Trend Study 16A-15-07

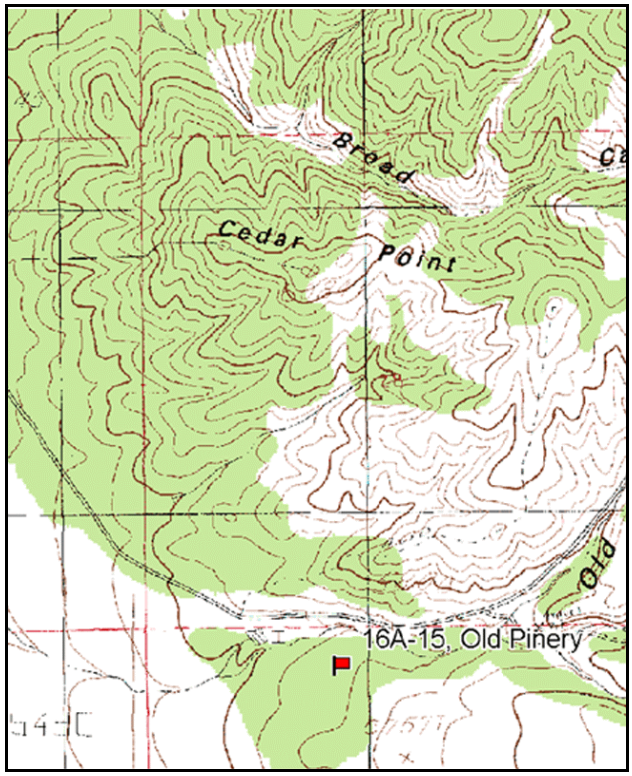
Study site name: Old Pinery . Vegetation type: Chained, Seeded P-J .

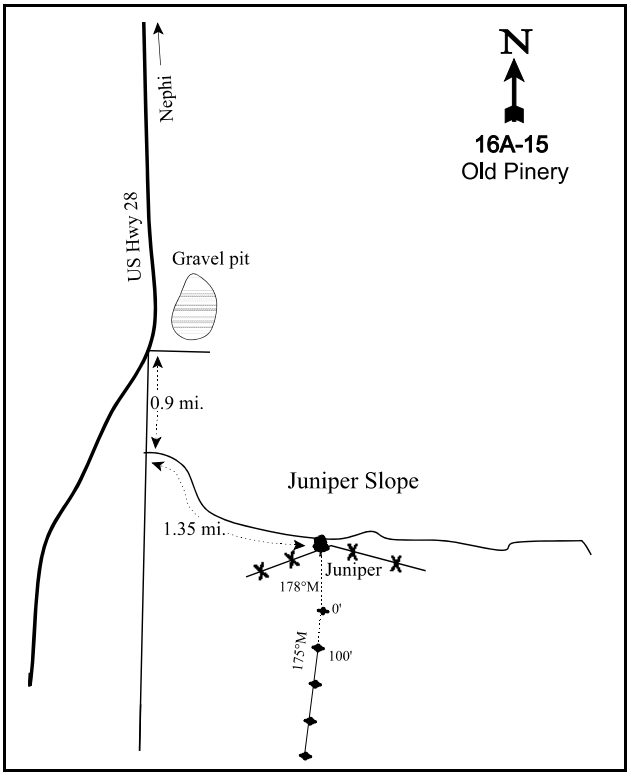
Compass bearing: frequency baseline 175 degrees magnetic.

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

LOCATION DESCRIPTION

From Nephi, proceed south on U.S. 28 to a dirt road just past a gravel pit. Turn left on the dirt road, and proceed south 0.9 miles to another intersection. Turn left at the intersection and proceed southeast for 1.35 miles toward Old Pinery Canyon. Stop at the corner of the fenceline. From the easternmost of the two middle fenceposts, the 0-foot marker of the baseline is located 130 paces away at an azimuth of 178 degrees magnetic. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height. A red browse tag, number 3960, is attached to the 0-foot baseline stake.





Map Name: Nephi

Diagrammatic Sketch

Township 13S , Range 1E , Section 33

GPS: NAD 83, UTM 12S 428825 E 4388666 N

DISCUSSION

Old Pinery - Trend Study No. 16A-15

Study Information

This study is located on privately-owned rangeland south of Old Pinery Creek [elevation: 5,650 feet (1,722 m), slope: 3%, aspect: west]. The area was dominated by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*), but was chained and seeded prior to study establishment in 1983. Animal use was very low in 1983 due to lack of cover and forage. However, deer pellet groups were common in 1997 with a quadrat frequency of 41%, and use was estimated at 94 deer days use/acre (233 ddu/ha) in 2002 and 90 days use/acre (222 ddu/ha) in 2007. Cattle sign was also noted in 1997 with a quadrat frequency of 18%, and use was estimated at 22 days use/acre (54 cdu/ha) in 2002 and 12 days use/acre (29 cdu/ha) in 2007. All of the cattle use appeared to be from previous years, but most deer pellet groups were from winter use. A dead deer and cow were noted on the study in 2007.

Soil

The soil is classified within the Borvant series (USDA-NRCS 2007). The soils in this series are shallow and well-drained, with possible petrocalcic horizons. They formed in alluvium or colluvium derived from limestone and sandstone. The soil texture is a loam, and it is slightly acidic (pH 6.2). Few rocks are found on the surface and in the profile. Vegetation and litter have accounted for at least 75% of the relative ground cover since 1997. Abundant cover and the gentle slope prevent most erosion. The erosion condition was classified as stable in 2002 and 2007.

Browse

Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the main browse species, and comprised 83% of the total browse cover in 1997, 86% in 2002, and 93% in 2007. It provided only 6% cover in 1997, then increased to 10% in 2002 and 13% in 2007. Sagebrush density has varied greatly. It increased from 1,332 plants/acre (3,291 plants/ha) in 1983 to 4,532 plants/acre (11,198 plants/ha) in 1989, and ranged between 2,040 plants/acre (5,041 plants/ha) and 3,340 plants/acre (8,253 plants/ha) from 1997 to 2007. The population was made up of 95% mature plants in 1983, and in 1989, 76% of the population was young. Recruitment slowly declined but remained high until 2007, when 92% of the sampled plants were mature. Decadence has remained at 5% of the population or less since 1983. Vigor has been excellent in all sample years. Use was light from 1983 to 2002 with some moderate and heavy use in 1997 and 2002, and was moderate-heavy in 2007. Annual leader growth averaged 2.8 inches (7.1 cm) in 2002 and 1.7 inches (4.2 cm) in 2007.

Antelope bitterbrush (*Purshia tridentata*) has also been sampled since 1997. Density was estimated at 60 plants/acre (148 plants/ha) in 1997, 80 plants/acre (198 plants/ha) in 2002, and 100 plants/acre (247 plants/ha) in 2007. All of the sampled plants have been mature, vigorous, and heavily used.

The chaining appears to have been relatively successful, with a juniper density of only 12 trees/acre (30 trees/ha) in 1997, 21 trees/acre (52 trees/ha) in 2002, and 23 trees/acre (57 trees/ha) in 2007. A few of the sampled trees were tipped over, but still growing. Average trunk diameter was 3.2 inches (8.1 cm) in 1997, 6.8 inches (17.3 cm) in 2002, and 9.7 inches (24.6 cm) in 2007. Most of the sampled trees were 8-10 feet (2.4-3 m) tall in 2002 and over 12 feet (3.7 m) tall in 2007.

Herbaceous Understory

The herbaceous understory was dominated by cheatgrass (*Bromus tectorum*) in 1983, and it appeared that the seeding was not successful. Seeded and native perennial grasses were rare. By 1989, the sum of nested frequency for perennial grasses had increased nearly three-fold. Total grass cover was 23% in 1997, 35% in 2002, and 44% in 2007. Cheatgrass accounted for 10% of the total grass cover in 1997, 9% in 2002, and 21% in 2007. Perennial grass cover greatly increased between 1997 and 2007, however, the majority of this

increase was attributed to bulbous bluegrass (*Poa bulbosa*). Bulbous bluegrass provided 4% of the total grass cover in 1997, 43% in 2002, and 67% in 2007. It also accounted for 40% of the total herbaceous cover in 2002 and 57% in 2007. Other common perennial grass species include crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*Agropyron spicatum*), western wheatgrass (*Agropyron smithii*), and Sandberg bluegrass (*Poa secunda*).

Total forb cover was 7% in 1997, 3% in 2002, and returned to 7% in 2007. However, the majority of the forb cover is provided by annual species. Pale alyssum (*Alyssum alyssoides*), bur buttercup (*Ranunculus testiculatus*), blue-eyed Mary (*Collinsia parviflora*), and storksbill (*Erodium cicutarium*) are the most abundant forbs. Storksbill has been shown to outcompete and prevent the establishment of native species (Kimball and Schiffman 2003). Field bindweed (*Convolvulus arvensis*), a noxious weed, was sampled at low nested and quadrat frequencies in 1997 and 2007.

1989 TREND ASSESSMENT

The trend for browse is up. Sagebrush density increased from 1,332 plants/acre (3,291 plants/ha) to 4,532 plants/acre (11,198 plants/ha). Young recruitment greatly increased from 0% of the population to 76%, and reproduction also increased from 0 seedlings/acre to 8,166 seedlings/acre (20,178 seedlings/ha). Decadence remained low at 4% of the population. Vigor was good, and use remained light. The trend for grass is up. The sum of nested frequency for perennial grasses almost tripled. Crested wheatgrass, western wheatgrass, and Sandberg bluegrass increased significantly in nested frequency. The trend for forbs is up. Seven perennial forb species were sampled, which was an improvement from 1983 when no forbs were sampled.

browse - up (+2) grass - up (+2) forb - up (+2)

1997 TREND ASSESSMENT

The trend for browse is stable. The density decreased from 4,532 plants/acre (11,198 plants/ha) to 2,040 plants/acre (5,041 plants/ha). However, this decrease was attributed to the increase in sampling area, and may have also been due to self-thinning, since so many young plants were sampled in 1989. Young recruitment remained very high, but slightly decreased from 76% of the population to 69%. Decadence remained low at only 1% of the population. All of the sampled plants were vigorous, and use increased, with 21% of the plants showing moderate-heavy hedging. Bitterbrush was also sampled for the first time, at a density of 60 plants/acre (148 plants/ha). All of these plants were mature, vigorous, and heavily browsed. The trend for grass is up. The sum of nested frequency for perennial grasses increased almost 30%. Western wheatgrass, bluebunch wheatgrass, and Sandberg bluegrass increased significantly in nested frequency. The trend for forbs is up. The sum of nested frequency for perennial forbs increased almost 50%. The number of sampled perennial species doubled from seven to 14. However, bindweed was sampled in one quadrat. The Desirable Components Index (DCI) was rated as fair due to high perennial grass cover, high preferred browse recruitment, and low browse decadence. However, low browse and perennial forb cover, as well as the presence of a noxious weed, prevented the score from being higher.

winter range condition (DCI) - fair (59) Mid-level potential scale
browse - stable (0) grass - up (+2) forb - up (+2)

2002 TREND ASSESSMENT

The trend for browse is up. Sagebrush density increased from 2,040 plants/acre (5,041 plants/ha) to 3,340 plants/acre (8,253 plants/ha), and average cover increased from 6% to 10%. Young recruitment decreased from 69% of the population to 35%, and decadence slightly increased from 1% of the population to 5%. Vigor remained good, and plants showing moderate-heavy use increased from 21% of the population to 31%. Bitterbrush density slightly increased from 60 plants/acre (148 plants/ha) to 80 plants/acre (198 plants/ha). Vigor remained good, and use remained heavy. The trend for grass is stable. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, decreased only 9%. Sandberg bluegrass decreased

significantly in nested frequency, while bulbous bluegrass increased significantly in nested frequency. Bulbous bluegrass average cover increased from less than 1% to 15%. Cheatgrass cover also increased from 2% to 3%. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased 62%, and total forb cover decreased from 7% to 3%. Numerous species decreased significantly in nested frequency. Bindweed was not sampled. The DCI rating increased to good due to the increase in preferred browse cover and the absence of noxious weeds.

winter range condition (DCI) - good (69) Mid-level potential scale
browse - up (+2) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The trend for browse is slightly down. Sagebrush density decreased from 3,340 plants/acre (8,253 plants/ha) to 2,700 plants/acre (6,672 plants/ha), however, average cover increased from 10% to 13%. Young recruitment decreased from 35% of the population to 4%, but decadence remained low at 4%. Vigor remained good, with only 3% of the sampled plants displaying poor vigor. Use increased to moderate-heavy. Bitterbrush density slightly increased from 80 plants/acre (198 plants/ha) to 100 plants/acre (247 plants/ha). Use continued to be heavy on these plants, and vigor was good. The trend for grass is down. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, decreased 34%. Sandberg bluegrass continued to decrease significantly in nested frequency, while cheatgrass and bulbous bluegrass increased significantly in nested frequency. Average cheatgrass cover increased from 3% to 9%, and average bulbous bluegrass cover almost doubled from 15% to 29%. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs increased 20%. However, storksbill increased significantly in nested frequency, and its average cover increased from less than 1% to 5%. Average perennial forb cover did not change, while annual forb cover increased from 3% to 7%. Additionally, bindweed was sampled in one quadrat. The DCI rating declined to very poor due to decreases in young recruitment for preferred browse and valuable perennial grass cover, an increase in annual grass cover, and the presence of a noxious weed.

winter range condition (DCI) - very poor (32) Mid-level potential scale
browse - slightly down (-1) grass - down (-2) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 16A, Study no: 15

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	a35	b121	b110	b107	b87	5.19	6.10	1.00
G	Agropyron smithii	a23	b148	c163	bc144	bc131	3.49	3.78	1.63
G	Agropyron spicatum	ab23	a7	bc36	c60	bc37	1.39	3.37	1.23
G	Bromus japonicus (a)	-	-	-	a18	a10	-	.04	.05
G	Bromus tectorum (a)	-	-	a259	a259	b317	2.30	3.27	9.00
G	Festuca myuros (a)	-	-	b277	a81	a105	5.50	.20	1.08
G	Poa bulbosa	-	-	a64	b246	c346	.89	14.90	29.20
G	Poa pratensis	b55	-	-	a4	-	-	.15	-
G	Poa secunda	a4	c104	d190	c138	b45	3.79	2.79	.59

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'97	'02	'07	'97	'02	'07
G	Sitanion hystrix	-	$_{a}$8	-	$_{a}$3	-	-	.03	-
Total for Annual Grasses		0	0	536	358	432	7.80	3.52	10.14
Total for Perennial Grasses		140	388	563	702	646	14.77	31.14	33.66
Total for Grasses		140	388	1099	1060	1078	22.58	34.68	43.81
F	Agoseris glauca	-	-	$_{a}$7	$_{a}$4	$_{a}$5	.01	.01	.01
F	Alyssum alyssoides (a)	-	-	$_{c}$281	$_{b}$127	$_{a}$47	.91	.31	.27
F	Allium sp.	-	$_{b}$57	$_{b}$47	$_{a}$4	-	.13	.01	-
F	Astragalus sp.	-	-	$_{a}$9	$_{a}$4	$_{a}$1	.10	.03	.00
F	Astragalus utahensis	-	-	$_{a}$2	$_{a}$3	$_{a}$3	.15	.00	.00
F	Calochortus nuttallii	-	-	$_{a}$11	$_{a}$3	$_{a}$1	.02	.00	.00
F	Cerastium sp.	-	16	-	-	-	-	-	-
F	Cirsium sp.	-	-	$_{a}$9	$_{a}$3	$_{a}$1	.05	.06	.03
F	Convolvulus arvensis	-	-	$_{a}$2	-	$_{a}$1	.00	-	.00
F	Collinsia parviflora (a)	-	-	$_{b}$196	$_{a}$103	$_{a}$106	.78	.57	.59
F	Cymopterus longipes	-	$_{a}$3	$_{a}$17	$_{a}$7	$_{a}$10	.21	.06	.02
F	Descurainia pinnata (a)	-	3	-	-	-	-	-	-
F	Draba sp. (a)	-	-	-	$_{a}$5	$_{b}$132	-	.01	.72
F	Epilobium brachycarpum (a)	-	-	$_{b}$75	$_{a}$7	-	.14	.01	-
F	Erodium cicutarium (a)	-	-	$_{b}$158	$_{a}$31	$_{c}$236	1.72	.57	4.87
F	Erigeron sp.	-	-	2	-	-	.00	-	-
F	Eriogonum racemosum	-	-	$_{a}$6	$_{a}$5	$_{a}$1	.04	.01	.00
F	Galium aparine (a)	-	-	-	-	1	-	-	.00
F	Grindelia squarrosa	-	-	3	-	-	.00	-	-
F	Holosteum umbellatum (a)	-	-	-	$_{a}$6	$_{b}$65	-	.01	.14
F	Lactuca serriola	-	$_{b}$26	$_{a}$11	-	$_{a}$3	.02	-	.01
F	Microsteris gracilis (a)	-	-	$_{b}$58	$_{a}$5	$_{a}$12	.16	.01	.03
F	Phlox longifolia	-	$_{a}$9	$_{ab}$32	$_{ab}$24	$_{b}$41	.09	.08	.22
F	Polygonum douglasii (a)	-	-	$_{b}$23	$_{a}$1	$_{a}$1	.05	.00	.00
F	Ranunculus testiculatus (a)	-	-	$_{c}$287	$_{b}$163	$_{a}$33	2.15	1.01	.10
F	Sphaeralcea coccinea	-	$_{a}$3	-	-	$_{a}$1	-	-	.00
F	Tragopogon dubius	-	$_{a}$3	$_{b}$9	-	$_{a}$3	.05	-	.00
F	Vicia americana	-	-	$_{a}$9	$_{a}$9	$_{a}$9	.06	.12	.12
Total for Annual Forbs		0	3	1078	448	633	5.93	2.52	6.74
Total for Perennial Forbs		0	117	176	66	80	0.96	0.40	0.46
Total for Forbs		0	120	1254	514	713	6.89	2.92	7.20

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

BROWSE TRENDS --
Management unit 16A, Study no: 15

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata vaseyana	46	66	64	5.53	10.01	12.58
B	Gutierrezia sarothrae	19	17	25	.53	.83	.06
B	Juniperus osteosperma	1	1	1	.15	.76	.76
B	Purshia tridentata	3	4	5	.42	.07	.06
Total for Browse		69	88	95	6.63	11.67	13.47

CANOPY COVER, LINE INTERCEPT --
Management unit 16A, Study no: 15

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	14.93
Gutierrezia sarothrae	-	.10
Juniperus osteosperma	.05	1.58

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 16A, Study no: 15

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.8	1.6

POINT-QUARTER TREE DATA --
Management unit 16A, Study no: 15

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	21	23

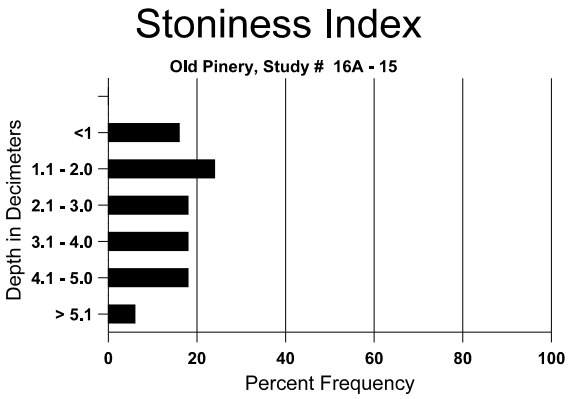
Average diameter (in)	
'02	'07
6.8	9.7

BASIC COVER --
Management unit 16A, Study no: 15

Cover Type	Average Cover %				
	'83	'89	'97	'02	'07
Vegetation	3.00	9.50	43.06	53.96	61.49
Rock	2.25	.25	4.32	1.16	.98
Pavement	0	.50	.67	1.03	1.56
Litter	75.00	63.00	36.01	38.60	35.81
Cryptogams	1.50	0	5.95	1.58	3.71
Bare Ground	18.25	26.75	14.39	16.45	11.89

SOIL ANALYSIS DATA --
Herd Unit 16A, Study no: 15, Old Pinery

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
19.1	44.8 (16.9)	6.2	37.4	39.7	22.8	1.8	19.2	208.0	.4



PELLET GROUP DATA --
Management unit 16A, Study no: 15

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	12	12	77
Elk	-	1	4
Deer	41	58	67
Cattle	18	9	7

Days use per acre (ha)	
'02	'07
-	-
-	-
94 (233)	90 (222)
22 (54)	12 (29)

BROWSE CHARACTERISTICS --
Management unit 16A, Study no: 15

		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	**1332**	-	-	1266	66	-	0	0	5	-	3	13/13
89	**4532**	8166	3433	933	166	-	1	0	4	1	.73	15/16
97	**2040**	920	1400	620	20	-	11	10	1	-	0	22/41
02	**3340**	140	1160	2000	180	-	23	8	5	1	1	18/27
07	**2700**	40	100	2480	120	80	35	17	4	3	3	24/35
Gutierrezia sarothrae												
83	**633**	-	-	633	-	-	0	0	0	-	0	11/13
89	**8565**	-	3966	4133	466	-	0	0	5	-	0	11/9
97	**1560**	140	280	1280	-	-	0	0	0	-	0	7/8
02	**900**	-	-	680	220	200	0	0	24	4	4	7/8
07	**1100**	60	260	800	40	40	0	0	4	-	0	8/8
Juniperus osteosperma												
83	**33**	-	33	-	-	-	0	0	-	-	0	-/-
89	**33**	-	33	-	-	-	0	0	-	-	0	-/-
97	**20**	-	20	-	-	60	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	0	-	-	0	-/-
Purshia tridentata												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**60**	-	-	60	-	-	0	100	-	-	0	11/43
02	**80**	-	-	80	-	20	0	100	-	-	0	16/49
07	**100**	-	-	100	-	-	0	100	-	-	0	17/51