



Nutritional characteristics of the vegetation of clearcut and uncut sites on summer-fall elk range  
by Gary Roy Hammond

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE  
in Fish and Wildlife Management  
Montana State University  
© Copyright by Gary Roy Hammond (1980)

Abstract:

A study was established in 1978, and carried out largely during the summer and early fall of 1979, to evaluate forage characteristics as a possible influence on elk distribution and use of logged and uncut sites in Long Tom Creek of southwestern Montana. Composite samples from forbs and graminoids were selectively harvested in both uncut and cut-through wet meadows, dry parks and forested sites. Nutritional quality of forage was at a seasonal high during early summer on all sites. This was evident in the high percentages of both crude protein and cell-soluble material as well as a low degree of cell-wall lignification. Overall, through summer, forbs demonstrated higher quality than grasses and sedges. During September, forb cell-soluble values averaged 65.3 percent, while grasses and sedges averaged only 38.3 percent. Since forage quality was similarly high on all sites examined, forage availability was probably more important than quality in early-summer elk habitat selection. Both uncut and cut-through dry parks and wet meadows, which represented the most productive and species diverse types available during early summer, also received the greatest elk use. The higher nutritive value of forage species on phenologically delayed sites was reflected in the comparatively high cell-soluble content values for forage species on both forested and wet meadow sites. At this time, despite higher protein and cell-soluble values for forbs on forested sites, elk displayed a strong affinity for wet meadows. Therefore, good nutritional quality, high forage production, high security and thermal cover and a diverse species composition all contributed to the overall importance of wet meadows to summering elk. Opening up the forest canopy by clear-cutting increased forage production and species diversity. Cattle utilization, concentrated on uncut and cut-through dry parks and wet meadows, removed from 64 percent to 88 percent of the available herbage on these types by October. Clearcutting did not appear to increase the amount of dry park habitat on the study area. Dry park and forested site herbage composition and homogeneity apparently also were altered by this practice. Forages on cut-through dry parks and cut-through forest sites were slightly lower in nutritional quality than their uncut counterparts, at least after early summer. The highly nutritious but limited quantity of forage on forested sites coupled with high energy provided by dry site grasses and sedges enabled elk to maintain a high quality diet into early fall.

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 Jay L. Hammond  
Date 5/12/80

NUTRITIONAL CHARACTERISTICS OF THE VEGETATION OF  
CLEARCUT AND UNCUT SITES ON SUMMER-FALL ELK RANGE

by

GARY ROY HAMMOND

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

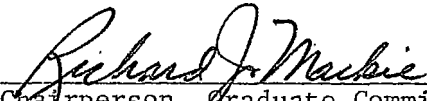
of

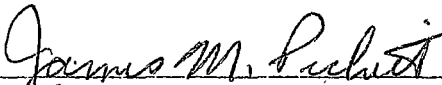
MASTER OF SCIENCE

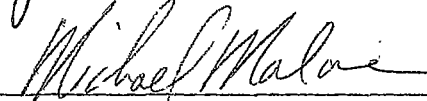
in

Fish and Wildlife Management

Approved:

  
Chairperson, Graduate Committee

  
Head, Major Department

  
Graduate Dean

MONTANA STATE UNIVERSITY  
Bozeman, Montana

May, 1980

## ACKNOWLEDGMENT

The author wishes to express his sincere appreciation to the following people for their contributions to this study: Mr. Terry N. Lonner, Montana Department of Fish, Wildlife and Parks, for aid in project planning, field assistance, reviewing the manuscript, and his patience, support and friendship for the duration of this study; Dr. Richard J. Mackie, Montana State University, for advice and guidance in the preparation of this manuscript; Dr. Robert L. Eng, Dr. John E. Taylor and Dr. Lynn R. Irby, for reviewing the manuscript; Dr. Henry E. Jorgensen, Montana Department of Fish, Wildlife and Parks, for his time, patience and advice throughout the study; Mr. Bernie Hildebrand, Montana Department of Fish, Wildlife and Parks, for field assistance; and my family for their support and understanding. I also wish to extend a special thanks to my wife, Kathy, for her aid in typing, field assistance and her patient support and encouragement throughout my graduate career.

This study was funded by the Montana Department of Fish, Wildlife and Parks through funds provided by Pittman-Robertson project number W-120-R.

## TABLE OF CONTENTS

	<u>Page</u>
VITA . . . . .	ii
ACKNOWLEDGMENT . . . . .	iii
TABLE OF CONTENTS . . . . .	iv
LIST OF TABLES . . . . .	v
LIST OF FIGURES . . . . .	vi
ABSTRACT . . . . .	viii
INTRODUCTION . . . . .	1
DESCRIPTION OF STUDY AREA . . . . .	2
Location and Physiography . . . . .	2
Land Use . . . . .	4
Climate . . . . .	4
Vegetation . . . . .	5
METHODS . . . . .	8
RESULTS . . . . .	12
Vegetational Composition . . . . .	12
Uncut Sites . . . . .	12
Cut-through Sites . . . . .	22
Species Richness and Vegetational Coverage . . . . .	24
Forage Production . . . . .	26
Nutritional Characteristics . . . . .	32
Plant Moisture Content . . . . .	32
Cell Soluble Material . . . . .	36
Cell Wall Constituents . . . . .	39
Crude Protein . . . . .	43
Digestible Energy . . . . .	49
CONCLUSIONS . . . . .	55
APPENDIX . . . . .	61
LITERATURE CITED . . . . .	66

## LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Physiographic characteristics of 10 sites sampled for forage quality and quantity at 3 week intervals from June 26 to October 2, 1979 on the Long Tom Creek study area . . . . .	13
2. Number of plant species in uncut and adjacent cut-through sites on the Long Tom Creek study area . . . . .	15
3. Vegetational coverages by sampling period on study sites on the Long Tom Creek study area . . . . .	16
4. Standing crop estimates (kilograms/hectare) of forbs, graminoids and shrubs, and total production for study sites on the Long Tom Creek study area . . . . .	27
5. Nutritional characteristics of graminoids for forbs for June through September, 1979, on study sites on the Long Tom Creek study area . . . . .	62

## LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Map of Long Tom Creek study area showing major features and locations of 10 study sites . . . . .	3
2. The dry park type (A) uncut and (B) cut-through on the Long Tom Creek study area . . . . .	17
3. The forested type (A) uncut and (B) cut-through on the Long Tom Creek study area . . . . .	19
4. The wet meadow type (A) uncut and (B) cut-through on the Long Tom Creek study area . . . . .	21
5. Forb production on uncut and cut-through sites, excluding wet meadows, on the Long Tom Creek study area . . . . .	29
6. Standing crop of adjacent grazed and ungrazed sites at the end of the grazing season on the Long Tom Creek Study area . . . . .	31
7. Percent plant moisture content from June to September for uncut and cut-through sites on the Long Tom Creek study area. . . . .	33
8. Range in plant moisture content by sampling period for uncut and cut-through sites on the Long Tom Creek study area . . . . .	34
9. Percent cell soluble contents for forbs by sampling period for uncut and cut-through sites on the Long Tom Creek study area. . . . .	37
10. Range in forb cell soluble contents by sampling period for uncut and cut-through sites on the Long Tom Creek study area. . . . .	38
11. Percent lignin by sampling period for forbs on uncut and cut-through sites on the Long Tom Creek study area . . .	40
12. Percent lignin by sampling period of grasses and sedges on uncut and cut-through sites producing appreciable quantities of this component on the Long Tom Creek Study area . . . . .	41

<u>Figure</u>	<u>Page</u>
13. Percent crude protein by sampling period of forbs on uncut and cut-through sites on the Long Tom Creek study area . . . . .	44
14. Range in crude protein by sampling period of forbs on study sites, and high protein values for site 3, on the Long Tom Creek study area . . . . .	45
15. Percent crude protein by sampling period of grasses and sedges on uncut and cut-through sites on the Long Tom Creek study area . . . . .	46
16. Percent digestible energy by sampling period of forbs on uncut and cut-through sites on the Long Tom Creek study area . . . . .	51
17. Range in digestible energy by sampling period of forbs on uncut and cut-through sites on the Long Tom Creek study area . . . . .	52
18. Percent digestible energy by sampling period of grasses and sedges on uncut and cut-through sites on the Long Tom Creek study area . . . . .	53



## ABSTRACT

A study was established in 1978, and carried out largely during the summer and early fall of 1979, to evaluate forage characteristics as a possible influence on elk distribution and use of logged and uncut sites in Long Tom Creek of southwestern Montana. Composite samples from forbs and graminoids were selectively harvested in both uncut and cut-through wet meadows, dry parks and forested sites. Nutritional quality of forage was at a seasonal high during early summer on all sites. This was evident in the high percentages of both crude protein and cell-soluble material as well as a low degree of cell-wall lignification. Overall, through summer, forbs demonstrated higher quality than grasses and sedges. During September, forb cell-soluble values averaged 65.3 percent, while grasses and sedges averaged only 38.3 percent. Since forage quality was similarly high on all sites examined, forage availability was probably more important than quality in early-summer elk habitat selection. Both uncut and cut-through dry parks and wet meadows, which represented the most productive and species diverse types available during early summer, also received the greatest elk use. The higher nutritive value of forage species on phenologically delayed sites was reflected in the comparatively high cell-soluble content values for forage species on both forested and wet meadow sites. At this time, despite higher protein and cell-soluble values for forbs on forested sites, elk displayed a strong affinity for wet meadows. Therefore, good nutritional quality, high forage production, high security and thermal cover and a diverse species composition all contributed to the overall importance of wet meadows to summering elk. Opening up the forest canopy by clearcutting increased forage production and species diversity. Cattle utilization, concentrated on uncut and cut-through dry parks and wet meadows, removed from 64 percent to 88 percent of the available herbage on these types by October. Clearcutting did not appear to increase the amount of dry park habitat on the study area. Dry park and forested site herbage composition and homogeneity apparently also were altered by this practice. Forages on cut-through dry parks and cut-through forest sites were slightly lower in nutritional quality than their uncut counterparts, at least after early summer. The highly nutritious but limited quantity of forage on forested sites coupled with high energy provided by dry site grasses and sedges enabled elk to maintain a high quality diet into early fall.

## INTRODUCTION

In 1970, the Montana Cooperative Elk-Logging Study was initiated to evaluate the ecological impacts of roads and/or logging on elk occupying mountain rangeland in western Montana. One segment of this investigation, the Long Tom Creek Study, was initiated in 1971 to obtain baseline data on the environmental requirements of elk and their behavior prior to, during and following clearcut logging on summer-fall range. Lonner's (1979) findings to date indicated that 27 biotic and abiotic factors can influence habitat selection and use by elk on the Long Tom Creek area. These include the quantity and quality of forage produced and available in various vegetation types.

The study described herein was established during the summer of 1978 to evaluate forage characteristics as a possible influence on elk distribution and use of logged and uncut sites within the Long Tom Creek Study Area. Specific objectives were: 1) to measure and describe seasonal changes in composition, frequency and canopy coverage of plant species and net primary production and nutritional values of herbage in various "habitat" types available to elk and 2) to compare clearcut and uncut sites with respect to forage production and quality.

Field studies were conducted largely during the summer and fall of 1979.

## DESCRIPTION OF THE STUDY AREA

### Location and Physiography

The study area (Fig. 1) was located in Silver Bow County approximately 40 km southwest of Butte, Montana. General boundaries were Dickie Peak on the west, the Big Hole River on the south, Hogback Ridge on the east, and the Continental Divide on the north. Two major stream drainages, Long Tom Creek and Jerry Creek, were included with the former being a tributary of the latter. Jerry Creek descends at a slight to moderate gradient in a southerly direction and flows into the Big Hole River between the small communities of Dewey and Wise River. Hungry Hill, a heavily timbered ridge, bisected the area in a north-south direction. Similarly timbered ridges bounded the area to the north, west, and east.

Slope gradients within the study area were generally moderate, except for areas adjacent to lower Long Tom Creek and south and west of Fish Lake which consisted of numerous severe slopes and talus fields. The most prominent peaks in the region include Granulated Mountain (2792 m), Dickie Peak (2779 m) and Hungry Hill (2662 m), all of which were located in the western 1/3 of the study area. Elevations within the study area ranged downward from these maxima to approximately 2098 m along lower Jerry Creek at the southeastern margin.

Geologically, Moore (1956) considered the Long Tom area to be a northward extension of the Pioneer Mountains. Numerous strongly-





























































































































































