Avian diversity in Southern Africa: patterns, processes and conservation

by

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Submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy (Zoology)

in the Faculty of Natural & Agricultural Sciences

University of Pretoria

Pretoria

July 2002

"If we give our very best to all the children of today, and if we pass on our planet in the fullness of her beauty and natural richness, we will be serving the children of the future."

Nelson R. Mandela (2001)

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Abstract

Understanding the mechanisms, both biological and anthropogenic, that account for changes in environmental variables and that translate into altered species richness and species turnover (β-diversity) patterns is an important component of efficient conservation planning. However, several issues need to be addressed to understand these mechanisms. First, at which scale(s) should species richness and turnover patterns be examined? These patterns, as well as the role of variables explaining them, may differ across scales. Second, what influences do landscape transformation and human population size have on species biogeographic patterns? These factors pose the single most important threat to biodiversity, and are often overlooked. If anthropogenic land transformation plays a dominant role in determining species richness and turnover patterns, then using present patterns to understand biological processes could provide erroneous answers. Third, despite the dynamic nature of the environment, studies that take the manner in which humans may affect biodiversity patterns into account are often based on static perspectives. Environmental change could therefore also precipitate changes in the relationships between species richness, environmental variables and human densities. Consequently, it is crucial for land-use decision makers to incorporate such changes into conservation strategies to achieve effective long-term conservation. Fourth, spatial autocorrelation in ecological data results in lack of data independence and, consequently, may lead to spurious results in statistical analyses. Finally, are ecological transition zones spatially congruent and are these adequate conservation areas? This thesis addresses these issues by combining South African avifaunal, environmental, human population and land use data in a GIS and statistically analysing the emergent patterns. The potential effects of climate change on these species and human patterns and their conservation implications are also investigated. The results indicate that: (i) bird richness is correlated with, and hence likely a function of several environmental variables including primary productivity, precipitation, absolute minimum temperature, and, at coarser resolutions, habitat heterogeneity; (ii) spatial resolution and extent must be considered during investigations of these relationships; (iii) species richness and human density are positively correlated, apparently because both respond positively to increased levels of primary productivity; and (iv) conservation area selection procedures tend to identify high ecological transition areas as important for biodiversity conservation. Elevated β-diversity in the avifauna is found in biome transition areas but not in land

transformation transition areas, suggesting that the latter has little influence on the avifauna. Finally, although current human demands on natural resources are high in and around most conservation areas, there are some areas important for biodiversity conservation outside formal protected areas with lower than expected human population densities both prior to and after considering climate change. These latter areas could minimize potential future conflict between human resource and conservation needs.

Keywords: biological mechanisms, anthropogenic mechanisms, species richness, species turnover, β-diversity, conservation, scale, human population, biogeography, spatial autocorrelation, ecological transition zones

Acknowledgements

Disclaimer

This thesis consists of a series of chapters that have been prepared for submission to, or publication in, a range of scientific journals. As a result styles may very between chapters in the thesis and overlap may occur to secure publication entities.

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