

Trend Study 6-1-06

Study site name: Anshutz Ranch .

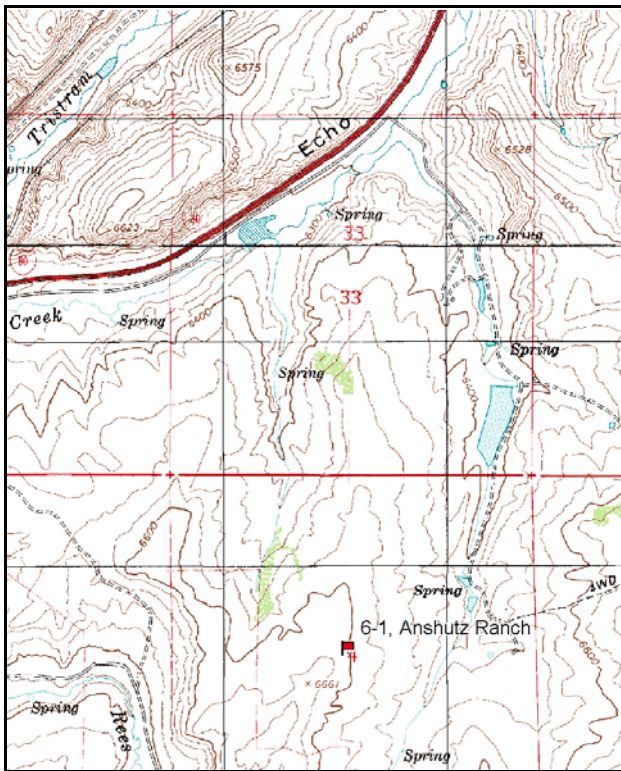
Vegetation type: Low Sagebrush .

Compass bearing: frequency baseline 163 degrees magnetic.

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

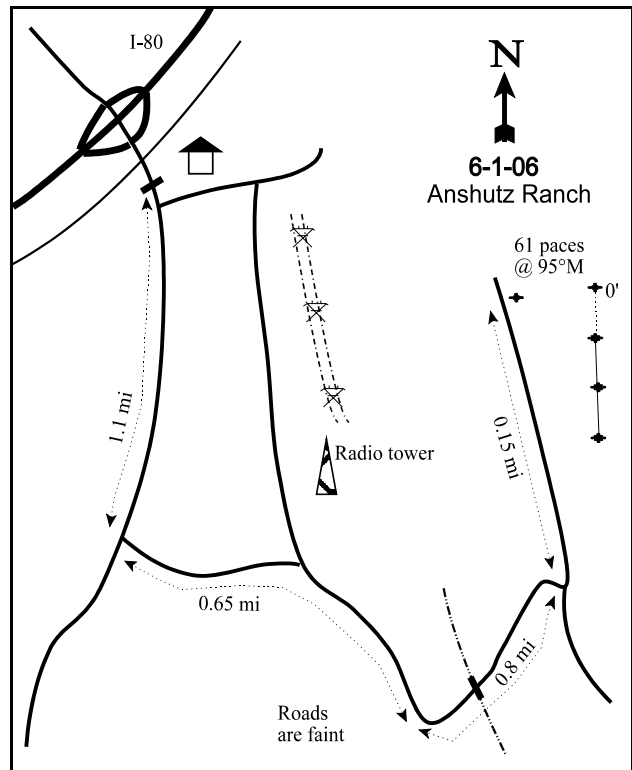
LOCATION DESCRIPTION

Proceeding east on I-80 from Echo, leave I-80 at exit number 185 and proceed east to Anshutz Ranch headquarters. From the security guard house proceed 1.1 miles and turn left. Proceed 0.65 miles (passing ranch lumber and equipment yard and a gate) to a faint road to the left. Turn left, proceed 0.8 miles (go through 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

Township 4N, Range 7E, Section 4



Diagrammatic Sketch

UTM NAD 27, UTM 12T 4550593 N 486531 E

## DISCUSSION

### Anshutz Ranch - Trend Study No. 6-1

#### Study Information

This trend study is located southeast of the Anshutz Ranch headquarters (elevation: 6,600 feet, slope: 6%, aspect: northeast). Big game use of the area is light to moderate and comes chiefly from elk. The area is also important for sage grouse. The land is part of the Ensign Ranch and is utilized by sheep, cattle, and horses. A number of range types are closely intermixed. In swales, grass and/or basin big sagebrush is often dominant. On gentle slopes and flat areas are mixed communities of basin big sagebrush and low sagebrush with occasional Wyoming big sagebrush and mountain big sagebrush. On the more well-drained ridgetops, low sagebrush is dominant. Scattered around the area is an abundance of stickyleaf low rabbitbrush and broom snakeweed, which are dominant in a few patches. The entire area is very open with little protective cover and gently rolling topography. The actual study area vegetation consists of a mixture of basin big sagebrush and low sagebrush. Pellet group transect data in 2001 estimated 3 deer, 48 elk, and 4 cow days use/acre (8 ddu/ha, 117 edu/ha, and 9 cdu/ha). Horse and sage grouse droppings were also sampled. The pellet group data estimates in 2006 were 13 deer, 38 elk, 4 cow, 1 sheep, and 1 horse days use/acre (31 ddu/ha, 93 edu/ha, 9cdu/ha, 3 sdu/ha, and 1 hdu/ha). Deer pellets were from winter, elk pellets from spring or early summer, and sheep were from winter or fall. Thirty-five sage grouse pellet groups/acre were sampled as well. A sheep carcass was identified in 2006.

#### Soil

The soil is in the Richsum-Heiners series complex, which are shallow to very deep, well drained, moderately permeable soils on high tablelands, low mountains, and valley sides. They formed in residuum, slope alluvium, and valley side alluvium derived from shale, sandstone, and conglomerate (USDA-NRCS 2006). The effective rooting depth is nearly 14 inches. The soil is classified as a clay loam, with a slightly alkaline soil reaction (7.6 pH). Percent organic matter is moderate at 2.9%. Phosphorus concentration is 5.9 ppm; values less than 6 ppm may limit normal plant growth and development (Tiedemann and Lopez 2004). The soil has some variable-sized rock interspersed throughout the profile. Surface rock and pavement provided 3% combined average cover in 1996, 2001, and 2006. Protective cover provided by vegetation, litter, and cryptogams is abundant. Relative bare ground cover was 13% in 1996, 17% in 2001, and 24% in 2006. Some localized soil movement is apparent. The erosion condition class rating was stable in 2006.

#### Browse

Browse composition is dominated by low sagebrush (*Artemisia arbuscula*), which has provided 21-22% cover since 1996. Low sagebrush density was estimated at 8,040 plants/acre in 1996, 9,580 plants/acre in 2001, and 8,280 plants/acre in 2006. Young plants made up 5% of the population in 1996, 2% in 2001, and 3% in 2006. Decadent individuals made up 13% of the population in 1996, 22% in 2001, and 10% in 2006, which is much lower than in 1984 and 1990. Plants classified as dying made up 3% of the population in 1996, 10% in 2001, and 7% in 2006. Utilization has consistently been light to moderate, with the exception of moderate in 1984. Vigor has been generally good in all sampling years. Poor vigor has ranged from 4% in 1996 to 13% in 1990. In 2006, 200 plants/acre were classified as being infested with insects and an additional 160 plants/acre were classified as having other indications of poor vigor. It was not recorded that the sagebrush defoliator moth (*Aroga websterii*) 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. Annual leader growth averaged less than 1 inch in 2001 and 2006, but seed production was abundant.

Basin big sagebrush (*Artemisia tridentata tridentata*), which occurs mostly in the swales where soils are deeper, has provided 7% cover since 1996. Density estimates have varied from 2,200 plants/acre in 1996 and 2006 to 3,120 plants/acre in 2001. Density estimates in 1984 and 1990 were overestimated due to the small sample sized used during those readings. The larger sample used starting in 1996 provides more accurate density estimates for shrubs that have clumped and/or discontinuous population distributions. From 1984 to

1996, use was light to moderate and percent decadence ranged from 20-28%. Vigor was generally good, except in 1996, when plants with poor vigor made up 20% of the population. In 2001 and 2006, utilization was light and decadence was moderately high. Vigor was good in 2001, but nearly 20% of the population was classified as having poor vigor in 2006. Some of this is due to insect infestation on approximately 140 plants/acre in 2006, which could be sagebrush defoliator moth infestation. The young made up 8% of the population in 1996, 4% in 2001, and 3% in 2006. Annual leader growth averaged just over 1 inch in 2001 and just under 1 inch in 2006.

Gray horsebrush and winterfat have been sampled in low densities. Broom snakeweed and stickyleaf low rabbitbrush have also been sampled. They appeared to be increasing in earlier readings (1984 and 1990), but population density estimates have been much lower since the increased sample size in 1996.

#### Herbaceous Understory

The herbaceous understory is fairly diverse, but not overly abundant. Composition has been quite variable with perennials showing increased nested frequency values from 1984 to 1996. However, in 2001 the sum of nested frequency for all perennial herbaceous species decreased by 29% and cover decreased by half. These decreases, at least in part, are due to the extremely dry conditions during the spring and summer of 2001 (Utah climate summaries 2006). Thickspike wheatgrass and Sandberg bluegrass have been the dominant perennial grasses since 2001. Bottlebrush squirreltail was abundant in 1984 and 1990, but has steadily decreased since. Annual grasses are present, but not very abundant. In 2001, some utilization on grasses by cattle was noted, especially on plants within the shrub interspaces. Little change in grasses occurred by 2006. Forbs were depleted in 2001 due to the drought. Perennial forbs not only recovered by 2006, but provided the highest nested frequency and cover values of all readings. Desert phlox, longleaf phlox, and silky milkvetch have been the most abundant perennials.

#### 1990 TREND ASSESSMENT

Big game use is not concentrated on this large expanse of sagebrush range. Big sagebrush displays light to moderate hedging and low sagebrush are lightly used. There is a high percentage of decadence in the low sagebrush population, but a large number of young sagebrush were also sampled. Total sagebrush canopy cover is 26%, with equal percentages for both species. Density slightly decreased, while 55% of the population continues to be decadent. Broom snakeweed did not increase. Nested frequency of both Sandberg bluegrass and bottlebrush squirreltail increased significantly, while no species decreased. Utilization of grasses has been light this year, but overall there is limited herbaceous forage available. Perennial forb abundance doubled, but most are low growing species.

browse - stable (0)

grass - up (+2)

forb - up (+2)

#### 1996 TREND ASSESSMENT

Big game use continues to be light for both elk and deer. The browse trend is stable. The density of low sagebrush has not changed, but that of basin big sagebrush decreased substantially. This change in density of basin is likely due to the increased sample size starting this year. Decadence of low sagebrush decreased substantially. The grass trend is stable. The nested frequency of perennial grasses is unchanged. Bottlebrush squirreltail nested frequency decreased significantly, but is the only species which showed a significant change. The forb trend is slightly down. The nested frequency of perennial forbs decreased 25%, but much of the decrease is likely due to the change in placement of quadrats with the change in sampling procedures. The Desirable Components Index score is good due to excellent browse cover, good perennial grass cover, and good perennial forb cover.

winter range condition (DC Index) - good (71) Mid-level potential scale

browse - stable (0)

grass - stable (0)

forb - slightly down (-1)

### 2001 TREND ASSESSMENT

Trend for browse is slightly up. Low sagebrush and basin big sagebrush both increased in density; low sagebrush increased 16% and basin increased 29%. Decadence also increased in each population, as did the percentage of plants classified as dying. The number of young in the population for both species is low as well. The grass trend is slightly down. The nested frequency of perennial grasses decreased 20%, but the nested frequency of cheatgrass decreased significantly as well. The only perennial grass which decreased significantly was bottlebrush squirreltail. The forb trend is down. The nested frequency of perennial forbs decreased 44%, due to a significant decrease in longleaf phlox, which is very beneficial to sage grouse hens (Barnett and Crawford 1994). The DCI score decreased to fair due to decreased perennial grass and forb cover and increased browse decadence.

winter range condition (DC Index) - fair (54) Mid-level potential scale

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

### 2006 TREND ASSESSMENT

The browse trend is slightly down. The density of low sagebrush decreased 14% and the density of basin big sagebrush decreased 29%. Sagebrush cover and decadence for each species did not change. The grass trend is stable. The nested frequency of perennial grasses is unchanged. The nested frequency of cheatgrass remained low. The forb trend is up. The nested frequency of perennial forbs increased, mainly due to significant increases in rose pussytoes and silky milkvetch, which provide forage for sage grouse (Barnett and Crawford 1994). The DCI score increased to good due to improved decadence, increased perennial grass cover, and increased perennial forb cover.

winter range condition (DC Index) - good (74) Mid-level potential scale

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

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

Type	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
G	Agropyron dasystachyum	a72	ab71	a72	bc111	c157	1.80	.76	4.19
G	Agropyron spicatum	a4	a12	c98	ab27	b43	2.77	.38	1.10
G	Bromus japonicus (a)	-	-	2	3	-	.03	.03	-
G	Bromus tectorum (a)	-	-	b78	a25	a17	2.00	.09	.08
G	Carex sp.	-	-	-	2	-	-	.03	-
G	Oryzopsis hymenoides	3	-	8	-	5	.09	-	.06
G	Poa fendleriana	a-	a-	ab26	b33	a6	.42	.53	.04
G	Poa pratensis	a3	ab8	b27	ab11	ab11	.75	.10	.24
G	Poa secunda	a76	d230	bc154	c182	ab108	2.01	2.61	2.14
G	Sitanion hystrix	b118	c162	b127	a32	a50	2.63	.46	.92
G	Stipa comata	ab17	a9	ab14	ab14	b19	.25	.59	.63
G	Stipa lettermani	a5	ab23	a10	ab19	b39	.35	.16	1.53
Total for Annual Grasses		0	0	80	28	17	2.03	0.12	0.08
Total for Perennial Grasses		298	515	536	431	438	11.11	5.64	10.88
Total for Grasses		298	515	616	459	455	13.15	5.76	10.97
F	Achillea millefolium	4	13	7	8	7	.07	.21	.33
F	Agoseris glauca	4	3	-	6	3	-	.03	.01
F	Allium acuminatum	b44	a-	a-	a-	a7	-	-	.01
F	Alyssum alyssoides (a)	-	-	a-	ab7	b13	-	.02	.06
F	Antennaria rosea	ab35	c82	a10	a16	b37	.27	.10	.61
F	Arabis sp.	a-	b22	b9	a-	b17	.02	-	.08
F	Astragalus cibarius	a-	a-	a-	a-	b104	-	-	1.13
F	Astragalus convallarius	11	5	7	18	9	.12	.19	.05
F	Astragalus utahensis	-	-	-	3	1	-	.03	.00
F	Castilleja linariaefolia	-	-	-	-	-	-	-	.00
F	Calochortus nuttallii	8	2	-	-	5	-	-	.01
F	Cirsium undulatum	a15	b40	a12	a6	a4	.13	.12	.07
F	Collomia linearis (a)	-	-	a-	b24	a4	-	.05	.01
F	Comandra pallida	-	-	-	-	2	-	-	.15
F	Collinsia parviflora (a)	-	-	b43	a13	a3	.14	.03	.00
F	Cordylanthus ramosus (a)	-	-	a-	b43	a-	-	1.39	-
F	Epilobium brachycarpum (a)	-	-	-	3	-	-	.01	-
F	Erigeron pumilus	ab47	b74	a31	a16	a15	.22	.12	.18
F	Eriogonum umbellatum	-	1	3	5	3	.06	.21	.18
F	Gayophytum ramosissimum(a)	-	-	-	4	-	-	.01	-

Type	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
F	Holosteum umbellatum (a)	-	-	b18	a-	a-	.03	-	-
F	Linum lewisii	a-	a-	a3	ab7	b16	.03	.04	.13
F	Lomatium sp.	-	-	-	-	3	-	-	.01
F	Machaeranthera canescens	a-	b9	a-	a-	a-	-	.00	-
F	Microsteris gracilis (a)	-	-	-	-	11	-	-	.04
F	Phlox austromontana	a-	a2	b60	b46	b63	1.36	.85	1.50
F	Phlox longifolia	a40	b164	b158	a39	b134	1.16	.20	.58
F	Polygonum douglasii (a)	-	-	c85	b27	a-	1.08	.08	-
F	Ranunculus testiculatus (a)	-	-	a14	a5	b51	.03	.01	.17
F	Senecio multilobatus	-	-	-	2	-	-	.00	-
F	Sphaeralcea coccinea	1	2	-	-	-	-	-	-
F	Taraxacum officinale	a-	b9	b8	ab5	ab2	.05	.01	.00
F	Tragopogon dubius	a-	a-	b11	ab3	a-	.02	.00	-
F	Unknown forb-perennial	3	-	-	-	-	-	-	-
Total for Annual Forbs		0	0	160	126	82	1.29	1.61	0.30
Total for Perennial Forbs		212	428	319	180	432	3.54	2.16	5.10
Total for Forbs		212	428	479	306	514	4.84	3.77	5.40

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	'96	'01	'06
B	Artemisia arbuscula	90	86	86	22.02	20.63	21.67
B	Artemisia tridentata tridentata	53	61	51	7.44	6.64	7.19
B	Ceratoides lanata	3	4	3	-	.01	-
B	Chrysothamnus viscidiflorus viscidiflorus	94	89	83	5.53	4.28	4.36
B	Gutierrezia sarothrae	18	28	31	.28	1.20	1.05
B	Tetradymia canescens	9	8	10	.03	.03	.21
Total for Browse		267	276	264	35.31	32.81	34.50

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

Species	Percent Cover
	'06
Artemisia arbuscula	27.14
Artemisia tridentata tridentata	11.60
Chrysothamnus viscidiflorus viscidiflorus	6.23
Gutierrezia sarothrae	1.04

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

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

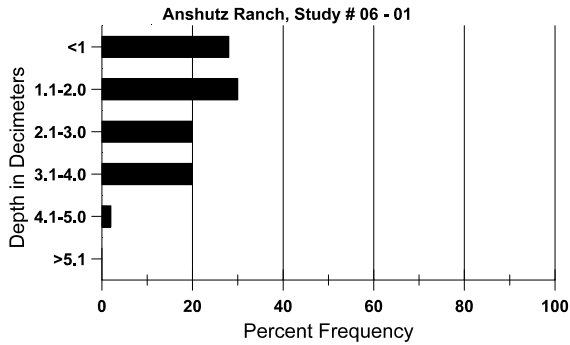
BASIC COVER --  
Management unit 06 , Study no: 1

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

SOIL ANALYSIS DATA --  
Herd Unit 06, Study no: 01, Anshutz Ranch

Effective rooting depth (in)	Temp °F (depth)	PH	Clay loam			%OM	PPM P	PPM K	dS/m
			%sand	%silt	%clay				
13.9	63.3 (14.9)	7.6	40.7	26.0	33.3	2.9	5.9	83.2	0.8

# Stoniness Index



**PELLET GROUP DATA --**

Management unit 06 , Study no: 1

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

Days use per acre (ha)	
'01	'06
-	1 (3)
-	-
6 (16)	1 (1)
8.7 (21) groups/acre	35 (86) groups/acre
48 (117)	38 (93)
3 (8)	13 (31)
4 (9)	4 (9)

**BROWSE CHARACTERISTICS --**

Management unit 06 , Study no: 1

		Age class distribution (plants per acre)					Utilization					
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
<i>Artemisia arbuscula</i>												
84	<b>7866</b>	-	200	3733	3933	-	84	3	50	-	5	12/17
90	<b>8532</b>	533	866	3000	4666	-	.78	0	55	4	13	9/15
96	<b>8040</b>	40	420	6580	1040	340	18	1	13	3	4	9/20
01	<b>9580</b>	80	200	7260	2120	240	22	0	22	10	10	10/20
06	<b>8280</b>	500	260	7180	840	240	1	0	10	7	9	11/21

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
<i>Artemisia tridentata tridentata</i>												
84	<b>8599</b>	2466	4666	2200	1733	-	38	3	20	-	2	27/35
90	<b>6466</b>	400	3266	1400	1800	-	21	2	28	.92	5	28/29
96	<b>2200</b>	-	180	1560	460	460	49	5	21	.90	20	29/34
01	<b>3120</b>	-	140	1880	1100	480	6	0	35	4	4	29/38
06	<b>2200</b>	20	60	1440	700	300	9	0	32	17	19	31/35
<i>Ceratoides lanata</i>												
84	<b>66</b>	-	-	66	-	-	0	0	0	-	0	7/3
90	<b>0</b>	-	-	-	-	-	0	0	0	-	0	-/-
96	<b>60</b>	-	20	40	-	-	33	0	0	-	0	7/8
01	<b>140</b>	-	-	120	20	-	43	0	14	14	14	6/9
06	<b>60</b>	-	20	40	-	-	33	67	0	-	0	5/5
<i>Chrysothamnus viscidiflorus viscidiflorus</i>												
84	<b>16132</b>	-	-	7666	8466	-	0	0	52	-	2	9/11
90	<b>15066</b>	-	1800	5266	8000	-	2	0	53	6	28	9/13
96	<b>8100</b>	180	1940	6120	40	-	.98	0	0	-	.24	8/12
01	<b>7340</b>	40	60	6760	520	20	0	0	7	1	1	7/11
06	<b>6620</b>	40	380	6020	220	-	0	0	3	.90	.90	8/13
<i>Gutierrezia sarothrae</i>												
84	<b>9000</b>	-	-	8200	800	-	0	0	9	-	0	7/6
90	<b>8466</b>	66	1000	6666	800	-	0	0	9	.47	2	5/7
96	<b>900</b>	-	80	820	-	-	0	0	0	-	0	5/6
01	<b>1620</b>	-	20	1600	-	-	4	0	0	-	0	6/11
06	<b>1200</b>	-	120	1080	-	-	0	0	0	-	0	6/9
<i>Tetradymia canescens</i>												
84	<b>132</b>	-	66	66	-	-	0	0	0	-	0	8/3
90	<b>66</b>	-	-	66	-	-	100	0	0	-	0	4/5
96	<b>240</b>	-	60	160	20	-	8	33	8	-	0	7/13
01	<b>180</b>	-	-	120	60	-	0	0	33	11	11	6/12
06	<b>280</b>	-	20	240	20	-	0	0	7	7	7	8/12