Network analysis tools in ecology
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An ecosystem consists of numerous species, their interactions with each other and with the internal and external environment. A so-called 'healthy' ecosystem is declared one that can deliver ecosystem services to humans, is resilient to impacts and persists over time. Network analysis tools have been traditionally used to investigate the 'health' status of ecosystems by examining their structure (species and interactions) and their function. The latter includes weighted links of the network, diversity of pathways, recycling ability, or properties emerging from weighted interactions such as measures of network robustness, or indirect effects between species.

Network construction and evaluation is of methodological significance to assess the degree of realism regarding how well a network model depicts the ecosystem. Ecology is often a data-poor discipline[1] in that only a small proportion of interactions between species can be measured, therefore the networks are usually underdetermined. One of the network construction methods used is therefore linear inverse modelling (LIM) that results in a polytope containing all realistic solutions from provided equalities and inequalities[2]. These are fairly recent developments for ecological network models, and are as yet far from resolved with respect to sampling the resulting solution polytope, and the interpretation of a large number of resulting plausible solutions. From an ecological point of view, how the plausible solutions should be sampled, used in ecosystem assessment and communicated to policy makers is still a question of finding appropriate methodologies[3].

The biodiversity crisis is unfolding as a result of human impacts (including climate change), and planetary boundaries are overstepped, therefore we aim to address practical applications of ecosystem network analysis to broader ecological questions such as assessing the natural variability of ecosystems, impacts of extraction and other human use on ecosystem services, and overall the causes of and impediments to their persistence and resilience. The presentation highlights a few of the methods commonly used to construct and analyse ecological networks, and provides examples of their application to ecological questions and policy needs.

Keywords: ecosystems, species interactions, network construction, ecosystem management

References

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