

Trend Study 2-16-06

Study site name: Garden City Canyon .

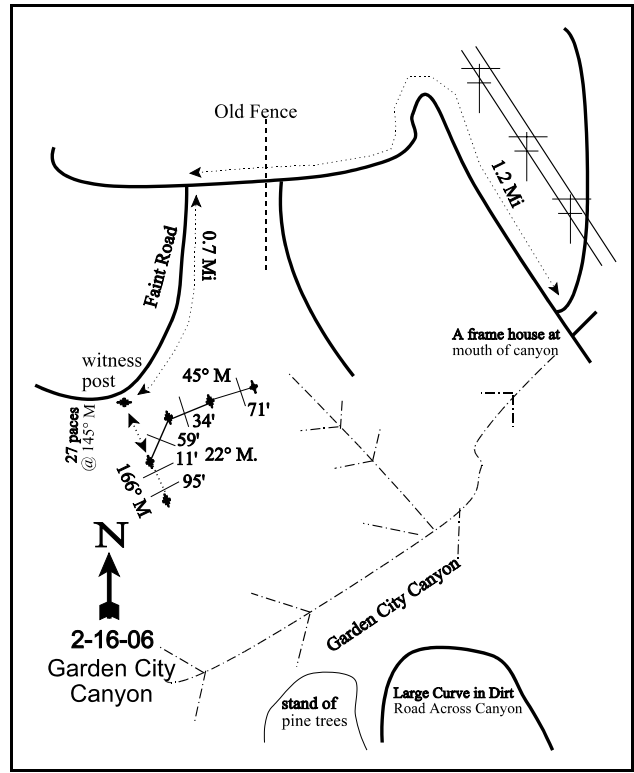
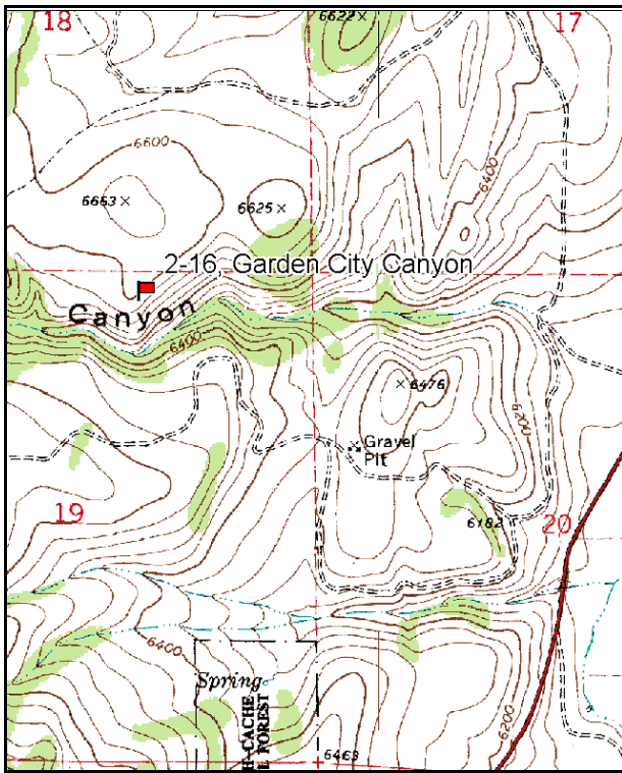
Vegetation type: Curlleaf Mahogany .

Compass bearing: frequency baseline 166 degrees magnetic.

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

LOCATION DESCRIPTION

From Garden City, proceed west on US-89. Turn right at 525 W. Proceed 0.25 miles and turn right. Stay left and continue for 1.2 miles to a fence with a gate (fence may be gone in 5 years). Follow a faint road 0.7 miles, staying right at the fork to the witness post at the left. From here walk down the road to a witness post on the edge of the canyon. From the witness post walk 27 paces at 145 degrees magnetic to the 0-foot stake of the baseline. The 0-foot stake is marked by browse tag #7936. Azimuth of the baseline is 166 degrees magnetic. Line 2 runs 22 degrees magnetic. Lines 3 and 4 run 45 degrees magnetic.



Map Name: Garden City

Diagrammatic Sketch

Township 14N, Range 5E, Section 19

UTM NAD 27, UTM 12T 4644019 N, 464684 E

DISCUSSION

Garden City Canyon - Trend Study No. 2-16

Study Information

This study samples winter range on the north rim of Garden City Canyon in Rich County (elevation: 6,580 feet, slope: 50%, aspect: southeast). The vegetation type is characterized by curleaf mountain mahogany with an associated mixture of mountain brush. The knolls and hillsides of the area are dominated by curleaf mountain mahogany and the adjacent level areas are dominated by vigorous stands of mountain big sagebrush and antelope bitterbrush. The area is heavily used by deer and elk and they seem to prefer the more exposed and less densely vegetated knolls and hillsides. Pellet group transect data from 2001 estimated 55 deer and 16 elk days use/acre (136 ddu/ha and 40 edu/ha). All of the elk and about 60% of the deer pellet groups were from winter use, while about 40% of the deer pellet groups were from late spring and early summer. Pellet group data from 2006 was estimated at 23 deer, 67 elk, and 2 moose days use/acre (56 ddu/ha, 165 edu/ha, and 4 mdu/ha).

Soil

Soil is classified in the Foxol series and occurs on moderately steep slopes. Foxol soil is shallow, moderately permeable, and excessively drained. Soil parent material is quartzite and depth to bedrock is normally about 15 inches (Campbell and Lacey 1982). Soil has a clay loam texture with an effective rooting depth estimated at only 9 inches in 1996. The soil reaction is moderately acidic (pH of 5.8). The surface is exceptionally rocky with many large boulders and exposed bedrock. In spite of these characteristics, there is relatively little erosion. The ratio of protective cover (vegetation, litter, and cryptograms) to bare ground was good at 6:1 in 2006, leaving little unprotected soil. The soil erosion condition class was determined to be stable in 2001 and slight in 2006.

Browse

The browse composition includes 12 species of shrubs with 5 species that are highly preferred by wildlife. The most conspicuous shrub, although not the most numerous, is curleaf mountain mahogany. Many of the mahogany are tree-like in stature and unavailable to further browsing. The majority of the mature plants are over 8 feet in height. Shrub density strips indicate a slight decrease in the population from 280 plants/acre in 1996 to 140 plants/acre in 2006. Overhead canopy cover of mahogany has averaged 16-17% in both 2001 and 2006. Most of the tall mahogany have been highlined and utilization of available plants is moderate to heavy. Decadence was moderate at 36% in 2001, but vigor and decadence were normal for most individuals in 2006.

Other important browse include a combination of low sagebrush, mountain big sagebrush, bitterbrush, and serviceberry. Low sagebrush is much more abundant and widespread than the other shrubs. It has averaged 6-8% cover from 1996 to 2006 and density was estimated at 2,600 plants/acre in 1996 and slightly declined to 2,100 plants/acre in 2001 and 2006. Utilization was heavy in 1984, but light to moderate use has occurred since. In 1996, 11% of the population was classified as decadent and this increased to about 20% in 2001 and 2006. Plants classified as dying increased from 2% of the population in 1996 to 12% in 2006.

Bitterbrush is not abundant, with density estimated at just over 100 plants/acre. Plants have displayed heavy use. In 2001, decadence was low, but it increased to 67% in 2006. Serviceberry has also been moderately to heavily browsed since the study was established in 1984. Density has been low at around 200 plants/acre since 1996. Mature plants are stunted and have measured only about 2 feet in height. Decadence has improved from 67% in 1990 to 14% in 2006. Vigor was normal on all plants sampled.

Herbaceous Understory

The herbaceous understory consists primarily of perennial grasses. Most important were bluebunch wheatgrass followed by Sandberg bluegrass. In 1984, Kentucky bluegrass was fairly common, but has not been sampled since. Also, cheatgrass was observed in isolated patches in 1984, but was not included in the

sample. Annual grasses were first included in the sample in 1996 at which point cheatgrass and Japanese brome cover was extremely high at 20%. It was reported in 1996 that about half of the brome grasses were infected with smut. In 2001, cheatgrass nested frequency decreased significantly and cover only averaged 2%, which remained the same in 2006.

Bluebunch wheatgrass and Sandberg bluegrass both have averaged about 7-8% cover in 2001 and 2006. Other perennial grasses that have been sampled, but are not abundant include: Prairie Junegrass, mutton bluegrass, squirreltail, Letterman needlegrass, oniongrass, and Kentucky bluegrass.

Forbs are a minor component. Composition includes relatively few species that are palatable. All perennial forbs combined have produced less than 2% cover. It is possible that the shallow and excessively drained soil is not conducive to a productive forb component.

1990 TREND ASSESSMENT

Within the diverse browse community, only curlleaf mountain mahogany is heavily to severely hedged. This is not unusual as it is the most preferred browse. The bulk of the mahogany forage production is unavailable to most big game animals due to highlining. Mahogany density has increased slightly because of the young age class. The increased decadence should not be of concern because it is a long-lived species. It is not unusual to find individuals more than 300 years of age in most areas of Utah. Data for sagebrush shows a stable population of low sagebrush. Trend for grasses is up. Perennial grass sum of nested frequency increased by 26%, mainly due to an increase in Sandberg bluegrass. Trend for forbs is stable. Very little change in perennial forb production.

browse - stable (0)

grasses - up (+2)

forbs - stable (0)

1996 TREND ASSESSMENT

Trend for the key browse species, curlleaf mountain mahogany, appears stable. The increased sample size used this year may be responsible for differences in density data between 1990 and 1996. Mahogany are very unevenly distributed. Utilization was more moderate on available plants and decadence was slightly lower. Understory browse, serviceberry and low sagebrush, display stable trends with lighter use and improved decadence rates. Bitterbrush is heavily utilized but maintains good vigor and low decadence. Overall, the browse trend appears stable. Trend for grasses was stable. There was very little change in perennial grass sum of nested frequency. Annual grasses were included in the study for the first time and cheatgrass cover was extremely high at 19%. Since annuals were not included in the previous readings, we do not know if change has occurred. However, the 1984 report states that cheatgrass occurred only in isolated patches. Trend for forbs is stable. Forbs continue to play a very minor role in this community. The Desirable Components Index rated this study as poor due to high annual grass cover.

winter range condition (DC Index) - poor (40) Mid-level potential scale

browse - stable (0)

grasses - stable (0)

forbs - stable (0)

2001 TREND ASSESSMENT

Overall, browse trend is slightly down. Curlleaf mountain mahogany utilization was heavy on available portions, vigor was poor on 18% of the plants sampled, and decadence has increased from 21% in 1996 to 36% in 2001. Low sagebrush density decreased slightly from 2,600 plants/acre in 1996 to 2,160 in 2001 and decadence increased from 11% to 20%. The secondary browse species, serviceberry and bitterbrush, appear to have stable populations. Trend for grasses is up. Bluebunch wheatgrass has not changed, but Sandberg bluegrass nested frequency increased significantly. Cheatgrass nested frequency decreased significantly and cover dropped from 19% to under 2%. Trend for forbs is stable. Perennial forbs are still uncommon and produce little forage. The Desirable Components Index rated this study as fair due to moderate browse, grass, and forb cover with low annual grass cover.

winter range condition (DC Index) - fair (62) Mid-level potential scale
 browse - slightly down (-1) grasses - up (+2) forbs - stable (0)

2006 TREND ASSESSMENT

Trend for key browse species is stable. Low sagebrush, bitterbrush, and serviceberry populations have remained similar to values in 2001. Curlleaf mahogany decreased slightly in density from 220 plants/acre in 2001 to 140 in 2006. Decadence was fairly high in 2001 at 36%, but decreased to 0% in 2006. Trend for grasses is stable. Perennial grasses remained similar to 2001. Cheatgrass has also remained low at 3% cover. Trend for forbs is stable. Perennial forbs are still uncommon and produce little forage. The Desirable Components Index rated this study as fair due to moderate browse, grass, and forb cover with low annual grass cover.

winter range condition (DC Index) - fair (53) Mid-level potential scale
 browse - stable (0) grasses - stable (0) forbs - stable (0)

HERBACEOUS TRENDS --
 Management unit 02 , Study no: 16

T y p e	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
G	Agropyron spicatum	157	167	165	176	157	7.06	8.40	6.54
G	Bromus japonicus (a)	-	-	b ⁵⁵	a ²⁴	ab ⁴³	1.23	.10	.13
G	Bromus tectorum (a)	-	-	b ³⁴¹	a ¹⁴²	a ¹⁵⁷	18.94	2.33	2.54
G	Koeleria cristata	7	-	-	3	3	-	.03	.06
G	Melica bulbosa	-	-	-	-	11	-	-	.07
G	Poa fendleriana	3	-	-	-	-	-	-	.03
G	Poa pratensis	b ²⁵	a ⁻	a ⁻	a ⁻	a ⁻	-	-	-
G	Poa secunda	a ⁴⁴	b ¹³¹	b ¹³⁷	c ²²⁶	c ²¹⁷	3.46	7.52	8.17
G	Sitanion hystrix	-	-	1	-	-	.03	-	-
G	Stipa lettermani	-	-	-	1	-	-	.03	-
Total for Annual Grasses		0	0	396	166	200	20.17	2.44	2.67
Total for Perennial Grasses		236	298	303	406	388	10.55	15.98	14.88
Total for Grasses		236	298	699	572	588	30.72	18.43	17.55
F	Agoseris glauca	4	1	4	13	12	.00	.07	.08
F	Alyssum alyssoides (a)	-	-	b ¹²²	b ¹⁵⁰	a ⁶⁹	.56	.67	.14
F	Arabis sp.	-	3	4	4	4	.04	.01	.01
F	Artemisia ludoviciana	1	-	-	-	-	-	-	-
F	Balsamorhiza sagittata	-	-	-	-	-	-	.03	.00
F	Camelina microcarpa (a)	-	-	a ³	ab ⁶	b ¹⁴	.00	.07	.03
F	Calochortus nuttallii	-	6	-	-	-	-	-	-
F	Cirsium undulatum	ab ⁷	ab ⁷	b ¹¹	ab ⁵	a ⁻	.28	.36	-
F	Collomia linearis (a)	-	-	-	3	2	-	.03	.01
F	Comandra pallida	19	24	24	24	18	.15	.33	.31

Type	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
F	<i>Collinsia parviflora</i> (a)	-	-	_a 4	_c 135	_b 101	.01	.42	.41
F	<i>Crepis acuminata</i>	_a -	_a 1	_{ab} 7	_b 18	_b 19	.24	.72	.58
F	<i>Descurainia pinnata</i> (a)	-	-	-	3	-	-	.01	-
F	<i>Draba verna</i> (a)	-	-	_a -	_b 15	_c 36	-	.07	.07
F	<i>Epilobium brachycarpum</i> (a)	-	-	_a 48	_a 29	_b 69	.28	.14	.37
F	<i>Erodium cicutarium</i> (a)	-	-	-	8	3	-	.09	.15
F	<i>Erigeron divergens</i>	-	1	-	-	-	-	-	-
F	<i>Erigeron pumilus</i>	-	-	-	-	3	-	-	.00
F	<i>Eriogonum umbellatum</i>	-	-	-	-	3	-	.00	.03
F	<i>Gayophytum ramosissimum</i> (a)	-	-	_a 1	_a -	_b 46	.00	-	.23
F	<i>Holosteum umbellatum</i> (a)	-	-	-	1	6	-	.00	.02
F	<i>Lappula occidentalis</i> (a)	-	-	_a 2	_a 1	_b 16	.00	.00	.03
F	<i>Microsteris gracilis</i> (a)	-	-	_a -	_b 64	_b 67	-	.22	.18
F	<i>Pellaea breweri</i>	5	-	-	-	-	-	-	-
F	<i>Penstemon</i> sp.	-	1	-	-	-	-	-	-
F	<i>Petradoria pumila</i>	-	-	1	-	-	.03	.03	-
F	<i>Phlox longifolia</i>	_a -	_a 2	_a -	_a 1	_b 16	-	.00	.03
F	<i>Polygonum douglasii</i> (a)	-	-	3	2	-	.00	.01	-
F	<i>Sisymbrium altissimum</i> (a)	-	-	3	-	-	.03	.03	-
F	<i>Tragopogon dubius</i>	_b 15	_a 4	_a 6	_{ab} 8	_a 3	.01	.06	.01
F	<i>Wyethia amplexicaulis</i>	1	3	3	-	-	.03	-	-
Total for Annual Forbs		0	0	186	417	429	0.89	1.80	1.66
Total for Perennial Forbs		52	53	60	73	78	0.78	1.65	1.07
Total for Forbs		52	53	246	490	507	1.68	3.46	2.73

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

BROWSE TRENDS --

Management unit 02 , Study no: 16

Type	Species	Strip Frequency			Average Cover %		
		'96	'01	'06	'96	'01	'06
B	Amelanchier alnifolia	11	8	6	.41	.30	.30
B	Artemisia arbuscula	56	54	51	7.85	8.18	6.48
B	Artemisia tridentata vaseyana	0	4	3	-	1.16	1.16
B	Cercocarpus ledifolius	14	10	7	3.65	1.72	1.67
B	Eriogonum heracleoides	2	2	2	-	-	-
B	Eriogonum microthecum	1	0	1	-	.15	.38
B	Juniperus scopulorum	0	0	0	.88	1.02	1.41
B	Mahonia repens	7	10	9	.03	.48	.07
B	Opuntia sp.	3	3	3	.18	.38	.63
B	Pachistima myrsinites	3	4	2	.18	.18	-
B	Purshia tridentata	6	6	6	.71	1.64	.81
B	Symphoricarpos oreophilus	16	16	14	1.72	3.23	1.98
Total for Browse		119	117	104	15.64	18.46	14.91

CANOPY COVER, LINE INTERCEPT --

Management unit 02 , Study no: 16

Species	Percent Cover	
	'01	'06
Amelanchier alnifolia	-	.45
Artemisia arbuscula	-	8.81
Artemisia tridentata vaseyana	-	.51
Cercocarpus ledifolius	15.60	17.06
Eriogonum heracleoides	-	.08
Eriogonum microthecum	-	.11
Juniperus scopulorum	.60	2.28
Mahonia repens	-	.28
Opuntia sp.	-	.36
Purshia tridentata	-	1.56
Symphoricarpos oreophilus	-	3.23

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 02 , Study no: 16

Species	Average leader growth (in)	
	'01	'06
Cercocarpus ledifolius	3.3	3.0
Purshia tridentata	-	2.8

POINT-QUARTER TREE DATA --
Management unit 02 , Study no: 16

Species	Trees per Acre	
	'01	'06
Cercocarpus ledifolius	-	70

Average diameter (in)	
'01	'06
-	6.3

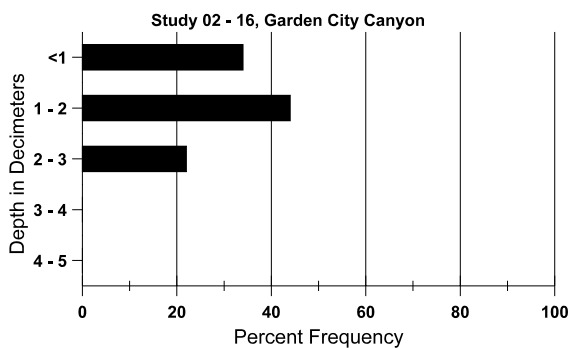
BASIC COVER --
Management unit 02 , Study no: 16

Cover Type	Average Cover %				
	'84	'90	'96	'01	'06
Vegetation	2.25	10.25	50.30	37.32	33.77
Rock	33.75	28.00	20.68	22.32	27.85
Pavement	.50	.25	.58	3.29	1.12
Litter	58.75	55.00	56.87	44.82	54.39
Cryptogams	1.75	1.75	.48	.56	.31
Bare Ground	3.00	4.75	2.30	8.35	6.93

SOIL ANALYSIS DATA --
Herd Unit 02, Study no: 16, Garden City Canyon

Effective rooting depth (in)	Temp °F (depth)	PH	Clay loam			%OM	PPM P	PPM K	dS/m
			% sand	% silt	% clay				
9.0	65.5 (9.0)	5.8	32.6	39.1	28.4	4.7	31.5	259.2	0.4

Stoniness Index



PELLET GROUP DATA --
Management unit 02 , Study no: 16

Type	Quadrat Frequency		
	'96	'01	'06
Rabbit	6	8	3
Elk	25	10	29
Deer	19	36	36

Days use per acre (ha)	
'01	'06
-	-
16 (40)	67 (165)
55 (136)	23 (56)

BROWSE CHARACTERISTICS --
Management unit 02 , Study no: 16

		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)
Amelanchier alnifolia												
84	666	-	233	333	100	-	30	35	15	-	0	31/33
90	499	33	100	66	333	-	33	40	67	12	20	35/25
96	220	-	40	120	60	40	64	0	27	18	36	27/26
01	200	-	100	80	20	20	60	20	10	-	0	26/28
06	140	-	-	120	20	-	14	57	14	-	0	25/29
Artemisia arbuscula												
84	1733	66	100	1033	600	-	58	40	35	-	19	13/26
90	1632	-	166	1000	466	-	16	2	29	1	12	17/16
96	2600	-	140	2180	280	580	18	2	11	2	2	13/26
01	2160	-	40	1680	440	240	8	0	20	5	5	13/29
06	2140	-	-	1740	400	200	0	3	19	12	12	10/24
Artemisia tridentata vaseyana												
84	0	-	-	-	-	-	0	0	0	-	0	-/-
90	0	-	-	-	-	-	0	0	0	-	0	-/-
96	0	-	-	-	-	-	0	0	0	-	0	-/-
01	100	-	-	80	20	20	0	0	20	-	0	20/29
06	60	-	-	20	40	20	0	0	67	67	67	32/57
Cercocarpus ledifolius												
84	433	133	33	400	-	-	0	23	0	-	0	68/74
90	565	33	166	233	166	-	12	29	29	-	0	183/83
96	280	-	20	200	60	100	7	14	21	-	0	-/-
01	220	-	20	120	80	120	9	27	36	18	18	46/46
06	140	180	-	140	-	40	0	0	0	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
84	0	-	-	-	-	-	0	0	-	-	0	-/-
90	0	-	-	-	-	-	0	0	-	-	0	-/-
96	0	-	-	-	-	-	0	0	-	-	0	-/-
01	0	-	-	-	-	-	0	0	-	-	0	-/-
06	0	-	-	-	-	-	0	0	-	-	0	18/52

		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)
Eriogonum heracleoides												
84	0	-	-	-	-	-	0	0	-	-	0	-/-
90	0	-	-	-	-	-	0	0	-	-	0	-/-
96	40	-	-	40	-	-	0	0	-	-	0	-/-
01	40	-	-	40	-	-	0	0	-	-	0	16/9
06	60	-	-	60	-	-	0	0	-	-	0	5/11
Eriogonum microthecum												
84	0	-	-	-	-	-	0	0	-	-	0	-/-
90	0	-	-	-	-	-	0	0	-	-	0	-/-
96	20	-	-	20	-	-	0	0	-	-	0	10/26
01	0	-	-	-	-	-	0	0	-	-	0	12/22
06	20	-	-	20	-	-	0	0	-	-	0	-/-
Juniperus scopulorum												
84	66	-	33	33	-	-	50	0	-	-	0	67/83
90	66	-	33	33	-	-	0	0	-	-	0	118/98
96	0	-	-	-	-	-	0	0	-	-	0	-/-
01	0	-	-	-	-	-	0	0	-	-	0	-/-
06	0	-	-	-	-	-	0	0	-	-	0	-/-
Mahonia repens												
84	2466	-	766	1700	-	-	0	0	-	-	0	8/6
90	4266	200	500	3766	-	-	3	0	-	-	0	7/4
96	800	-	-	800	-	-	0	0	-	-	0	4/6
01	2140	-	-	2140	-	-	0	0	-	-	0	3/4
06	2260	-	-	2260	-	-	0	0	-	-	0	5/5
Opuntia sp.												
84	0	-	-	-	-	-	0	0	0	-	0	-/-
90	0	-	-	-	-	-	0	0	0	-	0	-/-
96	100	-	-	100	-	-	0	0	0	-	0	6/29
01	160	-	20	140	-	-	0	0	0	-	0	5/15
06	120	-	-	100	20	20	0	0	17	-	0	5/20
Pachistima myrsinites												
84	33	-	-	33	-	-	0	0	-	-	0	6/7
90	0	-	-	-	-	-	0	0	-	-	0	-/-
96	180	-	60	120	-	-	0	0	-	-	0	7/12
01	140	-	60	80	-	-	0	0	-	-	0	5/7
06	40	-	-	40	-	-	0	0	-	-	0	9/14

		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)
Purshia tridentata												
84	0	-	-	-	-	-	0	0	0	-	0	-/-
90	132	-	66	33	33	-	0	25	25	-	0	24/33
96	140	-	-	120	20	20	43	57	14	-	0	16/36
01	120	-	-	120	-	-	50	17	0	-	0	18/40
06	120	-	-	40	80	120	33	50	67	50	50	14/39
Symphoricarpos oreophilus												
84	99	-	33	66	-	-	0	0	0	-	0	18/26
90	199	-	33	166	-	-	0	0	0	-	0	15/28
96	460	-	100	320	40	-	4	0	9	-	4	19/37
01	400	-	-	380	20	-	0	0	5	-	5	27/52
06	600	-	40	520	40	40	0	0	7	7	13	21/34