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What sort of interspecific interactions leads to deviation from a neutral community?

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The neutral theory in community ecology attempts to explain its species-abundance composition by the balance between local extinction of species due to demographic stochasticity and immigrational supply of new species from a meta-community. The original neutral theory is described by two parameters; the one (“theta”) that represents biodiversity in the meta-community, and the other (m) is the immigration rate. Quite surprisingly, such a two-parameter model often shows a good fit to real community data, leading to the impression that many real communities significantly look “neutral”. Inspired by the methodology in evolutionary game theory, here I try to reveal whether non-neutral communities with intra- and inter-specific interactions really look “neutral”, and if not, under what condition. My random community model explicitly incorporates those interactions and has new parameters that control the proportions of mutualistic (+/+), competitive (-/-), and exploitative (+/-) interactions in the community. Extensive computer simulations have revealed that communities that are rich with mutualistic interactions, or those with exploitative ones tend to look neutral although they are not, whereas those communities that have a mixture of competitive and exploitative interactions are often deemed non-neutral. Those results tell us limited statistical power in existing neutrality tests.

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