

POSTER ABSTRACT

Functional diversity of bird communities: a large-scale study of the Afrotropics

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Birds provide many ecosystem services including seed dispersal, pollination and predation. The efficacy of provision depends on the diversity of communities. Biodiversity is often reported as species diversity, which can be partitioned into species richness (number of species) and species evenness (relative abundance). A limitation of this approach is that species are treated as equivalent to one another and their identities and roles are not acknowledged. For example, seed dispersal could be poor in a species rich ecosystem if few granivores or frugivores are present. An alternative measure, functional diversity (FD) measures the value and range of traits exhibited by species in a community, thus providing the link between biodiversity and ecosystem-level processes.

In order to measure FD, species are described in terms of relevant traits (e.g. body mass, diet, etc.) and plotted in multi-dimensional trait space. Species are then clustered and arranged on a functional dendrogram. This is analogous to a phylogenetic cladogram, but represents functional relationships; species with more similar traits are closer to together on the dendrogram. The length of branches required to connect species in a given community is a measure of FD. A community of species with dissimilar traits has its members spread across the dendrogram and therefore the sum of connecting branches is large. Like species diversity, FD can also be divided into richness and evenness. Functional richness is the volume of trait space occupied by the community and evenness describes the distribution of species within that space; where species are unevenly clustered in trait space the assemblage has low evenness since these species share similar traits.

In this study, a macro-ecological analysis of avian assemblages at a one-degree scale in the Afrotropics is used to explore patterns on a continental scale. Observed FD (FD_{obs}) is compared with the value expected with random assembly of communities (FD_{exp}) by computing null models. The standardised effect size (SES) is calculated using:

$$SES = \frac{FD_{obs} - FD_{exp}}{SD(FD_{exp})}$$

A negative value indicates that the grid cell has lower FD than expected by chance and a positive value denotes those grid cells with higher than expected FD.

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Of the 2232 assemblages measured, 66.8% have lower than expected FD. Regions of higher than expected FD include southern Africa, the forest crescent around Lake Victoria, Ethiopia and parts of the Congo basin. Areas with low functional richness have high functional evenness; there is a significant negative correlation. These aspects show a latitudinal gradient; areas closer to the equator tend to have higher functional richness and lower functional evenness. Topography also significantly affects functional diversity; areas with a higher range of elevations tend to have higher functional richness and lower functional evenness.

The lower than expected values of FD may indicate that assemblages are subject to environmental filtering; species are more similar than expected by chance because they share traits that make them adapted to their environment. We are now investigating the underlying climatic drivers that vary with latitude and topography to identify the factors influencing FD and causing some assemblages to have higher than expected FD.