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Project No.: W-67-R-13

Study No.: C-VII: BIG GAME EXCLOSURE STUDY
By
James V. McKenzie and Jack Samuelson

A B S T R A C T

Job No. C-VII-1: EXCLOSURE STUDIES IN THE BADLANDS OF WESTERN NORTH DAKOTA

The Cedar Hills (initiated 1967) and the Bye (initiated in 1960) 3-Way Exclosure Studies were initiated to demonstrate the effects, on browse plants, of grazing wildlife and domestic livestock. Equally represented for each of these studies is a deer proof fenced enclosure, a cattle proof fenced enclosure and a control area.

Techniques used in collecting data include the Parker 3-Step, Line Intercept and Pellet Group Transects; also is a photo study of permanent photo points. All survey data is included in this report with the exception of the photo studies. These photos are on file at the Bismarck office of the North Dakota Game and Fish Department.

Generally, the survey data relates a picture of improved browse conditions for the deer proof and cattle proof area, while the control areas show continued heavy use.

Job No. C-VII-2: THE WAKOPA GAME MANAGEMENT AREA BROWSE EXCLOSURE STUDIES

Part I: Clear-cut Exclosure Study

A line intercept-pellet group transect combination was established on each the meadow edge, the clear-cut and the uncut forest portion of a 2-way exclosure (a total of six transects) on Wakopa Game Management Area in 1964, and the browse portion was reinspected in 1965 to show woody plant browse rejuvenation immediately after removal of the forest canopy from this wooded portion of North Dakota. Due to personnel scheduling problems and inclement weather in October, the scheduled

*copy
for
enclosure
and photo
study
planned*

*Project
W-67-R-13
Big Game
Investigations*

State of: North Dakota

Project No.: W-67-R-13 Wildlife Surveys and Investigations

Phase: C Big Game Investigations

Study No.: C-VII BIG GAME EXCLOSURE STUDIES

Job No.: C-VII-1 Exclosure Studies in the Badlands of western North Dakota

Period Covered: 1962 through June 30, 1973

Personnel: Jack Samuelson, James V. McKenzie and summer student assistants

Submitted by: Jack Samuelson

OBJECTIVES

The purpose of this job was to cooperate with the U.S. Bureau of Land Management and the U.S. Forest Service in determining forage utilization and long term trends of browse conditions and relative usage by browsing wildlife (deer and antelope) and domestic livestock on key deer areas in the government lands of western North Dakota and also as a visual demonstration, of the results of vegetative utilization by browsing animals, to the general public.

PROCEDURE

This report involves two 3-Way Exclosure studies; The Cedar Hills 3-Way Exclosure located in Bowman County, North Dakota, and the Bye 3-Way Exclosure in Billings County, North Dakota.

The Cedar Hills 3-Way Exclosure: This exclosure was constructed by the Bureau of Land Management in 1966 in Bowman County, North Dakota, and the vegetational study was initiated by the Game and Fish Department in 1967.

The physical description of this enclosure, the field techniques used in gathering data, the photo study information and the schedule for the long term study are presented in a previous report.¹

The Bye 3-Way Exclosure: This exclosure study was established through the cooperation of the U.S. Forest Service and the Game and Fish Department in 1960 in Billings County, North Dakota.

¹ Big Game Browse Studies, 1971; North Dakota Game and Fish Department; Pittman-Robertson Division, Project No. W-67-R-10, Phase C, Big Game Investigations, Job No. 6, James V. McKenzie.

The physical description and data gathering techniques are presented in previous reports.^{2,3}

RESULTS

Cedar Hills 3-Way Exclosure:

Photo Study:

The photo study pictures and records are on file at the Bismarck office of the Game and Fish Department. The photo study pictures have been taken annually except for the year 1971.

Parker 3-Step Transects:

Table 1 includes the ground cover and vegetational analysis for the three Parker Transects associated with this study for the years 1967 and 1972.

Line Intercept Browse Transects:

The condition and indicated trend of browse plants on each 3-Way exclosure site (control, cattle proof and deer proof) will indicate what may be expected for the future carrying capacity of this range. Particularly in view of the fact that each site is exposed to controlled animal use or non-use - i.e., the control area is exposed to both wildlife and domestic animal use; the cattle proof exclosure is limited to wildlife use; and the deer proof area excludes both domestic animal and browsing wildlife (pronghorn antelope, deer, rabbits and hares).

Table 2 includes the woody browse data for the years 1967, 1969 and 1972.

Condition and Trend Indices by Woody Plant Species:

The form and age classification of each browse species represented by this 3-Way Exclosure study in Bowman County, North Dakota, was used to determine the present condition of this portion of the deer range.

When this information is compared to the 1967 and 1969 data for the same exclosure site (i.e. either control area, cattle proof exclosure or deer proof exclosure), a trend emerges as to what has happened during the intervening years. Also, the present condition of browse species provides an insight as to direction of the future trend.

Tables 3, 4, and 5 provide this condition and trend comparison by exclosure site.

² Big Game Browse Studies, 1963; North Dakota Game and Fish Department, Pittman-Robertson Division, Project No. W-67-R-2; Phase C, Big Game Investigations, Job No. 7, James V. McKenzie

³ Big Game Browse Studies, 1961; North Dakota Game and Fish Department, Pittman-Robertson Division, Project No. W-67-R-1; Phase C, Big Game Investigations, Job No. 9, James V. McKenzie

Table 1. Comparative ground cover, vegetational types and species composition, resulting from Parker 3-step transects located on each site of the Cedar Hills 3-Way Exclosure for the years 1967 and 1972.

Ground Cover Vegetative Type Common Name - Scientific Name **	Control Area	1967 Cattle Proof Exclosure	Deer Proof Exclosure	Control Area	1972 Cattle Proof Exclosure	Deer Proof Exclosure
<u>Ground Cover</u>						
Bare ground	10	28	46	27	45	52
Erosion pavement	0	27	12	0	19	22
Rock	0	1	2	0	0	0
Litter	63	34	33	42	31	19
Moss	14	0	0	18	0	0
Plant density	13	10	7	13	5	7
<u>Grass-like plants</u>	0	0	0	0	0	0
<u>Grasses</u>						
Western Wheatgrass, <u>Agropyron smithii</u>	3	5	2	2	2	3
Slender Wheatgrass, <u>Agropyron trachycaulum</u>	4	0	0	1	1	0
Little Bluestem, <u>Andropogon scoparius</u>	1	0	0	1	0	0
Kentucky Bluegrass, <u>Poa pratensis</u>	4	0	0	0	0	0
Indian Ricegrass, <u>Oryzopsis hymenoides</u>	0	0	0	8	0	0
<u>Annual herbs</u>	0	0	0	0	0	0
<u>Biennial herbs</u>						
Yellow Sweet Clover, <u>Melilotus officinalis</u>	0	0	0	0	1	3
<u>Perennial herbs</u>	0	0	0	0	0	0
<u>Coniferous shrubs</u>	0	0	0	0	0	0
<u>Coniferous trees</u>						
Western Red Cedar, <u>Juniperus scopulorum</u>	0	0	2	0	0	0
<u>Deciduous shrubs</u>						
Dwarf Sage, <u>Artemesia cana</u>	0	1	0	0	0	0
Big Sage, <u>Artemesia tridentata</u>	1	3	0	1	1	0
Rabbit brush, <u>Chrysothamnus graveolens</u>	0	0	3	0	0	0
Wolfberry, <u>Symphoricarpos occidentalis</u>	0	1	0	0	0	0
Rillscale, <u>Atriplex dioica</u>	0	0	0	0	0	1
<u>Deciduous trees</u>	0	0	0	0	0	0
<u>Deciduous vines</u>	0	0	0	0	0	0

** All identification was accomplished with reference to this publication: Handbook of North Dakota Plants, O. A. Stevens, North Dakota Institute for Region Studies, North Dakota Agricultural College, Fargo, North Dakota, 1950.

Table 2. Species composition and relative abundance of all woody plants recorded on each 100-foot Line Intercept Browse Transect associated with the Cedar Hills 3-way Exclosure in Bowman County, North Dakota, for the years 1967, 1969, and 1972.

Woody Vegetative Type Common Names - Scientific Name	Percentage by woody type and lineal feet by species below 5-foot level								
	Control Area			Cattle Proof Exclosure			Deer Proof Exclosure		
	1967	1969	1972	1967	1969	1972	1967	1969	1972
<u>Coniferous shrubs</u> (total lineal feet)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% coniferous shrubs	0%	0%	0%	0%	0%	0%	0%	0%	0%
<u>Coniferous trees</u> (total lineal feet)	13.3	13.6	22.3	0.0	0.0	0.0	2.7	3.1	3.4
Western Red Cedar, <u>Juniperus scopulorum</u> ✓	13.3	13.6	22.3	0.0	0.0	0.0	2.7	3.1	3.4
% coniferous trees	33.0%	39.2%	30.8%	0%	0%	0%	23.5%	21.1%	12.9%
<u>Deciduous shrubs</u> (total lineal feet)	27.0	21.1	50.1	15.1	17.7	13.6	8.8	11.6	9.3
Dwarf Sage, <u>Artemesia cana</u> ✓	0.0	0.0	0.0	1.0	3.8	1.1	0.0	0.9	0.0
Big Sage, <u>Artemesia tridentata</u> ✓	5.6	4.8	3.1	5.0	5.7	5.2	0.0	0.0	0.0
Rabbitbrush, <u>Chrysothamius graveolens</u> ✓	0.0	0.0	0.0	4.3	6.7	6.7	8.8	10.7	9.3
Oregon Grape, <u>Odostemon aquifolium</u> ✓	0.4	1.4	5.0	0.0	0.0	0.0	0.0	0.0	0.0
Skunk Bush, <u>Rhus trilobata</u> ✓	4.9	5.4	8.6	0.0	0.0	0.0	0.0	0.0	0.0
Golden Currant, <u>Ribes oderatum</u>	0.8	0.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Bristley Gooseberry, <u>Ribes setosa</u> ✓	4.1	7.1	6.2	0.0	0.0	0.0	0.0	0.0	0.0
Rose, <u>Rosa</u> (species undetermined)	11.2	2.0	2.2	1.0	1.5	0.6	0.0	0.0	0.0
Wolfberry, <u>Symphoricarpos occidentalis</u> ✓	0.0	0.3	1.5	3.8	0.0	0.0	0.0	0.0	0.0
% deciduous shrubs	67.0%	60.8%	69.2%	100%	100%	100%	76.5%	78.9%	73.2%
<u>Deciduous trees</u> (total lineal feet)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% deciduous trees	0%	0%	0%	0%	0%	0%	0%	0%	0%
<u>Deciduous vines</u> (total lineal feet)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% deciduous vines	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total lineal feet of intercept	40.3	34.7	72.4	15.1	17.7	13.6	11.5	14.7	12.7
	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 3. The condition and trend of all woody species recorded on a 100-foot line Intercept Browse Transect located on the Control Area of the Cedar Hills 3-Way Exclosure in Bowman County, North Dakota, for the years 1967, 1969 and 1972.

Common Names	Year	Age data* = 100%				Form - class data* = 100%							
		S	Y	M	D	1	2	3	4	5	6	7	8
Western Red Cedar	1967	Not Determined				Not		Determined					
	1969	0	0	80.1	19.9	61.8	0	0	31.6	0	0	0	6.6
	1972	0	0	50.7	49.3	0	9.9	11.7	5.4	59.6	0	0	13.4
Big Sage	1967	0	0	58.9	41.1	10.7	48.2	0	0	0	0	0	41.1
	1969	0	0	0	100%	0	37.5	62.5	0	0	0	0	0
	1972	0	0	64.5	35.5	45.2	0	54.8	0	0	0	0	0
Oregon Grape	1967	Not Determined				Not		Determined					
	1969	0	0	100%	0	0	0	100%	0	0	0	0	0
	1972	0	26.0	74.0	0	100%	0	0	0	0	0	0	0
Skunk Bush	1967	0	12.2	87.8	0	36.7	14.3	0	0	0	0	0	49.0
	1969	0	0	63.0	37.0	0	27.8	72.2	0	0	0	0	0
	1972	0	0	100%	0	5.9	17.4	76.7	0	0	0	0	0
Golden Currant	1967	0	0	100%	0	0	0	100%	0	0	0	0	0
	1969	0	0	100%	0	0	0	100%	0	0	0	0	0
	1972	0	0	100%	0	0	50.0	50.0	0	0	0	0	0
Bristley Gooseberry	1967	0	0	100%	0	0	100%	0	0	0	0	0	0
	1969	0	0	42.3	57.7	100%	0	0	0	0	0	0	0
	1972	0	0	100%	0	17.7	82.3	0	0	0	0	0	0
Rose	1967	0	0	100%	0	0	0	100%	0	0	0	0	0
	1969	0	5.0	20.0	75.0	5.0	0	95.0	0	0	0	0	0
	1972	0	0	100%	0	0	86.4	13.6	0	0	0	0	0
Wolfberry	1967	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	35.3	60.7	0	33.3	0	66.7	0	0	0	0	0
	1972	0	0	100%	0	75.0	25.0	0	0	0	0	0	0

* Key S-Seedling
Y-Young
M-Mature
D-Decadent

1-All available-little or no hedging
2-All available-moderate hedging
3-All available-severely hedged
4-Partly available-little or no hedging

5-Partly available-moderately hedged
6-Partly available-severely hedged
7-Unavailable
8-Dead

Table 4. The condition and trend of all woody species recorded on a 100-foot Line Intercept Browse Transect located on the Cattle-Proof Exclosure of the Cedar Hills 3-Way Exclosure in Bowman County, North Dakota, for the years 1967, 1969 and 1972.

Common Names	Year	Age data*=100%				Form-class*=100%							
		S	Y	M	D	1	2	3	4	5	6	7	8
Dwarf Sage	1967	0	0	100%	0	30.0	50.0	20.0	0	0	0	0	0
	1969	0	31.6	21.0	47.4	31.6	0	68.4	0	0	0	0	0
	1972	0	0	0	100%	0	100%	0	0	0	0	0	0
Big Sage	1967	0	0	100%	0	0	0	100%	0	0	0	0	0
	1969	0	0	3.5	96.5	0	0	100%	0	0	0	0	0
	1972	0	0	0	100%	0	0	100%	0	0	0	0	0
Rabbitbrush	1967	0	0	74.4	25.6	7.0	0	93.0	0	0	0	0	0
	1969	0	0	94.0	6.0	0	0	100%	0	0	0	0	0
	1972	0	0	17.9	82.1	0	0	100%	0	0	0	0	0
Rose	1967	0	20.0	80.0	0	20.0	0	80.0	0	0	0	0	0
	1969	0	0	80.0	20.0	0	26.7	73.3	0	0	0	0	0
	1972	100%	0	0	0	100%	0	0	0	0	0	0	0
Wolfberry	1967	0	65.8	34.2	0	100%	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0

*Key:

S-Seedling
Y-Young
M-Mature
D-Decadent

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4-Partly available-little or no hedging
5-Partly available-moderately hedged
6-Partly available-severely hedged
7-Unavailable
8-Dead

Table 5. The condition and trend of all woody species recorded on a 100-foot Line Intercept Browse Transect located on the deer-proof enclosure of the Cedar Hills 3-way Enclosure in Bowman County, North Dakota, for the years 1967, 1969 and 1972.

Common Names	Year	Age-class*=100%				Form-class*=100%							
		S	Y	M	D	1	2	3	4	5	6	7	8
Western Red Cedar	1967	0	0	100%	0	0	0	100%	0	0	0	0	0
	1969	0	0	100%	0	0	100%	0	0	0	0	0	0
	1972	0	0	100%	0	0	100%	0	0	0	0	0	0
Dwarf Sage	1967	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	0	11.1	88.9	88.9	0	11.1	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0
Rabbitbrush	1967	0	0	84.1	15.9	0	0	100%	0	0	0	0	0
	1969	0	0	100%	0	0	0	100%	0	0	0	0	0
	1972	0	0	0	100%	0	0	100%	0	0	0	0	0

* Key:

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Pellet Group Transects:

The annual reading of each 1/50 acre transect provided information on the amount of deer or American Pronghorn usage per acre at each study site. The number of pellet groups observed on each transect is expanded on an acreage basis to provide an indication of comparative usage (or non-usage) at each site. This information is presented in Table 6.

Table 6. Deer or American Pronghorn pellet groups per acre on the Cedar Hills 3-Way Exclosure in Bowman County, North Dakota, resulting from annual surveys.

Year	Control area	Cattle-proof Exclosure	Deer-proof Exclosure
1967	0 (initial)	0 (initial)	0 (initial)
1968	150 (deer)	100 (pronghorn)	0
1969	650 (deer)	50* (pronghorn)	0
1970	450 (deer)	50 (deer)	0
1971	200	No Survey Taken	----
1972	300	250 (not identified)	0**

* Much rabbit use--many pellets and much cutting of woody species on the transect.

** Much rabbit sign--small break in S.E. corner of fence that would permit passage for rabbit sized animal

Bye 3-Way Exclosure:

Photo Study:

In addition to six permanent photo sites associated with the Three Parker 3-step transects, sixteen other permanent photo points were established. The latter sites have been photographed each year. These photos will provide a visible record as the study progresses. All photos are on file at the Game and Fish Department's Bismarck office.

Parker 3-Step Transects:

Ground cover and vegetational analysis of the Parker Transects associated with the Bye Exclosure study for the years 1960, 1966 and 1972 are found in Table 7.

Line Intercept Browse Transect:

Table 8 includes the woody browse data from five surveys, 1960 (initial), 1963, 1966, 1969 and 1972.

The condition and trend of browse plants on each 3-way exclosure site (control, cattle proof and deer proof) should indicate what may be expected for the future carrying capacity of this range.

Table 7. Comparative ground cover, vegetational analysis and species composition resulting from Parker 3-Step Transects located on each site of the Bye 3-Way Exclosure study for the years 1960, 1966 and 1972.

Ground Cover Vegetative Type Common Name - Scientific Name	1960			1966			1972		
	Control Area	Cattle Proof Exclosure	Deer Proof Exclosure	Control Area	Cattle Proof Exclosure	Deer Proof Exclosure	Control Area	Cattle Proof Exclosure	Deer Proof Exclosure
<u>Ground Cover</u>									
Bare ground	2	4	11	1	0	5	2	0	3
Erosion pavement	0	0	0	0	0	0	0	0	0
Rock	0	0	0	1	0	0	0	0	0
Litter	78	84	65	70	94	72	79	95	85
Moss	0	0	0	0	0	3	0	0	1
Plant density	20	12	24	28	6	20	19	5	11
<u>Grass-like plants</u>									
Sedge, <u>Carex pennsylvanica</u>	0	1	1	0	0	1	0	0	0
Sedge, <u>Carex saximontana</u>	0	1	0	0	0	0	0	0	0
<u>Grasses</u>									
Blue Grama, <u>Bouteloua gracilis</u>	0	0	0	0	0	0	0	0	4
Hairy Grama, <u>Bouteloua hirsuta</u>	0	0	0	0	0	0	0	0	3
Western Wheatgrass, <u>Agropyron smithii</u>	0	0	1	13	1	2	7	0	2
Slender Wheatgrass, <u>Agropyron trachycaulum</u>	7	3	0	1	0	2	0	0	0
Hallis Bluestem, <u>Andropogon hallii</u>	0	0	7	0	0	0	0	0	0
Little Bluestem, <u>Andropogon scoparius</u>	4	1	5	0	0	4	1	0	0
Side-Oats Grama, <u>Bouteloua curtipendula</u>	0	0	3	0	0	0	0	0	0
Virginia Wild-rye, <u>Elymus virginicus</u>	5	0	0	0	0	0	0	0	0
Little Rice grass, <u>Oryzopsis micrantha</u>	2	1	3	0	0	0	0	0	0
Kentucky Bluegrass, <u>Poa pratensis</u>	1	0	0	2	0	0	7	0	0
Unknown grass	0	0	0	4	1	4	0	0	0
Plains Muhly, <u>Muhlenbergia cuspidata</u>	0	0	0	0	0	3	0	0	0
Blackseed Ricegrass, <u>Oryzopsis racemosa</u>	0	0	0	0	0	0	0	0	1
Green Needlegrass, <u>Stipa viridula</u>	0	0	0	1	0	0	0	0	0
Sandberg Bluegrass, <u>Poa secunda</u>	0	0	0	1	0	0	0	0	0
<u>Annual Herbs</u>									
Pellitory, <u>Parientaria pennsylvanica</u>	0	1	0	0	0	0	0	0	0
Owl Clover, <u>Orthocarpus luteus</u>	0	0	0	0	0	0	2	0	0
<u>Perennial Herbs</u>									
Yarrow, <u>Achillea lanulosa</u>	0	1	0	0	0	0	0	0	0
Northern Bedstraw, <u>Galium boreale</u>	0	0	3	0	0	0	0	0	0
Blue Wild Lettuce, <u>Lactuca pulchella</u>	0	1	0	1	2	0	0	1	0
Aster (Species undetermined)	0	0	1	0	0	0	0	0	0
Unknown herbs	1	0	0	3	0	1	0	0	1
Panicum (Species undetermined)	0	0	0	0	0	0	0	0	0
Lilly (Species undetermined)	0	0	0	0	0	0	0	1	0
Western Virgin's Bower, <u>Clematis ligusticifolia</u>	0	0	0	1	0	0	0	0	0
<u>Deciduous shrubs</u>									
Chokecherry, <u>Prunus virginiana</u>	0	1	0	0	0	1	0	1	0
Rose, <u>Rosa</u> (Species undetermined)	0	1	0	0	1	0	1	0	0
Wolfberry, <u>Symphoricarpos occidentalis</u>	0	0	0	1	1	1	0	0	0
<u>Deciduous tree</u>									
Green Ash, <u>Fraxinus pennsylvanica</u>	0	0	0	0	0	0	1	0	0
<u>Deciduous Vine</u>									
Climing Bittersweet, <u>Celastrus scandens</u>	0	0	0	0	0	1	0	0	0

Table 8. The species composition and relative abundance of all woody plants recorded on each 100-foot Line Intercept Browse Transect associated with the Bye 3-Way Exclosure in Billings County, North Dakota, for the years 1960 (initial), 1963, 1966, 1969 and 1972.

Woody vegetative type	1960	1963	1966	1969	1972	1960	1963	1966	1969	1972	1960	1963	1966	1969	1972
Common names-Scientific names															
<u>Deciduous shrubs</u> (Total lineal feet)	45.9	28.7	32.2	25.9	61.2	52.4	81.4	91.0	74.2	82.6	51.4	49.1	54.5	58.2	114.8
Juneberry, <u>Amelanchier alnifolia</u> ✓	0.5	0	3.5	0	0	0.5	0	0	0	3.3	3.6	1.2	0	1.8	3.5
Chokecherry, <u>Prunus virginiana</u> ✓	5.3	13.2	7.5	5.6	6.1	20.0	35.9	48.6	37.4	44.4	7.3	19.0	15.1	12.9	21.0
Plum, <u>Prunus americana</u>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6
Skunk bush, <u>Rhus trilobata</u> ✓	0	.6	1.3	0	0	0	0	0	0	0	7.8	9.2	9.8	12.0	14.9
Golden Currant, <u>Ribes oideratum</u> ✓	0.5	2.4	0.7	0	0	0.8	0	0	0	0	0	0	2.1	3.0	2.1
Bristley Gooseberry, <u>Ribes setosa</u>	0	0	0.6	0	2.2	0	0	0	0	0	0.2	0.1	0	1.0	4.6
Rose, <u>Rosa</u> (Species undetermined)	3.9	3.8	5.6	9.2	23.1	7.4	5.5	6.4	3.9	11.5	21.3	13.6	11.4	15.5	29.0
Wolfberry, <u>Symphoricarpos occidentalis</u> ✓	35.7	8.7	13.0	11.1	29.8	23.7	39.7	35.7	32.9	23.4	11.2	6.0	15.6	10.9	34.2
Dwarf Sage, <u>Artemesia cana</u> ✓	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0
Poison Ivy, <u>Rhus radicans</u> ✓	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0
Buffaloberry, <u>Sheperdia argentea</u>	0	0	0	0	0	0	0	0	0	0	0	0	0.6	1.1	1.9
% Deciduous shrubs	95.8%	66.6%	93.1%	92.8%	70.3%	95.5%	95.9%	99.7%	93.7%	56.2%	79.9%	82.2%	84.6%	79.2%	73.7%
<u>Deciduous trees</u> (Total lineal feet)	0.3	12.8	1.9	1.6	16.6	2.2	1.8	0.3	5.0	59.7	10.3	10.6	9.9	9.4	37.5
Green Ash, <u>Fraxinus pennsylvanica</u> ✓	0.3	12.8	1.9	1.6	16.6	2.2	1.8	0.3	5.0	59.7	10.3	10.6	9.9	9.4	37.5
% Deciduous trees	.6%	29.7%	5.5%	5.7%	19.1%	4.0%	2.1%	.3%	6.3%	40.6%	16.0%	17.8%	15.4%	12.8%	24.1%
<u>Deciduous vines</u> (Total lineal feet)	1.7	1.6	0.5	.4	9.3	0.3	1.7	0	0	4.8	2.6	0	0	5.9	3.4
Climbing Bittersweet, <u>Celastrus scandens</u>	1.7	0	0.5	.4	9.3	0.3	0	0	0	4.8	2.6	0	0	5.9	3.4
Wild Grape, <u>Vitis vulpina</u>	0	1.6	0	0	0	0	1.7	0	0	0	0	0	0	0	0
% Deciduous Vines	3.6%	3.7%	1.4%	1.5%	10.6%	.5%	2.0%	0.0%	0.0%	3.2%	4.1%	0.0%	0.0%	8.0%	2.2%
Total lineal feet of browse plants	47.9	43.1	34.6	27.9	87.1	54.9	84.9	91.3	79.2	147.1	64.3	59.7	64.4	73.5	155.7

Condition and trend indices by woody plant species:

The form and age class of each browse species represented by the Bye 3-way exclosure study was used to determine the present condition of this portion of the deer range. This information, when compared to previous years data for the same exclosure site (i.e., either control area, cattle proof exclosure or deer proof exclosure), presents a picture as to what has happened in the intervening years. Also, the present condition of browse species provides a probable future trend direction.

Tables 9, 10 and 11 provide this condition and trend comparison by exclosure site and years 1960, 1963, 1966, 1969 and 1972.

Table 9. The condition and trend of all woody species recorded on a 100-foot Line Intercept Browse Transect located on the Control area of the Bye 3-Way Exclosure in Billings County, North Dakota, for the years 1960, 1963, 1966, 1969 and 1972.

Common Names Scientific names	Year	Age data* = 100%				Form-class* = 100%							
		S	Y	M	D	1	2	3	4	5	6	7	8
Green Ash	1960	0	0	100%	0	0	0	0	0	0	0	100%	0
<u>Fraxinus pennsylvanica</u>	1963	0	0	3.9	96.1	0	0	0	60.2	3.9	0	2.3	33.6
	1966	0	31.6	42.1	26.3	0	0	31.6	42.1	0	0	26.3	0
	1969	0	0	100%	0	0	25.0	0	0	0	75.0	0	0
	1972	0	0	37.3	62.7	0	0	0	15.7	0	21.7	47.6	15.0
Climbing Bittersweet	1960	0	0	100%	0	0	30.0	70.0	0	0	0	0	0
<u>Celastrus scandens</u>	1963	0	0	0	0	0	0	0	0	0	0	0	0
	1966	0	0	100%	0	0	0	100%	0	0	0	0	0
	1969	0	0	100%	0	100%	0	0	0	0	0	0	0
	1972	0	0	100%	0	100%	0	0	0	0	0	0	0
Juneberry	1960	0	0	100%	0	0	0	0	0	0	0	100%	0
<u>Amelanchier alnifolia</u>	1963	0	0	0	0	0	0	0	0	0	0	0	0
	1966	0	0	0	100%	94.3	0	0	0	0	0	0	5.7
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0
Chokecherry	1960	0	17.5	82.5	0	11.1	17.5	71.4	0	0	0	0	0
<u>Prunus virginiana</u>	1963	0	0	50.8	49.2	0	12.2	24.2	0	28.0	0	24.2	11.4
	1966	2.7	0	44.0	53.3	32.0	0	22.7	0	0	28.0	0	17.3
	1969	0	0	83.9	16.1	0	0	80.4	0	0	3.6	7.1	8.9
	1972	0	11.5	0	88.5	0	0	11.5	0	0	0	82.0	6.5
Skunk Bush	1960	0	0	0	0	0	0	0	0	0	0	0	0
<u>Rhus trilobata</u>	1963	0	33.3	66.7	0	0	33.3	66.7	0	0	0	0	0
	1966	0	0	100%	0	100%	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0
Golden Currant	1960	0	16.7	83.3	0	16.7	0	83.3	0	0	0	0	0
<u>Ribes odoratum</u>	1963	0	12.5	87.5	0	12.5	0	87.5	0	0	0	0	0
	1966	0	0	100%	0	0	0	100%	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0
Bristley Gooseberry	1960	0	0	0	0	0	0	0	0	0	0	0	0
<u>Ribes setosa</u>	1963	0	0	0	0	0	0	0	0	0	0	0	0
	1966	0	0	100%	0	100%	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	100%	0	100%	0	0	0	0	0	0	0
Rose	1960	0	0	61.7	38.3	49.0	17.0	34.0	0	0	0	0	0
<u>Rosa</u> (Species undetermined)	1963	0	0	73.7	26.3	5.3	0	94.7	0	0	0	0	0
	1966	0	0	83.9	16.1	7.2	46.4	46.4	0	0	0	0	0
	1969	0	0	84.8	15.2	9.8	40.2	50.0	0	0	0	0	0
	1972	0	0	100%	0	38.1	37.7	0	0	24.2	0	0	0
Wolfberry	1960	0	0	100%	0	43.2	51.4	5.4	0	0	0	0	0
<u>Symphoricarpos occidentalis</u>	1963	9.2	23.0	67.8	0	58.6	41.4	0	0	0	0	0	0
	1966	3.8	0	86.2	10.0	34.6	50.8	14.6	0	0	0	0	0
	1969	0	11.7	83.8	4.5	18.0	73.9	8.1	0	0	0	0	0
	1972	0	9.4	90.6	0	98.0	2.0	0	0	0	0	0	0
Wilde Grape	1960	0	0	0	0	0	0	0	0	0	0	0	0
<u>Vitis vulpina</u>	1963	0	37.5	62.5	0	100%	0	0	0	0	0	0	0
	1966	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0

* Key:
S-Seedling
Y-Young
M-Mature
D-Decadent

1-All available-little or no hedging
2-All available-moderate hedging
3-All available-severely hedged
4-Partly available-little or no hedging

5-Partly available-moderately hedged
6-Partly available-severely hedged
7-Unavailable
8-Dead

Table 10. The condition and trend of all woody species recorded on a 100-foot Line Intercept Browse Transect located on the Cattle Proof Exclosure of the Bye 3-Way Exclosure study in Billings County, North Dakota, for the years 1960, 1963, 1966, 1969 and 1972.

Common Name Scientific Name	Year	Age class* = 100%				Form-class* = 100%							
		S	Y	M	D	1	2	3	4	5	6	7	8
Juneberry, <u>Amelanchier anifolia</u>	1960	0	0	100%	0	0	0	100%	0	0	0	0	0
	1963	0	0	0	0	0	0	0	0	0	0	0	0
	1966	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	24.2	75.8	0	100%	0	0	0	0	0	0	0
Chokecherry, <u>Prunus virginiana</u>	1960	0	9.6	84.2	6.2	1.2	4.2	94.2	0.4	0	0	0	0
	1963	0	3.3	92.5	4.2	1.4	19.2	61.3	0	0	13.9	0	4.2
	1966	0	3.5	96.5	0	65.2	0	0	34.8	0	0	0	0
	1969	0	0	99.5	0.5	20.9	1.6	1.1	75.9	0	0	0	0.5
	1972	0	4.5	95.5	0	35.8	13.7	0	31.8	18.7	0	0	0
Golden Currant <u>Ribes odoratum</u>	1960	0	0	100%	0	0	0	100%	0	0	0	0	0
	1963	0	0	0	0	0	0	0	0	0	0	0	0
	1966	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0
Rose, <u>Rosa</u> (Species Undetermined)	1960	0	6.7	93.3	0	19.1	18.0	62.9	0	0	0	0	0
	1963	0	12.7	87.3	0	16.4	60.0	23.6	0	0	0	0	0
	1966	0	0	87.5	12.5	93.8	0	6.2	0	0	0	0	0
	1969	0	0	74.4	25.6	74.3	2.7	0	0	0	0	0	23.0
	1972	0	3.5	70.4	26.1	33.9	40.0	0	0	0	0	0	26.1
Wolfberry, <u>Symphoricarpos occidentalis</u>	1960	0	6.0	94.0	0	32.4	54.9	12.7	0	0	0	0	0
	1963	0	10.3	89.7	0	56.2	34.3	9.5	0	0	0	0	0
	1966	0	0	100%	0	100%	0	0	0	0	0	0	0
	1969	0	0	94.2	5.8	73.6	20.7	0	0	0	0	0	5.7
	1972	0	20.5	79.5	0	83.3	16.7	0	0	0	0	0	0
Dwarf Sage, <u>Artemisia cana</u>	1960	0	0	0	0	0	0	0	0	0	0	0	0
	1963	100%	0	0	0	100%	0	0	0	0	0	0	0
	1966	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0
Poison Ivy, <u>Rhus radicans</u>	1960	0	0	0	0	0	0	0	0	0	0	0	0
	1963	0	0	0	0	0	0	0	0	0	0	0	0
	1966	0	100%	0	0	100%	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0
Green Ash, <u>Fraxinus pennsylvanica</u>	1960	0	23.1	76.9	0	0	23.1	0	0	0	0	76.9	0
	1963	0	100%	0	0	0	0	100%	0	0	0	0	0
	1966	0	100%	0	0	100%	0	0	0	0	0	0	0
	1969	0	0	34.0	66.0	66.0	0	0	2.0	32.0	0	0	0
	1972	0	0	23.3	76.7	0	0	0	0	9.2	6.4	74.0	10.4
Climbing Bittersweet, <u>Celastrus scandens</u>	1960	0	100%	0	0	100%	0	0	0	0	0	0	0
	1963	0	0	0	0	0	0	0	0	0	0	0	0
	1966	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	100%	0	100%	0	0	0	0	0	0	0
Wild Grape, <u>Vitis vulpina</u>	1960	0	0	0	0	0	0	0	0	0	0	0	0
	1963	100%	0	0	0	100%	0	0	0	0	0	0	0
	1966	0	0	0	0	0	0	0	0	0	0	0	0
	1969	0	0	0	0	0	0	0	0	0	0	0	0
	1972	0	0	0	0	0	0	0	0	0	0	0	0

* Key

S-Seedling
Y-Young
M-Mature
D-Decadent

1-All available-little or no hedging
2-All available-moderate hedging
3-All available-severely hedged
4-Partly available-little or no hedging
5-Partly available-moderately hedged
6-Partly available-severely hedged
7-Unavailable
8-Dead

Table 11. The condition and trend of all woody species recorded on a 100-foot Line Intercept located on the Deer Proof Exclosure of the Bye 3-Way Exclosure study in Billings county, North Dakota, for the years 1960, 1963, 1966, 1969 and 1972.

Common Name			Age class* = 100%				Form-class* = 100%							
Scientific Name	Year	S	Y	M	D	1	2	3	4	5	6	7	8	
Juneberry	1960	0	37.2	23.3	39.5	37.2	0	62.8	0	0	0	0	0	
<u>Amelanchier alnifolia</u>	1963	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1966	0	0	0	0	0	0	0	0	0	0	0	0	
	1969	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1972	0	0	100%	0	0	0	0	100%	0	0	0	0	
Plum	1960	0	0	0	0	0	0	0	0	0	0	0	0	
<u>Prunus americana</u>	1963	0	0	0	0	0	0	0	0	0	0	0	0	
	1966	0	0	0	0	0	0	0	0	0	0	0	0	
	1969	0	0	0	0	0	0	0	0	0	0	0	0	
	1972	0	69.4	30.6	0	69.4	0	0	30.6	0	0	0	0	
Chokecherry	1960	0	6.8	93.2	0	0	0	93.2	6.8	0	0	0	0	
<u>Prunus virginiana</u>	1963	0	2.1	92.1	5.8	77.4	0	0	19.5	0	0	0	3.1	
	1966	0	0	100%	0	37.7	0	0	62.3	0	0	0	0	
	1969	0	0	88.4	11.6	53.5	0	0	39.5	0	0	7.0	0	
	1972	0	22.4	77.6	0	40.5	0	0	59.5	0	0	0	0	
Skunk Bush	1960	0	0	93.5	6.5	0	16.1	83.9	0	0	0	0	0	
<u>Rhus trilobata</u>	1963	0	1.1	91.3	7.6	92.4	0	0	0	0	0	0	7.6	
	1966	0	0	100%	0	0	0	0	100%	0	0	0	0	
	1969	0	0	16.7	83.3	100%	0	0	0	0	0	0	0	
	1972	0	0	100%	0	100%	0	0	0	0	0	0	0	
Golden Currant	1960	0	0	0	0	0	0	0	0	0	0	0	0	
<u>Ribes odoratum</u>	1963	0	0	0	0	0	0	0	0	0	0	0	0	
	1966	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1969	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1972	0	0	100%	0	100%	0	0	0	0	0	0	0	
Bristly Gooseberry	1960	0	0	100%	0	100%	0	0	0	0	0	0	0	
<u>Ribes setosa</u>	1963	0	100%	0	0	100%	0	0	0	0	0	0	0	
	1966	0	0	0	0	0	0	0	0	0	0	0	0	
	1969	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1972	0	0	100%	0	0	0	0	100%	0	0	0	0	
Rose	1960	0	0	88.7	11.3	0.8	59.3	14.1	0	25.8	0	0	0	
<u>Rosa</u> , (Species undetermined)	1963	0	0	97.1	2.9	97.1	0	0	0	0	0	0	2.9	
	1966	0	0	95.6	4.4	69.3	0	0	26.3	0	0	0	4.4	
	1969	0	0	89.7	10.3	100%	0	0	0	0	0	0	0	
	1972	0	1.3	89.7	9.0	72.4	0	0	15.2	3.4	0	0	9.0	
Wolfberry	1960	0	6.0	94.0	0	53.0	44.0	3.0	0	0	0	0	0	
<u>Symphoricarpos occidentalis</u>	1963	1.7	55.0	43.3	0	100%	0	0	0	0	0	0	0	
	1966	0.6	0	99.4	0	59.6	0	0	40.4	0	0	0	0	
	1969	0	0	41.3	58.7	93.6	0	0	0	0	0	0	6.4	
	1972	0	8.9	86.1	5.0	59.5	0	0	16.8	3.0	0	15.6	5.1	
Buffaloberry	1960	0	0	0	0	0	0	0	0	0	0	0	0	
<u>Shepherdia argentea</u>	1963	0	0	0	0	0	0	0	0	0	0	0	0	
	1966	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1969	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1972	0	0	100%	0	100%	0	0	0	0	0	0	0	
Green Ash	1960	0.8	29.3	4.1	65.8	0	0.8	20.3	4.1	8.1	0	66.7	0	
<u>Fraxinus pennsylvanica</u>	1963	0	30.2	60.4	9.4	39.6	0	0	50.9	0	0	0	9.5	
	1966	0	13.1	35.4	51.5	44.4	0	0	4.1	0	0	0	51.5	
	1969	0	8.5	53.2	38.3	43.6	0	0	18.1	0	0	0	38.3	
	1972	0	7.8	78.1	14.1	11.2	0	0	0	9.9	0	64.8	14.1	
Climbing Bittersweet	1960	0	22.6	77.4	0	0	0	100%	0	0	0	0	0	
<u>Celastrus scandens</u>	1963	0	0	0	0	0	0	0	0	0	0	0	0	
	1966	0	0	0	0	0	0	0	0	0	0	0	0	
	1969	0	0	100%	0	100%	0	0	0	0	0	0	0	
	1972	0	0	100%	0	100%	0	0	0	0	0	0	0	

*Key

S-Seedling
Y-Young
M-Mature
D-Decadent

1-All available-little or no hedging
2-All available-moderate hedging
3-All available-severely hedged
4-Partly available-little or no hedging

5-Partly available-moderately hedged
6-Partly available-severely hedged
7-Unavailable
8-Dead

Table 12. Deer pellet groups per acre on the Bye 3-Way Exclosure in Billings County, North Dakota, resulting from annual surveys.

Year	Control Area	Cattle-Proof Exclosure	Deer-Proof Exclosure
1960	0(initial)	0(initial)	50(initial)
1961	50	150	0
1962	0	150	0
1963	0	0	0
1964	0	200	0
1965	0	0	0
1966	0	100	(Not
1967	0	150	taken
1968	0	0	as
1969	0	0	no
1970	0	50	deer
1971	0	No Data	usage
1972	0	0	observed)

Pellet Group Transects:

The number of pellet groups observed on each transect annually is expanded on an acreage basis to provide an indication of comparative usage (or non-usage) at each site. These results are provided in Table 12.

DISCUSSION

Cedar Hills 3-Way Exclosure Study:

Photo Study: The photographs (from annual photo study) depict a marked improvement in plant density and growth within the cattle and deer proof areas as compared to the control area. These photos are on file at the Bismarck office.

Ground Cover and Species Composition: The amount of data (2 years) resulting from the Parker 3-Step Transect is too limited to indicate a definite trend as yet. The techniques and mechanics used on this type of transect requires several years data before producing results.

Condition and Trend of Woody Species: The control area woody plants age increased with no new seedlings showing up and usage, for the most part, appeared to increase. The cattle and deer proof exclosures showed a decrease in plant utilization and some seedlings showing up.

Pellet Group Data: Increases in pellet groups occurred in both the control and cattle proof areas. Rabbit use was apparent within the deer proof exclosure in 1972.

Generally, the cattle and deer proof areas indicated more improved conditions while the control area remained about the same.

Bye 3-Way Exclosure Study:

Photo Study: The Bye photo file shows an exceptional improvement in plant growth and density within the cattle and deer proof exclosure, while the control area shows continued over use.

Ground Cover and Species Composition: Again, it is felt that because of the mechanics employed in setting up and reading these transects, more years data are required before any trend can emerge.

Condition and Trend of Woody Species: Plant growth and vigor, generally, improved within the cattle and deer proof areas and seedling production was apparent.

The control area indicates movement toward decadent plants with few seedlings showing up.

Usage continued to be heavy on the control area while the cattle proof area usage declined.

Pellet Group Data: Pellet group counts on the control area declined to zero, which indicated that usage by deer was non-existent, therefore, it would appear that domestic livestock is the cause of the continued heavy use in this area.

SUMMARY

Generally, photo study, usable transect and pellet group information indicates that definite improvement in woody browse species can be attained with the restriction of domestic livestock usage.

Cattle proof and deer proof exclosure sites indicate improved browse species conditions while the control area sites continue to be over used.