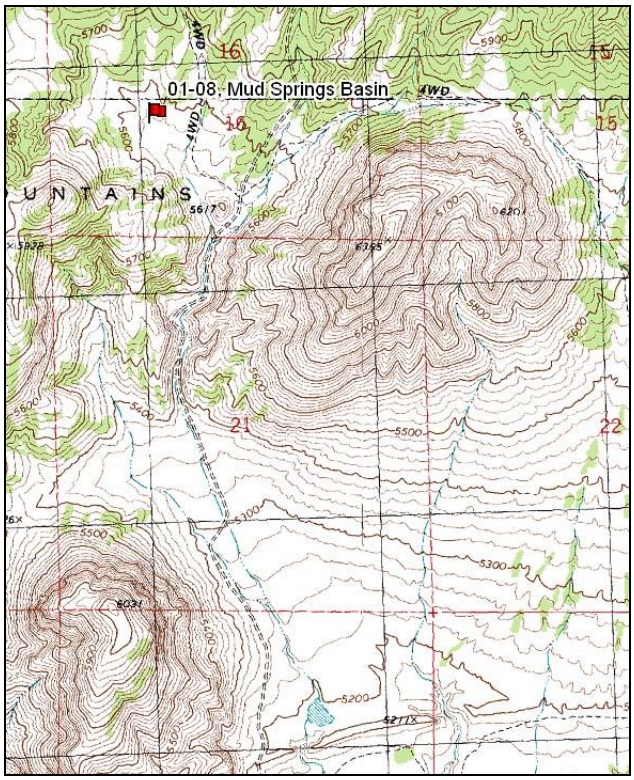
MUD SPRINGS BASIN - TREND STUDY NO. 1-8-11

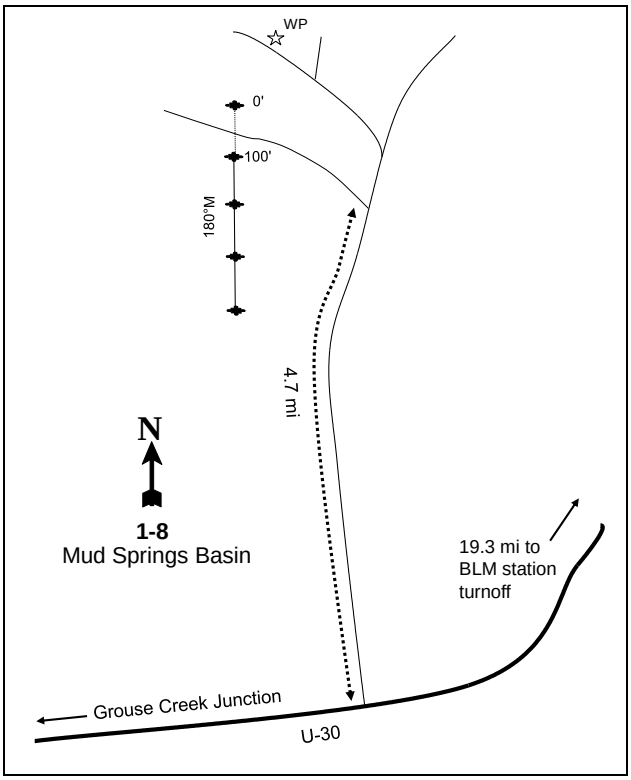
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Year-long
NRCS Ecological Site Description: Upland Juniper Savanna (Utah Juniper), R025XY322UT
Land Ownership: BLM
Elevation: 5,580 ft. (1,701 m)
Aspect: Southeast
Slope: 7%
Transect bearing: 180° magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
On U-30 proceed 19 miles southwest from the Rosebud BLM station turn-off and turn right (north) onto a gravel road just before mile marker 14. Proceed 4.7 miles and take a fork to the left for 0.3 miles. The transect intersects with the road. Look for the 100 foot stake on the left side of the road, and 0 foot stake will be found on the right hand side of the road. The 0 foot stake is marked by browse tag #7913. Bearing of the baseline is 180 degrees.

Map Name: Lucin NE



Diagrammatic Sketch:



Township: 9N Range: 17W Section: 16

GPS: NAD 83, UTM 12S 265978 E 4597940 N

Site Information

Site Description: The study is located approximately two miles southwest of Mud Springs Basin, at the south end of the Grouse Creek Mountains. The site is located on land administered by the State Institutional Trust Lands Administration (SITLA). The small basin in which the study is located contains numerous small ridges occupied by fingers of Utah juniper (*Juniperus osteosperma*) and black sagebrush (*Artemisia nova*) separated by low areas (swales) occupied by the more deep rooted Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*). The study samples a large sagebrush swale because of the importance of sagebrush during the winter. A road crosses the first line of the transect, and one of the sample belts is affected. Deer pellet groups were sampled in moderate abundance in 2001 and 2011, but low abundance in 2006. Cattle sign has been sampled in low abundance since 2001 (Table - Pellet Group Data).

Browse: The key browse species is Wyoming big sagebrush, which provides nearly all of the browse cover on the site (Table - Canopy Cover). There were a considerable number of rodent damaged plants encountered in 1984, but decadence was still relatively low. Wyoming big sagebrush is comprised of a moderately dense population of lightly utilized plants. Decadence and poor vigor have been moderate over the course of the sample years. Recruitment of young big sagebrush plants was good at the outset of the study, but has been poor since 2001. Other shrubs sampled include prickly phlox (*Leptodactylon pungens*), narrowleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *stenophyllus*), black sagebrush, and Nevada ephedra (*Ephedra nevadensis*). Black sagebrush was sampled when the sampling design was expanded in 1996. Density of narrowleaf rabbitbrush was high in 1996, but has decreased since that time (Table - Browse Characteristics).

Herbaceous Understory: Perennial grasses are fairly diverse and abundant, but the site has often been dominated by the annual species cheatgrass (*Bromus tectorum*). Native perennial grasses include western wheatgrass (*Agropyron smithii*), bluebunch wheatgrass (*A. spicatum*), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), and bottlebrush squirreltail (*Sitanion hystrix*). Cheatgrass has fluctuated in frequency and cover, but both measurements were high in 2001 and 2006. Forbs are not particularly abundant on the site, though diversity appears to vary based on the timing and amount of precipitation (Table - Herbaceous Trends).

Soil: The soil is in the Dahar-Codquin gravelly sandy loams, likely as part of the Dahar component. These soils occur on hillslopes, and parent material consists of alluvium and colluviums derived from sandstone and limestone (Soil Survey Staff 2011). The texture is a loam with a slightly alkaline reaction (pH 7.8) (Table - Soil Analysis Data). Bare interspaces have pavement covering the surface, but the soil beneath is easily erodible. Vegetation cover comes principally from sagebrush crowns, native grasses, and cheatgrass. Bare ground cover was low in most years, but was relatively high in 2011 (Table - Basic Cover). A number of small drainage channels traverse the area; however, none are deep or highly active. The soil erosion condition was classified as moderate in 2001, slight in 2006, and stable in 2011. Most signs of erosion are from pedestalling, flow patterns, and abundant rills.

Trend Assessments

Browse:

- **1984 to 1990 - down (-2):** The density of Wyoming big sagebrush decreased by 36% from 5,864 plants/acre to 3,731 plants/acre. Decadence increased from 14% to 29%, and poor vigor increased from 7% to 14%.
- **1990 to 1996 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined based on other parameters. Decadence of Wyoming big sagebrush remained similar at 25%, and poor vigor decreased slightly to 7%. Recruitment of young big sagebrush plants decreased from 34% to 12%, but is still considered to be good.

- **1996 to 2001 - slightly down (-1):** Wyoming big sagebrush decreased by 22% from 3,240 plants/acre to 2,540 plants/acre, but cover increased slightly from 12% to 14%. Decadence decreased to 19%, and poor vigor increased to 13%. Recruitment of young big sagebrush plants decreased to just 3% of the population. The weedy species narrowleaf rabbitbrush decreased by 42% from 3,300 plants/acre to 1,900 plants/acre, and cover decreased from 6% to 1%.
- **2001 to 2006 - down (-2):** The density of Wyoming big sagebrush decreased by 49% to 1,300 plants/acre, and cover decreased to 7%. Decadence increased to 35%, and poor vigor increased to 22%. There were no young big sagebrush plants sampled. Narrowleaf rabbitbrush decreased 55% in density to 860 plants/acre, and cover decreased to less than 1%.
- **2006 to 2011 - stable (0):** The density of Wyoming big sagebrush remained similar at 1,400 plants/acre, and cover increased to 9%. Decadence decreased to 19%, and poor vigor decreased to 14%.

Grass:

- **1984 to 1990 - up (+2):** The sum of nested frequency of perennial grasses increased two-fold.
- **1990 to 1996 - stable (0):** There was little change in the perennial grass sum of nested frequency.
- **1996 to 2001 - slightly down (-1):** The perennial grass sum of nested frequency remained similar, but cheatgrass increased significantly in nested frequency. Cover of perennial grasses decreased from 15% to 10%, and cover of cheatgrass increased from 5% to 13%.
- **2001 to 2006 - stable (0):** The sum of nested frequency of perennial grasses remained similar, but cover increased to 12%. Cheatgrass nested frequency also remained similar, but cover increased to 27%.
- **2006 to 2011 - slightly up (+1):** There was little change in the sum of nested frequency of perennial grasses, and cover of perennial grasses increased to 13%. However, cheatgrass decreased significantly in nested frequency, and cover of cheatgrass decreased to 2%.

Forb:

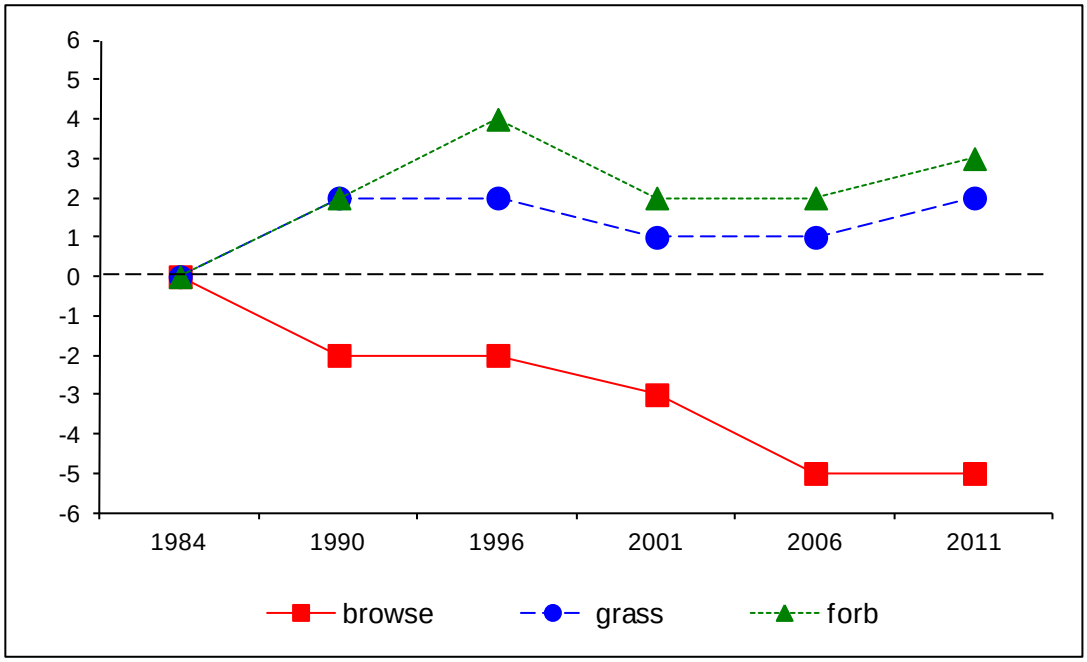
- **1984 to 1990 - up (+2):** The perennial forb sum of nested frequency increased more than two-fold, but forbs are not abundant on the site.
- **1990 to 1996 - up (+2):** The sum of nested frequency of perennial forbs increased two-fold.
- **1996 to 2001 - down (-2):** There was a 61% decrease in the sum of nested frequency of perennial forbs, and cover decreased from 3% to 1%.
- **2001 to 2006 - stable (0):** There was a 16% decrease in the sum of nested frequency of perennial forbs, but forbs are not abundant on the site. Cover of perennial forbs remained similar.
- **2006 to 2011 - slightly up (+1):** The sum of nested frequency of perennial forbs increased by 48%, and cover increased to 2%. The sum of nested frequency of annual forbs also increased substantially, and cover increased from less than 1% to 8%.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --
Management unit 1, study no: 8

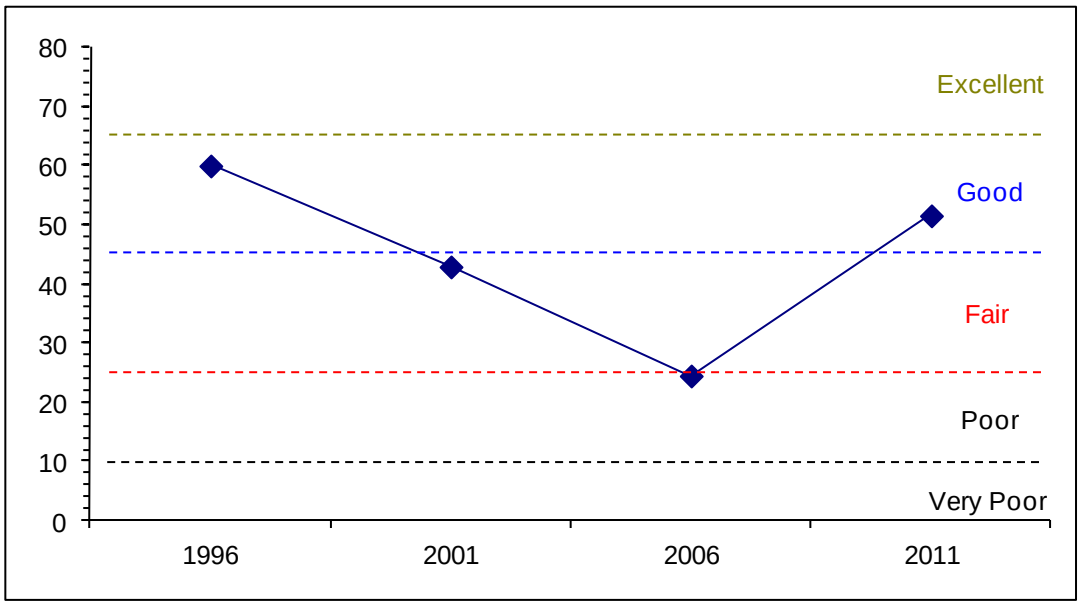
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
96	16.5	6.0	5.7	29.2	-4.0	6.7	0.0	**60.0**	Good
01	19.1	8.8	1.6	21.1	-9.7	2.1	0.0	**42.9**	Fair
06	10.9	5.8	0.7	24.8	-20.0	2.2	0.0	**24.5**	Poor-Fair
11	12.4	9.0	2.1	26.2	-1.4	3.2	0.0	**51.5**	Good

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 1 Study no: 8



DEER DESIRABLE COMPONENTS INDEX TREND, LOW POTENTIAL SCALE--
Management unit 1, Study no: 8



HERBACEOUS TRENDS--
Management unit 01, Study no: 8

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
G	Agropyron smithii	a-	ab16	a-	b30	ab12	a10	-	.58	.08	.44
G	Agropyron spicatum	46	84	78	77	80	72	3.88	3.45	3.53	2.54
G	Bromus tectorum (a)	-	-	a154	b268	b295	a180	5.38	12.92	27.35	1.90
G	Oryzopsis hymenoides	24	27	34	35	27	28	2.56	1.57	1.19	.92
G	Poa secunda	a51	b182	b176	b179	b198	b159	6.24	4.49	7.14	7.85
G	Sitanion hystrix	b58	b63	b57	a21	a13	ab34	1.89	.45	.44	1.35
Total for Annual Grasses		0	0	154	268	295	180	5.38	12.92	27.35	1.90
Total for Perennial Grasses		179	372	345	342	330	303	14.59	10.55	12.40	13.12
Total for Grasses		179	372	499	610	625	483	19.97	23.47	39.75	15.03
F	Agoseris glauca	1	-	-	1	2	-	-	.00	.00	-
F	Allium sp.	-	-	-	2	-	6	-	.00	-	.02
F	Alyssum alyssoides (a)	-	-	a6	a-	b36	c95	.01	-	.17	2.97
F	Ambrosia artemisifolia	-	2	-	-	-	-	-	-	-	-
F	Androsace septentrionalis (a)	-	-	-	1	-	-	-	.00	-	-
F	Antennaria rosea	-	-	6	4	10	10	.07	.01	.15	.30
F	Arabis sp.	-	-	-	-	-	3	-	-	-	.00
F	Arenaria sp.	-	-	-	1	-	2	-	.00	-	.00
F	Astragalus beckwithii	8	-	6	3	-	2	.18	.03	-	.03
F	Astragalus cibarius	a5	a6	b32	ab18	b28	ab12	.47	.22	.32	.50
F	Astragalus newberryi	-	-	10	-	-	-	.07	-	-	-
F	Astragalus utahensis	-	8	1	-	1	2	.00	-	.00	.00
F	Balsamorhiza hookeri	ab2	a-	b7	ab1	ab2	a-	.30	.00	.06	.00
F	Calochortus flexuosus	3	-	-	-	-	3	-	-	-	.00
F	Camelina microcarpa (a)	-	-	c71	b26	a6	a-	.18	.14	.01	-
F	Castilleja chromosa	3	-	-	-	-	-	-	-	-	-
F	Chaenactis douglasii	-	-	1	-	-	-	.00	-	-	-
F	Chenopodium album (a)	-	-	-	-	-	1	-	-	-	.00
F	Chorispora tenella (a)	-	-	a4	a-	a8	b26	.01	-	.07	.90
F	Collinsia parviflora (a)	-	-	-	-	-	4	-	-	-	.01
F	Crepis acuminata	a1	ab15	ab10	a1	a2	b17	.25	.00	.16	.26
F	Cryptantha sp.	a-	a-	b32	a-	a-	b35	.35	-	-	.11
F	Descurainia pinnata (a)	-	-	b46	c79	a6	d141	.47	.33	.01	2.97
F	Erigeron pumilus	-	-	14	5	1	-	.05	.07	.03	-
F	Eriogonum ovalifolium	-	-	1	-	-	-	.00	-	-	-
F	Gayophytum ramosissimum(a)	-	-	b19	a-	a-	a-	.04	-	-	-
F	Gilia sp. (a)	-	-	a8	a4	a-	b40	.02	.01	-	.08
F	Hackelia patens	a-	b16	c71	a-	a-	a-	.18	-	-	-
F	Halogeton glomeratus (a)	-	10	-	-	-	-	-	-	-	-
F	Haplopappus acaulis	a-	a-	b20	a-	a-	a-	.46	-	-	-
F	Lappula occidentalis (a)	-	-	ab29	b41	a15	a21	.11	.13	.05	.10
F	Mentzelia albicaulis (a)	-	-	b21	a-	a-	a-	.08	-	-	-
F	Penstemon cyananthus	a-	a-	b17	a-	a-	a-	.05	-	-	-
F	Penstemon sp.	-	-	1	-	-	-	.00	-	-	-

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
F	Phlox hoodii	$_{a}$3	$_{ab}$13	$_{d}$54	$_{cd}$49	$_{bc}$31	$_{ab}$6	.72	.45	.24	.01
F	Phlox longifolia	$_{a}$29	$_{b}$66	$_{a}$30	$_{ab}$37	$_{a}$24	$_{ab}$54	.16	.21	.09	.32
F	Ranunculus testiculatus (a)	-	-	$_{a}$-	$_{a}$7	$_{a}$20	$_{b}$51	-	.01	.20	.17
F	Sisymbrium altissimum (a)	-	-	$_{a}$14	$_{a}$3	$_{a}$-	$_{b}$42	.05	.00	-	.30
F	Sphaeralcea grossulariifolia	3	-	-	-	-	-	-	-	-	-
F	Stellaria jamesiana	-	-	-	-	2	-	-	-	.03	-
F	Taraxacum officinale	-	-	3	-	-	-	.00	-	-	-
F	Tragopogon dubius (a)	-	-	3	-	3	-	.03	-	.01	-
F	Unknown forb-perennial	-	27	-	-	-	-	-	-	-	-
F	Veronica biloba (a)	-	-	$_{a}$3	$_{a}$-	$_{ab}$8	$_{b}$11	.01	-	.04	.06
Total for Annual Forbs		0	10	224	161	102	432	1.02	0.64	0.58	7.58
Total for Perennial Forbs		58	153	316	122	103	152	3.36	1.03	1.10	1.60
Total for Forbs		58	163	540	283	205	584	4.39	1.68	1.69	9.18

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

BROWSE TRENDS--
Management unit 01, Study no: 8

Type	Species	Strip Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
B	Artemisia nova	6	15	17	16	1.54	1.28	1.44	.66
B	Artemisia tridentata wyomingensis	75	65	39	45	11.66	13.98	7.30	9.25
B	Chrysothamnus viscidiflorus stenophyllus	48	39	24	24	5.67	1.29	.45	.48
B	Ephedra nevadensis	0	0	0	1	-	-	-	-
B	Juniperus osteosperma	2	1	1	1	.15	.15	.15	.85
B	Leptodactylon pungens	5	7	8	9	.33	.48	.12	.04
B	Opuntia polyacantha	0	2	3	5	.00	.03	.18	.03
Total for Browse		136	129	92	101	19.35	17.22	9.65	11.31

CANOPY COVER, LINE INTERCEPT--
Management unit 01, Study no: 8

Species	Percent Cover	
	'06	'11
Artemisia nova	1.96	2.53
Artemisia tridentata wyomingensis	7.63	12.13
Chrysothamnus viscidiflorus stenophyllus	1.41	1.04
Juniperus osteosperma	.28	.75
Leptodactylon pungens	.26	.21
Opuntia polyacantha	.15	.10

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 01, Study no: 8

Species	Average leader growth (in)		
	'01	'06	'11
Artemisia tridentata wyomingensis	1.0	2.1	1.2

POINT-QUARTER TREE DATA--
Management unit 01, Study no: 8

Species	Trees per Acre			
	'96	'01	'06	'11
Juniperus osteosperma	23	52	29	31

Average diameter (in)			
'96	'01	'06	'11
9.6	6.7	9.6	13

BASIC COVER--
Management unit 01, Study no: 8

Cover Type	Average Cover %					
	'84	'90	'96	'01	'06	'11
Vegetation	2.25	7.00	47.15	42.79	52.86	36.04
Rock	1.75	1.75	3.30	1.93	1.60	2.26
Pavement	12.00	21.25	13.01	12.39	10.67	19.07
Litter	70.25	39.00	41.55	31.90	32.35	21.12
Cryptogams	1.00	1.25	1.82	2.78	.29	1.21
Bare Ground	12.75	29.75	12.91	19.01	18.38	35.95

SOIL ANALYSIS DATA --
Management unit 01, Study no: 8, Study Name: Mud Springs Basin

Effective rooting depth (in)	pH	Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
20.3	7.8	43.4	32.4	25.3	2.3	6.3	540.8	0.7

PELLET GROUP DATA--
Management unit 01, Study no: 8

Type	Quadrat Frequency			
	'96	'01	'06	'11
Rabbit	10	2	18	10
Elk	-	1	-	-
Deer/ Antelope	53	22	3	8
Cattle	1	-	5	3

Days use per acre (ha)		
'01	'06	'11
-	-	-
-	-	-
32 (80)	8 (20)	23 (58)
-	11 (27)	17 (43)

BROWSE CHARACTERISTICS--
Management unit 01, Study no: 8

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia nova									
84	**0**	0	0	0	-	0	0	0	-/-
90	**0**	0	0	0	-	0	0	0	-/-
96	**320**	6	25	69	-	19	69	31	8/25
01	**840**	5	55	40	-	0	0	12	7/22
06	**940**	9	83	9	-	0	0	9	11/23
11	**680**	21	47	32	-	0	0	32	11/25
Artemisia tridentata wyomingensis									
84	**5864**	34	52	14	25333	42	31	7	26/34
90	**3731**	34	37	29	466	0	0	14	22/22
96	**3240**	12	64	25	20	3	1	7	23/37
01	**2540**	3	78	19	60	6	.78	13	22/28
06	**1300**	0	65	35	200	5	0	22	24/33
11	**1400**	3	79	19	-	23	0	14	23/41
Atriplex canescens									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**0**	0	0	-	-	0	0	0	-/-
01	**0**	0	0	-	-	0	0	0	-/-
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Chrysothamnus viscidiflorus stenophyllus									
84	**266**	0	100	0	66	100	0	75	12/14
90	**199**	33	67	0	-	0	0	0	10/9
96	**3300**	8	89	2	-	0	0	.60	12/20
01	**1900**	9	60	31	-	0	0	11	9/14
06	**860**	2	98	0	20	0	0	0	9/16
11	**880**	2	93	5	-	2	0	5	7/14
Ephedra nevadensis									
84	**0**	0	0	0	-	0	0	0	-/-
90	**0**	0	0	0	-	0	0	0	-/-
96	**0**	0	0	0	-	0	0	0	-/-
01	**0**	0	0	0	-	0	0	0	-/-
06	**0**	0	0	0	-	0	0	0	-/-
11	**20**	0	0	100	-	0	100	100	14/29

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**0**	0	0	-	-	0	0	0	-/-
01	**0**	0	0	-	-	0	0	0	-/-
06	**0**	0	0	-	-	0	0	0	9/13
11	**0**	0	0	-	-	0	0	0	-/-
Juniperus osteosperma									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**40**	50	50	-	-	0	0	0	-/-
01	**20**	0	100	-	-	0	0	0	-/-
06	**20**	100	0	-	-	0	0	0	-/-
11	**20**	100	0	-	-	0	0	0	-/-
Leptodactylon pungens									
84	**0**	0	0	0	-	0	0	0	-/-
90	**0**	0	0	0	-	0	0	0	-/-
96	**100**	20	80	0	-	0	0	0	5/11
01	**280**	0	100	0	20	0	0	0	6/7
06	**240**	0	100	0	20	0	0	0	9/9
11	**280**	7	71	21	-	0	0	21	5/8
Opuntia polyacantha									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**0**	0	0	-	-	0	0	0	5/14
01	**40**	0	100	-	-	0	0	0	3/6
06	**60**	0	100	-	-	0	0	0	5/9
11	**100**	0	100	-	-	0	0	0	4/8