Trend Study 16B-6-07

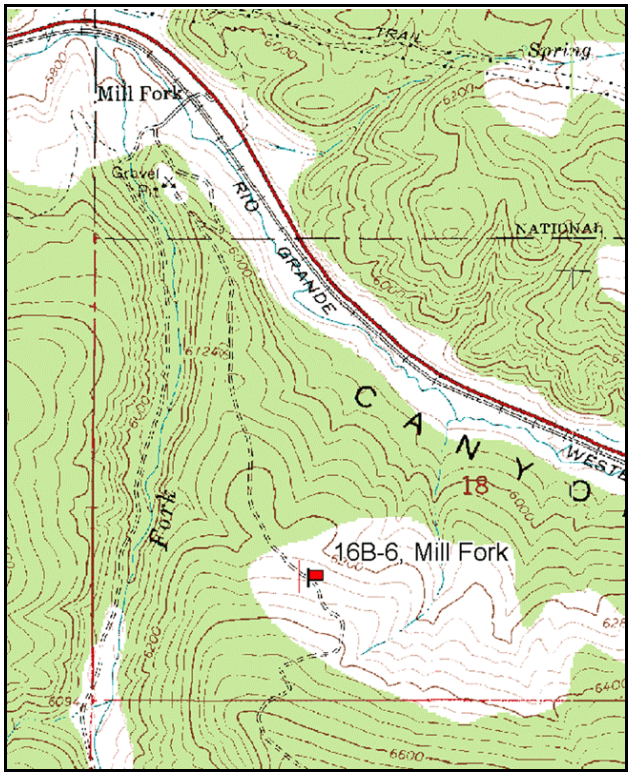
Study site name: Mill Fork . Vegetation type: Big Sagebrush .

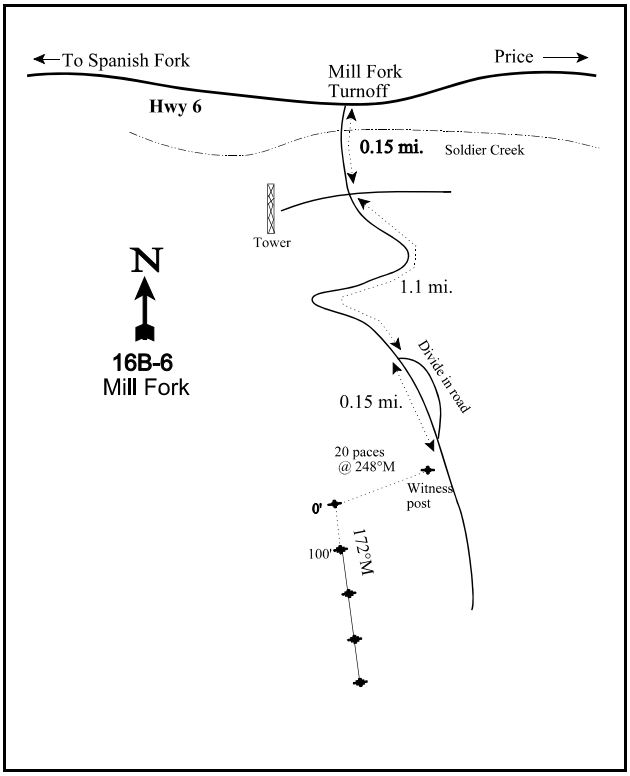
Compass bearing: frequency baseline 172 degrees magnetic.

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

LOCATION DESCRIPTION

From the Sheep Creek Cafe and Sheep Creek Turnoff on Highway 6, travel east on Highway 6 (toward Price) for 1.9 miles to the Mill Fork turnoff on the south side of the highway. Take this road 0.15 miles through a gate and crossing the river to a fork. Stay left (east) and go up the hill 1.1 miles to a division in the road. Here the dense pinyon/juniper forest opens up into a sagebrush stand (this p/j stand was chained in the fall of 2007). Proceed another 0.15 miles to a witness post on the west side of the road. From the witness post the 0-foot baseline stake is 20 paces away at 248 degrees magnetic. It is marked by browse tag #9091.





Map Name: Mill Fork

Diagrammatic Sketch

Township 10S , Range 6E , Section 18

GPS: NAD 83, UTM 12S 474109 E 4422068 N

DISCUSSION

Mill Fork - Trend Study No. 16B-6

Study Information

This study is considered important winter range for deer and elk, although the area supports a depleted sagebrush range [elevation: 6,300 feet (1,920 m), slope: 10%-15%, aspect: north]. There is a small, perennial stream located 0.25 miles (0.4 km) to the north. This same sagebrush community was originally sampled by a line-intercept transect in 1978. The 1978 report identified the sagebrush as basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), but in 1989 it was classified as mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana)*. It is likely a hybrid between the two subspecies. The sagebrush population is a relatively dense, old stand with low recruitment. Wildlife use has been light for elk and moderate for deer. From the pellet group transect, there were an estimated 58 deer days use/acre (144 ddu/ha) in 2002 and 69 deer days use/acre (170 ddu/ha) in 2007. There were an estimated 18 elk days use/acre (45 edu/ha) in 2002 and 25 elk days use/acre (61 edu/ha) in 2007. In 2007, a deer skeleton was found on the study. Domestic sheep are trailed through the general area during spring and summer, but use by sheep on the study itself is minimal.

Soil

The soil texture is a clay, and reactivity is neutral (pH of 7.3). Due to minimal understory vegetation and a high proportion of bare soil, erosion tends to be an increasingly negative factor. Soils have little protection, especially in the barren shrub interspaces. The erosion condition was classified as slight in 2002 and 2007. Pedestalling and active gullies throughout the study provide evidence that erosion is occurring. Bare soil is high, accounting for approximately 27% of the ground surface during all sampling years. The 2007 reading was conducted days after a large storm and there was ample evidence of recent soil movement along flow paths.

Browse

Mountain big sagebrush is the dominant species and has provided at least 80% of the vegetative cover. Sagebrush canopy cover increased from 27% in 2002 to 32% in 2007. Sagebrush density has fluctuated between sample years. The estimated density was highest in 1989 and 2002, at approximately 5,100 plants/acre (12,625 plants/ha). In alternate sample years the density decreased to 3,700 plants/acre (9,158 plants/ha) in 1997 and 4,060 plants/acre (10,050 plants/ha) in 2007. Decadence has been generally high but has also varied between sampling years. Decadence was lowest in 1997 (15%), which incidentally was a year of above normal precipitation throughout the region. Reproduction and recruitment have been low in all years after 1989. The proportion of sagebrush plants with poor vigor has ranged from 8% to 27% of the population. The sagebrush defoliator moth (*Aroga websteri*) had infested 17% of the sampled sagebrush plants in 2007. Annual growth averaged 1.4 inches (3.6 cm) in 2002 and 1.1 inches (2.8 cm) in 2007. Browse use has been predominantly light-moderate, though there was a shift towards moderate-heavy in 2007. This area was scheduled to receive a chaining treatment in the fall of 2007 to reduce the density and canopy cover of sagebrush. Treatment could help stimulate the reproduction of sagebrush and the establishment of perennial herbaceous species.

The study supports a variety of other browse, although these species are limited in abundance. Stickyleaf low rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) density has steadily decreased from 2,266 plants/acre (5,610 plants/ha) in 1989 to 1,460 plants/acre (3,614 plants/ha) in 2007. Utah serviceberry (*Amelanchier utahensis*) and mountain snowberry (*Symphoricarpos oreophilus*) are also present, providing some additional forage.

Utah juniper (*Juniperus osteosperma*) canopy cover increased slightly from 4% in 2002 to 5% in 2007. Density was estimated at 64 trees/acre 158 trees/ha) in 1997. The density increased to 140 trees/acre (347 trees/ha) in 2002 and decreased to 115 trees/acre (285 trees/ha) in 2007. The average trunk diameter increased

from 2.8 inches (7.1 cm) in 1997 to 4.0 inches (10.2 cm) in 2002, and decreased to 3.2 inches (8.1 cm) in 2007. Several young trees were sampled in 2002, increasing the density estimate. In 2007, the juniper trees were found to be in good vigor and have high seed production.

Herbaceous Understory

The herbaceous component has been insignificant. Forb cover has been higher than grass cover, and both have provided less than 5% total cover since 1997. Diversity has been fair, suggesting a higher site potential. Five perennial grass species have been measured, producing about 1% cover each year since 1997. Bluebunch wheatgrass (*Agropyron spicatum*) is the most common perennial grass. In 2007, cheatgrass (*Bromus tectorum*) was sampled for the first time and was in one quadrat.

There is a moderate density of forbs, none of which are considered to be important forage species. The species that account for the majority of forb cover have been Western aster (*Aster chilensis*), longleaf phlox (*Phlox longifolia*), mat penstemon (*Penstemon caespitosus*), and low penstemon (*Penstemon humilis*). Annual forbs are a small component and only account for 1% of the total forb cover. The understory appears to be suppressed by the overabundance of sagebrush.

1997 TREND ASSESSMENT

The browse trend is slightly down. The density of mountain big sagebrush decreased by 28%. The decrease in density is likely the result of the larger area sampled beginning in 1997. The decadent age class decreased from 78% to 15%, and dying plants dropped from 27% to 12% of the population. These trends indicate that the sagebrush population was composed of fewer, but healthier plants. The density of Utah serviceberry was stable and mountain snowberry density increased two-fold. Neither of these species exhibited heavy browse use. The grass trend is stable. Although the sum of nested frequency for perennial grasses increased, these grasses occurred infrequently. Bluebunch wheatgrass was sampled for the first time. The forb trend is stable. Seven new species were observed in 1997 (5 perennial species), but the sum of nested frequency remained stable. The Desirable Components Index (DCI) score was poor-fair due to the high cover of mountain big sagebrush, low decadence, and low perennial grass cover.

winter range condition (DCI) - poor-fair (51) Mid-level potential scale
browse - slightly down (-1) grass - stable (0) forb - stable (0)

2002 TREND ASSESSMENT

The browse trend is slightly up. Mountain big sagebrush density increased 37%, nearly returning to the 1989 density. Decadence increased to 43% of the population and the estimated number of dead plants nearly doubled to 1,100 plants/acre (2,723 plants/ha). Vigor improved and use shifted to predominantly light. Sagebrush cover also increased, even though the height and crown data indicated that the individual plants were slightly smaller. The grass trend is stable. The sum of nested frequency was stable, and only two species were sampled in 2002. The forb trend is down. The sum of nested frequency for perennial forbs declined by 48%, and 8 fewer species were sampled. Drought, coupled with high sagebrush competition, has severely depressed the understory. The DCI score declined to poor due to the increase in sagebrush decadence and the loss of perennial forbs.

winter range condition (DCI) - poor (39) Mid-level potential scale
browse - slightly up (+1) grass - stable (0) forb - down (-2)

2007 TREND ASSESSMENT

The browse trend is down. Sagebrush density decreased by 20%, and few young plants were sampled. Decadence increased from 43% of the population to 59%. Plants exhibiting poor vigor increased from 8% of the population to 19%, and heavily browsed plants increased from 12% to 27%. There was also some insect infestation on the sagebrush and graystem rabbitbrush (*Chrysothamnus nauseosus* ssp. *hololeucus*). The

number of dead sagebrush plants decreased to 660 plants/acre (1,634 plants/ha). The grass trend is stable. The sum of nested frequency and cover of perennial grasses were stable, and the number of perennial species sampled increased to four. Additionally, cheatgrass was found on the study for the first time, in one quadrat. All grasses had low cover values and made up a small portion of the vegetative community. The forb trend is up. The sum of nested frequency increased by 34%, but forbs continued to provide relatively little forage. Species richness remained stable. Bur buttercup (*Ranunculus testiculatus*), an allelopathic annual (Buchanan et al. 1978) was sampled for the first time, in three quadrats. The DCI score decreased to very poor due to a decrease in browse cover and the high number of decadent browse plants.

winter range condition (DCI) - very poor (33) Mid-level potential scale
browse - down (-2) grass - stable (0) forb - up (+2)

HERBACEOUS TRENDS --
Management unit 16B, Study no: 6

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
G	Agropyron spicatum	-	a22	a29	a27	.91	.85	1.10
G	Bromus tectorum (a)	-	-	-	2	-	-	.00
G	Oryzopsis hymenoides	a2	a1	-	a4	.00	-	.01
G	Poa fendleriana	a4	-	-	a2	-	-	.03
G	Sitanion hystrix	a2	a4	-	a3	.03	-	.00
G	Stipa lettermani	-	a3	a3	-	.03	.03	-
Total for Annual Grasses		0	0	0	2	0	0	0.00
Total for Perennial Grasses		8	30	32	36	0.99	0.88	1.14
Total for Grasses		8	30	32	38	0.99	0.88	1.14
F	Achillea millefolium	-	a4	a4	a3	.03	.03	.03
F	Astragalus beckwithii	-	a7	a1	b18	.10	.00	.06
F	Aster chilensis	a34	a28	a17	a14	.51	.22	.20
F	Astragalus convallarius	b43	a21	a11	ab28	.18	.05	.19
F	Astragalus utahensis	a2	a4	-	-	.10	-	-
F	Calochortus nuttallii	a1	b35	-	a2	.10	-	.00
F	Castilleja sp.	-	2	-	-	.03	-	-
F	Chaenactis douglasii	b17	b28	a2	-	.26	.01	-
F	Cirsium sp.	a2	a5	-	-	.01	-	-
F	Collinsia parviflora (a)	-	1	-	-	.00	-	-
F	Cymopterus sp.	-	a7	a5	a4	.02	.01	.01
F	Epilobium brachycarpum (a)	-	-	-	3	-	-	.03
F	Eriogonum brevicaule	a1	a1	a3	a5	.03	.15	.01
F	Erigeron eatonii	-	-	3	-	-	.00	-
F	Lomatium sp.	-	7	-	-	.02	-	-
F	Machaeranthera canescens	b24	ab13	a6	a4	.03	.04	.03

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
F	Penstemon caespitosus	-	-	$_{a}$27	$_{b}$65	-	.80	2.61
F	Penstemon humilis	$_{a}$41	$_{a}$40	$_{a}$29	-	1.59	.85	-
F	Phlox longifolia	$_{c}$159	$_{b}$106	$_{a}$60	$_{ab}$82	.57	.26	.53
F	Polygonum douglasii (a)	-	3	-	-	.00	-	-
F	Ranunculus testiculatus (a)	-	-	-	8	-	-	.01
F	Taraxacum officinale	$_{a}$3	$_{a}$2	-	-	.00	-	-
F	Verbascum thapsus	$_{a}$3	$_{a}$7	-	-	.04	-	-
F	Vicia americana	$_{a}$4	$_{a}$4	$_{a}$2	$_{a}$3	.03	.00	.00
F	Viola sp.	-	4	-	-	.03	-	-
Total for Annual Forbs		0	4	0	11	0.00	0	0.04
Total for Perennial Forbs		334	325	170	228	3.73	2.44	3.71
Total for Forbs		334	329	170	239	3.74	2.44	3.75

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

BROWSE TRENDS --
Management unit 16B, Study no: 6

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Amelanchier utahensis	7	5	3	.36	.03	.15
B	Artemisia tridentata vaseyana	89	89	86	29.47	33.22	19.85
B	Chrysothamnus depressus	3	6	2	.18	.03	-
B	Chrysothamnus nauseosus hololeucus	2	5	6	.00	.09	.21
B	Chrysothamnus viscidiflorus viscidiflorus	44	37	32	1.15	.49	.42
B	Eriogonum corymbosum	0	0	2	-	-	-
B	Gutierrezia sarothrae	6	5	7	.15	.03	-
B	Juniperus osteosperma	6	4	5	2.67	3.29	2.34
B	Opuntia sp.	1	0	1	.00	-	-
B	Symphoricarpos oreophilus	13	17	18	.68	.21	.60
B	Tetradymia canescens	7	6	3	.06	.15	.15
Total for Browse		178	174	165	34.75	37.57	23.75

CANOPY COVER, LINE INTERCEPT --
Management unit 16B, Study no: 6

Species	Percent Cover	
	'02	'07
Amelanchier utahensis	.16	.08
Artemisia tridentata vaseyana	26.91	32.23
Chrysothamnus depressus	.06	-
Chrysothamnus nauseosus hololeucus	.35	.45
Chrysothamnus viscidiflorus viscidiflorus	.30	.50
Juniperus osteosperma	4.30	4.86
Symphoricarpos oreophilus	.48	2.40
Tetradymia canescens	.38	-

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 16B, Study no: 6

Species	Average leader growth (in)	
	'02	'07
Artemisia tridentata vaseyana	3.5	1.1

POINT-QUARTER TREE DATA --
Management unit 16B, Study no: 6

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	140	122

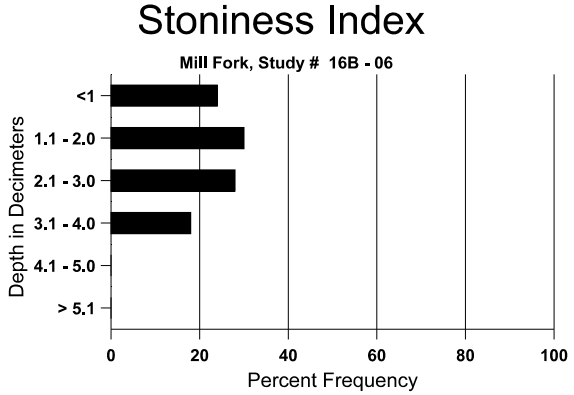
Average diameter (in)	
'02	'07
4.0	3.2

BASIC COVER --
Management unit 16B, Study no: 6

Cover Type	Average Cover %			
	'89	'97	'02	'07
Vegetation	6.50	35.90	40.29	29.35
Rock	2.50	4.87	4.59	3.00
Pavement	15.25	6.28	5.86	10.11
Litter	47.25	42.78	38.99	39.10
Cryptogams	2.00	2.34	3.95	4.88
Bare Ground	26.50	27.07	27.53	30.68

SOIL ANALYSIS DATA --
Herd Unit 16B, Study no: 06, Mill Fork

Effective rooting depth (in)	Temp °F (depth)	pH	Clay			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
13.9	42.8 (15.0)	7.3	20.7	22.7	56.6	2.8	12.3	83.2	.5



PELLET GROUP DATA --
Management unit 16B, Study no: 6

Type	Quadrat Frequency		
	'97	'02	'07
Rabbit	2	5	19
Elk	11	3	7
Deer	26	30	25

Days use per acre (ha)	
'02	'07
-	-
18 (45)	25 (61)
58 (144)	69 (170)

BROWSE CHARACTERISTICS --
Management unit 16B, Study no: 6

		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)
Amelanchier utahensis												
89	**133**	-	133	-	-	-	0	100	0	-	0	-/-
97	**140**	-	-	140	-	-	29	0	0	-	0	23/25
02	**120**	-	20	-	100	-	50	17	83	67	67	15/17
07	**60**	-	-	60	-	-	0	100	0	-	0	28/28

		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)
Artemisia tridentata vaseyana												
89	**5133**	-	533	600	4000	-	61	5	78	27	27	32/36
97	**3700**	40	20	3140	540	580	75	3	15	12	12	34/56
02	**5080**	20	-	2920	2160	1100	30	12	43	8	8	31/40
07	**4060**	-	40	1640	2380	660	41	27	59	14	19	34/44
Chrysothamnus depressus												
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**80**	-	-	80	-	-	0	0	0	-	0	11/11
02	**200**	-	-	100	100	-	0	0	50	40	40	3/9
07	**40**	-	-	-	40	-	0	0	100	-	0	5/7
Chrysothamnus nauseosus hololeucus												
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**40**	-	20	-	20	-	0	0	50	50	50	34/35
02	**160**	-	60	80	20	-	0	0	13	-	0	10/12
07	**200**	40	20	120	60	-	0	0	30	-	10	21/19
Chrysothamnus viscidiflorus viscidiflorus												
89	**2266**	-	1133	733	400	-	0	0	18	-	0	13/14
97	**2160**	40	560	1600	-	20	0	0	0	-	0	22/13
02	**1660**	-	40	1480	140	-	0	0	8	1	1	8/10
07	**1460**	120	20	780	660	100	8	0	45	7	26	8/10
Eriogonum corymbosum												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**40**	-	-	40	-	-	0	50	-	-	0	4/4
Gutierrezia sarothrae												
89	**1466**	66	66	1400	-	-	0	0	0	-	0	10/13
97	**160**	-	20	140	-	-	0	0	0	-	0	9/9
02	**140**	-	20	100	20	-	0	0	14	-	0	9/10
07	**160**	-	20	140	-	-	13	0	0	-	0	8/7
Juniperus osteosperma												
89	**0**	133	-	-	-	-	0	0	-	-	0	-/-
97	**140**	-	60	80	-	-	0	0	-	-	14	161/115
02	**80**	-	20	60	-	-	0	0	-	-	0	-/-
07	**100**	20	40	60	-	-	0	0	-	-	0	-/-

		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)
Mahonia repens												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	2/5
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Opuntia sp.												
89	**132**	-	66	-	66	-	0	0	50	-	0	-/-
97	**20**	-	20	-	-	-	0	0	0	-	0	2/1
02	**0**	-	-	-	-	-	0	0	0	-	0	-/-
07	**20**	-	-	20	-	-	0	0	0	-	0	3/3
Quercus gambelii												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	20	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	-/-
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Symphoricarpos oreophilus												
89	**199**	-	66	133	-	-	67	0	0	-	0	13/19
97	**400**	-	80	320	-	-	0	0	0	-	0	16/26
02	**460**	-	-	380	80	-	0	0	17	-	0	13/24
07	**480**	-	40	440	-	-	0	4	0	-	4	16/24
Tetradymia canescens												
89	**66**	-	-	66	-	-	0	0	0	-	0	8/4
97	**320**	-	60	260	-	-	0	0	0	-	0	8/6
02	**220**	-	-	180	40	-	0	0	18	-	0	8/8
07	**100**	-	-	60	40	-	0	0	40	-	0	7/8