Trend Study 16C-6-07

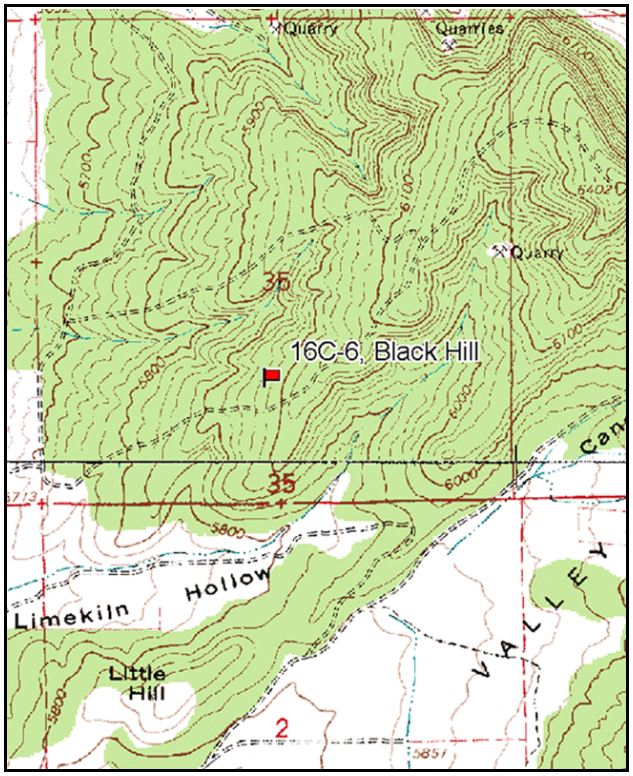
Study site name: Black Hill . Vegetation type: Chained, Seeded P-J .

Compass bearing: frequency baseline 190 degrees magnetic.

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

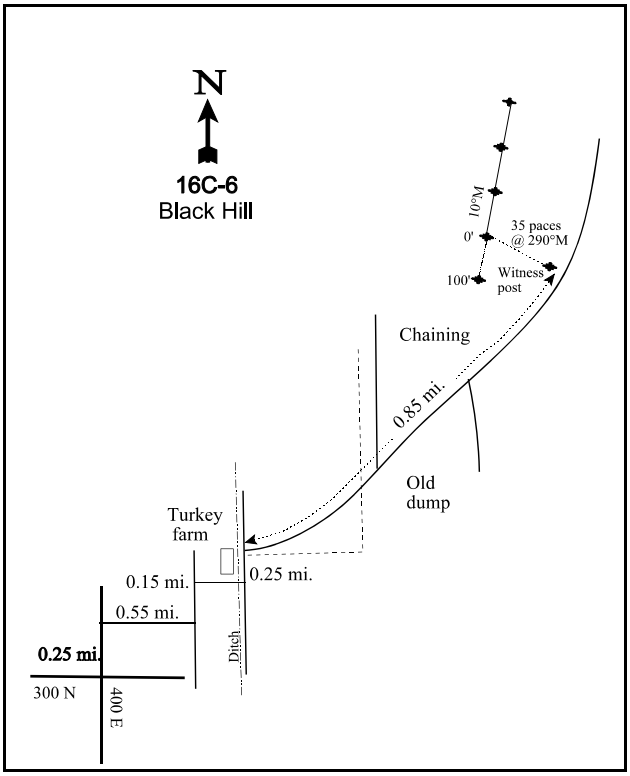
LOCATION DESCRIPTION

From the intersection of 300 North and 400 East in Ephraim, go north on 400 East for 0.25 miles. Just before the white brick home, turn east and go 0.55 miles. From here, bear left and then right, going 0.15 miles to where the road crosses the Gobble field ditch on the south side of a turkey pen. Cross the ditch and turn left (north) for 0.25 miles. Turn right here and go 0.85 miles into the chaining where you will come to a 4 foot, green witness post on the west side of the road. Stop here and walk 35 paces westward at 290 degrees magnetic to the 0-foot baseline stake marked by browse tag # 427.



Map Name: Chester

Township 16S , Range 3E , Section 35



Diagrammatic Sketch

GPS: NAD 83, UTM 12S 452432 E 4358785 N

DISCUSSION

Black Hill - Trend Study No. 16C-6

Study Information

This study is located on a chained and seeded juniper (*Juniperus osteosperma*) treatment northeast of Ephraim [elevation: 5,985 feet (1,824 meters), slope: 10%-16%, aspect: west]. It is located on Utah Division of Wildlife Resources land above several turkey farms, pastures, and alfalfa fields. The Black Hills drop sharply down to Cane Valley on the east, but slope moderately to the west. Prior to the 1987 chaining and seedling treatment, the area was characterized as an open stand of juniper with a sparse understory of black sagebrush (*Artemsia nova*) and cheatgrass (*Bromus tectorum*). Patches of juniper were left on the ridge for cover and travel corridors for big game. Most of the big game use comes from wintering deer. From the pellet group transect, deer use was estimated at 66 days use/acre (164 ddu/ha) in 2002 and 171 days use/acre (422 ddu/ha) in 2007. Elk use was estimated at 13 days use/acre (33 edu/ha) in 2002 and 18 days use/acre (45 edu/ha) in 2007. Livestock also graze the area during the summer. Cattle use was estimated at 11 days use/acre (27 cdu/ha) in 2002 and 5 days use/acre (13 cdu/ha) in 2007.

Soil

The soil is in the Amtoft series which consists of shallow, well-drained and somewhat excessively drained soils formed in material weathered from calcareous sedimentary rocks. The soil is described as Amtoft flaggy loam which characteristically is 12-18 inches (30-46 cm) deep over limestone (USDA-NRCS 2007). The soil has a clay loam texture with a neutral to slightly alkaline reactivity (pH of 7.3). Since 1997, combined relative cover of vegetation and litter was 71%-78%, rock and pavement combined relative cover was 8%-11%, and relative bare ground cover was 13%-16%. The erosion condition was classified as stable in 2002. In 2007, the erosion condition was classified as slight due to the increased translocation of soil, surface rock, and litter.

Browse

As with the nearby Cane Valley study, palatable browse is limited. Black sagebrush, Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) , fourwing saltbush (*Atriplex canescens*), and bitterbrush (*Purshia tridentata*) are all present, but only black sagebrush is moderately abundant. Black sagebrush density was 732 plants/acre (1,808 plants/ha) in 1989, 420 plants/acre (1,037 plants/ha) in 1997, 760 plants/acre (1,877 plants/ha) in 2002, and 620 plants/acre (1,534 plants/ha) in 2007. Recruitment of young has been low at less than 15% of the population. Decadence decreased from 36% of the population in 1989 to 14% in 1997, and increased to 42% by 2007. Plants classified as having poor vigor have been low-moderat at 3%-23% of the population. Browse use was light in 1997, light-moderate in 1989 and 2002, and heavy in 2007. The average annual leader growth on black sagebrush was 1.4 inches (3.6 cm) in 2002 and 1.2 inches (3.1 cm) in 2007.

Wyoming big sagebrush density increased from 0 plants/acre in 1989 to 440 plants/acre (1,087 plants/ha) in 1997, decreasing to 40 plants/acre (99 plants/ha) in 2002 and 20 plants/acre (49 plants/ha) in 2007. The wide fluctuation in density was caused by the difficulty in distinguishing between black sagebrush and Wyoming sagebrush. Apparently, most of the plants classified as Wyoming big sagebrush in 1997 were classified as black sage in 2002. It is likely that many of the sagebrush are hybrids between Wyoming big sagebrush and black sage. The recruitment of young was low at 0%-9%, and decadence was low at 0%-5% of the population in all sample years. The plant vigor has been excellent, and browse use has increased from light in 1989 and 1997, to light-moderate in 2002, and heavy in 2007.

The junipers on the ridge surrounding the study have been highlined. The point-center quarter data estimate of juniper density was 69 trees/acre (170 trees/ha) in 1997, 77 trees/acre (190 trees/ha) in 2002, and 58 trees/acre (143 trees/ha) in 2007. A small proportion of the trees are survivors from the treatment but many were young trees in the 2 to 3 foot size class. Average diameter of juniper was 3 inches (7.6 cm) in 1997 and 2002, and 3.5 inches (8.9 cm) in 2007.

Herbaceous Understory

Perennial grasses, both seeded and native, dominate the vegetative community. Perennial grasses comprised 17% of the ground cover in 1997, 21% in 2002, and 23% in 2007. Perennial grasses contributed 48% of the total vegetative cover in 1997, 65% in 2002, and 46% in 2007. Intermediate wheatgrass (*Agropyron intermedium*) is the most abundant species, providing 13%-17% cover every sample year. Crested wheatgrass (*Agropyron cristatum*) and Indian ricegrass (*Oryzopsis hymenoides*) are moderately abundant. Cheatgrass provided 2% cover in 1997, decreased to less than 1% cover in 2002, and increased to 6% cover in 2007. Grasses appeared to have been grazed by cattle prior to sampling in 2002, but with abundant litter and wolfy material on many plants, grazing has not been a problem in the past.

Forbs, especially perennial species, have not been significant in the understory, providing less than 2% cover in all sample years. Small burnet (*Sanguisorba minor*), a seeded species, was moderately abundant in 1989. However, the quadrat frequency of small burnet decreased from 40% in 1989 to 5% in 1997, and has not been sampled since. Only three perennial forbs were measured in 2002. Annual species were moderately abundant, providing 6% cover in 1997, 3% cover in 2002, and 13% cover in 2007. Bur buttercup (*Ranunculus testiculatus*) and pale alyssum (*Alyssum alyssoides*) have been the most abundant forbs. Bur buttercup has been shown to be allelopathic (Buchanan et al. 1978).

1997 TREND ASSESSMENT

The browse trend is stable. Black sagebrush density decreased 43%, to 420 plants/acre (1,037 plants/ha). This decrease was partly attributed to the larger sample area used in 1997. The recruitment of young remained stable at 14% of the population. Decadence decreased to 14%. Plants showing poor vigor increased to 14% of the population, and browse use decreased to light. Wyoming big sagebrush density increased from 0 plants/acre to 440 plants/acre (1,087 plants/ha). The recruitment of young increased slightly from 0% to 9%. Decadence increased slightly to 5%. Plant vigor was excellent, and browse use remained light. The grass trend is up. The sum of nested frequency for perennial grasses increased 80%. Intermediate wheatgrass and Sandberg bluegrass (*Poa secunda*) increased significantly in nested frequency. The forb trend is down. The sum of nested frequency of perennial forbs decreased 68%. The weedy species, pale alyssum and bur buttercup, provided 75% of the total forb cover. The Desirable Components Index (DCI) score was fair due very low browse cover, excellent perennial grass cover, low annual grass cover, and low perennial forb cover.

winter range condition (DCI) - fair (33) Low potential scale
browse - stable (0) grass - up (+2) forb - down (-2)

2002 TREND ASSESSMENT

The browse trend is stable. Overall sagebrush density is stable. The density of black sagebrush increased 81%. The recruitment of young decreased to 0% of the population, and decadence changed little at 16%. Plants classified with poor vigor decreased to 3% of the population, and browse use was mostly light-moderate. The density of Wyoming big sagebrush decreased 91%. The recruitment of young decreased to 0% of the population, and decadence and plants classified with poor vigor remained stable. Browse use was light-moderate. The grass trend is slightly up. The sum of nested frequency for perennial grasses remained stable. The nested frequency of intermediate wheatgrass increased significantly, and that of Indian ricegrass and bottlebrush squirreltail decreased significantly. However, the nested frequency for cheatgrass decreased 71%. The forb trend is slightly down. The number of perennial species sampled decreased from 10 to three. The sum of nested frequency for perennial forbs decreased 77%, and, the sum of nested frequency for annual forbs decreased 60%. Even though the nested frequencies of pale alyssum and bur buttercup significantly decreased, these species increased to 99% of the total forb cover. The DCI score remained fair.

winter range condition (DCI) - fair (31) Low potential scale
browse - stable (0) grass - slightly up (+1) forb - slightly down (-1)

2007 TREND ASSESSMENT

The browse trend is slightly down. The density of black sagebrush decreased 18%. The recruitment of young plants increased slightly to 3% of the population, and decadent plants increased to 42%. Plants classified as having poor vigor increased to 23% of the population. Browse use shifted to heavy, and heavily browsed plants increased to 90% of the black sagebrush population. The density of Wyoming big sagebrush decreased 50%. Recruitment, decadence, and vigor all remained stable at 0% of the population. All of the sampled plants had been heavily browsed. The grass trend is slightly up. The sum of nested frequency of perennial grasses increased 33%. Crested wheatgrass and Sandberg bluegrass increased significantly in nested frequency. However, the nested frequency of cheatgrass increased more than four-fold. The forb trend is down. Only two perennial forbs were measured, and the sum of nested frequency for perennial forbs changed little. The sum of nested frequency of annual forbs greatly increased. Pale alyssum and bur buttercup both increased significantly in nested frequency and continued to provide 99% of the total forb cover. The DCI score remained fair.

winter range condition (DCI) - fair (27) Low potential scale
browse - slightly down (-1) grass - slightly up (+1) forb - down (-2)

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

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
G	Agropyron cristatum	a16	ab34	b52	c90	1.50	2.34	4.92
G	Agropyron intermedium	a93	b178	c225	c249	12.55	16.99	14.70
G	Agropyron spicatum	-	a-	-	a1	.00	-	.15
G	Bromus inermis	-	3	-	-	.03	-	-
G	Bromus tectorum (a)	-	b181	a52	c226	1.98	.34	5.96
G	Elymus junceus	-	a4	a4	a7	.21	.03	.18
G	Oryzopsis hymenoides	ab52	b90	a35	a34	1.21	1.47	1.38
G	Poa bulbosa	-	-	-	1	-	-	.03
G	Poa fendleriana	1	-	-	-	-	-	-
G	Poa pratensis	1	-	-	-	-	-	-
G	Poa secunda	a9	b44	b43	c103	.16	.26	1.15
G	Sitanion hystrix	b46	b39	a6	-	1.14	.07	-
Total for Annual Grasses		0	181	52	226	1.98	0.34	5.96
Total for Perennial Grasses		218	392	365	485	16.81	21.18	22.54
Total for Grasses		218	573	417	711	18.80	21.52	28.50
F	Alyssum alyssoides (a)	-	b271	a32	c336	1.96	.10	7.75
F	Allium sp.	-	-	7	-	-	.01	-
F	Arabis sp.	-	3	-	-	.03	-	-
F	Astragalus sp.	3	-	-	-	-	-	-
F	Camelina microcarpa (a)	-	a5	-	a2	.01	-	.01
F	Chenopodium album (a)	-	1	-	-	.00	-	-

Type	Species	Nested Frequency				Average Cover %		
		'89	'97	'02	'07	'97	'02	'07
F	Cirsium sp.	6	-	-	-	-	-	-
F	Cymopterus sp.	-	$_{a}$1	-	$_{b}$10	.00	-	.04
F	Descurainia pinnata (a)	-	-	-	20	-	-	.06
F	Lactuca serriola	$_{a}$14	$_{a}$4	-	-	.01	-	-
F	Linum lewisii	$_{a}$1	$_{a}$2	-	-	.03	-	-
F	Mentzelia albicaulis (a)	-	3	-	-	.03	-	-
F	Medicago sativa	$_{a}$7	$_{a}$2	-	-	.04	-	-
F	Phlox longifolia	-	$_{a}$2	$_{a}$1	$_{a}$1	.00	.00	.01
F	Ranunculus testiculatus (a)	-	$_{b}$272	$_{a}$193	$_{b}$289	3.46	2.81	5.59
F	Sanguisorba minor	$_{b}$88	$_{a}$15	-	-	1.12	-	-
F	Sisymbrium altissimum (a)	$_{a}$3	$_{a}$3	-	-	.41	-	-
F	Sphaeralcea coccinea	-	$_{a}$1	$_{a}$1	-	.03	.00	-
F	Trifolium douglasii	-	3	-	-	.06	-	-
F	Tragopogon dubius	$_{a}$3	$_{a}$6	-	-	.04	-	-
Total for Annual Forbs		3	555	225	647	5.87	2.91	13.42
Total for Perennial Forbs		122	39	9	11	1.39	0.01	0.05
Total for Forbs		125	594	234	658	7.27	2.93	13.47

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

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

Type	Species	Strip Frequency			Average Cover %		
		'97	'02	'07	'97	'02	'07
B	Artemisia nova	10	21	19	.39	.66	1.01
B	Artemisia tridentata wyomingensis	15	2	1	.45	.30	-
B	Atriplex canescens	3	1	1	-	-	.03
B	Chrysothamnus viscidiflorus stenophyllus	57	50	44	5.29	4.30	1.85
B	Gutierrezia sarothrae	5	7	1	.07	.03	-
B	Juniperus osteosperma	7	8	7	2.51	2.75	3.58
B	Opuntia sp.	0	1	2	-	-	.03
Total for Browse		97	90	75	8.72	8.06	6.51

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

Species	Percent Cover	
	'02	'07
Artemisia nova	.95	1.20
Artemisia tridentata wyomingensis	.28	-
Atriplex canescens	.56	-
Chrysothamnus viscidiflorus stenophyllus	4.59	2.48
Gutierrezia sarothrae	.05	-
Juniperus osteosperma	3.56	4.86

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

Species	Average leader growth (in)	
	'02	'07
Artemisia nova	1.4	1.2

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

Species	Trees per Acre	
	'02	'07
Juniperus osteosperma	77	58

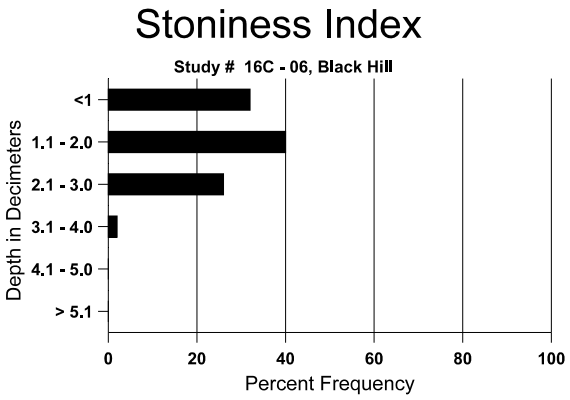
Average diameter (in)	
'02	'07
3.2	3.5

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

Cover Type	Average Cover %			
	'89	'97	'02	'07
Vegetation	4.50	34.90	32.80	43.96
Rock	2.50	2.73	4.11	4.49
Pavement	13.75	4.38	7.83	6.02
Litter	63.25	40.56	50.98	38.87
Cryptogams	1.00	1.42	4.36	3.31
Bare Ground	15.00	12.78	18.33	17.43

SOIL ANALYSIS DATA --
Herd Unit 16C, Study no: 06, Black Hill

Effective rooting depth (in)	Temp °F (depth)	pH	Clay loam			%0M	ppm P	ppm K	dS/m
			%sand	%silt	%clay				
8.5	61.6 (10.4)	7.3	36.7	34.7	28.6	4.5	13.1	160.0	.5



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

Type	Quadrat Frequency		
	'97	'02	'07
Sheep	1	-	1
Rabbit	12	19	56
Elk	1	9	8
Deer	40	31	47
Cattle	-	2	3

Days use per acre (ha)	
'02	'07
-	1 (3)
-	-
13 (33)	18 (45)
66 (164)	171 (422)
11 (27)	5 (13)

BROWSE CHARACTERISTICS --
Management unit 16C, 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)
Artemisia nova												
89	**732**	66	100	366	266	-	41	9	36	-	5	12/12
97	**420**	-	60	300	60	20	0	0	14	14	14	13/23
02	**760**	-	-	640	120	60	42	16	16	3	3	10/18
07	**620**	60	20	340	260	80	10	90	42	23	23	11/17
Artemisia tridentata wyomingensis												
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**440**	-	40	380	20	-	5	0	5	-	0	15/20
02	**40**	-	-	40	-	-	50	0	0	-	0	19/20
07	**20**	-	-	20	-	-	0	100	0	-	0	23/28

		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)
Atriplex canescens												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**60**	-	-	60	-	-	0	0	-	-	0	41/21
02	**20**	-	-	20	-	-	0	0	-	-	0	59/57
07	**20**	-	-	20	-	-	100	0	-	-	0	63/49
Chrysothamnus nauseosus albicaulis												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	54/85
02	**0**	-	-	-	-	-	0	0	-	-	0	38/44
07	**0**	-	-	-	-	-	0	0	-	-	0	64/81
Chrysothamnus viscidiflorus stenophyllus												
89	**1832**	-	66	1166	600	-	0	0	33	9	93	15/22
97	**2920**	-	400	2440	80	-	0	0	3	.68	.68	14/23
02	**2460**	-	20	2140	300	80	3	0	12	2	2	12/21
07	**2000**	-	100	1140	760	60	41	37	38	11	14	9/14
Gutierrezia sarothrae												
89	**0**	-	-	-	-	-	0	0	0	-	0	-/-
97	**300**	60	140	160	-	-	0	0	0	-	0	10/9
02	**320**	-	-	240	80	100	0	0	25	-	0	6/8
07	**20**	-	-	20	-	-	0	0	0	-	0	9/11
Juniperus osteosperma												
89	**199**	33	66	-	133	-	0	0	67	-	17	-/-
97	**160**	-	60	100	-	40	0	0	0	-	0	-/-
02	**240**	-	20	180	40	40	0	0	17	-	8	-/-
07	**160**	-	20	140	-	-	0	0	0	-	25	-/-
Opuntia sp.												
89	**66**	-	33	33	-	-	0	0	-	-	0	4/15
97	**0**	-	-	-	-	-	0	0	-	-	0	4/18
02	**20**	-	-	20	-	-	0	0	-	-	0	5/30
07	**100**	-	20	80	-	-	0	0	-	-	0	3/5
Purshia tridentata												
89	**0**	-	-	-	-	-	0	0	-	-	0	-/-
97	**0**	-	-	-	-	-	0	0	-	-	0	-/-
02	**0**	-	-	-	-	-	0	0	-	-	0	4/10
07	**0**	-	-	-	-	-	0	0	-	-	0	-/-