

Trend Study 19C-15-07

Study site name: Upper Broad Canyon .

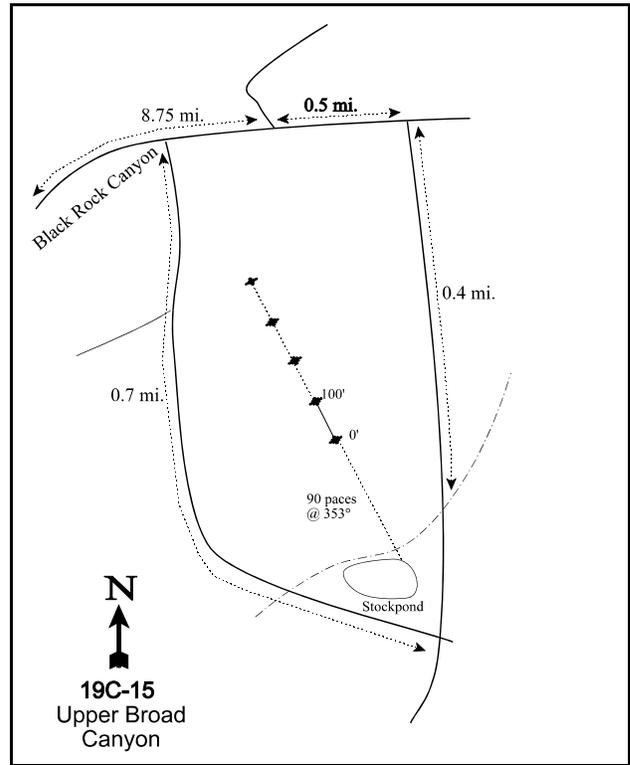
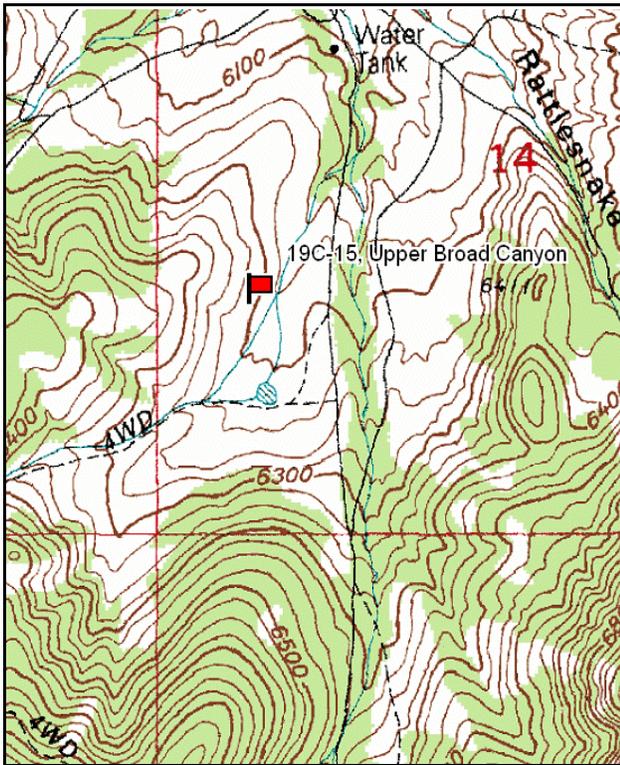
Vegetation type: Big Sagebrush-Grass .

Compass bearing: frequency baseline 319 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). Rebar: belt 1 on 1ft, belt 2 on 1ft, belt 3 on 2ft, belt 5 on 5 ft..

LOCATION DESCRIPTION

From Highway U-36 between Vernon and Tintic Junction, proceed east on the Black Rock Canyon Road for 8.75 miles, to the road junction in Broad Canyon within Utah County. At this point, take the right fork (east) and travel an additional 0.50 miles to another fork. Turn right and travel 0.40 miles to another fork. Turn left and travel approximately 0.10 miles to where there is a stock pond surrounded by a fence on the west side of the road. From the northwest corner of the stock pond, walk 90 paces at 353 degrees magnetic toward a large juniper at the base of the hill. At this point, there will be a green steel fencepost, 15 inches high with a red browse tag, number 3935, attached, which marks the 0-foot end of the frequency baseline.



Map Name: Boulder Peak

Diagrammatic Sketch

Township 9S, Range 3W, Section 14

GPS: NAD 83, UTM 12T 401604 E 4431971 N

## DISCUSSION

### Upper Broad Canyon - Trend Study No. 19C-15

#### Study Information

This transitional deer range study is located on a sheep allotment that is administered by the Bureau of Land Management [elevation: 6,250 feet (1,905 m), slope: 15%-20%, aspect: southeast]. The range type is mountain big sagebrush-grass and is intermixed with smaller densities of antelope bitterbrush. A wildfire burned through the surrounding area in either 2000 or 2001, leaving the study intact. There are obvious signs of livestock trailing to a stock pond located 600 feet (183 m) to the south. Wildlife pellet groups are frequent, especially deer. Two antler sheds were found within the transect in 1983, and in 2002 four bucks and a couple of does were seen just north of the study. From the pellet group transect, there were an estimated 22 deer days use/acre (55 ddu/ha) in 2002 and 30 deer days use/acre (74 ddu/ha) in 2007. Sheep use was estimated at 19 days use/acre (48 sdu/ha) in 2002 and 3 days use/acre (8 sdu/ha) in 2007.

#### Soil

The study lies within the Lodar-Rock outcrop complex. Soils in this series formed in residuum and colluvium from limestone and sandstone. The soils are well or somewhat excessively-drained, moderately permeable soils on ridges, mountains, and hills. Soil depths are 10-20 inches (25-51 cm) (USDA-NRCS 2007). At the study, the soil has a clay loam texture and a neutral reactivity (pH of 7.1). There is an abundance of rocks and pavement, both on and below the soil surface. Relative rock cover has averaged 16%, and pavement cover has averaged 12% since 1997. The erosion condition was classified as stable in 2002 and declined to slight in 2007, due to decreases in surface rock and soil movement, flow patterns, and pedestalling.

#### Browse

The dominant key browse species are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and, to a lesser extent, antelope bitterbrush (*Purshia tridentata*). Canopy cover of sagebrush was 6% in 2002 and increased to 8% in 2007. The density of sagebrush increased from an estimated 2,232 plants/acre (5,525 plants/ha) in 1983 to 2,432 plants/acre (6,020 plants/ha) in 1989. The density was approximately 2,080 plants/acre (5,149 plants/ha) in 1997 and 2002, and decreased to 1,560 plants/acre (3,861 plants/ha) in 2007. Reproduction and recruitment have been low since 1989. In addition, decadence has been high every sample year, and has ranged from 27% of the population to 47%. Decadent sagebrush were most abundant in 1989, 2002, and 2007. Since 1997, a high percentage of the plants have been classified as dying and the density of dead plants has averaged 873 plants/acre (2,162 plants/ha). The proportion of plants exhibiting poor vigor has varied from 18% to 93%. The mean annual sagebrush leader growth was 1.8 inches (4.6 cm) in 2002 and 1.4 inches (3.5 cm) in 2007. Browse use has been characterized as light, light-moderate, and heavy.

The canopy cover of antelope bitterbrush has been approximately 3% since 2002. The estimated density increased from 299 plants/acre (740 plants/ha) in 1983 to 380 plants/acre (941 plants/ha) in 1997, and decreased to 220 plants/acre (545 plants/ha) by 2007. The bitterbrush population has maintained generally good vigor and low decadence in spite of moderate-heavy browse use every sample year. Individual plants have acquired a prostrate growth form due to many years of elevated browse use. Annual bitterbrush leader growth averaged 2.7 inches (6.9 cm) in 2002 and 2.2 inches (5.7 cm) in 2007.

Singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) are scattered across the study in moderate densities. Juniper trees were not sampled in the canopy cover transect, but pinyon pine canopy cover has been less than 1% since 2002. From point-centered quarter data, there were an estimated 73 pinyon trees/acre (181 trees/ha) in 2002 and 49 trees/acre (121 trees/ha) in 2007. There were an estimated 32 juniper trees/acre (79 trees/ha) in 2002 and 25 trees/acre (62 trees/ha) in 2007. The mean diameter of both species increased considerably in 2007. These data suggest that the tree community is comprised of fewer, larger trees.

### Herbaceous Understory

Grasses are the dominant component of the understory and have accounted for 59% to 73% of the vegetative cover since 1997. Perennial grass cover was 20% in 1997, 18% in 2002, and 27% in 2007. The dominant grasses are bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg bluegrass (*Poa secunda*). Even though Sandberg bluegrass has a higher frequency, average bluebunch wheatgrass cover is greater. Less abundant perennials include crested wheatgrass (*Agropyron cristatum*) and bottlebrush squirreltail (*Sitanion hystrix*). Cheatgrass (*Bromus tectorum*) is present, but has accounted for a small proportion of grass cover.

Perennial forb cover has been less than 1% since 1997. The few perennial forbs that are present occur in low frequencies and offer little forage. The most common perennial species are rose pussytoes (*Antennaria rosea*) and desert parsley (*Lomatium* sp.). Annual forbs are dominated by pale alyssum (*Alyssum alyssoides*) and bur buttercup (*Ranunculus testiculatus*). Annual forb cover was 2% in 1997, 0% in 2002, and 1% in 2007.

### 1989 TREND ASSESSMENT

The browse trend is slightly down. The density of mountain big sagebrush increased 9%. However, decadence increased from 27% to 44% of the sagebrush population, and the proportion of plants exhibiting poor vigor increased from 25% to 93%. Thus, the small increase in sagebrush density was offset by a decline in population health. Browse use on sagebrush shifted from heavy to light-moderate. Bitterbrush density increased 11%, decadence remained stable, and plants in poor vigor decreased from 11% to 0% of the population. The grass trend is stable. The sum of nested frequency of perennial grasses increased 8%. Two species increased significantly in nested frequency and two species decreased significantly. The forb trend is stable. The sum of nested frequency of perennial forbs increased 11%. Perennial forbs are a very insignificant part of the vegetation component.

browse - slightly down (-1)      grass - stable (0)      forb - stable (0)

### 1997 TREND ASSESSMENT

The browse trend is stable. The density of mountain big sagebrush decreased 15%. Some of the changes in sagebrush density are due to the larger area sampled beginning in 1997. Sagebrush recruitment changed little; young plants increased from 5% of the population to 8%. Decadence decreased to 29% of the population, and plants with poor vigor decreased to 34%. Plants that were classified as dying comprised 20% of the population. The density of dead plants increased from 0 plants/acre to 920 plants/acre (2,277 plants/ha), but again, this increase may be the result of the larger area sampled. The bitterbrush density increased 15%, and both decadence and vigor remained constant. The grass trend is stable. The sum of nested frequency of perennial grasses decreased only 1%. There was a significant increase in the nested frequency of bluebunch wheatgrass, and a significant decrease in that of crested wheatgrass. The forb trend is slightly down. Although the sum of nested frequency of perennial forbs decreased 29%, forbs have such a low abundance that the decrease is muted. The Desirable Components Index (DCI) score is fair due to the moderate browse cover, and high perennial grass cover.

winter range condition (DCI) - fair (54) Mid-level potential scale  
browse - stable (0)      grass - stable (0)      forb - slightly down (-1)

### 2002 TREND ASSESSMENT

The browse trend is stable. The density of mountain big sagebrush remained stable even though there was no improvement in reproduction. Decadence increased to 47% of the population, and 17% of the population was classified as dying. However, plants with poor vigor decreased to 18%, and browse use shifted from light-moderate to light. Bitterbrush density also remained stable, but decadence increased from 11% to 22% of the population. Browse use on bitterbrush shifted from heavy to moderate-heavy. The grass trend is slightly up. The sum of nested frequency of perennial grasses decreased only 1%, but there was a significant decrease in the nested frequency of cheatgrass. Cheatgrass quadrat frequency decreased from 76% to 10%. Grazing use

on grasses was minimal. The forb trend is stable. Even though the sum of nested frequency of perennial forbs decreased again by 29%, perennial forb abundance was already low. However, there was a significant decrease in the nested frequency of bur buttercup. This allelopathic annual may inhibit germination and growth of other herbaceous species (Buchanan et al. 1978). The DCI score declined to poor due to the increase in browse decadence and decrease in young, preferred browse plants.

winter range condition (DCI) - poor (46) Mid-level potential scale  
browse - stable (0)                      grass - slightly up (+1)                      forb - stable (0)

**2007 TREND ASSESSMENT**

The browse trend is down. The density of mountain big sagebrush decreased 26%. Sagebrush decadence remained stable at 47%, but dying plants increased to 33% of the population. Plants exhibiting poor vigor increased from 18% to 45% of the population, and many of the plants were chlorotic. Browse use on sagebrush shifted from light to light-moderate. Bitterbrush density decreased 39%, though none of the plants were decadent or had poor vigor. The grass trend is stable. The sum of nested frequency of perennial grasses did not change, although average cover increased from 18% to 27%. Cheatgrass increased significantly in nested frequency, but did not return to the frequency or cover values measured in 1997. The forb trend is stable. The nested frequency of perennial forbs increased two-fold, but perennial forbs are still an insignificant vegetative component. Bur buttercup significantly increased in nested frequency. The DCI score remained poor.

winter range condition (DCI) - poor (46) Mid-level potential scale  
browse - down (-2)                      grass - stable (0)                      forb - stable (0)

**HERBACEOUS TRENDS --**  
**Management unit 19C, Study no: 15**

T y p e	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	<sub>a</sub> 12	<sub>b</sub> 83	<sub>a</sub> 40	<sub>a</sub> 16	<sub>a</sub> 14	.79	1.12	.68
G	Agropyron spicatum	<sub>ab</sub> 189	<sub>a</sub> 147	<sub>b</sub> 202	<sub>b</sub> 204	<sub>ab</sub> 195	14.03	12.96	15.57
G	Bromus carinatus	-	-	-	-	3	-	-	.15
G	Bromus tectorum (a)	-	-	<sub>c</sub> 212	<sub>a</sub> 17	<sub>b</sub> 94	1.23	.05	.47
G	Oryzopsis hymenoides	<sub>b</sub> 30	<sub>a</sub> 10	<sub>a</sub> 1	-	<sub>a</sub> 2	.00	-	.30
G	Poa fendleriana	-	-	4	-	-	.01	-	-
G	Poa secunda	<sub>a</sub> 212	<sub>b</sub> 259	<sub>b</sub> 261	<sub>b</sub> 282	<sub>b</sub> 287	5.13	4.10	10.05
G	Sitanion hystrix	<sub>b</sub> 34	<sub>a</sub> 17	<sub>a</sub> 3	<sub>a</sub> 3	<sub>a</sub> 3	.03	.00	.03
Total for Annual Grasses		0	0	212	17	94	1.23	0.05	0.47
Total for Perennial Grasses		477	516	511	505	504	19.99	18.20	26.79
Total for Grasses		477	516	723	522	598	21.23	18.25	27.26
F	Agoseris glauca	-	-	<sub>a</sub> 2	<sub>a</sub> 1	<sub>a</sub> 3	.00	.00	.00
F	Alyssum alyssoides (a)	-	-	<sub>b</sub> 328	<sub>a</sub> 11	<sub>c</sub> 234	1.34	.02	.78
F	Antennaria rosea	<sub>a</sub> 13	<sub>a</sub> 33	<sub>a</sub> 19	<sub>a</sub> 29	<sub>a</sub> 18	.12	.31	.15
F	Arabis sp.	<sub>a</sub> 4	<sub>a</sub> 3	<sub>a</sub> 5	-	-	.01	-	-

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	<i>Calochortus nuttallii</i>	<sub>a</sub> 11	<sub>a</sub> 7	-	-	<sub>a</sub> 12	-	-	.03
F	<i>Chaenactis douglasii</i>	<sub>a</sub> 12	<sub>a</sub> 6	-	-	-	-	-	-
F	<i>Cirsium</i> sp.	-	-	1	-	-	.00	-	-
F	<i>Collinsia parviflora</i> (a)	-	-	<sub>a</sub> 16	-	<sub>a</sub> 25	.03	-	.06
F	<i>Delphinium nuttallianum</i>	4	-	-	-	-	-	-	-
F	<i>Descurainia pinnata</i> (a)	-	-	-	-	10	-	-	.05
F	<i>Draba</i> sp. (a)	-	-	-	-	11	-	-	.05
F	<i>Epilobium brachycarpum</i> (a)	-	-	14	-	-	.03	-	-
F	<i>Holosteum umbellatum</i> (a)	-	-	-	<sub>a</sub> 1	<sub>a</sub> 5	-	.00	.01
F	<i>Lomatium</i> sp.	-	-	<sub>a</sub> 12	-	<sub>b</sub> 30	.03	-	.21
F	<i>Microsteris gracilis</i> (a)	-	-	<sub>b</sub> 59	-	<sub>a</sub> 8	.12	-	.01
F	<i>Phlox longifolia</i>	-	-	-	1	-	-	.00	-
F	<i>Ranunculus testiculatus</i> (a)	-	-	<sub>b</sub> 135	<sub>a</sub> 12	<sub>b</sub> 114	.70	.02	.31
F	<i>Tragopogon dubius</i>	<sub>a</sub> 6	<sub>a</sub> 1	-	-	-	-	-	-
F	Unknown forb-perennial	4	-	-	-	-	-	-	-
F	<i>Zigadenus paniculatus</i>	<sub>a</sub> 3	<sub>a</sub> 13	<sub>a</sub> 6	<sub>a</sub> 1	<sub>a</sub> 2	.01	.03	.01
Total for Annual Forbs		0	0	552	24	407	2.24	0.05	1.29
Total for Perennial Forbs		57	63	45	32	65	0.18	0.35	0.40
Total for Forbs		57	63	597	56	472	2.42	0.40	1.70

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

BROWSE TRENDS --

Management unit 19C, Study no: 15

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	<i>Amelanchier utahensis</i>	2	2	2	-	-	-
B	<i>Artemisia tridentata vaseyana</i>	69	68	59	8.61	7.26	5.50
B	<i>Eriogonum microthecum</i>	1	1	1	-	-	-
B	<i>Gutierrezia sarothrae</i>	86	57	43	1.20	.68	.78
B	<i>Juniperus osteosperma</i>	0	1	1	.00	-	-
B	<i>Pinus monophylla</i>	0	0	0	.85	.00	.03
B	<i>Purshia tridentata</i>	12	11	9	1.91	1.92	2.01
Total for Browse		170	140	115	12.58	9.88	8.34

CANOPY COVER, LINE INTERCEPT --  
Management unit 19C, Study no: 15

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	6.18	7.93
Eriogonum microthecum	-	.08
Gutierrezia sarothrae	.83	.91
Pinus monophylla	.83	.90
Purshia tridentata	2.54	2.46

KEY BROWSE ANNUAL LEADER GROWTH --  
Management unit 19C, Study no: 15

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.8	1.4
Purshia tridentata	2.7	2.2

POINT-QUARTER TREE DATA --  
Management unit 19C, Study no: 15

Species	Trees per Acre		Average diameter (in)	
	'02	'07	'02	'07
Juniperus osteosperma	32	25	1.8	5.1
Pinus monophylla	73	49	1.8	3.4

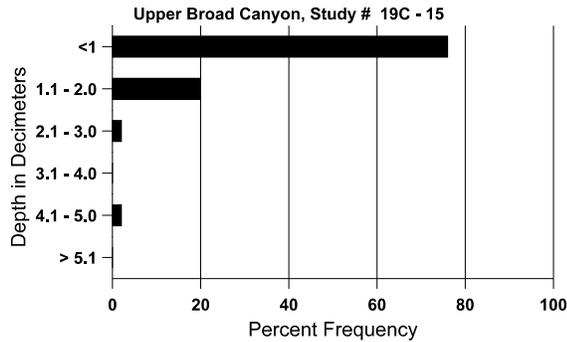
BASIC COVER --  
Management unit 19C, Study no: 15

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	0	5.25	34.31	27.71	35.45
Rock	11.75	17.25	19.31	19.66	17.38
Pavement	28.00	24.75	12.09	13.53	13.80
Litter	49.50	38.50	28.56	28.13	21.09
Cryptogams	.50	2.50	3.05	4.07	4.90
Bare Ground	10.25	11.75	14.59	16.81	16.55

SOIL ANALYSIS DATA --  
Herd Unit 19C, Study no: 15, Upper Broad Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%OM	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
9.6	64.2 (11.3)	7.1	42.4	29.1	28.6	3.0	7.1	166.4	.6

## Stoniness Index



### PELLET GROUP DATA --

Management unit 19C, Study no: 15

Type	Quadrat Frequency		
	'97	'02	'07
Sheep	12	3	-
Rabbit	7	3	9
Elk	-	3	-
Deer	17	15	7
Cattle	-	3	-

Days use per acre (ha)	
'02	'07
19 (48)	-
-	-
-	3 (8)
22 (55)	30 (74)
-	-

### BROWSE CHARACTERISTICS --

Management unit 19C, Study no: 15

		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)
<b>Amelanchier utahensis</b>												
83	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
89	<b>0</b>	-	-	-	-	-	0	0	-	-	0	-/-
97	<b>40</b>	-	-	40	-	-	50	0	-	-	0	12/12
02	<b>40</b>	-	-	40	-	-	100	0	-	-	0	11/16
07	<b>40</b>	-	-	40	-	-	50	0	-	-	0	22/23
<b>Artemisia tridentata vaseyana</b>												
83	<b>2232</b>	-	266	1366	600	-	10	69	27	-	25	24/23
89	<b>2432</b>	100	133	1233	1066	-	38	26	44	-	93	16/23
97	<b>2060</b>	20	160	1300	600	920	42	9	29	20	34	22/35
02	<b>2100</b>	-	60	1060	980	900	17	0	47	17	18	21/34
07	<b>1560</b>	-	40	780	740	800	35	24	47	33	45	22/39

		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>Eriogonum microthecum</i>												
83	0	-	-	-	-	-	0	0	0	-	0	-/-
89	0	-	-	-	-	-	0	0	0	-	0	-/-
97	20	-	-	20	-	-	0	0	0	-	0	5/8
02	20	-	-	20	-	-	0	0	0	-	0	4/5
07	20	-	-	-	20	-	0	0	100	100	100	7/9
<i>Gutierrezia sarothrae</i>												
83	5166	2066	1233	3933	-	-	0	0	0	-	0	8/8
89	7999	800	2200	5566	233	-	0	0	3	-	0	8/12
97	6760	20	1340	5380	40	-	0	0	1	-	0	7/7
02	2500	-	40	1860	600	2520	.80	0	24	9	10	5/8
07	1360	40	60	1300	-	60	0	0	0	-	0	7/10
<i>Juniperus osteosperma</i>												
83	0	-	-	-	-	-	0	0	-	-	0	-/-
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	20	-	-	20	-	-	0	0	-	-	0	-/-
07	20	-	20	-	-	-	0	0	-	-	0	-/-
<i>Pinus monophylla</i>												
83	0	-	-	-	-	-	0	0	-	-	0	-/-
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	0	80	-	-	-	-	0	0	-	-	0	-/-
07	0	40	-	-	-	-	0	0	-	-	0	-/-
<i>Purshia tridentata</i>												
83	299	-	-	266	33	-	0	100	11	-	11	11/29
89	332	-	133	166	33	-	20	60	10	-	0	10/18
97	380	-	20	320	40	40	16	68	11	-	0	18/34
02	360	-	-	280	80	20	28	39	22	11	11	20/46
07	220	-	-	220	-	-	36	45	0	-	0	24/56
<i>Ribes sp.</i>												
83	0	-	-	-	-	-	0	0	-	-	0	-/-
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	-/-
02	0	-	-	-	-	-	0	0	-	-	0	14/33
07	0	-	-	-	-	-	0	0	-	-	0	-/-

		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>Symphoricarpos oreophilus</i>												
83	0	-	-	-	-	-	0	0	-	-	0	-/-
89	0	-	-	-	-	-	0	0	-	-	0	-/-
97	0	-	-	-	-	-	0	0	-	-	0	14/65
02	0	-	-	-	-	-	0	0	-	-	0	-/-
07	0	-	-	-	-	-	0	0	-	-	0	-/-