Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Research Progress Report

1 May 1994 - 31 December 1994

Effects of Weather on Caribou Forages, Productivity, and Nutrition within the Range of the Chisana Herd

Elizabeth A. Lenart


Tim Lewis Rue

Grant W-24-3
Study 3.41
June 1995

Alaska Department of Fish and Game
Division of Wildlife Conservation
June 1995

Effects of Weather on Caribou Forages, Productivity, and Nutrition Within the Range of the Chisana Herd

Elizabeth A. Lenart

Federal Aid in Wildlife Restoration
Research Progress Report
1 May 1994–31 December 1994

Grant W-24-3
Study 3.41

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
Frank Rue, Commissioner

DIVISION OF WILDLIFE CONSERVATION
Wayne L. Regelin, Acting Director

Additional copies of this report and other Division of Wildlife Conservation publications are available from:

Publications Specialist
ADF&G, Wildlife Conservation
P.O. Box 25526
Juneau, AK 99802
(907) 465-4190

RESEARCH PROGRESS REPORT

State: Alaska

Cooperator: None

Project No.: W-24-3   Project Title: Wildlife Research and Management

Study No.: 3.41   Study Title: Effects of Weather on Caribou Forage, Productivity, and Nutrition Within the Range of the Chisana Herd

Period Covered: 1 May 1994-31 December 1994

SUMMARY

Progress this period focused on refining the research proposal and implementing the research design to study the effects of weather on caribou (*Rangifer tarandus*) forage, productivity, and nutrition within the range of the Chisana Herd. The first field season was successfully completed 17 May 1994 through 15 August 1994. All clipped vegetation from the tundra habitat was sorted into the following forage classes: dead matter, live forbs, live deciduous shrubs, live sedges and grasses, and lichen. The vegetation was oven dried at 60°C for 48 hours to estimate aboveground biomass. Biomass and percent cover (estimated during clipping) was entered into a database and currently is being analyzed statistically. Vegetation from 2 clippings (210 samples) were ground to determine in vitro dry matter digestibility and nitrogen content. Analyses of in vitro dry matter digestibility and nitrogen should be completed by 30 May 1995 at University of Alaska Fairbanks. All shoots that were clipped from the *Salix pulchra* plots have been air dried. Caribou fecal pellets collected from 17 May 1994 through 15 August 1994 were sent to Washington State University to determine diet composition through microhistological analyses.

CONTENTS

BACKGROUND

The Chisana Caribou (*Rangifer tarandus*) Herd ranges in the Nutzotin and north Wrangell Mountains from the Nabesna River east into the Yukon Territory, Canada (Kelleyhouse 1990). In the early 1960s, Skoog (1968) thought the Chisana Herd numbered approximately 3000 caribou. During the late 1970s, however, the herd was estimated to be < 1000 animals (Kelleyhouse 1980). Between 1981 and 1988, the herd increased to 1900 caribou; calf:cow ratios in October ranged from 34:100 to 43:100. Recently, the Chisana Caribou Herd declined in both size and productivity. The herd decreased from 1900 animals in 1989 to 1300 in 1992; calf:cow ratios in autumn declined from 31:100 in 1988 to < 1:100 in 1992, the lowest recorded for any caribou herd in Alaska. During 1992 adult mortality increased substantially and the bull:cow ratio approached the minimum management objective of 30:100 established by the Alaska Department of Fish and Game (Gardner 1993).

From 1984 through 1989, the average annual harvest of the Chisana Caribou Herd was 44 bulls; 50% to 60% of this harvest was taken by nonresidents guided by local outfitters and 9% to 12% by local residents. Beginning in 1990, a voluntary harvest restriction initiated by local guides and outfitters in response to the herd's decline resulted in an average take of 22 bulls. In 1993 the Alaska Board of Game established a registration permit system allowing a maximum harvest of 20 bulls (Craig Gardner, pers. commun.). It is unlikely this small harvest influenced the decline of the herd.

Staff biologists studying the Delta and Fortymile caribou herds (in Interior Alaska) reported high adult mortality, low calf recruitment, and significantly lower body weights of calves from 1989 through 1992 (Valkenburg 1992). They hypothesized that warm, dry summers and heavy snow in winter in the last few years may have depressed forage quality, quantity, or availability and, hence, body condition of caribou in Interior Alaska (Pat Valkenburg, pers. commun.). Factors limiting productivity in the Delta and Fortymile caribou herds also may be affecting the Chisana Caribou Herd.

GOAL

My goal is to investigate the effects of summer temperature, precipitation, and variable sunlight on forage production and nutrient content within the summer range of the Chisana Caribou Herd. In addition, I will examine relationships between historical weather patterns and parameters of the caribou population. This study may increase our understanding of how weather influences forage quality and availability in the Chisana caribou range, in particular, and in Interior Alaska. In conjunction with other studies, a knowledge of weather effects may help explain the widespread decline of Interior Alaska caribou herds. Thus, weather data may become useful in predicting or explaining variations in productivity of caribou populations.

STUDY OBJECTIVES

Plant Response to Treatment Effects

To determine the effects of simulated variation in sunlight intensity, precipitation, temperature on nutrient quality, biomass, and digestibility of forages within the summer range of the Chisana caribou, I will test the following null hypotheses:

- Changes in available sunlight do not affect forage nutrient quality, biomass, and digestibility.
- Changes in amount of precipitation do not affect forage nutrient quality, biomass, and digestibility.
- Changes in temperature do not affect forage nutrient quality, biomass, and digestibility.
- Changes in temperature and precipitation combined do not affect forage nutrient quality, biomass, and digestibility.
- Changes in sunlight availability and precipitation combined do not affect nutrient quality, biomass, and digestibility.

Historical Weather Patterns and Caribou Population Parameters

To determine relationships between calf production and survival and weather patterns in the Chisana caribou range, I will test the following null hypotheses:

- During the period of caribou decline (1989-1993), patterns of summer rainfall, summer temperature, and winter snowfall were not different from previous years when the herd appeared stable or increasing.
- There is no significant relationship between climatic variables and recruitment rate.

PROCEDURES

Tundra-mat Experimental Design

A 48 m by 60 m grid consisting of 30 treatment plots was established in a traditional postcalving area of the Chisana Herd. Each plot contained 8 subplots, making a total of 240 vegetation subplots, each 0.25 m^2. Five replicates of 6 treatments (including controls) were applied to simulate a cloudy summer; a cloudy, wet summer; a warm, dry summer; and a warm, wet summer. The 6 treatments included: 1) unaltered control, 2) control with supplemental watering, 3) clear plastic only (to increase temperature by 3° to 4°C and decrease precipitation), 4) clear plastic with supplemental watering (to increase temperature by 3° to 4°C, 5) shade only (50% shade tarp), and 6) shade with supplemental watering (50% shade tarp). Temperature, precipitation, and amounts of supplemental watering under control, shaded, and clear-plastic plots were recorded. In addition, a local weather station recording ambient temperature, sunlight availability, and rainfall was established.

The clear tarps and shade tarps are 1.8 m by 3.6 m. One 0.25 m^2 subplot was clipped during the 4 time periods (9 June, 26 June, 18 July, 9 August). Beginning 22 June 1994, 30 liters of water was added once a week to those treatments requiring water. On 14 June a data logger, recording temperature every 1.6 hour, and a rain gauge were placed at 1 of the 5 replicates for each of the 6 treatments. On 16 July soil core samples were collected from each plot. During summer 1995 I will apply the same treatments to the same areas and clip the remaining subplots 4 times throughout the summer. Thus, I will be able to look at plant response to 2 seasons of treatment.

Shrub Habitat Experimental Design

Five replicates of 3 treatments (including controls) were applied to plots in a community consisting mainly of *Salix pulchra*. These plots were not treated until 10 July 1994 due to weather and time. The treatments included: 1) unaltered control, 2) clear plastic tarp, and 3) 50% shade tarp. The tarps are 3.6 m by 3.6 m and cover 4 to 5 willow plants or the clonal plant. A data logger and rain gauge were placed at 1 of the 5 replicates for each of the 3 treatments. Plant density was estimated and approximately 25 annual shoots were clipped on 8 August and 9 August in summer 1994. During summer 1995 approximately 10 annual shoots will be clipped several times through the summer in each plot to track nutrient quality following treatment. (Thus, the same willow plants I clipped in summer 1994 are the same plants I will clip in summer 1995).

Plant Analyses

Biomass, nutrient quality, and digestibility will be determined for all vegetation clipped. Forage vegetation samples will be analyzed for nitrogen and in vitro dry matter digestibility at University of Alaska Fairbanks.

Diet Composition and Fecal Samples

Fecal pellets were collected from nearby caribou groups throughout summer 1994 and will be collected during summer 1995. Pellets will be sent to Washington State University Laboratory for analyses to determine diet composition, identify forage fragments from microhistological characteristics (Dearden et al. 1975), and analyze fecal nitrogen to determine when forage nutrient quality is highest.

Historical Data

Historical weather data (e.g., annual averages for summer temperature, summer precipitation, snow depth, and snow-free days) will be collected from weather stations at Nabesna or Northway Airport to assess the influence of weather patterns on the Chisana caribou population (e.g., calf:cow ratios, population abundance). Data will be analyzed using multiple regression modeling and correlation analyses.

RESULTS

Vegetation Analyses

All clipped vegetation from the tundra community habitat has been air dried and sorted into the following forage classes: dead matter, live forbs, live deciduous shrubs, live sedges and grasses, and lichen; oven-dried at 60°C for 48 hours and weighed (biomass estimate). Biomass and percent cover (estimated during clipping) have been entered in a database and are being analyzed statistically. I am grinding plants to prepare samples for the nitrogen and in vitro dry matter digestibility (Person et al. 1980) analyses. This analysis will be completed at University of Alaska Fairbanks. I am anticipating statistically analyzing 2 time periods for the nitrogen and in vitro dry matter digestibility data (from the tundra-mat vegetation samples) before I return to the field (1 June 1995). All other analyses will be completed during fall 1995 and spring 1996. In accordance with the experimental design, I will perform a repeated measure of analysis of variance on biomass, nitrogen, and in vitro dry matter digestibility data.

Fecal Analyses

Caribou fecal samples have been sent to Washington State University to determine diet composition through microhistological analyses and fecal nitrogen.

Presentations

A poster paper was presented at the annual Alaska Cooperative Fish and Wildlife Research Unit meeting on 1 March 1995. I will present another poster paper at the Second International Arctic Ungulate Conference on 13-17 August 1995. During the next year, I will attend an international meeting to give an oral presentation on my project.

CONCLUSIONS

There are no conclusions at this time.

ACKNOWLEDGMENTS

I acknowledge technical assistance from R. Cameron, R. DeLong, D. Grangaard, B. Hunter, S. Kennedy, D. Lambert, L. McCarthy, L. Rossow, B. Scotton, S. Murley, S. Warner, and K. Taylor in designing tarps; constructing, maintaining, and taking down field camp; identifying plants; clipping vegetation; sorting plants; collecting caribou fecals, and editing manuscripts. Research design assistance from J. Ver Hoef, C. Gardner, D. Reed, T. Bowyer, R. Ruess, P. Valkenburg, and R. DeLong. Pilots P. Zaczkowski flew in technical assistance, T. Overly flew in all field gear from Chisana, and P. Valkenburg flew field gear from Fairbanks to Chisana.

LITERATURE CITED

Dearden BL, RE Pegau, and RM Hansen. 1975. Precision of Microhistological Estimates of Ruminant Food Habits. J Wildl Manage. 39(2):402-407.

Gardner C. 1993. Chisana Herd survey-inventory management report. Pages 62-73 *in* SM Abbott, ed. Survey Inventory Management Report, 1 July 1990-30 June 1992. Alaska Dep Fish and Game. Fed Aid in Wildl Restor. Proj W-23-3, W-23-4, Study 30, Juneau. 233pp.

Kelleyhouse DG. 1980. Chisana Herd survey-inventory progress report. Pages 29-30 *in* RA Hinman, ed. Annual report of survey-inventory activities. Vol X. Part II. Bison, Caribou, Moose, and Muskoxen. Alaska Dep Fish and Game. Fed Aid in Wildl Restor. Prog Rep. Juneau. 198pp.

____. 1990. Chisana Herd survey-inventory progress report. Pages 46-54 *in* SO Morgan, ed. Annual report of survey-inventory activities. Vol XX. Part II. Caribou. Alaska Dep Fish and Game. Fed Aid in Wildl Restor. Prog Rep. Juneau. 183pp.

Person SJ, RE Pegau, RG White, and JR Luick. 1980. In vitro and Nylon Bag Digestibility of Reindeer and Caribou Forages. J Wildl Manage. 44(3):613-622.

Skoog RD. 1968. Ecology of the caribou (*Rangifer tarandus*) in Alaska. PhD Thesis, Univ California, Berkeley. 699pp.

Valkenburg P. 1992. Investigation of regulating and limiting factors in the Delta caribou herd. Alaska Dep Fish and Game. Fed Aid in Wildl Restor. Prog Rep. Proj W-23-5. Juneau. 22pp.

Prepared by:

Elizabeth A. Lenart
F&W Technician IV

Submitted by:

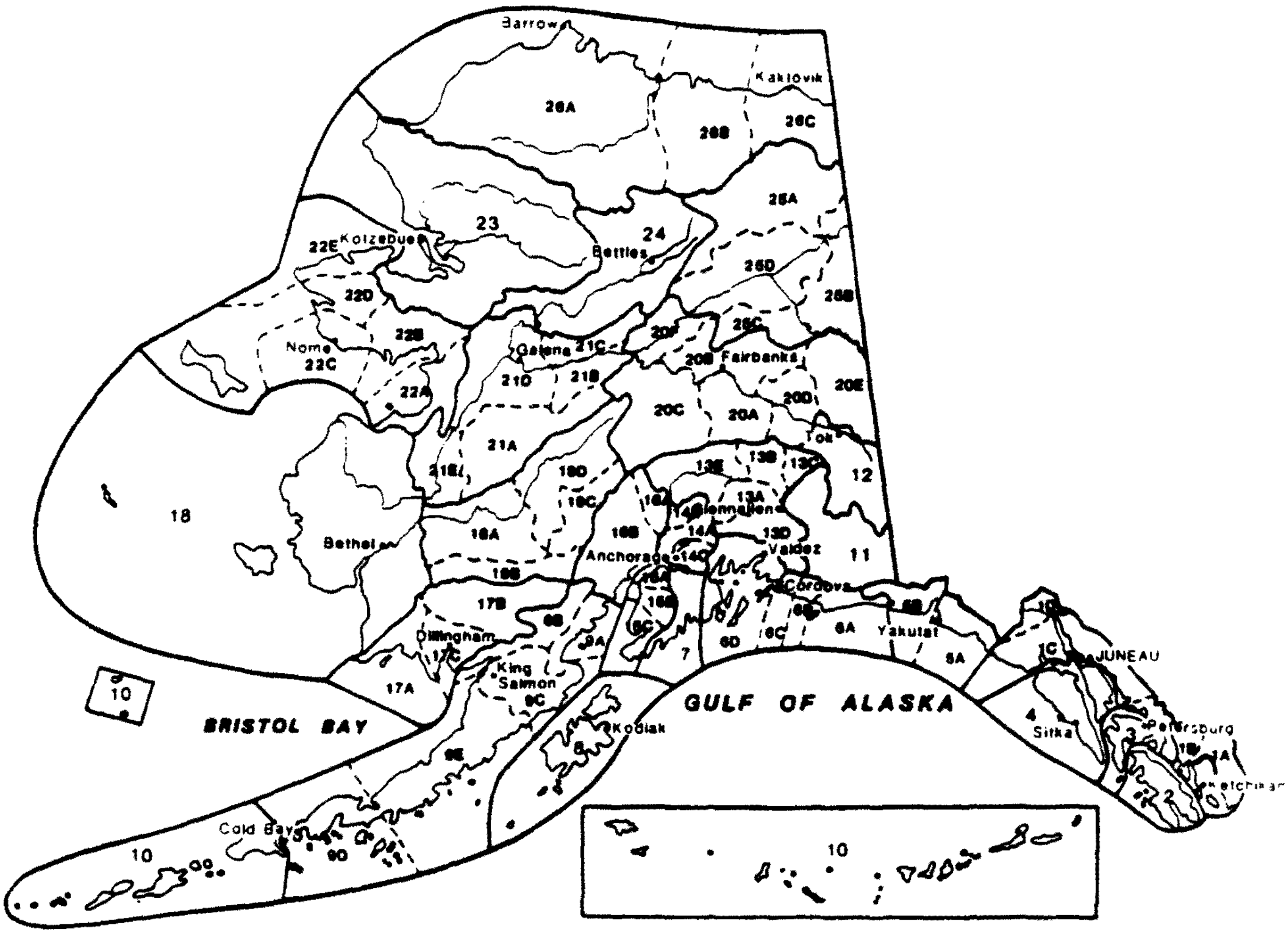
Daniel J. Reed
Research Coordinator

Approved by:

Wayne L. Regelin, Acting Director
Division of Wildlife Conservation

Steven R. Peterson, Senior Staff Biologist
Division of Wildlife Conservation

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.