Use Patterns by Female Grizzly Bears in the Central Rockies Ecosystem

By Tony Viveiros

The grizzly bear (*Ursus arctos*) is considered a species that "may be at risk" of extinction or extirpation in Alberta. The primary source of known grizzly bear deaths in Alberta and B.C. is human-caused mortality and the loss of effective habitat. Although grizzly bears have adapted behaviourally to exploit a variety of habitats through their omnivorous generalist lifestyle, high mobility rate, and intelligence, critical habitat components and diversity are still necessary to enable bears to cope with climatic stresses, human impacts, and changing environmental conditions. These important habitat components include travel areas, feeding areas, denning sites, and sanctuary or security areas.

Security Areas

Security areas represent habitat where grizzly bears have a low probability of encountering humans and can also meet their daily energetic requirements. Adult females are often the focus of security area analyses because of their slow maturity, low reproductive rate, and role in cub rearing. In the Central Rockies Ecosystem (CRE), secure habitat excludes areas of rock, snow, ice, or bare soil larger than 9 km^2, as well as habitat within 500 m of high human use (Gibeau et al., *Ursus* 12, 121-30, 2001). Secure habitat is important because it can foster wary behaviour in grizzly bears, potentially minimizing dangerous encounters with humans, and help reduce habituated bear incidence. Along with adequate space and food resources, security is believed necessary to support viable grizzly bear metapopulations: that is, groups of populations that exist at the same time but in different places. Secure habitat is also believed to be particularly important to the survival and reproductive success of adult female grizzly bears.

Study Design

The objective of my University of Calgary Masters in GIS project was to identify the seasonal importance of security areas in resource selection by adult female grizzly bears of differing reproductive status. The hypothesis that the reproductive status of adult female grizzly bears influences their selection of security areas was tested. Additionally, to account for variation in habitat use through time, the hypothesis that food season (pre-berry and berry) influences the selection of habitat and security by reproductive category was also explored. Eight study categories defined by season and reproductive status were defined for female grizzlies with young-of-year (YOY) cubs, older cubs, all cubs, and no cubs in both the pre-berry and berry seasons.

Resource selection function (RSF) models were developed for each of the eight study categories. Locations from 31 adult female bears radio-collared and monitored between 1994 and 2004 in the CRE of Alberta as part of the Eastern Slopes Grizzly Bear Project were used to define the 4,211 km^2 study area. RSF models represent the relative probability of occurrence of female grizzlies on the landscape. Landscape characteristics used in RSF model-building included elevation, land cover, crown closure, terrain ruggedness, distance to edge, distance to roads, distance to water, and security areas. Models were initially developed without security areas for each of the eight study categories. Security areas were then added to each of the eight RSF models to determine if improvements occurred. Six of the eight RSF models improved with the addition of a security areas variable: YOY cubs in the pre-berry season, older cubs in the berry season, females without cubs in the pre-berry/berry seasons, and females with cubs (YOY + older) in the pre-berry/berry season. Security areas, therefore, were an important predictor of grizzly bear probability of occurrence for six of the eight categories within the study area.

Results

Although my results showed security areas influenced seasonal resource selection by female grizzly bears of differing reproductive status, negative security model coefficients, implying security avoidance, existed for all but the two no-cub categories. A number of possibilities could explain these findings. Firstly, my methodology involved pooling all female locations within each category across years. Given the intelligence and individual behaviours displayed by grizzly bears, variation within and amongst bears could be influencing results.

Secondly, the scale of analysis could be a factor. Although Gibeau et al. (2001) reported on the importance and selection of security areas within individual bear home ranges, my findings show that security areas are not positively selected for by females with cubs at the landscape scale. Recent studies have identified the importance of scale on grizzly bear selection patterns. Scale-dependent resource selection could also be occurring within this population.

Finally, the question needs to be asked if sufficient security areas remain. If females with cubs are utilizing non-secure areas, perhaps it is simply too difficult for them to avoid non-secure areas and still meet their daily energy requirements. Only 37 percent of the study area defined by all adult female grizzly bear locations was considered secure, even though 68 percent of the study area fell within parks.

Tony Viveiros recently graduated from the University of Calgary with a Masters in GIS. This article summarizes his MGIS research project. For more information (including references), visit members.shaw.ca/aviveiros. Tony now lives and works in Winnipeg.