Trend Study 17-19-07

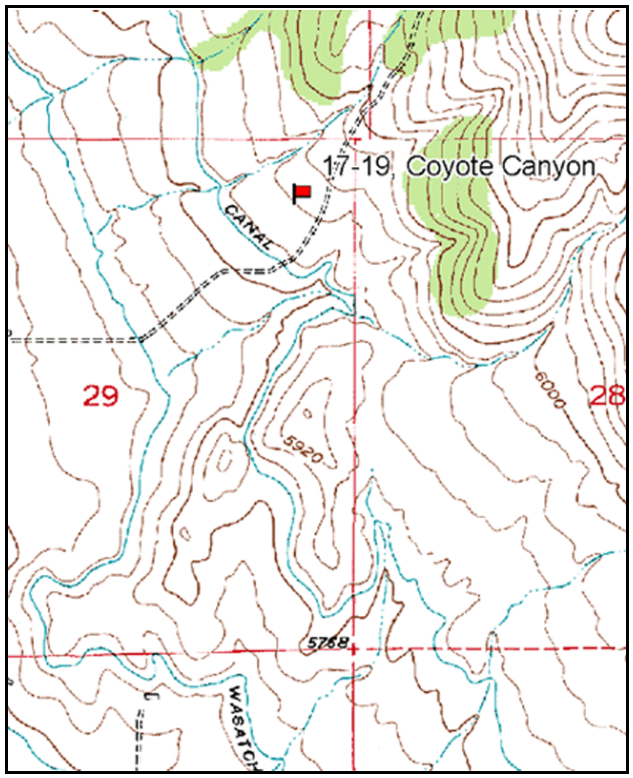
Study site name: Coyote Canyon . Vegetation type: Big Sagebrush .

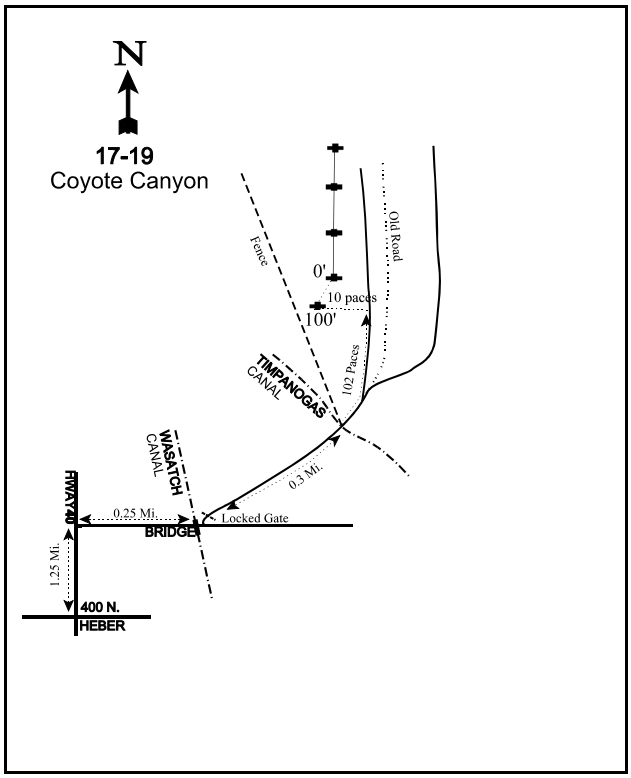
Compass bearing: frequency baseline 187 degrees magnetic.

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

LOCATION DESCRIPTION

From 400 North and Highway 40 (Main) in Heber, travel north for 1.25 miles and turn right onto a paved road. Proceed east for 0.25 miles to a left turn just past the Wasatch Canal (will need a key or combination to pass thru locked gate). Follow this road 0.3 miles to a fork immediately past Timpanogos Canal (locked gate with two combo locks). From the canal, take a left and walk 102 paces up the road. From this point, walk 10 paces west from the edge of the road to the 100-foot baseline stake. The 0-foot baseline stake is marked by a red browse tag. The baseline runs 187 degrees magnetic. The rest of the baseline runs off the 0-foot baseline stake in a direction of 345 degrees magnetic.





Map Name: Heber

Township 3S , Range 5E , Section 29

Diagrammatic Sketch

GPS: NAD 83, UTM 12T 466328 E 4487184 N

DISCUSSION

Coyote Canyon - Trend Study No. 17-19

Study Information

Prior to 2002, this study was known as Northeast of Heber. It is located on the northeast side of the Heber Valley [elevation: 5,900 feet (1,798 m), slope: 6%, aspect: south to southwest). In 1996, the 100 foot stake had to be moved approximately 25 feet (7.6 m) to the west to avoid sampling on a newly built road. Some seeded grasses and forbs, which were planted along the road, occur in several of the belts. It was also noted in 1996 that new homes had been built approximately 1000 feet (305 m) to the south and west. The nearest source of perennial water is Timpanogos Canal, 600 feet (183 m) to the southwest. From the pellet group transect, there were 166 deer days use/acre (410 ddu/ha) in 2002 and 47 deer days use/acre (116 ddu/ha) in 2007. Elk use was estimated at 21 days use/acre (53 edu/ha) in 2002 and 55 days use/acre (136 edu/ha) in 2007. Sheep use in 2002 was estimated at 21 days use/acre (51 sdu/ha). There was 1 horse day use/acre (3 hdu/ha) in 2007. Part of a deer skeleton was observed near the baseline in 2007.

Soil

This study is located within the Bezzant soil series, which consists of very deep, well-drained, moderately permeable soils. These soils formed in alluvium, colluvium, and residuum from mixed sedimentary rocks. The soil is classified as loamy-skeletal, mixed, superactive, frigid Typic Calcixerolls (USDA-NRCS 2007). Specifically at the study, the soil texture is a sandy clay loam with a slightly acidic reactivity (pH of 6.4). The relative bare ground cover has ranged from a low of 10% in 1996 to a high of 28% in 2002. Between 25% 50% of the surface litter has been recently translocated and redeposited against shrubs, and 5% to 10% of an onsite gully is actively eroding. As a result, the erosion condition was classified as slight in 2002 and 2007.

Browse

Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant browse species. Sagebrush canopy cover decreased from 22% in 2002 to 14% in 2007. The density was estimated at 6,866 plants/acre (16,995 plants/ha) in 1984, and decreased to 3,820 plants/acre (9,455 plants/ha) in 1996. The density increased to 4,180 plants/acre (10,347 plants/ha) in 2002, and decreased to3,240 plants/acre (8,020 plants/ha) in 2007. Seedling plants were sampled in 1996 and 2007 at a density of 400 seedlings/acre (990 seedlings/ha). Young plants were not sampled in 1984, but accounted for 18% of the population in 1996, and 8% in 2002 and 2007. Decadence is high, ranging from 22% to 42% of the population, and was highest in 1984 and 2002 when the population was largest. Since 1996, the density of dead plants has ranged from 1,160 plants/acre (2,870 plants/ha) to 1,580 plants/acre (3,910 plants/ha). Between 2% and 23% of the plants have exhibited poor vigor, and most of those have been classified as dying since 1996. The sagebrush defoliator moth (*Aroga websteri*) had infected half of the population in 2007. However, moth infestations elsewhere have been episodic, and infested populations may recover (Hsiao 1986). The average annual leader growth was 2.4 inches (6.1 cm) in 2002 and 1.5 inches (3.9 cm) in 2007. Browse use has varied from light-moderate to moderate-heavy, and was heaviest in 2002.

Other shrubs that are present, but less dominant, include rubber rabbitbrush (*Chrysothamnus nauseosus*), pricklypear cactus (*Opuntia* sp.), and antelope bitterbrush (*Purshia tridentata*). The bitterbrush population is comprised mostly of mature plants, and the density has been 80 plants/acre (200 plants/ha) since 1996. Browse use on bitterbrush has been moderate and heavy.

Herbaceous Understory

The herbaceous understory largely consists of annual species. Annual grass cover was 21% in 1996, 3% in 2002, and 20% in 2007. Although it was not recorded until 1996, cheatgrass (*Bromus tectorum*) has dominated the understory since 1984. Cheatgrass was sampled in every quadrat in 1996 and 2007. Perennial grass cover has averaged 2% cover since 1996. They are sparsely scattered throughout the study with most

being found beneath sagebrush plants or along the nearby road. Crested wheatgrass (*Agropyron cristatum)* and bottlebrush squirreltail (*Sitanion hystrix*) are the most common perennial species.

The forb component is dominated by weedy species and comprises a very little ground cover. Annual species account for more cover than perennial species. Annual forb cover has averaged 2%, and perennial forb cover has been 1% or less since 1996. Pale alyssum (*Alyssum alyssoides*) is the most abundant species.

1996 TREND ASSESSMENT

The browse trend is slightly down. Although the density of sagebrush decreased 44%, the decrease was partly attributed to the larger area sampled. The browse trend was determined from other parameters. For example, the density of seedlings increased from 0 to 400 seedlings/acre (990 seedlings/ha), and young plants increased from 0 to 680 plants/acre (1,685 plants/ha). In addition to the increase in reproduction and recruitment, decadence decreased from 42% to 22% of the population. Although 1,440 dead plants/acre (3,565 plants/ha) were sampled, it is not known if this is an increase or a decrease from 1984 because data on dead plants were not collected in 1984. The proportion of plants exhibiting poor vigor decreased from 9% to 2%, and browse use remained light-moderate. The grass trend is stable. Although the sum of nested frequency of perennial grasses increased 54%, they occurred at a very low frequency. Cheatgrass was sampled in 100% of the quadrats. The forb trend is slightly up. The sum of nested frequency of perennial forbs increased approximately eight-fold, but forb frequency remained low. The trend was determined to be slightly up because the number of perennial species increased from one to seven. Lewis flax (*Linum lewisii*) was the most abundant perennial forb, and was sampled in 11 quadrats. The Desirable Components Index (DCI) score was poor. The high browse cover was countered by the low perennial grass and forb cover, and high annual grass cover.

winter range condition (DCI) - very poor (30) Mid-level potential scale
browse - slightly down (-1) grass - stable (0) forb - slightly up (+1)

2002 TREND ASSESSMENT

The browse trend is slightly down. The cover of mountain big sagebrush was stable, and sagebrush density increased 9%. However, all other parameters indicate that the population was in decline. No seedling plants were sampled, and young plants decreased from 18% to 8% of the population. Decadence increased to 38%, and 16% of the population was classified as dying. The density of dead plants increased 10% to 1,580 plants/acre (3,910 plants/ha). Plants with poor vigor increased from 2% to 23% of the population. Browse use shifted from light-moderate to moderate-heavy, with 48% of the plants exhibiting heavy use. The grass trend is slightly up. The sum of nested frequency of perennial grasses increased 30%, but they remained infrequent. There was a significant increase in the nested frequency of crested wheatgrass, and a significant decrease in that of cheatgrass. Cheatgrass cover decreased from 21% to 3%, but quadrat frequency only decreased from 100% to 89%. Domestic sheep had grazed most of the crested wheatgrass plants. The forb trend is slightly down. The sum of nested frequency of perennial forbs decreased 67%, but again, perennial forbs were a small component of the vegetation community. The DCI score improved to very poor-poor due to an increase in browse cover and a decrease in the annual grass cover.

winter range condition (DCI) - very poor-poor (35) Mid-level potential scale
browse - slightly down (-1) grass - slightly up (+1) forb - slightly down (-1)

2007 TREND ASSESSMENT

The browse trend is down. Sagebrush cover decreased from 20% to 12% of the total ground cover, and the density decreased 22%. Seedling plants were sampled again at a density of 400 plants/acre (990 plants/ha). Even though the density of young plants decreased, the young age class still comprised 8% of the population. Decadence decreased to 31%, and dying plants decreased to 9% of the population. The density of dead plants decreased to 1,160 plants/acre (2,870 plants/ha). Half of the population was infested by the sagebrush

defoliator moth (*Aroga websteri*). Browse use shifted once again to light-moderate, and 16% of the plants exhibited heavy use. The grass trend is slightly down. The sum of nested frequency of perennial grasses decreased 13%. Cheatgrass increased significantly in nested frequency, and its average cover increased from 3% to 20%. All of the perennial species exhibited heavy grazing use. The forb trend is stable. The sum of nested frequency of perennial forbs increased more than two-fold, but perennial forbs remain a very small vegetative component. Pale alyssum increased significantly in nested frequency and comprised 75% of the total forb cover. The DCI score decreased to very poor due to the decrease in browse cover and increase in annual grass cover.

winter range condition (DCI) - very poor (15) Mid-level potential scale
browse - down (-2) grass - slightly down (-1) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 17 , Study no: 19

Type	Species	Nested Frequency				Average Cover %		
		'84	'96	'02	'07	'96	'02	'07
G	Agropyron cristatum	-	a24	b40	ab32	1.26	1.95	1.17
G	Agropyron intermedium	-	a-	b6	ab3	.06	.04	.03
G	Agropyron spicatum	a8	a7	-	-	.06	-	-
G	Bromus japonicus (a)	-	a2	a8	-	.00	.04	-
G	Bromus tectorum (a)	-	c368	a236	b353	21.32	2.78	19.87
G	Oryzopsis hymenoides	-	-	-	2	.03	-	.03
G	Poa secunda	-	-	-	12	-	-	.07
G	Sitanion hystrix	a33	a31	a32	a21	.66	.17	.47
G	Stipa comata	-	a1	a4	a1	.03	.03	.03
Total for Annual Grasses		0	370	244	353	21.33	2.82	19.87
Total for Perennial Grasses		41	63	82	71	2.12	2.21	1.81
Total for Grasses		41	433	326	424	23.45	5.03	21.69
F	Agoseris glauca	-	6	-	-	.01	-	-
F	Allium acuminatum	a6	a11	a6	-	.03	.01	-
F	Alyssum alyssoides (a)	-	a92	b133	c314	.81	.64	3.16
F	Allium sp.	-	-	-	16	-	-	.06
F	Calochortus nuttallii	-	-	-	3	-	-	.00
F	Collomia linearis (a)	-	a13	-	a36	.04	-	.07
F	Collinsia parviflora (a)	-	a2	a3	b20	.01	.01	.06
F	Epilobium brachycarpum (a)	-	b23	-	a2	.06	-	.00
F	Erodium cicutarium (a)	-	-	-	18	-	-	.25
F	Gayophytum ramosissimum(a)	-	-	b29	a5	-	.09	.01
F	Grindelia squarrosa	-	-	-	10	-	-	.09
F	Hedysarum boreale	-	2	-	-	.00	-	-
F	Holosteum umbellatum (a)	-	-	-	1	-	-	.00

Type	Species	Nested Frequency				Average Cover %		
		'84	'96	'02	'07	'96	'02	'07
F	Lappula occidentalis (a)	-	-	-	1	-	-	.00
F	Lactuca serriola	-	$_{a}$-	-	$_{a}$5	.00	-	.03
F	Linum lewisii	-	25	-	-	.49	-	-
F	Madia glomerata (a)	-	9	-	-	.03	-	-
F	Medicago sativa	-	$_{a}$1	$_{a}$1	-	.03	.00	-
F	Microsteris gracilis (a)	-	$_{ab}$8	$_{a}$7	$_{b}$19	.02	.01	.07
F	Orthocarpus sp. (a)	-	38	-	-	1.05	-	-
F	Phlox longifolia	-	$_{a}$5	$_{a}$4	$_{a}$2	.02	.01	.00
F	Polygonum douglasii (a)	-	$_{b}$46	$_{a}$5	$_{a}$8	.09	.01	.01
F	Ranunculus testiculatus (a)	-	-	$_{a}$1	$_{b}$15	-	.00	.10
F	Schoencrambe linifolia	-	-	3	-	-	.00	-
F	Sisymbrium altissimum (a)	-	-	4	-	-	.01	-
F	Sphaeralcea coccinea	-	-	-	1	-	-	.00
F	Tragopogon dubius	-	$_{a}$2	$_{a}$3	$_{a}$3	.01	.00	.00
F	Trifolium sp.	-	-	-	2	-	-	.00
Total for Annual Forbs		0	231	182	439	2.12	0.78	3.77
Total for Perennial Forbs		6	52	17	42	0.60	0.03	0.22
Total for Forbs		6	283	199	481	2.73	0.82	3.99

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

BROWSE TRENDS --
Management unit 17 , Study no: 19

Type	Species	Strip Frequency			Average Cover %		
		'96	'02	'07	'96	'02	'07
B	Artemisia tridentata vaseyana	89	88	83	18.38	20.00	11.68
B	Chrysothamnus nauseosus	0	0	2	-	-	.15
B	Opuntia sp.	30	19	16	1.27	.52	.21
B	Purshia tridentata	4	4	4	.21	.30	.53
Total for Browse		123	111	105	19.87	20.82	12.56

CANOPY COVER, LINE INTERCEPT --
Management unit 17 , Study no: 19

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	21.50	14.35
Opuntia sp.	.60	5.41
Purshia tridentata	.11	.18

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 17 , Study no: 19

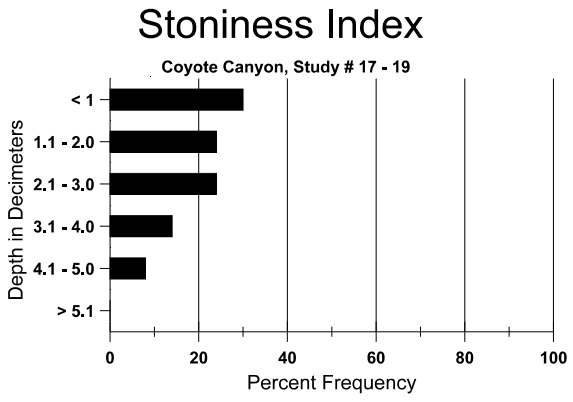
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	2.4	1.5

BASIC COVER --
Management unit 17 , Study no: 19

Cover Type	Average Cover %			
	'84	'96	'02	'07
Vegetation	2.00	39.08	25.59	39.96
Rock	6.25	8.19	8.55	9.02
Pavement	3.50	.35	.54	.65
Litter	71.00	56.29	48.02	41.11
Cryptogams	1.75	.43	.45	.36
Bare Ground	15.50	11.37	32.95	23.32

SOIL ANALYSIS DATA --
Herd Unit 17, Study no: 19, Coyote Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	Sandy clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.7	61.0 (12.7)	6.4	46.2	26.1	27.7	3.6	34.4	160.0	.5



PELLET GROUP DATA --
Management unit 17 , Study no: 19

Type	Quadrat Frequency			Days use per acre (ha)	
	'96	'02	'07	'02	'07
Sheep	-	12	2	21 (51)	-
Rabbit	11	14	21	-	-
Horse	-	-	2	-	-
Elk	5	3	17	21 (53)	55 (136)
Deer	47	58	44	166 (410)	47 (116)
Cattle	-	1	2	-	-

BROWSE CHARACTERISTICS --
Management unit 17 , Study no: 19

		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												
84	**6866**	-	-	4000	2866	-	35	4	42	1	9	26/32
96	**3820**	400	680	2300	840	1440	35	2	22	2	2	23/41
02	**4180**	-	320	2260	1600	1580	20	48	38	16	23	20/31
07	**3240**	400	260	1960	1020	1160	29	16	31	9	9	26/36
Chrysothamnus nauseosus												
84	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**120**	-	60	60	-	20	0	0	-	-	0	11/7
Opuntia sp.												
84	**1133**	-	333	800	-	-	0	0	0	-	0	5/12
96	**1020**	80	80	880	60	40	0	0	6	4	8	5/13
02	**560**	-	20	480	60	-	0	4	11	11	11	6/12
07	**400**	20	-	280	120	-	0	0	30	25	25	6/16
Purshia tridentata												
84	**266**	-	-	133	133	-	50	50	50	-	50	17/22
96	**80**	-	-	60	20	-	100	0	25	-	0	15/31
02	**80**	-	-	60	20	-	0	100	25	-	0	14/41
07	**80**	-	-	80	-	-	0	100	0	-	0	24/37