Alaska Department of Fish and Game
Division of Wildlife Conservation
2006

Assessing wildland fire impacts on nutritional performance and distribution of caribou within Alaska's boreal forest ecosystem

Bruce W. Dale

Research Final Performance Report
1 July 1999–30 June 2006
Federal Aid in Wildlife Restoration
Grants W-27-3 and W-33-3
Project 3.44

This is a progress report on continuing research. Information may be refined at a later date.

FEDERAL AID RESEARCH FINAL PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
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PROJECT TITLE: Assessing wildland fire impacts on the nutritional performance and distribution of caribou within Alaska's boreal forest ecosystem

PRINCIPAL INVESTIGATOR: Bruce W. Dale

COOPERATORS: K. Joly and L. Adams (USGS)

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR: Initiated under W-27-3, completed under W-33-3

PROJECT NUMBER: 3.44

WORK LOCATION: GMU 11, 12, 13 and 20E: The Nelchina, Copper and Upper Tanana River Drainages

STATE: Alaska

PERIOD: 1 July 1999–30 June 2006.

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

This project was revised in 2003. The scope of the original study (entitled "The influence of seasonal spatial distribution on growth and age of first reproduction of Nelchina caribou with comparisons to the Mentasta herd") was greatly expanded in 1999 when ADF&G began a cooperative project with USGS. Many, if not all, of the objectives of the initial study are essentially encompassed in the expanded effort. However, U.S. Department of Interior fire research funds were secured to add significant habitat components to the initial objectives. This fortuitous event essentially rendered the initial project statement obsolete.

Caribou wintering in boreal forest ecosystems of Alaska forage primarily on "climax" stage fruticose lichens. Wildland fires, however, chronically burn boreal forests, reducing the availability of forage lichens for decades. In addition, prescribed fires have been implemented to reduce fire hazards, restore biodiversity or enhance moose habitat.

Funding under this grant addressed the seasonal nutritional performance of caribou utilizing various areas with varying fire history and lichen abundance. In addition, these activities provided instrumented caribou to determine distribution and movements relative to fire history and winter forage availability.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

Since the early 1900s, wildland fire has been implicated in caribou population declines. Numerous studies reveal reduced lichen availability, long lichen recovery periods, and caribou avoidance of recently burned winter ranges. However, direct evidence for fire-induced population decline is notably lacking. Moreover, researchers have long debated the importance of lichens to caribou. Although lichens dominate winter diets when available, examples of robust caribou populations utilizing lichen-poor ranges suggest that high-quality summer range or alternate winter forages can supplant lichen-rich winter range.

In addition, numerous investigators suggest that fire may rejuvenate older lichen ranges by favorably altering moss-lichen relationships, reducing overstory, or removing decadent lichens. Fire may also alter caribou movement patterns, thereby allowing recovery of overgrazed lichen ranges. Lastly, fire likely enhances summer range through nutrient turnover and increased quality and abundance of vascular forages. Contrary to assertions that fire is detrimental to caribou, these mechanisms suggest that wildland fire may play a role in maintaining caribou winter range or enhancing nutritional status.

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: Determine the nutritional status of 4 cohorts of female caribou prior to their first winter.

We completed evaluation of the nutritional status of 4 cohorts of female caribou in October 2003. We examined nutritional status by measuring mass at birth, 4, 11, and 16 months of age to evaluate the relative importance of seasonal nutritional performance to growth, the persistence of cohort-specific variation in body mass through time, and compensatory growth of individuals. Relative mean body mass of cohorts did not persist through time. Compensatory growth of smaller individuals was not observed in summer; however, small calves performed better over winter than large calves. Compensation occurred during periods of nutritional restriction (winter) rather than during periods of rapid growth (summer) thus differing from the conventional view of compensatory growth.

OBJECTIVE 2: Determine distribution and habitat use (relative to fire history and lichen abundance) of female caribou during their first winter.

By the end of this segment period, we have determined and analyzed the monthly distribution and habitat use of approximately 100 caribou for each of 4 years. Caribou avoided recent fires and most caribou apparently selected habitats with abundant fruticose lichens in winter. Caribou using the western winter range had superior nutritional performance over winter. However, the northern winter range was the most important to the population based on both nutritional performance and relative use. We generated one draft manuscript on this topic. That manuscript is still in peer review and should be submitted by November 2006.

OBJECTIVE 3: Determine seasonal changes in body mass of young female caribou to evaluate the influence of fire history and lichen abundance on nutritional performance.

We collected the final data in October 2003. Summer weight change had a much greater influence on weight at 11 and 16 months than winter weight change. However, winter change in body mass has not been greater than zero since 1998, even though snow depths have been below average, suggesting that winter resources are becoming more limited. We generated one draft manuscript on this topic. That manuscript is in co-author and peer review and should be submitted by November 2006.

OBJECTIVE 4: Evaluate influences of density, distribution, and habitat indices on changes in body mass.

We continued developing indices and summarized body mass data and have begun analyses and writing. Winter and summer distributions varied during the third year from the patterns seen during the first 2 years. The fourth year winter distribution was similar to the first 2 winters. Fewer caribou wintered on the current winter range, and caribou were more disbursed during summer during the third year. Summer body weights, which were higher in the third year, returned to values similar to previous years.

OBJECTIVE 5: Evaluate relationships between distribution and survival.

We completed development of distribution indices and summarized annual survival data. We incorporated survival patterns into a manuscript with those from Objective 4. That manuscript is currently in draft form.

IV. MANAGEMENT IMPLICATIONS

1. Because caribou strongly avoid recently burned areas, fire history has substantial affects on the distribution of caribou. Human uses of caribou for subsistence, hunting, and viewing in winter all depend on the accessibility of caribou. Regardless of population level impacts of fire, managers may choose to modify fire suppression schemes and land-use plans to maintain older spruce-lichen stands in areas of traditional or desired winter use of caribou.
2. While forage lichens become present at about 60 years post-fire, NCH caribou selected for older stands and lichen is more abundant in older stands. Thus managers concerned with maintaining availability of winter range will want to ensure continued abundance of older stands. Caribou selected for areas with approximately 19% cover of forage lichens in stands older than 80-110 years. Over winter change in body mass can also be used to evaluate the quality of winter range.
3. Simulations indicated that increased fire frequency resulted in less boreal forest and reduced age of remaining stands. Reduced fire frequency resulted in only slightly older and more abundant forest, but those stands may be smaller in size. Furthermore, reduced fire frequency resulted in large reductions in diversity and deciduous forest, which may be unfavorable for many species. Thus the current fire regime is perhaps best in terms of overall wildlife habitat.

4. Good quality summer range can likely offset poor quality winter range. While not empirically demonstrated at this time, wildland fire likely enhances summer forage abundance and quality if it occurs on appropriate summer or autumn ranges. Nutritional performance on summer range can be obtained by sampling calf body masses at 4 months of age and comparing to data for other herds. Age specific natality rates, especially for young (2-4 year-old) animals, may also indicate the quality of summer range.

V. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN FOR LAST SEGMENT PERIOD ONLY

Objective 6:

Job/Activity a. Edit manuscripts and accepted papers.

As noted in Section III, review, editing and submittal of manuscripts is ongoing. These tasks were not completed due to commitments to new projects and slow response from editors and reviewers. However, substantial progress was made on these tasks and we hope to have all manuscripts in press by the end of the calender year.

VI. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THE LAST SEGMENT PERIOD, IF NOT REPORTED PREVIOUSLY

None

VII. PUBLICATIONS

Kyle Joly, Bruce W. Dale, William B. Collins, and Layne G. Adams. 2003. Winter habitat use by female caribou in relation to wildland fires in interior Alaska Canadian Journal of Zoology. 81:1192-1201

Rupp, S., M. Olson, L.G. Adams, B.W. Dale, K. Joly, J. Henkelman, W.B. Collins, and A.M. Starfield. 2006. Simulating the influences of a changing fire regime on caribou winter habitat. Ecological Applications. In press.

Bruce W. Dale, Layne G. Adams, William B.Collins, Kyle Joly, Patrick Valkenburg, and Robert Tobey. Submitted. Stochastic and compensatory effects limit persistence of variation in body mass of young caribou.

Bruce W. Dale, Layne G. Adams, Kyle Joly, and William B.Collins. in prep. Spatial variation in nutritional performance of caribou: testing the ideal free distribution and ranking the value of discrete habitats.

Collins, W. B., B. W. Dale, D. E. McElwain, K. Joly, and L. G. Adams. In prep. Fire, Lichen Abundance, Grazing History, and Distribution of Barren-ground Caribou in Alaska's Taiga

These manuscripts can be accessed at:

http://www.absc.usgs.gov/research/caribou/fire_impacts.htm

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS

IX. PROJECT COSTS FROM LAST SEGMENT PERIOD ONLY

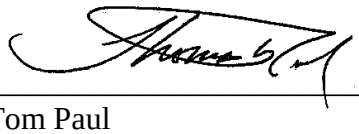
Total Costs
FEDERAL AID SHARE $628.5 STATE SHARE $209.5 = TOTAL $838

X. APPENDIX

XI. PREPARED BY:

Bruce W Dale
Wildlife Biologist

APPROVED BY:



Tom Paul
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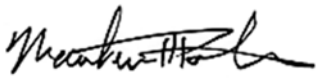

Matt Robus, Director
Division of Wildlife Conservation

APPROVAL DATE: September 30, 2006