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Peer Review

Review of: "A Quantitative Analysis of Co-occurrence Matrices in Ecological Systems: Measuring Connectance and Entropy"

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This manuscript proposes an information-theoretic framework for quantifying ecological connectance through entropy differences between diagonal (node) and off-diagonal (edge) elements of co-occurrence matrices, offering a mathematically coherent and historically grounded extension of Shannon entropy to weighted graph representations of community structure. A major strength is the conceptual integration of co-occurrence matrices, graph theory, beta diversity, nestedness, eigenvalue evenness, and redundancy into a unified analytical comparison, supported by systematic testing on synthetic matrices and minimally connected graphs. The demonstration that H(C) and its relativized form K(C) capture most variance across multiple structural metrics is compelling and suggests internal consistency of the proposed measure. However, the study relies exclusively on small artificial matrices and stylized graphs, limiting ecological validation; no empirical community datasets are analyzed to demonstrate performance under realistic sampling noise, sparsity, or uneven abundance distributions. The mathematical exposition, while rigorous, is dense and occasionally difficult to follow, and clearer separation between conceptual interpretation (negentropy as cohesion) and formal derivation would improve accessibility. Additionally, the interpretation of negative entropy as “cohesion” would benefit from stronger theoretical justification and comparison with established connectance metrics used in ecological network analysis. Overall, the work is conceptually original and intellectually ambitious, but its impact would be substantially strengthened by empirical application, sensitivity analysis, and clearer positioning relative to contemporary network ecology metrics.

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Declarations

Potential competing interests: No potential competing interests to declare.