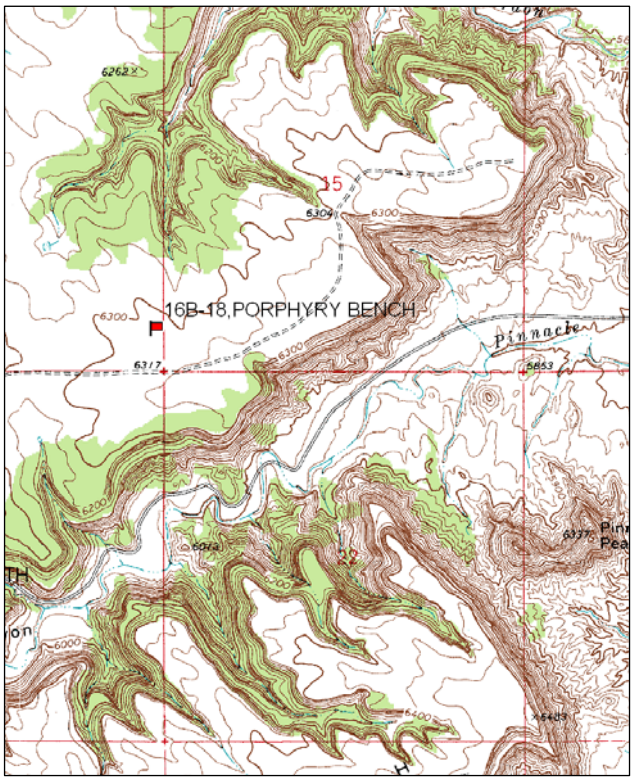
PORPHYRY BENCH - TREND STUDY NO. 16B-18-09

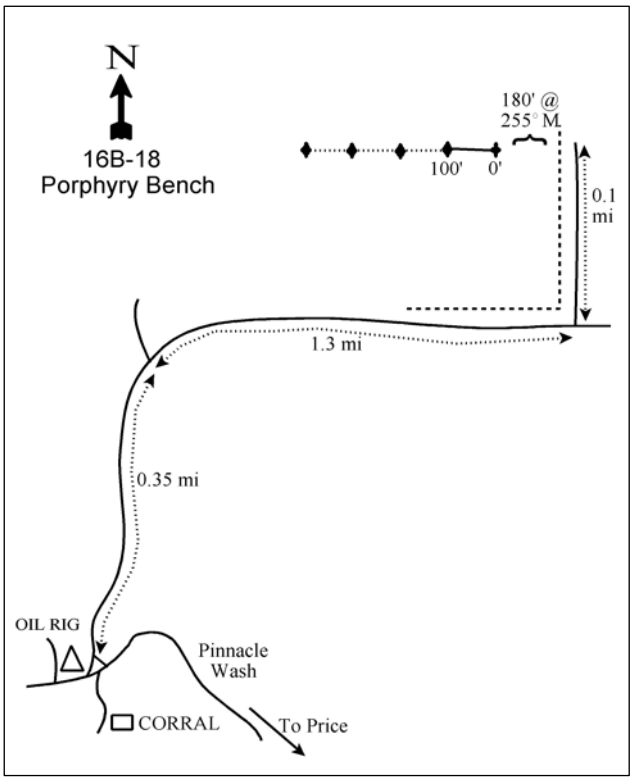
Vegetation Type: Wyoming Big Sagebrush
Range Type: Crucial Deer Winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R047XA308UT
Land Ownership: DWR
Elevation: 6,300 ft (1,920 m)
Aspect: West
Slope: 1%-2%
Transect bearing: 270 degrees magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
Take Westwood Blvd (1550 W) northwest out of Price 2.35 miles to a major intersection. Turn left onto Gordon Creek Road and travel 0.45 miles to a fork. Bear left away from Gordon Creek, going 0.1 miles to a gravel pit. Continue 5.2 miles on the Pinnacle Peak Road to a 3-way fork at the top of the bench. Go right 0.35 miles to a fork. Bear right and continue 1.3 miles, going alongside a fence to the SE corner. Turn left and go along the fence 0.1 mile to the fifth wood post from the corner. Walk west into the sagebrush 180 feet to the 0-foot baseline stake. It is a 1 1/2 foot tall fencepost marked by browse tag #9021.

Map Name: Pinnacle Peak



Diagrammatic Sketch:



Township: 14S, Range: 9E, Section: 16

GPS: NAD 83, UTM 12S 507669 E 4383587 N

PORPHYRY BENCH - TREND STUDY NO. 16B-18

Site Information

Site Description: The study is located on DWR land that is largely a sagebrush/grass community, with juniper covered side hills and draws. The area was part of the Price West Benches, Porphyry Bench Watershed Restoration Initiative project (project# 229) that was implemented in 2005. The area was treated by an aerator and reseeded (Table - Seed Mix) to address the long-term decline of sagebrush winter range for grater sage grouse and mule deer. The treatment was done in 100 foot strips, by repeatedly alternating treated and untreated strips. Two sample belts sampled treated strips and three sample belts sampled untreated strips. A nearby pellet group transect had an average of 45 deer days use/acre between 1988 and 1994. Pellet group transect data has indicated extremely heavy deer use since 1999. Estimated elk use was light in 1999, but increased to moderate use since 2004. Cattle use has been minimal on the site since 1999 (Table - Pellet Group Data).

Browse: Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) is the key species for this site, but has decreased in cover (Table - Browse Trends) and density since 1999. There was a large die-off of sagebrush between 1999 and 2004 attributed to a severe drought in the years prior to the 2004 sampling. The sagebrush population is mostly decadent with a high proportion of plants displaying poor vigor since 2004. Recruitment of young sagebrush plants has fluctuated over the sample years, but was good in 2009. The average height crown of mature sagebrush plants has decreased steadily since 1999. Utilization of sagebrush has been mostly heavy in most sample years (Table - Browse Characteristics).

Brittle pricklypear cactus (*Opuntia fragilis*) has been the dominant browse on the site since 2004. Density of cactus has steadily decreased since 1999 as well, but this population appears to have endured the drought better than sagebrush. The seeded species prostrate kochia (*Kochia prostrata*) was sampled on the site in low density and cover for the first time in 2009, after the treatment and seeding. Winterfat (*Ceratoides lanata*) was also sampled, but is relatively uncommon (Table - Browse Trends, Table - Browse Characteristics).

Herbaceous Understory: The dominant species on the site is the native perennial grass needle-and-thread (*Stipa comata*). Native perennial grasses were abundant at the outset of the study in 1988, but had decreased substantially by 2004. In 2009, after the treatment, perennial grasses were again abundant with two additional introduced species, crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass (*A. intermedium*) also being present. Other common grasses include Indian ricegrass (*Oryzopsis hymenoides*) and western wheatgrass (*Agropyron smithii*). Perennial forbs are somewhat rare on the site except for scarlet globemallow (*Sphaeralcea coccinea*), which has steadily increased in cover and frequency since 1999 (Table - Herbaceous Trends).

Soil: The soil is a loam with a moderately alkaline pH and moderately deep effective rooting depth. Potassium has a low availability for plant growth and development at 25.6 ppm (Tiedemann and Lopez 2004) (Table - Soil Analysis Data). Bare ground cover is quite high, but the level topography of the site limits erosion. Litter cover also provides fairly good protection from erosion (Table - Basic Cover). The soil erosion condition was classified as stable in 2009.

SEED MIX
Management unit 16B, study no. 18
Project name: Price West Benches, Porphyry Bench

WRI Database #: 229	Size (acre):	1000
Seed type	lbs in mix	lbs/acre
Crested Wheatgrass 'Hycrest'	410	0.4
Thickspike Wheatgrass 'Critana'	85	0.1
Siberian Wheatgrass 'Vavilov'	410	0.4
Great Basin Wildrye 'Trailhead'	85	0.1
Russian Wildrye 'Bozoisky'	820	0.8
Sheep Fescue	85	0.1
Indian Ricegrass 'Rimrock'	85	0.1
Yellow Sweetclover	205	0.2
Small Burnet 'Delar'	205	0.2
Winterfat--Duchesne/Uintah UT	116	0.1
Whitestem Rubber Rabbitbrush	43	0.0
Forage Kochia	580	0.6
Fourwing Saltbush	870	0.9
Wyoming big sagebrush	145	0.1
Blue Flax	9	0.0
Rocky Mt. Beeplant	17	0.0
TOTAL:	4170	4.17

Trend Assessments

Browse:

- **1988 to 1994 - stable (0):** Differences in density may be related to the larger sample area used in 1994; therefore, trend was determined using other parameters. Decadence and poor vigor of sagebrush both decreased slightly. Recruitment of young sagebrush plants also decreased to just 4% of the population.
- **1994 to 1999 - slightly up (+1):** The density of sagebrush increased 22% to 7,540 plants/acre, and cover increased from 11% to 12%. Recruitment of young sagebrush plants increased to 10% of the population.
- **1999 to 2004 - down (-2):** There was a large sagebrush die-off that is attributed to a drought in the years prior to the 2004 sample. Density of sagebrush decreased 84% to 1,200 plants/acre, and cover decreased to only 1%. Decadence of sagebrush increased to 95% and plants displaying poor vigor increased to 87% of the population. Recruitment of young sagebrush plants decreased to only 3% of the population.
- **2004 to 2009 - stable (0):** Density of sagebrush remained similar, but cover decreased to less than 1%. Decadence and poor vigor of sagebrush both decreased, but are still quite high. Recruitment of young sagebrush plants increased to 19% of the population. Prostrate kochia was sampled for the first time at low density and cover.

Grass:

- **1988 to 1994 - up (+2):** The sum of nested frequency of perennial grasses increased by 23%. There was a significant increase in the nested frequency of western wheatgrass and sand dropseed (*Sporobolus cryptandrus*).
- **1994 to 1999 - slightly down (-1):** The sum of nested frequency of perennial grasses decreased 10%, though cover increased from 12% to 14%. There was a significant decrease in the nested frequency of sand dropseed and bottlebrush squirreltail (*Sitanion hystrix*).

- **1999 to 2004 - down (-2):** The sum of nested frequency of perennial grasses decreased 56% and cover decreased to only 1%. There was a significant decrease in nested frequency of the dominant grass, needle-and-thread, and bottlebrush squirreltail.
- **2004 to 2009 - up (+2):** The sum of nested frequency of perennial grasses increased to 1999 levels and cover increased to a recorded high of 24%. Two seeded species, crested wheatgrass and intermediate wheatgrass, were sampled for the first time. There was a significant increase in nested frequency of Indian ricegrass, bottlebrush squirreltail, and needle-and-thread.

Forb:

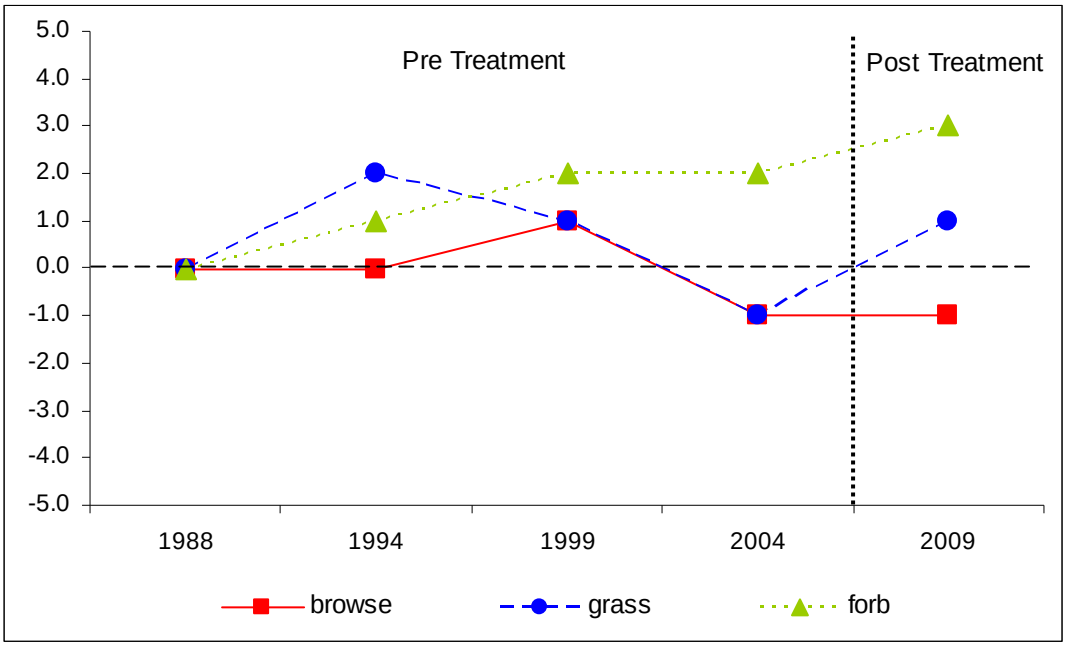
- **1988 to 1994 - slightly up (+1):** There was an 18% increase in the sum of nested frequency of perennial forbs.
- **1994 to 1999 - slightly up (+1):** There was a 48% increase in the sum of nested frequency of perennial forbs and cover increased from 1% to 2%. The increase in nested frequency was primarily due to a significant increase in longleaf phlox (*Phlox longifolia*). Forbs are not abundant on this site.
- **1999 to 2004 - stable (0):** The sum of nested frequency of perennial forbs decreased to 1994 levels, but cover increased to 9%. The increase in cover was due to the substantial increase in cover of scarlet globemallow.
- **2004 to 2009 - slightly up (+1):** There was a 51% increase in the sum of nested frequency of perennial forbs, but cover decreased slightly. There was a significant increase in the nested frequency of scarlet globemallow.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --
Management unit 16B, study no: 18

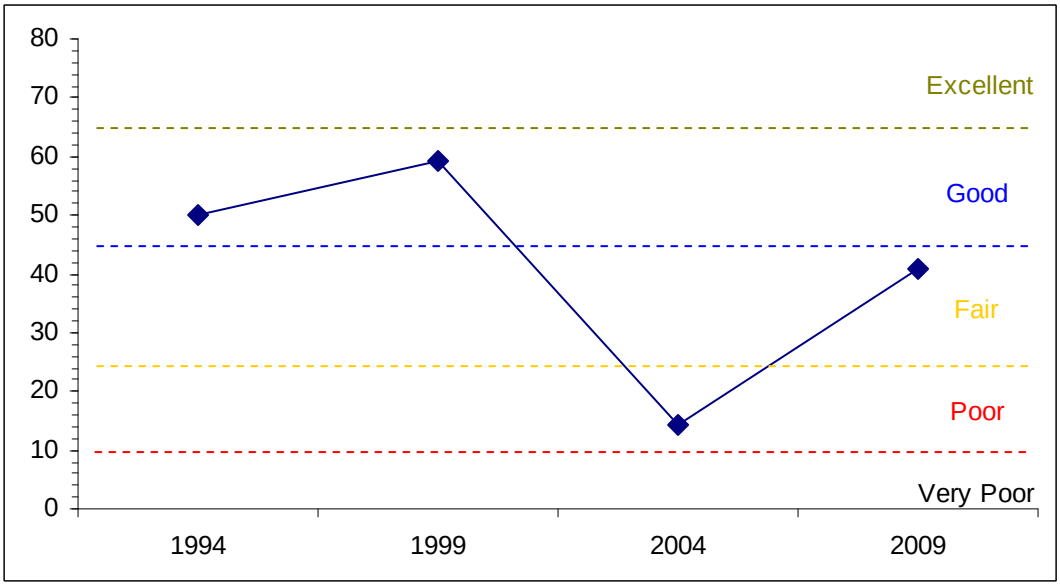
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
94	13.5	7.5	2.0	24.5	0.0	2.4	0.0	**49.9**	Good
99	14.9	6.6	5.0	28.6	0.0	4.0	0.0	**59.1**	Good
04	1.7	0.0	0.0	2.7	0.0	10.0	0.0	**14.4**	Poor
09	0.8	0.0	0.0	30.0	0.0	10.0	0.0	**40.8**	Fair

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 16B Study no: 18



DEER DESIRABLE COMPONENTS INDEX TREND, LOW POTENTIAL SCALE
Management unit 16B, Study no: 18



HERBACEOUS TRENDS--
Management unit 16B, Study no: 18

Type	Species	Nested Frequency					Average Cover %			
		'88	'94	'99	'04	'09	'94	'99	'04	'09
G	Agropyron cristatum	a-	a-	a-	a-	b91	-	-	-	5.22
G	Agropyron intermedium	a-	a-	a-	a-	b25	-	-	-	.95
G	Agropyron smithii	a21	c86	bc84	b52	a7	.67	1.79	.26	.04
G	Bouteloua gracilis	a1	ab8	b11	ab2	a-	.06	.22	.01	-
G	Bromus tectorum (a)	-	3	-	-	9	.00	-	-	.02
G	Oryzopsis hymenoides	a59	a40	ab67	a59	b97	1.26	2.12	.20	4.74
G	Sitanion hystrix	c43	c77	b13	a-	b14	1.15	.28	-	.52
G	Sporobolus cryptandrus	a3	b13	a-	a3	a-	.39	-	.00	-
G	Stipa comata	c262	c250	c256	a74	b191	8.67	9.88	.88	12.21
Total for Annual Grasses		0	3	0	0	9	0.00	0	0	0.01
Total for Perennial Grasses		389	474	431	190	427	12.24	14.31	1.36	23.70
Total for Grasses		389	477	431	190	436	12.24	14.31	1.36	23.72
F	Alyssum alyssoides (a)	-	-	-	-	5	-	-	-	.01
F	Astragalus convallarius	10	-	4	4	2	-	.00	.07	.00
F	Calochortus nuttallii	-	-	5	2	6	-	.03	.00	.01
F	Castilleja sp.	-	-	2	-	2	-	.00	-	.00
F	Chenopodium fremontii (a)	-	-	-	8	-	-	-	.07	-
F	Chenopodium leptophyllum(a)	-	b19	a-	c279	b15	.03	-	7.03	.04
F	Cruciferae	6	-	-	-	-	-	-	-	-
F	Descurainia pinnata (a)	-	a-	a-	b37	a-	-	-	.16	-
F	Eriogonum alatum	-	-	2	-	-	-	.00	-	-
F	Eriogonum cernuum (a)	-	8	-	3	6	.01	-	.03	.01
F	Gayophytum ramosissimum(a)	-	a-	a-	b95	a3	-	-	1.77	.01
F	Lappula occidentalis (a)	-	b16	a-	c38	a-	.05	-	.23	-
F	Lesquerella sp.	5	7	-	-	-	.01	-	-	-
F	Lomatium sp.	-	-	4	4	-	-	.01	.01	-
F	Machaeranthera canescens	2	-	-	-	-	-	-	-	-
F	Mentzelia albicaulis (a)	-	-	-	-	8	-	-	-	.06
F	Orobanche sp.	1	-	-	-	-	-	-	-	-
F	Penstemon caespitosus	1	-	-	-	-	-	.00	-	-
F	Penstemon carnosus	-	-	-	-	-	-	-	.00	-
F	Phlox longifolia	a-	a4	b68	ab13	ab14	.04	.32	.08	.10
F	Plantago patagonica (a)	-	bc37	a9	c53	ab26	.08	.01	.38	.07
F	Salsola iberica (a)	-	-	-	16	15	-	-	.37	.06
F	Schoencrambe linifolia	a-	a-	a3	ab2	b11	-	.00	.03	.05
F	Sedum lanceolatum	-	-	-	-	3	-	-	-	.00
F	Senecio multilobatus	6	5	6	1	-	.01	.04	.00	-
F	Sisymbrium altissimum (a)	-	-	-	2	-	-	-	.03	-
F	Sphaeralcea coccinea	a94	ab125	ab126	b141	c214	1.13	1.59	9.13	6.66
F	Taraxacum officinale	-	10	-	-	-	.01	-	-	-
F	Tragopogon dubius	3	-	-	-	-	-	-	-	-
F	Zigadenus paniculatus	-	-	3	2	3	-	.00	.00	.00
Total for Annual Forbs		0	80	9	531	78	0.18	0.01	10.10	0.27

Type	Species	Nested Frequency					Average Cover %			
		'88	'94	'99	'04	'09	'94	'99	'04	'09
Total for Perennial Forbs		128	151	223	169	255	1.22	2.02	9.35	6.85
Total for Forbs		128	231	232	700	333	1.40	2.04	19.46	7.12

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

BROWSE TRENDS--
Management unit 16B, Study no: 18

Type	Species	Strip Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
B	Artemisia tridentata wyomingensis	85	95	42	42	10.81	11.91	1.36	.52
B	Ceratoides lanata	0	0	0	3	-	-	-	.03
B	Chrysothamnus viscidiflorus viscidiflorus	0	4	1	5	-	.03	.00	.09
B	Gutierrezia sarothrae	3	11	0	0	.03	.10	-	-
B	Kochia prostrata	0	0	0	8	-	-	-	.06
B	Opuntia fragilis	93	93	80	68	2.96	3.74	2.83	2.81
Total for Browse		181	203	123	126	13.81	15.78	4.19	3.52

CANOPY COVER, LINE INTERCEPT--
Management unit 16B, Study no: 18

Species	Percent Cover	
	'04	'09
Artemisia tridentata wyomingensis	1.36	.46
Chrysothamnus viscidiflorus viscidiflorus	-	.25
Opuntia fragilis	2.78	1.36

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 16B, Study no: 18

Species	Average leader growth (in)	
	'04	'09
Artemisia tridentata wyomingensis	3.2	1.8

BASIC COVER--
Management unit 16B, Study no: 18

Cover Type	Average Cover %				
	'88	'94	'99	'04	'09
Vegetation	5.50	27.77	31.73	26.38	32.28
Rock	0	.00	0	0	0
Pavement	0	.05	.00	.05	.00
Litter	49.50	35.52	29.25	42.54	39.57
Cryptogams	2.25	.90	7.30	.72	.27
Bare Ground	42.75	35.40	26.54	44.39	41.62

SOIL ANALYSIS DATA --

Management unit 16B, Study no: 18, Study Name: Porphyry Bench

Effective rooting depth (in)	pH	loam			%0M	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
16.1	8.1	47.3	30.2	22.6	1.1	12.3	25.6	0.6

PELLET GROUP DATA--

Management unit 16B, Study no: 18

Type	Quadrat Frequency			
	'94	'99	'04	'09
Rabbit	21	32	19	42
Elk	11	2	4	5
Deer	52	79	67	63
Cattle	-	1	-	-
Antelope	-	-	-	1

Days use per acre (ha)		
'99	'04	'09
-	-	-
1 (3)	31 (76)	40 (98)
149 (369)	317 (784)	217 (536)
4 (9)	-	-
-	-	-

BROWSE CHARACTERISTICS--

Management unit 16B, Study no: 18

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Artemisia tridentata wyomingensis									
88	**6931**	19	35	46	66	35	48	13	17/21
94	**6200**	4	71	25	-	2	0	6	17/24
99	**7540**	10	62	28	60	31	56	7	16/24
04	**1200**	3	2	95	40	10	88	87	13/18
09	**1180**	19	17	64	-	7	64	29	9/12
Atriplex canescens									
88	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	12/11
Ceratoides lanata									
88	**199**	33	67	-	-	33	33	0	15/8
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	12/11
09	**60**	0	100	-	-	0	0	0	12/10
Chrysothamnus viscidiflorus viscidiflorus									
88	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**100**	0	100	-	-	0	0	0	4/10
04	**40**	0	100	-	-	0	0	0	8/8
09	**440**	50	50	-	-	0	5	0	5/9

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Gutierrezia sarothrae									
88	**1065**	25	75	-	-	0	0	0	8/4
94	**80**	0	100	-	-	0	0	0	6/7
99	**1040**	54	46	-	-	0	0	0	3/5
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	7/10
Kochia prostrata									
88	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**220**	0	100	-	-	64	27	0	6/8
Opuntia fragilis									
88	**8131**	43	52	5	266	0	0	4	3/9
94	**6960**	1	98	1	-	0	0	0	3/12
99	**7360**	4	86	10	20	0	0	15	3/12
04	**5080**	2	85	13	-	0	0	6	4/13
09	**4040**	1	87	12	20	0	0	6	3/12