Trend Study 30-46-08

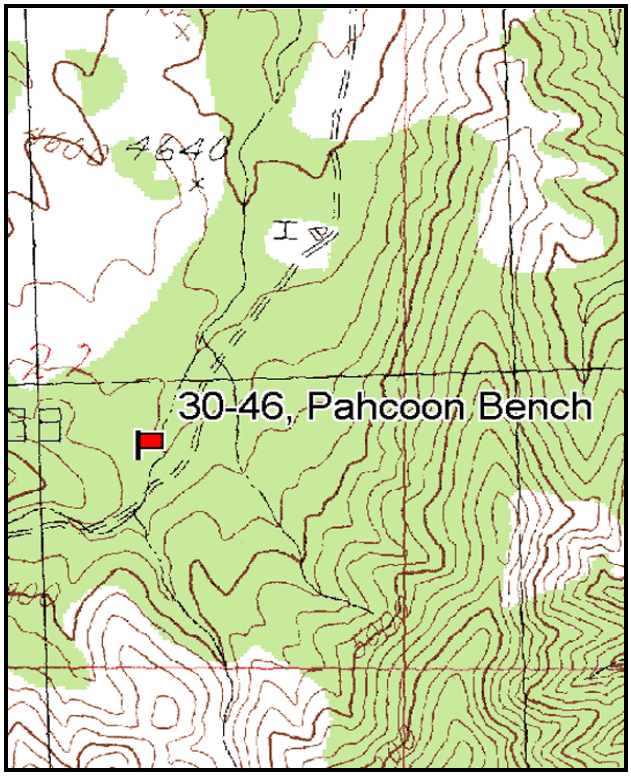
Study site name: Pahcoon Bench . Vegetation type: Burn-Seeding .

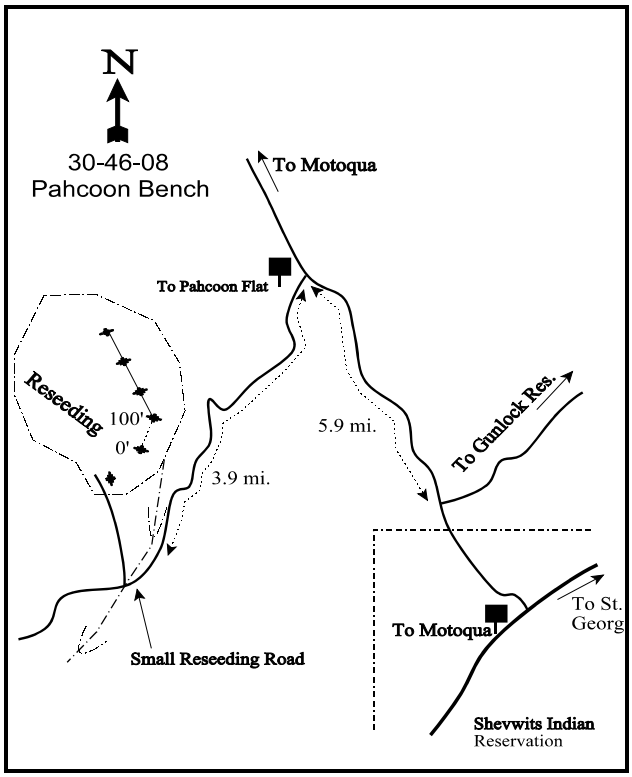
Compass bearing: frequency baseline 22 degrees magnetic. (Lines 2-4, 336°M)

Frequency belt placement: line 1 (18 & 96ft), line 2 (57ft), line 3 (20ft), line 4 (73ft). Rebar: Belt 1 on 50ft and 100ft (because of road), belt 5 on 1ft, and belt 4 on 7ft.

LOCATION DESCRIPTION

Proceed past Shivwits approximately 0.9 mile and turn north on the Jackson Springs-Motoqua road. Proceed 5.9 miles on this road past a road to Motoqua to a fork on the left towards Pahcoon Flat. Take the road towards Pahcoon Flat for 3.9 miles, traveling through a seeding. At 3.9 miles, there will be a small, obscure road to the right. Walk 67 paces up the road to the witness post off the east side of the road. The 0-foot baseline stake is 2.5 paces from the witness post at 22 degrees magnetic. The study is marked by green steel "T" fence posts approximately 12 to 18 inches in height. The 0-foot stake is marked by browse tag #471.





Map Name: Shivwits Diagrammatic Sketch

Township 41S , Range 18W , Section 22 GPS: NAD 83, UTM 12S 247139 E, 4121023 N

DISCUSSION

Pahcoon Bench - Trend Study No. 30-46

Study Information

This trend study is located on severe winter range on the east side of the Beaver Dam Mountains [elevation: 4,670 feet (1,423 m), slope: 3%-5%, aspect: northeast]. It is placed near the south end of Pahcoon Flat on a 1979 chained and seeded singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) woodland. The area is dry, yet has responded well to treatment. The area has burned multiple times over the years. The Pahcoon fire burned 6,363 acres (2,575 ha) in the area in the summer of 1998 after the sampling for that year, with only a few juniper trees and shrubs surviving. The site burned again in 2003 when the Apex fire burned 29,933 acres (12,113 ha) in the area. Utilization of the area by cattle and wildlife appears light, even with a guzzler nearby. Pellet group data estimated deer use to be lightly moderate in 1998 and 2003 (20 deer days ues/acre:49 ddu/ha and 25 ddu/acre:62 ddu/ha, respectively), and light in 2008 (7 ddu/acre:18 ddu/ha). Cattle use was estimated to be light in 1998 and 2003 (13 cow days use/acre:32 cdu/ha and 8 cdu/acre:20 cdu/ha, respectively), and lightly moderate in 2008 (27 cdu/acre:66 cdu/ha).

Soil

The soil is relatively shallow and moderately rocky. Effective rooting depth is estimated at just over 10 inches. Soil is hard and compacted. Texture is a loam which is neutral in reaction (pH 7.0). Parent material is limestone, some of which has a white calcium carbonate coating. Relative combined vegetation and litter cover ranged from 72%-79% from 1998 to 2008. Relative bare ground was low at 5% in 1998, but increased after the fire to 13% in 2003 and 11% in 2008. The erosion condition class was rated as stable in 2003 and 2008.

Browse

In 1998, key browse species consisted of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), with lesser amounts of antelope bitterbrush (*Purshia tridentata*) and Stansbury cliffrose (*Cowania mexicana* ssp. *stansburiana*). Sagebrush was well established, but declined in density from 4,866 plants/acre in 1982, to 3,400 in 1992, and 800 plants/acre by 1998. The number of dead plants can only explain about 10% of the decrease from 1992, therefore the difference is likely due to the larger sample area utilized in 1998. The larger sample area gives more accurate population estimates for shrubs that have discontinuous and/or clumped distributions. Reproduction of sagebrush has been good in the past with abundant seedlings and young plants sampled in 1982 and 1992, however, recruitment was poor in 1998. Utilization was light in 1982 and 1992, but some moderate use was reported in 1998. The wildfire that burned the area in the summer of 1998 eliminated most of the mountain big sagebrush on the site. Density was estimated at only 120 plants/acre in 2003, with more than one-half of these being young plants. After the second fire in 2003, no sagebrush plants were encountered in the density strip in 2008. Sagebrush vigor was normal on most plants and decadence low in all the other sample years.

Secondary browse species, antelope bitterbrush and desert bitterbrush (*Purshia landulosa*), are also well established and contained healthy age class structures prior to the burn. Individuals were large and vigorous and displayed abundant annual growth in 1992. Utilization of all shrubs appeared light to moderate. During the 1998 reading, all bitterbrush was classified as antelope bitterbrush. There may have been a classification problem between desert bitterbrush and cliffrose in 1982 and 1992. Density of the bitterbrush species was

estimated at 732 plants/acre in 1992. This density declined to 60 plants/acre by 1998. Density of cliffrose increased from 66 to 260 plants/acre between 1992 and 1998. There were no dead plants within the population, therefore the changes in density are likely due to the larger sample size used in 1998 and confusion between desert bitterbrush and cliffrose. The antelope bitterbrush displayed moderate to heavy use in 1998. Vigor was normal, but reproduction limited. Cliffrose increased dramatically in size between 1992 and 1998 according to photo point comparisons. Mature plants averaged 5 feet in height with a crown diameter of 4 feet in 1998. Plants showed moderate to heavy use, yet vigor was good and percent decadence low at 8%. The 1998 wildfire reduced these respective populations. Only 20 cliffrose plants/acre and 20 bitterbrush plants/acre were estimated in 2003. Population density estimates from both cliffrose and bitterbrush declined to 0 plants/acre in 2008. Some seeded forage kochia (*Kochia prostrata*) was encountered in 2003 at an estimated density of 260 plant/acre and increased to 1,080 plants/acre in 2008.

Threadleaf snakeweed (*Gutierrezia micorcephala*) was the most abundant shrub on the site prior to and after the fire. It increased dramatically in density from 1982 when its density was only 466 plants/acre, to 3,933 plants/acre in 1992, and to 7,360 plants/acre in 1998. After the fire, density was estimated at 17,600 plants/acre in 2003. Density of snakeweed declined after the fire in 2003 by 92% to 1,340 plants/acre in 2008.

Juniper trees were also found on the site in small numbers prior the fire. Point-quarter data from 1998 estimated 90 juniper trees/acre with an average basal diameter of 3.3 inches. Of these trees, 21% were larger, tipped over trees that were still alive since the chaining. Average basal diameter of these trees was 7 inches. All juniper trees were killed by fires which burned the area in 1998 and 2003.

Herbaceous Understory

The seeded grass species, crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*), had been fairly successful in 1982 and 1992, then declined in 1998. The annuals, cheatgrass (*Bromus tectorum*) and foxtail brome (*B. rubens*), were both common. Cheatgrass appeared to have increased in abundance creating a fire hazard on this site. These annuals accounted for 89% of the grass cover in 1998. After the 1998 wildfire, abundance of perennial grasses declined and dominance of annual grasses increased in 2003. Very little crested and intermediate wheatgrass remained on the site in 2003. Neither crested or intermediate wheatgrass was encountered in 2008.

The forb composition is deficient with all species providing only 2% cover in 1998. The only forb included in the chaining seed mixture was yellow sweetclover (*Melilotus officinalis*), which is a short-lived perennial. No sweet clover was encountered during any reading. Annual forbs such as a Draba sp., storksbill (*Erodium cicutarium*), and slender phlox (*Microsteris gracilis*), dominated the forb composition in 1998 producing 95% of the forb cover. After the fire, these same annuals still provide nearly all of the forb cover. The most prominent perennial species prior to and after the 1998 wildfire is gooseberryleaf globemallow (*Sphaeralcea grossulariifolia*).

1992 TREND ASSESSMENT

The browse trend is mixed. Mountain big sagebrush has decreased slightly in density. No young plants were encountered, but abundant seedlings were counted. Secondary species have healthy populations, good vigor, and adequate reproductive potentials. On the down side, threadleaf snakeweed has increased dramatically and is currently the most numerous shrub with an estimated density of 3,933 plants/acre. Overall, the browse trend is stable. Data for herbaceous species from 1982 is limited to quadrat frequency. With that in mind, trend for

both grasses and forbs is stable, but in very poor condition. Herbaceous plants are dominated by seeded grasses and cheatgrass. Quadrat frequencies of perennial grasses have not changed since 1982. Forbs are severely deficient. Only one perennial forb, gooseberryleaf globemallow, was encountered either year.

browse - stable (0) grass - stable (0) forb - stable (0)

1998 TREND ASSESSMENT

Trend for browse is slightly down. Differences in density of browse species may be related to the larger sample area used in 1998; therefore, trend for browse was determined using other parameters. The primary browse species, mountain big sagebrush, vigor and decadence remained good. Recruitment was poor with young plants comprising only 3% of the population. There appears to have been an identification problem with desert bitterbrush and cliffrose in the 1982 and 1992 readings. Cliffrose and bitterbrush vigor remains normal and decadence was low. Trend for the grasses is down and in poor condition due to the dominance of annual cheatgrass and foxtail brome. Sum of nested frequency for perennial grasses has declined by 29% since 1992. Nested frequency for intermediate wheatgrass declined significantly. The trend for forbs is slightly up, but in poor condition. Sum of nested frequency of perennial forbs increased, although perennial forbs are still scarce, and annual forbs comprised 95% of the forb cover.

winter range condition (DCI) - very poor (10) Mid-level potential scale
browse - slightly down (-1) grass - down (-2) forb - slightly up (+1)

2003 TREND ASSESSMENT

A wildfire, which burned the site in 1998, has caused downward trends in all categories. Trend for browse is down with the most preferred species nearly being eliminated by fire. Only 120 sagebrush plants/acre, 20 cliffrose plants/acre, and 20 bitterbrush plants/acre were estimated. The invasive increaser, threadleaf snakeweed, has increased dramatically to 17,600 plants/acre. It now provides 93% of the total shrub cover. Some prostate kochia was seeded after the fire and had a density of 260 plants/acre. Trend for grasses is also down. Sum of nested frequency for perennial grasses declined by 92% from 1998, and there are few perennial grasses left on the site. Annuals, cheatgrass and foxtail brome totally dominate the grass composition by providing 94% of the grass cover. The trend for forbs is slightly up, but is still poor. The sum of nested frequency of perennial forbs increased three-fold, but perennial cover is still only 1%. The sum of nested frequency of annual forbs declined, but cover of annual forbs increased from 2% in 1998 to 16%. Annual forbs dominate the forb composition, especially storksbill which provides 83% of the forb cover. The only fairly common perennial forb remains gooseberryleaf globemallow.

winter range condition (DCI) - very poor (-9) Mid-level potential scale
browse - down (-2) grass - down (-2) forb - slightly up (+1)

2008 TREND ASSESSMENT

This area burned again in July of 2003 as part of the Apex fire. This increase in the burn frequency will likely only push the community more toward an annual dominated type and limit the areas usefulness as deer winter range. The fire that burned the site only exasperated the downward trend for browse. The native preferred browse species, mountain big sagebrush, cliffrose, and bitterbrush, were eliminated by the fire. The density of the seeded species, prostrate kochia, increased by 76% from 2003 to 1,080 plants/acre. Threadleaf snakeweed density declined by 92% from 2003 to 1,340 plants/acre. Trend for both the grasses and forbs is stable, but

very poor. There was little change in the sum of nested frequency of perennial grasses or perennial forbs. Cheatgrass comprised 93% of the total grass cover and only one perennial grass, sand dropseed (*Sporobolus cryptandrus*), was sampled on the site. Cover of perennial forbs increased from 1% in 2003 to nearly 3%, but cover of annual forbs also increased from 16% in 2003 to 43%.

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

HERBACEOUS TRENDS --
Management unit 30 , Study no: 46

Type	Species	Frequency				Average Cover %		
		'92	'98	'03	'08	'98	'03	'08
G	Agropyron cristatum	b44	b52	a-	a-	1.23	.00	.00
G	Agropyron intermedium	c136	b79	a2	a-	1.89	.15	-
G	Bromus rubens (a)	-	c169	b113	a8	4.65	1.62	.02
G	Bromus tectorum (a)	-	b366	a304	a285	29.75	13.42	6.41
G	Elymus junceus	3	-	-	-	-	-	-
G	Poa pratensis	4	-	-	-	-	-	-
G	Poa secunda	-	4	9	-	.01	.04	-
G	Sitanion hystrix	-	1	-	-	.00	-	-
G	Sporobolus cryptandrus	ab4	a-	a-	b11	-	.00	.39
G	Vulpia octoflora (a)	-	b94	b104	a19	1.13	.80	.03
Total for Annual Grasses		0	629	521	312	35.54	15.85	6.46
Total for Perennial Grasses		191	136	11	11	3.14	0.20	0.40
Total for Grasses		191	765	532	323	38.68	16.05	6.87
F	Alyssum alyssoides (a)	-	-	5	5	-	.01	.04
F	Allium sp.	-	2	-	-	.01	-	-
F	Astragalus sp.	-	2	-	1	.01	-	.03
F	Calochortus nuttallii	-	7	3	3	.01	.00	.03
F	Chenopodium fremontii (a)	-	a-	b11	a3	-	.02	.00
F	Descurainia pinnata (a)	-	7	3	-	.01	.00	-
F	Draba sp. (a)	-	b102	a9	a3	.31	.03	.00
F	Erodium cicutarium (a)	-	a28	b185	c364	.73	13.87	42.31
F	Gilia sp. (a)	-	a3	a-	b12	.00	-	.03
F	Lactuca serriola	-	-	3	-	-	.03	-
F	Lupinus sp. (a)	-	a-	a-	b13	-	-	.51
F	Lychnis drummondii	a-	b8	a-	a-	.05	-	-
F	Microsteris gracilis (a)	-	b154	a8	a-	.64	.02	-
F	Navarretia intertexta (a)	-	-	3	4	-	.01	.01

Type	Species	Strip Frequency				Average Cover %		
		'92	'98	'03	'08	'98	'03	'08
F	Nyctaginaceae	-	-	-	2	-	-	.15
F	Oenothera sp.	-	-	-	1	-	-	.00
F	Plantago patagonica (a)	-	$_{a}$28	$_{a}$29	$_{b}$60	.13	.21	.33
F	Ranunculus testiculatus (a)	-	-	-	3	-	-	.00
F	Sisymbrium altissimum (a)	-	$_{a}$-	$_{b}$20	$_{a}$3	-	1.46	.07
F	Sphaeralcea grossulariifolia	$_{a}$4	$_{a}$3	$_{b}$60	$_{b}$54	.00	.97	2.52
Total for Annual Forbs		0	322	273	470	1.83	15.64	43.33
Total for Perennial Forbs		4	22	66	61	0.08	1.01	2.74
Total for Forbs		4	344	339	531	1.92	16.65	46.08

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

BROWSE TRENDS --
Management unit 30 , Study no: 46

Type	Species	Strip Frequency			Average Cover %		
		'98	'03	'08	'98	'03	'08
B	Artemisia tridentata vaseyana	26	6	0	4.31	.03	-
B	Chrysothamnus nauseosus hololeucus	0	0	0	.15	-	-
B	Cowania mexicana stansburiana	12	1	0	1.52	.00	-
B	Ephedra viridis	1	0	0	.63	-	-
B	Gutierrezia micorcephala	69	86	17	6.17	11.85	.40
B	Juniperus osteosperma	7	0	0	2.75	-	-
B	Kochia prostrata	0	10	16	-	.34	.40
B	Opuntia sp.	3	0	0	.00	-	-
B	Prunus fasciculata	5	5	4	.00	.39	.66
B	Purshia tridentata	3	1	0	1.48	.15	-
Total for Browse		126	109	37	17.03	12.76	1.46

CANOPY COVER, LINE INTERCEPT --
Management unit 30 , Study no: 46

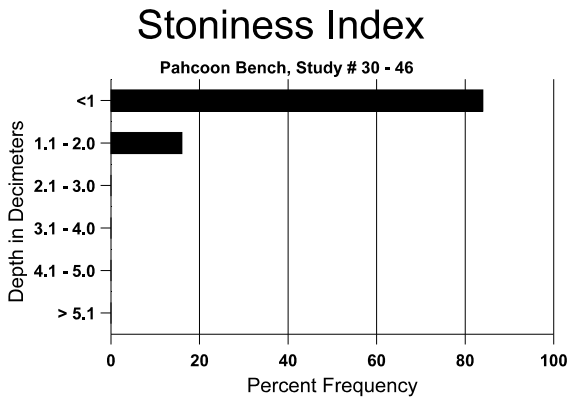
Species	Percent Cover		
	'98	'03	'08
Cowania mexicana stansburiana	.80	-	-
Gutierrezia micorcephala	-	14.85	.53
Juniperus osteosperma	3.20	-	-
Kochia prostrata	-	.60	.91
Pinus monophylla	.20	-	-
Prunus fasciculata	-	.83	1.06

BASIC COVER --
Management unit 30 , Study no: 46

Cover Type	Average Cover %				
	'82	'92	'98	'03	'08
Vegetation	0	5.50	53.28	48.50	51.93
Rock	0	7.25	10.22	11.40	10.77
Pavement	0	8.50	9.86	7.26	8.51
Litter	0	70.50	55.49	31.16	27.81
Cryptogams	0	0	1.21	.03	.05
Bare Ground	11.75	8.25	7.42	13.06	12.21

SOIL ANALYSIS DATA --
Management unit 30, Study no: 46, Study Name: Pahcoon Bench

Effective rooting depth (in)	Temp °F (depth)	pH	loam			%0M	PPM P	PPM K	ds/m
			%sand	%silt	%clay				
10.3	50.4 (14.4)	7.0	48.0	33.4	18.6	2.6	12.6	108.8	0.8



PELLET GROUP DATA --
Management unit 30 , Study no: 46

Type	Quadrat Frequency		
	'98	'03	'08
Rabbit	34	10	7
Elk	-	-	2
Deer	33	20	29
Cattle	3	2	4

Days use per acre (ha)		
'98	'03	'08
-	-	-
-	-	-
19 (47)	25 (63)	7 (18)
13 (32)	8 (20)	27 (66)

BROWSE CHARACTERISTICS --
Management unit 30 , Study no: 46

		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)
Artemisia tridentata vaseyana												
82	**4866**	733	3333	1533	-	-	0	0	0	-	0	25/19
92	**3398**	6933	-	3199	199	-	0	0	6	-	0	28/28
98	**800**	-	20	660	120	280	20	0	15	3	3	28/36
03	**120**	20	80	40	-	-	0	17	0	-	0	17/15
08	**0**	-	-	-	-	-	0	0	0	-	0	77/17
Cowania mexicana stansburiana												
82	**66**	-	-	66	-	-	0	0	0	-	0	28/28
92	**66**	-	-	66	-	-	0	0	0	-	0	57/44
98	**260**	100	-	240	20	20	31	15	8	-	0	61/52
03	**20**	-	-	-	20	580	0	0	100	-	0	26/23
08	**0**	-	-	-	-	-	0	0	0	-	0	-/-
Ephedra viridis												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**20**	-	-	20	-	-	100	0	-	-	0	30/38
03	**0**	-	-	-	-	-	0	0	-	-	0	25/48
08	**0**	-	-	-	-	-	0	0	-	-	0	11/19
Gutierrezia micorcephala												
82	**466**	-	-	466	-	-	0	0	0	-	0	13/11
92	**3932**	7933	199	3733	-	-	0	0	0	-	0	14/15
98	**7360**	80	160	7120	80	80	0	0	1	1	1	9/12
03	**17600**	80	1980	15180	440	1020	0	0	3	1	1	12/13
08	**1340**	-	160	1120	60	120	0	1	4	1	3	9/10

		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)
Juniperus osteosperma												
82	**0**	66	-	-	-	-	0	0	-	-	0	-/-
92	**66**	-	66	-	-	-	0	0	-	-	0	-/-
98	**140**	20	80	60	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	40	0	0	-	-	0	-/-
08	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Kochia prostrata												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**260**	40	80	180	-	-	0	0	-	-	0	10/15
08	**1080**	-	600	480	-	-	6	6	-	-	0	10/16
Opuntia sp.												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**60**	-	20	40	-	-	0	0	-	-	0	8/20
03	**0**	-	-	-	-	-	0	0	-	-	0	8/18
08	**0**	-	-	-	-	-	0	0	-	-	0	10/27
Prunus fasciculata												
82	**0**	-	-	-	-	-	0	0	0	-	0	-/-
92	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**100**	-	20	60	20	-	0	0	20	20	20	51/72
03	**100**	-	-	100	-	-	20	0	0	-	20	39/56
08	**80**	-	-	20	60	-	0	0	75	-	0	28/38
Purshia glandulosa												
82	**265**	-	199	66	-	-	25	0	-	-	0	32/44
92	**266**	-	266	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	-/-
08	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Purshia tridentata												
82	**0**	-	-	-	-	-	0	0	0	-	0	-/-
92	**465**	66	66	399	-	-	29	0	0	-	0	34/50
98	**60**	60	-	60	-	-	33	67	0	-	0	47/71
03	**20**	-	-	-	20	-	100	0	100	-	0	44/38
08	**0**	-	-	-	-	-	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)
Quercus turbinella												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
92	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	20	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	-/-
08	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Yucca baccata baccata												
82	**133**	-	-	133	-	-	50	0	-	-	0	7/10
92	**199**	-	199	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	-/-
08	**0**	-	-	-	-	-	0	0	-	-	0	-/-