Alaska Department of Fish and Game
Division of Wildlife Conservation
2006

Development of GIS techniques for the collection, modeling and analyses of wildlife movement data and spatial dynamics in Unit 13

Elizabeth K. Solomon

Research Annual Performance Report
1 July 2005 – 30 June 2006
Federal Aid in Wildlife Restoration
Grant W-33-4
Project 27.10

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
Juneau, AK 99802-5526

PROJECT TITLE: Development of GIS techniques for the collection, modeling, and analyses of wildlife movement data and spatial dynamics in Unit 13.

PRINCIPAL INVESTIGATOR: Elizabeth K. Solomon

COOPERATORS: Howard N. Golden, Todd A. Rinaldi

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR: Initiated under W-33-4, completed under W-33-4

PROJECT NUMBER: 27.10

WORK LOCATION: The Nelchina Study Area (NSA) is located in the western Nelchina Basin of Game Management Unit 13 (GMU 13) in South-Central Alaska (61.7° N to 62.5° N, -147.7° W to –145.9° W), bisecting the Glenn Highway to the north and south.

STATE: Alaska

PERIOD: July 1, 2005 – June 30, 2006

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

The advancing techniques of GIS mapping, Global Positioning Systems (GPS), remote sensing and radiotelemetry have greatly enhanced opportunities for resource managers and agencies to better understand the complex spatial and temporal patterns across the landscape. Despite these improvements in technology, it was evident that techniques for data processing and analysis required to deal with the quantity and quality of data being collected were not adequate. Game Management Unit 13 (GMU 13) presented a unique opportunity to examine and develop strategies for spatial analyses of predator–prey systems in the GIS environment. The overall objective of this project is to develop and test applications and techniques that would enable researchers to collect, integrate/compile, and analyze the geospatial data derived from cooperative research efforts on predator and prey species in the Nelchina basin.

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

Ongoing studies in the Nelchina Basin have employed radiotelemetry methods with state-of-the-art VHF, remote, and “store-on-board” GPS technologies deployed on wolves, bears, and moose.

In addition to the collection of location data, population monitoring and modeling efforts, vegetation/habitat work, nutritional studies of moose, and assessments of human activity patterns are in progress. However, due to the broad change in direction/objectives of related research projects, in addition to the loss of study animals (due to harvest pressure), the objectives of this study plan changed, and consequently ended the efforts of this work plan prior to the projected end date.

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

OBJECTIVE 1: Examine and develop specialized techniques for the collection of fine-scale radiotelemetry data in the GIS environment. This objective was approached by developing GIS tools and database models to accommodate the input, processing, validation, and standardization of wildlife telemetry data collected directly and remotely via GPS radiocollar techniques.

OBJECTIVE 2: Develop and assess methodologies/models for the analysis of spatial and temporal animal movement patterns of moose and predators. A geodatabase model and mapping interface was developed to structure the spatial datasets collected by collaborative research projects, providing users with seamless data integration in a GIS environment.

Objectives 3 and 4 were not in the FY06 AWP; therefore, they were not completed.

IV. MANAGEMENT IMPLICATIONS

The geospatial data, and most significantly, tools and techniques, derived from this project will help provide a better understanding of the spatially complex landscape present in this intensely managed game management area. The methodologies developed here provide an approach for analyzing spatial and temporal wildlife movement patterns, as well as constructing a seamless integration of geospatial technologies for end users. These methodologies can be applied to other wildlife research, and ultimately provide decision-makers with specialized tools to manage populations more effectively.

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

JOB _1A: Design and test mobile mapping applications for backtracking animal locations with remotely downloaded GPS radiocollar data.

Backtracking methodologies in the GIS environment were designed and then tested by research crews conducting work on population ecology and spatial dynamics of wolves. Customized field mapping methods incorporating mobile devices (HP IPAQ handheld devices) and wireless communications (via Bluetooth technology) were set up to provide field researchers with tools for backtracking collared animals via aircraft. Specifically, we developed an application that enabled aerial surveyors to import remotely downloaded GPS files into a file structure that could be uploaded both via standard GPS receivers and/or mobile mapping hardware/software in order to facilitate backtracking flights.

JOB _1B: Develop strategies to standardize spatial data capture.

Various data collection forms for animal captures and tracking were designed to standardize data collection in the field. Matching electronic forms were developed and maintained in a front-end database application for data entry by multiple users. Field types with constraints were created that could store various types of spatial and attribute data in an efficient database structure, ensuring data verification and accuracy. Protocols were established for standardizing geographic coordinate data in order to provide integration to a GIS.

JOB _1C: Create and maintain relational database management system (DBMS) and front-end applications for input, verification, storage, manipulation, and output of spatial data to GIS.

Using standard database management software, a relational database was created to input, store, manipulate, and manage large volumes of data collected from "Store-on-Board" radio collars deployed on wolves and moose. A front-end application linked to the DBMS was structured on a network server so that hierarchical levels of data storage and manipulation could take place. In order to allow filtering and data field manipulation, numerous queries were developed based on SQL. In addition, stored procedures were written to automate radiocollar data input into the database by the database user. Currently, the database stores over 275,000 GPS locations, including over 100,000 moose locations and over 175,000 wolf locations. Over 85 animals are indexed in this database, with relational data on their captures, status, and geographic locations. Bear captures were not completed last year due to limitations in funding and other priorities.

JOB _2A: Customize specialized GIS mapping software to give users a seamless integration of GPS-based and other types of spatial data into a common GIS.

In order to standardize the varied datasets collected for GMU 13, such as GPS telemetry locations, infrastructure (roads and new trails), hydrology, satellite imagery, DEMS, etc., we designed a spatial database in the standard ESRI Geodatabase model. In addition, standardized map applications were developed. This enabled GIS users to employ common projections and coordinate systems, and to facilitate spatial analyses on wildlife data. We provided consultation with other project cooperators on how to georeference new data, minimize spatial errors, and seamlessly manage, process, and visualize huge volumes of geospatial data.

JOB _2B: Investigate tools and models for exploratory spatial analyses in the GIS environment.

We did not conduct this work due to change in research objectives.

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

None

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS

This project was primarily supporting project 14.24 studying wolf ecology in the Nelchina Basin in GMU 13. However, GMU 13 wolf control has compromised the GMU 13 wolf research so we are ending the field work on that project and closing down this project.

IX. PROJECT COSTS FROM LAST SEGMENT PERIOD ONLY

Total Costs
FEDERAL AID SHARE $25,556 STATE SHARE $8,518 = TOTAL $34,074

X. APPENDIX

XI. PREPARED BY:

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APPROVAL DATE: _____