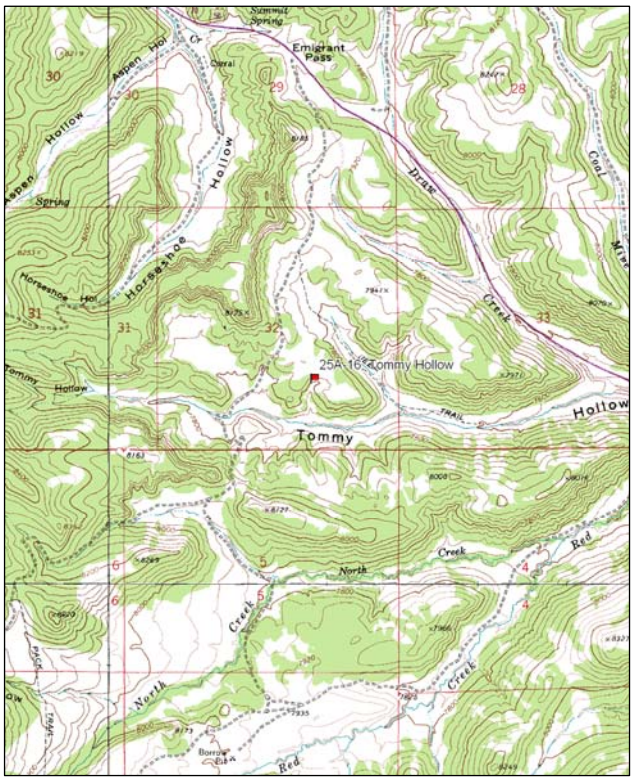
TOMMY HOLLOW - TREND STUDY NO. 25A-16-09

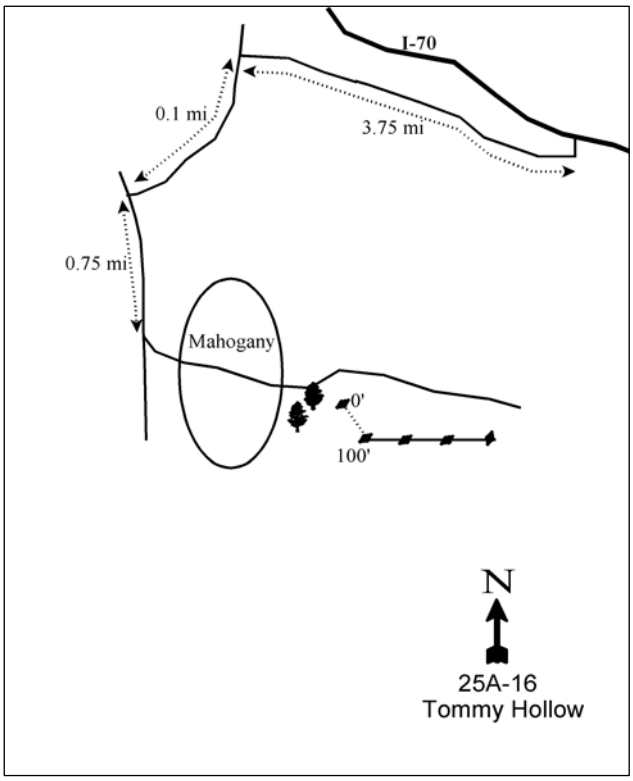
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Not Available
Land Ownership: USFS
Elevation: 7,800 ft (2,377 m)
Aspect: Northeast
Slope: 1%-2%
Transect bearing: 167 degrees magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
Take I-70 east for about 37.5 miles from Salina to a rest area exit. From the exit, turn right once, then right again to go west on the frontage road paralleling the freeway. Drive on the frontage road for 3.75 miles to a road (FS #013) turning left. Take this left turn and proceed 0.1 miles to a "T" in the road, turn left again and go south for 0.75 miles to the crest of the second hill. On the crest there is an old jeep trail turning left and going down the top of the hill. This road goes through a small clearing at the intersection, then through a thick patch of mahogany and junipers. The transect begins in the next sage clearing beyond the trees, about 50 feet past two pinyons standing beside each other near the edge of the clearing. The transect is marked with 2-1/2 foot tall rebar. The 0-foot baseline stake has a red browse tag #7193 attached.

Map Name: Old Woman Plateau, Utah



Diagrammatic Sketch:



Township: 23S, Range: 4E, Section: 32

GPS: NAD 83, UTM 12S 457783 E 4290680 N

TOMMY HOLLOW - TREND STUDY NO. 25A-16

Site Information

Site Description: The study is located on the low rolling mountains about one mile south of Emigrant Pass on I-70. It samples a flat that is dominated by sagebrush (*Artemisia spp.*) and grass, surrounded by pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*) and curlleaf mountain mahogany (*Cercocarpus ledifolius*). The area is managed by the Forest Service as part of the Beaver Dams allotment. Cattle were seen on site in July of 1985. In 1985, there were also signs to indicate that elk and deer use the site in winter. Pellet group data in 1991 estimated 42 deer and 15 elk days use/acre (103 ddu/ha, 38 edu/ha). Pellet group data estimated heavy deer use in 1999, but deer use was light in 2004 and 2009. Estimated elk use has fluctuated with heavy use in 1999, light use in 2004, and more moderate use in 2009. Estimated cattle use has been light since 1999. Rabbit sign has also been very common (Table - Pellet Group Data).

Browse: The key species in the flat are mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), black sagebrush (*A. nova*), and antelope bitterbrush (*Purshia tridentata*). Mountain big sagebrush is the dominant browse species in cover, but has steadily decreased since 1999 (Table - Browse Trends). The population of mountain big sagebrush has displayed high to moderate levels of decadence with many plants displaying poor vigor. Recruitment of young mountain big sagebrush plants was good in the early years of the study, but has been low since 2004. Utilization of mountain big sagebrush has been mostly moderate to heavy over the study years. Black sagebrush occurs at higher density than mountain big sagebrush, but displays only light use. Black sagebrush recruitment was also good at the outset of the study, but has been poor since 2004. Bitterbrush density has steadily increased since 1999 and is common on the site. Decadence in the bitterbrush population has also steadily decreased since 1991. Bitterbrush has displayed moderate to heavy utilization in the past, but use was light in 2009 (Table - Browse Characteristics).

Several other desirable browse species available on or near the site include winterfat (*Ceratoides lanata*), curlleaf mountain mahogany, and Utah serviceberry (*Amelanchier utahensis*). Besides providing variety in forage, the nearby curlleaf mountain mahogany and pinyon-juniper stands provide good protective cover. It appears there was some confusion with identification of stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*) in 1985 and 1991. Both species occur at fairly high densities (Table- Browse Characteristics) and have provided a moderate amount of combined cover since 1999 (Table - Browse Trends).

Herbaceous Understory: The understory vegetation is composed of a variety of grasses and forbs. The dominant grass species on the site is mutton bluegrass (*Poa fendleriana*) and other common species include bottlebrush squirreltail (*Sitanion hystrix*), blue grama (*Bouteloua gracilis*), sedge (*Carex sp.*), Letterman needlegrass *(Stipa lettermani*), and western wheatgrass (*Agropyron smithii*). There was a large decrease in the nested frequency and cover of many of the common grass species in 2009. Forbs are diverse but most species occur only occasionally. The most common perennial forbs include rose pussytoes (*Antennaria rosea*), redroot eriogonum (*Eriogonum racemosum*), and scarlet globemallow (*Sphaeralcea coccinea*).

Soil: The soil is a sandy clay loam with a slightly acid pH. Phosphorus has limited availability for plant growth and development at only 4.1 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is moderately low, but there is a high amount of bare soil exposed in the shrub interspaces. Most of the protective ground cover is provided by litter cover with a fairly high amount of cryptogam cover (Table - Basic Cover). The soil erosion condition was classified as moderate in 2004 due to a high amount of pedestaling, but was classified as stable in 2009.

Trend Assessments

Browse:

- **1985 to 1991 - slightly down (-1):** There may have been some identification problems between black sagebrush and mountain big sagebrush. The density of black sagebrush decreased by 12% and the density of mountain big sagebrush increased more than two-fold. Decadence of both species increased to over 50% and recruitment of young plants decreased, but remained very good. The density of bitterbrush increased by 33%, but all of the sampled plants were decadent.
- **1991 to 1999 - slightly up (+1):** Differences in density may be related to the larger sample area used in 1999; therefore, trend was determined using other parameters. Decadence of the three key species, mountain big sagebrush, black sagebrush, and bitterbrush, decreased to more moderate levels.
- **1999 to 2004 - down (-2):** The density of mountain big sagebrush decreased by 37% and the density of black sagebrush decreased by 19%. Recruitment of young plants in both species decreased substantially and was poor in 2004.
- **2004 to 2009 - up (+2):** The density of bitterbrush increased almost three-fold, the density of black sagebrush increased 28%, and the density of mountain big sagebrush increased 12%. Decadence remained similar in black and mountain big sagebrush, but continued to decrease in bitterbrush. Recruitment of all three species remained poor.

Grass:

- **1985 to 1991 - stable (0):** There was little change in the sum of nested frequency of perennial grasses.
- **1991 to 1999 - stable (0):** Perennial grass sum of nested frequency changed little, though composition changed with a significant decrease in the nested frequency of sedge and bottlebrush squirreltail and a significant increase in mutton bluegrass.
- **1999 to 2004 - stable (0):** The sum of nested frequency and cover of perennial grasses changed little, but mutton bluegrass and sedge increased significantly in nested frequency while blue grama and bottlebrush squirreltail decreased significantly.
- **2004 to 2009 - down (-2):** There was a 22% decrease in the sum of nested frequency of perennial grasses and cover decreased from 13% to 11%. There was a significant decrease in the nested frequency of sedge and bottlebrush squirreltail, and the cover of blue grama decreased substantially.

Forb:

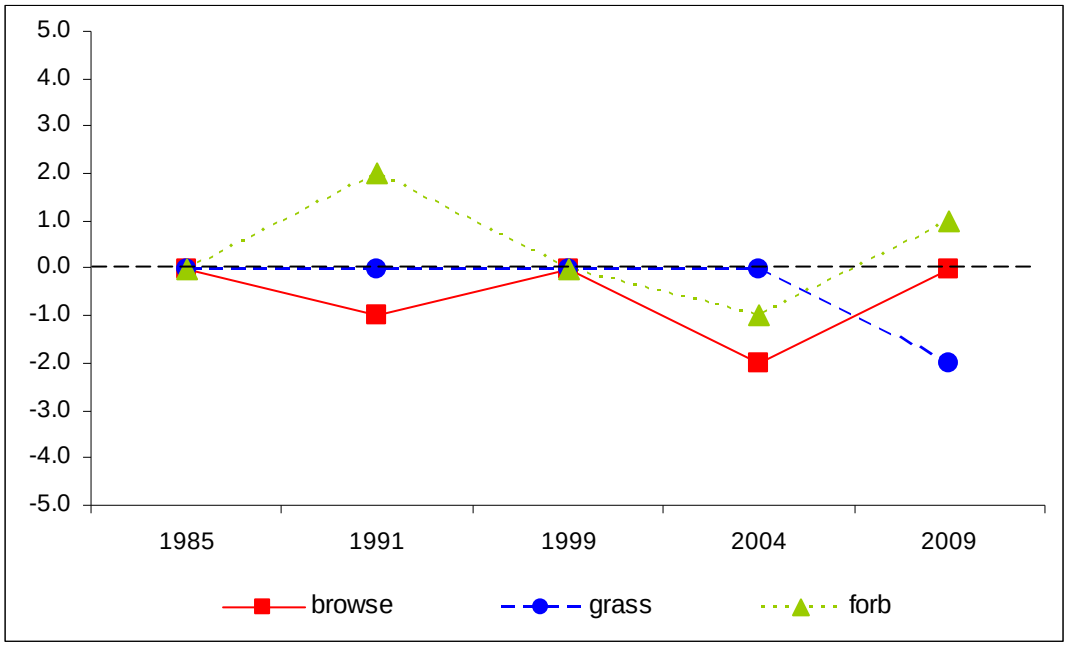
- **1985 to 1991 - up (+2):** The sum of nested frequency of perennial forbs increased by 21% with a significant increase in the nested frequency of pussytoes.
- **1991 to 1999 - down (-2):** Perennial forb sum of nested frequency decreased by 46%.
- **1999 to 2004 - slightly down (-1):** There was a 14% decrease in the sum of nested frequency of perennial forbs and cover decreased from 4% to 1%.
- **2004 to 2009 - up (+2):** The sum of nested frequency of perennial forbs increased by 37% and cover increased to 3%.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --
Management unit 25A, study no: 16

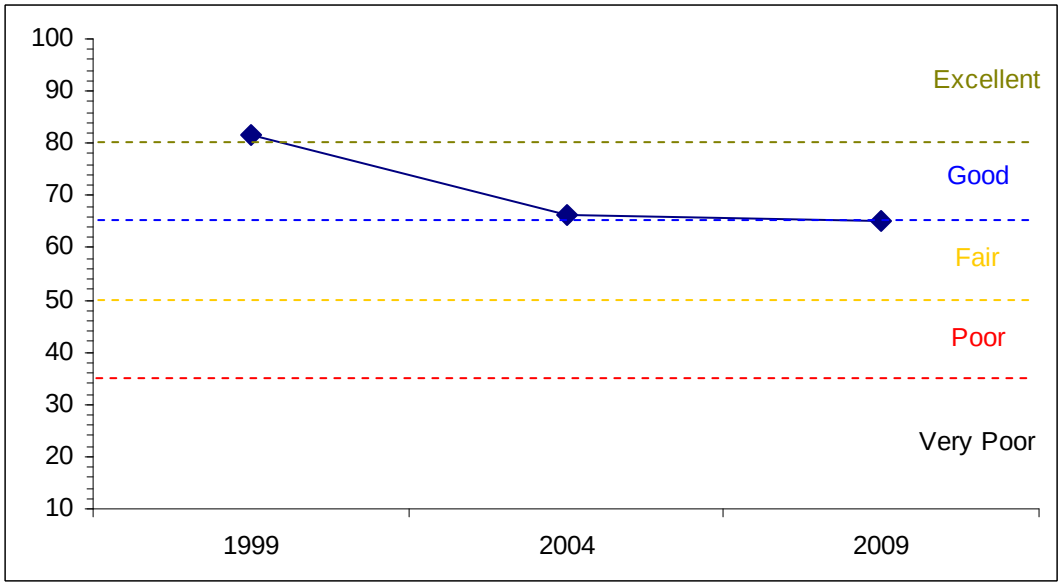
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
99	26.5	8.8	13.5	24.8	0.0	7.9	0.0	**81.5**	Good-Excellent
04	27.9	6.4	3.0	26.1	0.0	2.9	0.0	**66.2**	Fair-Good
09	27.5	8.7	2.2	21.3	0.0	5.5	0.0	**65.3**	Fair-Good

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 25A Study no: 16



DEER DESIRABLE COMPONENTS INDEX TREND, MID-LEVEL POTENTIAL
Management unit 25A, Study no: 16



HERBACEOUS TRENDS--
Management unit 25A, Study no: 16

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'99	'04	'09	'99	'04	'09
G	Agropyron smithii	a19	b84	b109	b90	b85	1.16	1.09	1.24
G	Bouteloua gracilis	b116	b117	b91	a51	a32	1.48	1.08	.54
G	Bromus tectorum (a)	-	-	2	-	-	.00	-	-
G	Carex sp.	d269	d264	a27	c153	b72	.69	1.56	.40
G	Festuca ovina	bc11	a-	b62	a4	a-	.84	.06	-
G	Oryzopsis hymenoides	b72	a8	a4	a-	a-	.01	-	-
G	Poa fendleriana	a23	a30	b174	c220	c250	4.87	6.17	7.28
G	Poa pratensis	-	-	-	9	-	-	.12	-
G	Poa secunda	9	-	2	17	18	.00	.06	.11
G	Sitanion hystrix	cd142	d166	c110	b68	a19	2.10	2.15	.19
G	Stipa comata	8	5	5	-	-	.07	.00	-
G	Stipa lettermani	a8	a14	b52	b49	b41	1.18	.71	.89
Total for Annual Grasses		0	0	2	0	0	0.00	0	0
Total for Perennial Grasses		677	688	636	661	517	12.42	13.03	10.67
Total for Grasses		677	688	638	661	517	12.43	13.03	10.67
F	Agoseris glauca	-	5	-	-	-	-	-	-
F	Allium sp.	1	-	2	-	-	.03	-	-
F	Androsace septentrionalis (a)	-	-	b28	b20	a1	.07	.08	.00
F	Antennaria rosea	a14	b74	a27	a16	a8	2.40	.20	.21
F	Arabis demissa	b47	b116	a13	a2	a8	.03	.00	.03
F	Astragalus convallarius	-	-	1	6	1	.03	.03	.00
F	Astragalus sp.	1	1	9	4	3	.22	.03	.00
F	Astragalus utahensis	-	-	-	2	-	-	.00	-
F	Calochortus nuttallii	ab23	b50	a5	a-	a-	.01	-	-
F	Castilleja chromosa	1	1	3	-	2	.01	-	.00
F	Collinsia parviflora (a)	-	-	a-	a6	b27	-	.01	.06
F	Crepis acuminata	-	2	-	-	-	-	-	-
F	Cymopterus sp.	-	3	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	-	-	1	-	-	.00	-
F	Erigeron eatonii	ab6	a1	abc13	c22	bc25	.08	.09	.30
F	Erigeron flagellaris	a-	a-	a-	a4	b28	-	.01	.32
F	Erigeron pumilus	c110	b39	a14	ab13	a17	.03	.09	.09
F	Eriogonum racemosum	a3	a-	ab13	ab10	b22	.13	.13	.52
F	Hymenoxys richardsonii	a-	a-	b13	b17	b18	.18	.18	.33
F	Ipomopsis aggregata	-	-	3	-	-	.03	-	-
F	Machaeranthera canescens	-	1	2	-	-	.01	-	-
F	Microsteris gracilis (a)	-	-	-	3	6	-	.01	.01
F	Penstemon comarrhenus	-	-	-	3	5	-	.01	.04
F	Penstemon pachyphyllus	3	2	2	-	-	.06	-	-
F	Penstemon sp.	-	-	8	5	13	.07	.06	.27
F	Phlox austromontana	a2	a-	b21	ab10	ab14	.22	.22	.30
F	Phlox longifolia	-	-	-	3	3	-	.00	.01
F	Polygonum douglasii (a)	-	-	9	24	19	.02	.05	.06

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'99	'04	'09	'99	'04	'09
F	Potentilla gracilis	-	-	3	-	-	.00	-	-
F	Ranunculus testiculatus (a)	-	-	$_{a}$-	$_{a}$6	$_{b}$113	-	.01	.55
F	Sphaeralcea coccinea	$_{b}$83	$_{ab}$60	$_{a}$34	$_{a}$45	$_{ab}$57	.34	.37	.26
F	Taraxacum officinale	-	-	4	3	-	.01	.01	-
F	Unknown forb-perennial	-	-	2	-	-	.00	-	-
F	Zigadenus paniculatus	-	-	-	-	2	-	-	.00
Total for Annual Forbs		0	0	37	60	166	0.09	0.17	0.70
Total for Perennial Forbs		294	355	192	165	226	3.94	1.47	2.74
Total for Forbs		294	355	229	225	392	4.03	1.64	3.44

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

BROWSE TRENDS--
Management unit 25A, Study no: 16

Type	Species	Strip Frequency			Average Cover %		
		'99	'04	'09	'99	'04	'09
B	Amelanchier utahensis	4	5	3	.38	.41	.00
B	Artemisia frigida	0	0	1	-	-	.15
B	Artemisia nova	69	65	56	3.59	6.27	5.61
B	Artemisia tridentata tridentata	1	2	1	.15	.66	.15
B	Artemisia tridentata vaseyana	85	79	79	13.40	10.92	8.73
B	Ceratoides lanata	5	8	12	.00	.07	.09
B	Chrysothamnus depressus	5	10	20	.03	.09	1.27
B	Chrysothamnus viscidiflorus viscidiflorus	84	95	55	5.66	7.72	2.59
B	Echinocereus triglochidatus	0	1	0	-	.00	-
B	Gutierrezia sarothrae	53	43	28	.93	1.83	.23
B	Juniperus osteosperma	0	1	0	-	.00	-
B	Opuntia sp.	15	21	15	.26	.42	.35
B	Pinus edulis	2	3	3	.00	.03	.81
B	Purshia tridentata	8	10	18	2.97	3.17	5.02
B	Symphoricarpos oreophilus	4	4	3	.21	.00	.15
B	Tetradymia canescens	3	4	5	.00	.00	.00
Total for Browse		338	351	299	27.61	31.63	25.19

CANOPY COVER, LINE INTERCEPT--
Management unit 25A, Study no: 16

Species	Percent Cover	
	'04	'09
Amelanchier utahensis	.63	.06
Artemisia nova	11.01	7.66
Artemisia tridentata tridentata	1.26	.36
Artemisia tridentata vaseyana	14.75	9.16
Ceratoides lanata	-	.03
Chrysothamnus depressus	-	1.85
Chrysothamnus viscidiflorus viscidiflorus	13.63	4.13
Gutierrezia sarothrae	3.00	.23
Opuntia sp.	.15	.06
Pinus edulis	.06	.60
Purshia tridentata	1.91	7.65
Symphoricarpos oreophilus	.13	.58
Tetradymia canescens	.05	.03

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 25A, Study no: 16

Species	Average leader growth (in)	
	'04	'09
Artemisia nova	1.0	0.4
Artemisia tridentata vaseyana	1.4	0.7

POINT-QUARTER TREE DATA--
Management unit 25A, Study no: 16

Species	Trees per Acre		
	'99	'04	'09
Juniperus osteosperma	6	<18	<18
Pinus edulis	12	<18	<18

Average diameter (in)		
'99	'04	'09
6.5	-	-
4.7	-	-

BASIC COVER--
Management unit 25A, Study no: 16

Cover Type	Average Cover %				
	'85	'91	'99	'04	'09
Vegetation	13.50	9.75	45.80	44.76	39.38
Rock	.25	0	.04	.05	.01
Pavement	1.50	1.75	.53	2.88	.77
Litter	43.25	46.00	36.16	38.02	44.73
Cryptogams	0	8.50	6.69	9.32	5.21
Bare Ground	41.50	34.00	27.71	25.63	26.80

SOIL ANALYSIS DATA --
Management unit 25A, Study no: 16, Study Name: Tommy Hollow

Effective rooting depth (in)	pH	sandy clay loam			%0M	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
18.8	6.5	52.9	15.8	31.3	1.6	4.1	163.2	0.6

PELLET GROUP DATA--
Management unit 25A, Study no: 16

Type	Quadrat Frequency		
	'99	'04	'09
Rabbit	67	65	63
Elk	32	17	12
Deer	15	21	4
Cattle	3	3	3

Days use per acre (ha)		
'99	'04	'09
-	-	-
93 (229)	13 (33)	34 (83)
96 (237)	12 (30)	5 (13)
9 (22)	9 (21)	8 (20)

BROWSE CHARACTERISTICS--
Management unit 25A, Study no: 16

		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 utahensis									
85	**0**	0	0	0	-	0	0	0	-/-
91	**132**	50	0	50	-	50	0	0	-/-
99	**100**	40	60	0	-	40	40	0	38/29
04	**120**	50	50	0	20	33	33	0	15/15
09	**60**	0	100	0	-	67	33	0	11/13
Artemisia frigida									
85	**0**	0	0	-	-	0	0	0	-/-
91	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**120**	0	100	-	-	100	0	0	-/-
Artemisia nova									
85	**10865**	45	48	7	799	4	2	.61	8/11
91	**9531**	25	20	55	599	37	37	13	7/10
99	**7800**	24	67	9	140	17	.25	4	9/16
04	**6280**	1	82	17	100	0	0	6	8/17
09	**8100**	4	75	21	700	16	2	13	6/14
Artemisia tridentata tridentata									
85	**0**	0	0	0	-	0	0	0	-/-
91	**132**	50	0	50	-	50	50	0	-/-
99	**20**	0	0	100	-	0	0	0	-/-
04	**40**	0	0	100	-	0	0	50	69/69
09	**20**	0	0	100	-	100	0	100	52/67
Artemisia tridentata vaseyana									
85	**7731**	49	45	6	2466	10	2	.86	11/11
91	**16532**	36	13	51	8466	36	33	18	11/18
99	**6880**	29	51	21	260	31	.29	3	21/32
04	**4340**	7	56	37	180	29	26	24	18/28
09	**4880**	8	57	35	280	41	6	25	19/25

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Ceratoides lanata									
85	**2731**	15	78	7	66	0	0	0	4/3
91	**3332**	8	88	4	133	2	94	2	1/2
99	**220**	0	91	9	20	27	73	0	3/3
04	**360**	6	94	0	-	50	44	6	4/3
09	**360**	6	94	0	-	0	0	0	3/4
Cercocarpus ledifolius									
85	**0**	0	0	-	-	0	0	0	-/-
91	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	20	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	34/44
09	**0**	0	0	-	-	0	0	0	47/35
Chrysothamnus depressus									
85	**66**	0	0	100	-	0	0	0	-/-
91	**798**	8	83	8	-	17	83	0	2/2
99	**180**	0	100	0	-	33	33	0	3/5
04	**400**	25	75	0	-	0	25	0	4/8
09	**2500**	0	100	0	-	32	0	0	3/7
Chrysothamnus viscidiflorus viscidiflorus									
85	**0**	0	0	0	-	0	0	0	-/-
91	**24732**	27	70	3	533	33	23	1	5/5
99	**12580**	3	95	2	-	.31	0	0	4/9
04	**7120**	1	98	1	360	0	0	.28	5/10
09	**7680**	10	89	1	-	0	0	2	5/9
Echinocereus triglochidatus									
85	**0**	0	0	-	-	0	0	0	-/-
91	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**20**	0	100	-	-	0	0	0	2/3
09	**0**	0	0	-	-	0	0	0	-/-
Gutierrezia sarothrae									
85	**17932**	17	83	-	1199	0	0	0	5/7
91	**133**	0	100	-	-	0	0	0	4/5
99	**5780**	14	86	-	40	0	0	0	6/7
04	**2060**	0	100	-	-	0	0	0	6/8
09	**1360**	0	100	-	-	0	12	0	4/5
Juniperus osteosperma									
85	**0**	0	0	-	-	0	0	0	-/-
91	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**20**	100	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Opuntia sp.									
85	**0**	0	0	0	-	0	0	0	-/-
91	**399**	67	33	0	66	0	0	0	2/1
99	**580**	28	66	7	-	0	0	7	3/12
04	**920**	2	98	0	-	0	0	0	2/7
09	**700**	31	69	0	20	0	0	0	2/8
Pinus edulis									
85	**0**	0	0	0	-	0	0	0	-/-
91	**0**	0	0	0	-	0	0	0	-/-
99	**40**	100	0	0	20	0	0	0	-/-
04	**60**	67	0	33	-	0	0	0	-/-
09	**60**	100	0	0	-	0	0	0	-/-
Purshia tridentata									
85	**199**	33	67	0	-	33	33	0	20/23
91	**266**	0	0	100	-	0	75	100	-/-
99	**180**	22	44	33	-	33	33	0	20/48
04	**280**	7	79	14	20	0	93	7	16/44
09	**800**	0	100	0	-	0	10	3	22/38
Symphoricarpos oreophilus									
85	**0**	0	0	0	-	0	0	0	-/-
91	**0**	0	0	0	-	0	0	0	-/-
99	**120**	33	67	0	-	0	0	0	14/27
04	**100**	40	40	20	-	20	0	0	9/14
09	**80**	0	100	0	-	0	0	0	13/21
Tetradymia canescens									
85	**0**	0	0	-	-	0	0	0	-/-
91	**0**	0	0	-	-	0	0	0	-/-
99	**60**	67	33	-	-	0	33	0	12/15
04	**160**	88	13	-	-	0	0	0	3/8
09	**100**	0	100	-	-	0	0	0	5/7