Trend Study 2-13-06

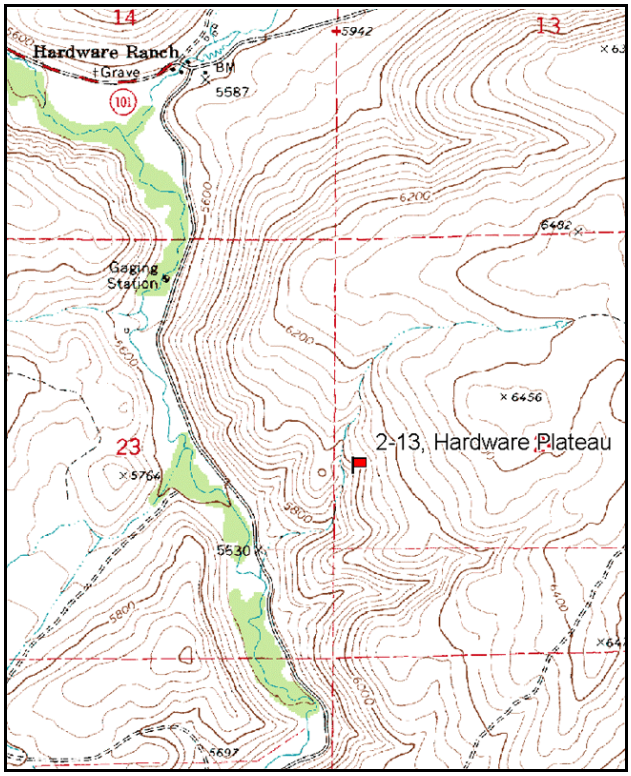
Study site name: Hardware Plateau . Vegetation type: Big Sagebrush .

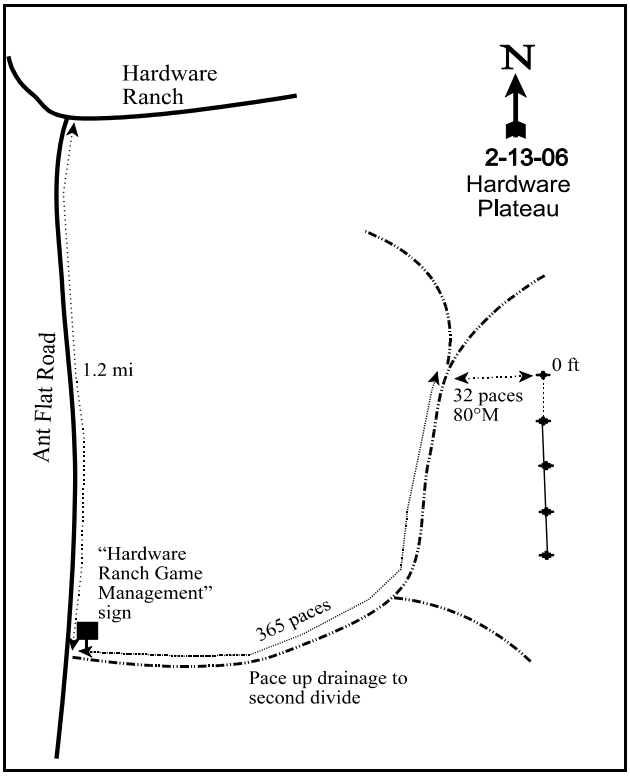
Compass bearing: frequency baseline 163 degrees magnetic.

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

LOCATION DESCRIPTION

From Hardware Ranch, proceed south on the Ant Flat road for 1.2 miles. This mileage should end at a sign that reads: "Welcome to Hardware Ranch Game Management Area." Stop here. Walk up the bottom of the wash (to the east of the sign) 365 paces, to the second very definite fork in the drainage. From the point where the wash divides take a bearing of 80 degrees magnetic and walk 32 paces to the 0-foot stake of the baseline, marked by browse tab #7984. The baseline runs at 163 degrees magnetic.





Map Name: Hardware Ranch Diagrammatic Sketch

Township 10N , Range 3E , Section 24 UTM NAD 27, UTM 12T 4603964 N, 453491 E

DISCUSSION

Hardware Plateau - Trend Study No. 2-13

Study Information

This study is located a short distance up one of the small draws at the western edge of the Hardware Plateau (elevation: 6,000 feet, slope: 50%, aspect: west), which is located on the DWR Hardware Ranch property. Slopes like this are very important to wintering deer and elk. The vegetation type is mountain big sagebrush/grass which also contains a scattered mixture of other shrub species, but the study area is dominated by perennial grasses. Due to the low density of preferred shrubs on many of the areas at Hardware Ranch WMA a cattle grazing treatment was implemented with the goal to increase browse for wintering deer. This treatment study began in 2005. The range monitoring crew has established paired grazed and ungrazed studies to monitor the effects of this treatment. This study serves as a grazed area with an ungrazed study located to the east, higher on the hill. Pellet group data show that cattle rarely utilize slopes this steep. In 2006, it was obvious that cattle utilized the less steep slopes above this trend study more than the 50% slope where the trend study is located.

Pellet groups were abundant and two carcasses from the 1983-84 winter were found during the study establishment in 1984. Chukars were noted in 1990. Use appeared lighter in 1996 with quadrat frequencies of deer and elk pellet groups at 18% and 7%, respectively. One deer was flushed from a drainage and 3 dead deer and 1 dead elk were found near the study in 1996. A pellet group transect read in 2001 estimated 39 deer and 13 elk days use/acre (96 ddu/ha and 32 edu/ha). Yellow bellied marmots were numerous around the larger rock outcrops. Pellet group data from 2006 was estimated at 28 deer, 9 elk, and 3 cow days use/acre (69 ddu/ha, 22 edu/ha, and 7 cdu/ha).

Soil

Soils in this area are classified in Yeates Hollow series (USDA-NRCS 2006). These are moderately shallow soils where bedrock is normally encountered at about 4 feet in depth. Derived from quartzite and sandstone, the Yeates Hollow soil has poor permeability and runoff is normally quite rapid. Roots penetrate to bedrock and soil reaction ranges from neutral to slightly acidic (Erickson and Mortensen, 1974). The soil has a loam texture and is very rocky on the surface and through the profile. Due to the rocky nature of the soil, effective rooting depth was estimated at about 10 inches with a soil penetrometer. Some inevitable soil erosion occurs due to the steep slope, but the ratio of protective cover (vegetation, litter, and cryptograms) to bare ground was still moderate at 3.3:1 in 2006. There is little unprotected bare soil and even though there are some rills and active gullies, the erosion condition class was determined to be only slight in 2001 and 2006.

Browse

Although the study is classified as a mountain big sagebrush-grass type, increaser shrubs, including narrowleaf low rabbitbrush, mountain snowberry, woods rose, and Oregon grape are quite numerous. Mountain big sagebrush occurs in low densities. In 1984, sagebrush averaged 333 plants/acre and was fairly similar in 1996 at 280 plants/acre. This decreased to 120 plants/acre in both 2001 and 2006. Decadence has been high during most of the readings. In 1984 and 1990, over 70% of the population was classified as decadent. Percent decadence decreased in 1996 to 21%, increased to 50% by 2001, and decreased to 33% in 2006. Utilization was heavy in 1984 and 1990, but has been moderate since 1996. Dead plants, first counted in 1996, have numbered more than the live plants every year indicating a die-off had occurred. The number of dead sagebrush plants are a concern as they outnumber live ones by a ratio of nearly 2:1. Because of slope (50%), aspect (west), soils, drought, and competition, some thinning and die-off would be expected for mountain big sagebrush, but this is excessive. Annual leader growth averaged 4.9 inches in 2001 and 2.5 inches in 2006.

Serviceberry and bitterbrush offer additional preferred forage, but these shrubs occur in low numbers. Serviceberry averaged 440 plants/acre in 1996, 160 in 2001 and 200 plants/acre in 2006 with less than 1% cover each year. Bitterbrush has steadily declined in density from 333 plants/acre in 1984 to only 80

plants/acre since 1996. However, some of this change can be explained by the larger sample size used beginning in 1996, which gives a more accurate population estimate for species that characteristically have distributions that are clumped or discontinuous. Use of the bitterbrush and serviceberry has been heavy during all readings. Vigor has been normal on both species even though no bitterbrush seedlings or young plants have been encountered during any reading. Bitterbrush leader growth averaged 5.3 inches in 2001.

Herbaceous Understory

The study area has good perennial grass cover, however a few annuals, like cheatgrass, provide a high amount of fine fuel litter. Cheatgrass cover and nested frequency have steadily declined with each reading since 1996. In 1996, cheatgrass cover averaged 10% and had decreased to 1% in 2006. The most abundant perennial grasses include: bluebunch wheatgrass and Sandberg bluegrass. Kentucky bluegrass is an increaser under grazing and was significantly more abundant in 2006. Perennial grasses combined to produce nearly 26% cover in 2001 and 22% in 2006. Common perennial forbs include Louisiana sagebrush, arrowleaf balsamroot, western yarrow, tapertip hawksbeard, and silvery lupine. Forbs and grasses show little evidence of any grazing and are in good vigor.

1990 TREND ASSESSMENT

The overall poor vigor and heavy use of the browse is compounded by drought and competition with annual grasses and forbs. Together, this is causing low seed production. Even with good seed production, there are not many safe sites for seedling establishment. A majority of the sagebrush, bitterbrush, and serviceberry plants are decadent or already dead. The serviceberry classified as young are sprouts from old root crowns. The samples of these key species are small due to the sparsity of the browse population, but all the data indicate a decline in density. Trend for grasses is slightly up. Sum of nested frequency of perennial grasses increased, mostly due to an increase in bluebunch wheatgrass. Trend for forbs is stable. Very little change occurred in perennial forbs.

browse - down (-2) grasses - slightly up (+1) forbs - stable (0)

1996 TREND ASSESSMENT

The key browse species, mountain big sagebrush, appears to have a stable trend. Density is still low at only 280 plants/acre. However, young plants comprise 14% of the population, utilization is more moderate, vigor improved, and decadence has declined from 75% to 21%. Bitterbrush density was lower, which may be due the larger sample size. Bitterbrush only contributes less than 1% cover. Population density is down to 80 plants/acre, but utilization is not as heavy (from 100% down to 50% heavy use), and decadence has declined from 50% to 25%. Serviceberry also shows reduced heavy use, improved vigor, and less decadent plants. Preferred browse is lacking. Trend for grasses is down. Sum of nested frequency for perennial grasses is down 23%. Nested frequency for the key perennial grass, bluebunch wheatgrass, has declined significantly. Annuals grasses were included in the sample for the first time and cheatgrass is abundant. Trend for forbs is down. The sum of nested frequency of forbs has declined by 48%. Key forbs include western yarrow, arrowleaf balsamroot, sulfur eriogonum, and silvery lupine which have all declined significantly since 1990. The Desirable Components Index rated this study as very poor-poor due to low browse cover, good perennial grass cover, and high annual grass cover.

winter range condition (DC Index) - very poor-poor (35) Mid-level potential scale
browse - stable (0) grasses - down (-2) forbs - down (-2)

2001 TREND ASSESSMENT

Trend for browse is down. Mountain big sagebrush density declined to only 120 plants/acre, half of these classified as decadent. Use is lighter than in 1996, vigor remains good, and there are a few young plants in the population. Bitterbrush shows heavier use than in 1996. Bitterbrush density is unchanged, vigor is normal, and percent decadence has remained stable. Trend for grasses is slightly up. Nested frequency of the

dominant grass, bluebunch wheatgrass, has remained stable although cover increased from 10% to 18%. Cheatgrass declined significantly in nested frequency and cover declined from 10% to 6%. Trend for forbs is slightly down. Sum of nested frequency of perennial forbs decreased by 9% and dyer's woad was sampled for the first time. Annual forbs nested frequency and cover more than doubled, especially storksbill. The Desirable Components Index rated this study as very poor-poor due to low browse cover, good perennial grass cover, and moderate annual grass cover.

winter range condition (DC Index) - very poor-poor (36) Mid-level potential scale
browse - down (-2) grasses - slightly up (+1) forbs - slightly down (-1)

2006 TREND ASSESSMENT

Trend for key browse, mountain big sagebrush, bitterbrush, and serviceberry, is stable. Both mountain big sagebrush and bitterbrush densities remained exactly the same as 2001. Serviceberry increased slightly, mostly from an increase in young plants. Decadence also decreased on both sagebrush and bitterbrush. There are still very few seedlings or young plants in the population to replace older plants. Trend for grasses is stable. The sum of nested frequency for perennial grasses did not change much. Sandberg bluegrass decreased significantly and Kentucky bluegrass increased significantly. Cheatgrass nested frequency and cover continues to decrease and only averaged 1% cover. Trend for forbs is stable. Perennial forb sum of nested frequency changed very little, although annual forb sum of nested frequency continued to rapidly increase. Dyer's woad has not increased much from 2001. The Desirable Components Index rated this study as poor due to decreasing browse cover, good perennial grass cover, and decreasing annual grass cover.

winter range condition (DC Index) - poor (38) Mid-level potential scale
browse - stable (0) grasses - stable (0) forbs - stable (0)

HERBACEOUS TRENDS --
Management unit 02 , Study no: 13

Type	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
G	Agropyron spicatum	a267	c305	a232	ab244	bc258	9.70	17.86	18.21
G	Bromus japonicus (a)	-	-	10	14	2	.05	.10	.00
G	Bromus tectorum (a)	-	-	c296	b250	a174	9.67	5.96	1.04
G	Koeleria cristata	-	2	-	2	2	-	.03	.03
G	Poa fendleriana	-	-	4	-	-	.04	-	-
G	Poa pratensis	a-	a4	a3	a3	b62	.03	.03	1.49
G	Poa secunda	b244	b252	ab197	b249	a171	7.83	7.89	2.53
Total for Annual Grasses		0	0	306	264	176	9.72	6.06	1.05
Total for Perennial Grasses		511	563	436	498	493	17.61	25.82	22.27
Total for Grasses		511	563	742	762	669	27.33	31.88	23.32
F	Achillea millefolium	b175	b133	a69	a65	a48	.82	1.52	1.93
F	Agoseris glauca	-	1	-	6	6	-	.04	.05
F	Alyssum alyssoides (a)	-	-	b64	c95	a37	.42	.30	.10
F	Arabis sp.	-	6	8	2	-	.01	.00	-
F	Artemisia ludoviciana	15	20	21	23	21	2.30	1.77	1.02

Type	Species	Nested Frequency					Average Cover %		
		'84	'90	'96	'01	'06	'96	'01	'06
F	Balsamorhiza sagittata	$_{b}$60	$_{b}$61	$_{a}$26	$_{a}$19	$_{a}$13	.77	.60	.66
F	Calochortus nuttallii	-	3	-	-	-	-	-	-
F	Cirsium undulatum	10	19	5	13	12	.19	.71	.30
F	Collomia linearis (a)	-	-	$_{a}$-	$_{b}$15	$_{c}$74	-	.03	.22
F	Comandra pallida	-	-	-	1	-	-	.00	-
F	Collinsia parviflora (a)	-	-	50	66	47	.15	.16	.09
F	Crepis acuminata	$_{a}$-	$_{c}$153	$_{b}$28	$_{b}$18	$_{b}$34	.34	.45	1.17
F	Cymopterus sp.	$_{a}$-	$_{a}$-	$_{a}$2	$_{b}$21	$_{b}$32	.00	.40	.38
F	Draba sp. (a)	-	-	$_{a}$-	$_{b}$21	$_{c}$92	-	.03	.27
F	Epilobium brachycarpum (a)	-	-	$_{b}$83	$_{a}$11	$_{c}$123	.93	.03	.90
F	Erodium cicutarium (a)	-	-	$_{a}$52	$_{c}$132	$_{b}$103	.65	7.74	1.45
F	Eriogonum umbellatum	$_{b}$20	$_{b}$12	$_{ab}$7	$_{a}$-	$_{a}$-	.33	-	-
F	Galium aparine (a)	-	-	-	-	2	-	-	.00
F	Hackelia patens	$_{b}$27	$_{ab}$15	$_{b}$33	$_{a}$7	$_{ab}$24	.33	.07	.69
F	Holosteum umbellatum (a)	-	-	$_{a}$12	$_{b}$168	$_{c}$205	.03	.65	.49
F	Isatis tinctoria	-	-	-	1	3	-	.15	.15
F	Lappula occidentalis (a)	-	-	-	1	-	-	.03	-
F	Lactuca serriola	$_{a}$-	$_{a}$-	$_{b}$16	$_{b}$19	$_{ab}$8	.03	.07	.02
F	Lomatium grayi	-	1	-	1	6	-	.03	.06
F	Lupinus argenteus	$_{c}$58	$_{b}$34	$_{a}$12	$_{a}$11	$_{a}$5	.34	.39	.30
F	Microsteris gracilis (a)	-	-	$_{a}$-	$_{a}$4	$_{b}$67	-	.01	.16
F	Penstemon humilis	13	12	4	4	4	.06	.24	.21
F	Phacelia sp.$_{a}$	$_{a}$-	$_{a}$-	$_{ab}$12	$_{b}$10	$_{a}$-	.48	.12	.00
F	Phlox longifolia	-	-	-	-	2	-	-	.00
F	Ranunculus testiculatus (a)	-	-	$_{a}$23	$_{a}$13	$_{b}$118	.07	.05	.47
F	Senecio multilobatus	$_{b}$80	$_{a}$-	$_{a}$-	$_{a}$-	$_{a}$4	-	-	.03
F	Sisymbrium altissimum (a)	-	-	$_{b}$12	$_{a}$-	$_{a}$-	.09	-	-
F	Tragopogon dubius	2	-	2	3	3	.01	.06	.00
Total for Annual Forbs		0	0	296	526	868	2.36	9.05	4.17
Total for Perennial Forbs		460	470	245	224	225	6.05	6.67	7.02
Total for Forbs		460	470	541	750	1093	8.41	15.72	11.20

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

BROWSE TRENDS --
Management unit 02 , Study no: 13

Type	Species	Strip Frequency			Average Cover %		
		'96	'01	'06	'96	'01	'06
B	Amelanchier alnifolia	9	7	8	.06	.03	.06
B	Artemisia tridentata vaseyana	14	6	6	1.30	.36	-
B	Chrysothamnus viscidiflorus viscidiflorus	17	16	18	1.79	1.27	.91
B	Eriogonum heracleoides	0	1	1	-	-	-
B	Mahonia repens	15	19	18	.07	.67	.49
B	Prunus virginiana	5	4	5	.03	.03	.03
B	Purshia tridentata	3	3	3	.38	1.00	.21
B	Rhus glabra cismontana	0	0	0	-	-	-
B	Rosa woodsii	12	16	14	.72	.51	.95
B	Sambucus cerulea	0	2	0	-	.03	-
B	Symphoricarpos oreophilus	6	4	8	1.31	1.62	1.25
Total for Browse		81	78	81	5.68	5.55	3.90

CANOPY COVER, LINE INTERCEPT --
Management unit 02 , Study no: 13

Species	Percent Cover '06
Amelanchier alnifolia	.98
Artemisia tridentata vaseyana	.18
Chrysothamnus viscidiflorus viscidiflorus	2.20
Mahonia repens	.90
Prunus virginiana	.43
Purshia tridentata	.90
Rosa woodsii	.70
Symphoricarpos oreophilus	2.36

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 02 , Study no: 13

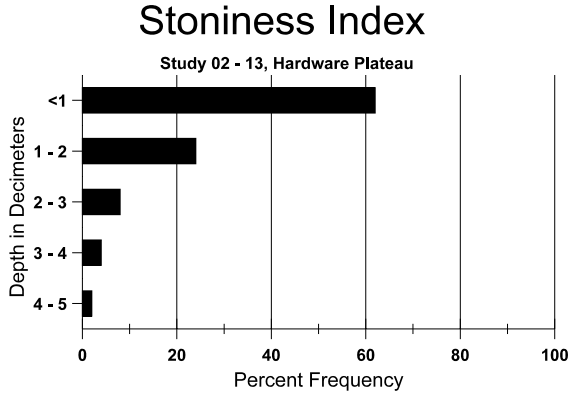
Species	Average leader growth (in)	
	'01	'06
Amelanchier alnifolia	-	4.8
Artemisia tridentata vaseyana	4.9	2.5
Purshia tridentata	5.3	-

BASIC COVER --
Management unit 02 , Study no: 13

Cover Type	Average Cover %				
	'84	'90	'96	'01	'06
Vegetation	1.75	16.25	43.72	48.98	36.74
Rock	17.50	20.50	25.35	30.16	30.41
Pavement	2.25	.75	5.00	4.30	3.75
Litter	66.75	44.50	45.87	33.00	29.17
Cryptogams	6.50	1.25	1.18	1.94	.56
Bare Ground	5.25	16.75	7.04	4.88	16.10

SOIL ANALYSIS DATA --
Herd Unit 02, Study no: 13, Hardware Plateau

Effective rooting depth (in)	Temp °F (depth)	PH	Loam			%0M	PPM P	PPM K	dS/m
			%sand	%silt	%clay				
9.9	73.8 (10.1)	6.7	42.3	31.7	26.0	4.0	34.0	307.2	0.5



PELLET GROUP DATA --
Management unit 02 , Study no: 13

Type	Quadrat Frequency		
	'96	'01	'06
Rabbit	-	6	-
Elk	7	3	-
Deer	18	19	8
Cattle	-	-	-

Days use per acre (ha)	
'01	'06
-	-
13 (31)	9 (22)
39 (96)	28 (69)
-	3 (7)

BROWSE CHARACTERISTICS --
Management unit 02 , Study no: 13

		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	**366**	166	300	33	33	-	82	18	9	-	0	27/22
90	**566**	-	433	-	133	-	29	53	23	-	6	-/-
96	**440**	-	240	200	-	40	36	36	0	-	0	17/21
01	**160**	-	20	140	-	-	38	25	0	-	0	20/21
06	**200**	-	100	100	-	-	0	90	0	-	0	21/21
Artemisia tridentata vaseyana												
84	**333**	-	-	100	233	-	30	50	70	-	0	14/9
90	**133**	-	-	33	100	-	0	75	75	-	25	13/13
96	**280**	-	40	180	60	480	71	14	21	7	7	24/34
01	**120**	-	20	40	60	260	67	0	50	-	0	32/37
06	**120**	-	20	60	40	260	33	17	33	-	0	29/37
Chrysothamnus viscidiflorus viscidiflorus												
84	**766**	-	100	633	33	-	4	0	4	-	4	16/18
90	**433**	-	33	400	-	-	8	0	0	-	0	17/21
96	**440**	-	-	440	-	-	9	0	0	-	0	15/24
01	**500**	-	20	480	-	-	0	0	0	-	0	12/22
06	**480**	-	60	400	20	-	0	4	4	-	0	16/26
Eriogonum heracleoides												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**0**	-	-	-	-	-	0	0	-	-	0	-/-
01	**20**	-	-	20	-	-	0	0	-	-	0	4/7
06	**20**	-	-	20	-	-	0	0	-	-	0	-/-
Gutierrezia sarothrae												
84	**66**	-	33	33	-	-	0	0	-	-	0	7/11
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**0**	-	-	-	-	-	0	0	-	-	0	-/-
01	**0**	-	-	-	-	-	0	0	-	-	0	-/-
06	**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)
Mahonia repens												
84	**0**	-	-	-	-	-	0	0	0	-	0	-/-
90	**0**	-	-	-	-	-	0	0	0	-	0	-/-
96	**980**	-	160	820	-	-	0	0	0	-	0	4/5
01	**3120**	-	60	3020	40	-	0	0	1	-	0	4/5
06	**3380**	-	-	3380	-	-	0	0	0	-	0	2/6
Prunus virginiana												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**100**	-	40	60	-	-	20	40	-	-	0	19/18
01	**100**	-	40	60	-	-	80	0	-	-	0	16/35
06	**260**	-	240	20	-	-	38	62	-	-	0	14/19
Purshia tridentata												
84	**333**	-	-	133	200	-	0	100	60	-	0	18/20
90	**132**	-	-	66	66	-	0	100	50	-	0	15/18
96	**80**	-	-	60	20	20	0	50	25	-	0	19/36
01	**80**	-	-	60	20	80	25	75	25	-	0	20/44
06	**80**	-	-	80	-	-	0	100	0	-	0	23/59
Rhus glabra cismontana												
84	**66**	-	-	66	-	-	50	0	-	-	0	43/41
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**0**	-	-	-	-	-	0	0	-	-	0	-/-
01	**0**	-	-	-	-	-	0	0	-	-	0	-/-
06	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Rosa woodsii												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**1520**	20	340	1180	-	40	11	62	-	-	0	12/11
01	**1220**	-	440	780	-	-	8	0	-	-	0	13/12
06	**1900**	-	280	1620	-	20	26	0	-	-	0	12/11
Sambucus cerulea												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**33**	-	-	33	-	-	0	100	-	-	0	31/20
96	**0**	-	-	-	-	-	0	0	-	-	0	84/135
01	**60**	-	-	60	-	-	0	0	-	-	0	47/69
06	**0**	-	-	-	-	-	0	0	-	-	0	73/91

		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)
Symphoricarpos oreophilus												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
90	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**460**	-	160	300	-	-	78	0	-	-	0	20/27
01	**100**	-	-	100	-	-	0	0	-	-	0	26/50
06	**180**	-	20	160	-	-	44	0	-	-	0	28/46