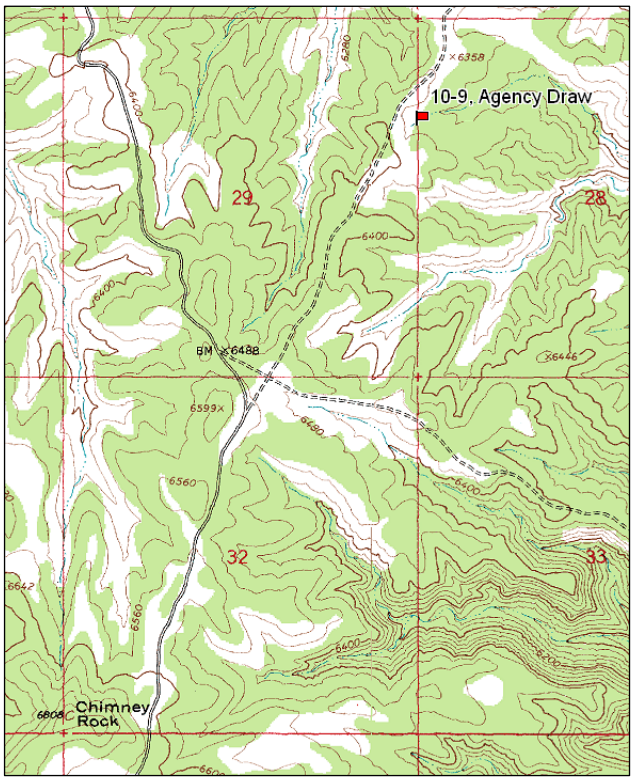
AGENCY DRAW - TREND STUDY NO. 10-9-10

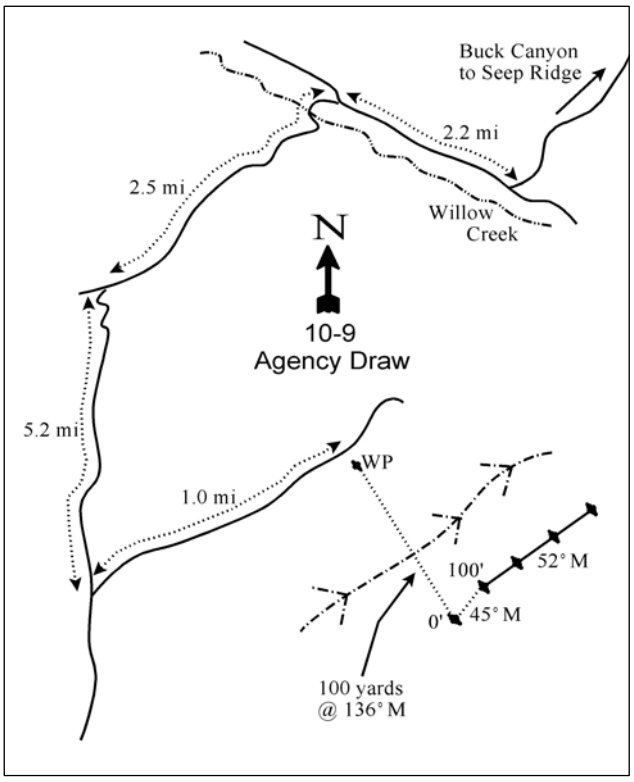
Vegetation Type: Desert Shrub
Range Type: Crucial Deer Winter, Substantial Elk Winter
NRCS Ecological Site Description: Desert Shaly Shallow Loam (Spiny Greasebush), R034XY131UT
Land Ownership: BLM
Elevation: 6319 ft. (1927 m)
Aspect: Northeast
Slope: 5-8%
Transect bearing: 45° magnetic
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

Directions:
From the Seep Ridge Road, go down Buck Canyon to Willow Creek. Travel north on Willow Creek 2.2 miles to a fork. Bear left, cross Willow Creek then drive up out of the canyon 2.5 miles to a fork. Bear left. Continue 5.2 miles to an intersection. Turn left off the main road. Go down 0.1 miles to a small flat. Continue going straight (Northeast) down the ridge 0.9 miles to a witness post on the right side of the road. From the witness post, walk 100 yards down into the draw at a bearing of 136°M. The 0-foot baseline stake is marked with a red browse tag, #9040. The frequency baseline is marked by green fenceposts, 12-18 inches in height.

Map Name: Agency Draw



Diagrammatic Sketch:



Township: 13S Range: 21E Section: 28

GPS: NAD 83, UTM 12S 6216734 E 4391037 N

AGENCY DRAW - TREND STUDY NO. 10-9

Site Information

Site Description: The study is actually located in the Willow Creek drainage and is representative of the Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and desert shrub communities found throughout the area. At 6,300 feet in elevation, Agency Draw is the lowest trend study on the northern end of the Book Cliffs management unit. The study site is located in the relatively flat bottom at the head of a draw. Drainage, via a three-foot deep gullied wash, is to the northeast with tall basin big sagebrush (*A. tridentata* ssp. *tridentata*) and black greasewood (*Sarcobatus vermiculatus*) plants grow along the wash. The surrounding low ridges are occupied by pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*) and black sagebrush (*Artemisia nova*). Grazing in the area is managed by the Bureau of Land Management as part of the Horse Point allotment. This is important winter range for deer judging by the abundance of pellet groups. There has been abundant sign of winter use by sage grouse in the past, with a few birds being observed on an adjacent ridge at the time of study establishment in 1988. A small herd of elk has also been observed in the area. Wild horses also frequent the area and were seen in 2000, 2005 and 2010. Pellet group data has estimated moderate use by deer and light use by elk since 2000. Estimated horse use has been mostly light since 2005 and estimated cattle use was only sampled in 2005 at light use (Table - Pellet Group Data).

Browse: The key browse species are Wyoming big sagebrush, black sagebrush, shadscale (*Atriplex confertifolia*) and winterfat (*Ceratoides lanata*). All the key species provide winter forage, although winterfat may be unavailable due to snow depth in some years. The Wyoming big sagebrush population is a mixture of mature, decadent and young plants that has had mostly moderate use, with some years of heavy use. The proportion of big sagebrush plants displaying poor vigor has increased since 1995 and is moderately high. Black sagebrush also has a mixed population of mature, decadent and young plants, but utilization has decreased since the outset of the study and is mostly light. Decadence of both sagebrush species increased markedly in 2000 and has been moderately high to high since. The shadscale population is mostly mature, but has had good recruitment of young plants over the course of the study. Decadence was moderately high from 1988 to 2005, but decreased substantially in 2010. Utilization of shadscale has been mostly light since 1988. The population of winterfat is mostly mature with good recruitment and low decadence. Utilization of winterfat has been mostly light with the exception of 2005, which had heavy use. The introduced species prostrate kochia (*Kochia prostrata*) was sampled for the first time in 2005 with heavy use. The density and size of kochia increased in 2010, but only light use was noted (Table - Browse Characteristics). It is unknown how or when kochia was seeded in this area.

Herbaceous Understory: Grasses on the site are fairly diverse for a desert shrub community, though perennial species are not overly abundant. Cheatgrass (*Bromus tectorum*) is a major component of the community and at times has dominated the grasses. Cheatgrass cover has fluctuated over the study years, but had a high of nearly 12% in 1995. Common perennial grasses include thickspike wheatgrass (*Agropyron dasystachyum*) and Sandberg bluegrass (*Poa secunda*). Thickspike wheatgrass and bluebunch wheatgrass (*Agropyron spicatum*) may have been lumped together prior to 2005. Other species include: Indian ricegrass (*Oryzopsis hymenoides*), bottlebrush squirreltail (*Sitanion hystrix*) and needle-and-thread (*Stipa comata*). Perennial forbs are fairly diverse, but none are abundant. Annual forb species dominate the forb component including weedy species such as halogeton (*Halogeton glomeratus*) (Table - Herbaceous Cover).

Soil: The site occurs between the deep saline soil along the wash and the shallow, very rocky soil on the ridges. The soil on the study site is a light brown, stony clay loam and is slightly alkaline (pH 7.7). Phosphorus has limited availability for plant growth and development at 4.1 ppm (Tiedemann and Lopez 2004) (Table - Soil Data Analysis). Bare ground cover has fluctuated over the course of the study, but has been moderately. Fluctuations in bare ground, vegetation and litter cover are due to the changes in cheatgrass cover (Table - Basic Cover). The shallow, rocky soils allow rapid runoff. Soil loss from the slopes and wash were evident with moderate pedestaling being noted around the base of shrubs in 2000. The soil erosion

condition was classified as stable in 2005, but was slight in 2010 due to surface litter and soil movement, and flow patterns.

Trend Assessments

Browse:

- **1988 to 1995 - stable (0):** Differences in density may be related to the larger sample area used in 1995; therefore, trend was determined using other parameters. There was little change in any of the preferred browse populations. There was a decrease in the recruitment of young Wyoming big sagebrush plants, but recruitment remained good.
- **1995 to 2000 - slightly down (-1):** There were decreases in the density of black sagebrush and shadscale, and decadence increased markedly in Wyoming big sagebrush, black sagebrush and shadscale.
- **2000 to 2005 - down (-2):** The density of Wyoming big sagebrush, black sagebrush and shadscale all decreased substantially, with an increase in decadence of both of the sagebrush species. The introduced species, forage kochia, was sampled for the first time.
- **2005 to 2010 - up (+2):** Density of Wyoming big sagebrush, black sagebrush, shadscale and winterfat increased substantially, many returning to 2000 levels. Decadence of the sagebrush species and shadscale decreased.

Grass:

- **1988 to 1995 - up (+2):** Perennial grass sum of nested frequency increased by 43% with a significant increase in the nested frequency of thickspike wheatgrass and Sandberg bluegrass.
- **1995 to 2000 - slightly down (-1):** There was a 10% decrease in the sum of nested frequency of perennial grasses, though cover remained similar. Much of the decrease came from a significant decrease in the nested frequency of Sandberg bluegrass.
- **2000 to 2005 - up (+2):** The sum of nested frequency of perennial grasses increased by 23% and cover increased from 6% to 9%.
- **2005 to 2010 - slightly down (-1):** The perennial grass sum of nested frequency decreased by 13% and cover decreased to 6%. The cover of thickspike wheatgrass decreased from 4% to 2%.

Forb:

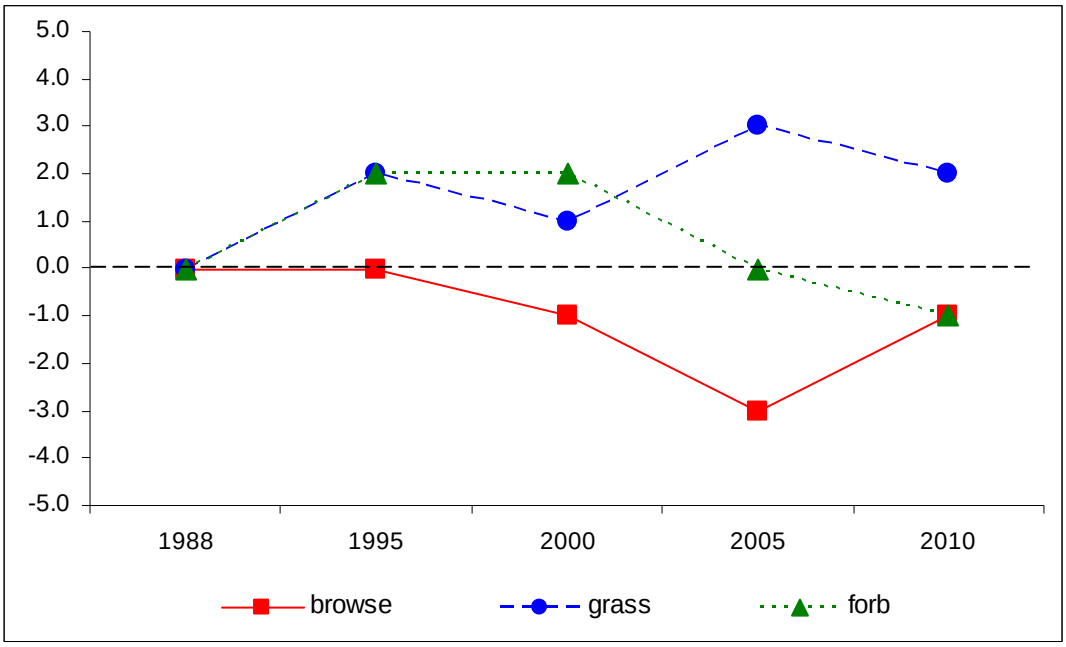
- **1988 to 1995 - up (+2):** The sum of nested frequency of perennial forbs increased seven-fold, but forbs remain rare on the site.
- **1995 to 2000 - stable (0):** There was little change in the sum of nested frequency and cover of perennial forbs.
- **2000 to 2005 - down (-2):** The perennial forb sum of nested frequency decreased by 50% and perennial forbs are very rare on the site. Annual forbs also increased in frequency and cover.
- **2005 to 2010 - slightly down (-1):** The trend is downward despite a 30% increase in the sum of nested frequency of perennial forbs and an increase in cover to over 1% for the first time in the study. Perennial forbs remain rare and weedy annual species have increased on the site, particularly annual stickseed (*Lappula occidentalis*) and halogeton which both increased significantly in nested frequency.

DEER DESIRABLE COMPONENTS INDEX - LOW POTENTIAL SCALE --
Management unit 10, study no: 9

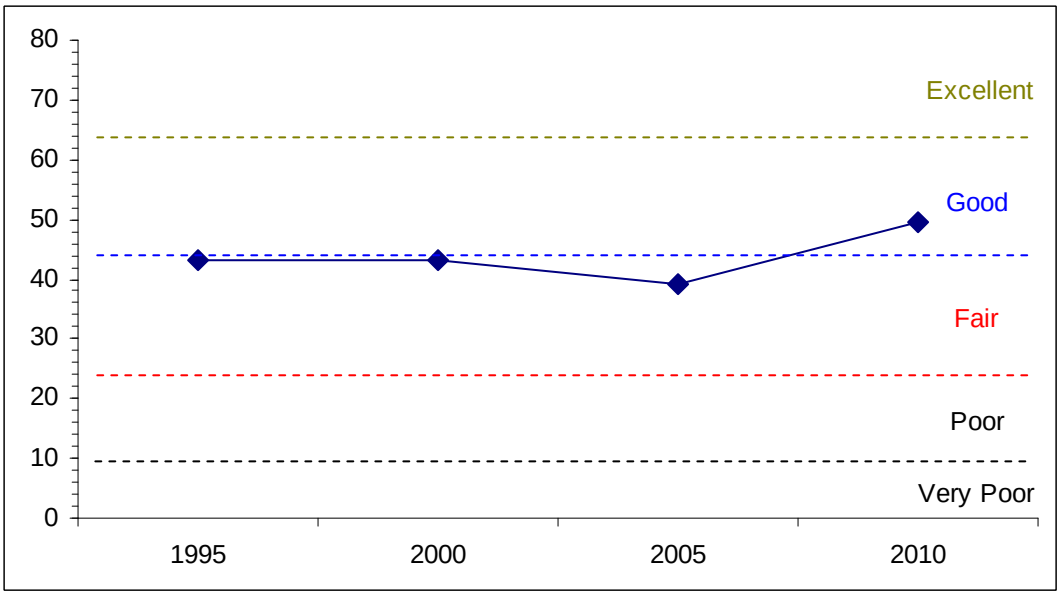
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
95	14.3	11.1	14.0	11.9	-8.8	0.8	0.0	**43.2**	Fair-Good
00	12.7	6.7	11.9	11.6	-0.6	1.0	0.0	**43.3**	Fair-Good
05	12.2	3.9	6.2	17.7	-1.3	0.5	0.0	**39.1**	Fair
10	12.6	10.3	15.0	11.2	-2.0	2.3	0.0	**49.4**	Good

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 10, Study no: 9



DEER DESIRABLE COMPONENTS INDEX TREND, LOW POTENTIAL SCALE--
Management unit 10, Study no: 9



HERBACEOUS TRENDS--
Management unit 10, Study no: 9

Type	Species	Nested Frequency					Average Cover %			
		'88	'95	'00	'05	'10	'95	'00	'05	'10
G	Agropyron dasystachyum	a7	bc110	c132	b96	b81	1.83	3.28	4.09	1.54
G	Agropyron spicatum	a-	a-	a-	b20	b30	-	-	.34	.22

Type	Species	Nested Frequency					Average Cover %			
		'88	'95	'00	'05	'10	'95	'00	'05	'10
G	Bromus tectorum (a)	-	$_{b}$209	$_{a}$97	$_{a}$81	$_{a}$99	11.78	.77	1.77	2.69
G	Carex sp.	-	3	-	-	-	.01	-	-	-
G	Oryzopsis hymenoides	$_{b}$114	$_{a}$54	$_{a}$46	$_{a}$48	$_{a}$44	.84	.39	.36	.77
G	Poa secunda	$_{a}$31	$_{c}$125	$_{b}$88	$_{c}$157	$_{c}$145	1.75	.81	2.70	1.83
G	Sitanion hystrix	$_{a}$85	$_{ab}$56	$_{ab}$46	$_{bc}$55	$_{a}$28	1.13	.63	.71	.58
G	Stipa comata	22	23	22	33	26	.34	.66	.62	.65
Total for Annual Grasses		0	209	97	81	99	11.78	0.77	1.77	2.69
Total for Perennial Grasses		259	371	334	409	354	5.93	5.79	8.84	5.62
Total for Grasses		259	580	431	490	453	17.71	6.57	10.61	8.31
F	Allium sp.	-	-	-	2	1	-	-	.01	.03
F	Antennaria rosea	-	-	-	-	-	-	-	.00	-
F	Arenaria fendleri	-	-	3	5	5	.00	.00	.01	.06
F	Astragalus sp.	$_{a}$-	$_{b}$13	$_{a}$1	$_{a}$-	$_{a}$-	.06	.00	-	-
F	Astragalus utahensis	-	-	1	2	2	-	.00	.03	.03
F	Castilleja linariaefolia	-	-	-	-	4	-	-	-	.01
F	Chenopodium leptophyllum(a)	-	-	-	-	3	-	-	-	.01
F	Chorispora tenella (a)	-	$_{a}$-	$_{a}$-	$_{a}$4	$_{b}$32	-	-	.03	.16
F	Cordylanthus kingii (a)	-	5	-	-	-	.01	-	.00	-
F	Cryptantha sp.	2	5	-	-	3	.03	-	-	.15
F	Cymopterus sp.	-	-	-	1	-	-	-	.00	-
F	Descurainia pinnata (a)	-	$_{b}$48	$_{a}$18	$_{a}$14	$_{a}$14	.14	.15	.06	.10
F	Erigeron pumilus	-	4	4	-	-	.01	.01	-	-
F	Halogeton glomeratus (a)	-	$_{b}$13	$_{a}$-	$_{ab}$8	$_{c}$44	.71	-	.16	.75
F	Haplopappus acaulis	$_{a}$-	$_{ab}$2	$_{b}$9	$_{ab}$2	$_{ab}$4	.00	.05	.00	.33
F	Lappula occidentalis (a)	-	$_{b}$25	$_{a}$5	$_{c}$82	$_{d}$156	.12	.06	2.30	2.57
F	Lepidium sp. (a)	$_{c}$31	$_{b}$26	$_{a}$-	$_{a}$7	$_{b}$15	.11	-	.05	.41
F	Machaeranthera canescens	6	2	-	-	-	.01	-	-	-
F	Machaeranthera grindelioides	-	7	4	4	4	.04	.02	.01	.03
F	Penstemon sp.	-	-	4	-	-	-	.01	-	-
F	Petradoria pumila	-	1	-	-	-	.00	-	-	-
F	Phlox austromontana	-	8	6	3	1	.04	.16	.00	.15
F	Phlox longifolia	$_{a}$-	$_{c}$41	$_{c}$37	$_{ab}$8	$_{b}$14	.11	.10	.04	.10
F	Polygonum douglasii (a)	-	4	-	-	-	.00	-	-	-
F	Salsola iberica (a)	-	-	-	1	-	-	-	.00	-
F	Schoencrambe linifolia	-	-	-	3	6	-	-	.01	.09
F	Sphaeralcea coccinea	6	4	11	12	7	.03	.09	.08	.09
F	Streptanthus cordatus	-	1	-	-	1	.00	-	-	.00
F	Townsendia incana	$_{a}$-	$_{b}$12	$_{b}$14	$_{ab}$5	$_{ab}$9	.05	.04	.01	.04
Total for Annual Forbs		31	121	23	116	264	1.11	0.21	2.62	4.01
Total for Perennial Forbs		14	100	94	47	61	0.41	0.50	0.24	1.14
Total for Forbs		45	221	117	163	325	1.52	0.71	2.87	5.15

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

BROWSE TRENDS--
Management unit 10, Study no: 9

Type	Species	Strip Frequency				Average Cover %			
		'95	'00	'05	'10	'95	'00	'05	'10
B	Artemisia frigida	33	22	12	3	.15	.17	.01	-
B	Artemisia nova	24	20	19	32	2.13	1.35	1.00	2.38
B	Artemisia tridentata wyomingensis	44	50	42	34	5.95	5.68	5.13	4.49
B	Atriplex confertifolia	54	49	36	44	3.15	3.50	2.54	2.35
B	Ceratoides lanata	40	36	36	39	.69	.22	.90	1.14
B	Gutierrezia sarothrae	11	12	5	20	.02	.01	.03	.40
B	Juniperus osteosperma	0	1	2	2	-	-	.15	.85
B	Kochia prostrata	0	0	8	8	-	-	.56	.18
B	Opuntia sp.	2	2	2	1	-	.03	-	-
B	Pediocactus simpsonii	0	0	1	0	-	-	-	-
B	Pinus edulis	0	1	2	0	-	.03	.03	-
B	Sarcobatus vermiculatus	19	20	20	21	6.06	6.24	4.31	4.85
Total for Browse		227	213	185	205	18.17	17.24	14.68	16.68

CANOPY COVER, LINE INTERCEPT--
Management unit 10, Study no: 9

Species	Percent Cover		
	'00	'05	'10
Artemisia frigida	-	.10	.11
Artemisia nova	-	1.04	2.28
Artemisia tridentata wyomingensis	-	4.31	3.53
Atriplex confertifolia	-	1.45	1.51
Ceratoides lanata	-	.75	.51
Gutierrezia sarothrae	-	-	.06
Juniperus osteosperma	.20	-	.33
Kochia prostrata	-	.13	.81
Opuntia sp.	-	.03	-
Sarcobatus vermiculatus	-	4.33	7.26

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 10, Study no: 9

Species	Average leader growth (in)	
	'05	'10
Artemisia nova	1.1	1.1
Artemisia tridentata wyomingensis	2.2	2.5
Ceratoides lanata	2.4	6.3

BASIC COVER--
Management unit 10, Study no: 9

Cover Type	Average Cover %				
	'88	'95	'00	'05	'10
Vegetation	2.50	36.44	26.27	25.42	32.75
Rock	.50	3.76	1.76	2.25	2.48
Pavement	2.50	8.98	11.08	14.17	9.68
Litter	60.00	33.42	39.20	25.56	33.84
Cryptogams	1.50	2.37	5.07	2.11	.97
Bare Ground	33.00	25.00	32.34	40.70	31.66

SOIL ANALYSIS DATA --
Management unit 10, Study no: 9, Study Name: Agency Draw

Effective rooting depth (in)	pH	clay loam			%OM	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
16.2	7.7	29.0	40.4	30.6	1.4	4.1	329.6	0.9

PELLET GROUP DATA--
Management unit 10, Study no: 9

Type	Quadrat Frequency			
	'95	'00	'05	'10
Rabbit	4	10	28	12
Horse	5	8	10	4
Elk	1	3	3	2
Deer	19	29	45	15
Cattle	1	-	1	-

Days use per acre (ha)		
'00	'05	'10
-	-	-
-	23 (57)	17 (43)
11 (29)	13 (31)	1 (2)
49 (121)	23 (58)	27 (66)
-	12 (29)	-

BROWSE CHARACTERISTICS--
Management unit 10, Study no: 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)
Artemisia frigida									
88	**5198**	27	73	0	866	0	0	0	8/3
95	**1060**	11	89	0	180	0	0	0	11/7
00	**660**	24	73	3	60	9	3	0	5/7
05	**360**	11	89	0	-	6	0	0	7/6
10	**60**	0	100	0	-	0	0	0	13/7
Artemisia nova									
88	**665**	60	40	0	66	10	40	0	11/21
95	**1280**	14	77	9	200	64	6	6	15/18
00	**1120**	16	52	32	20	38	2	11	13/20
05	**980**	0	55	45	100	27	27	10	8/13
10	**1380**	23	49	28	420	9	19	13	12/20

		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	**3865**	36	45	19	66	31	16	5	21/25
95	**2620**	44	47	10	980	34	2	2	21/29
00	**2760**	35	40	25	180	41	17	12	23/30
05	**1600**	13	35	53	140	34	53	38	20/26
10	**2040**	49	31	20	120	24	14	23	24/28
Atriplex confertifolia									
88	**2197**	9	73	18	-	6	0	0	16/18
95	**1840**	10	65	25	40	11	0	11	14/21
00	**1600**	8	60	33	-	9	10	13	15/20
05	**1180**	19	59	22	380	8	2	10	16/22
10	**1500**	25	71	4	20	0	0	0	16/20
Ceratoides lanata									
88	**1265**	74	16	11	66	5	0	5	6/6
95	**1780**	19	80	1	100	4	0	0	10/9
00	**1740**	30	64	6	-	13	17	3	11/9
05	**2040**	12	86	2	80	7	79	2	9/10
10	**2500**	19	81	0	20	7	4	2	12/9
Chrysothamnus nauseosus									
88	**0**	0	0	-	-	0	0	0	-/-
95	**0**	0	0	-	-	0	0	0	-/-
00	**0**	0	0	-	-	0	0	0	-/-
05	**0**	0	0	-	-	0	0	0	-/-
10	**0**	0	0	-	-	0	0	0	16/20
Gutierrezia sarothrae									
88	**799**	0	100	0	66	0	0	0	7/5
95	**340**	53	47	0	240	0	0	0	9/11
00	**560**	14	57	29	-	0	0	25	5/8
05	**180**	22	78	0	20	0	0	0	8/9
10	**1320**	39	61	0	-	0	0	0	9/8
Juniperus osteosperma									
88	**0**	0	0	0	-	0	0	0	-/-
95	**0**	0	0	0	-	0	0	0	-/-
00	**20**	100	0	0	20	0	0	0	-/-
05	**40**	50	0	50	-	0	0	0	-/-
10	**40**	50	50	0	-	0	0	0	-/-
Kochia prostrata									
88	**0**	0	0	-	-	0	0	0	-/-
95	**0**	0	0	-	-	0	0	0	-/-
00	**0**	0	0	-	-	0	0	0	-/-
05	**700**	0	100	-	-	0	63	0	11/13
10	**780**	28	72	-	-	0	0	0	18/21

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Opuntia sp.									
88	**66**	0	100	0	-	0	0	0	2/3
95	**40**	0	50	50	-	0	0	0	5/14
00	**40**	0	50	50	20	0	0	50	2/9
05	**40**	0	100	0	-	0	0	0	5/16
10	**20**	0	100	0	-	0	0	0	4/13
Pediocactus simpsonii									
88	**0**	0	0	-	-	0	0	0	-/-
95	**0**	0	0	-	-	0	0	0	-/-
00	**0**	0	0	-	-	0	0	0	-/-
05	**20**	0	100	-	-	0	0	0	3/5
10	**0**	0	0	-	-	0	0	0	-/-
Pinus edulis									
88	**0**	0	0	-	-	0	0	0	-/-
95	**0**	0	0	-	-	0	0	0	-/-
00	**20**	100	0	-	-	0	0	0	-/-
05	**40**	100	0	-	-	0	50	0	-/-
10	**0**	0	0	-	20	0	0	0	-/-
Sarcobatus vermiculatus									
88	**66**	0	100	0	-	0	0	0	54/63
95	**680**	18	76	6	-	0	0	0	34/49
00	**1680**	64	33	2	-	0	0	1	37/54
05	**660**	3	85	12	40	15	3	3	29/44
10	**660**	12	85	3	-	0	0	0	33/50
Sclerocactus sp.									
88	**0**	0	0	-	-	0	0	0	-/-
95	**0**	0	0	-	-	0	0	0	-/-
00	**0**	0	0	-	-	0	0	0	3/3
05	**0**	0	0	-	-	0	0	0	-/-
10	**0**	0	0	-	-	0	0	0	-/-
Tetradymia spinosa									
88	**0**	0	0	-	-	0	0	0	-/-
95	**0**	0	0	-	-	0	0	0	-/-
00	**0**	0	0	-	-	0	0	0	-/-
05	**0**	0	0	-	-	0	0	0	23/31
10	**0**	0	0	-	-	0	0	0	-/-