

**Alaska Department of Fish and Game
Division of Wildlife Conservation**

**Federal Aid in Wildlife Restoration
Research Progress Report
1 July 1998- 30 June 1999**

Analysis and Publication of Deer Research Data in Southeast Alaska

Matthew D. Kirchhoff



**Grant W-27-2
Study 2.12
December 1999**

STATE OF ALASKA

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DEPARTMENT OF FISH AND GAME

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DIVISION OF WILDLIFE CONSERVATION

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RESEARCH PROGRESS REPORT

STATE: Alaska **STUDY:** 2.12
COOPERATOR: None
GRANT: W-27-2
STUDY TITLE: Analysis and Publication of Deer Research Data in Southeast Alaska, 1978-1998.
AUTHOR: Matthew D. Kirchhoff
PERIOD: 1 July 1998–30 June, 1999

SUMMARY

The purpose of this project is to compile unpublished data on Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) and forest ecology for the scientific community, agency personnel, and the public. The highest priority is publication of results from 3 Federal Aid research projects, which I supervised, dating from 1987 through 1998. In addition, there is earlier deer work, much of it unpublished, which I plan to summarize in the form of an annotated bibliography. At present, 2 research papers have been submitted; 8 papers are in preparation; and several in-house publications or projects are planned. Brief descriptions of each of these efforts and a timeline for completion are provided here. Completion of this project is expected to take more than 1 year.

Key words: forest ecology, logging, *Odocoileus hemionus sitkensis*, old growth, publications, Southeast Alaska.

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BACKGROUND

There is a long history of deer research in Alaska, dating back to statehood. A number of research biologists have contributed substantially to our knowledge of Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) ecology over these years, including Dave Klein, Harry Merriam, Charlie Wallmo, John Schoen, and Tom Hanley, among others. Much of the early research by these individuals has been published in symposia (e.g., Wallmo and Schoen 1979, Meehan et al. 1984) or in peer-reviewed publications (referenced in ADF&G 1995). In recent years, Tom Hanley, of the Forestry Science Lab, and his cooperators have published a large body of work on deer nutritional ecology (e.g, Parker et al. 1999, and references therein). Much of the recent deer research by the Department of Fish and Game has not been published.

As project leader for deer research in Southeast Alaska since 1988, I have overseen 4 federal aid projects:

1. Evaluation of methods for assessing deer population trends in Southeast Alaska (W-22-6 and W-23-1, 2, 3, 1987–90).
2. Effects of forest fragmentation on deer in Southeast Alaska (W-23-3,4,5, W-24-1,2, 1990–93)
3. Effects of selection logging on deer habitat in Southeast Alaska (W-24-4, 1994–98)
4. Effects of even-aged timber management on survivorship in Sitka black-tailed deer, Southeast Alaska (W-25-1, 1996–1999)

Little information from these studies has been published in peer-reviewed journals, and results are generally unavailable to resource managers and the public. Before starting new field studies, I would like this prior work published.

OBJECTIVES

The objective of this Federal Aid project is to make available to the scientific community, agency personnel, and the public the Alaska Department of Fish and Game's unpublished data on deer and forest ecology.

METHODS

Final reports on the first 3 of these studies have been completed, and administrative oversight on the 4th (a PhD candidate's project) has been transferred to Dave Person, who was recently hired to supervise predator-prey research in Ketchikan. Most of the planned publications focus on different components of these Federal Aid reports. The planned publications will all require substantial original writing, and in some cases, new analyses of data. Draft papers will be submitted for informal reviews before submitting to journals, and changes made as recommended. Revised final drafts will be submitted to an appropriate journal. Assuming papers are accepted, I will begin the process of responding to reviewers' suggestions and preparing papers for publication. Papers that are rejected will be substantially revised to address identified weaknesses and will be submitted to a different journal or published in-house.

Preparing scientific papers requires good familiarity with the existing scientific literature. As I read relevant papers, I annotate them for future reference. I intend to compile these in an annotated bibliography and searchable database for broad distribution. Slides and digital photos will also be made readily accessible within the department and to the public for their information and use.

As part of my on-going training and professional development, I have participated in course work, consultations, and independent reading to strengthen my knowledge of statistics and my technical writing skills. Duties as a reviewer have also provided useful experience and strengthened my analytical skills.

RESULTS

PAPERS IN REVIEW OR PREPARATION

Papers are listed in order of priority for submission.

Title: Making Ecology a Predictive Science.

Authors: Emlen, J. M., D. C. Freeman, M. D. Kirchhoff and 3 others

Status: In Peer Review.

Outlet: *Ecological Applications*

Submission: July 1999

Description: This paper is the result of collaboration with Dr. John Emlen of the Biological Resources Division, U. S. Geological Survey in Seattle, WA. John is the originator of a predictive modeling approach known as

interaction assessment (INTASS). This paper describes a new generation of models that predicts population dynamics of species in a community as a function of local densities, the densities of plant resources per individual, density of competitors and predators, and physical environmental values. We used detailed vegetation and deer density data from small islands in Southeast Alaska (study 2, Background section above) to illustrate how this model works. I believe this type of model holds promise for ecologists and resource managers, and hope to continue gathering empirical data to refine and promote this predictive approach.

- Title: Forest-mammal Associations of Prince William Sound, Alaska
- Author: Kirchhoff, M. D.
- Status: In Peer Review.
- Outlet: *Biological Conservation*
- Submission: October 1999
- Description: This paper was invited at a conference sponsored by the Prince William Sound Science Center and Copper River Delta Institute in 1992. The paper was accepted as one of 8 that were to be published in a special issue of Biological Conservation. However, several other authors never completed their promised papers, and the special issue was subsequently dropped. I have asked that my paper be returned, and I will submit it for publication independently.
- Title: Effects of Early Selective Logging (1899-1940) on Forest Composition, Growth, and Structure in western hemlock-Sitka spruce forest of Southeast Alaska.
- Authors: Kirchhoff, M. D. and S. R.G. Thomson
- Status: Manuscript in Prep.
- Outlet: *Ecological Applications or Journal of Applied Ecology*
- Submission: Jan 2000
- Description: Publishing this research is my highest priority. The final report has been reviewed by Bob Deal of the Forestry Sciences Lab and by staff of the USFS Stikine Area office. Addressing their comments required rereading the tree ring data from my increment cores, calculating new growth equations, and reanalyzing my data. I am in the midst of that reanalysis and will be consulting with Dr. Robert Fagen on some advanced regression techniques. Preliminary results indicate (1) that tree growth rates increase as logging intensity (% of basal area removed) increases, (2) Sitka spruce (*Picea sitkensis*) regenerates adequately under very light selection harvest, and (3) biomass of shrubs and important deer forages decrease as logging intensity increases. We concluded that light selection harvest (1–6

individual trees per 0.2 ha) can occur and still preserve functional winter deer habitat. The published results will be useful to land managers and conservationists who are interested in prescribing effective alternatives to clear-cut logging.

Title: Equations for Estimating Biomass and Browse Consumption of Common Deer Forage Plants in Southeast Alaska

Author: Kirchhoff, M. D.

Status: Manuscript in Prep.

Outlet: *Journal of Range Management*

Submission: March 2000

Description: There are numerous papers in the literature on the subject of predicting plant biomass from various measures. While these are helpful, they suffer some important limitations. For equations to be useful and accurate, they must reflect measures on *randomly* collected plants; they must account for the effects of deer density (or browsing) on the plants; and they must distinguish biomass that is above and below the reach of deer. None of the existing papers from Southeast Alaska do this, and so all tend to over-estimate available biomass for deer. The regression equations I report in this paper will be for the primary browse species (*Vaccinium* spp) and to incorporate terms for relative browsing intensity. The data were gathered in conjunction with the study on effects of habitat fragmentation on deer. This paper will be useful for measuring vegetative carrying capacity for deer in different habitat types in SE Alaska.

Title: Effect of Forest Fragmentation on Habitat Selection and Survival of Sitka Black-tailed Deer in Southeast Alaska

Author: M. D. Kirchhoff

Status: Manuscript in prep.

Outlet: *Conservation Biology or Landscape Ecology*

Submission: May 2000

Description: This paper documents the relative forage availability, deer abundance and distribution, and overwinter deer mortality on 2 contrasting landscapes in Peril Strait, one heavily fragmented by logging and the other unlogged. Despite higher deer densities on the unlogged landscape, mortality on the fragmented landscape was 2 times higher than on the unlogged landscape. The original plan of the study was to sample 20 sites over 2 field seasons. However, logistics, time, and costs associated with the project were higher than expected, and I ended the project early. Although the results were intriguing, the small sample size may make publication difficult.

Title: Balancing Predation Risk and Starvation Risk by Deer: Empirical Evidence from Islands in Southeast Alaska.

Authors: M. D. Kirchhoff and C. J. Farmer

Status: Manuscript in prep.

Outlet: *Behavioral Ecology or Ecography*

Submission: July 2000

Description: This research was conducted as part of the forest fragmentation study, the original purpose of which was to assess effects of island size on deer distribution. I found that other factors besides island size had a much greater influence on deer distribution, namely, security from predators. By carefully monitoring deer densities and forage conditions on 97 islands over a 4-year period, and factoring in proximity to large islands with resident wolves, it was clear that deer were making demonstrable tradeoffs between risk of starvation and risk of predation in their habitat (island) selection. Because islands constitute such discrete habitat choices, this is a clean experimental design that nicely demonstrates optimal habitat selection by a large mammal. I am reanalyzing these data using more sophisticated multivariate techniques. I plan to coauthor this paper with Chris Farmer (PhD candidate and ADF&G cooperator), who is testing similar theories about optimal foraging and habitat selection in a terrestrial setting (see job 4 above).

Title: A Nonintrusive Technique for Radiocollaring Large Mammals.

Authors: Kirchhoff, M. D. and C. Farmer

Status: Manuscript in Prep.

Outlet: *Wildlife Society Bulletin*

Submission: September 2000

Description: The only techniques currently used to capture and radiocollar deer all require restraint and handling of the animals. In Southeast Alaska, the requirement of capture has limited efforts primarily to alpine habitats, young clearcuts, beaches, and road edges where deer can be approached and either darted or net-gunned. Success rates are variable with darting, and net-gunning from helicopters is expensive and logistically difficult in remote study areas. More problematic is the fact that we simply cannot sample deer effectively in forest habitats, which leads to biased results. Finally, physical capture and handling increases stress in these deer and associated risk of serious injury or death. I have developed an inexpensive self-collaring snare that carries a 2-year transmitter, requires no human presence to apply or monitor, requires no restraining or handling deer, and falls off after 2-years (or can be broken off in the case of nontarget animals like wolves and bears). Prototypes have been developed in the office and 5 will be tested on Heceta Island this winter. If successful, this technique should find

widespread application in Southeast Alaska and other areas with similar forest cover.

- Title: Vegetative Characteristics of Deer Habitats in Southeast Alaska.
- Authors: Farmer, C. J. and M. D. Kirchhoff
- Status: Manuscript in Prep.
- Outlet: *Canadian Journal of Zoology*
- Submission: November 2000
- Discussion: There are numerous classification systems for vegetation in Southeast Alaska based on various measures of stand structure, composition, and biomass. While the classifications may use qualitative or quantitative measurements, all rely on sampling relevés, stands that are subjectively selected. I am unaware of an objective classification based on random or systematic sampling of vegetation in the region. On Heceta Island, we sampled vegetation on a random sample of plots that were laid out in a systematic grid (1 km x 1 km) across the Island. We will use a cluster analysis to characterize the composition and biomass of understory plants within each functional habitat category. The results will be useful in modeling carrying capacities for deer
- Title: Deer Population Trends in Southeast Alaska- A 20 year history.
- Authors: Kirchhoff, M. D., and M. J. Kirchhoff
- Status: Manuscript in Prep.
- Outlet: *ADF&G in-house Publication*
- Submission: Not yet scheduled
- Description: There are very few survey programs in the country that have been conducted with consistent methodology over 20+ years. The Region's pellet-group survey program, conducted throughout Southeast Alaska each year, is one such example. Although we typically compare each year's results with the previous year's, we have never looked at long-term population trends or biogeographical patterns across the Archipelago. Some editing may be necessary, and assumptions built in before the year-to-year data are directly comparable. Results could be presented by drainage, but more likely, we will be looking for larger-scale and longer-term patterns using smoothing algorithms and exploratory data techniques. The product should be of high interest to both hunters and biologists.
- Title: Predicting Deer Hunter Success.
- Authors: Kirchhoff, M. D. and T. Straugh
- Status: Manuscript in Prep.

Outlet: *ADF&G in-house publication*

Submission: Not scheduled

Description: We frequently hear questions from hunters asking where they should go to have the best chance of killing a deer. Certainly, the density of deer in an area is one factor, but other factors such as mode of access, habitat type, time of season, and existing weather conditions play a big part as well. I would like to look at these various factors, drawing from our deer survey data and our hunter survey data, to develop a model for predicting sport hunting success. Limited telephone surveys of a sample of hunters may be incorporated as well. Results of this exercise might result in GIS maps showing hunters locations of the historically highest deer densities or the historically highest catch per unit effort areas. This product would be useful to managers and to deer hunters.

Author: Kirchhoff, M. D.

Status: Manuscript in Prep.

Outlet: *ADF&G in-house publication*

Submission: Not scheduled

Description: Over the last 20 years, I have gathered (or inherited) a large collection of research papers on Sitka black-tailed deer. Other information is unpublished "gray" literature, including agency reports and administrative studies dating back to the 1950s. Many biologists, especially those who prepare Forest Service EIS's on contract, are unfamiliar with some of this work. I would like to summarize this research in the form of an annotated bibliography so that these materials and information are more readily accessible.

Title: A Searchable Literature and Slide Database on CD-Rom: Deer, Forests, and Conservation Biology

Author: Kirchhoff, M. D.

Status: Product in Development

Outlet: *ADF&G in-house publication*

Submission: Not scheduled

Description: I would like to transfer the above information on deer, along with literature on forest ecology and conservation biology, to CD-ROM so that the information can be more easily searched and retrieved. This will by no means be a comprehensive database, but it should be a useful contribution. Related to this project, I will label and organize approximately 500 35-mm slides and digital images into a computerized database for use by the region and the public.

Title: Old-growth and Wildlife in Southeast Alaska – on the Web.
Author: Kirchhoff, M. D.
Status: Product in Development
Outlet: *ADF&G in-house publication*
Submission: Not scheduled
Description: I frequently receive requests from teachers to make presentations in their classrooms on wildlife or forest ecology. More recently, I have been approached by tourism operators who would like me to either help train their employees or work as a naturalist on their cruises. I do regularly speak to classes, but have declined requests from commercial operators. The opportunity to educate students, as well as hundreds if not thousands of cruise ship visitors annually about wildlife and forest issues in Southeast Alaska is a valuable one. Therefore, I propose developing a web page that contains the kind of natural history information people are requesting. This web page will also provide a forum for answering commonly asked questions. There would be a significant investment of my time in development and creation of the site (linked to the ADF&G web page), but maintaining and updating it after that would probably be manageable. This would be freely accessible to anyone with an interest, including teachers, tourists, and commercial operators.

MANUSCRIPTS REVIEWED

Manuscripts received and reviewed in the last year are shown below.

Great Basin Naturalist

Elk and cattle diets in the Big Horn Mountains of Wyoming.

Journal of Wildlife Management

Estimating the density of large herbivores from pellet-group counts.

Alaska Applied Science and Technology Foundation

Influence of early stand density management on tree form growth and habitat development in Southeast Alaska forests.

Reviewed at Author's Request

Assessment of marine resources in the diet of the Alexander Archipelago wolf using stable isotope analysis

State dependent wolf packs: an optimal strategy employing variable pack sizes

Deer-predator relationships: a review of recent North American studies with emphasis on mule and black-tailed deer.

Habitat use and movement of black-tailed deer under reduced predation and climatic stress

TECHNICAL TRAINING

I participated in the following training and professional development activities this year.

- Presenting Data with SPSS Tables for Windows. A 2-day course taught in Redmond Washington
- ActiveStats: An Interactive Statistics Course by SPSS
- Training Course Guide Library on CD-ROM Advanced Techniques: Regression
- Consultations with Dr. John Emlen (USGS, BRD, Seattle) and Dr. Robert Fagen (University of Alaska, Juneau)

CONCLUSIONS AND RECOMMENDATIONS

In working on this project, I found more potentially publishable information than originally anticipated. In particular, there is a great volume of information and data that, while not publishable in peer-reviewed outlets, is worthy of summarizing and publishing in-house. An annotated bibliography (and CD-ROM) will be valuable to students and researchers. Regional and historical perspectives on deer distribution, abundance, and harvest patterns will be valuable to wildlife managers and the hunting public. A web page on Wildlife-old-growth relationships will be very useful to students and visitors to Alaska. Much of our job revolves around gathering and interpreting this type of information, and we should make it accessible to as broad an audience as possible

The scope of work initiated in this first year exceeds what can be reasonably accomplished in the remaining year of this project. I will work on the peer-reviewed technical articles as my first priority, but I will also be requesting a project extension to permit completion of the remaining publications and products. I value the opportunity to focus attention solely on publishing, and believe this same opportunity should periodically be afforded (and encouraged) for all research biologists in the department.

ACKNOWLEDGMENTS

I would like to thank Bill Martin, former federal aid coordinator, for his valuable support of my work, and the Department's wildlife research program. Tom Straugh, programmer-analyst, offered valuable assistance on several projects. I am grateful to Dave Person, Chris Farmer, John Emlen, and Bob Fagan for their ecological insights and many stimulating discussions. Thanks to Kim Titus for his support and advice on this project, and to Mary Hicks for her editorial assistance. Finally, I'd like to acknowledge two of my mentors, John

Schoen (retired) and Olaf Wallmo (deceased), whose pioneering work set the standard for deer research in Southeast Alaska.

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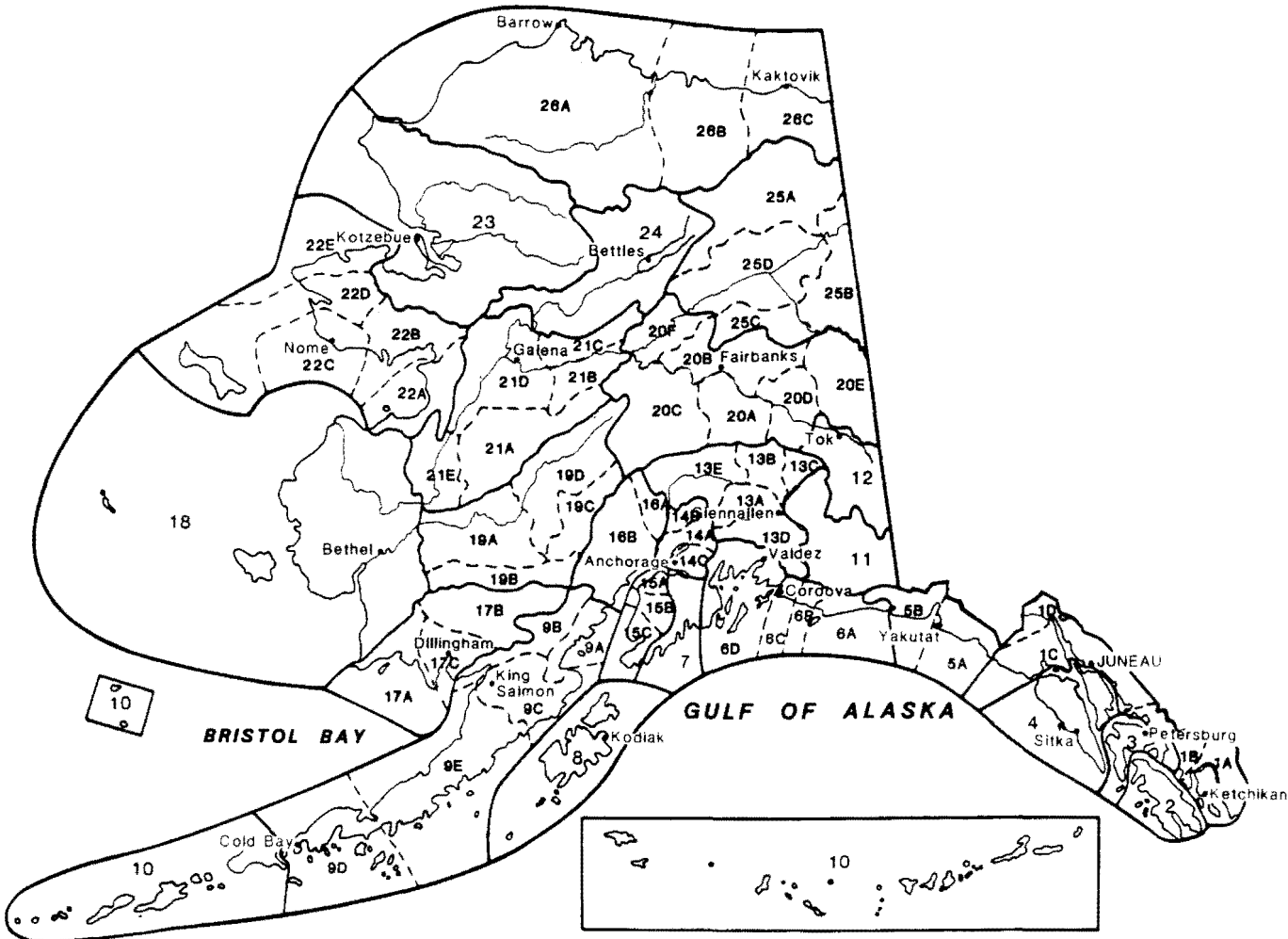
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The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back 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 attitude for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.

