



Effects of ecological changes induced by various sagebrush control techniques on non-game birds
by Louis Brown Best

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE in Fish and Wildlife Management

Montana State University

© Copyright by Louis Brown Best (1970)

Abstract:

This study, conducted in central Montana during the summers of 1968 and 1969, was designed to determine the effects of various sagebrush control measures on non-game birds. Study plots were established in sagebrush-grassland habitat and subjected to the following treatments: total kill spray, strip spray, partial kill spray, defer control and open control. Plots were sprayed with 2,4-D in late June, 1968.

The total kill spray eradicated the sagebrush (*Artemisia tridentata*), increased grass coverage, and reduced the occurrence of forbs. Similar but less extreme vegetational changes followed partial kill. Only on the total kill spray plot did Brewer's Sparrow (*Spizella breweri*) breeding pairs notably decline following spraying (54 percent). No significant change occurred in Vesper Sparrow (*Pooecetes gramineus*) pairs on the sprayed plots. Although both birds utilized sagebrush for nesting cover, the Vesper Sparrow nested on the ground, while the Brewer's Sparrow nested within the shrub. Vesper Sparrows generally utilized smaller sagebrush for nesting cover than Brewer's Sparrows. The Brewer's Sparrow tended to select larger sagebrush for nest sites when the shrub was dead, while spraying apparently did not influence shrub size selected by the Vesper Sparrow. Often the Brewer's Sparrow compensated for the lack of foliage by selecting large, densely branched sagebrush. Additional concealment by grass tended to be greater at nest sites of both species when the shrub was dead. Plant foods (primarily grass seeds) represented a greater portion of the diet of birds collected on sprayed areas than of those obtained from unsprayed areas. Animal foods showed an opposite trend. Differences in major plant and animal foods occurred in amount rather than variety as a result of spraying. The dependence upon sagebrush for nesting cover will largely determine the ultimate effects of sagebrush control on the Brewer's and Vesper Sparrows.

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 Louis B. Best

Date march 20, 1970

EFFECTS OF ECOLOGICAL CHANGES INDUCED BY VARIOUS SAGEBRUSH CONTROL
TECHNIQUES ON NON-GAME BIRDS

by

LOUIS BROWN BEST

A thesis submitted to the Graduate Faculty in partial
fulfillment of the requirements for the degree

of

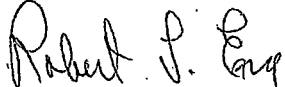
MASTER OF SCIENCE

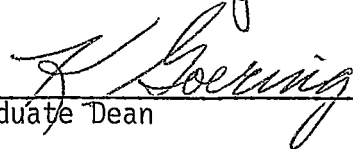
in

Fish and Wildlife Management

Approved:


Head, Major Department


Chairman, Examining Committee


Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

June, 1970

ACKNOWLEDGMENT

To the following, among others, I wish to express sincere appreciation for their contributions to this study: Dr. Robert L. Eng, Montana State University, for technical supervision and guidance in preparation of the manuscript; Mr. Francis G. Feist, former graduate student at Montana State University, for his work in initiating the non-game bird investigation and for orientation to the various phases of the study; Dr. Edward F. Schlatterer and Mr. Duane Pyrah, Montana Department of Fish and Game, for assistance in the field; Dr. Don C. Quimby and Dr. Richard J. Graham, Montana State University, for critical reading of the manuscript; Mr. Thomas W. Mussehl, Montana Department of Fish and Game, for assistance and cooperation in various phases of the study; the other graduate students who worked on the project; and to my wife, Kathleen, for patience and encouragement. During the study, I was supported by the Montana State Department of Fish and Game under Federal Aid Project No. W-105-R-4 and No. W-105-R-5, and the United States Department of the Interior, Bureau of Land Management.

TABLE OF CONTENTS

	Page
VITA	ii
ACKNOWLEDGMENT	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	v
LIST OF FIGURES	vii
ABSTRACT	ix
INTRODUCTION	1
DESCRIPTION OF STUDY AREA	3
METHODS	5
RESULTS AND DISCUSSION	12
Changes in Vegetation	12
Breeding Bird Populations	17
Nest Site Selection	32
Food Habits	47
CONCLUSIONS	61
APPENDIX	64
LITERATURE CITED	73

LIST OF TABLES

Table	Page
1. COMPARISON OF VEGETATION ON THE WINNETT TOTAL KILL SPRAY PLOT BEFORE AND AFTER SPRAYING FOR TOTAL KILL OF SAGEBRUSH WITH 2,4-D AS DETERMINED BY MEASUREMENTS WITHIN 20 X 50 CENTIMETER PLOTS AT BREWER'S AND VESPER SPARROW NEST SITES.....	65
2. COMPARISON OF VEGETATION ON THE IVERSON PARTIAL KILL SPRAY PLOT BEFORE AND AFTER SPRAYING FOR PARTIAL KILL OF SAGEBRUSH WITH 2,4-D AS DETERMINED BY MEASUREMENTS WITHIN 20 X 50 CENTIMETER PLOTS AT BREWER'S AND VESPER SPARROW NEST SITES.....	67
3. ESTIMATED NUMBERS OF BREEDING BIRDS ON THE WINNETT DEFER CONTROL PLOT	22
4. ESTIMATED NUMBERS OF BREEDING BIRDS ON THE WINNETT TOTAL KILL SPRAY PLOT	23
5. ESTIMATED NUMBERS OF BREEDING BIRDS ON THE WINNETT STRIP SPRAY PLOT	24
6. ESTIMATED NUMBERS OF BREEDING BIRDS ON THE IVERSON OPEN CONTROL PLOT	26
7. ESTIMATED NUMBERS OF BREEDING BIRDS ON THE IVERSON PARTIAL KILL SPRAY PLOT	27
8. AVERAGE CANOPY COVERAGES OF SAGEBRUSH IN THE VICINITY OF VESPER SPARROW NESTS	69
9. AVERAGE CANOPY COVERAGES OF SAGEBRUSH IN THE VICINITY OF BREWER'S SPARROW NESTS	70
10. DATA COLLECTED FROM BREWER'S AND VESPER SPARROW NEST SITES LOCATED ON THE WINNETT STRIP SPRAY PLOT IN 1969	71
11. DATA COLLECTED FROM BREWER'S AND VESPER SPARROW NEST SITES LOCATED ON THE WINNETT TOTAL KILL SPRAY PLOT IN 1968 AND 1969	72
12. FREQUENCY OF OCCURRENCE AND PERCENT OF TOTAL VOLUME COMPRISED BY ITEMS FOUND IN GIZZARDS OF BREWER'S SPARROWS COLLECTED DURING THE SUMMER OF 1968 ON AN AREA SPRAYED WITH 2,4-D FOR TOTAL KILL OF SAGEBRUSH	50

LIST OF TABLES (CONTINUED)

Table	Page
13. FREQUENCY OF OCCURRENCE AND PERCENT OF TOTAL VOLUME COMPRISED BY ITEMS FOUND IN GIZZARDS OF BREWER'S SPARROWS COLLECTED ON THE KING STUDY AREA DURING JUNE AND JULY, 1969	52
14. FREQUENCY OF OCCURRENCE AND PERCENT OF TOTAL VOLUME COMPRISED BY ITEMS FOUND IN GIZZARDS OF VESPER SPARROWS COLLECTED DURING THE SUMMER OF 1968 ON AN AREA SPRAYED WITH 2,4-D FOR TOTAL KILL OF SAGEBRUSH	56
15. FREQUENCY OF OCCURRENCE AND PERCENT OF TOTAL VOLUME COMPRISED BY ITEMS FOUND IN GIZZARDS OF VESPER SPARROWS COLLECTED ON THE KING STUDY AREA DURING JUNE AND JULY, 1969	58

LIST OF FIGURES

Figure	Page
1. Map showing the locations of the sagebrush control study areas	4
2. Locations of the five study plots in relation to the various treatments	6
3. Fluctuations among years in percent canopy coverages of grasses, forbs, and shrubs on the Winnett total kill spray plot and Iverson partial kill spray plot	13
4. Winnett defer control plot	18
5. Winnett total kill spray plot	18
6. Winnett strip spray plot	19
7. Iverson open control plot	20
8. Iverson partial kill spray plot	20
9. Estimated numbers of breeding pairs of Brewer's Sparrows ...	28
10. Estimated numbers of breeding pairs of Vesper Sparrows	30
11. Estimated total numbers of breeding bird pairs	31
12. Typical habitat of Brewer's Sparrow nest sites	34
13. Typical habitat of Vesper Sparrow nest sites	34
14. Average percent canopy coverages of the various sagebrush height classes at all Brewer's and Vesper Sparrow nest sites located on unsprayed portions of the Winnett study area and Iverson study area	36
15. Volumes of sagebrush selected as nest sites by the Brewer's Sparrow and Vesper Sparrow	40
16. Vesper Sparrow nest No. 26	43
17. Brewer's Sparrow nest No. 21	43

LIST OF FIGURES (CONTINUED)

Figure	Page
18. Brewer's Sparrow nest No. 5	45
19. Brewer's Sparrow nest No. 18	45
20. Percent of the total volume of gizzard contents comprised by plant and animal foods in Brewer's Sparrows collected on areas unsprayed and sprayed with 2,4-D for total kill of sagebrush	48
21. Percent of the total volume of gizzard contents comprised by plant and animal foods in Vesper Sparrows collected on areas unsprayed and sprayed with 2,4-D for total kill of sagebrush	55

ABSTRACT

This study, conducted in central Montana during the summers of 1968 and 1969, was designed to determine the effects of various sagebrush control measures on non-game birds. Study plots were established in sagebrush-grassland habitat and subjected to the following treatments: total kill spray, strip spray, partial kill spray, defer control and open control. Plots were sprayed with 2,4-D in late June, 1968. The total kill spray eradicated the sagebrush (*Artemisia tridentata*), increased grass coverage, and reduced the occurrence of forbs. Similar but less extreme vegetational changes followed partial kill. Only on the total kill spray plot did Brewer's Sparrow (*Spizella breweri*) breeding pairs notably decline following spraying (54 percent). No significant change occurred in Vesper Sparrow (*Pooecetes gramineus*) pairs on the sprayed plots. Although both birds utilized sagebrush for nesting cover, the Vesper Sparrow nested on the ground, while the Brewer's Sparrow nested within the shrub. Vesper Sparrows generally utilized smaller sagebrush for nesting cover than Brewer's Sparrows. The Brewer's Sparrow tended to select larger sagebrush for nest sites when the shrub was dead, while spraying apparently did not influence shrub size selected by the Vesper Sparrow. Often the Brewer's Sparrow compensated for the lack of foliage by selecting large, densely branched sagebrush. Additional concealment by grass tended to be greater at nest sites of both species when the shrub was dead. Plant foods (primarily grass seeds) represented a greater portion of the diet of birds collected on sprayed areas than of those obtained from unsprayed areas. Animal foods showed an opposite trend. Differences in major plant and animal foods occurred in amount rather than variety as a result of spraying. The dependence upon sagebrush for nesting cover will largely determine the ultimate effects of sagebrush control on the Brewer's and Vesper Sparrows.

INTRODUCTION

Large acreages of sagebrush in the West have been subjected to various control methods to increase forage production for domestic livestock. Despite continued sagebrush manipulation, little is known of the effects of such practices on wildlife habitat. To determine the ecological effects of various sagebrush control measures, a 10-year cooperative study was initiated in 1965 by the Montana State Fish and Game Department and the Bureau of Land Management.

One aspect of this study was to determine the effects of sagebrush control through aerial spraying on non-game bird populations. Feist (1968a) reported on a pre-spray investigation, conducted during the summers of 1966 and 1967. My study was initially planned to collect post-spray data during the summers of 1968 and 1969. Due to a delay in spraying, pre-spray data were collected during the summer of 1968.

The literature revealed limited quantitative data on the effects of sagebrush removal on non-game birds. Carhart (1954) states that the Sage Sparrow, Brewer's Sparrow, and Sage Thrasher are among the birds that will suffer through eradication of large acreages of sagebrush. The census results obtained by Scott, Scott, and Scott (1966) suggest that sagebrush spraying tends to increase the total number of birds; but certain species dependent on the sagebrush, such as the Brewer's Sparrow, tend to be eliminated with the sagebrush.

My major objectives were to determine the effects of sagebrush manipulation on the food and cover requirements of non-game species of

birds. Research was concentrated in four major areas: changes in vegetation, breeding bird populations, nest site selection, and food habits.

DESCRIPTION OF STUDY AREA

The area of study was located in Petroleum County in central Montana within 20 miles of Winnett (Figure 1). According to Gieseke (1938) the climate of Petroleum County is semiarid, being characterized by relatively low rainfall and wide temperature extremes. The mean annual precipitation is 12.57 inches and the mean annual temperature is 45.4 F. The total precipitation and average temperature for the period March, April and May, 1968 were 4.45 inches and 44.8 F, respectively. The same measurements for 1969 were 2.20 and 44.2. For the period June, July and August, 1968 the total precipitation and average temperature were 8.80 inches and 65.2 F, respectively; and for 1969, 6.69 and 65.6 (U. S. Department of Commerce weather station at Flatwillow 4ENE).

Sagebrush-grassland predominates in the area. Big sagebrush (*Artemisia tridentata*) was by far the most abundant shrub on the study area. Bluestem wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*), Junegrass (*Koeleria cristata*), bluegrass species (*Poa* spp.), particularly Sandberg bluegrass (*Poa secunda*), needle-and-thread (*Stipa comata*), and green needlegrass (*Stipa viridula*) were dominant grasses. Needleleaf sedge (*Carex eleocharis*) was also common. Prevalent forbs included yarrow (*Achillea millefolium*), fringed sagewort (*Artemisia frigida*), plantain (*Plantago* spp.), Hood's phlox (*Phlox hoodii*), common salsify (*Tragopogon dubius*), and American vetch (*Vicia americana*).

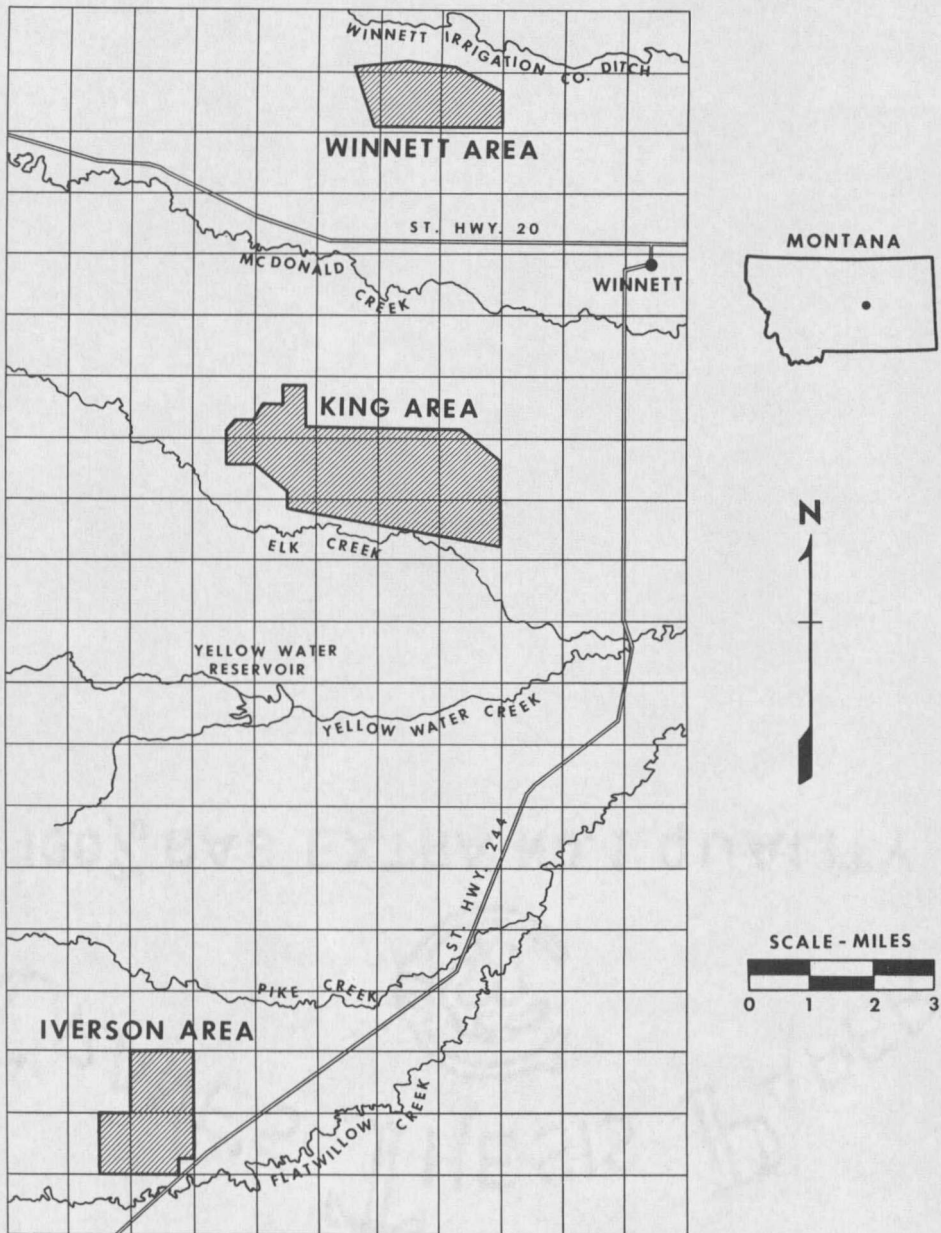


Figure 1. Map showing the locations of the sagebrush control study areas.

METHODS

The five study plots (Figure 2) selected in 1966 for intensive study each measured 40 acres, and were gridded throughout at 330-foot intervals with small plastic flag markers projecting above the sagebrush. In 1968 three plots were aeri ally sprayed. Two pounds of isoctyl ester of 2,4-D (2,4-dichlorophenoxyacetic acid) in 6 gallons of water per acre was applied on the Winnett total kill spray plot. The same mixture was applied in strips on the Winnett strip spray plot. One pound of dimethylamine salt of 2,4-D in 6 gallons of water per acre was applied on the Iverson partial kill spray plot. The Winnett defer control and Iverson open control plots received no treatment. The spraying, initially planned for May, was delayed until June 19-21 due to inclement weather. Grazing of cattle was permitted on the Iverson open control plot, but the other four plots have been deferred from grazing by domestic livestock since 1967. Prior to 1967 the Iverson study area was more intensively grazed than the Winnett study area.

Bird censuses were conducted on the five study plots during the height of the nesting season, from June 14 to July 12, 1968 and from June 4 to July 10, 1969. Generally two plots were censused each day; the first census beginning approximately 5:15 a.m. and the second approximately 7:30 a.m., the beginning time being alternated for each plot on successive censuses. Censuses were not conducted on days with strong winds or rain. Each plot was censused seven times in 1968 and at least eight times in 1969.

