

Trend Study 16B-9-07

Study site name: Starvation Mountain Brush.

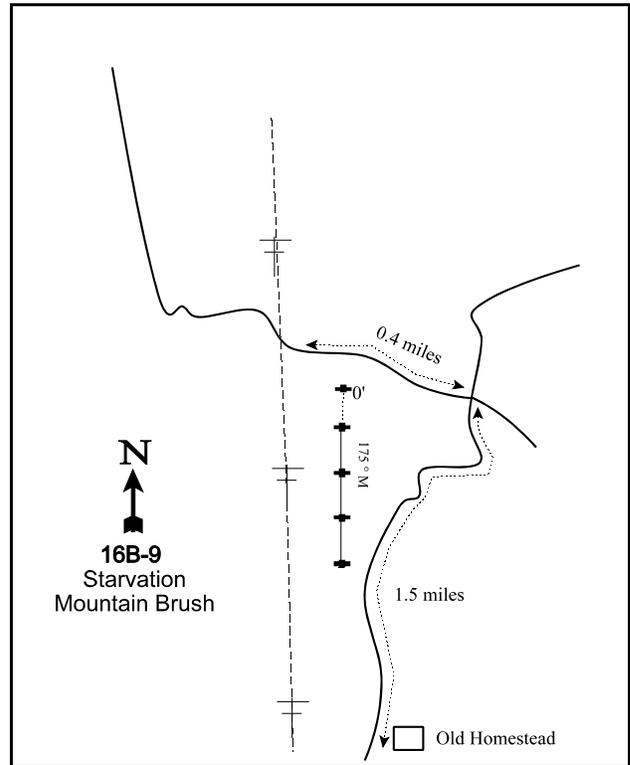
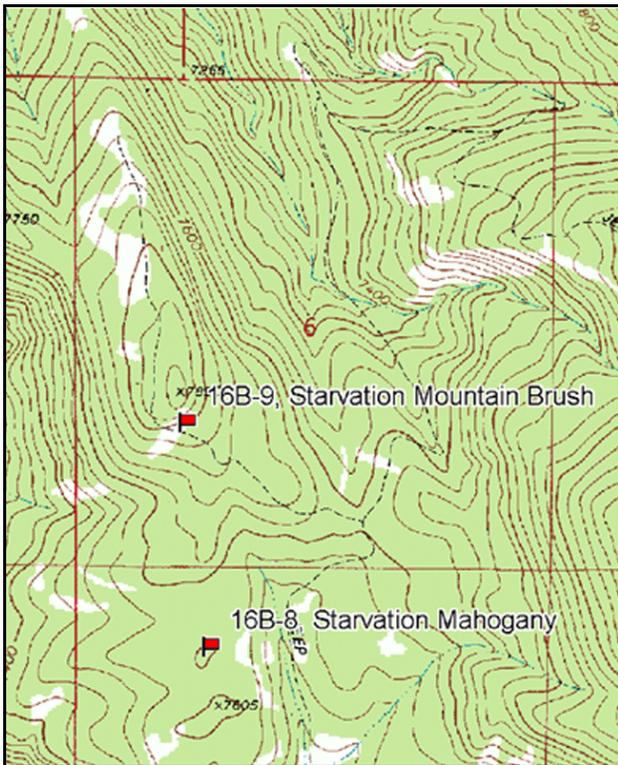
Vegetation type: Mountain Brush.

Compass bearing: frequency baseline 175 degrees magnetic.

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

LOCATION DESCRIPTION

From Tucker rest area on Highway 50/6 in Spanish Fork Canyon, take the Starvation Canyon road 4.6 miles. Turn left and go 0.5 miles to another fork. Turn left and go up a small canyon on a rough road for 1.15 miles to a fork. Turn left, cross the creek, and go 0.3 miles to an old homestead site. Continue on this road for 1.5 miles to a 4-way intersection. Turn left (west) and go 0.4 miles and park beneath the powerlines. The 0-foot stake of the baseline is 30 feet away from the road marked by browse tag #432.



Map Name: Tucker

Diagrammatic Sketch

Township 11S, Range 7E, Section 6

GPS: NAD 83, UTM 12S 484035 E 4415604 N

DISCUSSION

Starvation Mountain Brush - Trend Study No. 16B-9

Study Information

This study was established in 1989 and samples a mixed mountain brush community in the Starvation Creek drainage on Division of Wildlife Resources property [elevation: 7,800 feet (2,378 m), slope: 25%-35%, aspect: south]. This study lies above and north of the curl-leaf mahogany bench sampled by the Starvation Mahogany study (16B-8), and is within a power line easement. Starvation Creek is located 0.75 miles (1.2 km) to the west and there is a spring 0.75 miles (1.2 km) to the south. From the pellet group transect data, there were an estimated 45 deer days use/acre (111 ddu/ha) in 1999, 68 deer days use/acre (169 ddu/ha) in 2002, and 31 deer days use/acre (76 ddu/ha) in 2007. Elk use was estimated at 64 days use/acre (159 edu/ha) in 1999, 19 days use/acre (48 edu/ha) in 2002, and 94 days use/acre (233 edu/ha) in 2007. The surrounding area provides excellent thermal and escape cover for wildlife, with large curl-leaf mahogany thickets scattered in all directions.

Soil

The soil has a clay loam texture and is slightly alkaline in reactivity (pH of 7.4). The profile is shallow and rocky. Organic matter content is very high at 5.5% and may be related to the abundance of surface litter. Relative bare ground cover has been between 15% and 23% since 1999. When coupled with the steep slope, the rocky soils may produce runoff and reduce the amount of effective precipitation. Pedestalling and terracing occur on the steeper areas. The erosion condition was classified as slight in 2002 and improved to stable in 2007.

Browse

Browse is diverse with many key species present. The most important species include Utah serviceberry (*Amelanchier utahensis*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), true mountain mahogany (*Cercocarpus montanus*), and antelope bitterbrush (*Purshia tridentata*). These key species provide about half of the total browse cover and approximately 40% of the total vegetative cover. The sagebrush is classified as mountain big sagebrush, but some of the population displays characteristics of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). It is likely that a portion of the population is a hybrid of the two subspecies. Since 2002, sagebrush canopy cover has been 7%. The estimated sagebrush density has varied little since 1999 and averages 1,670 plants/acre (4,134 plants/ha). These estimates are lower than the initial estimate of 2,666 plants/acre (6,588 plants/ha) in 1989. The extension of the baseline in 1999 accounts for most of the differences in sagebrush density. This larger sample area better samples browse populations that have clumped and/or discontinuous distributions. Decadency has fluctuated each sample year and was highest in 1989 and 2002 at 35% and 26%, respectively. Reproduction and recruitment have been low since 1999. All of the sampled plants had good vigor in 1989, and in all successive sample years the plants exhibiting poor vigor have ranged from 10% to 14%. Annual growth on sagebrush averaged just under 1.9 inches (4.7 cm) in 2002 and 1.6 inches (4.0 cm) in 2007. About half of the sagebrush plants have had heavy browse use, except for in 1999 when only 13% of the plants had heavy use.

Canopy cover of Utah serviceberry has been approximately 1% since 2002. In 1999 the density of serviceberry was 1,060 plants/acre (2,624 plants/ha). The density increased to 1,400 plants/acre (3,465 plants/ha) in 2002, and decreased to 740 plants/acre (1,832 plants/ha) in 2007. Seedling plants were present at moderate densities in 1989 and 1999, but have not been sampled since. Young plants decreased from 72% of the population in 1989, to 25% in 1999, then increased to 30% in 2002, and decreased to 16% in 2007. Decadence was highest in 2002 (31%) and lowest in 2007 (5%). Since 1999, the proportion of plants with poor vigor decreased from 25% to 5%. In 1999, the annual leader growth on serviceberry averaged 3-5 inches (7.6-12.7 cm). The annual growth was longest on stems which were protected and/or unavailable to browsing animals. Average leader growth decreased to approximately 2 inches (5 cm) in 2002 and 2007. The majority

of browse use was moderate-heavy from 1989 to 2002, but changed to light use in 2007.

The canopy cover of true mountain mahogany has been approximately 3% since 2002. There was an estimated density of 1,120 plants/acre (2,772 plants/ha) in 1999 and 2002, which decreased slightly to 1,000 plants/acre (2,475 plants/ha) in 2007. Young plants have comprised a decreasing proportion of the population, declining from 33% in 1989 to approximately 9% in 2002 and 2007. Decadence has been moderate to low, ranging from 0% in 1989 to 27% in 2002. The moderate decadence in 2002 was likely the result of dry conditions (Utah Climate Summaries 2007). Eleven percent or less of the population has had poor vigor. Plants with moderate to heavy browse use have accounted for 84% or more since 1989. However, mahogany can tolerate heavy browsing, and may even require it to maintain new growth (Turley et al. 2003). Most of the population has had normal vigor in spite of the heavy browse use.

The canopy cover of antelope bitterbrush was 3% in 2002 and 2% in 2007. Bitterbrush has the lowest population density of the browse species, estimated at approximately 500 plants/acre (1,235 plants/ha). Decadence increased from 0% of the population in 1989 and 1999 to 50% in 2002, and decreased to 8% in 2007. Plants with moderate-heavy use increased each sample year and peaked at 100% of the population in 2002, then decreased slightly to 92% in 2007. In 2002, the few juniper trees present were cut down as routine maintenance on the powerline easement.

Herbaceous Understory

The herbaceous understory is dominated by perennial species and is quite diverse. Seeded grasses are present and were probably used to revegetate the power line corridor which runs directly through the area. Perennial grass cover increased from 6% in 1997 to 20% by 2007. Crested wheatgrass (*Agropyron cristatum*) is the dominant species, providing between 71% and 92% of the grass cover since 1999. Other perennial grasses include bluebunch wheatgrass (*Agropyron spicatum*), mutton bluegrass (*Poa fendleriana*), Indian ricegrass (*Oryzopsis hymenoides*), Kentucky bluegrass (*Poa pratensis*), and intermediate wheatgrass (*Agropyron intermedium*). Cheatgrass (*Bromus tectorum*) quadrat frequency was less than 10% in 1997 and 2002, and increased to 47% in 2007, but cover has been less than 1% all sample years.

Forbs are diverse as well, but perennial forb cover has been 4% or less since 1997. Hood's phlox (*Phlox hoodii*) is the most abundant forb, which provides nearly half of the forb cover. All other species occur infrequently. Annuals are present but infrequent, and have not been a significant component of the vegetative community. Houndstongue (*Cynoglossum officinale*), a noxious weed, was sampled in 1989 in one quadrat and has not been sampled since. With drought in 2002, the sum of nested frequency for perennial forbs declined while perennial grasses remained stable.

1999 TREND ASSESSMENT

The browse trend is stable. Density of Utah serviceberry and mountain big sagebrush decreased, and density of true mountain mahogany and bitterbrush increased. However, the changes were attributed to the change in the sample area measured in 1999. In this instance, trend was determined from other parameters. Decadence increased for serviceberry and true mountain mahogany, decreased for sagebrush, and remained the same for bitterbrush. There was a decline in recruitment for all four key browse species. The proportion of plants exhibiting poor vigor increased for serviceberry, sagebrush, and true mountain mahogany, but remained constant for bitterbrush. Use is moderate-heavy on these species. The grass trend is slightly up. The sum of nested frequency for perennial grasses increased by 23%, and two new perennial species were measured. Crested wheatgrass nested frequency increased significantly. However, these changes were likely to also be the result of the larger area sampled. The forb trend is stable. The sum of nested frequency changed little, decreasing 2%. The noxious weed houndstongue had been sampled in 1989, and was absent in 1999. The Desirable Components Index (DCI) score was fair due to the high preferred browse cover, moderate percentage of browse decadency, and low perennial herbaceous cover.

winter range condition (DCI) - fair (60) High potential scale
browse - stable (0) grass - slightly up (+1) forb - stable (0)

2002 TREND ASSESSMENT

The browse trend is stable. Overall, there was a 11% increase in density of Utah serviceberry, mountain big sagebrush, true mountain mahogany, and antelope bitterbrush. However, the preferred browse species showed some negative effects from the drought. Decadency increased for all four preferred browse species, and plants showing poor vigor increased in the sagebrush, mahogany, and bitterbrush populations. Moderate-heavy browse use increased on the four preferred species. With the exception of sagebrush, the key browse are tolerant to heavy browsing (Wandera et al. 1992). The grass trend is stable. The sum of nested frequency of perennial grasses changed little, increasing 2%, and species richness remained stable. The forb trend is down. The sum of nested frequency for perennial forbs decreased by 29%, including significant decreases in the nested frequencies of two perennial species. The DCI score remained fair because the increase in perennial grass cover countered the increase in browse decadency.

winter range condition (DCI) - fair (60) High potential scale
browse - stable (0) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is slightly down. The density of serviceberry and sagebrush decreased by 47% and 14%, respectively. Bitterbrush and mahogany densities also decreased, but to a smaller degree. However, vigor improved and decadency decreased for the four preferred browse species, but the overall decrease in plant density was given more weight than the improved plant health. The grass trend is stable. The sum of nested frequency for perennial grasses increased 6%, but the nested frequency of cheatgrass increased by nearly thirty-fold. The quadrat frequency of cheatgrass increased from 2% to 47%, however, it still provided less than 1% cover. Crested wheatgrass cover increased from 9% to 18%. The forb trend is stable. The sum of nested frequency for perennial forbs decreased 6%, and diversity remained high. The sum of nested frequency for annual forbs increased ten-fold, due to increases in pale alyssum (*Alyssum alyssoides*) and blue-eyed Mary (*Collinsia parviflora*). The DCI score improved to good due to the increase in perennial grass cover and a decrease in browse decadency.

winter range condition (DCI) - good (73) High potential scale
browse - slightly down (-1) grass - stable (0) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 16B, Study no: 9

Type	Species	Nested Frequency				Average Cover %		
		'89	'99	'02	'07	'99	'02	'07
G	Agropyron cristatum	a78	b168	b180	b197	4.31	9.44	17.70
G	Agropyron intermedium	a6	a8	a6	a6	.18	.07	.63
G	Agropyron smithii	-	-	a4	a2	-	.15	.01
G	Agropyron spicatum	b55	ab25	a10	a19	.62	.08	1.14
G	Bromus inermis	a4	a1	-	-	.00	-	-
G	Bromus tectorum (a)	-	a23	a4	b118	.22	.03	.82
G	Carex sp.	-	a3	a5	-	.00	.09	-
G	Oryzopsis hymenoides	-	a3	a8	-	.03	.06	-

Type	Species	Nested Frequency				Average Cover %		
		'89	'99	'02	'07	'99	'02	'07
G	<i>Poa fendleriana</i>	_b 26	_{ab} 18	_b 20	_a 3	.36	.14	.03
G	<i>Poa pratensis</i>	-	_a 5	_a 6	_a 21	.30	.18	.72
G	<i>Sitanion hystrix</i>	_b 21	_{ab} 4	_a 1	_{ab} 6	.02	.03	.18
G	<i>Stipa lettermani</i>	1	-	-	-	-	-	-
Total for Annual Grasses		0	23	4	118	0.21	0.03	0.82
Total for Perennial Grasses		191	235	240	254	5.85	10.26	20.44
Total for Grasses		191	258	244	372	6.07	10.29	21.27
F	<i>Achillea millefolium</i>	-	-	-	1	-	-	.00
F	<i>Agoseris glauca</i>	-	-	_a 2	_a 3	-	.00	.01
F	<i>Alyssum alyssoides</i> (a)	-	-	-	54	-	-	.21
F	<i>Arabis</i> sp.	-	-	_a 1	_a 2	-	.00	.01
F	<i>Aster chilensis</i>	-	-	_a 4	_a 3	-	.01	.01
F	<i>Astragalus convallarius</i>	-	-	1	-	-	.00	-
F	<i>Astragalus</i> sp.	8	-	-	-	-	-	-
F	<i>Calochortus nuttallii</i>	-	-	_a 2	_a 1	-	.00	.00
F	<i>Chaenactis douglasii</i>	_a 14	_a 19	_a 4	_a 6	.07	.01	.03
F	<i>Cirsium</i> sp.	_{ab} 8	_b 19	_{ab} 7	_a 2	.08	.09	.15
F	<i>Collomia linearis</i> (a)	-	-	3	-	-	.00	-
F	<i>Comandra pallida</i>	-	-	-	5	-	-	.03
F	<i>Collinsia parviflora</i> (a)	-	-	-	19	-	-	.09
F	<i>Cryptantha</i> sp.	-	_b 16	_a 7	_{ab} 14	.45	.18	.22
F	<i>Cymopterus</i> sp.	-	-	-	3	-	-	.00
F	<i>Cynoglossum officinale</i>	2	-	-	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	2	-	-	.03
F	<i>Eriogonum racemosum</i>	_a 1	_a 1	-	-	.00	-	-
F	<i>Eriogonum umbellatum</i>	_a 2	_a 3	_a 3	_a 2	.03	.00	.00
F	<i>Lappula occidentalis</i> (a)	-	-	-	1	-	-	.00
F	<i>Lepidium</i> sp. (a)	-	-	-	6	-	-	.02
F	<i>Lomatium</i> sp.	-	-	-	2	-	-	.03
F	<i>Machaeranthera canescens</i>	_b 91	_a 21	_a 20	_a 8	.13	.23	.18
F	<i>Microsteris gracilis</i> (a)	-	1	-	-	.00	-	-
F	<i>Penstemon caespitosus</i>	-	_a 1	_a 2	_a 4	.00	.01	.03
F	<i>Penstemon cyananthus</i>	_a 30	_a 31	_a 21	-	.18	.53	-
F	<i>Penstemon humilis</i>	_a 11	-	_a 4	-	-	.01	-
F	<i>Penstemon</i> sp.	_a 14	_b 31	_a 14	_{ab} 29	.85	.10	.32
F	<i>Phlox hoodii</i>	_a 16	_c 81	_{bc} 59	_b 44	1.89	1.14	1.07

Type	Species	Nested Frequency				Average Cover %		
		'89	'99	'02	'07	'99	'02	'07
F	Phlox longifolia	_b 51	_a 7	_a 17	_a 21	.01	.06	.05
F	Ranunculus testiculatus (a)	-	-	_a 3	_b 15	-	.01	.03
F	Senecio multilobatus	-	-	-	4	-	-	.06
F	Streptanthus cordatus	_a 4	_a 4	_a 3	_a 3	.01	.00	.03
F	Taraxacum officinale	_a 1	_a 7	-	_a 6	.04	-	.07
F	Tragopogon dubius	-	3	-	-	.00	-	-
F	Veronica biloba (a)	-	-	3	-	-	.00	-
F	Verbascum thapsus	1	-	-	-	-	-	-
F	Viguiera multiflora	-	_a 5	_a 5	_a 3	.06	.06	.03
Total for Annual Forbs		0	1	9	97	0.00	0.01	0.39
Total for Perennial Forbs		254	249	176	166	3.84	2.50	2.37
Total for Forbs		254	250	185	263	3.85	2.51	2.77

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

BROWSE TRENDS --

Management unit 16B, Study no: 9

Type	Species	Strip Frequency			Average Cover %		
		'99	'02	'07	'99	'02	'07
B	Amelanchier utahensis	42	42	28	2.33	2.07	2.00
B	Artemisia tridentata vaseyana	50	54	51	7.06	9.42	8.68
B	Cercocarpus montanus	46	41	38	4.28	3.96	3.57
B	Chrysothamnus depressus	2	3	0	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	44	47	35	2.21	1.54	1.37
B	Juniperus osteosperma	0	0	0	1.23	.00	-
B	Mahonia repens	7	6	7	.51	.01	.09
B	Opuntia sp.	1	2	0	.00	.01	-
B	Purshia tridentata	19	18	19	3.33	2.73	2.52
B	Quercus gambelii	0	0	1	.00	-	.00
B	Symphoricarpos oreophilus	91	87	72	14.12	10.95	7.21
B	Tetradymia canescens	20	15	20	1.09	1.88	2.46
Total for Browse		322	315	271	36.20	32.61	27.94

CANOPY COVER, LINE INTERCEPT --
 Management unit 16B, Study no: 9

Species	Percent Cover	
	'02	'07
Amelanchier utahensis	1.46	1.26
Artemisia tridentata vaseyana	6.05	8.56
Cercocarpus montanus	4.01	2.18
Chrysothamnus depressus	.11	-
Chrysothamnus viscidiflorus viscidiflorus	2.84	2.88
Juniperus osteosperma	-	-
Mahonia repens	-	.20
Purshia tridentata	3.13	2.00
Symphoricarpos oreophilus	13.39	8.63
Tetradymia canescens	1.60	1.78

KEY BROWSE ANNUAL LEADER GROWTH --
 Management unit 16B, Study no: 9

Species	Average leader growth (in)	
	'02	'07
Amelanchier utahensis	1.6	2.0
Artemisia tridentata vaseyana	1.9	1.6
Cercocarpus montanus	1.3	2.0
Purshia tridentata	3.8	-

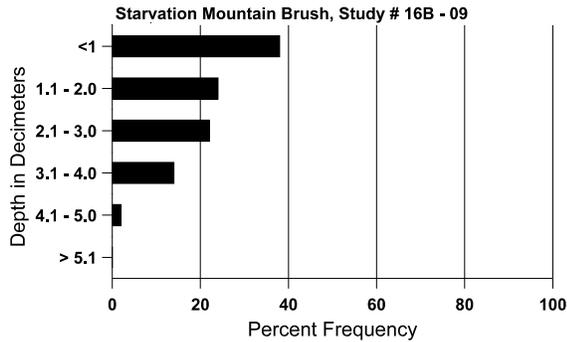
BASIC COVER --
 Management unit 16B, Study no: 9

Cover Type	Average Cover %			
	'89	'99	'02	'07
Vegetation	12.50	41.06	41.41	47.06
Rock	12.00	6.14	5.58	5.63
Pavement	11.50	3.91	3.01	2.76
Litter	54.25	50.65	40.02	35.72
Cryptogams	.50	2.03	.10	.03
Bare Ground	4.00	18.73	26.22	25.08

SOIL ANALYSIS DATA --
 Herd Unit 16B, Study # 09, Starvation Mountain Brush

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%OM	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
12.5	51.0 (13.3)	7.4	36.7	22.7	40.6	5.5	8.5	121.6	0.7

Stoniness Index



PELLET GROUP DATA --

Management unit 16B, Study no: 9

Type	Quadrat Frequency		
	'99	'02	'07
Sheep	3	1	-
Rabbit	2	7	-
Elk	37	20	47
Deer	22	31	6

Days use per acre (ha)		
'99	'02	'07
5 (11)	-	-
-	-	-
64 (158)	19 (48)	94 (233)
54 (111)	68 (168)	31 (76)

BROWSE CHARACTERISTICS --

Management unit 16B, Study no: 9

		Age class distribution (plants per acre)					Utilization					
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
89	4733	733	3400	733	600	-	41	34	13	-	3	28/27
99	1060	100	260	540	260	180	30	36	25	19	25	24/23
02	1400	-	420	540	440	60	7	60	31	14	14	19/21
07	740	-	120	580	40	-	22	8	5	5	5	19/15
Artemisia tridentata vaseyana												
89	2666	66	600	1133	933	-	25	48	35	-	0	21/22
99	1660	40	100	1240	320	980	36	13	19	10	10	23/30
02	1800	-	20	1320	460	600	31	53	26	9	14	21/27
07	1540	-	80	1220	240	220	34	51	16	10	13	23/32
Cercocarpus montanus												
89	399	66	133	266	-	-	17	67	0	-	0	25/27
99	1120	120	160	820	140	-	29	55	13	5	9	32/33
02	1120	-	100	720	300	60	2	93	27	11	11	27/32
07	1000	20	100	720	180	40	24	74	18	4	4	24/23

		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)
Chrysothamnus depressus												
89	0	-	-	-	-	-	0	0	0	-	0	-/-
99	160	-	-	140	20	-	0	13	13	13	13	-/-
02	220	-	-	220	-	-	73	0	0	-	0	6/11
07	0	-	-	-	-	-	0	0	0	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
89	4333	-	533	3400	400	-	0	0	9	-	2	12/15
99	2780	-	220	2400	160	-	8	0	6	4	4	8/14
02	2300	-	180	2080	40	-	0	0	2	-	.86	7/12
07	1520	-	40	1460	20	-	0	0	1	-	0	7/12
Cowania mexicana stansburiana												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
99	0	-	-	-	-	-	0	0	-	-	0	44/48
02	0	-	-	-	-	-	0	0	-	-	0	-/-
07	0	-	-	-	-	-	0	0	-	-	0	-/-
Juniperus osteosperma												
89	0	66	-	-	-	-	0	0	-	-	0	-/-
99	0	20	-	-	-	-	0	0	-	-	0	-/-
02	0	20	-	-	-	-	0	0	-	-	0	-/-
07	0	-	-	-	-	-	0	0	-	-	0	-/-
Mahonia repens												
89	200	-	200	-	-	-	0	0	-	-	0	-/-
99	2040	-	420	1620	-	-	0	0	-	-	0	2/5
02	1140	-	-	1140	-	-	0	0	-	-	0	4/4
07	1480	-	-	1480	-	-	0	0	-	-	0	2/3
Opuntia sp.												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
99	20	-	-	20	-	-	0	0	-	-	0	3/21
02	60	-	40	20	-	-	0	0	-	-	0	2/13
07	0	-	-	-	-	-	0	0	-	-	0	-/-
Purshia tridentata												
89	132	66	66	66	-	-	50	0	0	-	0	17/19
99	540	-	100	440	-	40	63	15	0	-	0	23/51
02	520	-	40	220	260	-	12	88	50	23	23	16/43
07	500	-	100	360	40	-	24	68	8	4	4	20/37

		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)
Quercus gambelii												
89	0	-	-	-	-	-	0	0	-	-	0	-/-
99	0	20	-	-	-	-	0	0	-	-	0	-/-
02	0	-	-	-	-	-	0	0	-	-	0	-/-
07	20	-	20	-	-	-	0	0	-	-	0	33/15
Symphoricarpos oreophilus												
89	8332	200	1533	5933	866	-	4	.80	10	.72	10	16/21
99	5800	320	1400	4160	240	60	2	0	4	3	5	19/33
02	6980	-	1060	5660	260	20	0	0	4	1	2	11/17
07	3560	40	1060	2500	-	-	3	0	0	-	0	12/18
Tetradymia canescens												
89	0	-	-	-	-	-	0	0	0	-	0	-/-
99	960	140	220	600	140	-	6	0	15	2	2	13/20
02	600	-	20	460	120	-	3	3	20	13	13	12/21
07	800	40	80	680	40	-	0	0	5	-	0	11/22