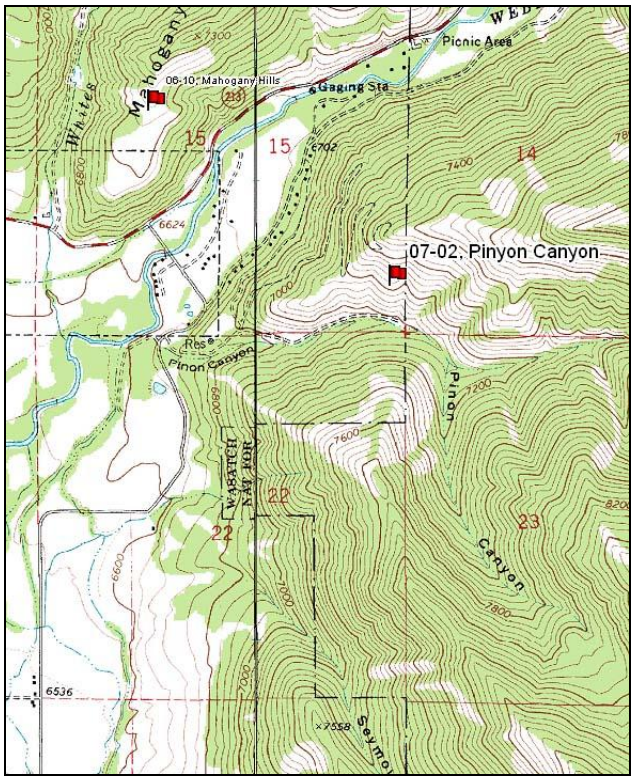
PINYON CANYON - TREND STUDY NO. 7-2-11

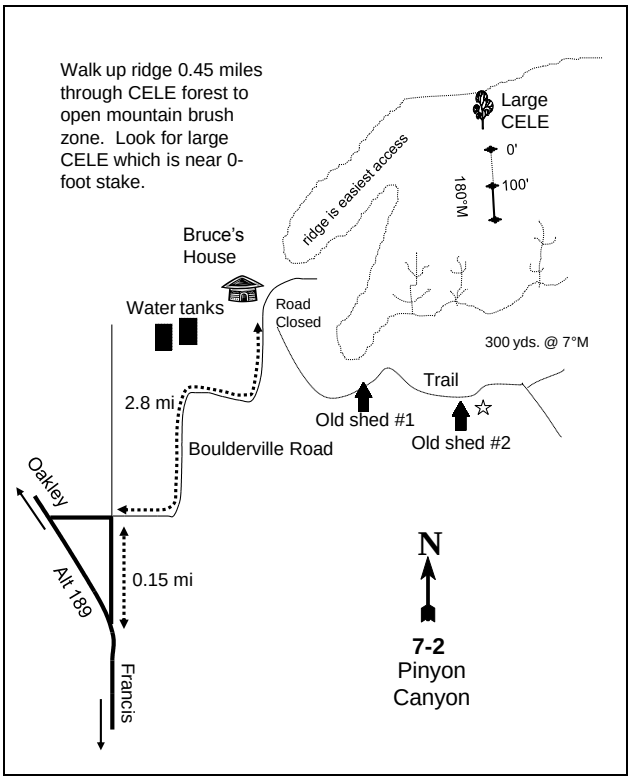
Vegetation Type: Mountain Brush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Mountain Loam (Oak), R047XA446UT
Land Ownership: Private
Elevation: 7,160 ft (2,182 m)
Aspect: 35-45%
Slope: South
Transect bearing: 180° magnetic
Belt placement: line 1 (11, 59, & 95ft), line 2 (34 & 71ft)

Directions:
Where Highway 189 turns northwest between Kamas and Oakley, proceed north for 0.15 miles. At this intersection turn right (east) onto Boulderville Road and travel 2.8 miles. Turn right onto a dirt road proceeding up Pinyon Canyon to a private home, passing two water storage tanks. Contact landowner before proceeding through private land. From the land owners home, walk up the ridge through a Curlleaf mahogany and pinyon forest for about a half mile. As the forest opens up into a mountain brush vegetation type look for a lone, large Curlleaf mahogany on the southwest facing slope. The 0-foot baseline stake is just below this mahogany. The 0-foot stake is marked by browse tag #7957.

Map Name: Hoyt Peak



Diagrammatic Sketch:



Township: 1S Range: 6E Section: 15

GPS: NAD 83, UTM 12S 479419 E 4508739 N

Site Information

Site Description: The study is located in a drainage containing one of the better and more important mountain brush big game wintering areas in the herd unit. This site is at a high elevation for winter range, but with the favorable aspect and slope, the area remains available to big game during all but the most severe winters. Pellet group data have indicated that elk are found in the area much more than deer. Elk pellet groups have been sampled in high abundance since 2001. Deer pellet groups were sampled in moderate abundance in 2001, but in low abundance since 2006 (Table - Pellet Group Data). Several moose pellet groups have also been observed on the site, but occurred outside the sampling area.

Browse: The mountain brush community throughout the area exhibits considerable variation in over-story dominance. The mixture of shrubs includes varying densities of true mountain mahogany (*Cercocarpus montanus* ssp. *montanus*), Saskatoon serviceberry (*Amelanchier alnifolia*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), mountain snowberry (*Symphoricarpos oreophilus*), and a few scattered curlleaf mountain mahogany (*C. ledifolius* ssp. *ledifolius*). The browse component on the study is a mixture of true mountain mahogany, snowberry, mountain big sagebrush, bitterbrush, oak, and serviceberry. Total browse cover has remained similar on the site over the course of the study, but composition has changed with an increase in the cover of serviceberry and sagebrush, and a decrease in the cover of true mountain mahogany and snowberry (Table - Browse Trends). Health of the preferred species, serviceberry, mountain big sagebrush, true mountain mahogany, and bitterbrush, has been relatively good with low decadence and good vigor since 1996. Decadence was higher in the serviceberry and sagebrush populations at the outset of the study in 1984. Serviceberry, true mountain mahogany, and bitterbrush have displayed mostly moderate to heavy use, while sagebrush has had mostly light to moderate use. It was also noted that Gambel oak was heavily utilized in 1984 and 2011. Recruitment from young plants has been moderate to high for serviceberry and true mountain mahogany in all sample years. Recruitment of young sagebrush and bitterbrush plants has been poor over the course of the study, with the exception of 1996 when the recruitment of young sagebrush plants was high (Table - Browse Characteristics).

Herbaceous Understory: Grasses are abundant on the site, but are not particularly diverse. The grass component is dominated in cover by bluebunch wheatgrass (*Agropyron spicatum*). Sandberg bluegrass (*Poa secunda*) is the only other prevalent perennial grass species. Cheatgrass (*Bromus tectorum*) is also moderately abundant, but has decreased steadily in cover since 1996. Nested frequency of cheatgrass, however, has remained high. Perennial forbs are not particularly abundant on the study, with the dominant perennial forb being rock goldenrod (*Petradoria pumila*). The annual forb species pale alyssum (*Alyssum alyssoides*) has steadily increased since 1996, and was the dominant forb in 2011 (Table - Herbaceous Trends).

Soil: The study is part of the Agassiz-Rock outcrop complex, likely as part of the Agassiz component. These soils occur on mountain slopes, with parent material consisting of colluviums derived from limestone. Depth of these soils is considered to be shallow (Soil Survey Staff 2011). The soil texture is a clay loam with a slightly alkaline soil reaction (pH 7.7) (Table - Soil Analysis Data). Soils are moderately rocky on the surface and throughout the profile. Permeability would be moderately slow when combined with the steep slope and high surface rock cover. There is a moderately high potential for runoff and erosion. Bare ground is moderately low, with a fair amount of vegetation, litter, and rock cover providing protective ground cover (Table - Basic Cover). Under most conditions this will help prevent erosion from most high intensity summer rain events. The soil erosion condition was classified as slight 2001, but was stable in 2006 and 2011.

Trend Assessments

Browse:

- **1984 to 1990 - stable (0):** The density of true mountain mahogany decreased by 12% from 1,064 plants/acre to 932 plants/acre. Decadence increased from 19% to 36%, though vigor remained good within the population. However, serviceberry increased 12% in density from 1,131 plants/acre to 1,265 plants/acre. Decadence of serviceberry decreased from 65% to 11%, and plants displaying poor vigor decreased from 65% to 0%.
- **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 serviceberry and true mountain mahogany decreased to 2% and 3%, respectively. Mountain big sagebrush decadence also decreased from 100% of the population to 21%. Recruitment of young sagebrush plants increased from 0% to 42%.
- **1996 to 2001 - stable (0):** Density of true mountain mahogany remained similar at 760 plants/acre, but serviceberry increased by 34% from 940 plants/acre to 1,260 plants/acre. Most of this increase in serviceberry was due to an increase in the recruitment of young plants from 45% to 51% of the population. Cover of serviceberry decreased slightly from just over 1% to less than 1%. Decadence and poor vigor remained low in the preferred browse species on the study.
- **2001 to 2006 - stable (0):** The density of serviceberry decreased by 56% to 560 plants/acre, though cover remained similar at 1%. True mountain mahogany density remained similar at 740 plants/acre, though cover decreased slightly from 4% to 3%. Recruitment of young serviceberry and true mountain mahogany plants remained very good.
- **2006 to 2011 - stable (0):** Serviceberry density increased by 75% to 980 plants/acre, and cover increased to 2%. True mountain mahogany density decreased by 30% to 520 plants/acre, but cover remained similar. Decadence of mahogany has increased steadily since 1996 from 3% to 23%. Poor vigor of mahogany has also steadily increased since 2001 from 0% to 15%.

Grass:

- **1984 to 1990 - stable (0):** There was little change in the sum of nested frequency of perennial grasses.
- **1990 to 1996 - slightly up (+1):** The sum of nested frequency of perennial grasses increased slightly by 9%, and there was a significant increase in the nested frequency of bluebunch wheatgrass.
- **1996 to 2001 - stable (0):** There was a slight decrease in the sum of nested frequency for perennial grasses, and cover decreased from 24% to 16%. There was a significant decrease in the nested frequency of bluebunch wheatgrass, but cheatgrass also decreased significantly in nested frequency.
- **2001 to 2006 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased by 14%, which is due to a significant decrease in the nested frequency of Sandberg bluegrass. Cover of perennial grasses increased to 20%. There was a significant increase in the nested frequency of cheatgrass, though cover of cheatgrass decreased from 6% to 4%.
- **2006 to 2011 - stable (0):** There was a slight increase in the sum of nested frequency of perennial grasses, but cover decreased to 15%. Cheatgrass decreased significantly in nested frequency, and cover decreased to 2%.

Forb:

- **1984 to 1990 - up (+2):** The sum of nested frequency of perennial forbs increased by 32%.
- **1990 to 1996 - down (-2):** The sum of nested frequency of perennial forbs decreased by 44%.
- **1996 to 2001 - up (+2):** There was a 27% increase in the sum of nested frequency of perennial forbs, and cover increased from 3% to 4%.
- **2001 to 2006 - stable (0):** There was little change in the sum of nested frequency or cover of perennial forbs. The annual species pale alyssum increased significantly in nested frequency.

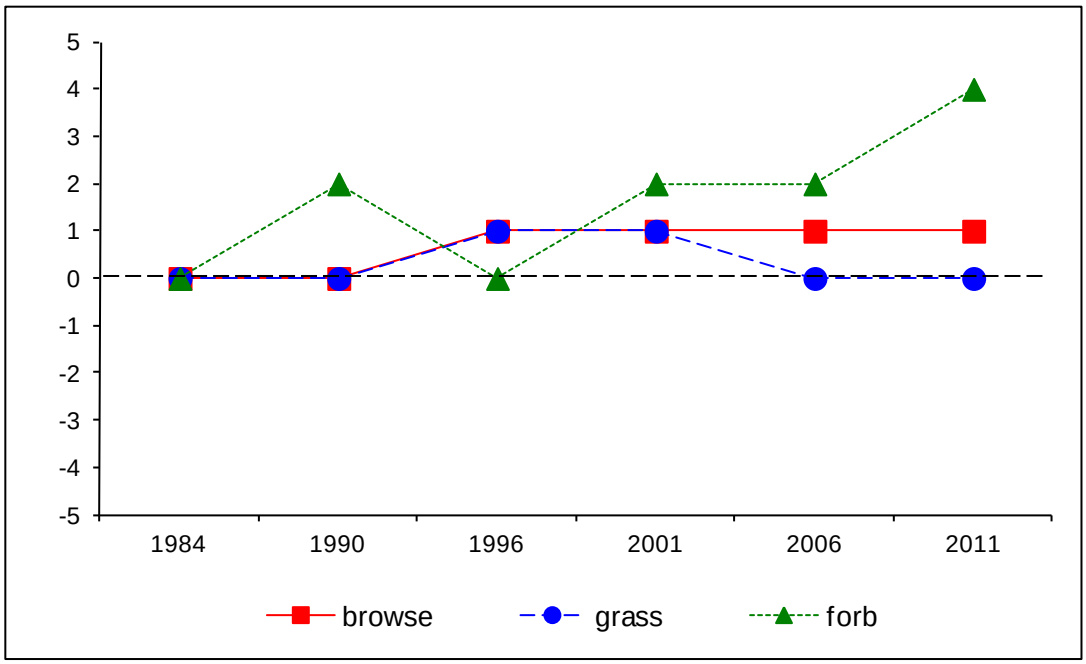
- **2006 to 2011 - up (+2):** The sum of nested frequency of perennial forbs increased by 42%, and cover increased to 6%. The annual species pale alyssum increased significantly in nested frequency and was the dominant forb species in cover and frequency on the site in 2011.

DEER DESIRABLE COMPONENTS INDEX - HIGH POTENTIAL SCALE --
Management unit 7, study no: 2

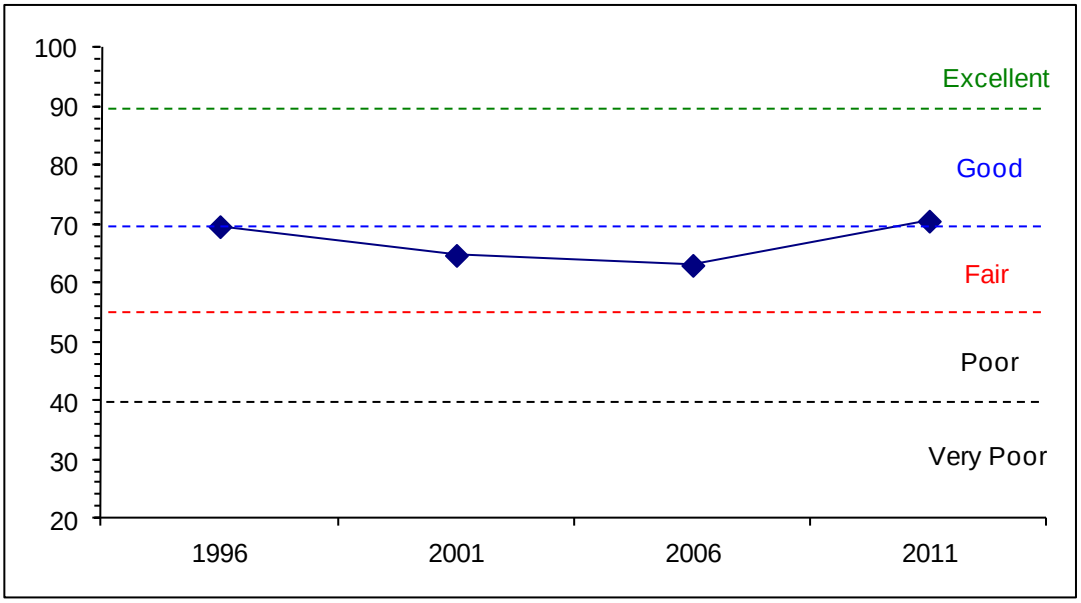
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
96	11.0	13.8	14.9	30.0	-4.9	4.7	0.0	**69.6**	Fair-Good
01	13.1	12.1	6.1	30.0	-4.2	7.6	0.0	**64.7**	Fair
06	12.9	10.2	5.4	30.0	-3.0	7.5	0.0	**63.0**	Fair
11	14.0	9.9	8.4	29.7	-1.4	10.0	0.0	**70.5**	Fair-Good

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 7 Study no: 2



DEER DESIRABLE COMPONENTS INDEX TREND, HIGH POTENTIAL--
Management unit 7, Study no: 2



HERBACEOUS TRENDS--
Management unit 07, Study no: 2

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
G	Agropyron dasystachyum	5	-	-	-	-	-	-	-	-	-
G	Agropyron spicatum	$_{ab}$275	$_{a}$266	$_{c}$322	$_{ab}$286	$_{abc}$288	$_{bc}$304	19.45	11.37	17.66	12.08
G	Bromus japonicus (a)	-	-	-	-	4	6	-	-	.01	.01
G	Bromus tectorum (a)	-	-	$_{b}$274	$_{a}$215	$_{b}$272	$_{a}$212	6.51	5.66	3.95	1.85
G	Poa fendleriana	$_{d}$107	$_{cd}$65	$_{bc}$50	$_{ab}$28	$_{ab}$23	$_{a}$9	.67	.60	.53	.21
G	Poa pratensis	-	-	-	-	-	7	-	-	-	.04
G	Poa secunda	$_{a}$93	$_{cd}$172	$_{cd}$175	$_{d}$196	$_{ab}$127	$_{bc}$147	3.40	4.27	1.92	2.51
Total for Annual Grasses		0	0	274	215	276	218	6.51	5.66	3.96	1.86
Total for Perennial Grasses		480	503	547	510	438	467	23.54	16.25	20.12	14.85
Total for Grasses		480	503	821	725	714	685	30.05	21.92	24.08	16.71
F	Agoseris glauca	-	-	-	10	11	17	-	.05	.07	.33
F	Allium acuminatum	$_{b}$34	$_{b}$37	$_{a}$5	$_{b}$50	$_{b}$64	$_{c}$101	.01	.25	.33	.55
F	Alyssum alyssoides (a)	-	-	$_{a}$28	$_{b}$64	$_{c}$281	$_{d}$334	.16	.61	2.60	11.84
F	Astragalus sp.	-	1	-	2	2	6	-	.01	.15	.30
F	Balsamorhiza sagittata	3	-	-	-	1	-	-	-	.15	.03
F	Calochortus nuttallii	6	3	-	4	6	-	-	.01	.02	-
F	Camelina microcarpa (a)	-	-	$_{c}$117	$_{b}$51	$_{a}$3	$_{a}$2	.61	.23	.03	.00
F	Chaenactis douglasii	$_{a}$6	$_{b}$28	$_{a}$13	$_{a}$-	$_{a}$-	$_{a}$-	.05	-	-	-
F	Chenopodium fremontii (a)	-	-	-	1	-	-	-	.00	-	-
F	Cirsium undulatum	$_{b}$41	$_{b}$40	$_{a}$9	$_{a}$12	$_{a}$6	$_{a}$3	.10	.54	.59	.09
F	Collinsia parviflora (a)	-	-	-	2	-	4	-	.00	-	.01
F	Comandra pallida	24	21	26	21	18	16	.23	.31	.53	.69
F	Crepis acuminata	-	3	1	2	7	2	.03	.03	.12	.09

Type	Species	Nested Frequency						Average Cover %			
		'84	'90	'96	'01	'06	'11	'96	'01	'06	'11
F	Cymopterus sp.	-	-	2	5	1	3	.03	.36	.00	.01
F	Descurainia pinnata (a)	-	-	-	7	5	5	-	.07	.01	.01
F	Draba sp. (a)	-	-	-	-	6	-	-	-	.01	-
F	Epilobium brachycarpum (a)	-	-	-	9	8	9	-	.02	.04	.05
F	Erigeron pumilus	-	-	2	2	1	4	.15	.03	.03	.03
F	Erigeron strigosis	-	-	2	-	-	-	.00	-	-	-
F	Gayophytum ramosissimum(a)	-	-	6	-	1	-	.01	-	.00	-
F	Gilia sp. (a)	-	-	-	4	-	1	-	.00	-	.00
F	Helianthus sp.	-	-	7	-	-	3	.06	-	-	.00
F	Holosteum umbellatum (a)	-	-	8	8	-	10	.09	.01	-	.02
F	Ipomopsis aggregata	-	-	-	2	-	-	-	.00	-	-
F	Lappula occidentalis (a)	-	-	-	-	1	-	-	-	.00	-
F	Lomatium sp.	$_{a}$-	$_{a}$-	$_{a}$1	$_{a}$-	$_{a}$5	$_{b}$13	.01	-	.18	.34
F	Microsteris gracilis (a)	-	-	$_{a}$-	$_{b}$68	$_{a}$7	$_{a}$11	-	.24	.01	.02
F	Penstemon humilis	14	22	19	11	11	15	.43	.27	.45	1.00
F	Petradoria pumila	$_{ab}$41	$_{b}$61	$_{ab}$38	$_{a}$34	$_{a}$24	$_{a}$28	1.62	1.86	1.11	2.58
F	Phlox longifolia	-	-	1	-	-	-	.00	-	-	-
F	Polygonum douglasii (a)	-	-	3	-	-	-	.00	-	-	-
F	Ranunculus testiculatus (a)	-	-	$_{a}$8	$_{b}$47	$_{b}$54	$_{c}$109	.02	.41	.62	.49
F	Streptanthus cordatus	-	3	-	-	-	-	-	-	-	-
F	Tragopogon dubius (a)	$_{a}$4	$_{a}$-	$_{ab}$7	$_{b}$21	$_{a}$5	$_{ab}$15	.09	.38	.07	.08
F	Unknown forb-perennial	-	2	-	-	-	-	-	-	-	-
F	Viguiera multiflora	2	3	-	5	1	11	-	.03	.00	.09
F	Zigadenus paniculatus	-	1	-	-	-	3	-	-	-	.18
Total for Annual Forbs		4	0	177	282	371	500	1.00	2.01	3.43	12.55
Total for Perennial Forbs		171	225	126	160	158	225	2.75	3.80	3.76	6.35
Total for Forbs		175	225	303	442	529	725	3.75	5.82	7.20	18.90

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

BROWSE TRENDS--
Management unit 07, Study no: 2

Type	Species	Strip Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
B	Amelanchier alnifolia	27	25	19	21	1.41	.66	.93	2.32
B	Artemisia tridentata vaseyana	17	13	12	14	.68	1.86	2.51	3.10
B	Cercocarpus montanus	35	32	33	25	3.99	4.24	3.01	2.78
B	Gutierrezia sarothrae	3	0	1	0	.18	-	-	-
B	Mahonia repens	3	4	5	6	.15	.24	.09	.24
B	Purshia tridentata	4	3	4	5	1.14	1.66	1.76	1.62
B	Quercus gambelii	1	3	1	1	.33	.93	1.17	-
B	Symphoricarpos oreophilus	19	19	22	22	2.37	3.75	3.40	1.59
Total for Browse		109	99	97	94	10.26	13.35	12.91	11.68

CANOPY COVER, LINE INTERCEPT--
Management unit 07, Study no: 2

Species	Percent Cover	
	'06	'11
Amelanchier alnifolia	3.08	2.18
Artemisia tridentata vaseyana	3.63	3.86
Cercocarpus montanus	3.84	3.71
Mahonia repens	.08	.06
Purshia tridentata	2.90	2.95
Quercus gambelii	1.08	.23
Symphoricarpos oreophilus	1.54	.85

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 07, Study no: 2

Species	Average leader growth (in)		
	'01	'06	'11
Amelanchier alnifolia	3.8	4.6	4.2
Artemisia tridentata vaseyana	-	1.3	4.0
Cercocarpus montanus	2.1	4.0	3.2
Purshia tridentata	-	3.7	2.3

BASIC COVER--
Management unit 07, Study no: 2

Cover Type	Average Cover %					
	'84	'90	'96	'01	'06	'11
Vegetation	3.50	9.50	43.43	39.25	39.79	46.36
Rock	23.00	25.25	17.19	15.94	18.73	17.00
Pavement	8.25	4.00	6.61	5.94	7.36	3.48
Litter	45.75	40.00	41.18	30.26	25.50	17.08
Cryptogams	1.75	0	.39	.15	.01	.42
Bare Ground	17.75	21.25	14.82	33.31	22.39	24.96

SOIL ANALYSIS DATA --
Management unit 07, Study no: 2, Study Name: Pinyon Canyon

Effective rooting depth (in)	pH	Clay-Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
11.9	7.7	40.6	32.4	27.0	3.8	8.4	89.6	0.8

PELLET GROUP DATA--
Management unit 07, Study no: 2

Type	Quadrat Frequency			
	'96	'01	'06	'11
Elk	32	43	49	59
Deer	11	14	3	8

Days use per acre (ha)		
'01	'06	'11
69 (170)	100 (248)	160 (395)
30 (74)	11 (26)	11 (26)

BROWSE CHARACTERISTICS--
Management unit 07, Study no: 2

		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	**1131**	18	18	65	66	6	88	65	27/21
90	**1265**	42	47	11	-	21	26	0	22/22
96	**940**	45	53	2	80	53	13	2	29/37
01	**1260**	51	37	13	-	19	22	14	30/39
06	**560**	36	57	7	20	0	50	4	31/35
11	**980**	45	53	2	40	24	20	2	31/42
Artemisia tridentata vaseyana									
84	**132**	0	50	50	-	0	100	0	24/20
90	**66**	0	0	100	-	100	0	0	-/-
96	**380**	37	42	21	-	47	0	11	21/31
01	**280**	7	79	14	-	14	0	7	22/34
06	**240**	8	83	8	-	33	17	17	31/43
11	**340**	6	76	18	-	41	6	24	29/45
Cercocarpus montanus									
84	**1064**	44	38	19	-	0	56	0	46/28
90	**932**	36	29	36	-	14	64	0	42/27
96	**780**	26	72	3	-	44	41	0	34/40
01	**760**	16	71	13	20	34	50	0	34/37
06	**740**	16	65	19	40	19	70	8	32/36
11	**520**	15	62	23	-	23	58	15	28/33
Chrysothamnus viscidiflorus viscidiflorus									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**0**	0	0	-	-	0	0	0	14/21
01	**0**	0	0	-	-	0	0	0	19/27
06	**0**	0	0	-	-	0	0	0	12/24
11	**0**	0	0	-	-	0	0	0	8/23
Gutierrezia sarothrae									
84	**0**	0	0	-	-	0	0	0	-/-
90	**0**	0	0	-	-	0	0	0	-/-
96	**140**	0	100	-	-	0	0	0	7/10
01	**0**	0	0	-	-	0	0	0	9/32
06	**20**	0	100	-	-	0	0	0	8/9
11	**0**	0	0	-	-	0	0	0	-/-

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Mahonia repens									
84	**8599**	100	0	-	-	0	0	0	-/-
90	**10465**	46	54	-	-	0	0	0	4/4
96	**380**	21	79	-	20	0	0	0	4/5
01	**680**	0	100	-	-	0	0	0	4/6
06	**840**	7	93	-	-	0	0	0	4/4
11	**1140**	0	100	-	-	0	0	0	3/34
Purshia tridentata									
84	**0**	0	0	0	-	0	0	0	-/-
90	**0**	0	0	0	-	0	0	0	-/-
96	**240**	0	100	0	-	75	25	0	19/47
01	**60**	0	100	0	-	100	0	0	22/84
06	**420**	0	95	5	-	29	5	0	24/55
11	**220**	0	73	27	-	18	82	27	20/42
Quercus gambelii									
84	**2197**	18	64	18	-	15	61	0	47/19
90	**1932**	62	38	0	-	66	0	0	43/29
96	**20**	100	0	0	-	0	0	0	64/65
01	**120**	0	100	0	-	0	0	0	58/34
06	**40**	0	50	50	80	0	0	50	58/39
11	**20**	0	0	100	-	0	100	100	32/25
Sambucus cerulea									
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	28/66
06	**0**	0	0	-	-	0	0	0	37/72
11	**0**	0	0	-	-	0	0	0	-/-
Symphoricarpos oreophilus									
84	**1531**	13	65	22	-	65	13	0	22/23
90	**2198**	18	52	30	-	42	0	3	21/26
96	**600**	27	73	0	40	27	0	0	18/33
01	**420**	0	100	0	-	14	0	0	20/43
06	**700**	11	83	6	40	0	3	3	20/25
11	**700**	17	83	0	-	20	0	0	17/29