MODELING AVIFAUNA RESPONSES TO MIOMBO WOODLAND DEGRADATION IN SERENJE DISTRICT, CENTRAL PROVINCE, ZAMBIA

By

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Declaration

I hereby declare that this thesis, submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Animal Ecology at the University of Zambia, is the result of my own original research. Where use has been made of the findings of others, it has been acknowledged in the text.

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Abstract

An ecological study was undertaken over a period of one and half years in miombo woodland found in Serenje District, Zambia in order to determine the extent of woodland degradation in the study area as well as determining the avifauna community structure in the study area, and how it responds to miombo woodland degradation.

Avian community structure data was obtained from bird censuses that were conducted using the point count method in 50 m radius circular plots whereas vegetation data was obtained from 0.01 ha square plots that were established within the 50 m radius circular plots.

PC-ORD © was used to determine plant species composition and structure from plant species presence data and DBH data of the woody vegetation in each plot. Principal Component Analysis and Cluster Analysis using SPSS © were used to identify the principal vegetation variables as well as grouping the sample plots along a woodland degradation gradient using the principal vegetation variables respectively. Discriminant Function Analysis using SPSS © was used to determine whether the sample plots were correctly classified into clusters or not. Analysis of Variance using Statistix © was performed on the vegetation characteristics in the different clusters in order to determine whether vegetation structure and composition was affected by woodland degradation. Cluster Analysis and PCA were used to determine bird species groupings in the study area using pooled bird abundance data. ANOVA was performed on avian species richness, avian guild richness and bird abundance in order to determine whether they were affected by woodland degradation or not. Linear regression analysis was performed on vegetation and avian variables in order to develop models that can predict avian community structure characteristics from habitat factors. Correspondence Analysis was performed on avian community structure variables and woodland status in order to determine how the bird community responds to woodland degradation.

Four miombo woodland types based on woodland degradation were identified using Cluster Analysis. These are old growth miombo, degraded old growth miombo, old regrowth miombo and young regrowth miombo. Old growth miombo was the least disturbed along the woodland degradation gradient whereas young regrowth miombo was the most degraded of the four woodland types. Discriminant Function Analysis revealed that 95.3% of the sample plots were correctly classified into miombo woodland types. Significant differences were

observed in vegetation composition and structure among different miombo woodland types. Tree height, tree size and canopy cover showed a clear decreasing trend along the woodland degradation gradient.

Sixty-seven bird species were recorded in the study area belonging to 16 dietary and foraging guilds. Cluster Analysis divided the avian community into two groups of species whereas PCA identified 22 principal components of bird species. There were no significant differences in avian species richness, avian guild richness and bird abundance among different miombo woodland types.

The linear equation for predicting avian species richness (y) from vegetation variables is:

y = 2.19 tree height + 0.242 sapling density – 2.06DBH – 0.322 total species richness + 5.21.

The linear equation for predicting avian guild richness (y) from vegetation variables is:

y = 6.959 + 0.788 tree species evenness – 0.952 tree species diversity – 0.223DBH.

The linear equation for predicting avian abundance (y) from vegetation variables is:

y = 46.854 + 0.400 tree species diversity + 0.239 sapling density – 0.425 tree species richness – 0.293 total species richness.

Correspondence analysis between avian species and woodland status revealed that forty-four percent of the bird species correlated with old growth miombo were miombo woodland endemics while 40% of the bird species correlated with degraded old growth miombo were miombo endemics. The percentage of miombo endemics correlated with old regrowth miombo was 11.1% while young regrowth miombo was not correlated with any endemic bird species.

Woodland degradation affects the vegetation structure and species composition of miombo woodland. Miombo woodland with high vegetation structural diversity such as degraded old growth miombo and old regrowth miombo is expected to support high avian species diversity and guild diversity compared to woodland with low structural diversity such as old growth miombo and young regrowth miombo. In order to conserve the endemic miombo avifauna, there is need to protect old growth miombo while allowing low intensity harvest practices of woodland resources in order to create the spatial heterogeneity in vegetation structure that is critical for increased avian diversity.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
BSD	Bird Species Diversity
DBH	Diameter at Breast Height
DFO	District Forestry Officer
DRC	Democratic Republic of Congo
FHD	Foliage Height Diversity
GMA	Game Management Area
GPS	Global Positioning System
IBA	Important Bird Area
MENR	Ministry of Environment and Natural Resources
MTENR	Ministry of Tourism, Environment and Natural Resources
PA	Protected Area
PCA	Principal Component Analysis
PC-ORD	Multivariate Analysis of Ecological Data Software
PFA	Protected Forest Area
SPSS	Statistical Package for the Social Sciences
TAZARA	Tanzania and Zambia Railways
WWF	Worldwide Wildlife Fund
ZESCO	Zambia Electricity Supply Corporation
ZOS	Zambia Ornithological Society