

**FEDERAL AID  
ANNUAL RESEARCH PERFORMANCE REPORT**

ALASKA DEPARTMENT OF FISH AND GAME  
DIVISION OF WILDLIFE CONSERVATION  
PO Box 25526  
Juneau, AK 99802-5526

**PROJECT TITLE:** Identifying and evaluating techniques for wildlife habitat management in Interior Alaska

**PRINCIPAL INVESTIGATORS:** Dale A Haggstrom and Thomas F Paragi

**COOPERATORS:** Alaska Bird Observatory (ABO), Alaska Department of Environmental Conservation (ADEC), Alaska Department of Natural Resources (DNR), Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Doyon Limited, Tanana Chiefs Conference (TCC), The Ruffed Grouse Society (RGS), Toghothele Corporation, US Fish and Wildlife Service (FWS), and the University of Alaska Fairbanks

**FEDERAL AID GRANT PROGRAM:** Wildlife Restoration

**GRANT AND SEGMENT NR.:** W-27-5

**PROJECT NR.:** 5.0

**WORK LOCATION:** Various locations within ADF&G/Division of Wildlife Conservation's Region III

**STATE:** Alaska

**PERIOD:** 1 July 2001–30 June 2002

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**I PROGRESS ON PROJECT OBJECTIVES**

**OBJECTIVE 1:** Work with state and federal agencies and the private sector to plan, coordinate and implement forest management activities to maintain or improve wildlife habitat.

Since 1995 we have initiated cooperative projects with the Alaska Department of National Resources (DNR)/Division of Forestry (DOF) and the Ruffed Grouse Society (RGS) to alter the forest structure, age and composition at both the landscape and stand level to improve wildlife habitat. Approximately 91,085 acres have been treated at 98 sites to date (Table 1).

Landscape-scale habitat treatment is being accomplished with prescribed fire, and involves much greater planning, coordination, and public outreach because of its scale and potential to affect people and lands outside the treated areas.

Stand-scale habitat treatments are divided into 3 categories: (1) postlogging site treatment, (2) ruffed grouse habitat enhancement, and (3) moose habitat enhancement. Postlogging site treatments have included prescribed burning, mechanical scarification, and willow planting. Ruffed grouse (*Bonasa umbellus*) habitat enhancement treatments have included prescribed burning, felling, and shearblading (dozer mounted shearing blade). Moose (*Alces alces*) habitat enhancement has primarily involved willow crushing (standard dozer blade).

These management activities provide the range of treatments needed to evaluate the biological and economic efficacy of prescribed burning and other forestry practices for maintaining or enhancing wildlife habitat (Objective 3). The experience gained can also be applied to broader management decisions regarding burning and other forestry practices (Objective 2). Prescribed burning requires the use of state and federal firefighters; mechanical treatments are contracted to the private sector.

In 1998 we initiated a cooperative project with the DOF to establish a state prescribed burning protocol. The purpose of this project is to develop a state prescribed burning program that adequately addresses environmental and social issues, and meets criteria for Categorical Exclusion under the National Environmental Policy Act (NEPA).

**OBJECTIVE 2:** Encourage prescribed burning and other appropriate forestry practices in developed areas to offset the negative ecological effects of increased suppression of natural fires.

We continued the fire advocacy program in Fairbanks and the surrounding communities that began in spring 2001. The purpose of this initiative is to inform the public and various interest groups of the need for prescribed burning, particularly on the Tanana Flats.

We continued giving presentations on boreal forest succession and disturbance, as requested at local schools, the University of Alaska Fairbanks (UAF) and other venues.

We continued to provide comments on Forest Land Use Plans and the 5-year Schedule of Timber Sales, for proposed timber sales to the DOF through the ADF&G/Division of Habitat and Restoration.

**OBJECTIVE 3:** Evaluate biological and economic efficacy of prescribed burning and other forestry practices for maintaining or enhancing wildlife habitat.

Tom Paragi was hired in August 1999 to, in part, (a) evaluate whether the habitat enhancement projects implemented since 1995 are meeting management objectives; (b) develop cost-effective ways for area office staff to evaluate habitat enhancement projects; and (c) evaluate the biological and economic efficacy of various habitat enhancement techniques.

Biological efficacy of habitat treatments is obtained by monitoring the response of vegetation and the subsequent animal use or population response, relative to objectives set forth in the treatment prescription. The economic efficacy of treatments, which

incorporates both cost and biological response, will be addressed in subsequent reporting periods as information on vegetation and animal responses is gained.

In autumn 1999 we established permanent vegetation sampling plots at the Nenana Ridge, Two Rivers, and Delta Junction ruffed grouse project areas, the Heritage Forest Outdoor Education and Recreation Site, and the 1996 prescribed burn at Standard Creek. All except the Delta Junction project are in the Fairbanks area. The Standard Creek plots will be used to monitor long-term survival of planted feltleaf willow (*Salix alaxensis*). The plots in the remaining areas are for long-term monitoring of aspen regeneration in treated units.

In 2000 we established line transects for winter track surveys of furbearers, gallinaceous birds, snowshoe hares (*Lepus americanus*), and moose at the Nenana Ridge ruffed grouse project area and along the Tok River in the proposed DOF timber sale NC-837-T. Data from multiple counts per winter over several winters will allow statistical comparison of intersection rates, corrected for time since snowfall, among habitat types or treatments.

In 2000 we also facilitated a cooperative project entitled "Habitat selection of birds breeding in the Tok River watershed" with the Alaska Bird Observatory (ABO) to determine how the proposed timber sale NC-837-T might influence passerine habitat selection.

## **II SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD**

**JOB 1:** Develop operational knowledge necessary to conduct habitat enhancement projects and monitor effectiveness in meeting management objectives.

We continued to obtain current literature on topics germane to study projects. A ProCite® database on this literature was developed in autumn 2001 with the aid of a college intern to facilitate searching and access by other agency biologists. Paragi worked with the ADF&G librarian to encourage an internet bibliographic database on wildlife publications maintained by NISC International, Inc. (BiblioLine<sup>SM</sup> Wildlife and Ecology Studies Worldwide) to incorporate automated download of citations into ProCite®, a time-saving service that is now operational. Paragi also began gathering information on sources of weather data (real-time and archived) and reviewing literature on how these data can be incorporated into a winter severity index for moose. The index is intended to be predictive of energetic stress caused by deep snow that influences spatial use of winter range and winter mortality.

Paragi attended a UAF workshop on remote sensing.

**JOB 2:** Plan, design, and conduct habitat management projects to maintain, enhance, or restore wildlife populations.

### *Landscape-scale habitat treatments*

Planning was completed for a 30,000-acre landscape-scale prescribed burn in the Robertson River drainage west of Tok. Implementation was not possible in summer 2002

because fire staff were busy elsewhere when conditions may have been suitable for burning in the burn plan area. Burning will remain a priority for summer 2003.

Revision of the Western Tanana Flats Prescribed Burn Plan was completed in late summer 2001. Federal fuels management funding was obtained from the Bureau of Indian Affairs to assist with allotment protection needs. Implementation was not possible in summer 2002 because fire staff were busy elsewhere when conditions may have been suitable for burning in the burn plan area. Burning will remain a priority for summer 2003.

Haggstrom prepared a draft Wolf Lake Prescribed Burn Plan for Native corporation land near Tanacross. The Tanana Chiefs Conference continues to review and revise the draft, and is preparing a request for Bureau of Indian Affairs funding to assist with allotment protection needs. Field assessment to determine archaeological and historical site concerns and allotment protection needs will be conducted in summer 2002. Implementation of the burn is planned for summer 2003.

We were unable to get the DOF MatSu Area Office, which includes the McGrath District Office, to commit to implementing the Farewell Bison Prescribed Burn in summer 2002. Subsequent wildland fire management decisions regarding fires in the McGrath District during the 2002 fire season raised serious doubts about the MatSu Area's ability to conduct a large-scale prescribed burn in a cost-effective manner. In addition, the Windy Fire (fire # 204428) in summer 2002 has burned over 70,000 acres just west of the planned prescribed burn area, reducing the urgency for implementation of the Farewell Bison Prescribed Burn Plan. Funds tentatively allocated for the Farewell prescribed burn will be reallocated for other program needs.

#### *Stand-scale habitat treatments*

##### 1 Postlogging Site Treatment

Two old timber harvest sites, one each at the Nenana Ridge and Standard Creek timber harvesting areas west of Fairbanks, were evaluated for blade scarification to prepare seed beds for both hardwood and coniferous trees. The heavy grass growth in these units is impeding reforestation efforts. Paragi prepared contracting documents for DOF to finalize and process. The treatments will be evaluated under Job 3 of this study.

We continued working with Tok Wildlife Conservation and DOF staff to design an 880-acre timber sale (NC-837-T) in white spruce (*Picea glauca*) along the Tok River within the Tanana Valley State Forest. Our intent is to minimize negative effects of harvest and road construction on wildlife populations, and enhance habitat. A small proportion of the dead, standing trees were marked with red paint for retention as wildlife habitat in all the planned sale units. These marked trees may not be cut or knocked over, except as safety requires, or salvaged by the contractor. Likewise, we marked known animal dens in the planned sale units. Use of machinery will not be allowed in the vicinity of these dens.

## 2 Ruffed Grouse Habitat Enhancement

Shearblading was contracted and completed in 5 new units at the Delta Junction Ruffed Grouse Habitat Enhancement Project Area on the Delta Junction Bison Range in spring 2002. The units ranged in size from 16.6–45.4 acres and totaled 130.1 acres. The contract cost was \$96.00 per acre.

Contractors felled aspen on 4 new units at the Nenana Ridge Ruffed Grouse Habitat Enhancement Project Area in autumn 2001. The 4 units, ranging in size from 4.1–14.4 acres, totaled 48.5 acres. The contract cost was \$179.00 per acre. This will be the last felling for the foreseeable future until we finish evaluating whether the resulting debris either restricts use of the new aspen stands by grouse broods or increases predation rates. Meanwhile, we will continue the spring burning of standing aspen as an alternative to felling.

Division of Forestry crews flagged 2 more prescribed burn units in autumn 2001, bringing the total available for burning to 3. The burn units, ranging in size from 20.0–26.3 acres, total 72.4 acres. However, DOF crews were not able to burn any of the units in spring 2002. Unseasonably cool, wet conditions in early May rapidly transitioned to unusually hot, dry conditions, leaving scant opportunity to prescribed burn before leaf emergence, and creating need for firefighters elsewhere in the Interior.

In recent years, lack of available bulldozer shearblades has hindered bidding competition for enhancement projects in the Interior. We purchased an old “vee” shearblade from the Delta Soil and Water Conservation District that fits common dozers and will be made available to contractors for use on habitat enhancement projects done by ADF&G or cooperators.

## 3 Moose Habitat Enhancement

Paragi evaluated willow stands along the Alaska Highway near the Dry Creek community east of Delta Junction in summer 2001 for potential crushing sites to improve browse availability and decided they were not worth crushing at this time. Several willows species and young balsam poplar (*Populus balsamifera*) are currently providing a lot of browse biomass with little use by moose. The larger willows at the site are Bebb willow (*Salix bebbiana*), which does not respond well to crushing and is not a preferred browse species.

### *Prescribed Burning Protocol*

Haggstrom participated on the Prescribed Fire breakout group at the DOF Fire Management Workshop in Fairbanks in October 2001 to review revisions-to-date in the Section 2800 (prescribed fire) of the DOF Policy and Procedures Manual.

### *Miscellaneous*

We continued tracking project expenditures by job and activity using Microsoft® Excel for Windows® software, with information available from program receipts, the DOF, and the Alaska Statewide Accounting System.

JOB 3: Design and conduct long-term studies to evaluate the effectiveness of different habitat management techniques and applications.

*Vegetation response on landscape-scale habitat treatments*

A method for detecting changes in vegetative cover is needed to see whether habitat enhancement objectives are being met on landscape-scale prescribed burns. A cooperative study with the DOF is planned for FY03 to compare pre- and post-fire color infrared imagery of the area northwest of Tok that was treated with prescribed fire during 1998. Negatives from the burn photography will be scanned and loaded into the DOF's geographic information system to create a digital vegetation mosaic of the burn. Merging the digital images with a digital elevation model will enhance resolution.

We conducted photographic tests from an aircraft mounted camera near Fairbanks during late summer 2001 to determine the optimal exposure times and camera settings for a new color infrared film developed by Kodak®, which we plan to use for the East Fork study. We also drafted a reimbursable services agreement with DOF for most of the computer-based geographic information system analysis.

*Vegetation response on stand-scale habitat treatments*

We established permanent sampling plots (1x5 m) for long-term monitoring of aspen response to shearblading treatments in the Delta Junction area Forest (near Fairbanks) and Delta Junction. At Delta we compared sprouting response between cleared sites and adjacent parallel windrows of debris after having placed recording thermometers in the soil rooting zone in each debris treatment during the growing season (see Job 4 for windrowing rationale). We also put in permanent plots to measure paper birch (*Betula papyrifera*) and willow density at a postlogging prescribed burn at Standard Creek near Fairbanks. Data on stem density and the covariates slope, aspect, density class of debris, and herbaceous community composition were collected at the end of the second growing season after disturbance in all instances.

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We also continued gathering baseline data in the 12 units that have been selected for study in Block B of the planned NC-837-T timber sale along the Tok River. Three postlogging site treatments (techniques M, N, and O: trenching, blade scarification, and broadcast burning) will be evaluated to determine their effectiveness in regenerating deciduous shrubs and trees.

JOB 4: Design and conduct long-term studies to determine the response of wildlife populations to habitat treatments.

*Wildlife response to landscape-scale habitat treatments*

Spring drumming surveys for males, late summer brood surveys with trained dogs, and a kiosk with hunter reporting cards were again conducted to index changes in relative abundance of ruffed grouse at Nenana Ridge.

We worked with the RGS, the ABO, and the ADF&G Nongame Program to develop and fund a study to compare the abundance of selected passerines in treated (felled and burned) and untreated aspen stands at the Nenana Ridge Ruffed Grouse Habitat Enhancement

Project. Subsequently, the study was expanded to compare songbird abundance, diversity, and habitat use in 2 other habitat types in the Tanana River drainage and encompass 2 breeding seasons. The first passerine point-count surveys were conducted at Nenana Ridge by ABO staff in June 2002.

*Wildlife response to stand-scale habitat treatments*

Track surveys of furbearers, gallinaceous birds, snowshoe hares, and moose were conducted at the Nenana Ridge ruffed grouse project area and along the Tok River in the proposed DOF timber sale NC-837-T in winter 2001–2002. Three surveys were completed at Tok and 1 at Nenana Ridge during the reporting period.

JOB 5: Facilitate greater and more effective use of prescribed burning and other appropriate forestry practices by other state and federal agencies and the private sector, and the subsequent use of cost-effective and appropriate monitoring techniques to evaluate progress toward meeting management objectives.

We continued to review and comment on DOF's 5-year Schedule of Timber Sales and Forest Land Use Plans for the Fairbanks, Delta, and Tok areas.

We negotiated with DOF to ensure that the contract for the Tok River value-added timber sale (NC-837-T) will maintain habitat features at the stand and landscape scales. Mechanical scarification with dozer blades or disk trenchers by the contractors is being considered, as is broadcast burning by DOF personnel.

We worked with Tok Wildlife Conservation staff to take oblique aerial photos of selected harvest units at timber sale NC-837-T during summer and winter. These photos will provide a baseline for comparisons after harvest. Photos are a visual means for showing the public how certain practices, such as retention of dead trees in sale units or purposeful regeneration of willows, can improve wildlife habitat in timber sales.

We met with fire managers at DOF and natural resources staff at Clear Air Force Base near Anderson to discuss options for using prescribed fire to maintain aspen clones as wildlife habitat. Previously, we had helped Clear Air Force Base staff prepare an environmental assessment for shearblading as an immediate means to produce young aspen forest while a burn program is considered. We suggested that shearblading would create fuel breaks for future use of prescribed fire and reduce the risk of wildland fire spreading into the developed area. We believe burning is a more effective way to remove the black spruce understory to achieve both habitat and fuels management objectives.

Paragi met with Steve Dykstra (Delta Area Biola) Steve Reidsma and Jeff Mason (US Army) in summer 2001 to evaluate the potential for future habitat improvement projects along the 33-mile Loop Road and Meadows Road on Fort Greely. The tentative plan is to test several different shearblading treatments near the northern end of 33-Mile Loop Road and conduct some crushing experiments in the 15-year-old aspen in the 1987 burn.

We agreed to provide an internship opportunity for a new UAF program on cross-disciplinary graduate training in sustainable development (ecology, economics, and social science), tentatively set to begin in summer 2003. In concert with DOF, we plan to work with an intern to begin retrospective studies of forest regeneration on past timber sales with respect to their present value as wildlife habitat. Paragi visited several timber sales in the Delta area with DOF staff to examine hardwood regeneration on sites where white spruce had been harvested 10–20 years previously.

**JOB 6: Involve and inform other professionals and the general public.**

The following activities were completed in the last period on the fire advocacy initiative:

- At our request, the Fairbanks Area Biologist has continued discussions with the Fairbanks and Middle Nenana River Fish and Game advisory committees concerning the need for habitat enhancement on the Tanana Flats and the status of the Western Tanana Flats Prescribed Burn Plan.
- A fire poster was displayed and leaflets made available during the Outdoor Show at the Carlson Center in Fairbanks and at the Tanana Valley Fair.
- A slide presentation was made to the Fairbanks Chamber of Commerce. Haggstrom gave an updated talk to the Fairbanks Chamber of Commerce in April 2002 about the 2 large wildland fires that occurred on the Tanana Flats in 2001.
- Haggstrom and Paragi took a local newspaper reporter into the 2001 Survey Line fire on the flats by boat in June 2002, and the reporter subsequently wrote a feature article on wildlife benefits from the burn.
- We drafted a legislative resolution in support of prescribed fire in boreal forest to provide talking points between ADF&G and DOF at the Commissioner's level to give political support to fire professionals at the regional and area level within DOF.

Paragi presented a talk on floodplain forest as wildlife habitat at a continuing education workshop of Yukon River Chapter of the Society of American Foresters in Fairbanks. Paragi also co-organized the first joint annual meeting of the Alaska Society of American Foresters and Alaska Chapter of The Wildlife Society. At that meeting he presented posters on aspen regeneration and on landscape-scale wildlife surveys and a talk on data needs for landscape-level management.

We gave presentations on boreal forest succession and disturbance to local schools and undergraduate classes at the University of Alaska Fairbanks.

Haggstrom and Paragi attended the Bonanza Creek Long-Term Ecological Research Symposium at UAF in October 2001. Paragi participated on the panel discussion on data sharing.



A poster and handouts were prepared on aspen treatment projects for the annual banquet of the Interior Alaska Chapter of the RGS in February 2002.

A FY01 Federal Aid Research Performance Report and a FY03 budget request were submitted.

Paragi drafted an interim progress report on all projects in Jobs 3 and 4 as a preliminary model for the final research report.

Table 1 Summary of accomplishments, 1 July 1995–30 June 2002

Job	Number of sites treated	Number of acres treated
Landscape-scale prescribed fire	5	89,541
Postlogging site treatment	8	173
Ruffed grouse habitat enhancement	57	675
Moose habitat enhancement	<u>28</u>	<u>696</u>
<b>Total:</b>	<b>98</b>	<b>91,085</b>

**III ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD**

None.

**IV PUBLICATIONS**

BOWYER RT, BM PIERCE, LK DUFFY, AND DA HAGGSTROM. 2001. Sexual segregation in moose: effects of habitat manipulation. *Alces* 37(1):109–122.

**V RECOMMENDATIONS FOR THIS PROJECT**

Activities planned for FY03 include (1) implementation of landscape-scale prescribed burns on the western Tanana Flats southwest of Fairbanks, in the Robertson River drainage west of Tok, and north of Tanacross near Wolf Lake; (2) implementation of stand-scale prescribed burns at the Nenana Ridge and Standard Creek timber harvesting areas west of Fairbanks, and at research plots on Timber Sale NC-837-T south of Tok; (3) contracting for mechanical scarification in past timber harvest units at the Nenana Ridge and Standard Creek timber harvesting areas west of Fairbanks, and near the Gerstle River east of Delta; and (4) evaluation of additional areas for future treatment. We will also work with the DOF to complete revision of the Prescribed Fire Policy and Procedures Manual, which is an essential part of a state Prescribed Fire Protocol.

Implementation of a landscape-scale prescribed burn near Farewell (east of McGrath) will be postponed until the DOF Mat-Su Area Office and McGrath District Office develop the needed leadership and expertise. We will work to expand the Farewell Bison Prescribed Burn Plan to include adjacent Bureau of Land Management managed lands in the 1977 Farewell Burn.

We are suspending aspen felling operations on the ruffed grouse projects, where ruffed grouse are the primary focus for habitat enhancement efforts, until we are able to determine whether aspen felling debris hinders chick movement or increases predation rates. We intend to evaluate the feasibility of doing a study to determine hen habitat selection, chick survival, and cause-specific mortality of grouse after the grouse population rebounds from its cyclic low abundance. We will attempt to increase the number of units burned annually to aid in the evaluation of the long-term efficacy of prescribed burning as an alternative to mechanical treatments.

Progress in evaluating techniques for habitat enhancement and restoration is inherently limited by the relatively slow processes in forest succession, particularly in boreal regions. To date our applied research has focused on establishing long-term monitoring plots. The complementary approach is to also conduct retrospective studies of how past forestry practices or wildland fires have influenced the present structure and composition of forests as wildlife habitat. In summer 2003 we hope to provide a volunteer internship to a UAF graduate student through a new interdisciplinary training program funded by a National Science Foundation grant to a UAF faculty member. Our intent is to collaborate with university faculty and state foresters to conduct retrospective studies of past timber sales in the Tanana Valley.

We will continue to facilitate the passerine bird breeding surveys that the ABO is conducting at the Nenana Ridge Ruffed Grouse Habitat Enhancement Project. The breeding survey that was completed at Nenana Ridge in June 2002 will be repeated during June 2003.

Two types of scarification and the first of 3 planned broadcast burns will be conducted in summer 2003 at Tok River timber sale NC-837-T, if timber is harvested from the research units during winter 2002–2003.

We will finalize and distribute a research progress report for research activities to date.

We have begun tracking project hours by activity to separate time spent on research activities from time spent on management activities such as planning and implementing prescribed burns, contracting mechanical treatments, reviewing forest planning documents, and conducting public outreach.

## VI APPENDIX

### Sexual segregation in moose: effects of habitat manipulation

R Terry Bowyer<sup>1</sup>, Becky M Pierce<sup>1,2</sup>, Lawrence K Duffy<sup>3</sup>, and Dale A Haggstrom<sup>4</sup>

<sup>1</sup>Institute of Arctic Biology and Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, AK 99775, USA; <sup>3</sup>Institute of Arctic Biology, and Department of Chemistry and Biochemistry, University of Alaska Fairbanks, Fairbanks, AK 99775, USA; <sup>4</sup>Alaska Department of Fish and Game, 1300 College Road, Fairbanks, AK 99701-1599, USA

*Abstract:* We studied effects of mechanical crushing on abundance of forage and quality of feltleaf willow in winter, 3 years following habitat manipulation in Interior Alaska, USA. We also examined differences in snow depth and track counts for Alaskan moose (*Alces alces gigas*) between the crushed site and an adjacent area containing old-growth stands of willow. Likewise we tested for differences in foraging by moose between areas, and noted differences in use of the 2 sites by adult males, and females and their young. Mechanical crushing resulted in a 5-fold increase in the number of leaders of current annual growth and a 3-fold increase in dry mass for willows subjected to crushing compared with the uncrushed site. The size of individual leaders of feltleaf willow did not differ between sites, probably because the growth form of leaders re-sprouting from the crushed area was similar to stump sprouts available to moose on the uncrushed area. Moose took larger bites, however, on the crushed compared with the uncrushed site. No significant differences occurred in the chemical composition of willows, including concentration of tannins, between crushed and uncrushed areas. Similarly, there were no differences in in vitro dry matter digestibility of willows between sites. Moose sexually segregated in winter. Males occurred predominantly on the more open crushed area, whereas females and young used the uncrushed area where the dense vegetation offered substantial concealment cover. We hypothesized that mechanical manipulation of willows benefited primarily male moose 3 years following crushing, and that females and young faced a tradeoff between feeding on the greater abundance of forage on the crushed area and a reduced risk of predation on the uncrushed site. We see merits in considering the sexes of moose as if they were separate species for purposes of management, and recommend that future management of habitat to benefit moose consider differences in requirements of the sexes, especially factors related to risk of predation.

*Status:* *Alces* 37(1):109–122 (2001).

**VII PROJECT COSTS FOR THIS SEGMENT PERIOD**

FEDERAL AID SHARE \$96.8 + STATE SHARE \$32.2 = TOTAL \$129.0

**VIII PREPARED BY:**

Dale A Haggstrom  
Wildlife Biologist III

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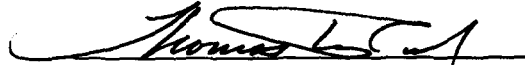
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APPROVAL DATE: 9/25/02