Trend Study 17-45-07

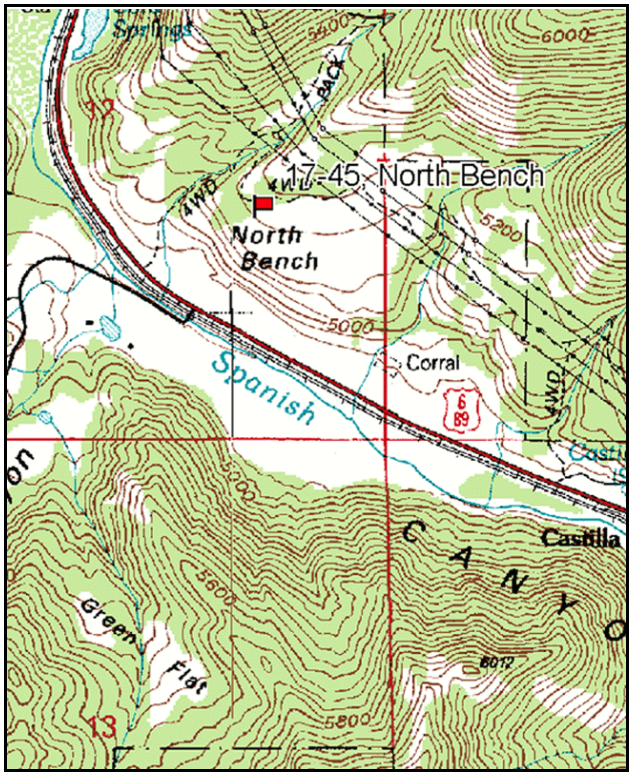
Study site name: North Bench . Vegetation type: Big Sagebrush .

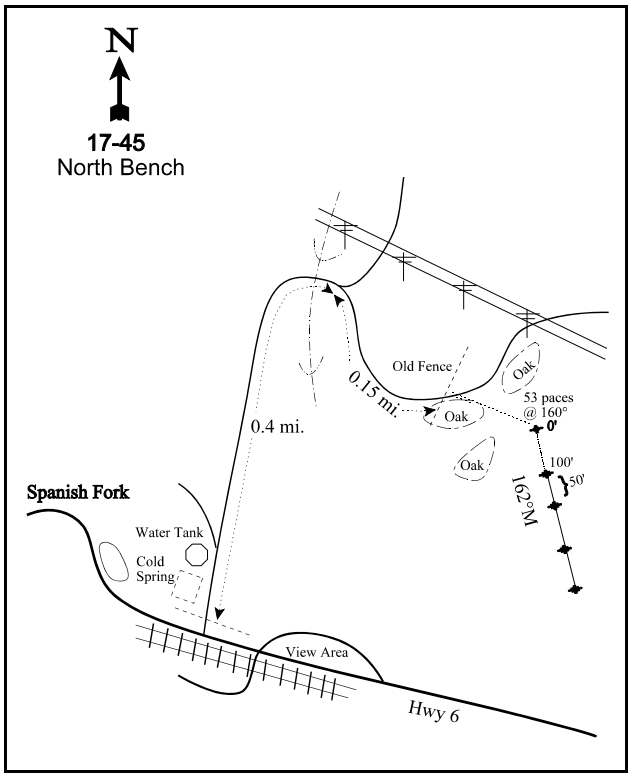
Compass bearing: frequency baseline 162 degrees magnetic.

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

LOCATION DESCRIPTION

From the west side of the view area in lower Spanish Fork Canyon (about 3.5 miles up from the mouth) look for a dirt road going up through a gate and by an old corral. Take this rough road for 0.4 miles to an intersection. Turn right and go 0.15 miles to the top of the bench and an old fence line. From the wood post near the left hand side of the road, walk 53 paces bearing 160 degrees into the sage flat. The first stake marks the 0-foot end of the baseline. The remainder of the study stakes are south at 100 foot intervals.





Map Name: Spanish Fork Peak

Diagrammatic Sketch

Township 9S , Range 3E , Section 12

GPS: NAD 83, UTM 12T 453800 E 4432787 N

DISCUSSION

North Bench - Trend Study No. 17-45

Study Information

This study is located on a 40 acre section of private land in lower Spanish Fork Canyon, and is on the north side of US-6 [elevation: 5,100 feet (1,554 m), slope: 3%-10%, aspect: southwest]. The nearest perennial sources of water are Spanish Fork 0.2 miles (350 m) to the southwest and Cold Springs 0.4 miles (700 m) to the northwest. Spanish Fork is on the opposite side of US-6, but Cold Springs is on the same side, which may make it the primary water source. Deer and elk use has been light in all sample years. From the pellet group transect data, deer use was estimated at 8 days use/acre (20 ddu/ha) in 2002 and 4 days use/acre (10 ddu/ha) in 2007. Elk use was estimated at 4 days use/acre (10 edu/ha) in 2007. Deer and elk pellet groups appear to be from fall and winter use. Cattle use was estimated at 6 days use/acre (14 cdu/ha) in 2002 and 31 days use/acre (77 cdu/ha) in 2007. In 2002, cattle pats were from the previous summer, and in 2007 they were from cattle that were present during sampling. Grasshoppers were abundant in 2002 and some utilization on herbaceous plants was apparent. The slope to the west of the study was being developed when the study was sampled in 2007.

Soil

The soil has a loamy texture with a slightly acidic soil reaction (pH 6.1). Few rocks were encountered in the soil profile, but there is a clay horizon about 10 inches (25 cm) below the soil surface. The soil surface is quite compacted, which has likely been caused by livestock as suggested by the numerous cattle paths crossing the study. Relative vegetation cover increased from 53% in 1997 to 62% in 2002, and decreased to 50% in 2007. Relative bare ground cover decreased from 10% in 1997 to 4% in 2002, and increased to 12% in 2007. The high vegetation cover and gentle slope minimize the erosion potential. The erosion condition was classified as stable in 2002 and 2007.

Browse

Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is the dominant preferred species. Sagebrush canopy cover was 19% in 2007, and it has provided an average 87% of the shrub cover since 1997. The estimated density increased from 2,999 plants/acre (7,423 plants/ha) in 1989 to 5,500 plants/acre (13,614 plants/ha) in 1997, and decreased to 3,380 plants/acre (8,366 plants/ha) by 2007. Seedlings have been present in each sample year, but were most abundant in 1997 at 1,480 seedlings/acre (3,663 seedlings/ha), and least abundant in 2002 at 40 seedlings/acre (99 seedlings/ha). Young plants increased from 2% of the population in 1989 to 56% in 1997, and decreased to 2% by 2007. Decadence was highest in 1989 (58%) and lowest in 1997 (9%). Decadent plants accounted for 14% of the population in 2007. The density of dead plants has decreased from 860 plants/acre (2,129 plants/ha) in 1997 to 400 plants/acre (990 plants/ha) in 2007. Vigor has been good in all sample years. The average annual leader growth was 3.4 inches (8.6 cm) in 2002 and 2.1 inches (5.3 cm) in 2007. Browse use has been light, except in 2007 when it was light-moderate.

Broom snakeweed (*Gutierrezia sarothrae*) is the next dominant shrub species. Canopy cover was 1% in 2007. The density increased from 400 plants/acre (990 plants/ha) in 1989 to 4,800 plants/acre (11,881 plants/ha) in 2002, and decreased to 2,180 plants/acre (5,396 plants/ha) in 2007. Clumps of large, mature Gambel oak (*Quercus gambelii*) occur on the slopes near the bench and dominate the hillsides above, providing escape and thermal cover until leaf drop. There are also scattered white rubber rabbitbrush (*Chrysothamnus nauseosus* ssp. *albicaulis*) and antelope bitterbrush (*Purshia tridentata*) present.

Herbaceous Understory

The herbaceous understory has accounted for the majority of the vegetation cover since 1997. Perennial grass cover was 46% in 1997, 51% in 2002, and 27% in 2007. Bulbous bluegrass is the dominant perennial species, and provided 32% cover in 1997, 33% in 2002, and 12% in 2007. This perennial species has a phenology

similar to that of annual grasses (Stewart and Hull 1949) and may be limiting the establishment of other species, including sagebrush. Other common perennial grass species include crested wheatgrass (*Agropyron cristatum*) and Kentucky bluegrass (*Poa pratensis*). Cheatgrass (*Bromus tectorum*) was sampled in 1997 in 4% of the quadrats, but has not been sampled since.

Perennial forb cover was 12% in 1997, 16% in 2002, and 14% in 2007. Between seven and 17 perennial species have been sampled, many of which are weedy species. The most abundant species is hairy goldaster (*Heterotheca villosa*), which increased in cover from 4% in 1997 to 10% in 2007. Other common perennial species include curlycup gumweed (*Grindelia squarrosa*), silvery lupine (*Lupinus argenteus*), alfalfa (*Medicago sativa*), dandelion (*Taraxacum officinale*), and yellow salsify (*Tragopogon dubius*). Most of these species indicate past excessive grazing. Annual forb cover has been less than 1% since 1997. Two noxious weed species have been sampled, whitetop (*Cardaria draba*) and houndstongue (*Cynoglossum officinale*). Whitetop was sampled only in 2002, and the quadrat frequency of houndstongue has steadily decreased from 27% in 1997 to 1% in 2007.

1997 TREND ASSESSMENT

The browse trend is up. The density of sagebrush increased 83%. However, some of the increase is likely the result of the larger area sampled beginning in 1997. Yet parameters other than density also indicate an up trend. For example, the density of seedling sagebrush plants increased from 266 seedlings/acre (658 seedlings/ha) to 1,480 seedlings/acre (3,663 seedlings/ha), and young plants increased from 2% of the population to 56%. Decadence decreased from 58% of the population to 9%, and vigor remained good. Browse use remained light. The grass trend is down. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses decreased 37%. There was a significant increase in the nested frequency of Kentucky bluegrass. However, there was a significant decrease in the nested frequency of Sandberg bluegrass and a significant increase in that of bulbous bluegrass. Bulbous bluegrass quadrat frequency increased from 55% to 96%. The forb trend is up. Excluding noxious weeds, the sum of nested frequency of perennial forbs increased four-fold, and the number of perennial species sampled increased from seven to 13. There were significant increases in the nested frequencies of low fleabane (*Erigeron pumilus*), curlycup gumweed, and yellow salsify. However, houndstongue was also sampled for the first time. It was sampled in 27% of the quadrats, but accounted for less than 1% cover. The Desirable Components Index (DCI) score was good due to the moderate browse cover, low decadence, high browse recruitment, low annual grass cover, and high perennial grass and forb cover.

winter range condition (DCI) - good (75) Mid-level potential scale
browse - up (+2) grass - down (-2) forb - up (+2)

2002 TREND ASSESSMENT

The browse trend is slightly down. The density of sagebrush decreased 9%. Reproduction and recruitment both decreased. Only 40 seedlings/acre (99 seedlings/ha) were sampled, and young plants decreased to 11% of the population. Decadence increased to 21%, but the density of dead plants decreased from 860 plants/acre (2,128 plants/ha) to 720 plants/acre (1,782 plants/ha). Vigor remained good and browse use remained light. The average crown height and width decreased 17 inches (43 cm) and 19 inches (48 cm), respectively. The grass trend is stable. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses increased 9%. Bulbous bluegrass was sampled in 99% of the quadrats. The forb trend is down. Excluding noxious weeds, the sum of nested frequency of perennial forbs decreased 25%. There were significant decreases in the nested frequencies of thistle (*Cirsium* sp.), annual sunflower (*Helianthus annuus*), dandelion, and yellow salsify. There was a significant increase in hairy goldaster. Whitetop was sampled for the first time and had a quadrat frequency of 12%. However, houndstongue significantly decreased in nested frequency, and quadrat frequency decreased to 11%. The DCI score decreased to fair-good due to a decrease in browse recruitment and an increase in decadence. These changes were somewhat countered by an increase in browse cover.

winter range condition (DCI) - fair-good (67) Mid-level potential scale
browse - slightly down (-1) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is down. The density of sagebrush decreased 32%. The seedling density increased to 380 seedlings/acre (941 seedlings/ha), and the plants had abundant flowering stalks. Young plants decreased to 2% of the population, but decadence decreased to 14%. The density of dead plants decreased to 400 plants/acre (990 plants/ha). Vigor remained good, but browse use shifted to light-moderate. Some of the oak stems surrounding the study had also been browsed. The grass trend is stable. Excluding bulbous bluegrass, the sum of nested frequency of perennial grasses decreased 2%, including a significant decrease in the nested frequency of crested wheatgrass. However, the nested frequency of bulbous bluegrass also decreased significantly, quadrat frequency decreased to 80%, and cover decreased from 33% to 12%. Crested wheatgrass, orchardgrass (*Dactylis glomerata*), and Kentucky bluegrass had all been heavily grazed. The forb trend is slightly up. Excluding noxious weeds, the sum of nested frequency of perennial forbs increased 6%. The nested frequencies of curlycup gumweed, hairy goldaster, and silvery lupine significantly increased. Yellow salsify significantly decreased in nested frequency. Alfalfa, yellow sweetclover (*Melilotus officinalis*), and yellow salsify all had been grazed heavily. Whitetop was not sampled, and houndstongue quadrat frequency decreased to 1%. The DCI score remained fair-good.

winter range condition (DCI) - fair-good (65) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - slightly up (+1)

HERBACEOUS TRENDS --
Management unit 17 , Study no: 45

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	$_{ab}$202	$_{ab}$198	$_{b}$221	$_{a}$176	9.33	12.38	6.34
G	Bromus tectorum (a)	-	14	-	-	.07	-	-
G	Dactylis glomerata	$_{a}$5	$_{a}$12	$_{a}$17	$_{a}$11	.70	.74	.25
G	Poa bulbosa	$_{a}$144	$_{c}$358	$_{c}$368	$_{b}$260	31.65	33.20	12.41
G	Poa pratensis	$_{a}$43	$_{b}$135	$_{bc}$143	$_{c}$185	4.02	4.80	8.17
G	Poa secunda	$_{b}$314	$_{a}$13	$_{a}$9	$_{a}$10	.45	.03	.04
Total for Annual Grasses		0	14	0	0	0.07	0	0
Total for Perennial Grasses		708	716	758	642	46.17	51.15	27.22
Total for Grasses		708	730	758	642	46.24	51.15	27.22
F	Agoseris glauca	-	-	-	1	-	-	.00
F	Antennaria rosea	-	-	-	1	-	-	.03
F	Artemisia ludoviciana	-	$_{a}$3	$_{a}$2	$_{a}$4	.15	.15	.03
F	Aster chilensis	-	$_{a}$4	$_{ab}$6	$_{b}$14	.15	.18	.25
F	Cardaria draba	-	-	29	-	-	.35	-
F	Cirsium sp.	-	$_{b}$25	$_{a}$10	$_{a}$3	.68	.02	.00
F	Collomia linearis (a)	-	-	2	-	-	.00	-
F	Comandra pallida	$_{a}$1	-	$_{b}$8	-	-	.04	-

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
F	Collinsia parviflora (a)	-	2	-	-	.00	-	-
F	Cynoglossum officinale	-	$_{b}$63	$_{a}$19	$_{a}$1	.72	.42	.00
F	Epilobium brachycarpum (a)	-	$_{b}$152	$_{a}$57	$_{a}$34	.40	.20	.11
F	Erigeron pumilus	$_{a}$1	$_{b}$31	-	$_{a}$2	.15	-	.03
F	Grindelia squarrosa	$_{a}$25	$_{c}$80	$_{a}$7	$_{b}$41	1.09	.06	.66
F	Helianthus annuus (a)	$_{b}$35	$_{b}$28	$_{a}$5	$_{a}$2	.25	.01	.03
F	Heterotheca villosa	-	$_{a}$131	$_{b}$193	$_{c}$245	3.53	9.06	9.98
F	Lactuca serriola	$_{a}$6	$_{a}$6	-	$_{a}$3	.01	-	.01
F	Lithospermum sp.	47	-	-	-	-	-	-
F	Lupinus argenteus	-	$_{a}$20	$_{a}$27	$_{b}$46	.95	1.26	2.62
F	Machaeranthera canescens	-	-	-	8	-	-	.04
F	Melilotus officinalis	-	$_{a}$4	$_{a}$1	$_{a}$8	.15	.00	.05
F	Medicago sativa	$_{a}$1	$_{ab}$14	$_{b}$20	$_{ab}$11	.90	1.48	.34
F	Phlox longifolia	-	-	-	5	-	-	.01
F	Polygonum douglasii (a)	-	3	-	-	.00	-	-
F	Taraxacum officinale	-	$_{b}$53	$_{a}$14	$_{a}$5	1.07	.32	.03
F	Tragopogon dubius	$_{a}$61	$_{c}$205	$_{b}$133	$_{a}$61	2.44	2.50	.36
Total for Annual Forbs		35	185	64	36	0.67	0.21	0.15
Total for Perennial Forbs		142	639	469	459	12.02	15.88	14.49
Total for Forbs		177	824	533	495	12.69	16.10	14.64

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

BROWSE TRENDS --
Management unit 17 , Study no: 45

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia tridentata vaseyana	89	85	80	8.82	13.24	12.17
B	Chrysothamnus nauseosus albicaulis	1	0	1	-	-	.03
B	Gutierrezia sarothrae	27	41	43	1.20	2.37	1.57
B	Purshia tridentata	0	0	1	-	-	-
B	Quercus gambelii	0	0	1	-	-	-
Total for Browse		117	126	126	10.02	15.61	13.77

CANOPY COVER, LINE INTERCEPT --
Management unit 17 , Study no: 45

Species	Percent Cover	
	'02	'07
Artemisia tridentata vaseyana	-	18.68
Chrysothamnus nauseosus albicaulis	-	.08
Gutierrezia sarothrae	-	.73

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 17 , Study no: 45

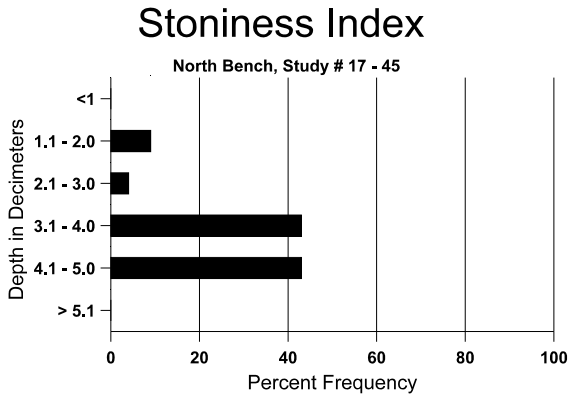
Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	3.4	2.1

BASIC COVER --
Management unit 17 , Study no: 45

Cover Type	Average Cover %			
	'89	'97	'02	'07
Vegetation	24.00	59.20	71.77	56.59
Rock	.75	.10	.02	0
Pavement	1.25	.28	.14	.03
Litter	58.25	39.26	37.77	42.80
Cryptogams	0	.97	.81	.04
Bare Ground	15.75	10.44	5.02	13.96

SOIL ANALYSIS DATA --
Herd Unit 17, Study no: 45, North Bench

Effective rooting depth (in)	Temp °F (depth)	pH	Loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
20.0	44.6 (17.7)	6.1	36.7	36.4	26.8	1.7	27.3	227.2	.4



PELLET GROUP DATA --
Management unit 17 , Study no: 45

Type	Quadrat Frequency		
	'97	'02	'07
Elk	-	1	4
Deer	1	7	4
Cattle	2	5	3

Days use per acre (ha)	
'02	'07
-	4 (10)
8 (20)	4 (10)
6 (14)	31 (77)

BROWSE CHARACTERISTICS --
Management unit 17 , Study no: 45

		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												
89	**2999**	266	66	1200	1733	-	16	0	58	-	4	29/31
97	**5500**	1480	3100	1920	480	860	3	0	9	4	4	36/42
02	**5000**	40	560	3380	1060	720	10	2	21	6	6	19/23
07	**3380**	380	60	2860	460	400	24	7	14	6	6	21/29
Chrysothamnus nauseosus albicaulis												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**20**	-	-	20	-	-	0	0	-	-	0	27/46
02	**0**	-	-	-	-	-	0	0	-	-	0	19/28
07	**40**	-	-	40	-	-	0	0	-	-	0	27/24
Gutierrezia sarothrae												
89	**400**	466	200	200	-	-	0	0	0	-	0	6/8
97	**3400**	1100	1320	2020	60	20	0	0	2	-	0	6/7
02	**4800**	20	200	4220	380	20	.41	0	8	.41	.41	8/8
07	**2180**	20	100	2060	20	-	7	2	1	.91	.91	9/10
Purshia tridentata												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	-	20	-	-	0	0	-	-	0	-/-
Quercus gambelii												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**20**	-	20	-	-	-	0	0	-	-	0	33/28

		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)
Symphoricarpos oreophilus												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	14/16