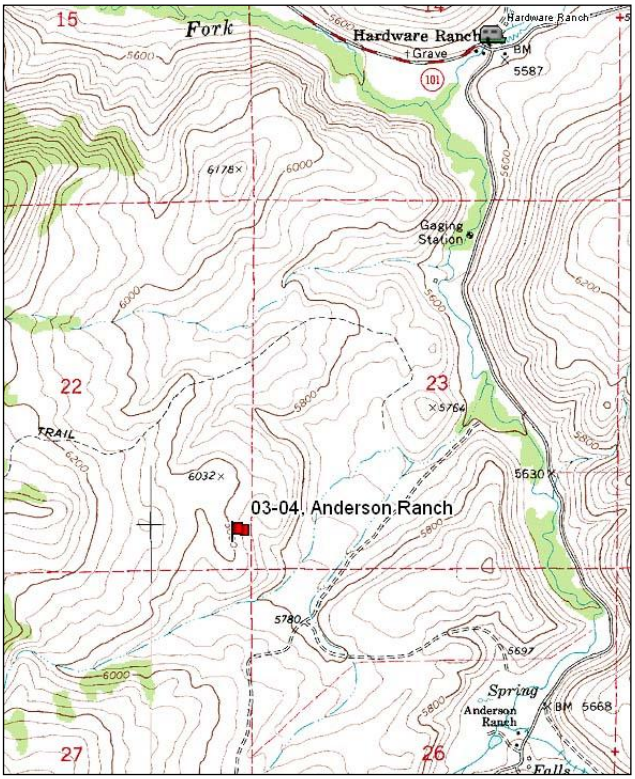
ANDERSON RANCH - TREND STUDY NO. 3-4-11

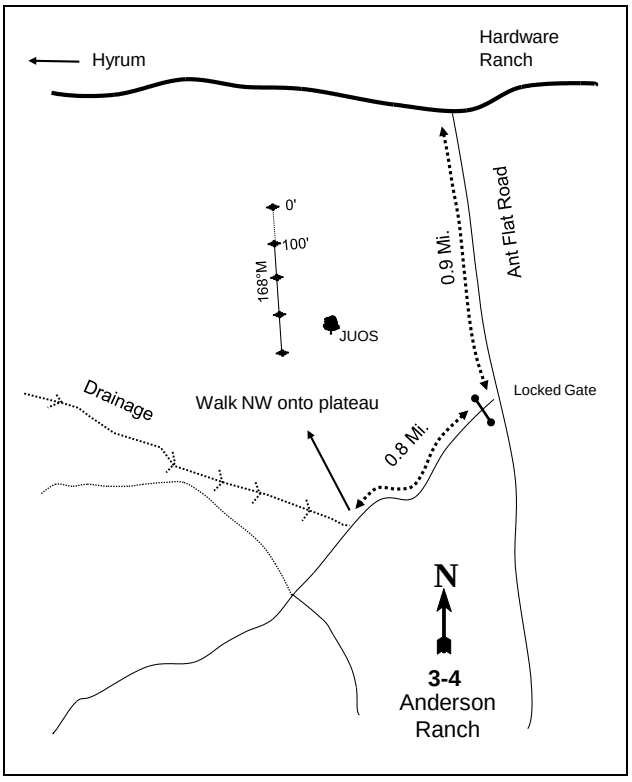
Vegetation Type: Mountain Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Mountain Loam (Mountain Big Sagebrush), R047XA430UT
Land Ownership: Private
Elevation: 6,000 ft (1,829 m)
Aspect: South
Slope: Near Level
Transect bearing: 168° magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
From Hardware Ranch, travel south on the Ant Flat Road for 0.9 miles. Turn right and go through a locked gate. Cross the Blacksmith Fork River and then proceed up the canyon 0.8 to where the drainage and road separate. Walk approximately 1500 ft. at 310 degrees to the 0 foot stake. The 0-foot stake is marked by browse tag #7932. The baseline bearing is 168 degrees magnetic.

Map Name: Hardware Ranch



Diagrammatic Sketch:



Township: 10N Range: 3E Section: 22

GPS: NAD 83, UTM 12S 451663 E 4603594 N

ANDERSON RANCH - TREND STUDY NO. 3-4

Site Information

Site Description: The study is located on what was formerly called the Anderson Ranch, but is now part of the Coldwater Ranch. The study is within deer and elk winter range in the upper Blacksmith Fork Canyon. The plant community is dominated by mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and grasses. The landowner treated the area with an aerial application of 2,4-D in June of 2011, which impacted the health of many of the browse species. Deer pellet groups were sampled in high abundance in 2001, but moderately high abundance since 2006. Elk pellet groups have been sampled in high abundance since 2001. Sampled sheep sign has been moderate, and cattle sign has been minimal since 2001. Sheep and deer pellet numbers may have some overlap due to the difficultly in distinguishing between the two species. Sage-grouse sign has also been low in abundance (Table - Pellet Group Data).

Browse: The key browse species on the site are antelope bitterbrush and mountain big sagebrush, and combined provide the majority of the browse cover (Table - Browse Trends). Both species occur with scattered populations. Utilization of bitterbrush has been moderate to heavy in most years, but was light in 2011. Mountain big sagebrush displayed heavy utilization in 1984, but use has been mostly light to moderate in the other sample years. Decadence of both species was high at the outset of the study, decreased steadily to low rates in 1996, but again steadily increased to moderate levels in 2011. The most abundant shrub is stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*). This species appears to be stable with a predominantly mature population. Poor vigor for all three species was low over most study years, but all species showed extremely poor vigor in 2011. The poor vigor in 2011 was primarily due to a 2,4-D treatment in June of that year, which had caused much of the new leader growth to twist. Other browse species are rare on the site (Table - Browse Characteristics).

Herbaceous Understory: Understory composition is dominated by perennial grasses, most notably bluebunch wheatgrass (*Agropyron spicatum*), Sandberg bluegrass (*Poa secunda*), and the weedy species bulbous bluegrass (*P. bulbosa*). Bulbous bluegrass has steadily increased in nested frequency and cover since 1996. The annual grasses Japanese chess (*Bromus japonicus*) and cheatgrass (*B. tectorum*) were first included in the sample in 1996, and were abundant in that year, but have been less prevalent since 2001. Considering elevation and annual precipitation, the forb composition is not very abundant and composition is poor. Annual forb species are predominant in the forb composition. The most common perennial forb is western yarrow (*Achillea millefolium*). Most forbs are occasional in their occurrence and provide relatively little forage (Table - Herbaceous Trends).

Soil: The soil is in the Ant Flat series, which occurs on mountain slopes. Parent material consists of residium and colluvium derived from sandstone and shale. These soils are classified as deep, well drained, and slightly permeable (Soil Survey Staff 2011). This soil has a porous surface horizon about 7 inches thick. Below this depth, the subsoil is increasingly clay in texture and has concentrations of leached calcium carbonate at about 60 inches. Soils have an extremely rocky and compacted clay loam texture with a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is low with an abundance of vegetation and litter cover (Table - Basic Cover). The soil erosion condition has been classified as stable since 2001.

Trend Assessments

Browse:

- **1984 to 1990 - up (+2):** Density of bitterbrush increased 15% from 865 plants/acre to 998 plants/acre, and density of mountain big sagebrush increased more than two-fold from 399 plants/acre to 998 plants/acre. Decadence of bitterbrush decreased from 92% to 67%, and decadence of sagebrush decreased from 67% to 20%. Recruitment of young bitterbrush plants increased from 0% to 20%, and recruitment of young sagebrush increased from 0% to 27%.

- **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 bitterbrush and sagebrush decreased to 0%. Recruitment of young bitterbrush decreased to 6%, but recruitment of young sagebrush remained similar at 25%.
- **1996 to 2001 - stable (0):** Density of bitterbrush and sagebrush remained similar at 340 plants/acre and 420 plants/acre, respectively. Cover of bitterbrush increased slightly from 4% to 5%, and sagebrush cover increased from 4% to 5%. Decadence of bitterbrush increased to 6%, and decadence of sagebrush increased to 19%. Recruitment of young bitterbrush increased to 12%, and recruitment of young sagebrush decreased to 14%.
- **2001 to 2006 - up (+2):** Density of bitterbrush increased 24% to 420 plants/acre, and cover increased to 6%. Density of sagebrush increased 48% to 620 plants/acre, but cover remained similar at 5%. Decadence of bitterbrush increased to 19%, but decadence of sagebrush decreased to 13%. Recruitment of young bitterbrush remained similar at 10%, but recruitment of young sagebrush plants increased to 26%.
- **2006 to 2011 - down (-2):** Bitterbrush density decreased by 43% to 240 plants/acre, and cover decreased to 3%. Density of sagebrush remained similar at 600 plants/acre, but cover increased slightly to 7%. Plants displaying poor vigor increased dramatically from 5% to 92% in bitterbrush, and from 3% to 100% in sagebrush. Decadence increased to 33% in bitterbrush, and to 27% in sagebrush. Recruitment of young plants decreased to 0% in bitterbrush, and 7% in sagebrush.

Grass:

- **1984 to 1990 - slightly up (+1):** The sum of nested frequency of perennial grasses increased 14%, with a significant increase in the nested frequency of Sandberg bluegrass.
- **1990 to 1996 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased 24%. The weedy species bulbous bluegrass was sampled for the first time at moderate abundance. The annual species Japanese chess and cheatgrass were included in the sample for the first time, and were sampled in moderately high abundance.
- **1996 to 2001 - stable (0):** The sum of nested frequency and cover of perennial grasses, excluding bulbous bluegrass, remained similar. There was a significant increase in the nested frequency of the weedy species bulbous bluegrass, and cover increased from 2% to 3%. The nested frequencies of Japanese chess and cheatgrass decreased significantly, and combined cover decreased from 8% to 2%.
- **2001 to 2006 - slightly down (-1):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, remained similar, but cover increased from 19% to 26%. However, there was a significant increase in the nested frequency of the weedy species bulbous bluegrass, and cover increased to 15%.
- **2006 to 2011 - down (-2):** The sum of nested frequency of perennial grasses, excluding bulbous bluegrass, decreased by 18%, but cover remained similar at 27%. Bulbous bluegrass increased significantly in nested frequency, and cover increased from 15% to 25%.

Forb:

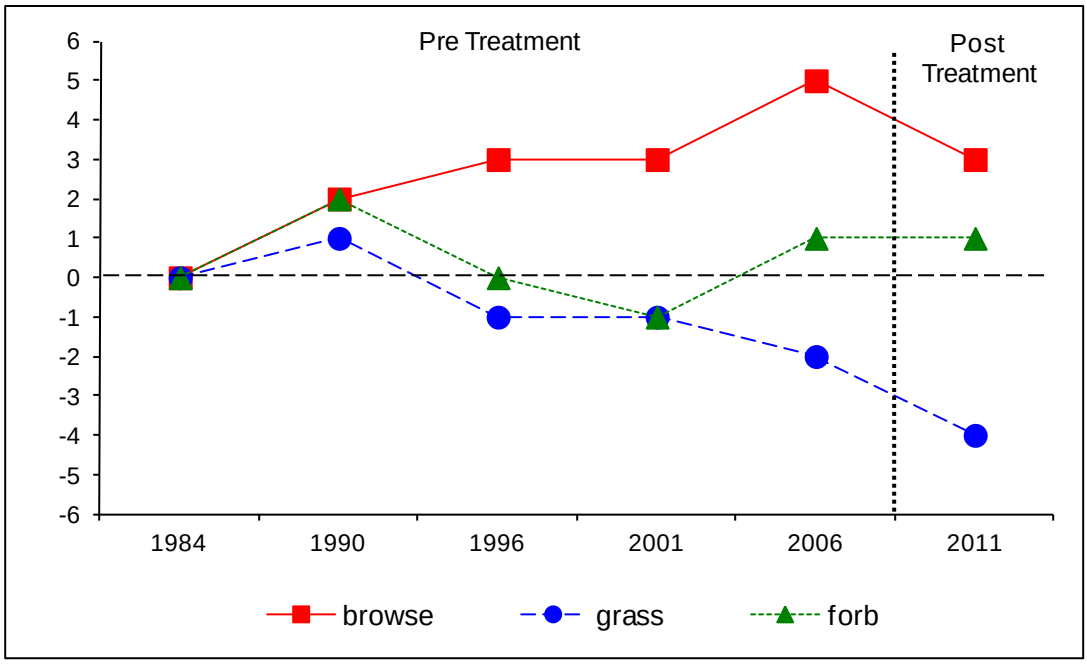
- **1984 to 1990 - up (+2):** The sum of nested frequency of perennial forbs increased 22%.
- **1990 to 1996 - down (-2):** The perennial forb sum of nested frequency decreased 62%.
- **1996 to 2001 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased 26%, but forbs were already rare and provided only 1% cover.
- **2001 to 2006 - up (+2):** There was a two-fold increase in the sum of nested frequency of perennial forbs, and cover increased to 2%.
- **2006 to 2011 - stable (0):** The sum of nested frequency of perennial forbs remained similar, but cover increased slightly to 4%. The sum of nested frequency of annual forbs increased by 57%, and cover increased from 3% to 5%.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --
Management unit 3, study no: 4

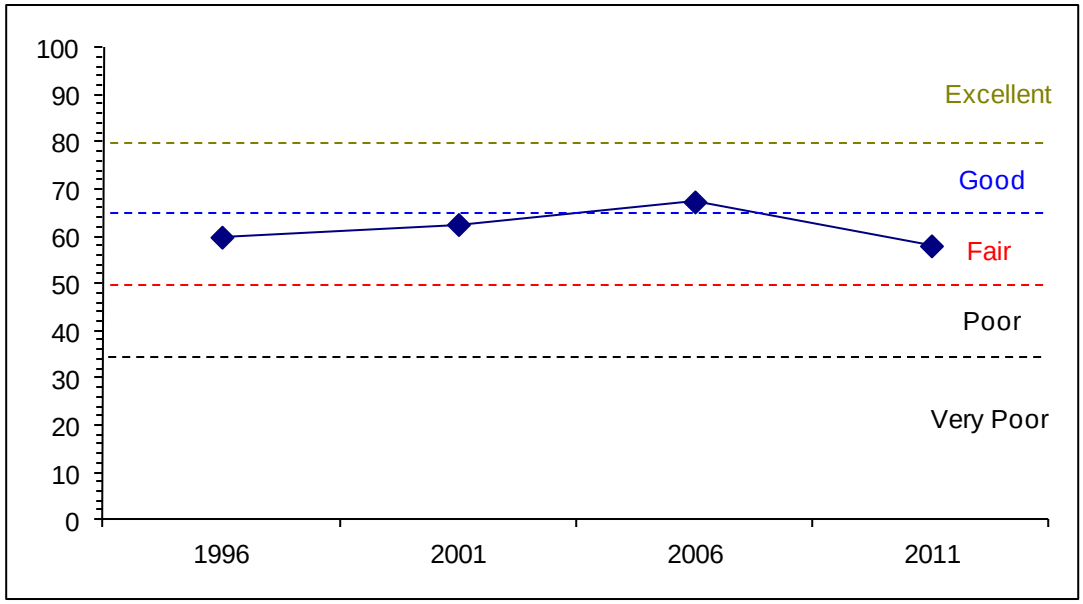
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
96	10.5	15.0	7.4	30.0	-5.8	2.9	0.0	**59.9**	Fair
01	14.2	11.3	6.5	30.0	-1.2	1.8	0.0	**62.6**	Fair
06	15.5	10.2	8.1	30.0	-0.8	4.3	0.0	**67.3**	Good
11	12.6	6.5	2.5	30.0	-0.7	7.1	0.0	**58.0**	Fair

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 3, Study no: 4



DEER DESIRABLE COMPONENTS INDEX TREND, MID-LEVEL POTENTIAL--
Management unit 3, Study no: 4



HERBACEOUS TRENDS--
Management unit 03, Study no: 4

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
G	Agropyron smithii	a-	a-	a-	a-	b19	c111	-	-	.16	3.59
G	Agropyron spicatum	b271	b276	b267	b237	b224	a132	12.89	12.87	16.86	7.20
G	Bromus japonicus (a)	-	-	c186	b81	a20	a36	5.14	.85	.12	.10
G	Bromus tectorum (a)	-	-	b114	a46	a35	a50	2.62	.73	.91	.87
G	Elymus cinereus	-	-	2	3	2	4	.53	.85	1.00	.88
G	Hordeum jubatum	4	5	-	-	-	-	-	-	-	-
G	Koeleria cristata	ab52	b53	ab28	ab32	b42	a16	.79	.55	.94	.28
G	Poa bulbosa	a-	a-	b52	b85	c225	d300	1.55	2.82	15.37	25.17
G	Poa pratensis	-	-	-	4	10	10	-	.04	.04	.21
G	Poa secunda	b202	c267	b160	bc213	b162	a104	3.42	4.59	7.33	14.96
G	Stipa comata	-	-	-	1	-	-	-	.00	-	-
G	Stipa lettermani	-	-	-	-	1	1	-	-	.00	.00
Total for Annual Grasses		0	0	300	127	55	86	7.76	1.59	1.03	0.97
Total for Perennial Grasses		529	601	509	575	685	678	19.20	21.74	41.72	52.31
Total for Grasses		529	601	809	702	740	764	26.96	23.33	42.76	53.29
F	Achillea millefolium	c191	b84	ab49	ab55	ab56	a41	.60	.42	1.07	1.41
F	Agoseris glauca	a-	c126	a1	a2	b25	ab15	.00	.00	.08	.07
F	Allium acuminatum	bc23	a4	a-	a1	ab6	c32	-	.00	.03	.24
F	Alyssum alyssoides (a)	-	-	b114	a67	a39	a49	.32	.18	.08	.35
F	Antennaria rosea	-	-	-	2	4	-	-	.03	.03	-
F	Arabis drummondi	a-	a1	b9	a-	a1	a-	.02	-	.00	-
F	Aster chilensis	-	1	3	3	2	2	.00	.03	.01	.00
F	Astragalus convallarius	a-	b17	ab10	a2	b18	ab9	.05	.03	.13	.09

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
F	Calochortus nuttallii	3	-	-	1	-	-	-	.00	-	-
F	Cirsium undulatum	12	12	14	7	12	10	.39	.24	.38	.63
F	Collinsia parviflora (a)	-	-	$_{b}$60	$_{b}$58	$_{b}$58	$_{a}$18	.11	.16	.17	.06
F	Collomia linearis (a)	-	-	$_{a}$9	$_{a}$4	$_{b}$80	$_{c}$140	.02	.01	.19	3.01
F	Comandra pallida	-	-	-	-	-	3	-	-	-	.03
F	Cordylanthus sp. (a)	-	-	$_{b}$19	$_{a}$-	$_{ab}$13	$_{a}$3	.30	-	.57	.01
F	Crepis acuminata	$_{a}$-	$_{b}$10	$_{a}$-	$_{a}$-	$_{ab}$5	$_{b}$9	-	-	.09	.24
F	Cryptantha sp.	-	6	-	-	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	$_{a}$3	$_{a}$-	$_{a}$-	$_{b}$28	.00	-	-	.05
F	Draba sp. (a)	-	-	$_{a}$-	$_{a}$3	$_{a}$11	$_{b}$128	-	.00	.02	.40
F	Epilobium brachycarpum (a)	-	-	$_{a}$13	$_{a}$19	$_{b}$46	$_{a}$1	.03	.16	.18	.00
F	Erigeron sp.	-	-	-	3	4	-	-	.06	.03	-
F	Eriogonum cernuum (a)	-	-	1	-	-	-	.00	-	-	-
F	Eriogonum umbellatum	-	3	1	2	2	1	.03	.00	.15	.15
F	Erodium cicutarium (a)	-	-	$_{a}$7	$_{b}$50	$_{b}$42	$_{b}$65	.07	1.65	.76	.33
F	Galium aparine (a)	-	-	-	-	-	3	-	-	-	.03
F	Holosteum umbellatum (a)	-	-	$_{b}$76	$_{a}$29	$_{a}$17	$_{b}$87	.28	.44	.10	.38
F	Lactuca serriola (a)	-	-	-	3	3	-	-	.01	.03	-
F	Lappula occidentalis (a)	-	-	$_{a}$2	$_{a}$11	$_{a}$-	$_{b}$48	.00	.03	-	.57
F	Lithospermum ruderale	$_{a}$-	$_{a}$-	$_{b}$10	$_{a}$-	$_{a}$1	$_{a}$-	.24	-	.03	-
F	Lomatium triternatum	-	-	-	-	9	11	-	-	.01	.10
F	Lupinus argenteus	9	7	8	3	6	9	.06	.04	.05	.33
F	Microsteris gracilis (a)	-	-	$_{b}$44	$_{a}$4	$_{a}$3	$_{a}$8	.08	.01	.01	.02
F	Orthocarpus tolmiei (a)	-	-	-	-	-	-	-	.03	-	-
F	Phlox longifolia	-	5	-	-	9	8	-	-	.01	.02
F	Polygonum douglasii (a)	-	-	$_{bc}$32	$_{a}$5	$_{c}$43	$_{ab}$21	.07	.01	.11	.08
F	Ranunculus testiculatus (a)	-	-	9	-	6	-	.01	-	.01	-
F	Senecio multilobatus	-	-	-	-	-	5	-	-	-	.21
F	Taraxacum officinale	-	9	-	-	-	-	-	-	-	-
F	Tragopogon dubius (a)	$_{ab}$21	$_{a}$3	$_{a}$9	$_{b}$33	$_{a}$17	$_{a}$2	.05	.34	.24	.03
F	Trifolium gymnocarpon	-	-	4	-	-	-	.01	-	-	-
F	Trifolium sp.	-	-	-	-	2	-	-	-	.00	-
F	Unknown forb-perennial	-	2	-	-	-	-	-	-	-	-
F	Veronica biloba (a)	-	-	1	-	6	-	.00	-	.01	-
F	Zigadenus paniculatus	-	3	-	-	-	-	-	-	-	-
Total for Annual Forbs		21	3	399	286	384	601	1.39	3.07	2.49	5.35
Total for Perennial Forbs		238	290	109	81	162	155	1.42	0.88	2.15	3.56
Total for Forbs		259	293	508	367	546	756	2.82	3.95	4.65	8.91

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

BROWSE TRENDS--
Management unit 03, Study no: 4

Type	Species	Strip Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
B	Artemisia tridentata vaseyana	19	15	22	25	3.47	5.05	4.53	6.81
B	Chrysothamnus viscidiflorus viscidiflorus	66	57	65	57	4.69	3.65	4.42	3.28
B	Eriogonum heracleoides	0	1	0	0	-	-	-	-
B	Gutierrezia sarothrae	9	1	6	0	.24	-	.15	-
B	Purshia tridentata	15	16	14	12	4.09	5.25	6.25	2.61
B	Ribes sp.	0	0	1	1	-	-	.38	.15
B	Tetradymia canescens	2	4	6	5	-	-	.03	.18
Total for Browse		111	94	114	100	12.50	13.97	15.76	13.04

CANOPY COVER, LINE INTERCEPT--
Management unit 03, Study no: 4

Species	Percent Cover	
	'06	'11
Artemisia tridentata vaseyana	5.86	8.76
Chrysothamnus viscidiflorus viscidiflorus	5.76	4.13
Gutierrezia sarothrae	-	.05
Purshia tridentata	8.66	4.75
Ribes sp.	-	.56
Tetradymia canescens	.43	.38

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 03, Study no: 4

Species	Average leader growth (in)		
	'01	'06	'11
Artemisia tridentata vaseyana	2.3	2.4	4.7
Purshia tridentata	4.2	4.3	1.3

BASIC COVER--
Management unit 03, Study no: 4

Cover Type	Average Cover %					
	'84	'90	'96	'01	'06	'11
Vegetation	6.25	19.75	43.24	47.43	61.08	61.86
Rock	1.00	.75	.86	.36	.49	.36
Pavement	1.25	0	.95	.93	1.17	2.83
Litter	70.75	50.75	51.29	52.27	36.35	37.90
Cryptogams	5.50	7.00	12.98	6.75	5.71	1.02
Bare Ground	15.25	21.75	10.92	14.55	10.28	7.59

SOIL ANALYSIS DATA --

Management unit 03, Study no: 4, Study Name: Anderson Ranch

Effective rooting depth (in)	pH	Clay-Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.5	7.0	42.7	24.0	33.3	3.7	14.3	115.2	0.6

PELLET GROUP DATA--

Management unit 03, Study no: 4

Type	Quadrat Frequency				Days use per acre (ha)		
	'96	'01	'06	'11	'01	'06	'11
Sheep	4	3	1	-	20 (50)	27 (68)	-
Rabbit	5	8	11	2	-	-	-
Grouse	-	1	-	-	9 (22) Groups/Acre	-	-
Elk	23	10	13	17	32 (79)	38 (94)	52 (127)
Deer	38	53	47	25	140 (346)	55 (136)	38 (94)
Cattle	2	-	-	2	-	1 (2)	5 (13)

BROWSE CHARACTERISTICS--

Management unit 03, Study no: 4

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier alnifolia									
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	36/51
Artemisia tridentata vaseyana									
84	**399**	0	33	67	-	0	100	0	28/35
90	**998**	27	53	20	-	20	0	0	28/31
96	**400**	25	75	0	160	65	0	0	35/50
01	**420**	14	67	19	-	29	0	0	33/50
06	**620**	26	61	13	500	23	23	3	36/54
11	**600**	7	67	27	120	7	0	100	32/51
Chrysothamnus viscidiflorus viscidiflorus									
84	**2465**	19	81	0	-	0	0	0	12/13
90	**3398**	20	76	4	-	6	0	2	13/17
96	**3120**	3	96	2	20	8	0	0	15/23
01	**2380**	3	85	13	-	2	0	.84	12/20
06	**2620**	7	86	7	-	4	3	4	15/23
11	**2020**	14	68	18	-	8	0	77	11/19

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Eriogonum heracleoides									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**0**	0	0	-	-	0	0	0	-/-
01	**20**	0	100	-	-	0	0	0	4/10
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Gutierrezia sarothrae									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**440**	5	95	-	-	0	0	0	7/9
01	**20**	0	100	-	-	0	0	0	4/5
06	**140**	0	100	-	-	0	0	0	10/16
11	**0**	0	0	-	-	0	0	0	14/29
Juniperus scopulorum									
84	**0**	0	0	-	-	0	0	0	-/-
90	**66**	0	100	-	-	0	0	0	134/81
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	-/-
Purshia tridentata									
84	**865**	0	8	92	-	8	92	8	32/37
90	**998**	20	13	67	-	33	33	13	15/26
96	**320**	6	94	0	-	44	25	0	29/55
01	**340**	12	82	6	-	12	53	6	36/62
06	**420**	10	71	19	-	48	14	5	37/62
11	**240**	0	67	33	-	8	0	92	39/62
Ribes sp.									
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	**20**	0	100	-	-	0	0	0	48/22
11	**20**	0	100	-	-	0	0	100	63/33
Symphoricarpos oreophilus									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**0**	0	0	-	-	0	0	0	15/16
01	**0**	0	0	-	-	0	0	0	19/28
06	**0**	0	0	-	-	0	0	0	24/24
11	**0**	0	0	-	-	0	0	0	23/44

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Tetradymia canescens									
84	**0**	0	0	0	-	0	0	0	-/-
90	**0**	0	0	0	-	0	0	0	-/-
96	**40**	0	100	0	-	0	0	0	18/33
01	**80**	0	100	0	-	0	0	0	17/33
06	**180**	33	22	44	-	0	0	44	21/34
11	**140**	29	57	14	-	14	0	29	13/25