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BIOCLIMATIC MAPPING OF ONTARIO REPTILES AND AMPHIBIANS

INTRODUCTION

Conservation planning for any species requires that the distribution of the species in question be known. This observation may appear trite, but decisions that affect taxa are often made in ignorance of their true distribution. Accumulating accurate data on species' distributions is costly and labour intensive. Thus, landscape models that employ habitat features of an organism's environment to predict its potential distribution will offer an invaluable tool for larger scale conservation planning.

A previous collaborative study at the Great Lakes Forestry Centre led to the development of climate-based models of potential distributions of amphibians and reptiles in Ontario. Amphibians and reptiles constitute a sizeable and diverse component of many ecosystems. Moreover, representatives of this group may be sensitive bio-indicators of ecosystem health given concerns over amphibian declines around the world. Distributions of species within this group are only broadly known, with information at the mesogeographic scale often poor to non-existent.

While many habitat factors affect the distribution of amphibians and reptiles, given the fact that all of these organisms are ectothermic (cold blooded), it is a reasonable expectation that their potential distributions might be determined by examining climatic profiles associated with actual sightings. In this research, the potential distributions of 43 reptile and amphibian species and subspecies resident to the province of Ontario, Canada, were modelled using ANUCLIM, a suite of computer-based modelling tools. ANUCLIM makes use of mathematical climate surfaces, a Digital Elevation Model (DEM) and species' location information to produce and subsequently map bioclimatic profiles.

DATA SOURCES AND MODELS

Historical species distribution information was obtained from the Ontario Herpetofaunal Summary (OHS), a compilation of more than 100,000 observations of 58 species and subspecies of reptiles (30) and amphibians (28) in Ontario. A new Ontario DEM (a regular grid of latitude, longitude, and elevation providing a computer-based model of the topography of the landscape) was used to append elevations to site data. ANUCLIM used climatic surfaces for Ontario developed from a network of 471 weather stations across Ontario, Quebec, and Manitoba — these surfaces have now been extended across the country. A location profile for each species was created and fed into BIOCLIM, which estimated a suite of climatic parameters at each species location. The values were used by the program to derive each species' bioclimatic profile. These profiles were used in the BIOMAP program (a module of ANUCLIM) to produce maps of a spatial hypothesis of potential species richness across the province.

RESULTS

Box plot bioclimatic profiles for four taxonomic groups (toads and frogs, salamanders, snakes, and lizards) were created, which provide a visual means of comparing the climatic domains across species (results were created for eight climate variables). BIOMAP results can be viewed for each species investigated at http://www.glfc.cfs.nrcan.gc.ca/landscape/herp_e.html. Figure 1 presents the overlay of BIOMAP results for all 43 species and subspecies.

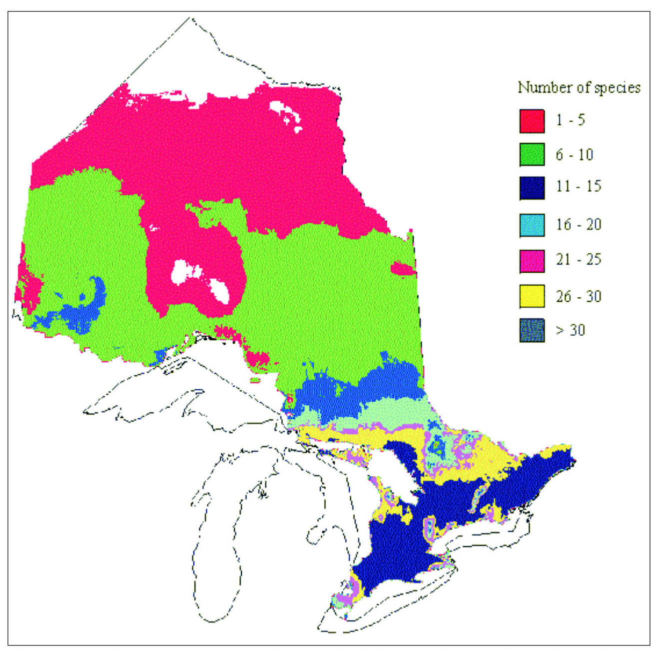

Figure 1. Biomap range results overlaid for 43 herpetofaunal species in Ontario. Areas that appear to be gaps are strong candidates for field-based inventory programs.

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Figure 2. A wood turtle (*Clemmys insculpta*) found in its predicted Northern range in Ontario.

CONCLUSIONS

These climatic domains represent a spatial hypothesis or prediction of places climatically suitable for each reptile and amphibian species. Whether the species is actually present will depend on the presence of additional habitat features, in particular, appropriate vegetation cover and water bodies.

The problem of over sampling in some areas was addressed through the development of algorithms to specify a minimum distance between locations. This process affects the amount and spatial distribution of the core climatic domain, but not the overall range limits. The concept of defining a core climatic domain is potentially very important from a conservation-biology perspective. Core habitats and core climatic domains need to be defined using data obtained by sampling a species' entire range. Hence, the estimates of core ranges produced in this study are probably of limited use at present.

MANAGEMENT IMPLICATIONS

Combining the BIOMAP results with additional geographic data such as wetlands, streams, rivers, and forest cover from satellite imagery can provide a much higher resolution prediction of potential habitat. Results can be used to help define monitoring programs for particular reptile and/or amphibian species and locations for restoration and conservation programs (Figure 2). Quantification of the climatic limits of taxa provides a context for investigating the effects of other environmental disturbance variables, and provides a basis for examining how species may respond to anticipated global warming.

SOURCES OF RELEVANT INFORMATION

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