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Annual plant communities used by the study authors to show that higher-order species interactions are common and strong in real plant communities. Credit: Margie Mayfield

A new University of Queensland-led study could help scientists more accurately predict and explain patterns of diversity in nature.

Ecology Centre Director in the UQ School of Biological Sciences Associate Professor Margie Mayfield said the project had developed a mathematically simple framework for accurately assessing the outcomes of species' interactions.

"This advancement will improve the accuracy of studies of the diversity of biological communities," she said.

Dr Mayfield said the framework was important because it could improve the accuracy of a wide range of models used in ecology, conservation biology, and global change research.

"We sometimes see patterns of plant, insect, mammal or bird diversity modelled, or predicted for biodiversity conservation, or even to predict responses to climate change," Dr Mayfield said.

"These values are usually estimated using models that rely on mathematical models of fitness that incorporate basic information about competition between species.

"The accuracy of these fitness models have the potential to change outcomes of the whole model and it is important to get this piece of the puzzle right."

Dr Mayfield said individual fitness models grossly over-simplified information on species interactions, making the assumption that scientists only needed to include information on direct competition between species to accurately model fitness outcomes.

"This is not actually true," Dr Mayfield said.

"Most of the time we just include poor estimates because of the widespread belief that there is no better alternative.

"A lot of research shows other types of interactions, in particular facilitation - or one species helping another - is common in nature.

"Indirect interactions among species, notably higher-order interactions, have also been studied but most evidence for the importance of these comes from mathematical models not real data."

Higher-order interactions are the effect that interactions between individuals within a neighbourhood of organisms have on the fitness of individuals.

"It has been considered infeasible to collect enough data from real communities to detect higher order interactions," Dr Mayfield said.

"Our framework shows it is indeed possible to detect these interactions in real communities and that as theoretically predicted, their impacts are strong and important.

"Because diversity models are so central to the way we study, understand and try to protect the natural world, it is very important that we make these models as accurate as possible.

"We use diversity models to predict the impact of climate change; areas to be targeted for protection or restoration; where biological invasions will be successful; or trying to estimate how many species there are on the planet or in regions of interest.

The study, published in *Nature Ecology and Evolution*, is co-authored by Associate Professor Daniel Stouffer of the University of Canterbury School of Biological Sciences in New Zealand.

More information: Margaret M. Mayfield et al, Higher-order interactions capture unexplained complexity in diverse communities, *Nature Ecology & Evolution* (2017). DOI: 10.1038/s41559-016-0062

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