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Tree Diversity of Green Spaces in Kumasi, Ghana: Theoretical Model and Ecosystem Function

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Abstract

Conserving biodiversity in cities is essential to halting global biodiversity loss. Nevertheless, there is paucity of data on the underlying mechanisms shaping species assemblages and species/trait diversity-productivity relationships in urban landscapes. The objectives of this study were to; 1) compile tree species diversity of different green space (GS) types, (2) describe the theoretical basis of species co-existence and 3) examine the links between species and life history trait diversity to GS and species productivity (carbon storage) in Kumasi, Ghana. Stratified sampling and species abundance models were combined in this study.

About 176 tree species in 46 families were recorded within Kumasi. About 96 species were in a natural forest located towards the outskirts of the city. Home gardens, institutional compounds, and public parks had the highest species richness of 76, 75 and 71, respectively while urban rangelands and farmlands were the least species rich with 6 and 23, respectively. Species richness (S) in the peri-urban (mean ndvi >0.2, S=142) and core urban (mean ndvi<0.2, S=108) areas were significantly different (X2 =15.7, $p < 0.0001$, n=1). Native species richness was lowest in the core urban area and highest in the neighbouring natural forest. There were moderate correlations between species richness and GS carbon storage ($p = 0.001$, r=0.57). Life history traits interacted antagonistically to affect the species carbon storage in the metropolis ($p = 0.02$; r=0.32). The geometric series model best fitted the tree assemblage of the city, depicting a species impoverished and environmentally hash landscape. Pioneers and anthropochory dispersed species were the most abundant suggesting that this urban landscape is shaped by both environment and social filters.

Plant species diversity and distribution depend on the type of GS and portray a perturbed landscape in early seres of succession with the overall ecosystem function sustained by both species and life history trait diversities.

Keywords: Geometric series, green spaces, species richness

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