Trend Study 16A-11-07

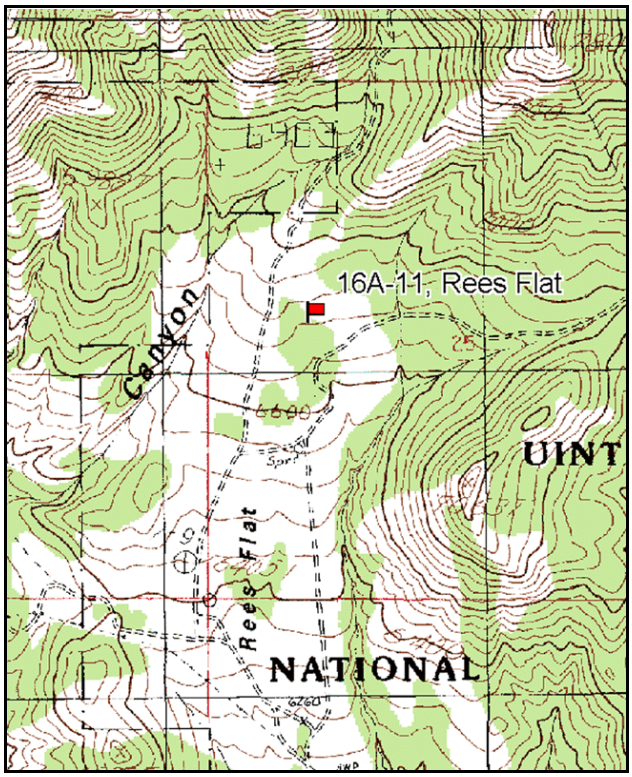
Study site name: Rees Flat . Vegetation type: Mixed Oak-Sage .

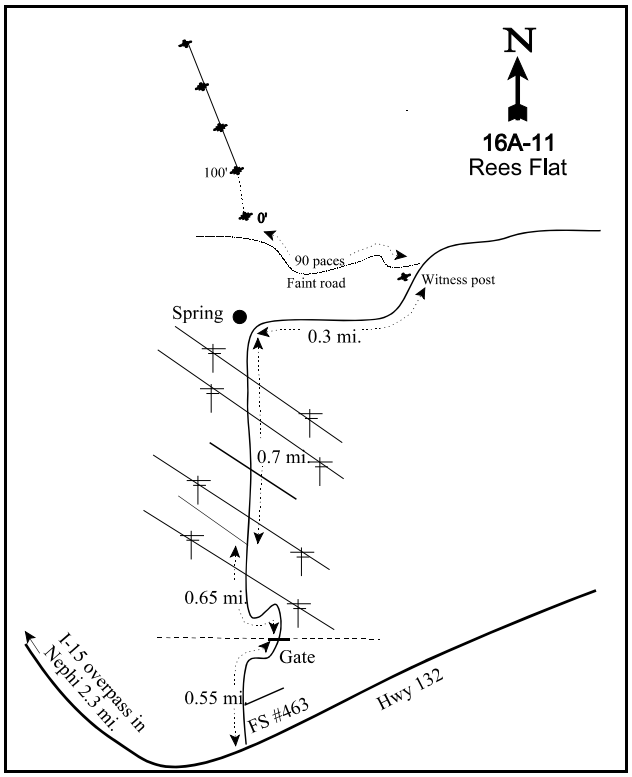
Compass bearing: frequency baseline 344 degrees magnetic (lines 2-4 @ 333°M).

Frequency belt placement: line 1 (11 & 95ft), line 2 (59ft), line 3 (34ft), line 4 (71ft). Rebar: belt 5 on 5ft.

LOCATION DESCRIPTION

Beginning at the overpass where Highway 132 crosses beneath I-15 in Nephi, take Highway 132 east for 2.3 miles. Turn north onto Forest Service Road #463 and go 0.2 miles to a fork in the road. Stay left and go another 0.35 miles to a gate. From the gate, go 0.65 miles to another fork. Stay right on the main road for 0.7 miles passing through a 4-way intersection beneath the powerlines until you come to a spring on the left. Continue 0.3 miles farther along to a 3-foot tall witness post 6 paces northwest of the road near some oak brush. Stop here and walk 90 paces west on a faint road. The 0-foot baseline stake is 9 paces north of the faint road. It is a 12 inch high red post marked by browse tag #3956.





Map Name: Nephi

Diagrammatic Sketch

Township 12S , Range 1E , Section 25

GPS: NAD 83, UTM 12S 433389 E 4399358 N

DISCUSSION

Rees Flat - Trend Study No. 16A-11

Study Information

This study is located on a mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Gambel oak (*Quercus gambelii*) mixed range that was burned and seeded before the study was established [elevation: 6,700 feet (2,042 m), slope: 17%, aspect: south]. It is used primarily by deer as high-elevation winter range, however, elk have also used it fairly consistently. A moderate number of deer and elk pellet groups, as well as two deer antler drops, were noted in 1983 when the study was established. Pellet group quadrat frequency was 26% for deer and 38% for elk in 1997. Deer use was estimated at 56 days use/acre (137 ddu/ha) in 2002 and 25 days use/acre (61 ddu/ha) in 2007. Elk use was estimated at 27 days use/acre (66 edu/ha) in 2002 and 22 days use/acre (55 edu/acre) in 2007. Most deer and elk pellets were from fall, winter, and early spring use. Cattle and horses also graze the area in the summer. Cattle use was estimated at 9 days use/acre (22 cdu/ha) in 2002 and 2 days use (4 cdu/ha) in 2007.

Soil

The soil is classified within the Yeates Hollow series (USDA-NRCS 2007). The soils in this series are deep and well-drained to moderately well-drained. They formed in alluvium, colluvium, and residuum from conglomerate, sandstone, and quartzite. The soil texture is a loam, and it is moderately acidic (pH 5.9). The majority of the soil surface is covered by vegetation and litter, with smaller percentages of rock and pavement cover. The erosion condition was classified as stable in 2002 and 2007.

Browse

The preferred browse species are mountain big sagebrush and antelope bitterbrush (*Purshia tridentata*). Sagebrush is the dominant species, and has fluctuated in density between 1,900 plants/acre (4,693 plants/ha) and 3,460 plants/acre (8,546 plants/ha) since the baseline was lengthened in 1997. Average cover has steadily increased from 4% in 1997 to 13% in 2007. The age structure of the population has shifted from 72% young to 91% mature since 1997, with low decadence. Vigor has been good on most plants since 1983 and use has been mostly light, with some moderate and heavy hedging. Some of the plants were noted to have an insect infestation, most likely the sagebrush defoliator moth (*Aroga websteri*), in 2007. Annual leader growth averaged 2.6 inches (6.6 cm) in 2002 and 1.7 inches (4.4 cm) in 2007.

Bitterbrush was sampled at a density of 200 plants/acre (494 plants/ha) in 1997 and 420 plants/acre (1,037 plants/ha) in 2002 and 2007. This population has consisted of mostly mature individuals since 1983. No decadent plants have been sampled, and recruitment has been high since 1989. The plants are vigorous, and use has been moderate-heavy. These plants were infested with tent caterpillars during the 2007 reading, but did not seem to be adversely impacted. Annual leader growth averaged 1.4 inches (3.6 cm) in 2002 and 1.6 inches (4 cm) in 2007.

Gambel oak is also present in scattered clones, with an average height that has ranged from 4 to 7 feet (1.2 to 2.1 m) since 1983. Average cover has remained stable between 3% and 5% since 1997, and density has ranged between 1,640 plants/acre (4,051 plants/ha) and 2,480 plants/acre (6,126 plants/ha). Plants showing poor vigor increased dramatically from 0% of the population in 1997 to 99% in 2007. The leaves of this species were stunted in 2002 due to a late frost and also showed some frost damage and silkworm infestation in 2007. There was some moderate and heavy use on individuals in 1997 and 2002, but use was light in 2007.

Herbaceous Understory

Average grass cover has been high and has increased from 37% to 46% between 1997 and 2007. However, species diversity is low. The majority of the total grass cover has been comprised of bulbous bluegrass (*Poa bulbosa*), an undesirable perennial, and smooth brome (*Bromus inermis*) since 1997. Bulbous bluegrass

provided 27% cover in 1997 and 2007 and 32% in 2002, while smooth brome cover increased from 5% in 1997 to 19% in 2007. Cheatgrass (*Bromus tectorum*) was the only annual grass present and was only sampled in 1997. Average forb cover has decreased from approximately 2% in 1997 to less than 1% in 2002 and 2007. Forbs are relatively diverse, but occur infrequently. Silky milkvetch (*Astragalus cibarius*) and longleaf phlox (*Phlox longifolia*) had the highest nested frequencies of the forbs in 2007.

1989 TREND ASSESSMENT

The trend for browse is slightly down. Sagebrush density decreased from approximately 500 plants/acre (1,235 plants/ha) to 200 plants/acre (494 plants/ha), and decadence increased by 10%. However, recruitment also increased to 33% of the population consisting of young plants. The percent of plants showing poor vigor increased from 0% of the population to 17%, and 34% of the sampled plants displayed moderate-heavy use. Bitterbrush density increased from 166 plants/acre (410 plants/ha) to approximately 300 plants/acre (741 plants/ha). Recruitment increased to 22% of the population, and all of the plants were vigorous. Eighty-nine percent of the sampled plants showed moderate-heavy use. The trend for grass is down. The sum of nested frequency for perennial species, excluding bulbous bluegrass, decreased by 51%. Bulbous bluegrass increased significantly in nested frequency, while Sandberg bluegrass and crested wheatgrass (*Agropyron cristatum*) decreased significantly in nested frequency. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little.

browse - slightly down (-1) grass - down (-2) forb - stable (0)

1997 TREND ASSESSMENT

The trend for browse is slightly up. Sagebrush density greatly increased from 199 plants/acre (492 plants/ha) to 1,900 plants/acre (4,693 plants/ha), however, some of this increase was attributed to the lengthening of the baseline. This species provided approximately 40% of the total shrub cover. Decadence decreased from 17% of the population to 3%. Young plants comprised 72% of the population, and vigor was good. Use was mostly light, with some moderate-heavy use. Fourteen percent of the total shrub cover was composed of bitterbrush. Its density decreased by 33% with the extended baseline. Young recruitment remained high, and all of the plants were vigorous. Use was mostly moderate, with some heavy hedging. The trend for grass is stable. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, changed very little. Bulbous bluegrass and smooth brome increased significantly in nested frequency. The trend for forbs is stable. The sum of nested frequency for perennial forbs changed little, and forbs only provided approximately 2% cover. The Desirable Components Index (DCI) was rated as fair due to low desirable perennial grass and forb cover, and moderate preferred browse cover.

winter range condition (DCI) - fair (58) Mid-level potential scale
browse - slightly up (+1) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The trend for browse is up. Sagebrush cover increased from 4% to 10%, and density increased from 1,900 plants/acre (4,693 plants/ha) to 3,460 plants/acre (8,546 plants/ha). Decadence remained low, and although recruitment decreased, it was high with 48% of the population consisting of young plants. Vigor was good, and use was mostly light, with some moderate-heavy browsing. Bitterbrush density also increased from 200 plants/acre (494 plants/ha) to 420 plants/acre (1,037 plants/ha), and cover almost tripled. The population was mostly mature, with 14% composed of young plants. Vigor was good on all plants, and use was heavy. The trend for grass is stable. The sum of nested frequency for desirable perennial grasses changed little. Smooth brome increased significantly in nested frequency , while crested wheatgrass (*Agropyron cristatum*) decreased significantly. Cheatgrass was not sampled. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 54%. The number of individual species sampled decreased from 17 to 10. Total forb cover declined below 1%. The DCI rating increased to good, mostly due to the increase in preferred browse cover.

winter range condition (DCI) - good (73) Mid-level potential scale
browse - up (+2) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is stable. Sagebrush density decreased 16%, but cover increased from 10% to 13%. Ninety-one percent of the population was mature, with low decadence and recruitment. Most of the sampled plants were vigorous, and use was mostly light. Bitterbrush density remained stable. This population was also mostly mature, and 10% of the sampled plants were young. Vigor was good, and use remained mostly moderate-heavy. The trend for grass is slightly up. The sum of nested frequency for perennial grasses increased 19% since 1997. Although its nested frequency did not change significantly, smooth brome cover increased from 8% to 19%. Bulbous bluegrass cover decreased from 32% to 26%. The trend for forbs is stable. Although the sum of nested frequency for forbs increased, average cover remained below 1%. The DCI rating remained good.

winter range condition (DCI) - good (77) Mid-level potential scale
browse - stable (0) grass - slightly up (+1) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 16A, Study no: 11

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	c159	b117	b94	a33	a43	2.14	.42	.64
G	Agropyron spicatum	b24	ab11	-	a4	a-	-	.03	.00
G	Bromus inermis	a88	a118	b170	c245	c272	5.09	8.34	18.73
G	Bromus tectorum (a)	-	-	48	-	-	2.26	-	-
G	Dactylis glomerata	a6	a2	-	-	-	-	-	-
G	Poa bulbosa	a3	b282	d352	cd335	c318	26.80	31.76	26.46
G	Poa fendleriana	-	a3	-	-	b13	-	-	.09
G	Poa pratensis	a14	a14	-	a3	a7	-	.38	.18
G	Poa secunda	b290	a18	a25	a29	a8	.37	.51	.04
Total for Annual Grasses		0	0	48	0	0	2.26	0	0
Total for Perennial Grasses		584	565	641	649	661	34.42	41.44	46.15
Total for Grasses		584	565	689	649	661	36.69	41.44	46.15
F	Agoseris glauca	a3	-	a7	a1	-	.19	.03	-
F	Artemisia ludoviciana	a4	a3	-	-	-	-	-	-
F	Astragalus beckwithii	-	-	-	14	-	-	.16	-
F	Aster chilensis	-	10	-	-	-	-	-	-
F	Astragalus cibarius	-	-	-	-	21	-	-	.40
F	Astragalus convallarius	-	-	2	-	-	.03	-	-
F	Astragalus sp.	-	-	15	-	-	.43	-	-
F	Calochortus nuttallii	a3	-	a7	-	a2	.02	-	.00
F	Cirsium sp.	a5	a6	a4	a5	a2	.04	.18	.15

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
F	Collomia sp. (a)	-	-	$_{a}$1	-	$_{a}$5	.00	-	.02
F	Comandra pallida	$_{bc}$23	$_{c}$29	$_{ab}$10	$_{a}$5	$_{a}$8	.48	.03	.04
F	Collinsia parviflora (a)	-	-	-	-	3	-	-	.01
F	Cymopterus longipes	$_{a}$10	-	$_{a}$5	$_{a}$6	$_{a}$7	.04	.04	.01
F	Draba sp. (a)	-	-	-	-	10	-	-	.05
F	Epilobium brachycarpum (a)	-	-	$_{b}$19	$_{a}$3	-	.04	.00	-
F	Erigeron divergens	-	-	2	-	-	.15	-	-
F	Lathyrus brachycalyx	2	-	-	-	-	-	-	-
F	Lactuca serriola	-	-	$_{a}$1	-	$_{a}$1	.00	-	.00
F	Lomatium sp.	-	$_{a}$3	$_{a}$9	-	-	.05	-	-
F	Machaeranthera canescens	-	$_{a}$9	$_{a}$2	-	-	.00	-	-
F	Phlox longifolia	$_{a}$16	$_{a}$15	$_{a}$26	$_{a}$11	$_{a}$31	.05	.40	.14
F	Polygonum douglasii (a)	-	-	-	3	-	-	.00	-
F	Solidago sparsiflora	2	-	-	-	-	-	-	-
F	Stellaria sp.	5	-	-	-	-	-	-	-
F	Tragopogon dubius	$_{b}$14	$_{ab}$6	$_{ab}$6	$_{a}$3	-	.01	.00	-
F	Unknown forb-annual (a)	-	-	2	-	-	.00	-	-
F	Viguiera multiflora	9	-	-	-	-	-	-	-
F	Zigadenus paniculatus	-	-	$_{a}$3	$_{a}$1	$_{a}$3	.03	.03	.00
Total for Annual Forbs		0	0	22	6	18	0.04	0.00	0.08
Total for Perennial Forbs		96	81	99	46	75	1.54	0.89	0.77
Total for Forbs		96	81	121	52	93	1.59	0.90	0.86

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

BROWSE TRENDS --
Management unit 16A, Study no: 11

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata vaseyana	45	55	57	4.21	9.89	12.74
B	Chrysothamnus nauseosus albicaulis	1	1	1	.15	.03	.03
B	Chrysothamnus viscidiflorus viscidiflorus	0	2	0	-	-	-
B	Gutierrezia sarothrae	18	37	23	.52	1.52	.24
B	Purshia tridentata	7	15	17	1.54	4.21	5.19
B	Quercus gambelii	14	16	16	4.35	4.57	3.32
Total for Browse		85	126	114	10.79	20.23	21.52

CANOPY COVER, LINE INTERCEPT --
Management unit 16A, Study no: 11

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	16.43
Chrysothamnus nauseosus albicaulis	-	.05
Gutierrezia sarothrae	-	.30
Purshia tridentata	-	5.56
Quercus gambelii	.10	6.46

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 16A, Study no: 11

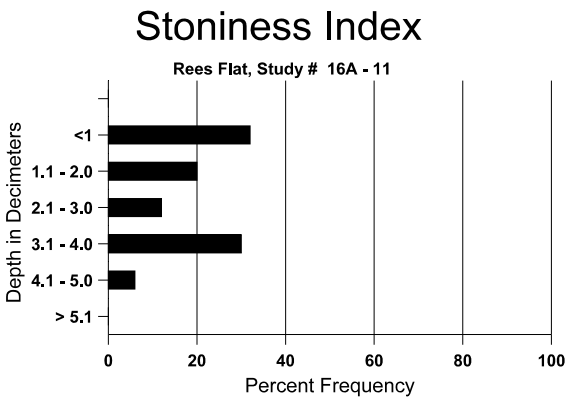
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.6	1.7
Purshia tridentata	1.4	1.6

BASIC COVER --
Management unit 16A, Study no: 11

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	.25	8.25	50.06	57.61	63.02
Rock	7.50	7.75	2.80	3.06	2.80
Pavement	3.50	8.25	5.17	2.70	4.69
Litter	54.50	50.00	33.86	38.47	33.59
Cryptogams	.50	3.00	8.60	4.12	1.22
Bare Ground	33.75	22.75	7.52	11.90	11.02

SOIL ANALYSIS DATA --
Herd Unit 16A, Study no: 11, Rees Flat

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
15.4	48.0 (17.0)	5.9	40.4	33.1	26.6	2.4	29.8	179.2	.4



PELLET GROUP DATA --
Management unit 16A, Study no: 11

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	2	3	5
Elk	38	13	9
Deer	26	29	33
Cattle	2	4	1

Days use per acre (ha)	
'02	'07
-	-
27 (66)	22 (55)
56 (137)	25 (61)
9 (22)	2 (4)

BROWSE CHARACTERISTICS --
Management unit 16A, Study no: 11

		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												
83	**499**	-	-	466	33	-	13	0	7	-	0	18/26
89	**199**	-	66	100	33	-	17	17	17	-	17	17/13
97	**1900**	560	1360	480	60	140	6	4	3	3	3	24/44
02	**3460**	360	1660	1580	220	80	18	5	6	2	6	18/36
07	**2900**	-	200	2640	60	40	14	.68	2	1	1	22/36
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**20**	-	-	20	-	-	100	0	0	-	0	9/13
02	**20**	-	-	-	20	-	100	0	100	100	100	19/37
07	**80**	-	-	80	-	-	0	0	0	-	0	19/18
Chrysothamnus viscidiflorus viscidiflorus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	10/28
02	**40**	-	20	20	-	-	0	0	-	-	0	9/22
07	**0**	-	-	-	-	-	0	0	-	-	0	7/14
Grayia spinosa												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	20	-	-	-	-	0	0	-	-	0	-/-
Gutierrezia sarothrae												
83	**2199**	733	1466	700	33	-	0	0	2	-	0	8/6
89	**1600**	-	100	1300	200	-	0	0	13	-	0	9/7
97	**1500**	380	500	900	100	20	0	0	7	7	7	5/8
02	**2600**	-	120	1880	600	200	0	0	23	8	8	4/7
07	**2140**	80	1380	580	180	-	10	0	8	.93	.93	7/8

		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)
Purshia tridentata												
83	**166**	-	-	166	-	-	80	0	-	-	0	16/28
89	**299**	66	66	233	-	-	78	11	-	-	0	23/39
97	**200**	40	40	160	-	-	60	10	-	-	0	27/81
02	**420**	-	60	360	-	-	10	81	-	-	0	27/72
07	**420**	-	40	380	-	-	19	52	-	-	0	30/66
Quercus gambelii												
83	**4900**	133	200	4700	-	-	0	0	0	-	0	46/24
89	**3966**	1033	1233	2033	700	-	.84	0	18	.50	3	77/36
97	**1740**	40	660	1080	-	120	1	0	0	-	0	86/76
02	**2480**	-	100	2220	160	300	0	14	6	2	31	62/32
07	**1640**	20	160	1300	180	520	0	0	11	-	99	68/47