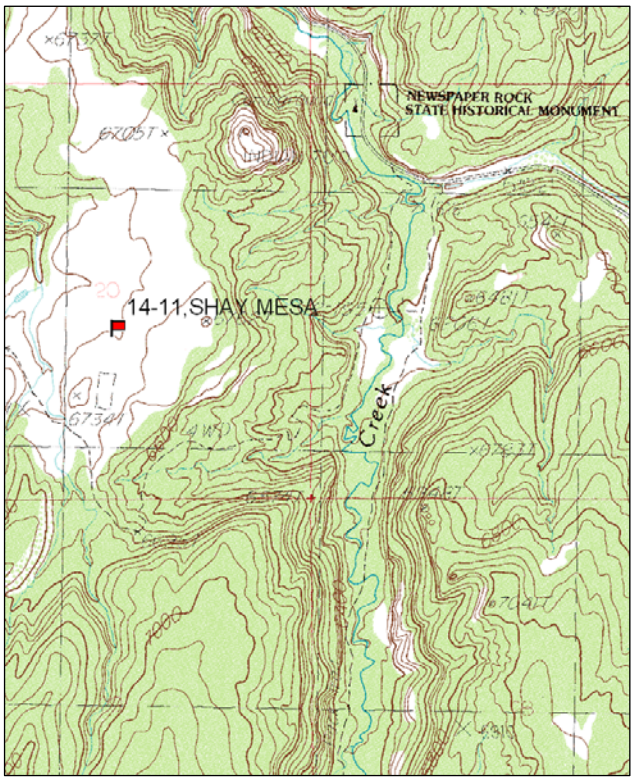
SHAY MESA - TREND STUDY NO. 14-11-09

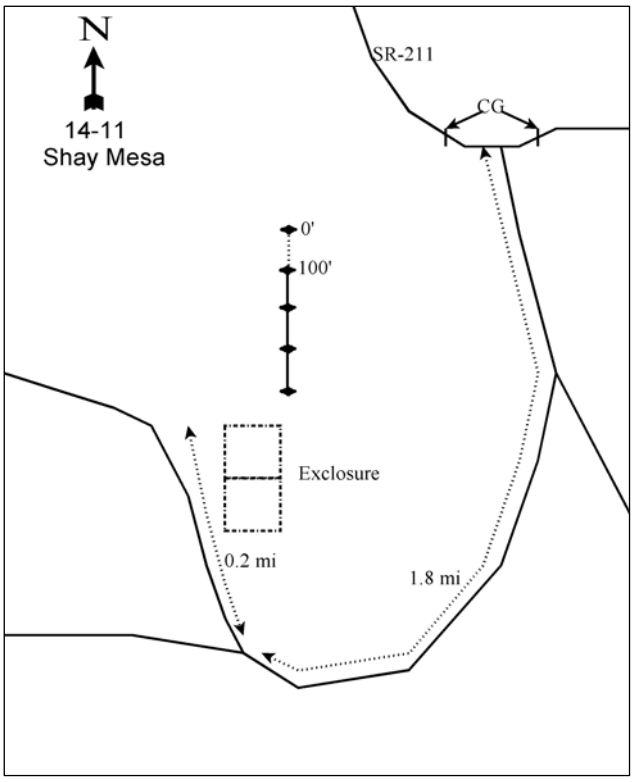
Vegetation Type: Chained, Seeded P-J
Range Type: Crucial Deer Winter, Crucial Elk Winter
NRCS Ecological Site Description: Upland Loam (Basin Big Sagebrush), R035XY306UT
Land Ownership: BLM
Elevation: 7,000 ft (2,134 m)
Aspect: East
Slope: 5%
Transect bearing: 165 degrees magnetic.
Belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft)

Directions:
From the junction of SR-l91 and 211 (about 14 miles north af Monticello), turn west on the road towards Canyonlands National Park and Newspaper Rock. Go approximately 13 miles on this paved road, the last two miles dropping into the canyon of a tributary to Indian Creek. Cross a cattleguard and turn left just before another cattleguard and 0.1 miles east of Newspaper Rock. Turn left on this road, cross Indian Creek and go 1.8 miles up onto the mesa. Look for a faint road going up to the right through an old pinyon-juniper chaining to an exclosure. Follow this road 0.2 miles to the north end of the exclosure. The end of the baseline is located 100 feet north of the northeast corner of the exclosure. The 0 foot end of the baseline is 400 feet north and the stake is tagged #7877.

Map Name: Shay Mountain



Diagrammatic Sketch:



Township: 32S, Range: 22E, Section: 20

GPS: NAD 83, UTM 12S 629124 E 4204634 N

SHAY MESA - TREND STUDY NO. 14-11

Site Information

Site Description: The study is located on Shay Mesa and samples a former mixed pinyon-juniper woodland. A large chaining and seeding project was done in the mid- 1960's on the high mesa foothills north of the Abajo Mountains. The seed mixture included crested wheatgrass (*Agropyron cristatum*), pubescent wheatgrass (*A. trichophorum*), alfalfa (*Medicago sativa*), and a ground application of four-wing saltbush (*Atriplex canescens*), bitterbrush (*Purshia tridentata*), and cliffrose (*Cowania mexicana* ssp. *stansburiana*) at selected locations. There was little evidence of the seeding on this particular study site, as all species encountered during all readings were native. The area was part of the Shay Mesa Phase II Watershed Restoration Initiative project (project# 1091) done in the early summer of 2009 that treated over 1,300 acres in the area. The study was within a bullhog and seeding section of the project (Table - Seed Mix) that was done in conjunction with several other treatment types in the area. The treatments were designed to reduce pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) cover and increase shrub and herbaceous production and diversity. The bullhog treatment removed nearly all the pinyon and juniper on the study site. The bullhog project was done just prior to the sampling in 2009 with many fresh tire tracks throughout the site and the cut trees still being green. The study transect was placed just outside a 1958 BLM two-way exclosure and is 700 feet above Indian Creek, which is a perennial stream. Pellet group data indicated minimal use by deer in 1999 and 2004, but increased to moderate use in 2009. Estimated elk use has been light on the site since 2004. Estimated cattle use was fairly moderate in 1999, but decreased to light use since 2004 (Table - Pellet Group Data).

Browse: The key browse species is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) which provides nearly all of the preferred browse forage on the site. The bullhog treatment reduced sagebrush cover, but with the reduction in pinyon and juniper, sagebrush is now the dominant browse species on the site (Table - Browse Trends). The bullhog treatment reduced the density of sagebrush and increased decadence, but the population still appeared healthy. The sagebrush population should recover over time. Utilization of sagebrush has been mostly moderate over the sample years (Table - Browse Characteristics). Other palatable browse species in the area include fourwing saltbush, slender buckwheat (*Eriogonum microthecum*), and winterfat (*Ceratoides lanata*). Broom snakeweed (*Gutierrezia sarothrae*), a weedy increaser, is also common.

Prior to the treatment, the dominant overstory was pinyon with a few juniper. Point-center quarter data from 2004 estimated 34 juniper and 79 pinyon trees/acre. Average diameter of juniper was estimated at 8.5 inches, while pinyon was estimated at just over 5 inches. About 50% of the juniper and 61% of the pinyon trees were greater than 12 feet in height. There were few trees sampled in 2009 and all of the sampled trees were less than 4 feet tall.

Herbaceous Understory: Grasses are fairly abundant with much of the cover provided by native perennial species. Blue grama (*Bouteloua gracilis*) is the dominant grass species, but the annual grass cheatgrass (*Bromus tectorum*) provided similar cover in 1999. Cheatgrass abundance has been related to precipitation patterns over the sample years. Other grass species found less frequently include needle-and-thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), and bottlebrush squirreltail (*Sitanion hystrix*). Several typical pinyon-juniper associated forb species are present, although overall density and usefulness is limited. The total cover of forbs has averaged only a little over 1% since 1994. The most common perennial species is scarlet globemallow (*Sphaeralcea coccinea*).

Soil: The soil is a light red sandy clay loam with a neutral pH and a moderately deep effective rooting depth (Table - Soil Analysis Data). There is one large gully about 20 yards northeast of the baseline which was active in 1986, but appeared to be healing as of 1999. Bare ground cover has been high in the past, but decreased slightly after the treatment in 2009 with an increase in litter cover (Table - Basic Cover). The soil erosion condition was classified as slight in 2004 due to pedestaling and flow patterns, but was stable in 2009.

SEED MIX
Management Unit 14, study no. 11
Project name: Shay Mesa Phase II

WRI Database #: 1091	Size (acre):	1310
Seed type	lbs in mix	lbs/acre
Ricegrass, Indian (N)	1968	1.5
Wheatgrass, Western (N)	2624	2.0
Bluegrass, Sandberg's (N)	656	0.5
Needle and Thread (N)	656	0.5
Wheatgrass, Crested (I)	1049.6	0.8
Milkvetch, Cicer (I)	1312	1.0
Blue Flax-Appar (I)	656	0.5
Sainfoin (I)	1968	1.5
Bitterbrush (N)	1312	1.0
Big sagebrush, Mountain (N)	656	0.5
Sweetclover, Yellow (I)	1312	1.0
Winterfat (N)	1312	1.0
TOTAL:	15481.6	11.82

Trend Assessments

Browse:

- **1986 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. There was little change in the sagebrush population, though poor vigor increased slightly and recruitment of young sagebrush plants decreased.
- **1994 to 1999 - stable (0):** There was little change in the density of mountain big sagebrush, though cover increased slightly. Sagebrush plants displaying poor vigor decreased to less than 1%, though recruitment of young sagebrush plants continued to decrease.
- **1999 to 2004 - slightly up (+1):** The density of mountain big sagebrush increased by 43% from 2,060 plants/acre to 2,960 plants/acre, and cover increased from 6% to 10%. However, decadence increased from 6% to 27% and plants displaying poor vigor increased to 18%. Recruitment of young sagebrush plants continued to decrease and now represents only 4% of the population.
- **2004 to 2009 - down (-2):** After the bullhog treatment, density of sagebrush decreased by 51% to 1,440 plants/acre and cover decreased to 6%. Decadence and poor vigor both increased slightly, and recruitment of young sagebrush plants was minimal at 1%. The sagebrush population should recover quickly with the removal of pinyon and juniper by the treatment.

Grass:

- **1986 to 1994 - down (-2):** The sum of nested frequency of perennial grasses decreased by 41% with a significant decrease in the nested frequency of western wheatgrass and needle-and-thread.
- **1994 to 1999 - slightly down (-1):** There was an 8% decrease in the sum of nested frequency of perennial grasses, though cover increased slightly. There was a significant increase in the nested frequency of cheatgrass and cover increased to 5%, making cheatgrass the dominant grass species in 1999. There was a significant decrease in the nested frequency of needle-and-thread.
- **1999 to 2004 - down (-2):** The sum of nested frequency of perennial grasses decreased by 30%, though cover remained similar. There was a significant decrease in the nested frequency of western wheatgrass and needle-and-thread. A positive trend was the significant decrease in the nested frequency of cheatgrass and a decrease in cover to less than 0.1%.
- **2004 to 2009 - stable (0):** There was little change in the sum of nested frequency of perennial grasses, though cover decreased slightly. There was a significant increase in the nested frequency of cheatgrass and cover increased to 2%.

Forb:

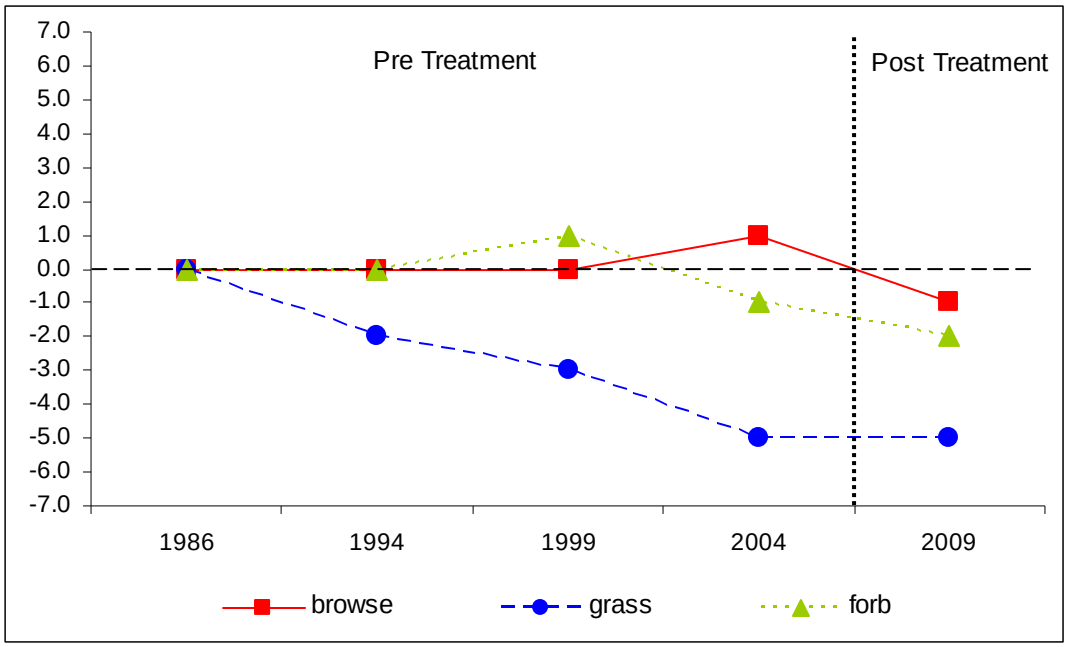
- **1986 to 1994 - stable (0):** There was little change in the sum of nested frequency of perennial forbs, though there was a significant decrease in the nested frequency of low fleabane (*Erigeron pumilus*).
- **1994 to 1999 - slightly up (+1):** The sum of nested frequency of perennial forbs increased by 11% and cover increased slightly.
- **1999 to 2004 - down (-2):** There was a 36% decrease in the sum of nested frequency of perennial forbs and cover decreased to less than 1%. There was a significant decrease in the nested frequency of the dominant forb, scarlet globemallow.
- **2004 to 2009 - slightly down (-1):** The sum of nested frequency of perennial forbs decreased by 15%, though cover remained similar.

DEER DESIRABLE COMPONENTS INDEX - MID-LEVEL POTENTIAL SCALE --
Management unit 14, study no: 11

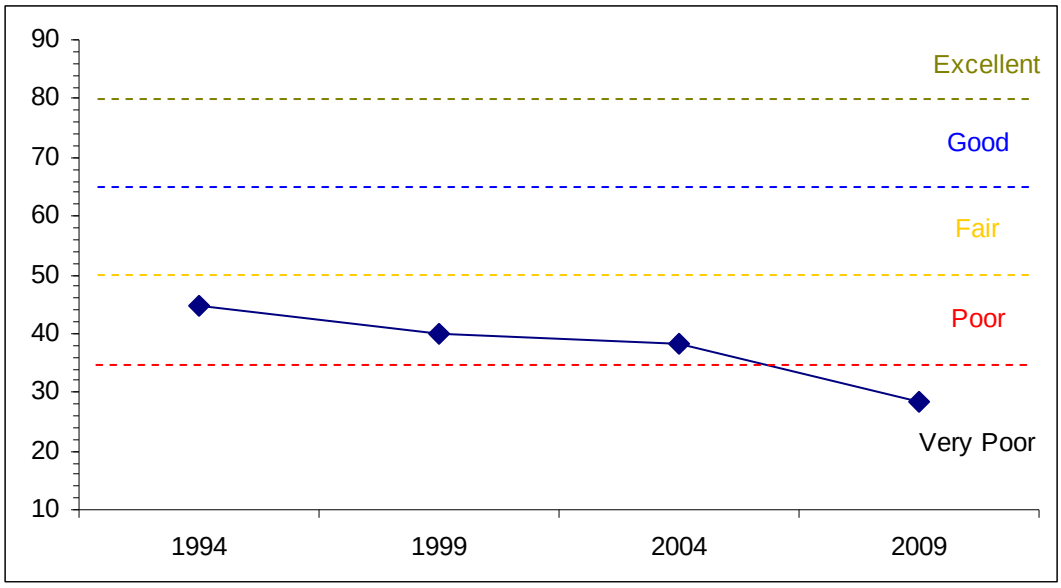
Year	Preferred Browse Cover	Preferred Browse Decadence	Preferred Browse Young	Perennial Grass Cover	Annual Grass Cover	Perennial Forb Cover	Noxious Weeds	**Total Score**	Ranking
94	4.6	13.7	10.6	14.4	-0.4	2.1	0.0	**44.8**	Poor
99	7.2	13.1	4.2	16.5	-4.2	3.2	0.0	**40.0**	Poor
04	13.1	7.2	1.9	14.7	0.0	1.4	0.0	**38.3**	Poor
09	7.8	5.9	1.1	13.6	-1.4	1.5	0.0	**28.5**	Very Poor

Trend Summary

CUMULATIVE RANGE TREND ASSESSMENT--
Management unit 14 Study no: 11



DEER DESIRABLE COMPONENTS INDEX TREND, MID-LEVEL POTENTIAL
Management unit 14, Study no: 11



HERBACEOUS TRENDS--
Management unit 14, Study no: 11

Type	Species	Nested Frequency					Average Cover %			
		'86	'94	'99	'04	'09	'94	'99	'04	'09
G	Agropyron smithii	$_{c}$204	$_{b}$69	$_{b}$72	$_{a}$38	$_{a}$25	.42	.46	.21	.12
G	Bouteloua gracilis	168	154	163	150	150	3.05	5.13	5.67	5.36
G	Bromus tectorum (a)	-	$_{b}$49	$_{d}$222	$_{a}$2	$_{c}$104	.18	5.43	.03	1.79
G	Hilaria jamesii	-	-	-	-	3	-	-	-	.03
G	Oryzopsis hymenoides	-	4	10	3	9	.03	.02	.03	.07
G	Poa fendleriana	1	1	-	-	1	.00	-	-	.00
G	Sitanion hystrix	2	12	19	12	17	.03	.09	.16	.18
G	Sporobolus cryptandrus	$_{b}$53	$_{a}$3	$_{a}$7	$_{a}$9	$_{a}$7	.00	.01	.07	.04
G	Stipa comata	$_{d}$280	$_{c}$178	$_{b}$117	$_{a}$60	$_{a}$47	3.65	2.50	1.19	.96
G	Vulpia octoflora (a)	-	$_{b}$121	$_{a}$39	$_{a}$12	$_{a}$20	.40	.17	.03	.06
Total for Annual Grasses		0	170	261	14	124	0.58	5.60	0.06	1.85
Total for Perennial Grasses		708	421	388	272	259	7.20	8.24	7.35	6.79
Total for Grasses		708	591	649	286	383	7.79	13.85	7.41	8.65
F	Astragalus mollissimus	$_{ab}$11	$_{b}$15	$_{a}$1	$_{a}$-	$_{ab}$11	.09	.03	-	.08
F	Calochortus nuttallii	2	-	4	-	2	-	.03	-	.00
F	Chaenactis douglasii	-	3	-	-	-	.01	-	-	-
F	Descurainia pinnata (a)	-	$_{b}$16	$_{b}$16	$_{a}$6	$_{a}$-	.04	.04	.01	-
F	Draba sp. (a)	-	$_{b}$65	$_{a}$-	$_{a}$-	$_{a}$1	.14	-	-	.00
F	Erigeron pumilus	$_{b}$44	$_{a}$-	$_{a}$9	$_{a}$-	$_{a}$2	-	.02	-	.03
F	Eriogonum cernuum (a)	3	5	4	-	3	.01	.01	-	.00
F	Gilia sp. (a)	-	4	-	4	1	.01	-	.01	.00
F	Holosteum umbellatum (a)	-	3	1	-	-	.01	.00	-	-
F	Lappula occidentalis (a)	-	$_{b}$18	$_{a}$4	$_{a}$4	$_{a}$2	.05	.01	.15	.01
F	Penstemon sp.	-	3	3	-	3	.03	.00	-	.03

Type	Species	Nested Frequency					Average Cover %			
		'86	'94	'99	'04	'09	'94	'99	'04	'09
F	Phlox hoodii	$_{a}$-	$_{b}$19	$_{b}$22	$_{b}$16	$_{b}$13	.26	.27	.06	.15
F	Phlox longifolia	$_{a}$-	$_{b}$8	$_{b}$16	$_{b}$10	$_{a}$3	.02	.06	.09	.03
F	Plantago patagonica (a)	-	$_{b}$99	$_{ab}$74	$_{b}$100	$_{a}$55	.25	.24	.31	.19
F	Ranunculus testiculatus (a)	-	$_{b}$16	$_{b}$36	$_{a}$-	$_{b}$24	.03	.14	-	.07
F	Senecio multilobatus	3	-	1	-	-	-	.03	-	-
F	Sphaeralcea coccinea	$_{bc}$118	$_{bc}$126	$_{c}$139	$_{ab}$98	$_{a}$72	.60	1.16	.56	.42
F	Tragopogon dubius	-	1	-	-	-	.00	-	-	-
Total for Annual Forbs		3	226	135	114	86	0.56	0.45	0.48	0.29
Total for Perennial Forbs		178	175	195	124	106	1.03	1.62	0.71	0.77
Total for Forbs		181	401	330	238	192	1.59	2.07	1.20	1.06

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

BROWSE TRENDS--
Management unit 14, Study no: 11

Type	Species	Strip Frequency				Average Cover %			
		'94	'99	'04	'09	'94	'99	'04	'09
B	Artemisia tridentata vaseyana	44	40	56	30	3.49	5.55	10.04	5.75
B	Atriplex canescens	3	2	2	2	.03	.03	.30	.03
B	Ceratoides lanata	0	1	1	1	-	.00	.00	.00
B	Chrysothamnus nauseosus	0	0	4	0	-	-	.00	-
B	Echinocereus sp.	0	5	2	0	.00	.01	.01	-
B	Eriogonum microthecum	14	18	19	17	.12	.15	.10	.44
B	Gutierrezia sarothrae	18	62	19	27	.11	1.12	.03	.13
B	Juniperus osteosperma	0	1	0	0	.76	1.88	-	-
B	Leptodactylon pungens	21	26	30	34	.00	.00	.00	.00
B	Opuntia sp.	0	0	1	0	.16	.55	.41	.81
B	Pediocactus simpsonii	0	8	3	0	-	.00	.00	.00
B	Pinus edulis	0	0	0	0	9.51	9.40	9.44	.15
B	Yucca sp.	0	0	0	0	-	.03	-	.03
Total for Browse		100	163	137	111	14.20	18.76	20.34	7.34

CANOPY COVER, LINE INTERCEPT--
Management unit 14, Study no: 11

Species	Percent Cover		
	'99	'04	'09
Artemisia tridentata vaseyana	-	13.81	5.66
Eriogonum microthecum	-	.05	.08
Gutierrezia sarothrae	-	.08	.26
Juniperus osteosperma	3.59	-	-
Opuntia sp.	-	3.56	2.25
Pinus edulis	12.80	12.93	-

KEY BROWSE ANNUAL LEADER GROWTH--
Management unit 14, Study no: 11

Species	Average leader growth (in)	
	'04	'09
Artemisia tridentata vaseyana	1.6	1.3

POINT-QUARTER TREE DATA--
Management unit 14, Study no: 11

Species	Trees per Acre		
	'99	'04	'09
Juniperus osteosperma	30	34	5
Pinus edulis	86	79	8

Average diameter (in)		
'99	'04	'09
5.4	8.5	1.0
4.8	5.1	0.9

BASIC COVER--
Management unit 14, Study no: 11

Cover Type	Average Cover %				
	'86	'94	'99	'04	'09
Vegetation	14.00	23.29	33.92	27.69	16.04
Rock	0	.01	0	0	0
Pavement	0	.01	.00	.01	0
Litter	61.25	36.06	40.02	29.13	58.26
Cryptogams	4.25	1.69	5.40	3.53	.84
Bare Ground	20.50	39.61	41.13	59.37	30.24

SOIL ANALYSIS DATA --
Management unit 14, Study no: 11, Study Name: Shay Mesa

Effective rooting depth (in)	pH	sandy clay loam			%0M	PPM P	PPM K	ds/m
		%sand	%silt	%clay				
15.8	7.3	58.9	18.6	22.6	1.5	7.9	83.2	0.6

PELLET GROUP DATA--
Management unit 14, Study no: 11

Type	Quadrat Frequency			
	'94	'99	'04	'09
Rabbit	62	60	56	43
Elk	-	-	20	4
Deer	9	3	1	12
Cattle	3	11	3	-

Days use per acre (ha)		
'99	'04	'09
-	-	-
-	13 (31)	11 (28)
1 (2)	2 (5)	25 (63)
26 (64)	8 (20)	7 (16)

BROWSE CHARACTERISTICS--
Management unit 14, Study no: 11

		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									
86	**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	3/11
Artemisia tridentata vaseyana									
86	**2265**	77	21	3	-	76	9	6	23/25
94	**2100**	20	76	4	20	0	0	18	18/22
99	**2060**	8	86	6	20	49	17	.97	22/30
04	**2960**	4	69	27	-	52	16	18	16/25
09	**1440**	1	67	32	-	35	21	28	19/29
Atriplex canescens									
86	**199**	0	100	0	-	67	33	0	5/3
94	**120**	50	17	33	20	0	0	33	20/30
99	**40**	0	50	50	-	0	50	50	23/21
04	**40**	0	100	0	-	0	0	0	16/19
09	**60**	67	33	0	-	0	0	0	22/20
Ceratoides lanata									
86	**0**	0	0	0	-	0	0	0	-/-
94	**0**	0	0	0	-	0	0	0	11/11
99	**20**	0	100	0	-	0	100	0	11/12
04	**20**	0	100	0	-	0	100	0	12/14
09	**20**	0	0	100	-	0	0	100	7/8
Chrysothamnus nauseosus									
86	**3199**	23	77	-	-	4	96	0	15/16
94	**0**	0	0	-	-	0	0	0	9/39
99	**0**	0	0	-	-	0	0	0	-/-
04	**80**	0	100	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	-/-
Echinocereus sp.									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**100**	60	40	-	-	0	0	0	3/6
04	**80**	100	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	2/17

		Age class distribution				Utilization			
Year	Plants per Acre (excluding seedlings)	% Young	% Mature	% Decadent	Seedling (plants/acre)	% moderate	% heavy	% poor vigor	Average Height Crown (in)
Ephedra viridis									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	26/28
99	**0**	0	0	-	-	0	0	0	20/30
04	**0**	0	0	-	-	0	0	0	15/24
09	**0**	0	0	-	-	0	0	0	25/39
Eriogonum microthecum									
86	**532**	37	63	0	-	0	0	0	11/6
94	**560**	46	43	11	60	0	0	0	3/4
99	**1020**	24	73	4	40	18	51	0	6/5
04	**620**	3	97	0	-	0	0	0	4/3
09	**620**	13	77	10	40	6	0	0	8/7
Gutierrezia sarothrae									
86	**8264**	17	80	3	-	0	0	0	7/5
94	**640**	19	72	9	-	0	0	0	6/6
99	**4120**	15	83	2	60	0	0	.97	7/7
04	**700**	3	97	0	40	0	0	0	6/7
09	**1100**	11	78	11	-	0	7	4	6/7
Leptodactylon pungens									
86	**999**	0	93	7	-	0	0	0	1/3
94	**0**	0	0	0	-	0	0	0	-/-
99	**20**	0	100	0	-	0	0	0	-/-
04	**0**	0	0	0	-	0	0	0	-/-
09	**0**	0	0	0	-	0	0	0	-/-
Opuntia sp.									
86	**265**	25	75	0	-	0	0	0	3/4
94	**580**	10	66	24	-	0	0	3	3/11
99	**760**	18	79	3	60	0	0	0	6/13
04	**1240**	2	95	3	-	0	0	3	5/14
09	**960**	6	88	6	-	0	4	19	3/13
Pediocactus simpsonii									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	-/-
99	**0**	0	0	-	-	0	0	0	-/-
04	**40**	0	100	-	-	0	0	0	2/2
09	**0**	0	0	-	-	0	0	0	-/-
Pinus edulis									
86	**199**	33	67	-	-	0	0	0	114/45
94	**0**	0	0	-	-	0	0	0	-/-
99	**160**	25	75	-	20	0	0	0	-/-
04	**60**	0	100	-	-	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)
Symphoricarpos oreophilus									
86	**199**	0	100	-	-	67	33	33	15/22
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	-/-
Yucca sp.									
86	**0**	0	0	-	-	0	0	0	-/-
94	**0**	0	0	-	-	0	0	0	33/38
99	**0**	0	0	-	-	0	0	0	-/-
04	**0**	0	0	-	-	0	0	0	-/-
09	**0**	0	0	-	-	0	0	0	7/19