

Trend Study 16B-1-07

Study site name: Long Ridge South.

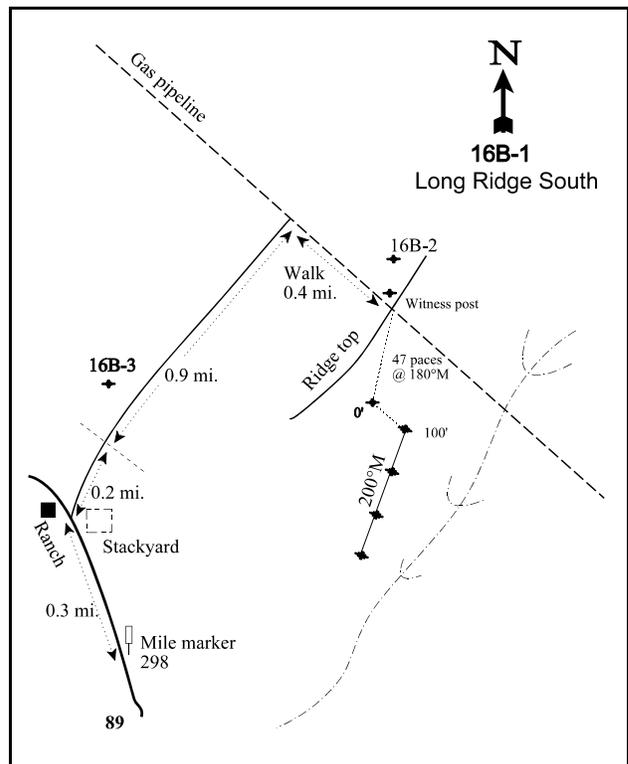
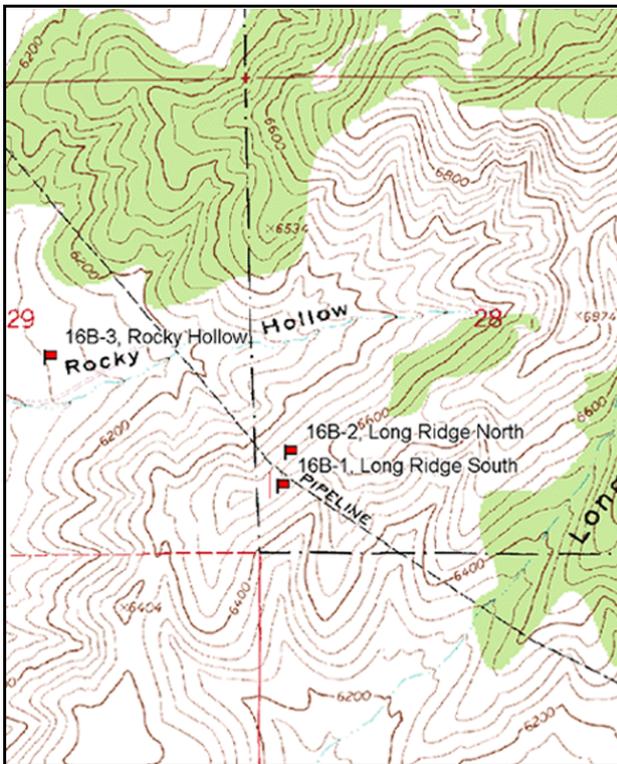
Vegetation type: Mountain Brush.

Compass bearing: frequency baseline 120 degrees magnetic (line 2-4 @ 200°M).

Frequency belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft).

LOCATION DESCRIPTION

Go north from Fairview on U.S. 89 for approximately 15 miles to a ranch house and stackyard (0.3 miles north of mile marker 298). Turn right, go through a DWR gate into Lassen Draw Property. Go 0.2 miles to another gate/fence. Continue up the road, past transect 16B-3, for about 0.9 miles to a pipeline intersection at the upper end of the valley. Walk 0.4 miles up the steep hill following the pipeline to the top of the first ridge. Stop here at an intersection/witness post. From the southwest corner of the intersection, walk 47 paces at a bearing of 180 degrees magnetic to the 0-foot baseline stake, marked by browse tag #9090.



Map name: Indianola

Diagrammatic Sketch

Township 11S, Range 4E, Section 28

GPS: NAD 83, UTM 12S 458213 E 4408848 N

## DISCUSSION

### Long Ridge South - Trend Study No. 16B-1

#### Study Information

This study, along with its companion study, Long Ridge North (16B-2), is located on Division of Wildlife Resources property north of Indianola [elevation: 6,480 feet (1,975 m), slope: 35%-40%, aspect: south]. Both studies are on mountain brush-covered hillsides that are important wintering areas for deer and elk. Thistle Creek is located about 1.5 miles (2.4 km) to the west of the study. An underground natural gas pipeline runs between this study and the Long Ridge North study. From the pellet group transect data, deer use was estimated at 106 days use/acre (261 ddu/ha) in 2002 and decreased to 49 days use/acre (121 ddu/ha) in 2007. Elk use was estimated at 17 days use/acre (41 edu/ha) in 2002 and increased to 29 days use/acre (73 edu/ha). Additionally, cattle use was estimated at 1 day use/acre (2 cdu/ha) in 2007.

#### Soil

The soil is relatively shallow and very rocky on the surface and throughout the profile. Soil texture is a sandy clay loam with a slightly acidic pH (6.2). The soil is very well drained, but does have moderate erosion and runoff hazard. Erosion is minimized due to the low bare soil cover (less than 5% since 1997) and high vegetation and litter cover. However, the majority of vegetation and litter cover are comprised of annual grasses. The erosion condition was classified as stable in 2002 and 2007.

#### Browse

This study supports a fair diversity of preferred browse species, including Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and antelope bitterbrush (*Purshia tridentata*). Serviceberry density decreased from 432 plants/acre (1,069 plants/ha) in 1989 to 260 plants/acre (644 plants/ha) by 2002 and 2007. Canopy cover of serviceberry increased from less than 1% in 2002 to 3% in 2007. Prior to 2007, the population was skewed towards mature and decadent plants. The age class distribution shifted in 2007 to a more normal distribution of young, mature, and decadent plants. Decadence has fluctuated during all sample years from a low of 15% in 1989 and 2002, to a high of 47% in 1997. In 2007, decadent plants comprised 23% of the population. The percent of serviceberry plants exhibiting poor vigor was low from 1989 through 2002, but increased to 23% in 2007. Serviceberry were also observed to have smaller live crowns in 2007, although there was dead crown material remaining from previous years. This dead material seems to offer some protection from browsing. Annual leader growth increased from 1.5 inches (3.8 cm) in 2002 to 2.5 inches (6.3 cm) in 2007. Browse use has been to moderate-heavy since 1989, though there was a shift in 2007 to more moderate-light use.

The sampled big sagebrush was classified as mountain big sagebrush. However, some plants exhibit characteristics of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and it appears that the two species have hybridized. Canopy cover was estimated at 2% in 2007. Density was estimated at approximately 800 plants/acre (1,980 plants/ha) in 1989, and has steadily decreased to 480 plants/acre (1,190 plants/ha) in 2007. The largest decrease in density occurred between 2002 and 2007. The proportion of the population that is decadent has steadily increased from 6% in 1997 to 42% in 2007. An increasing percentage of the population has been classified as dying since 1997. Plants with poor vigor increased from 4% in 1989 to 25% in 2007, and the largest increase occurred between 2002 and 2007. The cause for the decrease in plant vigor may be drought stress, understory competition with cheatgrass (*Bromus tectorum*), or damage from the sagebrush defoliator moth (*Aroga websteri*). In 2007, 17% of the sampled sagebrush plants were infested with this moth. Annual growth on sagebrush averaged 1.4 inches (3.5 cm) in 2002 and increased to 2.0 inches (5 cm) in 2007. The plants with moderate-heavy browse use has ranged from a low of 40% of the population in 1997 to 71% in 2007. The individuals displaying the heaviest use are those with the characteristics of mountain big sagebrush.

Canopy cover of antelope bitterbrush was 1% in 2007. It occurs at a low density and has decreased from an estimated 232 plants/acre (574 plants/ha) in 1989 to 120 plants per acre (298 plants/ha) in 2007. Seedling and young plants have never been sampled, which may explain the continually decreasing density. Decadence has fluctuated and was lowest at 27% in 1997 and highest at 86% in 2002. On average, 34% of the bitterbrush have been classified as dying. Bitterbrush displaying poor vigor increased from 27% in 1997 to 43% in 2002, then decreased to 33% in 2007. Mature plants exhibit a tall growth-form that has averaged approximately 4 feet (1.2 m) in height since 1997. Browse use was very heavy in both 1997 and 2002 and was less heavy in 2007.

Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) provided about 44% of the canopy cover in 2007. It had an estimated density of 2,460 plants/acre (6,090 plants/ha) in 1997, and had decreased to 1,820 plants/acre (4,505 plants/ha) by 2007.

### Herbaceous Understory

The herbaceous understory is abundant, but dominated by cheatgrass. Since 1997, cheatgrass has comprised an average of 66% of the total herbaceous cover and has had a quadrat frequency of 100%. Cheatgrass cover increased from approximately 25% in 1997 and 2002 to 33% in 2007. The only common perennial grass is bluebunch wheatgrass (*Agropyron spicatum*). Most of the bluebunch wheatgrass individuals were found either underneath or in close proximity to shrubs and had a moderate amount of seed production. Other perennial species have been sampled, but in low frequencies.

The forb composition is diverse, yet nearly half of the forb cover comes from annual species. Since 1997, both perennial and annual species have comprised an average 3% of the total ground cover. Pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*) are the most common annual species. The most common perennial species include cudweed sagewort (*Artemisia ludoviciana*), spreading fleabane (*Erigeron divergens*), redroot eriogonum (*Eriogonum racemosum*) and scarlet globemallow (*Sphaeralcea coccinea*).

### 1997 TREND ASSESSMENT

The browse trend is slightly down. Mountain big sagebrush density declined by 12%, but decadency decreased from 25% to 6% of the population. Serviceberry declined in density and increased in decadence. Bitterbrush was very heavily utilized and had reduced vigor on nearly one-third of the population. Reproduction and recruitment for the preferred browse species were either nonexistent or had decreased. The grass trend is slightly up. The sum of nested frequency of perennial grasses increased 23%. Although bluebunch wheatgrass increased significantly in nested frequency, cheatgrass dominated the understory. Approximately 61% of the herbaceous understory cover was cheatgrass. The forb trend is up. The sum of nested frequency of perennial forbs increased 74%. There was an increase in desirable forbs, including pale agoseris (*Agoseris glauca*), Beckwith milkvetch (*Astragalus beckwithii*), and scarlet globemallow (*Sphaeralcea coccinea*). There was also an abundance of weedy annual forbs. The Desirable Components Index (DCI) score was very poor due to the abundance of annual grasses, moderate preferred browse cover, and elevated shrub decadence.

winter range condition (DCI) - very poor (27) Mid-level potential scale  
browse - slightly down (-1)      grass - slightly up (+1)      forb -up (+2)

### 2002 TREND ASSESSMENT

The browse trend is slightly down. Utah serviceberry and antelope bitterbrush density decreased 24% and 36%, respectively. Mountain big sagebrush density remained stable. Recruitment was poor or nonexistent for all three preferred browse species, and was likely the result of cheatgrass competition and drought. Decadency and poor vigor increased for both bitterbrush and sagebrush. Trend for the grasses is slightly down. The sum of nested frequency of perennial grasses, specifically bluebunch wheatgrass, changed little. In addition, the nested frequency for cheatgrass increased significantly and Japanese chess (*Bromus japonicus*) was measured

on the study for the first time. The forb trend is down. The sum of nested frequency of perennial forbs decreased 53%, and the number of species decreased from 32 to 18. The DCI score remained very poor.

winter range condition (DCI) - very poor (16) Mid-level potential scale  
browse - slightly down (-1)      grass - slightly down (-1)      forb - down (-2)

**2007 TREND ASSESSMENT**

The browse trend is slightly down. Average cover declined in all preferred browse species. Plant density declined for mountain big sagebrush and remained nearly stable for antelope bitterbrush and Utah serviceberry. The percentage of plants exhibiting poor vigor increased for sagebrush and serviceberry, but decreased for bitterbrush. Competition from cheatgrass and dry conditions are likely to have increased the susceptibility of sagebrush to the sagebrush defoliator moth. The grass trend is down. The sum of nested frequency of perennial grasses decreased by 20%, including a significant decrease in the nested frequency of bluebunch wheatgrass. Cheatgrass cover increased to 32%, while that of bluebunch wheatgrass decreased to 6%. The forb trend is up. The sum of nested frequency of perennial forbs increased 59%, and account for more cover than annual forbs. Nested frequency of storksbill also increased significantly, and may be out-competing and preventing the establishment of native species (Kimball and Schiffman 2003). The DCI score continued to be very poor.

winter range condition (DCI) - very poor (16) Mid-level potential scale  
browse - slightly down (-1)      grass - down (-2)      forb - up (+2)

**HERBACEOUS TRENDS --**  
Management unit 16B, Study no: 1

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	a138	bc197	c226	ab182	5.51	8.96	5.85
G	Bromus brizaeformis (a)	-	-	-	4	-	-	.03
G	Bromus japonicus (a)	-	-	b62	a8	-	.27	.09
G	Bromus tectorum (a)	-	a347	b377	b379	23.89	24.84	33.20
G	Carex sp.	4	-	-	-	-	-	-
G	Poa fendleriana	b22	ab6	a1	a2	.09	.00	.00
G	Poa secunda	a4	a3	a5	a2	.03	.01	.03
G	Sitanion hystrix	-	4	-	-	.00	-	-
G	Sporobolus cryptandrus	-	1	-	-	.03	-	-
G	Stipa comata	a5	a1	-	-	.03	-	-
Total for Annual Grasses		0	347	439	391	23.89	25.11	33.34
Total for Perennial Grasses		173	212	232	186	5.70	8.98	5.89
Total for Grasses		173	559	671	577	29.60	34.10	39.23
F	Agoseris glauca	-	a16	a8	-	.12	.02	-
F	Alyssum alyssoides (a)	-	a171	b236	b207	.88	1.32	1.05
F	Antennaria rosea	-	-	-	3	-	-	.00
F	Artemisia ludoviciana	b74	a34	a44	a31	.92	.36	.59

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
F	<i>Astragalus beckwithii</i>	-	<sub>a</sub> 24	<sub>a</sub> 9	-	.38	.08	-
F	<i>Astragalus convallarius</i>	-	-	-	4	-	-	.06
F	<i>Astragalus utahensis</i>	-	5	-	-	.04	-	-
F	<i>Balsamorhiza sagittata</i>	<sub>a</sub> 15	<sub>a</sub> 4	<sub>a</sub> 6	<sub>a</sub> 7	.04	.31	.21
F	<i>Camelina microcarpa</i> (a)	-	<sub>b</sub> 52	<sub>b</sub> 42	<sub>a</sub> 6	1.78	.15	.03
F	<i>Calochortus nuttallii</i>	<sub>a</sub> 5	<sub>a</sub> 1	<sub>a</sub> 1	-	.01	.00	-
F	<i>Cirsium</i> sp.	<sub>a</sub> 6	<sub>a</sub> 5	-	-	.06	-	-
F	<i>Collomia linearis</i> (a)	-	<sub>b</sub> 40	<sub>a</sub> 2	-	.26	.00	-
F	<i>Collinsia parviflora</i> (a)	-	<sub>a</sub> 8	<sub>a</sub> 6	<sub>a</sub> 3	.04	.01	.00
F	<i>Crepis acuminata</i>	-	<sub>a</sub> 6	<sub>a</sub> 2	-	.02	.00	-
F	<i>Cryptantha</i> sp.	-	<sub>a</sub> 2	-	<sub>a</sub> 5	.03	-	.01
F	<i>Cymopterus</i> sp.	-	2	-	-	.00	-	-
F	<i>Cynoglossum officinale</i>	-	2	-	-	.03	-	-
F	<i>Descurainia pinnata</i> (a)	-	<sub>a</sub> 7	<sub>a</sub> 2	-	.04	.00	-
F	<i>Draba</i> sp. (a)	-	-	-	4	-	-	.01
F	<i>Epilobium brachycarpum</i> (a)	-	6	-	-	.02	-	-
F	<i>Erodium cicutarium</i> (a)	-	<sub>b</sub> 146	<sub>a</sub> 76	<sub>b</sub> 151	1.39	1.03	1.94
F	<i>Erigeron divergens</i>	-	<sub>b</sub> 75	-	<sub>a</sub> 47	1.75	-	.96
F	<i>Eriogonum racemosum</i>	<sub>a</sub> 10	<sub>a</sub> 6	<sub>a</sub> 4	<sub>b</sub> 54	.03	.01	1.30
F	<i>Haplopappus acaulis</i>	-	4	-	-	.30	-	-
F	<i>Lappula occidentalis</i> (a)	-	6	-	-	.01	-	-
F	<i>Lactuca serriola</i>	-	4	-	-	.02	-	-
F	<i>Lithospermum ruderale</i>	<sub>a</sub> 10	<sub>a</sub> 11	<sub>a</sub> 1	-	.22	.00	-
F	<i>Lomatium dissectum</i>	<sub>a</sub> 4	<sub>a</sub> -	-	-	.00	-	-
F	<i>Microsteris gracilis</i> (a)	-	<sub>a</sub> 1	<sub>a</sub> 6	-	.00	.01	-
F	<i>Phlox longifolia</i>	<sub>a</sub> 6	<sub>a</sub> 4	<sub>a</sub> 4	<sub>a</sub> 4	.01	.01	.04
F	<i>Polygonum douglasii</i> (a)	-	3	-	-	.01	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	3	-	-	.00	-	-
F	<i>Sisymbrium altissimum</i> (a)	-	<sub>a</sub> 1	-	<sub>a</sub> 6	.00	-	.01
F	<i>Sphaeralcea coccinea</i>	<sub>a</sub> 14	<sub>b</sub> 42	<sub>b</sub> 38	<sub>ab</sub> 31	.79	.25	.46
F	<i>Tragopogon dubius</i>	-	2	-	-	.00	-	-
F	<i>Viguiera multiflora</i>	-	1	-	-	.01	-	-
Total for Annual Forbs		0	444	370	377	4.46	2.53	3.06
Total for Perennial Forbs		144	250	117	186	4.84	1.07	3.66
Total for Forbs		144	694	487	563	9.30	3.61	6.73

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

BROWSE TRENDS --

Management unit 16B, Study no: 1

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier utahensis	16	12	13	4.17	2.87	1.86
B	Artemisia tridentata vaseyana	27	23	20	1.82	2.09	.95
B	Chrysothamnus nauseosus albicaulis	1	2	1	-	.00	.38
B	Chrysothamnus viscidiflorus viscidiflorus	46	53	44	7.42	5.16	2.07
B	Gutierrezia sarothrae	12	2	5	.51	-	.00
B	Opuntia sp.	16	16	23	1.27	.86	1.66
B	Purshia tridentata	11	7	6	3.71	2.17	1.22
B	Tetradymia canescens	4	4	4	.03	.31	.21
Total for Browse		133	119	116	18.95	13.49	8.36

CANOPY COVER, LINE INTERCEPT --

Management unit 16B, Study no: 1

Species	Percent Cover	
	'02	'07
Amelanchier utahensis	.13	2.58
Artemisia tridentata vaseyana	-	2.33
Chrysothamnus nauseosus albicaulis	-	.13
Chrysothamnus viscidiflorus viscidiflorus	-	6.13
Opuntia sp.	-	1.76
Purshia tridentata	-	.93
Tetradymia canescens	-	.18

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 16B, Study no: 1

Species	Average leader growth (in)	
	'02	'07
Amelanchier utahensis	1.5	2.5
Artemisia tridentata vaseyana	1.4	2.0

BASIC COVER --

Management unit 16B, Study no: 1

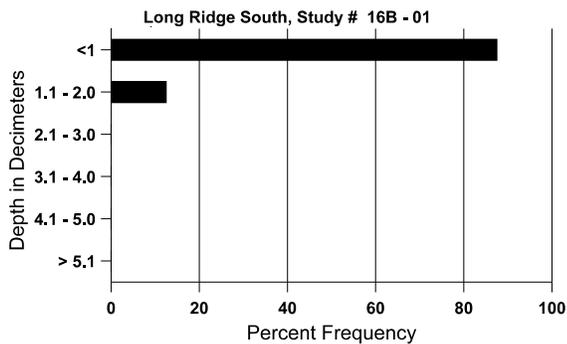
Cover Type	Average Cover %			
	'89	'97	'02	'07
Vegetation	6.75	49.93	54.82	52.74
Rock	18.00	15.18	13.60	13.30
Pavement	14.50	2.49	3.69	.66
Litter	52.00	52.19	40.37	46.25
Cryptogams	.25	.40	.03	.05
Bare Ground	8.50	2.52	4.48	2.05

SOIL ANALYSIS DATA --

Herd Unit 16B, Study no: 01, Long Ridge South

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy Clay Loam			%OM	PPM P	PPM K	dS/m
			%sand	%silt	%clay				
10.2	55.6 (13.1)	6.2	60.7	18.7	20.6	2.7	21.3	217.6	.5

### Stoniness Index



PELLET GROUP DATA --

Management unit 16B, Study no: 1

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	-	3	11
Elk	19	1	17
Deer	46	30	38
Cattle	-	-	-

Days use per acre (ha)	
'02	'07
-	-
17 (41)	29 (73)
106 (261)	49 (121)
-	1 (2)

BROWSE CHARACTERISTICS --  
Management unit 16B, Study no: 1

		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)
<b>Amelanchier utahensis</b>												
89	<b>432</b>	66	-	366	66	-	0	92	15	-	8	89/45
97	<b>340</b>	-	20	160	160	80	18	65	47	6	6	52/46
02	<b>260</b>	-	-	220	40	40	8	92	15	8	8	61/53
07	<b>260</b>	-	60	140	60	100	46	23	23	23	23	45/44
<b>Artemisia tridentata vaseyana</b>												
89	<b>799</b>	-	466	133	200	-	46	17	25	4	4	34/52
97	<b>700</b>	-	200	460	40	60	29	11	6	3	3	24/31
02	<b>680</b>	100	20	560	100	80	24	38	15	9	9	23/38
07	<b>480</b>	-	20	260	200	220	42	29	42	25	25	25/34
<b>Chrysothamnus nauseosus albicaulis</b>												
89	<b>33</b>	-	-	33	-	-	0	0	0	-	0	22/19
97	<b>20</b>	-	-	20	-	20	0	0	0	-	0	26/32
02	<b>40</b>	-	-	20	20	-	100	0	50	-	0	24/24
07	<b>20</b>	-	-	20	-	-	0	0	0	-	0	31/36
<b>Chrysothamnus viscidiflorus viscidiflorus</b>												
89	<b>1199</b>	-	-	1033	166	-	0	0	14	3	81	12/20
97	<b>2460</b>	-	260	2200	-	-	.81	.81	0	-	0	13/24
02	<b>2240</b>	-	-	1900	340	20	0	0	15	3	3	11/21
07	<b>1820</b>	-	100	1360	360	20	3	3	20	1	4	12/20
<b>Echinocereus sp.</b>												
89	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
02	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
07	<b>0</b>	-	-	-	-	-	0	0	-	-	0	7/16
<b>Ephedra nevadensis</b>												
89	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
97	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
02	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
07	<b>0</b>	-	-	-	-	-	0	0	-	-	0	21/26
<b>Gutierrezia sarothrae</b>												
89	<b>2066</b>	-	-	1866	200	-	0	0	10	.96	2	11/8
97	<b>480</b>	-	-	480	-	20	0	0	0	-	0	10/11
02	<b>40</b>	-	-	20	20	160	0	0	50	50	50	4/7
07	<b>100</b>	-	20	80	-	-	0	0	0	-	0	10/13

		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>Opuntia sp.</i>												
89	<b>799</b>	-	33	733	33	-	0	0	4	-	4	6/14
97	<b>440</b>	-	-	420	20	20	0	0	5	-	0	7/18
02	<b>520</b>	-	20	500	-	-	0	0	0	-	0	6/20
07	<b>1700</b>	-	20	1680	-	-	0	0	0	-	0	7/21
<i>Pediocactus simpsonii</i>												
89	<b>33</b>	-	-	33	-	-	0	0	-	-	0	4/6
97	<b>0</b>	-	-	-	-	-	0	0	-	-	0	6/13
02	<b>0</b>	-	-	-	-	-	0	0	-	-	0	6/15
07	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
<i>Purshia tridentata</i>												
89	<b>232</b>	-	-	166	66	-	57	43	28	-	0	26/43
97	<b>220</b>	-	-	160	60	20	9	91	27	27	27	42/63
02	<b>140</b>	-	-	20	120	20	0	100	86	43	43	52/65
07	<b>120</b>	-	-	60	60	60	33	33	50	33	33	46/53
<i>Tetradymia canescens</i>												
89	<b>166</b>	-	-	-	166	-	100	0	100	100	100	-/-
97	<b>80</b>	-	20	60	-	-	50	0	0	-	0	12/24
02	<b>120</b>	20	-	80	40	20	0	0	33	33	33	10/23
07	<b>80</b>	3160	20	60	-	-	0	0	0	-	0	11/24