

Trend Study 27R-4-03

Study site name: Nephi Pasture Total Enclosure .

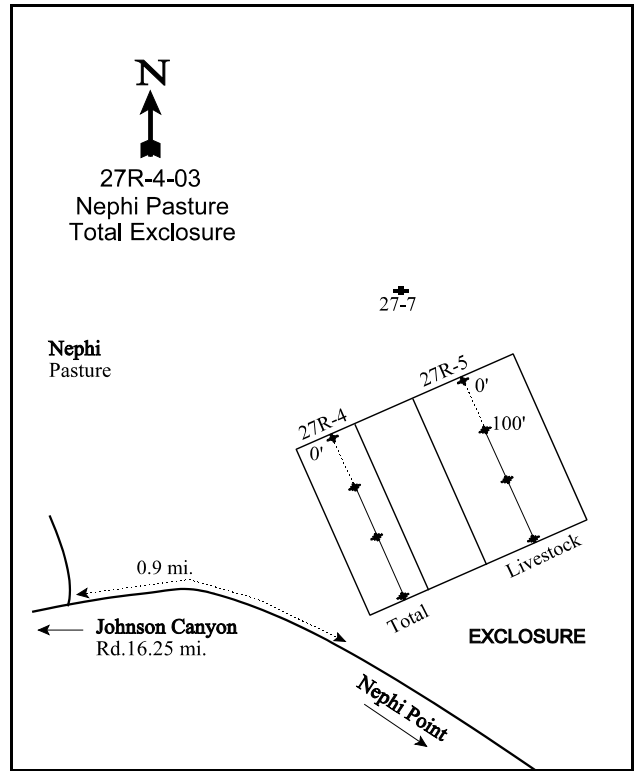
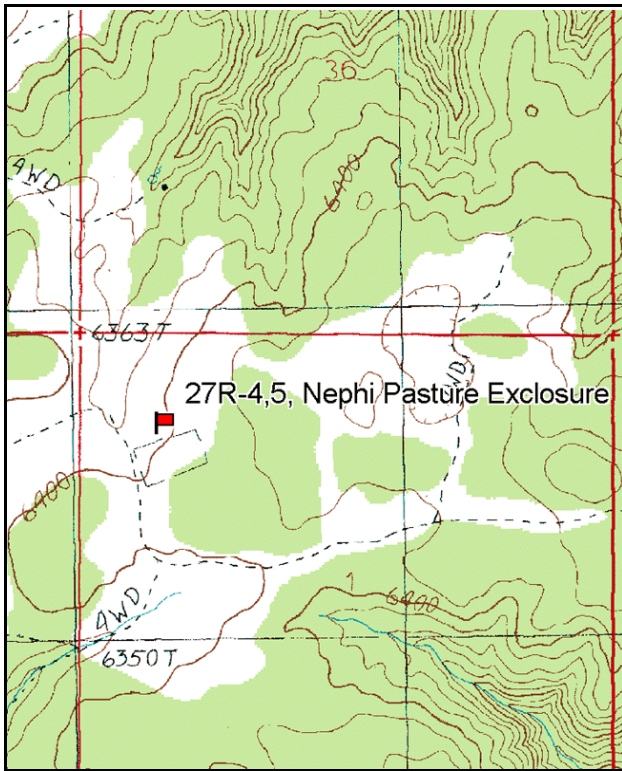
Vegetation type: P-J/ Big Sagebrush .

Compass bearing: frequency baseline 142 degrees magnetic.

Frequency belt placement: line 1 (11ft & 95 ft), line 2 (59ft), line 3 (34 ft & 71 ft). No rebar.

LOCATION DESCRIPTION

From Kanab, take US 89 east for 9.4 miles to Johnson Canyon. Travel north up Johnson Canyon 9.75 miles to the Lock Ridge-Nephi Pasture road. Turn right and go 16.25 miles (see 27-6-03 for more detail) on the main road to a major intersection in Nephi Pasture. Continue straight towards Nephi Point, going 0.9 miles to an enclosure. From the northwest corner of the enclosure, count up five posts to the 0 foot baseline on the inside of the enclosure. The baseline runs at 142 degrees magnetic.



Map Name: Nephi Point

Diagrammatic Sketch

Township 42S , Range 4W , Section 1

GPS: NAD 27, UTM 12S 4116576 N, 394199 E

## DISCUSSION

### Nephi Pasture Total Exclosure - Trend Study No. 27R-4

The Nephi Pasture exclosure complex was built in the 1960's and is found approximately 20 miles northeast of Kanab. This transect was established inside the total exclosure in 1998 as part of a 3-way comparison between the different exclosure grazing treatments; no grazing in the total exclosure, wildlife use in the livestock exclosure, and open to all grazing animals outside the exclosure. The area supports a mixed shrub community with a scattered overstory of pinyon and juniper trees. Slope is 13% with a northwest aspect, and elevation is approximately 6,400 feet. Deer generally utilize the area at high levels during the winter. The total exclosure is supposed to exclude all animals, but due to a hole in the fence, some deer had gotten into the exclosure prior to both the 1998 and 2003 surveys, and had moderately hedged many of the preferred shrubs.

Soils inside the exclosure are very deep, sandy loam in texture, and moderately acidic (pH of 5.9). Effective rooting depth was estimated at almost 23 inches in 1998. Phosphorus and potassium may be limiting to plant growth at just 8.2 ppm and 25.6 ppm respectively. Values higher than 10 ppm for phosphorus and 70 ppm for potassium are considered minimal for normal plant development. There is virtually no rock or pavement on the surface or within the soil profile. Some soil pedestalling is evident, but there is very little erosion occurring inside of the exclosure. Vegetation and litter combined to provide 83% and 78% total cover in 1998 and 2003 respectively. Bare ground has been moderately high inside the total exclosure at 23% and 35% in 1998 and 2003. An erosion condition class assessment completed on site in 2003 gave soils a stable rating.

The total exclosure supports a moderately dense stand of basin big sagebrush with a population that numbered 2,820 plants/acre in 1998. An increase in the number of dead individuals as well as a decline in young recruitment resulted in a population decrease in 2003 to 1,780 plants/acre. Percent decadence and poor vigor were both high in 1998 at 64% and 46% respectively. The proportion of the decadent age class that was classified as dying was very high in 1998 at 72%. Many of these plants died prior to the 2003 survey as evidenced by the large increase in dead plants. As a result, total decadence as well as the proportion of decadent sagebrush classified as dying declined in 2003. Vigor improved considerably in 2003 with only 18% of the population displaying poor vigor. Antelope bitterbrush density was estimated at 920 plants/acre in 1998 and 740 in 2003. Young bitterbrush made up 20% of the population in 1998, but none were sampled in 2003. The number of dead plants increased from 60 to 320 from 1998 to 2003, and percent decadence went from 2% to 30% over the same time period. Vigor was normal throughout the population in both surveys. A few large serviceberry are present inside the total exclosure, but in far lower numbers compared to the livestock exclosure and outside. Annual leader growth on these species was good in 2003 at 5.5 inches for serviceberry, 4 inches for bitterbrush, and 2 inches for basin big sagebrush.

The herbaceous understory was moderately productive in 1998 providing 17% cover. Diversity is only fair however, and cheatgrass accounted for over half of the total. With drought in 2003, the grass component virtually disappeared and produced less than 1% cover. Cheatgrass was not sampled in 2003, and the 3 most abundant perennial grasses all had lower nested frequency values including western wheatgrass, Sandberg bluegrass, and needle-and-thread. The forb component was dominated by toadflax in 1998 and 2003.

### 1998 APPARENT TREND ASSESSMENT

The soil appears to be stable with limited erosion occurring. Ground cover characteristics differ slightly compared to the livestock exclosure. Percent vegetative cover is 41% compared to 47% in the livestock exclosure. Litter cover is much lower at 42% in the total exclosure compared to 67% in the livestock exclosure. However, percent bare ground is similar at 23%. Trend for the key browse species, basin big sagebrush, appears to be declining. Percent decadence is high at 64% with 72% (1,300 plants/acre) of the decadent sagebrush classified as dying. Reproduction is poor with no seedlings found and only 12% (340

plants/acre) of the population consisting of young plants. Even though this is supposed to be a total enclosure, the fence is not well maintained. The deer were able to browse some of the sagebrush and bitterbrush. This use does not appear to be the cause for the poor condition of sagebrush however. Use is higher in the livestock enclosure, but the sagebrush there are much healthier. Trend for bitterbrush and serviceberry in the total enclosure appear stable. The herbaceous understory is similar in composition and abundance to the livestock enclosure, although annual grasses are more abundant providing 72% of the grass cover. The only fairly common perennial grass is needle-and-thread, which is found in low numbers in the livestock enclosure and outside. Forb composition is similar to the livestock enclosure with toadflax and wooly plantain being the most abundant.

2003 TREND ASSESSMENT

Trend for soil is down. Vegetation cover declined substantially and bare ground increased to 35%. Litter cover actually increased, but this is due partly to the increase of dead sagebrush plants which is more aerial litter cover than surface litter. The ratio of protective cover (vegetation, litter, and cryptogams) to bare soil declined from over 4:1 to 2.5:1. Erosion remains low however. Trend for browse is down. Basin big sagebrush has a lower density, decreased reproduction, and a large increase in the number of dead plants in the population. Although decadence improved, it still remains high at 54%. Bitterbrush also showed a population decline due to the increase in dead plants and less young in 2003. Bitterbrush decadence increased to 30% in 2003, but vigor remains mostly normal. Trend for the herbaceous understory is down. With drought conditions in 2003, grasses virtually disappeared. Cheatgrass was by far the most abundant herbaceous species in 1998, but was not sampled at all in 2003. Western wheatgrass, Sandberg bluegrass, and needle-and-thread all had lower nested frequency values in 2003. Toadflax was the only abundant forb in either 1998 or 2003 and it also declined significantly in 2003. All of these downward trends are due primarily to the dry precipitation cycle that southern Utah was in prior to and including the 2003 survey.

TREND ASSESSMENT

soil - down (1)

browse - down (1)

herbaceous understory - down (1)

HERBACEOUS TRENDS --

Management unit 27R, Study no: 4

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Agropyron smithii	56	29	.76	.26
G	Agropyron spicatum	2	-	.03	-
G	Bromus tectorum (a)	<sub>b</sub> 321	<sub>a</sub> -	7.44	-
G	Oryzopsis hymenoides	3	6	.18	.23
G	Poa secunda	<sub>b</sub> 37	<sub>a</sub> 8	.43	.05
G	Sitanion hystrix	8	-	.04	-
G	Sporobolus cryptandrus	3	5	.06	.03
G	Stipa comata	<sub>b</sub> 60	<sub>a</sub> 12	1.92	.27
G	Vulpia octoflora (a)	<sub>b</sub> 144	<sub>a</sub> -	1.41	-
Total for Annual Grasses		465	0	8.85	0
Total for Perennial Grasses		169	60	3.44	0.85

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
	Total for Grasses	634	60	12.29	0.85
F	Calochortus nuttallii	a-	b11	-	.05
F	Comandra pallida	b167	a132	3.32	2.77
F	Descurainia pinnata (a)	11	-	.07	-
F	Eriogonum cernuum (a)	5	-	.03	-
F	Erigeron spp.	6	-	.06	-
F	Eriogonum racemosum	-	8	-	.04
F	Gilia spp. (a)	a-	b42	-	1.23
F	Lupinus spp.	5	-	.18	.15
F	Microsteris gracilis (a)	6	6	.03	.04
F	Phlox austromontana	4	5	.03	.04
F	Plantago patagonica (a)	b66	a1	.76	.00
F	Polygonum douglasii (a)	3	-	.00	-
F	Sphaeralcea coccinea	1	-	.00	-
	Total for Annual Forbs	91	49	0.90	1.27
	Total for Perennial Forbs	183	156	3.60	3.06
	Total for Forbs	274	205	4.51	4.34

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

#### BROWSE TRENDS --

Management unit 27R, Study no: 4

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	4	3	1.03	3.75
B	Artemisia tridentata tridentata	73	54	10.35	7.36
B	Gutierrezia sarothrae	35	2	1.42	.15
B	Juniperus osteosperma	2	3	-	.63
B	Opuntia spp.	1	0	.03	-
B	Purshia tridentata	30	27	7.90	6.50
	Total for Browse	145	89	20.73	18.40

CANOPY COVER, LINE INTERCEPT --  
 Management unit 27R, Study no: 4

Species	Percent Cover
	'03
Amelanchier utahensis	5.36
Artemisia tridentata tridentata	8.63
Gutierrezia sarothrae	.06
Juniperus osteosperma	.98
Purshia tridentata	5.80

KEY BROWSE ANNUAL LEADER GROWTH --  
 Management unit 27R, Study no: 4

Species	Average leader growth (in)
	'03
Amelanchier utahensis	5.5
Artemisia tridentata tridentata	2.0
Purshia tridentata	4.0

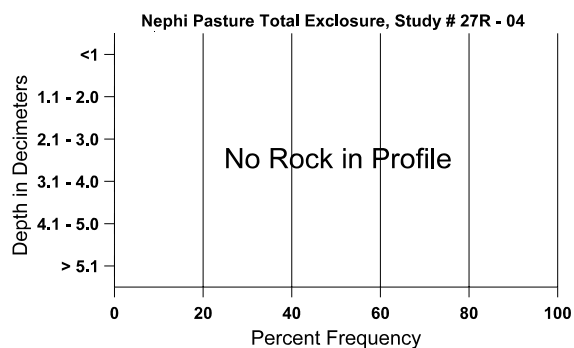
BASIC COVER --  
 Management unit 27R, Study no: 4

Cover Type	Average Cover %	
	'98	'03
Vegetation	41.18	23.88
Pavement	.01	0
Litter	41.79	54.27
Cryptogams	11.46	2.98
Bare Ground	23.23	34.92

SOIL ANALYSIS DATA --  
 Management unit 27R, Study no: 4, Study Name: Nephi Pasture Total Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
22.7	68.8 (17.7)	5.9	74.2	18.0	7.8	0.7	8.2	25.6	0.4

## Stoniness Index



### PELLET GROUP DATA --

Management unit 27R, Study no: 4

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	14	31	-	-
Elk	1	-	N/A	N/A
Deer	22	14	N/A	N/A

### BROWSE CHARACTERISTICS --

Management unit 27R, Study no: 4

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<b>Amelanchier utahensis</b>											
98	<b>80</b>	-	20	40	20	-	0	0	25	0	88/103
03	<b>60</b>	-	-	40	20	20	33	0	33	0	84/90
<b>Artemisia tridentata tridentata</b>											
98	<b>2820</b>	-	340	680	1800	2020	32	0	64	46	32/37
03	<b>1780</b>	-	-	820	960	3680	2	0	54	18	35/37
<b>Cercocarpus montanus</b>											
98	<b>0</b>	-	-	-	-	-	0	0	-	0	39/49
03	<b>0</b>	-	-	-	-	-	0	0	-	0	52/41
<b>Gutierrezia sarothrae</b>											
98	<b>1580</b>	-	80	1460	40	20	0	0	3	3	10/11
03	<b>60</b>	-	-	60	-	-	0	0	0	0	11/12
<b>Juniperus osteosperma</b>											
98	<b>40</b>	-	40	-	-	-	0	0	-	0	-/-
03	<b>60</b>	-	20	40	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Opuntia</i> spp.											
98	<b>20</b>	-	-	-	20	-	0	0	100	100	-/-
03	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
<i>Purshia tridentata</i>											
98	<b>920</b>	-	180	720	20	60	28	0	2	2	35/51
03	<b>740</b>	-	-	520	220	320	14	5	30	3	33/53

## Nephi Pasture Exclosure Comparison Summary

Ground cover characteristics differ slightly between grazing effects. Bare ground is more abundant outside of the exclosure, and similar between the livestock and total exclosures in both 1998 and 2003. Vegetation and litter cover are highest in the livestock exclosure and lowest outside. Soil characteristics are similar between treatments. Soils are deep with sandy loam to sand textures, a moderately acidic pH, low organic matter content, deficient values for phosphorus and potassium, and high average soil temperatures. The total exclosure showed the least amount of erosion in 2003, while both the livestock exclosure and outside treatments showed slight erosion.

All sites support good stands of basin big sagebrush, bitterbrush, and serviceberry, with sagebrush being the most prevalent. In 1998, the sagebrush stand in the total exclosure was the least healthy followed closely by outside. Percent decadence was high at 64% in the total exclosure compared to 34% in the livestock exclosure and 46% outside. Vigor was poor on 46% of the total exclosure population, compared to 18% in the livestock, and 23% outside. Utilization was moderate to heavy outside and within the livestock exclosure. In 1998, deer use was significantly higher within the livestock exclosure (111 ddu/acre vs 64 ddu/acre) where sagebrush was in the best condition. With this in mind, it appeared that sagebrush was more effected by climate in 1998 than use. In 2003, sagebrush decadence was high in all 3 treatments at over 50%, with the highest level occurring inside the livestock exclosure. Poor vigor was also highest inside the livestock exclosure with 51% of the sagebrush being classified as such. Young recruitment for sagebrush was good in all 3 treatments in 1998, but very low in 2003. Density was highest inside the livestock exclosure in both surveys, but density estimates declined over all 3 treatments between 1998 and 2003.

Several factors appear to be effecting sagebrush at Nephi Pasture. Drought is likely the primary driving force behind deteriorating sagebrush health, but winter injury could also be a factor. Winter injury is presumably caused by freezing due to a lack of sufficient cold hardiness and/or winter drought or dessication (Nelson and Tiernan 1983). During mild winters, sagebrush can break dormancy during the middle of the winter and begin growth too early in the year. By doing so, sagebrush plants become susceptible to dessication and crown death if temperatures become very cold for any substantial length of time or there is a lack of soil moisture within the profile, especially within these deep sandy soils. In 2003, the livestock exclosure appears to be a little worse off than the other treatments. A plausible explanation is that heavy deer use as well as high intraspecific competition are additive factors effecting sagebrush in the livestock exclosure. Because overall browse density and average cover are highest inside the livestock exclosure, competition for resources would be greatest here, and this would be intensified during the current drought.

Bitterbrush density slightly declined in the total exclosure and outside, but remained stable in the livestock exclosure between 1998 and 2003. Serviceberry showed slight decreases in all 3 treatments in 2003. Although both species had increased decadence rates in 2003, the current levels are considered only moderate. Utilization has been on the moderate side for serviceberry in the livestock exclosure and outside, but more heavy on bitterbrush. However, vigor has been generally normal for both species across all treatments in both sampling years. Bitterbrush recruitment declined in all 3 treatments between 1998 and 2003, while young recruitment in the serviceberry population remained stable in the livestock exclosure and outside.

The herbaceous understories were similar with respect to species composition and overall production between grazing effects in 1998. With drought in 2003, grass production declined drastically on all 3 transects, with forb production declining in the livestock exclosure and outside, but remaining nearly the same inside the total exclosure. Sum of nested frequency of perennial herbaceous species declined across all 3 treatments in 2003 with the dry conditions. Cheatgrass had the highest frequency and cover values inside the total exclosure in 1998, but cheatgrass was not sampled in any of the 3 transects in 2003. Herbaceous trends are down on all 3 sites in 2003 due to the decline in perennial species.