Trend Study 21B-7-08

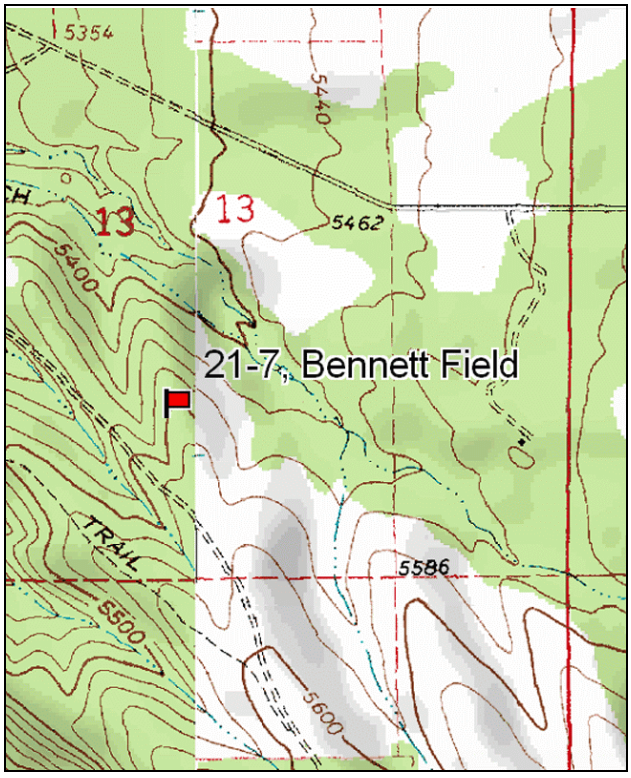
Study site name: Bennett Field . Vegetation type: Cliffrose chaining .

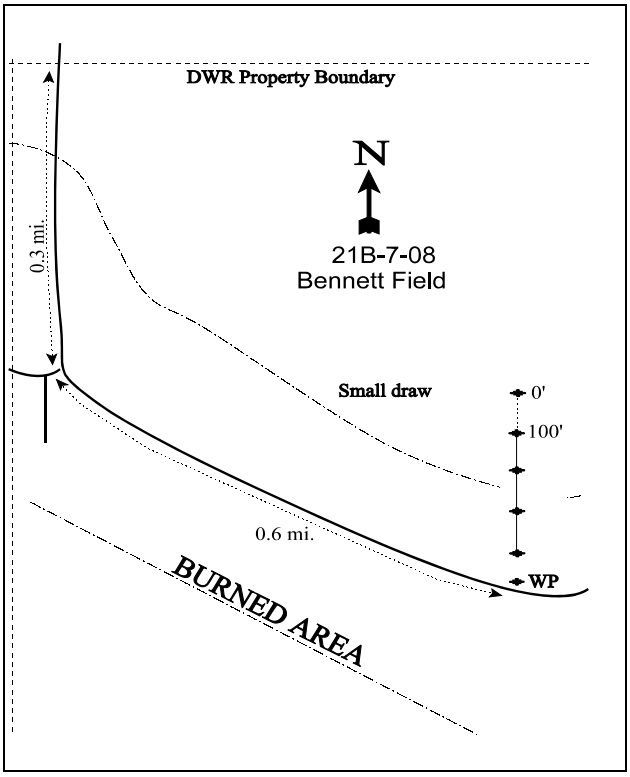
Compass bearing: frequency baseline 170 degrees magnetic.

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

LOCATION DESCRIPTION

Take I-15 exit #174 south of Holden. From the interchange proceed 0.9 miles straight east on a dirt road (towards Maple Canyon). Just after the cattleguard, turn right. Go 0.1 miles to a gate to DWR property. Proceed 0.3 miles down across a wash and over to a 3-way split. Follow the main road which bends to the left. Go 0.6 miles near the top of a small ridge. There is a witness post (steel rebar 3 feet tall) on the left side of the road. The 400' stake is 30 feet away from the witness post, bearing 15 degrees magnetic. The frequency baseline starts 400 feet further north and the 0-foot stake is tagged #7184.





Map Name: Holden

Diagrammatic Sketch

Township 20S , Range 4W , Section 13

GPS: NAD 83, UTM 12S 391733 E, 4325279 N

DISCUSSION

Bennett Field - Trend Study No 21B-7

Study Information

This study is located on DWR land two miles (3.2 km) southeast of Holden [elevation: 5,500 feet (1,676 m), slope: 10%, aspect: northwest]. The area was chained in 1958 and is now dominated by basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), cliffrose (*Cowania mexicana* ssp. *stansburiana*), and scattered Utah juniper (*Juniperus osteosperma*). Much of the land to the south and west of the study was burned by the Swain fire in 2000. Livestock grazing was heavy in the past, but forage for livestock is currently limited. This study receives heavy deer use in the winter and spring. Deer pellet groups are dense and literally cover the ground around the cliffrose plants. Pellet group transect data estimated deer use at 131 days use/acre (324 ddu/ha) in 1998, 162 days use/acre (400 ddu/ha) in 2003, and 145 days use/acre (359 ddu/ha) in 2008. Elk use was estimated at 2 days use/acre (5 edu/ha) in 1998 and 1 day use/acre (2 edu/ha) in 2008. There were no signs of cattle use in 1998 or 2003, but cattle use was estimated at 2 days use/acre (4 cdu/ha) in 2008.

Soil

The soil is classified as a Borvant-Pahvant complex (USDA-NRCS 2008). The Borvant series consists of well-drained soils that are shallow over a petrocalcic horizon. These soils formed in alluvium or colluvium derived from limestone and sandstone. The Pahvant series consists of well-drained soils that are shallow to a calcium carbonate cemented hardpan. The soil on the study is a sandy clay loam with a neutral reaction (pH 6.9). Soil phosphorus is marginal for plant growth and development at 7.5 ppm (Tiedemann and Lopez 2004). Relative combined vegetation and litter cover has been 79%-91% since 1998. Relative combined rock and pavement cover has been 4%-6%, and relative bare ground cover has been 3%-12%. The soil erosion condition was classified as stable in 2003 and 2008.

Browse

Basin big sagebrush is the dominant preferred browse, and it provided 10% quadrat cover in 1998, 16% in 2003 and 9% in 2008. Density has steadily decreased from 1,960 plants/acre in 1998 to 1,360 plants/acre in 2008. Decadence has increased from 22% of the population in 1985 to 57% in 2008, while young recruitment has remained low at 1%-4% of the population. Plant vigor has slowly declined, from 2% of the population displaying poor vigor in 1985 to 38% in 2008. Browse use has been light-moderate in all sample years, although individual sagebrush plants adjacent to cliffrose have sustained the heaviest use. Annual leader growth averaged 2.2 inches (5.6 cm) in 2003 and 2.0 inches (5.1 cm) in 2008.

Stansbury cliffrose provided 3% canopy cover in 1998, 10% in 2003, and 8% in 2008. Density has ranged from 360 plants/acre to 480 plants/acre since 1998. Decadence increased from 57% of the population in 1985 to 67% in 1991, decreased to 13% in 1998, and increased to 60% by 2008. Young plants were only sampled in 1998 and 2008 and comprised 13% and 20% of the population, respectively. Plants displaying poor vigor made up 29% of the population in 1985, 17% in 2003, and 25% in 2008. Browse use was mostly heavy in 1985 and 2003, mostly light in 1991 and 1998, and varied from light to heavy in 2008. Most of the cliffrose on the site are tall, tree-like forms that have been highlined and are mostly unavailable to browsing animals. In 1985, grasshoppers heavily damaged the new growth on the cliffrose, completely stripping the twigs of leaves. Annual leader growth averaged 4.0 inches (10.2 cm) in 2008.

A thick stand of juniper 0.25 miles (0.4 km) to the northeast provides escape and thermal cover. On the study, juniper provided 1% canopy cover in 1998, 2% in 2003, and 5% in 2008. Point-centered quarter data estimated density at 17 trees/acre in 2003 and 35 trees/acre in 2008. Average trunk diameter was 7.2 inches (18.3 cm) in 2003 and 4.9 inches (12.4 cm) in 2008. The majority of the sampled trees were 1-12 feet (0.3-3.7 m) in height in 2008.

Herbaceous Understory

The herbaceous understory is dominated by annuals. Total grass cover was 32% in 1998, 26% in 2003, and 24% in 2008, however, over 50% of the cover each year was provided by cheatgrass (*Bromus tectorum*). Sandberg bluegrass (*Poa secunda*) was the most abundant perennial grass, providing 11%-31% of the total grass cover since 1998. Bluebunch wheatgrass (*Agropyron spicatum*) and bulbous bluegrass (*Poa bulbosa*) were also relatively abundant. Grasshopper damage on the grasses was very heavy in 1985.

Total forb cover decreased from 14% in 1998 to 3% in 2008. The forb community is comprised almost entirely of pale alyssum (*Alyssum alyssoides*) and storksbill (*Erodium cicutarium*). Bur buttercup (*Ranunculus testiculatus*) was sampled in 2003 and 2008. Sego lily (*Calochortus nuttallii*), desert parsley (*Lomatium* sp.), and longleaf phlox (*Phlox longifolia*), although rare, are the most abundant perennial forbs species.

1991 TREND ASSESSMENT

The browse trend is slightly down. Basin big sagebrush density decreased 10%, and decadence increased from 22% of the population to 31%. Young recruitment remained low at 4% of the population. Stansbury cliffrose density decreased 14%, and decadence increased from 57% of the population to 67%. No young plants were sampled. The trend for grass is slightly up. The sum of nested frequency for perennial grasses increased by 11%. Only Sandberg bluegrass was sampled in 1985, and bluebunch wheatgrass was sampled for the first time in 1991. The trend for forbs is slightly up. No perennial forbs were sampled in 1985, and six perennial species were sampled in 1991 at low frequency values.

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

1998 TREND ASSESSMENT

The trend for browse is slightly down. Density changes may have been related to the larger sample area in 1998, therefore, the trend was determined using other parameters. Basin big sagebrush decadence continued to increase from 31% of the population to 41%, and young recruitment remained very low at 3% of the population. Stansbury cliffrose decadence decreased from 67% of the population to 13%, and young recruitment increased from 0% of the population to 13%. The trend for grass is down. The sum of nested frequency for perennial grasses decreased 21%. Sandberg bluegrass decreased significantly in nested frequency, while bluebunch wheatgrass increased significantly in nested frequency. The trend for forbs is slightly down. The sum of nested frequency for perennial forbs decreased 39%. Longleaf phlox decreased significantly in nested frequency. The winter range condition, determined by the Desirable Components Index (DCI), was rated as poor due to moderate preferred browse cover with high decadence and low young recruitment, low perennial grass and forb cover, and high annual grass cover.

winter range condition (DCI) - poor (18) Low potential scale
browse - slightly down (-1) grass - down (-2) forb - slightly down (-1)

2003 TREND ASSESSMENT

The trend for browse is stable. Basin big sagebrush density decreased 8%, but cover increased to over 15%. Decadence of sagebrush remained very high at 44% of the population. Young recruitment remained low at 1% of the population. Plants exhibiting poor vigor increased from 12% of the population to 20%. Stansbury cliffrose density decreased 25%, and decadence increased from 13% of the population to 44%. Young recruitment decreased from 13% of the population to 0%. Plants with poor vigor increased from 0% of the population to 17%. The trend for grass is up. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, increased 40%. Sandberg bluegrass and bulbous bluegrass increased significantly in nested frequency. Cheatgrass decreased significantly in nested frequency. The trend for forbs is slightly up. The sum of nested frequency for perennial forbs increased slightly. Longleaf phlox increased significantly in nested frequency, however, storksbill nested frequency also increased significantly. The DCI rating improved to fair due to increases in sagebrush and perennial grass cover and a decrease in cheatgrass cover.

winter range condition (DCI) - fair (36) Low potential scale
browse - stable (0) grass - up (+2) forb - slightly up (+1)

2008 TREND ASSESSMENT

The trend for browse is down. Basin big sagebrush density decreased 24%, and decadence continued to increase from 44% of the population to 57%. Young recruitment remained low at 3% of the population. Plants displaying poor vigor increased from 20% of the population to 38%. Stansbury cliffrose density remained relatively stable, however, decadence increased from 44% of the population to 60%. Young recruitment also increased from 0% of the population to 20%, but plants exhibiting poor vigor increased from 17% of the population to 25%. The trend for grass is down. The sum of nested frequency for perennial grasses, excluding bulbous bluegrass, decreased 29%. Sandberg bluegrass decreased significantly in nested frequency, while bulbous bluegrass and cheatgrass nested frequencies remained similar to 2003. The trend for forbs is down. The sum of nested frequency for perennial forbs decreased substantially, and the number of perennial forb species sampled decreased from 11 to four. Pale alyssum and bur buttercup decreased significantly in nested frequency. The DCI rating declined to poor due to decreases in preferred browse and perennial herbaceous cover, as well as increases in browse decadence and annual grass cover.

winter range condition (DCI) - poor (17) Low potential scale
browse - down (-2) grass - down (-2) forb - down (-2)

HERBACEOUS TRENDS --
Management unit 21B, Study no: 7

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'98	'03	'08	'98	'03	'08
G	Agropyron spicatum	a-	b17	c39	bc34	bc34	.96	1.79	2.79
G	Aristida purpurea	-	-	-	-	-	-	-	.00
G	Bromus japonicus (a)	-	-	3	-	10	.00	-	.04
G	Bromus tectorum (a)	-	-	b321	a305	ab319	27.62	13.06	14.77
G	Poa bulbosa	a-	a-	a4	b81	b66	.04	2.94	3.05
G	Poa fendleriana	a-	a-	a-	a-	b24	-	-	.66
G	Poa secunda	b241	b251	a165	b264	a152	3.45	7.94	3.01
G	Secale cereale (a)	-	-	2	-	-	.00	-	-
G	Sitanion hystrix	-	-	9	-	3	.09	-	.00
Total for Annual Grasses		0	0	326	305	329	27.63	13.06	14.82
Total for Perennial Grasses		241	268	217	379	279	4.55	12.67	9.54
Total for Grasses		241	268	543	684	608	32.19	25.73	24.36
F	Alyssum alyssoides (a)	-	-	c341	b305	a235	12.89	8.22	1.52
F	Allium sp.	-	-	4	6	4	.15	.06	.01
F	Astragalus sp.	-	-	-	-	-	-	.00	-
F	Castilleja linariaefolia	-	-	-	-	3	-	-	.00
F	Calochortus nuttallii	a-	b17	a-	b18	a-	-	.06	-
F	Castilleja sp.	-	-	2	-	-	.03	-	-
F	Cirsium sp.	-	2	-	2	-	-	.00	-

Type	Species	Nested Frequency					Average Cover %		
		'85	'91	'98	'03	'08	'98	'03	'08
F	Collinsia parviflora (a)	-	-	$_{a}$-	$_{b}$9	$_{ab}$5	-	.02	.01
F	Crepis acuminata	-	3	-	2	-	-	.03	-
F	Erodium cicutarium (a)	-	-	$_{a}$51	$_{b}$121	$_{b}$91	.13	3.77	1.37
F	Euphorbia sp.	-	-	-	-	3	-	-	.00
F	Galium sp.	-	-	-	3	-	-	.03	-
F	Holosteum umbellatum (a)	-	-	-	8	-	-	.01	-
F	Lactuca serriola	-	-	2	-	-	.00	-	-
F	Linum lewisii	-	1	6	3	-	.10	.00	-
F	Lomatium sp.	$_{a}$-	$_{a}$5	$_{a}$-	$_{b}$27	$_{a}$-	-	.16	-
F	Petradoria pumila	-	-	4	3	-	.41	.15	-
F	Phlox longifolia	$_{a}$-	$_{b}$13	$_{a}$1	$_{b}$11	$_{ab}$2	.01	.08	.01
F	Ranunculus testiculatus (a)	$_{a}$-	$_{a}$-	$_{a}$-	$_{b}$73	$_{a}$10	-	.21	.01
F	Tragopogon dubius	-	-	6	4	-	.21	.00	-
F	Zigadenus paniculatus	-	-	-	4	-	-	.01	.00
Total for Annual Forbs		0	0	392	516	341	13.02	12.25	2.92
Total for Perennial Forbs		0	41	25	83	12	0.91	0.60	0.03
Total for Forbs		0	41	417	599	353	13.93	12.85	2.95

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

BROWSE TRENDS --
Management unit 21B, Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'98	'03	'08	'98	'03	'08
B	Artemisia tridentata tridentata	71	63	57	10.39	15.50	9.39
B	Chrysothamnus viscidiflorus viscidiflorus	1	0	0	.00	-	-
B	Cowania mexicana stansburiana	14	16	19	4.11	2.66	1.58
B	Gutierrezia sarothrae	32	8	11	.81	.09	.48
B	Juniperus osteosperma	2	1	1	.15	.68	1.00
Total for Browse		120	88	88	15.47	18.93	12.46

CANOPY COVER, LINE INTERCEPT --
Management unit 21B, Study no: 7

Species	Percent Cover		
	'98	'03	'08
Artemisia tridentata tridentata	-	17.35	12.55
Cowania mexicana stansburiana	3.20	10.00	8.03
Gutierrezia sarothrae	-	-	.73
Juniperus osteosperma	1.00	1.78	5.40

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21B, Study no: 7

Species	Average leader growth (in)	
	'03	'08
Artemisia tridentata tridentata	2.2	2.0
Cowania mexicana stansburiana	-	4

POINT-QUARTER TREE DATA --
Management unit 21B, Study no: 7

Species	Trees per Acre		
	'98	'03	'08
Juniperus osteosperma	24	17	35

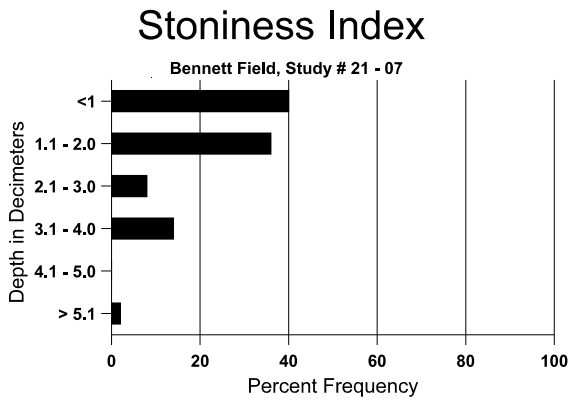
Average diameter (in)		
'98	'03	'08
3.5	7.2	4.9

BASIC COVER --
Management unit 21B, Study no: 7

Cover Type	Average Cover %				
	'85	'91	'98	'03	'08
Vegetation	6.00	2.25	54.45	54.18	47.89
Rock	2.50	4.25	2.92	3.19	3.96
Pavement	11.75	7.25	5.23	1.27	2.28
Litter	62.00	74.25	70.33	39.44	55.15
Cryptogams	0	2.25	2.04	5.81	.67
Bare Ground	17.75	9.75	5.70	14.69	3.10

SOIL ANALYSIS DATA --
Management unit 21, Study no: 7, Study Name: Bennett Field

Effective rooting depth (in)	Temp °F (depth)	pH	sandy clay loam			%0M	PPM P	PPM K	ds/m
			%sand	%silt	%clay				
10.6	56.4 (11.4)	6.9	48.7	27.7	23.6	3.2	7.5	140.8	0.8



PELLET GROUP DATA --
Management unit 21B, Study no: 7

Type	Quadrat Frequency		
	'98	'03	'08
Rabbit	20	16	49
Elk	1	2	-
Deer	57	55	55
Cattle	3	-	-

Days use per acre (ha)		
'98	'03	'08
-	-	-
2 (5)	-	1 (2)
131 (324)	162 (400)	145 (359)
-	-	2 (4)

BROWSE CHARACTERISTICS --
Management unit 21B, Study no: 7

		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 tridentata												
85	**3332**	-	66	2533	733	-	44	4	22	-	2	33/32
91	**2999**	-	133	1933	933	-	33	2	31	2	9	28/27
98	**1960**	-	60	1100	800	660	26	3	41	8	12	35/42
03	**1800**	-	20	980	800	640	24	6	44	20	20	35/42
08	**1360**	-	40	540	780	720	32	4	57	37	38	39/49
Chrysothamnus viscidiflorus stenophyllus												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	-	0	-/-
08	**0**	-	-	-	-	-	0	0	-	-	0	10/17

		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 viscidiflorus viscidiflorus												
85	**0**	-	-	-	-	-	0	0	-	-	0	-/-
91	**66**	-	-	66	-	-	0	0	-	-	0	18/31
98	**60**	-	20	40	-	-	0	0	-	-	0	8/10
03	**0**	-	-	-	-	-	0	0	-	-	0	13/16
08	**0**	-	-	-	-	-	0	0	-	-	0	20/39
Cowania mexicana stansburiana												
85	**465**	-	-	199	266	-	14	86	57	-	29	60/46
91	**399**	66	-	133	266	-	0	17	67	-	0	26/21
98	**480**	20	60	360	60	40	21	0	13	-	0	77/69
03	**360**	-	-	200	160	100	11	67	44	17	17	84/72
08	**400**	-	80	80	240	60	20	35	60	25	25	86/70
Gutierrezia sarothrae												
85	**532**	-	-	133	399	-	0	0	75	-	0	9/7
91	**1666**	-	333	1333	-	-	0	0	0	-	0	10/9
98	**1080**	40	240	820	20	20	0	0	2	2	2	10/10
03	**220**	-	20	180	20	180	0	0	9	9	9	5/6
08	**260**	-	-	240	20	-	0	0	8	8	8	10/14
Juniperus osteosperma												
85	**0**	-	-	-	-	-	0	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	0	-	0	-/-
98	**40**	-	-	20	20	-	0	0	50	-	0	-/-
03	**20**	-	-	-	20	-	0	0	100	-	100	-/-
08	**20**	-	-	-	20	-	0	0	100	-	0	-/-