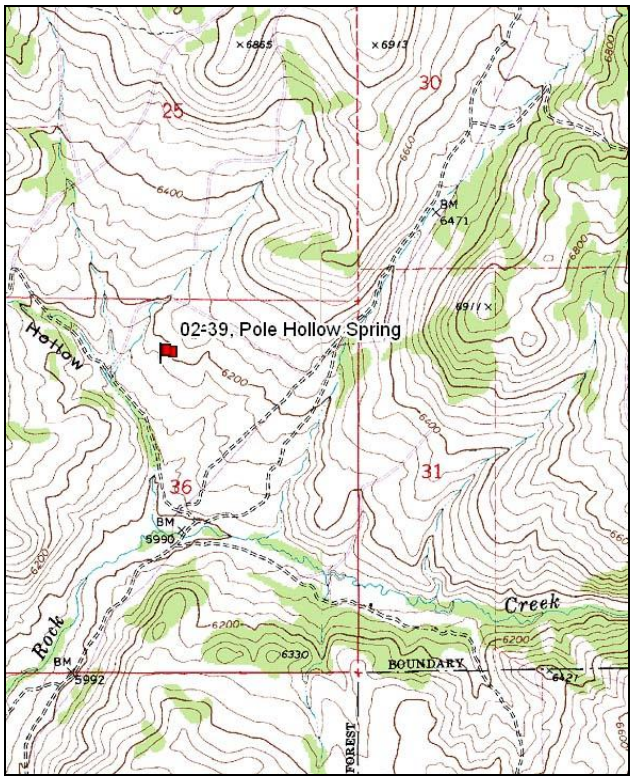
POLE HOLLOW SPRING - TREND STUDY NO. 2-39-11

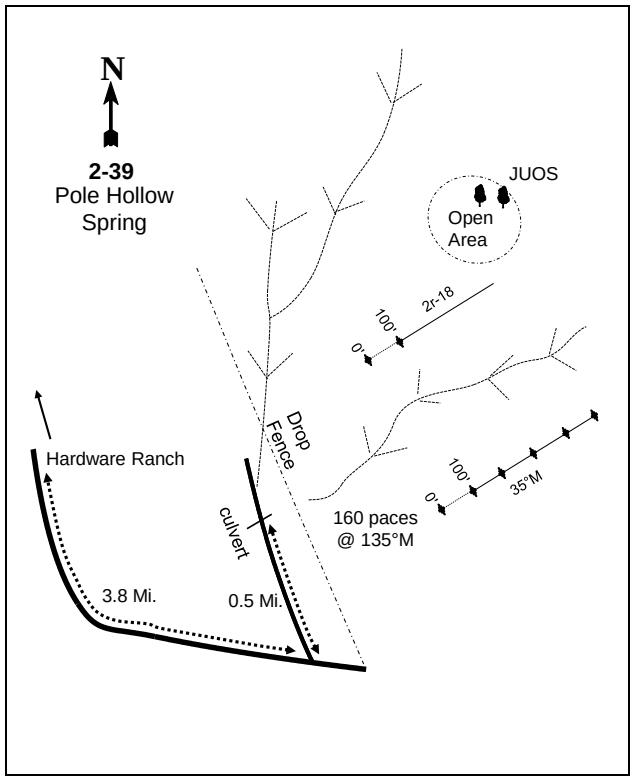
Vegetation Type: Mountain Brush
Range Type: Crucial Deer Summer (Fawning habitat), Crucial Elk Winter
NRCS Ecological Site Description: Not Available
Land Ownership: DWR
Elevation: 6,177 ft (1,883 m)
Aspect: Southwest
Slope: 15%
Transect bearing: 35° magnetic
Belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95 ft)

Directions:
From Hardware Ranch, travel northeast for 3.8 miles to the Pole Hollow Road. Take a left and travel up Pole Hollow for 0.5 miles to a culvert. From the open area, walk160 paces at a bearing of approximately 135 degrees magnetic to the 0-foot baseline stake. The baseline runs at a bearing of 35 degrees magnetic.

Map Name: Boulder Mountain



Diagrammatic Sketch:



Township: 11N Range: 3E Section: 36

GPS: NAD 83, UTM 12S 454128 E 4611223 N

POLE HOLLOW SPRING - TREND STUDY NO. 2-39

Site Information

Site Description: This study is located four miles northeast of the Hardware Ranch visitors' center on land administered by the Utah Division of Wildlife Resources (UDWR). The study monitors a mountain brush community and is best classified as summer/transitional range for wildlife. Cattle also use the area in summer. In the past, the study area may have been intensively grazed as part of the Hardware grazing study. A control study, temporarily surrounded by an electric fence, is located 300 feet to the northeast. In addition, sheep may have also grazed here in the past. Deer and cattle sign has been minimal since 2001. Sampled elk pellet groups inferred no presence in 2001, but low abundance in 2006 and 2011. A grouse pellet group was also sampled in 2006 (Table - Pellet Group Data).

Browse: The mixed mountain brush community has several important browse species. The key species are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), antelope bitterbrush (*Purshia tridentata*), and Saskatoon serviceberry (*Amelachier alnifolia*). The mountain big sagebrush population is moderately dense, and evenly distributed. The sagebrush population has been centered within the mature age class throughout the duration of the study, and has only fluctuated slightly. Decadence within the population has been low, but was at its peak in 2001. The sagebrush has had light to moderate utilization over the course of the study. The sagebrush population has been vigorous over the course of the study; however, chlorotic and diseased sagebrush have steadily increased, but are still a minor component of the population. Recruitment of young sagebrush has been mostly poor over the sampled years except in 2001. The antelope bitterbrush population has fluctuated slightly, and is modestly dense. The bitterbrush population has been centered within the mature age class throughout the duration of the study. Decadence within the population has been low, but was at its peak in 2001. Utilization of bitterbrush has been mostly light to moderate over the sample years. Saskatoon serviceberry is not abundant, but maintains a mature population. Utilization of serviceberry has been light to moderate over the course of the study. The majority of the serviceberry population has displayed good vigor, with few plants displaying chlorosis or disease. The mountain snowberry (*Symphoricarpos oreophilus*) population is mostly mature and has displayed very little utilization by wildlife (Table - Browse Characteristics).

Herbaceous Understory: The herbaceous understory is dominated by perennial grasses, but the sum of nested frequency of perennial grasses has steadily declined since 1996. Shrubs are very thick and are most likely competing with the grass community for resources. The most numerous perennial grass species was Kentucky bluegrass (*Poa pratensis*), but has decreased in abundance over the duration of the study. Bluebunch wheatgrass (*Agropyron spicatum*) has had moderate fluctuations in abundance, and was the most common grass species in 2011. Cheatgrass (*Bromus tectorum*) and Japanese chess (*B. japonicus*) are the only annual grass species found on the site. Japanese chess was fairly common in 1996, but has since decreased in abundance over the course of the study. Smooth brome (*B. inermis*), Prairie junegrass (*Koeleria cristata*), mutton bluegrass (*Poa fendleriana*), Sandberg bluegrass (*P. secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and Letterman needlegrass (*Stipa lettermani*) are all present, but in relatively low numbers. Forbs are fairly abundant and diverse. Common forb species include western yarrow (*Achillea millefolium*), pacific aster (*Aster chilensis*), silvery lupine (*Lupinus argenteus*), yellow salsify (*Tragopogon dubius*) and bastard toadflax (*Comandra pallida*) (Table - Herbaceous Trends).

Soil: Natural Resources Conservation Service (NRCS) soil data was not available for this site. Soil is moderately deep with a clay texture and a neutral soil reaction (pH 7.0) (Table - Soil Analysis Data). Bare ground cover is low and is primarily due to burrowing rodent activity. Protective ground cover effectively limits soil erosion and is provided by high amounts of vegetation and litter cover (Table - Basic Cover). Terracing and bare trails were noted in 2001, along with soil movement in small areas. The soil erosion condition was classified as slight in 2001, but stable in 2006 and 2011.

Trend Assessments

Browse:

- **1996 to 2001 - stable (0):** The density for mountain big sagebrush remained similar, increasing slightly from 4,020 plants/acre to 4,040 plants/acre. Decadence within the sagebrush population increased from 7% to 16%. The sagebrush population increased in poor vigor from 1% to 4%. Recruitment of young sagebrush plants increased from 9% to 12%. Antelope bitterbrush increased in density 32% from 500 plants/acre to 660 plants/acre. Decadence within the bitterbrush population increased from 0% to 16%. The bitterbrush population increased in poor vigor from 0% to 3%. Recruitment of young bitterbrush decreased from 12% to 6%. The density for Saskatoon serviceberry decreased 64% from 500 plants/acre to 180 plants/acre. Decadent plants were not observed within the serviceberry population. Poor vigor within the serviceberry population decreased from 4% to 0%.
- **2001 to 2006 - slightly down (-1):** The density for mountain big sagebrush decreased 15% to 3,440 plants/acre. Decadence within the sagebrush population decreased to 13%. The sagebrush population increased in poor vigor to 11%. Recruitment of young sagebrush plants decreased to 1% of the population. The density for antelope bitterbrush decreased 15% to 560 plants/acre. Decadence within the bitterbrush population decreased to 11%. The bitterbrush population increased in poor vigor to 4%. Young bitterbrush recruitment remained similar at 7% of the population. The density for Saskatoon serviceberry decreased 22% to 140 plants/acre. Decadence and poor vigor were not observed within the population. Young serviceberry plants were not observed within the population.
- **2006 to 2011 - slightly up (+1):** The density for mountain big sagebrush decreased 7% to 3,200 plants/acre. Decadence within the sagebrush population decreased to 9%. The sagebrush population increased in poor vigor to 21%. Recruitment of young sagebrush increased to 7% of the population. The density for antelope bitterbrush increased 54% to 860 plants/acre. Decadence within the bitterbrush population remained similar at 12%. The bitterbrush population increased in poor vigor to 12%. Recruitment of young bitterbrush remained similar at 2% of the population. The density for Saskatoon serviceberry increased just over two-fold to 320 plants/acre. Decadence within the serviceberry population was not observed, while poor vigor increased to 13% of the serviceberry population. Recruitment of young serviceberry plants increased to 13% of the population.

Grass:

- **1996 to 2001 - slightly down (-1):** The sum of nested frequency for perennial grasses decreased 11%. Bluebunch wheatgrass had a significant decrease in nested frequency, and decreased in cover from 7% to 3%. Mutton bluegrass had a significant increase in nested frequency, and increased in cover from less than 1% to 1%.
- **2001 to 2006 - slightly down (-1):** The sum of nested frequency for perennial grasses decreased 14%, but cover decreased from 19% to 10%. Slender wheatgrass (*Agropyron trachycaulum*) had a significant increase in nested frequency. Kentucky bluegrass decreased significantly in nested frequency, and decreased in cover from 12% to 3%. Bottlebrush squirreltail decreased significantly in nested frequency, and decreased in cover from 1% to near 0%.
- **2006 to 2011 - stable (0):** The sum of nested frequency for perennial grasses remained similar, though cover increased from 10% to 19%. Bluebunch wheatgrass increased significantly in nested frequency, and increased in cover from 4% to 11%. Mutton bluegrass and Kentucky bluegrass decreased significantly in nested frequency, which decreased in cover from 1% to less than 1% and 3% to 1%, respectively.

Forb:

- **1996 to 2001 - slightly up (+1):** The sum of nested frequency for perennial forbs increased 19%. Wild onion (*Allium sp.*) had a significant increase in nested frequency. Bastard toadflax increased significantly in nested frequency, and increased in cover from near 0% to 1%.

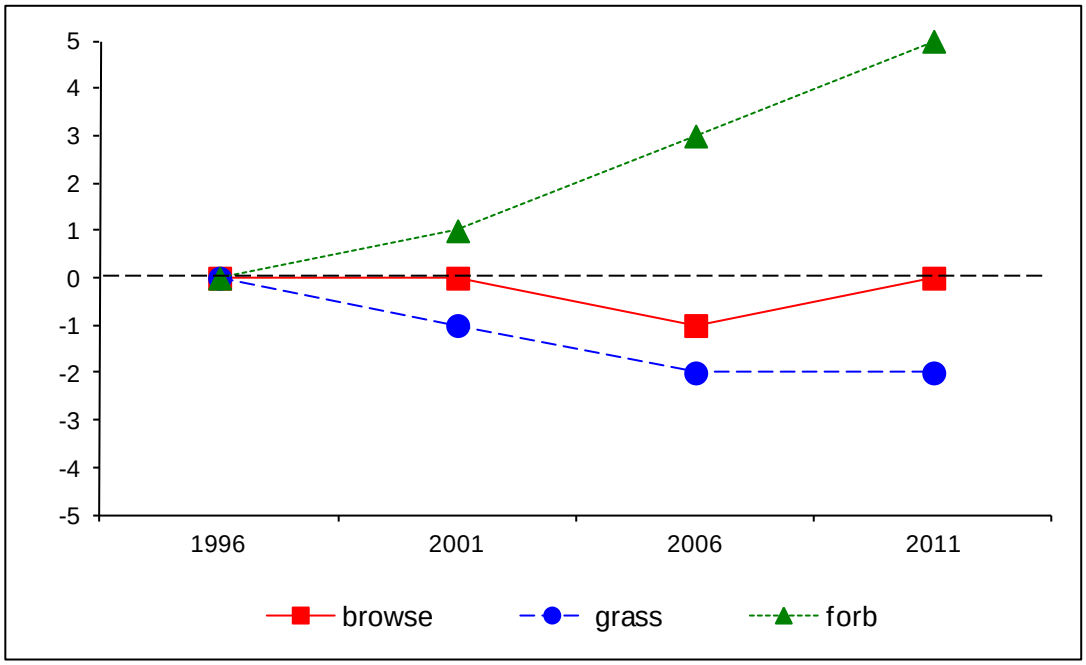
- **2001 to 2006 - up (+2):** The sum of nested frequency for perennial forbs increased 23%, and cover increased from 9% to 12%. Wild onion and timber poisonvetch (*Astragalus convallarius*) increased significantly in nested frequency. Western yarrow (*Achillea millefolium*) increased in cover from 1% to 3%. The annual species bush birdbeak (*Cordylanthus ramosus*) increased significantly in nested frequency, but yellow salsify and slenderleaf collomia (*Collomia linearis*) decreased significantly in nested frequency. The composition of the forb community increased slightly in diversity.
- **2006 to 2011 - up (+2):** The sum of nested frequency for perennial forbs increased 30% and cover increased to 25%. Wild onion, Wavyleaf thistle (*Cirsium undulatum),* and the unpalatable species mulesears wyethia (*Wyethia amplexicaulis*) increased significantly in nested frequency. The forb community maintained a diverse composition. Wild onion and wavyleaf thistle increased in cover from less than 1% to 11% and less than 1% to 1%, respectively.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --
Management unit 2, study no: 39

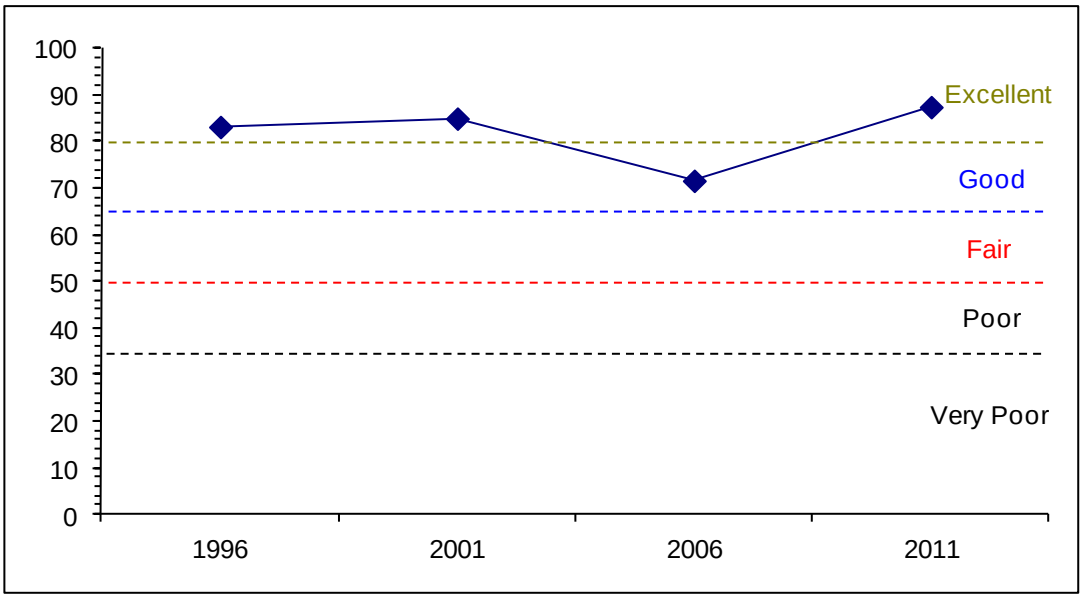
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
96	27.4	13.7	5.1	30.0	-3.1	10.0	0.0	**83.1**	Excellent
01	30.0	9.8	5.3	30.0	-0.2	10.0	0.0	**84.9**	Excellent
06	30.0	11.4	1.3	18.9	0.0	10.0	0.0	**71.6**	Good
11	30.0	12.2	5.5	30.0	-0.3	10.0	0.0	**87.4**	Excellent

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 2 Study no: 39



DEER DESIRABLE COMPONENTS INDEX TREND, MID-LEVEL POTENTIAL--
Management unit 2, Study no: 39



HERBACEOUS TRENDS--
Management unit 02, Study no: 39

Type	Species	Nested Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
G	Agropyron spicatum	$_{b}$214	$_{a}$109	$_{ab}$164	$_{c}$259	6.75	2.46	3.77	11.41
G	Agropyron trachycaulum	$_{a}$-	$_{a}$-	$_{b}$23	$_{b}$35	-	-	.21	.37
G	Bromus inermis	$_{a}$3	$_{ab}$16	$_{ab}$15	$_{b}$20	.03	.48	.09	1.82
G	Bromus japonicus (a)	$_{c}$144	$_{b}$66	$_{a}$10	$_{a}$14	2.54	.29	.02	.40
G	Bromus tectorum (a)	$_{b}$32	$_{a}$1	$_{a}$2	$_{a}$-	1.62	.03	.01	-
G	Carex sp.	-	-	-	5	-	-	-	.00
G	Elymus cinereus	-	1	-	-	-	.00	-	-
G	Koeleria cristata	29	32	27	65	.26	.49	.52	2.75
G	Poa bulbosa	-	-	-	1	-	-	-	.03
G	Poa fendleriana	$_{a}$13	$_{bc}$41	$_{c}$52	$_{ab}$28	.12	1.08	.58	.33
G	Poa pratensis	$_{c}$279	$_{c}$251	$_{b}$141	$_{a}$41	8.06	11.56	3.34	.86
G	Poa secunda	8	21	11	-	.19	.51	.18	-
G	Sitanion hystrix	$_{ab}$14	$_{b}$14	$_{a}$2	$_{b}$15	.10	.48	.00	.22
G	Stipa lettermani	42	50	28	32	.40	1.45	.75	1.61
Total for Annual Grasses		176	67	12	14	4.17	0.32	0.03	0.40
Total for Perennial Grasses		602	535	463	501	15.94	18.54	9.47	19.43
Total for Grasses		778	602	475	515	20.11	18.87	9.51	19.83
F	Achillea millefolium	$_{ab}$98	$_{a}$77	$_{ab}$95	$_{b}$115	1.71	.91	3.14	2.59
F	Agoseris glauca	5	-	2	-	.01	-	.00	-
F	Allium sp.	$_{a}$-	$_{b}$47	$_{c}$90	$_{d}$177	-	.33	.41	10.47
F	Alyssum alyssoides (a)	-	-	1	1	-	-	.00	.00
F	Artemisia ludoviciana	6	7	3	6	.30	.30	.03	.30
F	Aster chilensis	166	170	168	188	2.75	3.96	3.47	4.87
F	Astragalus beckwithii	-	-	4	-	-	-	.06	-

Type	Species	Nested Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
F	Astragalus cibarius	-	-	5	1	-	-	.18	.03
F	Astragalus convallarius	$_{a}$9	$_{ab}$16	$_{c}$47	$_{bc}$36	.04	.16	.49	.66
F	Balsamorhiza macrophylla	5	-	3	7	.03	.03	.03	.21
F	Calochortus nuttallii	-	3	2	2	-	.03	.00	.00
F	Cirsium undulatum	$_{ab}$19	$_{ab}$14	$_{a}$3	$_{b}$22	.49	.21	.18	.89
F	Collinsia parviflora (a)	$_{a}$3	$_{b}$27	$_{ab}$9	$_{a}$5	.01	.10	.02	.00
F	Collomia linearis (a)	$_{a}$-	$_{c}$48	$_{b}$12	$_{b}$28	-	.18	.02	.08
F	Comandra pallida	$_{a}$4	$_{b}$54	$_{b}$44	$_{b}$38	.07	.90	.68	.96
F	Cordylanthus ramosus (a)	$_{a}$1	21	73	$_{b}$71	.03	.72	1.70	1.50
F	Crepis acuminata	-	-	2	-	-	-	.03	-
F	Cryptantha sp.	1	-	-	-	.00	-	-	-
F	Eriogonum umbellatum	7	-	6	13	.06	-	.15	.21
F	Geranium viscosissimum	$_{a}$-	$_{ab}$2	$_{b}$13	$_{ab}$7	.03	.03	.19	.27
F	Hackelia patens	-	2	2	-	-	.00	.03	-
F	Helianthella uniflora	2	-	7	4	.06	-	.01	.30
F	Holosteum umbellatum (a)	-	-	5	1	-	-	.00	.00
F	Ipomopsis aggregata	2	-	1	13	.03	-	.03	.02
F	Lactuca serriola (a)	-	-	5	2	-	-	.03	.00
F	Lappula occidentalis (a)	3	-	-	-	.00	-	-	-
F	Lupinus argenteus	50	63	66	77	1.12	1.74	2.38	2.36
F	Microsteris gracilis (a)	$_{a}$10	$_{ab}$23	$_{b}$40	$_{ab}$21	.01	.05	.09	.08
F	Penstemon humilis	4	4	6	3	.01	.00	.06	.15
F	Penstemon sp.	-	-	-	4	-	-	-	.03
F	Phlox hoodii	-	-	2	-	-	-	.00	-
F	Phlox longifolia	5	-	-	-	.01	-	-	-
F	Polygonum douglasii (a)	14	20	6	1	.02	.03	.03	.00
F	Potentilla diversifolia	1	-	4	-	.15	-	.15	-
F	Senecio multilobatus	3	4	-	11	.00	.06	-	.04
F	Taraxacum officinale	3	7	6	3	.00	.01	.04	.00
F	Tragopogon dubius (a)	$_{ab}$19	$_{b}$28	$_{a}$8	$_{ab}$17	.20	.41	.10	.19
F	Veronica biloba (a)	12	13	15	14	.01	.04	.02	.05
F	Viguiera multiflora	3	-	-	-	.04	-	-	-
F	Viola sp.	-	-	-	8	-	-	-	.04
F	Wyethia amplexicaulis	$_{a}$3	$_{a}$3	$_{a}$-	$_{b}$20	.00	.00	-	.45
F	Zigadenus paniculatus	2	2	3	6	.00	.00	.06	.06
Total for Annual Forbs		62	180	174	161	0.31	1.55	2.04	1.93
Total for Perennial Forbs		398	475	584	761	6.96	8.72	11.84	24.95
Total for Forbs		460	655	758	922	7.27	10.27	13.89	26.88

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

BROWSE TRENDS--
Management unit 02, Study no: 39

Type	Species	Strip Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
B	Amelanchier alnifolia	12	7	6	12	.18	.97	1.08	1.72
B	Artemisia tridentata vaseyana	83	87	81	89	12.31	16.63	19.53	21.28
B	Chrysothamnus viscidiflorus viscidiflorus	72	54	65	50	2.93	2.71	3.27	3.14
B	Eriogonum heracleoides	2	1	0	1	-	-	-	-
B	Juniperus osteosperma	0	0	1	0	-	-	-	-
B	Mahonia repens	28	37	38	32	1.49	1.11	1.90	1.81
B	Opuntia sp.	0	0	0	1	-	-	-	-
B	Purshia tridentata	23	30	25	32	7.86	9.56	7.24	8.01
B	Symphoricarpos oreophilus	53	58	58	59	11.23	11.42	12.08	9.61
Total for Browse		273	274	274	276	36.02	42.42	45.13	45.57

CANOPY COVER, LINE INTERCEPT--
Management unit 02, Study no: 39

Species	Percent Cover	
	'06	'11
Amelanchier alnifolia	1.10	2.63
Artemisia tridentata vaseyana	26.31	21.63
Chrysothamnus viscidiflorus viscidiflorus	5.08	3.38
Eriogonum heracleoides	-	.05
Juniperus osteosperma	-	.06
Mahonia repens	1.10	.96
Purshia tridentata	9.68	13.96
Symphoricarpos oreophilus	17.29	23.21

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 02, Study no: 39

Species	Average leader growth (in)		
	'01	'06	'11
Amelanchier alnifolia	-	2.9	4.3
Artemisia tridentata vaseyana	1.6	1.9	2.4
Purshia tridentata	3.5	3.7	3.0

BASIC COVER--
Management unit 02, Study no: 39

Cover Type	Average Cover %			
	'96	'01	'06	'11
Vegetation	55.67	61.97	61.25	73.90
Rock	.50	.19	.09	.03
Pavement	1.85	1.89	.37	1.72
Litter	56.73	41.05	47.43	46.72
Bare Ground	14.36	15.38	22.48	8.72

SOIL ANALYSIS DATA --

Management unit 02, Study no: 39, Study Name: Pole Hollow Spring

Effective rooting depth (in)	pH	Clay			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
19.5	7.0	28.6	27.4	44.0	5.1	28.8	249.6	1.3

PELLET GROUP DATA--

Management unit 02, Study no: 39

Type	Quadrat Frequency				Days use per acre (ha)		
	'96	'01	'06	'11	'01	'06	'11
Rabbit	-	-	-	3	-	-	-
Elk	6	-	-	-	-	3 (7)	1 (2)
Deer	2	-	2	1	13 (32)	7 (17)	1 (2)
Cattle	2	-	1	-	2 (4)	8 (20)	-
Moose					-	1 (2)	-
Sage Grouse					-	9 Groups/acre	-

BROWSE CHARACTERISTICS--

Management unit 02, Study no: 39

		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									
96	**500**	8	92	-	-	24	4	4	33/33
01	**180**	33	67	-	20	22	0	0	44/44
06	**140**	0	100	-	-	71	29	0	36/39
11	**320**	13	88	-	-	25	0	13	37/41
Artemisia tridentata vaseyana									
96	**4020**	9	83	7	420	27	4	.99	25/34
01	**4040**	12	72	16	-	20	2	4	29/35
06	**3440**	1	86	13	180	36	3	11	28/39
11	**3200**	7	84	9	20	26	0	21	28/39
Chrysothamnus viscidiflorus viscidiflorus									
96	**3200**	4	89	8	-	.62	0	4	18/21
01	**2280**	1	99	0	-	0	0	0	14/16
06	**2400**	4	88	8	-	.83	0	13	14/17
11	**1720**	5	94	1	40	0	0	2	14/17
Eriogonum heracleoides									
96	**60**	0	100	-	-	0	0	0	7/19
01	**20**	0	100	-	-	100	0	0	6/9
06	**0**	0	0	-	-	0	0	0	-/-
11	**60**	100	0	-	-	0	0	0	19/4

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Juniperus osteosperma									
96	**0**	0	0	-	-	0	0	0	-/-
01	**0**	0	0	-	-	0	0	0	-/-
06	**20**	100	0	-	-	0	0	0	-/-
11	**0**	0	0	-	20	0	0	0	-/-
Mahonia repens									
96	**5640**	21	79	0	40	0	0	0	4/5
01	**6080**	0	100	0	-	0	0	0	3/4
06	**6900**	0	100	0	40	0	0	0	3/5
11	**3760**	11	89	1	-	0	0	0	3/5
Opuntia sp.									
96	**0**	0	0	-	-	0	0	0	-/-
01	**0**	0	0	-	-	0	0	0	-/-
06	**0**	0	0	-	-	0	0	0	-/-
11	**100**	0	100	-	-	0	0	0	-/-
Purshia tridentata									
96	**500**	12	88	0	-	40	0	0	35/62
01	**660**	6	73	21	-	30	9	3	34/47
06	**560**	7	82	11	20	29	50	4	32/61
11	**860**	21	67	12	20	37	7	12	34/53
Quercus gambelii									
96	**0**	0	0	-	-	0	0	0	-/-
01	**0**	0	0	-	-	0	0	0	36/43
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	-/-
Symphoricarpos oreophilus									
96	**2140**	12	85	3	100	.93	0	2	32/51
01	**1820**	3	89	8	-	0	0	2	32/51
06	**2280**	5	95	0	-	3	0	0	32/49
11	**2520**	4	96	0	20	2	0	0	36/53