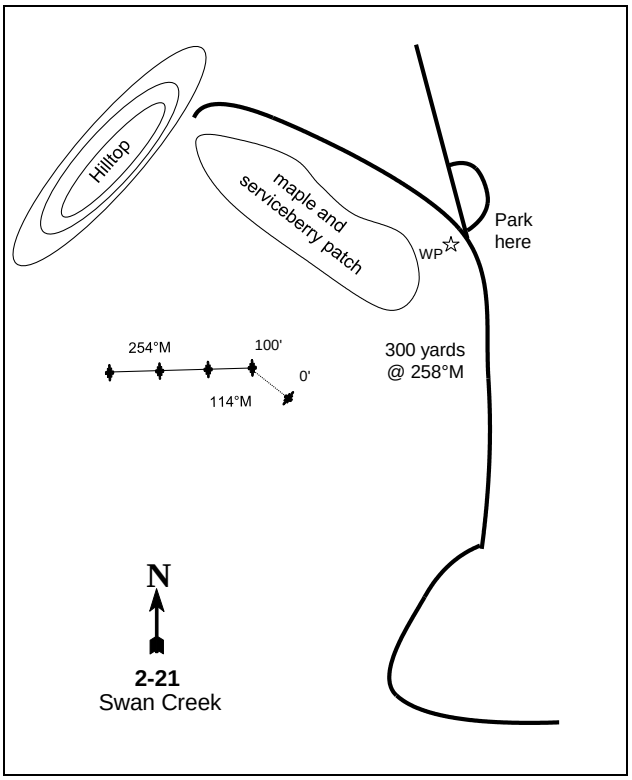
SWAN CREEK - TREND STUDY NO. 2-21-11

Vegetation Type: Curlleaf Mountain Mahogany
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Mountain Gravelly Loam (Mountain Big Sagebrush), R047XA406UT
Land Ownership: USFS
Elevation: 6,400 ft (1,951 m)
Aspect: East
Slope: 27%
Transect bearing: 114° magnetic
Belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft). Rebar: belt 1 on 5ft., belt 2 on 5ft., & belt 4 no rebar.

Directions:
Drive approximately 3.0 miles north of Garden City on US 89. Turn left on 2150 North in Lakota (1 mile south of Idaho border). Go approximately 1 mile on the narrow road up Swan Creek, staying right at one major fork. Just past the creek from the spring, before the pump house, turn right and go 0.2 miles up a jeep road to another fork. Park here, then walk up and across the slope 300 yards at 258 degrees magnetic to the 100-foot baseline stake. The 0-foot baseline stake is 100 feet to the northwest. The rest of the baseline runs 254 degrees magnetic off the 0-foot baseline stake. The study site is in the mahogany grove. The 0-foot baseline stake is marked by browse tag #97.

Map Name: Garden City

Diagrammatic Sketch:



Township: 14N Range: 5E Section: 6

GPS: NAD 83, UTM 12S 464642 E 4648467 N

SWAN CREEK - TREND STUDY NO. 2-21

Site Information

Site Description: This study was established on Utah Division of Wildlife Resources (UDWR) property in the Swan Creek drainage. The UDWR administrates only a portion of the section; the remainder is privately owned and is used for cabins, recreation, and limited agriculture. The site is dominated by curlleaf mountain mahogany (*Cercocarpus ledifolius*) and has areas that receive significant use by wintering elk, deer, and moose. Since 2001, deer pellet groups have been sampled in high abundance. Elk pellet groups were sampled in moderate abundance in 2001 and 2011, but high abundance in 2006. Quadrat data indicated high pellet group frequency by deer and elk in 1996. Moose pellet groups were sampled in low abundance in 2006 (Table - Pellet Group Data).

Browse: The preferred browse species is curlleaf mountain mahogany. The curlleaf mahogany population is tree like in form and creates the upper browse canopy on the site. The majority of curlleaf mahogany is unavailable to browsing due to height, but the available portions have been browsed moderately to heavily. The mahogany is a mostly mature population that has had good vigor and low decadence in most sample years. Decadence of mahogany plants was high in 2006. The recruitment of young mahogany plants to the population has been good over the course of the study. The associated understory shrubs are composed of antelope bitterbrush (*Purshia tridentata*), Saskatoon serviceberry (*Amelanchier alnifolia*), mountain snowberry (*Symphoricarpos oreophilus*), and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). Saskatoon serviceberry is moderately abundant and has steadily increased over the duration of the study. Serviceberry has consistently received moderate to heavy use since 1990, while maintaining a vigorous population. Poor vigor was noted on a small portion of plants sampled in 1996 due to an infestation of a rust. Recruitment of young serviceberry plants has been excellent. Mountain big sagebrush and antelope bitterbrush have small, vigorous populations, with little decadence observed within the populations (Table - Browse Characteristics).

Herbaceous Understory: Bluebunch wheatgrass (*Agropyron spicatum*) is the dominant perennial grass and comprises the majority of herbaceous understory cover. The weedy annual species cheatgrass (*Bromus tectorum*) and Japanese chess (*B. japonicus*) are the dominant annual grasses. The exotic weedy species bulbous bluegrass (*Poa bulbosa*) has historically had low abundance, but has been steadily increasing over the course of the study. Forbs are moderately diverse, but only a few species are abundant. The most common perennial forbs include arrowleaf balsamroot (*Balsamorhiza sagittata*), rock goldenrod (*Petradoria pumila*), and tapertip hawksbeard (*Crepis acuminata*).

Soil: The study is part of the Agassiz-Richville complex and likely as part of the Agassiz component. The parent material consists of colluvium over residuum weathered from limestone (Soil Survey Staff 2011). The soil has a loam texture with a soil reaction that is slightly alkaline (pH 7.5). The soil is rocky on the surface and throughout the profile with bedrock layers exposed on the slope. Protective cover is relatively high with vegetation, litter, and rock leaving little exposed bare ground. The soil erosion condition was classified as stable in 2001 and 2011, but slight in 2006.

Trend Assessments

Browse:

- **1990 to 1996 - stable (0):** Differences in density may be related to the larger sample area used in 1996; therefore, trend was determined using other parameters. Decadence and poor vigor for curlleaf mountain mahogany was not observed within the population. Saskatoon serviceberry displayed an increase in decadence from 8% to 17%. Serviceberry increased in poor vigor from 4% to 10% of the total population.
- **1996 to 2001 - slightly up (+1):** The density for curlleaf mountain mahogany decreased 21% from 280 plants/acre to 220 plants/acre. Decadence within the mahogany population increased to 9%, while

poor vigor was not observed within the population. The density of serviceberry increased 26% from 840 plants/acre to 1,060 plants/acre. Decadence and poor vigor was not observed within the serviceberry population.

- **2001 to 2006 - slightly up (+1):** The density for curlleaf mountain mahogany increased 73% to 380 plants/acre. Curlleaf mountain mahogany had a high amount of decadence and poor vigor, both of which increased to 37% of the total population. Serviceberry increased in density by 15% to 1,220 plants/acre. Serviceberry decadence increased to 5%, and poor vigor increased to 7%.
- **2006 to 2011 - stable (0):** The density for curlleaf mountain mahogany decreased 42% to 220 plants/acre. There was no display of decadence and poor vigor within the mahogany population. The density for serviceberry increased 15% to 1,400 plants/acre. Decadence and poor vigor for serviceberry were minimal at 3% and 1%, respectively.

Grass:

- **1990 to 1996 - stable (0):** The sum of nested frequency for perennial grasses remained similar. The preferred grass bluebunch wheatgrass had a significant decrease in nested frequency, and had a cover of 7%. However, Sandberg bluegrass had a significant increase in nested frequency, and had a cover of 2%. Annual species were included in the sample for the first time in 1996. The weedy annual cheatgrass was the dominant grass with a cover of 9%
- **1996 to 2001 - slightly up (+1):** The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, increased 10%. The majority of grass cover was comprised of bluebunch wheatgrass, which had a significant increase in nested frequency. Moreover, bluebunch wheatgrass increased in cover to 10%. Cheatgrass had a significant decrease in nested frequency, and decreased in cover to 1%.
- **2001 to 2006 - stable (0):** The sum of nested frequency for perennial grasses remained similar. There was no significant increase in nested frequencies for perennial grasses. The weedy annual species cheatgrass and Japanese chess both had a significant increase in nested frequencies. Cover for cheatgrass increased to 2%.
- **2006 to 2011 - stable (0):** The sum of nested frequency for perennial grasses remained similar. Sandberg bluegrass had a significant decrease in nested frequency. The weedy annual Japanese brome had a significant increase in nested frequency, and cover increased to 3%. Cheatgrass did not change significantly in nested frequency, but did increase in cover to 3%.

Forb:

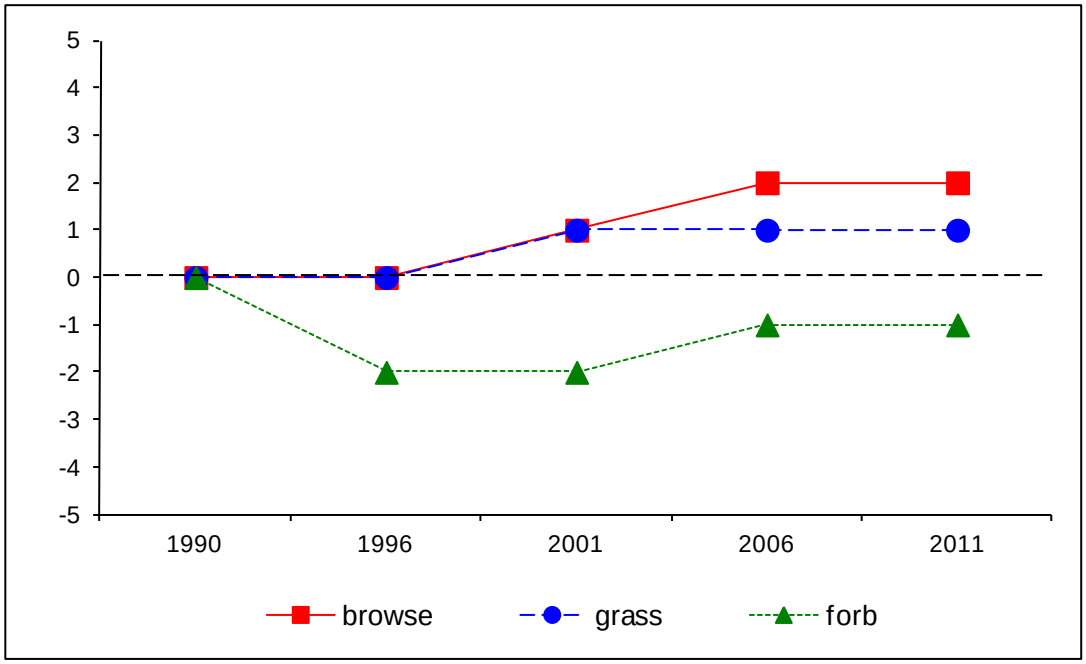
- **1990 to 1996 - down (-2):** The sum of nested frequency for perennial forbs decreased 53%. Several species decreased significantly in nested frequencies including longleaf phlox (*Phlox longifolia*), tapertip hawksbeard (*Crepis acuminata*), bastard toadflax (*Comandra pallida*), and sego lily (*Calochortus nuttallii*), all of which had covers less than 1%. Balsamroot sagittata was the most common forb and provided cover of 4%.
- **1996 to 2001 - stable (0):** The sum of nested frequency for perennial forbs remained similar. No one perennial forb species increased significantly in nested frequency.
- **2001 to 2006 - slightly up (+1):** The sum of nested frequency for perennial forbs increased 25%. However, the cover for perennial forbs was maintained near 9%. The perennial forb species low penstemon (*Penstemon humilis*) had a significant increase in nested frequency, but cover was less than 1%.
- **2006 to 2011 - stable (0):** The sum of nested frequency for perennial forbs remained similar. No significant change was observed within the perennial forb community. The weedy annual species pale alyssum had a significant increase in nested frequency, and had an increase in cover from less than 1% to 2%.

DEER DESIRABLE COMPONENTS INDEX - MID LEVEL POTENTIAL SCALE --
Management unit 2, study no: 21

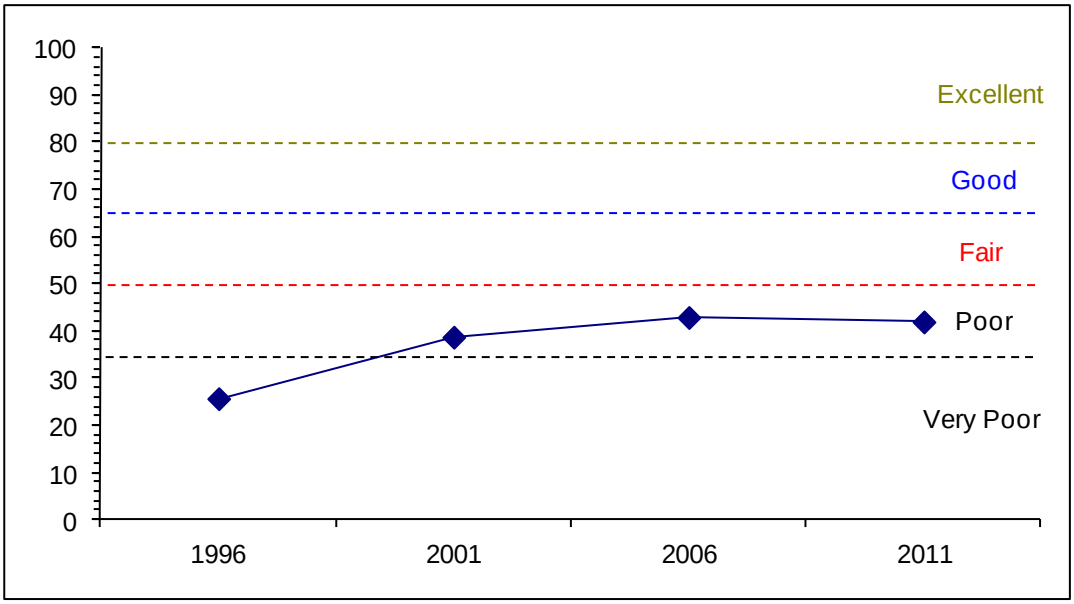
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover (-POBU)	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
96	9.2	0.0	0.0	16.9	-10.4	10.0	0.0	**25.7**	Very Poor
01	7.2	0.0	0.0	22.5	-1.0	10.0	0.0	**38.7**	Poor
06	6.2	0.0	0.0	28.3	-1.6	10.0	0.0	**42.9**	Poor
11	6.1	0.0	0.0	29.7	-3.9	10.0	0.0	**41.9**	Poor

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 2 Study no: 21



DEER DESIRABLE COMPONENTS INDEX TREND, MID-LEVEL POTENTIAL--
Management unit 2, Study no: 21



HERBACEOUS TRENDS--
Management unit 02, Study no: 21

Type	Species	Nested Frequency					Average Cover %			
		'90	'96	'01	'06	'11	'96	'01	'06	'11
G	Agropyron spicatum	b286	a222	ab241	a220	ab253	6.91	9.72	10.45	12.64
G	Bromus japonicus (a)	-	c162	a44	b89	d226	5.26	.26	.57	3.22
G	Bromus tectorum (a)	-	b168	a75	b136	a90	8.59	1.02	1.62	2.49
G	Koeleria cristata	-	-	-	2	5	-	-	.15	.01
G	Oryzopsis hymenoides	-	4	1	2	6	.03	.06	.07	.09
G	Poa bulbosa	-	a3	ab20	b39	c72	.09	.69	1.32	3.25
G	Poa pratensis	-	1	1	7	13	.03	.01	.30	.10
G	Poa secunda	a55	ab105	b122	b125	a74	1.46	1.46	3.18	1.98
Total for Annual Grasses		0	330	119	225	316	13.85	1.29	2.19	5.71
Total for Perennial Grasses		341	335	385	395	423	8.53	11.94	15.48	18.09
Total for Grasses		341	665	504	620	739	22.39	13.24	17.68	23.80
F	Achillea millefolium	6	7	1	9	10	.16	.03	.07	.21
F	Agoseris glauca	25	26	23	25	37	.12	.06	.18	.16
F	Alyssum alyssoides (a)	-	b183	b198	a131	c257	.99	.76	.43	1.65
F	Arabis sp.	b10	a-	a-	a-	a-	-	-	-	-
F	Balsamorhiza sagittata	b76	ab52	ab40	a31	a40	3.67	4.35	2.85	1.60
F	Calochortus nuttallii	b19	a-	a3	a-	ab7	-	.00	-	.02
F	Camelina microcarpa (a)	a-	a12	b43	a10	ab29	.06	.12	.05	.09
F	Castilleja linariaefolia	4	-	2	-	-	-	.03	-	-
F	Chaenactis douglasii	-	-	-	-	4	-	-	-	.04
F	Cirsium undulatum	7	4	2	6	6	.19	.15	.21	.13
F	Collinsia parviflora (a)	-	a9	b99	b85	b63	.01	.19	.20	.18
F	Collomia linearis (a)	-	-	7	-	2	-	.01	-	.01

Type	Species	Nested Frequency					Average Cover %			
		'90	'96	'01	'06	'11	'96	'01	'06	'11
F	Comandra pallida	$_{b}$26	$_{a}$4	$_{a}$2	$_{a}$3	$_{a}$6	.01	.03	.06	.09
F	Crepis acuminata	$_{c}$106	$_{a}$16	$_{ab}$33	$_{b}$55	$_{b}$47	.19	.54	1.54	.63
F	Delphinium nuttallianum	-	-	2	-	-	-	.01	-	-
F	Descurainia pinnata (a)	-	$_{a}$-	$_{b}$13	$_{a}$3	$_{ab}$5	-	.03	.00	.01
F	Draba sp. (a)	-	-	3	-	-	-	.03	-	-
F	Epilobium brachycarpum (a)	-	2	-	-	10	.01	-	-	.04
F	Eriogonum umbellatum	5	-	-	-	9	-	-	.00	.21
F	Gayophytum ramosissimum(a)	-	-	3	5	-	-	.01	.03	-
F	Hackelia patens	7	16	18	11	2	.19	.19	.14	.02
F	Holosteum umbellatum (a)	-	-	-	-	4	-	-	-	.01
F	Lactuca serriola (a)	3	-	3	-	1	-	.03	-	.00
F	Lappula occidentalis (a)	-	-	25	23	2	-	.19	.05	.01
F	Lithospermum arvense (a)	-	-	-	-	6	-	-	-	.04
F	Lomatium sp.	5	-	1	-	10	-	.00	-	.05
F	Machaeranthera canescens	-	-	-	2	5	-	.03	.01	.01
F	Microsteris gracilis (a)	-	$_{a}$-	$_{bc}$41	$_{c}$59	$_{b}$40	-	.08	.16	.10
F	Penstemon humilis	-	$_{a}$-	$_{a}$2	$_{b}$28	$_{a}$14	-	.04	.24	.13
F	Penstemon sp.	$_{b}$25	$_{ab}$13	$_{ab}$9	$_{a}$8	$_{a}$4	.13	.10	.30	.01
F	Petradoria pumila	58	58	50	46	47	3.01	3.36	2.84	4.31
F	Phlox longifolia	$_{b}$28	$_{a}$-	$_{a}$7	ab17	$_{a}$12	-	.02	.08	.05
F	Polygonum douglasii (a)	-	-	-	1	-	-	-	.00	-
F	Tragopogon dubius (a)	$_{a}$7	$_{a}$9	$_{ab}$19	$_{ab}$25	$_{b}$29	.02	.18	.14	.45
F	Veronica biloba (a)	-	10	5	9	9	.07	.01	.01	.02
F	Zigadenus paniculatus	9	-	5	8	4	-	.04	.08	.01
Total for Annual Forbs		10	225	459	351	457	1.17	1.65	1.11	2.64
Total for Perennial Forbs		416	196	200	249	264	7.69	9.01	8.65	7.71
Total for Forbs		426	421	659	600	721	8.87	10.67	9.76	10.35

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

BROWSE TRENDS--
Management unit 02, Study no: 21

Type	Species	Strip Frequency				Average Cover %			
		'96	'01	'06	'11	'96	'01	'06	'11
B	Amelanchier alnifolia	26	23	27	27	2.77	2.39	2.18	2.40
B	Artemisia tridentata vaseyana	7	5	3	5	.30	.00	.03	.15
B	Cercocarpus ledifolius	11	11	7	10	2.38	1.84	1.32	.25
B	Cercocarpus montanus	1	1	0	0	-	-	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	9	12	12	12	.86	1.38	1.06	1.71
B	Eriogonum microthecum	23	23	15	17	.87	.66	.73	1.58
B	Gutierrezia sarothrae	32	44	33	31	.69	1.74	1.36	.93
B	Mahonia repens	29	35	34	29	.40	.93	.70	1.37
B	Purshia tridentata	4	6	5	4	.06	.03	.30	.03
B	Symphoricarpos oreophilus	22	19	23	18	.93	1.10	.86	1.40
Total for Browse		164	179	159	153	9.30	10.11	8.57	9.85

CANOPY COVER, LINE INTERCEPT--
Management unit 02, Study no: 21

Species	Percent Cover		
	'01	'06	'11
Amelanchier alnifolia	-	2.84	2.03
Artemisia tridentata vaseyana	-	.61	.91
Cercocarpus ledifolius	22.00	18.29	21.50
Chrysothamnus viscidiflorus viscidiflorus	-	1.11	2.04
Eriogonum microthecum	-	.58	1.39
Gutierrezia sarothrae	-	2.00	1.23
Mahonia repens	-	.66	1.13
Purshia tridentata	-	.40	.01
Symphoricarpos oreophilus	-	.43	2.04

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 02, Study no: 21

Species	Average leader growth (in)		
	01	'06	'11
Amelanchier alnifolia	2.9	3.1	1.5
Cercocarpus ledifolius	4.1	3.0	1.6
Purshia tridentata	-	3.1	1.6

POINT-QUARTER TREE DATA--
Management unit 02, Study no: 21

Species	Trees per Acre			
	'96	'01	'06	'11
Cercocarpus ledifolius	148	-	126	198

Average diameter (in)			
'96	'01	'06	'11
4.7	-	10.1	6.8

BASIC COVER--
Management unit 02, Study no: 21

Cover Type	Average Cover %				
	'90	'96	'01	'06	'11
Vegetation	7.50	39.27	33.79	34.61	42.88
Rock	21.25	21.62	23.00	28.97	22.56
Pavement	3.00	1.18	2.80	2.49	.83
Litter	53.25	48.38	45.56	42.52	42.27
Cryptogams	0	.50	.99	.85	1.40
Bare Ground	15.00	5.15	9.51	8.11	6.03

SOIL ANALYSIS DATA --
Management unit 02, Study no: 21, Study Name: Swan Creek

Effective rooting depth (in)	pH	Clay Loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
10.3	7.5	34.6	38.1	27.4	6.6	9.6	230.4	0.7

PELLET GROUP DATA--
Management unit 02, Study no: 21

Type	Quadrat Frequency			
	'96	'01	'06	'11
Sheep	-	-	-	1
Rabbit	2	1	1	4
Moose	-	-	1	-
Elk	27	13	34	21
Deer	32	29	38	27
Cattle	-	-	1	-

Days use per acre (ha)		
'01	'06	'11
-	-	-
-	-	-
-	1 (2)	-
36 (89)	80 (198)	20 (50)
47 (116)	56 (137)	42 (103)
-	-	-

BROWSE CHARACTERISTICS--
Management unit 02, Study no: 21

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Amelanchier alnifolia									
90	**865**	54	38	8	66	58	12	4	28/17
96	**840**	24	60	17	-	55	17	10	18/31
01	**1060**	38	62	0	20	49	19	0	18/28
06	**1220**	31	64	5	60	33	39	7	17/29
11	**1400**	27	70	3	-	29	56	1	21/38
Artemisia tridentata vaseyana									
90	**99**	0	33	67	33	33	33	0	26/17
96	**180**	22	33	44	-	44	0	11	10/22
01	**100**	0	60	40	-	0	0	0	16/32
06	**60**	0	100	0	-	0	0	0	12/24
11	**100**	0	100	0	-	40	0	0	12/25

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Cercocarpus ledifolius									
90	**166**	20	80	0	33	0	20	0	157/152
96	**280**	14	86	0	-	29	36	0	11/24
01	**220**	45	45	9	-	18	27	0	20/22
06	**380**	16	47	37	80	0	11	37	-/-
11	**220**	36	64	0	2760	9	0	0	19/24
Cercocarpus montanus									
90	**0**	0	0	-	-	0	0	0	-/-
96	**20**	0	100	-	-	0	100	0	36/54
01	**20**	0	100	-	-	100	0	0	32/59
06	**0**	0	0	-	-	0	0	0	-/-
11	**0**	0	0	-	-	0	0	0	25/48
Chrysothamnus viscidiflorus viscidiflorus									
90	**66**	0	50	50	-	0	50	0	10/10
96	**300**	7	93	0	-	7	0	0	14/24
01	**500**	0	100	0	-	0	0	0	12/25
06	**440**	5	95	0	-	0	0	36	10/16
11	**560**	0	100	0	-	0	0	0	14/27
Eriogonum microthecum									
90	**0**	0	0	0	-	0	0	0	-/-
96	**540**	0	85	15	-	7	0	4	14/19
01	**760**	0	100	0	-	0	0	0	12/16
06	**480**	0	100	0	-	0	0	0	11/17
11	**540**	0	100	0	20	15	0	0	13/20
Gutierrezia sarothrae									
90	**2198**	15	82	3	66	0	0	2	11/16
96	**1100**	9	91	0	-	0	0	0	8/10
01	**1600**	3	96	1	20	0	0	1	10/15
06	**1080**	2	89	9	80	0	0	4	8/14
11	**1240**	0	98	2	20	0	0	2	11/15
Mahonia repens									
90	**2898**	31	69	-	-	2	0	0	4/4
96	**2380**	43	57	-	-	0	0	0	5/6
01	**4360**	5	95	-	-	0	0	0	3/5
06	**5020**	0	100	-	-	0	0	0	4/4
11	**4060**	2	98	-	-	0	0	0	4/10
Purshia tridentata									
90	**132**	25	75	-	-	25	0	0	11/12
96	**80**	0	100	-	-	100	0	0	7/20
01	**120**	17	83	-	-	33	33	0	19/41
06	**100**	0	100	-	-	0	80	0	9/22
11	**80**	0	100	-	-	0	0	0	13/36

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Symphoricarpos oreophilus									
90	**931**	18	72	11	66	7	0	14	19/17
96	**600**	30	67	3	-	0	0	0	14/23
01	**600**	3	90	7	-	3	0	3	14/23
06	**620**	0	77	23	-	0	0	42	15/24
11	**660**	15	85	0	-	42	3	0	15/25