia octoflora</i> (a)	<sub>b</sub> 124	<sub>a</sub> -	1.99	-
Total for Annual Grasses		301	0	6.68	0
Total for Perennial Grasses		226	20	6.87	0.71
Total for Grasses		527	20	13.55	0.71
F	<i>Arabis</i> spp.	5	-	.01	-
F	<i>Astragalus</i> spp.	7	-	.01	-
F	<i>Calochortus nuttallii</i>	-	5	-	.01
F	<i>Comandra pallida</i>	<sub>b</sub> 143	<sub>a</sub> 47	3.15	.68
F	<i>Descurainia pinnata</i> (a)	<sub>b</sub> 11	<sub>a</sub> -	.10	-
F	<i>Draba</i> spp. (a)	7	-	.01	-
F	<i>Erigeron</i> spp.	3	-	.00	-
F	<i>Eriogonum racemosum</i>	5	-	.01	-
F	<i>Gilia</i> spp. (a)	<sub>a</sub> -	<sub>b</sub> 17	-	.67
F	<i>Lappula occidentalis</i> (a)	5	-	.04	-
F	<i>Lupinus argenteus</i>	8	-	.57	-
F	<i>Microsteris gracilis</i> (a)	11	-	.02	-
F	<i>Penstemon</i> spp.	<sub>b</sub> 14	<sub>a</sub> -	.05	-
F	<i>Plantago patagonica</i> (a)	<sub>b</sub> 45	<sub>a</sub> -	.64	-
F	<i>Polygonum douglasii</i> (a)	1	-	.00	-
Total for Annual Forbs		80	17	0.82	0.67
Total for Perennial Forbs		185	52	3.81	0.69
Total for Forbs		265	69	4.64	1.37

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

BROWSE TRENDS --

Management unit 27R, Study no: 5

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	23	17	6.46	8.65
B	Artemisia tridentata tridentata	81	67	10.81	7.75
B	Gutierrezia sarothrae	36	5	2.20	.06
B	Juniperus osteosperma	3	3	1.72	1.21
B	Opuntia spp.	1	0	.03	-
B	Pinus edulis	0	0	.15	.15
B	Purshia tridentata	26	27	5.34	5.19
B	Ribes spp.	1	0	-	-
Total for Browse		171	119	26.72	23.02

CANOPY COVER, LINE INTERCEPT --

Management unit 27R, Study no: 5

Species	Percent Cover
	'03
Amelanchier utahensis	10.30
Artemisia tridentata tridentata	7.88
Gutierrezia sarothrae	.11
Juniperus osteosperma	2.86
Purshia tridentata	4.76

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27R, Study no: 5

Species	Average leader growth (in)
	'03
Amelanchier utahensis	2.6
Artemisia tridentata tridentata	2.3
Purshia tridentata	5.2

POINT-QUARTER TREE DATA --

Management unit 27R, Study no: 5

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	20	N/A
Pinus edulis	27	N/A

Average diameter (in)	
'98	'03
6.8	N/A
7.5	N/A

BASIC COVER --

Management unit 27R, Study no: 5

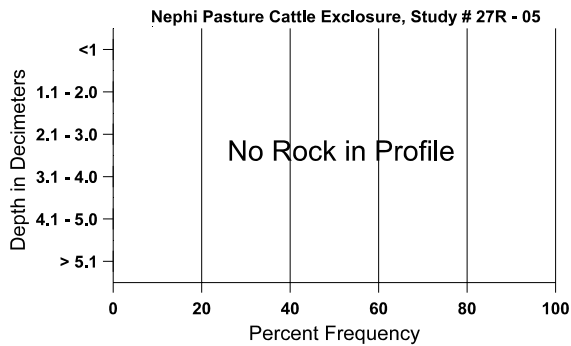
Cover Type	Average Cover %	
	'98	'03
Vegetation	47.41	25.80
Rock	0	.00
Litter	66.72	58.25
Cryptogams	1.73	1.35
Bare Ground	23.45	32.59

SOIL ANALYSIS DATA --

Management unit 27R, Study no: 5, Study Name: Nephi Pasture Livestock Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
20.5	70.5 (17.7)	5.8	90.2	2.0	7.8	0.8	6.9	12.8	0.2

Stoniness Index



PELLET GROUP DATA --

Management unit 27R, Study no: 5

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	28	23	-	-
Elk	1	-	-	-
Deer	39	34	111 (274)	169 (418)

BROWSE CHARACTERISTICS --  
Management unit 27R, Study no: 5

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Amelanchier utahensis</i>											
98	<b>740</b>	100	200	460	80	120	30	3	11	8	49/56
03	<b>540</b>	40	120	380	40	80	7	22	7	4	61/64
<i>Artemisia tridentata tridentata</i>											
98	<b>3340</b>	180	740	1460	1140	1480	27	13	34	18	29/30
03	<b>2420</b>	-	60	760	1600	2560	12	4	66	51	32/34
<i>Gutierrezia sarothrae</i>											
98	<b>1780</b>	40	40	1740	-	-	0	0	0	0	11/12
03	<b>120</b>	-	-	100	20	-	0	0	17	17	11/11
<i>Juniperus osteosperma</i>											
98	<b>60</b>	-	60	-	-	-	0	0	0	0	-/-
03	<b>60</b>	-	40	-	20	-	0	0	33	0	-/-
<i>Opuntia spp.</i>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	6/4
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Purshia tridentata</i>											
98	<b>800</b>	20	220	500	80	20	38	0	10	8	33/48
03	<b>840</b>	-	60	640	140	20	29	69	17	5	30/46
<i>Ribes spp.</i>											
98	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

Trend Study 27-7-03

Study site name: Nephi Pasture Exclosure Outside .

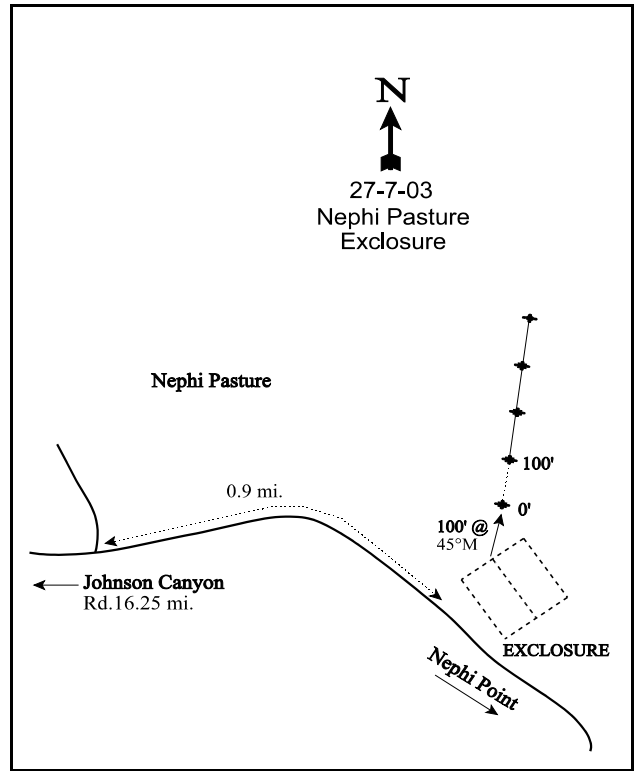
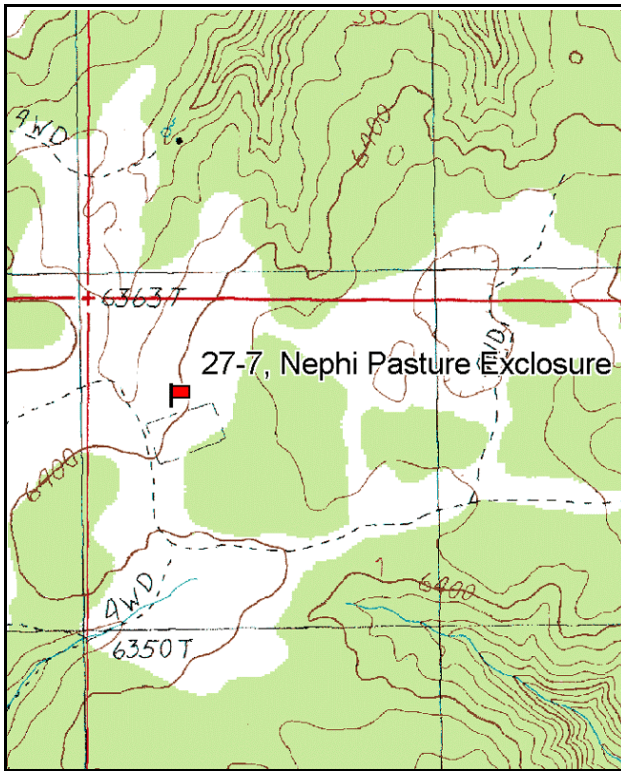
Vegetation type: Mountain Brush .

Compass bearing: frequency baseline 4 degrees magnetic.

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

LOCATION DESCRIPTION

From Kanab, take US 89 east for 9.4 miles to Johnson Canyon. Travel north up Johnson Canyon 9.75 miles to the Lock Ridge-Nephi Pasture road. Turn right. Go 16.25 miles (see 27-6-03 for more detail) on the main road to a major intersection in Nephi Pasture. Continue straight towards Nephi Point, going 0.9 miles to an exclosure. Walk east along the fence on the north side of the exclosure to the inner fence. From the northeast corner of the tallest fence, walk 100 feet northeast to the 0-foot baseline stake, a cut fencepost tagged #7808.



Map Name: Buckskin Mountain

Diagrammatic Sketch

Township 42S , Range 4W , Section 1

GPS: NAD 27, UTM 12S 4116622 N, 394254 E

## DISCUSSION

### Nephi Pasture Exclosure Outside - Trend Study No. 27-7

The Nephi Pasture exclosure complex was built in the 1960's and is found approximately 20 miles northeast of Kanab. This transect samples the outside of the exclosure which is a basin big sagebrush type with a significant bitterbrush component. The study area slopes 5% to the west at an elevation of 6,400 feet. The area is within the Vermillion-Nephi Pasture allotment which is grazed by cattle during the winter. Deer use this area during mild winters, but utilize areas south of US-89 during severe winters. Pellet group data from 1998 estimated 64 deer, 16 cow, and 1 elk days use/acre (158 ddu/ha, 40 cdu/ha, and 3 edu/ha). In 1998, cow sign appeared old and most of the deer pellet groups were from the previous fall and winter. Pellet transect data collected in 2003 estimated 70 deer and 23 cow days use/acre (174 ddu/ha and 57 cdu/ha).

The area was identified by the BLM as an Upland Sand site (11-13 inches precipitation) and a mountain big sagebrush/Indian ricegrass habitat type. On this study, the sagebrush was identified during the readings as basin big sagebrush, not mountain big sagebrush, because of its size and growth form, in addition to the depth of the soils on the site. Typical of all of the Nephi Pasture area, the soil is composed largely of fine sand, formed by aeolian derived sandstone parent materials. It has a loamy sand texture with a moderately acidic pH (5.9). The soil is deep with an effective rooting depth estimated at nearly 21 inches. There are no rock fragments apparent in the profile or on the surface. Soil temperature averaged 60-65°F in 1998 and 2003 at an average depth of 18 inches. Organic matter is limited at only 0.7%. Potassium may be limiting to plant growth at just 38.4 ppm. Values below 70 ppm are thought limiting to normal plant development. There is evidence of wind and surface water erosion, and an erosion condition class assessment rated soils as slightly eroding in 2003.

Serviceberry, basin big sagebrush, and antelope bitterbrush dominate the shrub component. These key species combined to produce 71% of the vegetative cover on the site in 1997, 51% in 1998, and 88% in 2003. Mature serviceberry plants are very large, averaging about 6 feet in height by 6 feet in width. Available parts of these shrubs have been moderately to heavily hedged during all readings, with the heaviest use reported in 1987 (100% heavy use). The increased density reported in 1992 (265 to 980 plants/acre) appears to have been caused by observer differences in counting this rhizomatous shrub. Clumps of several stems in the same area were considered one plant in 1997, 1998, and 2003. Vigor has been good on most plants since 1992, and percent decadence has been fairly low ranging from 10-20% over the same time period. Reproduction has been very good in all surveys ranging from 25-45%. Annual leaders averaged 5 inches of growth on serviceberry outside the exclosure in 2003.

The basin big sagebrush population remained relatively stable at around 1,800 plants/acre from 1987-1998. In 2003, density declined to 1,240 plants/acre resulting from the loss of the entire young age class and a continued abundant dead age class. Since 1992, sagebrush has exhibited generally light to moderate use, but vigor has been poor on a large proportion of the population and decadence has been moderately high ranging from 33%-63%. Half or more of the decadent age class was classified as dying in each of the last 4 readings. Young recruitment was adequate to replace the decadent, dying plants in 1987 and 1992, but has steadily declined since. Basin big sagebrush annual leaders averaged 3.4 inches of growth outside the exclosure in 2003.

Bitterbrush density was stable in 1997 and 1998 at about 1,200 plants/acre, but declined to 960 in 2003 with no young being sampled. Bitterbrush has received consistent moderate to heavy use since 1987, but has maintained generally good vigor and low to moderate decadence. The highest decadence estimates for bitterbrush occurred in the 1992 and 2003 surveys which both followed periods of drought in southern Utah. As this is a winter grazing allotment for livestock, bitterbrush likely receives dual use from big game and cattle in at least some years. Many plants are partly unavailable for use due to the extensive hedging over the years. It was noted in 2003 that all of the available forage on bitterbrush came from the current year leaders. Annual leader growth averaged 7.5 inches on bitterbrush in 2003.

The herbaceous understory had good diversity and fair production from 1987-1998. With drought conditions in 2003, very few grasses or forbs were sampled on the site. The most abundant perennial grasses prior to the 2003 survey were bottlebrush squirreltail, western wheatgrass, sand dropseed, Indian ricegrass, needle-and-thread, and Sandberg bluegrass. Two annual species, cheatgrass and sixweeks fescue, were both moderately abundant in 1997 and 1998, but neither were sampled in 2003 with drought conditions. Forbs have been nearly as abundant on this site as the grasses. Toadflax has been the most abundant perennial forb in all surveys, with all other perennial species being rare. Annual forbs had moderate abundance from 1992-1998, with woolly plantain being the most common. There was light grazing on the palatable grasses in 1998, mainly sand dropseed and western wheatgrass.

### 1992 TREND ASSESSMENT

Percent bare ground is estimated at 27%, down from 39% in 1987. Percent litter cover is similar to 1987 estimates. Trend for soil is considered slightly up, but still in poor condition. Because the sample size is much larger now, many of the estimates for browse density have increased from the 1987 survey. Therefore, percent decadence, form class, and vigor should be the parameters most important for trend evaluation. The key species for the site in order of dominance (percent of total plant cover) are: serviceberry (33%), basin big sagebrush (32%) and bitterbrush (18%). Basin big sagebrush has the highest decadence, but is not higher than expected with the site potential and condition, along with the length of the current drought. The key species also all have some evidence of reproduction and a good percent young age class of plants. The trend for browse would be considered stable. For the herbaceous understory, annuals in the past were ignored in the surveys. Now, if we “ignore” the annuals and look at the trend for only perennial species, the sum of nested frequencies would indicate a stable trend.

#### TREND ASSESSMENT

soil - up slightly (4)

browse - stable (3)

herbaceous understory - stable (3)

### 1997 TREND ASSESSMENT

Trend for soil is considered stable even with an increase in percent bare ground. Nested frequency of vegetation and litter increased as did the sum of nested frequency for grasses and forbs. There is some evidence of soil pedestalling, but much of this appears to be caused by livestock trails around shrubs. Erosion is not currently a problem on the site. Trend for the key browse species is mixed. Bitterbrush and serviceberry appear to be stable with moderate to heavy use, good vigor, and low decadence. The increase in density between 1992 and 1997 appear to be observer differences due to the lack of dead plants. This rhizomatous shrub can be difficult to count when in dense clusters. Several stems coming from the same general area were considered one plant in 1997. Basin big sagebrush appears to have a declining trend with a reduced population density, moderate to heavy use, reduced vigor, and increasing decadence. In addition, the large number of dead plants counted in 1997 indicate a definite die-off. A decline in density can also be seen in all age classes. Since sagebrush accounts for one third of the shrub cover, the browse trend is considered slightly down. The herbaceous trend is stable but still depleted. Sum of nested frequency for grasses increased, although this was due to a significant increase in the nested frequencies of cheatgrass and sixweeks fescue. The most common native grass, bottlebrush squirreltail, increased slightly. Sum of nested frequency for forbs also increased slightly, due mainly to a significant increase in the nested frequency of toadflax.

#### TREND ASSESSMENT

soil - stable (3)

browse - down for sagebrush, slightly down overall (2)

herbaceous understory - stable (3)

## 1998 TREND ASSESSMENT

Trend for soil appears up slightly due to a decline in percent bare ground from 36% to 31%, combined with an increase in vegetation and cryptogamic cover. Conditions are still poor however. Trend for the key browse species are similar to 1997 estimates. Utah serviceberry and antelope bitterbrush trends appear stable. Bitterbrush does show extremely heavy use, but vigor is good, reproduction adequate, and percent decadence low at only 13%. The sagebrush population has remained at a similar density since 1987, but the population has become increasingly decadent (46%), and 43% of the sagebrush are dead (1,440 plants/acre). This combined with poor reproduction in 1997 and 1998 point to a decline. This decline does not appear to be caused by utilization because the livestock exclosure and total exclosure also show similar trends. Overall browse trend is considered stable since conditions for sagebrush are similar to 1997. However, the sagebrush population should be watched closely. Trend for the herbaceous understory is stable, although in poor condition. Sum of nested frequency for perennial grasses and forbs are similar to 1997 estimates. One negative factor is the significant increase in nested frequency for the annuals; cheatgrass, sixweeks fescue, and woolly plantain.

### TREND ASSESSMENT

soil - slightly up (4)

browse - stable (3)

herbaceous understory - stable (3)

## 2003 TREND ASSESSMENT

Trend for soil is down. Bare ground increased from 31% to 45%, and vegetation cover declined from 35% to 21%. As a result, there is less protective cover on the soil surface and erosion is evident from rills, surface litter movement, and pedestalling. Trend for browse is slightly down. The 3 key species, serviceberry, bitterbrush, and basin big sagebrush all have lower population densities since 1998, and bitterbrush and basin big sagebrush have much lower young recruitment. Percent decadence increased for all 3 species in 2003, although sagebrush is the only species of the three that would be considered as having high decadence. Utilization on sagebrush is mostly light, moderate for serviceberry, and heavy on bitterbrush. One-third of the basin big sagebrush population showed poor vigor in 2003, and 59% of the decadent age class was classified as dying. Because basin big sagebrush is the least preferred of the key species, the deteriorating condition of this population is not as alarming as it may be on other sites without a good bitterbrush and/or serviceberry component. Trend for the herbaceous understory is down. Most perennial grass and forb species showed lower individual nested frequency values in 2003 compared to 1998, and total sum of nested frequency of all perennials declined from 336 to 155. Annual species also declined in abundance. The effect of drought on both the browse and herbaceous components is obvious.

### TREND ASSESSMENT

soil - down (1)

browse - slightly down (2)

herbaceous understory - down (1)



HERBACEOUS TRENDS --  
Management unit 27 , Study no: 7

T y p e	Species	Nested Frequency					Average Cover %			
		'87	'92	'97	'98	'03	'92	'97	'98	'03
G	Agropyron smithii	ab <sup>24</sup>	a <sup>4</sup>	bc <sup>48</sup>	c <sup>71</sup>	a <sup>10</sup>	.03	.29	.50	.07
G	Bromus tectorum (a)	-	a <sup>3</sup>	b <sup>112</sup>	c <sup>144</sup>	a <sup>-</sup>	.00	2.35	3.21	-
G	Oryzopsis hymenoides	11	25	21	14	16	.34	.10	.25	.21
G	Poa secunda	8	12	16	15	3	.10	.39	.10	.01
G	Sitanion hystrix	b <sup>54</sup>	b <sup>58</sup>	b <sup>62</sup>	b <sup>39</sup>	a <sup>-</sup>	.51	.83	.62	-
G	Sporobolus cryptandrus	ab <sup>24</sup>	b <sup>33</sup>	ab <sup>14</sup>	b <sup>31</sup>	a <sup>9</sup>	.63	.06	.33	.07
G	Stipa comata	22	24	25	21	7	.32	.14	.16	.03
G	Vulpia octoflora (a)	-	b <sup>27</sup>	c <sup>73</sup>	d <sup>144</sup>	a <sup>-</sup>	.11	.33	1.92	-
Total for Annual Grasses		0	30	185	288	0	0.11	2.69	5.13	0
Total for Perennial Grasses		143	156	186	191	45	1.94	1.82	1.97	0.40
Total for Grasses		143	186	371	479	45	2.06	4.51	7.10	0.40
F	Arabis spp.	-	-	5	3	-	-	.04	.01	-
F	Astragalus spp.	8	2	1	1	3	.00	.00	.00	.00
F	Calochortus nuttallii	-	-	1	-	4	-	.01	-	.01
F	Chaenactis douglasii	-	2	1	10	-	.01	.00	.19	-
F	Collomia linearis (a)	-	-	3	-	-	-	.00	-	-
F	Comandra pallida	ab <sup>72</sup>	a <sup>58</sup>	b <sup>117</sup>	b <sup>98</sup>	ab <sup>88</sup>	.50	1.79	1.04	1.42
F	Collinsia parviflora (a)	-	-	1	-	2	-	.15	-	.03
F	Delphinium nuttallianum	-	-	3	-	-	-	.00	-	-
F	Descurainia spp. (a)	-	b <sup>16</sup>	b <sup>30</sup>	b <sup>26</sup>	a <sup>-</sup>	.40	.12	.13	-
F	Draba spp. (a)	-	b <sup>16</sup>	a <sup>-</sup>	ab <sup>8</sup>	a <sup>-</sup>	.03	-	.04	-
F	Eriogonum cernuum (a)	-	b <sup>33</sup>	a <sup>10</sup>	a <sup>1</sup>	a <sup>2</sup>	.24	.05	.00	.03
F	Erigeron spp.	-	-	1	3	-	-	.00	.00	-
F	Eriogonum racemosum	1	-	7	4	-	-	.04	.01	-
F	Euphorbia glyptosperma (a)	b <sup>17</sup>	ab <sup>8</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	.04	-	-	-
F	Frasera speciosa	-	-	2	-	-	-	.00	-	-
F	Gilia spp. (a)	-	a <sup>-</sup>	b <sup>24</sup>	a <sup>-</sup>	b <sup>11</sup>	-	.12	-	.28
F	Lappula occidentalis (a)	-	-	4	-	-	-	.04	-	-
F	Lupinus argenteus	-	-	1	-	-	.03	.03	-	-
F	Microsteris gracilis (a)	-	b <sup>21</sup>	b <sup>31</sup>	a <sup>-</sup>	a <sup>-</sup>	.04	.15	-	-
F	Oenothera pallida	-	3	-	3	3	.03	-	.03	.00
F	Penstemon spp.	a <sup>-</sup>	b <sup>10</sup>	a <sup>-</sup>	ab <sup>8</sup>	ab <sup>-</sup>	.22	-	.04	-
F	Phlox austromontana	a <sup>-</sup>	b <sup>14</sup>	b <sup>22</sup>	b <sup>14</sup>	ab <sup>9</sup>	.30	.20	.35	.09
F	Plantago patagonica (a)	-	c <sup>88</sup>	b <sup>46</sup>	d <sup>195</sup>	a <sup>2</sup>	.40	.18	5.36	.03
F	Polygonum douglasii (a)	-	b <sup>15</sup>	b <sup>26</sup>	a <sup>-</sup>	a <sup>-</sup>	.03	.04	-	-

Type	Species	Nested Frequency					Average Cover %			
		'87	'92	'97	'98	'03	'92	'97	'98	'03
F	Senecio multilobatus	4	-	1	-	-	-	.00	-	-
F	Sphaeralcea parvifolia	<sub>b</sub> 12	<sub>ab</sub> 3	<sub>a</sub> 1	<sub>a</sub> 1	<sub>ab</sub> 3	.01	.00	.00	.03
F	Unknown forb-annual (a)	-	3	-	-	-	.01	-	-	-
Total for Annual Forbs		17	200	175	230	17	1.21	0.88	5.54	0.37
Total for Perennial Forbs		97	92	163	145	110	1.11	2.15	1.69	1.56
Total for Forbs		114	292	338	375	127	2.32	3.04	7.24	1.93

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

BROWSE TRENDS --

Management unit 27 , Study no: 7

Type	Species	Strip Frequency				Average Cover %			
		'92	'97	'98	'03	'92	'97	'98	'03
B	Amelanchier utahensis	23	13	13	11	12.05	8.44	3.32	5.71
B	Artemisia filifolia	0	0	3	0	-	-	.18	-
B	Artemisia tridentata tridentata	58	58	55	46	11.92	5.20	3.20	5.41
B	Chrysothamnus nauseosus	0	0	0	1	-	-	-	.00
B	Chrysothamnus viscidiflorus	0	1	1	0	-	.00	-	-
B	Eriogonum microthecum	0	0	1	0	-	-	-	-
B	Gutierrezia sarothrae	34	32	27	4	1.53	.26	.68	.03
B	Leptodactylon pungens	3	5	0	4	.06	.06	-	.06
B	Opuntia spp.	1	0	0	1	-	-	-	-
B	Purshia tridentata	36	34	37	34	6.50	6.59	7.64	7.50
Total for Browse		155	143	137	101	32.08	20.58	15.03	18.73

CANOPY COVER, LINE INTERCEPT --

Management unit 27 , Study no: 7

Species	Percent Cover
	'03
Amelanchier utahensis	8.19
Artemisia tridentata tridentata	8.03
Chrysothamnus nauseosus	.05
Purshia tridentata	7.71

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 27 , Study no: 7

Species	Average leader growth (in)
	'03
Amelanchier utahensis	3.9
Artemisia tridentata tridentata	2.2
Purshia tridentata	6.1

POINT-QUARTER TREE DATA --  
Management unit 27 , Study no: 7

Species	Trees per Acre		Average diameter (in)	
	'98	'03	'98	'03
Juniper osteosperma	6	N/A	8.5	N/A

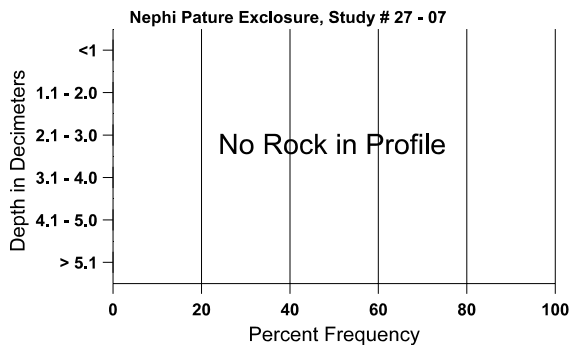
BASIC COVER --  
Management unit 27 , Study no: 7

Cover Type	Average Cover %				
	'87	'92	'97	'98	'03
Vegetation	.75	34.50	27.35	34.91	20.50
Rock	0	.04	.05	0	.03
Pavement	0	0	.02	.04	.01
Litter	59.75	54.40	47.79	48.41	47.10
Cryptogams	1.00	2.00	1.93	8.56	.67
Bare Ground	38.50	26.89	35.68	30.71	45.26

SOIL ANALYSIS DATA --  
Management unit 27, Study no: 7, Study Name: Nephi Pasture Enclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
20.8	65.0 (18.1)	5.9	87.0	7.4	5.6	0.7	11.9	38.4	0.2

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 27 , Study no: 7

Type	Quadrat Frequency			
	'92	'97	'98	'03
Rabbit	49	20	25	8
Elk	-	-	-	-
Deer	26	32	27	23
Cattle	3	5	5	5

Days use per acre (ha)	
'98	'03
-	-
1 (2)	-
64 (158)	70 (174)
16 (40)	23 (57)

BROWSE CHARACTERISTICS --  
 Management unit 27 , Study no: 7

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
87	<b>265</b>	66	66	133	66	-	0	100	25	25	60/56
92	<b>980</b>	120	440	440	100	-	18	18	10	10	-/-
97	<b>340</b>	-	100	200	40	20	47	18	12	12	83/86
98	<b>380</b>	20	120	220	40	-	26	21	11	0	66/73
03	<b>300</b>	-	80	160	60	20	60	7	20	7	70/72
<b>Artemisia filifolia</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>260</b>	60	140	120	-	-	0	0	-	0	9/15
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Artemisia tridentata tridentata</b>											
87	<b>1865</b>	66	466	1266	133	-	54	21	7	0	34/35
92	<b>2720</b>	200	800	1020	900	-	15	1	33	24	-/-
97	<b>1700</b>	20	320	600	780	1200	53	11	46	46	36/45
98	<b>1880</b>	100	240	780	860	1440	40	9	46	23	31/37
03	<b>1240</b>	-	-	460	780	1500	15	0	63	37	31/34
<b>Chrysothamnus nauseosus</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	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	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus viscidiflorus</b>											
87	<b>133</b>	66	133	-	-	-	0	0	-	50	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>20</b>	-	-	20	-	-	0	0	-	0	7/7
98	<b>20</b>	-	-	20	-	-	0	0	-	0	18/13
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Eriogonum microthecum</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	100	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Gutierrezia sarothrae</b>											
87	<b>3932</b>	66	-	3866	66	-	0	0	2	0	9/12
92	<b>1180</b>	200	120	1040	20	-	0	0	2	0	-/-
97	<b>1280</b>	20	180	1060	40	60	0	0	3	0	11/12
98	<b>1280</b>	20	40	1240	-	-	0	0	0	0	11/13
03	<b>120</b>	-	40	80	-	-	0	0	0	0	11/14
<b>Leptodactylon pungens</b>											
87	<b>599</b>	533	133	400	66	-	0	0	11	0	5/6
92	<b>340</b>	-	20	320	-	-	0	0	0	0	-/-
97	<b>280</b>	-	-	280	-	20	0	0	0	7	18/20
98	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
03	<b>180</b>	-	-	180	-	20	0	0	0	0	5/7
<b>Opuntia spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>40</b>	-	20	-	20	-	0	0	50	50	-/-
97	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	0	0	4/13
03	<b>20</b>	-	-	20	-	-	0	0	0	0	2/3
<b>Purshia tridentata</b>											
87	<b>1466</b>	-	400	1000	66	-	0	100	5	0	12/41
92	<b>1700</b>	40	420	840	440	-	13	80	26	16	-/-
97	<b>1240</b>	-	80	1060	100	40	35	55	8	8	21/43
98	<b>1220</b>	-	120	940	160	40	18	75	13	2	20/43
03	<b>960</b>	-	-	640	320	60	29	71	33	8	20/38

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Ribes spp.</b>											
87	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
97	0	-	-	-	-	-	0	0	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	30/25
03	0	-	-	-	-	-	0	0	-	0	-/-
<b>Tetradymia canescens</b>											
87	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
97	0	-	-	-	-	-	0	0	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	19/7

## Nephi Pasture Exclosure Comparison Summary

Ground cover characteristics differ slightly between grazing effects. Bare ground is more abundant outside of the exclosure, and similar between the livestock and total exclosures in both 1998 and 2003. Vegetation and litter cover are highest in the livestock exclosure and lowest outside. Soil characteristics are similar between treatments. Soils are deep with sandy loam to sand textures, a moderately acidic pH, low organic matter content, deficient values for phosphorus and potassium, and high average soil temperatures. The total exclosure showed the least amount of erosion in 2003, while both the livestock exclosure and outside treatments showed slight erosion.

All sites support good stands of basin big sagebrush, bitterbrush, and serviceberry, with sagebrush being the most prevalent. In 1998, the sagebrush stand in the total exclosure was the least healthy followed closely by outside. Percent decadence was high at 64% in the total exclosure compared to 34% in the livestock exclosure and 46% outside. Vigor was poor on 46% of the total exclosure population, compared to 18% in the livestock, and 23% outside. Utilization was moderate to heavy outside and within the livestock exclosure. In 1998, deer use was significantly higher within the livestock exclosure (111 ddu/acre vs 64 ddu/acre) where sagebrush was in the best condition. With this in mind, it appeared that sagebrush was more effected by climate in 1998 than use. In 2003, sagebrush decadence was high in all 3 treatments at over 50%, with the highest level occurring inside the livestock exclosure. Poor vigor was also highest inside the livestock exclosure with 51% of the sagebrush being classified as such. Young recruitment for sagebrush was good in all 3 treatments in 1998, but very low in 2003. Density was highest inside the livestock exclosure in both surveys, but density estimates declined over all 3 treatments between 1998 and 2003.

Several factors appear to be effecting sagebrush at Nephi Pasture. Drought is likely the primary driving force behind deteriorating sagebrush health, but winter injury could also be a factor. Winter injury is presumably caused by freezing due to a lack of sufficient cold hardiness and/or winter drought or dessication (Nelson and Tiernan 1983). During mild winters, sagebrush can break dormancy during the middle of the winter and begin growth too early in the year. By doing so, sagebrush plants become susceptible to dessication and crown death if temperatures become very cold for any substantial length of time or there is a lack of soil moisture within the profile, especially within these deep sandy soils. In 2003, the livestock exclosure appears to be a little worse off than the other treatments. A plausible explanation is that heavy deer use as well as high intraspecific competition are additive factors effecting sagebrush in the livestock exclosure. Because overall browse density and average cover are highest inside the livestock exclosure, competition for resources would be greatest here, and this would be intensified during the current drought.

Bitterbrush density slightly declined in the total exclosure and outside, but remained stable in the livestock exclosure between 1998 and 2003. Serviceberry showed slight decreases in all 3 treatments in 2003. Although both species had increased decadence rates in 2003, the current levels are considered only moderate. Utilization has been on the moderate side for serviceberry in the livestock exclosure and outside, but more heavy on bitterbrush. However, vigor has been generally normal for both species across all treatments in both sampling years. Bitterbrush recruitment declined in all 3 treatments between 1998 and 2003, while young recruitment in the serviceberry population remained stable in the livestock exclosure and outside.

The herbaceous understories were similar with respect to species composition and overall production between grazing effects in 1998. With drought in 2003, grass production declined drastically on all 3 transects, with forb production declining in the livestock exclosure and outside, but remaining nearly the same inside the total exclosure. Sum of nested frequency of perennial herbaceous species declined across all 3 treatments in 2003 with the dry conditions. Cheatgrass had the highest frequency and cover values inside the total exclosure in 1998, but cheatgrass was not sampled in any of the 3 transects in 2003. Herbaceous trends are down on all 3 sites in 2003 due to the decline in perennial species.

## SUMMARY

### WILDLIFE MANAGEMENT UNIT 27 - PAUNSAUGUNT

The majority of range trends on the Paunsaugunt management unit are in a downward state in 2003. Of the 18 studies that were sampled in 2003, only 1 site had an upward trend in any category which occurred at Moons Landing where the browse trend was slightly up. All other trends in all categories were either stable or declining at all other study locations. The browse and herbaceous understory components were in the worst condition in 2003 as 14 sites had downward browse and herbaceous trends. Soil trends are declining on 10 sites and stable on 8 others.

The primary factors influencing downward browse trends include decreasing key browse densities and young recruitment, reduced vigor, and increased decadence. The key browse on most of the studies in the unit is composed primarily of big sagebrush and antelope bitterbrush, with black sagebrush and serviceberry being important on select sites. Big sagebrush is represented by 2 subspecies, the basin and Wyoming varieties. Big sagebrush and/or black sagebrush was sampled on 16 of the 18 studies in the unit in 2003, and of these, percent decadence increased on 11 sites, remained stable on 3 sites, and declined on only two. Young recruitment declined on 14 of the 16 sites where sagebrush was sampled in 2003. Bitterbrush was sampled on 12 studies in the unit, with decadence increasing on 10 of these and young recruitment declining on all 12.

Herbaceous trends are primarily determined on composition and the abundance of perennial species. In 2003, nested frequency values of perennial grasses and forbs declined on 15 sites and 10 sites respectively. Average cover of perennial grasses declined on 11 sites, remained stable on 4 others, and increased on 3 summer range locations (Proctor Canyon, Ahlstrom Hollow, and Sand Pass). Perennial forb cover declined on only 7 studies in 2003, remained stable on 5 sites, and increased at 6 locations, most of which were in the summer or transitional zones. The forb component often shows a larger magnitude of decline during drought years compared to perennial grasses, but in this unit the reverse was true in 2003. Cheatgrass brome was only sampled on 7 of the 18 sites prior to the 2003 reading. This species was moderately abundant on only 5 of these, and declined in nested frequency and average cover on 4 of the 5 sites in 2003. The only increase in cheatgrass was found at Fivemile Mountain.

Downward soil trends occur when protective cover on the soil surface from vegetation, litter, and cryptogams declines. As bare ground increases, soils become more susceptible to erosion. Erosion condition class assessments were completed on each site in 2003 to determine the extent of erosive forces effecting a site. The most apparent changes on the soil surface in 2003 was an increase in bare ground on many areas, and a subsequent decline in one or more of the protective cover categories (vegetation, litter, and/or cryptogams).

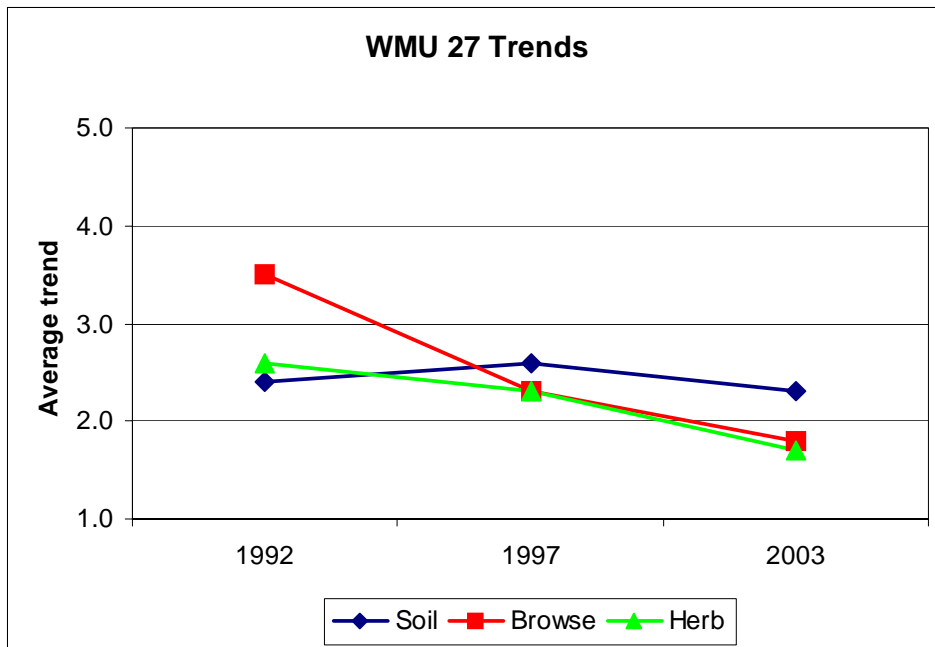
Range trends are largely driven by precipitation. As a whole, Utah has been in a drought for the past 5 years, and southern Utah has been one of the driest area of the state during this period. Weather station data at 4 locations was analyzed to look at precipitation trends in the unit since range trend studies were established in 1987. These stations occur at Bryce Canyon National Park, Alton, Orderville, and Kanab (Utah Climate Summaries 2004). Precipitation data was averaged over the 4 weather stations listed above, and data indicate that from 1987-2002, total annual precipitation was below normal in 1988-89, 1991, 1994, 1999, and 2002 (see precipitation graphs below). Below normal precipitation in this discussion is defined as less than 90% of the normal average for a given area. Perhaps more important than total annual precipitation is seasonal distribution. Data were analyzed for both spring (April-June) and fall (September-November) totals. Spring precipitation is particularly important for cool season perennial grasses and forbs, as well as shrub populations, as these species initiate growth during the spring. Weather data indicate that spring precipitation in the Paunsaugunt unit was below normal in 1989, 1991, 1993, 1996, 2000, and 2002-03 (see precipitation graphs below). Fall precipitation totals have been normal or above normal in most years since 1987 with exception of 1988-89, 1992, 1995, 1999, and 2001 (see precipitation graphs below).



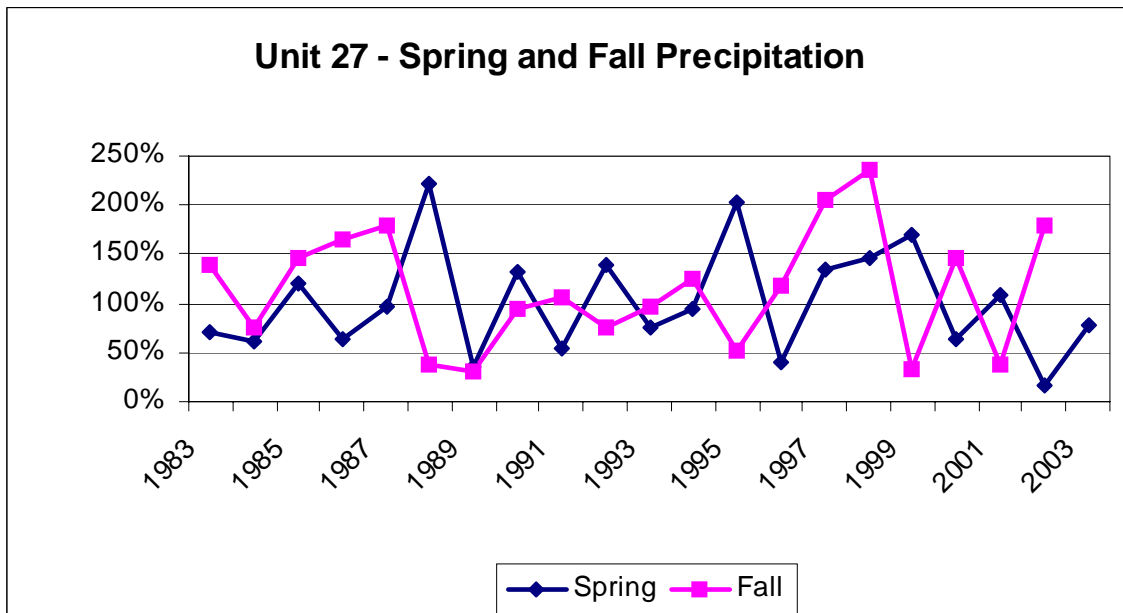
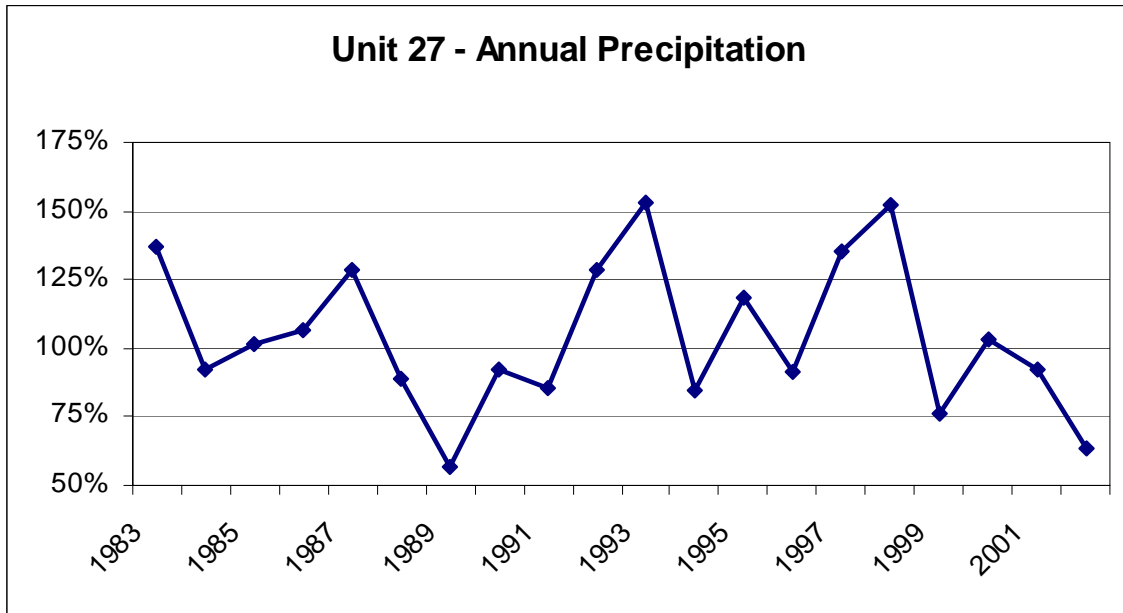
For this report, the period from 2000-present is the focus as it would most effect current range trends. Below normal spring precipitation in 2000 and 2002-03 is a primary reason for the decline in grasses and to some extent forbs in 2003, especially on lower elevation winter ranges. Without good spring precipitation, cool season perennials are not able to sustain high productivity as their primary growing season occurs during the spring and early summer. Big sagebrush populations on winter ranges were in particularly bad condition in 2003. Decadence levels were moderate to extreme at Nephi Pasture and John R. Flat as well as most other studies that sampled winter range. The dead age class also increased on many sites in 2003, and this trend may continue as several sites have a high proportion of decadent, dying plants. Declining young recruitment in sagebrush and bitterbrush populations is drought related and will continue until precipitation patterns improve.

Average Trends – WMU 27 Paunsaugunt

	1992	1997	2003
Soil	2.4	2.6	2.3
Browse	3.5	2.3	1.8
Herb	2.6	2.3	1.7
	8 sites	8 sites	18 sites



Precipitation graphs for the Paunsaugunt management unit. Data is percent of normal precipitation averaged for 4 weather stations at Bryce Canyon National Park, Alton, Orderville, and Kanab (Utah Climate Summaries 2004).



Trend Summary

	Category	1987	1992	1997	2003
27-1 Proctor Canyon	soil	est	2	2	3
	browse	est	4	2	3
	herbaceous understory	est	3	2	1
27-2 Ahlstrom Hollow	soil	est	2	4	2
	browse	est	5	3	2
	herbaceous understory	est	2	3	2
27-3 Whiteman Bench	soil	est	2	2	3
	browse	est	4	2	3
	herbaceous understory	est	3	1	2
27-4 Sand Pass	soil	est	2	2	3
	browse	est	4	3	3
	herbaceous understory	est	1	1	2
27-5 Podunk Creek	soil	est	3	3	2
	browse	est	3	4	1
	herbaceous understory	est	4	2	2
27-6 Nephi Pasture I	soil	est	1	3	2
	browse	est	2	1	1
	herbaceous understory	est	1	3	1
27-8 Fivemile Mountain	soil	est	3	2	3
	browse	est	3	1	1
	herbaceous understory	est	4	3	1

(1) = down, (2), slightly down, (3) = stable, (4) = slightly up, (5) = up  
 (est) = established, (n/a) = no trend, (susp) = suspended, (NR) = not read

	Category	1997	2003
27-9 Buckskin Mountain	soil	est	3
	browse	est	2
	herbaceous understory	est	2
27-10 Telegraph Flat	soil	est	3
	browse	est	1
	herbaceous understory	est	1
27-11 Crocodile	soil	est	3
	browse	est	1
	herbaceous understory	est	1
27-12 Moons Landing	soil	est	2
	browse	est	4
	herbaceous understory	est	3
27-13 Heaton	soil	est	2
	browse	est	3
	herbaceous understory	est	1

(1) = down, (2), slightly down, (3) = stable, (4) = slightly up, (5) = up  
(est) = established, (n/a) = no trend, (susp) = suspended, (NR) = not read

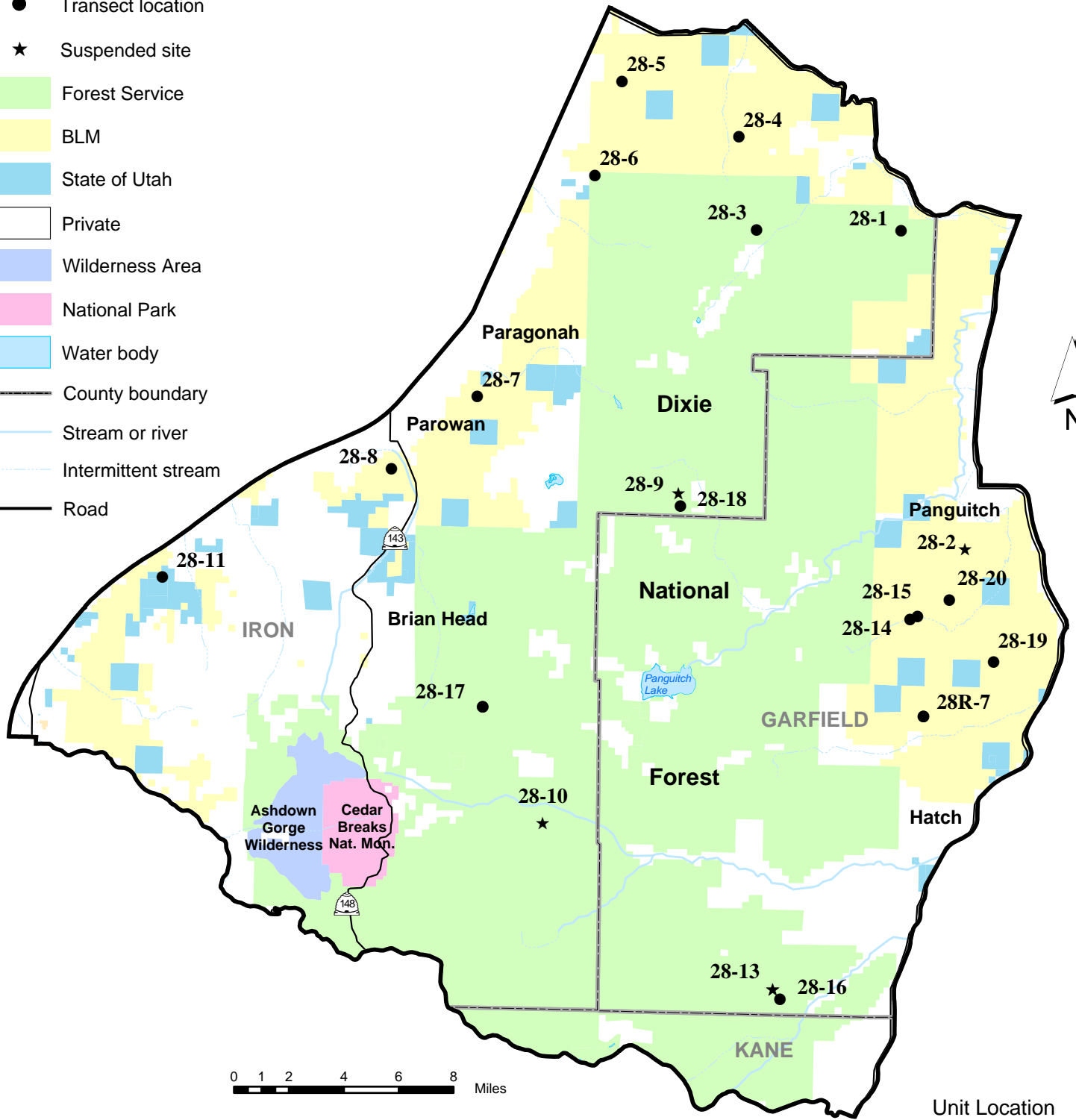
Trend Summary - Exclosures

	Category	1998	2003			
27R-1 John R. Flat Total Exclosure	soil	est	3			
	browse	est	1			
	herbaceous understory	est	3			
27R-2 John R. Flat Livestock Exclosure	soil	est	2			
	browse	est	1			
	herbaceous understory	est	3			
27R-3 John R. Flat Exclosure Outside	soil	est	2			
	browse	est	1			
	herbaceous understory	est	3			
27R-4 Nephi Pasture Total Exclosure	soil	est	1			
	browse	est	1			
	herbaceous understory	est	1			
27R-5 Nephi Pasture Livestock Exclosure	soil	est	1			
	browse	est	2			
	herbaceous understory	est	1			
	Category	1987	1992	1997	1998	2003
27-7 Nephi Pasture Exclosure Outside	soil	est	4	3	4	1
	browse	est	3	2	3	2
	herbaceous understory	est	3	3	3	1

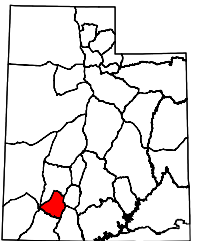
(1) = down, (2), slightly down, (3) = stable, (4) = slightly up, (5) = up  
 (est) = established, (n/a) = no trend, (susp) = suspended, (NR) = not read

# Management Unit 28

- Transect location
- ★ Suspended site
- Forest Service
- BLM
- State of Utah
- Private
- Wilderness Area
- National Park
- Water body
- County boundary
- Stream or river
- Intermittent stream
- Road



Unit Location



## WILDLIFE MANAGEMENT UNIT 28 - PANGUITCH LAKE

### Boundary Description

**Iron, Kane, and Garfield counties** - Boundary begins at Highway SR-14 and Highway US-89; then north on US-89 to Highway SR-20; then west on SR-20 to Interstate 15; then south on I-15 to Highway SR-14; then east on SR-14 to US-89 and beginning point.

### Management Unit Description

Total useable mule deer and elk range on this unit is 540,457 and 402,473 acres respectively (DWR 1998). Mule deer range consists of 63% summer and 37% winter range, while elk range is 78% summer and 22% winter range. Guinta (1982) presents a complete description of the summer and winter range on the Panguitch Lake unit. The winter range on the eastern portion of the unit is higher in elevation and experiences colder temperatures than on the Parowan side; and consequently, far fewer deer winter on the Panguitch side. Key areas that were identified on the winter range on the eastern side of the unit include the following: pinyon-juniper woodlands south of Panguitch, seeded range at the north end of Upper Bear Valley, the mixed brush type in Buckskin Valley, and the pinyon-juniper chainings in the Three Creeks drainage. These study sites range in elevation from 7,100 to 7,600 feet and represent key areas within the limits of normal winter range on the east side. The only severe winter range available on the unit is located on the pinyon-juniper slopes below the Hurricane Cliffs and on the sagebrush flats that extend from the slopes to I-15. During severe winters the deer on this herd unit are packed into the narrow area between the cliffs and the interstate. Habitat availability is effectively reduced by 80% during these severe winters. The key areas that were identified by the local interagency committee for this area include the Wyoming big sagebrush type west of Swayback Knoll, a Wyoming big sagebrush type in the mouth of Cottonwood Creek, a pinyon-juniper chaining east of Paragonah, a big sagebrush/ pinyon-juniper ecotone in Grass Valley south of Parowan, and a mountain big sagebrush/pinyon-juniper ecotone in Elliker Basin. The importance of each of these areas for deer has increased over the years as sagebrush flats have been converted to sprinkler irrigated agricultural lands; mainly from Highway U-20 to Parowan. Due to depredation problems, deer fences were constructed around many of these fields. In addition, the deer-proof fence along the I-15 corridor severely limits the winter range available to deer on the west side of the freeway. Urbanization of former winter range is continuing, especially in the Fiddler's Canyon area north of Cedar City. Of particular concern is the fact that much of the severe winter range from U-20 to Cedar City is privately owned. Additional habitat losses are to be expected on these privately owned parcels of land. Summer range is not considered a limiting factor for this deer herd. Summer range on the northern portion of the unit generally lies between 8,000 and 9,000 feet and consists largely of gentle rolling terrain. Summer ranges on the south side of the unit reach elevations of over 10,000 feet bordering Cedar Breaks National Park.

### Livestock Grazing on Key Areas

**The following discussion comes from the 1998 Range Trend Report and grazing information was current in 1998. Actual dates and numbers of grazing animals may have changed since.**

#### Eastern Portion - Normal Winter Deer Range

The Three Creeks study site is located in the USFS Three Creeks Cattle Allotment. A rest-rotation grazing system is used to manage livestock on this unit. The allotment is grazed from 6/1 to 10/15, with use on the study site occurring during the spring. The Upper Bear Valley site is located within the USFS Red Creek Cattle Allotment. This area was grazed by sheep and cattle prior to 1940. Since then, cattle have used the area exclusively. A deferred-rotation grazing system is used to manage livestock on the allotment. The season of use is from 6/16 to 10/15. The Buckskin Valley site is located in the BLM administered Buckskin

Mountain Allotment. The unit is grazed annually during the late spring by sheep and cattle. No grazing system is in use. The active preference for livestock has been set at 582 AUMs.

#### Western Portion - Severe Winter Deer Range

The Swayback Knoll site lies within the BLM, Bone Hollow Cattle Allotment. Recently, a 3 pasture rotation system has been implemented on this unit. This is one of the few allotments in the area that permits winter grazing on crucial deer winter range. The Paragonah study site is in an unallotted area of BLM land. Use by cattle does occur since forage production has been enhanced by an old chaining and seeding project. No monitoring of livestock use is carried out by BLM on this area. The Cottonwood site is located in the same allotment as the Upper Bear Valley site. This site is located in a unit that is grazed during the spring in most years.

The Grass Valley study is located in the P-Hill Allotment and is used by cattle from spring to mid-summer. The allotment is used season-long on an annual basis with no provision for deferred or rested pastures. The Elliker Basin study is located on DWR land which was acquired by way of a trade from the BLM.

#### High Elevation - Summer Range

The summer range sites, Red Desert and Little Valleys, are located in the Red Desert and Little Valleys Cattle Allotments. Both of these studies were suspended in 2003 and replaced by other studies. Both areas were grazed by sheep and cattle prior to 1939. Sheep use continued until 1947 in the Red Desert and until 1973 in Little Valleys. Cattle are managed on a deferred-rotation system in both allotments. The season of use runs from 7/6 to 9/20 on the Red Desert Allotment and from 6/1 to 10/15 in Little Valleys allotment. Suitable range appears to be twice as productive on the Little Valleys Allotment (5 acres/AUM) than on the Red Desert Allotment (11 acres/AUM). Asay Knoll, which was also suspended and replaced in 2003, occurs on the large Uinta Flat burn. It is located within the Buck Knoll pasture of the Asay Knoll Grazing Allotment. This area is allotted for 266 cattle for about one month beginning on June 16th. They are then moved to another pasture.

#### Herd Unit Management Objectives

The objective for this unit is to maintain winter deer herd size of 8,500 animals. Herd composition calls for 15 bucks/100 does with 30% of the bucks being 3-point or better. To achieve this level of harvest it will be necessary to maintain the amount of acreage providing severe winter deer range habitat on the west side of the unit (approximately 44,500 acres). As winter range habitat is lost to other land uses on private land, it will be necessary to increase the carrying capacity of key areas on public lands. Elk management objectives call for a target winter herd size of 900 animals with a bull to cow ratio of 20:100. At least half of the bulls are to be 2 ½ years of age or older. A more detailed discussion of deer and elk herd unit objectives can be found in the Division's big game management plans.

#### Trend Study Description

Range trend studies were initially established in 1987 and resurveyed in 1992, 1998, and 2003. Two additional studies were established in 1998 in the Sheep Hollow area south of Panguitch, and 5 studies were established in 2003 to replace 4 of the original trend studies that were suspended.



Trend Study 28-1-03

Study site name: Three Creeks.

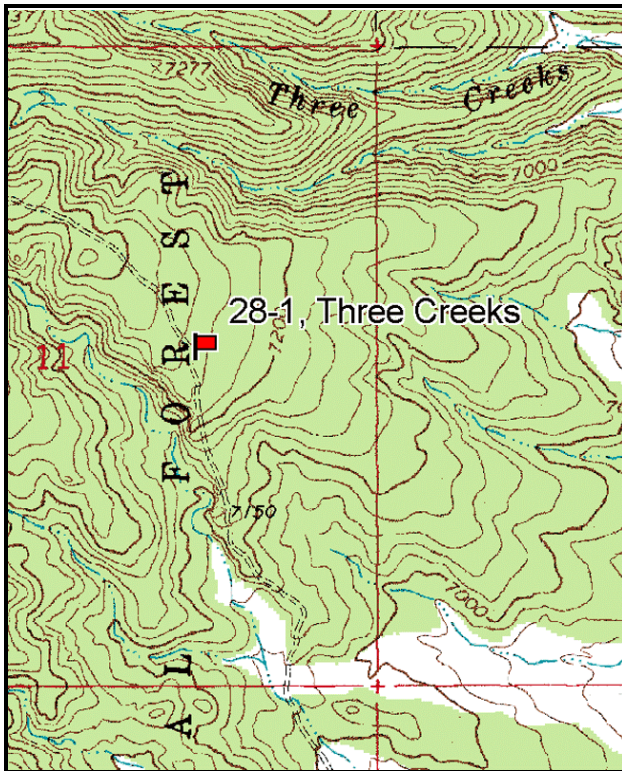
Vegetation type: Burn-Chained, Seeded P-J.

Compass bearing: frequency baseline 167 degrees magnetic.

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

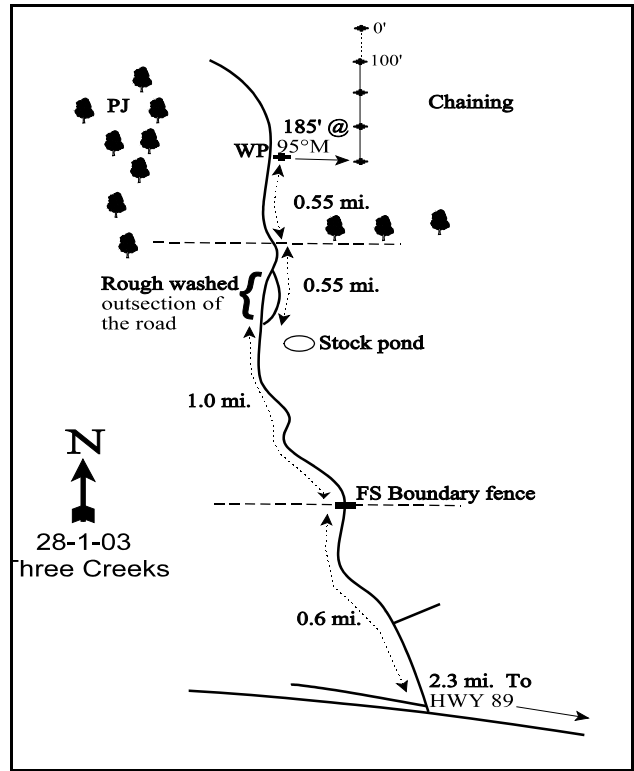
LOCATION DESCRIPTION

From the SR 20-US 89 junction, proceed south on US 89 for 3.1 miles to the Three Creeks road. Travel west on this road (do not take north fork by gate) for 0.5 miles to a fork. Bear right and go 1.85 miles to Three Forks taking the right most one. Travel 0.6 miles to a cattleguard. Continue 1.0 mile to a stockpond. Proceed up the washed out road for 0.55 miles to a fence taking a right fork at 0.3 miles. Continue 0.55 miles up to the chaining and to the witness post which is a short yellow fencepost. From the witness post by the road, walk 185 feet east to the 400-foot stake. The 0-foot baseline stake is 400 feet north, and the short green fencepost is marked by browse tag #7164.



Map Name: Panguitch NW

Township 33S, Range 6W, Section 11



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4201856 N, 369049 E

## DISCUSSION

### Three Creeks - Trend Study No. 28-1

This study is found on the northeast edge of the Markagunt Plateau. The transect lies at an elevation of 7,200 feet on a gentle 8% to 10% slope which drains easterly into the Sevier River. Numerous intermittent streams are nearby with a stock pond 1 mile to the south. The area is utilized by deer in light winters, by an expanding elk herd, and grazed in the summer by cattle. The study area was chained and seeded in 1967, and converted to a sagebrush-grass type with scattered pinyon and juniper trees. Due to an increase in the size of pinyon and juniper trees, a follow up treatment on these trees was done with chainsaws between 1987 and 1992. The site was also prescribed burned prior to the 2003 reading. Use of the site by wildlife was relatively low in 2003 at an estimated 15 deer and 9 elk days use/acre (38 ddu/ha and 21 edu/ha). Livestock use was estimated at 29 days use/acre (72 cdu/ha) in 2003. Deer and elk pellets appeared to be primarily from winter while cattle pats were from the previous grazing season.

The soil is tightly compacted with a high percentage of coarse fragments throughout the soil profile. Soil analysis indicates a sandy loam texture with a neutral pH (7.1). Both phosphorus and potassium could be limiting to vegetative growth and development with low values of 7.3 ppm for phosphorus and 28.8 ppm for potassium. Values of 10 ppm and 70 ppm respectively are thought to be minimal for normal plant development. During the 1987 reading, it was observed that the road and washes nearby showed signs of severe gully erosion and signs of minor sheet erosion on the study site. At that time, soil movement was detectable and some grasses were pedestalled. During the 1992 and 1998 surveys, no active gully erosion was observed and recent soil movement was not detected. In 2003, the proportion of the soil surface represented by bare ground was extremely high at 61%. Due to drought conditions, bare soil was loose and easily disturbed. Both vegetation and litter cover increased between 1992 and 1998, but decreased between 1998 and 2003. Even with the increase in bare ground and the corresponding decline in protective cover from vegetation and litter, soils were rated as stable in 2003 from an erosion condition class assessment.

Mountain big sagebrush is the dominant shrub species, although hybridization with basin big sagebrush is occurring on the site making identification difficult. In 1987, most of the sagebrush was classified as basin big sagebrush while the majority of the sagebrush was determined to be mountain big sagebrush in all other surveys. The mountain big sagebrush population declined to an estimated 700 plants/acre in 2003, much lower than the previous estimates of 1,760 plants/acre in 1992 and 1,340 in 1998. The decline in mountain big sagebrush in 2003 was due to a large decline in the number of young plants in the population as well as an increase in the number of dead. Some of the dead plants that were sampled in the density strips had been burned. In 1987 and 1992, utilization was moderate with a few individual plants displaying heavy hedging. In 1998 and 2003, utilization was mostly light. Vigor has been normal for most of the population in all surveys, and percent decadence increased to 26% in 2003, it's highest level in any reading. Mountain big sagebrush leaders had averaged 1.3 inches of annual growth when the site was read in late June 2003. Basin big sagebrush density was estimated at about 100 plants/acre in 1992 and 1998 although none of the sagebrush on the site was classified as basin big sagebrush in 2003.

Another important browse species on the site is bitterbrush, although density is very low at around 100 plants/acre. The bitterbrush population has shown moderate to heavy utilization in all readings and low reproduction. Vigor has been good except in 1992 when 67% of the population was classified with poor vigor. Percent decadence was estimated at 25% in 2003 while no decadent plants were sampled in any other year. Broom snakeweed, a subshrub that is considered an increaser, was very abundant 1987 and 1992 but less so in 1998 and 2003. Pinyon and juniper trees are scattered throughout the site. Point-center quarter data from 1992 estimated 53 pinyon trees/acre and 43 Utah juniper trees/acre. Fifty-five percent of the junipers sampled were tipped trees that were still growing. These were taken out during the followup chainsaw treatment. In 1998, tree density was estimated at 42 juniper trees/acre and 59 pinyon trees/acre. Tree density

declined in 2003 to an estimated 25 juniper and 34 pinyon trees/acre. Several trees had been killed by fire resulting in decreased tree density on the site.

The herbaceous understory is dominated by crested wheatgrass, which was seeded onto the site as part of the original chaining treatment. Crested wheatgrass maintained a high nested frequency value during the first 3 readings, but significantly declined in 2003. Crested wheatgrass was moderately utilized in 1998, but showed no sign of use in 2003. Several other perennial grasses have been sampled on the site including intermediate wheatgrass, western wheatgrass, blue grama, Indian ricegrass, bottlebrush squirreltail, and needle-and-thread grass. These species are important but occur in limited densities. Cheatgrass was encountered in 1 quadrat in 1998, but was not sampled in any other year. Forb diversity is high, but most species are rare. Silvery lupine is the most abundant forb on the site, and it has accounted for the majority of the forb cover in all readings. Other important perennial forbs include lobeleaf groundsel, longleaf phlox, and scarlet globemallow.

#### 1987 APPARENT TREND ASSESSMENT

Fourteen percent of the ground cover on the site comes from erosion pavement and a few larger rocks. Vegetative cover is scattered, but litter covers 54% of the soil surface while bare soil has a cover value of 26%. Erosion is evident, yet not a serious problem on the site. Sagebrush is well established on the site and should increase. Seeded grasses are also well established but forbs are deficient.

#### 1992 TREND ASSESSMENT

Visual observations of the site indicate stable soil conditions with no active gullies or recent soil movement. Bare ground, mostly the result of livestock trampling, has increased since the last reading from 26% to 35%. Trend for soil is stable. The key browse species are basin big sagebrush and mountain big sagebrush. Their combined density has increased substantially since 1986, but this was because of the larger sample size which gives much better estimates of browse densities. Age structure for the sagebrush species are good with acceptable percentages of decadency. The browse trend is up. Nested and quadrat frequencies of perennial grasses have increased while those of forbs have declined. Overall trend for herbaceous understory is up.

#### TREND ASSESSMENT

soil - stable (3)

browse - up (5)

herbaceous understory - up (5)

#### 1998 TREND ASSESSMENT

The soil trend continues to be stable. Vegetation and litter cover have increased slightly while percent bare ground and percent rock and pavement cover combined have decreased slightly. Percent bare ground is still quite high and there is still some erosion potential during moderate to intense rain events. The browse trend is stable. The mountain big sagebrush population density has decreased slightly since 1992 with only a few dead plants encountered in 1998. The age structure has changed very little since 1992 with a mostly mature population and moderate recruitment by the young age class. The bitterbrush population is also stable and exhibits moderate to heavy hedging. Broom snakeweed density has greatly declined since 1992, probably due to annual precipitation patterns. Although the density of pinyon pine and Utah juniper is currently similar to that reported in 1992, the trees have increased in size and will continue to do so to the point it will become more dominant on the site in the future. As these trees increase in size and dominance, the herbaceous understory and browse component will slowly decrease as canopy cover increases. The herbaceous understory trend is stable. Crested wheatgrass dominates the site with a significant increase of nested frequency since 1992. Perennial grass sum of nested frequency has changed little since 1992. Perennial forb sum of nested frequency shows a slight increase, but forbs are currently a minor component of the herbaceous understory.

TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - stable (3)

2003 TREND ASSESSMENT

Trend for soil is down. Bare soil increased from 30% to 61%, and vegetation and litter cover both declined. Erosion remains low due to drought for several years, but the potential for erosion is high especially during severe thunderstorms. Trend for browse is down. Mountain big sagebrush density declined from 1,340 plants/acre in 1998 to 700 in 2003, and percent young which was moderately high in both 1992 and 1998 declined to only 6% of the population. Decadence increased from 1% in 1998 to 26% in 2003. Bitterbrush density remains stable, but this species is in low abundance on the site. Bitterbrush continues to show moderate to heavy use. The herbaceous understory has a downward trend as perennial grass sum of nested frequency declined 58%. Five of the perennial grass species that were sampled on the site significantly declined in nested frequency in 2003, most notably crested wheatgrass. Perennial forbs remain limited on the site.

TREND ASSESSMENT

soil - down (1)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 1

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	Agropyron cristatum	c288	b216	c281	a107	12.81	17.80	3.30
G	Agropyron intermedium	b45	c143	b60	a7	4.77	1.26	.02
G	Agropyron smithii	a-	b39	b35	b52	1.27	.66	.84
G	Agropyron spicatum	-	4	8	-	.63	.05	-
G	Bouteloua gracilis	a27	b53	ab51	a28	2.32	.62	.51
G	Bromus tectorum (a)	-	-	2	-	-	.00	-
G	Carex spp.	a3	ab12	b22	a-	.27	.31	-
G	Elymus junceus	-	4	-	-	.06	-	-
G	Oryzopsis hymenoides	a-	c27	b12	ab3	.63	.06	.01
G	Poa fendleriana	a-	a4	b13	a1	.03	.06	.00
G	Poa secunda	-	-	4	3	-	.01	.00
G	Sitanion hystrix	a-	ab6	b14	a-	.33	.10	-
G	Stipa comata	9	7	6	13	.24	.22	.28
Total for Annual Grasses		0	0	2	0	0	0.00	0
Total for Perennial Grasses		372	515	506	214	23.39	21.17	5.00
Total for Grasses		372	515	508	214	23.39	21.17	5.00

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	<i>Alyssum alyssoides</i> (a)	-	-	3	-	-	.00	-
F	<i>Amaranthus</i> spp.	-	-	-	3	-	-	.03
F	<i>Arabis</i> spp.	<sub>b</sub> 11	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	-	-	-
F	<i>Astragalus argophyllus</i>	1	-	-	-	-	-	-
F	<i>Astragalus convallarius</i>	-	-	2	5	-	.03	.06
F	<i>Astragalus</i> spp.	2	1	-	-	.00	-	-
F	<i>Castilleja chromosa</i>	-	3	3	3	.03	.03	.03
F	<i>Calochortus nuttallii</i>	-	-	-	1	-	-	.00
F	<i>Cryptantha fulvocanescens</i>	<sub>b</sub> 15	<sub>ab</sub> 13	<sub>a</sub> 5	<sub>a</sub> -	.07	.04	.00
F	<i>Cymopterus</i> spp.	-	-	-	-	-	-	.00
F	<i>Descurainia</i> spp. (a)	-	<sub>b</sub> 16	<sub>a</sub> -	<sub>a</sub> -	.23	-	-
F	<i>Draba</i> spp. (a)	-	-	1	-	-	.00	-
F	<i>Erigeron pumilus</i>	4	-	-	-	-	-	-
F	<i>Ipomopsis aggregata</i>	7	3	-	-	.00	-	-
F	<i>Lappula occidentalis</i> (a)	-	-	3	1	-	.00	.00
F	<i>Lomatium</i> spp.	-	-	-	2	-	-	.03
F	<i>Lupinus argenteus</i>	<sub>b</sub> 46	<sub>b</sub> 49	<sub>b</sub> 51	<sub>a</sub> 18	2.59	2.61	2.07
F	<i>Lygodesmia spinosa</i>	-	2	2	5	.00	.03	.30
F	<i>Machaeranthera canescens</i>	3	-	4	-	-	.01	-
F	<i>Penstemon</i> spp.	11	5	4	-	.06	.00	-
F	<i>Phlox longifolia</i>	<sub>a</sub> 8	<sub>ab</sub> 11	<sub>c</sub> 39	<sub>bc</sub> 25	.08	.17	.08
F	<i>Polygonum douglasii</i> (a)	-	-	3	-	-	.01	-
F	<i>Senecio integerrimus</i>	-	-	-	1	-	-	.00
F	<i>Senecio multilobatus</i>	<sub>ab</sub> 13	<sub>a</sub> 4	<sub>a</sub> 3	<sub>b</sub> 30	.01	.03	.39
F	<i>Sphaeralcea coccinea</i>	-	6	5	6	.09	.01	.09
F	<i>Streptanthus cordatus</i>	3	-	-	1	-	-	.00
F	<i>Tragopogon dubius</i>	-	-	-	-	-	.00	-
F	<i>Trifolium</i> spp.	-	-	1	-	-	.00	-
F	Unknown forb-annual (a)	-	2	-	-	.03	-	-
F	Unknown forb-perennial	-	3	6	-	.00	.01	-
F	<i>Zigadenus paniculatus</i>	-	-	-	1	-	-	.00
Total for Annual Forbs		0	18	10	1	0.26	0.03	0.00
Total for Perennial Forbs		124	100	125	101	2.96	3.00	3.12
Total for Forbs		124	118	135	102	3.22	3.03	3.12

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

BROWSE TRENDS --

Management unit 28 , Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	Artemisia nova	1	1	0	-	.00	-
B	Artemisia tridentata tridentata	5	5	0	2.77	1.29	-
B	Artemisia tridentata vaseyana	33	45	23	4.02	6.34	2.74
B	Chrysothamnus viscidiflorus viscidiflorus	1	1	1	-	.00	-
B	Gutierrezia sarothrae	53	24	44	.51	.42	1.18
B	Juniperus osteosperma	6	4	1	1.13	.84	-
B	Opuntia spp.	12	5	9	.33	.06	.06
B	Pinus edulis	5	6	0	.15	.18	1.00
B	Purshia tridentata	2	5	4	.18	.68	.01
Total for Browse		118	96	82	9.11	9.83	4.99

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 1

Species	Percent Cover
	'03
Artemisia tridentata vaseyana	5.01
Gutierrezia sarothrae	.88
Pinus edulis	.13

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 1

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.3

POINT-QUARTER TREE DATA --

Management unit 28 , Study no: 1

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	41	25
Pinus edulis	59	34

Average diameter (in)	
'98	'03
2.7	3.2
1.6	1.9

BASIC COVER --

Management unit 28 , Study no: 1

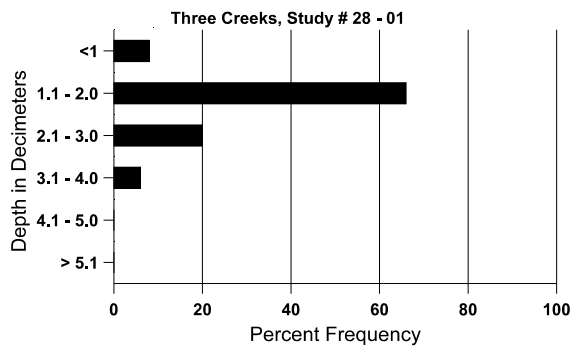
Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	4.75	31.85	35.06	13.53
Rock	3.25	12.85	3.88	3.44
Pavement	11.00	0	5.90	2.87
Litter	54.25	36.66	46.38	27.10
Cryptogams	.75	.03	.25	.00
Bare Ground	26.00	35.43	30.17	61.03

SOIL ANALYSIS DATA --

Management unit 28, Study no: 1, Study Name: Three Creeks

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
13.7	62.7 (14.6)	7.1	54.2	38.0	7.8	2.2	7.3	28.8	0.5

Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 1

Type	Quadrat Frequency		
	'92	'98	'03
Rabbit	61	29	31
Elk	-	7	15
Deer	18	18	15
Cattle	5	16	22

Days use per acre (ha)	
'98	'03
-	-
9 (22)	9 (22)
11 (27)	15 (38)
45 (111)	29 (72)

BROWSE CHARACTERISTICS --  
Management unit 28 , Study no: 1

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia nova</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>40</b>	-	-	40	-	-	0	100	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	18/30
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Artemisia tridentata tridentata</b>											
87	<b>399</b>	33	133	266	-	-	67	17	0	0	31/31
92	<b>100</b>	-	60	20	20	-	20	0	20	0	-/-
98	<b>120</b>	-	40	80	-	-	0	0	0	0	44/64
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<b>Artemisia tridentata vaseyana</b>											
87	<b>33</b>	-	-	33	-	-	100	0	0	0	9/11
92	<b>1760</b>	20	620	920	220	-	67	8	13	2	-/-
98	<b>1340</b>	20	400	920	20	160	10	0	1	0	22/30
03	<b>700</b>	-	40	480	180	460	11	6	26	6	20/28
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	19/42
03	<b>20</b>	-	-	20	-	-	0	0	-	0	19/27
<b>Gutierrezia sarothrae</b>											
87	<b>5132</b>	-	366	4700	66	-	0	0	1	0	9/9
92	<b>4300</b>	320	2040	2260	-	-	0	0	0	0	-/-
98	<b>900</b>	120	160	720	20	-	0	0	2	0	9/7
03	<b>1640</b>	-	60	1280	300	740	0	0	18	5	9/9
<b>Juniperus osteosperma</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>120</b>	-	80	40	-	-	0	0	-	0	-/-
98	<b>80</b>	-	60	20	-	80	0	0	-	0	-/-
03	<b>20</b>	-	20	-	-	140	0	0	-	0	-/-
<b>Leptodactylon pungens</b>											
87	<b>333</b>	-	-	333	-	-	0	0	-	0	6/7
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	6/10
03	<b>0</b>	-	-	-	-	-	0	0	-	0	7/9



		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Opuntia spp.</b>											
87	<b>266</b>	-	33	233	-	-	0	0	0	13	4/14
92	<b>400</b>	-	80	240	80	-	0	0	20	20	-/-
98	<b>140</b>	-	-	120	20	20	0	0	14	0	5/8
03	<b>220</b>	-	-	220	-	-	0	0	0	0	6/11
<b>Pinus edulis</b>											
87	<b>33</b>	-	33	-	-	-	0	0	-	0	-/-
92	<b>100</b>	-	80	20	-	-	0	40	-	0	-/-
98	<b>120</b>	-	80	40	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	60	0	0	-	0	-/-
<b>Purshia tridentata</b>											
87	<b>66</b>	-	-	66	-	-	0	100	0	0	6/18
92	<b>60</b>	-	-	60	-	-	0	33	0	67	-/-
98	<b>100</b>	-	20	80	-	-	60	20	0	0	15/27
03	<b>80</b>	-	-	60	20	-	25	75	25	0	7/24

Trend Study 28-3-03

Study site name: Bear Valley.

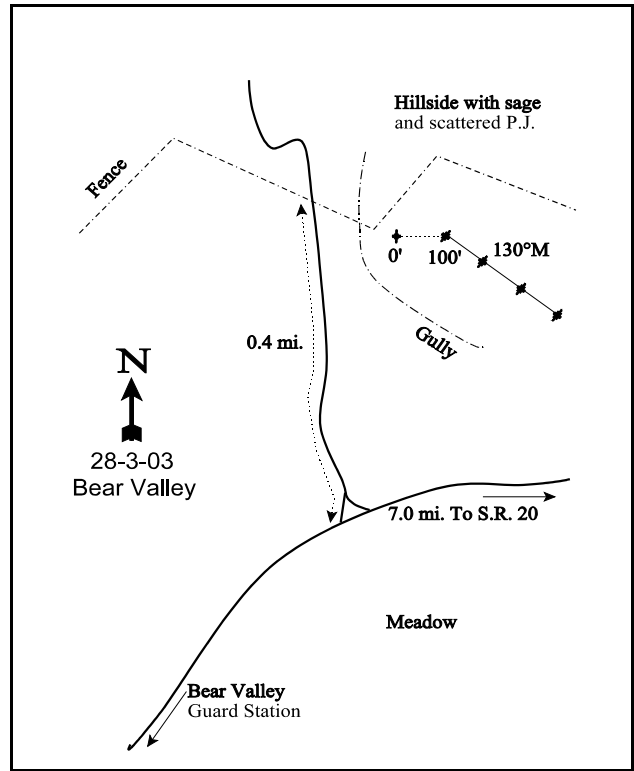
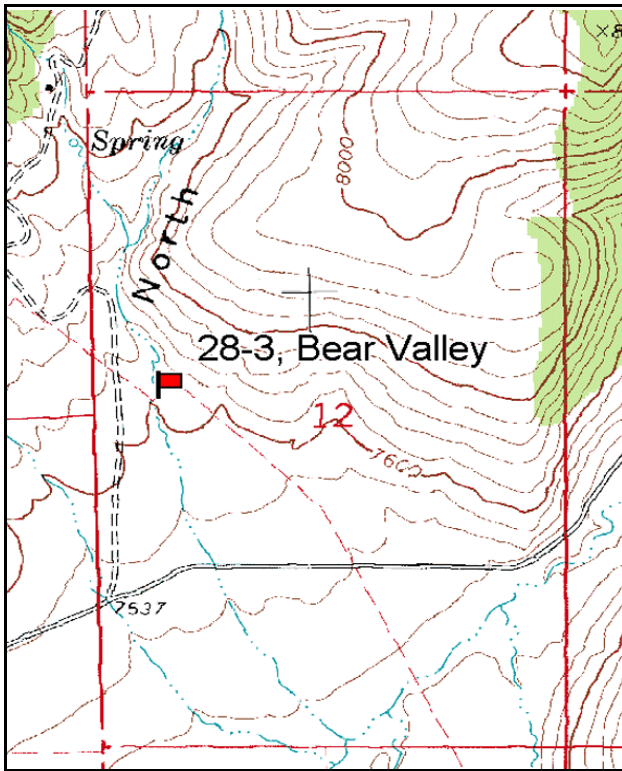
Vegetation type: Chained Shrubland.

Compass bearing: frequency baseline 77 degrees magnetic. (Lines 2-4 130°M).

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

LOCATION DESCRIPTION

From the US 89-SR 20 Junction, go approximately 7.0 miles west on SR 20 to a corral past mile marker 14. Turn left on the Little Creek Road that leads to Bear Valley. Travel 7.0 miles south on the main road to a minor fork. Turn right and go 0.4 miles to a fence and wire gate. Stop here and walk east along the fenceline to the corner. Walk 4 paces east from the fence corner to a short red fencepost tagged #7163 which is the 0-foot baseline stake. The 100-foot stake is rebar.



Map name: Little Creek Peak

Diagrammatic Sketch

Township 33S, Range 6 1/2W, Section 5

GPS: NAD 27, UTM 12S 4201913 N, 360559 E

## DISCUSSION

### Bear Valley - Trend Study No. 28-3

This study samples a seeded range in the bottom of a large valley at the north end of Upper Bear Valley. The site slopes gently (3-5%) to the southeast at an elevation of 7,600 feet. The area is at the upper limits of normal deer winter range and is also used by elk. Several cabins can be found a few miles from the transect. Pellet group transect data collected on site in 1998 estimated 3 elk, 19 deer, and 65 cow days use/acre (7 ddu/ha, 47 edu/ha, and 161 cdu/ha). Deer use remained low in 2003 at an estimated 11 days use/acre (28 ddu/ha) while cattle declined to only 22 days use/acre (56 cdu/ha). Cattle pats sampled in 2003 were from the previous grazing season. Rabbit pellets were very abundant on the site in 2003 as they were sampled in 82% of the sampling quadrats.

Soil analysis indicates a sandy loam texture with a moderately acidic pH (5.8). The soil is fairly deep with an average effective rooting depth of more than 17 inches. Vegetative cover provided primarily by perennial grasses is good, but scattered bare areas show evidence of slight erosion. An erosion condition class assessment rated soils to be stable in 2003, although pedestalling around bunchgrasses was moderately high and there was evidence of erosion in a nearby gully. Bare ground has been moderate to high in all readings, peaking at 43% in 2003.

Browse is not a prominent forage component on this seeding. Mountain big sagebrush increased in density between 1992 and 1998 due to the abundance of young plants in the population (1,200 plants/acre) in 1998. With drought prior to and including 2003, the number of young declined to only 20 plants/acre, and overall sagebrush density declined from 1,540 plants/acre in 1998 to 940 in 2003. Use varies from light to heavy depending on individual plants. No decadent plants were sampled during the first 3 readings, but 40% of the population was decadent in 2003. Annual sagebrush leaders had averaged 1.2 inches of growth when the site was read in late June of 2003. Big sagebrush is much more abundant on the slopes that surround this seeded valley bottom. Stickyleaf low rabbitbrush is the most abundant browse on the site. Density was estimated at 10,666 plants/acre in 1987, 17,080 plants/acre in 1992, and 11,320 plants/acre in 1998. The young age class was very abundant during all 3 of these readings ranging from 38-61% of the population. In 2003, density declined to 6,580 plants/acre due mostly to the decline in the number of young. Rabbitbrush plants are vigorous and most show light use. Other shrubs sampled on the site in low densities include rubber rabbitbrush, gray horsebrush, and broom snakeweed.

As mentioned above, mountain big sagebrush is abundant on the slopes that surround the valley bottom, although the transect samples the valley bottom which is dominated by seeded grasses, primarily crested wheatgrass. Crested wheatgrass has maintained a nearly stable frequency over the years and has been sampled in 98-100% of the quadrats in all readings. Crested wheatgrass has provided at least 90% of the total grass cover on the site since 1992. Western wheatgrass is second in abundance to crested wheatgrass. The wheatgrasses were noted as being large and vigorous with light to moderate utilization in 1998. Blue grama and a sedge are scattered throughout the site and both show a significant decline in nested frequency since 1987. Forbs were diverse and moderately abundant from 1987-1998. In 2003 with drought conditions, perennial forbs declined in sum of nested frequency by nearly 90%, and annual forbs declined by nearly 98%. Although forbs are less important as winter forage, lupine, yellow salsify, groundsel, and dandelion provide desirable spring and summer feed. Of these, only lupine was sampled in 2003 although it significantly declined in nested frequency.

### 1987 APPARENT TREND ASSESSMENT

Ground cover is good in this seeding even though bare soil was estimated at 18%. Rocks and/or pavement cover an additional 17% of the ground surface. The bunchgrasses and associated litter provide good ground cover, but there is apparently room for increase. Browse on the site is dominated by low rabbitbrush which appears to be increasing.

### 1992 TREND ASSESSMENT

The site had recently been grazed, so bare ground estimates were higher than in 1987 at 37%. Litter cover has also greatly declined with extended drought. No erosion was evident, although some soil pedestalling was noted. Trend for soil is slightly down. The browse trend is slightly down due to the low densities for mountain big sagebrush and rubber rabbitbrush. The less desirable low rabbitbrush has increased to 17,080 plants/acre and maintains a dynamic reproductive potential. Trend for herbaceous understory is stable. Nested frequencies of perennial grasses and forbs showed little change.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - stable (3)

### 1998 TREND ASSESSMENT

The soil trend is slightly upward with an increase in percent vegetation and litter cover. Erosion potential is still present, but is greatly reduced due to the levelness of the site. Bare ground also declined in 1998. The browse trend is stable. The mountain big sagebrush density has increased since 1992, but this is a mostly young population that still needs to become established. The population exhibits good biotic potential, no decadency, and light utilization. The low rabbitbrush population density is fluctuating between years most likely due to precipitation patterns. The herbaceous understory trend is stable as the total perennial herbaceous understory sum of nested frequency has increased since 1992. Perennial grass sum of nested frequency has declined slightly, while perennial forb sum of nested frequency has increased since 1992.

#### TREND ASSESSMENT

soil - slightly upward (4)

browse - stable (3)

herbaceous understory - stable (3)

### 2003 TREND ASSESSMENT

Trend for soil is down. Bare ground increased while vegetation and litter cover both decreased. Nested frequency of perennial grasses and forbs declined with drought conditions as well. These negative changes translate into increased erosion potential due to less protective cover on the soil surface. Trend for browse is down. The mountain big sagebrush population declined in density, and percent decadence increased to 40%. Recruitment into the population by young plants was very high in 1998 at 78%, but declined to only 2% in 2003. Trend for the herbaceous understory is slightly down overall. Crested wheatgrass dominates the site with western wheatgrass being of secondary importance. Perennial grasses are stable in nested frequency, and production increased as average cover went from 19% to 27%. Forbs are down with an 88% decline in sum of nested frequency due to drought conditions and competition with crested wheatgrass. Yellow salsify, dandelion, lupine, and groundsel are important species that provide spring and summer forage. Of these, only lupine was sampled in 2003.

TREND ASSESSMENT

soil - down (1)

browse - down (1)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 3

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	Agropyron cristatum	<sub>b</sub> 320	<sub>a</sub> 297	<sub>ab</sub> 299	<sub>ab</sub> 318	17.26	17.40	25.88
G	Agropyron smithii	41	73	58	42	.31	.45	.34
G	Bouteloua gracilis	<sub>c</sub> 32	<sub>bc</sub> 25	<sub>ab</sub> 7	<sub>a</sub> 3	.43	.21	.15
G	Bromus tectorum (a)	-	<sub>a</sub> -	<sub>b</sub> 18	<sub>b</sub> 38	-	.52	.76
G	Carex spp.	<sub>c</sub> 19	<sub>bc</sub> 10	<sub>a</sub> -	<sub>ab</sub> 3	.02	-	.00
G	Elymus junceus	3	1	2	3	.00	.00	.15
G	Poa pratensis	<sub>a</sub> 5	<sub>a</sub> 2	<sub>b</sub> 12	<sub>a</sub> -	.03	.37	-
G	Stipa comata	<sub>ab</sub> 27	<sub>b</sub> 44	<sub>a</sub> 13	<sub>a</sub> 9	1.10	.37	.26
Total for Annual Grasses		0	0	18	38	0	0.52	0.76
Total for Perennial Grasses		447	452	391	378	19.17	18.82	26.78
Total for Grasses		447	452	409	416	19.17	19.34	27.54
F	Agoseris glauca	-	-	2	2	-	.00	.03
F	Androsace septentrionalis (a)	-	<sub>b</sub> 15	<sub>c</sub> 162	<sub>a</sub> -	.03	2.82	-
F	Arabis spp.	2	-	-	-	-	-	-
F	Artemisia ludoviciana	11	3	11	3	.00	.56	.00
F	Astragalus panguicensis	3	8	2	-	.02	.01	-
F	Castilleja linariaefolia	-	-	-	10	-	-	.18
F	Chaenactis douglasii	3	-	-	-	-	-	-
F	Cirsium spp.	-	8	4	5	.04	.15	.04
F	Collinsia parviflora (a)	-	<sub>a</sub> -	<sub>b</sub> 112	<sub>a</sub> -	-	.91	-
F	Crepis acuminata	-	-	4	-	-	.01	-
F	Descurainia pinnata (a)	-	-	2	1	-	.00	.00
F	Dracocephalum parviflorum	-	-	3	-	-	.01	-
F	Epilobium brachycarpum (a)	-	-	1	-	-	.00	-
F	Eriogonum cernuum (a)	-	4	-	-	.01	-	-
F	Erigeron flagellaris	1	-	-	-	-	-	-
F	Erigeron pumilus	-	-	-	2	-	-	.00
F	Euphorbia spp.	-	-	3	-	-	.03	-
F	Ipomopsis aggregata	-	-	1	-	-	.00	-
F	Lappula occidentalis (a)	-	<sub>a</sub> 12	<sub>b</sub> 116	<sub>a</sub> 12	.03	1.89	.04
F	Lepidium spp. (a)	-	2	-	-	.00	-	-

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	Lupinus argenteus	c <sup>91</sup>	b <sup>70</sup>	c <sup>109</sup>	a <sup>7</sup>	2.97	1.35	.30
F	Lygodesmia spinosa	a <sup>10</sup>	b <sup>16</sup>	ab <sup>14</sup>	ab <sup>12</sup>	.27	.39	.39
F	Microsteris gracilis (a)	-	a <sup>3</sup>	b <sup>216</sup>	a <sup>3</sup>	.00	2.27	.00
F	Oenothera coronopifolia	-	-	10	-	-	.07	-
F	Oenothera pallida	c <sup>35</sup>	ab <sup>9</sup>	bc <sup>27</sup>	a <sup>-</sup>	.05	.31	-
F	Penstemon spp.	-	-	1	-	-	.00	-
F	Phlox longifolia	b <sup>50</sup>	b <sup>61</sup>	c <sup>140</sup>	a <sup>7</sup>	.15	.86	.16
F	Polygonum douglasii (a)	-	b <sup>31</sup>	c <sup>94</sup>	a <sup>-</sup>	.07	1.00	-
F	Senecio douglasii	b <sup>30</sup>	b <sup>27</sup>	a <sup>-</sup>	a <sup>-</sup>	.54	-	-
F	Senecio multilobatus	-	-	1	-	-	.00	-
F	Sphaeralcea coccinea	-	-	9	-	-	.07	-
F	Taraxacum officinale	b <sup>11</sup>	ab <sup>5</sup>	b <sup>12</sup>	a <sup>-</sup>	.01	.06	-
F	Tragopogon dubius	b <sup>18</sup>	ab <sup>1</sup>	c <sup>55</sup>	a <sup>-</sup>	.00	.62	-
F	Unknown forb-annual (a)	-	-	37	-	-	.12	-
Total for Annual Forbs		0	67	740	16	0.15	9.05	0.04
Total for Perennial Forbs		265	208	408	48	4.06	4.56	1.12
Total for Forbs		265	275	1148	64	4.21	13.61	1.17

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

#### BROWSE TRENDS --

Management unit 28 , Study no: 3

T y p e	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	Artemisia tridentata vaseyana	5	31	19	.13	1.25	2.79
B	Chrysothamnus nauseosus	1	19	0	.15	1.25	-
B	Chrysothamnus viscidiflorus viscidiflorus	99	99	86	4.56	10.96	2.63
B	Gutierrezia sarothrae	0	0	2	-	-	.00
B	Tetradymia canescens	5	6	5	.44	.21	.30
Total for Browse		110	155	112	5.28	13.68	5.73

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 3

Species	Percent Cover
	'03
Artemisia tridentata vaseyana	1.31
Chrysothamnus viscidiflorus viscidiflorus	2.08
Tetradymia canescens	.05

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 3

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.2

BASIC COVER --

Management unit 28 , Study no: 3

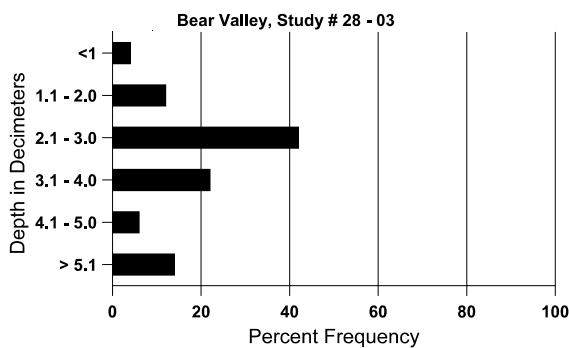
Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	7.00	28.50	45.32	34.58
Rock	4.75	6.33	.26	.27
Pavement	11.50	0	11.18	5.51
Litter	58.50	25.89	48.66	24.17
Cryptogams	0	0	.00	0
Bare Ground	18.25	37.15	28.85	42.65

SOIL ANALYSIS DATA --

Management unit 28, Study no: 3, Study Name: Bear Valley

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
17.3	62.0 (12.9)	5.8	64.2	20.0	15.8	2.3	19.9	1542.4	0.3

Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 3

Type	Quadrat Frequency		
	'92	'98	'03
Rabbit	88	19	82
Elk	-	2	-
Deer	10	23	9
Cattle	3	29	8

Days use per acre (ha)	
'98	'03
-	-
3 (7)	-
19 (47)	11 (28)
65 (161)	23 (56)

BROWSE CHARACTERISTICS --

Management unit 28 , Study no: 3

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>											
87	<b>933</b>	-	333	600	-	-	36	7	0	7	7/6
92	<b>120</b>	40	20	100	-	-	50	0	0	0	-/-
98	<b>1540</b>	160	1200	340	-	40	9	0	0	21	21/28
03	<b>940</b>	20	20	540	380	60	26	17	40	2	22/27
<i>Chrysothamnus nauseosus</i>											
87	<b>266</b>	-	66	200	-	-	0	0	-	0	20/13
92	<b>20</b>	-	-	20	-	-	100	0	-	100	-/-
98	<b>560</b>	-	100	460	-	-	0	0	-	0	11/17
03	<b>0</b>	-	-	-	-	20	0	0	-	0	24/34
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
87	<b>10666</b>	133	6466	3600	600	-	.62	0	6	6	17/12
92	<b>17080</b>	480	9060	7500	520	-	12	1	3	.93	-/-
98	<b>11320</b>	160	4260	6860	200	140	3	0	2	2	14/16
03	<b>6580</b>	20	920	4800	860	180	2	11	13	4	9/8
<i>Gutierrezia sarothrae</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>100</b>	-	-	100	-	-	0	0	-	0	3/4
<i>Symphoricarpos oreophilus</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	16/14
03	<b>0</b>	-	-	-	-	-	0	0	-	0	37/82



		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Tetradymia canescens</i>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>240</b>	-	80	140	20	-	8	0	8	0	-/-
98	<b>180</b>	-	20	160	-	-	11	0	0	0	14/21
03	<b>200</b>	-	-	140	60	-	10	10	30	0	11/13

Trend Study 28-4-03

Study site name: Buckskin Valley.

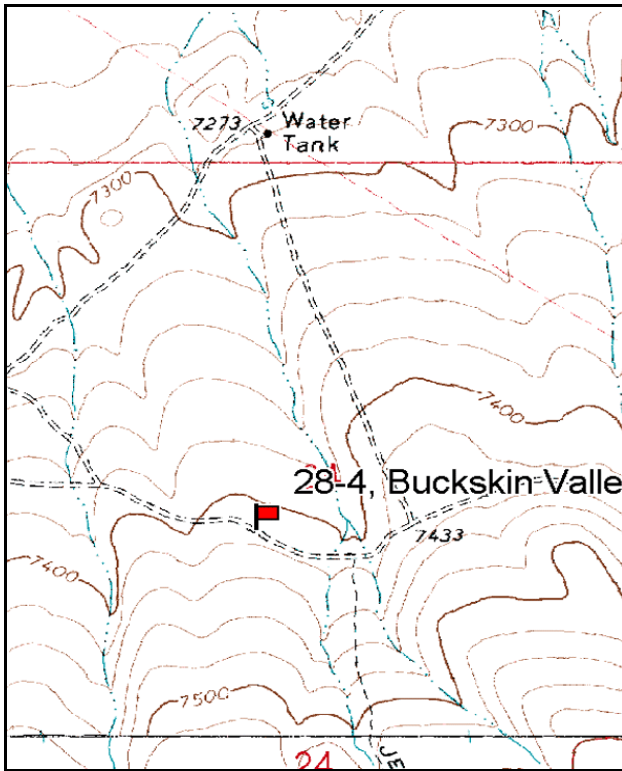
Vegetation type: Mixed Mountain Brush.

Compass bearing: frequency baseline 182 degrees magnetic.

Frequency belt placement: line 1 (11 & 71ft), line 2 (34ft), line 3 (59ft), line 4 (95ft). Rebar: belt 4 on 10ft.

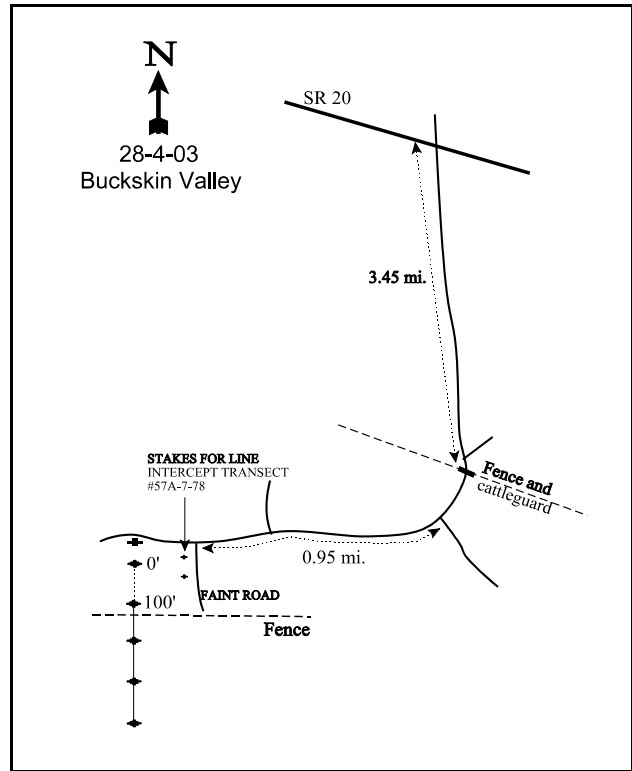
LOCATION DESCRIPTION

From SR 20 just west of mile marker 7, turn south onto the Buckskin Valley road. Travel 3.45 miles to a cattleguard. Just beyond the fence and cattleguard, bear right and proceed west 0.95 miles to an intersection where a very faint road goes to the south. About 60 feet west of this intersection is the witness post on the south (left) side of the road. The 0-foot stake is 6 feet southeast of the witness post. The 0-foot stake is a 2 foot tall green fencepost marked by a red browse tag #9005. The frequency baseline runs south-southwest from here. The old line-intercept transect 57A-7-78 is marked by a red-painted steel fencepost 10 feet east of this study.



Map Name: Burnt Peak

Township 32S, Range 7W, Section 24



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4207348 N, 359509 E

## DISCUSSION

### Buckskin Valley - Trend Study No. 28-4

Buckskin Valley, located on the northern end of the unit, is important big game transitional range. This study samples a mountain big sagebrush dominated community at an elevation of 7,400 feet. The study site slopes gently (5%) to the northeast. The lower areas have been extensively treated by the BLM to enhance livestock grazing. The area where the transect is located, in the upper part of the valley, is a cattle-sheep allotment used for late spring grazing, although cattle were on the site during the 1992 reading in early August. A pellet group transect read on the study site in 1998 estimated 49 deer days use/acre (121 ddu/ha) and 7 cow days use/acre (17 cdu/ha). Pellet group transect data collected in 2003 estimated 51 deer, 1 cow, and 12 sheep days use/acre (126 ddu/ha, 2 cdu/ha, and 30 sdu/ha). Sheep had grazed the site in 2003 prior to sampling, while deer use appeared to be from the winter.

Soil analysis indicates a loam texture with a moderately acidic pH (5.9). The effective rooting depth was estimated at just over 14 inches. The soil is dark in color and rocks are fairly common on the surface. There is evidence of compaction and crusting due to the relatively high clay content (26%). However, erosion is minimal and soils were given a stable rating in 2003 from an erosion condition class assessment. Vegetation and litter cover are abundant and effectively protect the soil surface from erosion. Bare ground was moderate in 2003 at 18%.

A dense stand of mountain big sagebrush dominates the study site. Population density was estimated at 5,160 plants/acre in 1998 and 4,620 plants/acre in 2003. Canopy cover of mountain big sagebrush was estimated at nearly 35% in 2003. The population is overly mature with moderate to high decadence in all years. Percent decadence has ranged from 26%-56%, with decadent plants making up 44% of the population in 2003. About 1/4 of the decadent age class in 1998 and 2003 was classified as dying. The proportion of the population made up of seedling and young plants has been low in all readings. Utilization of sagebrush was moderate to heavy in 1987 and 1992, moderate in 1998, and mostly light in 2003. Sagebrush vigor has been normal on the majority of the population in all years. Sagebrush leaders had averaged 1.5 inches of annual growth when the site was read in late June of 2003. This site would be a good candidate for mechanical treatment to thin out the sagebrush population in favor of bitterbrush and the herbaceous understory.

Interspersed in the dense sagebrush canopy are highly preferred bitterbrush plants. Bitterbrush density was estimated at just under 2,000 plants/acre in 1998 and 2003, and canopy cover was estimated at 7% in 2003. Young plants were very abundant in 1987 and 1992 as they made up 50% and 34% of the population respectively. The proportion of young in the population has steadily declined since 1992 at 15% in 1998 and 3% in 2003. Utilization has been moderate to heavy in all readings, while vigor has been mostly normal. Moderate to heavy use on bitterbrush occurs as a result of use by big game and sheep. Bitterbrush leaders averaged 2 inches of annual growth when the site was read in late June of 2003. Other browse species that occur in low densities include Gambel oak, snowberry, and prickly pear cactus.

Sheltered by the dense shrub overstory is a variety of fairly abundant herbaceous species. Western wheatgrass, bottlebrush squirreltail, Letterman needlegrass, mutton bluegrass, and Kentucky bluegrass are the predominant perennial grasses. Cheatgrass is also fairly abundant and was sampled in over half of the quadrats in 1998 and 2003, a significant increase since 1992. Cheatgrass does not pose a serious fire hazard yet, but with further increases it could. Perennial grass sum of nested frequency has declined with each reading since 1992. Forbs had high diversity and abundance on this site from 1987-1998, but showed a moderate decline in sum of nested frequency and average cover in 2003 with drought. Prior to 2003, the most abundant perennial forbs included timber milkvetch, douglas chaenactis, thistle, redroot eriogonum, silvery lupine, longleaf phlox, clover, and foothill deathcamas. A lot of these species had lower nested frequency values in 2003 compared to 1998. The annual, littleflower collinsia, was very abundant in 1998 and 2003.

This species accounted for 69% of the total forb cover in 2003. As with grasses, sum of nested frequency of perennial forbs declined in 2003.

#### 1987 APPARENT TREND ASSESSMENT

Soil is well protected from erosion on this site with litter providing an estimated 75% ground cover. Overstory and basal vegetative cover is also good, leaving only 9% bare soil exposed. The soil trend appears stable. The sagebrush population is overly mature with little reproductive potential and a high proportion of decadent plants. Bitterbrush has a younger population with good biotic and reproductive potentials. However, 73% of the bitterbrush encountered displayed heavy use. Trend for these key browse species appears stable for the time being. Herbaceous plants are diverse and fairly abundant.

#### 1992 TREND ASSESSMENT

The soil trend appears stable with abundant litter and vegetation cover with 15% bare ground. Browse trend is down for sagebrush due to low biotic and reproductive potentials and increased heavy use and decadence. Decadence increased from 36% to 56% in 1992. Sagebrush makes up 72% of the total browse cover. Trend for bitterbrush is slightly up, but it is still being heavily utilized and it only makes up 17% of the browse cover. Overall, the browse trend is slightly down. The herbaceous understory is diverse and abundant. Grasses account for 18% of the total vegetative cover while forbs make up 13%. Perennial herbaceous understory sum of nested frequency slightly increased indicating a slightly upward trend.

##### TREND ASSESSMENT

soil - stable (3)

browse - slightly down (2)

herbaceous understory - slightly upward (4)

#### 1998 TREND ASSESSMENT

The soil trend is slightly upward with an increase in the proportion of protective ground cover. Although percent bare ground increased slightly, there is adequate vegetative and litter cover to protect against erosion. Ideally, percent browse cover would be lower and more of the cover would be contributed by the herbaceous understory. While browse dominates the site, herbaceous cover will remain low as the grasses and forbs are shaded out. The browse trend is slightly downward. The mountain big sagebrush population will continue to decline as long as the biotic potential stays low. The mountain big sagebrush population has a lower rate of decadence than in 1992, but the percentage of decadent plants classified as dying has increased. A slight thinning of the mountain big sagebrush population would not be detrimental and would greatly benefit the herbaceous understory. The antelope bitterbrush population is healthy with good biotic potential and many young plants encountered. The herbaceous understory trend is downward with a decrease in perennial herbaceous understory sum of nested frequency from 919 in 1992 to 705 in 1998. Cheatgrass has significantly increased in nested frequency since 1992 and could easily dominate the understory in a matter of years. If this happens, the site is at risk of being lost due to a wildfire.

##### TREND ASSESSMENT

soil - slightly upward (4)

browse - slightly downward (2)

herbaceous understory - down (1)

2003 TREND ASSESSMENT

Trend for soil is stable. Protective cover from vegetation and litter is high, even with a slight increase in bare ground. Erosion remains minimal. Trend for browse is slightly down. Mountain big sagebrush density decreased, percent decadence increased from 26% to 44%, and recruitment declined to only 1% of the population. In addition, about 1/4 of the decadent sagebrush sampled were classified as dying. The health of the mountain big sagebrush population is suffering from both drought and high intraspecific competition, as sagebrush canopy cover was estimated at nearly 35%, and population density numbers almost 5,000 plants/acre. The sagebrush population could use a period of self-thinning which appears to be happening at the present time. The bitterbrush population showed lower recruitment and higher decadence in 2003, but total density was stable at just under 1,900 plants/acre. Use on bitterbrush is mostly heavy, but vigor remains good. The stability of the bitterbrush population helps moderate the downward trends for sagebrush. Trend for the herbaceous understory is down. Both perennial grasses and forbs have decreased sum of nested frequency values since 1998. Drought and an overly abundant mountain big sagebrush population are having a detrimental effect on the herbaceous component. This site needs to be considered for treatment. As mountain big sagebrush and bitterbrush are typically fire intolerant, prescribed fire is probably not the best alternative. Mountain big sagebrush and bitterbrush are important on this site as forage during mild winters. However, the mountain big sagebrush population needs to be lowered to allow the herbaceous species to reverse their declines since 1992. The best alternative would be mechanical treatment to decrease the sagebrush population in favor of bitterbrush and the herbaceous understory.

TREND ASSESSMENT

soil - stable (3)

browse - slightly down (2)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 4

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	Agropyron cristatum	-	-	6	-	-	.06	-
G	Agropyron smithii	<sub>b</sub> 173	<sub>ab</sub> 185	<sub>a</sub> 136	103	4.03	1.58	.94
G	Agropyron spicatum	-	-	2	3	-	.00	.03
G	Bromus ciliatus	-	2	-	-	.01	-	-
G	Bromus tectorum (a)	-	<sub>a</sub> 42	<sub>c</sub> 167	<sub>b</sub> 143	.11	2.90	1.62
G	Poa fendleriana	<sub>b</sub> 37	<sub>b</sub> 47	<sub>ab</sub> 33	<sub>a</sub> 13	1.52	.95	.40
G	Poa pratensis	<sub>a</sub> -	<sub>a</sub> -	<sub>c</sub> 44	<sub>b</sub> 14	-	2.20	.28
G	Poa secunda	-	3	2	-	.01	.01	-
G	Sitanion hystrix	<sub>b</sub> 119	<sub>b</sub> 115	<sub>a</sub> 89	<sub>a</sub> 64	2.17	1.43	.78
G	Stipa comata	<sub>a</sub> 5	<sub>b</sub> 31	<sub>a</sub> 2	<sub>a</sub> 3	.18	.01	.03
G	Stipa lettermani	<sub>a</sub> -	<sub>b</sub> 28	<sub>b</sub> 33	<sub>a</sub> 6	.51	.22	.18
Total for Annual Grasses		0	42	167	143	0.10	2.90	1.62
Total for Perennial Grasses		334	411	347	206	8.46	6.47	2.66
Total for Grasses		334	453	514	349	8.57	9.37	4.29

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	<i>Agoseris glauca</i>	-	-	4	6	-	.04	.07
F	<i>Allium</i> spp.	-	3	1	-	.00	.00	-
F	<i>Arabis holboellii</i>	<sub>b</sub> 44	<sub>b</sub> 27	<sub>a</sub> 2	<sub>a</sub> -	.06	.01	-
F	<i>Astragalus convallarius</i>	1	8	5	10	.67	.06	.12
F	<i>Astragalus panguicensis</i>	<sub>ab</sub> 6	<sub>bc</sub> 9	<sub>c</sub> 27	<sub>a</sub> -	.03	.36	-
F	<i>Astragalus</i> spp.	<sub>b</sub> 15	<sub>b</sub> 16	<sub>a</sub> 1	<sub>a</sub> -	.07	.09	-
F	<i>Balsamorhiza sagittata</i>	-	-	2	-	-	.00	-
F	<i>Calochortus nuttallii</i>	2	-	5	4	-	.01	.01
F	<i>Chaenactis douglasii</i>	<sub>c</sub> 84	<sub>c</sub> 32	<sub>b</sub> 12	<sub>a</sub> -	.17	.02	-
F	<i>Cirsium wheeleri</i>	<sub>c</sub> 35	<sub>bc</sub> 24	<sub>ab</sub> 16	<sub>a</sub> 1	.38	.41	.01
F	<i>Cordylanthus kingii</i> (a)	-	-	-	4	-	-	.03
F	<i>Comandra pallida</i>	5	7	6	12	.03	.03	.07
F	<i>Collinsia parviflora</i> (a)	-	<sub>a</sub> 115	<sub>b</sub> 262	<sub>c</sub> 330	.55	2.22	9.04
F	<i>Crepis acuminata</i>	-	9	6	5	.04	.05	.07
F	<i>Cryptantha</i> spp.	-	-	-	1	-	-	.00
F	<i>Erigeron eatonii</i>	<sub>b</sub> 11	<sub>a</sub> -	<sub>a</sub> -	<sub>ab</sub> 1	-	-	.00
F	<i>Erigeron</i> spp.	-	-	2	-	-	.00	-
F	<i>Eriogonum racemosum</i>	<sub>b</sub> 41	<sub>b</sub> 32	<sub>ab</sub> 24	<sub>a</sub> 8	.28	.14	.05
F	<i>Eriogonum umbellatum</i>	19	18	8	3	.07	.09	.01
F	<i>Gayophytum ramosissimum</i> (a)	-	-	-	7	-	-	.01
F	<i>Ipomopsis aggregata</i>	2	-	-	-	-	-	-
F	<i>Lappula occidentalis</i> (a)	-	-	-	2	-	-	.00
F	<i>Linum lewisii</i>	-	-	2	-	-	.03	-
F	<i>Lithospermum</i> spp.	-	-	3	-	-	.03	-
F	<i>Lomatium</i> spp.	<sub>a</sub> -	<sub>b</sub> 9	<sub>a</sub> -	<sub>a</sub> -	.03	-	.00
F	<i>Lupinus argenteus</i>	31	45	55	35	1.42	3.22	1.65
F	<i>Machaeranthera canescens</i>	<sub>b</sub> 36	<sub>a</sub> 4	<sub>a</sub> 2	<sub>a</sub> -	.04	.00	-
F	<i>Microsteris gracilis</i> (a)	-	<sub>b</sub> 112	<sub>a</sub> 61	<sub>b</sub> 138	.44	.26	1.08
F	<i>Navarretia intertexta</i> (a)	-	-	-	2	-	-	.03
F	<i>Penstemon</i> spp.	-	-	-	2	-	-	.03
F	<i>Phlox longifolia</i>	<sub>b</sub> 118	<sub>c</sub> 177	<sub>b</sub> 115	<sub>a</sub> 53	1.02	.97	.24
F	<i>Polygonum douglasii</i> (a)	-	-	4	-	-	.04	-
F	<i>Senecio douglasii</i>	4	-	-	-	-	-	-
F	<i>Senecio multilobatus</i>	<sub>b</sub> 18	<sub>a</sub> 1	<sub>a</sub> 1	<sub>a</sub> -	.00	.00	-
F	<i>Sphaeralcea coccinea</i>	8	4	4	3	.01	.01	.00
F	<i>Taraxacum officinale</i>	6	1	-	-	.03	-	-

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	Tragopogon dubius	8	2	7	-	.00	.04	-
F	Trifolium spp.	<sub>a</sub> 16	<sub>b</sub> 42	<sub>b</sub> 43	<sub>ab</sub> 30	.15	.31	.11
F	Zigadenus paniculatus	<sub>a</sub> 7	<sub>b</sub> 38	<sub>a</sub> 5	<sub>b</sub> 37	.82	.04	.37
Total for Annual Forbs		0	227	327	483	0.99	2.53	10.21
Total for Perennial Forbs		517	508	358	211	5.38	6.02	2.86
Total for Forbs		517	735	685	694	6.37	8.55	13.08

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

#### BROWSE TRENDS --

Management unit 28 , Study no: 4

Type	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	Artemisia tridentata vaseyana	98	94	92	24.29	24.87	27.41
B	Chrysothamnus depressus	1	0	0	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	2	0	0	-	-	-
B	Juniperus scopulorum	1	1	1	-	.03	.53
B	Mahonia repens	0	0	1	-	-	.03
B	Opuntia spp.	44	28	24	1.29	1.03	.57
B	Purshia tridentata	79	65	61	5.57	8.25	6.44
B	Quercus gambelii	2	3	6	1.62	.56	.41
B	Symphoricarpos oreophilus	17	17	18	.77	3.24	1.67
Total for Browse		244	208	203	33.56	38.00	37.07

#### CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 4

Species	Percent Cover
	'03
Artemisia tridentata vaseyana	34.73
Juniperus scopulorum	.70
Opuntia spp.	.33
Purshia tridentata	6.55
Quercus gambelii	1.00
Symphoricarpos oreophilus	1.61

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 28 , Study no: 4

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.5
Purshia tridentata	2.0

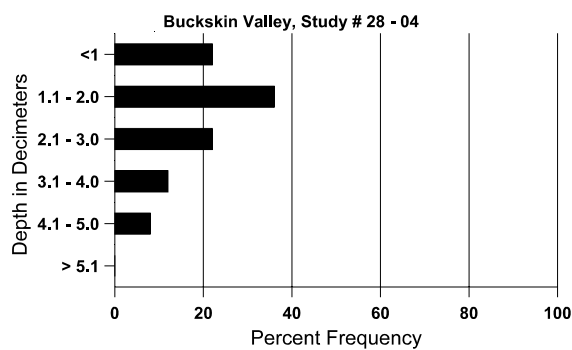
BASIC COVER --  
Management unit 28 , Study no: 4

Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	7.50	42.98	50.00	48.48
Rock	5.50	5.53	4.95	3.54
Pavement	1.00	1.26	1.68	.55
Litter	74.50	59.12	66.59	53.09
Cryptogams	2.25	1.64	.98	.21
Bare Ground	9.25	14.50	16.27	18.33

SOIL ANALYSIS DATA --  
Management unit 28, Study no: 4, Study Name: Buckskin Valley

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
14.3	50.4 (15.7)	5.9	44.2	30.0	25.8	3.8	22.7	236.8	0.4

### Stoniness Index





PELLET GROUP DATA --

Management unit 28 , Study no: 4

Type	Quadrat Frequency		
	'92	'98	'03
Sheep	-	1	6
Rabbit	44	22	37
Elk	-	1	-
Deer	28	37	20
Cattle	-	2	1

Days use per acre (ha)	
'98	'03
-	12 (30)
-	-
-	-
49 (121)	51 (126)
7 (17)	1 (2)

BROWSE CHARACTERISTICS --

Management unit 28 , Study no: 4

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>											
87	<b>8732</b>	66	933	4666	3133	-	53	20	36	7	26/28
92	<b>8980</b>	160	300	3660	5020	-	49	32	56	16	-/-
98	<b>5160</b>	200	200	3640	1320	1160	40	5	26	8	29/37
03	<b>4620</b>	-	40	2560	2020	1360	10	3	44	13	35/37
<i>Cercocarpus ledifolius</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	20	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Chrysothamnus depressus</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	8/28
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>40</b>	-	40	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Juniperus scopulorum</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	20	-	-	-	100	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	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	% poor vigor	Average Height Crown (in)
<b>Mahonia repens</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	3/4
<b>Opuntia spp.</b>											
87	<b>1132</b>	200	466	666	-	-	18	0	0	53	3/4
92	<b>2140</b>	100	820	1120	200	-	0	2	9	20	-/-
98	<b>740</b>	-	120	560	60	-	0	3	8	5	6/13
03	<b>840</b>	-	40	660	140	-	0	2	17	5	7/14
<b>Purshia tridentata</b>											
87	<b>1732</b>	866	866	866	-	-	19	73	0	0	22/31
92	<b>3080</b>	140	1060	1700	320	-	34	53	10	3	-/-
98	<b>1900</b>	180	280	1560	60	40	36	47	3	2	22/35
03	<b>1860</b>	-	60	1360	440	60	13	72	24	3	22/35
<b>Quercus gambelii</b>											
87	<b>133</b>	66	133	-	-	-	50	0	0	0	-/-
92	<b>460</b>	120	100	320	40	-	43	0	9	9	-/-
98	<b>400</b>	20	40	360	-	-	0	0	0	0	75/39
03	<b>380</b>	-	180	-	200	40	0	0	53	0	58/32
<b>Symphoricarpos oreophilus</b>											
87	<b>599</b>	-	466	133	-	-	22	0	0	0	20/19
92	<b>700</b>	100	200	480	20	-	57	11	3	9	-/-
98	<b>720</b>	-	120	600	-	-	33	0	0	0	14/25
03	<b>980</b>	-	20	960	-	-	6	29	0	0	11/18

Trend Study 28-5-03

Study site name: Swayback Knoll.

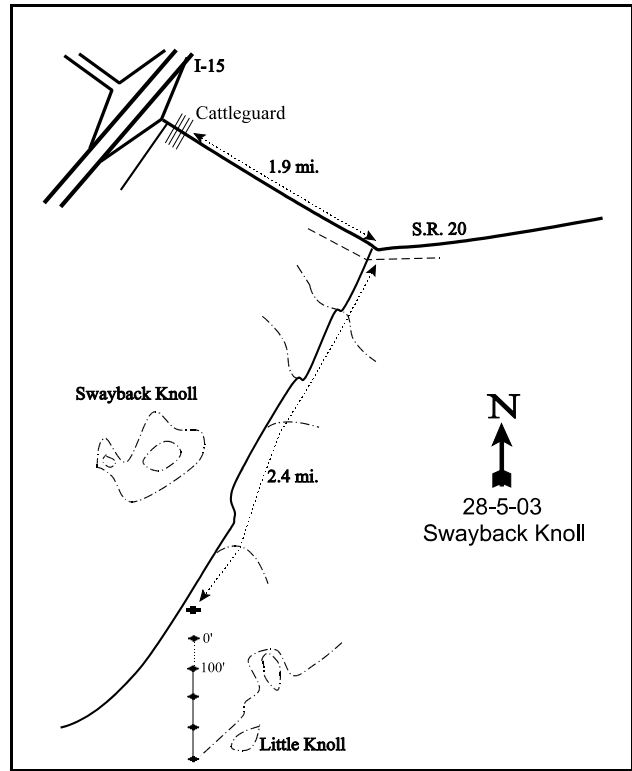
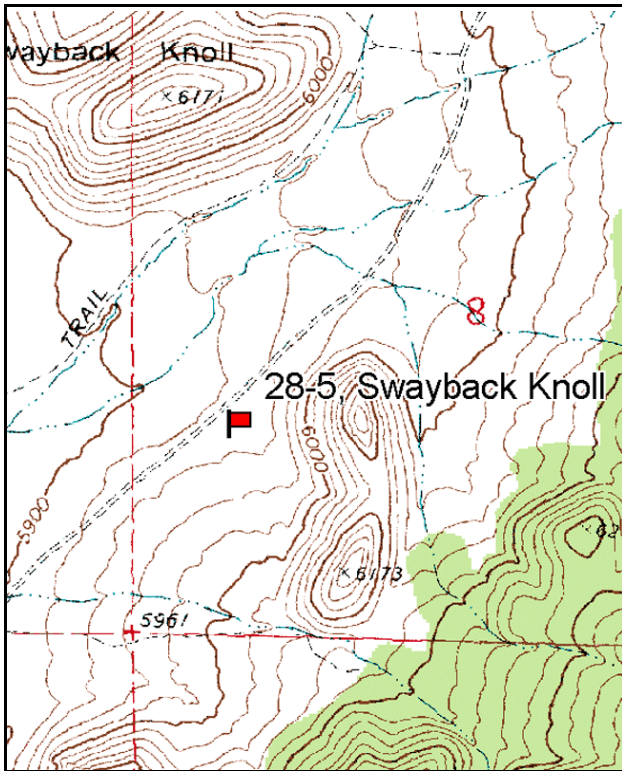
Vegetation type: Wyoming Big Sagebrush.

Compass bearing: frequency baseline 164 degrees magnetic.

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

LOCATION DESCRIPTION

From the cattleguard off SR 20 and I-15, travel 1.9 miles on SR 20 to a dirt road on the right. Travel south for 2.4 miles to a sage flat west of rocky knolls. There is a witness post on the left (east) side of the road. The 0-foot baseline stake is 200 feet away from the witness post at a bearing of 118 degrees magnetic. The 0-foot stake is marked by browse tag #477.



Map Name: Buckhorn Flat

Diagrammatic Sketch

Township 32S, Range 7W, Section 8

GPS: NAD 27, UTM 12S 4210617 N, 352662 E

## DISCUSSION

### Swayback Knoll - Trend Study No. 28-5

This trend study samples critical deer winter range below the Hurricane Cliffs in the northwest corner of the Panguitch Lake management unit. The transect lies on an alluvial fan at the base of the foothills east of I-15 and just south of Highway 20. This study samples one of the key wintering areas for mule deer on the east side of I-15, and has been used by as many as 400 deer during winter months. The transect is located on land administered by the BLM at an elevation of 6,000 feet. The study site slopes gently to the northwest at 6%. The range for many miles around is dominated by a depleted Wyoming big sagebrush type bordered by pinyon-juniper covered hills, which provide the nearest protective cover. Very little other forage is available. Winter range in this particular area is limited by the deer-proof fence along I-15 as well as the predominance of agricultural land which is also being fenced to prevent deer depredation. A pellet group transect read on site in 1998 and 2003 estimated 82 deer days use/acre (203 ddu/ha) in both years. A single elk pellet group was also sampled in 2003. Several dead deer carcasses were found on the site in 1998 and 2003, and a 4-point antler shed was found in 1998.

Soil analysis indicates a loam texture with a neutral pH (6.7). The average effective rooting depth was almost 12 inches with rock and pavement scattered throughout the soil profile. Some soil loss occurs from the bare interspaces, but erosion is minimal for the most part. The shrub interspaces have a continuous, unbroken surface of rocks and erosion pavement. Rocks are of igneous origin (basalt), which causes higher soil temperatures during the summer months. Soil temperature averaged 66°F at 13 inches in depth in 1998 and 70.2°F in 2003. Two small active gullies are located near the study site. An erosion condition class assessment completed in 2003 gave soils a stable rating. Bare ground has been moderate in all readings ranging from 16%-32%. Vegetation and litter cover, together with the abundance and rock and pavement on the soil surface are adequate to protect against severe erosion.

The only browse species encountered on the site consists of a dense stand of Wyoming big sagebrush with low densities of prickly pear and cholla cactus. Wyoming big sagebrush density was estimated at 5,220 plants/acre in 2003. From 1987-1998, the age structure of the Wyoming big sagebrush population was stable with moderate recruitment by young plants (12-18%) and moderate decadence (22-29%). In 2003, recruitment declined to 4%, while percent decadence increased from 22% to 33%. From 1987-1998, the number of young in the population exceeded the number of decadent plants classified as dying. In 2003, this was not the case as the decadent, dying class of plants was estimated at 38% (~650 plants/acre), a large increase from an average of 15% between 1987-1998. Utilization of sagebrush has been moderate to heavy in all readings, with the heaviest use occurring in 1987 and 2003. Although drought conditions undoubtedly played a role in increased decadence and lower recruitment in the big sagebrush population in 2003, most plants displayed surprisingly good vigor. Canopy cover of Wyoming big sagebrush was estimated at 16% in 2003, and annual leaders had averaged less than 1 inch of growth when the site was sampled in mid-June.

Desirable herbaceous vegetation is very limited and diversity is low, even for a Wyoming big sagebrush type. Only 3 perennial grasses were encountered in 1987 while no perennial forbs were found. During the 1992 reading, 5 perennial grasses were sampled, with bottlebrush squirreltail, galleta, and purple three-awn being the most numerous. Two annual grasses, cheatgrass and six weeks fescue, contributed 15% of the herbaceous understory cover in 1992. In 1998, cheatgrass dominated the understory as it provided 85% of the grass cover and 53% of the total vegetation cover. Due to the fine fuels provided by dried cheatgrass, the site was primed for a major wildfire in 1998. With drought conditions following the 1998 reading, cheatgrass declined significantly in 2003 in both nested frequency and average cover, but was still sampled in 51% of the quadrats. In 2003, cheatgrass was visibly more abundant on the hillsides that surround the transect, and with normal precipitation patterns, cheatgrass will likely again dominate the site. Sum of nested frequency of perennial grasses increased between 1987 and 1992, but has declined with each reading since. Bottlebrush

squirreltail has been the most abundant desirable perennial grass on the site in all readings. Perennial forbs have been almost non-existent on the site since it was established. Only 2 perennial forbs were sampled in 2003. Annual forbs have steadily decreased on the site since 1992 with a *Gilia* being the most abundant.

#### 1987 APPARENT TREND ASSESSMENT

An almost complete ground covering of rock and erosion pavement is interrupted only by litter under the shrubs and occasional bare patches. This amounts to an estimated 50% ground cover from rock and pavement and 18% exposed soil. Basal vegetative cover is low due to the lack of herbaceous vegetation. Sagebrush is heavily hedged, but has good vigor and an adequate number of seedlings and young. Herbaceous vegetation is deficient. Only 3 perennial grasses and no perennial forbs were encountered. High surface temperatures and dry conditions are likely responsible for the lack of herbaceous plants. This trend could reverse itself with increased precipitation.

#### 1992 TREND ASSESSMENT

Soil trend is down. Bare ground has increased, while litter and the combination of rock and pavement have decreased. The soil remains adequately protected by the vegetation canopy and a continuous layer of rock and pavement. Some soil movement was evident this year, likely due to recent high intensity thunderstorms, but erosion on the site is minimal. Trend for sagebrush is stable due to decreased heavy utilization and a stable decadence rate. Vigor, however has declined slightly with 9% of the shrubs sampled displaying poor vigor compared to 4% in 1987. The herbaceous understory has improved considerably since the last reading but composition is poor, especially for forbs.

##### TREND ASSESSMENT

soil - down (1)

browse - stable (3)

herbaceous understory - up (5)

#### 1998 TREND ASSESSMENT

Soil trend is slightly upward. Although percent bare ground cover has decreased by nearly 50%, and percent vegetative cover has more than doubled, the cover is mostly provided by cheatgrass. Although cheatgrass does provide some soil protection, it is not as effective at protecting the soil from overland flow as perennial grasses or forbs. The browse trend is slightly down with a decreased population density which appeared to have peaked in 1992. The Wyoming big sagebrush population appears more healthy with a fairly good biotic potential (proportion of seedlings). As cheatgrass density and cover increases in the future, there may be a decrease in the number of seedling and young plants encountered due to early spring drying soils from competition with cheatgrass. Also, as cheatgrass density and cover increases in the future, there is a risk of losing the Wyoming big sagebrush population due to a catastrophic fire. The herbaceous trend is slightly down. Cheatgrass now dominates the site. While individual perennial species nested frequency has not significantly declined since 1992, overall perennial grass sum of nested frequency has declined. Forbs are currently almost non-existent and provide little cover or forage to this site.

##### TREND ASSESSMENT

soil - slightly upward (4)

browse - slightly down (2)

herbaceous understory - slightly down (2)

2003 TREND ASSESSMENT

Trend for soil is slightly down. Bare ground increased while litter and vegetation cover both decreased. Erosion remains low, but the soil surface is less protected from high intensity thunderstorms. Trend for browse is slightly down. The density estimate for Wyoming big sagebrush is 19% higher since 1998, but recruitment is lower, and the decadence rate as well as the proportion of the decadent age class classified as dying have increased. The proportion of the sagebrush population displaying poor vigor has increased as has the number of plants displaying heavy use. Trend for the herbaceous understory is stable, but in very poor condition. Cheatgrass significantly declined in nested frequency due to drought, but remains moderately abundant and will likely dominate the site again with a return to normal precipitation patterns. Perennial grasses remain limited, and perennial forbs are virtually non-existent.

TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 5

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	<i>Aristida purpurea</i>	<sub>a</sub> 13	<sub>b</sub> 41	<sub>ab</sub> 28	<sub>ab</sub> 27	1.31	.94	.55
G	<i>Bouteloua gracilis</i>	-	-	3	1	-	.15	.00
G	<i>Bromus tectorum</i> (a)	-	<sub>b</sub> 168	<sub>c</sub> 357	<sub>a</sub> 101	.68	19.37	.98
G	<i>Hilaria jamesii</i>	<sub>a</sub> -	<sub>c</sub> 48	<sub>bc</sub> 32	<sub>b</sub> 25	.90	.39	.83
G	<i>Oryzopsis hymenoides</i>	2	5	6	9	.09	.23	.18
G	<i>Sitanion hystrix</i>	<sub>b</sub> 127	<sub>a</sub> 86	<sub>a</sub> 60	<sub>a</sub> 59	3.43	1.41	1.25
G	<i>Stipa comata</i>	<sub>a</sub> -	<sub>b</sub> 11	<sub>b</sub> 15	<sub>b</sub> 11	.15	.25	.36
G	<i>Vulpia octoflora</i> (a)	-	<sub>b</sub> 135	<sub>a</sub> 59	<sub>b</sub> 162	.51	.16	1.24
<b>Total for Annual Grasses</b>		<b>0</b>	<b>303</b>	<b>416</b>	<b>263</b>	<b>1.19</b>	<b>19.53</b>	<b>2.22</b>
<b>Total for Perennial Grasses</b>		<b>142</b>	<b>191</b>	<b>144</b>	<b>132</b>	<b>5.90</b>	<b>3.39</b>	<b>3.19</b>
<b>Total for Grasses</b>		<b>142</b>	<b>494</b>	<b>560</b>	<b>395</b>	<b>7.09</b>	<b>22.92</b>	<b>5.42</b>
F	<i>Allium</i> spp.	-	1	-	-	.00	-	-
F	<i>Calochortus nuttallii</i>	<sub>a</sub> -	<sub>b</sub> 8	<sub>ab</sub> 2	<sub>ab</sub> 3	.02	.01	.00
F	<i>Descurainia pinnata</i> (a)	-	<sub>b</sub> 16	<sub>a</sub> 2	<sub>ab</sub> 9	.04	.03	.05
F	<i>Draba</i> spp. (a)	-	-	3	4	-	.00	.01
F	<i>Eriogonum cernuum</i> (a)	-	<sub>b</sub> 24	<sub>a</sub> -	<sub>a</sub> 3	.06	-	.00
F	<i>Gilia</i> spp. (a)	-	<sub>c</sub> 160	<sub>a</sub> -	<sub>b</sub> 61	.38	-	.57
F	<i>Hackelia patens</i>	-	4	-	-	.01	-	-
F	<i>Lappula occidentalis</i> (a)	-	-	1	3	-	.00	.01
F	<i>Microsteris gracilis</i> (a)	-	12	-	-	.02	-	-
F	<i>Navarretia intertexta</i> (a)	-	-	-	3	-	-	.00

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	Orobanche fasciculata	-	-	1	-	-	.00	-
F	Phlox longifolia	-	5	5	-	.01	.01	-
F	Plantago patagonica (a)	-	<sub>a</sub> 13	<sub>b</sub> 52	<sub>a</sub> 5	.04	.38	.01
F	Ranunculus testiculatus (a)	-	<sub>b</sub> 12	<sub>c</sub> 45	<sub>a</sub> -	.04	.35	-
F	Sphaeralcea coccinea	-	6	3	1	.01	.06	.00
Total for Annual Forbs		0	237	103	88	0.59	0.77	0.66
Total for Perennial Forbs		0	24	11	4	0.06	0.09	0.00
Total for Forbs		0	261	114	92	0.66	0.87	0.67

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

#### BROWSE TRENDS --

Management unit 28 , Study no: 5

Type	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	Artemisia tridentata wyomingensis	92	92	90	11.11	12.46	18.76
B	Opuntia spp.	0	0	2	-	-	-
B	Opuntia whipplei	16	14	12	1.25	.59	1.14
Total for Browse		108	106	104	12.36	13.06	19.89

#### CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 5

Species	Percent Cover
	'03
Artemisia tridentata wyomingensis	16.26
Opuntia whipplei	1.14

#### KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 5

Species	Average leader growth (in)
	'03
Artemisia tridentata wyomingensis	0.7

BASIC COVER --

Management unit 28 , Study no: 5

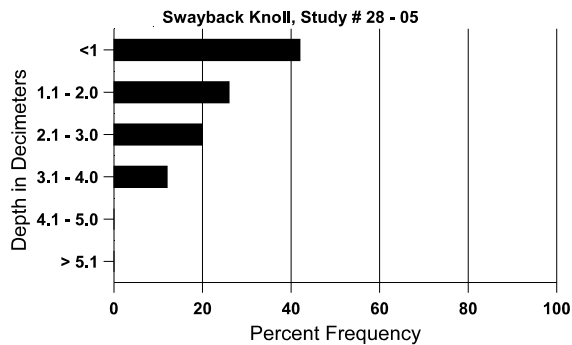
Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	5.00	15.86	34.86	28.36
Rock	9.50	17.97	8.12	13.06
Pavement	39.75	9.97	21.18	25.84
Litter	27.75	22.08	34.52	25.44
Cryptogams	.25	.22	.51	.06
Bare Ground	17.75	31.76	16.11	21.64

SOIL ANALYSIS DATA --

Management unit 28, Study no: 5, Study Name: Swayback Knoll

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
11.9	70.2 (10.9)	6.7	49.8	30.4	19.8	1.1	9.7	67.2	0.4

### Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 5

Type	Quadrat Frequency		
	'92	'98	'03
Rabbit	68	18	30
Elk	-	1	1
Deer	59	32	38

Days use per acre (ha)	
'98	'03
-	-
-	1 (2)
82 (202)	83 (205)



BROWSE CHARACTERISTICS --  
 Management unit 28 , Study no: 5

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>											
87	<b>4866</b>	466	866	2600	1400	-	23	75	29	4	21/20
92	<b>5900</b>	480	940	3240	1720	-	52	22	29	9	-/-
98	<b>4240</b>	540	500	2800	940	780	42	8	22	3	21/27
03	<b>5220</b>	-	220	3300	1700	560	48	37	33	12	20/25
<i>Opuntia spp.</i>											
87	<b>532</b>	-	266	133	133	-	0	0	25	13	6/13
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
03	<b>40</b>	-	-	40	-	-	0	0	0	0	4/6
<i>Opuntia whipplei</i>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>660</b>	100	20	580	60	-	0	0	9	0	-/-
98	<b>360</b>	-	20	320	20	60	6	0	6	6	13/34
03	<b>320</b>	-	-	240	80	40	0	0	25	13	12/27

Trend Study 28-6-03

Study site name: Cottonwood.

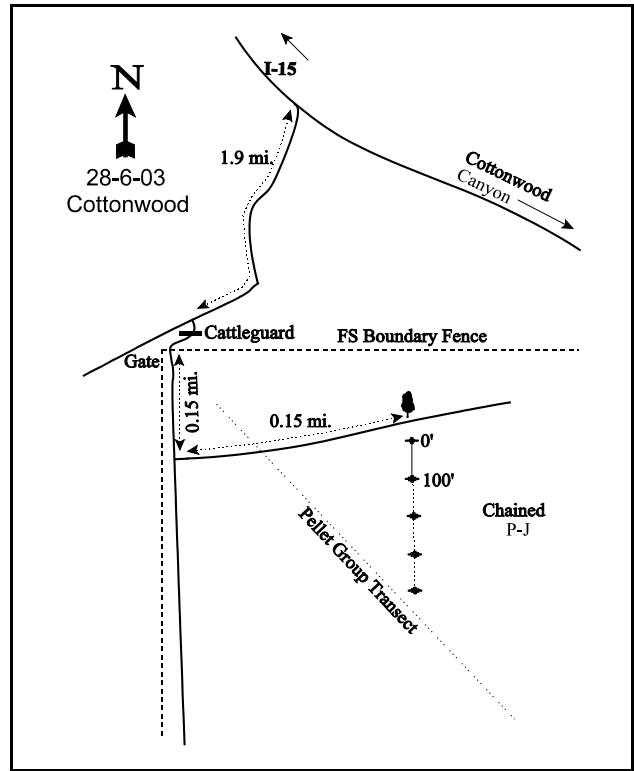
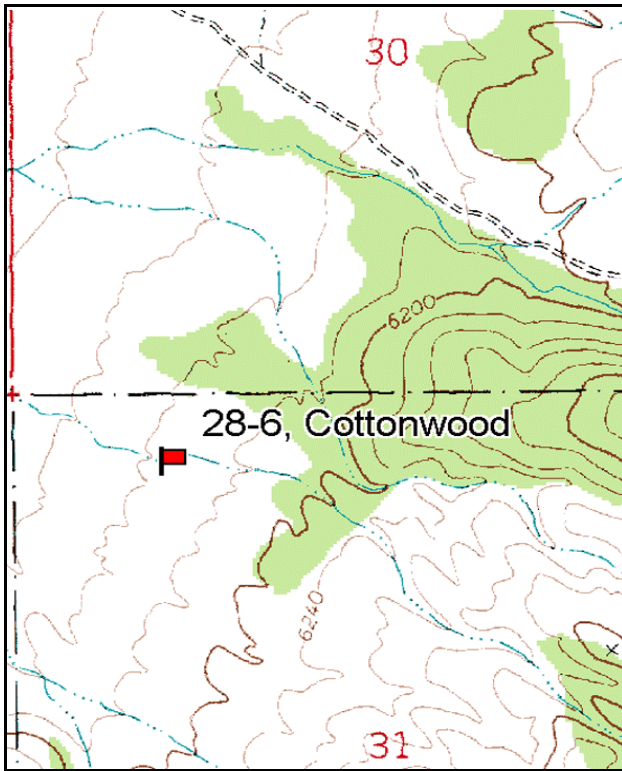
Vegetation type: Chained, Seeded P-J.

Compass bearing: frequency baseline 165 degrees magnetic.

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

LOCATION DESCRIPTION

From the intersection of SR 20 and the frontage road along the east side of I-15, travel south down the frontage road 6.6 miles to a gate on the left. Go through the gate and travel east for 1.9 miles to a cattleguard on the right. From the cattleguard, go 0.15 miles south along the fence. Turn left on an old road going up into the chaining. Continue 0.15 miles to the study site on the south side of the road. Stop next to a large pinyon. From large pinyon, walk 75 feet at 130 degrees magnetic. The 0-foot baseline stake is 20 feet south of the road. This 2 foot tall fencepost is marked with a browse tag #9006.



Map Name: Cottonwood Mountain

Diagrammatic Sketch

Township 32S, Range 7W, Section 31

GPS: NAD 27, UTM 12S 4205113 N, 351067 E

## DISCUSSION

### Cottonwood - Trend Study No. 28-6

This trend study is located on critical deer winter range west of the Hurricane Cliffs and samples a sagebrush area at the mouth of Cottonwood Canyon. The site is just above the Forest Service boundary fence at an elevation of 6,100 feet. Slope is 2-3% with a westerly aspect. The area is part of a large chaining project completed in 1970. The site is now dominated by a Wyoming big sagebrush-grass type with few pinyon or juniper trees being present. In 1992, deer sign was abundant including antler drops, pellet groups, and a carcass. A pellet group transect read on site in 1998 estimated 41 deer, 7 elk, and 2 cow days use/acre (101 ddu/ha, 17 edu/ha, and 5 cdu/ha). Pellet group transect data collected in 2003 estimated 60 deer, 3 elk, and 5 cow days use/acre (149 ddu/ha, 7 edu/ha, and 13 cdu/ha) on the site.

The soil is light brown in color with an average effective rooting depth of almost 15 inches. Textural and chemical analysis indicates a sandy loam with a slightly alkaline pH (7.5). Soil temperature averaged almost 69°F at a depth of 15 inches in 2003. Several gullies are found crossing the site, but do not appear to be very active. Some erosion is occurring on the site, but overall it is not severe. An erosion condition class assessment completed on site in 2003 resulted in a slightly eroding rating. Evidence of erosion came in several categories including surface litter movement, pedestalling, flow patterns, and rill formation. Bare ground has been moderate since 1992 ranging between 21-26% with most bare soil occurring in the shrub interspaces.

Wyoming big sagebrush is the only browse species of worth on the site. The sagebrush density appears to have stabilized at about 1,600 plants/acre in 2003 after having declined in 1992 and 1998. Utilization was very high in 1987 when 89% of the sagebrush sampled displayed heavy hedging (>60% of twigs browsed). Use declined to a more moderate level in 1992 and 1998, but again was moderate to heavy in 2003. Plants displaying poor vigor has been steady since 1992 ranging from 13-17%. The population has steadily become more decadent with each reading. Decadence was low in 1987 at 8%, peaking at 49% in 2003. The number of young in the population has steadily declined with each reading, and was numbered at only 20 plants/acre in 2003. Furthermore, 28% (220 plants/acre) of the decadent age class was classified as dying in 2003, and with low reproduction, the population could decline by the next assessment. Annual sagebrush leaders averaged 1.6 inches of growth when the site was read in mid-June 2003. The only other browse encountered on the site include a few prickly phlox and prickly pear cactus. Mature stands of pinyon-juniper to the north provide thermal cover. On the site itself, there are only scattered mature trees and a few young ones.

For a chained and seeded site, perennial herbaceous vegetation is limited. In 1987, crested wheatgrass was the most frequently encountered perennial grass being sampled in 18 of the 100 quadrats, while all other perennial grasses were sampled in 8 quadrats or less. Crested wheatgrass has slowly declined in nested and quadrat frequencies since 1987 while the warm season increaser, purple three-awn, has increased and become the most abundant perennial grass on the site. Crested wheatgrass is primarily found underneath sagebrush plants, the result of selective livestock grazing since the chaining and seeding treatment. Although annual species were not sampled in 1987, photographs from that year show that cheatgrass was moderately abundant. In 1992 and 1998, cheatgrass significantly increased in nested frequency and was the dominant species in the understory being sampled in all of the quadrats in 1998. With drought in 2003, cheatgrass had a drastic decline in frequency and cover and was sampled in only 18 quadrats, and its nested frequency value declined 88%. The forb component has poor composition and diversity. The only common perennial forb is scarlet globemallow which is a desirable species that has maintained a stable frequency since 1992.

### 1987 APPARENT TREND ASSESSMENT

A concentration of rocks and pavement occurs on the soil surface constituting 23% of the ground cover for the area. Vegetative cover is low and litter cover quite high (64%), most of which is provided by the annual cheatgrass. Although of rather poor quality, ground cover of some kind occurs on all but 9% of the surface. Browse trend appears slightly down due to the degree of heavy hedging and lack of seedlings for sagebrush. The herbaceous understory is dominated by ephemeral plants. Perennial forbs are lacking.

### 1992 TREND ASSESSMENT

Soil conditions appear similar to those of 1987. Using the new cover estimation procedure, rock and pavement cover increased to 31%, litter declined to 26%, while percent bare ground cover increased to 21%. Some of these changes are the result of the new, much larger sampling design. Little erosion occurs on this site due to the nearly continuous cover of rock and pavement. In addition, dead cheatgrass plants provide abundant cover. Trend for soil is slightly down. Wyoming big sagebrush, the only abundant browse species on the site, declined in density since 1987, but this is more reflective of the larger sampling design than any real change in its density. Percent decadence doubled but is still relatively low at only 16%. The proportion of heavily hedged plants declined from 89% to 14%. Plants were very vigorous this year, producing abundant seed. Overall trend for browse is stable. Nested frequencies for perennial grasses increased while those for forbs declined. Nested frequencies for perennial grasses and forbs combined, remained basically unchanged. Annual grasses and forbs dominate the herbaceous understory. Cheatgrass accounts for 45% of the herbaceous understory cover. Trend for herbaceous understory is stable.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - stable (3)

herbaceous understory - stable (3)

### 1998 TREND ASSESSMENT

The soil trend is slightly upward. Even though percent vegetative cover increased, most of the increase is due to cheatgrass. Although cheatgrass does provide some soil protection, it is not as effective at protecting the soil from overland flow as perennial grasses or forbs. Percent bare ground cover increased slightly while percent rock and pavement cover combined decreased. Erosion is currently minimal, although there are several gullies crossing the site. The browse trend is stable. Although percent decadence for Wyoming big sagebrush has increased since 1987 and 1992, there are currently enough seedling plants to make up for the losses. It is a little surprising that any seedling plants were encountered in 1998 considering the abundance of cheatgrass. If cheatgrass abundance continues to increase, it will be difficult for seedlings to establish and the possibility of losing the browse population due to a fire event increases. The herbaceous understory is slightly downward. Perennial grasses, although sparse, are still present throughout the site with a slight increase in sum of nested frequency since 1992. The problem lies with cheatgrass. Nested frequency has significantly increased since 1992. The wet spring of 1998 produced high cheatgrass cover values and ample seed for future years.

#### TREND ASSESSMENT

soil - slightly up (4)

browse - stable (3)

herbaceous understory - slightly down (2)

## 2003 TREND ASSESSMENT

Trend for soil is slightly down. Vegetation and litter cover both show declines which is due to the drastic decrease in cheatgrass with drought conditions prior to and including the 2003 sampling period. Bare ground only slightly increased in 2003. Although erosion is evident on the site, it is not severe. Soils were rated as slightly eroding in 2003 partly due to the formation of rills on the soil surface as well as moderate pedestalling. Trend for browse is slightly down. The Wyoming big sagebrush population shows increased decadence, less young in the population, and increased heavy use. There are now more decadent, dying plants in the population than young to replace them, but the current level is not excessive. Overall, sagebrush density remained stable in 2003. Trend for the herbaceous understory is stable. Although the sum of nested frequency of perennial grasses has declined since 1998, cheatgrass significantly declined in cover and frequency which is a positive sign. Cool season grasses show declines in frequency while purple three-awn, a warm season species, remained stable. Perennial forbs are stable in frequency, and doubled in cover in 2003.

### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - stable (3)

### HERBACEOUS TRENDS --

Management unit 28 , Study no: 6

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	<i>Agropyron cristatum</i>	<sub>b</sub> 35	<sub>ab</sub> 22	<sub>ab</sub> 25	<sub>a</sub> 18	.88	.97	.61
G	<i>Aristida purpurea</i>	<sub>a</sub> 8	<sub>b</sub> 53	<sub>bc</sub> 75	<sub>c</sub> 74	3.02	4.52	2.42
G	<i>Bouteloua gracilis</i>	3	-	-	-	-	-	-
G	<i>Bromus tectorum</i> (a)	-	<sub>b</sub> 302	<sub>c</sub> 367	<sub>a</sub> 44	8.19	17.91	.33
G	<i>Oryzopsis hymenoides</i>	8	6	8	2	.07	.10	.03
G	<i>Poa secunda</i>	-	-	1	1	-	.03	.00
G	<i>Sitanion hystrix</i>	<sub>a</sub> 11	<sub>b</sub> 46	<sub>b</sub> 44	<sub>a</sub> 16	.93	.86	.19
G	<i>Sporobolus cryptandrus</i>	3	-	3	-	-	.00	.00
G	<i>Stipa comata</i>	<sub>ab</sub> 6	<sub>a</sub> 6	<sub>b</sub> 19	<sub>ab</sub> 12	.21	.43	.19
Total for Annual Grasses		0	302	367	44	8.19	17.91	0.33
Total for Perennial Grasses		74	133	175	123	5.12	6.92	3.46
Total for Grasses		74	435	542	167	13.32	24.84	3.80
F	<i>Ambrosia</i> spp.	-	5	-	-	.01	-	-
F	<i>Astragalus panguicensis</i>	2	-	-	-	-	-	-
F	<i>Chaenactis douglasii</i>	-	-	1	-	-	.00	-
F	<i>Chenopodium fremontii</i> (a)	-	3	-	1	.00	-	.00
F	<i>Descurainia pinnata</i> (a)	-	<sub>b</sub> 42	<sub>a</sub> -	<sub>a</sub> 1	1.47	-	.00
F	<i>Eriogonum cernuum</i> (a)	-	6	-	-	.04	-	-
F	<i>Erigeron</i> spp.	-	-	2	-	-	.01	-
F	<i>Euphorbia fendleri</i>	<sub>b</sub> 90	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	-	-	-

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	<i>Gilia</i> spp. (a)	-	<sub>c</sub> 112	<sub>a</sub> -	<sub>b</sub> 27	.66	-	.47
F	<i>Ipomopsis aggregata</i>	-	3	-	-	.00	-	-
F	<i>Phlox longifolia</i>	-	-	-	6	-	-	.15
F	<i>Polygonum</i> spp.	-	3	-	-	.01	-	-
F	<i>Senecio multilobatus</i>	-	2	-	-	.00	-	-
F	<i>Sphaeralcea coccinea</i>	<sub>a</sub> 71	<sub>b</sub> 103	<sub>b</sub> 125	<sub>b</sub> 130	2.59	2.29	4.25
Total for Annual Forbs		0	163	0	29	2.18	0	0.48
Total for Perennial Forbs		163	116	128	136	2.62	2.31	4.40
Total for Forbs		163	279	128	165	4.81	2.31	4.89

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

#### BROWSE TRENDS --

Management unit 28 , Study no: 6

T y p e	Species	Average Cover %		
		'92	'98	'03
B	<i>Artemisia tridentata wyomingensis</i>	9.88	7.56	12.17
B	<i>Leptodactylon pungens</i>	.15	.03	-
B	<i>Opuntia</i> spp.	.00	-	-
B	<i>Pinus edulis</i>	-	-	-
Total for Browse		10.03	7.59	12.17

#### KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 6

Species	Average leader growth (in)
	'03
<i>Artemisia tridentata wyomingensis</i>	1.6

BASIC COVER --

Management unit 28 , Study no: 6

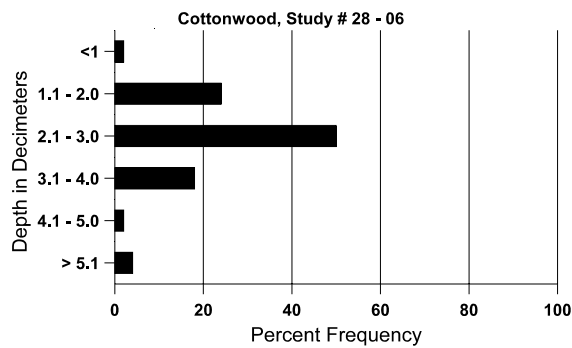
Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	3.25	24.97	34.35	22.39
Rock	12.75	5.65	4.45	5.30
Pavement	10.50	24.90	16.75	30.56
Litter	64.25	25.82	38.24	28.77
Cryptogams	0	.01	.24	.10
Bare Ground	9.25	21.09	23.68	26.27

SOIL ANALYSIS DATA --

Management unit 28, Study no: 6, Study Name: Cottonwood

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
14.8	68.8 (15.0)	7.5	61.4	20.4	18.2	1.3	7.8	147.2	0.5

### Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 6

Type	Quadrat Frequency		
	'92	'98	'03
Rabbit	61	38	35
Elk	-	1	-
Deer	57	47	28
Cattle	2	-	2

Days use per acre (ha)	
'98	'03
-	-
7 (17)	3 (7)
41 (101)	60 (149)
2 (5)	5 (13)

BROWSE CHARACTERISTICS --  
 Management unit 28 , Study no: 6

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>											
87	<b>2466</b>	-	466	1800	200	-	11	89	8	3	23/29
92	<b>1920</b>	-	120	1500	300	-	57	14	16	14	-/-
98	<b>1560</b>	140	100	1000	460	340	64	6	29	13	26/37
03	<b>1620</b>	-	20	800	800	280	37	42	49	17	27/35
<i>Juniperus osteosperma</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	20	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Leptodactylon pungens</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>60</b>	-	-	60	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	3/10
03	<b>20</b>	-	-	20	-	-	0	0	-	0	6/5
<i>Opuntia spp.</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>40</b>	20	20	20	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	5/9
03	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-



Trend Study 28-7-03

Study site name: Paragonah.

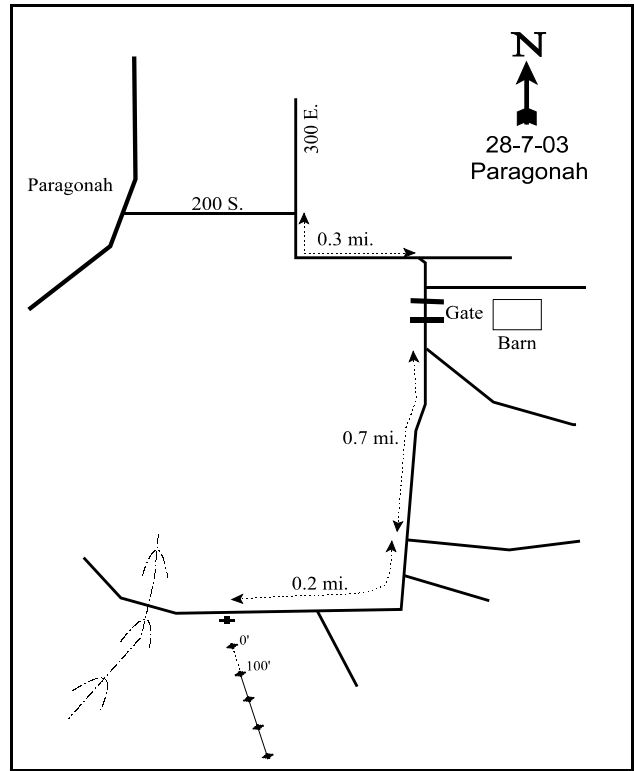
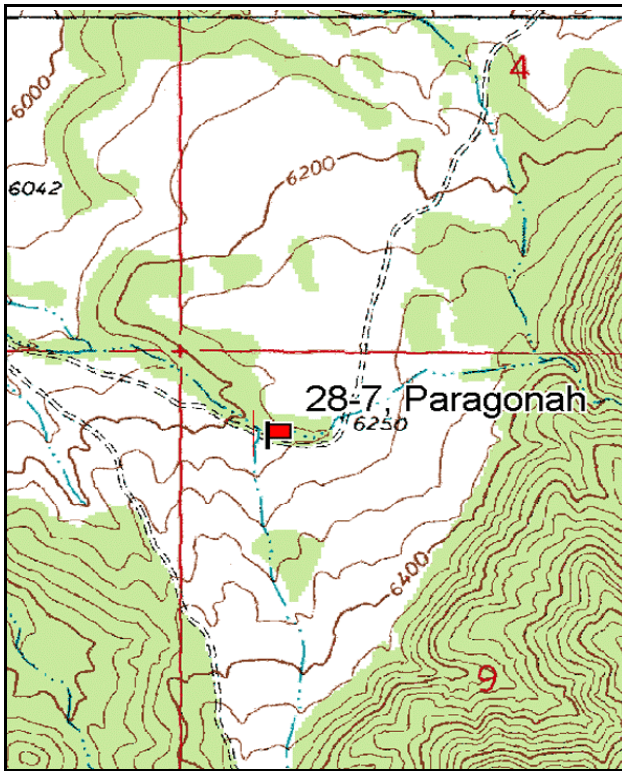
Vegetation type: Chained, Seeded P-J.

Compass bearing: frequency baseline 132 degrees magnetic.

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

LOCATION DESCRIPTION

From 200 South and 300 East in Paragonah, continue south on 300 East for 0.3 miles to where the road turns south. Drive 0.1 miles to a gate and a barn. Go through a series of two gates and to a fork. Stay right on the road that goes south and drive for 0.7 miles to another fork. Continue south for 0.2 miles (the road will bend and go west) to the witness post on the south (left) side of the road (just beyond the witness post is a large gully). The baseline starts 92 feet at 188 degrees magnetic from the witness post. The study is marked by short fenceposts.



Map Name: Parowan

Diagrammatic Sketch

Township 34S, Range 8W, Section 9

GPS: NAD 27, UTM 12S 4192156 N, 344157 E

## DISCUSSION

### Paragonah - Trend Study No. 28-7

This study is located in an old chained and seeded pinyon-juniper area on critical winter range for deer. The site slopes to the northwest at 10% and elevation is 6,200 feet. The site slopes away from the cliffs and towards the fields at the base of the bench. There was considerable regrowth of pinyon and juniper on this site until a hand thinning treatment was done prior to the 2003 survey. A pellet group transect read on site in 1998 and 2003 estimated about 23 deer days use/acre (58 ddu/ha) during both readings.

Soil textural and chemical analysis indicates a sandy loam with a slightly acidic pH (6.3). Rock and pavement are scattered throughout the site on the soil surface and throughout the soil profile. The average effective rooting depth is almost 11 inches with a rocky horizon encountered at a depth of 6 to 8 inches. Chemical analysis measured phosphorus at 6.0 ppm and potassium at 3.2 ppm, both of which could limit plant development. Ten ppm of phosphorus and 70 ppm of potassium are thought necessary for normal plant growth and development. Bare areas continue to be subjected to sheet erosion and runoff has formed various sized gullies throughout the site. Some soil movement was noticeable in 1992 and 1998, and several old gullies have been noted to exist on the site. Vegetation and litter cover left from the chaining process help to stabilize the soil. Vegetation cover was very low in 2003 with drought conditions and the hand thinning treatment which effectively removed most of the pinyon and juniper trees on the site. Litter cover was high in 2003 at an estimated 57%. An erosion condition class assessment rated soils as stable in 2003.

Eleven species of shrubs or trees have been sampled on the site in at least 1 year, but only black sagebrush, broom snakeweed, and Gambel oak are abundant. Black sagebrush is the key browse species with an estimated density of 2,540 plants/acre in 1998, and 2,960 in 2003. These estimates are somewhat lower than the 1987 and 1992 estimates which averaged about 4,000 plants/acre. Utilization on black sagebrush was heavy in 1987 when 76% of the shrubs displayed heavy use. Use declined to a more moderate level in 1992, and was mostly light in 1998 and 2003. Vigor has been mostly normal in all readings with 11% of the population displaying poor vigor in 2003. The black sagebrush population has steadily become more mature and decadent with every reading. Seedling and young plants were moderately abundant from 1987-1998, but few were sampled in 2003 which is expected with drought conditions. Percent decadence was low to moderate between 1987-1998 (7-29%), but increased to 43% in 2003. The increase in decadence in 2003 is also not surprising with the drought experienced prior to and including the 2003 sampling year. Black sagebrush leaders had averaged 1.6 inches of growth when the site was read in June 2003. Small numbers of mountain big sagebrush also occur on the site, and some of the black sagebrush are hybrids with mountain big sagebrush.

Broom snakeweed was the most abundant shrub during the initial reading in 1987 at an estimated 7,932 plants/acre. Density declined to 4,320 plants/acre in 1992, 1,320 in 1998, and 2,560 in 2003. A significant portion of the population has been made up of young plants since 1992. The Gambel oak on the site occurs in large scattered clones. Density was estimated at 2,160 stems/acre in 2003. Oak has shown mostly light use in all surveys and is used primarily for cover by wintering animals. Canopy cover of oak was estimated at about 6% in both 1998 and 2003. Pinyon and juniper, although not numerous, figured prominently in the vegetative structure of this site prior to the hand thinning treatment. Point-center quarter data in 1998 estimated 49 Utah juniper trees/acre and 71 pinyon pine trees/acre for a total of 120 trees/acre. Most of the trees were in the 4 to 8 foot category. Pinyon-juniper canopy cover was estimated at 23% in 1998. Following the hand thinning treatment, pinyon-juniper canopy cover was reduced to less than 1% in 2003.

The herbaceous understory is dominated by a patchy stand of crested and intermediate wheatgrasses. Nested frequency for both of these species declined significantly in 1992. Intermediate wheatgrass nested frequency significantly increased in 1998 while crested wheatgrass remained stable. Both species significantly declined

in 2003. Cheatgrass significantly increased in 1998, but also declined in 2003 with drought conditions. Perennial forbs are diverse but are rarely encountered. The only common forb encountered during any year was the prostrate fendler spurge. Perennial forb sum of nested frequency has decreased with each reading since 1992. Annual forbs increased in 2003 due primarily to bur buttercup.

### 1987 APPARENT TREND ASSESSMENT

The percentage of erosion pavement covering the ground surface is very high (27%). Rocks are also common. Where shrubs and grasses occur, litter has accumulated providing excellent soil protection. However, plants are scattered, and consequently, the percent cover provided by vegetation and litter is only 46%. Bare soil is exposed on 15% of the ground surface and there is plenty of evidence of soil loss. Most erosion took place gradually over time and likely prior to the chaining treatment. The preferred browse species, black sagebrush, and mountain big sagebrush, have been heavily hedged but display good vigor with an adequate amount of seedlings and young. The abundance of broom snakeweed is a negative factor that should be closely monitored.

### 1992 TREND ASSESSMENT

Looking at the data and photos, it appears that herbaceous ground cover has declined slightly while bare ground has increased. Most open areas are still covered by a nearly continuous layer of rock and pavement. Even though some soil movement is detectable, erosion is not presently a problem on this site, but the potential is still present especially if there is further loss of the herbaceous understory. Trend for soil is down slightly. The key browse on the site consist of black sagebrush, mountain big sagebrush, and oak. Trend for all these species is stable with increased densities, good vigor, and less heavy hedging, but increased decadence for black sagebrush which makes up the majority of the preferred browse. Broom snakeweed also declined significantly. The only negative factor is the increase in pinyon and juniper trees which are regaining dominance of the site. The herbaceous component consists primarily of 2 seeded grasses which declined in nested and quadrat frequencies since the last reading. The increase in the summed nested frequencies of forbs is likely the result of the increased sample size which picked up an additional 6 perennial forbs. Grass and forb summed nested frequencies combined declined since 1987 indicating a downward trend.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - stable (3)

herbaceous understory - down (1)

### 1998 TREND ASSESSMENT

The soil trend is upward with an increase in percent vegetation and litter cover and a decrease in percent bare ground. Erosion potential has decreased with an increase in protective ground cover. Some slight soil erosion is apparent, but not excessive. The browse trend is slightly down. Utilization is currently light with the percentage of plants in poor vigor remaining low over all years. However, the population of black sagebrush has decreased by 41% and the number of seedling and young plants are not adequate to replace the plants being lost from the population. The herbaceous understory trend is stable with a slight increase in perennial herbaceous understory sum of nested frequency. Cheatgrass sum of nested frequency increased significantly since 1992 and currently accounts for 27% of the total herbaceous understory cover. Crested wheatgrass and intermediate wheatgrass are the dominate perennial species contributing 55% of the herbaceous understory cover combined.

TREND ASSESSMENT

soil - up (5)

browse - slightly down (2)

herbaceous understory - stable (3)

2003 TREND ASSESSMENT

Trend for soil is stable even with a large decline in vegetation cover. The majority of the decline in vegetation is due to the hand thinning treatment which effectively eliminated most of the pinyon and juniper trees from the site. Drought conditions also resulted in very little herbaceous cover in 2003. Even with less vegetation cover, litter cover increased and erosion remains low. The ratio of protective cover to bare ground remained unchanged. Trend for browse is slightly down. Black sagebrush has a higher density estimate, but shows increases in percent decadence and poor vigor, and a decrease in the number of young plants in the population. The number of decadent, dying plants in the population is more than double the number of young which may result in a population decline by the next reading. Although not as abundant as black sagebrush, mountain big sagebrush is important on this winter range. In 2003, mountain big sagebrush decadence increased to 67%, no young were sampled, and 1/3 of the population displayed poor vigor. The pinyon-juniper thinning treatment should help both sagebrush species as well as the herbaceous understory. Trend for the herbaceous understory is down. Sum of nested frequency of perennial grasses and forbs have declined by nearly half since 1998, and the 2 most prominent grasses, crested wheatgrass and intermediate wheatgrass, both significantly declined in nested frequency and cover individually.

TREND ASSESSMENT

soil - stable (3)

browse - slightly down (2)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 7

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	Agropyron cristatum	c211	b146	bc154	a90	3.39	4.71	.71
G	Agropyron intermedium	b58	a27	b59	a13	.49	2.13	.05
G	Agropyron smithii	-	-	11	-	-	.02	-
G	Bromus tectorum (a)	-	a45	c219	b91	.33	3.40	.33
G	Oryzopsis hymenoides	10	8	5	1	.07	.18	.15
G	Poa secunda	a2	a3	b24	b21	.00	.19	.12
G	Sitanion hystrix	b13	a-	ab7	a4	.00	.19	.01
G	Stipa comata	-	-	3	-	-	.00	-
G	Vulpia octoflora (a)	-	a-	a-	b12	-	-	.03
Total for Annual Grasses		0	45	219	103	0.32	3.40	0.36
Total for Perennial Grasses		294	184	263	129	3.97	7.46	1.04
Total for Grasses		294	229	482	232	4.30	10.87	1.40

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	<i>Alyssum alyssoides</i> (a)	-	3	7	10	.00	.02	.02
F	<i>Arabis</i> spp.	-	3	-	-	.00	-	-
F	<i>Artemisia dracunculoides</i>	-	-	4	-	-	.03	-
F	<i>Astragalus lentiginosus</i>	-	2	-	-	.01	-	-
F	<i>Astragalus newberryi</i>	1	4	3	-	.01	.01	-
F	<i>Collinsia parviflora</i> (a)	-	-	-	5	-	-	.01
F	<i>Delphinium nuttallianum</i>	-	-	-	2	-	-	.00
F	<i>Draba</i> spp. (a)	-	-	-	7	-	-	.02
F	<i>Eriogonum cernuum</i> (a)	-	2	-	-	.00	-	-
F	<i>Erigeron pumilus</i>	<sub>b</sub> 10	<sub>ab</sub> 10	<sub>a</sub> 4	<sub>a</sub> -	.04	.01	-
F	<i>Eriogonum racemosum</i>	-	1	-	3	.00	-	.00
F	<i>Eriogonum umbellatum</i>	5	1	3	3	.03	.01	.00
F	<i>Euphorbia fendleri</i>	<sub>b</sub> 80	<sub>ab</sub> 75	<sub>ab</sub> 55	<sub>a</sub> 40	1.12	.88	.40
F	<i>Lactuca serriola</i>	-	1	6	-	.00	.02	-
F	<i>Leucelene ericoides</i>	<sub>a</sub> -	<sub>b</sub> 12	<sub>ab</sub> 8	<sub>b</sub> 15	.22	.30	.36
F	<i>Lithospermum ruderales</i>	<sub>a</sub> -	<sub>b</sub> 13	<sub>a</sub> 2	<sub>a</sub> 3	.06	.15	.01
F	<i>Machaeranthera canescens</i>	3	3	-	-	.03	-	-
F	<i>Microsteris gracilis</i> (a)	-	-	-	4	-	-	.01
F	<i>Penstemon eatoni</i>	-	-	-	-	-	.00	-
F	<i>Petrorhiza pumila</i>	1	-	-	-	-	-	-
F	<i>Phlox longifolia</i>	-	-	7	6	-	.01	.01
F	<i>Ranunculus testiculatus</i> (a)	-	<sub>a</sub> 18	<sub>a</sub> 7	<sub>b</sub> 98	.09	.02	.74
F	<i>Senecio douglasii</i>	2	-	-	-	-	-	-
F	<i>Sphaeralcea coccinea</i>	-	10	2	1	.19	.03	.03
F	<i>Streptanthus cordatus</i>	3	9	10	9	.31	.09	.02
F	<i>Tragopogon dubius</i>	1	-	-	-	-	-	-
F	Unknown forb-perennial	24	-	-	-	-	-	-
Total for Annual Forbs		0	23	14	124	0.09	0.04	0.80
Total for Perennial Forbs		130	144	104	82	2.05	1.57	0.85
Total for Forbs		130	167	118	206	2.15	1.61	1.66

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

BROWSE TRENDS --

Management unit 28 , Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	Artemisia nova	59	50	47	4.31	5.88	3.88
B	Artemisia tridentata vaseyana	7	8	3	.03	.15	-
B	Brickellia spp.	1	0	0	-	-	-
B	Chrysothamnus nauseosus	1	2	0	.00	-	-
B	Eriogonum microthecum	12	4	2	1.05	.07	.03
B	Gutierrezia sarothrae	49	30	43	1.46	.79	1.07
B	Juniperus osteosperma	4	2	0	1.92	1.25	-
B	Leptodactylon pungens	11	7	5	.27	.39	.15
B	Opuntia spp.	2	2	1	.03	.04	.15
B	Pinus edulis	13	14	0	8.71	9.66	.39
B	Quercus gambelii	8	7	9	4.50	4.65	3.42
Total for Browse		167	126	110	22.31	22.91	9.11

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 7

Species	Percent Cover	
	'98	'03
Artemisia nova	-	3.26
Gutierrezia sarothrae	-	.61
Juniperus osteosperma	4.19	.40
Leptodactylon pungens	-	.03
Pinus edulis	18.60	.50
Quercus gambelii	6.00	5.31

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 7

Species	Average leader growth (in)
	'03
Artemisia nova	1.6

POINT-QUARTER TREE DATA --  
Management unit 28 , Study no: 7

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	49	-
Pinus edulis	71	18

Average diameter (in)	
'98	'03
4.7	-
5.1	1.0

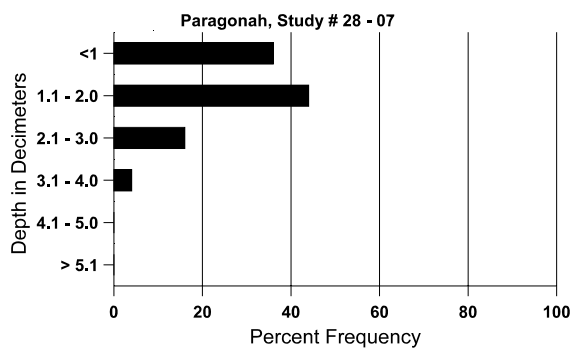
BASIC COVER --  
Management unit 28 , Study no: 7

Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	2.75	25.71	35.17	11.72
Rock	12.25	29.99	9.75	7.34
Pavement	27.00	0	18.49	9.14
Litter	43.50	34.60	47.87	57.23
Cryptogams	0	2.03	2.18	1.27
Bare Ground	14.50	24.43	17.53	20.29

SOIL ANALYSIS DATA --  
Management unit 28, Study no: 7, Study Name: Paragonah

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
10.9	68.4 (12.1)	6.3	65.4	20.4	14.2	2.2	6.0	3.2	0.4

### Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 7

Type	Quadrat Frequency		
	'92	'98	'03
Sheep	2	-	-
Rabbit	84	56	24
Elk	-	1	-
Deer	26	28	4

Days use per acre (ha)	
'98	'03
-	-
-	-
-	-
23 (57)	23 (58)

BROWSE CHARACTERISTICS --

Management unit 28 , Study no: 7

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia nova</i>											
87	<b>3665</b>	333	466	2933	266	-	11	76	7	2	10/18
92	<b>4300</b>	440	840	2200	1260	-	53	22	29	1	-/-
98	<b>2540</b>	100	480	1560	500	260	13	0	20	3	11/21
03	<b>2960</b>	-	140	1560	1260	160	9	4	43	11	9/15
<i>Artemisia tridentata vaseyana</i>											
87	<b>199</b>	66	133	-	66	-	0	100	33	0	-/-
92	<b>280</b>	40	120	100	60	-	21	14	21	0	-/-
98	<b>240</b>	20	60	120	60	40	25	0	25	0	14/26
03	<b>60</b>	-	-	20	40	-	0	33	67	33	22/33
<i>Brickellia spp.</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Chrysothamnus nauseosus</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	20	20	-	-	-	0	0	-	0	-/-
98	<b>40</b>	-	-	40	-	-	0	0	-	0	8/12
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Eriogonum microthecum</i>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>520</b>	20	120	400	-	-	4	8	0	0	-/-
98	<b>140</b>	-	80	40	20	-	0	29	14	29	7/11
03	<b>80</b>	-	-	80	-	-	0	25	0	0	5/6



		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Gutierrezia sarothrae</b>											
87	<b>7932</b>	466	400	7266	266	-	0	0	3	3	8/5
92	<b>4320</b>	120	1640	2660	20	-	0	0	0	0	-/-
98	<b>1320</b>	20	400	900	20	40	0	0	2	2	9/9
03	<b>2560</b>	60	420	2120	20	80	0	0	1	.78	6/6
<b>Juniperus osteosperma</b>											
87	<b>0</b>	66	-	-	-	-	0	0	-	0	-/-
92	<b>80</b>	20	-	80	-	-	0	0	-	0	-/-
98	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	80	0	0	-	0	-/-
<b>Leptodactylon pungens</b>											
87	<b>932</b>	-	66	866	-	-	0	0	0	93	3/5
92	<b>600</b>	-	80	520	-	-	3	0	0	0	-/-
98	<b>360</b>	-	40	300	20	-	0	0	6	0	7/12
03	<b>320</b>	-	60	240	20	-	0	0	6	6	4/7
<b>Opuntia spp.</b>											
87	<b>66</b>	-	-	66	-	-	0	0	0	100	2/8
92	<b>100</b>	20	20	60	20	-	0	0	20	20	-/-
98	<b>60</b>	20	20	20	20	-	0	0	33	67	5/9
03	<b>60</b>	-	-	60	-	-	0	0	0	0	6/11
<b>Pinus edulis</b>											
87	<b>200</b>	-	-	200	-	-	0	0	-	0	85/47
92	<b>400</b>	-	240	160	-	-	0	0	-	0	-/-
98	<b>300</b>	60	80	220	-	20	0	0	-	0	-/-
03	<b>0</b>	80	-	-	-	180	0	0	-	0	-/-
<b>Quercus gambelii</b>											
87	<b>200</b>	-	200	-	-	-	0	0	0	0	-/-
92	<b>2620</b>	400	1860	520	240	-	9	18	9	6	-/-
98	<b>1020</b>	-	640	380	-	80	0	0	0	0	87/29
03	<b>2160</b>	-	740	1340	80	160	0	0	4	2	59/31

Trend Study 28-8-03

Study site name: Grass Valley.

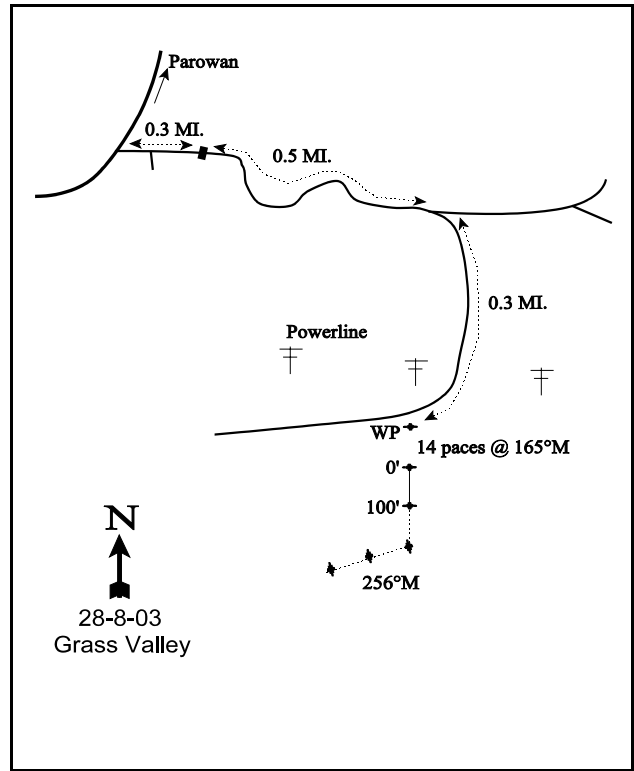
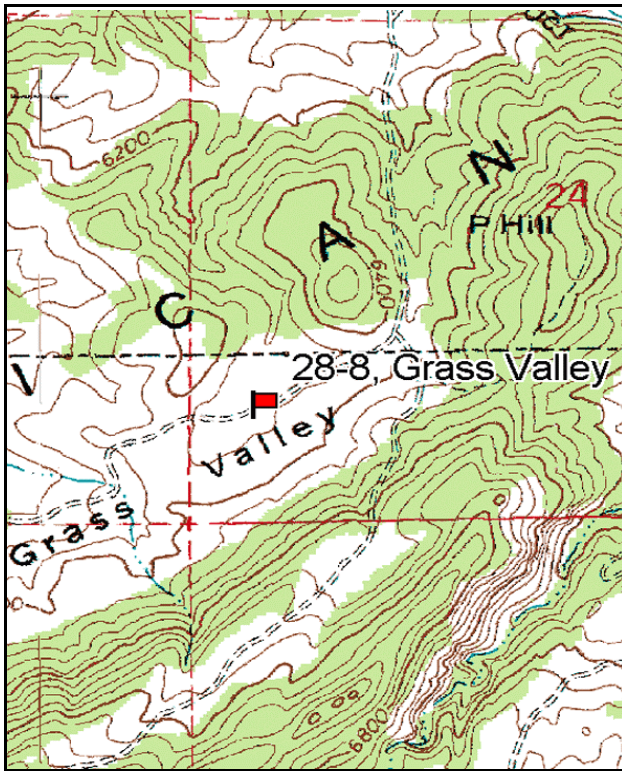
Vegetation type: Mountain Big Sagebrush.

Compass bearing: frequency baseline 165 degrees magnetic. (Lines 3-4, 256° M degrees).

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

LOCATION DESCRIPTION

From I-15 take the north Parowan exit south into town. Continue down Main Street to a big gradual curve on the south end of town. Turn east off the highway across from a log house onto a dirt road, go past other houses staying on the main road 0.3 miles to cattleguard. From the cattleguard, continue 0.5 miles to a fork. Bear right. Proceed 0.3 miles underneath the powerlines to a witness post on left side of the road. The baseline starts 68 feet away at a bearing of 165 degrees magnetic and is marked by 2 foot tall fenceposts with no browse tag.



Map Name: Parowan

Diagrammatic Sketch

Township 34S, Range 9W, Section 24

GPS: NAD 27, UTM 12S 4187913 N, 339118 E

## DISCUSSION

### Grass Valley - Trend Study No. 28-8

This trend study is located in the foothills south of Parowan. Elevation is approximately 6,400 feet with a northwest aspect and a gentle 5% slope. The site is surrounded by pinyon-juniper covered hills. Most of the valley was chained and seeded in the mid-1960's by the BLM. The site itself is dominated by mountain big sagebrush and seeded grasses and is considered critical deer winter range. A pellet group transect read in conjunction with the vegetative baseline in 1998 estimated 61 deer, 1 elk, and 9 cow days use/acre (151 ddu/ha, 3 edu/ha, and 22 cdu/ha). Pellet group transect data collected in 2003 estimated 57 deer, 1 elk, and 11 cow days use/acre (141 ddu/ha, 3 edu/ha, and 27 cdu/ha) on the site. There is a 3-way exclosure which was built in the late 1970's approximately 0.3 miles west of the site.

Soil textural and chemical analysis indicates a sandy loam with a slightly acidic pH (6.4). The average effective rooting depth is almost 16 inches with a layer of rocks encountered between 4 and 8 inches below the surface. The soil surface in the shrub interspaces is characterized by bare patches with concentrations of small rocks and pavement that appear to be of volcanic origin. Further erosion does not appear to be a problem on this site, with only localized soil movement being evident. The abundance of perennial grasses as well as their associated litter adequately protect the soil surface from severe erosion events.

Mountain big sagebrush is the dominant browse as it provides over 90% of the browse cover on the transect in all readings. Canopy cover of mountain big sagebrush was estimated at 13% in 2003. The population is moderately dense with an estimated 3,460 plants/acre in 1998 and 3,280 in 2003. This population has been characterized by moderate to high decadence and only fair recruitment. Percent decadence has ranged from 34-60% over the life of the transect with 47% of the population being classified as decadent in 2003. With such high levels of decadence it is not surprising that overall population density has steadily declined with each reading. In 2003, 44% of the decadent age class was classified as dying which equates to ~680 plants/acre that could be lost from the population by the next reading. Utilization has been moderate to heavy in all surveys, with the highest use being documented in 1987 and 1992. Some of the sagebrush plants have the growth form of the more erect but less preferred basin big sagebrush and are likely hybrids between the 2 subspecies. Additional evidence of hybridization comes from differential use throughout the site where some plants have received heavy use while others show light to no use. Sagebrush leaders had averaged 1.7 inches of growth when the site was read in mid-June of 2003. Additional palatable forage is provided by bitterbrush and squaw apple which are heavily browsed, but occur in very low densities on the site.

Pinyon and juniper trees are more prominent as you move south toward the hills. Point-center quarter data estimated 76 pinyon and 17 juniper trees/acre in 2003. Additional browse sampled on the site include mostly less preferred increasers such as low rabbitbrush, prickly phlox, and prickly pear cactus.

Perennial grasses are abundant and dominate the herbaceous understory. Two seeded species, crested wheatgrass and intermediate wheatgrass, are the most common species. Of the perennials, they have the highest nested frequency values in all years and combined to provide 70% of the grass cover in 1998 and 56% in 2003. Native perennials include Sandberg bluegrass, bottlebrush squirreltail, and needle-and-thread grass. Cheatgrass has steadily increased on the site with significant increases in nested frequency each reading since 1992. In 2003, the fire hazard resulting from the presence of cheatgrass on the site was not severe with an average cover of only 6%. However, further increases in frequency and cover of cheatgrass will elevate the threat of a wildfire that could eliminate the key browse, mountain big sagebrush. Further increases in cheatgrass will also be detrimental to seedling and young sagebrush plants which have a difficult time competing against cheatgrass for resources. Another negative factor is the continued increase of bulbous bluegrass, a low value short-lived perennial. The forb component is limited, and perennial species are insignificant on the site.

### 1987 APPARENT TREND ASSESSMENT

Ground cover percentages are typical for this type of site. Litter cover is good, and combined with basal vegetation, provides almost 60% of the total cover. Pavement and small rocks contribute prominently in the open areas. Exposed soil accounts for 17% of the ground surface and presents an erosion problem only in some of the larger bare areas. Heavy use, high decadence, and low biotic and reproductive potentials are a concern for mountain big sagebrush. This population will continue to decline. Grasses are adequately established but forbs are basically absent.

### 1992 TREND ASSESSMENT

Soil conditions appear stable. Some seasonal erosion is still occurring but it is not serious. Mountain big sagebrush has declined in density by 19% since 1987. It is also showing increased decadence. On the positive side, the proportion of plants displaying heavy hedging declined from 80% in 1987 to 40% in 1992. The population appears to be slowly declining with continued low biotic and reproductive potentials. Overall browse trend is slightly down. The herbaceous understory consists almost entirely of grasses. Perennial forbs are nearly absent. Combined summed nested frequencies of grasses and forbs (excluding the annuals which were not counted in 1987) have remained basically unchanged since the last reading indicating a stable trend.

#### TREND ASSESSMENT

soil - stable (3)

browse - slightly down (2)

herbaceous understory - stable (3)

### 1998 TREND ASSESSMENT

The soil trend is slightly up with an increase in vegetation and litter cover. Although percent bare ground cover has slightly increased, the vegetative and litter cover are still adequate to protect the area from extensive runoff. The browse trend is continuing downward. The population has declined by 23% since 1992. It appears that the population may not be able to sustain itself at current levels. The herbaceous understory trend is slightly upward. Perennial herbaceous species sum of nested frequency has increased slightly since 1992 from 403 to 446. One positive aspect is continued high cover values for crested wheatgrass and intermediate wheatgrass. These relatively higher cover values will help keep cheatgrass in check. Although cheatgrass nested frequency significantly increased, the cover values stayed nearly the same.

#### TREND ASSESSMENT

soil - slightly up (4)

browse - slightly down (2)

herbaceous understory - slightly up (4)

### 2003 TREND ASSESSMENT

Trend for soil is slightly down as litter cover declined and bare ground increased. Erosion remains low, but the ratio of protective cover (vegetation, litter, and cryptogams) to bare soil declined. Trend for browse is slightly down. Mountain big sagebrush continues to decline in density although at a slower rate than in previous surveys. The sagebrush population has increased decadence, and 44% of the decadent plants sampled in 2003 were classified as dying. The proportion of young in the population continues to decline, and poor vigor and heavy use showed slight increases in 2003. If cheatgrass continues to increase, the big sagebrush population will be negatively effected in 2 ways. First, the threat of a wildfire will increase, and second, seedling and young plants will have a difficult time competing for resources. Trend for the herbaceous understory is stable. Perennial grasses and forbs slightly declined in sum of nested frequency, but not enough to warrant a downward trend. Cheatgrass continues to increase and may soon dominate the site if this trend continues.

TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 8

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	Agropyron cristatum	<sub>b</sub> 144	<sub>ab</sub> 111	<sub>ab</sub> 132	<sub>a</sub> 97	6.79	10.14	5.32
G	Agropyron intermedium	<sub>a</sub> 133	<sub>b</sub> 168	<sub>a</sub> 120	<sub>ab</sub> 146	8.02	5.08	5.65
G	Aristida purpurea	-	-	-	-	-	.15	.00
G	Bromus inermis	<sub>b</sub> 21	<sub>ab</sub> 16	<sub>ab</sub> 18	<sub>a</sub> 5	.25	.21	.06
G	Bromus tectorum (a)	-	<sub>a</sub> 124	<sub>b</sub> 194	<sub>c</sub> 261	2.26	2.14	5.69
G	Oryzopsis hymenoides	6	9	5	2	.21	.04	.03
G	Poa bulbosa	<sub>a</sub> -	<sub>b</sub> 7	<sub>c</sub> 77	<sub>d</sub> 94	.10	1.10	1.67
G	Poa secunda	<sub>a</sub> -	<sub>ab</sub> 4	<sub>ab</sub> 12	<sub>b</sub> 15	.02	.07	.25
G	Sitanion hystrix	<sub>ab</sub> 29	<sub>ab</sub> 46	<sub>b</sub> 56	<sub>a</sub> 26	1.90	2.02	.55
G	Stipa comata	<sub>b</sub> 53	<sub>ab</sub> 30	<sub>a</sub> 13	<sub>a</sub> 14	.69	.72	.37
Total for Annual Grasses		0	124	194	261	2.26	2.14	5.69
Total for Perennial Grasses		386	391	433	399	18.00	19.54	13.92
Total for Grasses		386	515	627	660	20.27	21.69	19.61
F	Agoseris glauca	-	-	-	2	-	-	.00
F	Alyssum alyssoides (a)	-	-	1	1	-	.00	.00
F	Astragalus spp.	-	-	4	-	-	.06	-
F	Chaenactis douglasii	1	-	2	-	-	.01	-
F	Cruciferae	-	9	4	-	.04	.01	-
F	Draba spp. (a)	-	-	1	-	-	.00	-
F	Eriogonum cernuum (a)	-	6	-	-	.39	-	-
F	Gayophytum ramosissimum(a)	-	-	-	7	-	-	.02
F	Microsteris gracilis (a)	-	<sub>a</sub> -	<sub>a</sub> 8	<sub>b</sub> 35	-	.02	.10
F	Orobanche fasciculata	-	-	2	-	-	.00	-
F	Phlox longifolia	-	-	-	3	-	-	.00
F	Polygonum douglasii (a)	-	1	4	-	.00	.01	-
F	Ranunculus testiculatus (a)	-	<sub>a</sub> -	<sub>b</sub> 12	<sub>c</sub> 47	-	.03	.21
F	Streptanthus cordatus	-	-	-	3	-	-	.00
F	Taraxacum officinale	-	3	1	3	.00	.00	.01
F	Unknown forb-annual (a)	-	<sub>b</sub> 40	<sub>a</sub> -	<sub>a</sub> -	.11	-	-
F	Unknown forb-perennial	1	-	-	-	-	-	-

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
	Total for Annual Forbs	0	47	26	90	0.50	0.07	0.34
	Total for Perennial Forbs	2	12	13	11	0.04	0.08	0.02
	Total for Forbs	2	59	39	101	0.55	0.15	0.36

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

#### BROWSE TRENDS --

Management unit 28 , Study no: 8

T y p e	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	<i>Artemisia tridentata vaseyana</i>	90	85	79	16.55	13.69	16.11
B	<i>Chrysothamnus viscidiflorus</i>	1	0	0	.00	-	-
B	<i>Juniperus osteosperma</i>	0	2	1	.03	.93	.15
B	<i>Leptodactylon pungens</i>	11	7	7	.25	.27	.24
B	<i>Opuntia spp.</i>	3	0	0	-	-	-
B	<i>Peraphyllum ramosissimum</i>	0	1	1	-	-	-
B	<i>Pinus edulis</i>	0	0	0	-	-	.00
	Total for Browse	105	95	88	16.84	14.90	16.51

#### CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 8

Species	Percent Cover
	'03
<i>Artemisia tridentata vaseyana</i>	12.75

#### KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 8

Species	Average leader growth (in)
	'03
<i>Artemisia tridentata vaseyana</i>	1.6

POINT-QUARTER TREE DATA --  
Management unit 28 , Study no: 8

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	40	17
Pinus edulis	20	7

Average diameter (in)	
'98	'03
3.4	1.6
4.7	1.3

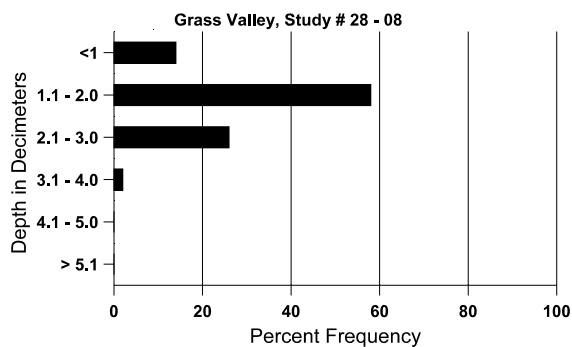
BASIC COVER --  
Management unit 28 , Study no: 8

Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	4.75	32.46	37.59	35.54
Rock	3.00	1.86	3.20	3.13
Pavement	21.25	23.52	20.40	11.61
Litter	54.25	31.47	48.00	34.69
Cryptogams	0	.16	.47	.10
Bare Ground	16.75	16.85	21.84	28.43

SOIL ANALYSIS DATA --  
Management unit 28, Study no: 8, Study Name: Grass Valley

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
15.9	69.6 (12.4)	6.4	60.7	20.7	18.6	1.7	9.4	192.0	0.4

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 28 , Study no: 8

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Sheep	1	-	-	-
Rabbit	48	30	-	-
Elk	-	1	1 (2)	1 (3)
Deer	46	30	61 (151)	57 (141)
Cattle	3	3	9 (22)	11 (27)

BROWSE CHARACTERISTICS --  
 Management unit 28 , Study no: 8

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata vaseyana</b>											
87	<b>5533</b>	66	200	2533	2800	-	20	80	51	11	20/20
92	<b>4480</b>	240	300	1480	2700	-	41	40	60	16	-/-
98	<b>3460</b>	100	320	1960	1180	1080	47	3	34	5	25/35
03	<b>3280</b>	-	80	1660	1540	1060	35	24	47	21	22/29
<b>Chrysothamnus viscidiflorus</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Juniperus osteosperma</b>											
87	<b>66</b>	-	-	66	-	-	0	0	-	0	57/39
92	<b>0</b>	40	-	-	-	-	0	0	-	0	-/-
98	<b>40</b>	20	-	40	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	35/11
<b>Leptodactylon pungens</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>920</b>	20	160	760	-	-	11	9	0	4	-/-
98	<b>320</b>	-	-	320	-	-	0	0	0	0	6/9
03	<b>300</b>	-	-	260	40	-	0	0	13	7	6/8



		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Opuntia spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>60</b>	-	-	60	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	3/7
<b>Peraphyllum ramosissimum</b>											
87	<b>133</b>	-	-	-	133	-	0	100	100	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>20</b>	-	-	20	-	-	0	100	0	0	25/22
03	<b>20</b>	-	-	20	-	-	0	100	0	0	27/40
<b>Pinus edulis</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	20	-	-	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	42/81

Trend Study 28-11-03

Study site name: Elliker Basin .

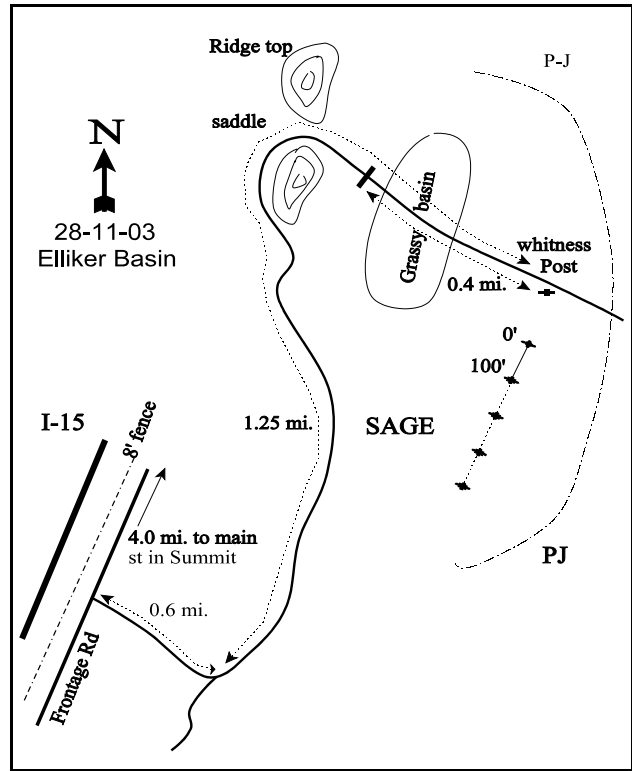
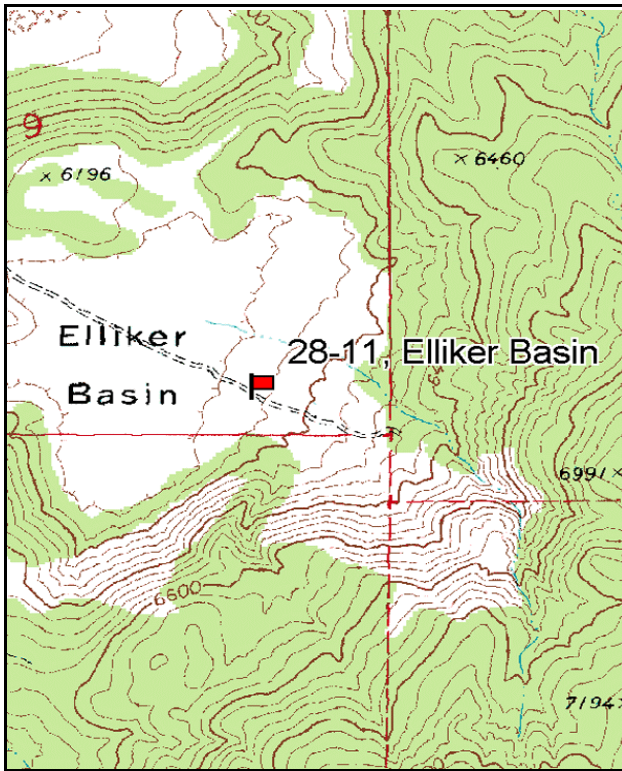
Vegetation type: Mountain Big Sagebrush .

Compass bearing: frequency baseline 231 degrees magnetic.

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

LOCATION DESCRIPTION

At the I-15 interchange (exit 71) in Summit, go south on the frontage road (Summer Tree Dr.) on the east side of the freeway for 4.0 miles. Turn left onto a dirt road, proceed through a gate and go east for 0.6 miles. Bear left at the fork and continue 1.25 miles to Elliker Basin and up to a half-high witness post in the sagebrush on the right. The transect starts 12 paces away at a bearing of 221 degrees magnetic. The 0-foot stake is marked with browse tag #495.



Map Name: Summit

Diagrammatic Sketch

Township 35S, Range 10W, Section 9

GPS: NAD 27, UTM 12S 4181555 N, 325672 E

## DISCUSSION

### Elliker Basin - Trend Study No. 28-11

Elliker Basin is a small sagebrush valley at the base of the Hurricane Cliffs, about 8 miles northeast of Cedar City. The transect itself is located on the southeastern slope of the basin just below the line of pinyon-juniper which continue up the cliffs. The study site slopes to the west at 10-15% at an elevation of 6,160 feet. Pinyon and juniper dominate the slopes bordering the valley. The area is important deer winter range, which was acquired by the DWR in a trade with the BLM. The area was apparently seeded years ago. Additionally, a hand chainsaw treatment was done during the spring of 1992 to eliminate encroaching juniper trees. Many of the trees seen in 1992 were reported to be still alive and growing below the cut, however in 1998, all the trees were dead. A pellet group transect read on site in 1998 estimated 44 deer and 1 elk day use/acre (109 ddu/ha and 3 edu/ha). Use increased on the site in 2003 with 151 deer days use/acre (374 ddu/ha). Pellet groups were difficult to differentiate between in 2003 as they were very abundant and piled on top of one another. Half of the deer pellets appeared to be from fall and early winter, while the other half appeared to be from late winter and spring.

Soil textural and chemical analysis indicates a loam soil with a moderately acidic pH (5.8). In 1998, the average effective rooting depth was just over 14 inches with an average temperature of 52°F measured at a depth of 16 inches. Soil temperature was much higher in 2003 estimated at nearly 76°F. High soil temperatures in 2003 was due to several years of drought that resulted in very low soil moisture and elevated temperatures. Both the soil surface and profile are rocky throughout. Soil movement is a problem on roads up to the basin, and there were signs of overland water flow in some areas across the flat in 1998. An erosion condition class assessment completed in 2003 rated soils as stable, and signs of erosion were minimal. Vegetation and litter cover have been abundant in all surveys, and bare ground has been quite low.

The key browse species is mountain big sagebrush as it has provided 99% of the browse cover since 1992. Population density was estimated at 3,400 plants/acre in 1992, 3,120 in 1998, and 2,520 in 2003. The steady decline in population numbers is the result of moderate to high decadence in the population as well as more decadent, dying individuals than young plants since 1992. Seedlings were very abundant in 1998 due to consecutive years of above normal precipitation preceding the 1998 sampling (Utah Climate Summaries 2004). However, very few of the seedlings sampled in 1998 lived as evidenced by the very low number of young and the population decline in 2003. Percent decadence was high in 1992 and 2003 at 51% and 57% respectively, and moderate in 1987 and 1998 at 27% and 25% respectively. Utilization has varied between individuals and location in the basin. It was noted in 1998 that plants in the lowest area appeared heavily hedged and had comparatively poor growth and vigor, although this condition could also be related to soil type and/or water table conditions which could cause problems during exceptionally wet years. Differential use was noted in 2003 as some plants were heavily hedged and nearby ones had received little to no use. Overall, utilization on big sagebrush was moderate to heavy in 1987, 1992, and 2003, but light to moderate in 1998. Seed production was fair to good in 2003 with annual leaders averaging 1.4 inches of growth by mid-June.

Pinyon and juniper dominate the surrounding slopes and have invaded into the upper part of the sagebrush valley. The juniper trees to the west and on the slope below the basin were severely highlined in 1987. The chainsaw treatment cut down all the juniper on the study site, but some trees were still alive at the time of the 1992 reading. In 1998, the pinyon and juniper trees that were cut down, but reported to be alive on the site in 1992, were dead. Other browse sampled on the site include small numbers of Utah serviceberry, bitterbrush, rubber rabbitbrush, low rabbitbrush, broom snakeweed, yucca, and prickly pear cactus.

The herbaceous understory is dominated by cheatgrass. Even with several years of below normal spring precipitation between the 1998 and 2003 readings, cheatgrass maintained a stable nested frequency and

increased in average cover in 2003. Cheatgrass has been sampled in nearly every quadrat since 1992, and its presence on the site has created a severe fire hazard which would be detrimental to this area as the sagebrush would be lost. Another annual, sixweeks fescue, is moderately abundant but is low in stature. All perennial grasses combined are less abundant than cheatgrass. Intermediate wheatgrass is the most abundant perennial grass on the site and did significantly increase in 2003. Other grasses that have been sampled include purple three-awn, galleta, sand dropseed, bulbous bluegrass, and bottlebrush squirreltail. Most of the perennial grasses found on the site grow under the protection of sagebrush plants. Forbs are insignificant on this site, especially perennial species. All forbs combined have provided less than 1% average cover since 1992.

#### 1987 APPARENT TREND ASSESSMENT

Litter greatly contributes to the ground cover beneath sagebrush plants, but in the shrub interspaces vegetation and litter cover are limited. The very high concentration of pavement and rocks on the surface in the exposed areas made up 58% of the ground cover. Therefore, the soil itself is fairly well protected and only 2% of the surface was identified as bare soil. The key browse consisting of mountain big sagebrush is mostly mature, 30% of which are heavily hedged. Vigor is generally good and percent decadence is average for a site like this (27%). Sagebrush recruitment is very low however, with only a few seedlings and no young encountered. The abundance of grasses is fair and dominated by warm season species. Cheatgrass is prevalent in the understory. Forbs are rare.

#### 1992 TREND ASSESSMENT

Soil conditions are similar to the 1987 reading. Some of the differences in bare soil and rock cover are likely due to the new and larger sample size. Litter increased due to downed juniper trees from the chainsaw treatment. Some soil movement is still detectable, but the nearly continuous cover of rock, pavement and cheatgrass adequately protects what is left of the soil. Trend for soil is stable. Sagebrush, the key browse species, has an increased density estimate, but decadence has increased from 27% to 51%, and nearly half of the decadent plants were classified as dying. Along with increased decadence, vigor is also reduced with 28% of the mature and decadent shrubs displaying poor vigor. These factors, combined with a poor biotic and reproductive potential indicate a downward trend. The herbaceous understory is dominated by cheatgrass, sixweeks fescue, and a few annual forbs which make up 55% of the herbaceous understory cover. Perennial grasses consist primarily of 3 warm season species. Perennial forbs are rare. Sum of nested frequencies for perennial grasses and forbs combined, have remained stable since 1987.

#### TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - stable (3)

#### 1998 TREND ASSESSMENT

The soil trend is stable. Percent vegetation cover has declined while percent litter cover increased. The browse trend is slightly up. Both percent decadence and the percentage of plants classified as dying have decreased since 1992. Biotic potential is extremely high this season, but it is unlikely that many of the seedling plants will survive through the summer. Population density has declined by 8% since 1992, but vigor has greatly improved and use is lighter. Utilization has shifted from moderate to heavy use in 1987 to light to moderate in 1998. The herbaceous understory is stable. Cheatgrass still dominates the herbaceous understory, but has significantly declined in nested frequency since 1992. Sum of nested frequency of perennial species increased.

TREND ASSESSMENT

soil - stable (3)

browse - slightly up (4)

herbaceous understory - stable (3)

2003 TREND ASSESSMENT

Trend for soil is stable. Bare soil declined and remains very low. Vegetation and litter cover are abundant and effectively limit erosion on the site. Trend for browse is down. Density of mountain big sagebrush continues to decline, and recruitment decreased for the third consecutive survey. Percent decadence increased from 25% to 57%, and poor vigor slightly increased to 11%. The number of decadent plants classified as dying remains higher than the number of young, and further population losses are likely. In addition, heavy use increased to 46% of the population in 2003. Trend for the herbaceous understory is stable, but remains in poor condition. Cheatgrass remains the dominant species with a cover value of 25%, and the hazard for a wildfire is high. Perennial grasses and forbs maintained stable sum of nested frequency values but they fail in comparison to cheatgrass.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 11

T y p e	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	Agropyron cristatum	7	-	-	-	-	-	-
G	Agropyron intermedium	<sub>a</sub> 25	<sub>a</sub> 17	<sub>a</sub> 38	<sub>b</sub> 65	.89	2.65	2.87
G	Agropyron smithii	3	-	-	-	-	-	-
G	Aristida purpurea	<sub>c</sub> 77	<sub>b</sub> 34	<sub>ab</sub> 9	<sub>a</sub> 9	.42	.19	.07
G	Bromus tectorum (a)	-	<sub>b</sub> 369	<sub>a</sub> 330	<sub>ab</sub> 347	32.16	7.40	25.13
G	Hilaria jamesii	<sub>a</sub> -	<sub>b</sub> 21	<sub>b</sub> 30	<sub>b</sub> 29	1.70	1.88	2.24
G	Oryzopsis hymenoides	-	1	-	-	.03	-	-
G	Poa bulbosa	<sub>a</sub> -	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 20	-	-	.23
G	Poa secunda	-	-	6	4	-	.18	.06
G	Sitanion hystrix	18	12	8	15	.49	.09	.44
G	Sporobolus cryptandrus	<sub>a</sub> 6	<sub>b</sub> 32	<sub>b</sub> 43	<sub>a</sub> 4	1.23	2.52	.18
G	Stipa comata	-	3	1	6	.15	.15	.18
G	Vulpia octoflora (a)	-	145	146	170	.77	.58	2.33
Total for Annual Grasses		0	514	476	517	32.94	7.99	27.46
Total for Perennial Grasses		136	120	135	152	4.91	7.69	6.29
Total for Grasses		136	634	611	669	37.85	15.68	33.76

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	<i>Agoseris glauca</i>	a-	a-	b <sup>15</sup>	a <sup>5</sup>	-	.14	.01
F	<i>Artemisia ludoviciana</i>	-	1	6	-	.01	.18	-
F	<i>Astragalus</i> spp.	-	2	-	-	.03	-	-
F	<i>Calochortus nuttallii</i>	-	-	6	-	-	.04	-
F	<i>Chenopodium</i> spp. (a)	-	1	-	-	.00	-	-
F	<i>Crepis acuminata</i>	-	-	-	1	-	-	.00
F	<i>Draba</i> spp. (a)	-	a-	b <sup>50</sup>	c <sup>70</sup>	-	.09	.23
F	<i>Lappula occidentalis</i> (a)	-	-	-	7	-	-	.02
F	<i>Microsteris gracilis</i> (a)	-	b <sup>81</sup>	a <sup>37</sup>	b <sup>96</sup>	.23	.13	.34
F	<i>Orobanche fasciculata</i>	-	1	3	-	.00	.00	-
F	<i>Plantago patagonica</i> (a)	-	8	4	-	.01	.01	-
F	<i>Ranunculus testiculatus</i> (a)	-	a-	b <sup>22</sup>	b <sup>18</sup>	-	.10	.04
F	<i>Tragopogon dubius</i>	-	-	4	-	-	.01	-
Total for Annual Forbs		0	90	113	191	0.25	0.34	0.64
Total for Perennial Forbs		0	4	34	6	0.04	0.37	0.01
Total for Forbs		0	94	147	197	0.29	0.71	0.65

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

#### BROWSE TRENDS --

Management unit 28 , Study no: 11

Type	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	<i>Artemisia tridentata vaseyana</i>	73	76	66	23.90	23.32	20.55
B	<i>Chrysothamnus nauseosus hololeucus</i>	0	1	0	-	-	-
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	0	1	0	-	.15	-
B	<i>Gutierrezia sarothrae</i>	7	4	8	.15	.03	.15
B	<i>Juniperus osteosperma</i>	0	0	1	-	-	-
B	<i>Opuntia</i> spp.	2	2	2	.15	.15	.00
Total for Browse		82	84	77	24.20	23.65	20.70

CANOPY COVER, LINE INTERCEPT --  
Management unit 28 , Study no: 11

Species	Percent Cover
	'03
Artemisia tridentata vaseyana	15.14

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 28 , Study no: 11

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.4

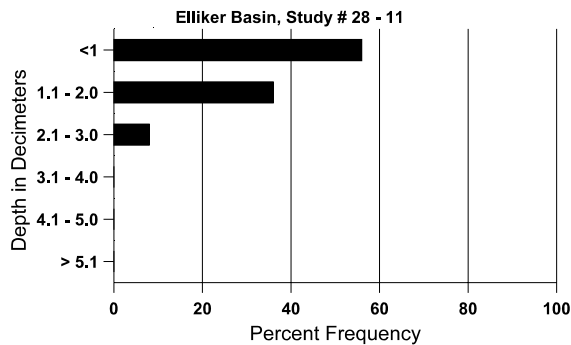
BASIC COVER --  
Management unit 28 , Study no: 11

Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	3.75	47.87	38.06	52.34
Rock	19.75	48.12	11.02	8.87
Pavement	37.75	0	27.36	22.20
Litter	37.25	23.97	41.11	31.03
Cryptogams	0	.04	.12	0
Bare Ground	1.50	4.53	9.89	4.15

SOIL ANALYSIS DATA --  
Management unit 28, Study no: 11, Study Name: Elliker Basin

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
14.2	75.8 (11.2)	5.8	50.7	31.4	17.8	2.8	10.6	99.2	0.5

### Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 11

Type	Quadrat Frequency		
	'92	'98	'03
Rabbit	26	19	13
Elk	-	1	1
Deer	27	47	31

Days use per acre (ha)	
'98	'03
-	-
1 (2)	-
44 (109)	151 (374)

BROWSE CHARACTERISTICS --

Management unit 28 , Study no: 11

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Amelanchier utahensis</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	80/71
<i>Artemisia tridentata vaseyana</i>											
87	<b>2466</b>	66	-	1800	666	-	57	30	27	5	27/33
92	<b>3400</b>	20	200	1480	1720	-	44	16	51	28	-/-
98	<b>3120</b>	3480	120	2220	780	540	31	0	25	5	23/39
03	<b>2520</b>	-	40	1040	1440	560	37	46	57	11	24/38
<i>Chrysothamnus nauseosus hololeucus</i>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>60</b>	-	-	-	60	-	100	0	100	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>60</b>	-	-	60	-	-	0	0	-	0	6/5
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Gutierrezia sarothrae</i>											
87	<b>265</b>	-	66	133	66	-	0	0	25	0	10/4
92	<b>180</b>	-	-	160	20	-	0	0	11	0	-/-
98	<b>160</b>	-	60	100	-	-	0	0	0	0	8/9
03	<b>380</b>	-	-	380	-	-	0	0	0	0	7/8



		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Juniperus osteosperma</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>40</b>	-	20	20	-	-	0	0	0	0	-/-
98	<b>40</b>	-	-	20	20	-	0	0	50	50	5/12
03	<b>40</b>	-	-	40	-	-	0	0	0	0	5/10
<b>Purshia tridentata</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	8/27
03	<b>0</b>	-	-	-	-	-	0	0	-	0	22/37
<b>Yucca spp.</b>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	24/21

Trend Study 28-14-03

Study site name: Sheep Hollow West .

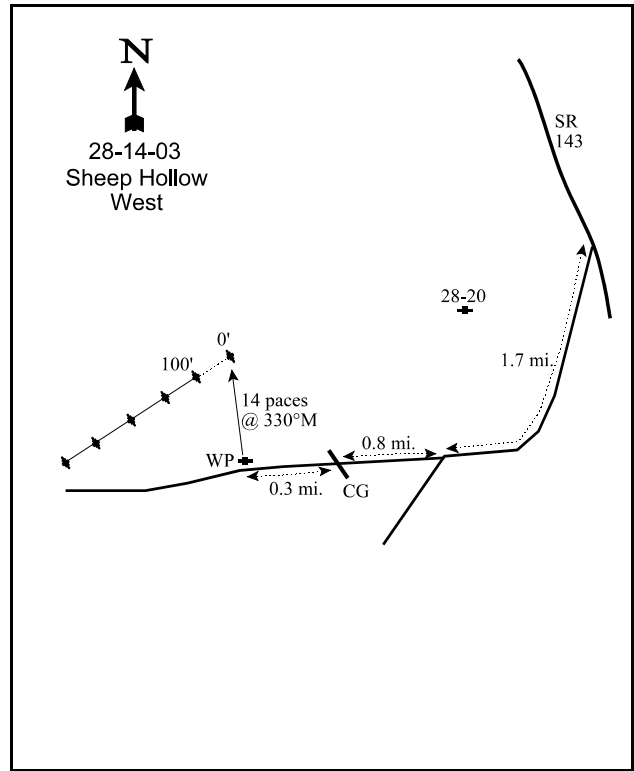
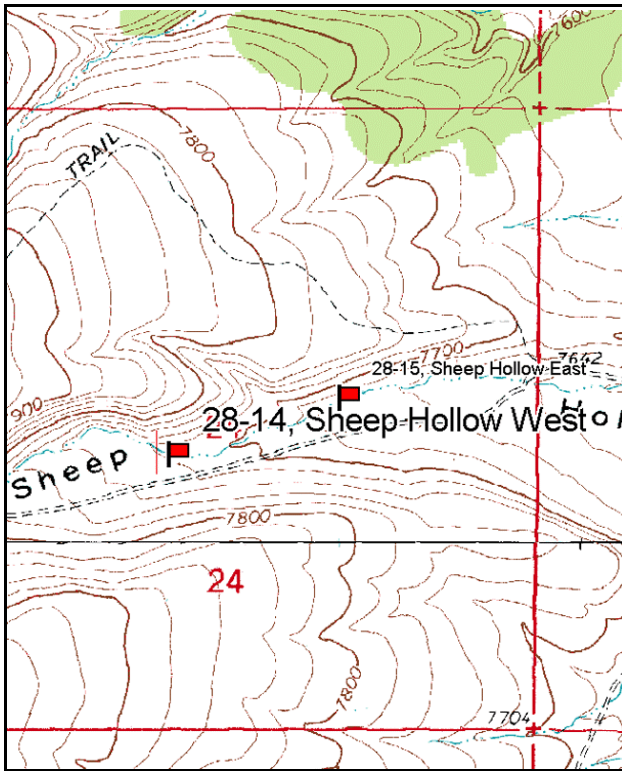
Vegetation type: Black Sagebrush .

Compass bearing: frequency baseline 246 degrees magnetic.

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

LOCATION DESCRIPTION

From Panguitch, head south on SR 143 to mile marker 47. Go 0.1 mile west of mile marker 47 and turn south onto a dirt road heading towards Sheep Hollow. Drive 1.7 miles to a fence and cattleguard. Cross the cattleguard and go 0.3 miles to a witness post on the right side of the road. The 0-foot baseline stake is 14 paces from the witness post at 330 degrees magnetic. The 0-foot stake has browse tag #500 attached.



Map Name: Panguitch

Diagrammatic Sketch

Township 35S, Range 6W, Section 24

GPS: NAD 27, UTM 12S 4179100 N, 369559 E

## DISCUSSION

### Sheep Hollow West - Study Site No. 28-14

This site was established in 1998 to monitor important winter range on the east side of the unit. Much of the winter range on this side of unit 28 is being effected by the encroachment of pinyon and juniper trees, and is represented by black sagebrush ridges with bitterbrush and big sagebrush in the deeper soils of the drainage bottoms. Big game animals, including pronghorn antelope, utilize these areas during most of the year and especially during the winter when deep snow pushes them to lower elevations. This site samples a wide drainage bottom which supports a dense population of black sagebrush with a good bitterbrush component. Slope is only 2-5% with a slight east aspect and an elevation of 7,800 feet. The area is used by a variety of wildlife and livestock. This area was historically a sheep range but use has been switched to cattle. The west side of the fence is permitted to be grazed by 296 AUM's from June to October (1998 grazing management information). The east side of the fence is grazed heavier and is monitored by trend study 28-15. Pellet group data collected in 1998 estimated 15 deer, 7 elk and 12 cow days use/acre (37 ddu/ha, 17 edu/ha, and 30 cdu/ha). Pellet group transect data from 2003 estimated 32 deer, less than 1 elk, and 7 cow days use/acre (79 ddu/ha, 2 edu/ha, and 18 cdu/ha). Deer and antelope pellets are difficult to differentiate and were lumped into deer pellets. Two dozen antelope were seen west of the site during study site establishment in 1998. Deer were also seen in the area.

Soil on the site is moderately deep with an effective rooting depth of 15 inches. Texture is a clay loam with a slightly acidic pH (6.3). Parent material is basalt. The soil profile is moderately rocky. Bare ground was moderately high in 1998 at 18%, increasing to 35% in 2003. Vegetation and litter cover were very abundant in 1998, with both decreasing in 2003 with drought conditions. An erosion condition class assessment in 2003 gave soils a slightly eroding rating due primarily to a gully in the road that was active and had dumped a lot of new soil on the site. Several categories in the assessment were given points including surface soil and litter movement, flow patterns, and moderately high pedestalling.

The site supports a dense stand of black sagebrush at an estimated density of 8,560 plants/acre in 1998 and 8,160 in 2003. Black sagebrush provides about 2/3 of the browse cover on the site in both 1998 and 2003, and canopy cover was estimated at 17% in 2003. The black sagebrush shows mostly moderate to heavy use with generally good vigor, but moderate decadence at 39% in 1998 and 34% in 2003. The proportion of the decadent age class classified as dying was low in 1998 at 7%, but increased to 42% in 2003. This translates into ~1,160 plants/acre that may be lost to die-off. Recruitment by young plants was not high enough in 2003 to replace the dying in the population, and it is likely that black sagebrush will decline in overall density by the next reading. Black sagebrush leaders had averaged just under 1 inch of annual growth when the site was read in late June 2003. Bitterbrush also provides important forage and has an estimated population density of about 500 plants/acre. These plants show moderate to heavy use. Decadence and poor vigor were very low in 1998, but both parameters increased in 2003. Recruitment by young bitterbrush plants was good in 1998 at 15%, decreasing to 4% in 2003. Bitterbrush leaders had averaged 1.6 inches of growth when the site was read in late June 2003.

Other browse encountered on the site include several rabbitbrush species (dwarf rabbitbrush, stickyleaf low rabbitbrush, and Parry rabbitbrush), broom snakeweed, and isolated patches of basin big sagebrush. Pinyon and juniper tree density was estimated at 10 to 15 trees/acre in 1998. These were hand cut prior to the 1998 reading as part of a tree thinning treatment. Only a few scattered young trees were left.

The herbaceous understory is diverse and abundant considering the high amount of shrub cover. Grasses dominate the herbaceous cover with 14 perennial species being sampled between 1998 and 2003. The most common species are mutton bluegrass and Letterman needlegrass which together produced over half of the total grass cover in both surveys. Less abundant perennials include western wheatgrass, blue grama, prairie

junegrass, bottlebrush squirreltail, and needle-and-thread grass. Forbs are also diverse. Eighteen perennial and 2 annual species were sampled in 1998. With drier conditions in 2003, only 8 perennial and 3 annual species were sampled. The most common species in 1998 included Indian paintbrush, Eaton fleabane, sulfur and redroot eriogonum, Lewis flax, and Utah deervetch. These species provide important succulent spring forage for big game animals.

1998 APPARENT TREND ASSESSMENT

Trend for soil appears stable with adequate protective ground cover to prevent erosion. Trend for browse appears stable with a relatively high turnover for black sagebrush. There is a high number of dead plants, but reproduction appears adequate to maintain the population at this time. Use is mostly moderate and vigor is good. Bitterbrush on the site also appear stable. Utilization is moderate to heavy, yet vigor is good on all plants and percent decadence is low at only 4%. The herbaceous understory is abundant and very diverse providing a total of 21% cover. Currently, mutton bluegrass and Letterman needlegrass dominate the grass component. Several preferred forbs occur on the site and provide important spring forage for big game.

2003 TREND ASSESSMENT

Trend for soil is down. A gully that parallels the road was active in 2003 and soil deposition onto the study site was apparent. As a result, bare ground nearly doubled. Vegetation and litter cover declined due to soil deposition onto the site as well as drought conditions. Trend for browse is slightly down. Black sagebrush had improved decadence but 42% of the decadent plants were classified as dying, an increase from 7% in 1998. The number of young in the population is not enough to replace these individuals. Basin big sagebrush density increased, but 43% of the population is decadent and no young were sampled in 2003. Bitterbrush slightly declined in overall density, and showed increases in both decadence and poor vigor. The number of young bitterbrush also declined. Trend for the herbaceous understory is down. Nested frequency values for most perennial species declined in 2003 with drought conditions. Perennial forbs showed a 59% decline in sum of nested frequency, while the frequency of perennial grasses declined by 20%.

TREND ASSESSMENT

soil - down (1)

browse - slightly down (2)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 28 , Study no: 14

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Agropyron intermedium	-	8	-	.08
G	Agropyron smithii	3	4	.00	.03
G	Agropyron spicatum	6	-	.03	-
G	Agropyron trachycaulum	4	3	.03	.03
G	Bouteloua gracilis	4	7	.03	.06
G	Bromus inermis	5	-	.03	-
G	Bromus tectorum (a)	-	4	-	.01
G	Carex spp.	<sub>b</sub> 21	<sub>a</sub> -	.63	-

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Koeleria cristata</i>	<sub>a</sub> 27	<sub>b</sub> 64	.44	1.48
G	<i>Oryzopsis hymenoides</i>	2	4	.03	.15
G	<i>Poa fendleriana</i>	<sub>b</sub> 232	<sub>a</sub> 186	8.61	4.21
G	<i>Sitanion hystrix</i>	74	71	.97	.90
G	<i>Stipa columbiana</i>	8	-	.19	-
G	<i>Stipa comata</i>	12	13	.10	.35
G	<i>Stipa lettermani</i>	<sub>b</sub> 183	<sub>a</sub> 102	4.86	1.08
Total for Annual Grasses		0	4	0	0.00
Total for Perennial Grasses		581	462	15.97	8.39
Total for Grasses		581	466	15.97	8.40
F	<i>Antennaria rosea</i>	16	9	.36	.01
F	<i>Arabis</i> spp.	1	-	.01	-
F	<i>Astragalus convallarius</i>	<sub>b</sub> 8	<sub>a</sub> -	.21	-
F	<i>Astragalus</i> spp.	3	-	.00	-
F	<i>Castilleja linariaefolia</i>	<sub>b</sub> 49	<sub>a</sub> 2	1.24	.03
F	<i>Chenopodium leptophyllum</i> (a)	<sub>a</sub> -	<sub>b</sub> 15	-	.09
F	<i>Erigeron eatonii</i>	<sub>b</sub> 63	<sub>a</sub> 5	.59	.03
F	<i>Erigeron flagellaris</i>	9	-	.07	-
F	<i>Erigeron pumilus</i>	<sub>b</sub> 25	<sub>a</sub> -	.04	-
F	<i>Eriogonum racemosum</i>	55	54	.45	.50
F	<i>Eriogonum umbellatum</i>	<sub>b</sub> 46	<sub>a</sub> 33	.79	.61
F	<i>Gayophytum ramosissimum</i> (a)	<sub>a</sub> -	<sub>b</sub> 87	-	.43
F	<i>Hymenoxys richardsonii</i>	1	-	.03	-
F	<i>Linum lewisii</i>	<sub>b</sub> 46	<sub>a</sub> 14	.25	.05
F	<i>Lotus utahensis</i>	<sub>b</sub> 35	<sub>a</sub> -	.42	-
F	<i>Lupinus kingii</i> (a)	4	-	.03	-
F	<i>Lychnis drummondii</i>	7	-	.01	-
F	<i>Machaeranthera canescens</i>	5	-	.06	-
F	<i>Penstemon caespitosus</i>	3	-	.03	-
F	<i>Penstemon</i> spp.	3	4	.00	.01
F	<i>Phlox longifolia</i>	58	56	.17	.19
F	<i>Polygonum douglasii</i> (a)	11	5	.02	.01
Total for Annual Forbs		15	107	0.05	0.53
Total for Perennial Forbs		433	177	4.79	1.45
Total for Forbs		448	284	4.84	1.99

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

BROWSE TRENDS --

Management unit 28 , Study no: 14

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia nova	95	98	13.73	17.06
B	Artemisia tridentata tridentata	2	12	-	.36
B	Chrysothamnus depressus	10	12	.40	.12
B	Chrysothamnus parryi	0	1	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	54	66	2.79	4.17
B	Gutierrezia sarothrae	3	8	.21	.31
B	Opuntia spp.	1	2	-	-
B	Purshia tridentata	23	21	4.41	3.42
Total for Browse		188	220	21.54	25.46

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 14

Species	Percent Cover
	'03
Artemisia nova	16.66
Chrysothamnus depressus	.11
Chrysothamnus viscidiflorus viscidiflorus	1.86
Gutierrezia sarothrae	.05
Purshia tridentata	3.45

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 14

Species	Average leader growth (in)
	'03
Artemisia nova	0.9
Purshia tridentata	1.6

**BASIC COVER --**

Management unit 28 , Study no: 14

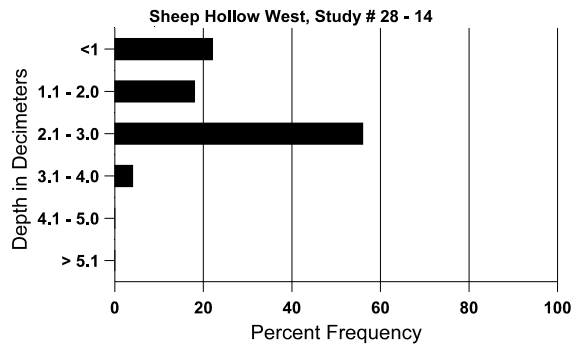
Cover Type	Average Cover %	
	'98	'03
Vegetation	51.18	35.06
Rock	5.71	5.79
Pavement	6.77	3.70
Litter	39.84	34.54
Cryptogams	3.50	1.47
Bare Ground	18.07	35.31

**SOIL ANALYSIS DATA --**

Management unit 28, Study no: 14, Study Name: Sheep Hollow West

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
15.0	57.3 (14.3)	6.3	40.7	27.4	31.8	2.2	18.4	131.2	0.3

**Stoniness Index**



**PELLET GROUP DATA --**

Management unit 28 , Study no: 14

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	6	2	-	-
Elk	5	2	7 (17)	1 (2)
Deer	11	11	15 (37)	32 (79)
Cattle	1	3	12 (30)	7 (18)

BROWSE CHARACTERISTICS --  
Management unit 28 , Study no: 14

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia nova</i>											
98	<b>8560</b>	380	580	4680	3300	1560	43	13	39	3	16/22
03	<b>8160</b>	-	400	4980	2780	2320	25	1	34	14	15/20
<i>Artemisia tridentata tridentata</i>											
98	<b>60</b>	-	20	40	-	-	0	33	0	0	-/-
03	<b>560</b>	-	-	320	240	40	18	0	43	21	20/26
<i>Chrysothamnus depressus</i>											
98	<b>240</b>	20	40	200	-	-	0	0	0	0	7/10
03	<b>340</b>	-	20	280	40	-	71	12	12	0	5/9
<i>Chrysothamnus parryi</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	20	-	-	-	0	0	-	0	7/9
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
98	<b>2740</b>	-	320	2420	-	-	0	0	0	0	8/12
03	<b>4120</b>	-	200	3820	100	-	0	0	2	.48	7/12
<i>Gutierrezia sarothrae</i>											
98	<b>80</b>	-	-	80	-	-	0	0	-	0	6/8
03	<b>260</b>	-	-	260	-	-	0	0	-	0	7/6
<i>Opuntia spp.</i>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	7/12
03	<b>40</b>	-	-	40	-	-	0	0	-	0	6/12
<i>Purshia tridentata</i>											
98	<b>540</b>	-	80	440	20	-	59	19	4	0	23/36
03	<b>480</b>	-	20	280	180	40	71	29	38	21	30/45



Trend Study 28-15-03

Study site name: Sheep Hollow East .

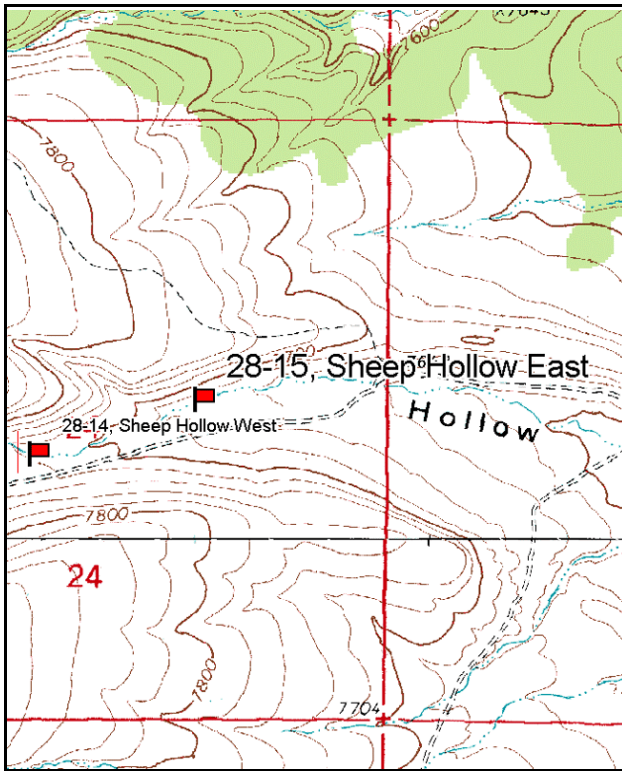
Vegetation type: Black Sagebrush .

Compass bearing: frequency baseline 64 degrees magnetic.

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

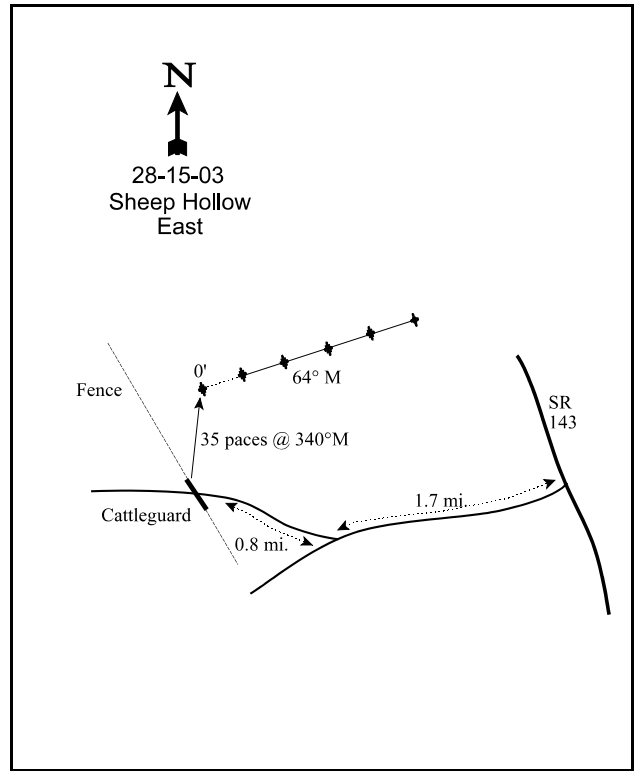
LOCATION DESCRIPTION

From Panguitch, head south on SR 143 to mile marker 47. Go 0.1 mile west of mile marker 47 and turn south onto a dirt road heading towards Sheep Hollow. Drive 1.7 miles to a fork. Stay right and continue 0.8 miles to a fence and cattleguard. The witness post is on the right side of the road just before the cattleguard. From the cattleguard, the 0-foot stake is 35 paces away at 340 degrees magnetic and is marked with browse tag #496.



Map Name: Panguitch

Township 35S , Range 6W , Section 24



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4179243 N, 370006 E

## DISCUSSION

### Sheep Hollow East - Trend Study No. 28-15

This study was established in 1998 in conjunction with study 28-14. It lies ½ mile to the east of study 28-14 and across the fence in a different grazing regime. The site drains gently to the east at 2-5%, and elevation is 7,700 feet. This site receives heavier grazing pressure than the previous study and was historically grazed by sheep until 1991 when use was changed to cattle. About 12 cows were utilizing the site during transect establishment in 1998. This pasture is permitted for 800 AUM's from June to October (1998 grazing management data). The cows are moved around the pasture by utilizing various water sources at different times of the grazing season. Wildlife also appear to be using this site more heavily than the previous study. Pellet group data from 1998 estimated 27 deer, 15 elk and 22 antelope days use/acre (67 ddu/ha, 37 edu/ha, and 54 adu/ha). A few antelope were seen near the site but most of the wildlife sign was old, likely from the previous winter. Pellet group data from 2003 estimated 33 deer and 31 cow days use/acre (83 ddu/ha and 77 cdu/ha). As with the previous site, antelope and deer pellets were combined in 2003 due to difficulty in identification.

Ground cover characteristics are very similar to the Sheep Hollow West study (28-14). However, soil on this site is more shallow with more rock concentrated near the surface compared to the adjacent study. Effective rooting depth is estimated at almost 12 inches. Soil texture is a sandy loam with a neutral pH (7.1). The profile is very rocky in most places, especially at the beginning of the baseline. Parent material is basalt. Erosion does not appear to be a serious problem on the site but some past erosion is evident in the form of severe soil pedestalling around bunchgrasses and shrubs. An erosion condition class assessment rated soils as stable in 2003. Two gullies also border the site. As with the previous study, vegetation and litter cover declined in 2003 while bare ground increased to over 30%.

This site supports a mix of black sagebrush, basin big sagebrush, and bitterbrush with a grass-forb understory. Black sagebrush is the most abundant shrub providing 21% cover in 1998 and 2003. Estimated density was 7,840 plants/acre in 1998 and 7,640 in 2003. This population is highly mature with moderate decadence at 28% and 25% in 1998 and 2003 respectively. There was a fair number of young in both surveys, but less than the number of plants classified as decadent and dying in both years. Utilization is mostly light to moderate, although a few plants are heavily hedged, and vigor is good on most plants. The densities of basin big sagebrush and bitterbrush are higher on this site compared to study 28-14. Basin big sagebrush density was estimated at 1,400 plants/acre in 2003. Some of the sagebrush on the site are hybrids between basin big sagebrush and black sagebrush and were classified mostly on growth form and foliage coloration. The increase in basin big sagebrush density in 2003 is mostly due to differences in identification between years. The basin big sagebrush on the site grow on scattered isolated patches of deeper soils. Basin big sagebrush had moderate decadence, low recruitment, and mostly light use in both surveys. Bitterbrush density was estimated at 600 plants/acre in both samples with most of the population being comprised of mature plants. Bitterbrush decadence was low in both readings, vigor normal, and use moderate to heavy. Annual leaders for black sagebrush and bitterbrush averaged 1 inch and 1.7 inches respectively in 2003.

The pinyon and juniper trees on this site were hand cut in the spring of 1998 with only a few scattered trees being left. Stickyleaf low rabbitbrush, broom snakeweed, Oregon grape, prickly pear, and gray horsebrush were also sampled on the site in small numbers.

The herbaceous understory is similar in diversity but not nearly as abundant compared to the Sheep Hollow West study site (28-14). Eleven species of perennial grasses, 1 annual grass, and 1 sedge were sampled in 1998. A few less species were sampled in 2003. In 2003, perennial species sampled in order of abundance were blue grama, bottlebrush squirreltail, mutton bluegrass, and Letterman needlegrass. Most of the preferred grass species are found growing under the protection of shrubs due to grazing. Blue grama is found in the

shrub interspaces, and being a warm season species, it would be less effected by livestock use than the cool season species. The forb component is very diverse, with fair abundance. Twenty-three perennial and 3 annual forbs were classified on the site in 1998. As with grasses, less forb species were sampled in 2003 due to drought. The most abundant perennial forbs include sulfur and redroot eriogonum, Indian paintbrush, low fleabane, skeletonweed, hoary aster, and longleaf phlox. Groundsmoke was the most abundant annual forb on the site in 2003.

#### 1998 APPARENT TREND ASSESSMENT

The soil trend appears stable but erosion has occurred on this site in the past and 2 gullies near the site appear to be occasionally active. Trend for the key browse, black sagebrush and bitterbrush, appears stable but black sagebrush on this site has more decadent plants which were classified as dying than young plants to replace them. This may lead to a slight decline in shrub density in the future if reproduction does not improve. The herbaceous understory is similarly diverse as the adjacent site, but grass cover is one-half that of the Sheep Hollow West site, and 1/3 of the grass cover comes from blue grama, a warm season increaser. The forb component is also similarly diverse but composition is lacking in preferred species. Preferred forbs, Indian paintbrush, Eaton fleabane, redroot eriogonum, sulfur eriogonum, Lewis flax, and Utah deervetch on this site have a sum of nested frequency value 3½ times lower and provide 1/4 less cover than the adjacent Sheep Hollow West site.

#### 2003 TREND ASSESSMENT

Trend for soil is down. Decreases in vegetation and litter cover and a corresponding increase in bare soil translates into less protective cover on the soil surface to guard against erosion. Erosion is low at the present time, but could increase when precipitation patterns improve. Trend for browse is stable overall, although black sagebrush is showing signs of decline. Decadence in the black sagebrush population remained nearly stable, but the proportion of the decadent age class classified as dying increased from 16% to 44%. Although recruitment improved in 2003, the number of young in the population is not adequate to replace these individuals should they die-off. Overall density will probably be slightly less by the next reading. Use remains light and vigor is generally good. Basin big sagebrush has a higher density estimate, but with few young in 1998, most of this difference is due to classification differences between black sagebrush and basin big sagebrush between years. Bitterbrush density remained stable in 2003 and the population has low decadence, good vigor, and receives continued heavy use. Trend for the herbaceous understory is down. Both perennial grasses and forbs have lower sum of nested frequency values in 2003.

#### TREND ASSESSMENT

soil - down (1)

browse - stable (3)

herbaceous understory - down (1)

HERBACEOUS TRENDS --  
Management unit 28 , Study no: 15

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Agropyron intermedium	3	-	.01	-
G	Agropyron smithii	2	8	.01	.01
G	Bouteloua gracilis	175	137	2.76	1.14
G	Bromus carinatus	<sub>b</sub> 23	<sub>a</sub> -	.12	-
G	Bromus tectorum (a)	7	9	.02	.01
G	Carex spp.	3	-	.06	.00
G	Koeleria cristata	3	3	.03	.15
G	Oryzopsis hymenoides	4	-	.18	-
G	Poa fendleriana	40	40	.76	.23
G	Sitanion hystrix	<sub>b</sub> 116	<sub>a</sub> 60	1.57	.46
G	Stipa columbiana	9	7	.21	.04
G	Stipa comata	16	8	.38	.07
G	Stipa lettermani	<sub>b</sub> 62	<sub>a</sub> 19	1.63	.18
Total for Annual Grasses		7	9	0.02	0.01
Total for Perennial Grasses		456	282	7.76	2.30
Total for Grasses		463	291	7.78	2.32
F	Alyssum alyssoides (a)	6	-	.01	-
F	Arabis spp.	<sub>b</sub> 11	<sub>a</sub> -	.05	-
F	Astragalus convallarius	11	13	.22	.11
F	Astragalus spp.	9	13	.02	.02
F	Castilleja linariaefolia	17	10	.16	.04
F	Calochortus nuttallii	-	5	-	.01
F	Chaenactis douglasii	7	1	.02	.03
F	Chenopodium leptophyllum(a)	-	3	-	.00
F	Cryptantha spp.	<sub>b</sub> 6	<sub>a</sub> -	.04	.00
F	Descurainia pinnata (a)	2	-	.01	-
F	Erigeron divergens	<sub>b</sub> 20	<sub>a</sub> -	.15	-
F	Erigeron eatonii	7	-	.01	-
F	Erigeron flagellaris	8	-	.38	-
F	Erigeron pumilus	<sub>b</sub> 25	<sub>a</sub> 6	.11	.04
F	Eriogonum racemosum	23	24	.21	.17
F	Eriogonum umbellatum	31	28	.49	.30
F	Euphorbia robusta	5	4	.09	.06
F	Gayophytum ramosissimum(a)	<sub>a</sub> -	<sub>b</sub> 108	-	.60

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
F	<i>Gilia</i> spp. (a)	4	-	.01	-
F	<i>Leucelene ericoides</i>	-	2	-	.03
F	<i>Linum lewisii</i>	9	3	.05	.01
F	<i>Lotus utahensis</i>	4	-	.06	-
F	<i>Lupinus argenteus</i>	12	2	.25	.07
F	<i>Lychnis drummondii</i>	1	4	.00	.01
F	<i>Lygodesmia spinosa</i>	23	29	.18	.14
F	<i>Machaeranthera canescens</i>	<sub>b</sub> 28	<sub>a</sub> 5	.15	.09
F	<i>Oenothera pallida</i>	17	3	.08	.00
F	<i>Phlox longifolia</i>	23	13	.08	.03
F	<i>Senecio multilobatus</i>	1	-	.03	-
F	<i>Trifolium</i> spp.	2	-	.00	-
Total for Annual Forbs		12	111	0.03	0.61
Total for Perennial Forbs		300	165	2.89	1.19
Total for Forbs		312	276	2.92	1.80

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

#### BROWSE TRENDS --

Management unit 28 , Study no: 15

T y p e	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	<i>Artemisia nova</i>	96	87	20.73	21.42
B	<i>Artemisia tridentata tridentata</i>	9	26	.77	6.57
B	<i>Ceanothus fendleri</i>	1	0	-	-
B	<i>Chrysothamnus parryi</i>	0	1	-	-
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	9	7	.24	.59
B	<i>Gutierrezia sarothrae</i>	1	2	.03	-
B	<i>Mahonia repens</i>	9	9	.01	.06
B	<i>Opuntia</i> spp.	3	2	-	-
B	<i>Pediocactus simpsonii</i>	0	1	-	-
B	<i>Pinus edulis</i>	1	2	.03	.30
B	<i>Purshia tridentata</i>	23	21	4.14	5.08
B	<i>Tetradymia canescens</i>	1	0	-	-
Total for Browse		153	158	25.96	34.04

CANOPY COVER, LINE INTERCEPT --  
Management unit 28 , Study no: 15

Species	Percent Cover
	'03
Artemisia nova	21.60
Artemisia tridentata tridentata	10.26
Chrysothamnus viscidiflorus viscidiflorus	.21
Gutierrezia sarothrae	.26
Mahonia repens	.05
Pinus edulis	.10
Purshia tridentata	7.68

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 28 , Study no: 15

Species	Average leader growth (in)
	'03
Artemisia nova	1.0
Purshia tridentata	1.7

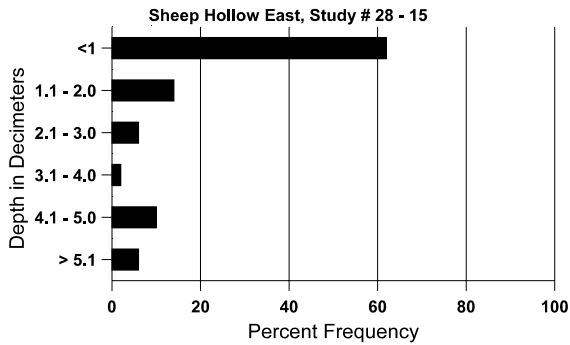
BASIC COVER --  
Management unit 28 , Study no: 15

Cover Type	Average Cover %	
	'98	'03
Vegetation	44.70	37.75
Rock	5.99	8.08
Pavement	6.91	5.80
Litter	45.79	37.56
Cryptogams	.04	.18
Bare Ground	16.03	30.54

SOIL ANALYSIS DATA --  
Management unit 28, Study no: 15, Study Name: Sheep Hollow East

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	%OM	PPM P	PPM K	ds/m
11.5	59.3 (12.7)	7.1	62.7	21.4	15.8	2.6	24.8	262.4	0.3

# Stoniness Index



## PELLET GROUP DATA --

Management unit 28 , Study no: 15

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	3	12	-	-
Elk	5	1	15 (37)	-
Deer	27	27	49 (121)	33 (83)
Cattle	6	3	-	31 (77)

## BROWSE CHARACTERISTICS --

Management unit 28 , Study no: 15

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia nova</b>											
98	<b>7840</b>	220	320	5320	2200	1180	35	7	28	5	18/28
03	<b>7640</b>	-	460	5300	1880	1060	17	1	25	11	13/19
<b>Artemisia tridentata tridentata</b>											
98	<b>260</b>	-	20	180	60	80	31	0	23	0	40/48
03	<b>1400</b>	-	-	1000	400	240	6	0	29	7	32/37
<b>Ceanothus fendleri</b>											
98	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Chrysothamnus nauseosus</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	26/24
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus parryi</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	8/10
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
98	<b>260</b>	-	20	220	20	-	8	0	8	0	8/15
03	<b>300</b>	-	-	300	-	-	0	0	0	0	6/10
<b>Gutierrezia sarothrae</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	7/18
03	<b>40</b>	-	-	40	-	40	0	0	-	0	8/16
<b>Mahonia repens</b>											
98	<b>880</b>	-	80	800	-	-	0	0	-	0	-/-
03	<b>520</b>	-	40	480	-	-	0	0	-	0	2/3
<b>Opuntia spp.</b>											
98	<b>60</b>	-	-	60	-	-	0	0	-	0	8/6
03	<b>40</b>	-	-	40	-	-	0	0	-	0	6/9
<b>Pediocactus simpsonii</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	2/3
<b>Pinus edulis</b>											
98	<b>20</b>	-	20	-	-	20	0	0	-	0	-/-
03	<b>40</b>	-	40	-	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
98	<b>600</b>	-	40	540	20	20	53	33	3	0	31/50
03	<b>600</b>	-	20	500	80	-	3	97	13	0	31/51
<b>Rhus trilobata</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	14/23
<b>Tetradymia canescens</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	12/18
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-



Trend Study 28-16-03

Study site name: Asay Bench.

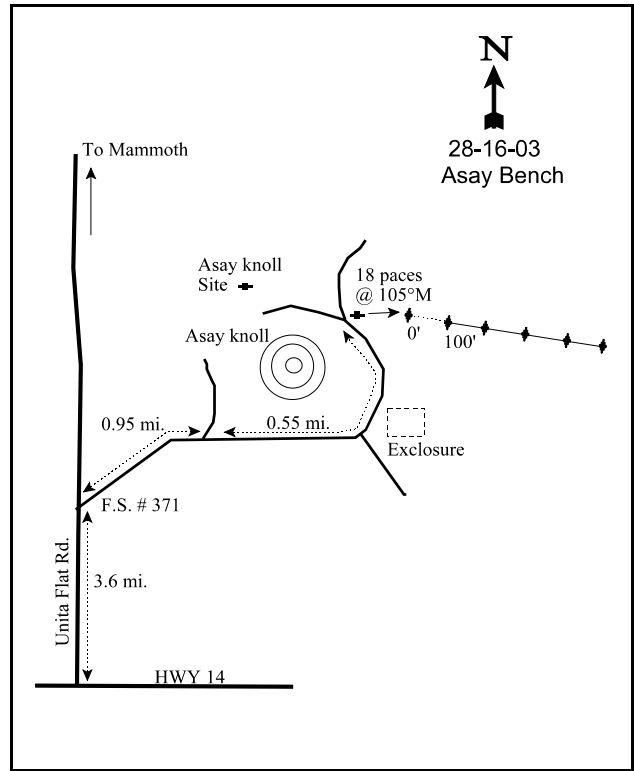
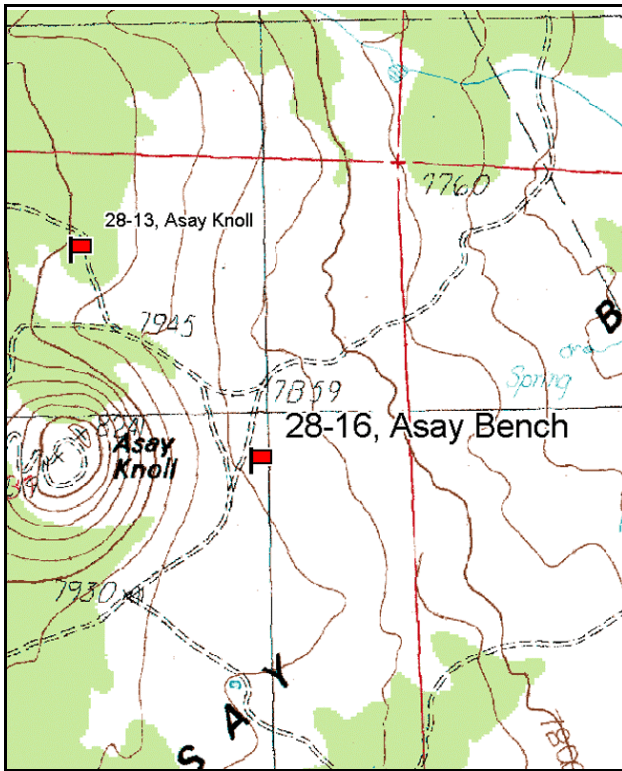
Vegetation type: Mountain Brush.

Compass bearing: frequency baseline 65 degrees magnetic.

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

LOCATION DESCRIPTION

Start at the junction of Highway 14 and Uinta Flat Road. Drive north on Uinta Flat Road for 3.6 miles to a fork going east (F.S. Rd. 371). Drive east for 0.95 miles crossing over a cattleguard and coming to a fork on the left (north). Continue straight (right) for 0.55 miles to a fork (an enclosure should be passed on the right before the fork). The witness post is on the east (right) side of the road just past the right fork. From the witness post the 0-foot stake is 18 paces at 105 degrees magnetic. The 0-foot stake is marked by browse tag #165.



Map Name: Asay Bench

Diagrammatic Sketch

Township 37S, Range 6W, Section 31

GPS: NAD 27, UTM 12S 4156808 N, 361940 E

## DISCUSSION

### Asay Bench - Trend Study No. 28-16

This study was established in 2003 to replace trend study 28-9 (Asay Knoll) which sampled marginal big game transitional range. This transect was placed just under ½ mile east of the Asay Knoll trend study and samples a mountain brush community dominated by mountain big sagebrush and bitterbrush. The study site slopes gently to the northeast at an elevation of 7,900 feet. Pellet group transect data collected on site in 2003 estimated 20 elk, 19 deer, and 7 cow days use/acre (50 edu/ha, 48 ddu/ha, and 18 cdu/ha). Deer and elk pellets were from winter and spring while cattle pats were from the previous summer.

Soils are derived from basalt parent material and have moderate depth with the effective rooting depth measured at over 11 inches. Soil temperature averaged 61.4°F in 2003. Soils are loam in texture and have a slightly acidic pH (6.2). Bare soil was high at nearly 24% in 2003, while rock and pavement cover were quite low combining for 7% average cover. Erosion is low for the most part although some of the shrub interspaces show shrink and swell cracking. An erosion condition class assessment rated soils as stable in 2003.

Mountain big sagebrush and bitterbrush combined to provide 81% of the total browse cover in 2003. Mountain big sagebrush density was estimated at 6,760 plants/acre in 2003, but mature plants are quite small averaging only 18 inches in height. This population is mostly mature with fair recruitment from the young age class (9%) and low decadence (14%). Utilization on mountain big sagebrush was light to moderate in 2003 and vigor was normal throughout the majority of the population. The sagebrush population had excellent seed production in and annual leaders averaged 1.7 inches. Bitterbrush density numbered 2,120 plants/acre in 2003. This population was highly decadent at 78%, and 1/3 of the population displayed poor vigor. Most of the population displayed heavy use in 2003 and young plants were few (4%). Bitterbrush leaders averaged 2.1 inches of growth in mid-July of 2003. The longest leaders were found growing underneath the canopy where hedging would be difficult. Other browse sampled on the site include snowberry, a few very large serviceberry plants, stickyleaf low rabbitbrush, broom snakeweed, Wood's rose, and gray horsebrush.

The herbaceous understory is moderately diverse but most of the species are not very abundant. Mutton bluegrass is by far the most abundant species in the understory as it provides 71% of the grass cover and 60% of the total herbaceous cover. A total of 11 perennial grasses were sampled in 2003 including prairie Junegrass, Kentucky bluegrass, Sandberg bluegrass, Letterman needlegrass, and needle-and-thread grass. Grasses showed no utilization. The forb component is dominated by annual species primarily littleflower collinsia and little polecat. Several important perennial species that were sampled in low numbers include pale agoseris, sego lily, low fleabane, and redroot eriogonum.

### 2003 APPARENT TREND ASSESSMENT

Soils were given a stable rating from an erosion condition class assessment. Some of the shrub interspaces showed shrink and swell cracking, but erosion will likely never be excessive due to the abundance of shrub cover as well as the gentle slope. The browse component shows both positive and negative signs. Mountain big sagebrush is very abundant and the population is healthy. Use is light to moderate and decadence is low. Bitterbrush is in poor condition with very high decadence, low recruitment by young plants, and 1/3 of the population is in poor vigor. It should be noted that this area is transitional/summer range at an elevation of 7,800 ft. Sagebrush is less important on transitional and summer ranges as a forage source and as it becomes dense, inhibits more important species, bitterbrush and herbaceous plants. The herbaceous understory appears stable and is dominated by small statured mutton bluegrass, although several other desirable grasses were sampled in low densities. The forb component is dominated by annual species with no perennials being particularly abundant. The combination of drought and a very abundant shrub community are suppressing understory production somewhat.

HERBACEOUS TRENDS --  
Management unit 28 , Study no: 16

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	Agropyron dasystachyum	3	.06
G	Agropyron intermedium	3	.03
G	Bouteloua gracilis	1	.00
G	Carex spp.	3	.06
G	Koeleria cristata	109	1.50
G	Poa fendleriana	249	9.31
G	Poa pratensis	11	.60
G	Poa secunda	29	.60
G	Sitanion hystrix	3	.01
G	Stipa comata	24	.34
G	Stipa lettermani	41	.56
Total for Annual Grasses		0	0
Total for Perennial Grasses		476	13.11
Total for Grasses		476	13.11
F	Agoseris glauca	25	.10
F	Antennaria rosea	7	.04
F	Arabis spp.	13	.02
F	Artemisia ludoviciana	15	.11
F	Calochortus nuttallii	18	.03
F	Comandra pallida	3	.03
F	Collinsia parviflora (a)	167	.72
F	Crepis acuminata	3	.01
F	Delphinium nuttallianum	2	.00
F	Erigeron flagellaris	1	.00
F	Erigeron pumilus	35	.10
F	Eriogonum racemosum	6	.03
F	Eriogonum umbellatum	2	.00
F	Gayophytum ramosissimum(a)	85	.24
F	Lactuca serriola	2	.00
F	Microsteris gracilis (a)	166	.84
F	Polygonum douglasii (a)	5	.01
Total for Annual Forbs		423	1.82
Total for Perennial Forbs		132	0.52
Total for Forbs		555	2.34

BROWSE TRENDS --

Management unit 28 , Study no: 16

Type	Species	Strip Frequency	Average Cover %
		'03	'03
B	Amelanchier utahensis	2	-
B	Artemisia tridentata vaseyana	90	13.83
B	Chrysothamnus viscidiflorus viscidiflorus	64	3.49
B	Gutierrezia sarothrae	19	1.33
B	Purshia tridentata	71	14.19
B	Rosa woodsii	2	.03
B	Symphoricarpos oreophilus	7	1.86
B	Tetradymia canescens	1	.03
Total for Browse		256	34.78

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 16

Species	Percent Cover
	'03
Amelanchier utahensis	.05
Artemisia tridentata vaseyana	17.11
Chrysothamnus viscidiflorus viscidiflorus	1.93
Gutierrezia sarothrae	.66
Purshia tridentata	10.13
Rosa woodsii	.03
Symphoricarpos oreophilus	1.39

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 16

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.7
Purshia tridentata	2.1

BASIC COVER --

Management unit 28 , Study no: 16

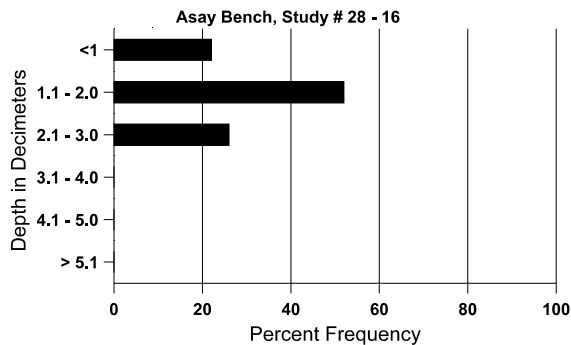
Cover Type	Average Cover % '03
Vegetation	49.34
Rock	5.65
Pavement	1.37
Litter	40.23
Cryptogams	.15
Bare Ground	23.70

SOIL ANALYSIS DATA --

Management unit 28, Study no: 16, Study Name: Asay Bench

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
11.4	61.4 (16.4)	6.2	36.6	39.2	24.2	2.9	28.4	572.8	0.6

### Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 16

Type	Quadrat Frequency '03	Days use per acre (ha) '03
Rabbit	2	-
Elk	12	20 (50)
Deer	5	19 (50)
Cattle	5	7 (18)

BROWSE CHARACTERISTICS --  
Management unit 28 , Study no: 16

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Amelanchier utahensis</i>											
03	<b>40</b>	-	-	-	40	-	0	0	100	50	-/-
<i>Artemisia tridentata vaseyana</i>											
03	<b>6760</b>	-	580	5200	980	460	33	2	14	3	18/19
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
03	<b>5080</b>	-	120	4780	180	-	1	0	4	2	7/9
<i>Gutierrezia sarothrae</i>											
03	<b>2640</b>	-	-	2640	-	-	0	0	-	0	6/7
<i>Opuntia spp.</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	3/9
<i>Purshia tridentata</i>											
03	<b>2120</b>	-	80	380	1660	-	20	77	78	32	19/31
<i>Ribes cereum inebrians</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	41/54
<i>Rosa woodsii</i>											
03	<b>80</b>	-	80	-	-	-	0	0	-	0	5/4
<i>Symphoricarpos oreophilus</i>											
03	<b>200</b>	-	20	160	20	-	0	0	10	0	17/25
<i>Tetradymia canescens</i>											
03	<b>20</b>	-	-	20	-	-	0	0	-	0	9/13

Trend Study 28-17-03

Study site name: Sidney Valley .

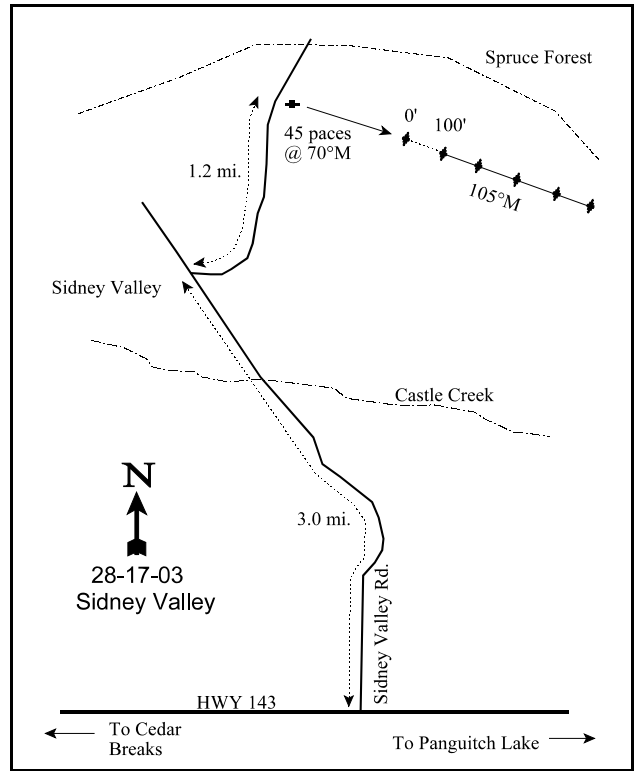
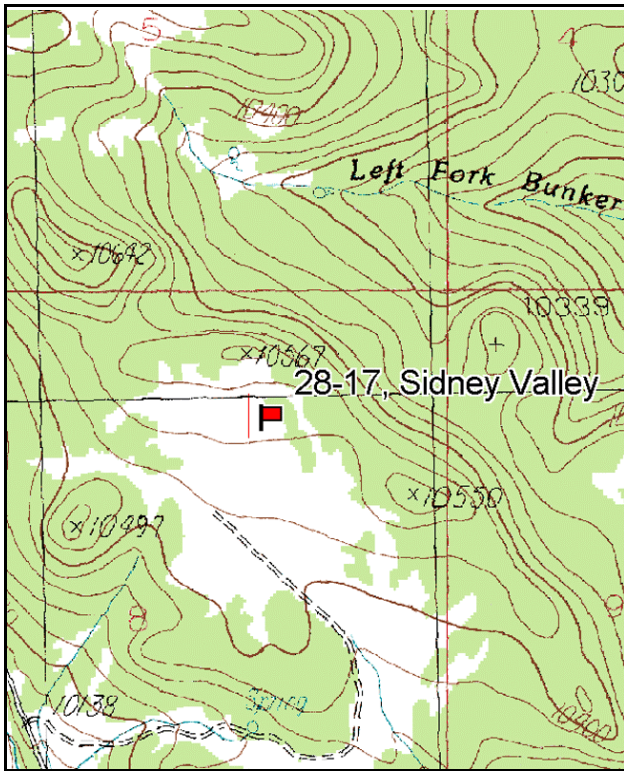
Vegetation type: Perennial Grass .

Compass bearing: frequency baseline 105 degrees magnetic.

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

LOCATION DESCRIPTION

Start at the junction of Highway 143 and the Sidney Valley Road. This junction is between Cedar Breaks and Panguitch Lake. Drive north on Sidney Valley Road for 3.0 miles to a fork on the right (east) side of the road (Castle Creek will be crossed). Take the right fork for 1.2 miles to the witness post on the right (east) side of the road. The 0-foot stake is 54 paces at 70 degrees magnetic from the witness post. The 0-foot stake is marked with browse tag #164.



Map Name: Brian Head

Diagrammatic Sketch

Township 36S, Range 8W, Section 8

GPS: NAD 27, UTM 12S 4179243 N, 370006 E

## DISCUSSION

### Sidney Valley - Trend Study No. 28-17

This is a new study established in 2003 to monitor elk summer range. Sidney Valley was chosen by the local biologist as elk use in the area has been increasing the past several years. The study site samples a dry meadow type at an elevation of 10,500 feet. The site slopes to the south at 8%. Pellet group transect data taken in 2003 estimated 97 elk and 27 deer days use/acre (240 edu/ha and 66 ddu/ha) on the meadow. Use was primarily from late spring and summer. This area is also apparently grazed by sheep in some years as a mineral lick is found near the site.

Soils on the site are loam in texture and moderately acidic in pH (5.6). These are deep mountain soils derived from igneous parent material. Effective rooting depth was measured at 18 inches, and soil temperature averaged just under 55°F in 2003. Rock and pavement covered a moderate portion of the soil surface at an estimated 20% in 2003. Erosion is low for the most part, with the majority of the soil disturbance coming from gopher activity. Perennial herbaceous vegetation and litter cover are high and adequately protect the surface. Bare ground was moderate in 2003 at 19%. An erosion condition class assessment rated soils as stable in 2003.

There were no browse species sampled on the site, but as this is high elevation summer range, browse is not of great importance. The herbaceous understory is abundant, but dominated by only a few species. The composition is poor with a high proportion of increasers present. Subalpine needlegrass, mountain muhly, and Letterman needlegrass are the predominant grass species while dandelion and yarrow dominate the forb component. These 5 species combined to provide 94% of the total vegetation cover on the site in 2003. The predominant grasses have fair to good forage value for big game and livestock, but become less palatable at maturity. Dandelion has fair to good forage value for elk and livestock, especially during spring green-up. Mormon crickets were surprisingly abundant on the site in 2003, but had not done a lot of damage to the vegetation on the site at least at the time of sampling.

### 2003 APPARENT TREND ASSESSMENT

Soils appear stable. Vegetation and litter cover are abundant and erosion is low. Most of the soil disturbance comes from gopher activity. The vegetative community is absent of browse, but as this is a high elevation summer range, browse is of minimal importance to big game on this site. The herbaceous component is very abundant overall, but composition is poor with a lot of increasers present. The composition indicates past heavy grazing. The predominant species have fair to good forage value for big game and livestock, especially during green-up when plants are young and succulent. Major changes in composition are unlikely and may only occur with changes in grazing management.



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

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	Agropyron trachycaulum	54	.75
G	Carex spp.	13	.22
G	Festuca ovina	11	.15
G	Muhlenbergia montana	100	6.28
G	Poa glauca	10	.36
G	Sitanion hystrix	5	.10
G	Stipa columbiana	272	15.90
G	Stipa lettermani	167	4.22
Total for Annual Grasses		0	0
Total for Perennial Grasses		632	28.01
Total for Grasses		632	28.01
F	Achillea millefolium	218	3.67
F	Agoseris aurantiaca	6	.07
F	Androsace septentrionalis (a)	1	.00
F	Arabis spp.	6	.01
F	Aster chilensis	16	.19
F	Erigeron spp.	19	.21
F	Lepidium densiflorum (a)	28	.16
F	Potentilla spp.	2	.00
F	Senecio integerrimus	19	.10
F	Taraxacum officinale	245	5.73
F	Tragopogon dubius	1	.03
F	Trifolium spp.	11	.07
Total for Annual Forbs		29	0.16
Total for Perennial Forbs		543	10.10
Total for Forbs		572	10.27

**BASIC COVER --**

Management unit 28 , Study no: 17

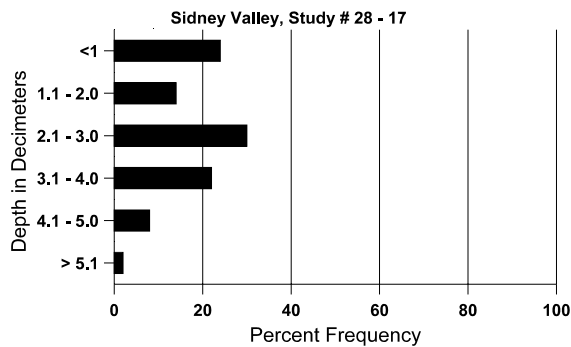
Cover Type	Average Cover % '03
Vegetation	41.18
Rock	6.98
Pavement	13.15
Litter	30.29
Bare Ground	18.93

**SOIL ANALYSIS DATA --**

Management unit 28, Study no: 17, Study Name: Sidney Valley

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
17.9	54.8 (18.1)	5.6	44.6	37.2	18.2	3.3	25.4	752.0	0.5

**Stoniness Index**



**PELLET GROUP DATA --**

Management unit 28 , Study no: 17

Type	Quadrat Frequency '03	Days use per acre (ha) '03
Rabbit	5	-
Elk	28	97 (240)
Deer	10	27 (66)
Cattle	3	-

Trend Study 28-18-03

Study site name: Shakespeare Hollow .

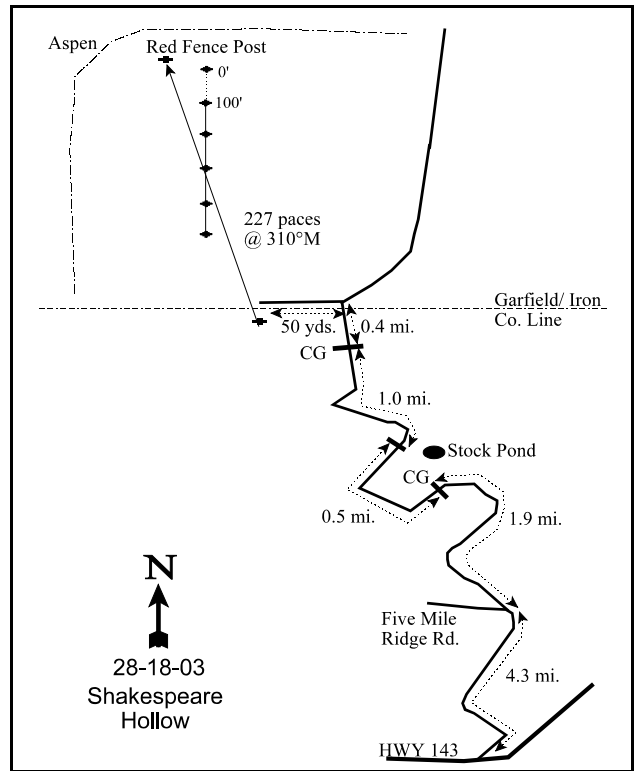
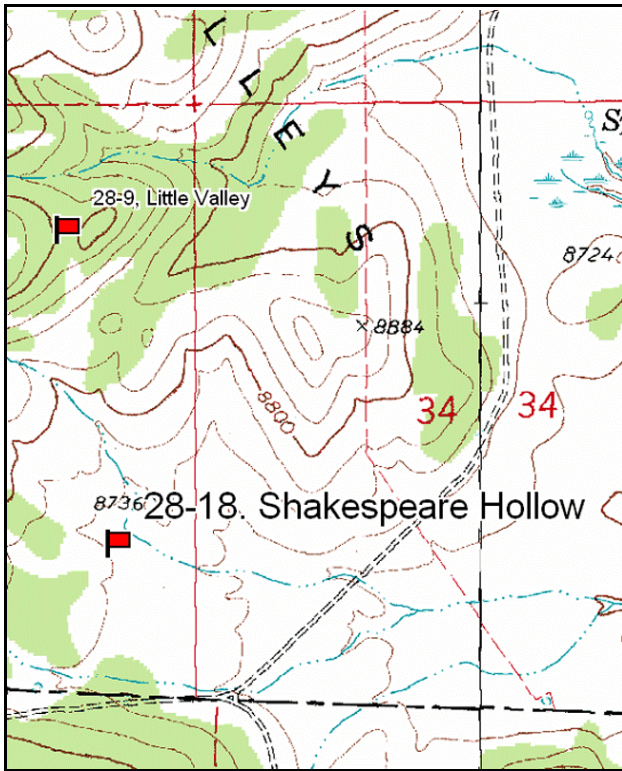
Vegetation type: Mountain Brush .

Compass bearing: frequency baseline 180 degrees magnetic.

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

LOCATION DESCRIPTION

From Panguitch, go south towards Panguitch Lake. At mile marker 41, turn right onto a dirt road. Proceed up Pole Hollow 4.3 miles to the Five Mile Ridge Road. Continue straight 1.9 miles to a cattleguard. Continue 0.5 miles to a cattleguard and stockpond. Continue 1.0 miles to another cattleguard. Go 0.4 miles to a fork at the Iron County-Garfield County line. Bear right, go 50 yards, and park by a witness post and aspen on the left side of the road (south). From the witness post, walk 227 paces at 310 degrees magnetic to another witness post. The 0-foot stake is west-southwest of the witness post.



Map Name: Red Creek Reservoir

Diagrammatic Sketch

Township 35S, Range 7W, Section 3

GPS: NAD 27, UTM 12S 4185721 N, 356083 E

## DISCUSSION

### Shakespeare Hollow - Trend Study No. 28-18

This study was established in 2003 to replace the Little Valleys transect (28-9) which no longer was representative of important summer range. The Little Valleys transect was placed inside a thick aspen clone with a very dense snowberry understory. The site received very little use by big game or livestock, and was difficult to sample due to the thick vegetation. This new study was placed about ½ mile south of the Little Valleys study and samples a mountain brush community surrounded by pockets of aspen. The new transect was left in the general area because of its importance to deer, elk, and sage grouse. The site slopes gently to the east (1-3%) at an elevation of 8,750 feet. Pellet group transect data collected on site in 2003 estimated 24 elk, 23 deer, and 16 cow days use/acre (60 edu/ha, 56 ddu/ha, and 39 cdu/ha). Deer and elk use appeared to be primarily from late spring and summer while cattle use was from the previous grazing season.

Soils are loam in texture and moderately acidic with a pH of 6.0. Soil depth is only fair with an effective rooting depth estimated at about 9 inches. Rock and pavement covered about 13% of the ground surface in 2003 and are distributed abundantly throughout the upper portions of the profile which limited deeper soil depth measurements. Pedestalling was evident around bunchgrasses and shrubs, but otherwise erosion was minimal in 2003. An erosion condition class assessment rated soils as stable in 2003.

Silver sagebrush and bitterbrush are the dominant browse species on the site as they contributed 83% of the total browse cover in 2003. Density of silver sagebrush was estimated at 6,400 plants/acre in 2003, with the majority of the population being classified as mature (80%). There were very few young in 2003 (1%) and decadence was fairly low at 19%. Silver sagebrush displayed mostly good vigor and light use. Seed production was high in 2003 for silver sagebrush and annual leaders averaged 1.4 inches of growth. Bitterbrush density was estimated at 1,000 plants/acre with a mostly mature population (90%). Decadence was low in 2003 at 8%, as was the number of young (2%). Eighty percent of the population displayed heavy use but vigor was normal and healthy on all plants sampled. The interior of some of the bitterbrush plants was partly unavailable since bitterbrush plants averaged just under 2 feet in height but averaged nearly 5 feet in width. Bitterbrush showed poor leader production overall, but leaders that could be found averaged 1.8 inches of annual growth. Other browse sampled on the site include Parry rabbitbrush, stickyleaf low rabbitbrush, and a few currant plants. About 1/3 of the Parry rabbitbrush population displayed moderate use in 2003.

The herbaceous understory is diverse and moderately abundant. Eight perennial grasses and 18 perennial forbs were sampled on the transect in 2003. Mutton bluegrass, needle-and-thread grass, and Letterman needlegrass were the most abundant grasses, while low fleabane, trailing fleabane, and redroot eriogonum were the most abundant forbs. Bottlebrush squirreltail and Kentucky bluegrass primarily grow underneath shrub crowns. Three species of annual forbs were also sampled, but all occur in low numbers. Utilization of grasses and forbs was low if any in 2003.

### 2003 APPARENT TREND ASSESSMENT

Soils appear to be stable with a moderate amount of vegetation and litter cover to protect against erosion. The browse component is comprised mainly of 2 co-dominants, silver sagebrush and bitterbrush. Trend for browse appears stable as both of the dominant species have low reproduction, but low decadence and good vigor. Bitterbrush is more preferred than silver sage, but as this is summer range and browse is not the most important component. The herbaceous component is evenly split between grasses and forbs and trend appears stable. The understory composition is good with few annuals being present. A decrease in browse cover and good grazing management should allow the understory to increase and remain diverse.

HERBACEOUS TRENDS --  
Management unit 28 , Study no: 18

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	<i>Bouteloua gracilis</i>	10	.38
G	<i>Koeleria cristata</i>	38	.31
G	<i>Poa fendleriana</i>	214	5.05
G	<i>Poa pratensis</i>	8	.16
G	<i>Sitanion hystrix</i>	36	.37
G	<i>Stipa columbiana</i>	10	.21
G	<i>Stipa comata</i>	66	1.37
G	<i>Stipa lettermani</i>	63	1.00
Total for Annual Grasses		0	0
Total for Perennial Grasses		445	8.88
Total for Grasses		445	8.88
F	<i>Achillea millefolium</i>	31	.13
F	<i>Agoseris glauca</i>	2	.00
F	<i>Antennaria rosea</i>	10	.09
F	<i>Artemisia dracunculus</i>	5	.38
F	<i>Artemisia ludoviciana</i>	79	.81
F	<i>Aster chilensis</i>	15	.10
F	<i>Calochortus nuttallii</i>	11	.03
F	<i>Collinsia parviflora</i> (a)	127	.63
F	<i>Delphinium nuttallianum</i>	4	.00
F	<i>Erigeron flagellaris</i>	79	1.05
F	<i>Erigeron pumilus</i>	133	2.11
F	<i>Eriogonum racemosum</i>	65	1.54
F	<i>Eriogonum umbellatum</i>	34	.56
F	<i>Microsteris gracilis</i> (a)	19	.06
F	<i>Penstemon</i> spp.	21	.16
F	<i>Potentilla</i> spp.	8	.10
F	<i>Senecio integerrimus</i>	3	.04
F	<i>Senecio multilobatus</i>	12	.05
F	<i>Sisymbrium altissimum</i> (a)	1	.00
F	<i>Tragopogon dubius</i>	20	.06
F	<i>Trifolium</i> spp.	21	.42
Total for Annual Forbs		147	0.69
Total for Perennial Forbs		553	7.69
Total for Forbs		700	8.39

BROWSE TRENDS --

Management unit 28 , Study no: 18

Type	Species	Strip Frequency	Average Cover %
		'03	'03
B	Artemisia cana	85	11.55
B	Chrysothamnus parryi	32	.74
B	Chrysothamnus viscidiflorus viscidiflorus	48	3.59
B	Gutierrezia sarothrae	2	-
B	Purshia tridentata	37	9.35
B	Ribes spp.	1	.01
Total for Browse		205	25.26

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 18

Species	Percent Cover
	'03
Artemisia cana	11.18
Chrysothamnus parryi	1.39
Chrysothamnus viscidiflorus viscidiflorus	3.75
Purshia tridentata	13.05
Ribes spp.	.11

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 18

Species	Average leader growth (in)
	'03
Artemisia cana	1.4
Purshia tridentata	1.8

**BASIC COVER --**

Management unit 28 , Study no: 18

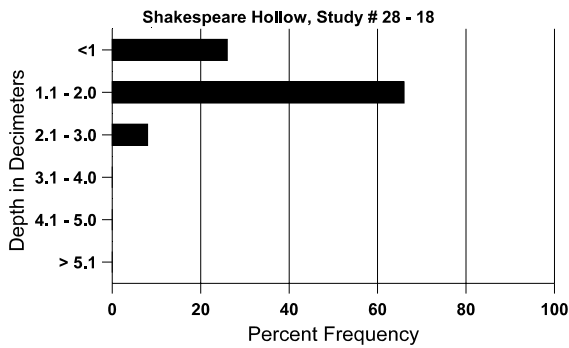
Cover Type	Average Cover % '03
Vegetation	39.65
Rock	9.71
Pavement	3.34
Litter	33.43
Cryptogams	.18
Bare Ground	30.55

**SOIL ANALYSIS DATA --**

Management unit 28, Study no: 18, Study Name: Shakespeare Hollow

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	%OM	PPM P	PPM K	ds/m
8.9	63.2 (13.0)	6.0	44.7	32.0	23.3	3.3	30.0	787.2	0.5

**Stoniness Index**



**PELLET GROUP DATA --**

Management unit 28 , Study no: 18

Type	Quadrat Frequency '03	Days use per acre (ha) '03
Rabbit	2	-
Elk	8	24 (60)
Deer	17	23 (56)
Cattle	5	16 (39)

BROWSE CHARACTERISTICS --  
Management unit 28 , Study no: 18

		Age class distribution (plants per acre)					Utilization				
Y e a r	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia cana</i>											
03	<b>6400</b>	-	60	5100	1240	20	14	2	19	6	12/19
<i>Chrysothamnus parryi</i>											
03	<b>1240</b>	-	-	1160	80	-	32	2	6	0	8/10
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
03	<b>3020</b>	-	-	2700	320	-	0	0	11	3	13/15
<i>Gutierrezia sarothrae</i>											
03	<b>60</b>	-	-	60	-	-	0	0	-	0	6/6
<i>Purshia tridentata</i>											
03	<b>1000</b>	-	20	900	80	-	20	80	8	0	21/59
<i>Ribes spp.</i>											
03	<b>20</b>	-	-	20	-	-	0	0	-	0	32/24
<i>Symphoricarpos oreophilus</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	15/18



Trend Study 28-19-03

Study site name: DD Hollow .

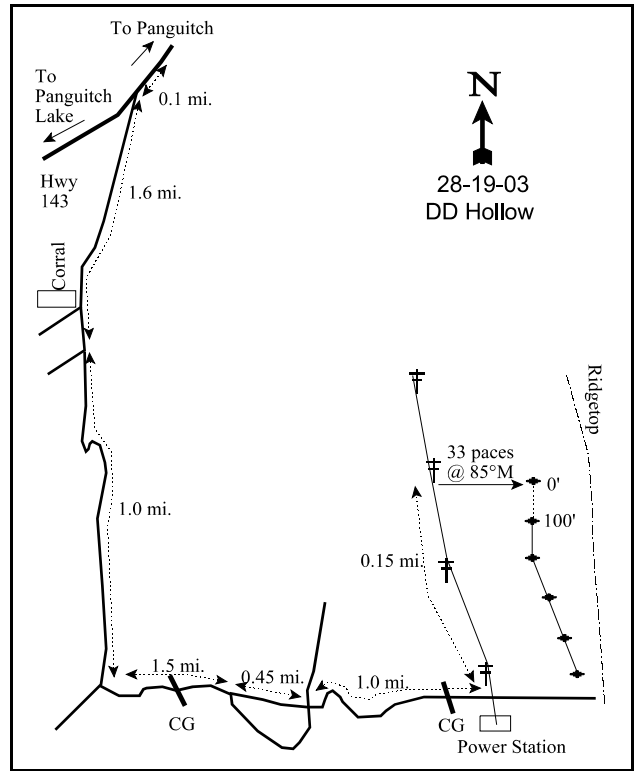
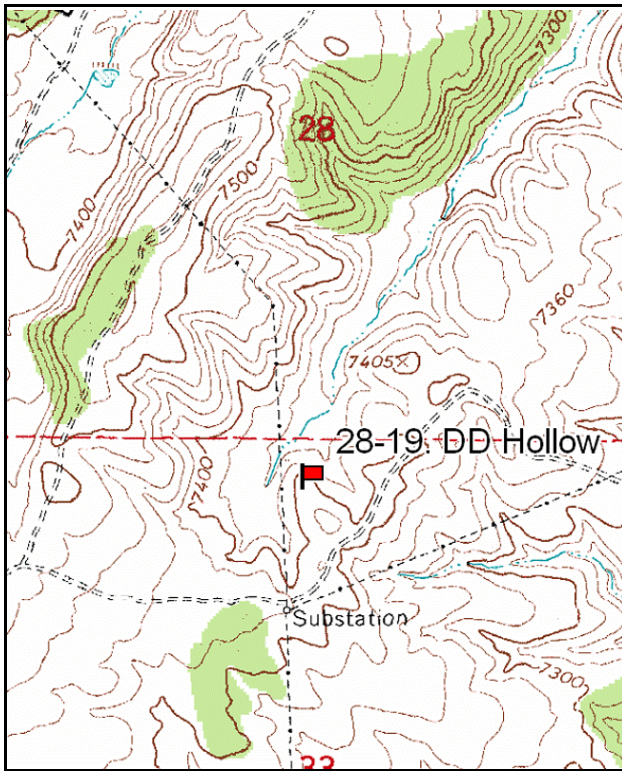
Vegetation type: Pinyon-Juniper .

Compass bearing: frequency baseline 165 degrees magnetic (line3-5 @ 135°M).

Frequency belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft). No Rebar.

LOCATION DESCRIPTION

On Highway 143, drive toward Panguitch to mile marker 47. About 0.1 miles before mile marker 47, turn on a road going south (right). Drive on this road for 1.6 miles to an intersection (a corral should be passed on the right). Take the left fork and drive 1.0 miles to a fork. Take the left fork and drive 1.5 miles to another fork. Once again, stay left and go 0.45 miles to an intersection. Continue straight and go 1.0 miles to a power substation and some powerlines crossing the road. Drive down the powerline road for 0.15 miles to the 3<sup>rd</sup> power pole and park. From the 3<sup>rd</sup> power pole, walk 33 paces at 85 degrees magnetic to the 0-foot stake. The 0-foot stake is marked with browse tag #163.



Map Name: Hatch

Diagrammatic Sketch

Township 35S, Range 5W, Section 33

GPS: NAD 27, UTM 12S 4176565 N, 374466 E

## DISCUSSION

### DD Hollow - Trend Study No. 28-19

This study was established in 2003 to gather baseline data for a proposed prescribed burn treatment in DD Hollow. This site lies on BLM administered land about 6 miles south of Panguitch, and is within the boundaries of a proposed prescribed burn project that was supposed to take place in late fall of 2003. The study site slopes at 7-10% to the west, southwest at an elevation of 7,400 feet. The range type is pinyon pine with an understory of black sagebrush and bitterbrush. The area is important winter range for deer and to a lesser extent elk, and the surrounding open areas are used by pronghorn antelope year-round. Deer use on the site in 2003 was light at an estimated 21 days use/acre (53 ddu/ha).

Soils on the site are sandy clay loam in texture and slightly acidic in pH (6.2). Soil depth is fair with an estimated effective rooting depth of just over 10 inches. Rock and pavement are abundant on the surface and throughout the upper portions of the profile, but are not limiting to deeper rooted trees and shrubs. Although total vegetation cover is high, very little comes from herbaceous species, and a high proportion of the litter on the site comes from dead pinyon needles underneath the canopy. Bare ground was estimated at 15% in 2003 with most coming in the shrub and tree interspaces. An erosion condition class assessment rated soils as stable.

Pinyon dominates the vegetative community with a canopy cover of 39%. Point-center quarter data estimated 337 trees/acre in 2003 with an average basal trunk diameter of 5.4 inches. Black sagebrush density was estimated at 3,380 plants/acre. The population had moderate recruitment (9%), but high decadence (45%). A high proportion of decadent age class was classified as dying (38%) which represents ~580 plants/acre that could be lost from the population in the near future. Black sage showed mostly light use and 17% of the population were classified as having poor vigor. Bitterbrush density was estimated at 360 plants/acre in 2003. Decadence was moderately high at 33% and use was moderate to heavy. Bitterbrush leaders had averaged 2.5 inches of annual growth when the site was read in late July of 2003.

The herbaceous understory is very poor and insignificant. Eight total herbaceous species were sampled in 2003 providing less than 1% cover. The dominance of pinyon on the site will continue to suppress the understory until the site can be treated. Due to the low amount of herbaceous species, this site will also need to be reseeded as part of the rehabilitation protocol. The BLM's choice to prescribe burn may not be the best alternative for treatment due to the importance of black sagebrush and bitterbrush to wintering big game. These species are typically fire intolerant and will likely be drastically reduced if not lost entirely from the site if burned. A better alternative may be mechanical treatment such as roller chopping or chaining that would take out pinyon, but leave the understory shrubs intact as well as prepare the seedbed for reseeded.

### 2003 APPARENT TREND ASSESSMENT

Soils appear stable. The abundance of tree and shrub canopy cover as well as pine needles underneath the canopy helps limit erosion. The browse component is dominated by pinyon pine which needs to be decreased. Black sagebrush occurs on the site in moderate densities but is in poor health with high decadence and a high proportion of dying. Bitterbrush provides additional preferred browse with an estimated density of 360 plants/acre. Bitterbrush decadence is moderate at 33% and reproduction is low. Sagebrush and bitterbrush will continue to decline until the pinyon overstory is treated. The proposed prescribed burn may not be the best alternative as black sagebrush and bitterbrush could be lost from the site. Mechanical treatment, although more expensive and controversial, would give more flexibility to treat pinyon but leave the understory shrubs intact. The herbaceous understory is minimal and in a downward state, and needs to be reseeded.

HERBACEOUS TRENDS --

Management unit 28 , Study no: 19

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	<i>Bouteloua gracilis</i>	29	.46
G	<i>Poa secunda</i>	3	.03
G	<i>Sitanion hystrix</i>	10	.05
G	<i>Stipa lettermani</i>	7	.01
Total for Annual Grasses		0	0
Total for Perennial Grasses		49	0.55
Total for Grasses		49	0.55
F	<i>Arabis</i> spp.	4	.00
F	<i>Descurainia pinnata</i> (a)	15	.09
F	<i>Gayophytum ramosissimum</i> (a)	3	.01
F	<i>Lappula occidentalis</i> (a)	1	.00
Total for Annual Forbs		19	0.10
Total for Perennial Forbs		4	0.00
Total for Forbs		23	0.11

BROWSE TRENDS --

Management unit 28 , Study no: 19

T y p e	Species	Strip Frequency	Average Cover %
		'03	'03
B	<i>Artemisia nova</i>	72	5.65
B	<i>Juniperus osteosperma</i>	0	.03
B	<i>Opuntia</i> spp.	3	-
B	<i>Pinus edulis</i>	29	23.40
B	<i>Purshia tridentata</i>	15	2.81
Total for Browse		119	31.91

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 19

Species	Percent Cover
	'03
<i>Artemisia nova</i>	4.46
<i>Pinus edulis</i>	38.48
<i>Purshia tridentata</i>	2.79

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 28 , Study no: 19

Species	Average leader growth (in)
	'03
Purshia tridentata	2.5

POINT-QUARTER TREE DATA --  
Management unit 28 , Study no: 19

Species	Trees per Acre	Average diameter (in)
	'03	'03
Pinus edulis	337	5.4

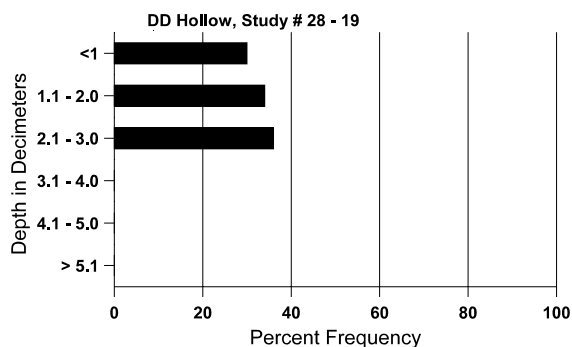
BASIC COVER --  
Management unit 28 , Study no: 19

Cover Type	Average Cover %
	'03
Vegetation	31.90
Rock	8.42
Pavement	15.64
Litter	55.50
Cryptogams	.83
Bare Ground	15.05

SOIL ANALYSIS DATA --  
Management unit 28, Study no: 19, Study Name: DD Hollow

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	ds/m
10.2	66.4 (10.4)	6.7	52.6	23.2	24.2	0.7	5.9	515.2	0.5

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 28 , Study no: 19

Type	Quadrat Frequency	Days use per acre (ha)
	'03	
Rabbit	20	-
Elk	1	-
Deer	9	22 (53)
Cattle	2	-

BROWSE CHARACTERISTICS --  
 Management unit 28 , Study no: 19

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
Artemisia nova											
03	<b>3380</b>	-	300	1560	1520	1740	22	1	45	17	14/22
Opuntia spp.											
03	<b>60</b>	-	-	60	-	-	0	0	-	0	5/11
Pinus edulis											
03	<b>680</b>	-	160	520	-	-	3	0	-	0	-/-
Purshia tridentata											
03	<b>360</b>	-	20	220	120	20	61	22	33	6	30/51
Ribes spp.											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	35/57

Trend Study 28-20-03

Study site name: South Canyon .

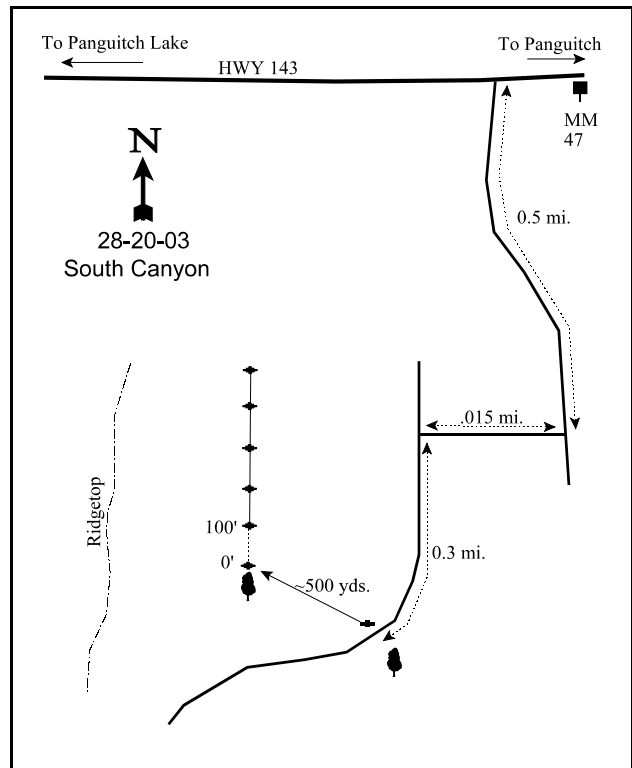
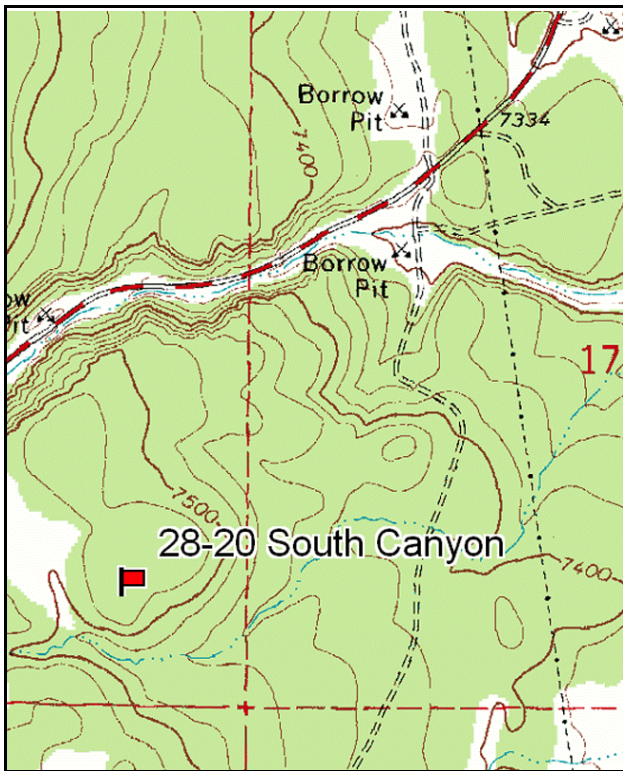
Vegetation type: Pinyon-Juniper .

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). No rebar.

LOCATION DESCRIPTION

On Highway 143, drive toward Panguitch to mile marker 47. About 0.1 miles before mile marker 47, turn on a road going south (right). Drive 0.5 miles to a road going left (west). Turn on this road and drive 0.15 miles until it intersects with a road running north and south. Turn left (south) and drive 0.3 miles to a witness post on the right side of the road. From the witness post, walk 500 yards in a northwest direction to a large ponderosa pine (you will probably need a GPS receiver to find this site as the trees are too thick to take a bearing and pace). The 0-foot stake is 3 paces north of the ponderosa pine.



Map Name: Panguitch

Diagrammatic Sketch

Township 35S, Range 5W, Section 18

GPS: NAD 27, UTM 12S 4180220 N, 371873 E

## DISCUSSION

### South Canyon - Trend Study No. 28-20

This study was established in 2003 to gather baseline data for a proposed prescribed burn treatment in South Canyon. This site lies on BLM administered land about 4 miles south of Panguitch, and is within the boundaries of a proposed prescribed burn project that was supposed to take place in the late fall of 2003. Terrain is basically level at an elevation of 7,500 feet. The range type is pinyon pine with an understory of black sagebrush and bitterbrush. The area is important winter range for deer and to a lesser extent elk, and the surrounding open areas are used by pronghorn antelope year-round. Pellet group transect data estimated 15 deer and 1 elk day use/acre (38 ddu/ha and 3 edu/ha) in 2003.

Soils are clay loam in texture and slightly acidic in pH (6.2). Soil depth is shallow with an estimated effective rooting depth of less than 9 inches. Rock is very abundant on the surface and throughout the upper portions of the profile. Percent cover of rock and pavement combined was nearly 40% in 2003. Most of the vegetation cover comes from pinyon with very little being provided by herbaceous species. Litter cover is abundant with a high proportion coming from dead pinyon needles underneath the canopy. Bare ground was estimated at only 7% in 2003. An erosion condition class assessment rated soils as stable in 2003.

Pinyon pine dominates the vegetative community with a canopy cover estimated at 37% in 2003. Point-center quarter data estimated 416 pinyon trees/acre with an average basal trunk diameter of 4.3 inches. Black sagebrush density was estimated at 4,300 plants/acre. The population has fair recruitment (6%), but moderate decadence (31%). About 1/4 of the decadent age class was classified as dying which represents ~320 plants/acre that could be lost from the population in the near future. Black sage showed mostly light use and normal vigor. Bitterbrush density was estimated at 800 plants/acre. Decadence was moderate at 33% and use was moderate to heavy. Bitterbrush leaders had averaged 3.3 inches of annual growth when the site was read in late July of 2003.

The herbaceous understory is very poor with low diversity and abundance. Eight total herbaceous species were sampled in 2003 providing only 1.3% ground cover. The dominance of pinyon on the site will continue to suppress the understory until the site can be treated. Due to the low amount of herbaceous species, this site will also need to be reseeded as part of the rehabilitation protocol. The BLM's choice to prescribe burn may not be the best alternative for treatment due to the importance of black sagebrush and bitterbrush to wintering big game. These species are typically fire intolerant and will likely be drastically reduced if not lost entirely from the site if burned. A better alternative may be mechanical treatment such as roller chopping or chaining that would take out pinyon, but leave the understory shrubs intact as well prepare the seedbed for reseeded.

### 2003 APPARENT TREND ASSESSMENT

Soils appear stable. The abundance of tree and shrub canopy cover as well as pine needles underneath the canopy helps limit erosion. The browse component is dominated by pinyon pine which needs to be decreased. Black sagebrush occurs on the site in moderately high densities but shows signs of depressed health with high decadence and low reproduction. Bitterbrush provides additional preferred browse with an estimated density of 800 plants/acre. Bitterbrush decadence is moderate at 33% and no young or seedling plants were sampled. The health of the sagebrush and bitterbrush populations will continue to decline until the pinyon overstory is treated. The proposed prescribed burn may not be the best alternative as black sagebrush and bitterbrush could be lost from the site. Mechanical treatment, although more expensive and controversial, would give more flexibility to treat pinyon but leave the understory shrubs intact. The herbaceous understory is minimal and in a downward state, and the site needs to be reseeded.

HERBACEOUS TRENDS --

Management unit 28 , Study no: 20

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	<i>Bouteloua gracilis</i>	72	1.00
G	<i>Carex</i> spp.	3	.03
G	<i>Poa fendleriana</i>	3	.03
G	<i>Poa secunda</i>	3	.00
G	<i>Sitanion hystrix</i>	7	.07
Total for Annual Grasses		0	0
Total for Perennial Grasses		88	1.13
Total for Grasses		88	1.13
F	<i>Arabis</i> spp.	3	.00
F	<i>Cryptantha</i> spp.	8	.16
F	<i>Descurainia pinnata</i> (a)	8	.01
Total for Annual Forbs		8	0.01
Total for Perennial Forbs		11	0.16
Total for Forbs		19	0.17

BROWSE TRENDS --

Management unit 28 , Study no: 20

T y p e	Species	Strip Frequency	Average Cover %
		'03	'03
B	<i>Artemisia nova</i>	82	6.67
B	<i>Gutierrezia sarothrae</i>	6	.01
B	<i>Juniperus osteosperma</i>	1	1.79
B	<i>Pediocactus simpsonii</i>	1	-
B	<i>Pinus edulis</i>	18	18.39
B	<i>Purshia tridentata</i>	22	4.11
Total for Browse		130	30.99



CANOPY COVER, LINE INTERCEPT --  
 Management unit 28 , Study no: 20

Species	Percent Cover
	'03
Artemisia nova	8.11
Juniperus osteosperma	2.73
Pinus edulis	37.15
Purshia tridentata	5.16

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 28 , Study no: 20

Species	Average leader growth (in)
	'03
Purshia tridentata	3.3

POINT-QUARTER TREE DATA --  
 Management unit 28 , Study no: 20

Species	Trees per Acre
	'03
Pinus edulis	416

Average diameter (in)
'03
4.3

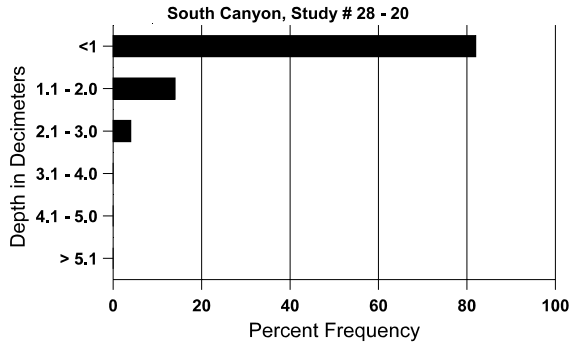
BASIC COVER --  
 Management unit 28 , Study no: 20

Cover Type	Average Cover %
	'03
Vegetation	30.63
Rock	35.03
Pavement	4.69
Litter	48.98
Cryptogams	.10
Bare Ground	6.78

SOIL ANALYSIS DATA --  
 Management unit 28, Study no: 20, Study Name: South Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
8.7	63.2 (9.4)	6.2	30.6	35.2	34.2	3.5	9.6	489.6	0.4

# Stoniness Index



## PELLET GROUP DATA --

Management unit 28 , Study no: 20

Type	Quadrat Frequency '03	Days use per acre (ha) '03
Rabbit	11	-
Elk	1	1 (3)
Deer	15	15 (38)

## BROWSE CHARACTERISTICS --

Management unit 28 , Study no: 20

		Age class distribution (plants per acre)					Utilization				
Y e a r	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia nova</i>											
03	<b>4300</b>	-	260	2700	1340	2100	5	0	31	7	12/20
<i>Gutierrezia sarothrae</i>											
03	<b>240</b>	-	160	80	-	-	0	0	-	0	8/6
<i>Juniperus osteosperma</i>											
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<i>Opuntia spp.</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	10/15
<i>Pediocactus simpsonii</i>											
03	<b>20</b>	-	-	20	-	-	0	0	-	0	2/7
<i>Pinus edulis</i>											
03	<b>420</b>	20	120	300	-	-	0	0	-	0	-/-
<i>Purshia tridentata</i>											
03	<b>800</b>	-	-	540	260	-	43	38	33	8	32/55

## SUMMARY

### WILDLIFE MANAGEMENT UNIT 28 - PANGUITCH LAKE

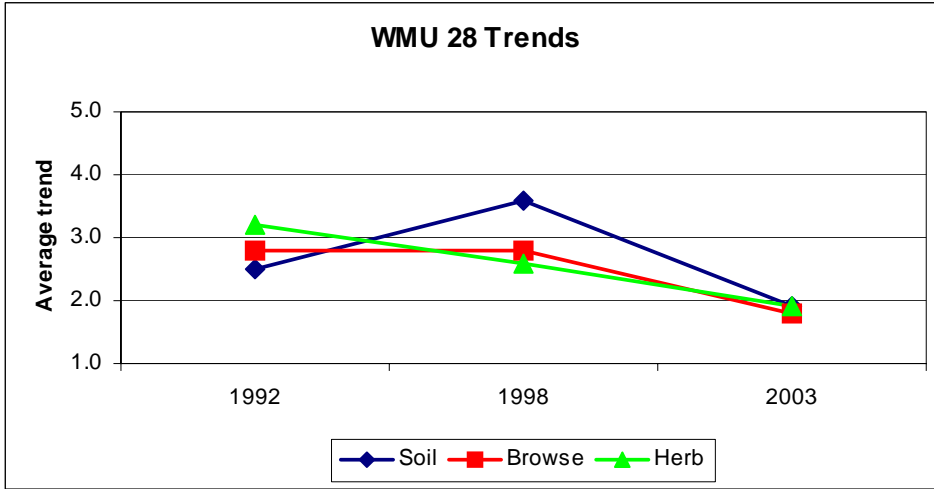
Fifteen trend studies were read in the Panguitch Lake unit in 2003. Eight of these were established in 1987 with rereads in 1992, 1998, and 2003. Two studies, Sheep Hollow East (28-15) and Sheep Hollow West (28-14), were established in 1998 and resurveyed in 2003. Four studies were suspended in 2003 including Panguitch (28-2), Little Valleys (28-9), Red Desert (28-10), and Asay Knoll (28-13). These sites were suspended as they no longer have values of critical big game ranges and were replaced by studies at Assay Bench (28-16), Sidney Valley (28-17), and Shakespeare Hollow (28-18). Two new studies, DD Hollow (28-19) and South Canyon (28-20), were established in 2003 to provide baseline data for future prescribed burns on big game winter ranges.

The majority of the range trends were downward for all categories (soil, browse, and herbaceous understory) in 2003. Soil and herbaceous trends were downward on 7 and 6 sites that were resurveyed in 2003 respectively, while the browse trend was downward on 9 of the 10 sites resampled. Downward soil trends were the result of increased bare soil and a decline in vegetation and/or litter cover which increases erosion potential. Downward herbaceous trends resulted from a decline in desirable perennial grasses and forbs due largely to drought conditions prior to and including 2003. Sum of nested frequency of perennial grasses declined on 8 of the 10 studies in 2003, and perennial forbs had lower sum of nested frequency values on 7 of the 10 sites. Surprisingly, cheatgrass had lower nested frequency and cover values on only 4 of the 10 sites in 2003. Downward browse trends resulted from key browse species showing declines in population density, increases in percent decadence and the proportion of these classified as dying, and decreased reproduction. Sagebrush species (mountain big sagebrush, Wyoming big sagebrush, and black sagebrush) showed higher decadence on 8 of the 10 sites that were reread in 2003 while recruitment by young sagebrush plants declined on 9 of 10 sites. Bitterbrush showed increased decadence and lower recruitment on all 4 of the studies it was sampled on in both 1998 and 2003. These negative trends in browse populations are largely due to drier conditions in 2003 compared to the previous reading in 1998 which occurred during a wetter precipitation cycle.

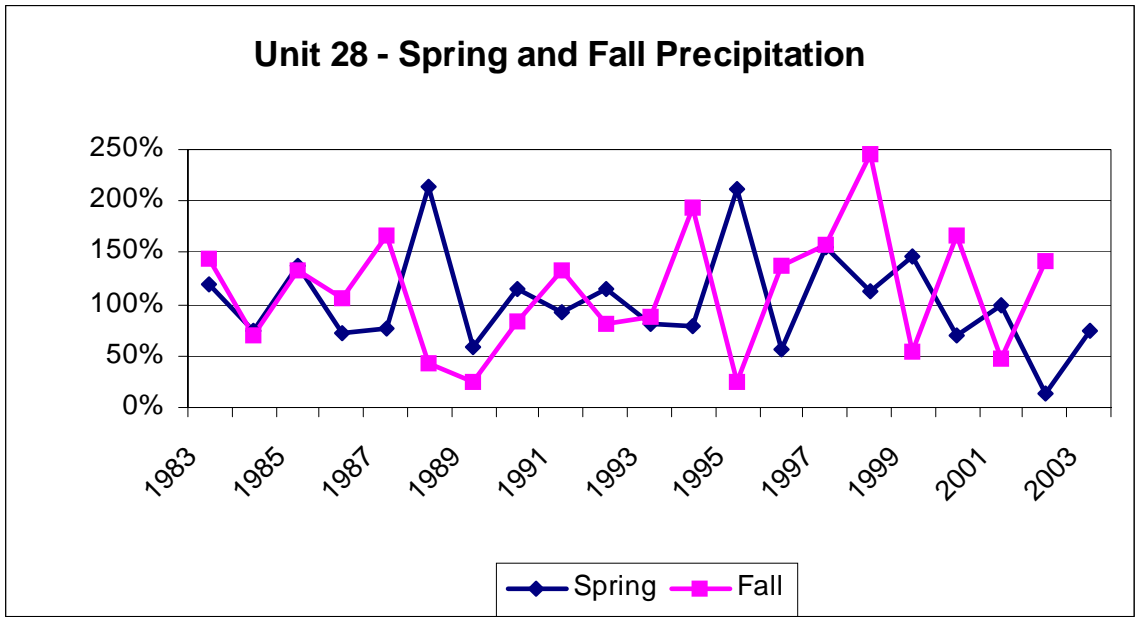
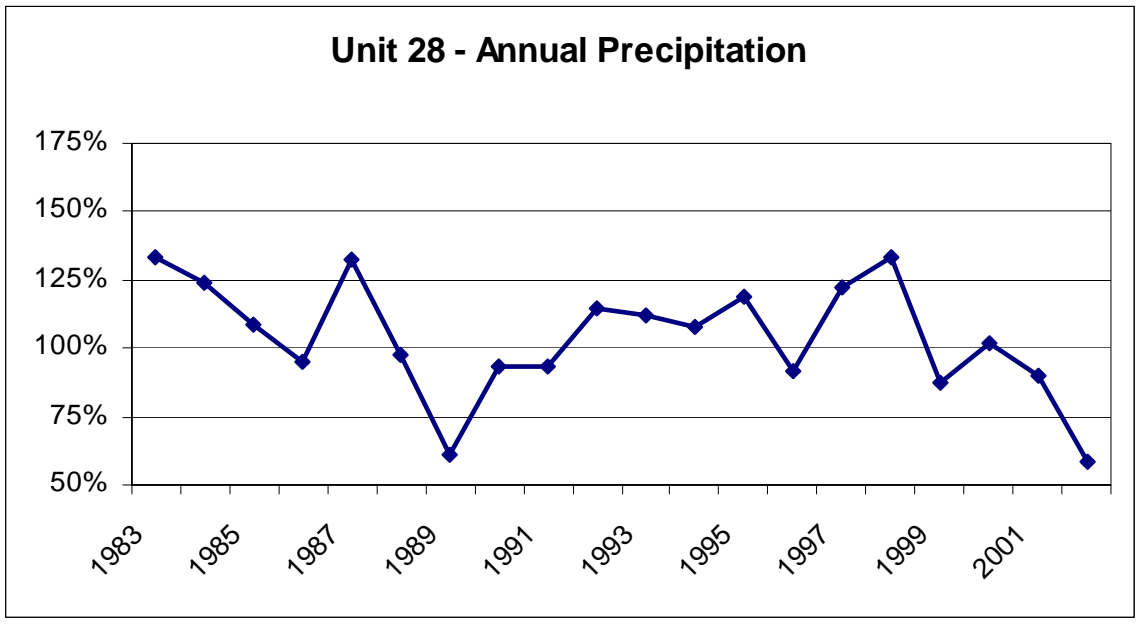
Soil and vegetation trends are largely driven by precipitation. As a whole, Utah has been in a drought for the past 5 years, and some of the areas within the Panguitch Lake unit reflect this. Weather station data at 3 locations was analyzed to look at precipitation trends in the unit since range trend studies were established in 1987. These stations occur at Panguitch, Hatch, and the Cedar City Airport (Utah Climate Summaries 2004). Precipitation data was averaged over the 3 weather stations listed above, and data indicate that from 1987-2002, total annual precipitation was normal or above normal in all years except 1989, 1999, and 2002 (see precipitation graphs below). Perhaps more important than total annual precipitation is seasonal distribution. Data were analyzed for both spring (April-June) and fall (September-November). Spring precipitation is important for cool season perennial grasses and forbs, as well as shrub populations, as these species initiate growth during the spring. Weather data indicate that spring precipitation in the Panguitch Lake unit was below normal in 1987, 1989, 1993-94, 1996, 2000, and 2002-03 (see precipitation graphs below). Fall precipitation totals have oscillated back and forth between wet and dry cycles with the driest period occurring in late 1980's and early 1990's with other dry years in 1995, 1999, and 2001. For this report, the period from 2000-2003 is the focus as it would most effect current range trends. Below normal spring precipitation in 2000 and 2002-03 is a primary reason for the decline in perennial grasses and forbs in 2003. Without good spring precipitation, cool season perennials are not able to sustain high productivity as their primary growing season occurs during the spring and early summer. Increased decadence and lower reproduction in sagebrush and bitterbrush populations are also linked to the dry conditions during the past several years. It is likely that these negative trends will continue until precipitation patterns improve.

Average Trends – WMU 28 Panguitch Lake

	1991	1998	2003
Soil	2.5	3.6	1.9
Browse	2.8	2.8	1.8
Herb	3.2	2.6	1.9
	12 sites	12 sites	10 sites



Precipitation graphs for the Panguitch Lake unit. Data is percent of normal precipitation averaged for 3 weather stations at Panguitch, Hatch, and the Cedar City Airport (Utah Climate Summaries 2004).



Trend Summary

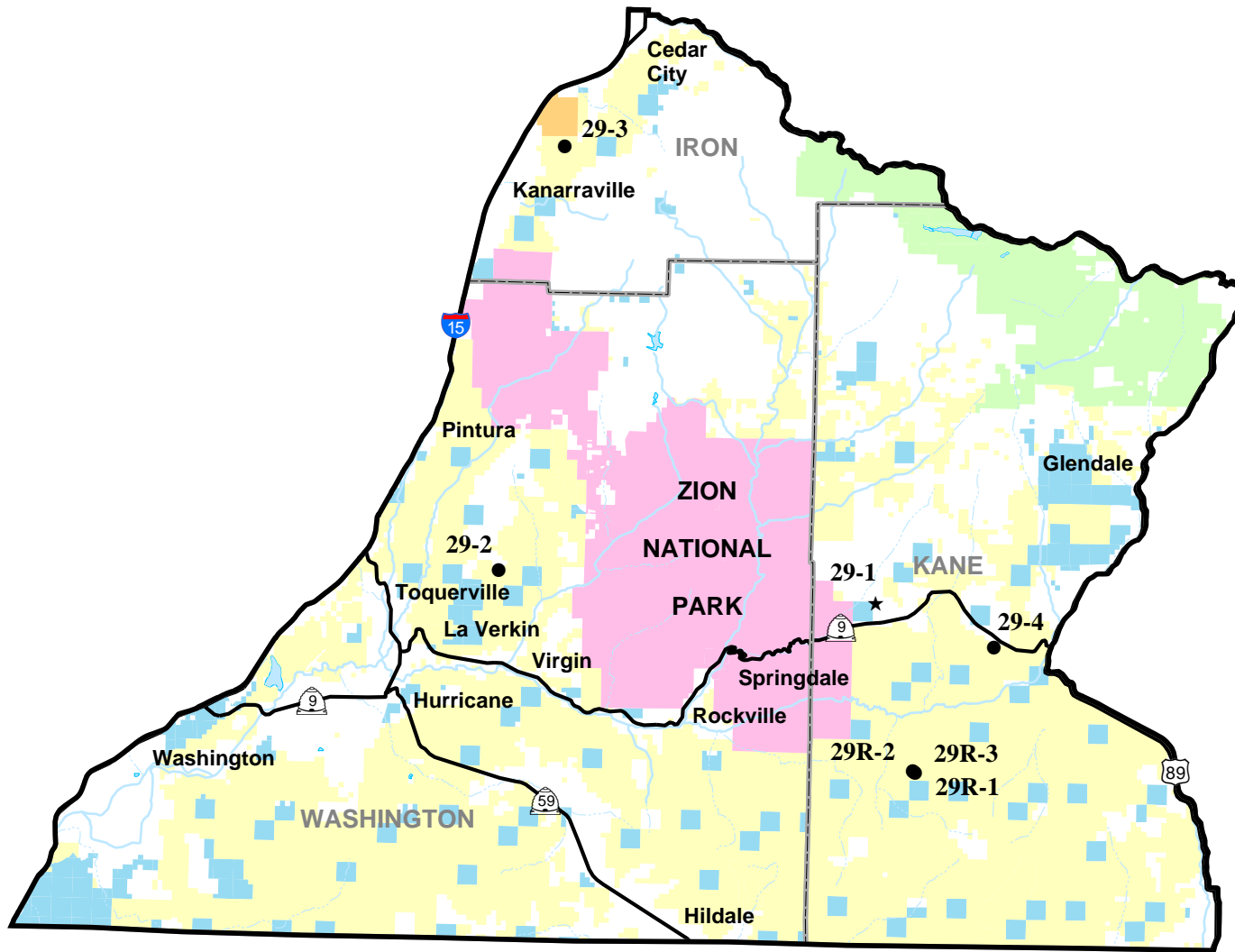
	Category	1987	1992	1998	2003
28-1 Three Creeks	soil	est	3	3	1
	browse	est	5	3	1
	herbaceous understory	est	5	3	1
28-3 Bear Valley	soil	est	2	4	1
	browse	est	2	3	1
	herbaceous understory	est	3	3	2
28-4 Buckskin Valley	soil	est	3	4	3
	browse	est	2	2	2
	herbaceous understory	est	4	1	1
28-5 Swayback Knoll	soil	est	1	4	2
	browse	est	3	2	2
	herbaceous understory	est	5	2	3
28-6 Cottonwood	soil	est	2	4	2
	browse	est	3	3	2
	herbaceous understory	est	3	2	3
28-7 Paragonah	soil	est	2	5	3
	browse	est	3	2	2
	herbaceous understory	est	1	3	1
28-8 Grass Valley	soil	est	3	4	2
	browse	est	2	2	2
	herbaceous understory	est	3	4	3
28-11 Elliker Basin	soil	est	3	3	3
	browse	est	1	4	1
	herbaceous understory	est	3	3	3

(1) = down, (2), slightly down, (3) = stable, (4) = slightly up, (5) = up  
 (est) = established, (n/a) = no trend, (susp) = suspended, (NR) = not read

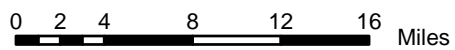
	Category	1998	2003
28-14 Sheep Hollow West	soil	est	1
	browse	est	2
	herbaceous understory	est	1
28-15 Sheep Hollow East	soil	est	1
	browse	est	3
	herbaceous understory	est	1
	Category		2003
28-16 Asay Bench	soil		est
	browse		est
	herbaceous understory		est
28-17 Sidney Valley	soil		est
	browse		est
	herbaceous understory		est
28-18 Shakespeare Hollow	soil		est
	browse		est
	herbaceous understory		est
28-19 DD Hollow	soil		est
	browse		est
	herbaceous understory		est
28-20 South Canyon	soil		est
	browse		est
	herbaceous understory		est

(1) = down, (2), slightly down, (3) = stable, (4) = slightly up, (5) = up  
(est) = established, (n/a) = no trend, (susp) = suspended, (NR) = not read

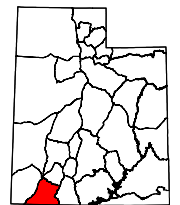
# Management Unit 29



- Transect location
- ★ Suspended site
- Forest Service
- BLM
- State of Utah
- Native American
- Private
- National Park
- Water body
- County boundary
- Stream or river
- Intermittent stream
- Road



Unit Location





## WILDLIFE MANAGEMENT UNIT 29 - ZION

### Boundary Description

**Iron, Kane and Washington counties** - Boundary begins at Interstate 15 and the Utah-Arizona state line; then north on I-15 to Highway SR-14; then east on SR-14 to Highway US-89; then south on US-89 to Highway US-89A; then south on US-89A to the Utah-Arizona state line; then west on this state line to I-15 and beginning point.

The Zion unit is relatively large, yet there are few trend studies located within the unit. There is an estimated 301,431 acres of deer summer range and 333,914 acres of winter range within the unit (DWR 1998). Most of the summer range is found in the northern part of the unit, which includes the southern end of the Markagunt Plateau. Unlike the majority of the wildlife management units in the state, most of the summer range (59%) in the Zion unit occurs on private land with increased summer home development becoming more of a management problem. Of the remaining summer range, 21% is administered by the Forest Service and another 12% occurs within Zion National Park. Winter range predominately occurs on BLM land (54% DeBloois 2001, with an additional 20% in Zion National Park and 18% private.

### Herd Unit Management Objectives

Current population management objectives are to maintain a target winter herd population of 9,000 deer. Population density was estimated at 5,000 in 1996. A total of 1,170 bucks are to be harvested annually. The herd composition is to be managed at 15 bucks/100 does post season, with 30% of those bucks being 3-point or better. The buck-doe ratio for 1996-97 was only 7 bucks/100 does.

Peak harvests were reached in the mid-1960's with over 1,700 bucks being harvested in 1965 and 1966. Since then, harvests have shown a downward trend with the lowest harvest occurring in 1979 when less than 400 bucks were taken. Harvests quickly rebounded in 1986 and 1989. Between 1990 and 1995, an average of 1,091 bucks were harvested from the unit. Fawn/100 doe ratios have been good, averaging 72 between 1991-92 and 1995-96. Between 1997-98 and 2000-01 fawn/100 doe ratios declined to an average of 60 (DeBloois 2001). A few elk are also harvested from the unit. A more detailed description of big game statistics including harvest and population classification data can be found in the Division's big game annual report.

### Study Site Description

Only one key area was selected for study in this unit in 1987. It was located at Wilson Ranch (now the Clear Creek Ranch). This study samples a Wyoming big sagebrush flat on private land which is located just east of the Zion National Park boundary, and north of Highway 9. This site was reread in 1992 and 1998. In 1998, two additional trend study sites were established, one at Smith's Mesa and the other at North Hills. Both occur on the west side of the unit. In 2003, the Wilson Ranch study was suspended and a new study was established in the Barracks chaining located about 3 miles west of Carmel Junction and ½ mile south of Highway 9.

Trend Study 29-2-03

Study site name: Smith's Mesa.

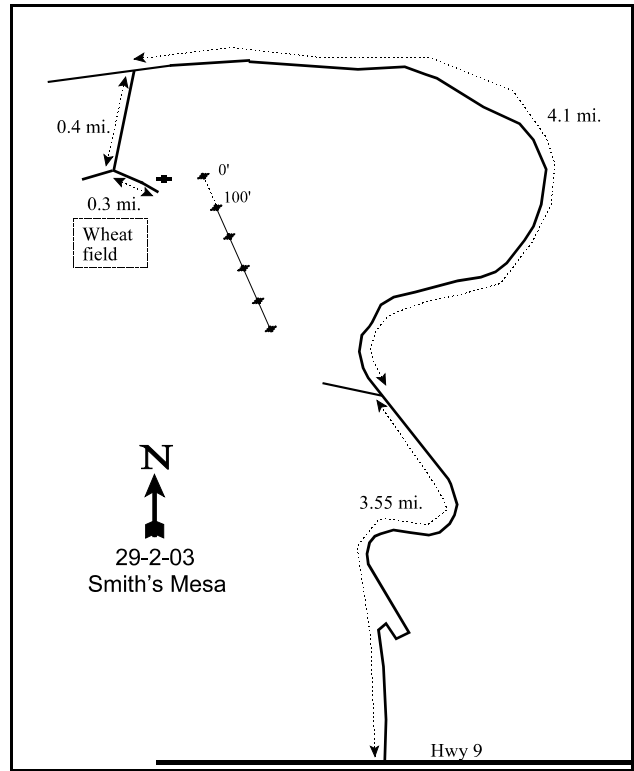
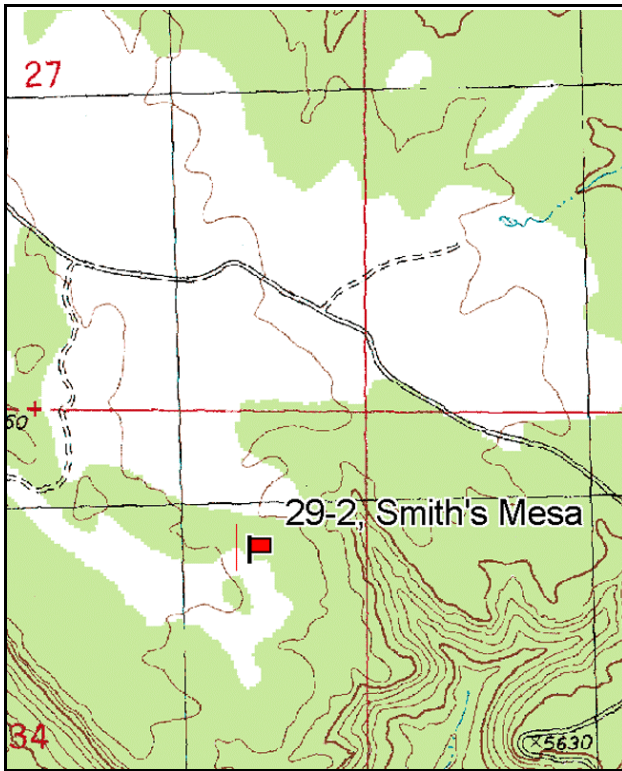
Vegetation type: Big Sagebrush-Grass.

Compass bearing: frequency baseline 145 degrees magnetic.

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

LOCATION DESCRIPTION

At mile marker 17 on Hwy 9, turn north onto Mesa Road. Drive up the old paved road up to the mesa top for 3.35 miles to a fork. Turn right and continue 4.1 miles to a small dirt road next to a wheat field on the left side of the main road. Turn left and follow this road 0.4 miles to a fork next to another wheat field. Turn left and follow the edge of the field 0.3 miles and stop. Walk east over a small P-J covered hill to a sage opening. The 0-foot stake is on the north end of the opening near some *Quercus turbinella*. The baseline runs at 145 degrees magnetic and is marked by half-high green fenceposts.



Map Name: Smith Mesa

Diagrammatic Sketch

Township 40S, Range 12W, Section 34

GPS: NAD 27, UTM 12S 4126851 N, 306165 E

## DISCUSSION

### Smith's Mesa - Trend Study No. 29-2

This trend study was established in 1998 in a Wyoming big sagebrush clearing on Smith's Mesa. The study site is surrounded on 3 sides by pinyon and juniper trees, and dryland wheat fields on the west. Slope is gentle (2-3%) with a southwest aspect and an elevation of about 5,700 feet. The large mesa is found about 3 miles north of the town of Virgin. It rises approximately 2,000 feet above the town and supports many sagebrush openings surrounded by pinyon and juniper woodland. Some dryland wheat fields are also found on the south end of the mesa on a large area of private land. Smith's Mesa provides important winter range for deer which summer in Zion National Park. Pellet group data from the site estimated 38 deer days use/acre in 1998 (94 ddu/ha). Some cattle sign was also encountered with an estimated 7 cow days use/acre (17 cdu/ha). Pellet group data from 2003 indicated much lighter use at 16 deer days use/acre (40 ddu/ha). No cattle sign was noted in 2003. A cattle pond is found about 1/3 of a mile east of the site but it appears to contain water only in the early spring.

Soil on the site is very sandy and deep with the effective rooting depth estimated at 23 inches. Soil texture is a sandy loam which is slightly acidic (pH 6.2). Phosphorus is low at 8.1 ppm, when 10 ppm is considered a minimum value for normal plant growth and development. Rock is absent on the surface and in the profile. Due to the sandy nature of the soil and poor water holding capacity, average soil temperature is high averaging over 70°F at a depth of between 12 and 21 inches in 1998 and 2003. Under most conditions, this would cause rapid drying of the soil profile during the summer. Herbaceous plants, mostly in the form of winter annuals, are common and provide adequate soil protection. In addition, cryptogamic crusts are abundant. Cover of bare ground is still high at 33% in 1998 and 42% in 2003. There appears to be some pedestalling of soil around shrubs, possibly caused as much by wind as by water. Erosion is not a problem due to the gentle terrain and the erosion condition class was determined to be stable in 2003.

The site supports a fair stand of big sagebrush with a few antelope bitterbrush. Some sagebrush plants exhibit characteristics of basin big sagebrush (*Artemisia tridentata tridentata*). There also appears to be some hybridization with mountain big sagebrush (*Artemisia tridentata vaseyana*) since a few sagebrush sampled fluoresced under a black light. Since most of the sagebrush appeared to be more like basin big sagebrush, all sagebrush on the site was lumped into that subspecies. Sagebrush density was estimated at 2,200 plants/acre in 1998 declining to 1,500 by 2003. The stand is mostly mature, light to moderately utilized, in good vigor, and shows low to moderate percent decadence. Young recruitment was good in 1998 with 10% of the population consisting of young plants. No seedlings or young were encountered in 2003. Only a few bitterbrush plants occur on the site. These plants generally show moderate to heavy use and annual leader growth was fair in 2003 averaging 3 inches.

The invasive shrub, broom snakeweed, is the most abundant shrub on the site with a population estimated at 5,380 plants/acre in 1998. Drought conditions in 2003 caused a 61% decline in density to 2,100 plants/acre. Most of the population is mature. Pinyon and juniper trees appear to be slowly encroaching into the clearing, but numbers are still low. Point-quarter data from 1998 estimated 6 juniper and 6 pinyon trees/acre. Average basal diameter was 10.4 inches for pinyon and 5.7 inches for juniper.

The herbaceous understory is very poor with two annual grasses, cheatgrass and six weeks fescue, providing 100% of the grass cover in 1998 and 88% in 2003. Another annual, rattail fescue was encountered in 2003 and was probably lumped with sixweeks fescue in 1998. Perennial grasses are represented by Sandberg bluegrass, bottlebrush squirreltail, and sand dropseed, but these species occur very rarely. The forb component is composed almost entirely of annuals. Total forb cover was estimated at nearly 3% in 1998 and nearly 4% in 2003. The most abundant species is storksbill, which accounted for 72% and 71% of the total forb cover in 1998 and 2003 respectively.

## 1998 APPARENT TREND ASSESSMENT

Trend for soil appears stable, primarily due to the level terrain and rapid infiltration capacity of the soil. Browse also appears stable with a relatively healthy population of basin big sagebrush. Use is light to moderate, vigor normal, and percent decadence moderately low at 13%. Reproduction is adequate to maintain the population if conditions do not change significantly. The herbaceous understory is poor. Composition of grasses and forbs is totally dominated by annuals. Perennial species are present yet rare.

## 2003 TREND ASSESSMENT

Trend for soil is down slightly. Percent cover of bare ground increased from 33% in 1998 to 42% in 2003. In addition, vegetation and litter cover declined. Most of the decrease in vegetation and litter cover is due to a 37% reduction in cover of annual grasses. Even with the abundant exposed bare ground, erosion is not a problem due to the sandy soil and the gentle terrain. Trend for sagebrush is slightly down. Density declined 32% from 2,200 to 1,500 plants/acre. Utilization was mostly light but vigor was poor on 15% of the plants sampled and percent decadence increased from 13% to 33%. No seedlings or young plants were encountered. Drought conditions did cause a 61% decline in the density of broom snakeweed. Trend for the herbaceous understory is difficult to determine due to the lack of perennial species. Sum of nested frequency of the few perennial grasses found on the site declined slightly while sum of nested frequency of perennial forbs increased slightly. Annual grasses and forbs dominate the understory. Sum of nested frequency of annual grasses and forbs increased slightly but cover dropped from 33% in 1998 to 23% in 2003. Trend is considered stable and in very poor condition.

### TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - stable but poor (3)

### HERBACEOUS TRENDS --

Management unit 29 , Study no: 2

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Bromus tectorum (a)	436	333	22.90	8.58
G	Festuca myuros (a)	-	105	-	2.18
G	Poa secunda	15	4	.05	.03
G	Sitanion hystrix	-	-	.00	-
G	Sporobolus cryptandrus	2	-	.03	-
G	Vulpia octoflora (a)	304	348	7.54	8.48
Total for Annual Grasses		740	786	30.45	19.25
Total for Perennial Grasses		17	4	0.08	0.03
Total for Grasses		757	790	30.53	19.29

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
F	Draba spp. (a)	25	-	.05	-
F	Erodium cicutarium (a)	78	55	1.95	2.74
F	Eriogonum racemosum	-	3	-	.00
F	Eriogonum umbellatum	4	3	.03	.06
F	Gilia spp. (a)	-	20	-	.17
F	Lappula occidentalis (a)	32	15	.11	.11
F	Lygodesmia grandiflora	-	3	-	.03
F	Microsteris gracilis (a)	17	-	.06	-
F	Navarretia intertexta (a)	5	39	.03	.30
F	Oenothera pallida	4	8	.01	.04
F	Orobanche fasciculata	1	-	.00	-
F	Plantago patagonica (a)	11	26	.39	.08
F	Polygonum douglasii (a)	3	-	.00	-
F	Senecio multilobatus	17	39	.05	.32
F	Unknown forb-perennial	2	-	.00	-
Total for Annual Forbs		171	155	2.60	3.41
Total for Perennial Forbs		28	56	0.11	0.47
Total for Forbs		199	211	2.71	3.88

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

#### BROWSE TRENDS --

Management unit 29 , Study no: 2

T y p e	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia tridentata tridentata	54	44	11.80	9.38
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	-	-
B	Gutierrezia sarothrae	51	28	3.29	1.75
B	Juniperus osteosperma	0	1	.78	1.48
B	Opuntia spp.	3	2	.18	.18
B	Pinus monophylla	1	2	1.70	1.29
B	Purshia tridentata	1	0	.00	-
B	Salvia dorrii	1	2	-	.15
Total for Browse		111	80	17.76	14.23

CANOPY COVER, LINE INTERCEPT --  
 Management unit 29 , Study no: 2

Species	Percent Cover	
	'98	'03
Artemisia tridentata tridentata	-	10.66
Gutierrezia sarothrae	-	.96
Juniperus osteosperma	-	3.20
Opuntia spp.	-	.03
Pinus monophylla	1.39	2.03
Salvia dorrii	-	.53

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 29 , Study no: 2

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	1.5
Purshia tridentata	3.1

POINT-QUARTER TREE DATA --  
 Management unit 29 , Study no: 2

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	6	N/A
Pinus monophylla	6	N/A

Average diameter (in)	
'98	'03
5.7	N/A
10.4	N/A

BASIC COVER --  
 Management unit 29 , Study no: 2

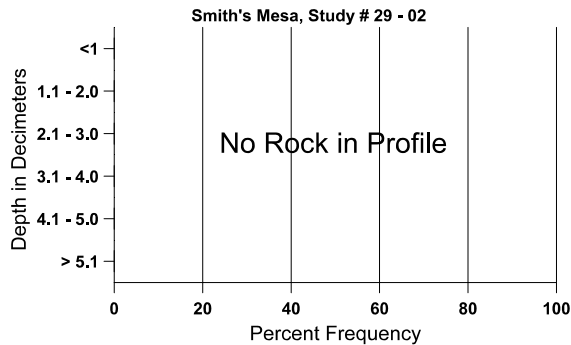
Cover Type	Average Cover %	
	'98	'03
Vegetation	46.12	38.27
Rock	.03	.00
Pavement	.04	.05
Litter	39.47	24.39
Cryptogams	12.36	10.87
Bare Ground	33.09	41.97

SOIL ANALYSIS DATA --

Management unit 29, Study no: 2, Study Name: Smith's Mesa

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
23.2	71.3 (11.7)	6.2	72.7	17.4	9.8	0.7	8.1	3.2	0.2

Stoniness Index



PELLET GROUP DATA --

Management unit 29, Study no: 2

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	23	25	-	-
Deer	44	2	38 (94)	16 (40)
Elk	-	-	-	1 (2)
Cattle	1	-	7 (17)	-

BROWSE CHARACTERISTICS --

Management unit 29, Study no: 2

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata tridentata</b>											
98	<b>2200</b>	20	220	1700	280	340	28	4	13	5	28/39
03	<b>1500</b>	-	-	1000	500	520	5	0	33	15	30/40
<b>Ceanothus greggii</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	76/121

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	7/13
03	<b>180</b>	-	-	180	-	-	0	0	-	0	-/-
<b>Gutierrezia sarothrae</b>											
98	<b>5380</b>	20	440	4840	100	220	0	0	2	.37	9/11
03	<b>2100</b>	200	120	1800	180	300	0	0	9	7	9/13
<b>Juniperus osteosperma</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
98	<b>60</b>	-	-	60	-	-	0	0	-	0	6/16
03	<b>40</b>	-	-	40	-	-	0	0	-	0	7/15
<b>Pinus monophylla</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>40</b>	20	20	20	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
98	<b>20</b>	-	20	-	-	-	0	0	-	0	23/99
03	<b>0</b>	-	-	-	-	-	0	0	-	0	17/46
<b>Quercus turbinella</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	129/216
<b>Salvia dorrii</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	13/46
03	<b>40</b>	-	20	20	-	-	0	0	-	0	15/36



Trend Study 29-3-03

Study site name: North Hills.

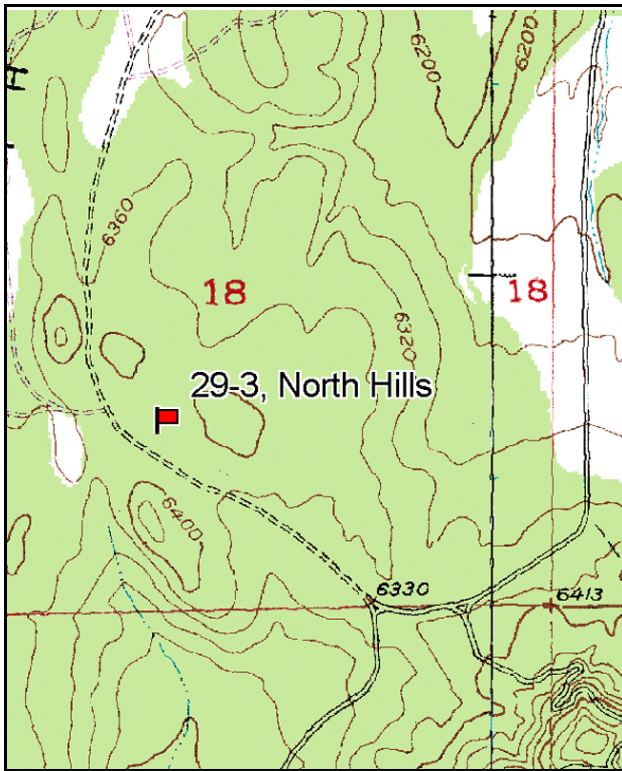
Vegetation type: Chained, Seeded P-J.

Compass bearing: frequency baseline 323 degrees magnetic.

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

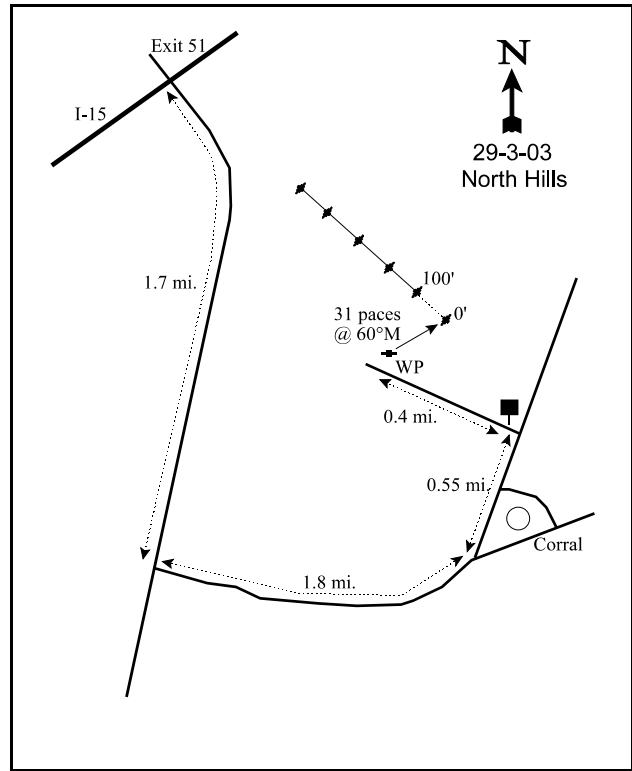
LOCATION DESCRIPTION

From Exit 52 (Hamilton Park), proceed south on the west side of the freeway for 1.7 miles. Turn left and go 1.8 miles to a corral. Stay left for 0.55 miles to a turnoff into the chaining with a sign that says “North Hills Reseeding.” Continue 0.4 miles to a witness post on the right. Walk 31 paces at 60 degrees magnetic to the 0-foot stake.



Map Name: Kanarraville

Township 37S, Range 11W, Section 18



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4161124 N, 311510 E

## DISCUSSION

### North Hills - Trend Study No. 29-3

This trend study was established in 1998 on a chained and seeded pinyon-juniper site in the North Hills located north of Kanarrville. The area lies between I-15 and the Hurricane Cliffs to the east. The site was chained in 1967 and seeded to crested wheatgrass and intermediate wheatgrass which now dominate the site. The area contains rolling terrain with the study established on a wide ridge top. Slope is gentle (5%) with a south aspect and an elevation of about 6,400 feet. Pinyon pine and Utah juniper trees are found on the site in low densities. Point-quarter data estimated only 18 pinyon and 29 juniper trees/acre in 1998. Average basal diameter was 2 inches for pinyon and 1.3 inches for juniper. There is some evidence of hand cutting of young trees in the past. Deer use on the site is heavy, and there is also some sign of elk and cattle use. Pellet group data from 1998 estimated 103 deer days use/acre (254 ddu/ha). Most pellet groups appeared to be several months old, but a deer were seen near the site during study site establishment on July 16<sup>th</sup> of 1998. Estimated elk and cattle use was low at 6 elk and 4 cow days use/acre (15 edu/ha and 10 cdu/ha) in 1998. Cattle pats appeared to be from the previous fall (1997). Pellet group data from 2003 estimated 118 deer days use/acre (291 ddu/ha). A few old cattle pats were counted but no elk pellet groups were encountered.

Soil is somewhat shallow with a moderate amount of rock and pavement on the surface and within the profile. Effective rooting depth is estimated at only 10 inches. Soil texture is a sandy loam which is neutral in reaction (pH 6.8). Due to the rocky nature of the soil, average soil temperature is very high measured at about 78°F at a depth of 9 to 11 inches in both 1998 and 2003. Erosion is not a problem on the site due to the abundance of herbaceous vegetation and the gentle terrain.

The site supports a variety of browse species including Utah serviceberry, black sagebrush, mountain big sagebrush, and Gambel oak. Mountain big sagebrush is the most numerous species with a cover value of 13% in 1998 and 11% in 2003. Sagebrush provides about 70% of the total browse cover with a stable density estimated at 1,860 plants/acre in 1998 and 1,820 in 2003. Utilization was moderate to heavy during both readings. Vigor was poor on 13% of the population in 1998 and 9% in 2003. The number of decadent plants was moderately high in 1998 at 31% of the population, increasing to 48% in 2003. Young recruitment has been marginal during each reading. There is also a small number of moderately utilized black sagebrush which appear to be black/mountain big sagebrush hybrids.

Utah serviceberry provides about 14% of the total browse cover with a population estimated at 560 plants/acre in 2003. Mature plants are large averaging nearly 4 feet in height. They display light to moderate use, good vigor, and low decadence. There are also some isolated thick oak clones on the site. Mature plants average over 4 feet in height, making much of the oak partly unavailable to browsing. Available plants appear unutilized however. A few scattered heavily hedged bitterbrush provide some additional browse forage.

The herbaceous understory dominates the site with seeded perennial grasses, crested and intermediate wheatgrass, providing most of the herbaceous cover. Both of these species significantly declined in nested frequency in 2003, and also showed large declines in cover. A few other perennial grasses occur occasionally. Forbs are severely limited and produce less than 1% cover.

### 1998 APPARENT TREND ASSESSMENT

The soil appears stable with abundant and well dispersed herbaceous vegetation. The browse trend appears stable for now, but reproduction of the key species, mountain big sagebrush, is poor. Utilization of preferred browse species is mostly moderate. The herbaceous understory is abundant, although composition is poor and dominated by seeded grasses, crested and intermediate wheatgrass. Forbs are nearly absent. Trend will continue to be stable as long as the these exotic grasses remain in high numbers.

2003 TREND ASSESSMENT

Trend for soil is slightly down. Cover of bare ground has increased while vegetation and litter cover have declined. There is still good protective ground cover to prevent most erosion and the erosion condition class was determined to be stable in 2003. The key browse species, mountain big sagebrush, is showing the effects of several years of drought. Annual precipitation was only 49% of normal in 2002 at Cedar City. Spring precipitation (April to June) has been poor for the past 3 years (2001 - 2003), averaging only 59% of normal. The population of mountain big sagebrush has remained stable in density since 1998 but utilization is heavier and the number of decadent plants has increased to 48% of the population. No seedlings were encountered and young plants accounted for only 4% of the population. It appears that this population will start to decline in the future if young recruitment does not improve. Serviceberry is also important although it provides only 15% of the browse cover. It has remained stable in average cover and strip frequency. Use is slightly heavier but vigor remains good and no plants were classified as decadent. Trend for browse is considered slightly down due to increasing decadence and poor young recruitment of the sagebrush population. The herbaceous understory is also showing the effects of drought. Sum of nested frequency of perennial grasses has declined 26%, and cover has dropped from 24% in 1998 to 9% in 2003, a decrease of more than 60%. Seeded crested and intermediate wheatgrass provide nearly all of the grass cover. Both species declined significantly in nested frequency. Forbs are still rare. Trend for the herbaceous understory is considered slightly down.

TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --

Management unit 29 , Study no: 3

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Agropyron cristatum	271	233	19.65	7.71
G	Agropyron intermedium	142	86	3.04	1.12
G	Aristida purpurea	-	4	-	.15
G	Bromus tectorum (a)	24	17	.23	.05
G	Hilaria jamesii	6	6	.41	.18
G	Oryzopsis hymenoides	3	-	.00	-
G	Poa secunda	10	-	.33	-
G	Sitanion hystrix	21	6	.46	.06
G	Vulpia octoflora (a)	3	-	.00	-
Total for Annual Grasses		27	17	0.23	0.05
Total for Perennial Grasses		453	335	23.91	9.22
Total for Grasses		480	352	24.15	9.27
F	Arabis spp.	1	-	.00	-
F	Astragalus spp.	12	9	.30	.36
F	Chaenactis douglasii	-	1	-	.03

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
F	Draba spp. (a)	-	2	-	.03
F	Gilia spp. (a)	-	3	-	.00
F	Lithospermum spp.	10	9	.03	.07
F	Microsteris gracilis (a)	-	4	-	.01
F	Navarretia intertexta (a)	1	-	.00	-
F	Oenothera spp.	-	3	-	.03
F	Ranunculus testiculatus (a)	-	4	-	.01
F	Sphaeralcea grossulariaefolia	-	2	-	.00
Total for Annual Forbs		1	13	0.00	0.06
Total for Perennial Forbs		23	24	0.34	0.50
Total for Forbs		24	37	0.34	0.56

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

#### BROWSE TRENDS --

Management unit 29 , Study no: 3

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	15	16	2.34	2.57
B	Artemisia nova	5	1	.30	.00
B	Artemisia tridentata vaseyana	59	55	13.00	11.44
B	Chrysothamnus viscidiflorus	0	1	.00	-
B	Gutierrezia sarothrae	0	1	-	-
B	Juniperus osteosperma	0	1	-	-
B	Opuntia spp.	2	0	-	-
B	Purshia tridentata	1	1	-	-
B	Quercus gambelii	6	10	2.19	2.79
Total for Browse		88	86	17.84	16.81

CANOPY COVER, LINE INTERCEPT --  
Management unit 29 , Study no: 3

Species	Percent Cover
	'03
Amelanchier utahensis	3.95
Artemisia nova	.15
Artemisia tridentata vaseyana	8.23
Quercus gambelii	4.36

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 29 , Study no: 3

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	2.9
Purshia tridentata	4.0

POINT-QUARTER TREE DATA --  
Management unit 29 , Study no: 3

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	29	38
Pinus edulis	18	N/A

Average diameter (in)	
'98	'03
1.3	1.2
2.0	N/A

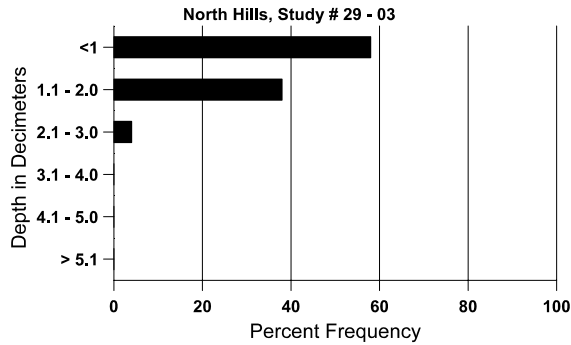
BASIC COVER --  
Management unit 29 , Study no: 3

Cover Type	Average Cover %	
	'98	'03
Vegetation	39.57	24.71
Rock	6.71	5.57
Pavement	12.20	17.24
Litter	51.77	36.99
Cryptogams	.41	.03
Bare Ground	21.43	34.08

SOIL ANALYSIS DATA --  
Management unit 29, Study no: 3, Study Name: North Hills

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
9.9	78.7 (8.5)	6.8	70.0	14.2	15.8	3.1	9.4	16.0	0.5

# Stoniness Index



## PELLET GROUP DATA --

Management unit 29 , Study no: 3

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	28	32	-	-
Elk	5	-	6 (15)	1 (2)
Deer	58	34	103 (254)	118 (291)
Cattle	1	2	4 (10)	5 (13)

## BROWSE CHARACTERISTICS --

Management unit 29 , Study no: 3

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
98	<b>1040</b>	-	380	620	40	-	21	2	4	0	38/56
03	<b>560</b>	-	280	280	-	20	29	14	0	0	42/51
<b>Artemisia nova</b>											
98	<b>120</b>	-	-	100	20	20	83	0	17	0	13/24
03	<b>20</b>	-	-	20	-	-	0	0	0	0	13/28
<b>Artemisia tridentata vaseyana</b>											
98	<b>1860</b>	120	100	1180	580	500	56	14	31	13	26/37
03	<b>1820</b>	-	80	860	880	400	48	37	48	9	25/33
<b>Chrysothamnus nauseosus hololeucus</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	42/26

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus viscidiflorus</b>											
98	<b>0</b>	20	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
<b>Gutierrezia sarothrae</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	12/9
03	<b>20</b>	-	-	20	-	-	0	0	-	0	8/11
<b>Juniperus osteosperma</b>											
98	<b>0</b>	-	-	-	-	20	0	0	-	0	-/-
03	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
98	<b>40</b>	-	-	20	20	-	0	0	50	50	5/6
03	<b>0</b>	-	-	-	-	-	0	0	0	0	5/13
<b>Purshia tridentata</b>											
98	<b>20</b>	-	-	20	-	-	100	0	-	0	39/72
03	<b>20</b>	-	-	20	-	-	0	100	-	0	37/52
<b>Quercus gambelii</b>											
98	<b>940</b>	60	340	600	-	-	0	0	-	0	50/28
03	<b>1420</b>	-	220	1200	-	140	0	0	-	0	49/32

Trend Study 29-4-03

Study site name: Barracks Chaining.

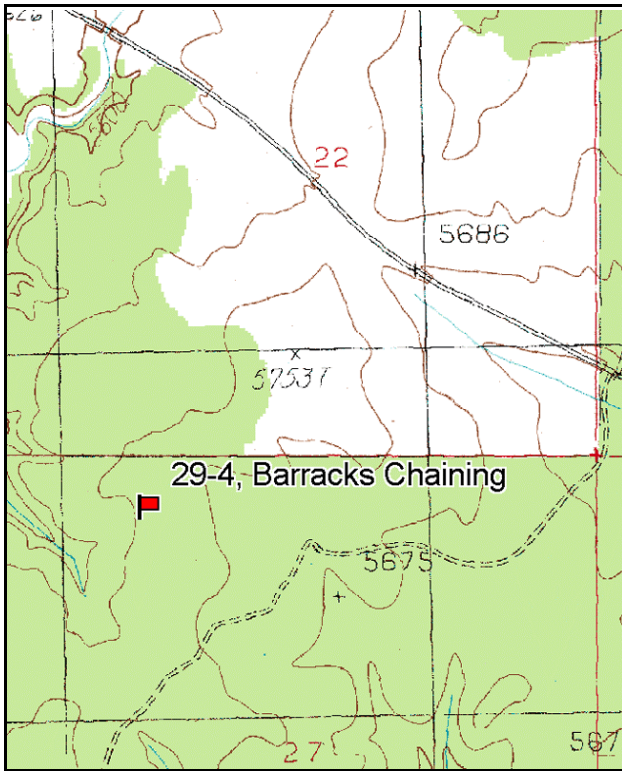
Vegetation type: Chaining.

Compass bearing: frequency baseline 165 degrees magnetic.

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

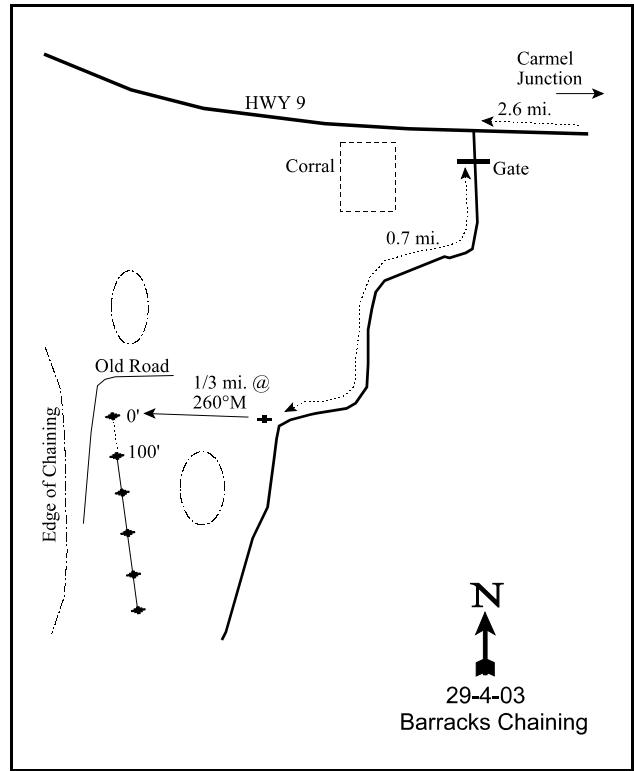
LOCATION DESCRIPTION

From the junction of Hwy 89 and Hwy 9 (Carmel Junction), proceed west on Hwy 9 for 2.6 miles to a road on the left (south) side of the Hwy. Turn left on this road, go through a gate, proceed 0.7 miles passing a corral on the right side of the road to a witness post on the right side of the road. From the witness post, walk ~1/3-1/2 mile at 260 degrees magnetic to the 0-foot stake.



Map Name: Mount Carmel

Township 41S, Range 8W, Section 27



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4120537 N, 346198 E



## DISCUSSION

### Barracks Chaining - Trend Study No. 29-4

This is a new trend study established in 2003 on an old chaining located about 3 miles west of Carmel Junction and approximately ½ mile south of Highway 9. The site samples a chained area surrounded on 3 sides by unchained pinyon-juniper woodland. It has a west aspect and a gentle slope of 7%. Elevation is 5,730 feet. This is an important area for wintering deer. Pellet group data taken on the site estimated 45 deer days use/acre in 2003. Cattle also use the site with 14 days use/acre being estimated (34 cdu/ha).

Soil at the site is a deep sandy clay loam. Effective rooting depth is estimated at 16 inches. There is very little rock or pavement on the surface or within the soil profile. Phosphorus is low at only 4 ppm when 10 ppm is considered minimal for normal plant growth and development. Organic matter is also low at about 1%. Soil temperature is high averaging nearly 71°F at a depth of 18 inches. The high temperature of the soil is indicative of a dry soil profile which makes shrub recruitment difficult. There is still a lot of old chaining litter scattered over the site but bare ground is common with a cover value of 47%. There are signs of erosion in the form of pedestalling, flow patterns, and soil movement. Most of this is localized and the erosion condition class was determined to be slight in 2003.

There are several species of preferred browse on the site including serviceberry, mountain big sagebrush, squaw-apple, and bitterbrush. All occur in very low numbers and total browse cover, including pinyon and juniper tree cover, averaged about 8% in 2003. Serviceberry numbers only 100 plants/acre. These are large shrubs averaging nearly 7 feet in height. Available portions of these shrubs show moderate use and good vigor. Mountain big sagebrush has a density estimated at only 60 plants/acre. They showed moderate to heavy use, good vigor, with 33% classified as decadent. No seedlings or young were encountered. Bitterbrush also showed moderate to heavy use. Vigor was classified as poor on 11% of the population and 33% were rated as decadent. Bitterbrush density numbers 180 plants/acre with no young being sampled in 2003.

Pinyon and juniper trees are still found in the chaining. Point-quarter data estimated a density of 47 pinyon and 56 juniper trees/acre. Average diameter was estimated at 3.1 inches for pinyon and 6.5 inches for juniper. About 41% of the pinyon and juniper were in the 1 to 4 foot height class while another 41% were in the 4 to 8 foot height class. Approximately 18% of the juniper trees sampled were mature trees that were chained over but still living. Total line-intercept canopy cover for pinyon and juniper was estimated at 3%.

The herbaceous understory is diverse but only moderately abundant. Six perennial and 2 annual grasses were encountered in 2003, producing only 6% cover. Seeded species, crested and intermediate wheatgrass, are the most abundant accounting for 20% and 56% of the total grass cover respectively. Forbs are abundant and produce more cover than grasses. Common species include Searls prairie clover, coyote tobacco, lemon scurf-pea, cutleaf nightshade, and scarlet globemallow. Use of grasses and forbs appeared light when the site was read on July 27<sup>th</sup> of 2003.

### APPARENT TREND ASSESSMENT

Soil conditions are marginal. There is some chaining litter remaining on the surface but a lot of bare ground remains. The soil is sandy and has a relatively high infiltration rate but some erosion is occurring. The soil erosion condition class was determined to be slight. Several preferred species of shrubs occur on the site including serviceberry, mountain big sagebrush, and bitterbrush. All of these species occur in very low numbers. Mountain big sagebrush and bitterbrush are moderately to heavily hedged, display good vigor, but have moderate levels of decadence. No seedlings or young for either species were encountered in 2003. The herbaceous understory is diverse with forbs producing more cover than grasses. Common grasses include seeded crested and intermediate wheatgrass which combine to produce 76% of the total grass cover. Several forbs are common

but most are weedy or early seral species.

HERBACEOUS TRENDS --

Management unit 29 , Study no: 4

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	Agropyron cristatum	46	1.20
G	Agropyron intermedium	117	3.42
G	Bouteloua gracilis	1	.15
G	Bromus tectorum (a)	9	.57
G	Oryzopsis hymenoides	5	.03
G	Sitanion hystrix	2	.00
G	Sporobolus cryptandrus	48	.71
G	Vulpia octoflora (a)	2	.01
Total for Annual Grasses		11	0.57
Total for Perennial Grasses		219	5.53
Total for Grasses		230	6.11
F	Amaranthus graecizans	4	.01
F	Chenopodium fremontii (a)	-	.15
F	Dalea searlsiae	33	2.53
F	Erigeron divergens	1	.03
F	Euphorbia spp.	27	.55
F	Hymenopappus filifolius	5	.06
F	Lotus utahensis	2	.15
F	Nicotiana attenuata (a)	6	1.04
F	Penstemon humilis	1	.00
F	Penstemon leonardi	1	.03
F	Phlox longifolia	9	.02
F	Psoralea lanceolata	15	1.61
F	Solanum triflorum (a)	23	1.40
F	Sphaeralcea grossulariaefolia	66	2.55
F	Tragopogon dubius	-	.03
Total for Annual Forbs		29	2.59
Total for Perennial Forbs		164	7.60
Total for Forbs		193	10.20

BROWSE TRENDS --

Management unit 29 , Study no: 4

Type	Species	Strip Frequency	Average Cover %
		'03	'03
B	Amelanchier utahensis	3	1.70
B	Artemisia tridentata vaseyana	3	.38
B	Juniperus osteosperma	3	1.62
B	Pinus edulis	3	1.00
B	Purshia tridentata	7	3.03
Total for Browse		19	7.75

CANOPY COVER, LINE INTERCEPT --

Management unit 29 , Study no: 4

Species	Percent Cover
	'03
Amelanchier utahensis	1.60
Artemisia tridentata vaseyana	.73
Juniperus osteosperma	1.83
Pinus edulis	1.23
Purshia tridentata	3.71

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 29 , Study no: 4

Species	Average leader growth (in)
	'03
Amelanchier utahensis	5.0
Artemisia tridentata vaseyana	4.8
Purshia tridentata	6.4

POINT-QUARTER TREE DATA --

Management unit 29 , Study no: 4

Species	Trees per Acre	Average diameter (in)
	'03	
Juniperus osteosperma	47	3.1
Pinus edulis	56	2.6

**BASIC COVER --**

Management unit 29 , Study no: 4

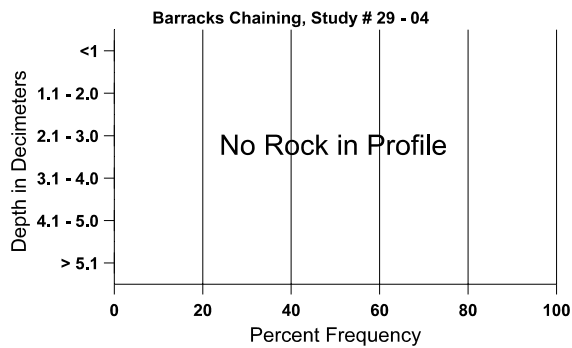
Cover Type	Average Cover % '03
Vegetation	22.40
Rock	.03
Pavement	.04
Litter	42.29
Cryptogams	.21
Bare Ground	47.20

**SOIL ANALYSIS DATA --**

Management unit 29, Study no: 4, Study Name: Barracks Chaining

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	ds/m
16.1	70.8 (18.1)	6.5	62.6	14.7	22.7	1.0	4.0	448.0	0.5

**Stoniness Index**



**PELLET GROUP DATA --**

Management unit 29 , Study no: 4

Type	Quadrat Frequency '03	Days use per acre (ha) '03
Rabbit	35	-
Horse	1	-
Elk	1	-
Deer	31	45 (111)
Cattle	9	14 (34)

BROWSE CHARACTERISTICS --  
Management unit 29 , Study no: 4

		Age class distribution (plants per acre)					Utilization				
Y e a r	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Amelanchier utahensis</i>											
03	<b>100</b>	-	40	60	-	-	40	0	-	0	81/92
<i>Artemisia tridentata vaseyana</i>											
03	<b>60</b>	-	-	40	20	-	33	33	33	0	16/27
<i>Juniperus osteosperma</i>											
03	<b>120</b>	-	120	-	-	-	0	0	-	0	-/-
<i>Peraphyllum ramosissimum</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	87/103
<i>Pinus edulis</i>											
03	<b>60</b>	-	20	40	-	-	0	0	-	0	-/-
<i>Purshia tridentata</i>											
03	<b>180</b>	-	-	120	60	-	56	44	33	11	54/86
<i>Quercus gambelii</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	26/25

Trend Study 29R-1-03

Study site name: Elephant Gap Total Enclosure.

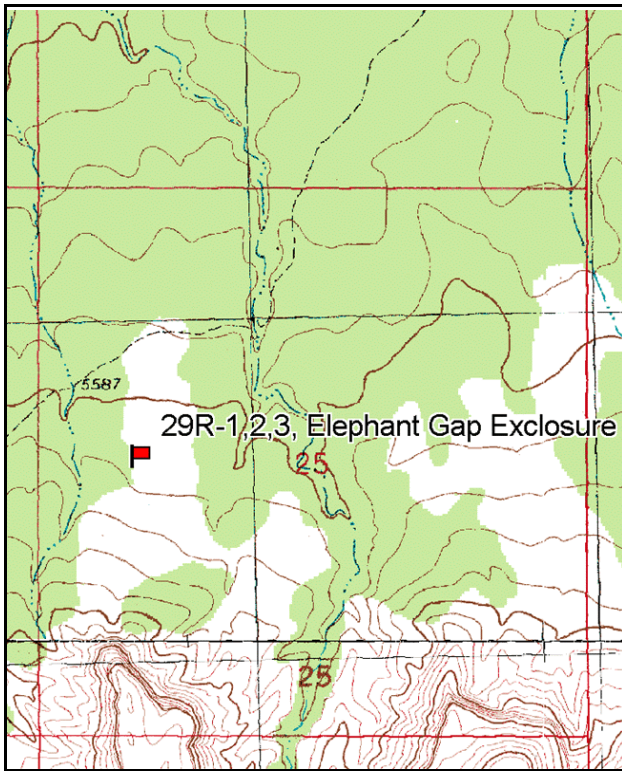
Vegetation type: Pinyon-Juniper .

Compass bearing: frequency baseline 50 degrees magnetic.

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

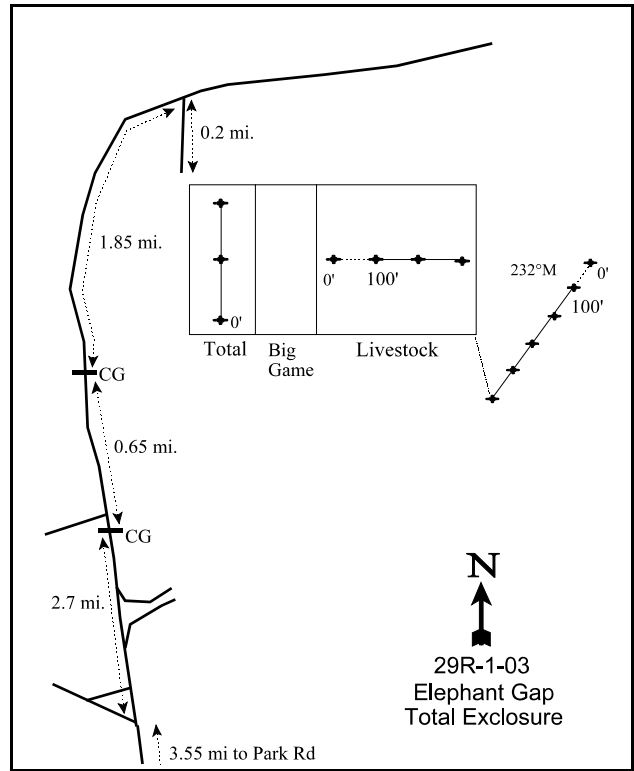
LOCATION DESCRIPTION

The starting point for this site is the entry to Coral Pink Sand Dunes State Park off of Hwy 89. From the entry of the park, travel south for 4.2 miles. Turn right and go 3.55 miles to a fork. Stay right and continue 2.7 miles to a cattleguard. Continue on main road for another 0.65 miles to another cattleguard. Drive another 1.85 miles to a faint road to the right (south). Drive on this road for 0.2 miles to the enclosure. The total enclosure is nearest to the road and the baseline (200 feet long) runs through the middle at 50 degrees magnetic. The 0 foot stake is marked by browse tag #116.



Map Name: The Barracks

Township 42S, Range 9W, Section 25



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4110568 N, 339641 E

## DISCUSSION

### Elephant Gap Total Exclosure - Trend Study No. 29R-1

This study was established in 1998 inside the total exclosure at Elephant Gap. The Elephant Gap exclosure complex is located about 16 miles west-northwest of Kanab and about 9 miles northwest of the Coral Pink Sand Dunes State Park. The exclosure was built in the 1960's just north of Harris Point, and the total exclosure is approximately 100 feet by 200 feet in size. Slope is about 6% with a north to northwest aspect at an elevation of about 5,600 feet. The area supports a moderately dense stand of pinyon and juniper trees with a mixture of basin big sagebrush, bitterbrush, and serviceberry in the understory.

Soil at the site is very deep with an effective rooting depth estimated at over 31 inches. Texture is sand and reactivity is slightly acidic (6.2 pH). Phosphorus and potassium are limited at just 5.6 ppm and 12.8 ppm respectively. This could be effecting plant growth and development. Values below 10 ppm for phosphorus and 70 ppm for potassium are considered deficient. Soil temperature averaged nearly 70°F at a depth of 18 inches in 1998 and 2003. High soil temperatures combined with the sandy nature of the soil cause rapid drying of the soil profile which effectively limits shallow rooted plants. There is virtually no rock or pavement on the surface or within the profile. A considerable amount of bare ground was estimated in both surveys, but there is little erosion occurring due to the gentle slope and the rapid infiltration capacity of the soil.

There are a few small pinyon pine and large Utah juniper trees inside of the total exclosure. Average basal diameter was approximately 14 inches for juniper and 4 inches for pinyon. Juniper canopy cover was estimated at 12% in 1998 and 19% in 2003. Basin big sagebrush and bitterbrush are the key browse species. They combined to provide 48% and 41% of the shrub cover in 1998 and 2003 respectively. Density of basin big sagebrush was estimated at 1,280 plants/acre in 1998, decreasing to 760 in 2003. Density of dead plants increased to 960 plants/acre. Percent decadence was moderately low in 1998 at 19%, but increased to 53% in 2003. In addition, half of the basin big sagebrush population displayed poor vigor in 2003, an increase from 13% in 1998. It appears that basin big sagebrush will continue to decline in the future as 95% (~380 plants/acre) of the decadent age class was classified as dying in 2003. Annual leaders for basin big sagebrush averaged 1.9 inches in 2003.

There are only about 200 bitterbrush plants/acre inside the total exclosure with most of these being mature. No young bitterbrush were sampled in either survey. Decadence was low in 1998 at 8%, but moderate in 2003 at 30%. Bitterbrush annual leaders averaged 3.5 inches of growth in 2003. Small numbers of sand sagebrush, rubber rabbitbrush, green ephedra, coin buckwheat, squawbush, and yucca are also found inside of the exclosure.

The herbaceous understory is very poor. Total herbaceous cover was estimated at only 6% in 1998 and 3% in 2003. The most common perennial grasses are blue grama and sand dropseed, both warm season species. They accounted for 93% of the grass cover in 1998. With the exception of milkvetch, most of the herbaceous species on the site declined in 2003 with drought. Annual species are few.

### 1998 APPARENT TREND ASSESSMENT

The soil appears relatively stable even with the abundance of bare soil. There is some soil pedestalling apparent, but soil erosion appears minimal due to the gentle terrain combined with the high infiltration capacity of the soil. The key browse species, basin big sagebrush and bitterbrush, appear to have healthy and stable populations. Vigor is normal on most plants and percent decadence is low at 19% for sagebrush and 8% for bitterbrush. The herbaceous understory is lacking, although this may be all the site can support. Composition of grasses is dominated by the warm season species, primarily blue grama and sand dropseed. Forb composition is composed mostly of milkvetch and pale evening primrose.

2003 TREND ASSESSMENT

Trend for soil is stable. There were some slight changes in protective cover on the soil surface, but none of them would warrant a downward trend. Bare soil increased from 38% to 41%, while both vegetation and cryptogamic cover slightly declined. Litter cover increased from 44% to 51% in 2003. Trend for browse is down. Basin big sagebrush and bitterbrush have reduced population densities and increased decadence. The sagebrush population displays very poor vigor, and nearly all of the decadent age class was classified as dying which will likely result in future declines. Trend for the herbaceous understory is slightly down. Perennial grasses and forbs have lower sum of nested frequency values in 2003. The most abundant grasses, blue grama and sand dropseed, both significantly declined in 2003. Milkvetch remained stable while pale evening primrose significantly declined.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --

Management unit 29R, Study no: 1

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Bouteloua gracilis</i>	<sub>b</sub> 51	38	1.21	.22
G	<i>Bromus tectorum</i> (a)	4	-	.01	-
G	<i>Muhlenbergia pungens</i>	2	2	.03	.00
G	<i>Oryzopsis hymenoides</i>	2	3	.03	.16
G	<i>Sitanion hystrix</i>	-	3	-	.00
G	<i>Sporobolus cryptandrus</i>	<sub>b</sub> 39	<sub>a</sub> 5	.77	.07
G	<i>Stipa comata</i>	5	4	.00	.15
G	<i>Vulpia octoflora</i> (a)	<sub>b</sub> 20	<sub>a</sub> -	.09	-
Total for Annual Grasses		24	0	0.10	0
Total for Perennial Grasses		99	55	2.04	0.62
Total for Grasses		123	55	2.15	0.62
F	<i>Artemisia dracunculus</i>	5	-	.01	.03
F	<i>Arenaria</i> spp.	-	1	-	.03
F	<i>Astragalus</i> spp.	60	52	1.92	1.57
F	<i>Descurainia pinnata</i> (a)	7	4	.16	.00
F	<i>Dithyrea wislizenii</i> (a)	10	-	.27	-
F	<i>Eriogonum cernuum</i> (a)	9	-	.02	-
F	<i>Gilia</i> spp. (a)	<sub>a</sub> 6	<sub>b</sub> 19	.03	.32
F	<i>Lappula occidentalis</i> (a)	3	-	.03	-
F	<i>Oenothera albicaulis</i> (a)	-	1	-	.00
F	<i>Oenothera pallida</i>	<sub>b</sub> 43	<sub>a</sub> 16	1.06	.05



Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
	Total for Annual Forbs	35	24	0.52	0.32
	Total for Perennial Forbs	108	69	3.00	1.69
	Total for Forbs	143	93	3.52	2.02

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

#### BROWSE TRENDS --

Management unit 29R, Study no: 1

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	<i>Artemisia filifolia</i>	15	12	.62	.73
B	<i>Artemisia tridentata tridentata</i>	37	33	6.46	5.61
B	<i>Chrysothamnus nauseosus hololeucus</i>	9	6	1.19	1.93
B	<i>Ephedra viridis</i>	6	5	.56	.57
B	<i>Eriogonum nummulare</i>	5	5	.33	.15
B	<i>Juniperus osteosperma</i>	1	2	7.94	9.25
B	<i>Opuntia</i> spp.	1	5	.03	.00
B	<i>Purshia tridentata</i>	9	9	3.56	4.09
B	<i>Rhus trilobata</i>	1	0	-	-
B	<i>Tetradymia canescens</i>	0	1	-	-
B	<i>Yucca</i> spp.	3	5	.16	1.34
	Total for Browse	87	83	20.88	23.71

CANOPY COVER, LINE INTERCEPT --

Management unit 29R, Study no: 1

Species	Percent Cover	
	'98	'03
Artemisia filifolia	-	1.13
Artemisia tridentata tridentata	-	3.71
Chrysothamnus nauseosus hololeucus	-	1.75
Ephedra viridis	-	1.13
Eriogonum nummulare	-	.38
Juniperus osteosperma	12.39	18.54
Opuntia spp.	-	.01
Purshia tridentata	-	4.34
Yucca spp.	-	1.06

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 29R, Study no: 1

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	1.9
Purshia tridentata	3.5

BASIC COVER --

Management unit 29R, Study no: 1

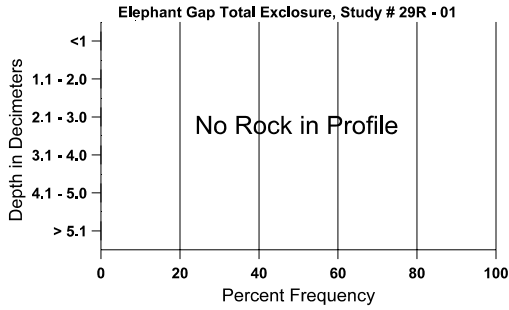
Cover Type	Average Cover %	
	'98	'03
Vegetation	28.10	25.73
Rock	0	.00
Pavement	0	.01
Litter	44.43	51.48
Cryptogams	5.10	2.59
Bare Ground	38.44	41.14

SOIL ANALYSIS DATA --

Management unit 29R, Study no: 1, Study Name: Elephant Gap Total Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	ds/m
31.4	68.0 (18.0)	6.2	90.7	4.7	4.6	0.6	5.6	12.8	0.3

## Stoniness Index



### PELLET GROUP DATA --

Management unit 29R, Study no: 1

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	2	22	N/A	N/A
Deer	1	9	N/A	N/A

### BROWSE CHARACTERISTICS --

Management unit 29R, Study no: 1

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia filifolia</b>											
98	<b>380</b>	-	120	260	-	20	0	0	0	0	24/63
03	<b>280</b>	-	20	120	140	40	0	0	50	7	23/25
<b>Artemisia tridentata tridentata</b>											
98	<b>1280</b>	120	220	820	240	560	0	0	19	13	35/45
03	<b>760</b>	-	80	280	400	960	0	0	53	50	31/33
<b>Chrysothamnus nauseosus hololeucus</b>											
98	<b>2400</b>	-	-	2400	-	40	0	0	0	0	41/81
03	<b>120</b>	-	-	40	80	60	0	0	67	33	36/55
<b>Ephedra viridis</b>											
98	<b>160</b>	-	40	60	60	-	0	0	38	0	28/26
03	<b>100</b>	-	-	100	-	-	0	0	0	0	29/32
<b>Eriogonum nummulare</b>											
98	<b>120</b>	-	40	80	-	-	0	0	0	0	22/23
03	<b>140</b>	-	-	100	40	40	0	0	29	14	17/19

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Juniperus osteosperma</b>											
98	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
03	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
98	<b>20</b>	-	-	-	20	-	0	0	100	0	4/14
03	<b>100</b>	-	-	80	20	-	0	0	20	20	5/16
<b>Purshia tridentata</b>											
98	<b>240</b>	-	-	220	20	40	0	0	8	8	48/64
03	<b>200</b>	-	-	140	60	100	20	10	30	10	48/92
<b>Rhus trilobata</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Ribes spp.</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	111/104
<b>Tetradymia canescens</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	34/42
<b>Yucca spp.</b>											
98	<b>60</b>	-	-	60	-	-	0	0	-	0	33/42
03	<b>180</b>	-	20	160	-	-	0	0	-	0	27/33

Trend Study 29R-2-03

Study site name: Elephant Gap Livestock Enclosure .

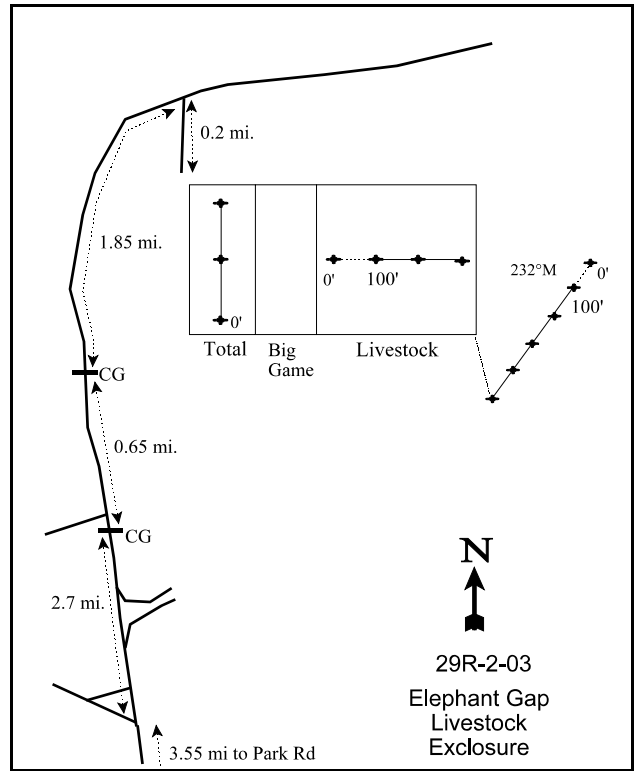
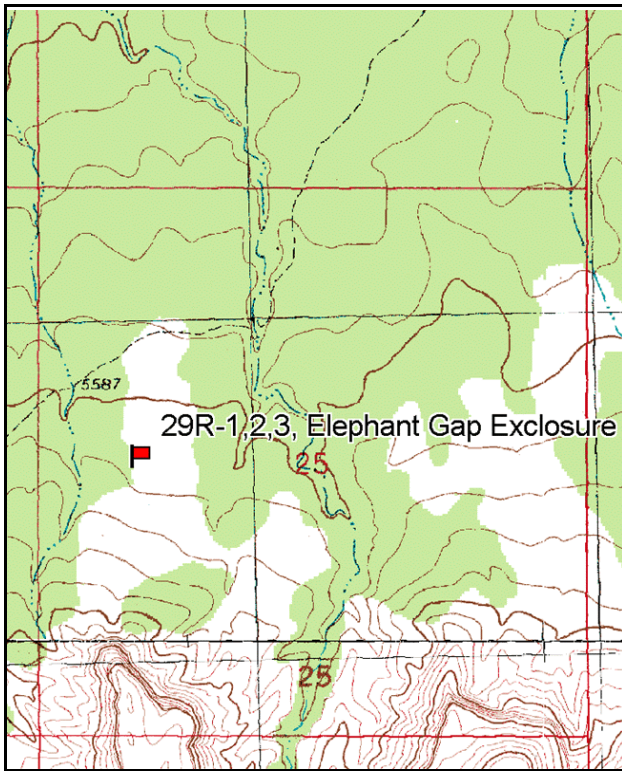
Vegetation type: Pinyon-Juniper .

Compass bearing: frequency baseline 90° degrees magnetic.

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

LOCATION DESCRIPTION

The starting point for this site is the entry to Coral Pink Sand Dunes State Park off of Hwy 89. From the entry of the park, travel south for 4.2 miles. Turn right and go 3.55 miles to a fork. Stay right and continue 2.7 miles to a cattleguard. Continue on main road for another 0.65 miles to another cattleguard. Drive another 1.85 miles to a faint road to the right (south). Drive on this road for 0.2 miles to the enclosure. The livestock enclosure is located on the east side of the enclosure complex. The baseline starts inside the livestock enclosure near the taller fence denoting the big game enclosure and runs through the middle of the enclosure (see map below).



Map Name: The Barracks

Diagrammatic Sketch

Township 42S, Range 9W, Section 25

GPS: NAD 27, UTM 12S 4110516 N, 339698

## DISCUSSION

### Elephant Gap Livestock Exclosure - Trend Study No. 29R-2

This study was established in 1998 inside the livestock exclosure at Elephant Gap. The Elephant Gap exclosure complex is located about 16 miles west-northwest of Kanab and about 9 miles northwest of the Coral Pink San Dunes State Park. The exclosure was built in the 1960's just north of Harris Point. Slope is 7% with a northwest aspect, and elevation is approximately 5,600 feet. The area is composed of an open pinyon-juniper woodland with a mixed shrub understory. Deer use this area as winter range and pellet group data estimated a high level of use within the livestock exclosure at 96 deer days use/acre (237 ddu/ha) in 1998 and 102 days use/acre (251 ddu/ha) in 2003.

Soil in the livestock exclosure is very similar to the total exclosure and outside. It is deep, sandy in texture, but strongly acidic (pH of 5.5). Phosphorus and potassium are limited at just 3.8 ppm and 3.2 ppm respectively, which may be limiting to plant growth and development. Values below 10 ppm for phosphorus and 70 ppm for potassium are considered deficient. There is very little rock or pavement on the surface or within the profile. Percent bare ground is similar to the total exclosure at 35% in 1998 and 40% in 2003, but cryptogamic cover is about twice as high inside the livestock exclosure. In 1998, average soil temperature was high at 71°F at 18 inches in depth. Combined with the sandy nature of the soil, high soil temperatures cause rapid drying of the soil profile which effectively limits shallow rooted plants. There is some soil pedestalling around shrubs, but erosion does not appear to be a problem due to the gentle terrain and high infiltration capacity.

Total shrub cover is similar to the total exclosure yet composition differs considerably. The key browse species consist of basin big sagebrush and green ephedra. Basin big sagebrush accounted for 24% and 10% of the browse cover in 1998 and 2003 respectively, while green ephedra provided 41% and 51% of the browse cover in the same years. The decline in basin big sagebrush cover in 2003 was the result of a large die-off. Sagebrush density was estimated at 1,180 plants/acre in 1998, declining to 740 in 2003. Not only did the number of dead sagebrush increase in 2003, but percent decadence increased from 46% to 95%, and young recruitment decreased from 7% to 0%. More than half of the remaining sagebrush (57%) were classified as having poor vigor in 2003. Annual leader growth on basin big sagebrush averaged 2.2 inches in 2003.

Green ephedra density numbered 1,060 plants/acre in 1998 and 900 in 2003. This population has maintained good vigor, low to moderate decadence, and light use. Young ephedra were very abundant in 1998 as they made up 53% of the population. In 2003, the ephedra population was mostly mature with less young (11%). Mature plants are large averaging about 4 feet in height and 5 feet in width. A few bitterbrush plants occur in the livestock exclosure but only numbered 20 plants/acre in 2003. Bitterbrush leaders averaged 5.1 inches of annual growth in 2003. Other shrubs found on the site include sand sagebrush, coin buckwheat, prickly pear cactus, and yucca. Juniper trees are scattered in the livestock exclosure at a density of 29 trees/acre. Overhead canopy cover averaged 14% in 2003.

Grass composition in the livestock exclosure closely resembles that of the total exclosure, but forbs are more diverse and were much more abundant in 1998. Sand dropseed was the most abundant grass in 1998, with pale evening primrose, toadflax, and milkvetch being the most common forbs. With drought in 2003, grasses and forbs declined in abundance, especially perennial forbs. Total forb cover was estimated at only 3% in 2003 compared to 11% in 1998. Sum of nested frequency of perennial grasses only slightly decreased in 2003, but perennial forbs showed a 56% decline in that category. The largest loss came from primrose, but toadflax and milkvetch also showed declines.

1998 APPARENT TREND ASSESSMENT

Soil at the site appears stable. There is a high amount of bare soil (35%), but erosion is minimal due to the gentle terrain combined with the high infiltration capacity of the soil. The key browse species are basin big sagebrush and green ephedra. Sagebrush appears to be in a state of decline even though utilization is mostly light. Forty-eight percent of the population is dead, percent decadence is at 46%, and nearly half (48%) of the decadent sagebrush appear to be dying. Reproduction is poor and not adequate to maintain the stand at current levels. The less preferred green ephedra population is healthy and appears to be increasing. Utilization is light, vigor normal, and percent decadence low at only 2%. The most preferred shrub on the site is antelope bitterbrush, but it only occurs in small numbers within the livestock enclosure. The population is mostly young and lightly utilized. The herbaceous understory is similar to the total enclosure with respect to grass diversity and abundance. Sand dropseed is the most abundant species followed by six weeks fescue. Forbs are more diverse and produce 3 times more cover compared to the total enclosure. Common species include pale and prairie evening primrose, milkvetch, and bastard toadflax.

2003 TREND ASSESSMENT

Trend for soil is slightly down. Bare soil increased from 35% to 40%, and vegetation cover declined from 38% to 26%. Cryptogamic cover also declined by nearly half. These changes result in less protective cover on the soil surface. Erosion is low because of high infiltration rates and the gentle slope. The key browse species, basin big sagebrush and green ephedra, have lower population densities, higher decadence, and lower recruitment. The decadence rate for sagebrush is extreme at 95%, and 60% of these plants were classified as dying which will likely result in further population losses in the future. Fifty-seven percent of the basin big sagebrush sampled were classified as having poor vigor in 2003, while most of the ephedra population maintained normal vigor. Ephedra is in better condition than sagebrush and since it accounts for half of the browse cover and has a higher density estimate, trend for browse is only slightly down. Trend for the herbaceous understory is down. Grasses provide little cover to the site and remained nearly stable in frequency. Perennial forbs showed a large decline in sum of nested frequency with drought in 2003. The largest loss came from pale evening primrose, but toadflax and milkvetch also showed decreases in their respective frequencies. The negative effect of drought on both sagebrush and the herbaceous species is obvious, and a return to normal precipitation patterns will help reverse these trends.

TREND ASSESSMENT

soil - slightly down (2)

browse - slightly down (2)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 29R, Study no: 2

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Bouteloua gracilis	7	11	.30	.34
G	Bromus tectorum (a)	<sub>b</sub> 11	<sub>a</sub> -	.08	-
G	Muhlenbergia pungens	4	3	.01	.03
G	Oryzopsis hymenoides	3	6	.06	.09
G	Sitanion hystrix	1	-	.00	-

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Sporobolus cryptandrus</i>	<sub>b</sub> 34	<sub>a</sub> 21	1.11	.58
G	<i>Vulpia octoflora</i> (a)	<sub>b</sub> 51	<sub>a</sub> -	.44	-
Total for Annual Grasses		62	0	0.52	0
Total for Perennial Grasses		49	41	1.49	1.04
Total for Grasses		111	41	2.01	1.04
F	<i>Artemisia dracunculus</i>	2	-	.06	-
F	<i>Astragalus</i> spp.	56	38	1.74	1.62
F	<i>Castilleja linariaefolia</i>	-	-	.03	-
F	<i>Carduus nutans</i> (a)	-	2	-	.03
F	<i>Chaenactis douglasii</i>	5	-	.03	-
F	<i>Comandra pallida</i>	<sub>b</sub> 88	<sub>a</sub> 64	1.35	.52
F	<i>Cordylanthus parviflorus</i>	5	-	.09	-
F	<i>Cordylanthus</i> spp. (a)	-	7	-	.29
F	<i>Descurainia pinnata</i> (a)	<sub>b</sub> 16	<sub>a</sub> -	.11	-
F	<i>Dithyrea wislizenii</i> (a)	4	-	.09	-
F	<i>Draba</i> spp. (a)	13	-	.07	-
F	<i>Eriogonum cernuum</i> (a)	<sub>b</sub> 11	<sub>a</sub> -	.12	-
F	<i>Euphorbia</i> spp.	<sub>B</sub> 14	<sub>a</sub> -	.02	-
F	<i>Gilia</i> spp. (a)	1	6	.03	.02
F	<i>Lappula occidentalis</i> (a)	-	-	.00	-
F	<i>Oenothera albicaulis</i> (a)	<sub>b</sub> 18	<sub>a</sub> -	.60	-
F	<i>Oenothera pallida</i>	<sub>b</sub> 155	<sub>a</sub> 42	6.51	.45
F	<i>Penstemon</i> spp.	-	4	-	.03
F	<i>Phlox longifolia</i>	2	-	.00	-
F	<i>Sphaeralcea parvifolia</i>	<sub>b</sub> 11	<sub>a</sub> -	.21	-
Total for Annual Forbs		63	15	1.03	0.34
Total for Perennial Forbs		338	148	10.07	2.64
Total for Forbs		401	163	11.11	2.99

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



BROWSE TRENDS --

Management unit 29R, Study no: 2

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia filifolia	3	2	.93	.78
B	Artemisia tridentata tridentata	47	26	4.79	2.14
B	Chrysothamnus nauseosus hololeucus	0	1	-	-
B	Ephedra viridis	23	24	8.32	11.07
B	Eriogonum nummulare	1	2	.03	.15
B	Juniperus osteosperma	1	1	5.21	6.52
B	Opuntia spp.	2	2	-	.06
B	Pediocactus simpsonii	0	0	-	.15
B	Purshia tridentata	2	1	.66	.53
B	Yucca spp.	2	3	.15	.41
Total for Browse		81	62	20.11	21.83

CANOPY COVER, LINE INTERCEPT --

Management unit 29R, Study no: 2

Species	Percent Cover	
	'98	'03
Artemisia filifolia	-	.61
Artemisia tridentata tridentata	-	.95
Ephedra viridis	-	16.64
Juniperus osteosperma	4.80	14.00
Purshia tridentata	-	1.18
Yucca spp.	-	.45

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 29R, Study no: 2

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	2.2
Purshia tridentata	5.1

BASIC COVER --

Management unit 29R, Study no: 2

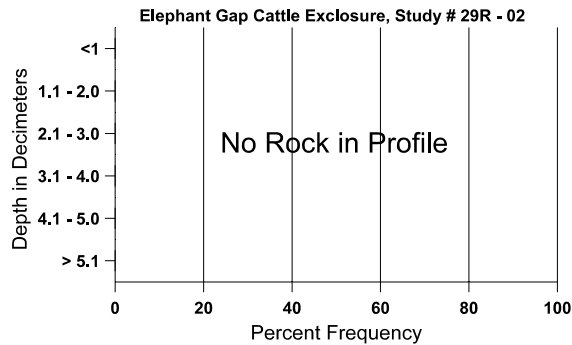
Cover Type	Average Cover %	
	'98	'03
Vegetation	37.53	25.90
Rock	.00	.00
Pavement	.08	0
Litter	42.49	42.98
Cryptogams	13.53	7.22
Bare Ground	34.80	40.44

SOIL ANALYSIS DATA --

Management unit 29R, Study no: 2, Study Name: Elephant Gap Livestock Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
25.7	70.8 (17.7)	5.5	90.7	2.7	6.6	0.6	3.8	3.2	0.8

### Stoniness Index



PELLET GROUP DATA --

Management unit 29R, Study no: 2

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	-	7	-	-
Deer	47	29	96 (237)	102 (251)

BROWSE CHARACTERISTICS --  
Management unit 29R, Study no: 2

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia filifolia</i>											
98	<b>60</b>	-	-	20	40	-	0	0	67	33	47/51
03	<b>40</b>	-	-	20	20	-	50	0	50	0	43/47
<i>Artemisia tridentata tridentata</i>											
98	<b>1180</b>	60	80	560	540	1060	15	0	46	24	37/38
03	<b>740</b>	-	-	40	700	1480	35	46	95	57	26/24
<i>Chrysothamnus nauseosus hololeucus</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	100	0	-	0	37/50
<i>Echinocereus spp.</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	31/23
<i>Ephedra viridis</i>											
98	<b>1060</b>	280	560	480	20	40	0	0	2	0	52/81
03	<b>900</b>	-	100	600	200	20	4	0	22	7	43/63
<i>Eriogonum nummularre</i>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	26/35
03	<b>40</b>	-	-	40	-	-	0	0	-	0	14/19
<i>Juniperus osteosperma</i>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<i>Opuntia spp.</i>											
98	<b>40</b>	-	-	40	-	-	0	0	0	0	4/9
03	<b>40</b>	-	-	20	20	-	0	0	50	50	4/11
<i>Purshia tridentata</i>											
98	<b>60</b>	-	40	20	-	-	0	0	-	0	36/44
03	<b>20</b>	-	-	20	-	-	0	100	-	0	48/61
<i>Tetradymia canescens</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	35/35
<i>Yucca spp.</i>											
98	<b>100</b>	-	20	80	-	-	0	0	-	0	24/17
03	<b>100</b>	-	-	100	-	40	0	0	-	0	28/28

Trend Study 29R-3-03

Study site name: Elephant Gap Exclosure-Outside .

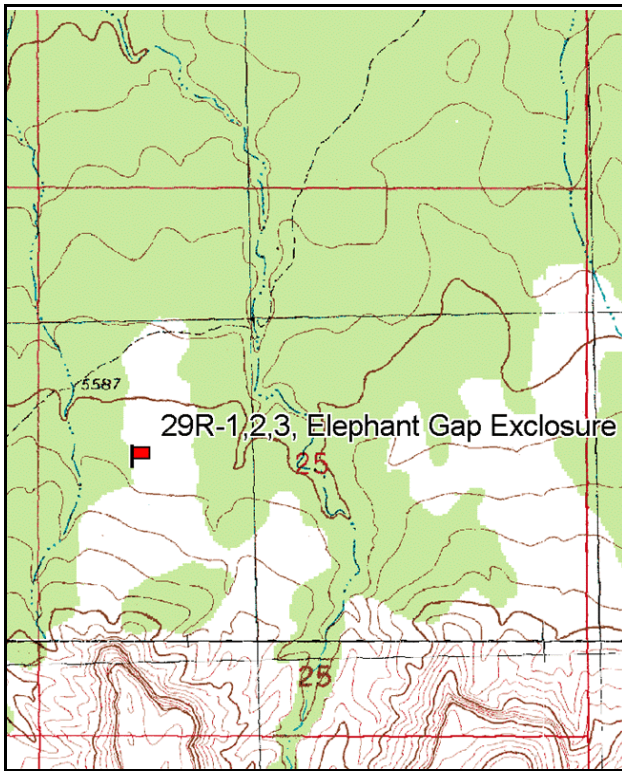
Vegetation type: Pinyon-Juniper .

Compass bearing: frequency baseline 232 degrees magnetic.

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

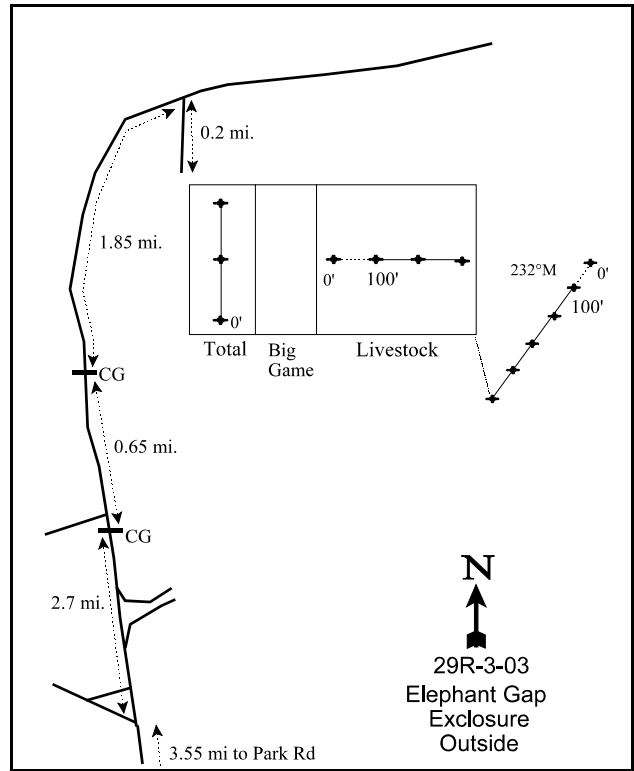
LOCATION DESCRIPTION

The starting point for this site is the entry to Coral Pink Sand Dunes State Park off of Hwy 89. From the entry of the park, travel south for 4.2 miles. Turn right and go 3.55 miles to a fork. Stay right and continue 2.7 miles to a cattleguard. Continue on main road for another 0.65 miles to another cattleguard. Drive another 1.85 miles to a faint road to the right (south). Drive on this road for 0.2 miles to the exclosure. From the southeast corner of the livestock exclosure, the 500 foot stake of the baseline is located 25 paces away at an azimuth of 186°M. The 0 foot stake is located 500 feet to the northeast at a bearing of 128°M. Browse tag #117 is attached to the 0 foot stake.



Map Name: The Barracks

Township 42S, Range 9W, Section 25



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4110447 N, 339832 E

## DISCUSSION

### Elephant Gap Exclosure Outside - Trend Study No. 29R-3

This study was established in 1998 outside of the exclosure complex at Elephant Gap. The Elephant Gap exclosure complex is located about 16 miles west-northwest of Kanab and about 9 miles northwest of the Coral Pink San Dunes State Park. This exclosure was built in the 1960's just north of Harris Point. The site has a slope of 7% with a northwest aspect. Elevation is approximately 5,600 feet. The area is composed of an open pinyon-juniper woodland with a mixed shrub understory. Deer use this area as winter range. Pellet group data estimated deer use at 95 days use/acre (235 ddu/ha) in 1998 and 46 days use/acre (114 ddu/ha) in 2003. Cattle use was estimated at only 2 days use/acre (5 cdu/ha) in 2003.

Soils are very deep, sand in texture, and strongly acidic (pH of 5.4). Effective rooting depth was estimated at 26 inches. Phosphorus and potassium are in limited amounts at just 3.5 ppm and 51.2 ppm respectively, which may be limiting to plant growth and development. Values below 10 ppm for phosphorus and 70 ppm for potassium are considered deficient. There is very little rock or pavement on the surface or within the profile. Cover of bare ground was higher outside than in either the total or livestock exclosures in both 1998 and 2003. Cryptogamic cover was estimated at 11% in 1998 and 7% in 2003. Soil temperature averaged nearly 70°F at a depth of 18 inches in 1998. High soil temperatures combined with the sandy nature of the soil result in rapid drying of the soil profile which effectively limits the establishment of shallow rooted plants. There is some soil pedestalling around shrubs, but erosion does not appear to be a significant problem due to the gentle terrain and high infiltration capacity of the soil.

The key browse species are basin big sagebrush, green ephedra, and antelope bitterbrush. The browse community outside of the exclosure provides much less cover compared to either the livestock or total exclosures. Basin big sagebrush provided 36% of the browse cover in 1998 and 26% in 2003. Total sagebrush cover was 5% in 1998 declining to 2% in 2003. Sagebrush density numbered 1,520 plants/acre in 1998, but decreased to only 540 plants/acre in 2003. The number of dead in the population nearly doubled in 2003, young recruitment slightly declined, and percent decadence increased from 45% to 74%. In 1998, utilization was light to moderate with a few plants displaying heavy use. Thirty percent of the plants sampled in 2003 displayed heavy use, and poor vigor increased from 28% to 44%. Over half of the decadent sagebrush in both surveys were classified as dying which will likely result in further losses for sagebrush. Sagebrush leaders averaged 2.5 inches of annual growth in 2003.

Ephedra density was estimated at 320 plants/acre in 1998, increasing to 500 in 2003. This population has received light to moderate use, maintained generally good vigor, and had moderate decadence. Mature plants are large, averaging 3 feet in height. Recruitment was high in 1998 as 44% of the population were classified as young plants. In 2003, the proportion of young decreased to 11%.

Bitterbrush is the most preferred species on the site, but it occurs in very low densities. Bitterbrush numbers only 20 plants/acre, and displayed heavy use and poor vigor in 2003. Bitterbrush leaders averaged nearly 6 inches of annual growth in 2003. Other shrubs occurring in limited numbers include sand sagebrush, rubber rabbitbrush, coin buckwheat, prickly pear, yucca, and gray horsebrush. Juniper and pinyon trees are found scattered throughout the area. Point-quarter data estimated 29 Utah juniper and 24 pinyon pine trees/acre in 1998. Average basal diameter was 9.8 inches for juniper and 5.5 inches for pinyon. Combined overhead canopy cover for juniper and pinyon was 10% in 2003.

The herbaceous understory is more abundant and diverse than the total exclosure and similar in composition and cover to the livestock exclosure. Grasses provided only 2% cover in 1998 and less than 1% in 2003. Sixweeks fescue was the most abundant grass in both surveys, although it declined significantly in nested frequency in 2003. Sand dropseed was the most abundant perennial species in 1998, but it also significantly decreased in 2003. The forb component is dominated by pale evening primrose, prairie evening primrose, and

milkvetch, as these species combined for 74% of the forb cover and 64% of the total herbaceous cover in 1998. Both of the primrose species significantly declined in 2003 with drought conditions, but milkvetch significantly increased in frequency and cover and now dominates the understory.

#### 1998 APPARENT TREND ASSESSMENT

Soil condition is poor with a considerable amount of bare ground (46%). There is some soil pedestalling evident around shrubs, but erosion is minimal due to the lack of slope combined with the high infiltration capacity of the sandy soil. The browse trend is very similar to the livestock enclosure. Basin big sagebrush appears to be in a state of decline with abundant dead plants, high decadence, and poor vigor on 62% of the decadent plants. Reproduction is fairly good with a biotic potential of 5% and 14% of the population being young. However, the current density of young plants is insufficient to replace the decadent/dying plants. The population could maintain itself with better recruitment in the future. Ephedra appears to be increasing with 44% of the population consisting of young plants. Utilization is light to moderate, vigor good, and percent decadence fairly low at 19%. The more preferred bitterbrush occurs in very limited numbers. Understandably, the one plant sampled was heavily hedged. The herbaceous understory is very similar to the livestock enclosure. Grasses provide only 2% cover with equal amounts of sand dropseed, blue grama, and six weeks fescue (an annual). Forbs combined to produce 12% cover with the most common species being pale evening primrose, prairie evening primrose, and milkvetch.

#### 2003 TREND ASSESSMENT

Trend for soil is slightly down. Bare ground increased to 54%, and vegetation, litter, and cryptogamic cover all declined in 2003. Erosion does not appear to be high due mostly to the gentle terrain and high infiltration rate of the sandy textured soil. Trend for browse is down. Basin big sagebrush is in very poor condition with a 64% decrease in population density, 3/4 of the remaining population being classified as decadent, and declining vigor and recruitment. The number of dead sagebrush sampled in 2003 was almost double that of 1998, and over half of the decadent age class was classified as dying. Ephedra increased in density due to the high proportion of young in the population in 1998. This species also showed increases in decadence in poor vigor in 2003, but neither is considered high. Bitterbrush remains very limited with only 1 plant being sampled on the transect. This plant was heavily utilized and was classified as having poor vigor. Trend for the herbaceous understory is down. Grasses were in low abundance in 1998, further decreasing in frequency and cover in 2003. Forbs had good production in 1998 and fair diversity. The evening primrose's both significantly decreased in 2003 while milkvetch significantly increased. With the drought in 2003, sum of nested frequency of perennial grasses and forbs declined by 35%. Nearly all of the herbaceous perennials showed significant declines in individual nested frequency values in 2003, and diversity was much lower as well.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --  
Management unit 29R, Study no: 3

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Bouteloua gracilis</i>	10	7	.53	.02
G	<i>Bromus tectorum</i> (a)	<sub>b</sub> 20	<sub>a</sub> -	.10	.00
G	<i>Oryzopsis hymenoides</i>	1	3	.03	.00
G	<i>Sitanion hystrix</i>	1	-	.03	-
G	<i>Sporobolus cryptandrus</i>	<sub>b</sub> 40	<sub>a</sub> 7	.68	.01
G	<i>Vulpia octoflora</i> (a)	<sub>b</sub> 106	<sub>a</sub> 43	.68	.72
Total for Annual Grasses		126	43	0.79	0.72
Total for Perennial Grasses		52	17	1.27	0.04
Total for Grasses		178	60	2.06	0.76
F	<i>Ambrosia</i> spp.	-	-	.03	-
F	<i>Artemisia dracunculus</i>	<sub>b</sub> 14	<sub>a</sub> -	.53	-
F	<i>Astragalus</i> spp.	<sub>a</sub> 40	<sub>b</sub> 118	1.77	6.56
F	<i>Castilleja linariaefolia</i>	-	-	.01	-
F	<i>Comandra pallida</i>	<sub>b</sub> 40	<sub>a</sub> 20	.42	.14
F	<i>Cryptantha</i> spp.	<sub>b</sub> 28	<sub>a</sub> -	.25	-
F	<i>Descurainia pinnata</i> (a)	<sub>b</sub> 26	<sub>a</sub> -	.09	-
F	<i>Dithyrea wislizenii</i> (a)	<sub>b</sub> 28	<sub>a</sub> -	.89	-
F	<i>Draba</i> spp. (a)	3	-	.01	-
F	<i>Eriogonum cernuum</i> (a)	<sub>b</sub> 92	<sub>a</sub> -	.63	-
F	<i>Euphorbia</i> spp.	<sub>b</sub> 26	<sub>a</sub> -	.05	-
F	<i>Gilia</i> spp. (a)	15	17	.13	.31
F	<i>Lappula occidentalis</i> (a)	5	-	.01	-
F	<i>Oenothera albicaulis</i> (a)	<sub>b</sub> 40	<sub>a</sub> -	1.77	-
F	<i>Oenothera pallida</i>	<sub>b</sub> 144	<sub>a</sub> 73	5.56	1.60
F	<i>Sphaeralcea parvifolia</i>	7	-	.01	-
F	<i>Stephanomeria exigua</i> (a)	-	5	-	.16
Total for Annual Forbs		209	22	3.55	0.47
Total for Perennial Forbs		299	211	8.66	8.30
Total for Forbs		508	233	12.22	8.78

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

BROWSE TRENDS --

Management unit 29R, Study no: 3

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia filifolia	0	0	.15	-
B	Artemisia tridentata tridentata	60	22	4.83	2.29
B	Chrysothamnus nauseosus hololeucus	1	3	.15	.03
B	Ephedra viridis	9	11	1.50	2.75
B	Eriogonum nummulare	0	2	.00	.03
B	Juniperus osteosperma	1	2	4.40	1.79
B	Opuntia spp.	7	6	.03	.36
B	Pinus edulis	0	0	.66	.63
B	Purshia tridentata	1	1	.15	.15
B	Tetradymia canescens	2	1	1.62	.66
Total for Browse		81	48	13.52	8.70

CANOPY COVER, LINE INTERCEPT --

Management unit 29R, Study no: 3

Species	Percent Cover	
	'98	'03
Artemisia tridentata tridentata	-	1.43
Ephedra viridis	-	2.84
Juniperus osteosperma	4.00	9.00
Pinus edulis	1.00	1.20
Tetradymia canescens	-	.41

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 29R, Study no: 3

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	2.5
Purshia tridentata	5.7



POINT-QUARTER TREE DATA --  
Management unit 29R, Study no: 3

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	29	32
Pinus edulis	24	24

Average diameter (in)	
'98	'03
9.8	9.8
5.5	7.2

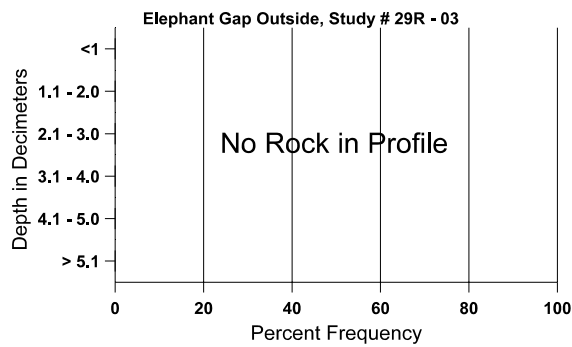
BASIC COVER --  
Management unit 29R, Study no: 3

Cover Type	Average Cover %	
	'98	'03
Vegetation	28.61	17.58
Rock	.01	.17
Pavement	.08	.02
Litter	38.06	33.89
Cryptogams	10.76	6.68
Bare Ground	46.34	54.31

SOIL ANALYSIS DATA --  
Management unit 29R, Study no: 3, Study Name: Elephant Gap Outside

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
25.9	69.0 (17.7)	5.4	90.7	2.7	6.6	1.3	3.5	51.2	0.1

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 29R, Study no: 3

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	7	22	-	-
Deer	45	37	95 (235)	46 (114)
Cattle	1	1	-	2 (5)

BROWSE CHARACTERISTICS --  
 Management unit 29R, Study no: 3

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia filifolia</i>											
98	0	20	-	-	-	-	0	0	-	0	32/32
03	0	-	-	-	-	-	0	0	-	0	48/47
<i>Artemisia tridentata tridentata</i>											
98	1520	80	220	620	680	980	28	3	45	28	42/44
03	540	-	60	80	400	1720	19	30	74	44	32/30
<i>Cercocarpus montanus</i>											
98	0	-	-	-	-	-	0	0	-	0	24/25
03	0	-	-	-	-	-	0	0	-	0	-/-
<i>Chrysothamnus nauseosus hololeucus</i>											
98	20	-	-	-	20	-	0	0	100	0	45/61
03	60	-	-	40	20	-	33	0	33	0	41/56
<i>Ephedra viridis</i>											
98	320	-	140	120	60	80	25	0	19	6	41/83
03	500	-	80	260	160	-	28	0	32	12	38/53
<i>Eriogonum nummularre</i>											
98	0	20	-	-	-	-	0	0	-	0	36/49
03	40	-	-	40	-	80	50	0	-	0	21/29
<i>Juniperus osteosperma</i>											
98	20	-	-	20	-	-	0	0	-	0	-/-
03	40	-	-	40	-	-	0	0	-	0	-/-
<i>Opuntia spp.</i>											
98	180	-	20	140	20	-	0	0	11	11	4/12
03	180	-	-	160	20	20	0	0	11	0	4/11

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Purshia tridentata</i>											
98	20	-	-	20	-	-	0	100	0	0	11/26
03	20	-	-	-	20	-	0	100	100	100	-/-
<i>Tetradymia canescens</i>											
98	40	-	-	20	20	-	0	0	50	0	58/65
03	20	-	-	-	20	-	0	0	100	0	53/84
<i>Yucca spp.</i>											
98	0	-	-	-	-	-	0	0	-	0	29/28
03	0	-	-	-	-	-	0	0	-	0	27/31

## ELEPHANT GAP EXCLOSURE COMPARISON SUMMARY

Soil conditions are very similar between grazing effects. The soil is deep with a sandy texture and a slightly acidic to strongly acidic pH (5.4 to 6.2). Phosphorus and potassium appear to be limiting to plant growth and development on all sites, with some values well below 10 ppm for phosphorus and 70 ppm for potassium. Organic matter is low over all treatments. Percent bare ground is high on all sites, but highest outside of the exclosures at over 50% in 2003. Vegetation cover was highest in the livestock exclosure in 1998, with similar amounts outside and in the total exclosure. In 2003, the livestock and total exclosures had similar vegetation cover estimates, while outside was considerably less. Cryptogamic crusts were abundant outside and in the livestock exclosure at over 10% in 1998 and 7% in 2003. Soil temperatures are high on all sites averaging about 70°F. High soil temperatures combined with the high infiltration rates of the soil result in rapid soil drying in the surface horizons. This could be limiting to the establishment of shallow rooted plants. Soil erosion on all treatment effects appears to be minimal due to the levelness of the terrain, combined with the high infiltration capacity of the soil.

The key browse species for all grazing effects is basin big sagebrush and green ephedra. Antelope bitterbrush is the most preferred but it occurs in very low densities and is not abundant enough to be considered a key species at Elephant Gap. It's highest density occurs inside the total exclosure where big game and livestock do not have access. Basin big sagebrush density is similar between all 3 grazing effects ranging from about 1,200-1,500 plants/acre in 1998. Sagebrush density declined in all 3 treatments in 2003 with the largest decrease coming outside. The number of dead sagebrush increased in all 3 treatments in 2003, nearly doubling inside the total exclosure and outside. Dead sagebrush now outnumber live individuals on all 3 transects in 2003. Sagebrush recruitment was lowest in the livestock exclosure in 1998 at 7%, and highest in the total exclosure at 17%. Recruitment decreased in all 3 treatments in 2003, but remained fair in the total exclosure and outside at 11%. Percent decadence was average inside the total exclosure at 19% in 1998, but moderately high in the livestock exclosure and outside at 46% and 45% respectively. In 2003, decadence increased to 53% in the total exclosure, 74% outside, and 95% in the livestock exclosure. Poor vigor was high on all 3 transects in 2003 ranging from 44%-57%.

Several factors appear to be effecting sagebrush at Elephant Gap. Drought is likely the primary driving force behind deteriorating sagebrush health, but winter injury could also be a factor. Winter injury is presumably caused by freezing due to a lack of sufficient cold hardiness and/or winter drought or dessication (Nelson and Tiernan 1983). During mild winters, sagebrush can break dormancy during the middle of the winter and begin growth too early in the year. By doing so, sagebrush plants become susceptible to dessication and crown death if temperatures become very cold for any substantial length of time. Sagebrush injury also occurs because available soil moisture is minimal during winter months, especially within these deep sandy soils. Sagebrush conditions inside the livestock exclosure and outside were worse compared to the total exclosure with higher decadence rates and a larger number of dead plants in 2003. It appears that use could be an additive factor in addition to drought and winter injury in these 2 grazing effects.

In 1998, green ephedra density was highest inside the livestock exclosure, intermediate outside, and lowest in the total exclosure. Density slightly declined in the exclosure treatments, but increased outside in 2003. The proportion of young ephedra plants was high in all 3 treatments in 1998, declining somewhat in the livestock exclosure and outside in 2003. No young were sampled in the total exclosure in 2003. Ephedra has maintained relatively good vigor in both surveys in all treatments, and decadence has been low to moderate.

The herbaceous understory is limited on all grazing effects, particularly grasses. In 1998 and 2003, total herbaceous cover in order of decreasing abundance was as follows: outside, livestock exclosure, and total exclosure. Grass composition is similar between all sites, with the most common perennial species being blue grama, sand dropseed, bottlebrush squirreltail, Indian ricegrass, and needle-and-thread. Annual grasses, cheatgrass and sixweeks fescue, were also sampled on all 3 sites in 1998. With drought conditions in 2003,

perennial grass nested frequency declined in all grazing effects, and sixweeks fescue was only sampled outside the exclosures. Forb composition is similar between treatment effects with respect to the dominant species, but more species are found in the livestock exclosure and outside. Forb cover was 3 times higher in both the livestock exclosure and outside the exclosure in 1998 than in the total exclosure. The most abundant forbs in 1998 were pale evening primrose, prairie evening primrose, toadflax, and milkvetch. Both primrose's and toadflax decreased on all 3 sites in 2003, with milkvetch remaining stable in the livestock and total exclosures, and increasing outside.

## SUMMARY

### WILDLIFE MANAGEMENT UNIT 29 - ZION

Only one trend study, Wilson Ranch (29-1), was established on this unit in 1987. This site was reread in 1992 and 1998 but replaced with a more representative site, Barracks Chaining (29-4) in 2003. Two additional trend studies were established in the unit in 1998 at Smith's Mesa (29-2) and North Hills (29-3). In addition, 3 studies at the Elephant Gap enclosure (29R-1,2,3) were also established in 1998 and reread in 2003. All of these studies sample winter ranges.

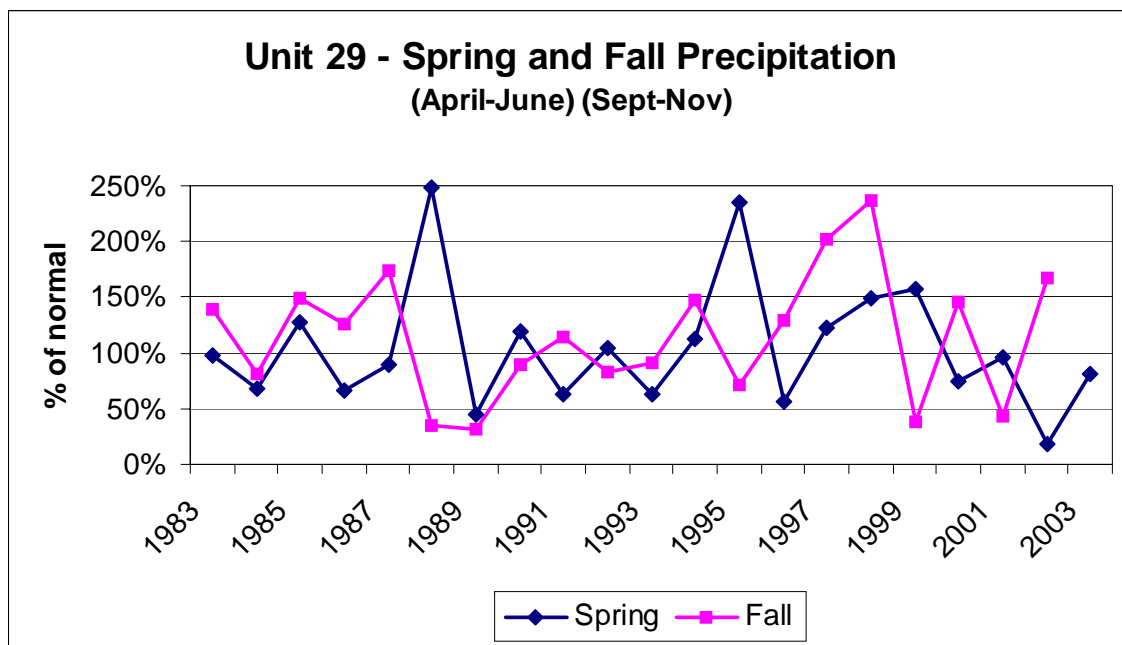
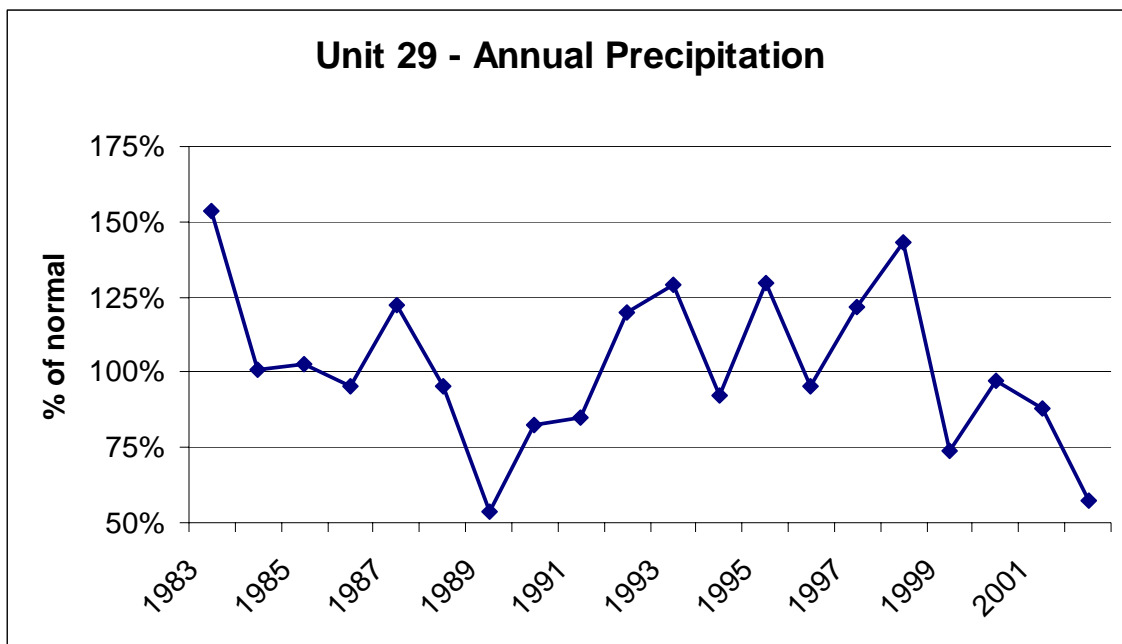
Soil trends are generally down at all sites with the exception of the Elephant Gap total enclosure which had a stable trend. Soils at all sites, except for North Hills, are sandy in texture and have gentle slopes. Erosion is not a serious problem at these sites due to the high infiltration capacity of the soil. However, protective cover in the form of vegetation, litter, and cryptogams have declined. Soil temperatures are universally high on this unit averaging about 72°F. This would suggest dry soil profiles which hinder young shrub recruitment and effect shallow rooted plants.

Browse trends are downward on all sites due to a general decline in density of key browse species, increasing percent decadence, increasing poor vigor, and poor young recruitment. Average percent decadence for sagebrush doubled since 1998, from 31% to 61%. The average number of young plants/acre dropped nearly 4 fold (168 plants/acre to 44).

Herbaceous trends were stable at Smith's Mesa but downward at all other sites. Average cover of perennial grasses declined 62% unit wide and sum of nested frequency dropped 33%. Perennial forb cover and frequency also declined unit wide by 39% and 36% respectively.

All of these trends are driven by drought which has effected much of the state for the past several years. Annual precipitation in the Zion unit was near normal in 2000 but below normal in 1999, 2001 and 2002. Conditions were extremely dry in 2002 when only 57% of normal precipitation was recorded. Timing of precipitation is also important. Spring precipitation (April - June) is key for herbaceous plants and shrub recruitment. It was near normal in 2001 but well below normal in 2000, 2002 and 2003. Conditions were exceptionally dry in 2002 when spring precipitation was only about 19% of normal. Precipitation graphs and trends for each study site can be found below.

Below are precipitation graphs for the Zion unit. Data represents percent of normal precipitation averaged for 5 weather stations which include La Verkin, Zion National Park, Orderville, Kanab, and Cedar City (Utah Climate Summaries 2004).



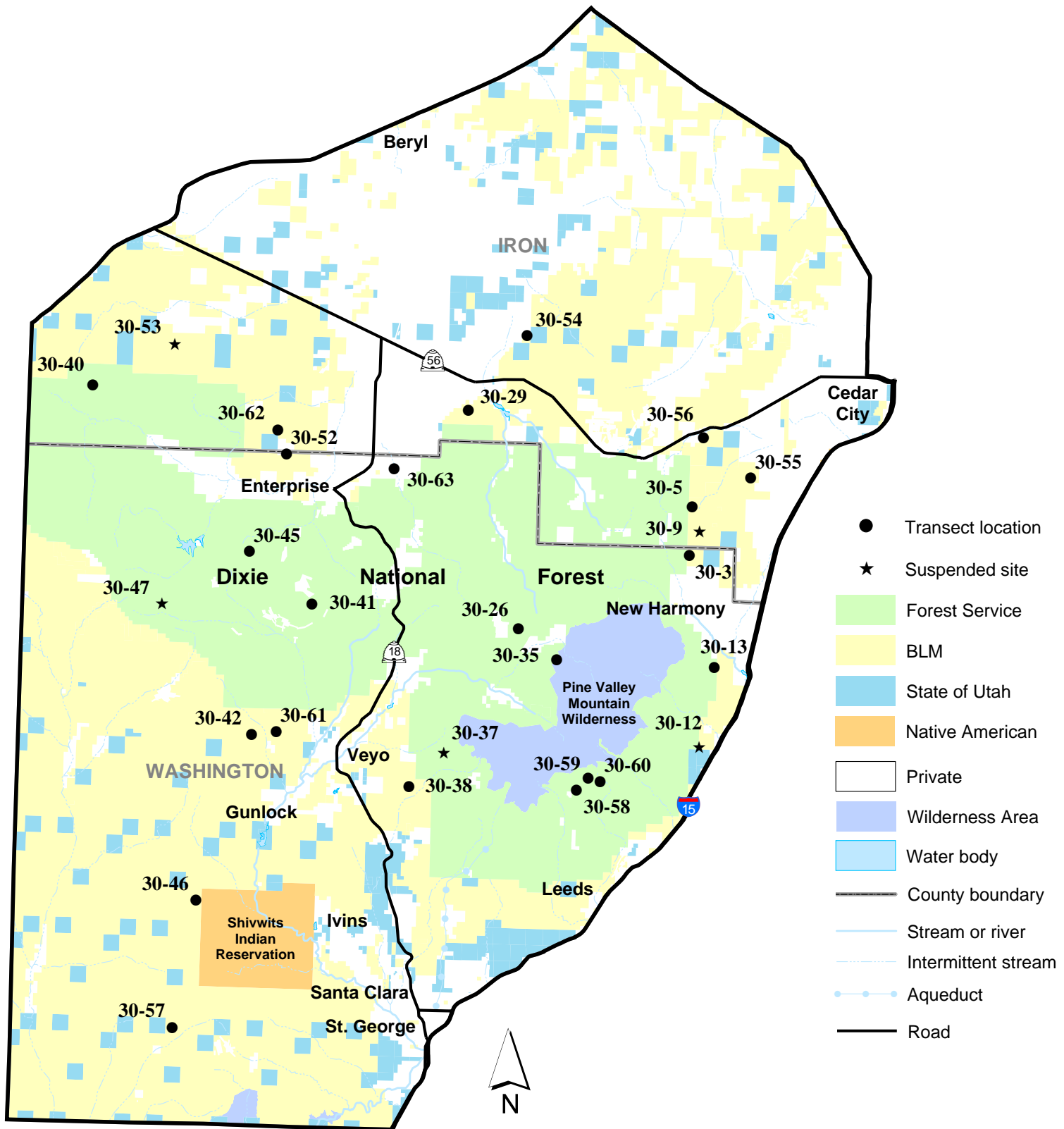
Trend Summary

	Category	1998	2003
29-2 Smith's Mesa	soil	est	2
	browse	est	2
	herbaceous understory	est	3
29-3 North Hills	soil	est	2
	browse	est	2
	herbaceous understory	est	2
29-4 Barracks Chaining	soil		est
	browse		est
	herbaceous understory		est
29R-1 Elephant Gap Total Exclosure	soil	est	3
	browse	est	1
	herbaceous understory	est	2
29R-2 Elephant Gap Livestock Exclosure	soil	est	2
	browse	est	2
	herbaceous understory	est	1
29R-3 Elephant Gap Exclosure Outside	soil	est	2
	browse	est	1
	herbaceous understory	est	1

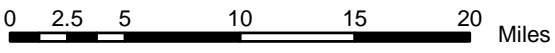
1 = down, 2 = slightly down, 3 = stable, 4 = slightly up, 5 = up,  
est = established, susp = suspended, NR = not read



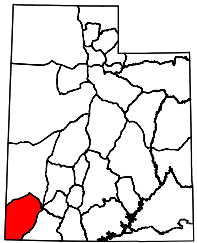
# Management Unit 30



- Transect location
- ★ Suspended site
- Forest Service
- BLM
- State of Utah
- Native American
- Private
- Wilderness Area
- Water body
- County boundary
- Stream or river
- Intermittent stream
- Aqueduct
- Road



Unit Location



## WILDLIFE MANAGEMENT UNIT 30 - PINE VALLEY

### Boundary Description

**Iron and Washington counties** - Boundary begins at I-15 and the Utah-Arizona state line; north on I-15 to SR-56; west on SR-56 to the Lund Highway; northwest along the Lund Highway to the Union Pacific railroad tracks at Lund; southwest on the Union Pacific railroad tracks to the Utah-Nevada state line; south on this state line to the Utah-Arizona state line; west on this state line to I-15 and beginning point.

### Management Unit Description

This unit was divided into 3 subunits; 30A West Pine Valley, 30B Comanche, and 30C Pine Valley/Browse prior to 1992. All subunits (A, B, and C) were combined for deer in 2001. The Pine Valley wildlife management unit encompasses the Antelope Range, Harmony Mountains, Pine Valley Mountains, Bull Valley Mountains, and the Beaver Dam Mountains. Unit 30 contains approximately 300,053 acres of summer range, 78% of which is managed by the U.S. Forest Service as part of the Dixie National Forest. Winter range encompasses 466,484 acres, 41% of which occurs on Forest Service lands and 41% occurs on lands administered by the Bureau of Land Management. The I-15 corridor runs on the eastern side of the unit, effectively eliminating deer movement east due to a deer proof fence.

In the past, the assumption has been that summer range is a limiting habitat factor on this unit. However, in reality, the situation is not that simple. There is also a resident deer population in the New Harmony area which further complicates management.

Summer range is confined to elevations above 6,000 to 6,500 feet on the New Harmony and Pine Valley Mountains. The vegetational character is principally oakbrush and mountain brush on the Harmony Mountains and on the lower slopes of the Pine Valleys. Aspen and coniferous types are common on the higher portions of the Pine Valley Mountains, but much less prevalent on the Harmony Mountains. Sagebrush-grass parks and meadowlands can be found at the summit of the Harmony Mountains. These are important areas to deer for short periods during the summer which have been heavily impacted by cattle. Many similar, but more interspersed parklands occur on the northern end of the Pine Valley Mountains. Summer deer concentrations are primarily on the Harmony Mountain and the north end of the Pine Valleys. Relatively few deer summer south of Timber Mountain within unit 30C.

Herd unit 30 winter range varies greatly, depending upon elevation. North of the Great Basin-Colorado River divide, pinyon-juniper and sagebrush-grass predominate. South of the divide, pinyon-juniper is still important, but there are increasing amounts of a desert shrub type dominated by shrub live oak (*Quercus turbinella*) and several other browse species not often found to the north. Both areas possess important acreages of seeded range, most notably east of Pinto at Page Ranch, Woolsey Ranch, New Harmony and Pintura Bench. Deer tend to concentrate on these sites, especially the latter three. The winter range south of Pintura currently supports few deer. A comprehensive study conducted by the Southern Region of the Division of Wildlife Resources on deer population dynamics and habitat use, has contributed greatly to understanding of this herd unit. This study was especially helpful in locating trend studies on critical sites. For example, it is now evident that fawning and fawn rearing habitat are very critical for this unit. Accordingly, studies have been located at known fawning areas. In addition, the winter range is now better defined and critical areas have been identified. These sites were also sampled.

The herd unit varies with elevations of 10,000 feet on the Pine Valley Mountains to lower and drier areas such as Motoqua at an elevation of 4,000 feet. Vegetationally, the summer range consists of dense conifers with a

few aspen clones and dry meadows at higher elevations, and mixed oakbrush, mountain brush, southern desert shrub, and sagebrush-grass on lower areas. Most of the summer range is within the officially designated "wilderness area" which is open to livestock use.

Winter range is extensive, but not uniformly utilized. Pinyon-juniper is the dominant vegetative type, but there are also large areas of sagebrush-grass, southern desert shrub, oakbrush, and mountain brush. Important critical winter concentration areas include the area east of Central, the lower Pinto Creek drainage, the Antelope Range, Iron Mountain, the Shoal Creek drainage, Moody Creek, Tobin Bench, and the middle portion of the East Fork of Beaver Dam Wash. Only during the most severe winters do deer utilize the lower portions of the winter range, especially the Mojave desert areas. During the spring, summer, and fall, critical concentration areas include the higher elevations of the Bull Valley Mountains, Lost Peak, Maple Ridge, the slopes surrounding Pine Valley Reservoir, the meadows of the Whipple Valley area, and Flattop Mountains.

#### Herd Unit Management Objectives

Target winter herd sizes for the entire unit is modeled at 16,000 deer. Herd composition for the Pine Valley area is to be managed at 15 bucks:100 does with 30% of the bucks being 3 point or better.

#### Trend Study Site Description

Trend study sites were originally established on the unit in 1982. Most of these sites were reread in 1992, and 1998. In 1986, 4 study sites were established on a burned area on the east side of the Pine Valley mountains. These sites were reread in 1987, 1992, and 1998. In 1998, several of the sites established in 1982 were discontinued and 3 sites were reread that were not read in 1992. In addition, 4 new study sites were established to cover important areas which were not previously being monitored. In 2003 most of the studies read in 1998 were revisited and 3 new trend studies were added.

Trend Study 30-3-03

Study site name: Upper Broad Hollow.

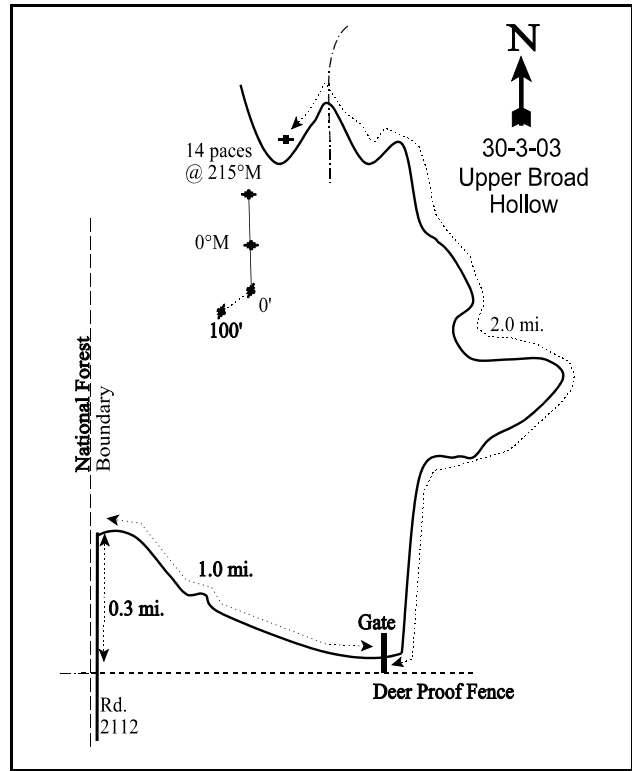
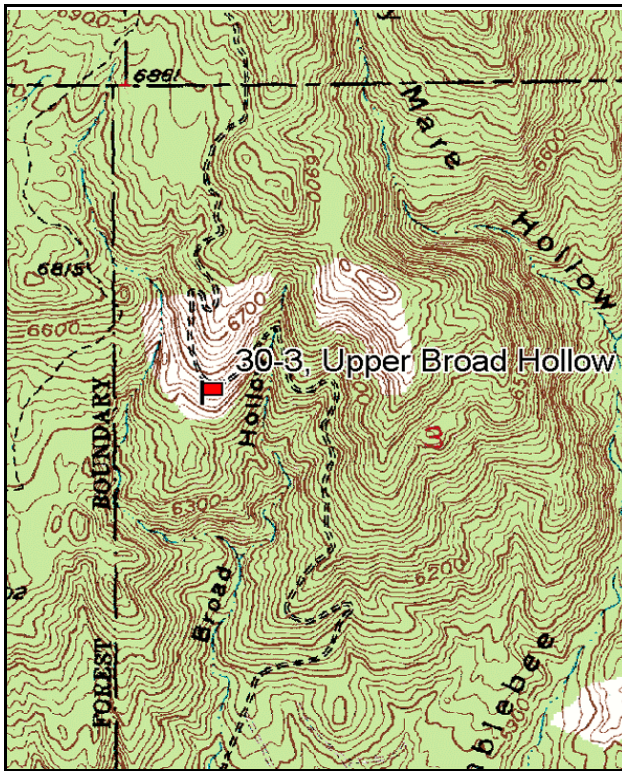
Vegetation type: Mountain Brush.

Compass bearing: frequency baseline 220 degrees magnetic. (Line 2 & 3, 0°M)

Frequency belt placement: line 1 (8 & 89ft), line 2 (34 & 71ft), line 3 (59ft). Rebar: belt 3 on 1ft.

LOCATION DESCRIPTION

From the Dixie National Forest boundary, proceed north on Pace Draw Road (Road 2112) for 0.30 miles. Turn right onto Harmony Mountain Road and travel 1.0 miles, at which point there will be a gate. Go through the gate, turn left and travel 2.0 miles to a sharp right-hand turn in the road. On the southwestern side of the road is a witness post. Walk 14 paces at 215 degrees magnetic to the 300-foot stake. The study is marked by green steel "T" fence posts approximately 18 to 24 inches in height.



Map Name: Stoddard Mountain

Diagrammatic Sketch

Township 38S, Range 13W, Section 3

GPS: NAD 27, UTM 12S 4154971 N, 296258 E

## DISCUSSION

### Upper Broad Hollow - Trend Study No. 30-3

This site at Upper Broad Hollow is intermediate in elevation, but is still critical deer winter range. It is located about 3 miles north of the town of New Harmony on the Harmony Mountains. Elevation is 6,500 feet, just above the juniper-pinyon belt. The site has a southerly aspect and a steep slope of 35%. The range type is mixed mountain brush, which varies somewhat in composition depending upon slope, exposure, and micro-site characteristics. On steeper south or west slopes, mountain big sagebrush and antelope bitterbrush prevail. On more easterly slopes, there is more shrub-live oak and Utah serviceberry with considerable amounts of bitterbrush, and occasional clumps of Gambel oak. Deer use of the entire area, judging from levels of utilization and the number of pellet groups observed, is moderate to heavy. Data from the nearby DWR Broad Hollow pellet group transect taken from 1988 through 1992, indicated heavy deer use with an average of 75 deer days use/acre (185 ddu/ha), the highest average on the herd unit (Jense et al. 1992). A pellet group transect read along the trend study site baseline in 1998 estimated a high level of deer use at 110 deer days use/acre (272 ddu/ha). Deer use remained high at 87 days use/acre in 2003 (215 ddu/ha). No signs of livestock grazing were noted during either reading.

Soils are relatively shallow and very rocky, derived from limestone parent material. Effective rooting depth is estimated at just over 7 inches. Rocks are very common on the surface and within the soil profile. There is little bare soil exposed, therefore erosion is not a serious problem due to the abundant protective ground cover.

The key browse species are Utah Serviceberry, mountain big sagebrush, and antelope bitterbrush. Important secondary species would include curlleaf mountain mahogany. Mountain big sagebrush provides about 25% of the total browse cover on the site. It remained at a relatively stable density between 1982 and 1998 at around 2,300 plants/acre. Utilization has been moderate with little heavy use. Vigor has remained good on most plants and percent decadence increased slightly from 18% in 1982 to 24% by 1998. Reproduction was good with a steadily increasing proportion of young plants. Data from 2003 show a 25% decline in density. Use was mostly light, vigor good on most plants, but the number of decadent plants increased to 36%.

Bitterbrush displays heavier use, especially in 1992 when 69% of the plants were classified as heavily hedged. Data from 1998 indicated 55% of the bitterbrush were heavily utilized with an additional 32% moderately hedged. Density has ranged from 2,133 plants/acre in 1982 to 860 in 2003. Some of the differences in numbers between years may be due to problems counting individual plants of this relatively low growing sprawling shrub which had an average crown diameter of 4 feet in 2003. It is apparent however that the population has declined slightly since 1998. Average cover and strip frequency both declined slightly and 80 dead bitterbrush plants/acre were estimated in 2003. Young recruitment is good and adequate to maintain the population at current levels.

Utah serviceberry, curlleaf mountain mahogany, and shrub-live oak are mainly large, mature populations. Serviceberry was encountered in higher density with the much larger sample size used in 1998. The average mature plant was about 4 feet in height in 1998 and 2003. Utilization has been mostly light to moderate with some heavy use on certain plants. Vigor has been normal and percent decadence low during all readings. Reproduction has been adequate to maintain the population.

Occasional shrubs which occur on the site include true mountain mahogany, narrowleaf low rabbitbrush, grey horsebrush, broom snakeweed, yellowleaf siltassel, Colorado pinyon, and Utah juniper. Point-quarter data from 2003 estimated 28 pinyon and 40 juniper trees/acre. Average basal diameter was estimated at 7 inches for pinyon and 5.4 inches for juniper.

The herbaceous understory is diverse but only moderately abundant. Total grass cover was estimated at 24% in 1998 and only 11.5% in 2003. The most common species is mutton bluegrass which provided 54% of the total grass cover in 1998 and 57% in 2003. The annual, cheatgrass, is also common providing an additional 39% of the grass cover in 1998 but declining to 23% in 2003. All other grasses occur occasionally. Forbs are very diverse but the 18 species encountered in 1998 and 22 species counted in 2003 produced only 5% cover during these 2 readings. The only common species include false dandelion, milkvetch, tansy mustard, an annual *Gilia*, and storksbill.

#### 1982 APPARENT TREND ASSESSMENT

Soil trend appears stable to declining. Erosion is ongoing but not greatly excessive, considering the character of the site. Vegetative trend is also stable but will depend in large part on future soil conditions. At present, browse populations seem healthy but static. Herbaceous understory conditions are fair but somewhat precarious. This is a relatively fragile site that could rapidly deteriorate if animal use, especially from livestock, were to become much more intense than it is now.

#### 1992 TREND ASSESSMENT

The soil trend is slightly up due to increased total protective ground cover. Basal vegetative cover has increased along with a 59% decrease in bare soil. Trend for browse is down due to declining populations of mountain big sagebrush and especially bitterbrush. Bitterbrush declined 50% in density and percent decadence increased to 31%. The number of heavily hedged plants rose from 22% in 1982 to 69% in 1992, while the number of plants displaying poor vigor also increased (0 to 13%). Trend for herbaceous understory is stable with increased quadrat frequency for perennial grasses and decreased quadrat frequency of perennial forbs.

##### TREND ASSESSMENT

soil - slightly up (4)

browse - down (1)

herbaceous understory - stable (3)

#### 1998 TREND ASSESSMENT

Trend for soil appears stable. Percent cover of bare ground declined slightly, but rock and pavement cover increased from 24% to 33%. Litter cover declined slightly. Trend for key browse species, mountain big sagebrush, bitterbrush and serviceberry, appear stable. Sagebrush displays a similar density, light to moderate use, good vigor, improved reproduction, and relatively low decadence at 24%. Bitterbrush also shows a similar density compared to 1992. Use continues to be moderate to heavy, but vigor has improved and percent decadence has declined from 31% to 14%. More serviceberry was picked up in the much larger sample used in 1998. It shows lighter use, good vigor, and low decadence. Trend for the herbaceous understory is mixed. Sum of nested frequency for perennial grasses has declined slightly, while frequency of perennial forbs has increased. Mutton bluegrass increased significantly in nested frequency, whereas bottlebrush squirreltail declined significantly. Overall, trend for the herbaceous understory is considered stable.

##### TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - stable (3)

2003 TREND ASSESSMENT

Trend for soil remains stable with similar ground cover characteristics compared to 1998. There is good protective ground cover on the site leaving little unprotected bare soil. Trend for the key browse species, serviceberry, mountain big sagebrush, and bitterbrush, is mixed. Trend for serviceberry and bitterbrush is relatively stable. Utilization of both species is moderate to heavy yet vigor remains good and percent decadence low. Density estimates have declined for both species. However, it appears that density was overestimated in 1998 since cover numbers are similar between readings and few dead plants were sampled in 2003. Mountain big sagebrush shows a downward trend. Density has declined 25%. Use has remained mostly light and the proportion of decadent plants increased from 24% to 36%. This is still not unacceptably high even though 42% of the decadent plants sampled were classified as dying (>50% crown death). This equates to 240 plants/acre. Currently, young plants are not abundant enough to maintain the stand at current levels. With this in mind, trend for browse is considered down slightly. Trend for the herbaceous understory is down slightly. Sum of nested frequency has declined slightly for perennial grasses and more sharply for perennial forbs. The key grasses, mutton bluegrass and bottlebrush squirreltail, both declined significantly. One positive aspect of the grass composition is the significant decline in nested frequency of cheatgrass. Total herbaceous production was poor this year due to drought conditions. In 1998, total herbaceous cover was estimated at nearly 30% (24% grasses 5% forbs). During the 2003 reading, total herbaceous cover was estimated at only 16%. Total forb cover remained at 5% but total grass cover declined to only 12%. Part of the decline is due to the drop in cheatgrass cover, 9.5% to 3% cover, but cover of mutton bluegrass also declined by 50% (13% to 6.6%).

TREND ASSESSMENT

soil - stable (3)

browse - down slightly (2)

herbaceous understory - down slightly (2)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 3

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron cristatum	-	-	-	.03	-
G	Bouteloua gracilis	2	3	2	.15	.03
G	Bromus tectorum (a)	-	<sub>b</sub> 264	<sub>a</sub> 124	9.47	2.66
G	Festuca ovina	-	3	-	.00	-
G	Koeleria cristata	34	31	27	.81	.94
G	Poa fendleriana	<sub>a</sub> 166	<sub>b</sub> 216	<sub>a</sub> 155	13.11	6.58
G	Sitanion hystrix	<sub>b</sub> 118	<sub>a</sub> 19	<sub>a</sub> 26	.31	.90
G	Stipa comata	7	6	10	.36	.39
Total for Annual Grasses		0	264	124	9.47	2.66
Total for Perennial Grasses		327	278	220	14.79	8.85
Total for Grasses		327	542	344	24.26	11.52
F	Agoseris glauca	<sub>a</sub> 6	<sub>c</sub> 46	<sub>b</sub> 26	.58	.18

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	Allium spp.	-	10	-	.04	-
F	Androstephium breviflorum	1	-	-	-	-
F	Arabis spp.	-	-	2	-	.00
F	Artemisia ludoviciana	<sub>b</sub> 18	<sub>a</sub> -	<sub>a</sub> -	-	-
F	Arenaria macradenia	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 16	-	1.09
F	Astragalus straturensis	7	-	-	-	-
F	Aster spp.	-	1	-	.00	-
F	Astragalus spp.	<sub>b</sub> 32	<sub>b</sub> 19	<sub>a</sub> 5	.91	.04
F	Astragalus utahensis	-	-	-	.03	-
F	Castilleja linariaefolia	<sub>b</sub> 23	<sub>ab</sub> 6	<sub>a</sub> 1	.06	.01
F	Calochortus nuttallii	-	-	2	-	.00
F	Collomia linearis (a)	-	<sub>a</sub> -	<sub>b</sub> 19	-	.37
F	Comandra pallida	-	-	5	-	.06
F	Collinsia parviflora (a)	-	<sub>a</sub> 14	<sub>b</sub> 53	.03	.55
F	Cymopterus spp.	-	8	-	.06	-
F	Descurainia pinnata (a)	-	57	67	.38	.99
F	Dichelostemma pulchellum	<sub>a</sub> -	<sub>b</sub> 33	<sub>a</sub> -	1.55	-
F	Draba spp. (a)	-	2	6	.00	.01
F	Erysimum asperum	4	3	-	.03	-
F	Erodium cicutarium (a)	-	<sub>b</sub> 13	<sub>a</sub> -	.52	-
F	Eriogonum spp.	-	-	1	-	.00
F	Erigeron pumilus	1	8	7	.07	.18
F	Eriogonum racemosum	-	-	1	-	.00
F	Gilia spp. (a)	-	<sub>a</sub> -	<sub>b</sub> 103	-	1.01
F	Lappula occidentalis (a)	-	-	3	-	.00
F	Lactuca serriola	6	-	-	-	-
F	Microsteris gracilis (a)	-	<sub>a</sub> 10	<sub>b</sub> 30	.03	.12
F	Phlox hoodii	-	-	1	-	.03
F	Senecio multilobatus	-	-	4	-	.01
F	Sphaeralcea grossulariaefolia	-	6	4	.06	.04
F	Stephanomeria tenuifolia	16	16	8	.13	.19
F	Zigadenus paniculatus	-	3	1	.00	.00
Total for Annual Forbs		0	96	281	0.97	3.07
Total for Perennial Forbs		114	159	84	3.57	1.88
Total for Forbs		114	255	365	4.54	4.96

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



BROWSE TRENDS --

Management unit 30 , Study no: 3

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	30	23	12.87	11.09
B	Artemisia nova	0	1	-	.15
B	Artemisia tridentata vaseyana	64	57	8.79	6.16
B	Chrysothamnus parryi	6	4	.30	1.32
B	Chrysothamnus viscidiflorus viscidiflorus	5	0	.15	-
B	Garrya flavescens	4	2	-	1.00
B	Gutierrezia sarothrae	1	3	-	.18
B	Juniperus osteosperma	1	1	.78	1.85
B	Opuntia spp.	3	5	.15	.15
B	Pinus edulis	3	1	2.99	3.12
B	Purshia tridentata	34	30	5.40	3.85
B	Quercus turbinella	4	2	.39	1.61
B	Tetradymia canescens	1	3	.03	.03
Total for Browse		156	132	31.87	30.53

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 3

Species	Percent Cover	
	'98	'03
Amelanchier utahensis	-	11.76
Artemisia tridentata vaseyana	-	5.96
Chrysothamnus parryi	-	.88
Chrysothamnus viscidiflorus viscidiflorus	-	.40
Garrya flavescens	-	.81
Juniperus osteosperma	5.00	8.00
Pinus edulis	3.59	3.98
Purshia tridentata	-	5.09
Quercus turbinella	-	1.53

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 30 , Study no: 3

Species	Average leader growth (in)
	'03
Amelanchier utahensis	1.2
Artemisia tridentata vaseyana	1.3
Purshia tridentata	1.4

POINT-QUARTER TREE DATA --  
Management unit 30 , Study no: 3

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	31	40
Pinus edulis	26	28

Average diameter (in)	
'98	'03
7.2	5.4
8.2	7.0

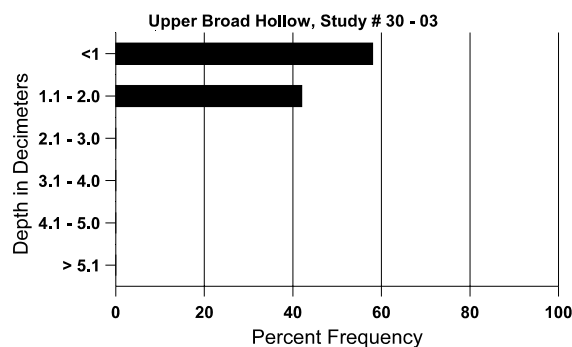
BASIC COVER --  
Management unit 30 , Study no: 3

Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	15.25	50.70	44.51
Rock	19.50	27.54	20.95
Pavement	4.25	5.34	3.90
Litter	51.75	45.95	47.70
Cryptogams	0	.03	0
Bare Ground	9.25	7.44	8.52

SOIL ANALYSIS DATA --  
Management unit 30, Study no: 3, Study Name: Upper Broad Hollow

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
7.3	68.5 (12.3)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 30 , Study no: 3

Type	Quadrat Frequency	
	'98	'03
Rabbit	29	10
Deer	59	32

Days use per acre (ha)	
'98	'03
-	-
110 (271)	87 (215)

BROWSE CHARACTERISTICS --  
 Management unit 30 , Study no: 3

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
82	<b>200</b>	-	-	200	-	-	33	0	0	0	33/41
92	<b>333</b>	-	133	200	-	-	0	40	0	0	34/36
98	<b>1880</b>	320	300	1480	100	240	27	2	5	2	50/55
03	<b>740</b>	20	220	500	20	40	32	11	3	0	51/72
<b>Artemisia nova</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>40</b>	-	-	40	-	-	0	0	-	0	6/15
<b>Artemisia tridentata vaseyana</b>											
82	<b>2599</b>	-	200	1933	466	-	31	10	18	0	18/26
92	<b>2198</b>	66	266	1466	466	-	48	9	21	0	16/18
98	<b>2300</b>	120	360	1380	560	980	24	.86	24	8	20/30
03	<b>1720</b>	-	100	1000	620	640	10	0	36	15	21/30
<b>Cercocarpus ledifolius</b>											
82	<b>133</b>	-	-	133	-	-	0	0	-	0	47/51
92	<b>66</b>	-	-	66	-	-	0	100	-	0	106/106
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	60/40
<b>Chrysothamnus parryi</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>520</b>	-	40	480	-	-	0	0	-	0	12/15
03	<b>120</b>	-	-	120	-	-	0	0	-	0	20/28

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	160	-	40	120	-	-	0	0	-	0	14/24
03	0	-	-	-	-	-	0	0	-	0	15/28
<b>Garrya flavescens</b>											
82	0	-	-	-	-	-	0	0	0	0	-/-
92	0	-	-	-	-	-	0	0	0	0	-/-
98	200	-	-	180	20	-	0	0	10	0	55/56
03	40	-	-	40	-	20	0	0	0	0	56/67
<b>Gutierrezia sarothrae</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	40	-	-	40	-	-	0	0	-	0	10/15
03	100	-	-	100	-	-	0	0	-	0	12/17
<b>Juniperus osteosperma</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	20	-	-	20	-	-	0	0	-	0	-/-
03	20	-	-	20	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
82	199	-	-	133	66	-	0	0	33	0	3/8
92	200	-	-	200	-	-	0	0	0	67	6/8
98	60	-	-	60	-	-	0	0	0	0	5/11
03	100	-	-	100	-	-	0	0	0	0	7/15
<b>Pinus edulis</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	60	-	20	40	-	-	0	0	-	0	-/-
03	20	20	-	20	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
82	2133	-	-	2133	-	-	31	22	0	0	24/32
92	1066	-	333	400	333	-	13	69	31	13	20/35
98	1320	100	80	1060	180	40	32	55	14	5	26/39
03	860	20	100	680	80	80	44	30	9	7	27/50

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Quercus turbinella</b>											
82	<b>266</b>	-	66	200	-	-	0	0	0	0	45/55
92	<b>399</b>	-	133	66	200	-	17	50	50	0	39/47
98	<b>120</b>	-	60	60	-	-	0	0	0	0	36/40
03	<b>40</b>	-	-	40	-	-	0	0	0	0	23/43
<b>Tetradymia canescens</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	0	0	7/8
03	<b>60</b>	-	-	40	20	-	0	0	33	0	13/13

Trend Study 30-5-03

Study site name: Harmony Mountain Summit.

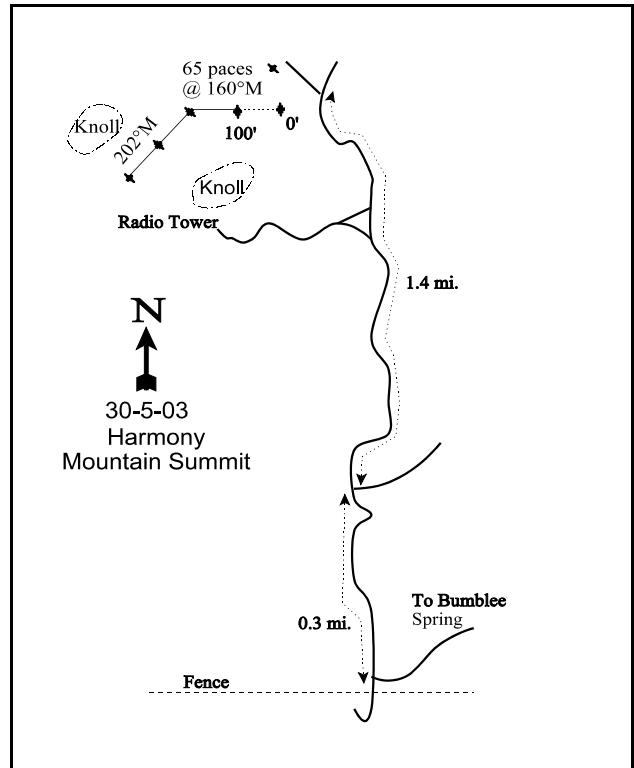
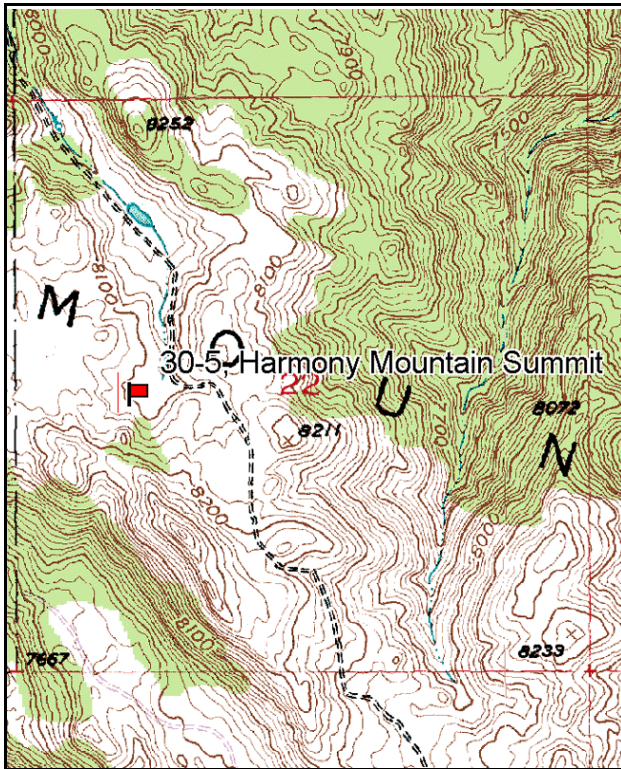
Vegetation type: Low Rabbitbrush.

Compass bearing: frequency baseline 266 degrees magnetic. (Lines 3 & 4, 202°M)

Frequency belt placement: line 1 (12 & 87ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 3 on 1ft.

LOCATION DESCRIPTION

From the Dixie National Forest boundary north of New Harmony, proceed north 0.3 miles on Pace Draw Road. Turn right on Harmony Mountain Road and drive 1.0 miles, at which point you should come to a gate. From the fence continue on the main road 4.7 miles to a fork. Stay left and continue on the main road. At 0.3 miles stay left again and continue on the main road 1.4 miles to a fork. Continue left less that 0.1 miles to a witness post on the left (south) side of the road. From the witness post walk 65 paces at 160 degrees magnetic to the 0-foot stake. The study is marked by green steel fence posts approximately 18 to 24 inches in height.



Map Name: Stoddard Mountain

Diagrammatic Sketch

Township 37S, Range 13W, Section 22

GPS: NAD 27, UTM 12S 4159822 N, 296544 E

## DISCUSSION

### Harmony Mountain Summit - Trend Study No. 30-5

The Harmony Mountain Summit study monitors deer summer range at 8,100 feet in elevation. Slope is 10% to 15% with a northeast aspect. This area is characterized by open parks interspersed with scattered aspen and oak clones. The area has been heavily impacted by domestic livestock grazing and undergone a nearly complete type conversion to rabbitbrush. What formerly was a mountain big sagebrush-grass type is now dominated by stickyleaf low rabbitbrush, needlegrass species, and limited numbers of increaser forb species. Cattle were using the site during the 1992 reading in mid-June. Deer also utilize the area in summer as two does were encountered on the site during the 1992 reading. Pellet group data taken on the site in 1998 estimated 73 deer and 26 cow days use/acre (180 ddu/ha and 64 cdu/acre). Many of the deer pellet groups appeared to be relatively recent. Cattle pats appeared to be older, although cows were seen down the road from the site. Pellet group data from 2003 estimated 88 deer days use/acre and 32 cow days use/acre (216 ddu/ha and 79 cdu/ha). Most of the deer pellet groups were from spring and summer use.

Soils are relatively deep and formed by sedimentation from surrounding ridges. Effective rooting depth is estimated at just over 17 inches. Soil texture is a sandy loam which is strongly acidic (pH 5.4). Soil organic matter is comparatively high at 4.5%. The principal soil disturbance comes from pocket gopher and rock squirrel activity, as well as livestock trampling. Soil erosion is minimal due to abundant vegetation and litter cover.

This area is considered summer range for deer, therefore shrubs are not the key vegetational component. However, the key browse species present on the site is mountain big sagebrush which provided 37% of the browse cover in 1998 and 49% of the cover in 2003. Density of sagebrush has increased from 1,532 plants/acre in 1982 to 8,640 plants/acre in 2003. Seedling and young recruitment has been good since 1992 indicating an expanding population. Utilization is mostly light, vigor good, and percent decadence low.

Stickyleaf low rabbitbrush is the most abundant shrub on the site. It provided 62% of the total shrub cover in 1998 and 50% in 2003. It has increased in density from 8,666 to 12,100 plants/acre between 1982 and 2003. Young recruitment has been excellent with each reading yet the population is becoming increasingly mature as it has apparently reached its carrying capacity. Most plants are not utilized and in good vigor. Other browse species found on the site include Parry rabbitbrush, slenderbush eriogonum, barberry, and snowberry. A few aspen trees are also found near the baseline.

The herbaceous understory is abundant and diverse although composition consists largely of increasers. The grass composition is dominated by Letterman needlegrass, subalpine needlegrass, and needle-and-thread grass. These grasses accounted for 92% of the grass cover in 1998 and 94% in 2003. Virtually all grass plants were 30% to 50% utilized in 1982. Many of the grasses were grazed in 1992, but percent utilization was not estimated. The site was reread on July 1<sup>st</sup> of 1998 and it did not appear that cows had been on the site at that time. More preferred grasses which would be considered decreasers on this site, include low numbers of slender wheatgrass and mountain brome.

Forbs are also abundant, except composition consists largely of increasers like pale agoseris, common dandelion, and the poisonous silky lupine. The more palatable species, Indian paintbrush and redroot eriogonum, have shown evidence of at least moderate use in the past. Pale agoseris and silky lupine produced 69% of the total forb cover in 1998 and 72% in 2003. Most other forbs produced less than one-half of 1% cover. Other, more preferred forbs are present, but in low numbers.

## 1982 APPARENT TREND ASSESSMENT

On this site, soil is stable with excellent protective ground cover to prevent erosion. However, vegetatively there are definite problems, most coming from livestock use. Stickyleaf low rabbitbrush currently dominates the site and is increasing. The more desirable mountain big sagebrush is declining and increaser grasses, especially the needlegrass species, will likely increase. Forbs, which are of great importance to deer in the summer, are not abundant.

## 1992 TREND ASSESSMENT

Erosion is not evident on this site. Basal vegetative cover has increased by 14% since 1982, while percent bare ground has decreased by 62%. Trend for soil is up. The trend for browse is mixed. The key browse species, mountain big sagebrush, has increased dramatically since the last reading. It has good vigor and low percent decadence. Slender eriogonum has also increased in density. On the downside, the increaser stickyleaf low rabbitbrush has also increased on the site and has an age structure that indicates possible continued increase, especially with continued heavy use of the herbaceous understory by livestock. Trend for browse is up slightly, but close attention should be given to stickyleaf low rabbitbrush in the future. The trend for the herbaceous understory is also up, even though it is dominated by less desirable increaser species and poisonous plants.

### TREND ASSESSMENT

soil - up (5)

browse - up slightly (4)

herbaceous understory - up, but dominated by increaser species (5)

## 1998 TREND ASSESSMENT

Trend for soil is stable with abundant vegetation and litter cover. Percent bare ground increased slightly, but it is still less than 10%. Erosion is not a problem on this site. Trend for browse is stable. Density of mountain big sagebrush is comparable to 1992 estimates. The population has become more mature, yet young plants are still common. Utilization is light, vigor good, and percent decadence low at only 7%. Stickyleaf low rabbitbrush is still the most abundant shrub on the site. Density of this increaser shrub has declined slightly, although some of the difference may be due to the much larger sample used in 1998. Young plants are still common, vigor is good, and percent decadence is low at 8%. Trend for the herbaceous understory is down slightly. Sum of nested frequency for perennial grasses and forbs has declined. Nested frequency of the most common grass, Letterman needlegrass, has remained similar but frequency of subalpine needlegrass declined significantly. Nested frequency of pale agoseris, Indian paintbrush, redroot eriogonum, and silky lupine all declined significantly.

### TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - down slightly (2)

## 2003 TREND ASSESSMENT

Trend for soil continues to be stable. Vegetation and litter cover declined since 1998 yet there is still little bare ground exposed and erosion is not a problem on this site. Trend for browse is up, but on a summer range this is not necessarily desirable. Density of mountain big sagebrush has increased by 30% since 1998 to a very high 8,640 plants/acre. The population is dynamic with high numbers of seedlings and young. The



increaser, stickyleaf low rabbitbrush, still dominates the browse composition and it has also increased in density to 12,100 plants/acre. This population is also dynamic with abundant young plants. However, the population will likely not increase significantly in the future since it appears to be at or near carrying capacity. The shrubs together produced 38% cover in 2003. Steps should be taken to reduce shrubs on this site. Trend for the herbaceous understory is down and species composition remains poor due to domination of increaser grasses and forbs. Sum of nested frequency for perennial grasses has declined with a significant decline in both needle-and-thread and Letterman needlegrass. Sum of nested frequency for perennial forbs declined more sharply. Total grass cover decreased by 37%, although total forb cover declined by 60%. Some of the decline in grasses and especially forbs is due to the incredibly dry conditions during the past few years. Herbaceous plants are the most important vegetational aspect of this site since it is considered summer range. For deer, perennial forbs are very important especially in the spring and early summer. Due to past and continued heavy livestock use of this area, sagebrush and stickyleaf low rabbitbrush have increased dramatically and the increaser needle grass dominates the herbaceous understory. More desirable grasses and forbs are not abundant. A prescribed burn would do much to enhance the herbaceous understory in this area.

TREND ASSESSMENT

soil - stable (3)

browse - up (5)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 5

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron trachycaulum	-	4	3	.09	.00
G	Bromus carinatus	8	7	3	.13	.06
G	Carex spp.	7	11	5	.56	.41
G	Poa fendleriana	3	7	4	.21	.06
G	Poa pratensis	27	20	10	.55	.18
G	Stipa columbiana	<sub>b</sub> 289	<sub>a</sub> 208	<sub>a</sub> 250	5.40	4.10
G	Stipa comata	<sub>b</sub> 119	<sub>b</sub> 112	<sub>a</sub> 54	2.92	.99
G	Stipa lettermani	<sub>b</sub> 287	<sub>b</sub> 256	<sub>a</sub> 220	10.28	6.90
Total for Annual Grasses		0	0	0	0	0
Total for Perennial Grasses		740	625	549	20.17	12.73
Total for Grasses		740	625	549	20.17	12.73
F	Achillea millefolium	-	7	3	.18	.00
F	Agoseris glauca	<sub>b</sub> 251	<sub>a</sub> 187	<sub>a</sub> 172	3.87	2.25
F	Antennaria rosea	3	-	-	-	-
F	Artemisia ludoviciana	3	-	-	-	-
F	Astragalus spp.	4	2	-	.03	-
F	Astragalus utahensis	-	6	-	.18	-
F	Castilleja linariaefolia	<sub>c</sub> 53	<sub>b</sub> 23	<sub>a</sub> 1	.27	.00

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	<i>Calochortus nuttallii</i>	-	2	2	.01	.01
F	<i>Chenopodium fremontii</i> (a)	-	28	25	.13	.10
F	<i>Collinsia parviflora</i> (a)	-	14	3	.13	.01
F	<i>Crepis acuminata</i>	a-	b34	a-	.34	-
F	<i>Delphinium nuttallianum</i>	-	a1	b15	.03	.06
F	<i>Epilobium brachycarpum</i> (a)	-	3	1	.00	.00
F	<i>Erigeron eatonii</i>	a-	a1	b8	.01	.07
F	<i>Erigeron pumilus</i>	3	2	2	.01	.00
F	<i>Eriogonum racemosum</i>	a4	b12	ab9	.30	.07
F	<i>Fritillaria atropurpurea</i>	1	-	-	-	-
F	<i>Galium</i> spp.	a-	b13	a-	.21	-
F	<i>Gayophytum ramosissimum</i> (a)	-	-	3	-	.00
F	<i>Hackelia patens</i>	a10	b28	ab20	.56	.58
F	<i>Hymenoxys acaulis</i>	-	6	-	.01	-
F	<i>Hydrophyllum occidentale</i>	3	-	-	-	-
F	<i>Lomatium</i> spp.	-	1	6	.00	.01
F	<i>Lupinus sericeus</i>	c219	b86	a35	3.59	.94
F	<i>Penstemon</i> spp.	-	3	-	.03	-
F	<i>Polygonum douglasii</i> (a)	-	b156	a22	.72	.05
F	<i>Taraxacum officinale</i>	b32	a15	a17	.22	.17
Total for Annual Forbs		0	201	54	0.98	0.17
Total for Perennial Forbs		586	429	290	9.90	4.20
Total for Forbs		586	630	344	10.89	4.38

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

BROWSE TRENDS --

Management unit 30 , Study no: 5

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia tridentata vaseyana	92	98	13.89	18.95
B	Chrysothamnus nauseosus	0	0	-	.03
B	Chrysothamnus parryi	0	16	-	.32
B	Chrysothamnus viscidiflorus viscidiflorus	96	96	23.36	19.12
B	Mahonia repens	1	3	.06	.01
B	Populus tremuloides	1	0	.18	-
B	Symphoricarpos oreophilus	1	3	.18	.18
Total for Browse		191	216	37.68	38.61

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 5

Species	Percent Cover
	'03
Artemisia tridentata vaseyana	16.51
Chrysothamnus parryi	.46
Chrysothamnus viscidiflorus viscidiflorus	22.04
Mahonia repens	.10
Populus tremuloides	3.79
Symphoricarpos oreophilus	.91

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 5

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.0

BASIC COVER --

Management unit 30 , Study no: 5

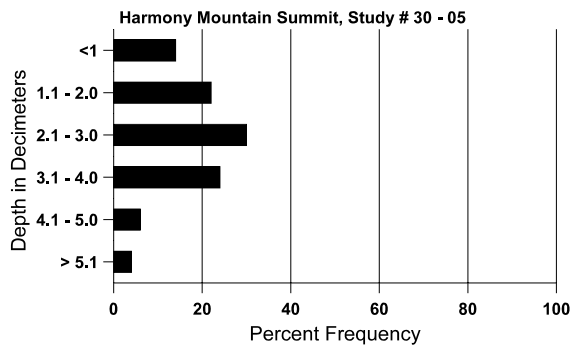
Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	33.00	60.90	53.04
Rock	0	2.23	1.72
Pavement	.25	1.01	.90
Litter	63.25	63.82	54.71
Cryptogams	0	0	0
Bare Ground	3.50	8.60	9.82

SOIL ANALYSIS DATA --

Management unit 30, Study no: 5, Study Name: Harmony Mountain Summit

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
17.2	52.2 (18.0)	5.4	62.0	19.4	18.6	4.5	41.9	268.8	0.4

Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 5

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Sheep	2	-	-	-
Rabbit	-	4	-	-
Deer	44	50	73 (180)	88 (217)
Cattle	18	11	26 (64)	32 (79)

BROWSE CHARACTERISTICS --  
Management unit 30 , Study no: 5

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	16/19
<b>Artemisia tridentata vaseyana</b>											
82	<b>1532</b>	-	66	800	666	-	57	0	43	0	15/12
92	<b>6666</b>	1933	4266	2000	400	-	14	1	6	5	15/30
98	<b>6060</b>	880	1580	4060	420	240	3	0	7	.33	16/24
03	<b>8640</b>	340	2500	5740	400	80	15	5	5	2	15/24
<b>Chrysothamnus parryi</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>666</b>	133	266	400	-	-	30	0	0	0	7/6
98	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
03	<b>780</b>	-	100	540	140	-	36	0	18	3	6/8
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
82	<b>8666</b>	-	2133	5000	1533	-	0	0	18	0	12/15
92	<b>14132</b>	400	3466	9666	1000	-	11	1	7	2	11/13
98	<b>11140</b>	220	1860	8420	860	20	.35	0	8	0	13/21
03	<b>12100</b>	-	1660	9780	660	40	.16	0	5	.16	11/18
<b>Eriogonum microthecum</b>											
82	<b>4733</b>	-	1400	2933	400	-	4	0	8	0	10/12
92	<b>10799</b>	-	5933	4600	266	-	6	0	2	3	5/7
98	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<b>Mahonia repens</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>120</b>	-	-	120	-	-	0	0	-	0	5/7
03	<b>140</b>	-	-	140	-	-	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	% poor vigor	Average Height Crown (in)
<b>Populus tremuloides</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	20	20	20	-	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	-/-
<b>Quercus gambelii</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	157/106
03	0	-	-	-	-	-	0	0	-	0	16/15
<b>Ribes viscosissimum</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	31/31
03	0	-	-	-	-	-	0	0	-	0	47/48
<b>Symphoricarpos oreophilus</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	20	-	-	20	-	-	100	0	-	0	25/51
03	60	-	-	60	-	-	0	0	-	0	23/47

Trend Study 30-13-03

Study site name: Black Ridge .

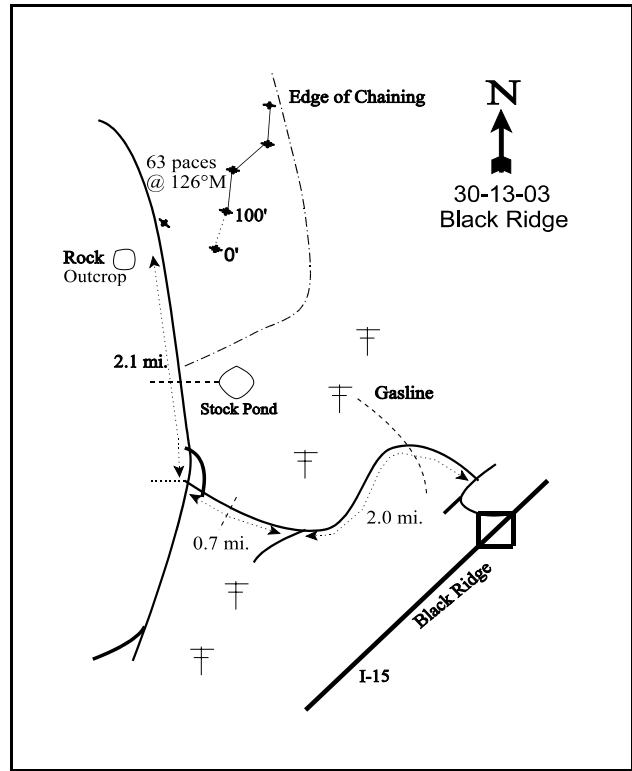
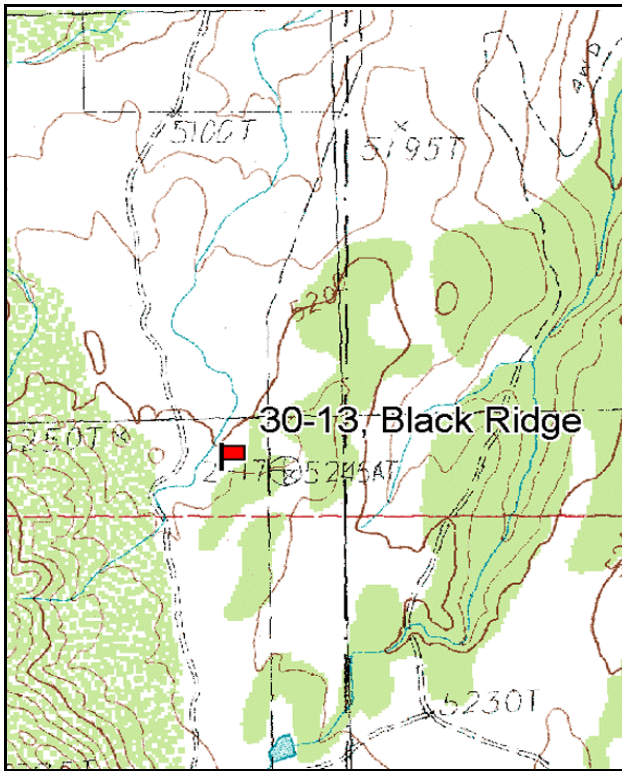
Vegetation type: Chained, seeded P-J .

Compass bearing: frequency baseline 2 degrees magnetic.

Frequency belt placement: line 1 (15 & 84ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). No rebar.

LOCATION DESCRIPTION

Traveling south on I-15 from Cedar City, take the Black Ridge exit (exit #36). Go west for a short distance to a frontage road. Turn north (right) on the frontage road and then take the first left turn heading west. Travel approximately 2.0 miles on this road going south and passing a corral, disregarding minor turnoffs. At this point, you will come to an intersection at the power lines. Take the road to the right. Proceed on this road for another 0.7 miles, at which point there will be another intersection. Turn right at the intersection and travel 2.1 miles, then stop. On the left side of the road is a large rock outcrop. On the right side of the road is a witness post. The 0-foot baseline stake is located 63 paces at a bearing of 126 degrees magnetic from the witness post. The study is marked by green steel "T" fence posts approximately 18 to 24 inches in height. The 0-foot baseline stake is marked with a browse tag #7003.



Map Name: New Harmony

Diagrammatic Sketch

Township 39S, Range 13W, Section 2

GPS: NAD 27, UTM 12S 4143873 N, 298732 E

## DISCUSSION

### Black Ridge - Trend Study No. 30-13

This trend study is located on a chained and seeded pinyon-juniper site slightly north of the Great Basin-Colorado River divide on Black Ridge. Elevation is approximately 5,200 feet, with a 8-10% slope and a north aspect. This area has been critical winter range for deer in the past, but currently receives little use because of low deer populations in the area. Cattle were observed in the area during the 1992 reading. Pellet group data taken on the site estimated 21 deer days use/acre in 1998 (52 ddu/ha) and 19 deer days use/acre in 2003 (47 ddu/ha). No sign of cattle use was encountered within the vicinity of the transect in 1998 or 2003.

Soils are igneous in origin, dark-colored, shallow in places, and very rocky. Surface temperatures would likely be high during the summer, especially on the south and west aspects. The soil is actually quite deep once you get past the rocky surface. Effective rooting depth is estimated at 24 inches. Soil texture is a clay loam which is moderately acidic (pH 6.0). Phosphorus is low at just 4.2 ppm, when 10 ppm is considered to be the minimum for normal plant development. Soil temperature is high averaging 73°F at a depth of over 15 inches. There has been erosion occurring on the site in the past as evidenced by the presence of gullies and fairly extensive areas of rock and erosion pavement. However, erosion appears to be controlled since the chaining treatment. Protective ground cover is abundant leaving little bare soil exposed.

This chaining is becoming increasingly dominated by shrubs and trees. During the 1982 reading, browse was not abundant on the site. Mountain big sagebrush (599 plants/acre) and Utah serviceberry (333 plants/acre) were the most common. Sagebrush on the site appears to be a hybrid between black sagebrush (*Artemisia nova*) and mountain big sagebrush (*A. tridentata vaseyana*). However, all sagebrush has been classified as mountain big sagebrush. Mountain big sagebrush increased 94% by 1992 to 10,199 plants/acre. Seedlings were abundant and young plants accounted for 61% of the population. The much larger sample size used in 1998 estimated 6,080 plants/acre. The change in density came mostly from the young age class which declined from 6,266 to 1,940 plants/acre. Density of mature plants remained comparable, and seedlings were still abundant. Sagebrush density increased 15% in 2003 to 7,120 plants/acre. The population is mostly lightly browsed and in good vigor. No seedlings were counted in 2003 and young plants have declined in number although they are still numerous enough to indicate an expanding population.

Serviceberry is scattered throughout the site at a density of just over 100 plants/acre. Mature shrubs average nearly 4 feet in height, and utilization is mostly light. Another preferred species, antelope bitterbrush, also occurs in limited numbers. It shows moderate to heavy use. Small populations of Gambel and shrub-live oak also occur on the site. The increaser, broom snakeweed, appeared in the density plots for the first time in 1992. Density was estimated at 2,066 plants/acre with an equal number of seedlings. By 1998, the number of broom snakeweed increased to 3,240 plants/acre. The population declined by 68% in 2003 due to drought conditions.

Juniper and pinyon trees are abundant and regaining dominance on this site. Point-quarter data from 2003 estimated 104 juniper trees/acre with an average basal diameter of 6.6 inches. Total line-intercept canopy cover was estimated at 12% in 2003. A photo point comparison between readings suggests that juniper has increased significantly in size since the first reading.

Seeded and native grasses are well established on the site even though they have steadily declined in abundance since 1992. Crested wheatgrass dominates with lesser amounts of mutton bluegrass and prairie junegrass. Forbs are diverse, although not particularly numerous. Yellow sweetclover was the only seeded forb encountered during any reading. It has persisted on the site and is one of the most abundant forbs. Other common native perennials include sego lily, thistle, low fleabane and sulfur eriogonum.



## 1982 APPARENT TREND ASSESSMENT

Soil trend appears to be slowly improving as the site becomes progressively more densely vegetated. There is soil movement and active gully formation, but this appears to be stabilizing. Vegetative trend is more difficult to gauge. The three key browse species appear to be expanding, but may be inhibited somewhat by the more rapid expansion and growth of crested wheatgrass and Utah juniper. The abundance of broom snakeweed should also be closely monitored.

## 1992 TREND ASSESSMENT

Soil trend is slightly down. Basal vegetative cover dropped 44% since 1982, while bare ground increased slightly. Litter cover also declined from 57% to 44%, likely due to the decrease in grass litter buildup. The browse trend has improved with increased densities of mountain big sagebrush. However, the density of broom snakeweed also increased and has an age class structure indicating an expanding population. The herbaceous trend is difficult to determine by looking solely at the data. Quadrat frequency of both grasses and forbs have increased. However, by looking at the photos it is apparent that grasses have declined in stature and vigor. If this trend continues it will result in a shrub and tree dominated system. Trend for herbaceous understory is therefore, slightly down.

### TREND ASSESSMENT

soil - slightly down (2)

browse - up (5)

herbaceous understory - down slightly (2)

## 1998 TREND ASSESSMENT

Trend for soil is stable since 1992. Percent bare ground declined slightly even though litter cover also went downward. Rock and pavement cover increased from 41% to 52%. However, soil erosion appears to be under control. Trend for the key browse species, mountain big sagebrush appears stable. Density has declined due to a reduction in young plants which were very abundant in 1992. Density of mature plants has remained similar between readings. There are still ample seedlings and young to maintain the population. Utilization is mostly light and vigor good. Percent decadence has increased, but it is still low at 11%. Broom snakeweed has increased 36% since 1992. However, the current population is mostly mature. Juniper density is similar to 1992 estimates, while trees have greatly increased in size. Currently, overhead canopy cover averages 5%. Trend for the herbaceous understory is mixed. Sum of nested frequency for perennial grasses has remained steady, although frequency of perennial forbs has increased. Nested frequency of crested wheatgrass declined significantly. Overall, trend is considered stable since grasses provide most of the herbaceous cover.

### TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - stable (3)

## 2003 TREND ASSESSMENT

Trend for soil is considered down slightly due to a decline in total protective ground cover and an increase in cover of bare ground, yet erosion does not appear to be a problem currently. Trend for the key browse species, mountain big sagebrush, is considered stable. Density has increased 15% since 1998 to 7,120 plants/acre. Utilization remains mostly light, vigor normal, and percent decadence low at 18%. It appears that the rapid expansion of sagebrush has slowed on this site. No seedlings were encountered in 2003, but young

plants are still numerous and more than enough to maintain the current population. Drought conditions for the past several years in this area has also helped slow expansion of sagebrush. Drought conditions are also a factor in the 68% decline of broom snakeweed. One negative aspect of the browse trend is the increase in density and size of juniper trees. Average canopy cover of juniper has more than doubled since 1998 (5% to 12%). The rapid expansion of shrubs and trees on this site, in addition to drought has resulted in a downward trend for the herbaceous understory. The rocky nature of the soil surface also gives shrubs and trees a competitive advantage over grasses. The primary seeded grass, crested wheatgrass, has declined significantly with each reading. All other grasses sampled in 2003 also have declining nested frequency values. Average cover of grasses has fallen threefold since 1998 (12% to 4%), while forb cover has declined more than twofold (17% to 7%). A return to normal precipitation patterns would do much to reverse this trend but a retreatment of surviving juniper trees on this old chaining would also improve conditions.

TREND ASSESSMENT

soil - down slightly (2)

browse - stable (3)

herbaceous understory - down (1)

HERBACEOUS TRENDS --  
Management unit 30 , Study no: 13

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron cristatum	c <sub>249</sub>	b <sub>192</sub>	a <sub>106</sub>	5.53	1.84
G	Agropyron intermedium	3	3	-	.03	-
G	Bromus tectorum (a)	-	b <sub>113</sub>	a <sub>53</sub>	1.32	.20
G	Elymus junceus	b <sub>10</sub>	a <sub>3</sub>	a <sub>-</sub>	.03	-
G	Koeleria cristata	a <sub>26</sub>	b <sub>63</sub>	a <sub>31</sub>	2.53	.43
G	Poa fendleriana	47	58	30	2.14	1.50
G	Poa secunda	-	4	-	.06	-
G	Sitanion hystrix	b <sub>32</sub>	ab <sub>17</sub>	a <sub>7</sub>	.33	.33
G	Vulpia octoflora (a)	-	11	11	.05	.07
Total for Annual Grasses		0	124	64	1.37	0.27
Total for Perennial Grasses		367	340	174	10.67	4.11
Total for Grasses		367	464	238	12.05	4.38
F	Agoseris glauca	a <sub>-</sub>	b <sub>18</sub>	a <sub>-</sub>	.12	-
F	Antennaria rosea	3	-	-	-	-
F	Arabis spp.	2	4	-	.01	-
F	Artemesia biennis	1	-	-	-	-
F	Aster spp.	2	5	3	.04	.03
F	Astragalus spp.	-	7	2	.09	.00
F	Balsamorhiza hookeri	2	-	-	-	.03
F	Calochortus nuttallii	a <sub>-</sub>	b <sub>20</sub>	ab <sub>5</sub>	.05	.01
F	Cirsium calcareum	a <sub>4</sub>	b <sub>17</sub>	ab <sub>13</sub>	.49	.63

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	<i>Comandra pallida</i>	-	-	2	-	.00
F	<i>Collinsia parviflora</i> (a)	<sub>b</sub> 43	<sub>a</sub> 17	<sub>a</sub> 7	.05	.01
F	<i>Cordylanthus</i> spp. (a)	-	<sub>b</sub> 80	<sub>a</sub> 44	.56	.72
F	<i>Crepis acuminata</i>	-	-	2	-	.15
F	<i>Crepis occidentalis</i>	1	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	3	-	.03
F	<i>Draba</i> spp. (a)	-	<sub>b</sub> 30	<sub>a</sub> 12	.15	.03
F	<i>Epilobium brachycarpum</i> (a)	-	<sub>b</sub> 29	<sub>a</sub> -	.06	-
F	<i>Erigeron pumilus</i>	<sub>a</sub> 2	<sub>b</sub> 34	<sub>a</sub> 4	.24	.03
F	<i>Eriogonum racemosum</i>	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 13	-	.07
F	<i>Eriogonum umbellatum</i>	<sub>a</sub> 15	<sub>b</sub> 40	<sub>a</sub> 17	.65	.13
F	<i>Lithospermum</i> spp.	-	4	4	.03	.06
F	<i>Lomatium</i> spp.	-	7	9	.02	.02
F	<i>Lupinus argenteus</i>	<sub>a</sub> -	<sub>b</sub> 12	<sub>a</sub> -	.19	-
F	<i>Melilotus officinalis</i>	<sub>a</sub> 28	<sub>b</sub> 60	<sub>a</sub> 23	1.88	.33
F	<i>Microsteris gracilis</i> (a)	-	<sub>a</sub> 13	<sub>b</sub> 73	.04	.63
F	<i>Phlox longifolia</i>	-	6	9	.01	.04
F	<i>Polygonum douglasii</i> (a)	-	<sub>b</sub> 14	<sub>a</sub> -	.03	-
F	<i>Ranunculus</i> spp.	-	<sub>b</sub> 54	<sub>a</sub> -	.22	-
F	<i>Sphaeralcea grossulariaefolia</i>	-	-	3	-	.00
F	<i>Tragopogon dubius</i>	1	-	-	-	-
F	<i>Viguiera multiflora</i>	<sub>b</sub> 35	<sub>a</sub> 5	<sub>a</sub> -	.18	-
F	<i>Zigadenus paniculatus</i>	-	3	3	.01	.03
Total for Annual Forbs		43	183	139	0.90	1.43
Total for Perennial Forbs		96	296	112	4.27	1.61
Total for Forbs		139	479	251	5.17	3.04

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

BROWSE TRENDS --

Management unit 30 , Study no: 13

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	5	4	1.08	1.54
B	Artemisia tridentata vaseyana	89	89	14.92	13.55
B	Chrysothamnus nauseosus hololeucus	1	0	-	-
B	Gutierrezia sarothrae	41	24	1.74	.43
B	Juniperus osteosperma	14	17	3.59	8.79
B	Opuntia spp.	2	2	-	-
B	Purshia tridentata	1	2	.15	-
B	Quercus gambelii	3	4	1.41	.45
B	Quercus turbinella	1	2	.38	.53
Total for Browse		157	144	23.30	25.29

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 13

Species	Percent Cover	
	'98	'03
Amelanchier utahensis	-	1.41
Artemisia tridentata vaseyana	-	16.33
Gutierrezia sarothrae	-	.35
Juniperus osteosperma	5.00	11.80
Opuntia spp.	-	.03
Pinus monophylla	.60	.63
Purshia tridentata	-	.38
Quercus gambelii	-	1.68

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 13

Species	Average leader growth (in)
	'03
Amelanchier utahensis	1.4
Artemisia tridentata vaseyana	3.1

POINT-QUARTER TREE DATA --  
Management unit 30 , Study no: 13

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	90	104
Pinus monophylla	6	-

Average diameter (in)	
'98	'03
3.8	6.6
4.0	-

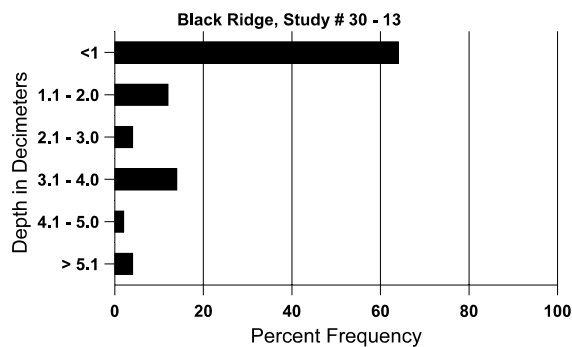
BASIC COVER --  
Management unit 30 , Study no: 13

Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	6.75	36.18	30.42
Rock	34.50	40.43	35.95
Pavement	6.00	11.23	5.14
Litter	44.00	39.61	38.73
Cryptogams	.75	.32	.19
Bare Ground	8.75	6.98	10.60

SOIL ANALYSIS DATA --  
Management unit 30, Study no: 13, Study Name: Black Ridge

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
24.2	72.5 (15.2)	6.0	32.0	33.4	34.6	2.1	4.2	76.8	0.5

**Stoniness Index**



PELLET GROUP DATA --  
Management unit 30 , Study no: 13

Type	Quadrat Frequency	
	'98	'03
Rabbit	12	12
Deer	18	4

Days use per acre (ha)	
'98	'03
-	-
21 (52)	19 (46)

BROWSE CHARACTERISTICS --  
Management unit 30 , Study no: 13

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
82	<b>333</b>	-	-	333	-	-	20	0	0	0	11/18
92	<b>133</b>	-	133	-	-	-	0	0	0	0	-/-
98	<b>1140</b>	-	380	760	-	-	2	0	0	0	41/45
03	<b>120</b>	-	40	60	20	-	17	0	17	0	47/53
<b>Artemisia tridentata vaseyana</b>											
82	<b>599</b>	-	133	466	-	-	0	0	0	0	14/25
92	<b>10199</b>	5466	6266	3800	133	-	7	0	1	.65	14/18
98	<b>6080</b>	2360	1940	3480	660	200	12	0	11	7	19/31
03	<b>7120</b>	-	780	5060	1280	380	14	0	18	6	20/25
<b>Chrysothamnus nauseosus hololeucus</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>40</b>	-	-	-	40	-	0	0	100	100	-/-
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<b>Gutierrezia sarothrae</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>2066</b>	2733	400	1666	-	-	0	0	0	0	9/9
98	<b>3240</b>	-	500	2660	80	20	0	0	2	.61	6/8
03	<b>1040</b>	-	20	900	120	20	0	0	12	6	8/8
<b>Juniperus osteosperma</b>											
82	<b>799</b>	-	133	666	-	-	0	0	0	0	47/27
92	<b>333</b>	66	133	200	-	-	0	0	0	0	30/62
98	<b>320</b>	-	120	200	-	20	0	0	0	0	-/-
03	<b>420</b>	-	80	300	40	-	0	0	10	0	-/-
<b>Opuntia spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>132</b>	-	66	66	-	-	0	0	-	0	11/17
98	<b>40</b>	-	-	40	-	-	0	0	-	0	4/3
03	<b>60</b>	-	-	60	-	-	0	0	-	0	6/9
<b>Purshia tridentata</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	100	0	-	0	12/100
03	<b>60</b>	-	-	60	-	-	0	67	-	0	16/34

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Quercus gambelii</b>											
82	<b>133</b>	-	133	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>140</b>	-	-	140	-	40	0	0	-	0	60/41
03	<b>220</b>	-	120	100	-	40	0	0	-	0	39/24
<b>Quercus turbinella</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>200</b>	-	-	200	-	-	0	0	-	0	61/28
03	<b>160</b>	-	-	160	-	-	0	0	-	0	62/11

Trend Study 30-26-03

Study site name: Grassy Flat Ridge.

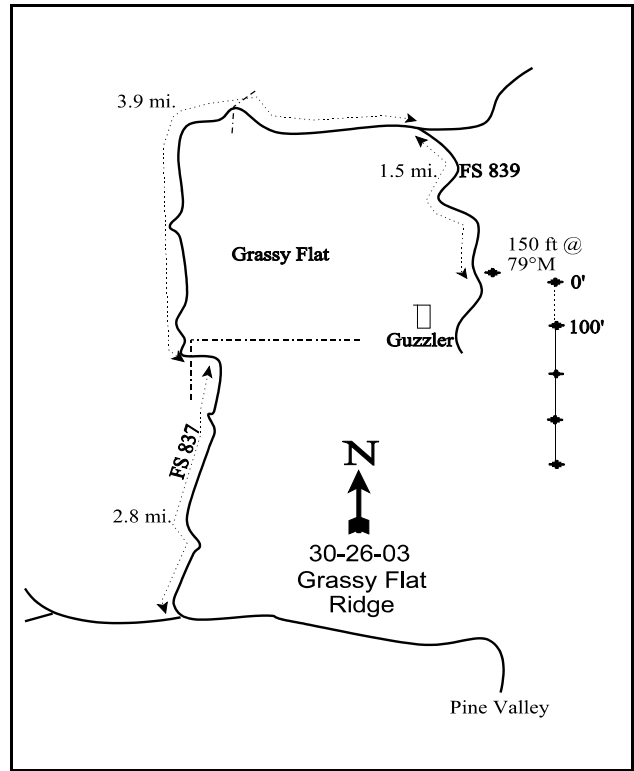
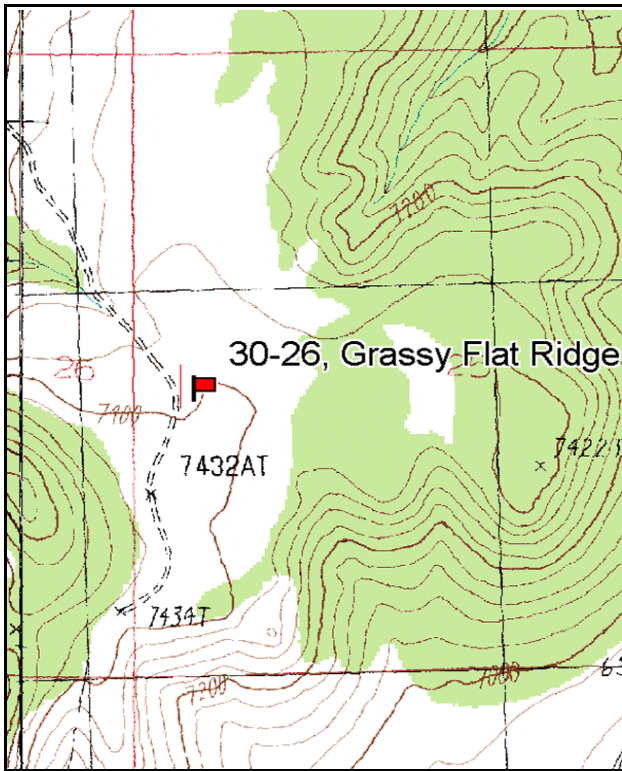
Vegetation type: Mountain Brush.

Compass bearing: frequency baseline 180 degrees magnetic.

Frequency belt placement: line 1 (16 & 89ft), line 2 (39ft), line 3 (48ft), line 4 (63ft). Rebar: belt 2 on 1ft, belt 3 on 4ft.

LOCATION DESCRIPTION

From the town of Pine Valley, travel west towards Central 1.5 miles to the dirt road to Pinto. Continue west 0.75 miles to the Gray's Ranch-Grassy Flat Road on the north side (right) of the road. Go north on this road approximately 2.8 miles and turn left. From here, continue on the road for 3.9 miles to Forest Service road #839. Bear right (south) and travel 1.5 miles to a witness post on the left (east) side of the road. A large guzzler can be found further down the road on the right (west) side. From the witness post, the 0-foot stake is 150 feet away at 79 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height.



Map Name: Grass Valley & Central East

Diagrammatic Sketch

Township 38S, Range 15W, Section 25

GPS: NAD 27, UTM 12S 4147710 N, 279276 E



## DISCUSSION

### Grassy Flat Ridge - Trend Study No. 30-26

The Grassy Flat Ridge trend study is located on a relatively low elevation summer range near the summit of the ridge, lying between the South Fork of Pinto Creek and Grassy Flat. Terrain varies, but the site has a 5% to 10% slope to the west and an elevation of 7,400 feet. The vegetative type is sagebrush-grass with low abundance of seeded grasses. A guzzler is located about 200 yards to the southwest of the study site. Wildlife and livestock use has been reported high in the past, most likely due to the close proximity of the guzzler. Pellet group data taken on the site on June 30, 1998 estimated moderate use by deer with 32 deer days use/acre (79 ddu/ha). No livestock had been on the site yet but use did occur later that summer. Livestock grazing typically occurs from July 1-August 15 on a deferred rotation system. Pellet group data from 2003 estimated 52 deer days use/acre (129 ddu/ha). Most of the use was from spring and early summer. No livestock use was noted when the site was read on May 28<sup>th</sup> of 2003, but cow use from the previous year was estimated at 7 days use/acre (17 cdu/ha).

Soils are igneous in origin, coarse in texture, and very rocky over most of the area. Effective rooting depth is estimated at almost 12 inches. Texture is a clay loam which is moderately acidic (pH 5.8). Phosphorus may be limiting at 7.2 ppm, when 10 ppm is considered a minimal value for normal plant development. Rock and pavement are abundant on the surface and have increased from 29% to 40% between 1982 and 2003. Erosion was noted as slight and the only active gullies occurred on the road.

The key browse species are mountain big sagebrush and antelope bitterbrush. Sagebrush accounted for 54% of the total browse cover in 1998 and 72% in 2003. Density of big sagebrush was estimated at 2,333 plants/acre in 1982. No seedlings or young plants were encountered. The population increased 64% by 1992. Seedlings and young plants were then very abundant. Density increased an additional 12% by 1998 to 7,260 plants/acre. Seedlings were still abundant and young plants accounted for 43% of the population. The population nearly doubled in 2003 to 13,440 plants/acre. Utilization has been mostly light to moderate over the years with a few individuals displaying heavy hedging. Vigor has been good and percent decadence has remained low.

Antelope bitterbrush has a relatively small population. It increased slightly in density in 1992 and 1998 to around 700 plants/acre, yet it declined in 2003 to 580 plants/acre. Utilization was mostly moderate in 1982, but has been extremely heavy since. Most plants are partly unavailable due to the high level of use. Even with this heavy use, vigor is still normal on most plants and percent decadence was moderately low at 17% in 1998. Percent decadence increased to 31% in 2003. The population has poor recruitment and has decreased in average height and crown measurements since 1998. Annual leader growth, only found in protected areas, averaged only 1 inch. There was no sign of flowering in 2003.

Secondary browse species include Utah serviceberry, dwarf rabbitbrush, and occasional individuals of Gambel oak and curlleaf mountain mahogany. Serviceberry plants also have displayed heavy use but many plants have become partly unavailable due to height. Broom snakeweed, an invader/increaser, also occurs on the site in moderate numbers.

The herbaceous understory is moderately abundant and diverse. Four perennial grasses dominate the grass composition. These include pubescent wheatgrass, mutton bluegrass, bottlebrush squirreltail, and Letterman needlegrass. Forbs are diverse, but the composition consists primarily of increasers, poisonous plants, and other low-growing species of minimal forage value. The most abundant forbs are wild onion, littleleaf pussytoes, and foothill deathcamas. Sulfur eriogonum and Eaton fleabane are also fairly common.

## 1982 APPARENT TREND ASSESSMENT

A best estimate of soil trend is slightly downward. Erosion and soil loss are not great, but only because of the gentle terrain. Ground cover is generally poor. Vegetative trend appears to also be declining. Both key species are barely holding their own in the face of a rapidly expanding broom snakeweed population. Grass density is good and may be a competitive influence on shrub reproduction. Forb composition is depleted and shows few signs of improvement.

## 1992 TREND ASSESSMENT

Erosion on the site is slight with an increase in rock and pavement cover and a decrease in bare ground. Ground cover is still poor, but has changed mostly from bare ground to mostly pavement and rock. Basal vegetative cover has increased from 7% to 10%. The grass species are mostly palatable and the composition is good, while the forb species are mostly unpalatable and composition poor. The key browse species, mountain big sagebrush and antelope bitterbrush, have both increased and should be able to tolerate the increase of broom snakeweed. The broom snakeweed population is expanding and should be monitored closely.

### TREND ASSESSMENT

soil - stable (3)

browse - slightly up (4)

herbaceous understory - slightly up (4)

## 1998 TREND ASSESSMENT

Trend for soil is stable with similar ground cover characteristics compared to 1992. Trend for the key browse species is mixed. Mountain big sagebrush displays an upward trend due to a 12% increase in population density, good reproduction, normal vigor, and low percent decadence. Bitterbrush shows a stable to slightly downward trend due to continued extremely heavy use. This use is not only from deer. Cattle using the site will switch from grasses to bitterbrush late in the summer, especially during dry years when the perennial grasses dry out. The bitterbrush population has remained at similar density compared to 1992, but reproduction is limited with just enough young plants to replace decadent & dying plants. With this in mind, trend for browse is considered up due the increase in sagebrush. Trend for the herbaceous understory is slightly down. Sum of nested frequency for both grasses and forbs has declined. Forb composition is still poor.

### TREND ASSESSMENT

soil - stable (3)

browse - up (5)

herbaceous understory - down slightly (2)

## 2003 TREND ASSESSMENT

Trend for soil remains stable. There is abundant protective ground cover to prevent erosion. Unfortunately, rock and pavement combine to produce 40% of the ground cover which results in high surface soil temperatures. Generally rocky sites like this one give shrubs a competitive advantage, especially during drought years. Trend for browse is up for sagebrush and down for the more preferred bitterbrush, although bitterbrush only contributes 10% of the browse cover. Density of mountain big sagebrush has grown to 13,440 plants/acre. Cover has increased from 9% in 1998 to 15% in 2003. Young recruitment remains extremely high suggesting a continued increase in the population. Bitterbrush has declined 17% in density, is heavily browsed, and has increased in percent decadence to 31%. No seedlings or young plants were sampled

and there was no sign of flowering in 2003. Overall, the browse trend is considered up due to the increase in sagebrush which contributes 72% of the browse cover. However, the continued increase in sagebrush comes at the expense of grasses and forbs. The elevation of this site at 7,400 feet suggests that this area is more important as spring and fall range than winter range. Therefore, it would be more important to maintain a healthy understory of grasses and forbs. Trend for the herbaceous understory is down for grasses and up for forbs. Sum of nested frequency for perennial grasses declined and average cover of grasses fell from 14% in 1998 to only 3% in 2003. Sum of nested frequency for perennial forbs increased 33% and average cover rose from 6% in 1998 to 9% in 2003. The improvement comes from significant increases in wild onion, sego lily, desert parsley, and foothill deathcamas, all bulb or large tap root forbs. Overall, the herbaceous trend is considered slightly down due to significant declines in the nested frequency of Letterman needlegrass, bottlebrush squirreltail, and mutton bluegrass, combined with the major loss of perennial grass cover (14% to 3%).

TREND ASSESSMENT

soil - stable (3)

browse - up (5)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 26

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron cristatum	ab17	a5	b30	.06	.33
G	Agropyron intermedium	39	46	28	3.02	.81
G	Agropyron smithii	b110	a29	a43	.21	.29
G	Bromus tectorum (a)	-	5	-	.15	-
G	Koeleria cristata	b32	ab27	a10	.74	.05
G	Poa bulbosa	a-	a11	b23	.33	.51
G	Poa fendleriana	b144	b162	a71	5.16	.55
G	Poa secunda	b44	a3	a6	.00	.15
G	Sitanion hystrix	b153	b138	a31	2.67	.26
G	Stipa lettermani	b65	b61	a20	1.72	.13
Total for Annual Grasses		0	5	0	0.15	0
Total for Perennial Grasses		604	482	262	13.94	3.09
Total for Grasses		604	487	262	14.09	3.09
F	Achillea millefolium	3	-	-	-	-
F	Agoseris glauca	b24	a11	a10	.05	.10
F	Allium acuminatum	a158	b267	c302	2.50	6.21
F	Antennaria parvifolia	b111	a38	a19	.71	.17
F	Arabis spp.	9	3	2	.01	.00
F	Astragalus agrestis	b10	b13	a-	.12	-
F	Astragalus argophyllus	ab1	b6	a-	.04	-

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	Astragalus spp.	8	-	2	-	.00
F	Balsamorhiza sagittata	-	-	2	-	.03
F	Castilleja linariaefolia	-	-	1	-	.00
F	Calochortus nuttallii	<sub>a</sub> 11	<sub>a</sub> 12	<sub>b</sub> 74	.05	.39
F	Cirsium wheeleri	5	7	-	.06	-
F	Comandra pallida	-	-	6	-	.06
F	Collinsia parviflora (a)	-	61	68	.18	.35
F	Crepis acuminata	-	3	3	.01	.00
F	Delphinium nuttallianum	-	-	7	-	.03
F	Descurainia pinnata (a)	-	-	3	-	.15
F	Epilobium brachycarpum (a)	-	<sub>b</sub> 27	<sub>a</sub> -	.10	-
F	Erigeron eatonii	<sub>b</sub> 56	<sub>a</sub> 7	<sub>a</sub> 2	.21	.01
F	Erigeron pumilus	<sub>a</sub> 4	<sub>b</sub> 13	<sub>a</sub> 4	.06	.01
F	Eriogonum umbellatum	<sub>b</sub> 76	<sub>a</sub> 28	<sub>a</sub> 21	.41	.07
F	Gayophytum ramosissimum(a)	-	-	4	-	.01
F	Haplopappus spp.	1	-	-	-	-
F	Hymenoxys richardsonii	4	-	-	-	-
F	Lomatium spp.	<sub>a</sub> 1	<sub>a</sub> 6	<sub>b</sub> 102	.03	.67
F	Lupinus argenteus	2	-	-	-	-
F	Machaeranthera canescens	3	-	2	-	.00
F	Microsteris gracilis (a)	-	1	-	.00	-
F	Penstemon caespitosus	1	-	-	-	-
F	Phlox longifolia	7	6	3	.03	.01
F	Polygonum douglasii (a)	-	<sub>b</sub> 77	<sub>a</sub> 12	.21	.04
F	Ranunculus testiculatus (a)	-	-	8	-	.02
F	Sphaeralcea coccinea	3	1	-	.00	-
F	Tragopogon dubius	-	3	-	.00	-
F	Viguiera multiflora	1	-	-	-	-
F	Zigadenus paniculatus	<sub>b</sub> 93	<sub>a</sub> 69	<sub>b</sub> 94	.67	1.01
Total for Annual Forbs		0	166	95	0.50	0.57
Total for Perennial Forbs		592	493	656	5.01	8.81
Total for Forbs		592	659	751	5.51	9.39

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

BROWSE TRENDS --

Management unit 30 , Study no: 26

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	12	14	1.54	1.52
B	Artemisia tridentata vaseyana	93	95	9.15	14.67
B	Cercocarpus ledifolius	2	1	.15	.85
B	Cercocarpus montanus	0	1	-	-
B	Chrysothamnus depressus	29	17	.42	.10
B	Gutierrezia sarothrae	45	44	.39	.40
B	Opuntia spp.	17	15	.31	.33
B	Pinus edulis	2	3	.38	.38
B	Purshia tridentata	29	23	4.09	1.97
B	Quercus gambelii	5	7	.56	.18
B	Tetradymia canescens	4	0	.03	-
Total for Browse		238	220	17.04	20.43

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 26

Species	Percent Cover
	'03
Amelanchier utahensis	2.36
Artemisia tridentata vaseyana	17.23
Cercocarpus ledifolius	.46
Chrysothamnus depressus	.06
Gutierrezia sarothrae	.46
Opuntia spp.	.86
Pinus edulis	.26
Purshia tridentata	1.46
Quercus gambelii	.80

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 26

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.2
Purshia tridentata	1.0

BASIC COVER --

Management unit 30 , Study no: 26

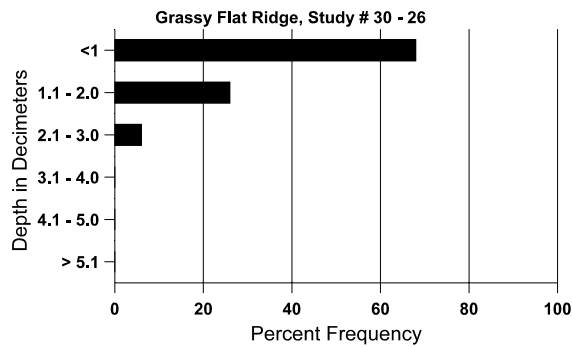
Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	9.75	37.62	35.23
Rock	28.75	35.28	36.70
Pavement	17.75	5.62	3.02
Litter	25.00	29.13	17.67
Cryptogams	0	.15	.06
Bare Ground	18.75	19.05	18.20

SOIL ANALYSIS DATA --

Management unit 30, Study no: 26, Study Name: Grassy Flat Ridge

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
11.6	61.6 (15.5)	5.8	36.0	31.4	32.6	1.5	7.2	83.2	0.5

Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 26

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Sheep	2	-	-	-
Rabbit	3	1	-	-
Deer	31	16	32 (79)	52 (129)
Cattle	4	-	-	7 (18)

BROWSE CHARACTERISTICS --  
Management unit 30 , Study no: 26

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
82	<b>200</b>	-	-	200	-	-	100	0	0	0	20/24
92	<b>333</b>	-	-	333	-	-	20	80	0	0	29/26
98	<b>380</b>	20	20	360	-	-	32	47	0	0	38/40
03	<b>360</b>	20	80	140	140	40	0	94	39	11	31/34
<b>Artemisia tridentata vaseyana</b>											
82	<b>2333</b>	-	-	2200	133	-	6	0	6	6	11/18
92	<b>6399</b>	3733	3600	1866	933	-	22	9	15	4	18/21
98	<b>7260</b>	1400	3120	3860	280	620	21	.82	4	4	24/26
03	<b>13440</b>	620	4440	8500	500	540	11	2	4	.74	12/21
<b>Cercocarpus ledifolius</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>40</b>	-	-	40	-	-	0	50	-	0	44/50
03	<b>40</b>	-	20	20	-	20	0	50	-	0	60/44
<b>Cercocarpus montanus</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	100	0	-	0	-/-
<b>Chrysothamnus depressus</b>											
82	<b>1133</b>	-	133	1000	-	-	0	0	0	0	7/9
92	<b>3732</b>	400	1666	1733	333	-	14	13	9	0	4/8
98	<b>1680</b>	40	340	1280	60	-	17	1	4	0	6/11
03	<b>560</b>	-	20	520	20	-	25	21	4	4	5/10
<b>Gutierrezia sarothrae</b>											
82	<b>1332</b>	-	1266	66	-	-	0	0	0	0	9/10
92	<b>5199</b>	466	1400	3733	66	-	0	0	1	0	12/7
98	<b>2720</b>	-	880	1840	-	-	2	1	0	0	7/6
03	<b>3060</b>	-	160	2800	100	-	0	0	3	2	4/5
<b>Opuntia spp.</b>											
82	<b>200</b>	-	-	200	-	-	0	0	0	0	6/15
92	<b>399</b>	-	-	333	66	-	0	0	17	17	7/9
98	<b>380</b>	-	20	320	40	40	0	0	11	11	7/20
03	<b>420</b>	20	-	320	100	-	0	0	24	24	6/14

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Pinus edulis</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>40</b>	-	20	20	-	-	0	0	-	0	-/-
03	<b>60</b>	20	40	20	-	20	0	0	-	0	-/-
<b>Purshia tridentata</b>											
82	<b>533</b>	-	-	533	-	-	88	0	0	0	16/22
92	<b>732</b>	-	133	466	133	-	0	82	18	0	11/25
98	<b>700</b>	-	60	520	120	120	9	83	17	9	12/34
03	<b>580</b>	-	-	400	180	60	17	79	31	14	9/29
<b>Quercus gambelii</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>460</b>	-	280	40	140	60	35	0	30	17	38/48
03	<b>1240</b>	-	1140	100	-	20	0	0	0	0	42/48
<b>Tetradymia canescens</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>100</b>	-	-	100	-	-	0	0	-	0	6/9
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-



Trend Study 30-29-03

Study site name: Southwest of New Castle.

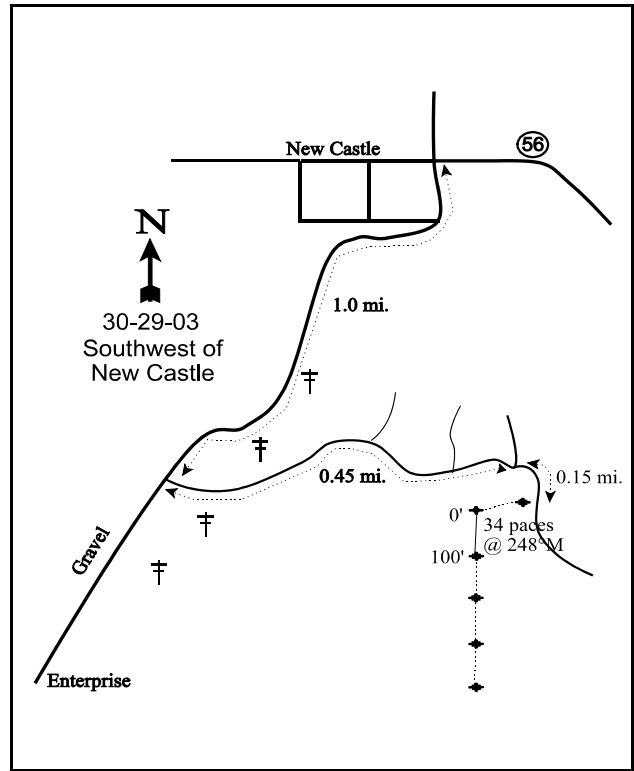
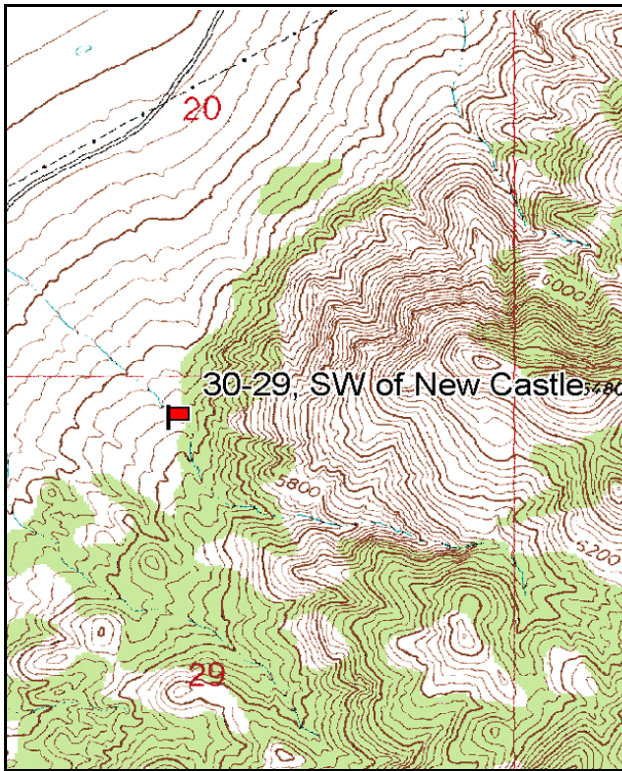
Vegetation type: Sagebrush-Grass.

Compass bearing: frequency baseline 176 degrees magnetic.

Frequency belt placement: line 1 (12 & 92ft), line 2 (39ft), line 3 (50ft), line 4 (79ft). Rebar: All belts on 1ft.

LOCATION DESCRIPTION

From the intersection of Pinto-Canyon Road and Main Street in New Castle, proceed south on Main Street 1.0 mile towards Enterprise. Turn left (east) and travel 0.45 miles until you come to a fork. Take a right and continue 0.15 miles to a witness post on the right side of the road. From the witness post walk 34 paces at 248 degrees magnetic to the 0-foot stake. The study is marked by green steel "T" fence posts approximately 18 to 24 inches in height.



Map Name: New Castle

Diagrammatic Sketch

Township 36S, Range 15W, Section 20

GPS: NAD 27, UTM 12S 4169413 N, 274301 E

## DISCUSSION

### Southwest of Newcastle - Trend Study No. 30-29

This range trend study surveys severe winter range southwest of the town of Newcastle. The site is an alluvial fan occupied by Wyoming big sagebrush underlain by a sparse herbaceous understory. The terrain has a slope of 11% and an aspect toward the west-northwest at an elevation of approximately 5,600 feet. Pellet group data taken on the site in 1998 estimated 68 deer days use/acre (168 ddu/ha). Most of the deer pellet groups appeared to be from winter use. Pellet group data from 2003 estimated 58 deer days use/acre (144 ddu/ha). No sign of cattle grazing was noted during either reading.

Soil is alluvially deposited from basalt parent material. Effective rooting depth is estimated at just over 15 inches. Soil texture is a sandy clay loam which is slightly acidic (pH 6.4). Soil temperature was moderately high in 2003, averaging 65°F at an average depth of 11 inches. This temperature was recorded on May 21<sup>st</sup> and demonstrates a relatively dry soil profile. Drought conditions have been especially pronounced in this area. The surface of the soil is covered by gravel 1/4" to 2" inches in size with some larger rocks mixed in. Rock is also common throughout the profile. Bare ground mostly occurs in small shrub interspaces associated with the rocky surface. Ground cover is composed mostly of shrub crowns and ephemeral litter from dead cheatgrass. Soil movement was widespread in 1982 with several small rills and gullies present. Currently, erosion appears minimal and the erosion condition class was determined to be stable in 2003.

Wyoming big sagebrush is the prominent and key browse species. Its population increased from 3,633 to 5,799 plants/acre between 1982 and 1992. However, density declined to 4,860 plants/acre by 1998 due to a reduction in the number of young and decadent plants. The number of dead plants in the population more than accounts for the decrease in the estimated population. Utilization was light in 1982, but heavy in 1992 with many plants displaying a clubbed growth form and stunted growth. Overall vigor was good in 1992, although some plants showed disease and insect infestation. During the 1998 reading, utilization was more moderate, yet heavy use was still noted on 20% of the sagebrush. Reproduction was poor in 1998. Percent decadence declined slightly between 1992 and 1998, although the proportion of decadent shrubs classified as dying increased from 18% to 38% (400 to 600 plants/acre). Dead plants were also common at an estimated 1,380 plants/acre in 1998. During the 2003 reading, the population of Wyoming big sagebrush looked very poor after being subjected to several years of extreme drought. Weather station data from Enterprise show that only 38% of the normal precipitation fell in 2002. In addition, the last four spring periods (1999-2003) have been very dry averaging only 55% of normal. The spring of 2002 was exceptionally dry at 16% of normal and the spring of 2003 was 56% of normal (Utah Climate Summaries 2004). In 2003, the sagebrush population was estimated at 3,680 plants/acre, only a 24% decline since 1998. However, the portion of the population displaying poor vigor increased from 15% to 91% and the number of decadent plants increased from 33% to 93%. In addition, 96% or 3,280 plants/acre of the decadent plants sampled were classified as dying (>50% crown death). There are very few healthy plants on the site. Reproduction remains poor. Utilization was rated as heavy in 2003 but several lightly browsed plants also had considerable crown death.

The only other shrub of significance is stickleaf low rabbitbrush which numbered 920 plants/acre in 1998 and 880 plants/acre in 2003. These shrubs have also been effected by drought with increased poor vigor and decadence. Broom snakeweed and prickly pear are both present in small quantities, but pose little threat to the community at this time. The much larger sample used in 1998, picked up a few green ephedra which provide some additional forage. Pinyon and juniper trees are increasing down slope from the tree dominated hills to the east. Point-center quarter data from 1998 estimated 26 singleleaf pinyon and 32 Utah juniper trees/acre. Average basal diameter was estimated at 2.3 inches for pinyon and 6.8 inches for juniper. Photo point comparisons suggest an increase in density and size of the trees, but no point-quarter data is available from 1982 or 1992. Point-center quarter density data from 2003 show an increase in tree density to 31 pinyon and 57

juniper trees/acre. Average basal diameter was 3.2 inches for pinyon and 3.7 inches for juniper. This is still a relatively low density of trees on the site where total tree canopy cover was estimated at only 1.6% in 2003.

Perennial grasses and forbs occur infrequently and are of little significance as a forage source. The two most abundant perennial grasses are galleta grass and Sandberg bluegrass. Indian ricegrass and bottlebrush squirreltail are also fairly common. Cheatgrass brome was present in 1982 but not widespread. By 1998, it represented the most abundant grass on the site, providing 65% of the total grass cover and 63% of the total herbaceous cover. Sixweeks fescue was also fairly abundant in 1998. Annual grasses and forbs were not included in previous samples so no comparisons can be made. By 2003, drought conditions caused a dramatic decline in cheatgrass frequency and cover. Perennial grasses also declined in cover but only bottlebrush squirreltail declined significantly in nested frequency. Forbs are fairly diverse but are rare in their occurrence. Total forb cover averaged less than 1% in 1998 and 2003. The most common species are annuals.

#### 1982 APPARENT TREND ASSESSMENT

The soil appears to be in a state of decline. Enough soil remains on the site to allow greater forage production than is currently available. The rate of erosion, while not rapid, is enough to result in a negative trend. Vegetative trend appears stable. Browse production is adequate, but the depleted understory lessens the value of this community. This site has a better potential for rehabilitation than similar sites in Bullion Canyon and near Newcastle Reservoir.

#### 1992 TREND ASSESSMENT

Soil conditions have improved. Cover of bare ground has decreased from 48% in 1982 to 8% in 1992. Rock and pavement have stayed nearly the same, while both vegetation and litter cover have greatly increased. Erosion appears to have slowed and is not as great as reported before. All grass species have increased, but are normally utilized more during the fall and spring. Wyoming big sagebrush has increased, but shows signs of heavy use. The rate of decadence has increased to 37%. Stickyleaf low rabbitbrush is stable and doesn't appear to be increasing.

##### TREND ASSESSMENT

soil - up (5)

browse - slightly up (4)

herbaceous understory - slightly up (4)

#### 1998 TREND ASSESSMENT

Soil trend is down slightly. Percent bare ground has increased from 8% to 18%, while litter cover has declined and pavement cover has increased from 4% to 23%. The increase in pavement cover suggests surface soil movement has occurred since 1992. Trend for browse is down slightly. Density of Wyoming big sagebrush has declined 16% since 1992 due to a reduction in young and decadent plants. The number of mature plants increased from 2,100 to 3,160 plants/acre. Utilization is more moderate, but the proportion of sagebrush displaying poor vigor has increased from 9% to 15%. Percent decadence has declined slightly from 37% to 33%. However, a greater number of decadent plants are classified as dying. Reproduction is currently poor. There are few seedlings, and young plants represent only 2% of the population which is not enough to replace the decadent/dying shrubs. Trend for the herbaceous understory is slightly down for grasses, although slightly up for forbs. Composition is still considered poor however. Cheatgrass dominates the herbaceous understory by providing 63% of the total herbaceous cover and perennial forbs are lacking. Overall, trend is considered slightly down since grasses provide the majority of the herbaceous cover.

TREND ASSESSMENT

soil - down slightly (2)

browse - down slightly (2)

herbaceous understory - down slightly (2)

2003 TREND ASSESSMENT

This site has been greatly effected by drought which has caused downward trends in most areas. Soil trend is down slightly. There is actually less bare ground estimated but cover of pavement has increased from 23% to 32% and vegetation cover has declined twofold (44% to 20%). Litter cover actually increased but this is due to the abundance of dead sagebrush sampled in 2003. Overall, the ratio of protective cover to bare ground declined slightly. Erosion is still not a serious problem and the erosion condition class was determined to be slight in 2003. Trend for the key browse species, Wyoming big sagebrush, is down. Total population density declined only 24% yet the remaining shrubs are nearly all decadent and dying. Only 220 relatively healthy mature sagebrush per acre were sampled. Decadent plants represented 93% of the 3,680 plants/acre estimated and 96% of these decadent plants were classified as dying (>50% crown death). Utilization was rated as heavy but this may have been overestimated due to the poor annual leader growth of most shrubs. There were many shrubs on site that were lightly browsed but still had significant crown death. Seedling and young recruitment is poor. Line-intercept cover of live sagebrush crowns was estimated at only 1.6% in 2003. A return to normal precipitation will help improve conditions here although most of the sagebrush on the site are likely too far gone to recover. Trend for the herbaceous understory is actually stable. Sum of nested frequency for perennial grasses remained similar to 1998 levels. The only negative aspect of the perennial grass trend is a significant decline in the nested frequency of bottlebrush squirreltail. Drought conditions also caused a significant decline in nested frequency of the cheatgrass. Cover of cheatgrass also declined from 18% in 1998 to less than one tenth of 1% in 2003. Forbs were fairly diverse in 1998 but they produced little cover (<1%). During the 2003 reading, fewer forbs were encountered even though average cover remained similar.

TREND ASSESSMENT

soil - down slightly (2)

browse - down (1)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 29

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Bromus tectorum (a)	-	<sub>b</sub> 368	<sub>a</sub> 35	18.18	.09
G	Hilaria jamesii	124	151	147	4.36	3.01
G	Oryzopsis hymenoides	26	30	19	1.47	.33
G	Poa secunda	77	85	104	2.15	1.79
G	Sitanion hystrix	<sub>c</sub> 151	<sub>b</sub> 36	<sub>a</sub> 1	1.02	.00
G	Vulpia octoflora (a)	-	<sub>b</sub> 150	<sub>a</sub> -	.98	-
Total for Annual Grasses		0	518	35	19.17	0.09
Total for Perennial Grasses		378	302	271	9.01	5.16
Total for Grasses		378	820	306	28.18	5.25

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	Arabis spp.	-	2	-	.03	-
F	Astragalus spp.	2	-	-	-	-
F	Castilleja linariaefolia	-	1	-	.03	-
F	Calochortus nuttallii	<sub>a</sub> 3	<sub>ab</sub> 16	<sub>b</sub> 22	.04	.06
F	Collomia linearis (a)	-	3	-	.00	-
F	Cryptantha spp.	<sub>a</sub> -	<sub>b</sub> 32	<sub>a</sub> -	.19	-
F	Cymopterus spp.	-	9	2	.02	.03
F	Descurainia pinnata (a)	-	<sub>b</sub> 24	<sub>a</sub> -	.08	-
F	Draba spp. (a)	-	<sub>b</sub> 14	<sub>a</sub> -	.05	-
F	Eriogonum cernuum (a)	-	2	-	.00	-
F	Eriogonum spp.	4	1	-	.03	-
F	Erigeron pumilus	3	7	-	.02	-
F	Gilia spp. (a)	-	49	27	.19	.36
F	Lupinus argenteus	-	4	-	.01	-
F	Navarretia intertexta (a)	-	37	29	.07	.10
F	Phlox longifolia	14	22	15	.08	.06
Total for Annual Forbs		0	129	56	0.42	0.46
Total for Perennial Forbs		26	94	39	0.44	0.15
Total for Forbs		26	223	95	0.87	0.62

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 29

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia tridentata wyomingensis	89	80	11.61	6.51
B	Chrysothamnus viscidiflorus viscidiflorus	32	31	1.56	2.55
B	Ephedra nevadensis	3	3	.00	.15
B	Gutierrezia sarothrae	1	0	.15	-
B	Juniperus osteosperma	2	4	-	-
B	Opuntia spp.	8	9	.91	.71
B	Pediocactus simpsonii	0	2	-	-
B	Pinus monophylla	1	2	1.41	1.70
B	Sclerocactus	1	0	-	-
Total for Browse		137	131	15.65	11.63

CANOPY COVER, LINE INTERCEPT --  
 Management unit 30 , Study no: 29

Species	Percent Cover
	'03
Artemisia tridentata wyomingensis	1.54
Chrysothamnus viscidiflorus viscidiflorus	1.28
Ephedra nevadensis	.03
Opuntia spp.	.86
Pinus monophylla	1.54

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 30 , Study no: 29

Species	Average leader growth (in)
	'03
Artemisia tridentata wyomingensis	1.7

POINT-QUARTER TREE DATA --  
 Management unit 30 , Study no: 29

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	32	57
Pinus monophylla	26	31

Average diameter (in)	
'98	'03
6.8	3.7
2.3	3.2

BASIC COVER --  
 Management unit 30 , Study no: 29

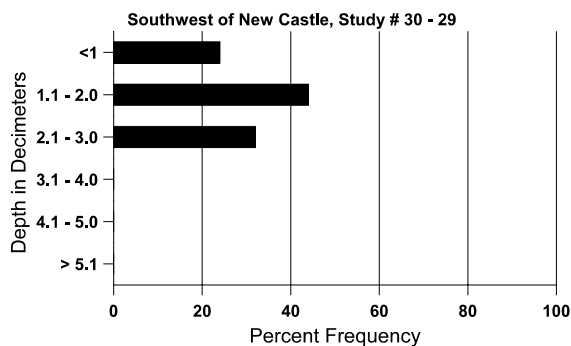
Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	24.25	43.79	19.89
Rock	10.50	7.65	7.56
Pavement	3.75	22.60	31.62
Litter	54.00	30.99	35.59
Cryptogams	0	.39	.80
Bare Ground	7.50	18.28	12.09

SOIL ANALYSIS DATA --

Management unit 30, Study no: 29, Study Name: Southwest of New Castle

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	% OM	PPM P	PPM K	ds/m
15.2	65.4 (11.1)	6.4	54.0	21.4	24.6	1.6	9.4	105.6	0.6

### Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 29

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	31	22	-	-
Deer	54	51	68 (168)	58 (144)

BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 29

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata wyomingensis</b>											
82	<b>3633</b>	500	533	2400	700	-	3	0	19	2	20/33
92	<b>5799</b>	100	1533	2100	2166	-	34	57	37	9	17/22
98	<b>4860</b>	40	100	3160	1600	1380	56	20	33	15	16/24
03	<b>3680</b>	40	40	220	3420	2440	9	85	93	91	13/20
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>466</b>	-	100	366	-	-	0	0	0	0	11/11
98	<b>920</b>	-	60	860	-	20	0	0	0	0	12/18
03	<b>880</b>	-	20	300	560	140	0	2	64	41	10/13

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Ephedra nevadensis</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>100</b>	-	20	80	-	-	80	0	-	0	10/21
03	<b>80</b>	-	-	80	-	-	0	25	-	25	8/12
<b>Gutierrezia sarothrae</b>											
82	<b>433</b>	-	-	433	-	-	46	0	-	0	8/7
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>40</b>	20	-	40	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Juniperus osteosperma</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>40</b>	-	40	-	-	-	0	0	-	0	-/-
03	<b>80</b>	-	80	-	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
82	<b>33</b>	-	-	33	-	-	0	0	0	0	4/17
92	<b>66</b>	-	-	66	-	-	0	0	0	0	5/14
98	<b>220</b>	-	20	200	-	-	0	0	0	0	7/13
03	<b>200</b>	-	-	180	20	-	0	0	10	10	8/23
<b>Pediocactus simpsonii</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>60</b>	-	-	60	-	-	0	0	-	0	1/3
<b>Pinus monophylla</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
03	<b>40</b>	-	40	-	-	-	0	0	-	50	-/-
<b>Sclerocactus</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	1/2



Trend Study 30-35-03

Study site name: Deep Canyon .

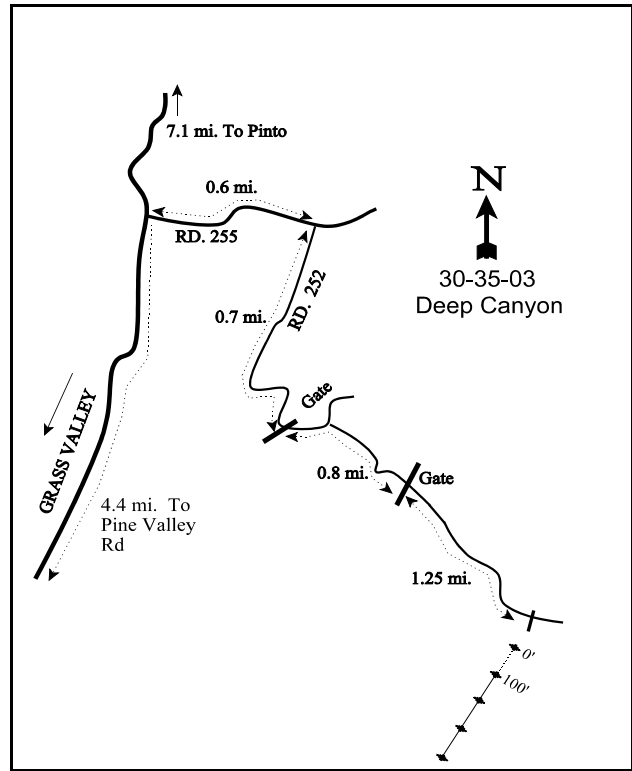
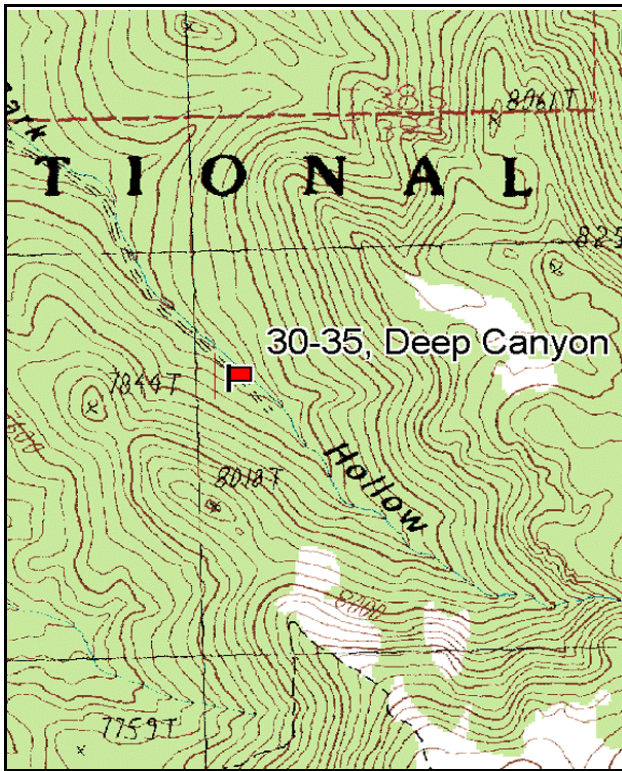
Vegetation type: Mountain Brush .

Compass bearing: frequency baseline 199 degrees magnetic.

Frequency belt placement: line 1 (19 & 88ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). No rebar.

LOCATION DESCRIPTION

From Pinto, drive south 7.1 miles toward Grass Valley. Turn left (east) on the road toward Whiterocks trail. Proceed on this road for 0.6 miles, at which point there will be an intersection. Go right (southeast) for 0.7 miles to a gate. Proceed through the gate for 0.8 miles to a second gate. Go through the second gate and drive 1.25 miles to the end of the road. There will be a witness post on the right side of the road at the base of a twin trunk *Pinus flexilis*. From the witness post walk uphill 33 paces at 193 degrees magnetic to the 0-foot stake. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height.



Map Name: New Harmony

Diagrammatic Sketch

Township 39S, Range 15W, Section unsurveyed

GPS: NAD 27, UTM 12S 4144653 N, 283079 E

## DISCUSSION

### Deep Canyon - Trend Study No. 30-35

This trend study is located on fawn rearing habitat in the Deep Creek drainage on the south side of Grass Valley. There is ample vegetation for browsing, escape, and thermal cover. A small stream is located approximately 1/4 mile away at the base of the hill. The study area is mixed mountain brush which is predominantly sagebrush and curlleaf mountain mahogany. Elevation is approximately 7,500 feet on a steep slope which varies from 40% near the beginning of the baseline to 65% near the end of the baseline. Aspect is north-northeast. The study is located on the USFS Pine Valley allotment and is grazed from July 15-October 15, although livestock don't appear to be using the steeper slopes. Pellet group data from 1998 (June 30) estimated 40 deer days use/acre (99 ddu/ha) and only 3 cow days use/acre (7 cdu/ha). Cattle pats counted appeared to be from the previous season. Pellet group data from 2003 estimated 75 deer days use/acre (185 ddu/ha) and only 4 cow days use/acre (10 cdu/ha) which occurred during the previous summer. This area would normally be considered summer range except during mild years when spring and fall use may also occur. With mild conditions several years prior to the 2003 reading, deer pellets in 2003 indicated spring-summer-fall use.

Soils are shallow in places and rocky on the surface and throughout the profile. There is some exposed bedrock. Soil depth is variable, but moderately deep overall with an estimated effective rooting depth of almost 16 inches. Texture is a sandy loam which is moderately acidic (pH 5.8). Soil movement is apparent, causing considerable pedestalling on the uphill side of shrubs and trees. Wildlife and livestock also trail across the slope causing substantial terracing. Ground cover is patchy with abundant rock and pavement cover. The high rock cover tends to accelerate runoff, and herbaceous vegetation cover is not sufficient to hold the soil. The erosion condition class was determined to be slight in 2003.

Browse composition is divided among several species. The taller growth forms include pinyon pine, curlleaf mountain mahogany, and a few mature Gambel oak. Lower growing, more available browse plants include mountain big sagebrush, slenderbush eriogonum, mountain snowberry, young curlleaf mahogany, young Gambel oak, and Utah serviceberry. Curlleaf mountain mahogany provided 35% of the browse cover in 1998 and 22% in 2003. They numbered 580 mostly mature plants/acre in 2003. Most plants are at least partly available to browsing while some are tree-like and unavailable due to height. Overhead canopy cover averaged about 30% in 1998 and 2003. Use of the available cliffrose has been moderate to heavy with the heaviest use reported in 1992. Vigor remains normal and percent decadence low. Seedling and young recruitment has been good during all readings.

The primary understory shrubs include mountain big sagebrush, slenderbush eriogonum, and snowberry. Sagebrush provided 31% of the browse cover in 1998 increasing to 53% in 2003. The sagebrush population has increased steadily with each reading from 1,266 plants/acre in 1982 to 4,660 by 2003. Use has been mostly light, vigor good, and percent decadence low. Age class composition indicates an increasing population. Slenderbush eriogonum and snowberry appear to have stable populations displaying light to moderate use, good vigor, and low decadence. Other preferred shrubs that occur in small numbers include Utah serviceberry, Parry rabbitbrush, and antelope bitterbrush.

The herbaceous understory is moderately abundant, yet provides irregular ground cover. Perennial grasses are diverse with mutton bluegrass and Letterman needlegrass combining to produce 76% of the grass cover in 1998 and 78% in 2003. Blue grama and bottlebrush squirreltail are also fairly abundant.

Forbs are abundant and diverse and produce as much cover as the grasses. However, composition could be better as annuals like littleflower collinsia and false flax (*Microsteris gracilis*) dominate and account for much of the forb cover. The most common perennial forbs include Eaton fleabane, redroot eriogonum, thicketleaf peavine, and desert phlox.

## 1982 APPARENT TREND ASSESSMENT

Soil condition is only fair, but is not obviously deteriorating. Increasing grasses appear to be moving into previously barren areas and may eventually stabilize them. Vegetatively, there is a stable browse component and a vigorous forb understory. Overall vegetative trend appears stable.

## 1992 TREND ASSESSMENT

Since 1982, bare ground has decreased and rock and pavement cover combined have increased. Some slight soil erosion is evident, but it was noted that vegetation and rocks have caused a terracing effect that may hold most of the soil in place. Vegetative cover is still low, but has doubled since 1982. Litter cover has increased slightly. Total forb quadrat frequency decreased with only a few select forbs increasing. Browse composition is good and has increased to a total of 12,125 browse plants/acre from the 6,197 plants/acre present in 1982.

### TREND ASSESSMENT

soil - stable (3)

browse - slightly up (4)

herbaceous understory - slightly up (4)

## 1998 TREND ASSESSMENT

Trend for soil is down slightly. Percent bare ground has increased slightly, while litter cover has declined from 46% to 32%. Pavement and rock cover have increased from 11% in 1982, to 29% in 1992, and 36% currently. This increase would suggest soil movement from the site leaving more rock and pavement exposed. Trend for browse is up slightly. Mountain big sagebrush is increasing, whereas other preferred species appear to have stable to slightly increasing populations. Use is lighter overall than what was reported in 1992, vigor is good, and percent decadence is low. Trend for the herbaceous understory is down slightly. Sum of nested frequency for perennial grasses is slightly down with a significant decline in the nested frequency of mutton bluegrass. Sum of nested frequency for forbs has declined even more, with several forbs abundant in 1992 declining significantly in frequency.

### TREND ASSESSMENT

soil - down slightly (2)

browse - up slightly (4)

herbaceous understory - down slightly (2)

## 2003 TREND ASSESSMENT

Trend for soil is slightly improved. Cover of bare ground has declined slightly while litter cover has increased. In addition, cover of rock and pavement has declined slightly. There is still some localized erosion occurring due to the steep slope, but it is not severe and the erosion condition class was determined to be slight in 2003. Trend for browse is up for the key species, curlleaf mountain mahogany and mountain big sagebrush. Mahogany has increased in density by 28%. It shows moderate to heavy use on available plants but vigor remains good and no decadent plants were sampled. Mountain big sagebrush provides most of the understory shrub cover. It has increased 25% in density to 4,660 plants/acre. Use remains mostly light, vigor good, and percent decadence low. Due to the high elevation, aspect, and importance of this area as fawning habitat, shrubs are not the most important vegetational aspect. The herbaceous understory, especially forbs is much more important for deer in the early spring. The herbaceous understory on this site is fairly abundant but patchy in its distribution. Trend is considered slightly down due to a decline in the sum of nested frequency for perennial grasses and forbs. Average herbaceous cover also declined nearly twofold since 1998. The forb composition is also poor with annuals and low growing perennials providing much of the cover.

TREND ASSESSMENT

soil - up slightly (4)

browse - up (5)

herbaceous understory - down slightly (2)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 35

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron trachycaulum	5	2	-	.18	-
G	Bouteloua gracilis	14	11	10	.83	.04
G	Bromus tectorum (a)	-	8	9	.01	.04
G	Carex spp.	3	-	-	-	-
G	Koeleria cristata	-	4	-	.15	-
G	Poa fendleriana	<sub>b</sub> 217	<sub>a</sub> 152	<sub>a</sub> 118	3.85	2.59
G	Poa pratensis	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 10	.03	.08
G	Poa secunda	<sub>a</sub> -	<sub>b</sub> 34	<sub>a</sub> 8	.45	.04
G	Sitanion hystrix	<sub>b</sub> 89	<sub>b</sub> 76	<sub>a</sub> 37	.71	.28
G	Stipa columbiana	8	9	12	.24	.11
G	Stipa comata	<sub>a</sub> 5	<sub>a</sub> -	<sub>b</sub> 44	-	.45
G	Stipa lettermani	<sub>b</sub> 137	<sub>b</sub> 141	<sub>a</sub> 69	4.42	1.23
Total for Annual Grasses		0	8	9	0.01	0.04
Total for Perennial Grasses		478	429	308	10.88	4.84
Total for Grasses		478	437	317	10.90	4.89
F	Agoseris glauca	<sub>a</sub> -	<sub>b</sub> 18	<sub>b</sub> 28	.06	.19
F	Antennaria rosea	<sub>a</sub> 10	<sub>ab</sub> 14	<sub>b</sub> 25	.60	.49
F	Arabis spp.	9	12	2	.02	.03
F	Astragalus argophyllus	<sub>b</sub> 13	<sub>a</sub> -	<sub>a</sub> -	-	-
F	Aster spp.	-	-	1	-	.00
F	Astragalus spp.	7	2	1	.30	.00
F	Balsamorhiza sagittata	-	3	7	.15	.08
F	Calochortus nuttallii	<sub>a</sub> -	<sub>a</sub> 1	<sub>b</sub> 14	.00	.05
F	Chenopodium fremontii (a)	-	-	2	-	.01
F	Comandra pallida	-	-	2	-	.00
F	Collinsia parviflora (a)	-	<sub>a</sub> 152	<sub>b</sub> 211	2.54	3.04
F	Crepis acuminata	<sub>a</sub> -	<sub>b</sub> 25	<sub>a</sub> 4	.15	.07
F	Delphinium nuttallianum	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 17	-	.07
F	Epilobium brachycarpum (a)	-	8	-	.02	-
F	Erigeron eatonii	<sub>b</sub> 91	<sub>b</sub> 82	<sub>a</sub> 41	1.14	.31

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	<i>Eriogonum racemosum</i>	<sub>b</sub> 70	<sub>a</sub> 19	<sub>a</sub> 13	.10	.16
F	<i>Eriogonum umbellatum</i>	-	4	4	.03	.03
F	<i>Fritillaria atropurpurea</i>	-	-	9	-	.04
F	<i>Galium</i> spp.	-	8	2	.07	.00
F	<i>Hackelia patens</i>	<sub>b</sub> 56	<sub>a</sub> 18	<sub>ab</sub> 36	.37	.54
F	<i>Heuchera parvifolia</i>	2	-	-	-	-
F	<i>Lathyrus brachycalyx</i>	<sub>b</sub> 60	<sub>a</sub> 21	<sub>a</sub> 13	.45	.10
F	<i>Lappula occidentalis</i> (a)	-	<sub>b</sub> 29	<sub>a</sub> -	.41	-
F	<i>Lithophragma tenella</i>	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 25	-	.14
F	<i>Lomatium</i> spp.	<sub>a</sub> -	<sub>a</sub> 4	<sub>b</sub> 32	.01	.35
F	<i>Lupinus argenteus</i>	<sub>b</sub> 23	<sub>b</sub> 19	<sub>a</sub> 5	.55	.21
F	<i>Machaeranthera canescens</i>	<sub>b</sub> 8	<sub>a</sub> -	<sub>a</sub> -	.01	-
F	<i>Microsteris gracilis</i> (a)	-	<sub>b</sub> 95	<sub>a</sub> 1	1.41	.00
F	<i>Pedicularis centranthera</i>	3	-	-	-	-
F	<i>Petroradia pumila</i>	<sub>ab</sub> 9	<sub>b</sub> 18	<sub>a</sub> 4	.71	.02
F	<i>Phlox austromontana</i>	79	63	45	1.04	.71
F	<i>Polygonum douglasii</i> (a)	-	<sub>b</sub> 38	<sub>a</sub> 7	.08	.05
F	<i>Senecio multilobatus</i>	3	-	3	-	.01
F	<i>Silene douglasii</i>	<sub>b</sub> 8	<sub>a</sub> -	<sub>a</sub> -	-	-
F	<i>Taraxacum officinale</i>	14	18	4	.13	.03
F	<i>Zigadenus paniculatus</i>	-	-	-	-	.00
Total for Annual Forbs		0	322	221	4.47	3.10
Total for Perennial Forbs		465	349	337	5.96	3.71
Total for Forbs		465	671	558	10.44	6.82

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

BROWSE TRENDS --

Management unit 30 , Study no: 35

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Abies concolor	2	4	-	.00
B	Amelanchier utahensis	4	1	-	.15
B	Artemisia tridentata vaseyana	75	79	6.40	11.10
B	Cercocarpus ledifolius	18	15	7.19	4.61
B	Chrysothamnus parryi	3	1	-	-
B	Eriogonum microthecum	75	51	4.66	1.89
B	Mahonia repens	2	4	.15	.04
B	Opuntia spp.	11	13	.01	.06
B	Pachistima myrsinites	4	15	.00	.90
B	Pinus edulis	4	2	.15	.38
B	Purshia tridentata	3	0	-	-
B	Quercus gambelii	7	2	.03	.18
B	Symphoricarpos oreophilus	30	25	2.00	1.80
Total for Browse		238	212	20.61	21.14

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 35

Species	Percent Cover	
	'98	'03
Abies concolor	-	.68
Amelanchier utahensis	-	6.73
Artemisia tridentata vaseyana	-	8.69
Cercocarpus ledifolius	30.00	28.79
Eriogonum microthecum	-	1.85
Opuntia spp.	-	.26
Pachistima myrsinites	-	.63
Pinus edulis	1.20	.76
Quercus gambelii	-	.08
Symphoricarpos oreophilus	-	1.39

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 30 , Study no: 35

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.7

POINT-QUARTER TREE DATA --  
Management unit 30 , Study no: 35

Species	Trees per Acre	
	'98	'03
Cercocarpus ledifolius	N/A	117

Average diameter (in)	
'98	'03
N/A	6.5

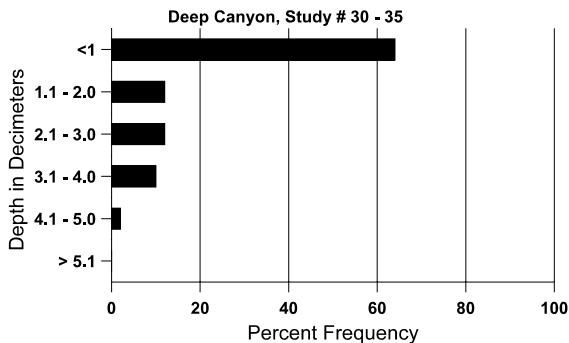
BASIC COVER --  
Management unit 30 , Study no: 35

Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	7.75	36.31	33.45
Rock	12.25	23.92	22.54
Pavement	17.00	11.67	7.75
Litter	46.00	31.70	33.90
Cryptogams	.50	.47	.10
Bare Ground	16.50	20.27	18.53

SOIL ANALYSIS DATA --  
Management unit 30, Study no: 35, Study Name: Deep Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
15.5	54.4 (15.3)	5.8	68.0	17.4	14.6	3.4	12.1	163.2	0.5

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 30 , Study no: 35

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Sheep	1	-	-	-
Rabbit	1	5	-	-
Deer	26	23	40 (99)	75 (185)
Cattle	4	1	2 (5)	4 (11)

BROWSE CHARACTERISTICS --  
 Management unit 30 , Study no: 35

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Abies concolor</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>66</b>	-	66	-	-	-	0	0	-	0	-/-
98	<b>60</b>	-	60	-	-	-	0	0	-	0	-/-
03	<b>80</b>	40	60	20	-	-	0	0	-	0	-/-
<b>Amelanchier utahensis</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>100</b>	-	40	40	20	-	20	20	20	20	26/21
03	<b>20</b>	-	-	20	-	-	0	100	0	0	14/17
<b>Artemisia tridentata vaseyana</b>											
82	<b>1266</b>	-	333	600	333	-	0	0	26	0	19/27
92	<b>2666</b>	1066	1266	1000	400	-	18	3	15	8	20/26
98	<b>3500</b>	780	840	2340	320	220	7	1	9	4	22/30
03	<b>4660</b>	260	1620	2520	520	360	0	0	11	3	16/30
<b>Cercocarpus ledifolius</b>											
82	<b>866</b>	-	200	666	-	-	31	0	0	0	40/42
92	<b>1199</b>	600	333	733	133	-	11	56	11	0	57/35
98	<b>420</b>	200	100	300	20	20	24	10	5	0	102/101
03	<b>580</b>	100	180	400	-	20	14	31	0	0	78/66
<b>Chrysothamnus parryi</b>											
82	<b>66</b>	-	-	66	-	-	0	0	-	0	21/22
92	<b>66</b>	-	66	-	-	-	0	100	-	0	-/-
98	<b>100</b>	-	20	80	-	-	20	0	-	0	6/7
03	<b>100</b>	-	-	100	-	-	0	100	-	0	5/7



		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Eriogonum microthecum</i>											
82	<b>2266</b>	-	-	2266	-	-	9	0	0	0	9/18
92	<b>6198</b>	-	1866	4266	66	-	41	3	1	2	7/8
98	<b>4920</b>	60	660	4240	20	40	16	0	0	0	7/12
03	<b>3560</b>	20	220	3240	100	120	0	0	3	.56	5/10
<i>Gutierrezia sarothrae</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	6/5
<i>Mahonia repens</i>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>180</b>	-	-	180	-	-	0	0	0	0	5/8
03	<b>720</b>	20	160	540	20	-	0	0	3	3	3/3
<i>Opuntia spp.</i>											
82	<b>133</b>	-	-	133	-	-	0	0	0	0	4/5
92	<b>398</b>	-	66	266	66	-	0	0	17	17	7/9
98	<b>220</b>	-	40	160	20	20	0	0	9	9	6/21
03	<b>400</b>	-	-	280	120	-	0	0	30	30	6/15
<i>Pachistima myrsinites</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>120</b>	-	20	100	-	-	0	0	-	0	5/4
03	<b>880</b>	-	-	880	-	-	41	36	-	0	3/8
<i>Pinus edulis</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>80</b>	40	60	20	-	-	0	0	-	0	-/-
03	<b>40</b>	20	20	20	-	-	0	0	-	0	-/-
<i>Purshia tridentata</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>120</b>	-	40	80	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Quercus gambelii</i>											
82	<b>600</b>	-	-	600	-	-	0	100	0	0	12/5
92	<b>133</b>	133	133	-	-	-	0	0	0	0	-/-
98	<b>480</b>	120	360	100	20	20	0	0	4	0	59/61
03	<b>60</b>	820	60	-	-	-	0	0	0	0	16/14
<i>Symphoricarpos oreophilus</i>											
82	<b>1000</b>	-	200	800	-	-	47	0	0	0	22/24
92	<b>1399</b>	400	600	666	133	-	5	38	10	0	20/26
98	<b>1120</b>	180	300	680	140	40	13	0	13	0	13/28
03	<b>1100</b>	100	280	800	20	60	4	13	2	2	13/28

Trend Study 30-38-03

Study site name: Wide Canyon .

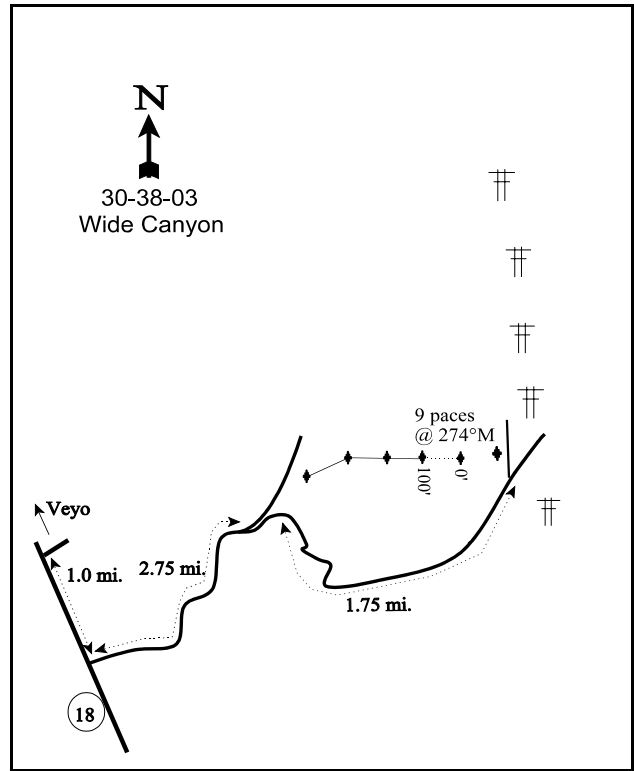
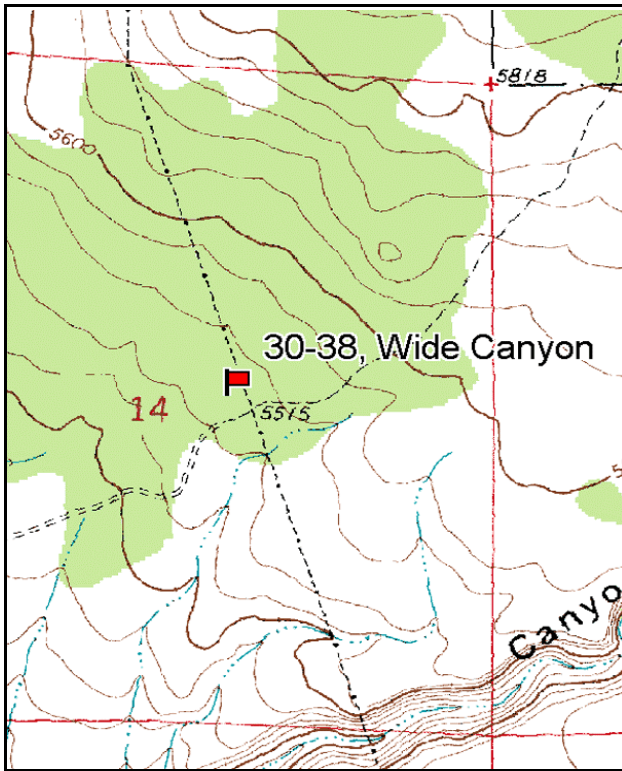
Vegetation type: Mountain Brush .

Compass bearing: frequency baseline 276 degrees magnetic. (Line 4, 228°M)

Frequency belt placement: line 1 (8 & 85ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

From the town of Veyo, proceed south 3.8 miles, at which point a road takes off to the east. Proceed east on this road for approximately 2.75 miles to a fork in the road. Take the right fork for an additional 1.75 miles to the point where the road crosses under power lines. At this point there is a road going north. The witness post is about 100 yards down this road. From the witness post the 0-foot stake is 9 paces at 274 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height. Line 3 is only 90 feet long.



Map Name: Saddle Mountain

Diagrammatic Sketch

Township 40S, Range 16W, Section 14

GPS: NAD 27, UTM 12S 4132034 N, 268401 E

## DISCUSSION

### Wide Canyon - Trend Study No. 30-38

This trend study is located on deer winter range at 5,500 feet on the north side of Wide Canyon. The study site slopes gently (3-5%) to the southwest. Vegetational characteristics of the community are essentially two-tiered. There is a scattered overstory of Utah juniper and large tree-like Stansbury cliffrose underlain by a rather sparse cover of lower growing shrubs and a dense carpet of cheatgrass brome. Perennial grasses and forbs are nearly nonexistent. Deer use, estimated by a nearby DWR pellet group transect, averaged 23 deer days use/acre (57 ddu/ha) between 1982 and 1992, with a high of 39 days use/acre (96 ddu/ha) in 1989-90, and a low of 14 (35 ddu/ha) in 1991-92. Pellet group data taken along the study site baseline in 1998 estimated a much higher level of use at 121 deer days use/acre (299 ddu/ha). A few cattle pats were also encountered. Pellet group data from 2003 estimated 64 deer days use/acre (158 ddu/ha) and 11 cow days use/acre (27 cdu/ha). About one-half of the deer pellet groups appeared to be from winter use and the remainder appeared to be from spring use.

This study is located on the same lava flow on which the Truman Bench study resides, but approximately 3 miles further away and 1,200 feet lower in elevation. On this site, there are still many variable sized basalt rocks littering the ground surface. However, these are interspersed with larger areas occupied by smaller size fragments. Much of this finer material has probably been deposited through sedimentation from above. Effective rooting depth was estimated at almost 17 inches. Soil texture is a clay loam which is slightly acidic (pH 6.5). Soil temperature was high averaging 68°F at an average depth of 14 inches in 2003. This would indicate a relatively dry soil profile when this site was sampled in late May of 2003. Drought conditions have been present in this area for several years, especially during the spring periods (April - June). Total precipitation at Veyo was only 37% of normal for 2002 and the spring period of that year was only 5% of normal. Spring precipitation for 2003 was 87% of normal but this is obviously not enough to recharge the dry soil profile. Erosion is not a problem on this site due to the level terrain, combined with adequate protective ground cover.

The key browse species are mountain big sagebrush and Stansbury cliffrose. Sagebrush density is low on this site producing only 4% cover in 1998 and 3% in 2003. Density increased from 799 plants/acre in 1982 to 1,599 by 1992, and 1,560 by 1998. Reproduction was good in 1992 with excellent seed production. By 1998, recruitment is still adequate but seed production was poor. Drought conditions have caused the population to decline by 53% to 740 plants/acre. More than half (54%) of the remaining population was classified as decadent in 2003. Utilization of sagebrush on this site has been moderate to heavy during most readings. Young plants also declined in 2003 to just 8% of the population.

The cliffrose plants are principally large tree-like forms which are at least partially unavailable because of height. Utilization of the available portion is moderate to heavy. Since there are no dead plants sampled in 1998, the decline in density since 1992 is primarily due to the much larger sample giving more accurate population estimates. This sample better estimates shrub populations which often have aggregated and/or discontinuous populations. Drought has also negatively effected the cliffrose population causing density to decline and decadence to increase in 2003. Seedling and young recruitment was absent. Green ephedra offers some additional forage for wintering big game. It is moderately abundant but has been mostly unutilized.

The most abundant shrub on the site was broom snakeweed prior to 2003. It provided 16% of the browse cover in 1998 with a density of 7,400 plants/acre. Drought conditions have caused a 99% decline in snakeweed density to a mere 60 plants/acre.

Large juniper trees are found throughout the site. They accounted for 40% of the total browse cover in 1998 and 50% in 2003 with a canopy cover value of 17% and 18% respectively. Point-quarter data from 1998 and 2003 estimated 34 juniper trees/acre with an average basal diameter of 11 inches.

The herbaceous understory is very poor and perennial grasses and forbs are quite rare. Cheatgrass brome is very abundant, but was not included in sampling prior to the 1998 reading because it is an annual. During the 1998 reading, cheatgrass produced a cover value of 23% which made up 99% of the total grass cover. A few perennial grasses including galleta, Indian ricegrass, and bottlebrush squirreltail are occasionally found. Forbs combine to produce less than 2% cover. The most common species are annuals.

#### 1982 APPARENT TREND ASSESSMENT

Soil is a limiting factor on this site. Current soil condition is fair to poor and not noticeably improving. Although the rate of erosion is not great, it is probably enough to prevent any immediate improvement. Vegetative trend appears to be declining. The key browse species are rather static with little evidence of reproduction, but also little decadence. However, sagebrush vigor is below optimum. Broom snakeweed and cheatgrass brome are both overly abundant and show few signs of becoming less so.

#### 1992 TREND ASSESSMENT

Vegetative basal cover has remained the same at 1%, which is extremely low. The vegetative cover would undoubtedly be higher if cheatgrass brome were counted. Rock and pavement cover combined have increased slightly from 32% cover to 39%. Litter cover has decreased from 55% to 41%. Overall, soil is not eroding and the changes in cover are slight, indicating a stable soil trend. Grass and forb species are slightly increasing and are not utilized much on this site. Browse density has increased by 24%, due mostly to broom snakeweed and mountain big sagebrush. The increase in mountain big sagebrush is encouraging, but the increase in broom snakeweed should be monitored. Broom snakeweed has the possibility of greatly expanding, depending on the survival rate of the seedlings. Browse trend is slightly up.

##### TREND ASSESSMENT

soil - stable (3)

browse - slightly up (4)

herbaceous understory - stable, but very poor (3)

#### 1998 TREND ASSESSMENT

Trend for soil is stable with similar ground cover characteristics compared to 1992. Trend for browse is down slightly for mountain big sagebrush and stable for cliffrose. However, sagebrush makes up 19% of the browse cover, or more realistically, 80% of the preferred browse cover. Sagebrush remained at a similar density of about 1,560 plants/acre, but nearly that many (1,240 plants/acre) sagebrush are dead. Percent decadence has increased from 8% in 1982, to 19% in 1992, and 29% by 1998. In addition, 61% (280 plants/acre) of the decadent sagebrush were classified as dying (>50% crown death). However, reproduction appears adequate to maintain the current population. Density of cliffrose declined apparently due to the much larger sample used in 1998. Utilization is moderate to heavy on available plants, vigor is normal and there are currently no plants classified as decadent. Another negative aspect of the browse trend is the 47% increase in the density of broom snakeweed from 3,899 to 7,400 plants/acre. Most of the plants are mature (93%) indicating a possibly stable population. Taking these factors into consideration, trend for browse is considered slightly down. Trend for the herbaceous understory is down. Perennial grasses and forbs are lacking and both have declined in sum of nested frequency since 1992. The herbaceous understory is totally dominated by cheatgrass which has a cover value of 23%. It actually accounts for 99% of the grass cover and 93% of the total herbaceous cover.

##### TREND ASSESSMENT

soil - stable (3)

browse - down slightly (2)

herbaceous understory - down (1)

2003 TREND ASSESSMENT

Trend for soil is essentially stable. Ground cover characteristics have changed slightly but there is still sufficient protective ground cover to prevent most erosion. Trend for browse is down. The key browse species, mountain big sagebrush, has declined 53% in density. The number of plants displaying poor vigor also increased from 18% in 1998 to 35% in 2003. In addition, 60% of the decadent plants sampled (240 plants/acre) were classified as dying (>50% crown death). No seedlings were encountered and young plants were rare. Cliffrose has also declined in density and increased in poor vigor and decadence. Utilization has remained similar between readings, providing evidence that this trend is drought related. One positive aspect of the browse trend also brought on by drought, is the 99% decline in density of broom snakeweed (7,400 plants/acre to 60). The herbaceous understory is still very poor and totally dominated by cheatgrass and annual forbs. Drought conditions did cause a significant decline in the nested frequency of cheatgrass while reducing its cover from 23% to 13%. Only one perennial grass, galleta, was encountered on the site in 2003, and it occurred in only 2 quadrats. The forb composition is still very poor and dominated by annuals. The 13 species found in 2003 produced less than 2% total cover. The most common species were annuals, storksbill and wooly plantain. Trend for the herbaceous understory is down slightly and very poor.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - down slightly (2)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 38

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron spp.	9	-	-	-	-
G	Bromus tectorum (a)	-	<sub>b</sub> 348	<sub>a</sub> 306	23.06	12.98
G	Hilaria jamesii	-	3	7	.06	.03
G	Oryzopsis hymenoides	-	2	-	.00	-
G	Poa fendleriana	<sub>b</sub> 13	<sub>a</sub> -	<sub>a</sub> -	-	-
G	Poa secunda	<sub>b</sub> 22	<sub>a</sub> -	<sub>a</sub> -	-	-
G	Sitanion hystrix	<sub>b</sub> 12	<sub>b</sub> 14	<sub>a</sub> -	.11	-
G	Vulpia octoflora (a)	-	<sub>b</sub> 17	<sub>a</sub> 11	.09	.05
Total for Annual Grasses		0	365	317	23.15	13.04
Total for Perennial Grasses		56	19	7	0.18	0.03
Total for Grasses		56	384	324	23.34	13.07
F	Agoseris glauca	3	-	3	-	.04
F	Alyssum alyssoides (a)	-	2	-	.00	-
F	Calochortus nuttallii	<sub>a</sub> 9	<sub>a</sub> 9	<sub>b</sub> 31	.05	.11
F	Cymopterus spp.	-	-	1	-	.03
F	Descurainia pinnata (a)	-	-	2	-	.01
F	Draba spp. (a)	-	<sub>b</sub> 28	<sub>a</sub> 4	.16	.01

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	<i>Erodium cicutarium</i> (a)	-	38	38	.39	.82
F	<i>Gilia</i> spp. (a)	-	a-	b <sup>22</sup>	-	.11
F	<i>Lappula occidentalis</i> (a)	-	a-	b <sup>32</sup>	-	.15
F	<i>Lupinus argenteus</i>	-	2	-	.04	-
F	<i>Microsteris gracilis</i> (a)	-	b <sup>65</sup>	a <sup>4</sup>	.30	.01
F	<i>Navarretia intertexta</i> (a)	-	-	-	-	.00
F	<i>Plantago patagonica</i> (a)	-	30	27	.47	.32
F	<i>Sphaeralcea grossulariaefolia</i>	8	-	-	-	-
F	<i>Thysanocarpus curvipes</i>	-	2	-	.03	-
F	Unknown forb-annual (a)	-	2	6	.03	.04
F	<i>Viguiera multiflora</i>	-	-	3	-	.03
Total for Annual Forbs		0	165	135	1.37	1.48
Total for Perennial Forbs		20	13	38	0.12	0.21
Total for Forbs		20	178	173	1.50	1.69

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 38

T y p e	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	<i>Artemisia tridentata vaseyana</i>	42	28	4.34	2.58
B	<i>Cowania mexicana stansburiana</i>	6	4	1.17	.93
B	<i>Ephedra viridis</i>	21	23	4.46	4.88
B	<i>Gutierrezia sarothrae</i>	76	3	3.73	.06
B	<i>Juniperus osteosperma</i>	5	4	9.19	9.00
B	<i>Prunus fasciculata</i>	1	1	.15	.63
B	<i>Yucca baccata</i>	1	0	-	-
Total for Browse		152	63	23.05	18.08

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 38

Species	Percent Cover	
	'98	'03
Artemisia tridentata vaseyana	-	2.18
Cowania mexicana stansburiana	-	2.61
Ephedra viridis	-	6.55
Gutierrezia sarothrae	-	.01
Juniperus osteosperma	16.79	18.13
Prunus fasciculata	-	.36

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 38

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	2.7

POINT-QUARTER TREE DATA --

Management unit 30 , Study no: 38

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	34	34

Average diameter (in)	
'98	'03
12.4	10.2

BASIC COVER --

Management unit 30 , Study no: 38

Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	.75	45.48	32.25
Rock	28.25	23.15	23.25
Pavement	10.75	6.17	3.37
Litter	41.00	44.79	43.21
Cryptogams	4.00	1.56	.17
Bare Ground	15.25	14.72	14.47

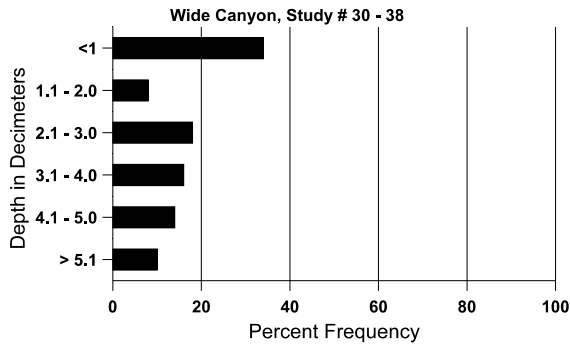
SOIL ANALYSIS DATA --

Management unit 30, Study no: 38, Study Name: Wide Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	% OM	PPM P	PPM K	ds/m
16.6	68.0 (14.1)	6.5	40.0	33.4	26.6	1.4	11.1	150.4	0.6



# Stoniness Index



## PELLET GROUP DATA --

Management unit 30 , Study no: 38

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	12	24	-	-
Cattle	-	-	2 (5)	11 (27)
Deer	45	32	121 (299)	64 (157)

## BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 38

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata vaseyana</b>											
82	<b>799</b>	-	33	700	66	-	21	13	8	8	22/26
92	<b>1599</b>	300	733	566	300	-	69	13	19	6	19/23
98	<b>1560</b>	60	340	760	460	1240	23	3	29	18	17/24
03	<b>740</b>	-	60	280	400	1540	14	16	54	35	15/21
<b>Cowania mexicana stansburiana</b>											
82	<b>466</b>	-	-	466	-	-	57	14	0	0	32/31
92	<b>466</b>	133	200	100	166	-	21	29	36	7	33/29
98	<b>120</b>	100	20	100	-	-	33	33	0	0	85/85
03	<b>80</b>	-	-	40	40	-	50	25	50	0	82/82
<b>Ephedra viridis</b>											
82	<b>200</b>	-	-	200	-	-	0	0	0	0	24/26
92	<b>300</b>	-	100	200	-	-	33	0	0	0	24/36
98	<b>480</b>	-	20	440	20	20	13	8	4	4	34/40
03	<b>500</b>	-	40	400	60	20	4	0	12	4	33/44

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Gutierrezia sarothrae</i>											
82	<b>3265</b>	-	266	2833	166	-	0	0	5	5	8/9
92	<b>3899</b>	30033	466	3400	33	-	0	0	1	3	13/12
98	<b>7400</b>	280	260	6880	260	280	0	0	4	2	8/10
03	<b>60</b>	-	-	60	-	340	0	0	0	0	14/18
<i>Juniperus osteosperma</i>											
82	<b>33</b>	-	33	-	-	-	0	0	-	0	-/-
92	<b>33</b>	66	33	-	-	-	0	0	-	0	-/-
98	<b>140</b>	-	40	100	-	-	0	0	-	0	-/-
03	<b>100</b>	-	20	80	-	-	0	0	-	0	-/-
<i>Prunus fasciculata</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	25/59
03	<b>20</b>	-	-	20	-	-	0	0	-	0	31/65
<i>Yucca baccata</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	33/45
03	<b>0</b>	-	-	-	-	-	0	0	-	0	37/56

Trend Study 30-40-03

Study site name: Telegraph Draw .

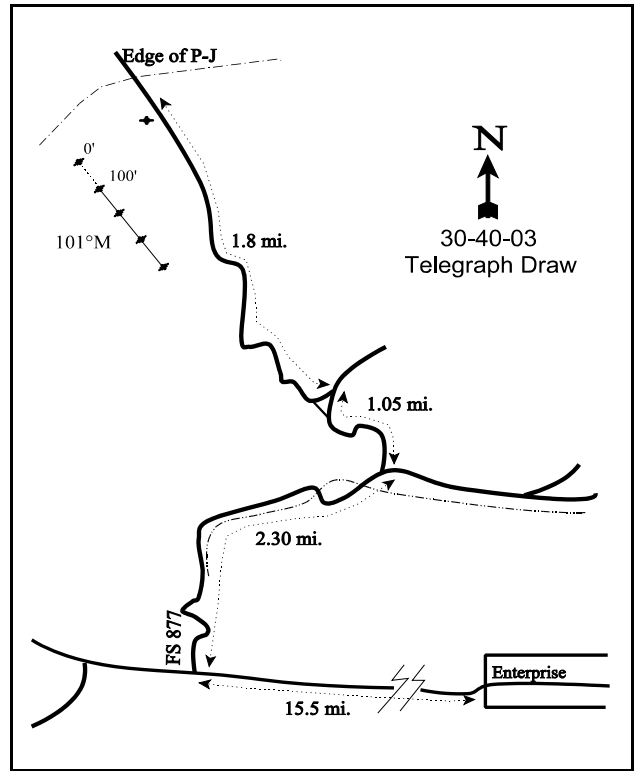
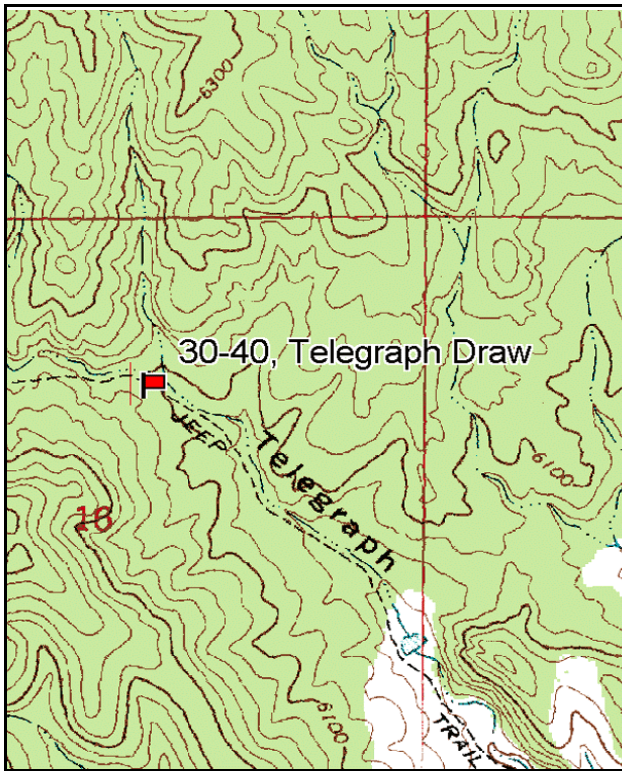
Vegetation type: Chained, seeded P-J .

Compass bearing: frequency baseline 101 degrees magnetic.

Frequency belt placement: line 1 (14 & 81ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). No rebar.

LOCATION DESCRIPTION

From Center and Main in Enterprise, go west on the Shoal Creek road for 15.5 miles then turn right (north). Clover Valley road is 0.1 miles too far. Stay on the main road heading north for approximately 2.3 miles. At this point, there will be a fork in the road. Go to the left (north) on F.S. road 1014 for approximately 1.05 miles to a triangle of roads at the top of the ridge. Stay to the left on the road that goes down into the draw for 1.8 miles, at which point the road enters pinyon-juniper. Just as you come to the pinyon-juniper, stop at the witness post on the left side of the road. The 0-foot baseline stake is located 49 paces from the witness post at 139 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height. The 0-foot stake is marked by browse tag #287.



Map Name: Mount Escalante

Diagrammatic Sketch

Township 36S, Range 19W, Section 16

GPS: NAD 27, UTM 12S 4171910 N, 236961 E

## DISCUSSION

### Telegraph Draw - Trend Study No. 30-40

This trend study is located on winter range in Telegraph Draw. The area has been chained and seeded, although the long range success of the seeded species has been minimal and pinyon and juniper trees are still abundant. The site has an elevation of approximately 6,080 feet and a 10% slope and southeast aspect. Vegetative cover on the study site is considerably improved over the surrounding pinyon-juniper woodland, but is still rather sparse and variably dispersed. The overall vegetative appearance is Wyoming big sagebrush interspersed with young pinyon and juniper trees. Deer use is primarily during the winter, however fresh pellet groups were observed during the summer of 1992. In addition, wild horses and stud piles were observed nearby, and fresh unshod pony tracks were encountered on the study site in 1992. This study is located in an area of the USFS Terryshoal Creek allotment that receives no use by livestock and is set aside for wild horses and burros. Use by either deer or horses appears light. Pellet group data from the site in 1998 estimated only 14 deer days use/acre (35 ddu/ha). Use by wild horses was estimated at 14 days use/acre (36 hdu/ha). Several wild horses were also seen near the site during the 1998 reading on May 29<sup>th</sup>. Pellet group data from the 2003 reading estimated only 4 deer days use/acre (10 ddu/ha) and 9 horse days use/acre (23 hdu/ha).

Soil is relatively deep and rocky with an effective rooting depth of 17 inches. Soil parent material is granite and rocks are common on the surface. Texture is a sandy clay which is moderately acidic (pH 5.6). The soil is sandy on the surface with a compacted clay layer encountered at a depth of 4 inches. This granitic soil is very low in phosphorus with a value of only 3.8 ppm. Values less than 10 ppm may limit normal plant growth and development. This may be the reason for the poor herbaceous growth on this site while trees are quickly returning to dominance. Some surface erosion has taken place, whereas active erosion has been greatly reduced from what occurs on untreated areas. Pinyon and juniper litter from downed and broken up trees is dispersed throughout the site. The association of litter and with the increased vegetation has tended to stabilize the site.

The key browse is Wyoming big sagebrush which has hybridized with black sagebrush in some areas. All sagebrush has been classified as Wyoming big sagebrush. Population density was estimated at 6,166 plants/acre in 1982 when the site was established. The stand is dynamic with abundant seedling and young recruitment causing major fluctuations in density over the years. Data from 2003 estimate a population of 6,740 plants/acre. Utilization has been mostly light during all readings, vigor good on most plants, and percent decadence low.

Other preferred browse include a small population of antelope bitterbrush. Presumably, the bitterbrush were seeded after the chaining. These plants have shown moderate to heavy use, good vigor, and low decadence since 1982. The average mature plant measures just over 3 feet in height with a crown diameter of more than 4 feet. Young recruitment has steadily improved and the population has steadily increased in density since study site establishment.

Increaser shrubs, including two species of rabbitbrush and broom snakeweed, appeared to be increasing on the site. However, drought conditions have caused major declines in their respective population densities. Pinyon and juniper trees have increased in density and stature. Point-quarter data from 1998 estimated 160 singleleaf pinyon and 56 juniper trees/acre. Average basal diameter was 2.5 inches for pinyon and 3.6 inches for juniper. Point-quarter data from 2003 is similar but shrub density strip data, which more effectively samples young and seedling trees, shows a 36% increase in juniper density (140 to 220 trees/acre) and a 5% increase in density of pinyon (380 to 400 trees/acre). About 40% of the trees were in the 8 to 12 foot height class. Average cover for juniper has doubled since 1998 (2% to 4%) and total line-intercept cover was estimated at 7% for juniper and 8% for pinyon in 2003.

The herbaceous understory is poor. Grasses are fairly diverse, yet they only produced 5% cover in 1998 and less than 1% in 2003. Cheatgrass provided 52% of the grass cover in 1998 and 39% in 2003. The only fairly common perennial grasses include crested wheatgrass, Indian ricegrass, mutton bluegrass, and bottlebrush squirreltail. Forbs outnumber grasses in abundance and species diversity. The principal species are desert phlox and rock goldenrod. Hooker balsamroot, bastard toadflax, and sulfur eriogonum are also fairly abundant. No seeded forbs were encountered or observed.

#### 1982 APPARENT TREND ASSESSMENT

Overall, trend appears to be improving. Considerable soil surface is exposed and potentially erodible, but much less so than in the surrounding pinyon-juniper woodland. However, further stabilization is likely to be slow because of the amount of rock and pavement and the relatively poor grass cover. Vegetational trend also appears to be improving, particularly with respect to the key species. Actual or potential deficiencies include a sparse grass density, lack of seeded forbs, scarcity of more preferred shrubs, and the abundance of young pinyon and juniper trees.

#### 1992 TREND ASSESSMENT

The soil trend appears to have improved since 1982. Basal vegetative cover has doubled since the last reading, although bare ground has decreased by 63% (27% to 10%). However, combined rock and pavement cover have also doubled, indicating past surface erosion. Litter has remained stable. Total protective ground cover has increased from 73% to 90%. The trend for browse is also up. The key browse species, Wyoming big sagebrush, has nearly doubled in density and have improved vigor. The herbaceous trend is stable. Grasses have increased slightly in quadrat frequency and forbs have remained stable. Forbs are abundant and diverse but consist of poor forage species. No seeded forbs were encountered.

##### TREND ASSESSMENT

soil - up (5)

browse - up (5)

herbaceous understory - stable (3)

#### 1998 TREND ASSESSMENT

Trend for soil is down slightly, due to an increase in percent bare ground from 10% to 20%, and a decline in litter cover from 58% to 51%. Trend for browse stable. Wyoming big sagebrush shows a major decline in density from 11,830 plants/acre to 4,560. Whereas, due to the lack of dead plants, it appears that the change is due mostly to the much larger sample used in 1998. Utilization, vigor, and percent decadence are similar to 1992 levels. Reproduction is also excellent with abundant seedlings and young. Bitterbrush is increasing. It has moderate use, good vigor, and low decadence. Trend for the herbaceous understory is stable. Sum of nested frequency for perennial grasses and forbs has remained similar to 1992 levels. Composition is poor with cheatgrass providing 52% of the grass cover, and rock goldenrod and desert phlox providing 51% of the forb cover.

##### TREND ASSESSMENT

soil - down slightly (2)

browse - stable (3)

herbaceous understory - stable, but poor (3)

2003 TREND ASSESSMENT

Trend for soil is stable with similar ground cover characteristics compared to 1998 estimates. There is little erosion occurring and the soil erosion condition class was determined to be stable in 2003. Trend for the key browse species, Wyoming big sagebrush and antelope bitterbrush is up. Both species have increased in density, 36% for sagebrush and 28% for bitterbrush. Sagebrush is mostly unutilized, in good vigor, and percent decadence is low at 15%. Young recruitment remains excellent indicating a dynamic and expanding population. Bitterbrush shows some moderate and heavy use yet good vigor and excellent young recruitment. Drought conditions have caused an increase in decadence from 6% of the population to 23%, but this is still relatively low. The only down side to the browse trend is the continued increase in density and cover of pinyon and juniper trees which are slowly regaining their dominance of this old chaining. Current line-intercept canopy cover is estimated at 7% for juniper and 8% for pinyon. Trend for the herbaceous understory is down. Sum of nested frequency for both perennial grasses and forbs has declined. Most perennial grasses have declined significantly in nested frequency and average cover has declined 77%. The only positive change in the grass composition is the significant decline in nested frequency of the annual, cheatgrass. The forb composition is diverse whereas only toadflax, rock goldenrod, and desert phlox are fairly common. Twenty four species of forbs were sampled in 1998 and only 18 in 2003.

TREND ASSESSMENT

soil - stable (3)

browse - up (5)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 40

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron cristatum	12	12	17	.11	.25
G	Bromus tectorum (a)	-	<sub>b</sub> 163	<sub>a</sub> 82	2.52	.35
G	Elymus junceus	9	-	-	-	-
G	Hilaria jamesii	-	4	-	.03	-
G	Koeleria cristata	3	-	-	-	-
G	Oryzopsis hymenoides	<sub>a</sub> 5	<sub>b</sub> 50	<sub>a</sub> 16	1.05	.06
G	Poa fendleriana	<sub>a</sub> 2	<sub>b</sub> 30	<sub>a</sub> 6	.47	.04
G	Poa secunda	-	2	-	.00	-
G	Sitanion hystrix	<sub>c</sub> 65	<sub>b</sub> 43	<sub>a</sub> 5	.57	.02
G	Stipa comata	3	-	-	-	-
G	Stipa coronata depauperata	<sub>b</sub> 45	<sub>a</sub> 5	<sub>a</sub> -	.06	-
G	Stipa lettermani	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 24	-	.16
Total for Annual Grasses		0	163	82	2.52	0.35
Total for Perennial Grasses		144	146	68	2.30	0.54
Total for Grasses		144	309	150	4.83	0.89

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	<i>Alyssum alyssoides</i> (a)	-	1	-	.00	-
F	<i>Allium</i> spp.	-	1	-	.00	-
F	<i>Antennaria rosea</i>	-	-	2	-	.00
F	<i>Astragalus</i> spp.	1	2	-	.03	-
F	<i>Balsamorhiza hookeri</i>	<sub>a</sub> 1	<sub>b</sub> 23	<sub>b</sub> 18	.57	.72
F	<i>Chaenactis douglasii</i>	<sub>a</sub> 5	<sub>b</sub> 20	<sub>a</sub> -	.09	-
F	<i>Comandra pallida</i>	<sub>a</sub> 9	<sub>a</sub> 30	<sub>b</sub> 55	.24	.45
F	<i>Collinsia parviflora</i> (a)	-	6	22	.02	.04
F	<i>Crepis acuminata</i>	2	-	1	-	.09
F	<i>Dalea searlsiae</i>	<sub>b</sub> 12	<sub>a</sub> -	<sub>a</sub> -	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	2	-	.00
F	<i>Eriogonum cernuum</i> (a)	-	5	-	.06	-
F	<i>Erigeron</i> spp.	-	3	-	.03	-
F	<i>Eriogonum</i> spp.	-	7	-	.16	-
F	<i>Eriogonum racemosum</i>	8	9	-	.10	-
F	<i>Eriogonum shockleyi</i>	1	-	5	-	.15
F	<i>Eriogonum umbellatum</i>	<sub>a</sub> 34	<sub>b</sub> 39	<sub>a</sub> 19	.29	.16
F	<i>Gilia</i> spp. (a)	-	6	-	.04	-
F	<i>Hymenopappus filifolius</i>	1	-	-	-	-
F	<i>Ipomopsis aggregata</i>	1	-	-	-	-
F	<i>Lappula occidentalis</i> (a)	-	12	14	.05	.03
F	<i>Lomatium</i> spp.	<sub>a</sub> -	<sub>a</sub> 4	<sub>b</sub> 13	.04	.03
F	<i>Lotus utahensis</i>	<sub>b</sub> 8	<sub>ab</sub> 3	<sub>a</sub> -	.03	-
F	<i>Lupinus argenteus</i>	<sub>b</sub> 17	<sub>ab</sub> 4	<sub>a</sub> 2	.06	.00
F	<i>Machaeranthera canescens</i>	5	-	-	-	-
F	<i>Microsteris gracilis</i> (a)	-	<sub>b</sub> 80	<sub>a</sub> 6	.20	.01
F	<i>Orobanche fasciculata</i>	-	-	1	-	.00
F	<i>Penstemon caespitosus</i>	<sub>b</sub> 45	<sub>a</sub> -	<sub>a</sub> -	-	-
F	<i>Penstemon</i> spp.	8	7	-	.07	-
F	<i>Petrorhiza pumila</i>	55	52	37	1.41	.74
F	<i>Phlox austromontana</i>	<sub>ab</sub> 63	<sub>b</sub> 76	<sub>a</sub> 34	1.62	.38
F	<i>Phlox longifolia</i>	14	6	7	.03	.04
F	<i>Polygonum douglasii</i> (a)	-	-	1	-	.00
F	<i>Senecio multilobatus</i>	9	-	-	-	-
F	<i>Sphaeralcea grossulariaefolia</i>	1	-	-	-	-
F	<i>Streptanthus cordatus</i>	<sub>a</sub> -	<sub>b</sub> 30	<sub>a</sub> -	.64	-

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	Trifolium spp.	<sub>b</sub> 22	<sub>a</sub> 12	<sub>a</sub> 13	.06	.05
Total for Annual Forbs		0	110	45	0.38	0.09
Total for Perennial Forbs		322	328	207	5.52	2.87
Total for Forbs		322	438	252	5.91	2.97

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 40

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia tridentata wyomingensis	80	82	14.61	21.35
B	Ceanothus greggii	0	1	-	.03
B	Chrysothamnus depressus	33	8	.44	.21
B	Chrysothamnus viscidiflorus	29	12	1.47	.57
B	Gutierrezia sarothrae	20	17	.17	.28
B	Juniperus osteosperma	7	10	2.04	4.28
B	Opuntia spp.	0	1	-	-
B	Pinus monophylla	18	15	5.69	4.85
B	Polygala subspinoso subspinoso	0	6	-	.01
B	Purshia tridentata	26	28	3.97	6.86
Total for Browse		213	180	28.41	38.46

#### CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 40

Species	Percent Cover	
	'98	'03
Artemisia tridentata wyomingensis	-	16.96
Ceanothus greggii	-	.03
Chrysothamnus depressus	-	.11
Chrysothamnus viscidiflorus	-	.35
Gutierrezia sarothrae	-	.10
Juniperus osteosperma	1.00	7.05
Pinus monophylla	-	7.76
Purshia tridentata	-	7.18



KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 30 , Study no: 40

Species	Average leader growth (in)
	'03
Artemisia tridentata wyomingensis	1.0
Purshia tridentata	0.6

POINT-QUARTER TREE DATA --  
Management unit 30 , Study no: 40

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	56	59
Pinus monophylla	161	122

Average diameter (in)	
'98	'03
3.6	6.4
2.5	3.3

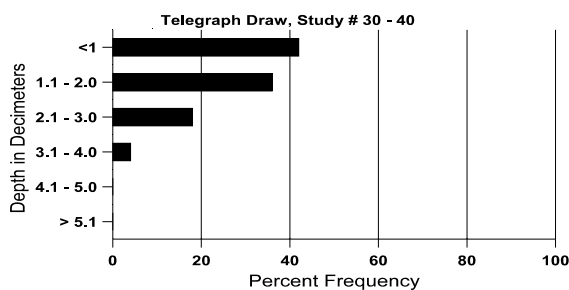
BASIC COVER --  
Management unit 30 , Study no: 40

Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	4.25	39.52	39.01
Rock	6.00	10.70	8.96
Pavement	22.25	13.13	8.37
Litter	58.00	51.14	44.97
Cryptogams	0	.17	.07
Bare Ground	9.50	20.32	17.92

SOIL ANALYSIS DATA --  
Management unit 30, Study no: 40, Study Name: Telegraph Draw

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
16.9	61.2 (14.7)	5.6	46.0	17.4	36.6	2.4	3.8	310.4	0.4

Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 40

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	8	2	-	-
Horse	3	4	16 (40)	9 (23)
Deer	9	3	21 (52)	4 (10)

BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 40

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>											
82	<b>6166</b>	466	3300	2866	-	-	6	2	0	0	16/18
92	<b>11833</b>	833	4700	6533	600	-	17	2	5	5	13/15
98	<b>4560</b>	1260	1120	3280	160	20	29	1	4	1	19/29
03	<b>6740</b>	40	1200	4560	980	180	0	0	15	5	20/27
<i>Ceanothus greggii</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	100	-	0	5/12
<i>Chrysothamnus depressus</i>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>2300</b>	220	640	1600	60	-	0	0	3	3	4/6
03	<b>280</b>	20	20	240	20	-	7	14	7	0	4/6
<i>Chrysothamnus nauseosus</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	5/8
<i>Chrysothamnus viscidiflorus</i>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>133</b>	-	100	-	33	-	0	0	25	25	-/-
98	<b>1360</b>	-	260	1040	60	-	0	0	4	1	11/16
03	<b>520</b>	-	80	340	100	20	0	4	19	12	13/18

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Gutierrezia sarothrae</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>66</b>	-	33	33	-	-	0	0	0	0	6/4
98	<b>1420</b>	580	300	1100	20	20	0	0	1	1	6/10
03	<b>720</b>	-	100	620	-	120	0	0	0	0	5/6
<b>Juniperus osteosperma</b>											
82	<b>166</b>	-	-	166	-	-	0	0	-	0	39/26
92	<b>99</b>	-	66	33	-	-	0	0	-	0	81/54
98	<b>140</b>	-	40	100	-	20	0	0	-	0	-/-
03	<b>220</b>	-	80	140	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	100	-	0	7/16
<b>Pinus monophylla</b>											
82	<b>166</b>	-	-	166	-	-	0	0	0	0	32/31
92	<b>332</b>	33	266	33	33	-	10	0	10	10	110/74
98	<b>380</b>	60	240	140	-	20	0	0	0	0	-/-
03	<b>400</b>	40	260	120	20	20	0	0	5	5	-/-
<b>Polygala subspinosa subspinosa</b>											
82	<b>66</b>	-	-	66	-	-	0	0	-	0	5/8
92	<b>266</b>	-	33	233	-	-	0	0	-	0	3/4
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>140</b>	-	20	120	-	-	0	0	-	0	3/3
<b>Purshia tridentata</b>											
82	<b>200</b>	-	-	200	-	-	50	17	0	0	26/31
92	<b>332</b>	66	33	233	66	-	10	20	20	0	34/43
98	<b>620</b>	240	140	440	40	20	48	16	6	0	34/49
03	<b>860</b>	20	220	440	200	-	12	5	23	5	38/53
<b>Ribes spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	40/65

Trend Study 30-41-03

Study site name: Joe Spring .

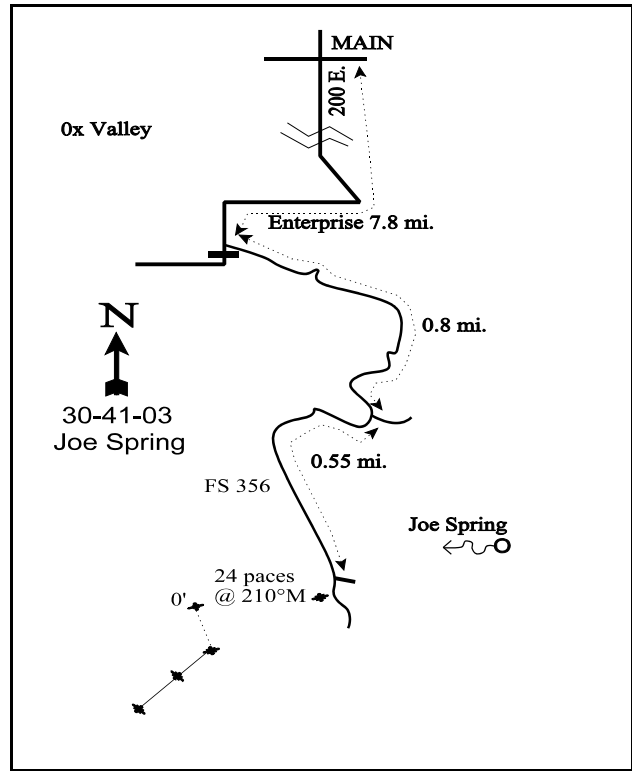
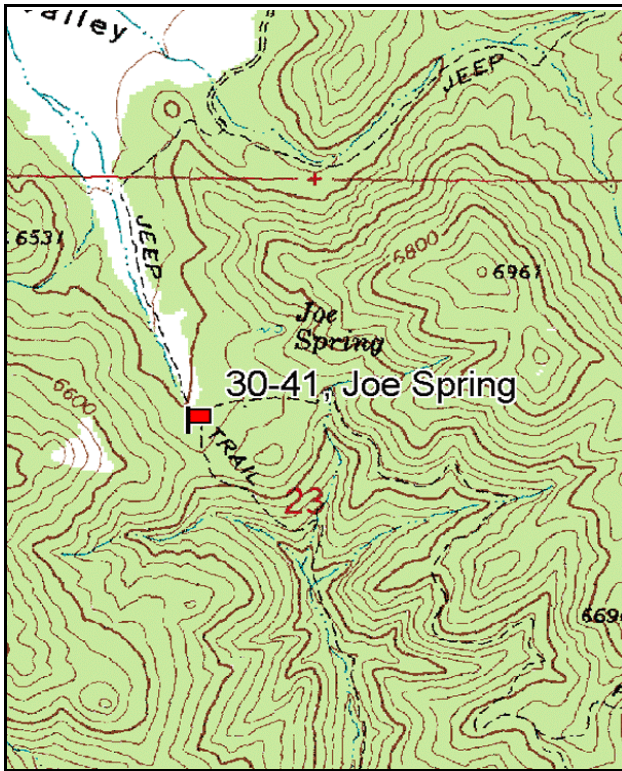
Vegetation type: Mountain Brush .

Compass bearing: frequency baseline 152 degrees magnetic. (Lines 2 & 3, 231°M)

Frequency belt placement: line 1 (1 & 93ft), line 2 (71ft), line 3 (34 & 59ft).

LOCATION DESCRIPTION

From 200 East and Main in Enterprise, travel southwest 7.8 miles to Ox Valley. Take a left at the ranch gate and continue east and south 0.8 miles to the next fork. Turn right on FS road 356 and travel 0.55 miles to the next fork at Joe Spring. From the intersection walk up the right fork 32 paces to a full-high marker post on the right side of the road. The 0-foot baseline is 24 paces at 210 degrees magnetic and is marked by browse tag #7015. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height.



Map Name: Central West

Diagrammatic Sketch

Township 38S, Range 17W, Section 23

GPS: NAD 27, UTM 12S 4150194 N, 258751 E

## DISCUSSION

### Joe Spring - Trend Study No. 30-41

This trend study is located on deer transitional/summer range on the south end of Ox Valley. Elevation at the site is approximately 6,400 feet with a 15% slope and east aspect. The range type is mixed mountain brush. The entire area surrounding Ox Valley receives heavy deer and cattle use. During study site establishment in 1982, cattle were in the area and several does with fawns were also observed. Pellet group data taken on the site in 1998 estimated 58 deer and 10 cow days use/acre (143 ddu/ha and 25 cdu/ha). Pellet group data from 2003 estimated 32 deer days use/acre (79 ddu/ha). No cattle had been on the site by the June 5<sup>th</sup> reading data but about 5 cow days use/acre was estimated from the previous summer. There is a water source and salt lick within ½ mile of the site. Mormon crickets were abundant in 2003.

Soils are coarse textured and rocky, but deep. Parent material is granite. Effective rooting depth is estimated at 18 inches. Texture is a sandy loam which is moderately acidic (pH 5.7). Ground cover from vegetation and litter is unevenly distributed, yet is an effective barrier to soil movement. Bare ground, which accounts for about 20% of the ground surface, is largely the result of livestock trailing and some deer trails which terrace the slope. There is some limited erosion occurring and the erosion condition class was determined to be slight in 2003.

Browse composition is diverse and overall productivity is high. The principal species include mountain big sagebrush, true mountain mahogany, Gambel oak, Utah serviceberry, mountain snowberry, and a few less desirable shrubs. Utah serviceberry decreased in density between 1982 and 1992. Percent decadence also increased and the proportion of individuals heavily hedged went up (33% to 43%). Gambel oak increased in density 43% between 1982 and 1992. During the 1998 reading, the study site baseline was extended from the original 100 ft to 300 ft in order to get a better sample. The original 3 circular shrub density plots were replaced with 5, 1/100<sup>th</sup> acre density strips. This much larger sample better estimates shrub densities which are very clumped on the Joe Spring site. As a result, density of many of the shrub species changed. Utah serviceberry density increased from 466 plants/acre estimated in 1992 to 4,640 in 1998. Due to the thick nature of the serviceberry on the site, individual stems were counted since individual plants were hard to distinguish. Serviceberry currently ('03) accounts for 24% of the browse cover. Utilization is moderate to heavy where available, vigor remains good, and percent decadence low.

Mountain big sagebrush has a moderate density which has remained similar since 1998 at around 2,000 plants/acre. It has displayed mostly light to moderate use during all readings and normal vigor on most plants. The number of decadent plants in the population remained low between 1982 and 1998, although it has risen to a moderate level of 30% in 2003. Reproduction was good in previous years, but no seedlings or young were encountered in 2003.

True mountain mahogany is very clumped in its distribution and it appears that past samples overestimated mahogany density. Density was estimated at 1,732 plants/acre in 1982 and 1,132 in 1992. These plants displayed heavy use with reduced vigor. Density counts from 1998 estimate only 20 mature plants/acre, all of which displayed heavy use. There were no dead plants sampled, so it appears that the change in sample size is the reason for the decline in density. No mahogany was sampled within the shrub density strips in 2003, but some plants were measured for height and crown.

A relatively stable population of Gambel oak provides about one-third of the total browse cover. Vigor was reduced in 29% of the plants sampled in 1998. This was due to the late frosts from the spring of that year but average vigor was normal in 2003.

Grasses, although fairly diverse, are not very abundant. Eight perennial grass species were encountered in 1998 and 7 species in 2003. Mutton bluegrass, bottlebrush squirreltail, and prairie junegrass are fairly

abundant. Cheatgrass brome was present in 1992 and it appeared to have increased significantly since the first reading in 1982. It was reported to dominate the understory in 1992, however annuals were not included in the previous surveys. In 1998, cheatgrass dominated the herbaceous understory by providing 68% of the total grass cover and 30% of the total herbaceous cover. Its dominance expanded in 2003, increasing to 82% of the total grass cover.

Forbs are a key vegetative element for transitional and summer range. They are fairly diverse and abundant, yet probably still below optimum for this type of site. The more important forbs include lupine, arrowleaf balsamroot, and redroot eriogonum. Overall, utilization of forbs is moderate with slightly heavier use on lupine, redroot eriogonum, and American vetch. The annual forb, littleflower collinsia, is very abundant and was growing in thick patches in 1998. It provided 28% of the forb cover in 1998 but only 9% in 2003. The native perennial forbs, desert phlox and American vetch, are the most abundant species, producing 28% of the forb cover in 1998 and 24% in 2003.

### 1982 APPARENT TREND ASSESSMENT

Overall range trend appears stable, even though utilization of the preferred browse species is relatively heavy. The rate of erosion is greater than it should be, although it is not currently a serious problem. Understory composition and density are fair and could be better.

### 1992 TREND ASSESSMENT

The soil trend has improved since 1982. Basal vegetative cover has more than doubled, whereas bare ground has decreased 30%. The browse trend is down due to significant decreases in density and increases in percent decadence of the two preferred browse species. Utah serviceberry decreased in density by 71% while the proportion of decadent and heavily hedged plants increased. Mountain mahogany saw a 35% decrease in its density, and an increase in percent decadence from 15% to 41%. Quadrat frequency of perennial grasses remained basically unchanged. Cheatgrass brome appears to have increased. It was not included in the analysis because it is an annual. Quadrat frequency of forbs increased slightly. Trend for herbaceous understory is stable.

#### TREND ASSESSMENT

soil - up (5)

browse - down (1)

herbaceous understory - stable (3)

### 1998 TREND ASSESSMENT

Trend for soil is stable with similar ground cover characteristics compared to 1992. Litter cover declined from 67% in 1982 to 64% in 1992, and 47% by 1998. It appears that the difference is due to including dried up cheatgrass as litter in 1982 and 1992, instead of classifying it as vegetation cover. Trend for the key browse species, serviceberry and mountain big sagebrush, is up slightly. Utilization of serviceberry is more moderate and percent decadence has declined from 14% to 6%. Reproduction is poor however. Sagebrush displays improved vigor, lower decadence, and good reproduction. Only one mountain mahogany plant was encountered with the larger sampling design. It appears that there are only a few isolated clumps on the site. They are heavily utilized, but do not occur in high enough numbers to be considered a key browse species. Gambel oak appears to be increasing. It was reportedly heavily hedged in 1992, but current use is light. A continued increase in oak will come at the expense of more desirable shrubs and herbaceous plants. Trend for the herbaceous understory is up. Sum of nested frequency for perennial grasses has remained similar, although frequency of perennial forbs has doubled.

### TREND ASSESSMENT

soil - stable (3)

browse - up slightly (4)

herbaceous understory - up (5)

### 2003 TREND ASSESSMENT

Trend for soil is stable with similar ground cover characteristics compared to 1998. There is some limited erosion occurring, mostly along trails. An erosion condition class was determined to be slight in 2003. Trend for the key browse species, serviceberry and mountain big sagebrush, is mixed. Trend for serviceberry is stable. The population density of serviceberry increased, while serviceberry on this site grows in thick clones similar to oakbrush. Individual stems were counted in 1998 and 2003. However, due to the large numbers of stems and difficulty counting within thick clones, it is better to concentrate on other factors to determine trend. Average cover of serviceberry declined slightly from 8.6% in 1998 to 7% in 2003. Strip frequency remained similar. Utilization was heavy on plants along the outer edges of the thick stands but lighter within. Vigor remained good and the number of decadent stems is low. Mountain big sagebrush declined slightly in density (11%) and remained at nearly 2,000 plants/acre. The drop in density comes mostly from the young age class which accounted for 21% of the population in 1998. It declined to 0% in 2003. Utilization remained light to moderate and vigor normal on most plants. The number of decadent plants did increase to 30% which is a cause for some concern. A third of the decadent plants sampled were classified as dying. It appears that drought combined with the thick competitive cheatgrass understory has caused some of these trends. The sagebrush population may decline slightly in the future but most of the plants on the site are vigorous and healthy. Annual leader growth was good in 2003 averaging nearly 2 inches. Trend for sagebrush is considered slightly down. Weighing all these factors, the overall browse trend is considered slightly down since sagebrush provides a majority of the preferred browse cover. This area is considered transitional/summer range so the herbaceous component is the most important aspect. The herbaceous understory on this site is diverse but poor. Perennial grasses are not abundant and confined mostly to growing within shrub canopies. Cheatgrass still dominates the herbaceous understory by providing 82% of the grass cover and 49% of the total herbaceous cover. The only somewhat common perennial grasses are mutton bluegrass, prairie junegrass, and bottlebrush squirreltail. Forbs are very diverse with 22 species sampled in 2003. Few species are abundant however. They include arrowleaf balsamroot, silky lupine, desert phlox and American vetch. Drought conditions combined with Mormon cricket use have caused a major decline in the nested frequency of perennial forbs. Eleven perennial species declined significantly in nested frequency since 1998. Trend is considered down for the herbaceous understory.

### TREND ASSESSMENT

soil - stable (3)

browse - down slightly (2)

herbaceous understory - down (1)

HERBACEOUS TRENDS --  
Management unit 30 , Study no: 41

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron intermedium	ab12	a1	b22	.00	.32
G	Agropyron smithii	b16	ab6	a-	.02	-
G	Agropyron spicatum	b56	a11	a1	.19	.03
G	Bouteloua gracilis	10	-	3	-	.06
G	Bromus carinatus	13	22	3	.37	.03
G	Bromus tectorum (a)	-	285	273	12.32	15.36
G	Koeleria cristata	a-	a-	b47	-	.68
G	Oryzopsis hymenoides	2	-	-	-	-
G	Poa fendleriana	a3	c85	b48	4.46	1.70
G	Poa pratensis	-	8	-	.18	-
G	Sitanion hystrix	b30	a15	b30	.63	.64
G	Stipa comata	9	2	-	.03	-
Total for Annual Grasses		0	285	273	12.32	15.36
Total for Perennial Grasses		151	150	154	5.89	3.47
Total for Grasses		151	435	427	18.22	18.84
F	Agoseris glauca	a-	b34	a9	.29	.02
F	Allium spp.	a-	b57	a-	.48	-
F	Arabis spp.	-	5	-	.16	.00
F	Artemisia ludoviciana	b30	a3	a5	.00	.06
F	Aster chilensis	a-	b28	a-	.09	-
F	Astragalus spp.	a2	b13	a-	.11	-
F	Balsamorhiza sagittata	a3	b33	b27	2.40	5.38
F	Calochortus nuttallii	a-	b8	a-	.03	-
F	Collomia linearis (a)	-	-	1	-	.00
F	Comandra pallida	17	18	13	.16	.10
F	Collinsia parviflora (a)	-	b283	a102	6.48	1.16
F	Crepis acuminata	a-	b11	a-	.27	-
F	Cymopterus spp.	a-	b36	a-	.32	-
F	Epilobium brachycarpum (a)	-	-	2	-	.03
F	Erigeron eatonii	11	15	24	.35	.26
F	Erigeron spp.	a-	b17	a2	.17	.00
F	Eriogonum racemosum	2	6	3	.21	.00
F	Eriogonum umbellatum	-	-	2	-	.00
F	Galium spp.	-	7	12	.01	.71
F	Hackelia patens	a-	b22	a-	.30	-



T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	<i>Hydrophyllum occidentale</i>	-	-	3	-	.03
F	<i>Lappula occidentalis</i> (a)	-	-	4	-	.16
F	<i>Linum lewisii</i>	-	2	-	.15	-
F	<i>Lomatium</i> spp.	-	1	-	.03	-
F	<i>Lupinus argenteus</i>	<sub>b</sub> 84	<sub>a</sub> 30	<sub>a</sub> 15	1.29	1.52
F	<i>Machaeranthera canescens</i>	<sub>b</sub> 18	<sub>a</sub> 3	<sub>a</sub> -	.00	-
F	<i>Microsteris gracilis</i> (a)	-	25	11	.16	.13
F	<i>Penstemon</i> spp.	-	4	-	.04	-
F	<i>Phlox austromontana</i>	<sub>a</sub> 85	<sub>b</sub> 124	<sub>b</sub> 112	6.40	2.80
F	<i>Phacelia heterophylla</i>	1	6	-	.79	-
F	<i>Polygonum douglasii</i> (a)	-	-	2	-	.00
F	<i>Senecio multilobatus</i>	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 14	-	.07
F	<i>Sphaeralcea grossulariaefolia</i>	-	1	2	.03	.03
F	<i>Stephanomeria tenuifolia</i>	<sub>a</sub> -	<sub>b</sub> 11	<sub>a</sub> -	.12	-
F	Unknown forb-annual (a)	-	4	-	.09	-
F	Unknown forb-perennial	-	5	-	.03	-
F	<i>Vicia americana</i>	<sub>b</sub> 54	<sub>c</sub> 101	<sub>a</sub> 29	2.21	.19
Total for Annual Forbs		0	312	122	6.73	1.49
Total for Perennial Forbs		307	601	272	16.52	11.22
Total for Forbs		307	913	394	23.25	12.72

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

BROWSE TRENDS --

Management unit 30 , Study no: 41

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	26	25	8.55	7.09
B	Artemisia tridentata vaseyana	61	53	10.19	8.72
B	Cercocarpus ledifolius	1	0	-	-
B	Cercocarpus montanus	1	0	-	-
B	Chrysothamnus depressus	3	0	.03	-
B	Chrysothamnus viscidiflorus viscidiflorus	26	25	1.43	1.46
B	Eriogonum microthecum	0	6	-	.57
B	Opuntia spp.	1	1	.03	.15
B	Quercus gambelii	34	34	10.28	10.94
B	Ribes spp.	1	1	.38	-
B	Symphoricarpos oreophilus	3	2	.33	.18
B	Tetradymia canescens	0	2	.03	.03
Total for Browse		157	149	31.28	29.14

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 41

Species	Percent Cover	
	'98	'03
Amelanchier utahensis	-	7.59
Artemisia tridentata vaseyana	-	9.23
Chrysothamnus viscidiflorus viscidiflorus	-	1.85
Eriogonum microthecum	-	.16
Quercus gambelii	10.80	13.93
Symphoricarpos oreophilus	-	.28

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 41

Species	Average leader growth (in)
	'03
Amelanchier utahensis	2.4
Artemisia tridentata vaseyana	1.8

**BASIC COVER --**

Management unit 30 , Study no: 41

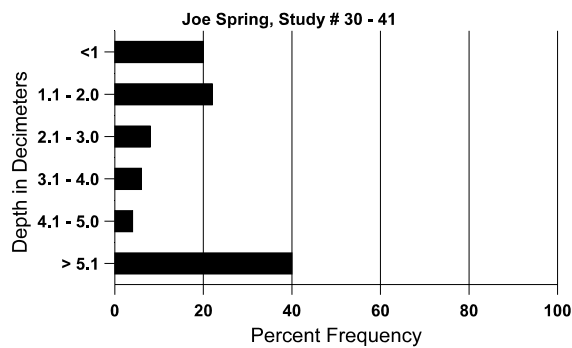
Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	3.00	59.19	56.87
Rock	3.00	7.60	7.53
Pavement	26.00	4.94	6.17
Litter	49.00	46.79	35.79
Bare Ground	21.00	20.56	18.29

**SOIL ANALYSIS DATA --**

Management unit 30, Study no: 41, Study Name: Joe Spring

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
18.0	59.5 (16.7)	5.7	68.0	17.4	14.6	1.8	15.0	150.4	0.4

**Stoniness Index**



**PELLET GROUP DATA --**

Management unit 30 , Study no: 41

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	3	3	-	-
Deer	30	11	39 (96)	32 (79)
Cattle	2	3	10 (25)	5 (13)

BROWSE CHARACTERISTICS --  
Management unit 30 , Study no: 41

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
82	<b>1599</b>	66	200	1333	66	-	0	33	4	0	46/11
92	<b>466</b>	-	200	200	66	-	0	43	14	0	20/36
98	<b>4640</b>	-	60	4300	280	220	51	13	6	0	45/33
03	<b>5480</b>	60	300	4860	320	420	.72	36	6	3	47/47
<b>Artemisia tridentata vaseyana</b>											
82	<b>1266</b>	-	133	1000	133	-	5	0	11	0	24/32
92	<b>1332</b>	66	266	800	266	-	15	5	20	15	22/27
98	<b>2220</b>	500	460	1480	280	420	29	5	13	3	22/33
03	<b>1980</b>	-	-	1380	600	220	20	9	30	9	24/29
<b>Cercocarpus ledifolius</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>66</b>	-	66	-	-	-	0	0	-	0	-/-
98	<b>40</b>	-	40	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Cercocarpus montanus</b>											
82	<b>1732</b>	-	1066	400	266	-	0	100	15	15	8/6
92	<b>1132</b>	200	533	133	466	-	35	53	41	18	6/7
98	<b>20</b>	-	-	20	-	-	0	100	0	0	14/20
03	<b>0</b>	-	-	-	-	-	0	0	0	0	22/29
<b>Chrysothamnus depressus</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>80</b>	-	-	80	-	-	25	0	-	0	8/15
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
82	<b>1066</b>	-	-	1066	-	-	0	0	0	0	15/29
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>960</b>	40	140	780	40	60	0	4	4	0	14/24
03	<b>700</b>	-	20	660	20	-	0	0	3	0	14/18
<b>Eriogonum microthecum</b>											
82	<b>266</b>	-	-	266	-	-	0	0	-	0	5/15
92	<b>66</b>	-	-	66	-	-	0	0	-	0	6/9
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>180</b>	-	20	160	-	-	11	0	-	0	7/16

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Opuntia spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>20</b>	-	-	20	-	-	0	0	-	0	3/20
<b>Quercus gambelii</b>											
82	<b>1066</b>	-	333	733	-	-	13	31	0	0	47/23
92	<b>1865</b>	800	733	466	666	-	7	79	36	0	71/47
98	<b>4920</b>	340	1180	3360	380	240	6	0	8	29	35/31
03	<b>8720</b>	20	1900	6320	500	540	18	1	6	.91	37/22
<b>Quercus turbinella</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	35/20
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Ribes spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	57/58
03	<b>20</b>	-	-	20	-	-	0	0	-	0	54/40
<b>Symphoricarpos oreophilus</b>											
82	<b>666</b>	-	-	666	-	-	0	0	0	0	25/22
92	<b>599</b>	-	333	200	66	-	22	0	11	0	19/29
98	<b>560</b>	120	300	260	-	-	14	0	0	0	12/17
03	<b>80</b>	-	-	80	-	-	0	0	0	0	20/41
<b>Tetradymia canescens</b>											
82	<b>66</b>	-	-	66	-	-	0	0	-	0	12/15
92	<b>199</b>	-	133	66	-	-	33	0	-	0	11/14
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>80</b>	-	60	20	-	-	0	0	-	0	31/36

Trend Study 30-42-03

Study site name: Grapevine Spring .

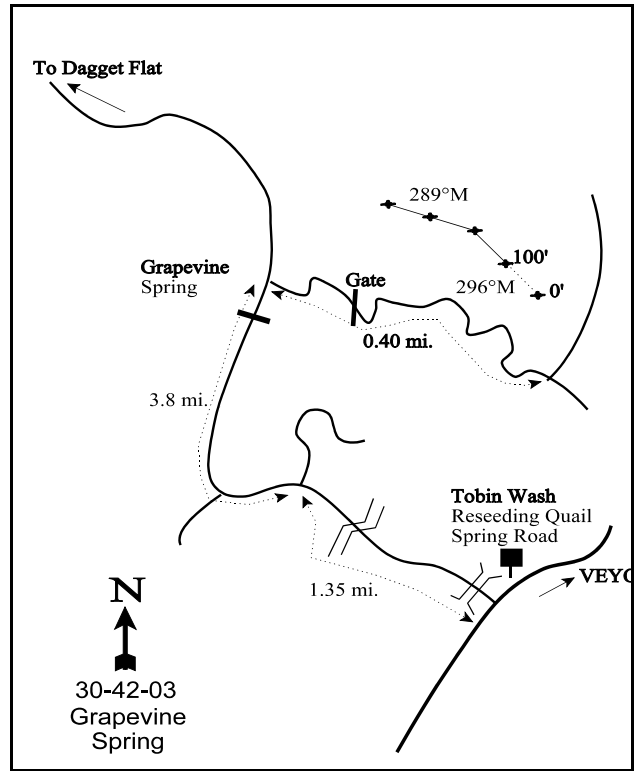
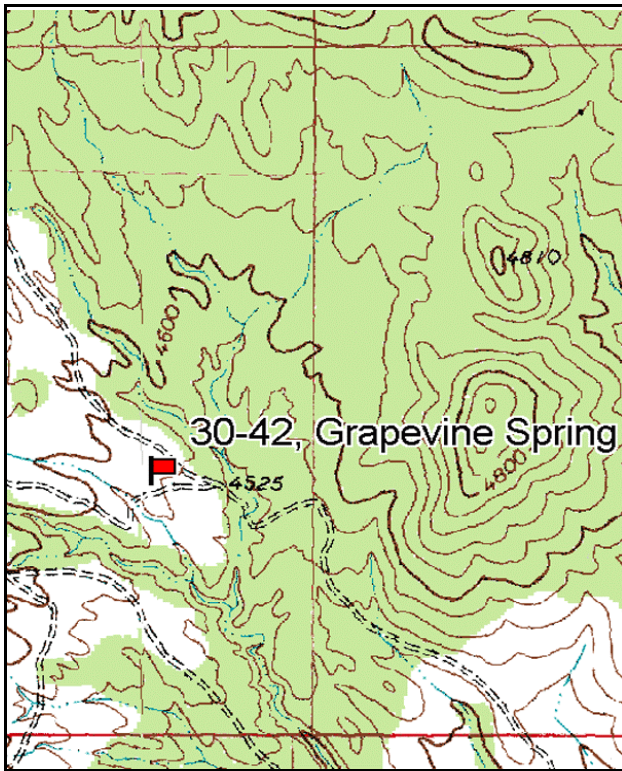
Vegetation type: Mtn. Brush Chaining .

Compass bearing: frequency baseline 296 degrees magnetic. (Lines 3 & 4, 289°M)

Frequency belt placement: line 1 (10 & 92ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). No rebar.

LOCATION DESCRIPTION

From the town of Veyo, proceed west on Gunlock Road 5.7 miles until you come to a sign saying Tobin Wash and with Eagle Mountain Ranch just off the road. Turn right (west) at Eagle Mt. Ranch and travel 1.35 miles on the main road. Turn left, across a small creek, and proceed 3.8 miles to Grapevine Spring. Just past Grapevine Spring, take the fork to the right. Travel 0.40 miles till you come to another fork in the road to the left and stop. From the fork in the road, the 0-foot baseline stake is 10 paces away at a bearing of 296 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height. The baseline is marked with browse tag #7098.



Map Name: Gunlock

Diagrammatic Sketch

Township 39S, Range 17W, Section 32

GPS: NAD 27, UTM 12S 4137238 N, 252748 E

## DISCUSSION

### Grapevine Spring - Trend Study No. 30-42

This trend study is located within critical deer winter range, one-half mile east of Grapevine Spring. The study lies within an old pinyon-juniper chaining that currently supports a mixed browse stand. Elevation is 4,600 feet on a gentle 5%-10% slope and a southeast aspect. Pellet group data from 1998 showed a moderate level of deer use at 32 days use/acre (79 ddu/ha). There were also a few cattle pats encountered (2 cow days use/acre). Pellet group data from 2003 show a similar amount of deer use estimated at 29 days use/acre (73 ddu/ha).

Soils are shallow, moderately rocky, and generally lack effective cover. Effective rooting depth was estimated at 14 inches in 1998. Soil texture is a sandy clay loam which is neutral in reactivity (pH 6.7). Phosphorus is low at just 8.5 ppm, when 10 ppm is considered the minimum value for normal plant development. There is a considerable amount of pavement concentrated on the ground surface in the shrub interspaces. Litter consists largely of dead cheatgrass. Some erosion is occurring, yet it is less severe than on untreated pinyon-juniper woodlands in the immediate area. The gentle, almost flat terrain helps prevent serious soil loss.

The key browse species is mountain big sagebrush with lesser amounts of desert ceanothus and Stansbury cliffrose. The population of big sagebrush has increased from 566 plants/acre in 1982 to 2,432 in 1992 and 4,380 by 1998. Seedling and young plants were numerous and vigor was good. In 2003, density of sagebrush declined by 51%. There were nearly as many dead as live sagebrush. No seedlings were encountered and young plants declined to only 3% of the population.

Desert ceanothus increased 53% in density between 1982 and 1992, but estimates from 1998 are similar to 1982 levels. The population follows the same trend as sagebrush in 2003 with a 50% decline in density. Half of the remaining population is decadent. Stansbury cliffrose occurs in similar densities as desert ceanothus. Utilization has been light to moderate. Other preferred browse species found on the site include a few scattered green ephedra.

The most abundant browse species in 1992 was the increaser broom snakeweed which had expanded from 8,799 plants/acre in 1982 to 11,933 by 1992. Seedlings and young were numerous, characterizing an expanding population at that time. During the 1998 reading, population density actually declined 74% to 3,080 plants/acre. Drought conditions have caused the population to decline even further to only 760 plants/acre by 2003. Surviving pinyon and juniper trees are increasing in size on the site. Point-quarter data from 2003 estimated 52 pinyon and 70 juniper trees/acre. Average basal diameter was estimated at 3.6 inches for pinyon and 4.4 inches for juniper. Average cover doubled between 1998 and 2003. Total line-intercept canopy cover was estimated at 2% for pinyon and 3% for juniper in 2003. Drought has caused many juniper in the area to have brown leaves.

The herbaceous understory is poor producing only 9% cover in 1998 and 4% in 2003. Grass composition consists of both native and seeded species which are not very vigorous and produce little available forage. The principal species, intermediate wheatgrass and bottlebrush squirreltail, had sustained approximately 30% utilization during the 1982 reading. The annual grasses, cheatgrass brome and foxtail brome, are also present and more numerous than the perennial grasses. These annual grasses provided over half of the total grass cover in 1998 and 87% in 2003. Perennial forbs are sparse with relatively few species found more than occasionally. The most abundant species in 1998 was Searls prairie clover which provided 65% of the forb cover but only 4% in 2003. Annual forbs dominated the composition in 2003. Forb utilization has generally been light.

## 1982 APPARENT TREND ASSESSMENT

Soil condition is poor, but not noticeably declining. There is a lot of bare ground and pavement, yet erosion has been limited somewhat by the gentle slope. Vegetation trend appears to be stable to improving, if one uses the key species as the principal criteria. Mountain big sagebrush appears to be expanding, but so also is broom snakeweed. Other browse species appear relatively static. Perennial herbaceous cover is poor, but could be improved with time and grazing management.

## 1992 TREND ASSESSMENT

Basal vegetative cover increased from 1% to 3% since the last reading, while bare ground increased by 14%. Litter cover has declined from 60% to 49%. Protective ground cover has declined slightly from 82% to 79%. Trend for soil is considered stable. The browse trend is up due to significant increases in the density and reproductive potentials of key shrub species. However, broom snakeweed is abundant and has also increased. Trend for the herbaceous understory is down with large decreases in quadrat frequencies of both grasses and forbs.

### TREND ASSESSMENT

soil - stable (3)

browse - up (5)

herbaceous understory - down (1)

## 1998 TREND ASSESSMENT

Trend for soil is stable with similar ground cover characteristics compared to 1992. Erosion is still not a serious problem due to the gentle terrain. Trend for browse is up slightly. Mountain big sagebrush appears to be increasing with light to moderate use, good vigor and low decadence. It currently contributes 60% of the browse cover. Desert ceanothus and cliffrose have lower densities compared to 1992, but most of the difference is due to the much larger sample used in 1998. Desert ceanothus displays less heavy use. Both desert ceanothus and cliffrose appear to have stable populations. Trend for the herbaceous understory is up slightly although total production is poor with a total herbaceous cover value of only 9%. Sum of nested frequency for perennial grasses increased slightly, whereas nested frequency for perennial forbs increased elevenfold. Several new forb species were encountered in the larger sample.

### TREND ASSESSMENT

soil - stable (3)

browse - up slightly (4)

herbaceous understory - up slightly, but poor (4)

## 2003 TREND ASSESSMENT

Trend for soil is stable. Cover of bare ground has declined even though vegetative cover has also declined. The ratio of frequency of protective cover to bare ground has remained similar to 1998 levels. There is some erosion occurring yet it is limited by the gentle terrain. Trend for browse is down. Density of the key species, mountain big sagebrush, has declined by 51%. The number of decadent shrubs has increased to 33%, young recruitment is down, and no seedlings were encountered. Dead sagebrush increased from only 180 plants/acre in 1998 to 2,040 in 2003, nearly as numerous as live plants. It is apparent that the drought has caused a significant die-off of sagebrush on this site. Drought has also caused an increase in decadent and dead desert ceanothus plants. Most of the sagebrush are unutilized while use of ceanothus has been mostly light. Cliffrose has maintained good vigor with light to moderate use. Juniper and pinyon trees are slowly increasing in size and provide additional competition for resources. Tree density was estimated at 122 trees/acre with a line-intercept cover value of 5%. Many of the juniper trees in the area displayed brown



leaves due to drought. The herbaceous understory is poor and produces little cover (4%). Trend is down due to a decline in the sum of nested frequency for both grasses and forbs. Only one perennial grass, bottlebrush squirreltail, was encountered on the site in 2003. Annual grasses, foxtail and cheatgrass brome, have also declined in frequency and cover. However, they along with sixweeks fescue, remain the most abundant grasses. The forb composition is diverse but the most common species in 2003 were annuals which provided 72% of the total forb cover. Searls prairie clover, which was the most abundant perennial forb in 1998, declined significantly in nested frequency.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - down and poor (1)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 42

T y p e	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron cristatum	-	5	-	.15	-
G	Agropyron intermedium	8	10	-	.07	-
G	Bromus rubens (a)	-	11	7	.37	.20
G	Bromus tectorum (a)	-	<sub>b</sub> 121	<sub>a</sub> 34	1.02	.72
G	Sitanion hystrix	<sub>b</sub> 32	<sub>c</sub> 50	<sub>a</sub> 3	.96	.03
G	Vulpia octoflora (a)	-	<sub>a</sub> 12	<sub>b</sub> 25	.02	.11
Total for Annual Grasses		0	144	66	1.42	1.03
Total for Perennial Grasses		40	65	3	1.19	0.02
Total for Grasses		40	209	69	2.62	1.06
F	Agoseris glauca	-	-	1	-	.00
F	Castilleja linariaefolia	-	2	6	.00	.01
F	Calochortus nuttallii	<sub>a</sub> -	<sub>b</sub> 15	<sub>a</sub> 3	.04	.01
F	Cirsium spp.	-	1	3	.00	.00
F	Cordylanthus parviflorus	9	-	-	-	-
F	Dalea searlsiae	<sub>a</sub> -	<sub>b</sub> 33	<sub>b</sub> 18	3.84	.12
F	Descurainia pinnata (a)	-	-	1	-	.00
F	Draba spp. (a)	-	66	78	.48	1.33
F	Erodium cicutarium (a)	-	-	1	-	.15
F	Eriogonum spp.	-	-	4	-	.04
F	Euphorbia spp.	<sub>a</sub> -	<sub>b</sub> 28	<sub>b</sub> 31	.28	.20
F	Frasera albomarginata	<sub>a</sub> -	<sub>b</sub> 13	<sub>a</sub> -	.25	-
F	Gilia spp. (a)	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 12	-	.12
F	Lomatium spp.	-	1	-	.00	-
F	Lotus plebeius	<sub>a</sub> 6	<sub>b</sub> 34	<sub>a</sub> 8	.57	.01

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	<i>Microsteris gracilis</i> (a)	-	3	-	.00	-
F	<i>Navarretia intertexta</i> (a)	-	a- 6	b- 31	-	.39
F	<i>Penstemon</i> spp.	-	6	11	.06	.05
F	<i>Phlox hoodii</i>	4	9	-	.33	-
F	<i>Sphaeralcea grossulariaefolia</i>	-	-	3	-	.16
F	Unknown forb-annual (a)	-	-	11	-	.04
F	Unknown forb-perennial	-	3	5	.00	.12
F	<i>Viguiera multiflora</i>	-	5	3	.04	.03
Total for Annual Forbs		0	69	134	0.49	2.04
Total for Perennial Forbs		19	150	96	5.45	0.78
Total for Forbs		19	219	230	5.94	2.83

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 42

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	<i>Artemisia tridentata vaseyana</i>	82	63	20.35	10.23
B	<i>Ceanothus greggii</i>	9	4	-	1.28
B	<i>Cowania mexicana stansburiana</i>	12	5	3.59	2.09
B	<i>Ephedra viridis</i>	0	0	.15	-
B	<i>Eriodictyon angustifolium</i>	6	7	-	.83
B	<i>Garrya flavescens</i>	2	3	1.00	1.23
B	<i>Gutierrezia sarothrae</i>	45	11	2.53	.23
B	<i>Juniperus osteosperma</i>	3	4	1.75	2.74
B	<i>Opuntia</i> spp.	0	1	-	-
B	<i>Pinus monophylla</i>	1	3	.53	1.84
B	<i>Quercus turbinella</i>	9	5	3.96	7.51
Total for Browse		169	106	33.90	28.02

CANOPY COVER, LINE INTERCEPT --  
 Management unit 30 , Study no: 42

Species	Percent Cover	
	'98	'03
Artemisia tridentata vaseyana	-	8.48
Ceanothus greggii	-	.83
Cowania mexicana stansburiana	-	3.29
Eriodictyon angustifolium	-	.60
Gutierrezia sarothrae	-	.08
Juniperus osteosperma	2.20	2.76
Pinus monophylla	1.20	2.29
Quercus turbinella	-	8.80

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 30 , Study no: 42

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	1.2
Cowania mexicana stansburiana	1.4

POINT-QUARTER TREE DATA --  
 Management unit 30 , Study no: 42

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	54	70
Pinus monophylla	47	52

Average diameter (in)	
'98	'03
3.1	4.4
2.6	3.6

BASIC COVER --  
 Management unit 30 , Study no: 42

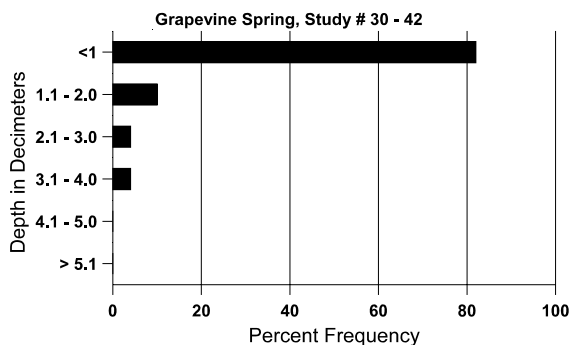
Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	3.00	39.41	31.20
Rock	3.00	7.40	10.19
Pavement	26.00	22.61	18.88
Litter	49.00	45.50	46.26
Cryptogams	0	.05	.18
Bare Ground	21.00	28.76	12.70

SOIL ANALYSIS DATA --

Management unit 30, Study no: 42, Study Name: Grapevine Spring

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	% OM	PPM P	PPM K	ds/m
14.3	70.6 (11.3)	6.7	48.0	25.4	26.6	1.8	8.5	108.8	0.6

Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 42

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	17	7	-	-
Deer	22	18	32 (79)	29 (73)
Cattle	1	-	2 (5)	-

BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 42

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Artemisia tridentata vaseyana</b>											
82	<b>566</b>	166	266	300	-	-	0	0	0	0	15/20
92	<b>2432</b>	200	766	1600	66	-	27	1	3	0	26/32
98	<b>4380</b>	1740	760	3520	100	180	27	0	2	2	22/33
03	<b>2160</b>	-	60	1380	720	2040	2	0	33	16	22/29
<b>Ceanothus greggii</b>											
82	<b>233</b>	-	-	233	-	-	0	14	0	0	31/29
92	<b>499</b>	300	166	300	33	-	13	27	7	0	26/40
98	<b>240</b>	20	20	180	40	40	17	0	17	8	27/42
03	<b>120</b>	-	-	60	60	140	17	0	50	33	27/41

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Chrysothamnus viscidiflorus viscidiflorus</i>											
82	<b>533</b>	-	-	533	-	-	0	0	-	0	11/16
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	20	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	20	0	0	-	0	-/-
<i>Cowania mexicana stansburiana</i>											
82	<b>99</b>	-	33	66	-	-	0	0	0	0	31/44
92	<b>532</b>	66	333	166	33	-	38	6	6	0	61/66
98	<b>260</b>	60	80	180	-	-	38	0	0	0	58/71
03	<b>120</b>	-	20	100	-	-	50	0	0	0	64/74
<i>Ephedra viridis</i>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	29/42
03	<b>0</b>	-	-	-	-	-	0	0	-	0	27/31
<i>Eriodictyon angustifolium</i>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>66</b>	-	-	66	-	-	0	0	0	0	20/22
98	<b>640</b>	-	20	520	100	-	0	0	16	3	24/16
03	<b>320</b>	-	20	140	160	120	44	13	50	25	17/15
<i>Garrya flavescens</i>											
82	<b>33</b>	-	-	33	-	-	0	0	0	0	24/30
92	<b>33</b>	-	-	33	-	-	0	0	0	0	20/24
98	<b>40</b>	-	-	40	-	-	0	50	0	0	22/31
03	<b>60</b>	-	20	-	40	-	0	0	67	67	-/-
<i>Gutierrezia sarothrae</i>											
82	<b>8799</b>	-	533	8266	-	-	0	0	0	0	12/12
92	<b>11933</b>	2333	900	10000	1033	-	.27	0	9	.55	10/12
98	<b>3080</b>	880	580	2200	300	500	0	1	10	7	8/10
03	<b>760</b>	360	400	360	-	260	0	0	0	0	9/10
<i>Juniperus osteosperma</i>											
82	<b>133</b>	-	33	100	-	-	0	0	-	0	53/43
92	<b>199</b>	33	66	133	-	-	33	0	-	0	73/58
98	<b>60</b>	-	-	60	-	-	0	0	-	0	-/-
03	<b>100</b>	-	40	60	-	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	% poor vigor	Average Height Crown (in)
<b>Opuntia spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	6/13
03	<b>20</b>	-	-	20	-	-	0	0	-	0	9/19
<b>Pinus monophylla</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>33</b>	-	33	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>60</b>	-	-	60	-	-	0	0	-	0	-/-
<b>Quercus turbinella</b>											
82	<b>33</b>	-	-	33	-	-	0	0	0	0	44/59
92	<b>66</b>	266	-	66	-	-	100	0	0	0	51/49
98	<b>460</b>	60	20	440	-	40	0	0	0	0	55/68
03	<b>100</b>	20	-	80	20	-	0	0	20	0	65/101

Trend Study 30-45-03

Study site name: Flat Top Mountain.

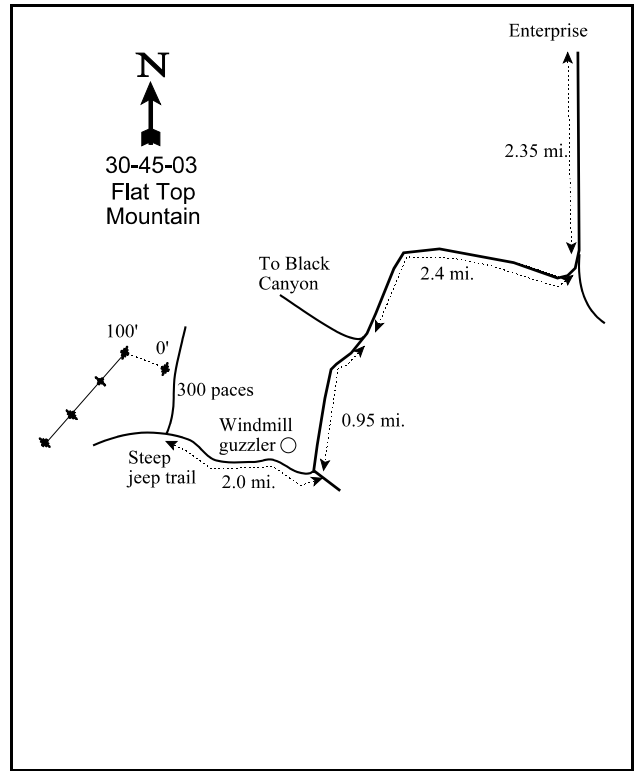
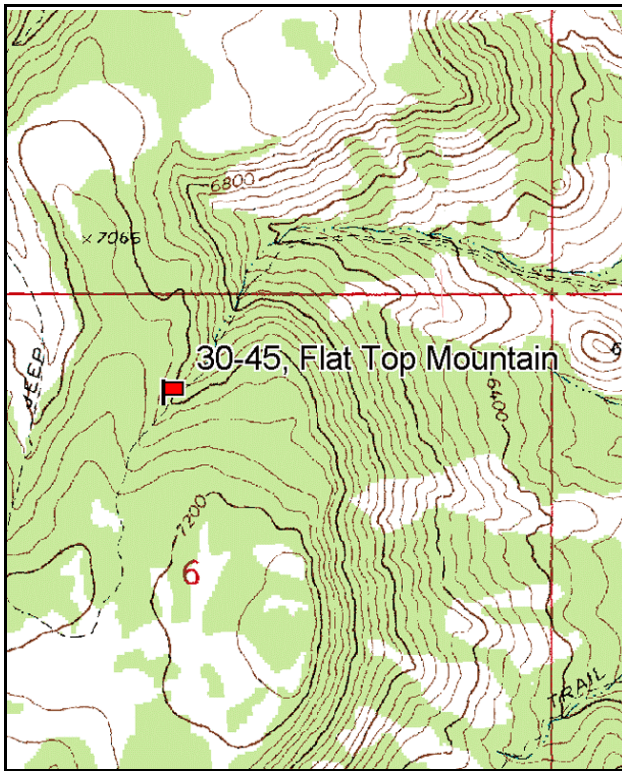
Vegetation type: Oakbrush.

Compass bearing: frequency baseline 285 degrees magnetic. (Lines 2-4, 220°M)

Frequency belt placement: line 1 (1 & 92ft), line 2 (59ft), line 3 (34ft), line 4 (71ft). Rebar: belt 1 on 8ft.

LOCATION DESCRIPTION

From the town of Enterprise, go south on 200 East for 2.45 miles, at which point there will be a fork in the road. Take a right and head towards Calf Springs. Stay on the main road for 2.3 miles until arriving at another fork in the road marked by a sign “Black Canyon.” Do not proceed towards Black Canyon. Take the left fork for 0.95 miles until arriving at another fork in the road. Take the right fork (F.S. Road 351) for 2.0 miles until the road turns into a steep jeep trail. Approximately 300 paces up the road from where it first becomes steep and rough will be an intersection (you can drive all the way to the intersection). Walk 10 paces down the road to the left (west). The 0-foot baseline stake is located 11 paces north of the road. The study is marked by green steel “T” fence posts approximately 12 to 18 inches in height.



Map Name: Hebron

Diagrammatic Sketch

Township 38S, Range 17W, Section 6

GPS: NAD 27, UTM 12S 4155402 N, 252530 E

## DISCUSSION

### Flat Top Mountain - Trend Study No. 30-45

This trend study is within deer summer range on the east side of Flat Top Mountain. The range type is mountain brush intermixed with dense oak clones which vary in stature from 12 to 15 feet in some areas and waist high in others. The site has an east aspect and an elevation of about 7,000 feet. Slope varies from 25% at the bottom of the hill to 5% on the more level ridge top. Deer appeared to be utilizing the area in 1982 as pellet groups and bedding areas were abundant. Pellet group data taken on the site in 1998 and 2003 estimated a moderate amount of deer use at 40 days use/acre (99 ddu/ha) in 1998 and 68 deer days use/acre (167 ddu/ha) in 2003. The site was also being utilized by a small number of Mormon crickets in 2003.

Soil is derived from basalt parent material. Basalt rocks are common on the soil surface, especially on the ridge top. Soil depth is deep with an estimated effective rooting depth of 16 inches. Texture is a loam which is moderately acidic (pH 5.6). Soil organic matter is relatively high at 5.2%. Soil erosion is not a problem on the site, although roads in the area are severely gullied.

Being summer range, shrubs are not as important a forage source as grasses and forbs are. However, the most abundant browse species on the site is Gambel oak. It provided 65% of the browse cover in 1998 and 84% in 2003. Oak varies in size from tall tree-like forms that are 12 to 15 feet in height, to lower growing forms that are only waist high. The oak has shown mostly light to moderate use, displayed good vigor with few decadent plants sampled during all readings. It appears to be thickening as cover nearly doubled since 1998 and the number of stems/acre increased by 35%. Line-intercept canopy cover for oak was estimated at 44% in 2003.

Understory shrubs include Utah serviceberry, mountain big sagebrush, and snowberry. Mature serviceberry averaged about 5 feet in height in 2003. They were mostly heavily hedged where available, but they were in good vigor. Mountain big sagebrush occur in limited numbers. They were classified as heavily hedged in 1998, but showed light to moderate use in 2003. Snowberry appears to be unutilized. There are also a few bitterbrush on the site that were not abundant enough to be adequately sampled. All plants were heavily hedged to the point of being mostly unavailable.

The herbaceous understory is dominated by forbs which provided 83% of the total herbaceous cover in 1998 and 74% in 2003. Grasses are represented by only one species, mutton bluegrass. Forbs are diverse and abundant with the primary species consisting of arrowleaf balsamroot, western waterleaf, tuber starwort, Pacific aster, and American vetch.

### 1982 APPARENT TREND ASSESSMENT

Range trend appears stable on this site. Soil movement is minimal and there are few areas not covered by litter or vegetation. Vegetatively, the area appears static, although there may be a trend toward taller, more mature oak trees and increasing shade. This may prove detrimental in the long run to some of the secondary browse species and some forbs.

### 1998 TREND ASSESSMENT

Trend for soil is stable with little bare ground exposed. Litter cover declined from 81% to 59%, likely due to the much larger sample used in 1998 which sampled more area outside of the oak clones. Trend for browse appears stable with some of the changes in density due to the much larger sample. Utilization is heavier on understory shrubs, but similar on oak. Reproduction of the key species appears adequate to maintain their populations. Trend for the herbaceous understory is up slightly. Quadrat frequency of mutton bluegrass increased from 2% to 41%. Quadrat frequency of perennial forbs also increased.



TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - up slightly (4)

2003 TREND ASSESSMENT

Trend for soil is stable. There is excellent protective ground cover and little bare soil exposed. Erosion is not a problem on the site. Trend for browse is down slightly for mountain big sagebrush and up for Gambel oak. Mountain big sagebrush declined 31% in density from 780 to 540 plants/acre and the number of decadent plants increased to 30% of the population. No seedlings or young were sampled. Gambel oakbrush has nearly doubled in cover. The increase in oak will have a negative effect on understory shrubs. Overall the browse trend is considered slightly down. The most important aspect of this site is the herbaceous understory since this site is used primarily as summer range. Trend for the herbaceous understory is also mixed. Trend for perennial grasses is stable. Mutton bluegrass makes up virtually all of the grass cover and it has remained stable in nested frequency. However, grasses provide only 26% of the total herbaceous cover and forbs provide 74%. Trend for forbs is down due to a major decline in the sum of nested frequency for perennial species. Average cover of forbs has also declined from 28% in 1998 to 18% in 2003. The primary species, Pacific aster, arrowleaf balsamroot, western waterleaf, tuber sandwort, and American vetch all declined significantly in nested frequency. Drought conditions for the past few years are the likely reason for these trends. An unknown amount of Mormon cricket use has also helped determine changes in trend. A return to normal precipitation patterns should help reverse these trends.

TREND ASSESSMENT

soil - stable (3)

browse - down slightly (2)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 45

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Bromus carinatus	-	8	-	.24
G	Poa fendleriana	110	103	5.82	6.05
G	Stipa columbiana	-	6	-	.10
Total for Annual Grasses		0	0	0	0
Total for Perennial Grasses		110	117	5.82	6.40
Total for Grasses		110	117	5.82	6.40
F	Agoseris glauca	1	-	.00	-
F	Allium spp.	<sub>b</sub> 44	<sub>a</sub> 7	.46	.02
F	Arabis spp.	1	7	.00	.04
F	Aster spp.	<sub>b</sub> 49	<sub>a</sub> 32	1.05	1.42
F	Balsamorhiza sagittata	<sub>b</sub> 108	<sub>a</sub> 85	11.13	12.56
F	Calochortus nuttallii	1	-	.03	-
F	Chenopodium fremontii (a)	-	7	-	.01

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
F	<i>Conium maculatum</i>	-	5	-	.42
F	<i>Collinsia parviflora</i> (a)	1	9	.00	.02
F	<i>Crepis acuminata</i>	1	3	.00	.00
F	<i>Cymopterus</i> spp.	9	-	.22	-
F	<i>Galium</i> spp.	-	2	-	.00
F	<i>Hydrophyllum occidentale</i>	<sub>b</sub> 99	<sub>a</sub> 45	6.28	.91
F	<i>Lupinus argenteus</i>	4	2	.15	.03
F	<i>Microsteris gracilis</i> (a)	34	21	.15	.13
F	<i>Petrorhiza pumila</i>	8	7	.21	.24
F	<i>Phlox austromontana</i>	10	4	.45	.04
F	<i>Phlox longifolia</i>	-	3	-	.03
F	<i>Polygonum douglasii</i> (a)	-	3	-	.00
F	<i>Senecio multilobatus</i>	9	13	.24	.11
F	<i>Stellaria jamesiana</i>	<sub>b</sub> 191	<sub>a</sub> 121	6.17	1.90
F	<i>Taraxacum officinale</i>	3	-	.03	-
F	<i>Vicia americana</i>	<sub>b</sub> 77	<sub>a</sub> 27	1.09	.11
F	<i>Zigadenus paniculatus</i>	6	4	.03	.01
Total for Annual Forbs		35	40	0.15	0.17
Total for Perennial Forbs		621	367	27.60	17.88
Total for Forbs		656	407	27.76	18.06

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 45

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	<i>Amelanchier utahensis</i>	9	2	.19	.81
B	<i>Artemisia tridentata vaseyana</i>	16	13	2.12	1.44
B	<i>Chrysothamnus depressus</i>	2	1	-	.15
B	<i>Chrysothamnus viscidiflorus viscidiflorus</i>	1	0	.03	-
B	<i>Opuntia</i> spp.	3	3	-	-
B	<i>Prunus virginiana</i>	0	1	-	-
B	<i>Quercus gambelii</i>	67	68	11.91	22.98
B	<i>Symphoricarpos oreophilus</i>	14	15	4.13	1.93
Total for Browse		112	103	18.40	27.33

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 45

Species	Percent Cover	
	'98	'03
Amelanchier utahensis	-	2.40
Artemisia tridentata vaseyana	-	2.25
Opuntia spp.	-	.33
Quercus gambelii	8.60	44.20
Symphoricarpos oreophilus	-	4.23

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 45

Species	Average leader growth (in)
	'03
Amelanchier utahensis	2.8
Artemisia tridentata vaseyana	1.0
Purshia tridentata	2.4

BASIC COVER --

Management unit 30 , Study no: 45

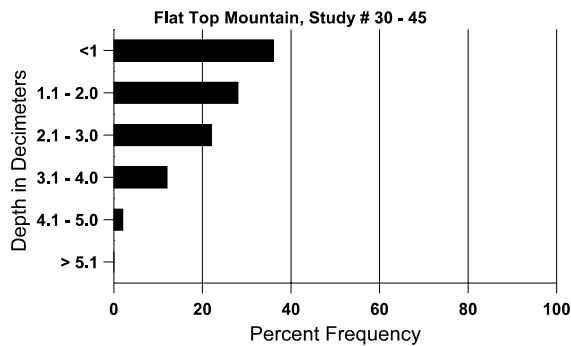
Cover Type	Average Cover %	
	'98	'03
Vegetation	46.23	48.97
Rock	21.60	22.73
Pavement	2.88	1.31
Litter	58.93	43.52
Bare Ground	5.19	8.32

SOIL ANALYSIS DATA --

Management unit 30, Study no: 45, Study Name: Flat Top Mountain

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
16.3	59.6 (11.34)	5.6	38.0	37.4	24.5	5.2	52.1	435.2	0.6

# Stoniness Index



## PELLET GROUP DATA --

Management unit 30 , Study no: 45

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	-	1	-	-
Deer	17	9	40 (99)	68 (167)

## BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 45

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
82	<b>200</b>	-	-	200	-	-	0	0	-	0	10/10
98	<b>800</b>	180	280	520	-	20	70	0	-	0	46/31
03	<b>40</b>	-	-	40	-	-	0	50	-	0	64/67
<b>Artemisia tridentata vaseyana</b>											
82	<b>66</b>	-	-	66	-	-	0	0	0	0	15/16
98	<b>780</b>	-	20	740	20	80	36	59	3	3	13/27
03	<b>540</b>	-	-	380	160	80	30	7	30	4	14/27
<b>Chrysothamnus depressus</b>											
82	<b>133</b>	-	-	133	-	-	100	0	-	0	7/16
98	<b>440</b>	-	420	20	-	-	0	0	-	0	8/15
03	<b>20</b>	-	-	20	-	-	100	0	-	0	7/19
<b>Chrysothamnus viscidiflorus viscidiflorus</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	30/61

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Opuntia spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>80</b>	-	-	80	-	-	0	0	-	75	8/17
03	<b>100</b>	-	-	100	-	-	0	0	-	0	6/15
<b>Prunus virginiana</b>											
82	<b>1066</b>	-	-	1066	-	-	0	0	-	0	10/5
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>20</b>	-	20	-	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	20	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Quercus gambelii</b>											
82	<b>7599</b>	66	1133	6466	-	-	30	4	0	0	19/20
98	<b>6760</b>	160	1320	5320	120	740	21	0	2	0	44/30
03	<b>10420</b>	40	2780	6500	1140	1120	12	7	11	4	46/30
<b>Symphoricarpos oreophilus</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>980</b>	100	100	880	-	-	0	0	-	0	21/30
03	<b>1160</b>	-	180	980	-	-	0	5	-	0	17/42

Trend Study 30-46-03

Study site name: Pahcoon Bench.

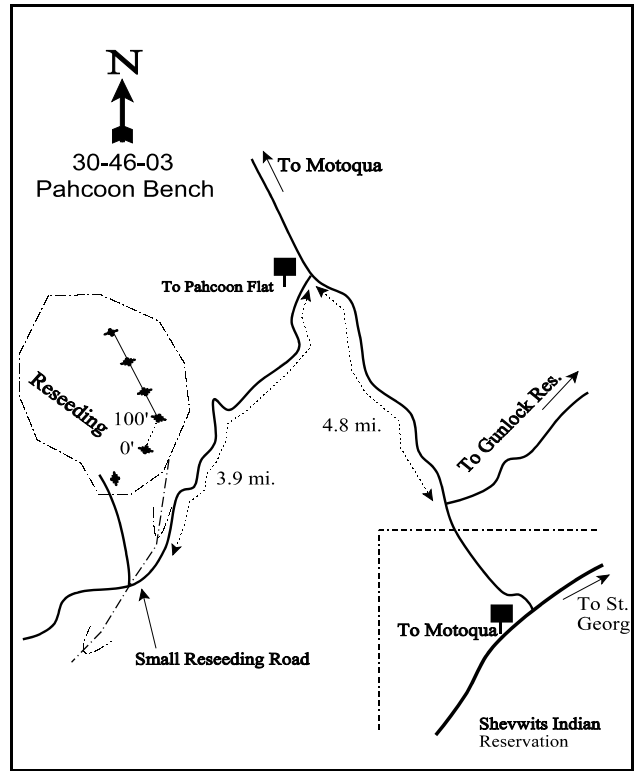
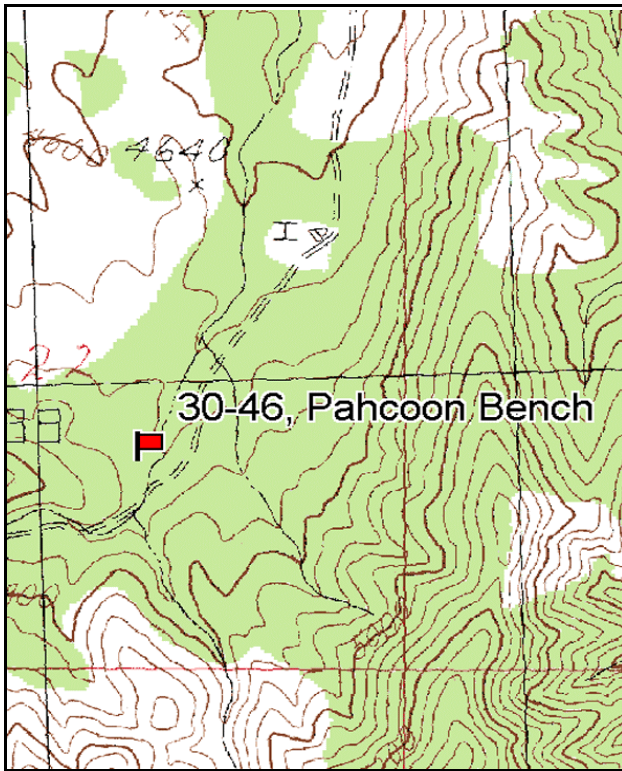
Vegetation type: Burn-Seeding.

Compass bearing: frequency baseline 22 degrees magnetic. (Lines 2-4, 336°M)

Frequency belt placement: line 1 (18 & 96ft), line 2 (57ft), line 3 (20ft), line 4 (73ft). Rebar: Belt 1 on 3ft, belt 5 on 1ft, and belt 4 on 7ft.

LOCATION DESCRIPTION

Proceed past Shivwits approximately 1.0 mile and turn north on the Jackson Springs-Motoqua road. Proceed 4.8 miles on this road past a road to Motoqua to a fork on the left towards Pahcoon Flat. Take the road towards Pahcoon Flat for 3.9 miles, traveling through a seeding. At 3.9 miles, there will be a small, obscure road to the right. Walk 67 paces up the road to the witness post off the east side of the road. The 0-foot baseline stake is 2.5 paces from the witness post at 22 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height. The 0-foot stake is marked by browse tag #471.



Map Name: Shivwits

Diagrammatic Sketch

Township 41S, Range 18W, Section 22

GPS: NAD 27, UTM 12S 4120818 N, 247204 E

## DISCUSSION

### Pahcoon Bench - Trend Study No. 30-46

This trend study is located on severe winter range on the east side of the Beaver Dam Mountains. It is placed near the south end of Pahcoon Flat on a 1979 chained and seeded pinyon-juniper woodland at an elevation of 4,670 feet. The area is dry, yet has responded well to treatment. Utilization of the area by cattle and wildlife appears light, even with a guzzler nearby. Pellet group data from 1998 estimated 20 deer and 13 cow days use/acre (49 ddu/ha and 32 cdu/ha). Cattle pats appeared to be from the previous fall or winter. The entire area burned sometime in 1999, with only a few juniper trees and shrubs surviving. Deer still use the area and pellet group data from 2003 estimated 25 deer and 8 cow days use/acre (62 ddu/ha and 20 cdu/ha). Cattle pats appeared to be from the previous grazing season (2002).

The soil is relatively shallow and moderately rocky. Effective rooting depth is estimated at just over 10 inches. Soil is hard and compacted. Texture is a loam which is neutral in reaction (pH 7.0). Parent material is limestone, some of which has a white calcium carbonate coating. There has been some signs of erosion in the past, but due to the minimal slope and increase of herbaceous cover since the chaining, it is currently minimal. A shallow drainage channel close to the study site shows signs of stabilization. Overall, protective ground cover has increased from 82% in 1982 to 93% by 1998.

Shrub composition was still developing during the 1998 reading. Key browse species consisted of mountain big sagebrush, with lesser amounts of antelope bitterbrush and Stansbury cliffrose. Sagebrush was well established, but had declined in density from 4,866 plants/acre in 1982, to 3,400 in 1992, and 800 plants/acre by 1998. The number of dead plants can only explain about 10% of the decrease from 1992, therefore the difference is mostly due to the much larger sample size utilized in 1998. The larger sample gives more accurate population estimates for shrubs that have discontinuous and/or clumped distributions. Reproduction has been good in the past with abundant seedlings and young plants sampled in 1982 and 1992. However, recruitment was poor in 1998. Utilization has been light in the past, but some moderate use was reported in 1998. Vigor was normal on most plants and percent decadence low. The wildfire that burned the area in 1999 eliminated most of the mountain big sagebrush on the site. Density was estimated at only 120 plants/acre in 2003, with more than one-half of these being young plants.

Secondary browse species, antelope and desert bitterbrush, are also well established and contained healthy age class structures prior the burn. Individuals were large and vigorous and displayed abundant annual growth in 1992. Utilization of all shrubs appeared light to moderate. During the 1998 reading, all bitterbrush was classified as antelope bitterbrush. There may have been a classification problem between desert bitterbrush and cliffrose in 1982 and 1992. Density of the bitterbrush species was estimated at 732 plants/acre in 1992. This density declined to 60 plants/acre by 1998. Density of cliffrose increased from 66 to 260 plants/acre between 1992 and 1998. There are no dead plants within the population, therefore the changes in density are due to the larger sample size used in 1998 and confusion between desert bitterbrush and cliffrose. The antelope bitterbrush displayed moderate to heavy use in 1998. Vigor was normal, but reproduction limited. Cliffrose increased dramatically in size between 1992 and 1998 according to photo point comparisons. Mature plants averaged 5 feet in height with a crown diameter of 4 feet in 1998. Plants showed moderate to heavy use, yet vigor was good and percent decadence low at 8%. The 1999 wildfire reduced these respective populations. Only 20 cliffrose and 20 bitterbrush plants/acre were estimated in 2003. Some seeded forage kochia was encountered in 2003 at an estimated density of 260 plant/acre.

Threadleaf snakeweed was the most abundant shrub on the site prior to and after the fire. It increased dramatically in density since 1982 when its density was only 466 plants/acre. By 1992, there were an estimated 3,933 young and mature plants/acre, and an additional 7,933 seedlings/acre. During the 1998 reading, density increased 47% to 7,360 plants/acre. Age class distribution indicated a stable population with 97% of the plants being mature. After the fire, density was estimated at an incredible 17,600 plants/acre in

2003. They totally dominate the shrub composition by providing 93% of the total shrub cover. Juniper trees were also found on the site in small numbers prior the fire. Point-quarter data from 1998 estimated 90 juniper trees/acre with an average basal diameter of 3.3 inches. Of these trees, 21% were larger, tipped over trees that were still alive since the chaining. Average basal diameter of these trees was 7 inches. All juniper trees were killed by the fire which burned the area in 1999.

Seeded grasses, crested and intermediate wheatgrass, had been fairly successful and appeared to be increasing in 1982. However, quadrat frequencies of perennial grasses remained stable by 1992, then declined in 1998. The annuals, cheatgrass and foxtail brome, were both quite common and have persisted even as perennials become more firmly established. It was noted in the 1982 report that these annual grasses were expected to decline as seeded grasses became established. On examination of photos taken during both readings, it appeared that the opposite was true. Cheatgrass appeared to have increased in abundance creating a fire hazard on this site. These annuals accounted for 89% of the grass cover in 1998. After the 1999 wildfire, abundance of perennial grasses has declined and dominance of annual grasses has increased. Very little crested and intermediate wheatgrass remains on the site.

The forb composition is deficient with all species providing only 2% cover in 1998. The only forb included in the chaining seed mixture was yellow sweetclover which is a short-lived perennial. No sweet clover was encountered during any reading. Annual forbs such as *Draba*, storksbill, and *Microsteris gracilis*, dominated the forb composition in 1998 by producing 95% of the forb cover. After the fire, these same annuals still provide nearly all of the forb cover. The most prominent perennial species prior to and after the 1999 wildfire is gooseberryleaf globemallow.

#### 1982 APPARENT TREND ASSESSMENT

Soil trend appears to be improving due to the seeding effort. Vegetational trend parameters indicate a rapidly expanding sagebrush population and fairly static populations of secondary shrubs. Increaser shrubs are present, but not currently abundant. A fair to good grass cover appears to be thickening. Although, forbs are almost nonexistent and unless inter-seeded, will never be an important vegetation component.

#### 1992 TREND ASSESSMENT

Soil conditions have improved. Basal vegetative cover increased by nearly fourfold, while bare ground declined by 30%. The browse trend is mixed. Mountain big sagebrush has decreased slightly in density. No young plants were encountered, but abundant seedlings were counted. Secondary species have healthy populations, good vigor, and adequate reproductive potentials. On the down side, threadleaf snakeweed has increased dramatically and is currently the most numerous shrub with an estimated density of 3,933 plants/acre. Age class structure indicates possible further increases. Overall, the browse trend is stable. Herbaceous plants are dominated by seeded grasses and cheatgrass brome. Quadrat frequencies of perennial grasses have not changed since 1982, while cheatgrass appears to have increased creating a fire hazard on this site. Forbs are severely deficient. Only one perennial forb, gooseberryleaf globemallow, was encountered either year. Trend for herbaceous understory is therefore stable and very poor condition.

#### TREND ASSESSMENT

soil - up (5)

browse - stable (3)

herbaceous understory - stable but poor (3)

#### 1998 TREND ASSESSMENT

Trend for soil appears stable with similar ground cover characteristics compared to 1992. Litter cover declined from 71% to 56%, possibly due to classifying dried up cheatgrass as litter in 1982 and 1992. Percent



bare ground remained similar. Trend for the key browse species, mountain big sagebrush, cliffrose, and bitterbrush, is mixed. Sagebrush density is declining, with cliffrose and bitterbrush appearing stable. There appears to have been an identification problem with desert bitterbrush and cliffrose in the past. Utilization of all shrubs has increased since 1992, but vigor remains normal and percent decadence low. Some of the changes in density are also due to the larger sample used in 1998. Overall, the browse trend is considered down slightly. Trend for the herbaceous understory is down and in poor condition due to the dominance of annual cheatgrass and foxtail brome. Sum of nested frequency for perennial grasses has declined. Frequency of perennial forbs increased slightly, although forbs are still scarce. Nested frequency for intermediate wheatgrass declined significantly.

TREND ASSESSMENT

soil - stable (3)

browse - down slightly (2)

herbaceous understory - down and in poor condition (1)

2003 TREND ASSESSMENT

A wildfire, which burned the site in 1999, has caused downward trends in all categories. Soil trend is down slightly. Cover of bare ground is still relatively low yet it has nearly doubled while litter and vegetation cover have declined. There is not a problem with erosion however, due to the gentle terrain and abundance of annual grass and forb cover. Trend for browse is down with the most preferred species nearly being eliminated by fire. Only 120 sagebrush, 20 cliffrose, and 20 bitterbrush plants/acre were estimated in 2003. The invasive increaser, threadleaf snakeweed, has increased dramatically to 17,600 plants/acre. It now provides 93% of the total shrub cover. The only positive aspect of the shrub trend is the appearance of some prostate kochia that was seeded after the fire. Trend for the herbaceous understory is also down. Sum of nested frequency for perennial grasses declined and there are few perennial grasses left on the site. Annuals, cheatgrass and foxtail brome totally dominate the grass composition by providing 94% of the grass cover. Annual forbs dominate the forb composition, especially storksbill which provides 83% of the forb cover. The only fairly common perennial forb remains gooseberryleaf globemallow. This area burned again in July of 2003 as part of the Apex fire. This increase in the burn frequency will only push the community more toward an annual dominated type and completely destroy the areas usefulness as deer winter range.

TREND ASSESSMENT

soil - down slightly (2)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 46

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron cristatum	<sub>b</sub> 44	<sub>b</sub> 52	<sub>a</sub> -	1.23	.00
G	Agropyron intermedium	<sub>c</sub> 136	<sub>b</sub> 79	<sub>a</sub> 2	1.89	.15
G	Bromus rubens (a)	-	<sub>b</sub> 169	<sub>a</sub> 113	4.65	1.62
G	Bromus tectorum (a)	-	<sub>b</sub> 366	<sub>a</sub> 304	29.75	13.42
G	Elymus junceus	3	-	-	-	-

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
		G	Poa pratensis	4	-	-
G	Poa secunda	-	4	9	.01	.04
G	Sitanion hystrix	-	1	-	.00	-
G	Sporobolus cryptandrus	4	-	-	-	.00
G	Vulpia octoflora (a)	-	94	104	1.13	.80
Total for Annual Grasses		0	629	521	35.54	15.85
Total for Perennial Grasses		191	136	11	3.14	0.20
Total for Grasses		191	765	532	38.68	16.05
F	Alyssum alyssoides (a)	-	-	5	-	.01
F	Allium spp.	-	2	-	.01	-
F	Astragalus spp.	-	2	-	.01	-
F	Calochortus nuttallii	-	7	3	.01	.00
F	Chenopodium fremontii (a)	-	-	11	-	.02
F	Descurainia pinnata (a)	-	7	3	.01	.00
F	Draba spp. (a)	-	<sub>b</sub> 102	<sub>a</sub> 9	.31	.03
F	Erodium cicutarium (a)	-	<sub>a</sub> 28	<sub>b</sub> 185	.73	13.87
F	Gilia spp. (a)	-	3	-	.00	-
F	Lactuca serriola	-	-	3	-	.03
F	Lychnis drummondii	<sub>a</sub> -	<sub>b</sub> 8	<sub>a</sub> -	.05	-
F	Microsteris gracilis (a)	-	<sub>b</sub> 154	<sub>a</sub> 8	.64	.02
F	Navarretia intertexta (a)	-	-	3	-	.01
F	Plantago patagonica (a)	-	28	29	.13	.21
F	Sisymbrium altissimum (a)	-	<sub>a</sub> -	<sub>b</sub> 20	-	1.46
F	Sphaeralcea grossulariaefolia	<sub>a</sub> 4	<sub>a</sub> 3	<sub>b</sub> 60	.00	.97
Total for Annual Forbs		0	322	273	1.83	15.64
Total for Perennial Forbs		4	22	66	0.08	1.01
Total for Forbs		4	344	339	1.92	16.65

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

BROWSE TRENDS --

Management unit 30 , Study no: 46

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	<i>Artemisia tridentata vaseyana</i>	26	6	4.31	.03
B	<i>Chrysothamnus nauseosus hololeucus</i>	0	0	.15	-
B	<i>Cowania mexicana stansburiana</i>	12	1	1.52	-
B	<i>Ephedra viridis</i>	1	0	.63	-
B	<i>Gutierrezia microrcephala</i>	69	86	6.17	11.85
B	<i>Juniperus osteosperma</i>	7	0	2.75	-
B	<i>Kochia prostrata</i>	0	10	-	.34
B	<i>Opuntia spp.</i>	3	0	.00	-
B	<i>Prunus fasciculata</i>	5	5	-	.39
B	<i>Purshia tridentata</i>	3	1	1.48	.15
Total for Browse		126	109	17.03	12.76

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 46

Species	Percent Cover	
	'98	'03
<i>Cowania mexicana stansburiana</i>	.80	-
<i>Gutierrezia microrcephala</i>	-	14.85
<i>Juniperus osteosperma</i>	3.20	-
<i>Kochia prostrata</i>	-	.60
<i>Pinus monophylla</i>	.20	-
<i>Prunus fasciculata</i>	-	.83

BASIC COVER --

Management unit 30 , Study no: 46

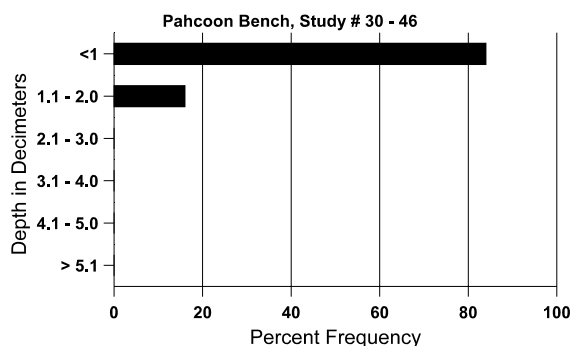
Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	5.50	53.28	48.50
Rock	7.25	10.22	11.40
Pavement	8.50	9.86	7.26
Litter	70.50	55.49	31.16
Cryptogams	0	1.21	.03
Bare Ground	8.25	7.42	13.06

SOIL ANALYSIS DATA --

Management unit 30, Study no: 46, Study Name: Pahcoon Bench

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	% OM	PPM P	PPM K	ds/m
10.3	71.6 (10.4)	7.0	48.0	33.4	18.6	2.6	12.6	108.8	0.8

Stoniness Index



PELLET GROUP DATA --

Management unit 30, Study no: 46

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	34	10	-	-
Deer	33	20	19 (47)	25 (63)
Cattle	3	2	13 (32)	8 (20)

BROWSE CHARACTERISTICS --

Management unit 30, Study no: 46

		Age class distribution (plants per acre)					Utilization				Average Height Crown (in)
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	
<b>Artemisia tridentata vaseyana</b>											
82	<b>4866</b>	733	3333	1533	-	-	0	0	0	0	25/19
92	<b>3400</b>	6933	-	3200	200	-	0	0	6	0	28/28
98	<b>800</b>	-	20	660	120	280	20	0	15	3	28/36
03	<b>120</b>	20	80	40	-	-	0	17	0	0	17/15
<b>Cowania mexicana stansburiana</b>											
82	<b>66</b>	-	-	66	-	-	0	0	0	0	28/28
92	<b>66</b>	-	-	66	-	-	0	0	0	0	57/44
98	<b>260</b>	100	-	240	20	20	31	15	8	0	61/52
03	<b>20</b>	-	-	-	20	580	0	0	100	0	26/23

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Ephedra viridis</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	100	0	-	0	30/38
03	<b>0</b>	-	-	-	-	-	0	0	-	0	25/48
<b>Gutierrezia microrcephala</b>											
82	<b>466</b>	-	-	466	-	-	0	0	0	0	13/11
92	<b>3933</b>	7933	200	3733	-	-	0	0	0	0	14/15
98	<b>7360</b>	80	160	7120	80	80	0	0	1	1	9/12
03	<b>17600</b>	80	1980	15180	440	1020	0	0	3	1	12/13
<b>Juniperus osteosperma</b>											
82	<b>0</b>	66	-	-	-	-	0	0	-	0	-/-
92	<b>66</b>	-	66	-	-	-	0	0	-	0	-/-
98	<b>140</b>	20	80	60	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	40	0	0	-	0	-/-
<b>Kochia prostrata</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>260</b>	40	80	180	-	-	0	0	-	0	10/15
<b>Opuntia spp.</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>60</b>	-	20	40	-	-	0	0	-	0	8/20
03	<b>0</b>	-	-	-	-	-	0	0	-	0	8/18
<b>Prunus fasciculata</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>100</b>	-	20	60	20	-	0	0	20	20	51/72
03	<b>100</b>	-	-	100	-	-	20	0	0	20	39/56
<b>Purshia glandulosa</b>											
82	<b>266</b>	-	200	66	-	-	25	0	-	0	32/44
92	<b>266</b>	-	266	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Purshia tridentata</b>											
82	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>466</b>	66	66	400	-	-	29	0	0	0	34/50
98	<b>60</b>	60	-	60	-	-	33	67	0	0	47/71
03	<b>20</b>	-	-	-	20	-	100	0	100	0	44/38
<b>Quercus turbinella</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	20	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Yucca baccata baccata</b>											
82	<b>133</b>	-	-	133	-	-	50	0	-	0	7/10
92	<b>200</b>	-	200	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

Trend Study 30-52-03

Study site name: Northwest of Enterprise .

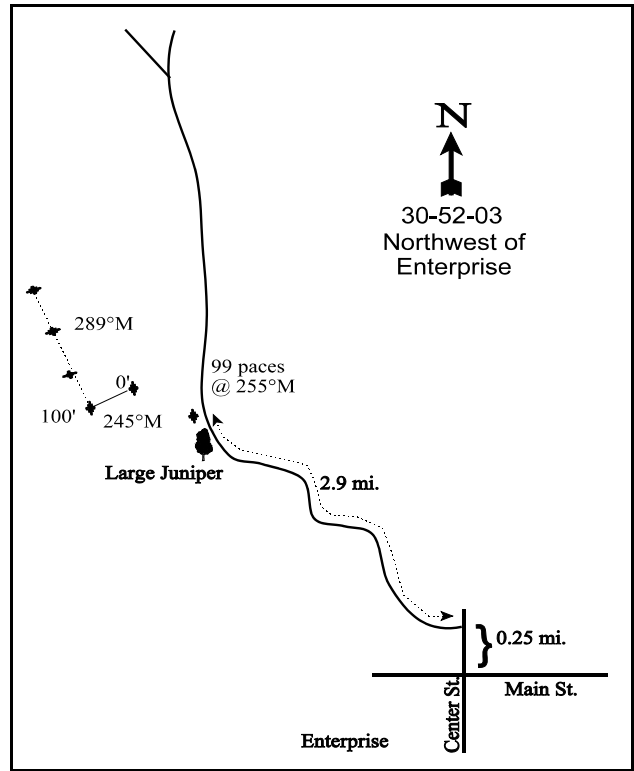
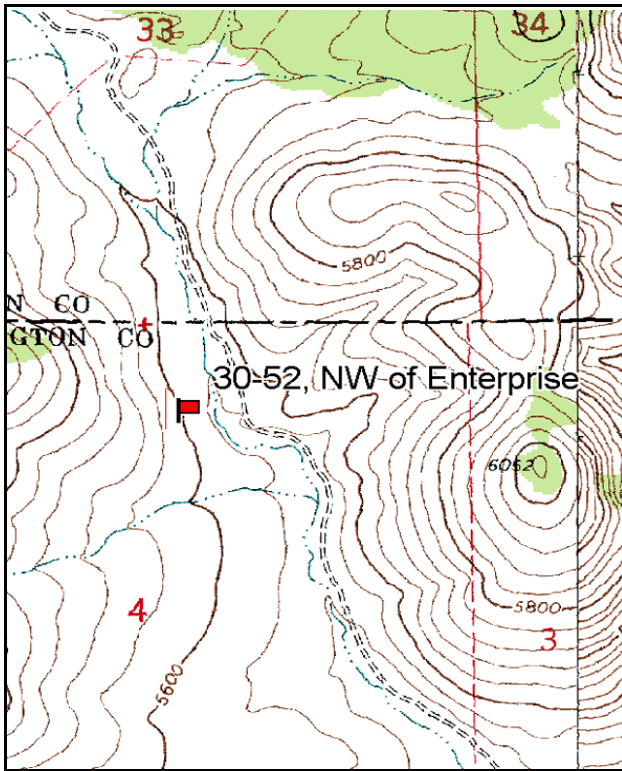
Vegetation type: Burn-Seeding .

Compass bearing: frequency baseline 245 degrees magnetic. (Line 2-4, 289°M)

Frequency belt placement: line 1 (8 & 94ft), line 2 (37ft), line 3 (51ft), line 4 (63ft).

LOCATION DESCRIPTION

Starting from the town of Enterprise, turn north on Center Street and travel 0.25 miles. Turn left (west) and travel 2.9 miles. Stop where the road makes a turn to the north. On the left side of the road, before the bend, are a few junipers. Past the junipers is a witness post on the left side of the road. From the witness post the 0-foot baseline stake is 99 paces at 255 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height.



Map Name: Hebron

Diagrammatic Sketch

Township 37S, Range 17W, Section 4

GPS: NAD 27, UTM 12S 4165067 N, 256231 E

## DISCUSSION

### Northwest of Enterprise - Trend Study No. 30-52

This trend study is located on critical deer winter range northwest of the town of Enterprise. Elevation is approximately 5,600 feet with a moderately steep slope (25%) and northeast aspect. The range type is Wyoming big sagebrush-grass. Little sign of deer was noted during the 1992 reading. Pellet group data from 1998 estimated 40 deer and 2 cow days use/acre (99 ddu/ha and 5 cdu/ha). The site burned prior to the 2003 reading which eliminated all the browse in the entire area. The lower, flatter terrain was chained after seed was flown on. Deer still use the area and pellet group data from 2003 estimated 23 deer days use/acre (56 ddu/ha). Cattle had used the site sometime in 2002 at an estimated 12 days use/acre (30 cdu/ha) but had not yet used the site in 2003.

Soils are moderately deep but rocky on the surface and within the profile. Effective rooting depth is estimated at about 19 inches. Rock and erosion pavement are abundant on the surface, making up nearly 40% cover in 2003. The upper part of the site is very rocky as soil has moved down slope. There are signs of past erosion in the form of soil pedestalling and terracing of the slope, but current litter and vegetative cover seem to be sufficient to hold the soil in place.

The key browse species prior to the fire was Wyoming big sagebrush, which comprised 55% of the browse cover in 1998. The sight supported an over mature stand of sagebrush, which has steadily declined in density from 6,733 plants/acre in 1982 to 2,660 by 1998. Utilization was moderate to heavy in 1982 and 1992, but more light to moderate in 1998. Percent decadence increased from 23% in 1982 to 48% in 1998. Vigor was good that year, yet 41% of the decadent sagebrush were classified as dying. Reproduction was poor with dead plants nearly as numerous as mature plants (1,180 live vs 1,160 dead plants/acre). The wildfire prior to the 2003 reading eliminated all of the sagebrush in the area.

Cliffrose provided some additional forage with an estimated 380 plants/acre in 1998. It had received moderate to heavy use, yet vigor was normal and reproduction good. The only other browse species of significance was broom snakeweed. Juniper trees were scattered throughout the site. Point-quarter data from 1998 estimated 20 trees/acre with an average basal diameter of 8 inches. Overhead canopy cover averaged 8%. Wildfire eliminated nearly all of the shrubs on the site. Burned juniper trees on the more level terrain were chained and seeded. The only shrubs left in 2003 were a few resprouting ephedra, some broom snakeweed, and a good stand of seeded prostrate kochia which numbered 3,200 plants/acre. Some kochia was moderately and heavily browsed in 2003.

Perennial grasses were abundant and diverse with mutton and Sandberg bluegrass being the most common prior to the fire. Annual cheatgrass was also present, providing 17% of the grass cover in 1998. Forbs were fairly diverse, yet no species was common. The 12 annual and perennial forbs encountered in 1998 provided less than 1% total cover. The most common species included deervetch, longleaf phlox, and an *astragalus*. After the burn, the herbaceous composition is still dominated by perennial grasses, but western wheatgrass and galleta now provide most of the grass cover (75%). Sandberg bluegrass was also common in 2003. Annual cheatgrass is still present but not nearly as abundant as it was in 1998. Forbs are still lacking and produced only about 1% total cover in 2003. Gooseberryleaf globemallow was the only fairly common species.

### 1982 APPARENT TREND ASSESSMENT

This study is fairly typical of depleted Wyoming big sagebrush range. Most parameters indicate soil and vegetative trend are both declining. Erosion is extensive and increaser and/or invader plants occupy a prominent place in the plant composition. The key species, Wyoming big sagebrush, does not appear to be maintaining itself. Direct management action will likely be required to reverse the trend. Restrictions on animal use, while a viable option, are unlikely to quickly bring the site to a productive state.



## 1992 TREND ASSESSMENT

Basal vegetative cover has more than doubled since 1982, while cover of bare ground has decreased by 42%. Protective ground cover has increased from 87% to 92%. All other observations point to an improving soil trend. The key browse species, Wyoming big sagebrush, has no recruitment, density has declined by 42%, and percent decadence has increased. On the positive side, utilization is lighter and vigor has improved. Broom snakeweed had declined in density by 34%. Overall, the browse trend is down. Quadrat frequencies for grasses are down slightly, while forbs have increased. Combined, summed quadrat frequencies of forbs and grasses have remained constant since the previous reading.

### TREND ASSESSMENT

soil - up (5)

browse - down (1)

herbaceous understory - stable (3)

## 1998 TREND ASSESSMENT

Trend for soil is down slightly. Percent bare ground has increased from 8% to 13% and litter cover has declined from 46% to 38%. However, erosion does not currently appear to be a serious problem. Trend for browse is slightly down. Density of Wyoming big sagebrush has steadily declined since 1982 even though heavy utilization has declined since 1992. Percent decadence has remained high (48%), vigor is poor on 42% of the decadent plants, and reproduction is not sufficient to maintain the population. Cliffrose is found on the site in small numbers. Density has increased from 133 plants/acre to 380. This increase in density from 1992 to 1998 is mostly due to the much larger sample taken in 1998. Reproduction is good. Utilization of this preferred shrub is moderate to heavy. Trend for the herbaceous understory is up for perennial grasses, but stable for forbs which only make up only 4% of the herbaceous cover. Sum of nested frequency for perennial grasses has increased dramatically with a significant increase in the frequency of mutton and Sandberg bluegrass.

### TREND ASSESSMENT

soil - down slightly (2)

browse - down slightly (2)

herbaceous understory - up (5)

## 2003 TREND ASSESSMENT

This site burned prior to the 2003 reading which eliminated all of the sagebrush on this site. The soil trend is down slightly due to a decline in litter and vegetation cover combined with a 27% increase in cover of bare ground. Erosion is not a problem however, due in part to the rocky nature of the soil surface. Trend for browse is down due to the elimination of Wyoming big sagebrush and cliffrose from the site. A good stand of seeded prostrate kochia has established at an estimated density of 3,100 plants/acre. Some of these plants displayed moderate to heavy use in 2003. Trend for the herbaceous understory is down slightly due to a decline in the sum of nested frequency for perennial grasses and forbs. Perennial grasses still dominate the composition with western wheatgrass, galleta, and Sandberg bluegrass providing most of the grass cover. Some seeded crested wheatgrass has established on the site. Forbs are still lacking with only gooseberryleaf globemallow being fairly common.

### TREND ASSESSMENT

soil - down slightly (2)

browse - down (1)

herbaceous understory - down slightly (2)

HERBACEOUS TRENDS --  
Management unit 30 , Study no: 52

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
G	Agropyron cristatum	a-	a-	b18	-	.27
G	Agropyron smithii	ab68	a44	b91	.55	3.40
G	Agropyron spicatum	-	-	3	-	.15
G	Bromus tectorum (a)	-	b261	a56	3.09	.16
G	Hilaria jamesii	a55	a81	b124	1.78	5.25
G	Koeleria cristata	2	2	-	.03	-
G	Oryzopsis hymenoides	11	1	6	.00	.16
G	Poa fendleriana	b60	c101	a-	5.88	-
G	Poa secunda	a41	c215	b132	5.57	2.00
G	Sitanion hystrix	b54	b54	a5	.92	.03
G	Unknown grass - perennial	3	-	-	-	-
G	Vulpia octoflora (a)	-	b67	a12	.30	.02
Total for Annual Grasses		0	328	68	3.40	0.18
Total for Perennial Grasses		294	498	379	14.76	11.28
Total for Grasses		294	826	447	18.17	11.46
F	Allium spp.	-	-	8	-	.01
F	Antennaria rosea	-	3	-	.03	-
F	Astragalus spp.	5	11	-	.19	-
F	Calochortus nuttallii	a3	b16	ab9	.03	.02
F	Collinsia parviflora (a)	-	b18	a-	.04	-
F	Crepis acuminata	-	-	2	-	.03
F	Cymopterus spp.	-	6	1	.07	.03
F	Draba spp. (a)	-	b20	a-	.05	-
F	Erigeron pumilus	-	1	-	.03	-
F	Eriogonum umbellatum	2	-	-	-	-
F	Helianthus annuus (a)	-	-	2	-	.00
F	Lithospermum spp.	-	-	-	-	.00
F	Lotus plebeius	c94	b39	a1	.18	.00
F	Machaeranthera canescens	3	-	-	-	-
F	Microsteris gracilis (a)	-	b25	a-	.05	-
F	Phlox longifolia	a15	b32	a13	.11	.08
F	Plantago patagonica (a)	-	4	-	.01	-
F	Sisymbrium altissimum (a)	-	2	-	.00	-
F	Sphaeralcea grossulariaefolia	a-	a-	b34	-	.71

Type	Species	Nested Frequency			Average Cover %	
		'92	'98	'03	'98	'03
F	Unknown forb-annual (a)	-	-	2	-	.03
Total for Annual Forbs		0	69	4	0.16	0.04
Total for Perennial Forbs		122	108	68	0.65	0.90
Total for Forbs		122	177	72	0.81	0.94

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 52

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	1	0	-	-
B	Artemisia tridentata wyomingensis	76	0	9.16	-
B	Chrysothamnus nauseosus	0	0	.38	-
B	Chrysothamnus viscidiflorus	14	0	.51	-
B	Cowania mexicana stansburiana	12	0	.49	-
B	Ephedra viridis	0	1	-	-
B	Gutierrezia sarothrae	54	46	1.14	.65
B	Juniperus osteosperma	2	0	5.09	-
B	Kochia prostrata	0	36	-	.98
B	Purshia tridentata	1	0	-	-
Total for Browse		160	83	16.79	1.64

#### CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 52

Species	Percent Cover	
	'98	'03
Gutierrezia sarothrae	-	.35
Juniperus osteosperma	8.39	-
Kochia prostrata	-	2.13

BASIC COVER --

Management unit 30 , Study no: 52

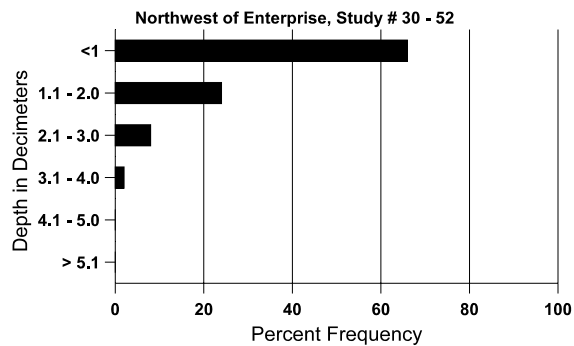
Cover Type	Average Cover %		
	'92	'98	'03
Vegetation	4.25	38.27	14.06
Rock	30.50	36.20	35.83
Pavement	10.75	6.67	3.94
Litter	45.75	38.02	38.18
Cryptogams	.75	2.40	.03
Bare Ground	7.50	13.41	16.97

SOIL ANALYSIS DATA --

Management unit 30, Study no: 52, Study Name: Northwest of Enterprise

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	%OM	PPM P	PPM K	ds/m
4.8	69.2 (17.8)	6.6	32.6	45.2	22.2	2.7	25.9	732.8	0.5

### Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 52

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	10	18	-	-
Horse	1	-	-	-
Deer	16	12	40 (99)	23 (56)
Cattle	-	4	2 (5)	12 (30)

BROWSE CHARACTERISTICS --  
Management unit 30 , Study no: 52

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
82	0	-	-	-	-	-	0	0	0	0	-/-
92	0	-	-	-	-	-	0	0	0	0	-/-
98	20	-	-	-	20	-	0	0	100	0	-/-
03	0	-	-	-	-	-	0	0	0	0	-/-
<b>Artemisia tridentata wyomingensis</b>											
82	6733	-	600	4600	1533	-	33	23	23	24	22/23
92	3933	-	200	1800	1933	-	61	14	49	2	24/24
98	2660	40	200	1180	1280	1160	23	0	48	20	19/28
03	0	-	-	-	-	-	0	0	0	0	-/-
<b>Chrysothamnus viscidiflorus</b>											
82	66	-	-	66	-	-	0	0	0	0	4/7
92	66	-	-	66	-	-	0	0	0	0	11/14
98	800	-	220	560	20	-	0	0	3	0	11/18
03	0	-	-	-	-	-	0	0	0	0	-/-
<b>Cowania mexicana stansburiana</b>											
82	0	-	-	-	-	-	0	0	-	0	-/-
92	133	-	133	-	-	-	0	0	-	0	-/-
98	380	80	120	260	-	-	26	47	-	0	31/25
03	0	-	-	-	-	-	0	0	-	0	-/-
<b>Ephedra viridis</b>											
82	133	-	-	133	-	-	50	0	0	0	11/6
92	200	-	200	-	-	-	33	0	0	0	-/-
98	0	-	-	-	-	-	0	0	0	0	32/51
03	40	-	20	-	20	-	0	100	50	0	17/12
<b>Gutierrezia sarothrae</b>											
82	8266	-	533	6600	1133	-	0	0	14	6	8/11
92	5466	66	-	5466	-	-	0	0	0	0	11/10
98	4060	80	540	3380	140	40	0	0	3	2	6/8
03	1740	20	380	680	680	640	5	5	39	28	4/7
<b>Juniperus osteosperma</b>											
82	66	-	-	66	-	-	0	0	-	0	67/131
92	0	66	-	-	-	-	0	0	-	0	-/-
98	40	-	-	40	-	-	0	0	-	0	-/-
03	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	% poor vigor	Average Height Crown (in)
<b>Kochia prostrata</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>3100</b>	-	1040	2060	-	-	27	4	-	0	8/11
<b>Leptodactylon pungens</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	4/5
<b>Purshia tridentata</b>											
82	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>20</b>	-	-	20	-	-	100	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

Trend Study 30-54-03

Study site name: Bullion Canyon .

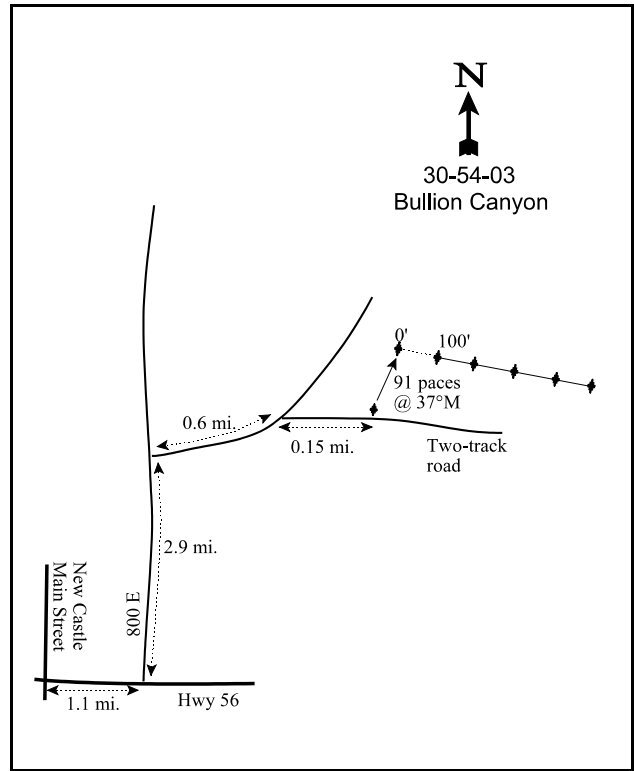
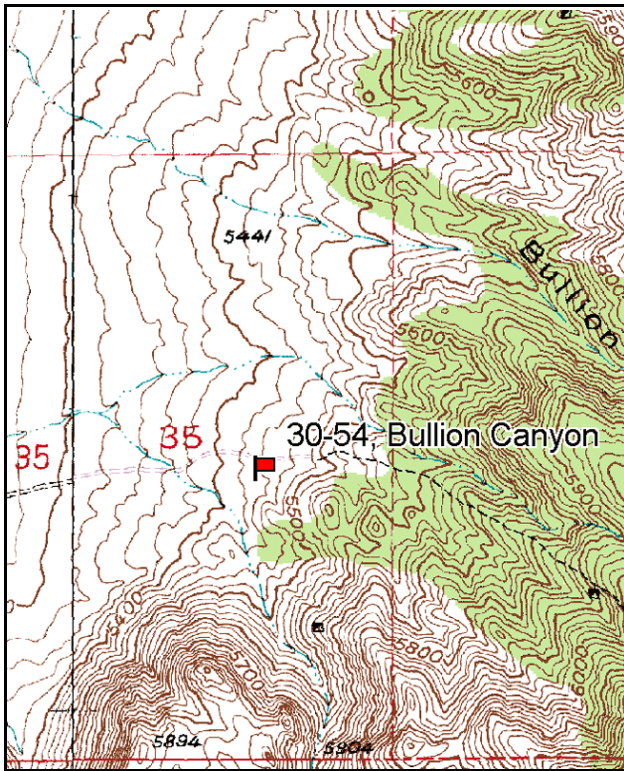
Vegetation type: Wyoming Big Sagebrush .

Compass bearing : frequency baseline 97 degrees magnetic.

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

LOCATION DESCRIPTION

Starting at the intersection of Hwy 56 and Main street in New Castle, head east on Hwy 56 1.1 miles to 800 E. Turn left (north) onto 800 E. and drive 2.9 miles to a right turn (0.3 miles past a gate). Go 0.6 miles to a fork. Take the faint two-track road to the right and go 0.15 miles to a witness post on the left side of the road. The 0-foot stake is 91 paces at 37 degrees magnetic from the witness post. The 0-foot stake is marked by browse tag #493. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height.



Map name: Silver Peak

Diagrammatic Sketch

Township 35S, Range 15W, Section 35

GPS: NAD 27, UTM 12S 4176790 N, 280124 E

## DISCUSSION

### Bullion Canyon - Trend Study No. 30-54

This trend study is located near the mouth of Bullion Canyon. It was established in 1998 and samples a sagebrush-grass range type within a scattered population of juniper trees. Slope varies from 5% to 10% near the bottom of the hill, to 25% at the end of the baseline. Aspect is to the west and elevation is approximately 5,400 feet. Agricultural fields are located in the valley bottom about 1½ miles to the west. Pellet group data from 1998 estimated light deer use at 23 deer days use/acre (57 ddu/ha). Some of the deer pellet groups were recent and bedding sites were present under several highlined juniper trees. A few old cattle pats were also encountered along with some horse sign. Pellet group data from 2003 estimated a higher level of use at 50 deer days use/acre (124 ddu/ha). About 80% of the pellet groups were from winter use while the other 20% were from spring.

Soil on the site is deep with an effective rooting depth estimated at 19 inches. Rock and gravel are abundant on the surface and within the profile. Soil texture is a loam which is neutral in reaction (pH 7.0). Phosphorus is low at only 6.4 ppm. Ten ppm is considered a minimum value for normal plant development. Protective ground cover consists mostly of rock and pavement cover and sagebrush crowns. Litter cover is lacking and percent bare ground was relatively high at 20% in 1998. There are some active gullies in the area. The upper hillside is terraced with some localized erosion occurring, but it does not appear to be excessive. The soil erosion condition class was determined to be slight in 2003.

The key browse species consist of a combination of black sagebrush and Wyoming big sagebrush. These species appear to be hybridizing with many shrubs displaying phenotypes of both black and Wyoming big sagebrush. All sagebrush has been lumped together as Wyoming big sagebrush. The population density of sagebrush was estimated at 6,420 plants/acre in 1998. Use was moderate, vigor normal on most plants, and percent decadence was low at 17%. Young recruitment was good with 13% of the population consisting of young plants. Data from 2003 show a 18% decline in sagebrush density. Use was classified as moderate to heavy. Due to drought, average vigor has declined and the number of decadent plants increased from 17% in 1998 to 54% in 2003. In addition, 53% of the decadent plants sampled were classified as dying which represents 1,500 plants/acre. Young recruitment is fair but not nearly enough to replace decadent/dying plants.

Other preferred species found on the site in small numbers include fourwing saltbush, green ephedra, and rubber rabbitbrush. Fourwing is scattered over the site, although it occurs in a dense patch near the baseline. Use was moderate and vigor poor on one-third of the plants sampled in 1998. Percent decadence was also high at 43%. Drought conditions also caused downward trends on fourwing. All plants sampled in 2003 were classified as decadent and 75% of those appeared to be dying. The green ephedra appears to be fairing better. They showed heavy use in 1998 and moderate to heavy use in 2003. Density increased 31% in 2003 to 840 plants/acre. Average vigor is still poor on nearly one-third of the population although the number of decadent plants declined to only 19%.

Increaser shrubs include narrowleaf low rabbitbrush and broom snakeweed. Snakeweed was the most abundant increaser in 1998 with an estimated density of 1,360 plants/acre. Age class distribution indicated a slightly expanding population. Due to drought, the population declined 59% in 2003 to only 560 plants/acre. Singleleaf pinyon and Utah juniper trees are scattered over the site. Point-quarter data from 1998 estimated 21 pinyon and 96 juniper trees/acre. Average basal diameter was 1.6 inches for pinyon and 1.9 inches for juniper. Many of the larger, older trees appeared to be highlined. Tree density has slowly increased. Point-quarter data from 2003 estimated 29 pinyon and 157 juniper trees/acre. Average diameter has remained similar (1.7" for pinyon and 1.7" for juniper). Size class analysis indicates that 40% of the trees sampled were young trees in the 1-4 foot class and another 25% were seedlings.



The herbaceous understory is poor. Grasses were dominated by the annual cheatgrass which provided 76% of the herbaceous cover in 1998. With drought, cover of cheatgrass declined and provided only 1% of the total grass cover in 2003. Perennial species are not abundant with only the warm season grass, galleta, occurring more than occasionally. Forbs are diverse, but produced less than 1% cover in 1998 and 2003. The most common species is longleaf phlox and spring parsley.

#### 1998 APPARENT TREND ASSESSMENT

The soil trend appears stable but in poor condition. There is a considerable amount of protective ground cover, although most of this comes from rock and pavement. The presence of this type of ground cover can accelerate runoff on moderate slopes. The site is terraced and erosion currently appears localized. Trend for browse appears to be slightly downward for the key species, Wyoming big sagebrush, which makes up 74% of the browse cover. Use is moderate and reproduction does not appear to be adequate to maintain the population. The less abundant fourwing saltbush and green ephedra appear to be declining due to heavy use and poor reproduction. The herbaceous understory is poor with cheatgrass providing almost three-fourths of the herbaceous cover. Several desirable perennial grasses are present, but in small numbers. The forb composition is very diverse for this type of site, although all species occur in low numbers. The herbaceous trend will likely not improve in the future due to the dominance of cheatgrass, combined with the extreme rockiness of the soil surface. Pavement and rock are dark in color which can greatly elevate soil surface temperatures and decrease soil moisture during the summer.

#### 2003 TREND ASSESSMENT

Trend for soil is stable. Average cover for vegetation declined due primarily to the major decline in cover of cheatgrass. Litter cover increased and cover of bare ground declined slightly. The ratio of protective ground cover to bare ground is marginal and some erosion is occurring on the site. The soil erosion condition class was determined to be slight in 2003. Trend for the key browse species, Wyoming big sagebrush, is down due to drought. Density has declined by 18% since 1998, poor vigor has increased, and the number of decadent plants has increased from 17% to 54% of the population. In addition, 53% of the decadent plants sampled were classified as dying (>50% crown death), which amounts to 1,500 plants/acre. No seedlings were sampled in 2003 and young plants accounted for only 6% of the population. The less abundant fourwing saltbush also displayed downward trends. Trend for the herbaceous understory is down slightly. Sum of nested frequency for perennial grasses declined slightly, although average cover of perennials has remained similar to 2003 levels. Drought conditions did cause a significant decline in nested frequency of the annual, cheatgrass. Cover of cheatgrass also declined from 13% in 1998 to less than one tenth of one percent in 2003. All perennial grasses declined in nested frequency but only Sandberg bluegrass and bottlebrush squirreltail declined significantly. Perennial forbs remain rare yet sum of nested frequency has remained stable since 1998.

#### TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - down slightly (2)

HERBACEOUS TRENDS --  
Management unit 30 , Study no: 54

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Aristida purpurea</i>	1	5	.03	.01
G	<i>Bromus tectorum</i> (a)	<sub>b</sub> 404	<sub>a</sub> 12	12.57	.02
G	<i>Carex</i> spp.	1	-	.00	-
G	<i>Hilaria jamesii</i>	112	96	2.07	2.59
G	<i>Oryzopsis hymenoides</i>	46	29	.95	.52
G	<i>Poa secunda</i>	<sub>b</sub> 22	<sub>a</sub> 7	.46	.05
G	<i>Sitanion hystrix</i>	<sub>b</sub> 40	<sub>a</sub> 2	.38	.01
G	<i>Stipa comata</i>	-	-	-	.00
G	<i>Vulpia octoflora</i> (a)	2	-	.00	-
Total for Annual Grasses		406	12	12.57	0.02
Total for Perennial Grasses		222	139	3.91	3.19
Total for Grasses		628	151	16.48	3.22
F	<i>Allium</i> spp.	2	-	.00	-
F	<i>Arabis</i> spp.	4	2	.00	.01
F	<i>Astragalus</i> spp.	5	-	.01	-
F	<i>Castilleja chromosa</i>	8	-	.09	-
F	<i>Calochortus nuttallii</i>	<sub>a</sub> 5	<sub>b</sub> 29	.01	.09
F	<i>Cirsium</i> spp.	8	-	.04	-
F	<i>Cryptantha</i> spp.	<sub>b</sub> 15	<sub>a</sub> -	.03	-
F	<i>Cymopterus</i> spp.	<sub>a</sub> 17	<sub>b</sub> 28	.07	.07
F	<i>Delphinium nuttallianum</i>	-	6	-	.04
F	<i>Descurainia pinnata</i> (a)	<sub>b</sub> 13	<sub>a</sub> -	.06	-
F	<i>Draba</i> spp. (a)	<sub>b</sub> 24	<sub>a</sub> -	.11	-
F	<i>Eriogonum</i> spp.	8	11	.06	.02
F	<i>Gilia</i> spp. (a)	<sub>b</sub> 10	<sub>a</sub> 4	.06	.00
F	<i>Lithospermum</i> spp.	-	5	-	.18
F	<i>Penstemon</i> spp.	2	-	.01	-
F	<i>Phlox longifolia</i>	48	45	.23	.10
F	<i>Senecio multilobatus</i>	1	-	.03	-
F	<i>Streptanthus cordatus</i>	11	8	.08	.02
Total for Annual Forbs		47	4	0.23	0.00
Total for Perennial Forbs		134	134	0.68	0.54
Total for Forbs		181	138	0.91	0.55

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

BROWSE TRENDS --

Management unit 30 , Study no: 54

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia tridentata wyomingensis	92	92	19.54	12.57
B	Atriplex canescens	6	4	.97	.21
B	Chrysothamnus viscidiflorus stenophyllus	32	19	.98	.07
B	Ephedra viridis	7	11	.45	.17
B	Gutierrezia sarothrae	18	14	.49	.13
B	Juniperus osteosperma	7	6	1.44	3.44
B	Opuntia spp.	4	9	-	.03
B	Pediocactus simpsonii	3	4	-	-
B	Pinus monophylla	0	0	-	.03
B	Sclerocactus	1	4	-	.00
Total for Browse		170	163	23.89	16.66

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 54

Species	Percent Cover	
	'98	'03
Artemisia tridentata wyomingensis	-	7.80
Atriplex canescens	-	.20
Chrysothamnus viscidiflorus stenophyllus	-	.15
Ephedra viridis	-	.05
Juniperus osteosperma	3.40	2.90
Opuntia spp.	-	.16
Sclerocactus	-	.03

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 54

Species	Average leader growth (in)
	'03
Artemisia tridentata wyomingensis	1.0

POINT-QUARTER TREE DATA --  
 Management unit 30 , Study no: 54

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	96	157
Pinus monophylla	-	29

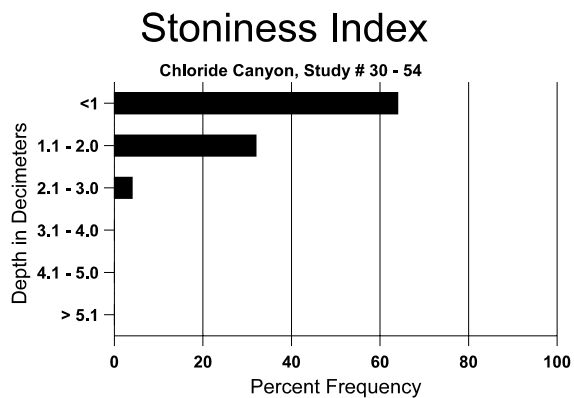
Average diameter (in)	
'98	'03
1.9	1.7
-	1.7

BASIC COVER --  
 Management unit 30 , Study no: 54

Cover Type	Average Cover %	
	'98	'03
Vegetation	33.48	21.92
Rock	14.30	16.04
Pavement	33.29	35.88
Litter	12.42	20.07
Cryptogams	.63	.31
Bare Ground	20.05	15.18

SOIL ANALYSIS DATA --  
 Management unit 30, Study no: 54, Study Name: Bullion Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
19.0	63.8 (15.8)	7.0	46.0	29.4	24.6	1.7	6.4	160.0	0.6



PELLET GROUP DATA --  
 Management unit 30 , Study no: 54

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	9	5	-	-
Deer	24	18	23 (57)	50 (124)
Cattle	-	1	2 (5)	-

BROWSE CHARACTERISTICS --  
 Management unit 30 , Study no: 54

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>											
98	<b>6420</b>	120	860	4460	1100	560	60	9	17	10	12/22
03	<b>5260</b>	-	320	2120	2820	1480	31	16	54	32	9/19
<i>Atriplex canescens</i>											
98	<b>140</b>	-	-	80	60	-	86	0	43	29	21/27
03	<b>80</b>	-	-	-	80	-	0	75	100	75	19/37
<i>Chrysothamnus nauseosus</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	8/18
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Chrysothamnus viscidiflorus stenophyllus</i>											
98	<b>960</b>	60	60	820	80	-	2	0	8	6	10/13
03	<b>480</b>	-	60	120	300	20	8	0	63	38	6/9
<i>Ephedra viridis</i>											
98	<b>580</b>	-	20	360	200	20	14	83	34	31	16/16
03	<b>840</b>	-	480	200	160	40	12	24	19	26	10/14
<i>Gutierrezia sarothrae</i>											
98	<b>1360</b>	20	420	920	20	20	0	0	1	1	6/6
03	<b>560</b>	-	-	520	40	260	0	0	7	7	5/7
<i>Juniperus osteosperma</i>											
98	<b>140</b>	20	120	20	-	40	0	0	-	0	-/-
03	<b>120</b>	-	40	80	-	-	0	0	-	0	-/-
<i>Opuntia spp.</i>											
98	<b>80</b>	-	-	40	40	20	0	0	50	0	4/7
03	<b>180</b>	-	-	120	60	-	0	0	33	33	5/16

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Pediocactus simpsonii</b>											
98	<b>60</b>	-	-	60	-	20	0	0	0	0	3/3
03	<b>80</b>	-	-	60	20	-	0	0	25	25	2/2
<b>Sclerocactus</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
03	<b>80</b>	-	-	80	-	-	0	0	-	0	3/2

Trend Study 30-55-03

Study site name: Quichapa Canyon

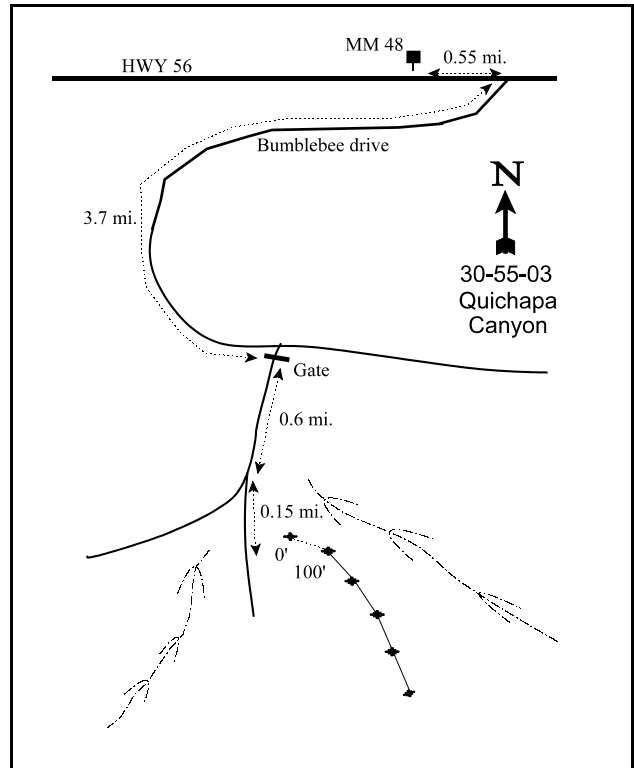
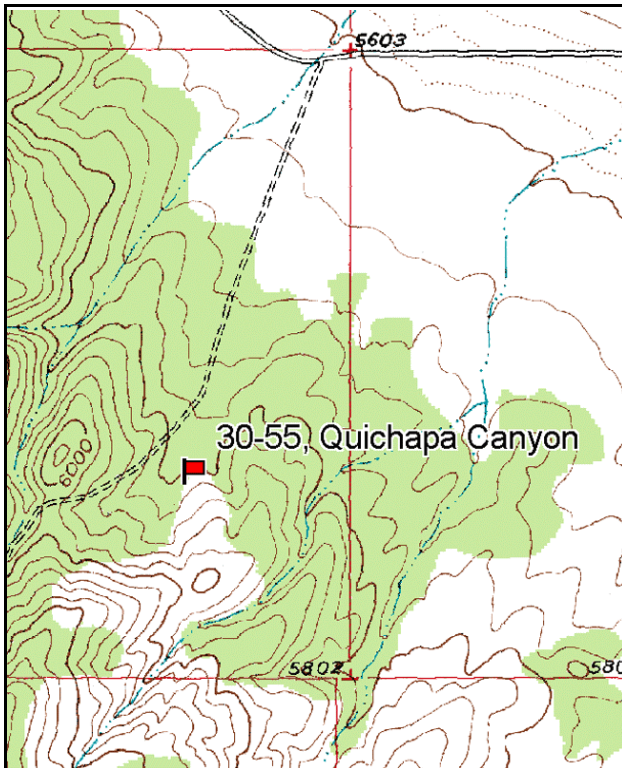
Vegetation type: Mountain Brush

Compass bearing: frequency baseline 103 degrees magnetic. (lines 2-3, 142°M, line 4, 156°M, line 5, 153°M).

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

LOCATION DESCRIPTION

From Highway 56, drive to mile marker 48 and continue east 0.55 miles to Bumble Bee Dr., a road on the right (south). Travel 3.7 miles south to a gate on the right. Proceed through the gate and drive 0.6 miles to a fork. Take the left fork for 0.15 miles to the witness post on the left side of the road. The 0-foot stake is 5 paces away at 77 degrees magnetic. The study is marked by half high fenceposts. The 0-foot stake is marked by browse tag # 498.



Map name: Kannarraville

Diagrammatic Sketch

Township 37S, Range 12W, Section 7

GPS: NAD 27, UTM 12S 4162671 N, 302367 E

## DISCUSSION

### Quichapa Canyon - Trend Study No. 30-55

This trend study was established in 1998 to monitor deer winter range on the northeast side of unit 30. The study samples a northwest facing ridge at an elevation of about 5,800 feet with a slope of 20%. The site is a mountain brush type with a juniper overstory. Water is available about 1/4 of a mile to the northeast in a stream. The area receives use by deer, sheep, and some cattle. Pellet group data taken from the site in 1998 estimated 41 deer days use/acre (101 ddu/ha). Several deer were seen near the site during study establishment and fresh pellet groups were also observed. Sheep had also recently used the site in 1998 and a sheep camp was located 1/2 mile to the northeast. Some cow sign was also observed in low numbers. Pellet group data from 2003 estimated 33 deer days use/acre (83 ddu/ha). Only 1cattle pat was encountered in 2003.

Soil at the site is moderately deep with an effective rooting depth of just over 14 inches. It has a sandy loam texture with clay concentrated in lower horizons. Rock and pavement are common on the surface and within the profile. Soil temperature was high in 2003 averaging 71°F at a depth of just over 11 inches. This high of a soil temperature in late May of 2003 would indicate a dry soil profile. In contrast, average soil temperature was only 55° F at a depth of 14 inches in 1998. Precipitation data from Cedar City shows that annual precipitation was 131% of normal in 1997, and spring precipitation (April to June) in 1998 was 129% of normal. Annual precipitation was only 49% of normal in 2002. Spring periods were well below normal in 2001 at 70% of normal and 2002 at only 19% or normal, while spring precipitation in 2003 was 88% of normal (Utah Climate Summaries 2004). Some erosion appears to be occurring due to poor protective ground cover combined with the steep terrain. The erosion condition class was determined as stable in 2003.

Utah juniper is abundant on the site and slowly increasing. Smaller numbers of pinyon pine are also found. Point-quarter data from 2003 estimated 196 juniper and 32 pinyon trees/acre. Average basal diameter was 4.9 inches for juniper and 2.8 inches for pinyon. These trees provided 37% of the browse cover in 2003 with a line-intercept canopy cover value of 14%. Drought conditions in 2003 caused several trees to have brown leaves. Key understory species consist of Utah serviceberry, mountain big sagebrush, and antelope bitterbrush. Serviceberry provided 26% of the browse cover in 1998 and 30% in 2003. Density was estimated at 1,240 plants/acre in 1998 and 1,780 in 2003. Mature plants average nearly 4 feet in height. They have been moderate to heavily utilized and percent decadence has been moderately high at 44% in 1998 and 34% in 2003. Reproduction has been good.

Mountain big sagebrush provides 30% of the shrub cover with an estimated density of around 2,000 plants/acre. Use of the sagebrush has been mostly light to moderate. Vigor is normal on most plants and percent decadence has increased from 25% in 1998 to 50% in 2003. Bitterbrush occurs in small numbers of about 300 plants/acre. It displays extreme hedging with most individuals sampled being classified as partly unavailable due to hedging. There is no sign of reproduction, although vigor is normal on most plants and percent decadence was only 13% in 1998 increasing to 38% in 2003. There are also small numbers of black sagebrush, true mountain mahogany, and Gambel oak which provide some additional forage.

The herbaceous understory is very poor. Cheatgrass is the most common species as it provided 72% of the grass cover and 66% of the total herbaceous cover in 1998. Drought conditions caused a significant decline in the nested frequency of cheatgrass in 2003 with a corresponding drop in cover from 7% in 1998 to less than 1% in 2003. Bottlebrush squirreltail is the only common perennial grass on the site with several other perennial species occurring less frequently. Forbs are diverse with 19 species encountered in 1998. However, none are very abundant with all of these forbs combining to produce less than 1% cover in 1998 and only 2% cover in 2003. The most abundant species are small annuals.



1998 APPARENT TREND ASSESSMENT

The soil is in poor condition with inadequate protective ground cover and abundant bare soil exposed. Erosion is occurring which further degrades the site potential. This trend will continue unless more herbaceous vegetation becomes established. Trend for browse appears to be going down due to extremely heavy use, poor vigor, high decadence, and poor reproduction for most preferred species. In addition, juniper and to a lesser extent pinyon appear to be increasing which will further reduce the shrub and herbaceous understory. The herbaceous understory is poor with most of the grass cover composed of cheatgrass. Perennial species are present but in small numbers. The forb component is very diverse but depleted.

2003 TREND ASSESSMENT

Trend for soil is stable but in poor condition. Vegetation and litter cover declined slightly while average cover of bare ground declined. The decline in vegetation and litter cover comes from a significant decline in the frequency and cover of cheatgrass. Average cover of rock and pavement increased from 29% in 1998 to 36% in 2003. Some localized erosion is occurring but it is currently minimal. Trend for browse is mixed. Trend for serviceberry is stable. Use remains moderate to heavy but average vigor remained similar and the number of decadent plants declined slightly to 34%. Serviceberry seedlings are fairly abundant and young plants account for 42% of the population. Trend for sagebrush and bitterbrush are down. Density of mountain big sagebrush declined slightly since 1998 but use is heavier, more plants display poor vigor, and one-half the population is now decadent. No seedlings or young were encountered in 2003. Bitterbrush is still being extremely heavily hedged. This is due primarily to its limited numbers (260 plants/acre). Vigor remains normal but the number of decadent plants has increased from 13% to 38%. Due to the high level of use, no flowering was occurring even though annual leader growth was good averaging 2 inches. Taking all of this into consideration, the overall browse trend is considered slightly down. Trend for the herbaceous understory is stable but poor. Sum of nested frequency for perennial grasses remained stable yet nested frequency of cheatgrass declined significantly. Average cover of cheatgrass declined from 7% in 1998 to less than 1% in 2003. Nested frequency of bottlebrush squirreltail also declined significantly as other species increased. Several sites on the unit also show a decline of bottlebrush squirreltail during this drought period. The forb composition remains poor with few perennial forbs found on the site more than occasionally. Annual forbs are more abundant.

TREND ASSESSMENT

soil - stable (3)

browse - down slightly (2)

herbaceous understory - stable but poor (3)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 55

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Bromus tectorum (a)	<sub>b</sub> 371	<sub>a</sub> 150	7.05	.87
G	Hilaria jamesii	<sub>a</sub> -	<sub>b</sub> 14	-	.22
G	Oryzopsis hymenoides	8	11	.21	.10
G	Poa bulbosa	2	-	.00	-
G	Poa fendleriana	31	44	.68	.20

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Poa secunda</i>	3	2	.03	.00
G	<i>Sitanion hystrix</i>	<sub>b</sub> 79	<sub>a</sub> 51	1.86	.66
G	<i>Vulpia octoflora</i> (a)	4	-	.01	-
Total for Annual Grasses		375	150	7.06	0.87
Total for Perennial Grasses		123	122	2.80	1.20
Total for Grasses		498	272	9.86	2.07
F	<i>Agoseris glauca</i>	6	5	.01	.01
F	<i>Allium</i> spp.	2	-	.00	-
F	<i>Arabis</i> spp.	-	8	-	.07
F	<i>Astragalus convallarius</i>	2	-	.15	-
F	<i>Astragalus</i> spp.	8	2	.02	.00
F	<i>Castilleja chromosa</i>	3	-	.00	-
F	<i>Calochortus nuttallii</i>	4	2	.01	.01
F	<i>Chaenactis douglasii</i>	9	-	.02	-
F	<i>Comandra pallida</i>	-	10	-	.06
F	<i>Collinsia parviflora</i> (a)	<sub>a</sub> 61	<sub>b</sub> 208	.15	1.25
F	<i>Cymopterus</i> spp.	-	2	.00	.00
F	<i>Descurainia pinnata</i> (a)	<sub>a</sub> 3	<sub>b</sub> 30	.01	.21
F	<i>Draba</i> spp. (a)	<sub>b</sub> 13	<sub>a</sub> 1	.03	.00
F	<i>Gilia</i> spp. (a)	<sub>a</sub> -	<sub>b</sub> 55	-	.30
F	<i>Lomatium</i> spp.	3	1	.00	.00
F	<i>Microsteris gracilis</i> (a)	<sub>a</sub> 73	<sub>b</sub> 100	.17	.28
F	<i>Orobanche fasciculata</i>	2	-	.00	-
F	<i>Penstemon</i> spp.	2	-	.00	-
F	<i>Phlox longifolia</i>	19	24	.05	.08
F	<i>Polygonum douglasii</i> (a)	-	5	-	.01
F	<i>Sphaeralcea grossulariaefolia</i>	-	2	-	.00
F	<i>Streptanthus cordatus</i>	-	1	-	.03
F	<i>Stellaria jamesiana</i>	1	-	.03	-
F	<i>Trifolium</i> spp.	18	8	.03	.02
F	<i>Zigadenus paniculatus</i>	3	-	.03	-
Total for Annual Forbs		150	399	0.36	2.08
Total for Perennial Forbs		82	65	0.39	0.31
Total for Forbs		232	464	0.76	2.39

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

BROWSE TRENDS --

Management unit 30 , Study no: 55

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	37	34	5.16	4.99
B	Artemisia nova	4	0	2.02	-
B	Artemisia tridentata vaseyana	68	59	3.82	3.53
B	Juniperus osteosperma	8	8	7.06	6.21
B	Opuntia spp.	1	3	-	-
B	Pinus edulis	2	2	.15	.63
B	Purshia tridentata	11	6	1.41	1.31
B	Quercus gambelii	5	5	.03	.06
Total for Browse		136	117	19.68	16.73

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 55

Species	Percent Cover	
	'98	'03
Amelanchier utahensis	-	4.26
Artemisia tridentata vaseyana	-	6.44
Juniperus osteosperma	10.19	13.50
Pinus edulis	-	.51
Purshia tridentata	-	.48
Quercus gambelii	1.00	.51

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 55

Species	Average leader growth (in)
	'03
Amelanchier utahensis	2.0
Artemisia tridentata vaseyana	1.0

POINT-QUARTER TREE DATA --

Management unit 30 , Study no: 55

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	163	196
Pinus edulis	23	32

Average diameter (in)	
'98	'03
6.4	4.9
7.2	2.8

**BASIC COVER --**

Management unit 30 , Study no: 55

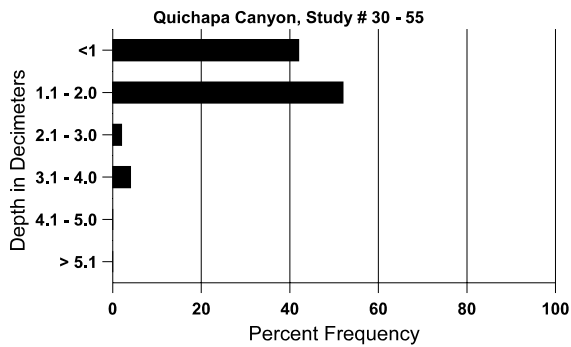
Cover Type	Average Cover %	
	'98	'03
Vegetation	30.07	25.30
Rock	11.87	13.54
Pavement	17.17	22.48
Litter	39.04	32.59
Cryptogams	.22	.05
Bare Ground	27.82	20.30

**SOIL ANALYSIS DATA --**

Management unit 30, Study no: 55, Study Name: Quichapa Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
14.3	71.4 (11.3)	6.5	36.6	38.7	24.7	3.7	14.1	492.8	0.6

**Stoniness Index**



**PELLET GROUP DATA --**

Management unit 30 , Study no: 55

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Sheep	2	-	6 (15)	-
Rabbit	30	19	-	-
Deer	35	23	41 (101)	33 (83)

BROWSE CHARACTERISTICS --  
Management unit 30 , Study no: 55

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
98	<b>1240</b>	400	260	440	540	240	27	52	44	26	45/42
03	<b>1780</b>	220	740	440	600	300	22	25	34	20	35/34
<b>Artemisia nova</b>											
98	<b>80</b>	-	-	-	80	160	0	0	100	75	8/17
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<b>Artemisia tridentata vaseyana</b>											
98	<b>2100</b>	80	240	1400	460	480	17	.95	22	6	21/28
03	<b>1880</b>	-	-	940	940	920	40	3	50	22	22/26
<b>Cercocarpus montanus</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	44/52
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Gutierrezia sarothrae</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	8/9
<b>Juniperus osteosperma</b>											
98	<b>160</b>	20	100	60	-	-	0	0	-	0	-/-
03	<b>160</b>	-	60	100	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	6/12
03	<b>60</b>	-	-	60	-	-	0	0	-	0	4/15
<b>Pinus edulis</b>											
98	<b>60</b>	20	60	-	-	-	0	0	-	0	-/-
03	<b>40</b>	-	40	-	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
98	<b>300</b>	-	-	260	40	20	0	93	13	13	20/34
03	<b>260</b>	-	-	160	100	100	23	69	38	0	14/29
<b>Quercus gambelii</b>											
98	<b>160</b>	20	120	40	-	-	0	13	-	13	31/30
03	<b>200</b>	-	160	40	-	-	0	20	-	0	46/37

Trend Study 30-56-03

Study site name: Woolsey Reseed .

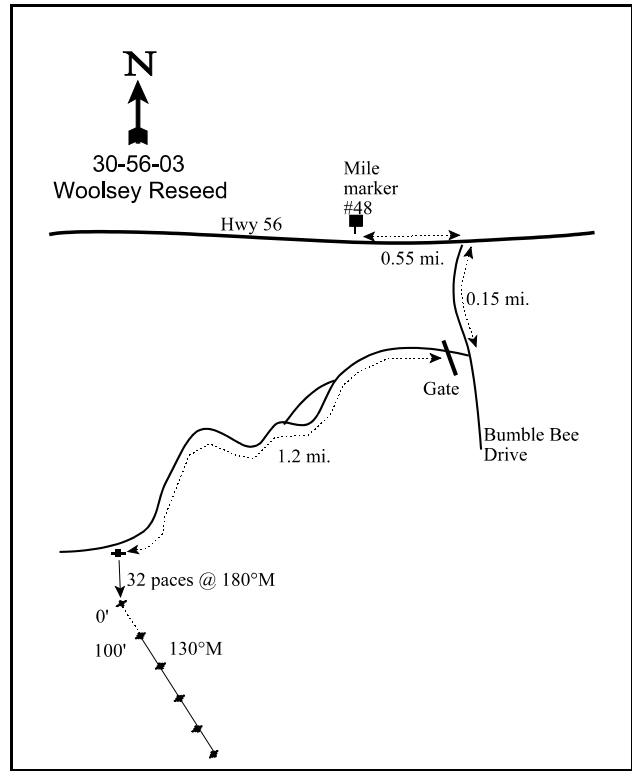
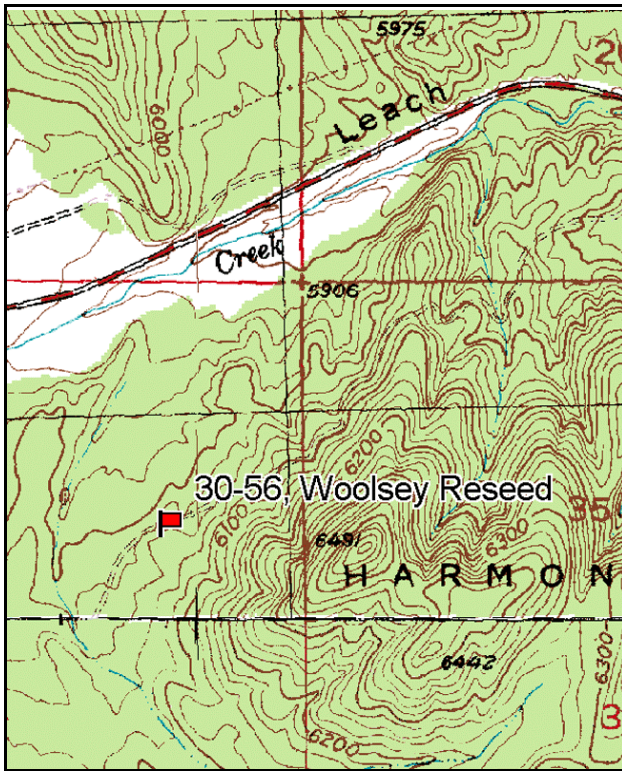
Vegetation type: Chained, Seeded P-J .

Compass bearing: frequency baseline 130 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 48 on Highway 56 go east 0.55 miles to Bumblebee drive. Turn right (south) and travel 0.15 miles crossing a bridge to a right turn. Take this turn, go thru a gate, and proceed 1.2 miles to a witness post in a chaining. From the witness post the 0-foot stake is 32 paces directly south. The 0-foot stake is marked by browse tag # 95. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height.



Map Name: Desert Mound

Diagrammatic Sketch

Township 36S, Range 13W, Section 34

GPS: NAD 27, UTM 12S 4166685 N, 297671 E

## DISCUSSION

### Woolsey Seeding - Trend Study No. 30-56

This trend study was established in 1998. It is located on the Woolsey seeding and samples a chained and seeded pinyon and juniper site that is considered important deer winter range. The site has a northwest aspect and a slope from 10% to 15%. Elevation is approximately 6,000 feet. The land is administered by the BLM. Deer are thought to concentrate on the chaining during the winter and cattle also graze the area during the spring and summer. Pellet group data estimated 37 deer days use/acre in 1998 and 44 in 2003 (91 and 109 ddu/ha). Cattle use was estimated at 55 cow days use/acre in 1998 and 26 in 2003 (136 and 65cdu/ha). The site was read in late May of 2003. Cattle had just started using the area at that time and cattle pats counted represented cattle use from the summer of 2002. Escape cover for deer is abundant in the form of large serviceberry on the site and unchained pinyon and juniper trees about 500 feet to the east.

Soil on the site is moderately deep, and rocky on the surface and through the profile. Effective rooting depth is estimated at 16 inches. Soil texture is a clay loam which is neutral in reaction (pH 7.0). Phosphorus is low at only 6.1 ppm when 10 ppm is considered a minimum value for normal plant development. Erosion is not a problem on the site due to the abundant protective ground cover consisting primarily of herbaceous vegetation and old chaining litter.

The site supports low densities of several preferred browse species including Utah serviceberry, mountain big sagebrush, dwarf rabbitbrush, rubber rabbitbrush, cliffrose, antelope bitterbrush, curlleaf and true mountain mahogany. The most abundant of these is rubber rabbitbrush which numbered about 300 plants/acre in 1998 and 2003. Most of the other preferred shrubs were not adequately sampled because they occur in such limited numbers. Cliffrose and bitterbrush were heavily hedged with serviceberry moderately utilized during both readings. True mountain mahogany and curlleaf mountain mahogany were also heavily hedged during both readings. Young pinyon and juniper trees have been released by the chaining. These are young trees in the 4 to 6 foot class, not killed by the chaining. They are fairly abundant. Point-quarter data from 2003 estimated 63 Utah juniper and 41 pinyon trees/acre. Average basal diameter was 3.4 inches for juniper and 2.3 inches for pinyon. Pinyon and juniper provided nearly 4% cover which accounted for 53% of the shrub cover in 1998. Overhead canopy cover was almost 3% for juniper and pinyon. Data from 2003 estimated a line-intercept canopy cover of 6% for juniper and 1.25% for pinyon, over a twofold increase since 1998.

Seeded grasses dominate the site. Crested wheatgrass, intermediate wheatgrass, and Russian wildrye are abundant and provided 96% of the grass cover in 1998 and 99% in 2003. Three native perennial grasses are also present in small numbers as is annual cheatgrass. The forb component is diverse with 15 and 17 species encountered in 1998 and 2003 respectively. However, all species occur rarely and all forbs combined produced only about 1% cover during either reading.

### 1998 APPARENT TREND ASSESSMENT

The soil appears stable due to the abundant protective ground cover consisting primarily of perennial herbaceous vegetation and litter from the chaining. There is a variety of browse species on the site, although none are very abundant. The most preferred species are being heavily utilized. Trend appears stable, but management strategies to increase the shrub component on the site would be desirable for deer winter range improvement. The herbaceous understory is abundant and well established. However, composition could be better as three seeded grasses dominate and forbs are limited.

### 2003 TREND ASSESSMENT

Trend for soil is stable. Relative percent cover of vegetation has declined slightly while litter cover increased

slightly and cover of bare ground declined to 10%. Cover of herbaceous vegetation declined since 1998 due to drought, but is still well distributed and has helped stabilized the soil on the site. Trend for browse is stable although the browse component is limited. There are several preferred species which occur in very small numbers and are heavily hedged. All species, serviceberry, mountain big sagebrush, curleaf mahogany, rubber rabbitbrush, cliffrose, and bitterbrush, displayed normal vigor even with the heavy use. Trend for the herbaceous understory is down. Sum of nested frequency for perennial grasses declined by 37% since 1998. There was some difficulty differentiating crested and intermediate wheatgrass in 2003 due to late flowering. However, the combined nested frequency value for these grasses declined 34%. Nested frequency of the only other seeded grass, Russian wildrye, also declined significantly. Average cover of perennial grasses declined more than twofold from 27% to 11%. Forbs remain diverse but all species are rare in their occurrence. Nested frequency of perennial forbs also declined although total cover of forbs remained similar to 1998 levels due to an increase in annual forb cover.

**TREND ASSESSMENT**

soil - stable (3)

browse - stable but limited (3)

herbaceous understory - down (1)

**HERBACEOUS TRENDS --**

Management unit 30 , Study no: 56

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Agropyron cristatum	<sub>a</sub> 190	<sub>b</sub> 262	8.09	8.57
G	Agropyron intermedium	<sub>b</sub> 287	<sub>a</sub> 54	13.56	1.39
G	Bromus tectorum (a)	<sub>b</sub> 75	<sub>a</sub> 14	.75	.04
G	Elymus junceus	<sub>b</sub> 110	<sub>a</sub> 57	4.10	1.38
G	Oryzopsis hymenoides	-	-	.03	.00
G	Poa secunda	4	2	.01	.03
G	Sitanion hystrix	3	-	.15	-
<b>Total for Annual Grasses</b>		<b>75</b>	<b>14</b>	<b>0.75</b>	<b>0.04</b>
<b>Total for Perennial Grasses</b>		<b>594</b>	<b>375</b>	<b>25.96</b>	<b>11.39</b>
<b>Total for Grasses</b>		<b>669</b>	<b>389</b>	<b>26.71</b>	<b>11.43</b>
F	Astragalus spp.	5	1	.09	.00
F	Cryptantha spp.	-	4	-	.03
F	Cymopterus spp.	7	8	.09	.04
F	Dalea flavescens	5	-	.30	-
F	Descurainia pinnata (a)	<sub>a</sub> 5	<sub>b</sub> 22	.01	.14
F	Draba spp. (a)	11	27	.03	.16
F	Eriogonum umbellatum	3	2	.03	.03
F	Lappula occidentalis (a)	3	15	.01	.20
F	Lesquerella spp.	4	3	.07	.01
F	Lotus utahensis	2	-	.03	-



Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
F	Lupinus argenteus	3	-	.00	-
F	Microsteris gracilis (a)	21	8	.05	.02
F	Pedicularis centranthera	-	6	-	.44
F	Penstemon spp.	4	4	.00	.01
F	Petradoria pumila	9	4	.18	.01
F	Phlox hoodii	5	4	.04	.01
F	Phlox longifolia	-	1	-	.00
F	Polygonum douglasii (a)	-	6	-	.01
F	Ranunculus testiculatus (a)	-	1	-	.00
F	Streptanthus cordatus	<sub>a</sub> 2	<sub>b</sub> 13	.01	.03
Total for Annual Forbs		40	79	0.10	0.54
Total for Perennial Forbs		49	50	0.85	0.64
Total for Forbs		89	129	0.96	1.19

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 56

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	2	1	.85	.98
B	Artemisia tridentata vaseyana	1	1	-	-
B	Cercocarpus montanus	1	1	-	-
B	Chrysothamnus depressus	18	4	.55	-
B	Chrysothamnus nauseosus hololeucus	8	6	1.56	.45
B	Cowania mexicana stansburiana	0	3	-	-
B	Eriogonum microthecum	3	3	.03	.01
B	Gutierrezia sarothrae	20	20	.45	.26
B	Juniperus osteosperma	4	4	1.94	5.10
B	Opuntia spp.	0	1	-	-
B	Pinus edulis	3	1	1.97	.18
B	Purshia tridentata	0	0	.03	-
B	Ribes spp.	1	0	-	-
Total for Browse		61	45	7.40	6.98

CANOPY COVER, LINE INTERCEPT --  
 Management unit 30 , Study no: 56

Species	Percent Cover	
	'98	'03
Amelanchier utahensis	-	.81
Chrysothamnus nauseosus hololeucus	-	.16
Cowania mexicana stansburiana	-	.08
Gutierrezia sarothrae	-	.50
Juniperus osteosperma	.60	6.15
Pinus edulis	2.20	1.26

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 30 , Study no: 56

Species	Average leader growth (in)
	'03
Amelanchier utahensis	1.6
Cowania mexicana stansburiana	1.8
Purshia tridentata	0.9

POINT-QUARTER TREE DATA --  
 Management unit 30 , Study no: 56

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	59	63
Pinus edulis	28	41

Average diameter (in)	
'98	'03
2.0	3.4
2.0	2.3

BASIC COVER --  
 Management unit 30 , Study no: 56

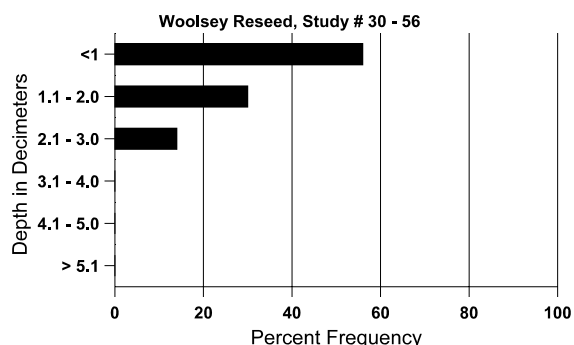
Cover Type	Average Cover %	
	'98	'03
Vegetation	39.56	20.13
Rock	5.94	8.19
Pavement	9.63	19.89
Litter	52.22	47.84
Cryptogams	.24	.04
Bare Ground	18.28	10.11

SOIL ANALYSIS DATA --

Management unit 30, Study no: 56, Study Name: Woolsey Reseed

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	% OM	PPM P	PPM K	ds/m
16.1	61.8 (14.7)	7.0	38.0	25.4	36.6	3.5	6.1	118.4	0.7

Stoniness Index



PELLET GROUP DATA --

Management unit 30, Study no: 56

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	25	23	-	-
Deer	24	30	36 (89)	44 (109)
Cattle	11	8	54 (133)	26 (64)

BROWSE CHARACTERISTICS --

Management unit 30, Study no: 56

		Age class distribution (plants per acre)					Utilization				Average Height Crown (in)
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	
<b>Amelanchier utahensis</b>											
98	40	-	-	40	-	-	100	0	-	0	37/51
03	40	20	20	20	-	-	50	0	-	0	58/70
<b>Artemisia tridentata vaseyana</b>											
98	20	-	20	-	-	-	0	0	-	0	-/-
03	20	-	-	20	-	-	0	100	-	0	8/-
<b>Cercocarpus ledifolius</b>											
98	0	-	-	-	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	35/47

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Cercocarpus montanus</b>											
98	20	-	-	20	-	-	0	100	0	0	50/54
03	20	-	-	-	20	-	0	100	100	0	64/60
<b>Chrysothamnus depressus</b>											
98	620	20	100	520	-	-	0	0	-	0	4/6
03	100	-	20	80	-	-	0	0	-	0	3/5
<b>Chrysothamnus nauseosus hololeucus</b>											
98	300	-	40	180	80	-	40	0	27	13	34/43
03	320	-	-	300	20	60	6	0	6	0	30/38
<b>Cowania mexicana stansburiana</b>											
98	0	-	-	-	-	20	0	0	0	0	62/66
03	60	-	-	40	20	-	0	33	33	0	54/56
<b>Eriogonum microthecum</b>											
98	60	-	20	40	-	-	0	0	0	0	4/11
03	80	-	-	60	20	-	100	0	25	0	1/2
<b>Gutierrezia sarothrae</b>											
98	1180	80	60	1120	-	20	0	0	0	0	7/10
03	1260	640	40	1180	40	40	0	0	3	2	5/6
<b>Juniperus osteosperma</b>											
98	100	40	40	60	-	60	0	0	-	0	-/-
03	100	-	-	100	-	-	0	0	-	0	-/-
<b>Opuntia spp.</b>											
98	0	-	-	-	-	-	0	0	-	0	-/-
03	20	-	-	20	-	-	0	0	-	0	3/5
<b>Pinus edulis</b>											
98	60	-	40	20	-	20	0	0	-	0	-/-
03	20	-	-	20	-	-	0	0	-	0	-/-
<b>Purshia tridentata</b>											
98	0	-	-	-	-	-	0	0	-	0	33/70
03	0	-	-	-	-	20	0	0	-	0	27/37
<b>Ribes spp.</b>											
98	80	-	-	80	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	-/-
<b>Sclerocactus</b>											
98	0	-	-	-	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	3/7

Trend Study 30-57-03

Study site name: Summit Spring .

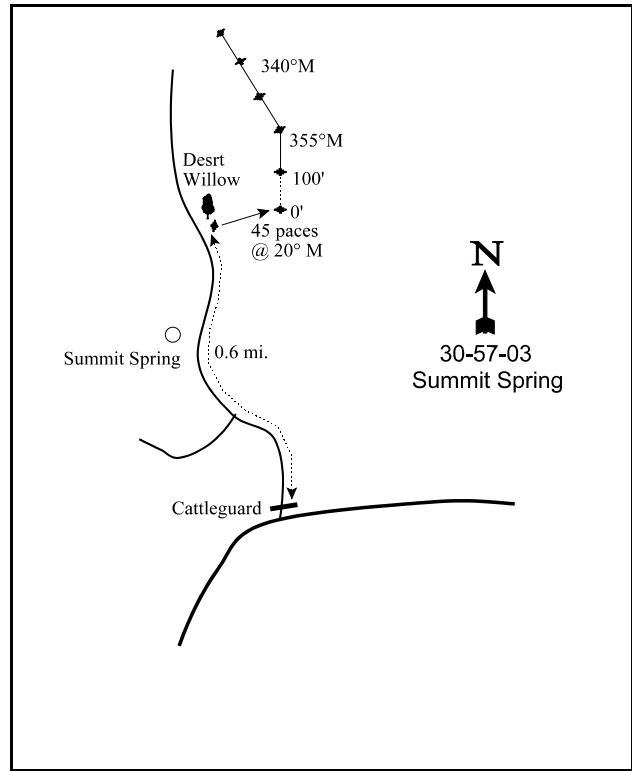
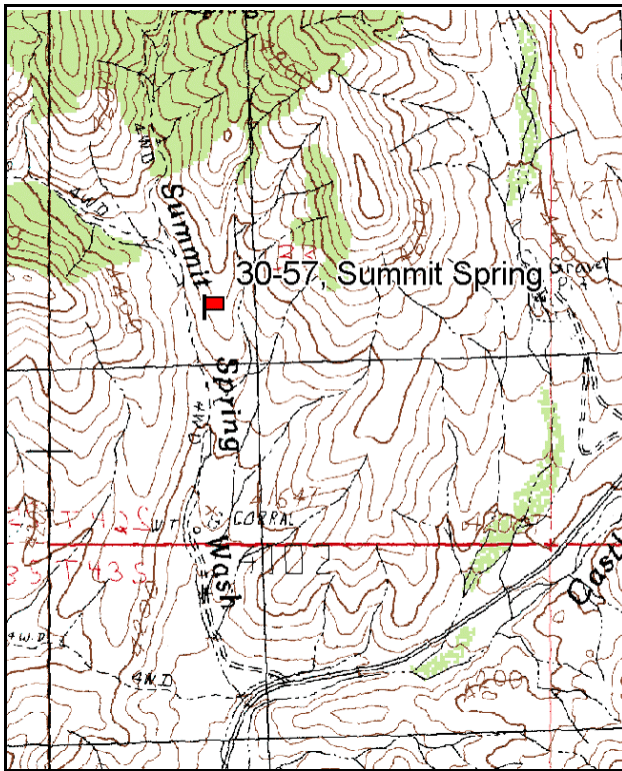
Vegetation type: Black Brush .

Compass bearing: frequency baseline 355 degrees magnetic. (lines 3-5, 340° M).

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

LOCATION DESCRIPTION

From the Lytle Ranch turnoff, just south of Castle Cliff, proceed northeast for approximately 1.5 miles to a dirt road on the left (north) that leads to Summit Spring. From the highway, go 0.3 miles to a cattle watering trough and corral. Continue 0.3 miles further to a desert willow on the right (east) side of the road. The 0-foot stake is 45 paces at 20 degrees magnetic from the desert willow. The 0-foot stake has browse tag #494 attached. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height.



Map Name Jarvis Peak

Diagrammatic Sketch

Township 42S, Range 18W, Section 33

GPS: NAD 27, UTM 12S 4108117 N, 244865 E

## DISCUSSION

### Summit Spring - Trend Study No. 30-57

This trend study was established in 1998, and was placed about ½ mile south of Summit Spring. It samples winter range on the southwest side of the unit. The transect samples a desert shrub community. Slope is 25% to 35% with a west aspect and an elevation of about 4,300 feet. The area is grazed by cattle, and cattle were present near the site during study site establishment on June 2<sup>nd</sup> of 1998 and during the 2003 reading on May 20<sup>th</sup>. A cattle watering trough, which is apparently fed by a pipe from nearby Summit Spring, is found about 1/4 of a mile to the south. Pellet group data estimated a high level of deer use at 61 days use/acre (151 ddu/ha) in 1998 and 76 days use/acre (187 ddu/ha) in 2003. Cow use was estimated at 4 days use/acre (10 cdu/ha) in 1998 and 7 days use/acre (18 cdu/ha) in 2003. Cattle use is higher on the more level areas and along the ridge top.

Soil on the site is relatively shallow and very rocky. Effective rooting depth is estimated at nearly 14 inches. Soil texture is a sandy loam which is neutral in reaction (pH 6.9). Rock and pavement are concentrated on the surface and account for more than half of the ground cover. Some erosion is apparent due to the steep slope but it is localized. Soil temperature was fairly high averaging 73°F at an average depth of nearly 12 inches in 2003. This is about 10 degrees warmer than what was measured in 1998. The difference is due to a dry soil profile caused by drought conditions that have effected this area for the past few years. Precipitation data from Gunlock and Veyo indicate that annual precipitation in 2002 was only about 36% of normal and the spring period (April - June) was only 5% of normal at Veyo in 2002. The spring of 2003 was also very dry, 32% of normal at Gunlock (Utah Climate Summaries 2004).

The site supports 12 shrub species, including the more preferred cliffrose and green ephedra. Blackbrush, slenderbush eriogonum, and desert peachbush also provide browse forage. Cliffrose provides 27% of the browse cover with an estimated density of about 230 plants/acre. Mature plants are large, averaging about 4 feet in height with a crown diameter of over 5 feet. They displayed light to moderate use and good vigor in 1998 with much heavier use in 2003. Vigor is still normal on most plants but decadent plants accounted for 25% of the population in 2003. Reproduction is poor and there was no sign of flowering in 2003.

Green ephedra density was estimated at 680 plants/acre in 1998 and 500 plants/acre in 2003. They have been lightly to moderately utilized. Blackbrush occurs at a low density of about 200 plants/acre. They were lightly browsed in 1998 but more heavily utilized in 2003. Vigor has remained good but reproduction is poor. Desert peachbush is also found at relatively low densities (180 plants/acre), yet on average it contributes 25% of the browse cover. They also displayed light use in 1998 and heavier use in 2003. Drought has obviously effected the population as the number of decadent plants has increased from 0% to 33%.

Undesirable shrubs found on the site include threadleaf snakeweed, Mojave desertrue (turpentine bush), and Datil yucca (banana yucca). Snakeweed was the most abundant with a density of 1,720 plants/acre in 1998. Drought has caused a 80% drop in density to 340 plants/acre in 2003. Seventy-one percent of the remaining population is decadent. Turpentine bush has remained more stable in density. Narrowleaf goldenweed (*Haplopappus linearifolius*) has also been effected by drought. It declined 74% in density in 2003 from 780 to 200 plants/acre. Half of the remaining population is decadent. Juniper trees in the area are also showing signs of stress with yellowing leaves.

The herbaceous understory is very poor and depleted. Cheatgrass totally dominates the understory providing 99% of the grass cover and 79% of the herbaceous cover in 1998. No perennial grasses were sampled on the site in 1998. However, some Indian ricegrass was observed growing under the protection of shrubs. A few Sandberg bluegrass plants were encountered in 2003. The forb component is also poor with storksbill providing most of the forb cover. Other forbs are rare and only a few perennial species were found. Perennial grass and forb cover combined, provide less than one-half of 1% cover. The only dependable forage source for deer or cattle on this site comes from the shrubs, although cheatgrass and storksbill can be utilized in the spring and fall under the right conditions.

1998 APPARENT TREND ASSESSMENT

The soil condition is poor. Rock and pavement provides most of the ground cover. Erosion is apparent, yet not severe. Shrubs are diverse and moderately abundant. Preferred species appear stable with light to moderate use, good vigor, and low decadence. Reproduction is limited for most species. The herbaceous understory is very poor and totally dominated by cheatgrass and storksbill. Perennial species are rare.

2003 TREND ASSESSMENT

Tend for soil is stable with similar ground cover characteristics compared to 1998. There is some limited, localized soil movement on site yet for the most part erosion is minimal. Trend for browse is considered stable. Preferred shrubs, cliffrose, blackbrush, and green ephedra, show heavier use compared to 1998. Vigor has remained good on most plants. The exception is cliffrose where the number of decadent plants has increased but is not of concern for this species as it commonly goes into and out of periods of decadence. Reproduction is poor this year, yet it is not a problem for a long-lived species. The small population of desert peachbush has remained stable in density even though decadence increased from 0% to 33%. One positive aspect of the browse trend is the 80% decline in snakeweed. Trend for the herbaceous understory is stable yet very depleted. The herbaceous understory is still totally dominated by annuals, primarily cheatgrass and storksbill. Cheatgrass has declined significantly in nested frequency and average cover declined from 22% to 13%. However, cheatgrass still accounts for 92% of the grass cover. Storksbill increased significantly in nested frequency and it provides 75% of the total forb cover. There are very few perennial grasses or forbs on the site except for some Sandberg bluegrass that was encountered in 2003. Due to the lack of perennial herbaceous plants, livestock and wildlife are dependent on shrubs for most of their forage needs.

TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - stable but depleted (3)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 57

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Bromus rubens (a)	a-	b <sup>90</sup>	-	.73
G	Bromus tectorum (a)	b <sup>432</sup>	a <sup>375</sup>	21.97	12.97
G	Oryzopsis hymenoides	-	-	.00	-
G	Poa secunda	a-	b <sup>17</sup>	-	.24
G	Vulpia octoflora (a)	a <sup>4</sup>	b <sup>28</sup>	.00	.18
Total for Annual Grasses		436	493	21.98	13.89
Total for Perennial Grasses		0	17	0.00	0.24
Total for Grasses		436	510	21.98	14.13
F	Aster spp.	6	-	.04	-
F	Compositae	-	2	-	.00
F	Cryptantha spp.	3	-	.00	-
F	Descurainia pinnata (a)	a-	b <sup>14</sup>	-	.06

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
F	Draba spp. (a)	8	7	.04	.04
F	Erodium cicutarium (a)	<sub>a</sub> 164	<sub>b</sub> 234	5.59	5.94
F	Eriogonum spp.	-	4	-	.15
F	Eriophyllum wallacei	-	5	-	.03
F	Galium spp.	-	3	-	.03
F	Gilia spp. (a)	<sub>a</sub> -	<sub>b</sub> 50	-	.30
F	Lappula occidentalis (a)	<sub>a</sub> -	<sub>b</sub> 25	-	.16
F	Microsteris gracilis (a)	2	-	.00	-
F	Navarretia intertexta (a)	<sub>a</sub> -	<sub>b</sub> 41	-	.52
F	Oenothera spp.	-	1	-	.03
F	Plantago patagonica (a)	<sub>a</sub> 10	<sub>b</sub> 47	.05	.16
F	Salvia columbariae	5	-	.19	-
F	Sedum lanceolatum	<sub>a</sub> -	<sub>b</sub> 17	-	.26
F	Unknown forb-annual (a)	<sub>a</sub> -	<sub>b</sub> 33	-	.22
Total for Annual Forbs		184	451	5.68	7.42
Total for Perennial Forbs		14	32	0.23	0.52
Total for Forbs		198	483	5.92	7.94

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 57

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Cowania mexicana stansburiana	8	8	5.73	4.96
B	Coleogyne ramosissima	11	8	-	2.01
B	Echinocereus engelmannii	1	1	.03	-
B	Ephedra viridis	17	14	.65	1.97
B	Eriogonum microthecum	0	0	.03	-
B	Gutierrezia microrcephala	45	14	3.47	.31
B	Haplopappus linearifolius	25	8	4.05	.12
B	Opuntia spp.	1	1	.00	.15
B	Prunus fasciculata	5	9	4.85	5.05
B	Thamnosma montana	21	18	.50	1.10
B	Yucca baccata baccata	12	15	2.24	2.42
Total for Browse		146	96	21.59	18.13



CANOPY COVER, LINE INTERCEPT --  
 Management unit 30 , Study no: 57

Species	Percent Cover
	'03
Cowania mexicana stansburiana	4.58
Coleogyne ramosissima	1.64
Ephedra viridis	1.56
Gutierrezia microrcephala	.20
Haplopappus linearifolius	1.08
Prunus fasciculata	4.88
Thamnosma montana	2.84
Yucca baccata baccata	2.83

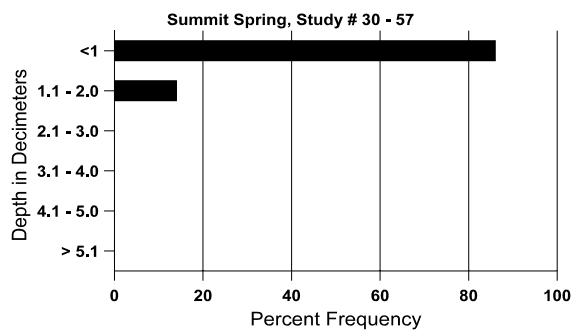
BASIC COVER --  
 Management unit 30 , Study no: 57

Cover Type	Average Cover %	
	'98	'03
Vegetation	45.40	36.82
Rock	19.40	18.57
Pavement	34.65	32.18
Litter	27.13	24.01
Cryptogams	0	.06
Bare Ground	6.44	6.24

SOIL ANALYSIS DATA --  
 Management unit 30, Study no: 57, Study Name: Summit Spring

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
13.9	73.4 (11.7)	6.9	66.0	21.4	12.6	0.7	10.4	83.2	0.5

### Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 57

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	5	3	-	-
Deer	28	27	61 (151)	76 (187)
Cattle	1	6	4 (10)	7 (18)

BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 57

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Cowania mexicana stansburiana</i>											
98	<b>220</b>	-	20	200	-	-	36	0	0	0	47/64
03	<b>240</b>	-	-	180	60	-	0	92	25	8	55/77
<i>Coleogyne ramosissima</i>											
98	<b>240</b>	80	-	240	-	20	8	0	-	0	27/46
03	<b>180</b>	-	-	180	-	40	89	11	-	0	32/49
<i>Echinocereus engelmannii</i>											
98	<b>20</b>	-	-	20	-	-	0	0	-	0	11/9
03	<b>20</b>	-	-	20	-	-	0	0	-	0	15/16
<i>Ephedra viridis</i>											
98	<b>680</b>	-	200	420	60	-	29	0	9	6	21/29
03	<b>500</b>	-	20	440	40	-	24	4	8	8	19/29
<i>Eriogonum microthecum</i>											
98	<b>0</b>	-	-	-	-	20	0	0	-	0	18/27
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Gutierrezia microrcephala</i>											
98	<b>1740</b>	100	140	1340	260	420	0	0	15	11	16/19
03	<b>340</b>	120	20	80	240	1000	0	0	71	53	15/15
<i>Haplopappus linearifolius</i>											
98	<b>780</b>	20	100	460	220	180	0	0	28	5	22/31
03	<b>200</b>	40	-	100	100	600	0	0	50	40	21/27
<i>Opuntia echinocarpa</i>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	23/15

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Opuntia</i> spp.											
98	<b>20</b>	-	20	-	-	20	0	0	-	0	11/12
03	<b>20</b>	-	-	20	-	-	0	0	-	0	12/11
<i>Prunus fasciculata</i>											
98	<b>180</b>	40	-	180	-	20	11	0	0	0	45/67
03	<b>180</b>	-	-	120	60	-	11	22	33	11	48/70
<i>Thamnosma montana</i>											
98	<b>480</b>	20	40	420	20	20	13	0	4	4	16/34
03	<b>400</b>	-	-	340	60	40	0	0	15	15	17/33
<i>Yucca baccata baccata</i>											
98	<b>740</b>	-	-	640	100	80	0	0	14	8	31/39
03	<b>800</b>	-	-	800	-	-	0	0	0	0	30/39

Trend Study 30-58-03

Study site name: Spirit Creek South Burned.

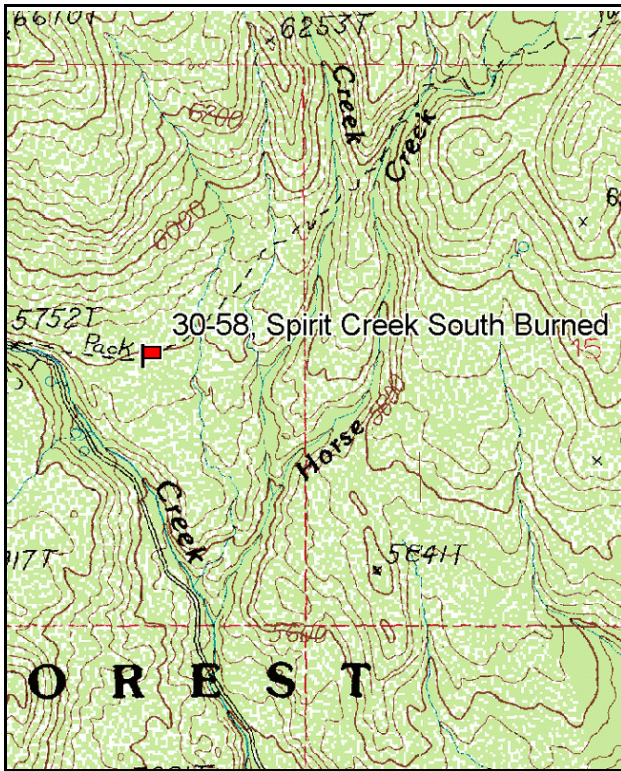
Vegetation type: Burn-seeding.

Compass bearing: frequency baseline 111 degrees magnetic. (Line 2, 94°M, line 3 &4, 15°M)

Frequency belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (71ft), line 4 (34ft). No rebar.

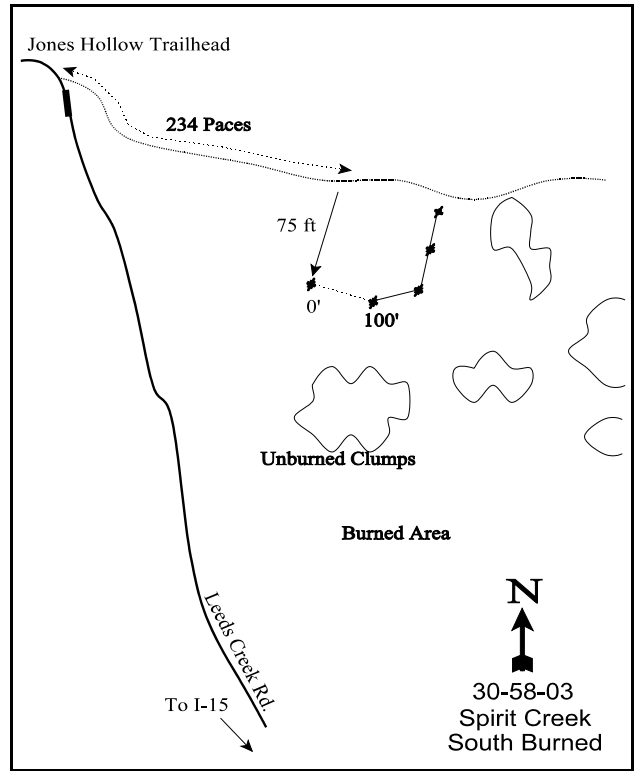
LOCATION DESCRIPTION

Traveling south on I-15 from Cedar City, take the first Leeds exit #23 (If traveling north, there is no off ramp at exit #23 take exit #22 and the frontage road to exit #23). Travel northwest on the Leeds Creek Road for 3.25 miles. Stay to the right at the fork and proceed about 4.0 miles towards the Oak Grove campground. Stop just past a bridge at the Jones Hollow (Blake-Harmony) trail head. Hike 234 paces up the trail to a 4-foot tall green fence post 75 feet southwest (212°M) of the trail. This is the 0-foot baseline stake. All stakes are 4 foot tall green fence posts.



Map Name: Signal Peak

Township 40S, Range 14W, Section 16



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4131708 N, 285031 E

## DISCUSSION

### Spirit Creek South - Trend Study No. 30-58

The Spirit Creek South Burn trend site consists of a nearly level grass meadow surrounded by Gambel and shrub-live oak. The site has an elevation of 5,800 feet, slope of 4-5%, and a south to southeast aspect. The site, which was previously a mountain big sagebrush flat, was burned in June of 1986 and seeded in early July by the Dixie National Forest. The area is important fawning habitat for mule deer which is evidenced by the abundant pellet groups in 1992. Pellet group data from 1998 also estimated a high level of use at 76 deer days use/acre (188 ddu/ha). Some of the deer pellet groups were fresh when the study was read in 1998 on June 4<sup>th</sup>. Deer use was much lighter in 2003 with just 17 days use/acre estimated (43 ddu/ha). No cattle grazing occurs in this area.

Soil is a deep sandy loam with little rock on the surface or within the profile. Effective rooting depth is estimated at over 27 inches. The soil is slightly acidic in reactivity (pH 6.1). Due to the flat topography, erosion is not a problem, even with high amounts of bare ground occurring after the fire. The study was established September 16, 1986, about 3 months after the fire. At that time, basal vegetative cover was less than one percent. Bare ground covered 94% of the ground surface, while litter cover left after the fire, averaged only 6%. The site was read again in September of 1987. Basal vegetative cover increased to 10%, litter increased to 16%, conversely bare ground declined to 74%. Some soil movement was noticed, yet it was not significant. During the 1992 reading, soil conditions continued to improve. Basal vegetative cover averaged 23%, while bare ground continued to decline significantly. Litter cover rose to 49%. Protective ground cover has continued to improve. By 2003, percent bare ground had declined to 14%.

The site previously was dominated by mountain big sagebrush. Burned sagebrush stumps counted during the 1986 reading indicated a pre-burn density of approximately 7,100 plants/acre. The only browse left on the site in 1986 consisted of re-sprouting Gambel oak which numbered 3,533 stems/acre. By 1987, there were an estimated 433 seedling sagebrush per acre on the site. Desert ceanothus and broom snakeweed seedlings also appeared in small numbers. Oak increased along the frequency baseline, but declined to 633 young plants/acre on the density plots. During the 1992 reading, there were an estimated 166 plants/acre of sagebrush, 19% of which were classified as decadent. All other sagebrush consisted of seedlings and young. Gambel oak continued to increase on the frequency belts, but disappeared in the density plots. Broom snakeweed occurred in small numbers. During the 1998 reading, the original 100 foot frequency baseline was extended another 300 feet in order to better sample the small meadow. Density of sagebrush increased to 340 plants/acre with no seedlings sampled. Young plants were also rare at only 60 plants/acre. Dead sagebrush listed in the table consisted of old burned stems. Utilization of the sagebrush was mostly light with some moderate use. Vigor was good on all except decadent sagebrush. Density of Gambel oak increased due to the much larger sample as it grows in vigorous scattered clones. Mature plants average nearly 4 feet in height. Sagebrush density declined slightly in 2003, but mature plants were healthy and vigorous with excellent leader growth. Gambel oakbrush increased in stems/acre due to an abundance of young sprouts. Utilization of browse in all years has been light.

The site is now dominated by seeded grasses and alfalfa. However, during the 1986 reading, no seeded species had established. Bottlebrush squirreltail and mutton grass were the only perennial grasses encountered. Forbs consisted of a few early seral species. By 1987, seeded grasses became well established with crested and intermediate wheatgrass being the most common. Seeded forbs, yellow sweetclover and alfalfa, also became well established along with several invasive weedy species. Crested and intermediate wheatgrass continued to dominate the site in 1992 with quadrat frequencies of 91% and 92% respectively. Smooth brome was also fairly abundant. Two species, orchard and mutton bluegrass, were not encountered in 1992. During the 1998 reading, intermediate wheatgrass was by far the most abundant species. It provided 58% of the grass cover and had a cover value of 23%. Crested wheatgrass and smooth brome were the only

other common perennial species as they accounted for 24% and 11% of the grass cover respectively. Annual cheatgrass was also encountered in 1998. Cheatgrass is found in the interspaces between bunch grasses, yet it is not abundant.

The forb composition is diverse but only a few species are abundant. Seeded forbs have all disappeared with the exception of alfalfa and a few yellow sweet clover. During the 1998 reading, alfalfa accounted for 82% of the forb cover. Forb diversity and abundance is likely hindered by the abundance of aggressive exotic grasses seeded onto the site.

### 1992 TREND ASSESSMENT

Soil conditions have improved dramatically since the burn. Basal vegetative cover has increased every year, while percent bare soil has declined. Litter cover has increased from 6% to 49%. Browse are not abundant on the site, but some sagebrush has become reestablished and oak has resprouted. Overall, the browse trend is down when compared to the pre-burn conditions, but has improved since the fire. Further improvements in the browse composition may be hindered by the dominance of seeded exotic grasses. The herbaceous understory has improved significantly since the burn. From 1986 to 1987, both grass and forb sum of nested frequencies increased significantly. Sum of nested frequency for crested wheatgrass and intermediate wheatgrass, and smooth brome continued to increase between 1987 and 1992. Other seeded and native grasses declined or disappeared from the site. Forb nested frequencies declined during the same interval. The only common forbs left on the site are a *Euphorbia* sp. and alfalfa. Combined nested frequencies of grasses and forbs have not increased since 1987. Overall, herbaceous understory has improved between 1986 and 1987 and is stable between 1987 and 1992. One area of concern is the lack of forbs on the site which are important for spring and summer forage for deer (Valentine 1990).

#### TREND ASSESSMENT

soil - up (5)

browse - up but limited (5)

herbaceous understory - stable (3)

### 1998 TREND ASSESSMENT

Trend for soil continues to improve with percent bare ground declining from 28% to 18% and litter cover increasing from 49% to 68%. Erosion does not appear to be a problem on this site. Trend for browse appears to be up slightly. Density of mountain big sagebrush has increased and broom snakeweed density has declined 55%. Use of the limited sagebrush is not as heavy as reported in 1992. Trend for the herbaceous understory is mixed. Trend for grasses is up with a significant increase in the nested frequency of intermediate wheatgrass and smooth brome. Sum of nested frequency for forbs has declined slightly. The most abundant forb, alfalfa, has remained stable however. Trend is considered up slightly, yet the forb composition is poor.

#### TREND ASSESSMENT

soil - up (5)

browse - up slightly (4)

herbaceous understory - up slightly (4)

### 2003 TREND ASSESSMENT

Trend for soil is stable. Relative percent cover of bare ground, litter, and vegetation are similar to 1998 estimates. There is no erosion occurring on the site due to the abundant protective ground cover consisting mostly of perennial grasses. Trend for the key browse species, mountain big sagebrush, is stable. Density of

mature plants has remained similar to 1998 but the number of young plants has declined. Mature sagebrush sampled in 2003 were very vigorous and annual leader growth averaged 2.6 inches by June 3<sup>rd</sup>. Gambel oakbrush, which occurs in scattered clones, has remained stable. Trend for the herbaceous understory is down slightly. Sum of nested frequency for perennial grasses has declined, while frequency of perennial forbs has increased. Nested frequency for all perennial grasses have declined significantly but they are still abundant. Average cover of perennial grasses declined from 37% to 20% due to drought. Nested frequency of alfalfa increased significantly but average cover declined from 7% to 3%. Annual *Microsteris gracilis* increased significantly and provided 68% of the total forb cover in 2003.

TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - down slightly (2)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 58

Type	Species	Nested Frequency					Average Cover %	
		'86	'87	'92	'98	'03	'98	'03
G	Agropyron cristatum	a <sup>-</sup>	c <sup>187</sup>	c <sup>223</sup>	c <sup>203</sup>	b <sup>129</sup>	9.51	6.75
G	Agropyron intermedium	a <sup>-</sup>	b <sup>163</sup>	d <sup>268</sup>	e <sup>299</sup>	c <sup>215</sup>	22.76	9.99
G	Bromus inermis	a <sup>-</sup>	b <sup>33</sup>	b <sup>62</sup>	d <sup>166</sup>	c <sup>112</sup>	4.42	3.32
G	Bromus tectorum (a)	-	-	-	b <sup>197</sup>	a <sup>45</sup>	1.82	.53
G	Dactylis glomerata	a <sup>-</sup>	b <sup>19</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	-	-
G	Festuca ovina	a <sup>-</sup>	b <sup>15</sup>	a <sup>2</sup>	a <sup>5</sup>	a <sup>-</sup>	.18	-
G	Poa fendleriana	ab <sup>2</sup>	b <sup>14</sup>	a <sup>-</sup>	ab <sup>2</sup>	a <sup>-</sup>	.15	-
G	Poa pratensis	-	-	-	-	-	.00	-
G	Sitanion hystrix	5	10	2	1	1	.03	.00
G	Vulpia octoflora (a)	-	-	-	a <sup>36</sup>	b <sup>60</sup>	.40	1.25
Total for Annual Grasses		0	0	0	233	105	2.22	1.78
Total for Perennial Grasses		7	441	557	676	457	37.07	20.07
Total for Grasses		7	441	557	909	562	39.30	21.86
F	Agoseris glauca	-	-	-	9	-	.04	-
F	Camelina microcarpa (a)	-	-	-	-	1	-	.00
F	Calochortus nuttallii	-	-	-	-	3	-	.01
F	Chenopodium spp. (a)	3	-	2	-	2	-	.00
F	Crepis acuminata	-	-	1	-	-	-	-
F	Cymopterus spp.	-	-	-	5	6	.02	.01
F	Draba spp. (a)	-	-	-	a <sup>22</sup>	b <sup>41</sup>	.09	.19
F	Dracocephalum parviflorum	-	-	-	-	1	-	.03
F	Erodium cicutarium (a)	-	-	-	-	2	-	.07
F	Erigeron spp.	-	-	3	-	-	-	-

Type	Species	Nested Frequency					Average Cover %	
		'86	'87	'92	'98	'03	'98	'03
F	Euphorbia spp.	17	16	23	9	27	.06	.56
F	Gilia spp. (a)	-	-	-	-	47	-	.55
F	Lotus utahensis	6	12	6	6	3	.33	.01
F	Melilotus officinalis	a <sup>-</sup>	b <sup>24</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>6</sup>	-	.01
F	Medicago sativa	a <sup>-</sup>	d <sup>88</sup>	bc <sup>41</sup>	b <sup>40</sup>	cd <sup>82</sup>	7.13	3.40
F	Microsteris gracilis (a)	-	-	-	a <sup>183</sup>	b <sup>254</sup>	1.00	10.71
F	Nicotiana attenuata (a)	a <sup>-</sup>	b <sup>39</sup>	a <sup>-</sup>	a <sup>-</sup>	a <sup>-</sup>	-	-
F	Penstemon leonardi	-	2	-	-	-	-	-
F	Physalis spp.	-	5	-	-	-	-	-
F	Sanguisorba minor	-	2	-	-	-	-	-
F	Sphaeralcea grossulariaefolia	a <sup>-</sup>	a <sup>3</sup>	a <sup>-</sup>	a <sup>-</sup>	b <sup>18</sup>	-	.09
F	Tragopogon dubius	-	-	-	-	3	-	.00
F	Unknown forb-perennial	-	-	6	-	-	-	-
Total for Annual Forbs		3	39	2	205	347	1.09	11.55
Total for Perennial Forbs		23	152	80	69	149	7.59	4.14
Total for Forbs		26	191	82	274	496	8.69	15.69

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 58

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Arctostaphylos patula	2	1	.03	.15
B	Artemisia tridentata vaseyana	13	11	.45	1.04
B	Gutierrezia sarothrae	3	1	.15	-
B	Opuntia spp.	2	0	.30	-
B	Quercus gambelii	27	27	5.15	1.98
B	Quercus turbinella	4	1	.03	.18
Total for Browse		51	41	6.11	3.35



CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 58

Species	Percent Cover	
	'98	'03
Arctostaphylos patula	-	.36
Artemisia tridentata vaseyana	-	1.93
Quercus gambelii	1.20	4.43

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 58

Species	Average leader growth (in)
	'03
Artemisia tridentata vaseyana	2.6

BASIC COVER --

Management unit 30 , Study no: 58

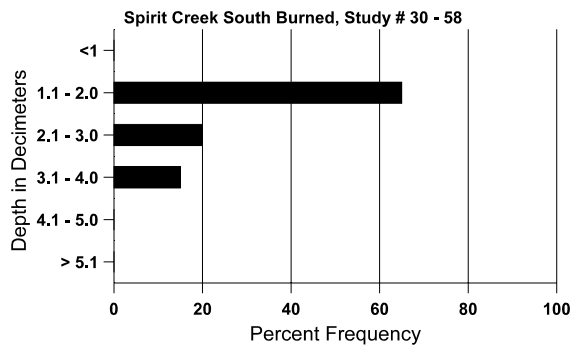
Cover Type	Average Cover %				
	'86	'87	'92	'98	'03
Vegetation	.25	9.75	22.50	55.70	43.92
Rock	0	0	0	.02	0
Pavement	0	.25	.75	.51	.24
Litter	5.50	15.75	48.50	68.34	58.87
Cryptogams	0	0	0	.46	.17
Bare Ground	94.25	74.25	28.25	18.20	13.81

SOIL ANALYSIS DATA --

Management unit 30, Study no: 58, Study Name: Spirit Creek South Burned

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
27.4	42.8 (1998) (17.7)	6.1	64.0	21.4	14.6	1.8	15.2	176.0	0.7

### Stoniness Index



PELLET GROUP DATA --  
 Management unit 30 , Study no: 58

Type	Quadrat Frequency	
	'98	'03
Rabbit	1	8
Deer	55	30

Days use per acre (ha)	
'98	'03
-	-
76 (188)	17 (43)

BROWSE CHARACTERISTICS --  
 Management unit 30 , Study no: 58

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Arctostaphylos patula</i>											
86	0	-	-	-	-	-	0	0	-	0	-/-
87	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	40	-	-	40	-	20	50	0	-	0	14/19
03	20	-	-	20	-	-	0	0	-	0	30/55
<i>Artemisia tridentata vaseyana</i>											
86	0	-	-	-	-	-	0	0	0	0	-/-
87	0	433	-	-	-	-	0	0	0	0	-/-
92	166	33	133	-	33	-	20	20	20	0	-/-
98	340	-	60	200	80	1880	18	0	24	18	17/24
03	280	-	-	280	-	80	0	0	0	0	31/38
<i>Ceanothus greggii</i>											
86	0	-	-	-	-	-	0	0	-	0	-/-
87	0	133	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	52/69
<i>Eriodictyon angustifolium</i>											
86	0	-	-	-	-	-	0	0	-	0	-/-
87	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	13/13
03	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	% poor vigor	Average Height Crown (in)
<b>Gutierrezia sarothrae</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>366</b>	-	33	333	-	-	0	0	-	9	9/7
92	<b>266</b>	-	133	133	-	-	0	0	-	0	10/15
98	<b>120</b>	-	-	120	-	-	0	0	-	0	6/12
03	<b>20</b>	-	-	20	-	-	0	0	-	0	6/6
<b>Opuntia spp.</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>66</b>	-	66	-	-	-	0	0	-	0	-/-
92	<b>33</b>	-	-	33	-	-	0	0	-	100	6/9
98	<b>40</b>	-	-	40	-	-	100	0	-	100	8/22
03	<b>0</b>	-	-	-	-	-	0	0	-	0	11/11
<b>Purshia tridentata</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	25/40
<b>Quercus gambelii</b>											
86	<b>0</b>	3533	-	-	-	-	0	0	0	0	-/-
87	<b>633</b>	-	633	-	-	-	5	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>2000</b>	60	600	1240	160	660	5	0	8	0	45/48
03	<b>2740</b>	60	1120	1060	560	3080	3	0	20	1	44/24
<b>Quercus turbinella</b>											
86	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>80</b>	-	20	20	40	20	0	0	50	50	50/59
03	<b>20</b>	20	-	-	20	40	0	0	100	100	51/46

Trend Study 30-59-03

Study site name: Upper Horse Creek.

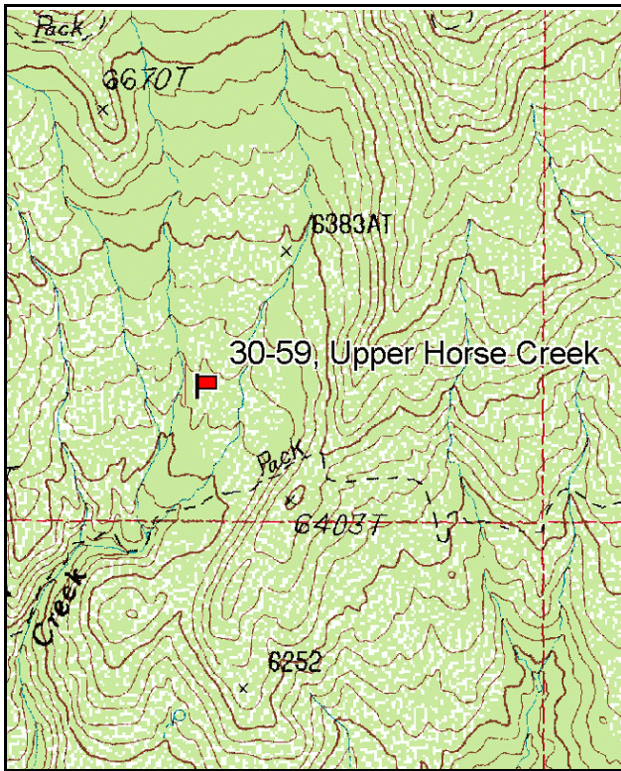
Vegetation type: Burn-Mtn. Brush.

Compass bearing: frequency baseline 210 degrees magnetic. (Line 2 193°, line 3 290°)

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

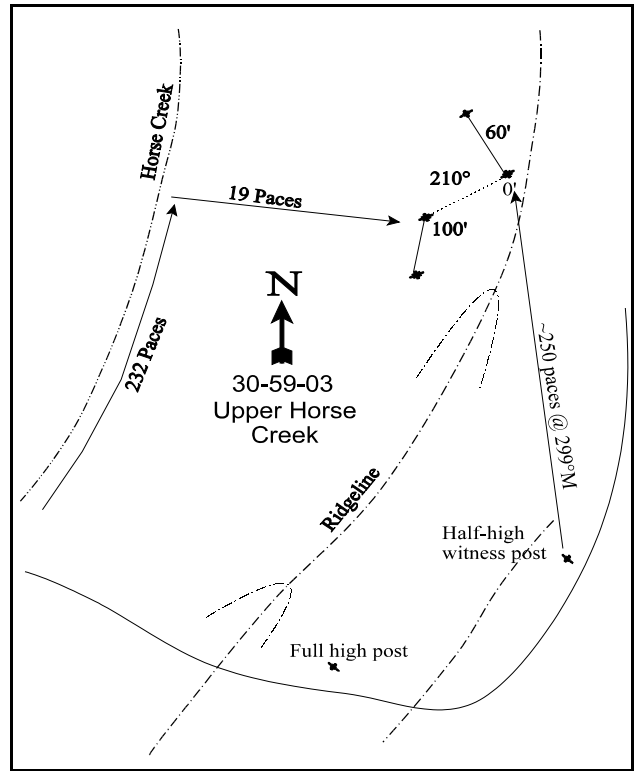
LOCATION DESCRIPTION

From Oak Grove campground travel back down the road about 2.0 miles to the Jones Hollow trail head on the northeast side of the road (it is blocked off by boulders). Park here and hike up the trail about 3/4 of a mile to Spirit Creek. Cross the creek and continue northeast for approximately 1/4 of a mile to horse creek. Follow the trail along the north side of the east fork of Horse Creek upstream to a half-high witness post. Walk approximately 250 paces at 299 degrees magnetic to the base of the ridge where there is a green fence post marking the 0-foot end of the frequency baseline. All transect stakes are 1½ foot tall green steel fence posts. The baseline starts on top of the ridge.



Map Name: Signal Peak

Township 40S, Range 14W, Section 10



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4132877 N, 286202 E

## DISCUSSION

### Upper Horse Creek - Trend Study No. 30-59

The Upper Horse Creek study samples a burned curlleaf mountain mahogany site. Elevation is approximately 6,200 feet with a south aspect and slope of 5% to 8%. The site was previously dominated by large mature curlleaf mountain mahogany trees with an oak understory. A wildfire burned the area in June of 1986 which killed all the mahogany. Deer use this area in the summer and sometimes year-long during mild winters. Nearby Horse Creek provides year-round water. Pellet group data estimate a low level of deer use at 31 deer days use/acre (77 ddu/ha) in 1998 and 20 days use/acre (50 ddu/ha) in 2003.

The soil is moderately deep, but very rocky with abundant rocks on the surface and within the profile. These rocks are large and appear to be granite. Effective rooting depth is estimated at nearly 19 inches. Soil texture is a sandy loam which is moderately acidic in reactivity (pH 6.0). Erosion increased immediately after the fire and continued in 1987. Basal vegetative cover was less than 1% in 1986. Bare ground averaged 19% while the remaining litter had a cover value of 50%. Basal vegetative cover increased to 5% by 1987, but bare ground increased to 45% and litter declined to 21%. Soil movement, active gullies, and other signs of erosion were reported during both years. By 1992, conditions had improved. Basal vegetative cover increased to 14%, litter increased to 48%, and bare ground declined to 12%. No signs of erosion were noticeable. During the 1998 reading, conditions continued to improve slightly with percent bare ground declining slightly. Litter cover increased from 48% to 57% and rock cover declined from 25% to 16%. There are currently no signs of erosion on the site, although there is a gully nearby which shows some signs of activity during high runoff events.

Curlleaf mountain mahogany was eliminated after the fire, but Utah serviceberry, Gambel oak, and a Gambel-shrub live oak hybrid, sprouted profusely. During the 1986 reading, there were an estimated 2,600 serviceberry and 3,499 oak seedlings per acre. The only other browse found included a small number of yellowleaf silktassel seedlings and an unidentified browse. By 1987, serviceberry density increased to 4,333 young and 400 seedlings per acre. Oak densities declined to 1,532 young and seedlings per acre. Desert ceanothus was encountered in 1987 with an estimated density of 600 plants/acre. Between 1987 and 1992, serviceberry densities declined by 54% to 1,999 plants/acre. Gambel oak declined from 833 to 166 plants/acre, while the oak hybrid decreased from 533 to 433 plants/acre. Reproductive potentials of all species declined. Desert ceanothus density remained fairly constant with an estimate of 566 plants/acre. A much larger sample was used in 1998 which better estimates shrub populations which often have discontinuous and/or aggregated distributions. As a result, some of the population changes may be due to the change in sample size. Density of serviceberry was estimated at 560 plants/acre. Density of desert ceanothus also declined from 566 to 180 plants/acre. Since there are no dead or decadent plants for either species, the change in density is due to the increased sample size. More Gambel oak was encountered in the larger sample. Density increased 93%, from 166 to 2,320 plants/acre. Mature plants averaging nearly 4 feet in height represented 68% of the population. No seedlings were encountered, yet young plants were fairly abundant. Data from 2003 show a stable strip frequency for Gambel oakbrush, while average cover increased from 7% to 10%. Serviceberry density has remained stable. Utilization of serviceberry was moderate in 1987 and 1992, yet browsing on oak has been light. Utilization of browse was mostly light in 1998, but some moderate and heavy use was noted on serviceberry and desert ceanothus. Most shrubs were only lightly browsed in 2003.

During the first reading in September of 1986, no perennial grasses were encountered, while only two forbs were found. Since then, seeded exotic grasses consisting of crested and intermediate wheatgrass, smooth brome, and alfalfa have dominated the understory and provide competition to shrub recruitment. However, shrubs are not as important as grasses and forbs on summer range. Cheatgrass brome is also well established. It provided 28% of the grass cover in 1998 and 22% in 2003. The forb component is diverse but dominated

by alfalfa which provided 76% of the forb cover in 1998. Alfalfa was heavily utilized in 1992, but appeared unutilized in 1998 and 2003. The only other fairly common forbs include wormwood and globemallow.

### 1992 TREND ASSESSMENT

Soil conditions have improved since 1986 and 1987. Basal vegetative cover has increased from 5% to 14% by 1992. Litter cover has increased to 48%, while bare ground has declined to only 12%. Key browse species increased dramatically after the burn, then declined in density between 1987 and 1992. All species currently display reduced reproductive potentials. It appears that competition from the herbaceous understory and the moderate to heavy wildlife use are effectively controlling shrub recruitment. But again, shrubs are not as important on this summer range. Trend for browse is slightly down since 1987. Seeded exotic grasses, crested wheatgrass, intermediate wheatgrass, and the seeded forb alfalfa dominate the site. Nested frequencies of these plants have increased steadily since the fire. On the downside, cheatgrass brome is also well established. Overall, trend for herbaceous understory is up.

#### TREND ASSESSMENT

soil - up (5)

browse - slightly down (2)

herbaceous understory - up (5)

### 1998 TREND ASSESSMENT

Trend for soil is up slightly with a slight decline in percent bare ground and an increase in litter cover from 48% to 57%. Currently, there is no problem with erosion on the site. Trend for browse appears stable. The changes in density appear to be due to the much larger sample size. Use of the browse is mostly light and recruitment adequate to maintain populations at current levels. Trend for the herbaceous understory is up slightly due to an increase in the sum of nested frequency for perennial grasses and forbs. Nested frequency of smooth brome increased significantly, while frequency of crested wheatgrass and intermediate wheatgrass remained similar. Eleven new perennial forb species were encountered in the new sample. The dominant forb, alfalfa, remained at a similar frequency compared to 1987 and 1992.

#### TREND ASSESSMENT

soil - up slightly (4)

browse - stable (3)

herbaceous understory - up slightly (4)

### 2003 TREND ASSESSMENT

Trend for soil is stable. There is abundant protective ground cover in the form of perennial grasses to prevent erosion. Trend for browse is stable. Most shrubs have stable population densities, light use, and normal vigor. Serviceberry is the primary preferred shrub. It has remained stable in density at 540 plants/acre. Use is mostly light and vigor is normal on all but a few of the decadent plants. Average height of mature plants has steadily increased from about 2 feet in 1992 to nearly 4 feet by 2003. Gambel oak cover has increased from 7% to 10% but strip frequency has remained stable. Trend for the herbaceous understory is stable. Sum of nested frequency for perennial grasses and forbs has declined slightly. However, the dominant perennial grasses have not declined significantly and average cover of perennial grasses has remained stable at around 16%. The forb composition is diverse but the sum of nested frequency has declined by 26%. However, the most abundant forb, alfalfa, did not decline significantly. Average cover of perennial forbs did decline from 13% to 6%. Drought conditions are obviously effecting the herbaceous species on this site, especially forbs, but not as dramatically at this elevation compared to other sites in the unit.

TREND ASSESSMENT

soil - stable (3)

browse - stable (3)

herbaceous understory - stable (3)

HERBACEOUS TRENDS --

Management unit 30 , Study no: 59

T y p e	Species	Nested Frequency					Average Cover %	
		'86	'87	'92	'98	'03	'98	'03
G	Agropyron cristatum	a-	b26	c80	c62	c75	2.00	3.90
G	Agropyron intermedium	a-	b45	c179	c191	c182	11.51	10.41
G	Agropyron smithii	-	-	-	4	-	.03	-
G	Bromus inermis	a-	a4	a4	b33	b39	1.17	1.63
G	Bromus tectorum (a)	-	-	-	b159	a113	6.13	4.65
G	Carex spp.	-	-	-	2	4	.15	.03
G	Dactylis glomerata	-	3	-	3	3	.15	.00
G	Festuca ovina	-	-	-	3	-	.03	-
G	Leucopoa kingii	-	2	-	-	-	-	-
G	Poa fendleriana	-	-	4	2	2	.09	.16
G	Sitanion hystrix	-	-	1	3	4	.06	.18
G	Sporobolus cryptandrus	a-	a-	a-	b23	a3	.84	.15
Total for Annual Grasses		0	0	0	159	113	6.13	4.65
Total for Perennial Grasses		0	80	268	326	312	16.06	16.47
Total for Grasses		0	80	268	485	425	22.20	21.13
F	Agoseris glauca	-	-	-	2	-	.03	-
F	Allium spp.	a-	a-	a-	b17	a-	.05	-
F	Artemisia dracunculus	a-	a-	a2	b25	a5	1.39	.52
F	Artemisia ludoviciana	-	-	4	7	1	.30	.00
F	Collomia linearis (a)	-	-	-	a2	b13	.01	.08
F	Collinsia parviflora (a)	-	-	-	-	4	-	.01
F	Crepis acuminata	-	-	3	1	5	.03	.09
F	Cryptantha spp.	-	-	-	4	-	.00	-
F	Delphinium nuttallianum	-	-	-	3	-	.00	.00
F	Descurainia pinnata (a)	-	-	-	-	-	-	.00
F	Dichelostemma pulchellum	a-	a-	a-	b12	a-	.05	-
F	Dracocephalum parviflorum	-	-	7	-	6	-	.45
F	Epilobium brachycarpum (a)	-	-	-	3	-	.00	-
F	Erodium cicutarium (a)	a-	ab5	a-	a-	b14	-	1.06
F	Erigeron spp.	a-	a-	a-	b14	ab4	.08	.01

T y p e	Species	Nested Frequency					Average Cover %	
		'86	'87	'92	'98	'03	'98	'03
F	<i>Eriogonum racemosum</i>	-	-	-	2	5	.03	.24
F	<i>Gilia</i> spp. (a)	-	-	-	<sub>a</sub> 3	<sub>b</sub> 31	.01	.24
F	<i>Lappula occidentalis</i> (a)	-	-	-	9	13	.04	.92
F	<i>Lupinus argenteus</i>	-	-	-	-	-	.03	-
F	<i>Machaeranthera canescens</i>	-	-	8	7	-	.04	-
F	<i>Medicago sativa</i>	<sub>a</sub> -	<sub>b</sub> 74	<sub>b</sub> 85	<sub>b</sub> 71	<sub>b</sub> 63	10.00	4.27
F	<i>Microsteris gracilis</i> (a)	-	-	-	69	87	.42	2.49
F	<i>Navarretia intertexta</i> (a)	-	-	-	-	1	-	.00
F	<i>Nicotiana attenuata</i> (a)	-	2	-	-	-	-	-
F	<i>Penstemon humilis</i>	-	-	-	-	3	-	.03
F	<i>Polygonum douglasii</i> (a)	-	-	-	1	-	.00	.00
F	<i>Senecio multilobatus</i>	-	1	3	-	-	-	-
F	<i>Sisymbrium altissimum</i> (a)	-	-	-	-	1	-	.03
F	<i>Sphaeralcea grossulariaefolia</i>	<sub>a</sub> 4	<sub>ab</sub> 17	<sub>bc</sub> 29	<sub>ab</sub> 11	<sub>c</sub> 43	.37	.75
F	<i>Taraxacum officinale</i>	-	-	1	-	-	-	-
F	<i>Tragopogon dubius</i>	-	-	-	1	-	.00	-
F	<i>Trifolium</i> spp.	-	1	-	-	-	-	-
F	Unknown forb-annual (a)	-	4	-	-	-	-	-
F	Unknown forb-perennial	2	-	-	-	-	-	-
F	<i>Verbascum thapsus</i>	-	-	3	-	-	-	-
F	<i>Viguiera multiflora</i>	-	-	-	5	-	.18	-
Total for Annual Forbs		0	11	0	87	164	0.50	4.87
Total for Perennial Forbs		6	93	145	182	135	12.62	6.38
Total for Forbs		6	104	145	269	299	13.12	11.25

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



BROWSE TRENDS --

Management unit 30 , Study no: 59

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Acer grandidentatum	0	1	-	-
B	Amelanchier utahensis	21	18	2.63	2.79
B	Arctostaphylos patula	0	0	-	.00
B	Artemisia tridentata vaseyana	1	1	.03	.15
B	Ceanothus greggii	9	8	2.13	2.47
B	Cercocarpus ledifolius	1	2	.15	.38
B	Clematis columbiana	2	1	-	-
B	Garrya flavescens	6	9	1.61	3.19
B	Opuntia spp.	1	1	.15	.15
B	Quercus gambelii	31	31	7.34	10.26
Total for Browse		72	72	14.05	19.40

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 59

Species	Percent Cover	
	'98	'03
Acer grandidentatum	1.60	.21
Amelanchier utahensis	-	4.63
Artemisia tridentata vaseyana	-	.10
Ceanothus greggii	-	3.70
Cercocarpus ledifolius	-	.30
Clematis columbiana	-	.16
Garrya flavescens	-	3.31
Opuntia spp.	-	.11
Quercus gambelii	2.40	15.36

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 59

Species	Average leader growth (in)
	'03
Amelanchier utahensis	2.1

BASIC COVER --

Management unit 30 , Study no: 59

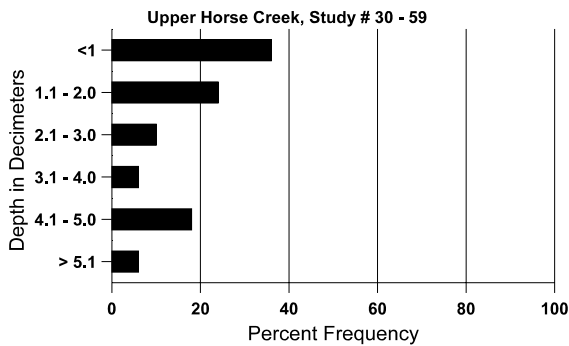
Cover Type	Average Cover %				
	'86	'87	'92	'98	'03
Vegetation	0	5.00	13.75	48.02	46.40
Rock	25.75	25.75	24.75	16.25	13.48
Pavement	5.00	4.00	1.75	.84	.12
Litter	50.00	20.75	48.25	57.31	55.57
Cryptogams	0	0	0	.04	0
Bare Ground	19.25	44.50	11.50	10.26	7.10

SOIL ANALYSIS DATA --

Management unit 30, Study no: 59, Study Name: Upper Horse Creek

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
18.5	45.3 (1998) (17.7)	6.0	72.0	17.4	10.6	2.1	16.2	86.4	0.5

### Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 59

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Deer	18	4	31 (77)	20 (50)

BROWSE CHARACTERISTICS --  
Management unit 30 , Study no: 59

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Acer grandidentatum</b>											
86	0	-	-	-	-	-	0	0	-	0	-/-
87	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	136/142
03	60	-	60	-	-	-	0	0	-	0	-/-
<b>Amelanchier utahensis</b>											
86	0	2600	-	-	-	-	0	0	0	0	-/-
87	4333	400	4333	-	-	-	38	0	0	0	-/-
92	1999	-	766	1233	-	-	55	5	0	2	26/25
98	560	-	260	300	-	-	7	7	0	0	33/31
03	540	40	100	320	120	-	7	0	22	15	45/33
<b>Arctostaphylos patula</b>											
86	0	-	-	-	-	-	0	0	-	0	-/-
87	0	-	-	-	-	-	0	0	-	0	-/-
92	33	-	33	-	-	-	0	100	-	0	-/-
98	0	-	-	-	-	-	0	0	-	0	22/45
03	0	-	-	-	-	-	0	0	-	0	38/61
<b>Artemisia tridentata vaseyana</b>											
86	0	-	-	-	-	-	0	0	-	0	-/-
87	0	-	-	-	-	-	0	0	-	0	-/-
92	0	-	-	-	-	-	0	0	-	0	-/-
98	20	-	-	20	-	60	0	0	-	0	22/39
03	20	-	-	20	-	-	0	0	-	0	34/49
<b>Ceanothus greggii</b>											
86	0	-	-	-	-	-	0	0	-	0	-/-
87	600	133	600	-	-	-	0	0	-	0	-/-
92	566	-	66	500	-	-	18	18	-	0	11/18
98	180	-	-	180	-	-	22	0	-	0	23/44
03	180	-	-	180	-	-	0	0	-	0	41/58

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Cercocarpus ledifolius</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>66</b>	-	66	-	-	-	50	0	-	0	-/-
98	<b>40</b>	-	40	-	-	80	0	0	-	0	44/30
03	<b>40</b>	-	40	-	-	-	0	0	-	0	73/43
<b>Clematis columbiana</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>60</b>	-	-	60	-	-	0	0	-	0	35/25
03	<b>20</b>	-	-	20	-	-	0	0	-	0	15/13
<b>Garrya flavescens</b>											
86	<b>0</b>	233	-	-	-	-	0	0	0	0	-/-
87	<b>266</b>	233	266	-	-	-	0	0	0	0	-/-
92	<b>233</b>	-	-	233	-	-	86	14	0	0	12/11
98	<b>220</b>	-	20	180	20	20	0	0	9	9	29/49
03	<b>240</b>	-	20	200	20	-	0	0	8	8	42/62
<b>Opuntia spp.</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>33</b>	-	33	-	-	-	0	0	-	0	-/-
92	<b>33</b>	-	-	33	-	-	0	0	-	100	7/13
98	<b>20</b>	-	-	20	-	-	0	0	-	0	8/12
03	<b>20</b>	-	-	20	-	-	0	0	-	0	13/19
<b>Quercus gambelii</b>											
86	<b>0</b>	1766	-	-	-	-	0	0	0	0	-/-
87	<b>833</b>	133	833	-	-	-	0	0	0	0	-/-
92	<b>166</b>	133	33	133	-	-	20	0	0	0	50/43
98	<b>2320</b>	-	620	1580	120	400	.86	0	5	4	44/45
03	<b>3340</b>	60	640	2480	220	580	1	0	7	3	45/29
<b>Quercus gambelii-turbinella hybrid</b>											
86	<b>0</b>	1733	-	-	-	-	0	0	-	0	-/-
87	<b>533</b>	33	533	-	-	-	0	0	-	0	-/-
92	<b>433</b>	-	33	400	-	-	8	0	-	0	63/47
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Ribes spp.</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	59/46
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Symphoricarpos oreophilus</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	30/56
03	<b>0</b>	-	-	-	-	-	0	0	-	0	25/44

Trend Study 30-60-03

Study site name: Jones Hollow .

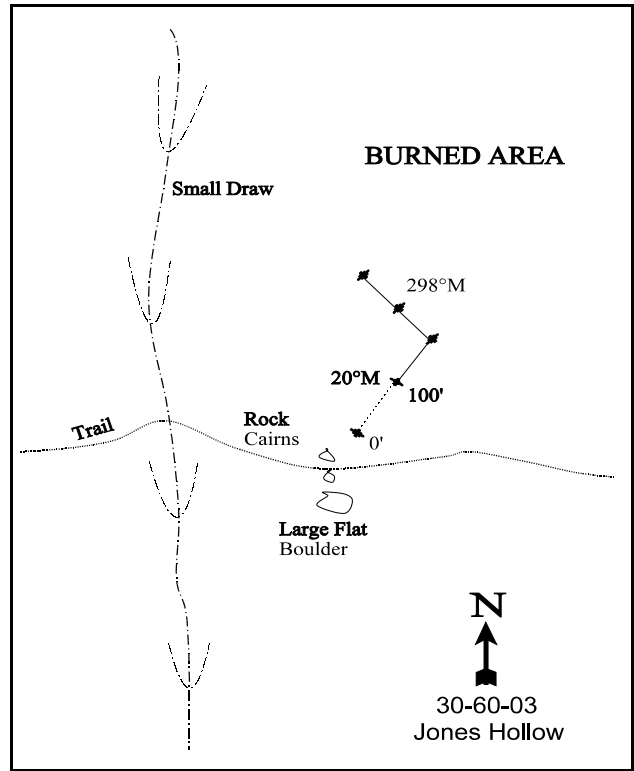
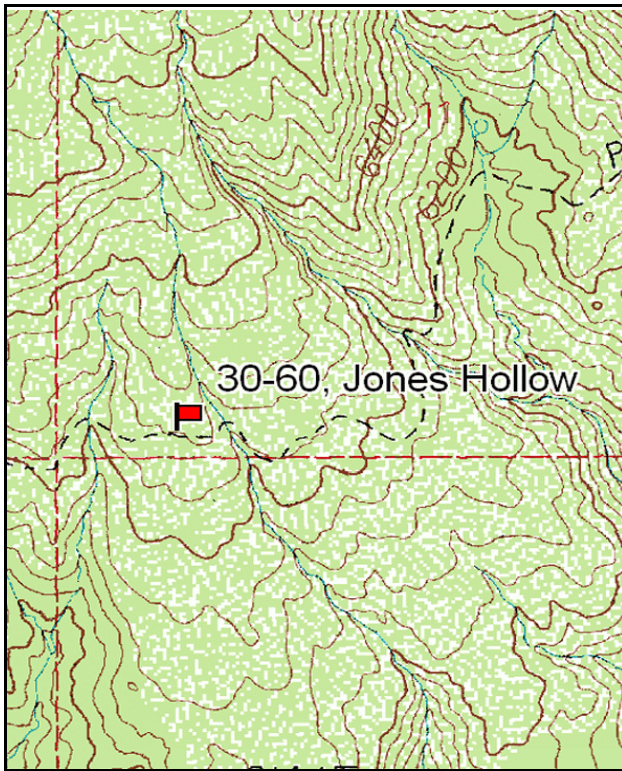
Vegetation type: Burn-Mtn. Brush .

Compass bearing: frequency baseline 20 degrees magnetic. (Lines 3 & 4, 298°M)

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). No rebar.

LOCATION DESCRIPTION

From Oak Grove campground travel back down the road about 2.0 miles to the Jones hollow trail head on the northeast side of the road (it is blocked off by boulders). Park here and hike up the trail about 3/4 of a mile to Spirit Creek. Cross the creek and continue northeast for approximately 1/4 of a mile to horse creek. Continue to where the trail goes to the right and goes out of a small wash. From here follow the trail for 937 paces (close to 1.0 mile) over several hills and creek crossings until you get on top of a relatively flat, rocky table. Rock cairns mark the transect site along the trail. Also, right across the trail from where the transect starts is a seasonal pool. The frequency baseline begins on the north (left) side of the trail and is marked by a 1½ tall, green fence post with browse tag #7860 attached. All transect stakes are 1½ foot tall green fence posts.



Map Name: Signal Peak

Diagrammatic Sketch

Township 40S, Range 14W, Section 11

GPS: NAD 27, UTM 12S 4132578 N, 287381 E

## DISCUSSION

### Jones Hollow - Trend Study No. 30-60

The Jones Hollow trend study samples mixed mountain brush, on a nearly level southwest facing slope on the east side of the Pine Valley Mountains. Elevation is approximately 6,200 feet. The entire area was burned by a wildfire in early June of 1986. Unlike the Upper Horse Creek site, this area received very little seed after the fire. Deer utilize this area during the summers and year-round during mild winters, but at a lower intensity than Upper Horse Creek or Spirit Creek. Pellet group data estimated only 17 deer days use/acre (42 ddu/ha) in 1998 and only 1 deer day use/acre (3 ddu/ha) in 2003. Two antler sheds were found in 1998.

Soils are coarse, sandy, shallow, and loosely compacted with large amounts of granite rock boulders on the surface and in the profile. Effective rooting depth is estimated at almost 15 inches. Soil texture is a sandy loam which is slightly acidic in reactivity (pH 6.1). Even with the slight slope, erosion has been a problem due to the lack of protective herbaceous cover. Large bare areas occur between oak clones and the bases of grasses are pedestalled. However, conditions have improved steadily since the fire. Bare ground, which occupied 71% of the ground surface in 1986, and 63% in 1987, declined to 22% by 1998. Basal vegetative cover increased from 2% in 1986 to 5% by 1992. Litter cover has also steadily increased from 12% in 1986 to 56% by 1998. Rock and pavement cover combined have remained fairly constant.

Browse is diverse with 10 species occurring on the site. The key species consist of Utah serviceberry, Gambel oak, and shrub-live oak. Other species, which occur in small numbers, include greenleaf manzanita, mountain big sagebrush, desert ceanothus, narrowleaf yerba-santa, cactus, and yellowleaf silktassel. Serviceberry, resprouting after the fire, had an estimated density of 10,533 seedlings and young per acre in 1986. It's density declined, but appeared to stabilize in 1992. In 1998, there were an estimated 1,520 plants/acre. Reproductive potential and the proportion of young plants in the population have steadily declined since 1986, but recruitment has remained sufficient to maintain the population at current levels. Utilization has been mostly light since 1986.

Gambel and shrub-live oak, also resprouting after the fire, have declined steadily on the density plots between 1986 and 1992 as part of a natural thinning process. The much larger sample size used in 1998 picked up more Gambel and shrub-live oak with estimated densities of 3,920 and 1,480 stems/acre respectively. Mature oak now averages five feet in height, creating thick clones which are mostly unavailable to wildlife. Oak has been only lightly utilized in all years and is in generally good vigor. Preferred understory shrubs consisting of mountain big sagebrush and desert ceanothus, provide additional forage. These shrubs occur in low numbers, and have received moderate use.

The site was revisited in 2003 but only line-intercept cover was estimated for shrubs. The site has returned to a shrub dominated community with total shrub cover totaling nearly 55%. Gambel and live oakbrush dominate the shrub composition by providing 44% of the total shrub cover. Serviceberry provides 17% of the total shrub cover and is the only abundant preferred browse species on the site. Mountain big sagebrush can be found in the understory in low numbers. All shrubs sampled in 2003 appeared to be unused.

The herbaceous understory on this site is sparse when compared to the other burn sites. In 1998, all grasses combined produced less than 1% cover with cheatgrass providing 49% of that cover. Smooth brome, intermediate wheatgrass and bottlebrush squirreltail are the most abundant perennial grasses on the site yet they occur rarely. None have a quadrat frequency of more than 6%. Forbs are more diverse and abundant with American vetch being the most numerous as it provided 69% of the forb cover in 1998. Wild onion and blue dicks (*Dichelostemma pulchellum*) are also fairly common. Sum of nested frequency for grasses has remained relatively stable since 1987, while frequency of forbs has increased with each reading.

## 1992 TREND ASSESSMENT

Since the burn, soil conditions have improved. Basal vegetative cover has increased from 2% to 5% since 1987, while bare ground has steadily decreased. Litter cover is increasing. Some erosion is still occurring on the site, but it is not significant. It will likely continue until the herbaceous understory becomes more extensively established. Trend for soil is up. There is a good mix of browse on the site. The key species, Utah serviceberry and Gambel oak, increased dramatically right after the burn, then declined as natural thinning occurred. Currently, both appear to have healthy populations with adequate reproductive potentials. Trend for browse is stable. The herbaceous understory is deficient on this site. Sum of nested frequency for all grasses combined came to only 69 in 1992. Forbs are more common, but still deficient. Nested and quadrat frequencies for both forbs and grasses have increased steadily since 1986. Trend for herbaceous understory is up, but deficient.

### TREND ASSESSMENT

soil - up (5)

browse - stable (3)

herbaceous understory - up, but deficient (5)

## 1998 TREND ASSESSMENT

Trend for soil is up slightly. Protective ground cover continues to increase and percent bare ground continues to decline. Unfortunately, the herbaceous understory is poor, with the bulk of the vegetative cover coming from shrubs. There is some localized erosion occurring but it is minimized by the level terrain. Trend for the key browse species, serviceberry and Gambel oak, is stable. Serviceberry appears to have a stable population with steadily declining seedling recruitment since the fire. The proportion of young plants has also decreased as the population becomes more mature. Utilization is light to moderate, vigor normal on most plants, and percent decadency low at only 7%. Gambel oak has increased in density from 1,000 to 3,920 stems/acre. This change is mostly due to the much larger sample size used in 1998. Biotic potential and the proportion of young plants in the population has remained stable. Oak appears unutilized, in good vigor, with low decadence. Important understory shrubs, mountain big sagebrush and desert ceanothus, occur in small numbers, although they appear to be increasing. Trend for the herbaceous understory is stable. Sum of nested frequency for perennial grasses has declined slightly, while frequency of perennial forbs has increased slightly. Composition and abundance of grasses is poor. All grasses produce less than 1% cover with annual cheatgrass providing 49% of that cover.

### TREND ASSESSMENT

soil - up slightly (4)

browse - stable (3)

herbaceous understory - stable, but deficient (3)

## 2003 TREND ASSESSMENT

The site was revisited in 2003. Due to the thick nature of the shrubs on this site and the lack of significant wildlife use, only pellet group data and line-intercept data for shrubs were taken. The site has returned to a very thick mountain shrub community with total shrub cover totaling nearly 55%. Gambel and live oak dominate the shrub composition by providing 44% of the browse cover. The oak brush occurs in thick clones which average 4 to 5 feet in height. They are mostly unutilized. The only preferred shrubs found on the site are serviceberry and mountain big sagebrush. Serviceberry has a canopy cover value of 9.4% while sagebrush averages about 3% cover. The herbaceous understory is poor, leaving shrub interspaces mostly bare. Since no other data was taken no trends can be determined. This site will be suspended in the future.



TREND ASSESSMENT

soil - n/a

browse - n/a

herbaceous understory - n/a

HERBACEOUS TRENDS --

Management unit 30 , Study no: 60

T y p e	Species	Nested Frequency				Average Cover %
		'86	'87	'92	'98	'98
G	Agropyron cristatum	-	16	11	-	-
G	Agropyron intermedium	-	1	12	15	.07
G	Bromus inermis	-	11	31	19	.13
G	Bromus tectorum (a)	-	-	-	74	.35
G	Dactylis glomerata	-	6	5	3	.03
G	Festuca ovina	-	-	6	-	-
G	Poa fendleriana	-	-	4	2	.04
G	Poa secunda	-	9	-	-	-
G	Sitanion hystrix	-	-	-	11	.10
G	Unknown grass - perennial	7	-	-	-	-
Total for Annual Grasses		0	0	0	74	0.34
Total for Perennial Grasses		7	43	69	50	0.37
Total for Grasses		7	43	69	124	0.72
F	Agoseris glauca	-	-	8	4	.01
F	Allium spp.	-	-	-	68	.26
F	Arabis spp.	-	6	1	3	.00
F	Astragalus straturensis	-	2	-	3	.03
F	Calochortus nuttallii	-	-	4	3	.01
F	Chaenactis douglasii	-	-	-	1	.00
F	Chenopodium fremontii (a)	-	5	-	-	-
F	Collomia grandiflora (a)	-	1	-	-	-
F	Cymopterus spp.	-	-	-	2	.03
F	Dichelostemma pulchellum	-	2	24	40	.70
F	Epilobium brachycarpum (a)	-	-	-	1	.00
F	Eriogonum racemosum	-	-	-	1	.03
F	Gilia spp. (a)	-	-	-	2	.01
F	Lotus utahensis	-	-	2	-	-
F	Melilotus officinalis	-	1	-	-	-
F	Medicago sativa	-	12	-	-	-
F	Microsteris gracilis (a)	-	-	-	55	.13

T y p e	Species	Nested Frequency				Average Cover %
		'86	'87	'92	'98	'98
F	Nicotiana attenuata (a)	-	3	-	-	-
F	Penstemon eatoni	-	2	3	-	-
F	Senecio multilobatus	-	-	7	1	.00
F	Sphaeralcea grossulariaefolia	-	13	14	-	-
F	Streptanthus cordatus	-	3	1	4	.06
F	Unknown forb-perennial	3	-	-	4	.16
F	Vicia americana	37	54	106	92	3.34
F	Zigadenus paniculatus	-	-	-	5	.03
Total for Annual Forbs		0	9	0	58	0.15
Total for Perennial Forbs		40	95	170	231	4.69
Total for Forbs		40	104	170	289	4.84

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

#### BROWSE TRENDS --

Management unit 30 , Study no: 60

T y p e	Species	Strip Frequency	Average Cover %
		'98	'98
B	Amelanchier utahensis	31	9.75
B	Arctostaphylos patula	18	3.46
B	Artemisia tridentata vaseyana	12	.51
B	Ceanothus greggii	25	5.67
B	Eriodictyon angustifolium	18	.18
B	Garrya flavescens	13	2.80
B	Gutierrezia sarothrae	4	.21
B	Opuntia spp.	3	.00
B	Quercus gambelii	27	11.30
B	Quercus turbinella	11	7.74
Total for Browse		162	41.65

CANOPY COVER, LINE INTERCEPT --  
 Management unit 30 , Study no: 60

Species	Percent Cover '03
Amelanchier utahensis	7.73
Arctostaphylos patula	8.25
Artemisia tridentata vaseyana	2.55
Ceanothus greggii	3.83
Eriodictyon angustifolium	0.02
Garrya flavescens	5.45
Opuntia spp.	0.32
Quercus gambelii	13.13
Quercus turbinella	11.10

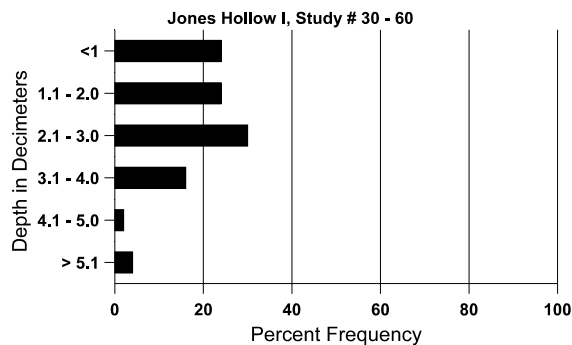
BASIC COVER --  
 Management unit 30 , Study no: 60

Cover Type	Average Cover %			
	'86	'87	'92	'98
Vegetation	2.00	1.50	5.25	47.57
Rock	9.50	9.75	6.00	7.06
Pavement	5.25	9.50	15.50	8.32
Litter	12.25	16.00	50.25	55.54
Cryptogams	0	0	0	.03
Bare Ground	71.00	63.25	23.00	21.59

SOIL ANALYSIS DATA --  
 Management unit 30, Study no: 60, Study Name: Jones Hollow 1

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	% OM	PPM P	PPM K	ds/m
14.5	48.6 (1998) (16.1)	6.1	68.0	17.4	14.6	1.5	10.2	99.2	0.7

### Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 60

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	4	N/A	-	-
Deer	13	N/A	17 (42)	1 (3)

BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 60

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Amelanchier utahensis</i>											
86	<b>6133</b>	4400	6133	-	-	-	0	0	0	16	-/-
87	<b>2900</b>	700	2900	-	-	-	11	3	0	0	-/-
92	<b>1133</b>	466	700	433	-	-	0	0	0	0	40/49
98	<b>1520</b>	180	80	1340	100	20	22	1	7	5	39/47
<i>Arctostaphylos patula</i>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>300</b>	-	300	-	-	-	0	0	-	0	-/-
98	<b>500</b>	40	20	480	-	-	0	0	-	0	25/43
<i>Artemisia tridentata vaseyana</i>											
86	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
87	<b>0</b>	100	-	-	-	-	0	0	0	0	-/-
92	<b>165</b>	-	66	66	33	-	0	0	20	0	17/18
98	<b>320</b>	20	80	240	-	200	6	0	0	0	22/31
<i>Ceanothus greggii</i>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	1533	-	-	-	-	0	0	-	0	-/-
92	<b>166</b>	-	166	-	-	-	0	0	-	0	-/-
98	<b>680</b>	-	-	680	-	-	21	0	-	0	22/34
<i>Eriodictyon angustifolium</i>											
86	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
87	<b>700</b>	333	700	-	-	-	0	0	0	0	-/-
92	<b>833</b>	133	200	633	-	-	0	0	0	0	14/11
98	<b>500</b>	-	-	440	60	20	0	4	12	32	25/24

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Garrya flavescens</b>											
86	<b>1866</b>	1166	1866	-	-	-	0	0	0	0	-/-
87	<b>266</b>	233	266	-	-	-	0	0	0	0	-/-
92	<b>100</b>	33	-	100	-	-	0	0	0	0	60/56
98	<b>360</b>	-	60	260	40	-	0	0	11	11	38/47
<b>Gutierrezia sarothrae</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>240</b>	-	-	240	-	-	0	0	-	0	5/6
<b>Opuntia spp.</b>											
86	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
98	<b>80</b>	-	-	60	20	-	0	0	25	0	7/16
<b>Quercus gambelii</b>											
86	<b>5966</b>	1833	5966	-	-	-	0	0	0	0	-/-
87	<b>3100</b>	300	3100	-	-	-	0	0	0	0	-/-
92	<b>1000</b>	33	200	800	-	-	0	0	0	0	64/51
98	<b>3920</b>	40	1060	2780	80	600	0	0	2	0	52/30
<b>Quercus gambelii-turbinella hybrid</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>433</b>	33	433	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<b>Quercus turbinella</b>											
86	<b>2566</b>	500	2566	-	-	-	0	0	-	39	-/-
87	<b>33</b>	-	33	-	-	-	0	0	-	0	-/-
92	<b>0</b>	33	-	-	-	-	0	0	-	0	-/-
98	<b>1480</b>	20	160	1320	-	60	0	0	-	0	67/62
<b>Unknown browse</b>											
86	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
87	<b>0</b>	500	-	-	-	-	0	0	-	0	-/-
92	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-

Trend Study 30-61-03

Study site name: Tobin Bench.

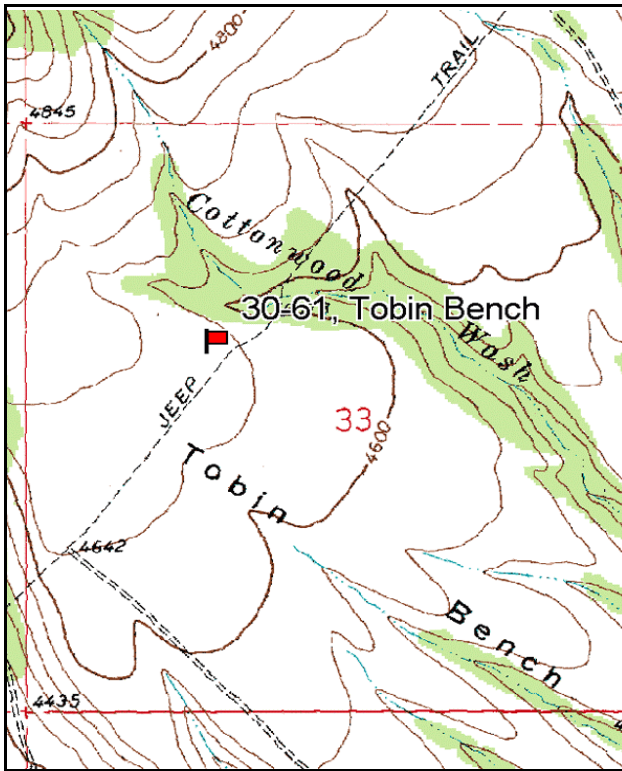
Vegetation type: Cliffrose-sagebrush.

Compass bearing: frequency baseline 306 degrees magnetic.

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

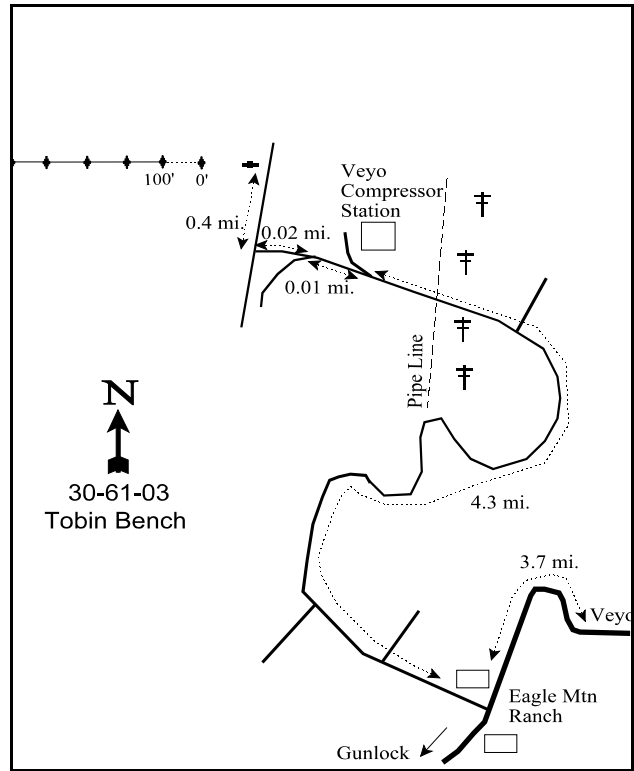
LOCATION DESCRIPTION

From Veyo, drive west on Center St. for 3.7 miles to a road on the right (north) side of the road. The Eagle Mountain Ranch will be on the left side of the road at this turn. Drive on this oiled road for 4.3 miles to Veyo Compressor Station and a fork in the road. Take the left fork for 0.01 miles to another fork. Stay right and drive 0.02 miles to an intersection and a wire gate. Turn right and drive 0.4 miles on an old powerline road to the witness post on the left side of the road. The 0-foot stake is 7 paces at 306 degrees magnetic from the witness post. The baseline runs approximately west. The study is marked by green steel "T" fence posts approximately 12 to 14 inches in height.



Map Name: Gunlock

Township 39S, Range 17W, Section 33



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4137526 N, 255178 E

## DISCUSSION

### Tobin Bench - Trend Study No. 30-61

This is a new trend study established in 2003. It samples a cliffrose/sagebrush winter range near the blackbrush ecotone. The transect is located west of the town of Veyo, and about 1.5 miles east of the Grapevine Spring trend study. The area has a gentle slope (3%) and an east aspect. Elevation is about 4,650 feet. This area receives heavy winter deer use and experienced severe sagebrush die-off in 2003 due to drought. Pellet group data from 2003 estimated heavy deer use at 225 deer days use/acre (555 ddu/ha). The local DWR biologist estimates that 1,000 deer routinely use this area from October through March.

Soil at the site is deep with an effective rooting depth estimated at a little over 17 inches. Texture is a sandy clay loam, and reactivity is neutral (pH of 7.1). There is some rock and pavement on the surface and abundant litter mostly from dead sagebrush plants. Rock on the soil surface is dark colored basalt which causes elevated surface temperatures. Soil temperature is also high averaging 72.8°F at a depth of almost 17 inches. High soil and surface temperatures can hinder shrub seedling establishment. Bare ground is found in the shrub interspaces with soil pedestalling around shrubs. There are some signs of erosion on the site but it is limited by the gentle terrain. The soil erosion condition class was determined as stable in 2003.

Prior to study site establishment on May 27<sup>th</sup> of 2003, this area supported a moderately dense stand of low elevation mountain big sagebrush possibly hybridized with Wyoming big sagebrush. Intermixed with the sagebrush is a population of about 500 moderately tall Stansbury cliffrose plants/acre. This area has experienced severe drought for the past few years. Precipitation data from the town of Veyo show that 3 of the past 4 years have been well below normal for annual precipitation, especially 2002, which was only 37% of normal. In addition, spring precipitation (April to June) has been drier than normal for the past 4 years (see precipitation graphs in unit summary). The spring of 2002 was exceptionally dry at only 5% of normal. This dry period has caused a major sagebrush die-off on Tobin Bench. Shrub density data estimate 4,340 dead sagebrush plants/acre with another 600 plants/acre of decadent plants. Of the 600 decadent plants/acre estimated, 77% of those were classified as dying, meaning that over 50% of the crown was dead. Only about 20 plants/acre are mature plants with normal vigor. Utilization of the surviving plants was moderate to heavy. There were no seedlings or young encountered. Due to the proximity of this site to the black brush ecotype less than ½ mile to the south, this area is probably marginal for mountain big sagebrush and the drier than average conditions of the past few years have caused the sagebrush die-off.

The cliffrose population appears healthy and vigorous. Mature plants average nearly 5 feet in height making some plants partly unavailable to browsing. Utilization is heavy on available portions. Annual leader growth is good averaging 2½ inches. Vigor is normal on most plants but half of the population was classified as decadent. Reproduction is minimal but cliffrose is long-lived and young recruitment will improve with a return to normal precipitation patterns. The only other shrubs on the site consist of some oakbrush and three species of cactus.

The herbaceous understory is very poor. Perennial grasses are rare and represented by a few intermediate wheatgrass and bottlebrush squirreltail plants. Forbs are somewhat more abundant but only four species were encountered. Euphorbia and sego lily are the only common species. Total grass and forb cover averaged less than 4% in 2003.

### 2003 APPARENT TREND ASSESSMENT

Soil conditions are currently poor with abundant bare ground exposed. Most of the litter cover is due to dead sagebrush. However, due to the gentle terrain, erosion is not a problem on this site. Sagebrush has declined

substantially with 4,340 dead plants/acre estimated. There are very few sagebrush that will survive. The cliffrose population numbers about 500 plants/acre. Most display normal vigor but 52% were classified as decadent. Utilization is heavy on available plants but the cliffrose are vigorous and have good annual leader growth. With the loss of sagebrush on this site, cliffrose will likely be more heavily hedged in coming years which could eventually have a detrimental effect. It will be important to try to get cliffrose to a more balanced age class distribution. The herbaceous understory is very poor. Perennial grasses are rare and only Euphorbia and sego lily are found more than occasionally. There is not much that can be done to improve the understory without seeding.

HERBACEOUS TRENDS --

Management unit 30 , Study no: 61

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	Agropyron intermedium	2	.03
G	Sitanion hystrix	7	.01
Total for Annual Grasses		0	0
Total for Perennial Grasses		9	0.04
Total for Grasses		9	0.04
F	Aster spp.	1	.00
F	Calochortus nuttallii	37	.37
F	Euphorbia spp.	46	2.89
F	Navarretia intertexta (a)	2	.03
Total for Annual Forbs		2	0.03
Total for Perennial Forbs		84	3.27
Total for Forbs		86	3.30

BROWSE TRENDS --

Management unit 30 , Study no: 61

T y p e	Species	Strip Frequency	Average Cover %
		'03	'03
B	Artemisia tridentata vaseyana	24	6.11
B	Cowania mexicana stansburiana	25	7.29
B	Quercus turbinella	2	.53
Total for Browse		51	13.94



CANOPY COVER, LINE INTERCEPT --  
 Management unit 30 , Study no: 61

Species	Percent Cover '03
Artemisia tridentata vaseyana	.93
Cowania mexicana stansburiana	7.88
Quercus turbinella	1.36

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 30 , Study no: 61

Species	Average leader growth (in) '03
Cowania mexicana stansburiana	2.5

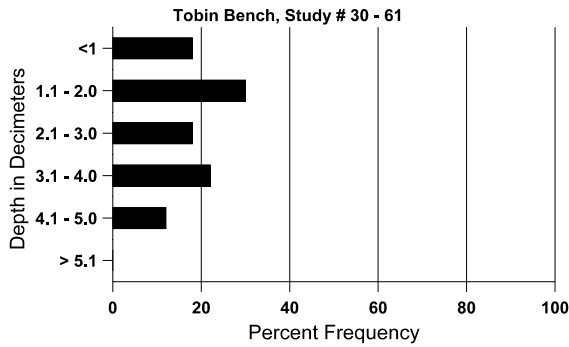
BASIC COVER --  
 Management unit 30 , Study no: 61

Cover Type	Average Cover % '03
Vegetation	17.18
Rock	7.96
Pavement	9.61
Litter	50.40
Cryptogams	.09
Bare Ground	23.35

SOIL ANALYSIS DATA --  
 Management unit 30, Study no: 61, Study Name: Tobin Bench

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
17.2	72.8 (16.6)	7.1	58.6	14.7	26.7	1.3	10.3	486.4	0.6

## Stoniness Index



### PELLET GROUP DATA --

Management unit 30 , Study no: 61

Type	Quadrat Frequency	Days use per acre (ha)
	'03	'03
Rabbit	7	-
Deer	50	225 (555)

### BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 61

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>											
03	<b>620</b>	-	-	20	600	4340	32	16	97	74	31/41
<i>Cowania mexicana stansburiana</i>											
03	<b>500</b>	20	20	220	260	20	24	48	52	8	57/67
<i>Coryphantha vivipara</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	6/5
<i>Ephedra viridis</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	30/34
<i>Opuntia spp.</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	13/26
<i>Quercus turbinella</i>											
03	<b>240</b>	-	-	240	-	40	0	0	-	0	52/44
<i>Sclerocactus</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	11/11

Trend Study 30-62-03

Study site name: North Hills.

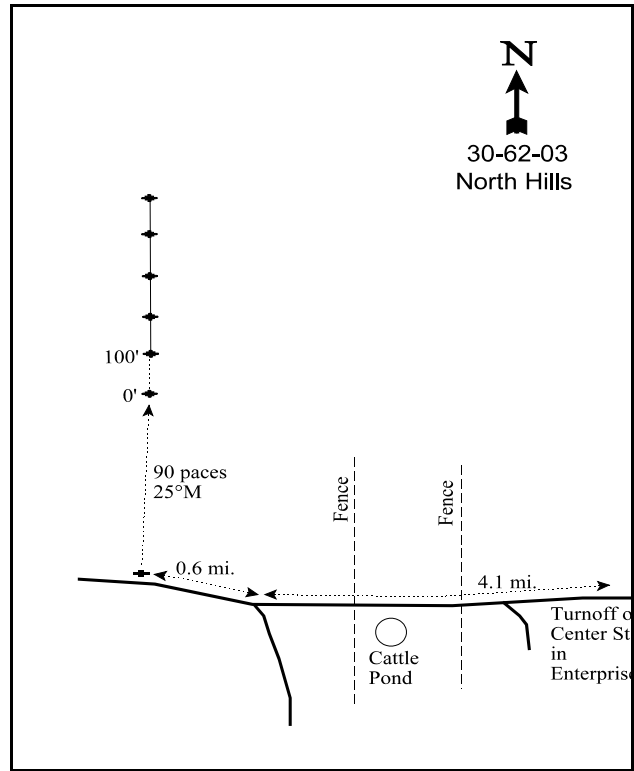
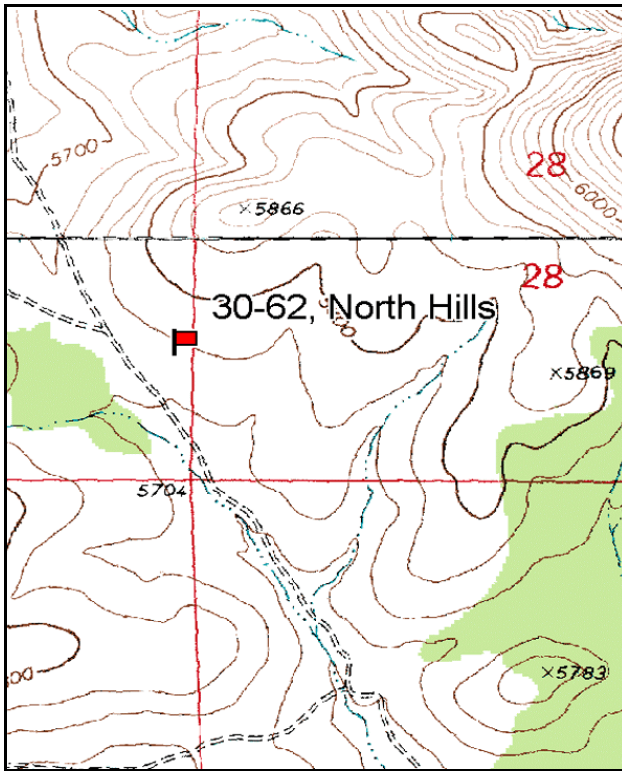
Vegetation type: Cliffrose-sagebrush.

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

Starting from the town of Enterprise, turn north on Center Street and travel 0.25 miles. Turn left (west) on Old Modena Rd. and travel 4.1 miles passing study 30-52 and a couple of fences to a fork on the left. Continue straight on the road for another 0.6 miles to the witness post on the right side of the road. The 0-foot stake is 90 paces at 25 degrees magnetic. The 0-foot stake is marked by browse tag # 434. The study is marked by green steel "T" fence posts approximately 12 to 14 inches in height.



Map Name: Hebron

Diagrammatic Sketch

Township 36S, Range 17W, Section 28

GPS: NAD 27, UTM 12S 4163561 N, 255357 E

## DISCUSSION

### North Hills - Trend Study No. 30-62

This is a new trend study established in 2003 to replace the Northwest of Enterprise study (30-52). It is located about 1.5 miles northwest of trend study 30-52 and about 5 miles northwest of the town of Enterprise. The study samples a sagebrush/cliffrose winter range with an elevation of about 5,800 feet. Aspect is southwest and slope is 11%. Pellet group transect data estimated 25 deer days use/acre (63 ddu/ha). Most of the pellet groups encountered appeared to be from winter use.

Soil is moderately shallow with effective rooting depth averaging just over 13 inches. Deeper soil depth measurements were limited by rock and a calcium carbonate layer which started at about 9 inches in depth. This layer does not appear to be a barrier to roots however. Rock and pavement are common on the surface providing 32% cover. Soil temperature is relatively high at 71.4°F at 14 inches in depth. Soil texture is a clay loam and reactivity is neutral (pH of 7.1). There is little unprotected bare ground exposed and erosion is not a problem on this site. The soil erosion condition class was determined as stable in 2003.

The site supports a moderate stand of mountain big sagebrush with a few scattered tall cliffrose. Sagebrush has an estimated density of 3,380 plants/acre. The population is overly mature but most plants display normal vigor. They are producing abundant seed heads and have good annual leader growth. However, many plants have partial crown death and nearly half of the population was classified as decadent (46%). About 42% of the decadent sagebrush sampled were rated as dying, meaning >50% of the crown was dead. Other decadent plants displayed normal vigor. Seedling and young recruitment are poor but should improve with a return to normal precipitation patterns.

Cliffrose numbers only about 80 plants/acre. These are large tree-like plants averaging nearly 5 feet in height. Use is heavy on available plants, vigor is normal and annual leaders are abundant. Many plants are producing plentiful flowers. The site also supports a very small number of heavily hedged bitterbrush. Other shrubs on the site include broom snakeweed, cactus, and yucca.

The herbaceous understory is poor. There were six species of perennial and two species of annual grasses sampled on the site. Total production is poor however, with total grass cover at only about 7%. Annual cheatgrass provides 65% of that cover. The most common perennial grasses include galleta and bottlebrush squirreltail. Several forbs were found on the site but most are rare in their occurrence. Total forb cover totaled less than 1%.

### 2003 APPARENT TREND ASSESSMENT

Soil conditions on the site are stable with respect to erosion. Protective ground cover, in the form of vegetation and litter, are marginal. However, due to the abundance of rock and pavement cover there is little exposed bare ground and erosion is not a problem. The sagebrush stand is showing some signs of drought stress but overall, the population is healthy and mostly lightly used. Seedling and young recruitment is currently poor but should improve with a return to more normal precipitation patterns. Cliffrose appears stable as most mature plants have grown partly out of reach to browsing. The herbaceous understory is poor with respect to perennial species. Annual cheatgrass provides 65% of the grass cover. Several perennial grasses are present but not abundant. Forbs are lacking.

HERBACEOUS TRENDS --  
 Management unit 30 , Study no: 62

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	Bromus japonicus (a)	1	.00
G	Bromus tectorum (a)	174	4.39
G	Hilaria jamesii	81	1.36
G	Oryzopsis hymenoides	11	.19
G	Poa fendleriana	5	.04
G	Poa secunda	14	.11
G	Sitanion hystrix	49	.29
G	Vulpia octoflora (a)	86	.32
Total for Annual Grasses		261	4.72
Total for Perennial Grasses		160	2.01
Total for Grasses		421	6.73
F	Calochortus nuttallii	12	.02
F	Compositae	5	.21
F	Draba spp. (a)	5	.01
F	Gilia spp. (a)	25	.13
F	Lupinus argenteus	3	.01
F	Microsteris gracilis (a)	2	.01
F	Navarretia intertexta (a)	32	.19
F	Phlox longifolia	2	.00
F	Sphaeralcea grossulariaefolia	4	.04
Total for Annual Forbs		64	0.35
Total for Perennial Forbs		26	0.29
Total for Forbs		90	0.64

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

BROWSE TRENDS --

Management unit 30 , Study no: 62

Type	Species	Strip Frequency	Average Cover %
		'03	'03
B	<i>Artemisia tridentata vaseyana</i>	83	13.61
B	<i>Cowania mexicana stansburiana</i>	4	.30
B	<i>Coryphantha vivipara</i>	1	-
B	<i>Gutierrezia sarothrae</i>	37	1.56
B	<i>Purshia tridentata</i>	1	.63
Total for Browse		126	16.11

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 62

Species	Percent Cover
	'03
<i>Artemisia tridentata vaseyana</i>	16.11
<i>Cowania mexicana stansburiana</i>	.58
<i>Gutierrezia sarothrae</i>	1.56
<i>Purshia tridentata</i>	.33

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 62

Species	Average leader growth (in)
	'03
<i>Artemisia tridentata vaseyana</i>	4.2
<i>Cowania mexicana stansburiana</i>	1.2

BASIC COVER --

Management unit 30 , Study no: 62

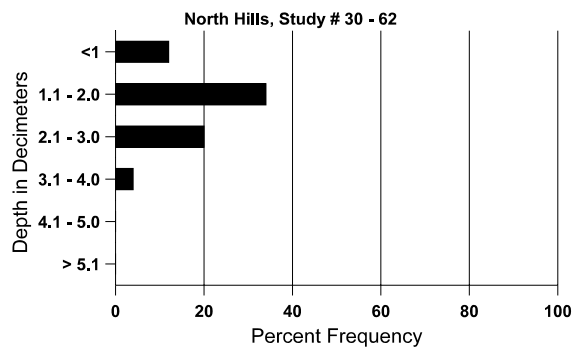
Cover Type	Average Cover %
	'03
Vegetation	28.15
Rock	19.44
Pavement	12.29
Litter	36.87
Cryptogams	.07
Bare Ground	11.86

SOIL ANALYSIS DATA --

Management unit 30, Study no: 62, Study Name: North Hills

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	%OM	PPM P	PPM K	ds/m
13.2	71.4 (14.0)	7.1	34.6	36.7	28.7	1.2	5.1	422.4	0.4

### Stoniness Index



PELLET GROUP DATA --

Management unit 30 , Study no: 62

Type	Quadrat Frequency	Days use per acre (ha)
	'03	'03
Rabbit	31	-
Deer	19	25 (63)

BROWSE CHARACTERISTICS --  
 Management unit 30 , Study no: 62

		Age class distribution (plants per acre)					Utilization				
Y e a r	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata vaseyana</i>											
03	<b>3380</b>	20	40	1780	1560	1240	22	8	46	20	23/31
<i>Chrysothamnus parryi</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	6/15
<i>Cowania mexicana stansburiana</i>											
03	<b>80</b>	20	20	60	-	20	25	75	-	0	57/50
<i>Coryphantha vivipara</i>											
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<i>Gutierrezia sarothrae</i>											
03	<b>2480</b>	40	40	2320	120	580	0	0	5	.80	8/10
<i>Purshia tridentata</i>											
03	<b>20</b>	-	-	-	20	-	0	100	100	100	10/21
<i>Yucca spp.</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	28/35



Trend Study 30-63-03

Study site name: Holt Canyon.

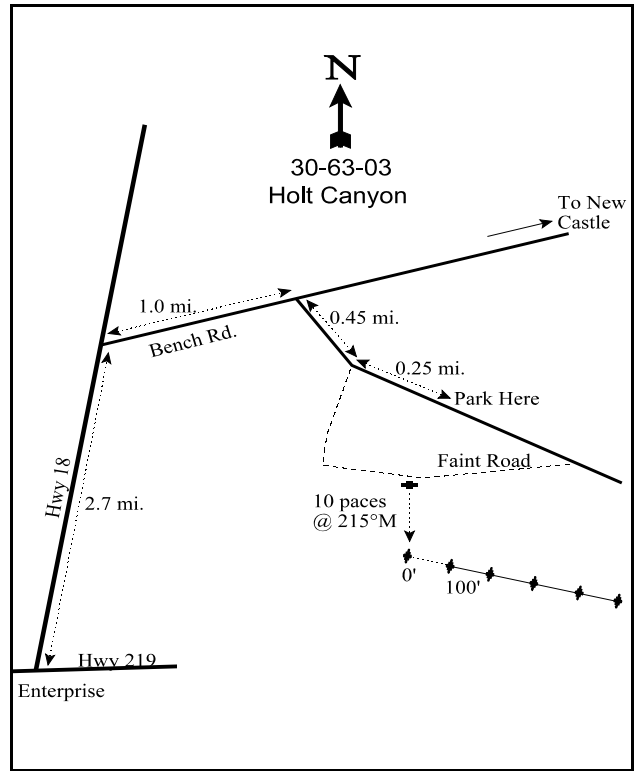
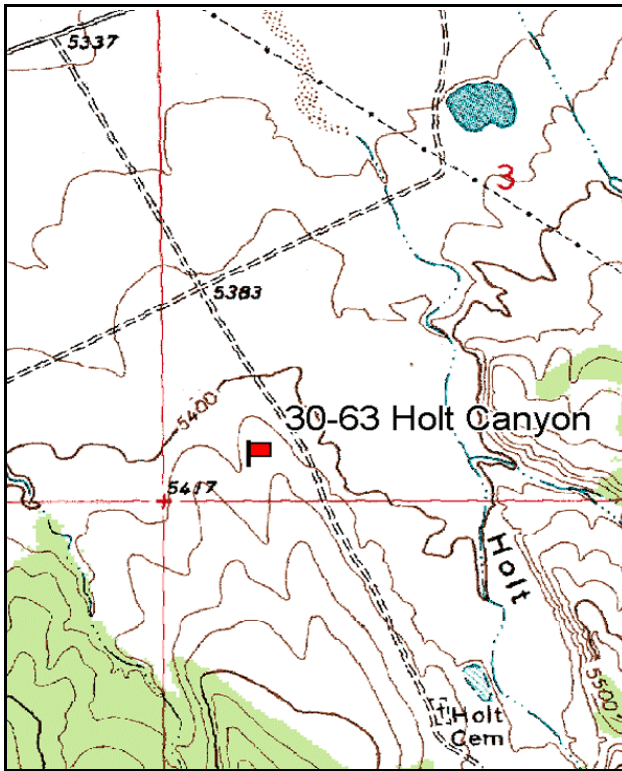
Vegetation type: Wyoming Big Sagebrush.

Compass bearing: frequency baseline 149 degrees magnetic.

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

LOCATION DESCRIPTION

From Enterprise, drive east on Highway 18 for 2.7 miles to Bench Rd. Turn left and drive approximately 1.0 mile to Holt Canyon Road, there is a sign. Drive on Holt Canyon Rd. for 0.45 miles to an intersection. Continue straight for 0.25 miles and park. Walk up the hill to the west and look for a full high witness post next to a faint road. From the witness post, the 0-foot stake is 10 paces at 215 degrees magnetic. The 0-foot stake is marked by browse tag #142. The study is marked by green steel "T" fence posts approximately 12 to 14 inches in height.



Map Name: Enterprise

Diagrammatic Sketch

Township 37S, Range 16W, Section 3

GPS: NAD 27, UTM 12S 4163561 N, 266913 E

## DISCUSSION

### Holt Canyon - Trend Study No. 30-63

This is a new trend study established in 2003 as a reference area for the Wyoming big sagebrush type. It is located about 7 miles south of the town of Newcastle and about 6 miles south of trend study 30-29, Southwest of Newcastle. The site is located on a Wyoming big sagebrush winter range at an elevation of about 5,400 feet at the mouth of Holt Canyon. Aspect is to the southwest and slope is 11%. This area has received little to no livestock use for many years. It does receive some use by wintering deer and pellet group data taken on the site in 2003 estimated 11 deer days use/acre (26 ddu/ha).

Soil at the site is relatively shallow with an effective rooting depth estimated at 11 inches. The soil temperature is 70.4°F at just over 11 inches. The soil surface is gravelly with larger rocks scattered on the surface and throughout the profile. Rock and pavement combine to produce nearly 30% ground cover. Parent material is basalt. Soil texture is a sandy loam and reactivity is neutral (pH of 7.2). Shrub interspaces are mostly bare of herbaceous vegetation but the soil surface is armored by pavement and the amount of exposed bare ground is low. There is little erosion occurring on the site and the erosion condition class was rated as stable.

The site supports a fairly dense stand for a Wyoming big sagebrush site. Density was estimated at 3,080 plants/acre in 2003 with a line-intercept cover estimate of nearly 19%. Most of the plants exhibited normal vigor, but 54% of the population was classified as decadent due to partial crown death. However, only 29% or 480 plants/acre of the decadent sagebrush were rated as dying (>50% crown death). All other decadent plants displayed normal vigor. Utilization was mostly light to moderate. Sagebrush were producing abundant seed heads and annual leader growth was good, averaging 1.7 inches. Young recruitment is marginal with only 100 young plants/acre estimated. This is not enough to maintain the population at current levels. The only other shrubs encountered on the site included a few cactus, Spiny polygala, and an occasional bitterbrush.

The herbaceous understory is poor with total grass cover of only 5%. The only common species are cheatgrass which accounts for 23% of the grass cover and galleta which accounts for 56% of the grass cover. Purple three-awn, Indian ricegrass, and bottlebrush squirreltail are also found on the site in small numbers. Perennial forbs are rare. Total forb cover averaged around 2% in 2003. Annual forbs, Gilia and wooly navarretia, are the only common species.

### 2003 APPARENT TREND ASSESSMENT

Soil conditions appear stable. There is little exposed bare ground and erosion is minimal. The sagebrush population is showing the effects of drought. Just over half of the population is decadent but only 29% of those were classified as dying. All other sagebrush displayed normal vigor. Most sagebrush look healthy and vigorous with excellent seed production and annual leader growth. Young recruitment is marginal and probably not sufficient to avoid a small decline in population density in the future. The herbaceous understory is fairly diverse for a dry Wyoming big sagebrush site, but most species are rare in their occurrence. Galleta provides over half of the grass cover estimated at only 4.5%. Perennial forbs are rare and all forbs combined produce less than 2% cover.

HERBACEOUS TRENDS --

Management unit 30 , Study no: 63

T y p e	Species	Nested Frequency	Average Cover %
		'03	'03
G	<i>Aristida purpurea</i>	22	.52
G	<i>Bromus tectorum</i> (a)	128	1.05
G	<i>Hilaria jamesii</i>	86	2.54
G	<i>Oryzopsis hymenoides</i>	9	.04
G	<i>Sitanion hystrix</i>	30	.33
G	<i>Vulpia octoflora</i> (a)	4	.00
Total for Annual Grasses		132	1.06
Total for Perennial Grasses		147	3.45
Total for Grasses		279	4.51
F	<i>Calochortus nuttallii</i>	8	.02
F	<i>Cymopterus</i> spp.	10	.04
F	<i>Euphorbia</i> spp.	5	.03
F	<i>Gilia</i> spp. (a)	66	.68
F	<i>Leucelene ericoides</i>	5	.15
F	<i>Navarretia intertexta</i> (a)	88	.84
F	<i>Penstemon</i> spp.	1	.03
F	<i>Phlox longifolia</i>	1	.00
Total for Annual Forbs		154	1.52
Total for Perennial Forbs		30	0.28
Total for Forbs		184	1.81

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

BROWSE TRENDS --

Management unit 30 , Study no: 63

T y p e	Species	Strip Frequency	Average Cover %
		'03	'03
B	<i>Amelanchier utahensis</i>	0	.38
B	<i>Artemisia tridentata</i> <i>wyomingensis</i>	81	22.93
B	<i>Opuntia</i> spp.	1	.38
B	<i>Polygala subspinosa</i> <i>subspinosa</i>	5	.06
Total for Browse		87	23.75

CANOPY COVER, LINE INTERCEPT --

Management unit 30 , Study no: 63

Species	Percent Cover '03
Artemisia tridentata wyomingensis	18.48
Opuntia spp.	.61

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 30 , Study no: 63

Species	Average leader growth (in) '03
Artemisia tridentata wyomingensis	1.7

BASIC COVER --

Management unit 30 , Study no: 63

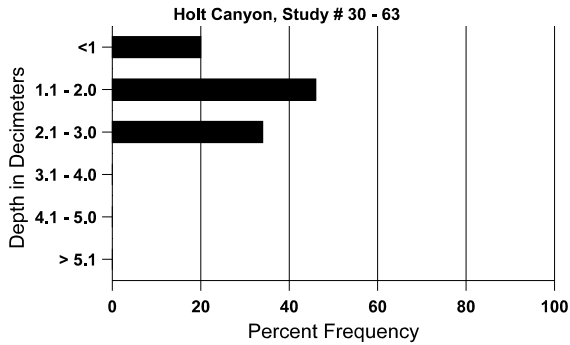
Cover Type	Average Cover % '03
Vegetation	31.81
Rock	4.84
Pavement	24.13
Litter	41.40
Cryptogams	.18
Bare Ground	11.53

SOIL ANALYSIS DATA --

Management unit 30, Study no: 63, Study Name: Holt Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
11.0	70.4 (11.2)	7.2	64.6	18.7	16.7	1.2	4.9	451.2	0.5

# Stoniness Index



## PELLET GROUP DATA --

Management unit 30 , Study no: 63

Type	Quadrat Frequency	Days use per acre (ha)
	'03	'03
Rabbit	26	-
Deer	8	11 (26)

## BROWSE CHARACTERISTICS --

Management unit 30 , Study no: 63

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata wyomingensis</i>											
03	<b>3080</b>	-	100	1320	1660	980	33	3	54	16	28/37
<i>Opuntia spp.</i>											
03	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
<i>Polygala subspinoso subspinoso</i>											
03	<b>100</b>	-	-	100	-	-	0	0	-	0	3/5
<i>Purshia tridentata</i>											
03	<b>0</b>	-	-	-	-	-	0	0	-	0	48/65

## SUMMARY

### WILDLIFE MANAGEMENT UNIT 30 - PINE VALLEY

Twenty-two trend studies were read in the Pine Valley Wildlife Management unit in 2003. Twelve of these trend studies were originally established in 1982. Three sites, Spirit Creek South Burn (30-58), Upper Horse Creek (30-59), and Jones Hollow (30-60), were established in 1986 to monitor rehabilitation efforts on a large wildfire. Eleven of the 12 sites established in 1982, were reread in 1992 and all 12 sites were reread in 1998. Four additional trend studies, Bullion Canyon (30-54), Quichapa Canyon (30-55), Woolsey Seeding (30-56), and Summit Spring (30-57), were established in 1998. During the 2003 reading, new trend study sites were established at Tobin Bench (30-61), North Hills (30-62), and Holt Canyon (30-63). Fifteen of the 22 trend studies on unit 30 sample deer winter ranges while the other 7 sample transitional and/or summer ranges.

#### Winter Range Trend

Average trends for the winter range sites are below stable for all categories due to extreme drought conditions. Average soil trend is 2.7, or just below stable. Browse trends average 2.0. Wyoming and/or mountain big sagebrush is the key browse species on 9 of the 12 winter range sites that have been surveyed more than once. One site, Northwest of Enterprise (30-52), burned prior to the 2003 reading and all sagebrush was eliminated. The number of decadent sagebrush increased on 8 of the remaining 9 winter range trend study sites. Young recruitment was also down on all but one site. Browse trends were down or slightly down on 8 of the 12 winter range sites. Two of these sites had downward trends due to wildfire, Pahcoon Bench (30-46) and Northwest of Enterprise (30-52). Conditions at Southwest of Newcastle (30-29), Grapevine Spring (30-42), and Bullion Canyon (30-54), were particularly bad and considerable sagebrush die-off had occurred.

Herbaceous trends were also down and have shown a steady decline in trend since 1992. Average herbaceous trend is currently only 1.8. Drought conditions have been extremely hard on these lower elevation winter ranges and 10 of the 12 winter range sites displayed a decline in cover and nested frequency of perennial grasses. On average, cover declined by 48%. Perennial forb cover and frequency are poor on most of these winter range sites and drought conditions have caused a 47% average decline in cover and a 32% decline in nested frequency of perennial forbs. One positive result of the dry conditions is a decline in annual cheatgrass. All 12 sites displayed a decline in cover and nested frequency of cheatgrass. On average, cover declined threefold while nested frequency declined twofold. This decline should not be mistaken for an elimination of cheatgrass on these sites. The drop in cover and frequency was the result of drier than normal precipitation patterns, especially during the fall and spring periods. Cheatgrass will recover with a return to normal precipitation.

#### Summer/Transitional Range Trends

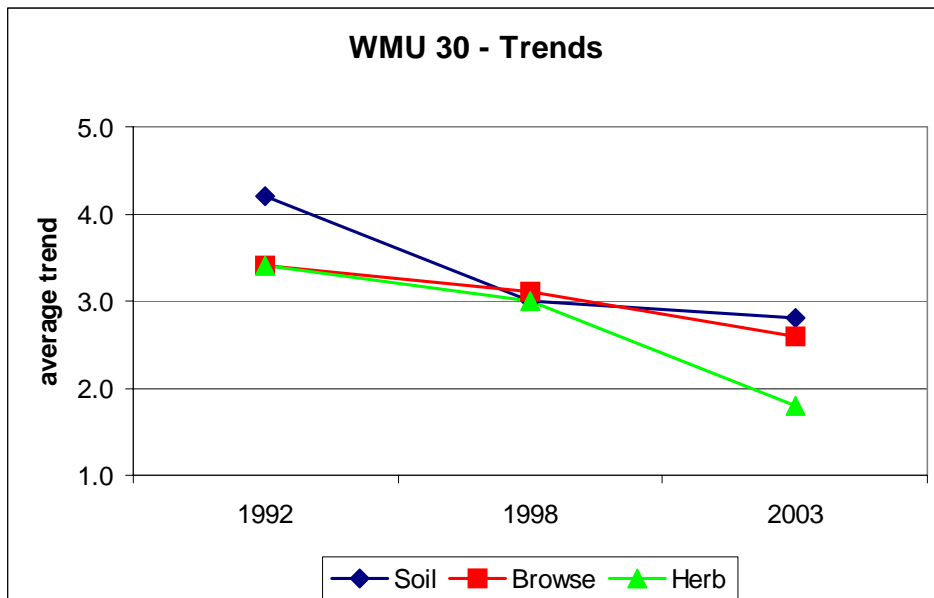
Seven trend studies were read on higher elevation transitional and summer ranges. These sites also have been effected by drought but not to the level of the winter range studies. Average soil trends are stable at 3.1. Average browse trends have remained at 3.6 since 1992 which is slightly up. It should be noted that the browse component of transitional and summer range is not nearly as important as grasses and forbs. An upward browse trend on summer range should be considered a negative change on most sites. Sagebrush is of little importance as a forage source on a site like Harmony Mountain Summit (30-5) which is located at 8,100 feet. Sagebrush is very abundant on this site at a density of 8,640 plants/acre with an average cover value of 19%. Young plants are abundant and age class analysis suggests an expanding population. An increase in browse cover on this type of site will reduce the abundance of grasses and forbs which is the key forage source for deer in the spring and summer. Herbaceous trends have steadily declined since 1992 when the average trend was rated at slightly up at 4.1. Average trends were stable in 1998 averaging 3.5 but declined to

1.7 in 2003, slightly lower than the average for winter range sites. Upper Horse Creek (30-59), had a stable herbaceous trend while the other six sites had down or slightly down herbaceous trends. Five of the 7 summer/transitional trend studies showed a decline in perennial grass cover while 4 of the 7 had a drop in nested frequency. Perennial grass cover declined 40% on average while nested frequency declined 23%. All 7 trend studies declined in perennial forb cover and 5 of the 7 sites displayed a decline in nested frequency. Cover declined an average of 34% while nested frequency declined 20%.

These downward trends are caused primarily by drought. Precipitation data from weather stations at Cedar City, New Harmony, Gunlock, Veyo, and Enterprise, show that 3 of the past 4 years were well below normal with respect to annual precipitation (Utah Climate Summaries 2004). Conditions were exceptionally dry in 1999 and 2002 at 66% and 41% of normal annual precipitation respectively. Spring precipitation (April-June) was also very dry from 2000 to 2003, averaging only 53% of normal. Conditions were extremely dry during the spring of 2002 when just 12% of normal precipitation was recorded. These dry spring periods are the primary factor in downward herbaceous trends in unit 30. The consecutive years of drier than normal conditions appear to have caused a dry soil profile in many areas. Average soil temperature on many sites was much higher in 2003 than temperatures recorded in 1998 when precipitation was well above normal. Dry soil profiles have contributed to sagebrush die-off in some areas due to winter dessication. Precipitation and trend summaries can be found below.

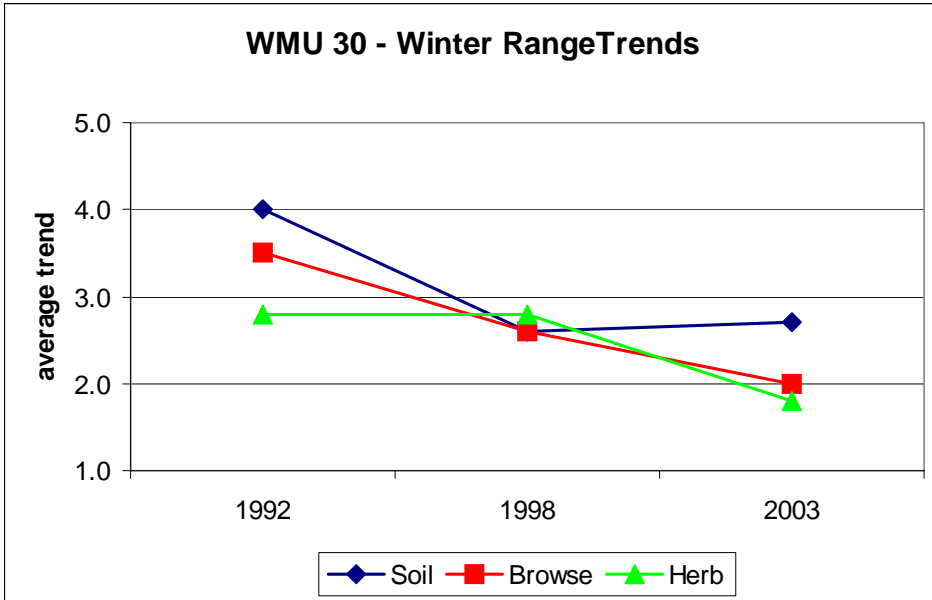
Unit 30 Average Trends

	1992	1998	2003
Soil	4.2	3.0	2.8
Browse	3.4	3.1	2.6
Herb	3.4	3.0	1.8
	15 sites	16 sites	19 sites



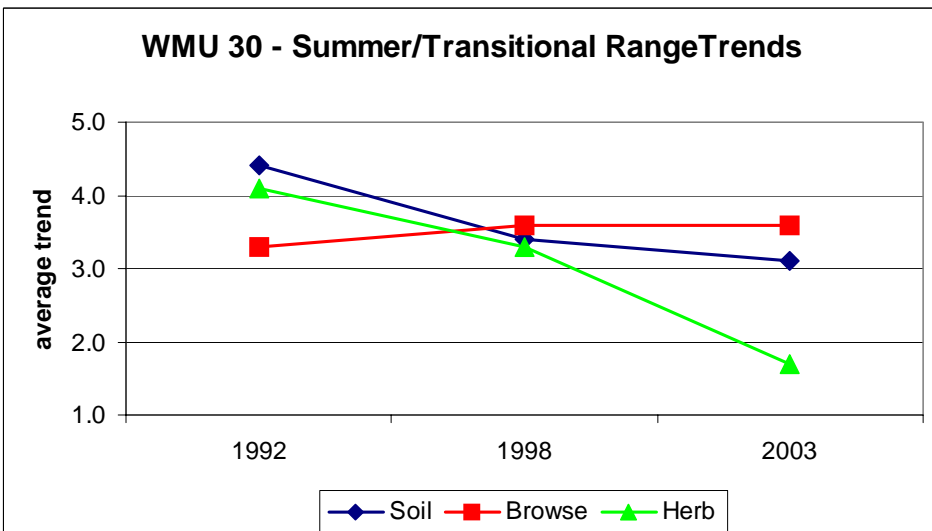
Unit 30 Winter Range Average Trends

	1992	1998	2003
Soil	4.0	2.6	2.7
Browse	3.5	2.6	2.0
Herb	2.8	2.8	1.8
	8 sites	8 sites	12 sites



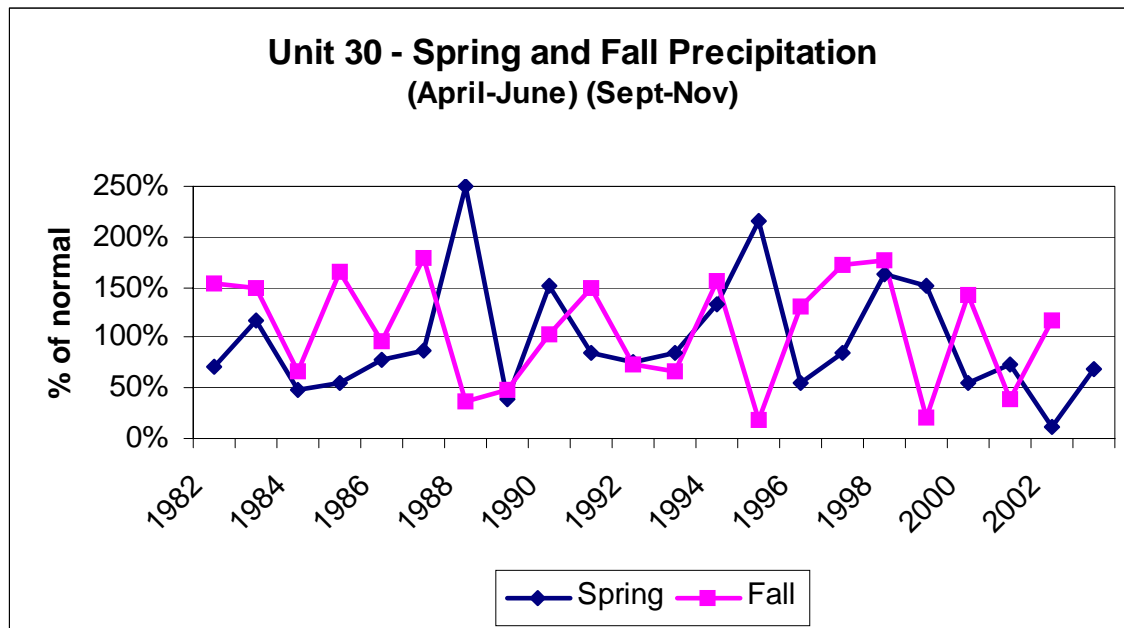
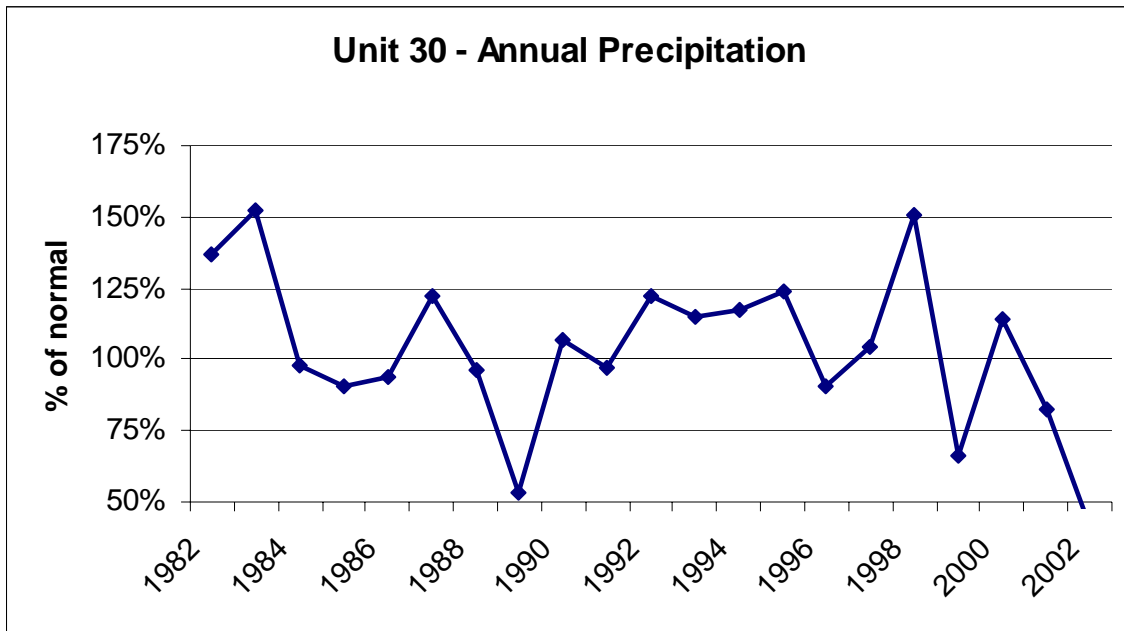
Unit 30 Transitional/Summer Range Average Trends

	1992	1998	2003
Soil	4.4	3.4	3.1
Browse	3.6	3.6	3.6
Herb	4.1	3.5	1.7
	7 sites	8 sites	7 sites





Below are precipitation graphs for the Pine Valley unit. Data represents percent of normal precipitation averaged for 5 weather stations which include Cedar City, New Harmony, Gun Lock, Veyo, and Enterprise (Utah Climate Summaries 2004).



Trend Summary

	Category	1982	1992	1998	2003
30-3 Upper Broad Hollow	soil	est	4	3	3
	browse	est	1	3	2
	herbaceous understory	est	3	3	2
30-5 Harmony Mountain Summit	soil	est	5	3	3
	browse	est	4	3	5
	herbaceous understory	est	5	2	1
30-13 Black Ridge	soil	est	2	3	2
	browse	est	5	3	3
	herbaceous understory	est	2	3	1
30-26 Grassy Flat Ridge	soil	est	3	3	3
	browse	est	4	5	5
	herbaceous understory	est	4	2	2
30-29 Southwest of Newcastle	soil	est	5	2	2
	browse	est	4	2	1
	herbaceous understory	est	4	2	3
30-35 Deep Canyon	soil	est	3	2	4
	browse	est	4	4	5
	herbaceous understory	est	4	2	2
30-38 Wide Canyon	soil	est	3	3	3
	browse	est	4	2	1
	herbaceous understory	est	3	1	2
30-40 Telegraph Draw	soil	est	5	2	3
	browse	est	5	3	5
	herbaceous understory	est	3	3	1
30-41 Joe Spring	soil	est	5	3	3
	browse	est	1	4	2
	herbaceous understory	est	3	5	1

(1) = down, (2), slightly down, (3) = stable, (4) = slightly up, (5) = up  
 (est) = established, (n/a) = no trend, (sus) = suspended, (NR) = not read

	Category	1982	1992	1998	2003
30-42 Grapevine Spring	soil	est	3	3	3
	browse	est	5	4	1
	herbaceous understory	est	1	4	1
30-45 Flat Top Mountain	soil	est	NR	3	3
	browse	est	NR	3	2
	herbaceous understory	est	NR	4	1
30-46 Pahcoon Bench	soil	est	5	3	2
	browse	est	3	2	1
	herbaceous understory	est	3	1	1
30-52 Northwest of Enterprise	soil	est	5	2	2
	browse	est	1	2	1
	herbaceous understory	est	3	5	2
	Category			1998	2003
30-54 Bullion Canyon	soil			est	3
	browse			est	1
	herbaceous understory			est	2
30-55 Quichapa Canyon	soil			est	3
	browse			est	2
	herbaceous understory			est	3
30-56 Woolsey Seeding	soil			est	3
	browse			est	3
	herbaceous understory			est	1
30-57 Summit Spring	soil			est	3
	browse			est	3
	herbaceous understory			est	3

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	Category	1987	1992	1998	2003
30-58 Spirit Creek South Burn	soil	est	5	5	3
	browse	est	5	4	3
	herbaceous understory	est	3	4	2
30-59 Upper Horse Creek	soil	est	5	4	3
	browse	est	2	3	3
	herbaceous understory	est	5	4	3
30-60 Jones Hollow	soil	est	5	4	n/a
	browse	est	3	3	n/a
	herbaceous understory	est	5	3	n/a
	Category				2003
30-61 Tobin Bench	soil				est
	browse				est
	herbaceous understory				est
30-62 North Hills	soil				est
	browse				est
	herbaceous understory				est
30-63 Holt Canyon	soil				est
	browse				est
	herbaceous understory				est

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