Trend Study 17-13-07

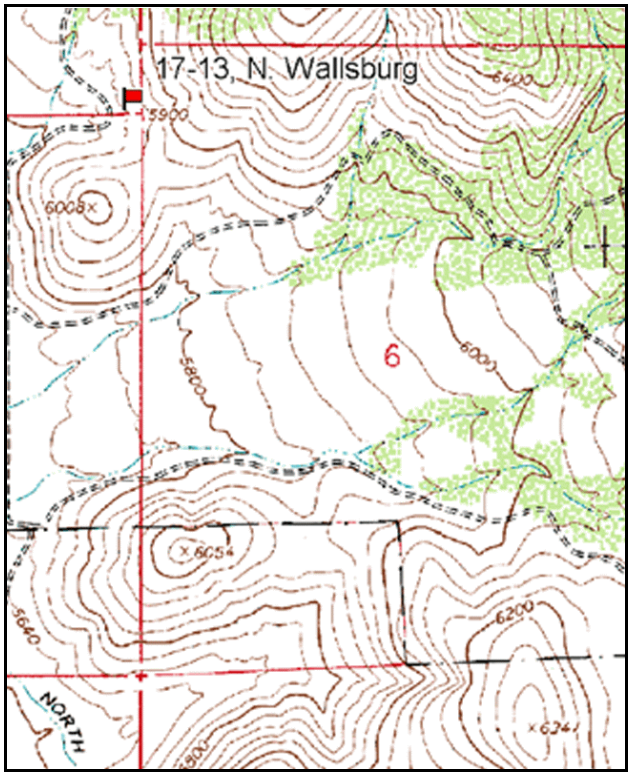
Study site name: North Wallsburg . Vegetation type: Big Sagebrush-Grass .

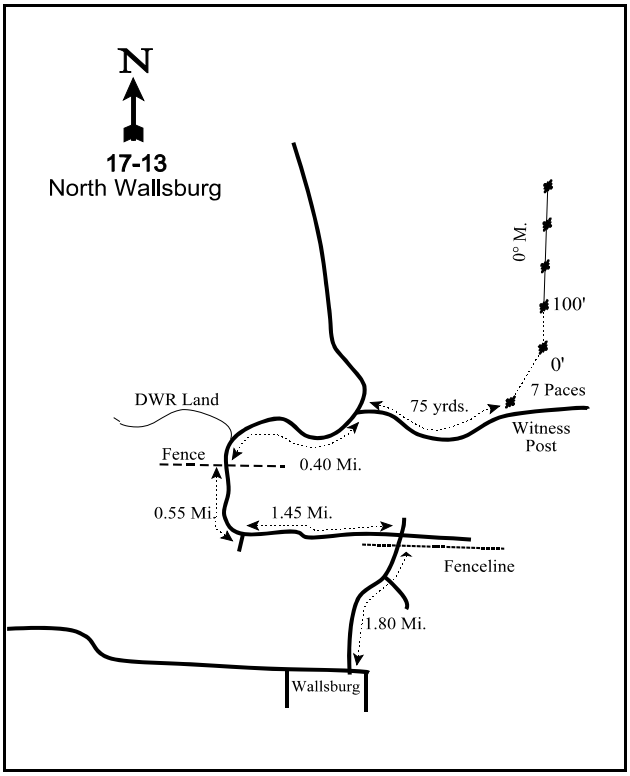
Compass bearing: frequency baseline 0 degrees magnetic.

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

LOCATION DESCRIPTION

Beginning at the town of Wallsburg, proceed northerly for 1.80 miles staying on the main road. At 1.80 miles the road will come to a fence line and a gate, proceed through the gate and turn left. Proceed west for 1.45 miles to where the road bends northward at the DWR fence line. Continue on the same road northward for 0.55 additional miles to a cattle guard. Cross the fence and take the immediate right fork, then proceed 0.40 miles to another fork in the road. Walk 75 yards up the old road to a red steel fencepost and a full high witness post on the left side of the road and stop. From the fencepost, the 0-foot stake of the baseline is 7 paces to the northeast.





Map Name: Charleston

Diagrammatic Sketch

Township 4S , Range 4E , Section 36

GPS: NAD 83, UTM 12T 463193 E 4474484 N

DISCUSSION

North Wallsburg - Trend Study No. 17-13

Study Information

This study is on Division of Wildlife Resources property located north of Wallsburg [elevation: 5,900 feet (1,798 m), slope: 20%, aspect: southwest]. The study site is typical of the sagebrush-grass communities that were prevalent in the Wallsburg area before a series of wildfires that burned much of the area in the 1960s and 1970s. There is an ephemeral stream 700 feet (213 m) to the west, and a group of stock ponds approximately 1 mile (1.6 km) to the southwest. The area reportedly receives heavy deer and light-moderate elk use in winter. From the pellet group transect, there were an estimated 147 deer days use/acre (364 ddu/ha) in 2002 and 87 deer days use/acre (215 ddu/ha) in 2007. Elk use was estimated at 9 days use/acre (21 edu/ha) in 2002 and increased to 38 days use/acre (93 edu/ha) in 2007. Numerous winter-killed fawns were found in 1989, and there were scattered bones near the baseline in 2007.

Soil

The soil is classified in the Wallsburg series and consists of shallow, well-drained, moderately-slowly permeable soils that formed in residuum and colluvium from limestone, sandstone and shale. The Wallsburg series is classified as clayey-skeletal, smectitic, frigid Lithic Argixerolls (USDA-NRCS 2007). Specifically at the study, the soil texture is a sandy clay loam and reactivity is neutral (pH of 7.1). The soil is moderately deep with some rocks on the surface and in the profile. The relative vegetation cover has increased from 40% in 1996 to 48% in 2007. Relative litter cover has decreased from 41% in 1996 to 34% in 2007. There was evidence of soil erosion when the study was established, but the erosion condition was classified as stable in 2002. In 2007, there was an increase in soil movement, resulting in an increase in the erosion condition to slight.

Browse

Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant browse species. Sagebrush canopy cover was 16% in 2002, and increased to 18% in 2007. The density of sagebrush was initially estimated at 2,866 plants/acre (7,094 plants/ha) in 1983, and decreased to 1,732 plants/acre (4,287 plants/ha) in 1989. During the next two sample years, the density increased and was 2,540 plants/acre (6,287 plants/ha) in 2002. In 2007, the density had decreased to 1,780 plants/acre (4,405 plants/ha). The number of seedling and young plants have been moderately low in all sample years except in 1996 when 16% of the population consisted of young plants. Decadent plants have accounted for 26% of the population or greater in all sample years, and was highest in 1989 at 69%. Dead plants were not sampled in 1983 or 1989, but have ranged in density from 880 plants/acre (2,178 plants/ha) to 1,180 plants/acre (2,921 plants/ha) since 1996. Plant vigor has been mostly good, and only 8%-16% of the population has exhibited poor vigor. The average annual leader growth was 1.2 inches (3.0 cm) in 2002 and 1.6 inches (4.0 cm) in 2007. Browse use has ranged from light-moderate to moderate.

White rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*), broom snakeweed (*Gutierrezia sarothrae*), and pricklypear cactus (*Opuntia* sp.) are also present. White rubber rabbitbrush were first sampled in 1996 when the baseline was extended and a larger area was sampled. The density of snakeweed has varied from a low of 399 plants/acre (988 plants/ha) in 1983 to a high of 4,500 plants/acre (11,140 plants/ha) in 1996, and the variation appears to be partly the result of drought periods. The pricklypear density has been steadily decreased from 799 plants/acre (1,978 plants/ha) in 1989 to 260 plants/acre (644 plants/ha) in 2007.

Herbaceous Understory

Perennial grass cover was 12% in 1996, 27% in 2002, and 28% in 2007. Grasses account for approximately two-thirds of the total vegetation cover. The grass component consists primarily of two less desirable species,

cheatgrass (*Bromus tectorum*) and bulbous bluegrass (*Poa bulbosa*). Bulbous bluegrass is a short-lived perennial that has a similar phenology to cheatgrass (Stewart and Hull 1949). Collectively, the cover of these two species increased from 24% in 1996 to 28% in 2002, and 33% in 2007. The quadrat frequency of bulbous bluegrass has steadily increased from 2% in 1983 to 86% in 2007. Cheatgrass quadrat frequency peaked at 96% in 2007. Other perennial species that have been present, but much less frequent, include four species of wheatgrass (*Agropyron* sp.), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread grass (*Stipa comata*).

Forbs, especially perennial species, have been a small component in all years. Collectively, the cover of annual and perennial forbs has averaged 1% since 1996. Frequency of perennial forbs was highest in 1989, and segolily (*Calochortus nuttallii*) was the dominant species. Since being included in 1996, annuals have been more frequent and provide more cover than perennial species. Pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*) have been the most dominant.

1989 TREND ASSESSMENT

The browse trend is down. The density of mountain big sagebrush decreased 40%. Decadence increased from 26% to 69% of the population. The proportion of plants exhibiting poor vigor decreased from 16% to 12%, and only 3% of the population was classified as dying. The average crown width decreased from 45 inches (114 cm) to 22 inches (59 cm). The decrease in density and average crown width, and the increase in decadence were attributed to lower than normal precipitation (Utah Climate Summaries 2007). The grass trend is slightly up. Excluding bulbous bluegrass, the sum of nested frequency of perennial species increased nearly four-fold, and there were significant increases in western wheatgrass (*Agropyron smithii*) and Sandberg bluegrass. However, there was also a significant increase in bulbous bluegrass. The grass trend was only slightly up because of the increase in bulbous bluegrass, and the low frequency of the other perennial species. The forb trend is up. The sum of nested frequency of perennial forbs increased four-fold, including a significant increase in segolily.

browse - down (-2) grass - slightly up (+1) forb - up (+2)

1996 TREND ASSESSMENT

The browse trend is up. The density of sagebrush increased 29%. Some of the change in density was attributed to the larger area sampled, so other parameters were emphasized in determining trend. For example, seedling plants were sampled for the first time, and the young age class increased from 4% of the population to 16%. Additionally, decadence declined to from 69% of the population to 31%. Dead plants were sampled at a density of 880 plants/acre (2,178 plants/ha). It is probable that dead plants were present, but not sampled, prior to 1996. Thus, it is difficult to determine a trend in the number of dead plants. Plants with poor vigor decreased to 8% of the population. Browse use shifted from moderate to light-moderate. The grass trend is slightly up. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses increased two-fold, and there was a significant increase in the nested frequency of Sandberg bluegrass. Conversely, there was also a significant increase in bulbous bluegrass. While it was not reported prior to 1996, cheatgrass was sampled in 88% of the quadrats. The forb trend is down. The sum of nested frequency of perennial forbs decreased 70%, and there was a change in species composition. Segolily and longleaf phlox (*Phlox longifolia*) had been the dominant forbs in 1989, yet neither species was sampled in 1996. Instead, the most frequent forbs were pale alyssum and storksbill. The Desirable Components Index score (DCI) was very poor due to the moderate-low browse cover, high browse decadence, low perennial grass and forb cover, and high annual grass cover.

winter range condition (DCI) - very poor (25) Mid-level potential scale
browse - up (+2) grass - slightly up (+1) forb - down (-2)

2002 TREND ASSESSMENT

The browse trend is stable. The density of sagebrush increased 13%, which was the only positive change in the population. No seedling plants were sampled, and young plants decreased to 5% of the population. Decadence increased to 33% of the population, and dying plants increased to 11%. The density of dead plants increased to 1,180 plants/acre (2,921 plants/ha). Browse use remained predominantly light-moderate, though there was an increase in the percentage of plants showing heavy browse use. The grass trend is stable. Excluding bulbous bluegrass, which increased significantly in nested frequency, the sum of nested frequency of perennial grasses decreased 3%. Despite the increase in bulbous bluegrass, trend was stable because the nested frequency of cheatgrass significantly decreased. Additionally, three perennial grasses, crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Agropyron intermedium*), and needle-and-thread grass were sampled for the first time. The forb trend is slightly down. The sum of nested frequency of perennial forbs decreased 73%, and forbs remained a very minor component of the vegetation community. Perennial forbs were only sampled in 6% of the quadrats. The DCI score remained very poor.

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

2007 TREND ASSESSMENT

The browse trend is down. The density of sagebrush decreased 30%. No seedlings were sampled, and the young age class decreased to 2% of the population. Decadence increased to 42%, and dying plants increased to 15% of the population. The density of dead plants decreased slightly to 1,060 plants/acre (2,624 plants/ha). More than half of the sampled population was infested with the sagebrush defoliator moth (*Aroga websteri*). Browse use remained light-moderate, and there was a decrease in the percentage of plants with heavy browse use. The grass trend is down. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses decreased 20%. There were significant increases in the nested frequencies of both cheatgrass and bulbous bluegrass. The quadrat frequency of cheatgrass increased from 67% to 96%, and cover increased from 5% to 9%. The forb trend is stable. The sum of nested frequency of perennial forbs increased 85%, but forbs remained a very minor component of the vegetation community. The DCI score remained very poor.

winter range condition (DCI) - very poor (19) Mid-level potential scale
browse - down (-2) grass - down (-2) forb - stable (0)

HERBACEOUS TRENDS --
Management unit 17 , Study no: 13

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'96	'02	'07	'96	'02	'07
G	Agropyron cristatum	-	-	-	a2	a3	-	.03	.30
G	Agropyron intermedium	-	-	-	a10	a6	-	.68	.15
G	Agropyron smithii	a10	b14	-	-	-	-	-	-
G	Agropyron spicatum	-	-	-	-	1	-	-	.00
G	Bromus tectorum (a)	-	-	b303	a200	b305	16.14	5.23	9.12
G	Oryzopsis hymenoides	a10	a13	a6	a17	a5	.36	.74	.21

Type	Species	Nested Frequency					Average Cover %		
		'83	'89	'96	'02	'07	'96	'02	'07
G	Poa bulbosa	$_{a}$5	$_{b}$69	$_{c}$157	$_{d}$285	$_{d}$299	7.55	22.75	23.93
G	Poa secunda	$_{a}$2	$_{b}$53	$_{c}$166	$_{c}$140	$_{c}$123	3.73	2.66	3.52
G	Sitanion hystrix	-	-	$_{a}$9	$_{a}$3	-	.19	.03	-
G	Stipa comata	-	-	-	$_{a}$4	$_{a}$3	-	.18	.00
Total for Annual Grasses		0	0	303	200	305	16.14	5.23	9.12
Total for Perennial Grasses		27	149	338	461	440	11.84	27.09	28.14
Total for Grasses		27	149	641	661	745	27.98	32.32	37.27
F	Agoseris glauca	-	-	4	-	-	.01	-	-
F	Alyssum alyssoides (a)	-	-	$_{b}$101	$_{a}$13	$_{a}$8	.69	.03	.02
F	Arabis sp.	-	$_{a}$3	$_{a}$1	-	-	.03	-	-
F	Astragalus eurekensis	-	-	-	-	-	-	.00	-
F	Astragalus sp.	$_{a}$3	$_{a}$3	-	-	-	-	-	-
F	Astragalus utahensis	$_{a}$3	-	$_{a}$1	$_{a}$4	$_{a}$2	.03	.01	.03
F	Calochortus nuttallii	$_{b}$25	$_{c}$112	-	$_{a}$1	$_{ab}$7	-	.00	.02
F	Descurainia pinnata (a)	-	-	-	-	3	-	-	.00
F	Draba sp. (a)	-	-	-	-	28	-	-	.10
F	Epilobium brachycarpum (a)	-	-	9	-	-	.02	-	-
F	Erodium cicutarium (a)	-	-	$_{ab}$49	$_{a}$28	$_{b}$64	.23	.08	.90
F	Erigeron sp.	-	-	6	-	-	.04	-	.00
F	Eriogonum racemosum	$_{a}$2	$_{a}$6	$_{a}$5	$_{a}$3	$_{a}$3	.01	.00	.03
F	Helianthus annuus (a)	-	-	-	2	-	-	.00	-
F	Holosteum umbellatum (a)	-	-	-	$_{a}$34	$_{a}$49	-	.11	.37
F	Machaeranthera canescens	2	-	-	-	-	-	-	-
F	Phlox longifolia	-	$_{b}$21	-	$_{a}$5	$_{ab}$8	-	.01	.02
F	Polygonum douglasii (a)	-	-	4	-	-	.01	-	-
F	Sisymbrium altissimum (a)	-	-	-	$_{b}$5	$_{a}$-	-	.01	.00
F	Tragopogon dubius	$_{a}$1	$_{a}$6	$_{b}$31	-	$_{a}$1	.17	-	.00
F	Zigadenus paniculatus	$_{a}$2	$_{b}$9	-	-	$_{a}$3	-	-	.03
Total for Annual Forbs		0	0	163	82	152	0.95	0.25	1.40
Total for Perennial Forbs		38	160	48	13	24	0.29	0.03	0.13
Total for Forbs		38	160	211	95	176	1.25	0.28	1.54

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

BROWSE TRENDS --
Management unit 17 , Study no: 13

Type	Species	Strip Frequency			Average Cover %		
		'96	'02	'07	'96	'02	'07
B	Artemisia tridentata vaseyana	74	71	56	9.16	13.57	11.05
B	Chrysothamnus nauseosus albicaulis	15	14	10	1.79	1.22	.94
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	0	-	-	-
B	Gutierrezia sarothrae	39	14	21	1.99	.10	.15
B	Opuntia sp.	19	15	11	.35	.18	.18
Total for Browse		147	115	98	13.30	15.08	12.32

CANOPY COVER, LINE INTERCEPT --
Management unit 17 , Study no: 13

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	16.06	17.64
Chrysothamnus nauseosus albicaulis	1.16	1.79
Gutierrezia sarothrae	.18	.58
Opuntia sp.	-	.25

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 17 , Study no: 13

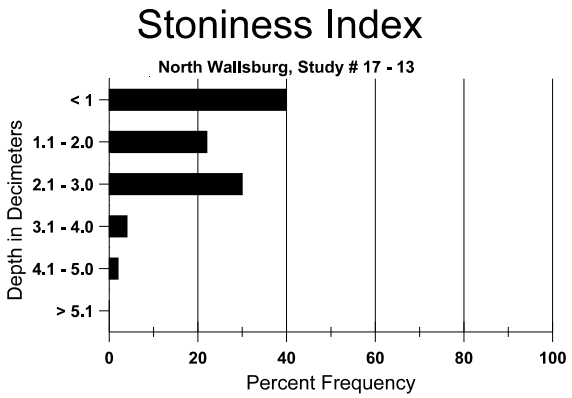
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	1.2	1.6

BASIC COVER --
Management unit 17 , Study no: 13

Cover Type	Average Cover %				
	'83	'89	'96	'02	'07
Vegetation	1.50	4.00	44.31	47.95	54.80
Rock	8.50	8.75	12.07	11.63	11.07
Pavement	3.75	14.00	3.82	4.53	2.47
Litter	64.75	53.25	44.58	41.18	39.22
Cryptogams	3.00	2.00	1.00	.87	.22
Bare Ground	18.50	18.00	4.32	12.44	6.54

SOIL ANALYSIS DATA --
Herd Unit 17, Study no: 13, North Wallsburg

Effective rooting depth (in)	Temp °F (depth)	pH				%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
11.8	50.0 (14.0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A



PELLET GROUP DATA --
Management unit 17 , Study no: 13

Type	Quadrat Frequency		
	'96	'02	'07
Sheep	1	-	-
Rabbit	11	6	2
Elk	12	4	10
Deer	36	47	56

Days use per acre (ha)	
'02	'07
-	-
-	-
9 (21)	38 (93)
147 (364)	87 (215)

BROWSE CHARACTERISTICS --
Management unit 17 , Study no: 13

		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	**2866**	-	200	1933	733	-	16	40	26	-	16	26/45
89	**1732**	-	66	466	1200	-	73	0	69	12	12	22/22
96	**2240**	380	360	1180	700	880	38	8	31	8	8	23/44
02	**2540**	-	120	1580	840	1180	31	30	33	11	11	21/30
07	**1780**	-	40	1000	740	1060	39	13	42	15	15	27/39

		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)
Chrysothamnus nauseosus albicaulis												
83	**0**	-	-	-	-	-	0	0	0	-	0	-/-
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
96	**360**	120	40	240	80	60	11	6	22	11	11	33/50
02	**280**	-	-	60	220	-	0	0	79	29	29	20/22
07	**280**	-	-	60	220	20	0	0	79	36	36	29/32
Chrysothamnus viscidiflorus viscidiflorus												
83	**0**	-	-	-	-	-	0	0	-	-	0	-/-
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
96	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**20**	-	-	20	-	-	0	0	-	-	0	8/11
07	**0**	-	-	-	-	-	0	0	-	-	0	11/16
Gutierrezia sarothrae												
83	**399**	66	133	266	-	-	0	0	0	-	0	11/11
89	**1266**	-	-	1266	-	-	0	0	0	-	0	10/15
96	**4500**	100	520	3980	-	-	0	0	0	-	0	9/13
02	**520**	-	-	400	120	320	0	0	23	8	8	9/8
07	**660**	20	80	540	40	-	0	0	6	-	0	9/9
Opuntia sp.												
83	**466**	-	133	333	-	-	0	0	0	-	0	6/14
89	**799**	-	133	666	-	-	8	0	0	-	0	7/22
96	**420**	-	40	340	40	-	0	0	10	-	0	5/18
02	**380**	-	40	300	40	-	0	0	11	-	0	5/11
07	**260**	-	-	240	20	-	0	0	8	-	8	6/12