Baseline data on vegetation, breeding bird populations, and small mammals in relation to proposed contour furrowing in southeastern Montana
by David Scott Goldan

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University

Abstract:
This study, conducted during the summers of 1980 and 1981 in southeastern Montana, represents the pre-treatment phase of a study designed to determine the effects of contour furrowing on wildlife populations. Experimental and control plots were established on similar sagebrush-grassland habitat. Quantitative data were obtained on canopy cover of vegetation, breeding bird population densities, small mammal populations, and comparative use of the plots by sage grouse. Visual similarity of the study plots was substantiated by vegetational analysis. A general consistency was found in the species composition and relative abundance of birds and mammals between plots. A small increase in the cover of big sagebrush in 1981 was thought to be responsible for an increase in the number of Brewer's sparrow breeding pairs, but did not affect the number of vesper sparrow pairs. Changes between years in the trapping success of deer mice and 13-lined ground squirrels were inversely related to precipitation levels. The preponderance of male deer mice captured during both years may have been due to low population levels.

STATEMENT OF PERMISSION TO COPY

In presenting this thesis in partial fulfillment of the requirements for an advanced degree at Montana State University, I agree that the Library shall make it freely available for inspection. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by my major professor, or, in his absence, by the Director of Libraries. It is understood that any copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Signature David A. Golden

Date March 26, 1982

BASELINE DATA ON VEGETATION, BREEDING BIRD POPULATIONS, AND SMALL MAMMALS IN RELATION TO PROPOSED CONTOUR FURROWING IN SOUTHEASTERN MONTANA

by

DAVID SCOTT GOLDAN

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Fish and Wildlife Management

Approved:

Robert L. Eng

Chairperson, Graduate Committee

J M Pickett

Head, Major Department

Michael P. Malone

Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

March, 1982

ACKNOWLEDGMENTS

I wish to extend my sincere appreciation to the following, among others, for their contributions to this study: Dr. Robert L. Eng, Montana State University, for project planning, technical supervision and guidance in preparation of the manuscript; Dan Bricco of the Bureau of Land Management for advice and field assistance; Dr. Jack Taylor and Dr. Robert Moore, Montana State University, for critical reading of the manuscript; James E. Mowbray of the Northern Plains Soil and Water Research Center, Sidney, Montana for help with plant identification; and to my future wife, Linda A. Zisch for patience, encouragement and assistance. During the study the writer was supported by the United States Department of the Interior, Bureau of Land Management.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This study, conducted during the summers of 1980 and 1981 in southeastern Montana, represents the pre-treatment phase of a study designed to determine the effects of contour furrowing on wildlife populations. Experimental and control plots were established on similar sagebrush-grassland habitat. Quantitative data were obtained on canopy cover of vegetation, breeding bird population densities, small mammal populations, and comparative use of the plots by sage grouse. Visual similarity of the study plots was substantiated by vegetational analysis. A general consistency was found in the species composition and relative abundance of birds and mammals between plots. A small increase in the cover of big sagebrush in 1981 was thought to be responsible for an increase in the number of Brewer's sparrow breeding pairs, but did not affect the number of vesper sparrow pairs. Changes between years in the trapping success of deer mice and 13-lined ground squirrels were inversely related to precipitation levels. The preponderance of male deer mice captured during both years may have been due to low population levels.

INTRODUCTION

Mechanical treatment of relatively unproductive rangelands has been widely used in the northern Great Plains to rehabilitate these lands (Wight 1976, Wight et al. 1978, Lacey et al. 1981). One common method of mechanically altering rangelands is contour furrowing. The U. S. Bureau of Land Management (BLM) and the Soil and Water Conservation Research Division of the Agricultural Research Service began conducting research on contour furrowed lands near Ekalaka in southeastern Montana in 1967.

Casual observation by range and soil scientists suggested that changes in wildlife accompanied changes in soil characteristics and vegetation on these contour furrowed areas. Little has been published on the effects of mechanical treatment of rangeland on wildlife.

The purpose of this study was to provide baseline data on vegetation, small birds, and mammals on experimental and control plots. Alteration of the experimental plot is tentatively scheduled for 1982, after which a comparison of native and contour furrowed range will be possible. Field research was conducted from mid-June to mid-August 1980, and from early April to mid-August in 1981.

DESCRIPTION OF STUDY AREA

The study area was located in southeastern Montana about 30 kilometers (km) south of Ekalaka. The study plots are in Section 28 of T2S, R58E, MPM, one being situated on either side of Dead Boy Creek (Figure 1). This area, administered by the BLM, consists of grazing lands and is managed under a deferred rotation grazing system.

Soils in the area are generally deep and moderately to well drained, with a thin loam surface layer and a clay or silty clay subsoil. Recent sampling by BLM soil scientists has identified soils immediately south of Dead Boy Creek as belonging to the Absher series, while those immediately north of the drainage belong to the closely allied Gerdrum series. Both soils are in the family of fine, montmorillontic Borollic Natrargids.

The climate is arid to semiarid continental, characterized by cold, relatively dry winters and warm summers (Neff 1980). The mean annual temperature for Ekalaka, Montana is about 9 Celsius (C) with means for January and July being about -11 C and 21 C, respectively. The long term average annual precipitation is 31 centimeters (cm), however, individual year amounts may be extremely variable with 13 cm and 64 cm being the recorded minimum and maximum in this area (Neff and Wight 1981). More than half of this precipitation occurs during the months of May, June, and July. Recording gauges installed at the ARS-BLM range study site near Ekalaka in 1967 indicate that

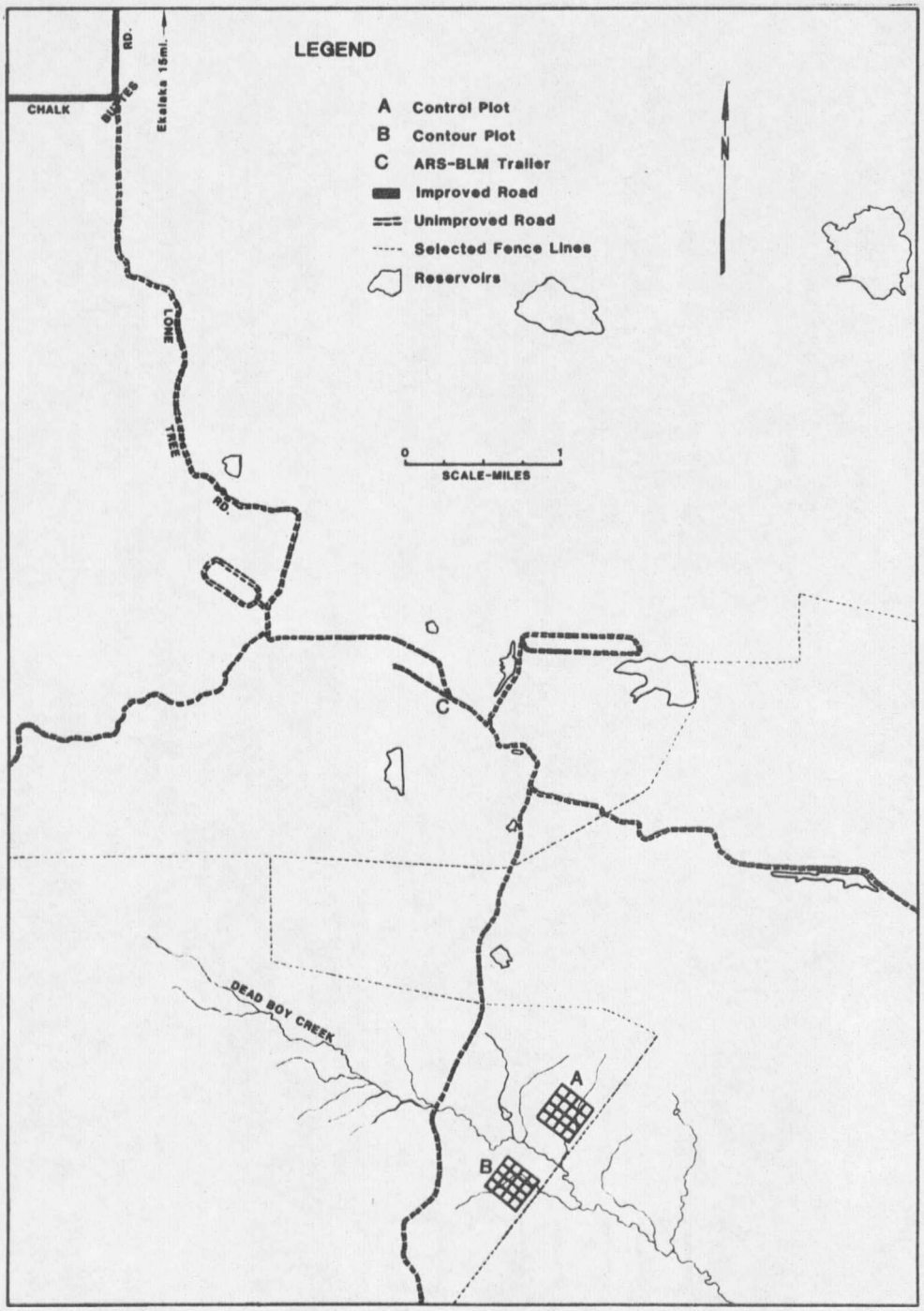

Figure 1. Map of study area.

precipitation has been somewhat lower at this site than at Ekalaka. During the period 1969-1980, average annual precipitation at Ekalaka was 44.6 cm compared to 36.8 cm at the study site.

The summer of 1980 was extremely dry. Precipitation for the period April-July was 42% of normal and the total annual precipitation was only 18.8 cm. Total precipitation in 1981 was near average levels, although July rainfall was 55% above normal.

Research conducted from 1968-1981 under the ARS-BLM cooperative agreement has provided information on flora and fauna of the area.

The ARS-BLM cooperative studies final report (Neff and Wight 1981) provides a description of vegetation and a list of plant species on the range study site near Ekalaka. A similar list of plant species was compiled by the BLM for the Ralph L. Curry allotment on which the present study plots are located.

The vegetation of the study plots is dominated by a blue grama (*Bouteloua gracilis*)-dense clubmoss (*Selaginella densa*) community interspersed with a western wheatgrass (*Agropyron smithii*)-thickspike wheatgrass (*Agropyron dasystachyum*) complex. Western and thickspike wheatgrass are almost indistinguishable in the absence of an inflorescence and are often found in close association (Hughes et al. 1973 and Yaeger et al. 1977). These grasses are considered hereafter as a single species complex. Other common grasses include prairie junegrass (*Koeleria cristata*), Sandberg bluegrass (*Poa sandbergii*), sand

dropseed (*Sporobolus cryptandrus*), and buffalograss (*Buchloe dactyloides*). The predominant shrub is big sagebrush (*Artemisia tridentata*), with Nuttall saltbush (*Atriplex nuttallii*), and broom snakeweed (*Xanthocephalum sarothrae*) also being present. Hood's phlox (*Phlox hoodii*), pricklypear cactus (*Opuntia polyacantha*), and pincushion cactus (*Mammillaria vivipara*) are the prevalent forbs. Other abundant plant species included lichens and yellow stonecrop (*Sedum stenopetalum*).

Crowston et al. (1973) described the wildlife of the Little Missouri Grasslands in southwestern North Dakota. Skaar (1975 and supplements) lists the latilong containing Carter County as containing 151 bird species. Annotated bird lists of the region have been made by Cameron (1907), Visher (1911, 1912, 1913), and Saunders (1916). Lampe et al. (1974) have described the mammals of Carter County.

METHODS

Two 16 hectare (ha) plots were established during the spring of 1980. The plot south of Dead Boy Creek (hereafter referred to as the contour plot) was predetermined to lie within a 64 ha area to be contour furrowed by the BLM. The plot north of Dead Boy Creek (the control plot) was established in an area deemed most similar to the contour plot by visual inspection. Each plot was 400 meters (m) on a side; plots were gridded and staked at 100 m intervals.

A modification of the method described by Daubenmire (1959) was used to measure canopy cover of vegetation. A 20 x 50 cm frame was placed at 20 foot (ft) intervals along a 100 ft tape. The tape was extended in four directions at 45 degrees to each of the grid lines at the nine interior points of both plots (Figure 2). Thus, vegetation cover was estimated on each plot with 180 frames. The percent canopy cover of each plant species was recorded into one of six classes: 1 = 0-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, and 6 = 95-100%. The midpoint of each class was used in computations.

Breeding bird pairs censuses were conducted from 18 June-4 July, 1980 and during the periods 10 May-21 May and 21 June-1 July, 1981. Censusing began about one half hour before sunrise and generally took about two hours. Only one plot was censused each day due to the distance between plots. Censuses were not conducted on days when inclement weather (rain, snow, high wind, etc.) inhibited the

+ 9 interior points used for sampling
1 a 100ft. vegetation sampling line (4 at each sampling point).
2 a 100ft. sage grouse dropping sampling line (2m. wide, 4 at each sampling point).
3 a small mammal trapping station (4 at each sampling point).

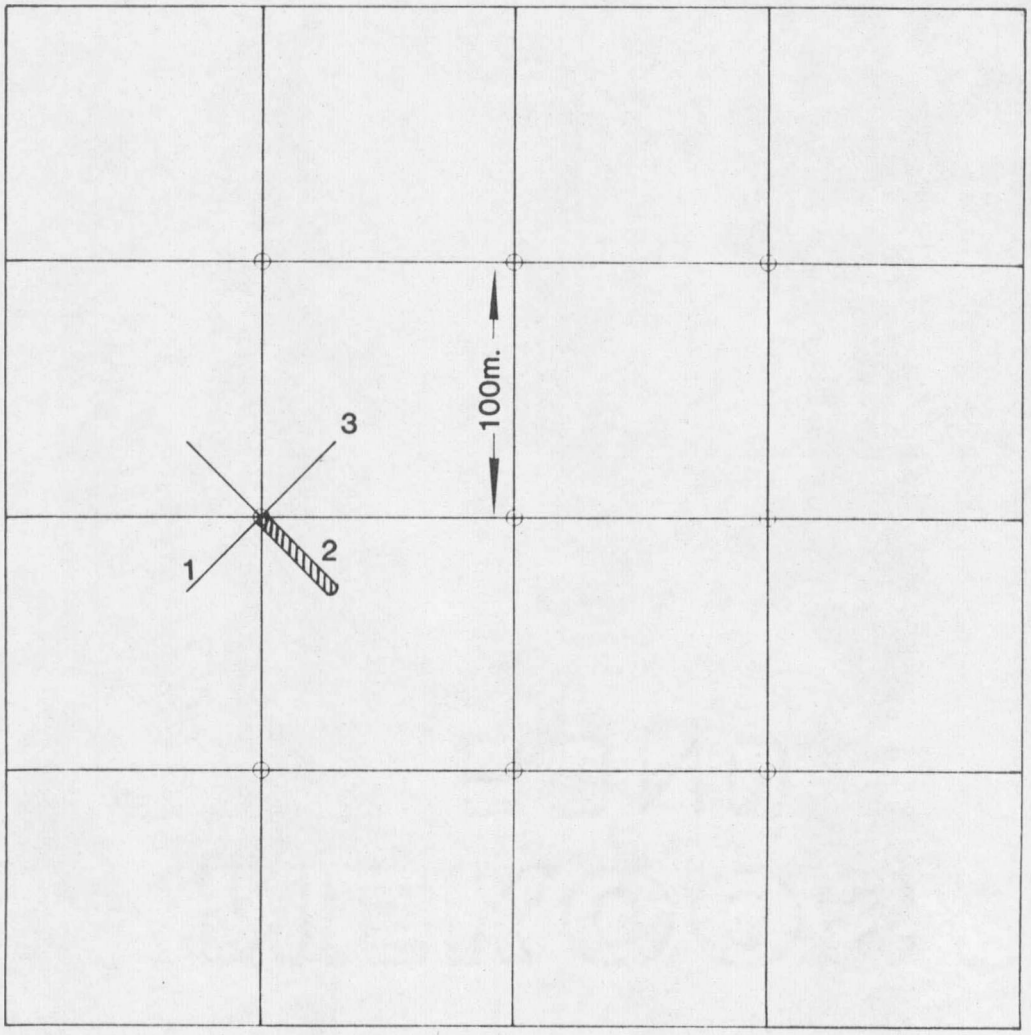

Figure 2. Study plot showing bird census transects, vegetation and sage grouse dropping sampling lines, and small mammal trapping station at one of the nine interior sampling points.

observers ability to locate or identify birds. The plots were censused alternately. Each plot was censused five times in 1980 and at least six times in 1981 using the territory mapping technique initially described by Williams (1936). The procedure consisted of walking one set of five grid lines, then returning to the starting point along the set perpendicular to the first. Observations were recorded on a grid map. Species, sex, territorial behavior, nest locations, and the presence of juveniles were recorded during each census. At the end of each census season a composite map for each species was constructed. A cluster of observations was considered to indicate the territory of a breeding pair. The number of breeding pairs for each species was estimated for each plot and is expressed as pairs per 40 ha. Supplemental nest searches during midday helped verify territory locations.

During the spring of 1981 an attempt was made to capture and mark breeding birds on the study plots. Territorial males were located from breeding bird censuses. Mist nets were erected within territories and birds lured in with tape recorded playbacks of their own vocalizations. Banding operations took place from 30 May-5 June with the exception of one bird which was banded on 19 June. Banded birds were marked with various colored waterproof felt pens on the crown, cheek, or chin.

Sage grouse dropping counts were made to compare winter use of the two plots by these birds. A 100 ft tape was stretched along the same lines used in vegetation sampling. A tally was made of droppings encountered along a 1-meter strip on each side of the tape. Patterson (1952) distinguished two types of sage grouse droppings. Single droppings were deposited randomly during periods of activity, while roost sites were composed of a cluster of individual droppings, frequently covered with a brownish-black caecal dropping. All droppings were removed from the search path as they were found. Thus, totals in 1980 represent use prior to the winter of 1980-81, while 1981 totals represent use during the fall and winter of 1980-81 exclusively.

Small mammal trapping was conducted from 6-10 August, 1980 and 7-11 August, 1981. Traps were generally checked between 9:00 a.m. and 1:00 p.m. each day, the plot checked first being alternated on successive days. Trapping stations were established near the end of each 100 ft vegetation transect. One Sherman live-trap, two mouse traps and one rat trap were placed at each station. Pitfalls were constructed from three pound coffee cans at 9 of the 36 stations on each plot. Species, sex, and body and tail length were recorded for all captured mammals, Empty sprung traps, or traps containing birds were deleted from that day's tabulations and rebaited. All traps

were rebaited every other day with a peanut butter/oatmeal mixture. Trapping success was calculated exclusive of pitfall-nights.

RESULTS

Visual similarity of the study plots was substantiated by vegetation analysis. The plant species present were almost identical. Percent canopy cover and frequency of occurrence of individual plant species were also similar. A summary of the data compiled on each plant species encountered during the study is presented in Tables 1 and 2. In 1980 the canopy cover of vegetation totalled 68% and 86% on the contour and control plots, respectively. Canopy cover in 1981 was 90% on the contour plot and 91% on the control plot. Only five species in 1980 and six in 1981 comprised more than 2% of the total canopy cover of vegetation on either plot. The dominant speces on both plots was dense clubmoss.

Large changes observed between years in either canopy cover or percent frequency on one plot were almost always observed on the other plot as well. Most notable were the increases in dense clubmoss, bare ground, pricklypear cactus and litter. The greatest difference between plots was the degree of dominance of the two major grass species. Although western-thickspike wheatgrass was by far the most frequent grass encountered on either plot, blue grama was the dominant grass in terms of canopy cover on the control plot.

Breeding bird census results for all birds encountered during the study on each plot are presented in Tables 3 and 4. The breeding avifauna of the two plots in 1980 was composed of the exact same bird

Table 1. Mean percent canopy cover and percent frequency of occurrence of plant species on the contour plot.

Category	1980 $\bar{X}$%can.	1980 %freg.	1981 $\bar{X}$%can.	1981 %freq.
Grasses and Grass-like Plants				
Agropyron smithii/ dasystachyum complex	13	94	14	91
Bouteloua gracilis	11	54	12	48
Bromus sp.	t[a]	1	t	3
Buchloe dactyloides	2	7	3	7
Carex filifolia	--	--	t	2
Hordeum jubatum	--	--	t	4
Koeleria cristata	1	7	1	8
Poa sandbergii	t	11	1	14
Schedonnardus paniculatus	t	2	--	--
Sporobolus airoides	t	3	1	4
Sporobolus cryptandrus	t	2	t	2
Stipa comata	t	1	--	--
Total	28	98	33	96
Forbs				
Achillea millefolium	t	1	--	--
Antennaria spp.	--	--	t	2
Astragalus spp.	--	--	t	2
Atriplex patula	--	--	t	3
Comandra umbellata	t	1	t	1
Eriogonum multiceps	--	--	t	7
Grindelia squarrosa	t	4	t	7
Lomatium foeniculaceum	--	--	t	7
Mammillaria vivipara	t	2	--	--
Opuntia polyacantha	2	21	4	23
Phlox hoodii	1	18	1	17
Vicia americana	--	--	t	1
Unidentified forbs	t	2	1	12
Total	4	49	7	61
Shrubs				
Artemisia tridentata	10	63	15	66
Atriplex nuttallii	2	16	2	14
Chrysothamnus viscidiflorus	--	--	t	1

Table 1. (continued).

Category	1980 $\bar{X}$%can.	1980 %freq.	1981 $\bar{X}$%can.	1981 %freq.
Shrubs (continued).				
Symphoricarpos albus	--	--	t	6
Xanthocephalum sarothrae	1	11	2	7
Total	13	80	19	81
Others				
Lichen	5	83	5	75
Sedum stenopetalum	1	33	1	27
Selaginella densa	22	53	31	66
Bare ground	29	82	37	89
Litter	1	28	6	77

[a] t = trace.

Table 2. Percent canopy coverage and percent frequency of occurrence of plant species on the control plot.

Category	1980 $\bar{X}$%can.	1980 %freq.	1981 $\bar{X}$%can.	1981 %freq.
Grasses and Grass-like Plants				
Agropyron smithii/ dasystachyum complex	10	87	9	78
Bouteloua gracilis	16	68	15	62
Bromus sp.	--	--	t[a]	1
Buchloe dactyloides	--	--	t	1
Carex filifolia	t	1	--	--
Koeleria cristata	1	12	t	4
Poa sandbergii	t	16	t	10
Sitanion hysterix	--	--	t	1
Sporobolus cryptandrus	t	6	1	8
Stipa comata	t	2	--	--
Total	27	93	26	91

Table 2. (continued).

Category	1980 $\bar{X}$%can.	1980 %freq.	1981 $\bar{X}$%can.	1981 %freq.
Forbs				
Antennaria spp.	--	--	t	1
Astragalus spp.	--	--	t	1
Comandra umbellata	t	2	t	7
Eriogonum multiceps	--	--	t	3
Grindelia squarrosa	--	--	t	3
Lomantium foeniculaceum	--	--	t	3
Mammillaria vivipara	t	1	t	2
Opuntia polyacantha	1	18	3	22
Phlox hoodii	1	14	t	10
Unidentified forbs	t	1	t	4
Total	2	33	5	48
Shrubs				
Artemisia tridentata	15	71	16	71
Atriplex nuttallii	1	15	2	16
Chrysothamnus viscidiflorus	--	--	t	2
Xanthocephalum sarothrae	1	11	1	7
Total	17	81	19	80
Others				
Lichen	7	89	5	88
Sedum stenopetalum	1	18	1	11
Selaginella densa	32	73	38	78
Bare ground	26	75	30	90
Litter	2	27	7	75

[a] t = trace.

Table 3. Estimated number of breeding birds on the contour plot.

Species[a]	1980[b] Average no. obs./census	1980[b] Number pairs	1980[b] Pairs per 40 ha	1981[c] Average no. obs./census	1981[c] Number pairs	1981[c] Pairs per 40 ha
Vesper Sparrow	15.6	8	20	19	8	20
Brewer's Sparrow	2.4	2	5	15.2	7	17.5
Horned Lark	23.6	?[d]	?	15	5[e]	12.5
Meadowlark	4.4	2	5	3.3	1	2.5
Lark Bunting	--	--	--	5	0	0
Total	46.0	?	?	57.5	21	52.5

[a]Species averaging fewer than 0.4 observations per census:
1980: Lark Bunting, Barn Swallow
1981: Killdeer, Marsh Hawk.

[b]Data obtained from five censuses: 18 June, 24 June, 26 June, 30 June, 2 July.

[c]Data obtained from six censuses: 10 May, 15 May, 20 May, 22 June, 25 June, 30 June.

[d]The number of breeding pairs could not be estimated.

[e]Data obtained from three censuses: 10 May, 15 May, 20 May.

Table 4. Estimated number of breeding birds on the control plot.

Species[a]	1980[b] Average no. obs./census	1980[b] Number pairs	1980[b] Pairs per 40 ha	1981[c] Average no. obs./census	1981[c] Number pairs	1981[c] Pairs per 40 ha
Vesper Sparrow	18	8	20	11.7	6	15
Brewer's Sparrow	15.6	7	17.5	20	11	27.5
Horned Lark	12	?[d]	?	16.3	7[e]	17.5
Meadow Lark	4.2	2	5	5	2	5
Mallard	--	--	--	0.1	1	2.5
Total	49.8	?	?	53.1	27	67.5

[a]Species averaging fewer than 0.5 observations per census:
1980: Common Nighthawk, Redwing Blackbird, Lark Bunting, Killdeer
1981: Lark Bunting, Killdeer, Sage Grouse, Forster's Tern.

[b]Data obtained from five censuses: 23 June, 25 June, 27 June, 1 July, 4 July.

[c]Data obtained from seven censuses: 14 May, 18 May, 21 May, 21 June, 23 June, 29 June, 1 July.

[d]The number of breeding pairs could not be estimated.

[e]Data obtained from three censuses: 14 May, 18 May, 21 May.

species. Species that established territories were the vesper sparrow (*Pooecetes gramineus*), the Brewer's sparrow (*Spizella breweri*), the horned lark (*Eremophila alpestris*), and the meadowlark (*Sturnella neglecta*). The first census of 1980 was conducted on 18 June. Because horned larks tend to nest in very early spring, the number of breeding pairs could not accurately be estimated in 1980. The nesting habits of the horned lark in relation to this study are discussed in a later section.

The breeding avifauna on the two plots in 1981 was the same as in 1980 except for a mallard hen that nested on the control plot. The most notable difference between years was the great increase in the number of breeding pairs of Brewer's sparrows on both plots. The total breeding pairs (excluding horned larks) increased 33.3% on the contour plot and 17.7% on the control plot. An estimation of the number of horned lark breeding pairs was made possible by the three censuses conducted on each plot in mid-May.

The contour plot had 29.5% fewer breeding pairs than the control plot in 1980 and 20% fewer in 1981. In both years the difference in total breeding pairs was due to differences in the number of pairs of Brewer's sparrows.

Mist netting of birds was not attempted during the first year of the study since field research began in mid-June. During the spring of 1981, 28 birds were captured. Eight Brewer's sparrows and

five vesper sparrows were captured and marked on the contour plot, while eleven Brewer's sparrows and one vesper sparrow were captured on the control plot. Several captured birds escaped before they could be banded but all banded birds received marks. The method used in marking small sparrows was found to be unsatisfactory for the purposes of this study. Although all banded birds were heavily marked with waterproof felt pens, no bird retained a mark more than one week after capture and some marks lasted less than three days. During censuses conducted after trapping, birds with bands were frequently observed but marks were undetectable.

In 1980, 25 sage grouse roost sites and 91 individual droppings were counted on the contour plot. On the control plot, 15 roost sites and 40 droppings were found. In 1981, 24 roost sites and 59 droppings were counted on the contour plot while 21 roost sites and 36 droppings were encountered on the control plot sample. Most sage grouse sign was found on the lower halves of both plots, near Dead Boy Creek. The northern half of the contour plot contained 64% of the feeding droppings encountered in 1980 and 88% encountered in 1981. The southern half of the control plot contained 72.5% of the feeding droppings found in 1980 and 83% of those found in 1981.

Small mammal trapping in 1980 resulted in 563 trap-nights on the contour plot and 571 trap-nights on the control plot. Fourteen deer mice (*Peromyscus maniculatus*), two 13-lined ground squirrels

(*Spermophilus tridecemlineatus*), and one shrew (*Sorex* sp.) were captured on the contour plot. Trapping success for the first two species was 2.49% and 0.36%, respectively. On the control plot, eighteen deer mice and four 13-lined ground squirrels were captured for a trapping success of 3.15% and 0.70%, respectively, for these two species.

In 1981 only deer mice and 13-lined ground squirrels were captured. There were 545 trap-nights on the contour plot and 538 trap-nights on the control plot. Twelve deer mice were captured on the contour plot for a trapping success of 2.20%. Only one 13-lined ground squirrel was captured, making trapping success 0.18% for this species. On the control plot, seven deer mice and two 13-lined ground squirrels were captured. Trapping success for these two species was 1.30% and 0.37%, respectively.

The decrease in trapping success for deer mice from 1980-81 was 17% on the contour plot and 59% on the control plot. Trapping success for 13-lined ground squirrels decreased 48% on the contour plot and 47% on the control plot.

There were distinct differences in the susceptibility to capture of both deer mice and 13-lined ground squirrels in the three types of traps used. Both species were captured almost twice as often in Sherman live-traps as in mouse traps. Deer mice were infrequently

caught in rat traps, while 13-lined ground squirrels were captured as often in rat traps as in mouse traps.

All of the deer mice captured on the contour plot in both years were males. On the control plot males comprised 89% of the deer mice captured in 1980 and 86% in 1981. Male and female 13-lined ground squirrels were captured in about equal numbers on both plots in both years.

DISCUSSION

Horned larks in the latitude of this study often initiate nesting in late March or early April. Two broods are raised per year, with three being common in favorable years (Pickwell 1931 and Dubois 1935). Clutch size is usually 3-4 eggs, incubation period about 11 days, and fledging time 10-14 days. Second nests are initiated approximately one week after fledging, making the period for one complete nesting cycle about 30-35 days (Kelso 1931 and Pickwell 1931). Had nesting begun on the study plots as late as mid-April during the extremely mild spring of 1980, second broods would have left the nest by late June. Thus, when 1980 censusing took place, horned larks had largely completed nesting or were rearing third broods. The population of horned larks at this time must have been composed primarily of juvenile birds. Although juveniles and adults are easily distinguished early in the breeding season or when at rest, moving, mixed flocks of juveniles and adults are common late in the breeding season. Some errors were undoubtedly made in recording juveniles as adults during censuses in June and July.

Horned larks usually nest on bare ground or where vegetation is extremely sparse (Dubois 1935). This nesting habit often necessitates a seasonal succession of breeding sites as vegetation becomes more profuse. Pickwell (1931) found that vegetation was the sole influence in modifying territories. The increase in vegetation in

late May and June greatly modified territory shape and size, leading to the abandonment of most territories by the close of second nesting. He further reported that horned lark pairs shared feeding sites outside of their nesting territories. The "type A" territory described by Nice (1941), in which the defended area is used for mating, nesting, and feeding of adults and young throughout the breeding season, clearly is not maintained by the horned lark. This accounts for my inability to delineate horned lark territories in 1980. Likewise, the data collected in 1981 were difficult to interpret. Thus, the average number of horned larks observed per census trip is probably a better basis for comparison between plots and years than the number of nesting pairs.

In contrast to the horned lark, Brewer's and vesper sparrows remain within a defended territory throughout the breeding season (Feist 1968). During this study an adult male vesper sparrow banded 3 June, 1981 was found in a snap trap on 9 August, 1981 about 100 m from the initial site of capture.

Best (1970) found that Brewer's sparrow nest sites were in regions of dense and large sagebrush, while vesper sparrows preferred areas of sparse and smaller sagebrush. Although available cover was determined to be a paramount factor in the nest site selection of the Brewer's sparrow in his study, no change in the number of Brewer's sparrow pairs was noted following a 50% reduction in live sagebrush.

However, he reported a 28% canopy cover of big sagebrush immediately following the reduction while in the present study maximum canopy cover of big sagebrush was less than 16%. Best found 40 Brewer's sparrows per 40 ha after the sagebrush reduction, whereas the average number of Brewer's sparrows on the two study plots was 15 per 40 ha in the present study. A 7% increase in canopy cover of big sagebrush on the control plot was concurrent with a 57% increase in Brewer's sparrow pairs. On the contour plot a 50% increase in big sagebrush cover and a 250% increase in the number of Brewer's sparrow pairs was observed. If the Brewer's sparrow requires regions of dense and large sagebrush for nesting and these regions are limited, as in the present study, breeding pairs may be responsive to small yearly changes in the canopy cover of this shrub. The vesper sparrow would not be expected to respond to small changes in the cover of big sagebrush and did not.

These two birds have similar food habits and exhibit a high degree of interspecific tolerance (Feist 1968 and Best 1970). An increase in available food supply would presumably benefit both species equally. The general consistency in the number of vesper sparrow pairs on both plots in both years indicates that food supply was not responsible for the observed increase in Brewer's sparrow breeding pairs.

Since sage grouse were rarely observed on either study plot in spring or summer, droppings can be assumed to be largely from fall

and winter use. The number of droppings found in 1981 was only slightly lower than in 1980, suggesting that most sage grouse sign deteriorates within 19-22 months.

Canopy cover of big sagebrush was higher and individual plants were encountered more frequently on the lower half of each study plot. Patterson (1952) found that sage grouse loafing and roosting grounds were selected along draws, gullies, and creek bottoms where sagebrush cover was most dense. Winter feeding was done wherever exposed sagebrush was available. The preponderance of sage grouse sign on the lower halves of the study plots is probably indicative of the heavy use of areas adjacent to Dead Boy Creek. Tall sagebrush plants in these areas may also be more exposed than the shorter plants on nearby upland slopes. In fall, a daily water supply and associated succulent vegetation are provided by a small stockpond next to Dead Boy Creek and within 400 m of the study plots.

Small mammal habitat characterized by sparse vegetation and large amounts of bare ground has been associated with large home range size and extensive movements of *Peromyscus* (Blair 1951, Gashweiler 1959, Allred and Beck 1963, and Cada 1968). Although trapping methods did not permit an estimation of population size, the nature of the habitat would indicate a low population density. Tschache (1970) found that the proportion of males in the population was higher when total population density was low, on a sparse

sagebrush-grassland habitat. This trend has also been observed by others on a variety of habitat types (Trout 1978 and Scow 1981). Storer et al. (1944), Fitch (1958), and others have shown that adult male deer mice have larger home ranges than do adult females and are therefore more susceptible to trapping. Laboratory data collected by Terman and Sassaman (1966) also indicate a secondary sex ratio of more males than females. Thus, the trapping of a preponderance of male deer mice during both years of this study should not be considered unusual.

The decline in trapping success of small mammals from 1980-81 is difficult to evaluate because of the small number of trap-nights. An inverse relationship between trapping success and precipitation levels is similar to findings of Blair (1948), Cada (1968), and Tschache (1970), but the relationship itself is not understood. Data collected by Blair (1941 and 1943), Manville (1949), and Klein (1960) suggest that controlling mechanisms function when there are no obvious environmental shortages or stresses.

LITERATURE CITED

Allred, D. and D. E. Beck. 1963. Range of movement and dispersal of some rodents at the Nevada atomic test site. J. Mammal. 44: 190-200.

Best, L. B. 1970. Effects of ecological changes induced by various sagebrush control techniques on non-game birds. M. S. Thesis, Montana State Univ., Bozeman. 74 pp.

Blair, W. F. 1941. The small mammal population of a hardwood forest in northern Michigan. Contr. Lab. Vert. Genet. Univ. Michigan. 17:1-10.

_____. 1943. Populations of the deer-mouse and associated small mammals in the mesquite association of southern New Mexico. Contr. Lab. Vert. Biol. Univ. Michigan. 21:1-40.

_____. 1948. Population density, life span, and mortality rates of small mammals in the blue-grass meadow and blue-grass field associations of southern Michigan. Amer. Midl. Nat. 40:395-416.

_____. 1951. Population structure, social behavior, and environmental relations in a natural population of the beach mouse (*Peromyscus polionotus leucocephalus*). Contr. Lab. Vert. Genet. Univ. Michigan. 48:1-47.

Cada, J. D. 1968. Populations of small mammals in central Montana with special reference to tentative sagebrush control sites. M. S. Thesis, Montana State Univ., Bozeman. 52 pp.

Cameron, E. S. 1907. The birds of Custer and Dawson counties, Montana. Auk. 24:241-270, 389-406; 25:39-46.

Crowston, W. A., H. Goetz, and L. Martin. 1973. Little Missouri Grasslands Study Final Background Report. Dept. Agric. Econ. North Dakota State Univ., Fargo.

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Sci. 33:43-64.

Dubois, A. D. 1935. Nests of horned larks and longspurs on a Montana prairie. Condor 37:46-72.

Feist, F. G. 1968. Breeding bird populations in relation to proposed sagebrush control in central Montana. M. S. Thesis, Montana State Univ., Bozeman. 41 pp.

Fitch, H. S. 1958. Home ranges, territories, and seasonal movements of vertebrates of the Natural History Reservation. Univ. Kansas Publ. Mus. Nat. Hist. 11:63-326.

Gashweiler, J. S. 1959. Small mammal study in west-central Oregon. J. Mammal. 40:128-139.

Hughes, H. D., M. E. Heath, and D. S. Metcalf. 1973. Forages 3rd edition, Chapter 8. Univ. of Iowa Press.

Kelso, L. H. 1931. Some notes on young desert horned larks. Condor 33:60-65.

Klein, H. G. 1960. Ecological relationships of *Peromyscus leucopus noveboracensis* and *P. maniculatus gracilis* in central New York. Ecol. Monogr. 30:387-407.

Lacey, J. R., J. E. Mowbray, and J. R. Wight. 1981. Ranchers evaluate contour furrows for livestock grazing. Rangelands 3(2):58-60.

Lampe, R. P., J. K. Jones, R. S. Hoffman, and E. C. Birney. 1974. The mammals of Carter County, southeastern Montana. Occ. Pap. Mus. Nat. Hist., Univ. Kansas. 25:1-39.

Manville, R. H. 1949. A study of small mammal populations in northern Michigan. Misc. Publ. Mus. Zool. Univ. Michigan. 73:1-83.

Neff, E. L. 1980. Snow trapping by contour furrows in southeastern Montana. J. Range Mgmt. 33(3):221-223.

Neff, E. L. and J. R. Wight. 1981. ARS-BLM Cooperative Soil-Vegetation-Hydrology studies final report, Vol. I. USDA, Agricultural Research Service, Northern Plains Soil and Water Research Center, Sidney, Montana.

Nice, M. M. 1941. The role of territory in bird life. Amer. Midl. Natl. 26(3):441-487.

Patterson, R. L. 1952. The sage grouse in Wyoming. Wyoming game and Fish Commission. 341 pp.

Pickwell, G. B. 1931. The prairie horned lark. Trans. Acad. Sci., St. Louis, Vol. 27.

Saunders, A. A. 1916. Additions to the birds of Custer County. Auk. 33:203-205.

Scow, K. L. 1981. Ecological distributions of small mammals at Sarpy Creek, Montana, with special consideration of the deer mouse, *Peromyscus maniculatus*. M. S. Thesis, Montana State Univ., Bozeman. 73 pp.

Skaar, P. D. 1975. Montana bird distribution; preliminary mapping by latilong. P. D. Skaar, 501 S. Third, Bozeman, Montana. 56 pp.

Storer, T. I., F. C. Evans, and F. G. Palmer. 1944. Some rodent populations in the Sierra Nevada of California. Ecol. Monogr. 14: 165-192.

Terman, C. R. and J. F. Sassaman. 1966. Sex ration in *Peromyscus* populations. (Abstract) Virginia J. Sci. 17:284.

Trout, R. G. 1978. Small mammal abundance and distribution in the Missouri River Breaks, Montana. M. S. Thesis, Montana State Univ., Bozeman. 64 pp.

Tschache, O. P. 1970. Effects of ecological changes induced by various sagebrush control techniques on small mammal populations. M. S. Thesis, Montana State Univ., Bozeman. 51 pp.

Visher, S. S. 1911. Annotated lists of the birds of Harding County, South Dakota. Auk. 28(1):5-16.

_____. 1912. Additions to a list of the birds of Harding County, northwestern South Dakota. Auk. 29:110-111.

_____. 1913. Additions to a list of the birds of Harding County, northwestern South Dakota II. Auk. 30:281.

Wight, J. R. 1976. Range fertilization in the northern Great Plains. J. Range Mgmt. 30:180-185.

Wight, J. R., E. L. Neff, and R. J. Soiseth. 1978. Vegetation response to contour furrowing. J. Range Mgmt. 31:97-101.

Williams, A. B. 1936. The composition and dynamics of a beech-maple climax community. Ecol. Monogr. 6(3):317-408.

Yaeger, R. R., W. C. Leininger, and D. E. Ryerson. 1977. A guide to common Montana range plants. Range Mgmt. Club, Montana State Univ., Bozeman. 111 pp.

Goldan, David Scott
Baseline data on vegetation, breeding bird populations, and small mammals in relation ...

DATE	ISSUED TO
2 WEEKS USE	INTERLIBRARY LOAN 11-1-83
2 WEEKS USE	INTERLIBRARY LOAN 3-28-85
SEP 29 [redacted]	5873810 2 Badger Dr #40