

GIS ANALYSIS OF HABITAT USE BY MASSASAUGA RATTLESNAKES IN BRUCE PENINSULA NATIONAL PARK

Brian Hutchinson, Caroline Duchesne, and Henry Schryver

SUMMARY

The objective of the study was to determine the habitat requirements of eastern massasauga rattlesnakes (*Sistrurus catenatus catenatus*). The biophysical data were collected in 1990 and 1991, using radiotelemetry tracking. The locations of the snake habitat were described with the help of satellite images and related to the data collected from a previous field survey.

Analysis of the data was carried out using a statistical package (SAS) which gave a general indication of habitat use. A Geographic Information System (SPANS) was used to spatially locate the habitats. SPANS was more specifically used to estimate the habitat composition of the whole Park, to calculate the composition of the habitats used by the snakes, and to generate habitat use probability maps for the Park.

The results indicate that massasauga rattlesnakes prefer wetland habitat, particularly marsh areas. The snakes are also found in low density coniferous forests, with high shrub density surroundings. They tend to avoid open water.

The use of GIS analysis for the massasauga rattlesnake's habitat-use study is essential. Knowing areas that are significant for the survival of the snakes will enhance the development of a snake management plan.

INTRODUCTION

This study, a continuation of a study conducted in 1989 and 1990, has the main objective of defining the habitat use of massasauga rattlesnakes (*Sistrurus catenatus catenatus*) in Bruce Peninsula National Park. Different methods can be used to analyse habitat use data. A statistical analysis of the sample coupled with a spatial analysis on a Geographic Information System (GIS) is probably the most efficient way to manipulate easily a large amount of geographic data. Plus, because the natural resources of the Park are already identified and mapped on GIS, it will become easy to integrate and analyze data in studies similar to this.

METHODS

The study in question was conducted through the 1990-1991 active season of the snakes. The methods are divided into three parts: (1) data collection, (2) statistical analysis of the variables and (3) spatial analysis of the habitat use of the snakes. These steps and the results associated with them are described as follows:

Data collection

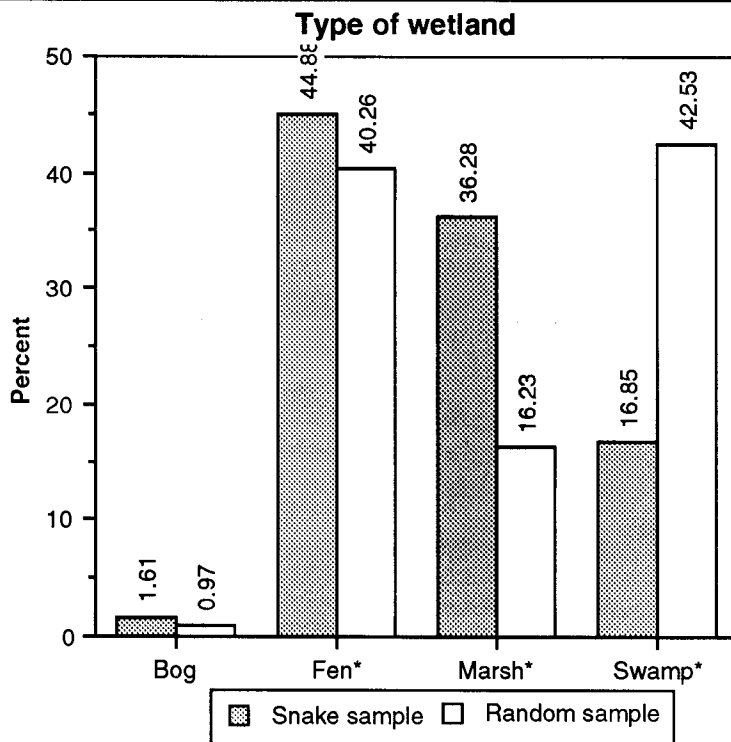
The data collection was done using radiotelemetry. Transmitters with a minimum longevity of one year were implanted in massasauga rattlesnakes of a sufficient size to accommodate the transmitter (Prior, 1991). There were 69 snakes tracked in the two years. These snakes were tracked on a daily basis until their transmitters were removed or until they were lost. Variables recorded included the location (UTM) of each snake for every tracking day and a data sheet with habitat variables, (e.g. wetland characteristics, type of cover). These data were entered in a database (dbase III) for easier manipulation.

Statistical analysis

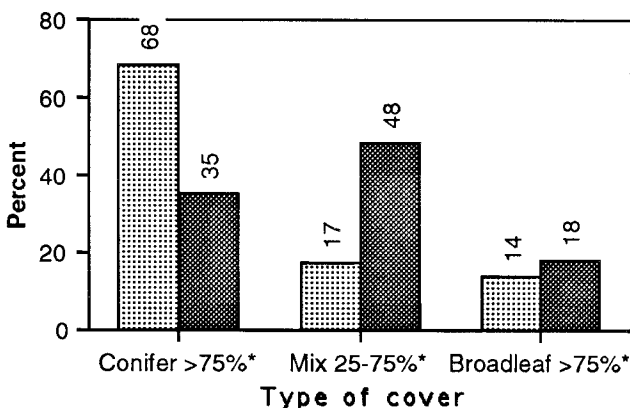
The statistical analysis was done using a Statistical Analysis System (SAS) to indicate habitat selected for use. Using existing biophysical data of the Bruce Peninsula National Park, a random sample of point locations in the Park was generated. Associated with these locations was a set of habitat variables, in the same format as the snake habitat variables recorded in the field. A frequency table of the habitat used by the snake was compared with the frequency table of the random sample. Differences in the frequency would indicate a snake preference or dislike of a particular environment. The statistical significance of these differences was determined using a chi-square contingency table (three examples of these are presented in Figure 1).

Spatial analysis

The spatial analysis of the habitat use of the massasauga rattlesnake was carried out on SPANS (Spatial Analysis System). Using the statistical analysis done previously, each polygon was weighted depending on the



Proportion Conifer/Broadleaf (Trees)



Tree canopy

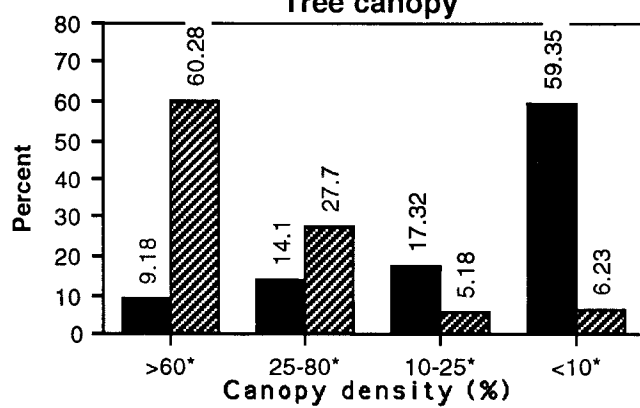


Figure 1. Chi-square contingency table examples.

importance of variables in these areas. From these weights a map was developed that showed the preferential habitat of the snakes, neutral habitat (those that the snakes choose randomly) and inhabitable areas (those that the snakes avoid) (Figure 2).

RESULTS

The results show different patterns. A temporal analysis of the snake movements through the tracking period shows a preference for upland in the spring and the fall to wetland in the summer. Based on that analysis, we could group the habitat use of the snake in two broad categories: the upland and wetland areas.

The upland habitats are mainly a coniferous cover type in a low tree canopy density (>10%). As well, the snakes seem to prefer low tree heights and, as a consequence, are also found in a high shrub density coverage. The shrubs are mostly coniferous.

Finally, the wetland areas where the snakes were found have specific characteristics. The snakes are almost always found within marshes and fens. They were practically never found in open water and seem to prefer high vegetation coverage. In the open wetland habitat (>75% cover) the type of coverage varies between broad leafed, robust emergents and graminoid and sedges.

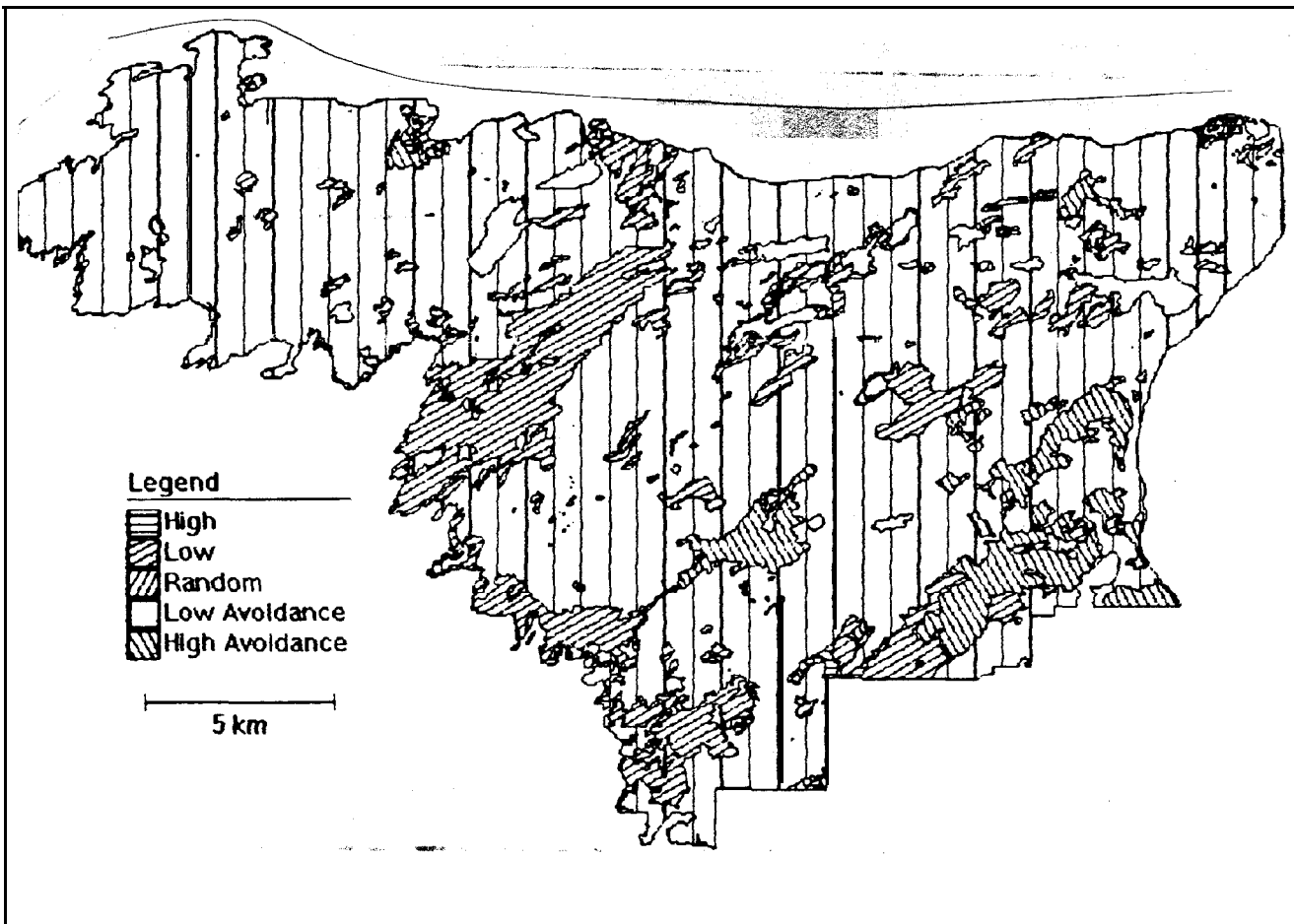


Fig. 2. Snake preferential habitat

DISCUSSION

The methods used allowed us to create a map of preferred, neutral and avoided habitats in the Park area. The number of observations and the range of the study made the habitat observations statistically significant. The GIS analysis used all the significant variables in the sample to weight the polygons. This gave a better approximation of habitat use by massasauga rattlesnakes.

Because of their threatened status in Ontario, it is important for the Canadian Parks Service to delimit and protect the preferred habitat of the massasauga rattlesnake. The use of a GIS allows that spatial delimitation and allows us to relate other components of the Park that are already integrated in SPANS such as roads, trails, public areas, beaches and camp grounds. Combining these results with other planning components, it will be possible to develop a snake management plan for the Park that adequately protects rattlesnake habitat.

REFERENCES

Prior, K. Dept. of Biology, Carleton University, 1991. Study of massasauga rattlesnakes, Bruce Peninsula National Park, prepared for the Canadian Parks Service, unpublished typescript 49 pp.