Trend Study 29R-2-08

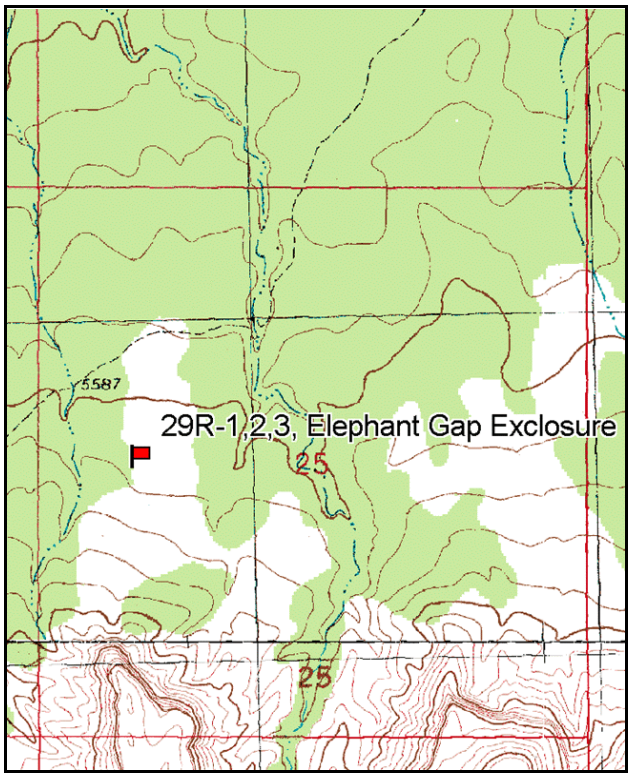
Study site name: Elephant Gap Livestock Exclosure . Vegetation type: Pinyon-Juniper .

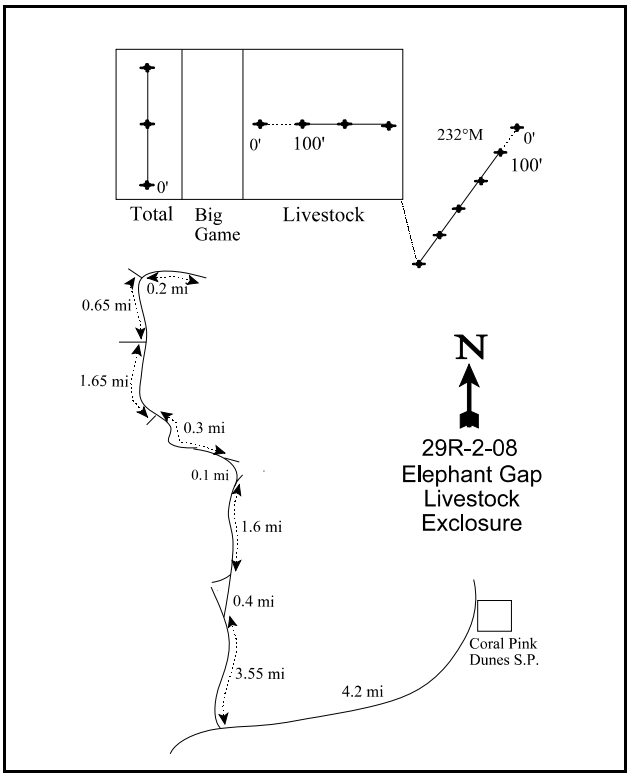
Compass bearing: frequency baseline 90 degrees magnetic.

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

LOCATION DESCRIPTION

The starting point for this site is the entry to Coral Pink Sand Dunes State Park off of Hwy 89. From the entry of the park, travel south for 4.2 miles. Turn right and go 3.55 miles to a fork. Stay right and continue 2.7 miles to a cattleguard. Continue on main road for another 0.65 miles to another cattleguard. Drive another 1.85 miles to a faint road to the right (south). Drive on this road for 0.2 miles to the exclosure. The livestock exclosure is located on the east side of the exclosure complex. The baseline starts inside the livestock exclosure near the taller fence denoting the big game exclosure and runs through the middle of the exclosure (see map below).





Map Name: The Barracks

Diagrammatic Sketch

Township 42S , Range 9W , Section 25

GPS: NAD 83, UTM 12S 339634 E, 4110719 N

DISCUSSION

Elephant Gap Livestock Exclosure - Trend Study No. 29R-2

Study information

This study was established in 1998 inside the livestock exclosure at Elephant Gap [elevation: 5,600 feet (1,707 m), slope: 7%, aspect: northwest]. The Elephant Gap exclosure complex is located about 16 miles west-northwest of Kanab and about 9 miles northwest of the Coral Pink San Dunes State Park. The exclosure was built in the 1960's just north of Harris Point. The area is composed of an open pinyon-juniper (*Pinus edulis* and *Juniperus osteosperma*) woodland with a mixed shrub understory. Deer use this area as winter range and pellet data estimated a high level of use within the livestock exclosure at 96 deer days use/acre (237 ddu/ha) in 1998 and 102 days use/acre (251 ddu/ha) in 2003, and 43 deer days use/acre (106 ddu/ha) in 2008.

Soils

Soil in the livestock exclosure is very similar to the total exclosure and outside. It is deep, sandy in texture, but strongly acidic (pH of 5.5). Phosphorus and potassium are limited at just 3.8 ppm and 3.2 ppm respectively, which may be limiting to plant growth and development (Tiedemann and Lopez 2004). There is very little rock or pavement on the surface or within the profile. Relative bare ground cover is similar to the total exclosure at 27%-35% since 1998. Relative cryptogamic cover is about twice as high inside the livestock exclosure as inside the total exclosure, but is similar to cover outside the exclosures. There is some soil pedestalling around shrubs, but erosion does not appear to be a problem due to the gentle terrain and high infiltration capacity. Soil erosion condition was classified as stable in 2008.

Browse

Total shrub cover is similar to the total exclosure yet composition differs considerably. The key browse species consist of basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and green ephedra (*Ephedra viridis*). Basin big sagebrush density decreased from 1,180 plants/acre in 1998 to an average of 780 plants/acre in 2003 and 2008, and decadence has decreased from 95% in 2003 to 56% in 2008. Recruitment of young sagebrush plants was at 10% (80 plants/acre) of the population in 2008. Green ephedra density has averaged 1,040 plants/acre from 1998 to 2008, this population has maintained good vigor, low to moderate decadence, and light use. Young plants increased from 100 plants/acre to 240 plants/acre (11% to 21%) from 2003to 2008. A few bitterbrush (*Purshia tridentata*) plants occur in the livestock exclosure but only numbered 20 plants/acre in 2003 and 2008. Other shrubs found on the site include sand sagebrush (*Artemisia filifolia*), coin buckwheat (*Eriogonum nummulare*), prickly pear cactus (*Opuntia sp.*), and yucca (*Yucca sp.*). Juniper trees are scattered in the livestock exclosure at a density of 29 trees/acre in 2003, no density was estimated in 2008 .

Herbaceous understory

Grass composition in the livestock exclosure closely resembles that of the total exclosure, but forbs are more diverse and were much more abundant in 1998. Sand dropseed (*Sporobolus cryptandrus*) was the most abundant grass in 1998, with pale evening primrose (*Oenothera pallida*), toadflax (*Comandra pallida*), and milkvetch (*Astragalus sp.*) being the most common forbs. With drought in 2003, grasses and forbs declined in abundance, especially perennial forbs. Total forb cover was estimated at only 3% in 2003 and 2008 compared to 11% in 1998. Sum of nested frequency of perennial grasses has remained constant since 1998 while cover has decreased from 1.5% in 1998 to 0.4% in 2008. Perennial forbs showed a 56% decline from 1998 to 2003 and 10% decline in 2008 in sum nested frequency.

1998 DESIRABLE COMPONENTS INDEX

Winter range condition - fair (55) Mid-level potential scale

2003 TREND ASSESSMENT

Browse trend is down. The key browse species, basin big sagebrush and green ephedra, have lower densities, higher decadence, and lower recruitment. The decadence rate for sagebrush is extreme at 95%. Ephedra is in better condition than sagebrush. Grass trend is stable. Grasses provide little cover to the site and perennial grasses remained similar in sum of nested frequency. Forb trend is down. Perennial forbs showed a large decline in sum of nested frequency with drought in 2003. The largest loss came from pale evening primrose, but toadflax (*Comandra pallida*) and milkvetch also showed decreases in their respective frequencies.

Winter range condition (DCI) - very poor-poor (34) Mid-level potential scale
browse - down (-2) grasses - stable (0) forbs - down (-2)

2008 TREND ASSESSMENT

Browse trend is slightly up. Basin big sagebrush has increased in density from 740 plants/acre in 2003 to 820 plants/acre. Decadence has decreased from 95% to 56% in the same period, while recruitment is improving from no young in 2003 to 80 young/acre. Ephedra densities have increased from 900 plants/acre in 2003 to 1,160/acre, decadence has increased from 22% in 2003 to 36%, and young have increased from 100 plants/acre to 240 plants/acre in the same period. Trend for the grasses is stable. Perennial grasses are rare and sum of nested frequency of perennial grasses has changed little, though cover of perennial grasses is now less than 0.5%. The nested frequency of cheatgrass has increased significantly, but is still rare and provides little cover. Trend for forbs is stable. Perennial forbs sum of nested frequency has remained similar to 2003. Perennial forbs are represented by a milkvetch and bastard toadflax.

Winter range condition - very poor (32) Mid-level potential scale
browse - slightly up (+1) grasses - stable (0) forbs - stable (0)

HERBACEOUS TRENDS --
Management unit 29R, Study no: 2

Type	Species	Nested Frequency			Average Cover %		
		'98	'03	'08	'98	'03	'08
G	Bouteloua gracilis	$_{a}$7	$_{a}$11	$_{b}$39	.30	.34	.35
G	Bromus tectorum (a)	$_{b}$11	$_{a}$-	$_{c}$68	.08	-	.54
G	Muhlenbergia pungens	4	3	2	.01	.03	.01
G	Oryzopsis hymenoides	$_{ab}$3	$_{b}$6	$_{a}$-	.06	.09	.00
G	Sitanion hystrix	1	-	-	.00	-	-
G	Sporobolus cryptandrus	$_{b}$34	$_{a}$21	$_{a}$5	1.11	.58	.01
G	Vulpia octoflora (a)	$_{b}$51	$_{a}$-	$_{b}$27	.44	-	.05
Total for Annual Grasses		62	0	95	0.52	0	0.59
Total for Perennial Grasses		49	41	46	1.49	1.04	0.37
Total for Grasses		111	41	141	2.01	1.04	0.97
F	Artemisia dracunculus	2	-	-	.06	-	-
F	Astragalus sp.	56	38	38	1.74	1.62	1.33
F	Castilleja linariaefolia	-	-	4	.03	-	.03
F	Carduus nutans (a)	-	2	-	-	.03	-
F	Chaenactis douglasii	5	-	-	.03	-	-
F	Comandra pallida	$_{b}$88	$_{ab}$64	$_{a}$52	1.35	.52	1.15
F	Cordylanthus parviflorus	5	-	-	.09	-	-
F	Cordylanthus sp. (a)	-	7	-	-	.29	-
F	Descurainia pinnata (a)	$_{b}$16	$_{a}$-	$_{b}$19	.11	-	.04
F	Dithyrea wislizenii (a)	$_{a}$4	$_{a}$-	$_{b}$35	.09	-	.14
F	Draba sp. (a)	13	-	9	.07	-	.02
F	Eriogonum cernuum (a)	$_{b}$11	$_{a}$-	$_{a}$-	.12	-	-
F	Euphorbia sp.	$_{b}$14	$_{a}$-	$_{a}$-	.02	-	-
F	Gilia sp. (a)	1	6	-	.03	.02	-
F	Lappula occidentalis (a)	$_{a}$-	$_{a}$-	$_{b}$55	.00	-	.16
F	Machaeranthera canescens	$_{a}$-	$_{a}$-	$_{b}$28	-	-	.11
F	Oenothera albicaulis (a)	$_{b}$18	$_{a}$-	$_{a}$-	.60	-	-
F	Oenothera pallida	$_{c}$155	$_{b}$42	$_{a}$-	6.51	.45	-
F	Penstemon sp.	-	4	-	-	.03	-
F	Phlox longifolia	2	-	-	.00	-	-
F	Sphaeralcea parvifolia	$_{b}$11	$_{a}$-	$_{b}$10	.21	-	.03
Total for Annual Forbs		63	15	118	1.03	0.34	0.36
Total for Perennial Forbs		338	148	132	10.07	2.64	2.66
Total for Forbs		401	163	250	11.11	2.99	3.02

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

BROWSE TRENDS --
Management unit 29R, Study no: 2

Type	Species	Strip Frequency			Average Cover %		
		'98	'03	'08	'98	'03	'08
B	Artemisia filifolia	3	2	1	.93	.78	.63
B	Artemisia tridentata tridentata	47	26	36	4.79	2.14	1.91
B	Chrysothamnus nauseosus hololeucus	0	1	1	-	.00	.00
B	Ephedra viridis	23	24	19	8.32	11.07	9.48
B	Eriogonum nummulare	1	2	2	.03	.15	.06
B	Juniperus osteosperma	1	1	1	5.21	6.52	2.42
B	Opuntia sp.	2	2	2	.00	.06	.00
B	Pediocactus simpsonii	0	0	0	-	.15	-
B	Purshia tridentata	2	1	1	.66	.53	.76
B	Yucca sp.	2	3	2	.15	.41	.00
Total for Browse		81	62	65	20.11	21.83	15.27

CANOPY COVER, LINE INTERCEPT --
Management unit 29R, Study no: 2

Species	Percent Cover		
	'98	'03	'08
Artemisia filifolia	-	.61	1.04
Artemisia tridentata tridentata	-	.95	5.03
Ephedra viridis	-	16.64	15.86
Eriogonum nummulare	-	-	.11
Juniperus osteosperma	4.80	14.00	9.83
Purshia tridentata	-	1.18	.76
Yucca sp.	-	.45	.63

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 29R, Study no: 2

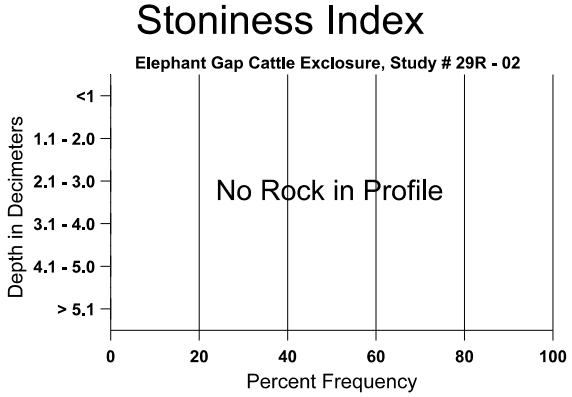
Species	Average leader growth (in)	
	'03	'08
Artemisia tridentata tridentata	2.2	2.1
Purshia tridentata	5.1	3.5

BASIC COVER --
Management unit 29R, Study no: 2

Cover Type	Average Cover %		
	'98	'03	'08
Vegetation	37.53	25.90	19.55
Rock	.00	.00	.01
Pavement	.08	0	.02
Litter	42.49	42.98	58.50
Cryptogams	13.53	7.22	3.94
Bare Ground	34.80	40.44	34.67

SOIL ANALYSIS DATA --
Management unit 29R, Study no: 2, Study Name: Elephant Gap Livestock Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	sand			%0M	PPM P	PPM K	ds/m
			%sand	%silt	%clay				
25.7	70.8 (17.7)	5.5	90.7	2.7	6.6	0.6	3.8	3.2	0.8



PELLET GROUP DATA --
Management unit 29R, Study no: 2

Type	Quadrat Frequency		
	'98	'03	'08
Rabbit	-	7	74
Deer	47	29	61

Days use per acre (ha)		
'98	'03	'08
-	-	-
96 (237)	102 (251)	43 (106)

BROWSE CHARACTERISTICS --
Management unit 29R, Study no: 2

		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 filifolia												
98	**60**	-	-	20	40	-	0	0	67	33	33	47/51
03	**40**	-	-	20	20	-	50	0	50	-	0	43/47
08	**60**	-	40	20	-	-	0	0	0	-	0	59/69
Artemisia tridentata tridentata												
98	**1180**	60	80	560	540	1060	15	0	46	22	24	37/38
03	**740**	-	-	40	700	1480	35	46	95	57	57	26/24
08	**820**	-	80	280	460	1640	5	0	56	41	46	27/25
Chrysothamnus nauseosus hololeucus												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**20**	-	-	20	-	-	100	0	-	-	0	37/50
08	**20**	-	20	-	-	-	0	0	-	-	0	33/57
Echinocereus sp.												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	31/23
08	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Ephedra viridis												
98	**1060**	280	560	480	20	40	0	0	2	-	0	52/81
03	**900**	-	100	600	200	20	4	0	22	7	7	43/63
08	**1160**	-	240	500	420	40	26	0	36	-	0	47/69
Eriogonum nummulare												
98	**20**	-	-	20	-	-	0	0	0	-	0	26/35
03	**40**	-	-	40	-	-	0	0	0	-	0	14/19
08	**40**	-	-	20	20	-	0	0	50	-	0	27/44
Juniperus osteosperma												
98	**20**	-	-	20	-	-	0	0	0	-	0	-/-
03	**20**	-	-	20	-	-	0	0	0	-	0	-/-
08	**20**	-	-	-	20	-	0	0	100	-	0	-/-
Opuntia sp.												
98	**40**	-	-	40	-	-	0	0	0	-	0	4/9
03	**40**	-	-	20	20	-	0	0	50	-	50	4/11
08	**60**	-	20	20	20	-	0	0	33	-	0	4/12

		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												
98	**60**	-	40	20	-	-	0	0	0	-	0	36/44
03	**20**	-	-	20	-	-	0	100	0	-	0	48/61
08	**20**	-	-	-	20	-	0	100	100	-	0	33/67
Tetradymia canescens												
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	35/35
08	**0**	-	-	-	-	-	0	0	-	-	0	39/62
Yucca sp.												
98	**100**	-	20	80	-	-	0	0	-	-	0	24/17
03	**100**	-	-	100	-	40	0	0	-	-	0	28/28
08	**60**	-	20	40	-	80	0	0	-	-	0	10/9