Grizzly Bear Management: Validating Existing Cumulative Effects Models

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Thirteenth Annual Conference on Geographic Information Systems

GIS 99

Vancouver

Abstract

Grizzly bears are a focus of concern for wildlife management in the 60,000 square kilometer Yellowhead region of Alberta and British Columbia. Grizzly bears are an important indicator of ecosystem health in the region. This species roams large areas within their home range, and while managers attempt to gain a better understanding of their population status, there are ever-increasing human use pressures on the landscape. Existing GIS based models, which study the cumulative effect of human disturbance on grizzly bears, have been applied to direct research. These models include analyzing potential and actual habitat, identifying security areas, and predicting potential zones of movement for grizzly bears. By using a new technology, GPS radio telemetry collars, we will be able to compare model predictions with actual grizzly bear movement data collected on a 24-hour basis. These results will be used to validate and improve the existing models and lead us to a better understanding of grizzly bear movements and habitat use.

Introduction

Grizzly bears are a focus of concern for wildlife management in the 60,000 square kilometer Yellowhead region of Alberta and British Columbia. Grizzly bears are considered to be an indicator of ecosystem health in the region. It is therefore important to increase our understanding of grizzly bear movement and habitat use, and to develop GIS based tools as a technique to assist resource managers with land use decisions related to the conservation of grizzly bears.

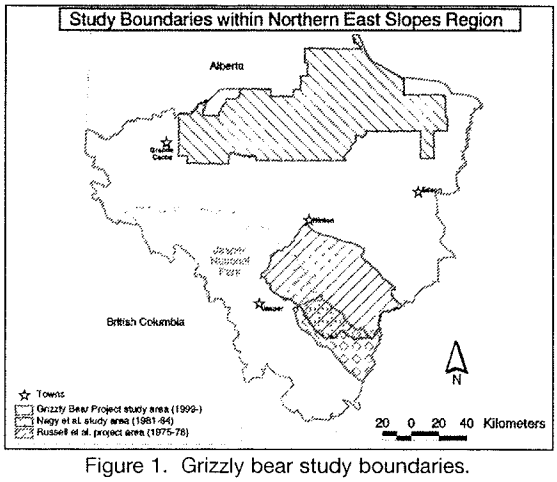

Figure 1. Grizzly bear study boundaries.

Previous Grizzly Bear Studies

Several grizzly bear population ecology studies were undertaken in the last 30 years in this area. These studies, boundaries shown in Figure 1, are important for historic data on bear movement and distribution 10 to 20 years previously, and can be used as such for model testing.

From 1975 to 1978, Jasper National Park and the Canadian Wildlife Service collected

grizzly bear data for a joint study. VHF telemetry radio collars were used for tracking 18 different grizzly bears. The goal was to study grizzly bear population ecology (i.e. densities, food habits, movements, home ranges, etc.) leading to recommendations for better grizzly bear management. A report (Russell et al., 1979) was compiled and illustrates this data at a scale of 1:250 000. Three hundred and sixty one bear locations were collected over a three-year period.

In 1981, a provincially sponsored study was initiated to determine grizzly bear population ecology in the Berland and Little Smokey areas in west central Alberta. Parts of this study were reported by Nagy *et al.* 1989 and Barrett *et al.* 1987, however the telemetry component was never reported. The data points were collected using VHF telemetry for the study of den sites, habitat use and home range movements over a four-year period. One thousand two hundred and forty eight data points were collected.

Current Grizzly Bear Models

Jasper National Park recently developed a GIS based grizzly bear cumulative effects assessment (CEA) application. This application allows Park managers to do "what if" scenarios, creating the ability to look at different land use management options and their effects on the landscape. This application is based on previous CEA work in the United States (USDA Forest Service, 1990) and has been expanded upon with more recent research findings (see Mattson 1993, Puchlerz & Servhenn 1994, Servheen & Sandstrom 1993 and Gibeau & Herrero1997).

There are three models that make up the current CEA application: habitat effectiveness, security area analysis, and linkage zone prediction. These models are based on the best science we have to date. However it is important to recognize that components within this application have relied on professional opinion when no data is available. The next step is to validate these models for this study area with empirical data and make improvements where necessary.

Habitat effectiveness

The habitat effectiveness model relates grizzly bear habitat quality (mapped at 1:50 000 scale) with human related disturbances. It firsts calculates the habitat potential of an area based primarily on vegetation characteristics, then includes human related disturbances in the picture to create the realized habitat of the same area. Comparing habitat potential and realized habitat provides a measure of habitat effectiveness. Table 1 contains the human disturbance buffers values for the habitat effectiveness model.

Activity	Feature	Intensity	Disturbance Buffer (m)	Variable
motorized	point	high	800.0	mph
motorized	point	low	800.0	mpl
motorized	line	high	800.0	mlh
motorized	line	low	800.0	mll
motorized	polygon	high	800.0	myh
motorized	polygon	low	800.0	myl
non-motorized	point	high	400.0	nph
non-motorized	point	low	400.0	npl
non-motorized	line	high	400.0	nlh
non-motorized	line	low	400.0	nll
non-motorized	polygon	high	400.0	nyh
non-motorized	polygon	low	400.0	nyl

Table 1. Human disturbance buffer values for habitat effectiveness model (values can be modified prior to using model). Taken from: Jasper National Park Cumulative Effects Assessment (CEA) application for grizzly bears, Version 1, User Guide – Draft. Prepared by The Forestry Corp, July 1998.

Security area analysis

The historical record and recent studies indicate that grizzly bears persist longer in areas with quality habitat that is relatively secure from human disturbances and mortality. A combination of research findings and professional opinion has concluded that bears need a 24-48 hour period secure from human disturbance. These security areas are defined according to the following criteria: 1. Neither motorized use nor high intensity use, 2. A minimum distance of 0.5 km from any open road or trail, and 3. Area is representative of important seasonal habitats. The areas of the landscape where these conditions are met show the security areas available for female grizzly bears. Recent findings from other grizzly bear research programs have concluded that a security area is approximately nine square kilometers (Gibeau, personal communication, June 1998).

Linkage zone prediction

Linkage zone prediction considers the degree of landscape fragmentation caused by human disturbance and identifies areas where grizzly bear movements are not adversely impacted. For example, mountain valleys and alpine passes where human disturbance is minimal. These areas with low levels of human disturbance represent potential linkage zones. This model manages the grizzly bear meta-population.

The CEA application provides land and park managers, planners, and wildlife specialists with the necessary tools to make better management decisions. (Purves & Doering, 1998). Decisions can be validated against suggested thresholds, and can result in various management options.

Why there is a need for better data and models

There is always a concern that if we have all these existing data and existing models, why do we need to get more? Why not take what we have and just move on to management action.

Lack of quality grizzly bear data for our study area

A significant amount of time and effort was spent on the two grizzly bear studies previously mentioned, which are now more than 15 years old. Today, the data is found in reports and/or old hand-plotted maps and film overlays. These programs utilized technologies and approaches that were available at that time yet had certain limitations. For example, the data collection process for animal

locations was sporadic, done when good weather conditions allowed relocation flights, and when aircraft were available. Flights were made only during daylight hours, and assumed that when a bear could not be located it was outside the survey area. Since GPS units were not readily available at that time, bear locations were tracked with radio telemetry collars. Estimated locations were marked on 1:250 000 scale mapsheets while in an aircraft. The small number of points collected estimated what the bear actually did between two relocation flights.

Habitat classification used for CEA models

Methods used to classify habitat types are based on a report applicable to Banff, Jasper, Kootenay and Yoho national parks (Kansas & Riddell 1995). The habitat layer needs to be validated with field grizzly bear observations. There may also be dissimilarities with the habitat use and behavioral responses of grizzly bears in non-protected land bases where settings are removed from alpine regions (boreal forest in the foothills).

Certainty of the models

The grizzly bear CEA application is based on the best science and expert opinion available to date. However the models need to be validated, especially for use in a non-protected multi-use land base such as our study area. Questions such as the following need to be addressed: Do bears actually use the areas the models predict? Is the minimum security area of nine square kilometers valid in this study area?

Given the importance of the proper management of this

Figure 2. GPS-simplex radio collar for brown bear (photo: P A Lemnell, Televilt).

species and the serious land use management decisions that are needed we need to gather more detailed bear data to strengthen the existing CEA tools and increase the confidence that managers will have in them. The next step is to validate these models in this study.

Grizzly Bear Research Program

The grizzly bear research program study area is approximately 4700 square kilometers. It has active GIS support and is currently planning for a five-year study, which will begin in the spring of 1999. GPS-units attached to collars will be placed on twenty grizzly bears. VHF radio ear tag transmitters will also be attached to all study animals to aid in aerial relocations and to assist in recapturing bears once GPS batteries have been expended. We will also attach these ear tag transmitters to cubs in an effort to learn more about mortality rates of this age cohort.

The use of GPS radio telemetry collars will enable movement tracking on a 24-hour basis. Movement patterns will help determine more realistic human disturbance buffers, female home ranges and sensitivity to such activities during the night and day. The massive amount of collected data will help validate and improve grizzly bear cumulative effects model. We anticipate having 20 collared bears and obtaining 6 locations per day for approximately 210 days (approximately 25,000 data points per year).

Two types of GPS collars will be used. The first type, see Figure 2, stores data in the GPS unit and can be uploaded through an FM modular uplink from an aircraft without having to retrieve the unit. The second type needs to be retrieved (via VHF radio signals) and uploaded directly from the collar to a computer. Since this technology is relatively new, the two types of GPS collars were adopted so to not put all eggs (or bears!) in one basket.

End Products

The grizzly bear research program will link GIS spatial analysis with statistical analysis to assess and improve the existing models. For example, we will be able to analyze a grizzly bear's frequency of use of a specific habitat type and compare it with the associated habitat effectiveness derived from the model; thus comparing predicted habitat use and security area prediction with actual habitat use.

It is our intention to follow these 20 collared bears over a minimum of a 5-year period to account for behavioral responses to environmental variation. Buffer values for different human disturbances at different times of the day will be more accurately reflected. The current default values can be tested and refined for the multi-use land base.

Habitat tools, such as satellite imagery, would allow the preparation of regional grizzly bear habitat maps when combined with the CEA application to study land use activities on grizzly bear conservation objectives. In addition we will investigate, through satellite imagery, how the landscape is changing over time and determine if bear responses are impacted by any of these changes.

Conclusion

The findings of the study will ultimately help land managers do a better job of factoring grizzly bears into their decisions about what level and type of human use will be allowed in the area. The primary goal is to develop validated, predictive GIS based tools that will allow more informed decisions on how land use activities may coexist with healthy grizzly bear populations.

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Biographies

Julie Dugas has an Advanced Diploma in GIS from the British Columbia Institute of Technology, Burnaby, BC (1998) and a Bachelor's degree in Chemical Engineering from the University of Ottawa, Ottawa, ON (1993). Involved in two projects with Foothills Model Forest: the Cumulative Effects Pilot Project which studies the cumulative impacts of human disturbance on wildlife and the Alberta Yellowhead Grizzly Bear Conservation Project.

Gordon B. Stenhouse obtained a Bachelors and Masters degree from the University of Manitoba. Worked on wildlife management and research programs in the North West Territories for 15 years before moving to Alberta in 1995. After 4 years as a wildlife biologist with Weldwood of Canada, I have taken a new position with Alberta Environmental Protection and will be leading the Alberta Yellowhead Ecosystem Grizzly Bear Conservation Program.