

Trend Study 17-40-07

Study site name: Long Hollow .

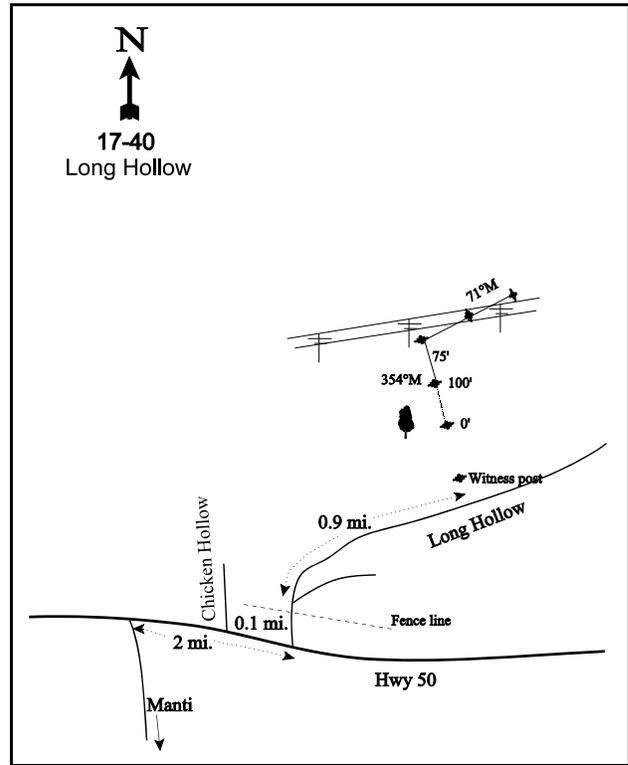
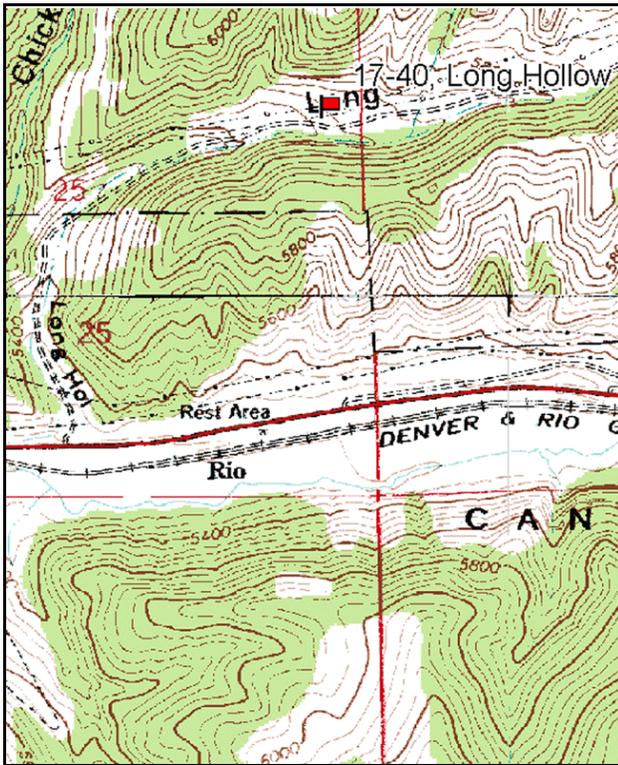
Vegetation type: Big Sagebrush-Grass .

Compass bearing: frequency baseline 354 degrees magnetic (line 3-4 @ 71°M).

Frequency belt placement: line 1 (11 & 95 ft), line 2 [only 75 ft. long] (34 ft), line 3 (59 ft), line 4 (71 ft).
Rebar: belt 2 on 1ft.

LOCATION DESCRIPTION

Beginning at the intersection of Highway 6 and Long Hollow Road, proceed northerly up Long Hollow for 0.10 miles to a fork. At the fork, stay to the left and proceed an additional 0.90 miles up Long Hollow, to a green steel "T" fencepost on the left side of the road. From the stake, the 0-foot marker of the baseline is 15 feet to the north, near a juniper. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height. A red browse tag, number 3946, is attached to the 0-foot baseline stake. High tension power lines run above the study site.



Map Name: Billies Mountain

Diagrammatic Sketch

Township 9S, Range 5E, Section 25

GPS: NAD 83, UTM 12T 463842 E 4428342 N

DISCUSSION

Long Hollow - Trend Study No. 17-40

Study Information

This study samples critical deer and elk winter range located in Long Hollow, a narrow canyon draining directly into the Spanish Fork River [elevation: 5,760 feet (1,755 m), slope: 5-10%, aspect: south]. The nearest perennial source of water is Soldier Creek and is approximately 1 mile (1.6 km) to the south. A portion of the baseline passes beneath a high-tension powerline. Long Hollow has been used by deer and elk in the winter, and has been grazed by cattle in the summer. From the pellet group transect, there were 87 deer days use/acre (215 ddu/ha) in 2002 and 31 deer days use/acre (76 ddu/ha) in 2007. Elk use was estimated at 23 days use/acre in 2002, which increased to 49 days use/acre (121 edu/ha) in 2007. Cattle use was estimated at 10 days use/acre (25 cdu/ha) in 2002 and 6 days use/acre (14 cdu/ha) in 2007. Three winter-killed deer were found on the site in 1983.

Soil

The soil was deposited as alluvium and colluvium, and is coarse and well-drained. The soil texture is a sandy clay loam with a neutral soil reaction (pH 7.2). Cobblestones and gravel are distributed throughout the soil profile and on the surface. Rock cover is relatively high, and has averaged 15% of the total ground cover since 1997. Conversely, bare ground cover has been less than 3% since 1997. The study is traversed by dormant gullies and flow patterns, which resulted in a slight erosion condition classification in 2002 and 2007.

Browse

The preferred browse species that are present include basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), and fourwing saltbush (*Atriplex canescens*). In 1983 and 1989, all sagebrush was classified as mountain big sagebrush. In subsequent sample years, sagebrush were split into the two subspecies. Mountain sagebrush has continued to be the more abundant of the two subspecies. Mountain big sagebrush canopy cover was 4% in 2007. Since the two subspecies were differentiated in 1997, the density of mountain big sagebrush was estimated at 880 plants/acre (2,180 plants/ha) in 1997, 1,240 plants/acre (3,070 plants/ha) in 2002, and 940 plants/acre (2,327 plants/ha) in 2007. There have been few to no seedlings, and since 1997 young plants have comprised 2% to 13% of the population. Decadence was low in 1997 (7%), increased in 2002 (47%), and decreased in 2007 (28%). The density of dead plants has ranged from 100 plants/acre (247 plants/ha) to 260 plants/acre (643 plants/ha). Vigor has been good, except in 2002 and 2007, when 15% and 32% of the population had poor vigor. The average annual leader growth was 2.4 inches (6.1 cm) in 2002 and 1.7 inches (4.4 cm) in 2007. Browse use has been predominantly light and light-moderate.

The density of basin big sagebrush has decreased from 460 plants/acre (1,140 plants/ha) in 1997 to 40 plants/acre (99 plants/ha) in 2007. No seedling plants have been sampled. Young plants were only sampled in 1997, and comprised 9% of the population. Decadent plants were only sampled in 1997 and 2002, and comprised 17% and 100% of the population, respectively. The density of dead plants has steadily decreased from 140 plants/acre (347 plants/ha) in 1997 to 40 plants/acre (99 plants/ha) in 2007. Plants with poor vigor have comprised between 9% and 89% of the population. All of the plants with poor vigor were classified as dying in 1997 and 2002. Browse use has been light to light-moderate.

Fourwing saltbush was first sampled in 1997, and the density has ranged from 140 plants/acre (347 plants/ha) to 280 plants/acre (693 plants/ha). No seedlings have been sampled, and young plants were only sampled in 1997. Decadence has ranged from 0% to 50% of the population. Plant vigor has been good, except for in 2002, when 21% of the population was classified as dying. Browse use has varied from light-moderate to heavy. Other species that are present include pricklypear cactus (*Opuntia* sp.), broom snakeweed (*Gutierrezia sarothrae*), and white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*). There was some

moderate browse use on rabbitbrush in 1997 and 2002.

Herbaceous Understory

The herbaceous understory is dominated by perennial grass and forb species. Perennial grass has increased from 23% in 1997 to 32% in 2002, and 36% in 2007. The dominant grass species has been bulbous bluegrass (*Poa bulbosa*), which has comprised an average 62% of the perennial grass cover since 1997. Bulbous bluegrass has a phenology that is similar to annual grasses (Stewart and Hull 1949), and may be limiting the establishment of other species. The remaining grass cover is largely comprised of crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Agropyron intermedium*), bluebunch wheatgrass (*Agropyron spicatum*), and sand dropseed (*Sporobolus cryptandrus*). Crested and intermediate wheatgrass were seeded around the powerline towers after the powerline was constructed. Cheatgrass (*Bromus tectorum*) cover was 8% in 1997, and decreased to less than 1% in 2002 and 2007.

On average, the forb component has accounted for 10% of the total ground cover since 1997. Cudweed sagewort (*Artemisia ludoviciana*), whitetop (*Cardaria draba*), spotted stickseed (*Hackelia patens*), and scarlet globemallow (*Sphaeralcea coccinea*) have been the dominant perennial species. With the exception of scarlet globemallow, these species have a low forage value. Two noxious weed species have been sampled: whitetop and houndstongue (*Cynoglossum officinale*).

1989 TREND ASSESSMENT

The browse trend is stable. The combined density of basin and mountain big sagebrush increased 3%. The density of seedling plants increased from 0 plants/acre to 533 plants/acre (1,320 plants/ha). Young plants decreased from 51% to 41% of the population. Decadence increased from 12% to 18%, and plants with poor vigor increased from 0% to 3% of the population. Browse use remained light. The grass trend is up. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses increased 71%. There were significant increases in the nested frequencies of crested wheatgrass and Sandberg bluegrass (*Poa secunda*). The forb trend is stable. There was a significant decrease in the nested frequency of yellow salsify (*Tragopogon dubius*), and a significant increase in that of spotted stickseed.

browse - stable (0)

grass - up (+2)

forb - stable (0)

1997 TREND ASSESSMENT

The browse trend is stable. As mentioned, a distinction was made between basin and mountain big sagebrush beginning in 1997. Although the collective density of both species decreased 72%, the decrease was attributed to the larger area sampled. Trend was determined from other parameters. For example, fewer mountain big sagebrush seedling plants were sampled, and young plants decreased to 9% of the population. However, decadence also decreased and comprised only 7% of the population. Browse use on mountain big sagebrush shifted from light to light-moderate. The basin big sagebrush population was found to consist predominantly of mature, healthy, lightly browsed plants. Fourwing saltbush was also sampled for the first time. The saltbush population was mostly mature, healthy, and heavily browsed. The grass trend is slightly down. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses decreased 8%. There were significant decreases in the nested frequencies of crested wheatgrass and Sandberg bluegrass. Bulbous bluegrass nested frequency increased significantly, and quadrat frequency increased from 8% to 66%. Cheatgrass was also found in 86% of the quadrats, and comprised 8% cover. The forb trend is slightly up. Excluding noxious weeds, the sum of nested frequency of perennial forbs increased 29%. There were significant increases in the nested frequencies of segolily (*Calochortus nuttallii*), spotted stickseed, scarlet globemallow, and yellow salsify. Additionally, the number of perennial species increased from 14 to 19. Conversely, whitetop and houndstongue were sampled for the first time. The Desirable Components Index (DCI) score was poor due to moderate browse cover, low browse recruitment, high annual grass cover, and the presence of two noxious weed species.

winter range condition (DCI) - poor (48) Mid-level potential scale
browse - stable (0) grass - slightly down (-1) forb - slightly up (+1)

2002 TREND ASSESSMENT

The browse trend is down. The density of mountain big sagebrush increased 41%. Although no seedlings were sampled, young plants increased to 13% of the population. However, decadence increased to 47%, the dying portion of population increased to 15%, and the density of dead plants increased from 100 plants/acre (247 plants/ha) to 260 plants/acre (642 plants/ha). Browse use on mountain big sagebrush remained light-moderate. The basin big sagebrush density decreased 61%. All basin big sagebrush were decadent, and those classified as dying increased to 89% of the population. The density of fourwing saltbush increased 40%. Half of the population was decadent, and 21% of the population was classified as dying. Browse use on saltbush shifted to light-moderate. The increases in decadent and dying browse plants was attributed to drought conditions (Utah Climate Summaries 2007). The grass trend is up. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses increased 32%. Although there was a significant increase in the nested frequency of bulbous bluegrass, there was a significant decrease in that of cheatgrass. Bulbous bluegrass cover increased from 14% to 23%, while cheatgrass cover decreased from 8% to 1%. There was also a significant increase in the nested frequency of Sandberg bluegrass. The forb trend is down. Excluding whitetop, the sum of nested frequency of perennial forbs decreased 37%. There were significant decreases in the nested frequencies of segolily, spotted stickseed, and yellow salsify. There was also a significant decrease in the nested frequency of storksbill (*Erodium cicutarium*). Houndstongue was not sampled. The DCI score remained poor.

winter range condition (DCI) - poor (42) Mid-level potential scale
browse - down (-2) grass - up (+2) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is down. The density of mountain big sagebrush decreased 24%. Very few seedlings were sampled, and young plants decreased to 2% of the population. Decadence decreased to 28% of the population, and the proportion of plants exhibiting poor vigor increased to 32%. Browse use on mountain big sagebrush remained light-moderate. The density of basin big sagebrush decreased 78%. All of the remaining plants were mature, though half had poor vigor. The average crown width of basin big sagebrush increased 32 inches (81 cm). The density of fourwing saltbush decreased 50%. No young plants were sampled, but decadence decreased to 14%. No saltbush plants had poor vigor, and the average height and crown measurements increased 22 inches (56 cm) and 44 inches (112 cm), respectively. The grass trend is stable. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses increased 2%. Despite the stable frequency, perennial grass cover increased from 9% to 17% of the total ground cover. There were significant increases in the nested frequencies of intermediate and bluebunch wheatgrasses. The forb trend is slightly up. Excluding whitetop, the sum of nested frequency of perennial forbs increased 7%. Whitetop nested frequency decreased significantly, and was only sampled in 1% of the quadrats. There was also a significant increase in the nested frequency of cudweed sagewort. The DCI score improved to fair due to decreased browse decadence and increased perennial grass cover

winter range condition (DCI) - fair (57) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 17 , Study no: 40

T y p e	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	a27	b50	a26	ab35	ab47	2.00	1.41	3.16
G	Agropyron intermedium	-	-	a36	a50	b74	2.80	3.67	9.74
G	Agropyron spicatum	a18	ab21	ab35	b36	c67	1.68	2.25	2.74
G	Bromus japonicus (a)	-	-	-	a6	a11	-	.04	.02
G	Bromus tectorum (a)	-	-	b285	a96	a129	7.91	.67	.76
G	Festuca sp.	-	-	12	-	-	.02	-	-
G	Oryzopsis hymenoides	-	a3	-	-	a1	-	-	.03
G	Poa bulbosa	a6	a16	b229	c306	c293	14.18	23.46	19.14
G	Poa pratensis	a1	a2	ab16	b21	-	.25	.11	-
G	Poa secunda	a1	b40	a6	b35	ab20	.01	.39	.50
G	Sitanion hystrix	a3	a8	-	a3	a6	-	.15	.06
G	Sporobolus cryptandrus	ab76	b91	ab67	ab81	a52	1.89	.87	1.00
Total for Annual Grasses		0	0	285	102	140	7.91	0.71	0.78
Total for Perennial Grasses		132	231	427	567	560	22.87	32.32	36.38
Total for Grasses		132	231	712	669	700	30.79	33.04	37.18
F	Alyssum alyssoides (a)	-	-	b69	-	a1	.22	-	.00
F	Allium sp.	-	-	b11	-	a3	.03	-	.00
F	Arabis sp.	-	a1	-	a2	a1	-	.00	.00
F	Artemisia dracunculus	a7	a5	a3	a4	a3	.00	.01	.15
F	Artemisia ludoviciana	ab101	b140	a86	a76	b123	2.83	2.37	4.36
F	Aster sp.	-	a8	-	-	a1	-	-	.03
F	Astragalus sp.	-	-	4	-	-	.01	-	-
F	Astragalus utahensis	a4	a6	a3	-	a1	.15	-	.00
F	Cardaria draba	-	-	ab24	b31	a3	2.36	1.01	.03
F	Castilleja linariaefolia	-	-	a1	a1	-	.03	.00	-
F	Calochortus nuttallii	ab10	a1	b18	a1	ab7	.06	.00	.63
F	Cirsium sp.	a14	a26	a10	a15	a5	.46	.50	.12
F	Collinsia parviflora (a)	-	-	-	-	4	-	-	.00
F	Cymopterus sp.	-	-	a2	a2	a2	.00	.01	.03
F	Cynoglossum officinale	-	-	a1	-	a-	.15	-	.00
F	Descurainia pinnata (a)	-	-	-	-	2	-	-	.00
F	Draba sp. (a)	-	-	2	-	-	.00	-	-
F	Epilobium brachycarpum (a)	-	-	1	-	-	.00	-	-
F	Erodium cicutarium (a)	-	-	b64	a7	a15	.63	.04	.13
F	Erigeron divergens	-	-	a16	a2	a13	.37	.01	.39

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	<i>Eriogonum racemosum</i>	_a 3	_a 5	_a 2	_a 3	_a 4	.03	.04	.16
F	<i>Hackelia patens</i>	_a 20	_b 51	_c 105	_{ab} 44	_a 27	2.51	.77	1.27
F	<i>Helianthus annuus</i> (a)	-	_b 26	_a 2	_a 1	-	.00	.00	-
F	<i>Lactuca pulchella</i>	-	_{ab} 8	_b 20	-	_a 6	.07	-	.01
F	<i>Lactuca serriola</i>	50	-	-	-	-	-	-	-
F	<i>Lithospermum ruderales</i>	-	_b 4	_a -	_a -	_a -	.03	.03	.15
F	<i>Medicago sativa</i>	-	-	_a 2	_a 5	_a 5	.45	.79	.44
F	<i>Oenothera</i> sp.	-	-	-	-	-	.00	-	-
F	<i>Phlox longifolia</i>	-	_b 15	_{ab} 9	_{ab} 8	_a 1	.02	.02	.00
F	<i>Polygonum douglasii</i> (a)	-	-	9	-	-	.01	-	-
F	<i>Ranunculus testiculatus</i> (a)	-	-	_a 5	_a 3	-	.03	.00	-
F	<i>Sisymbrium altissimum</i> (a)	-	-	3	-	-	.03	-	-
F	<i>Solidago</i> sp.	16	-	-	-	-	-	-	-
F	<i>Sphaeralcea coccinea</i>	_a 44	_{ab} 69	_c 106	_c 109	_{bc} 89	3.06	2.75	.74
F	<i>Tragopogon dubius</i>	_c 68	_a 1	_b 40	_a 3	_a 3	.36	.15	.00
F	<i>Vicia americana</i>	-	-	-	_a 1	_a 1	-	.00	.03
F	<i>Zigadenus paniculatus</i>	1	-	-	-	-	-	-	-
Total for Annual Forbs		0	26	155	11	22	0.95	0.04	0.14
Total for Perennial Forbs		338	340	463	307	298	13.04	8.50	8.61
Total for Forbs		338	366	618	318	320	14.00	8.55	8.76

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

BROWSE TRENDS --

Management unit 17 , Study no: 40

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata tridentata	15	6	2	3.11	1.21	1.00
B	Artemisia tridentata vaseyana	25	34	31	4.18	7.35	3.93
B	Atriplex canescens	7	6	4	.19	.21	.06
B	Chrysothamnus nauseosus albicaulis	30	27	22	3.86	1.90	3.02
B	Chrysothamnus viscidiflorus viscidiflorus	1	2	1	-	-	-
B	Gutierrezia sarothrae	45	57	63	.97	1.93	3.35
B	Juniperus osteosperma	0	1	1	1.00	2.67	-
B	Opuntia sp.	6	9	8	.04	.06	-
Total for Browse		129	142	132	13.37	15.36	11.38

CANOPY COVER, LINE INTERCEPT --

Management unit 17 , Study no: 40

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	4.38
Atriplex canescens	-	.66
Chrysothamnus nauseosus albicaulis	-	3.11
Gutierrezia sarothrae	-	1.56
Juniperus osteosperma	.30	-

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 17 , Study no: 40

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.4	1.7

BASIC COVER --

Management unit 17 , Study no: 40

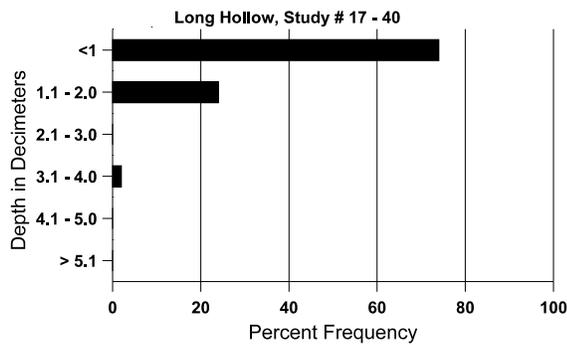
Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	.50	7.25	48.81	57.68	55.28
Rock	25.50	24.00	17.10	17.57	19.40
Pavement	1.50	4.25	2.41	1.37	1.60
Litter	64.25	59.00	49.95	37.77	31.20
Cryptogams	1.00	1.00	3.50	2.16	.45
Bare Ground	7.25	4.50	1.49	2.09	2.72

SOIL ANALYSIS DATA --

Herd Unit 17, Study no: 40, Long Hollow

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%OM	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.7	49.2 (14.3)	7.2	51.4	26.7	21.8	2.8	10.6	166.4	.7

Stoniness Index



PELLET GROUP DATA --

Management unit 17 , Study no: 40

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	-	-	1
Elk	63	15	15
Deer	32	51	38
Cattle	-	2	10

Days use per acre (ha)	
'02	'07
-	-
23 (58)	49 (121)
87 (215)	31 (76)
10 (25)	6 (14)

BROWSE CHARACTERISTICS --
Management unit 17 , Study no: 40

		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)
Artemisia tridentata tridentata												
83	0	-	-	-	-	-	0	0	0	-	0	-/-
89	0	-	-	-	-	-	0	0	0	-	0	-/-
97	460	-	40	340	80	140	13	0	17	9	9	34/42
02	180	-	-	-	180	80	44	0	100	89	89	59/45
07	40	-	-	40	-	40	50	0	0	-	50	59/77
Artemisia tridentata vaseyana												
83	4599	-	2333	1733	533	-	16	4	12	-	0	26/15
89	4732	533	1933	1933	866	-	6	3	18	-	3	23/18
97	880	80	80	740	60	100	59	0	7	-	0	26/42
02	1240	-	160	500	580	260	34	16	47	15	15	26/35
07	940	20	20	660	260	220	30	6	28	9	32	26/38
Atriplex canescens												
83	0	-	-	-	-	-	0	0	0	-	0	-/-
89	0	-	-	-	-	-	0	0	0	-	0	-/-
97	200	-	20	180	-	-	0	90	0	-	0	31/33
02	280	-	-	140	140	-	29	7	50	21	21	18/22
07	140	-	-	120	20	-	43	0	14	-	0	40/66
Chrysothamnus nauseosus albicaulis												
83	1532	-	-	666	866	-	0	0	57	-	0	25/21
89	1000	-	-	400	600	-	7	0	60	-	7	27/31
97	1060	-	100	820	140	160	36	19	13	9	11	34/35
02	900	-	80	320	500	200	38	2	56	33	33	19/22
07	680	-	20	540	120	20	3	0	18	9	12	25/29
Chrysothamnus viscidiflorus viscidiflorus												
83	200	-	-	200	-	-	0	0	0	-	0	20/26
89	400	-	-	200	200	-	0	0	50	-	17	13/14
97	20	-	-	20	-	-	0	0	0	-	0	14/19
02	40	-	-	20	20	-	0	0	50	50	50	14/17
07	20	-	-	20	-	-	0	0	0	-	0	15/22

		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)
Gutierrezia sarothrae												
83	2999	-	66	2933	-	-	0	0	0	-	0	13/9
89	4999	-	400	4466	133	-	0	0	3	-	0	13/13
97	3840	200	2080	1640	120	20	0	0	3	.52	.52	11/10
02	4620	-	100	3720	800	520	0	0	17	5	5	8/9
07	4720	-	480	4080	160	20	0	0	3	.42	.42	10/12
Juniperus osteosperma												
83	0	-	-	-	-	-	0	0	-	-	0	-/-
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	40	-	20	20	-	-	50	0	-	-	0	-/-
07	20	-	20	-	-	-	0	0	-	-	0	-/-
Opuntia sp.												
83	732	-	266	466	-	-	0	0	-	-	36	6/10
89	533	-	533	-	-	-	0	0	-	-	0	-/-
97	180	-	40	140	-	-	0	0	-	-	0	7/10
02	240	-	20	220	-	-	0	0	-	-	0	5/14
07	180	20	40	140	-	-	0	0	-	-	22	6/13
Rhus trilobata												
83	0	-	-	-	-	-	0	0	-	-	0	-/-
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	0	-	-	-	-	-	0	0	-	-	0	-/-
07	0	-	-	-	-	-	0	0	-	-	0	50/76