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Comparative analysis of taxonomic and functional diversity in habitat-driven beetle assemblages of tropical lowland and submontane Forests

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Beetles are one of the most diverse insect groups and play vital ecological roles in nutrient cycling, decomposition, and predation. However, their responses to habitat variation in tropical forests remain poorly understood. This study examined beetle family richness, abundance, and functional composition across three habitat types; central forest (CF), forest edge (FE), and grassland (GR) within two Sri Lankan Forest landscapes: Hiyare (lowland rainforest) and Riverston (submontane forest). We selected Hiyare and Riverston as elevational end-members that share CF, FE, GR habitats to assess whether habitat effects generalize across contrasting forests. Field surveys were conducted in 2019 and 2020 (Feb–Mar/Oct–Nov and Jun–Jul/Nov–Dec, respectively) using UV light traps (72 events total: 25, 25, and 22 in CF, FE, and GR), yielding >10,000 beetles. Species accumulation curves approached asymptotes at both localities, indicating adequate sampling. Assemblages were analyzed across habitat types for taxonomic and functional patterns. Forest edges consistently supported the highest beetle abundance and family richness in both forests: 77.3% of individuals and 37 families in Hiyare, and 44.5% and 58 families in Riverston. Grasslands at both sites exhibited the highest taxonomic evenness. Beta diversity analysis revealed significant taxonomic differences among habitats in Hiyare but not in Riverston ($p = 0.026$ and $p > 0.6$); NMDS plots supported this greater habitat separation in Hiyare. Functional trait analysis showed clear habitat specific patterns; predators dominated FE, xylophagous beetles were common in CF, and herbivores prevailed in GR. Functional richness and divergence were highest in CF and FE (1.44), with evenness highest in GR (0.89). While both forests showed trends toward distinct functional assemblages, only Riverston exhibited statistically significant functional divergence (Kruskal–Wallis, $p = 0.018$), indicating broader trait variation. These contrasting patterns highlight the importance of integrating both taxonomic and functional perspectives to better understand habitat-driven biodiversity in tropical forests. The study also emphasizes the ecological importance of forest edges and structurally diverse habitats in conserving beetle diversity and supporting ecosystem functioning.

Keywords: *Conservation, diversity patterns, ecological functions, forest edge*

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