



Ecological characteristics of the Armstrong mule deer winter range, Bridger Mountains, Montana  
by Richard Andrew Bucsis

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 Richard Andrew Bucsis (1974)

Abstract:

A study was conducted in the Bridger Mountains of southwestern Montana from July 1972 through June 1974 to provide current information on the ecological characteristics of the Armstrong Mule Deer Winter Range. Emphasis was placed upon distribution, production, and utilization of key mule deer browse plants. Fourteen habitat types were recognized and described: *Festuoia idahoensis*/*Agropyron spioatum* h.t., *Agropyron spioatum*/*Agropyron smithii* h.t., *Purshia tridentata*/*Agropyron spioatum* h.t., *Purshia tridentata*/*Artemisia tridentata* h.t., *Artemisia tridentata*/*Festuoia idahoensis* h.t., *Juniperus soopuorum*-*Purshia tridentata*/*Agropyron spioatum* h.t., *Juniperus sooputorum*-*Purshia tridentata*/*Festuoia idahoensis* h.t., *Juniperus sooputorum*-*Purshia tridentata*/*Artemisia tridentata* h.t., *Acer glabrum*/*Philadelphus lewisii* h.t., *Populus tremuloides*-*Prunus virginiana*/*Symphoricarpos aibus* h.t., *Pseudotsuga menziesii*/*Prunus virginiana* h.t., *Pseudotsuga menziesii*/*Symphoricarpos* h.t., *Pseudotsuga*/*Festuoia idahoensis* h.t., and *Pseudotsuga menziesii*/*Carex geyeri* h.t. Total forage production of big sagebrush, antelope bitterbrush, and Rocky Mountain juniper was determined on six shrubland habitat types. These 3 species comprised 44, 7, and 49 percent, respectively of the 71,069 kilograms of the total forage yield for 1972. Fifty-eight and 96 percent of the sagebrush and bitterbrush plants encountered in vegetational analyses were in a severely hedged condition, respectively, while approximately 1/3 of the plants of both species were rated decadent. One and 3 percent, respectively of the living bitterbrush and sagebrush plants tagged in 1973 were dead by 1974. Utilization of sagebrush current annual growth and bitterbrush current annual growth twigs averaged 34 and 53 percent, respectively for the winter of 1972-73 and 40 and 66 percent, respectively for 1973-74. Utilization of sagebrush varied according to site location; plants on the more favorable sites received only slight usage. Sagebrush and bitterbrush combined contributed about 1/3 of the total forage consumed by deer on the area during the winter of 1972-73 with sagebrush comprising the major portion (1.1 pounds/deer day). Bitterbrush contributed an average of 0.22 pounds/deer day, but most of the usage on this species apparently occurred during early winter. On one footslope site cattle utilized 37 percent of the current growth of bitterbrush during the summer-fall of 1973, while on adjacent slopes, where grasses were abundant, cattle utilization of bitterbrush ranged from 8 to 10 percent. The *Purshia tridentata*/*Artemisia tridentata* h.t. comprised 31 percent of the shrubland area and was considered the most important habitat type on the area for mule deer during the winter period.

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 Richard B. Bessis

Date June 10, 1974

ECOLOGICAL CHARACTERISTICS OF THE ARMSTRONG MULE DEER  
WINTER RANGE, BRIDGER MOUNTAINS, MONTANA

by

RICHARD ANDREW BUCSIS

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

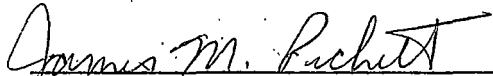
of

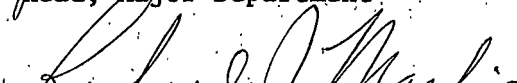
MASTER OF SCIENCE

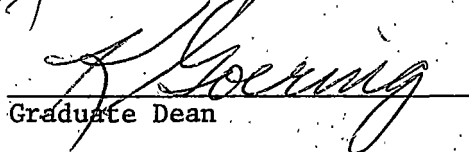
in

Fish and Wildlife Management

Approved:

  
Head, Major Department

  
Chairman, Examining Committee

  
Graduate Dean

MONTANA STATE UNIVERSITY  
Bozeman, Montana

August, 1974

## ACKNOWLEDGMENT

To the following, the author wishes to express his sincere appreciation for their contributions to this study: Dr. Richard J. Mackie, Montana State University, who directed the study and aided in preparation of the manuscript; Dr. Don C. Quimby and Dr. Robert L. Eng, Montana State University, for reviewing the manuscript; Drs. John H. Rumely and W. E. Booth, Montana State University, for aid in identification of plant specimens; Mr. Terry N. Lonner, Research Biologist, Montana Fish and Game Department, who provided advice and assistance in analyses of vegetational and browse production-utilization data; Mr. Kenneth Greer, Montana Fish and Game Department Laboratory Supervisor, for use of the laboratory facilities; and to my many unnamed friends who helped in countless ways, both technical and nontechnical. The author also wishes to express special thanks to the local landowners who gave their friendship and help, especially the following: the late Mr. Ralph Armstrong, Mr. Claude Maher and Mr. Lloyd Maher. He would also like to thank his wife, Dollie and family for their encouragement, endurance, and assistance. The author was supported by the Montana Fish and Game Department under Federal Aid projects W-120-R-4 and 5 during this study.

## TABLE OF CONTENTS

VITA . . . . .	ii
ACKNOWLEDGMENT . . . . .	iii
LIST OF TABLES . . . . .	v
LIST OF FIGURES . . . . .	viii
ABSTRACT . . . . .	x
INTRODUCTION . . . . .	1
DESCRIPTION OF THE STUDY AREA . . . . .	3
PROCEDURES . . . . .	9
Vegetational Analyses . . . . .	9
Grass-Forb Types . . . . .	10
Low-Shrub and Juniper Types . . . . .	10
Montane Forest and Aspen Types . . . . .	11
Forage Production and Utilization . . . . .	12
Production . . . . .	12
Utilization . . . . .	14
Summer-Fall Utilization of Key Browse Species by Livestock . . . . .	14
Climatic Characteristics and Conditions . . . . .	15
Edaphic Characteristics . . . . .	16
RESULTS . . . . .	18
Vegetation . . . . .	18
Climatological Characteristics and Conditions . . . . .	60
Browse Production . . . . .	66
Age Distribution and Condition of Big Sagebrush and Antelope Bitterbrush . . . . .	79
Browse Utilization . . . . .	83
Utilization of Antelope Bitterbrush by Cattle . . . . .	93
CONCLUSIONS . . . . .	97
LITERATURE CITED . . . . .	100
APPENDIX . . . . .	103

## LIST OF TABLES

Table	Page
1. CONSTANCY, CANOPY COVERAGE, AND FREQUENCY OF LOW GROWING TAXA FOR HABITAT TYPES AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS FOR HERBACEOUS PLANTS AND TWENTY 4X10 DECIMETER PLOTS FOR SHRUBS AND LOW TREES ON EACH OF 38 SITES . . . . .	21
2. CANOPY COVERAGE AND FREQUENCY OF LOW GROWING TAXA FOR HABITAT TYPES AS DETERMINED BY EXAMINATION OF TWENTY 2X5 DECIMETER PLOTS FOR HERBACEOUS PLANTS AND TWENTY 4X10 DECIMETER PLOTS FOR SHRUBS AND LOW TREES ON EACH OF 38 SITES . . . . .	31
3. CANOPY COVERAGE, ABSOLUTE DENSITIES, RELATIVE DENSITIES, AND IMPORTANCE VALUES OF VARIOUS SHRUBS AMONG SHRUBLAND HABITAT TYPES . . . . .	36
4. EDAPHIC CHARACTERISTICS OF VARIOUS STANDS BY HABITAT TYPE INCLUDING TEXTURAL CLASSIFICATION, pH, FIVE IMPORTANT ELEMENTS, ORGANIC MATTER AND SALT HAZARD ON THE ARMSTRONG WINTER RANGE . . . . .	39
5. DENSITIES, AVERAGE DIAMETERS AT BREAST HEIGHT (DBH), AND OVERHEAD CANOPY COVERAGE OF DOUGLAS-FIR TREES IN FOUR HABITAT TYPES . . . . .	56
6. MEAN MONTHLY TEMPERATURES FOR THREE WEATHER STATIONS AND MONTHLY PRECIPITATION ON THE ARMSTRONG WINTER RANGE DURING 1973 COMPARED WITH THE 22 YEAR AVERAGES (1952-73) AT BELGRADE, MONTANA . . . . .	61
7. NUMBER OF DAYS PER MONTH WHICH WERE GENERALLY CLEAR (C), MODERATELY CLOUDY = INTERMITTENTLY CLOUDY TO BRIGHT OVERCAST (M), AND HEAVILY OVERCAST (O) DURING THE PERIOD FROM NOVEMBER 1, 1972 THROUGH APRIL 27, 1974 . . . . .	64
8. REGRESSION EQUATIONS FOR CROWN AREA - TWIG AND PLANT AGE; TWIG DIAMETER - WEIGHT AND LENGTH RELATIONSHIPS FOR BIG SAGEBRUSH AND ANTELOPE BITTERBRUSH - TOTAL FOLIAGE YIELD - CROWN AREA AND BASAL STEM DIAMETER RELATIONSHIPS FOR ROCKY MOUNTAIN JUNIPER . . . . .	69

LIST OF TABLES  
(Continued)

Table	Page
9. MEAN CROWN AREA, DENSITY, AND CURRENT ANNUAL GROWTH TWIG PRODUCTION FOR BIG SAGEBRUSH AND ANTELOPE BITTERBRUSH DURING 1972 AND FOLIAGE YIELD FOR ROCKY MOUNTAIN JUNIPER DURING 1973 ON 6 SHRUBLAND HABITAT TYPES . . . . .	72
10. DISTRIBUTION OF TOTAL FORAGE PRODUCTION BY WEIGHT (KILOGRAMS) FOR BIG SAGEBRUSH, ANTELOPE BITTERBRUSH, AND ROCKY MOUNTAIN JUNIPER AMONG 6 SHRUBLAND HABITAT TYPES . . . . .	75
11. MEAN AND RANGE IN AGE OF BIG SAGEBRUSH AND ANTELOPE BITTERBRUSH PLANTS COLLECTED FROM THE ARMSTRONG WINTER RANGE . . . . .	80
12. FORM AND AGE CLASS DISTRIBUTIONS FOR BIG SAGEBRUSH AND ANTELOPE BITTERBRUSH PLANTS MEASURED IN VEGETATIONAL ANALYSES . . . . .	81
13. PERCENTAGES OF FORM CLASS, AGE CLASS, AND DECADENCY FOR MONTANA FISH AND GAME DEPARTMENT UTILIZATION - CONDITION TREND TRANSECTS . . . . .	82
14. MEAN DIAMETERS AT BASE OF CURRENT GROWTH (DCG), MEAN DIAMETERS AT POINT OF BROWSING (DPB), AND ESTIMATED TWIG LENGTH UTILIZED FOR BIG SAGEBRUSH DURING THE 1972-73 AND 1973-74 WINTERS . . . . .	84
15. MEAN DIAMETER AT BASE OF CURRENT GROWTH (DCG), MEAN DIAMETER AT POINT OF BROWSING (DPB), AND ESTIMATED TWIG LENGTH UTILIZED FOR ANTELOPE BITTERBRUSH DURING THE 1972-73 AND 1973-74 WINTERS . . . . .	85
16. PLANT CONDITION AND CURRENT ANNUAL GROWTH TWIG UTILIZATION FOR BIG SAGEBRUSH ON MAJOR HABITAT TYPES DURING THE WINTERS OF 1972-73 AND 1973-74 . . . . .	86
17. PLANT CONDITION AND CURRENT ANNUAL GROWTH TWIG UTILIZATION FOR ANTELOPE BITTERBRUSH ON MAJOR HABITAT TYPES DURING THE WINTERS OF 1972-73 AND 1973-74 . . . . .	87

LIST OF TABLES  
(Continued)

Table	Page
18. COMPARISON OF SUMMER-FALL CATTLE UTILIZATION AND TOTAL UTILIZATION OF ANTELOPE BITTERBRUSH ON THREE SITES DURING 1973-74 . . . . .	95



## LIST OF FIGURES

Figure	Page
1. Map of the Bridger Range showing major features and the location of the study area . . . . .	4
2. The Armstrong Winter Range topographical features and relationships . . . . .	6
3. Aerial view of the habitat types comprising the Armstrong Mule Deer Winter Range . . . . .	20
4. Douglas-fir type upper right, big sagebrush type lower center, antelope bitterbrush type center, and Idaho fescue/bluebunch wheatgrass type upper left . . . . .	38
5. Close up view of bitterbrush and sagebrush plants within the antelope bitterbrush/big sagebrush habitat type . . . . .	46
6. Antelope bitterbrush/big sagebrush habitat type . . . . .	46
7. Big sagebrush stand on footslope site . . . . .	48
8. Dense stand of sagebrush on footslope in foreground and on mountain slope at upper right . . . . .	48
9. Rocky Mountain juniper-antelope bitterbrush/Idaho fescue stand showing Douglas-fir and limber pine invasion . . . . .	53
10. Bi-monthly minimum and maximum temperatures at sites in the PSME/SYAL h.t. (6400 feet) and the PUTR/ARTR h.t. (6350 feet) on the Armstrong Winter Range . . . . .	62
11. Average snow depth on the ground at two week intervals during the winters of 1972-73 and 1973-74 by habitat type, elevation, and aspect on the Armstrong Winter Range. . . . .	65
12. Total miles of wind per month recorded on anemometer located on the mountain slope in PUTR/ARTR h.t. on the Armstrong Winter Range during the period April 1, 1973 through April 27, 1974 . . . . .	67
13. Plant densities of big sagebrush, antelope bitterbrush, and Rocky Mountain juniper in each of six shrubland habitat types . . . . .	76

LIST OF FIGURES  
(Continued)

Figure		Page
14.	Relative occurrence of 6 habitat types within the shrubland portion of the study area and the distribution of total combined browse (big sagebrush, antelope bitterbrush, and Rocky Mountain juniper) production by weight among these types . . . . .	77
15.	Percentage distributions by weight of available current annual growth of big sagebrush, antelope bitterbrush, and Rocky Mountain juniper among six shrubland habitat types . . . . .	78
16.	Percentage utilization by length of current annual growth of big sagebrush and antelope bitterbrush on major shrubland habitat types, 1972-73 and 1973-74 . . .	90

## ABSTRACT

A study was conducted in the Bridger Mountains of southwestern Montana from July 1972 through June 1974 to provide current information on the ecological characteristics of the Armstrong Mule Deer Winter Range. Emphasis was placed upon distribution, production, and utilization of key mule deer browse plants. Fourteen habitat types were recognized and described: *Festuca idahoensis*/*Agropyron spicatum* h.t., *Agropyron spicatum*/*Agropyron smithii* h.t., *Purshia tridentata*/*Agropyron spicatum* h.t., *Purshia tridentata*/*Artemisia tridentata* h.t., *Artemisia tridentata*/*Festuca idahoensis* h.t., *Juniperus scopulorum*-*Purshia tridentata*/*Agropyron spicatum* h.t., *Juniperus scopulorum*-*Purshia tridentata*/*Festuca idahoensis* h.t., *Juniperus scopulorum*-*Purshia tridentata*/*Artemisia tridentata* h.t., *Acer glabrum*/*Philadelphus lewisii* h.t., *Populus tremuloides*-*Prunus virginiana*/*Symphoricarpos albus* h.t., *Pseudotsuga menziesii*/*Prunus virginiana* h.t., *Pseudotsuga menziesii*/*Symphoricarpos* h.t., *Pseudotsuga*/*Festuca idahoensis* h.t., and *Pseudotsuga menziesii*/*Carex geyeri* h.t. Total forage production of big sagebrush, antelope bitterbrush, and Rocky Mountain juniper was determined on six shrubland habitat types. These 3 species comprised 44, 7, and 49 percent, respectively of the 71,069 kilograms of the total forage yield for 1972. Fifty-eight and 96 percent of the sagebrush and bitterbrush plants encountered in vegetational analyses were in a severely hedged condition, respectively, while approximately 1/3 of the plants of both species were rated decadent. One and 3 percent, respectively of the living bitterbrush and sagebrush plants tagged in 1973 were dead by 1974. Utilization of sagebrush current annual growth and bitterbrush current annual growth twigs averaged 34 and 53 percent, respectively for the winter of 1972-73 and 40 and 66 percent, respectively for 1973-74. Utilization of sagebrush varied according to site location; plants on the more favorable sites received only slight usage. Sagebrush and bitterbrush combined contributed about 1/3 of the total forage consumed by deer on the area during the winter of 1972-73 with sagebrush comprising the major portion (1.1 pounds/deer day). Bitterbrush contributed an average of 0.22 pounds/deer day, but most of the usage on this species apparently occurred during early winter. On one footslope site cattle utilized 37 percent of the current growth of bitterbrush during the summer-fall of 1973, while on adjacent slopes, where grasses were abundant, cattle utilization of bitterbrush ranged from 8 to 10 percent. The *Purshia tridentata*/*Artemisia tridentata* h.t. comprised 31 percent of the shrubland area and was considered the most important habitat type on the area for mule deer during the winter period.

## INTRODUCTION

Big game management in Montana, since the mid 1950's has been based largely on data from annual surveys used to determine condition and utilization trends of key forage species on critical winter range sites. These data together with population and harvest data are used to set bag limits and season lengths designed to balance big game populations with their food supplies (Mussehl and Howell 1971). By the early 1960's game managers and biologists began to express concern about the adequacy of the range survey techniques and procedures and whether survey data generally reflected an essential ecological relationship between the wild ungulate population and its habitat (Mackie 1972). In 1970 the Montana Department of Fish and Game established a research project to evaluate basic range survey methods, concepts, and criteria (Mackie *op. cit.*).

This study was established as a segment of the range evaluation project. Specific objectives were: (1) to provide basic information on physical, biological, and ecological attributes of an important, browse-type winter range for use in evaluating mule deer (*Odocoileus hemionus*) use and habitat relationships; and (2) to evaluate distribution, production, and utilization of important browse forage species on the winter range. The location was the Armstrong winter range which lies along the west slope of the Bridger Mountains, 20 miles north of Bozeman in Gallatin County, Montana. Field studies were

conducted full time during the summers of 1972 and 1973 and part time during fall, winter, and spring from October, 1972 through May 1974. The study was conducted concurrently with two investigations on range use, food habits, seasonal distribution, and population characteristics of the mule deer herd (Schwarzkopf 1973 and Hamlin 1974).

The first biological study of mule deer and their use of the Armstrong winter range was conducted by Wilkins (1957) during 1955 and 1956. Emphasis was placed upon mule deer food habits, range use and agriculture relationships. Browse utilization and condition trend surveys were conducted subsequently by the Montana Department of Fish and Game in the spring from 1957 through 1960 and 1965 through 1967. The general consensus from these earlier studies and most observers since has been that key forage plants, especially antelope bitterbrush (*Purshia tridentata*), were in poor condition and possibly deteriorating as a result of overuse by mule deer. Management efforts have generally been directed toward reducing mule deer numbers to allow forage plants and supplies to recover and thereby maintain or increase the carrying capacity of the range.

## DESCRIPTION OF THE STUDY AREA

The Armstrong mule deer winter range encompasses approximately 1260 acres of lower mountain and footslopes between North Cottonwood Creek and Bill Smith Creek, which form the northern and southern boundaries of the study area, respectively (Fig. 1). Elevations range from 5,250 to 7,803 feet.

McMannis (1955) described the Bridger Mountain Range as extending in a gently curving arc from Bridger Canyon northward for 23 miles to Blacktail Mountain. It forms part of the southwestern rim of the Crazy Mountain Basin and is bounded on the west by the Gallatin Valley, on the north by the Maudlow Basin, and on the south by a major oblique fault. Elevations range from 5,000 to 9,665 feet. Geologically, the Bridger Range is characterized by folds and faults consisting of exposed steeply dipping Paleozoic sediments which are flanked by Precambrian arkoses in the region of the study area. Specific rock types are sandstones, limestone, shale, siltstone, and conglomerates. Valley fills consist of Quaternary deposits of gravel fans, river gravels and muds, talus, morainal deposits, and avalanche debris. The area north of Ross Peak shows some evidence of glaciation.

The Armstrong winter range is situated along a westerly projecting convexity or "toe" of the main Bridger range. This "toe" is created as the base of the main mountain range gradually deviates from a





































































































































































































































