



Global variation in the relationship between avian phylogenetic diversity and functional distance.

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If evolutionary distance is akin to evolutionary chance, then it follows that species assemblages that are distantly related will also be more disparate in terms of their traits, features and the niches they occupy. Yet, studies have found that the total phylogenetic distance of an assemblage, known as phylogenetic diversity, is an unreliable surrogate for functional diversity. We investigate global variation in the relationship between Faith's Phylogenetic Diversity (PD) and Mean Pairwise Functional Distance (MPFD) across latitude and the influence of migratory species on both these aspects of diversity. We measure PD and MPFD for over 9,000 species of bird across more than 17,000 globally distributed assemblages. We obtain standardised effect sizes for both indices by simulating assemblage composition under an ecologically informed null model. We employ path analysis to characterise variation in the relationship between PD's and MPFD across latitude, elevation and with proportion of migratory species. Globally, assemblages that were phylogenetically diverse tended to be less functionally dispersed than expected; however this relationship showed considerable variation across latitude decreasing with distance from the equator. The proportion of migratory species in an assemblage was found to be an important predictor of functional diversity, with migrant rich assemblages generally showing less functional diversity than expected. We identify the Andes and Hengduan Mountains as regions of exceptional bird functional diversity. The relationship between phylogenetic diversity and function diversity is context specific, varying across environmental gradients such as latitude, and influenced by ecological phenomena such as migration. Thus, care should be taken using phylogenetic diversity as a proxy for functional diversity, particularly in clades with sparse functional data. Instead we recommend that studies consider how phylogenetic diversity's surrogacy for functional diversity may be impacted by environmental context and evaluate empirical observations against biogeographically constrained and ecological informed null models.

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