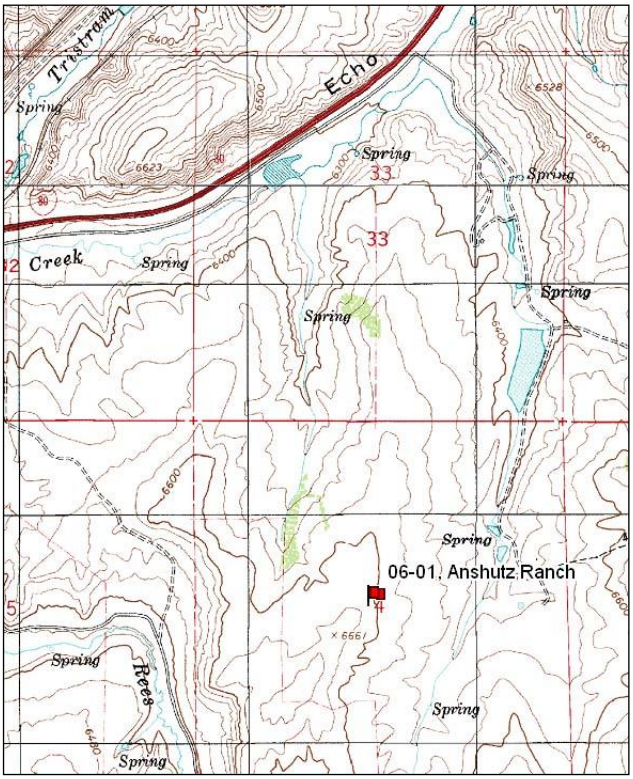
ANSHUTZ RANCH - TREND STUDY NO. 6-1-11

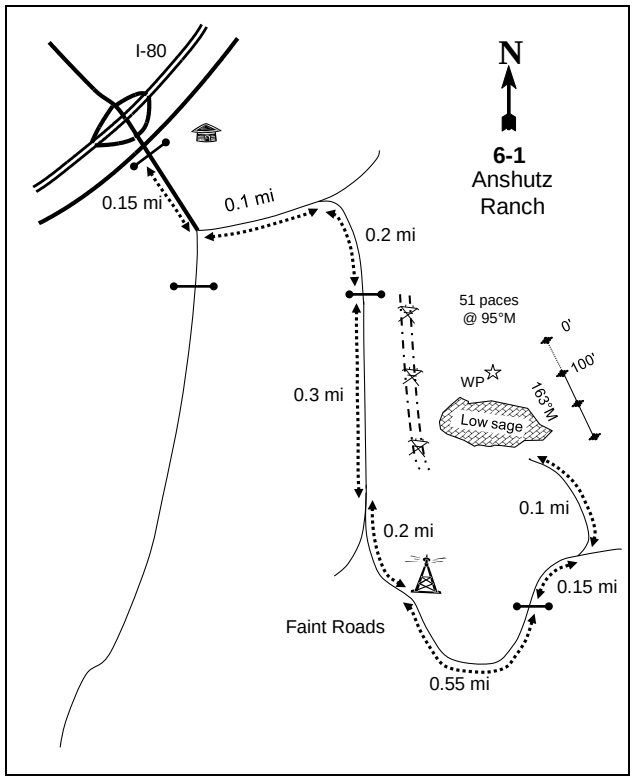
Vegetation Type: Low Sagebrush
Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Summer (Calving habitat)
NRCS Ecological Site Description: Mountain Loam (Mountain Big Sagebrush), R047XA308UT
Land Ownership: Private
Elevation: 6,580 ft (2,006 m)
Aspect: Northeast
Slope: 6%
Transect bearing: 163° magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34 & 71ft), line 3 (59ft)

Directions:
Proceeding east on I-80 from Echo, leave I-80 at exit number 185 and proceed east to Anshutz Ranch headquarters. From the main gate proceed 0.15 miles and turn left. Proceed 0.1 miles and turn right up the hill. Proceed 0.5 miles to an intersection near the radio tower. Turn left, proceed 0.8 miles (passing through the gate) to a crossroad on a small ridge. Turn left (road not on quad and quite faint) and proceed 0.15 miles to a green steel stake on the right (east) side of the road. From stake, walk 51 paces at 95 degrees magnetic to the 0-foot of the baseline marked by browse tag #7949.

Map Name: Castle Rock



Diagrammatic Sketch:



Township: 4N Range: 7E Section: 4

GPS: NAD 83, UTM 12S 486468 E 4550800 N

Site Information

Site Description: The study is located on private land south of Interstate 80, on the hills east of Rees Creek. The land is part of the Ensign Ranch and is utilized by sheep, cattle, and horses. The entire area is very open with little protective cover and gently rolling topography. A number of range types are closely intermixed in the general area. In swales, grass and/or basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) are often dominant. Gentle slopes and flat areas are typically mixed communities of basin big sagebrush and low sagebrush (*A. arbuscula*), with occasional Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) and mountain big sagebrush (*A. tridentata* ssp. *vaseyana*). On the well-drained ridge tops, low sagebrush is dominant. Scattered around the whole area is an abundance of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*), which are dominant in a few patches. The study area's vegetation consists of a mixture of basin big sagebrush and low sagebrush. Big game occupy the area is light to moderate numbers, but is chiefly of elk. The area is also important for sage grouse. Elk pellet groups were sampled in high abundance in 2001 and 2006, but in low abundance in 2011. Deer, cattle, and horse sign has been minimal since 2001. Grouse sign has also been sampled on the site, with the highest abundance in 2006, but no grouse pellets were sampled in 2011. Sign of sheep has been sampled infrequently, but a sheep carcass was identified in 2006 (Table - Pellet Group Data).

Browse: Browse composition is dominated by low sagebrush, which has provided over 60% of the browse cover since 1996 (Table - Browse Trends). The low sagebrush on the site is comprised of a dense population of low growing plants that has displayed mostly light to moderate use over the course of the study. Decadence in the low sagebrush population was high at the outset of the study, but has decreased through the sample years and was low in 2011. Recruitment of young low sagebrush plants has been fairly poor throughout the study years. Basin big sagebrush is also common on the site, but occurs mostly in the swales where soils are deeper. The basin big sagebrush population is moderately dense, and has had light to moderate use throughout the study years. Decadence in the big sagebrush population has been moderately high, with 20% or more of the plants classified as decadent in each sample year. Recruitment of young big sagebrush plants was excellent in the early years of the study, but has been poor since 1996. Broom snakeweed and stickyleaf low rabbitbrush are the only other common browse species. They appeared to be increasing in earlier readings, but population density estimates have decreased in later readings. Gray horsebrush (*Tetradymia canescens*) and winterfat (*Ceratoides lanata*) have also been sampled on the site, but in low densities (Table - Browse Characteristics).

Herbaceous Understory: Grasses on the site are fairly diverse, but are not overly abundant. Native perennial grass species are common and include species such as thickspike wheatgrass (*Agropyron dasystachyum*), bluebunch wheatgrass (*A. spicatum*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and Letterman needlegrass (*Stipa lettermani*). Cheatgrass is also on the site, but in low frequency and cover. The forbs species on the site are diverse, but are not overly abundant. Desert phlox (*Phlox austromontana*), longleaf phlox (*P. longifolia*), and silky milkvetch (*Astragalus cibarius*) have been the most abundant perennial forb species (Table - Herbaceous Trends).

Soil: The soil is in the Richsum-Heiners complex, likely part of the Richsum component. These soils occur on mountain slopes, with parent material derived from sandstone, conglomerate, and shale (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.6). Phosphorus may have limited availability for plant growth and development at 5.9 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Protective ground cover provided by vegetation and litter is abundant, with a low to moderate amount of bare ground cover (Table - Basic Cover). Some localized soil movement is apparent, but the soil erosion condition has been classified as stable since 2006.

Trend Assessments

Browse:

- **1984 to 1990 - stable (0):** There was little change in the density of low sagebrush. Decadence and poor vigor each increased slightly from 50% to 55% and 5% to 13%, respectively. However, recruitment of young low sagebrush plants also increased slightly from 3% to 10%. Basin big sagebrush density decreased 25% from 8,598 plants/acre to 6,464 plants/acre, with a slight increase in decadence from 20% to 28%. Recruitment of young basin big sagebrush plants remained excellent.
- **1990 to 1996 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Decadence of low sagebrush decreased to 13%, and poor vigor decreased to 4%. Decadence of basin big sagebrush decreased slightly to 21%, but poor vigor increased from 5% to 20%. Recruitment of young basin big sagebrush plants decreased from 51% to 8% of the population.
- **1996 to 2001 - slightly up (+1):** Density of low sagebrush increased by 19% from 8,040 plants/acre to 9,580 plants/acre, though cover decreased slightly from 22% to 21%. Decadence of low sagebrush increased to 22%, and poor vigor increased to 10%. Recruitment of young low sagebrush plants decreased from 5% to 2% of the population. Density of basin big sagebrush increased 42% from 2,200 plants/acre to 3,120 plants/acre, though cover remained similar at 7%. Decadence of big sagebrush increased to 35%, but poor vigor decreased to 4%. Recruitment of young big sagebrush plants decreased to just 4% of the population.
- **2001 to 2006 - slightly down (-1):** Low sagebrush density decreased 14% to 8,280 plants/acre , but cover increased slightly to 22%. Decadence of low sagebrush decreased slightly to 10%. Poor vigor remained similar in the low sagebrush population at 9%, but 200 plants/acre were classified as being infested with insects. It was not recorded that the sagebrush defoliator moth (*Aroga websteri*) was identified on the study, but with the widespread infestation in other areas of the northern region, it is quite possible that the moth was the cause of the infestation at this location. Basin big sagebrush density decreased by 29% to 2,200 plants/acre, but cover remained similar at 7%. Decadence of big sagebrush decreased slightly to 32%, but poor vigor increased to 19%. Recruitment of young plants in both sagebrush species remained poor.
- **2006 to 2011 - stable (0):** There was little change in the low sagebrush density, though cover increased to 28%. Decadence of low sagebrush decreased to 4%, and poor vigor decreased to 2% of the population. Basin big sagebrush density decreased 22% to 1,720 plants/acre, but cover remained similar at 7%.

Grass:

- **1984 to 1990 - up (+2):** The sum of nested frequency of perennial grasses increased 73%. There was a significant increase in the nested frequencies of bottlebrush squirreltail and Sandberg bluegrass.
- **1990 to 1996 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, though composition changed slightly. Bluebunch wheatgrass increased significantly in nested frequency, while bottlebrush squirreltail and Sandberg bluegrass decreased significantly.
- **1996 to 2001 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased by 20%, but there was also a significant decrease in the nested frequency of the annual species cheatgrass. Cover of perennial species decreased from 11% to 6%, and cover of cheatgrass decreased from 2% to near 0%. There was a significant decrease in the nested frequencies of bluebunch wheatgrass and bottlebrush squirreltail.
- **2001 to 2006 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, though cover increased to 11%.
- **2006 to 2011 - stable (0):** The perennial grass sum of nested frequency remained similar, though cover decreased to 9%. The nested frequency of cheatgrass changed little, but cover increased to over 1%.

Forb:

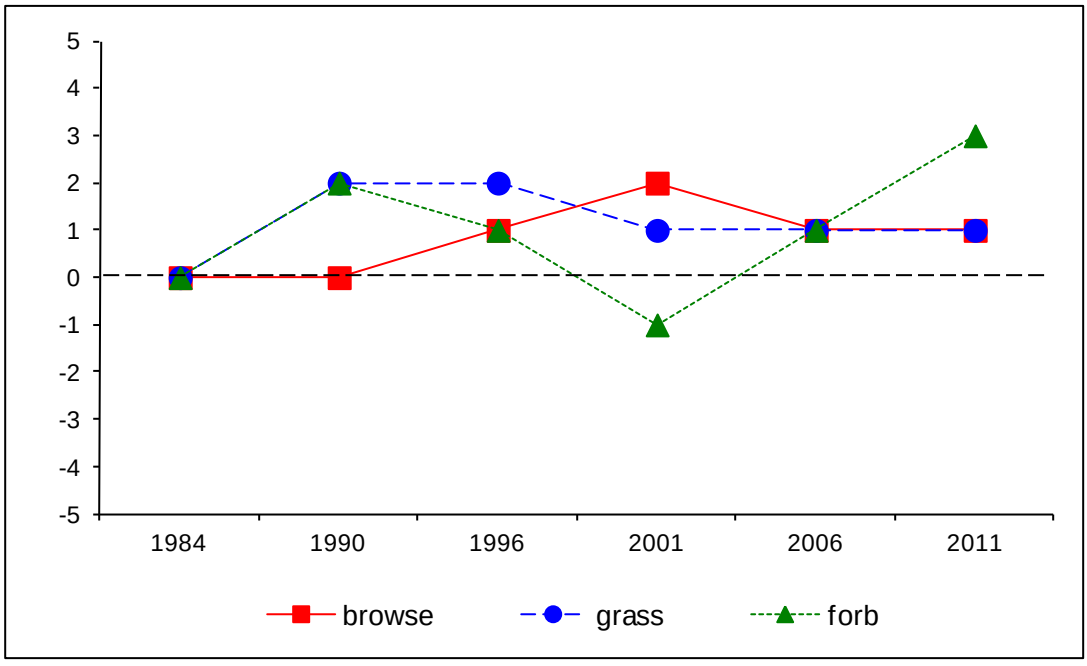
- **1984 to 1990 - up (+2):** The sum of nested frequency of perennial forbs increased two-fold.
- **1990 to 1996 - slightly down (-1):** There was a 28% decrease in the sum of nested frequency of perennial forbs, but much of this decrease may be due to the change in placement of quadrats with the change in sampling procedures.
- **1996 to 2001 - down (-2):** The sum of nested frequency of perennial forbs decreased by 43%, and cover decreased from 4% to 2%. There was a significant decrease in the nested frequency of longleaf phlox.
- **2001 to 2006 - up (+2):** The sum of nested frequency of perennial forbs increased more than two-fold, and cover increased to 5%. Much of the increase was due to a significant increase in silky milkvetch, which was sampled for the first time in 2006.
- **2006 to 2011 - up (+2):** There was a 63% increase in the sum of nested frequency of perennial forbs, and cover increased to 10%. Lambstongue groundsel (*Senecio integerrimus*) was sampled for the first time in 2011, with good frequency and cover.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --
Management unit 6, study no: 1

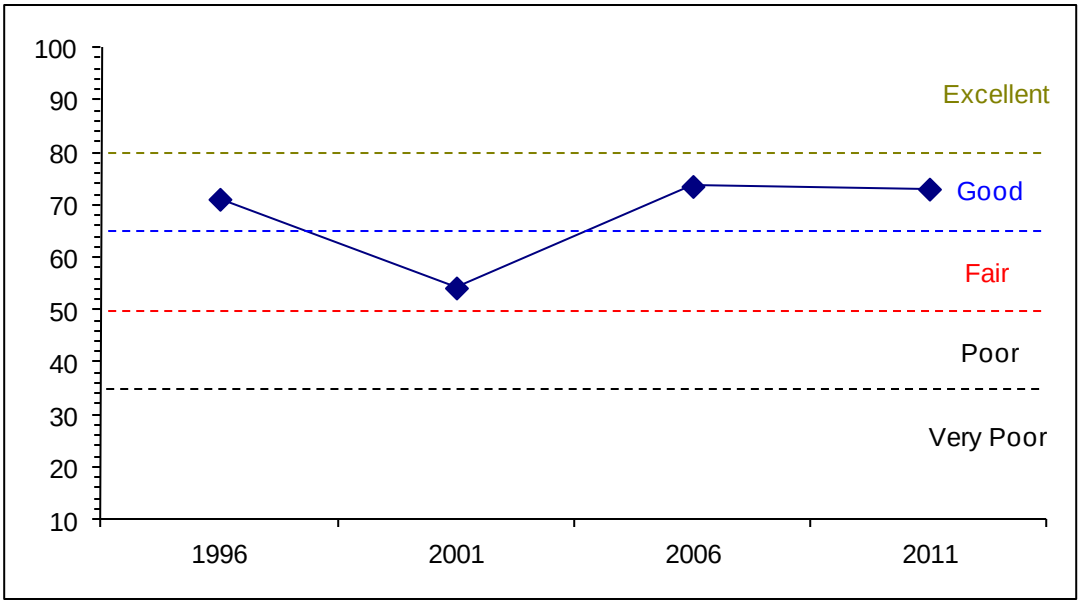
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
96	30.0	10.5	2.9	22.2	-1.5	7.0	0.0	**71.1**	Good
01	30.0	7.4	1.2	11.3	-0.1	4.3	0.0	**54.2**	Fair
06	30.0	10.4	1.5	21.8	-0.1	10.0	0.0	**73.6**	Good
11	30.0	12.8	3.7	17.6	-1.0	10.0	0.0	**73.0**	Good

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 6 Study no: 1



DEER DESIRABLE COMPONENTS INDEX TREND, MID-LEVEL POTENTIAL--
Management unit 6, Study no: 1



HERBACEOUS TRENDS--
Management unit 06, Study no: 1

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
G	Agropyron dasystachyum	a72	a71	a72	ab111	b157	c206	1.80	.76	4.19	3.72
G	Agropyron spicatum	a4	a12	c98	ab27	b43	a15	2.77	.38	1.10	.51
G	Bromus inermis	-	-	-	-	-	1	-	-	-	.00
G	Bromus japonicus (a)	-	-	2	3	-	-	.03	.03	-	-
G	Bromus tectorum (a)	-	-	b78	a25	a17	a43	2.00	.09	.08	1.34
G	Carex sp.	-	-	-	2	-	-	-	.03	-	-
G	Oryzopsis hymenoides	3	-	8	-	5	7	.09	-	.06	.15
G	Poa fendleriana	a-	a-	bc26	c33	b6	c39	.42	.53	.04	.42
G	Poa pratensis	a3	ab8	b27	ab11	ab11	ab11	.75	.10	.24	.08
G	Poa secunda	a76	d230	bc154	c182	ab108	ab114	2.01	2.61	2.14	3.09
G	Sitanion hystrix	c118	d162	c127	b32	b50	a-	2.63	.46	.92	-
G	Stipa comata	17	9	14	14	19	6	.25	.59	.63	.04
G	Stipa lettermani	a5	abc23	ab10	abc19	c39	bc33	.35	.16	1.53	.73
Total for Annual Grasses		0	0	80	28	17	43	2.03	0.12	0.08	1.34
Total for Perennial Grasses		298	515	536	431	438	432	11.11	5.64	10.88	8.78
Total for Grasses		298	515	616	459	455	475	13.15	5.76	10.97	10.12
F	Achillea millefolium	4	13	7	8	7	8	.07	.21	.33	.30
F	Agoseris glauca	a4	a3	a-	a6	a3	b50	-	.03	.01	.79
F	Allium acuminatum	b44	a-	a-	a-	a7	c100	-	-	.01	.47
F	Alyssum alyssoides (a)	-	-	a-	a7	a13	b128	-	.02	.06	1.69
F	Antennaria rosea	ab35	c82	a10	ab16	b37	ab30	.27	.10	.61	.53
F	Arabis sp.	-	22	9	-	17	14	.02	-	.08	.03
F	Astragalus cibarius	a-	a-	a-	a-	b104	b102	-	-	1.13	1.62

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
F	Astragalus convallarius	11	5	7	18	9	18	.12	.19	.05	.19
F	Astragalus utahensis	-	-	-	3	1	8	-	.03	.00	.04
F	Calochortus nuttallii	a8	a2	a-	a-	a5	b34	-	-	.01	.13
F	Castilleja linariaefolia	-	-	-	-	-	1	-	-	.00	.03
F	Cirsium undulatum	a15	b40	a12	a6	a4	a4	.13	.12	.07	.03
F	Collinsia parviflora (a)	-	-	b43	a13	a3	b62	.14	.03	.00	.31
F	Collomia linearis (a)	-	-	a-	a24	a4	b115	-	.05	.01	.74
F	Comandra pallida	-	-	-	-	2	-	-	-	.15	-
F	Cordylanthus ramosus (a)	-	-	a-	b43	a-	a4	-	1.39	-	.01
F	Cymopterus sp.	a-	a-	a-	a-	a-	b9	-	-	-	.07
F	Delphinium nuttallianum	a-	a-	a-	a-	a-	b11	-	-	-	.10
F	Epilobium brachycarpum (a)	-	-	-	3	-	-	-	.01	-	-
F	Erigeron pumilus	bc47	c74	ab31	ab16	ab15	a17	.22	.12	.18	.42
F	Eriogonum umbellatum	a-	a1	a3	a5	a3	b34	.06	.21	.18	.47
F	Gayophytum ramosissimum(a)	-	-	-	4	-	-	-	.01	-	-
F	Holosteum umbellatum (a)	-	-	b18	a-	a-	a-	.03	-	-	-
F	Linum lewisii	a-	a-	a3	ab7	b16	ab11	.03	.04	.13	.24
F	Lomatium sp.	a-	a-	a-	a-	a3	b9	-	-	.01	.19
F	Machaeranthera canescens	a-	b9	a-	a-	a-	a-	-	.00	-	-
F	Microsteris gracilis (a)	-	-	-	-	11	15	-	-	.04	.02
F	Phlox austromontana	a-	a2	bc60	bc46	c63	b37	1.36	.85	1.50	.55
F	Phlox longifolia	a40	c164	c158	a39	bc134	b111	1.16	.20	.58	.63
F	Polygonum douglasii (a)	-	-	b85	a27	a-	a3	1.08	.08	-	.01
F	Ranunculus testiculatus (a)	-	-	a14	a5	b51	c118	.03	.01	.17	1.23
F	Senecio integerrimus	a-	a-	a-	a-	a-	b57	-	-	-	2.00
F	Senecio multilobatus	-	-	-	2	-	-	-	.00	-	-
F	Sphaeralcea coccinea	1	2	-	-	-	-	-	-	-	-
F	Taraxacum officinale	-	9	8	5	2	3	.05	.01	.00	.06
F	Tragopogon dubius (a)	-	-	11	3	-	1	.02	.00	-	.00
F	Unknown forb-perennial	3	-	-	-	-	-	-	-	-	-
F	Viola sp.	a-	a-	a-	a-	a-	b38	-	-	-	.52
Total for Annual Forbs		0	0	171	129	82	446	1.31	1.61	0.30	4.03
Total for Perennial Forbs		212	428	308	177	432	706	3.52	2.16	5.10	9.49
Total for Forbs		212	428	479	306	514	1152	4.84	3.77	5.40	13.52

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

BROWSE TRENDS--
Management unit 06, Study no: 1

Type	Species	Strip Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
B	Artemisia arbuscula	90	86	86	87	22.02	20.63	21.67	27.67
B	Artemisia tridentata tridentata	53	61	51	54	7.44	6.64	7.19	6.86
B	Ceratoides lanata	3	4	3	0	-	.01	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	94	89	83	83	5.53	4.28	4.36	5.15
B	Gutierrezia sarothrae	18	28	31	5	.28	1.20	1.05	.36
B	Tetradymia canescens	9	8	10	10	.03	.03	.21	-
Total for Browse		267	276	264	239	35.31	32.81	34.50	40.05

CANOPY COVER, LINE INTERCEPT--
Management unit 06, Study no: 1

Species	Percent Cover	
	'06	'11
Artemisia arbuscula	27.14	30.31
Artemisia tridentata tridentata	11.60	13.58
Chrysothamnus viscidiflorus viscidiflorus	6.23	7.23
Gutierrezia sarothrae	1.04	.16
Tetradymia canescens	-	.13

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 06, Study no: 1

Species	Average leader growth (in)	
	'06	'11
Artemisia arbuscula	0.7	1.1
Artemisia tridentata tridentata	0.9	1.9

BASIC COVER--
Management unit 06, Study no: 1

Cover Type	Average Cover %					
	'84	'90	'96	'01	'06	'11
Vegetation	2.25	12.25	49.98	45.91	45.28	57.31
Rock	2.25	1.25	1.98	1.67	1.35	.83
Pavement	0	2.00	1.36	1.81	2.29	1.16
Litter	71.25	60.25	55.00	46.81	40.79	31.58
Cryptogams	.50	.50	.77	6.75	2.26	.66
Bare Ground	23.75	23.75	16.36	20.99	28.38	21.76

SOIL ANALYSIS DATA --
Management unit 06, Study no: 1, Study Name: Anshutz Ranch

Effective rooting depth (in)	pH	Clay-Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
13.9	7.6	40.7	26.0	33.3	2.9	5.9	83.2	0.8

PELLET GROUP DATA--
Management unit 06, Study no: 1

Type	Quadrat Frequency			
	'96	'01	'06	'11
Sheep	-	-	1	-
Rabbit	11	7	18	2
Horse	-	2	1	1
Grouse	-	1	1	-
Elk	8	7	9	2
Deer	6	2	1	5
Cattle	1	-	2	1

Days use per acre (ha)		
'01	'06	'11
-	1 (3)	-
-	-	-
6 (16)	1 (1)	-
9 (21) Groups/ Acre	35 (86) Groups/Acre	-
48 (117)	38 (93)	9 (22)
3 (8)	13 (31)	11 (28)
4 (9)	4 (9)	2 (5)

BROWSE CHARACTERISTICS--
Management unit 06, Study no: 1

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia arbuscula									
84	**7865**	3	47	50	-	84	3	5	12/17
90	**8531**	10	35	55	533	.78	0	13	9/15
96	**8040**	5	82	13	40	18	1	4	9/20
01	**9580**	2	76	22	80	22	0	10	10/20
06	**8280**	3	87	10	500	1	0	9	11/21
11	**8320**	9	87	4	-	18	0	2	10/19
Artemisia tridentata tridentata									
84	**8598**	54	26	20	2466	38	3	2	27/35
90	**6464**	51	22	28	399	21	2	5	28/29
96	**2200**	8	71	21	-	49	5	20	29/34
01	**3120**	4	60	35	-	6	0	4	29/38
06	**2200**	3	65	32	20	9	0	19	31/35
11	**1720**	1	78	21	-	26	0	17	29/33
Ceratoides lanata									
84	**66**	0	100	0	-	0	0	0	7/3
90	**0**	0	0	0	-	0	0	0	-/-
96	**60**	33	67	0	-	33	0	0	7/8
01	**140**	0	86	14	-	43	0	14	6/9
06	**60**	33	67	0	-	33	67	0	5/5
11	**0**	0	0	0	-	0	0	0	-/-
Chrysothamnus viscidiflorus viscidiflorus									
84	**16132**	0	48	52	-	0	0	2	9/11
90	**15064**	12	35	53	-	2	0	28	9/13
96	**8100**	24	76	0	180	.98	0	.24	8/12
01	**7340**	1	92	7	40	0	0	1	7/11
06	**6620**	6	91	3	40	0	0	.90	8/13
11	**5000**	22	78	0	20	0	0	.40	6/11

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae									
84	**8998**	0	91	9	-	0	0	0	7/6
90	**8464**	12	79	9	66	0	0	2	5/7
96	**900**	9	91	0	-	0	0	0	5/6
01	**1620**	1	99	0	-	4	0	0	6/11
06	**1200**	10	90	0	-	0	0	0	6/9
11	**100**	0	100	0	-	0	0	0	5/8
Tetradymia canescens									
84	**132**	50	50	0	-	0	0	0	8/3
90	**66**	0	100	0	-	100	0	0	4/5
96	**240**	25	67	8	-	8	33	0	7/13
01	**180**	0	67	33	-	0	0	11	6/12
06	**280**	7	86	7	-	0	0	7	8/12
11	**220**	9	91	0	-	0	0	0	8/15