Impact - Ecosystem responses to escalating drivers: linking species interactions and resilience

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The overall objective of my proposed research is to improve our current understanding of the ecosystems response to multiple anthopogenic drivers and their cumulative impacts. In particular, I will focus on the role that networks of species interactions have in modulating the resilience of ecosystems.

To answer those questions I will focus on model systems and drivers that have global relevance but are particularly important for New Zealand. Specifically I will focus on 1) mutuallistic plant-pollinator networks which are of tremendous importantance for the maintenance of biodiversity and production of crops[1,2]; and 2) biotic invasions and defaunation wich are a significant component of human-caused global change for which New Zealand is notably vulnerable[3]. However, the theoretical and quantitative approach I will use, will facilitate the future extension to other processes, ecosystems and drivers.

About two thirds or New Zealand plants are pollinated by birds or insects. For instance, they are responsible for the pollination of iconic native plants (like kowhai and pohutukawa), and economically important crops (like kiwifruit, apples and grapes). New Zealand flora is particularly vulnerable to declines in pollination services[4], yet those services have been distorted by the introduction of foreign bees[5], and the population depeltion of native birds[6,7]. Also, in contrast with other locations, pollination networks in New Zealand are dominated by generalist species[8,9]—plants that attract a wide range of pollinator species and pollinators that visit a wide range of plants. My proposed research will help elucidate how this structural differences are reflected on the resilience and stability of New Zealand's pollination systems when considering that original ecosystems have been changed by biotic invasions. Understanding how invasions interact with defaunation in ecological networks is a global research priority, and essential for conserving, restoring and managing New Zealand ecosystems[4].

It has been recently shown that the architecture of empirical and simulated interaction networks mediates the respose to drivers like defaunation and species invasions, and increase its ability to support greater numbers of species[10–14]. Very few studies have investigated the link between species interactions and reslience in the context of human-caused drivers[15,16]. My proposed research aims to fill this gap and to answer several exciting research questions that are raised when network theory is merged with resilience and critical transition theory.

My PhD will take place at Daniel Stouffer's lab—a Rutherfurd Discovery Fellow at the University of Canterbury. His group is very internationally active and has several current visiting scientists for example from the Universidade de Sao Paulo, the Ecole normale superieure and the University of Western Sydney. My proposed project also aligns nicely with the interests of several highly cited researchers: Jason Tylianakis (University of Canterbury), Jordi Bascompte (University of Zurich), Martin Scheffer (Wagenigen University), and Carl Folke (Stockholm Resilience Center). In fact, I've already initiated contact with some of them and collaborations seem highly likely.

Many ecosystems respond non-linearly to global change and human activities. When stresors reach a tipping point, ecosystems collapse and enter into a new undesirable regime. By using fundamental ecological theory and quantitave approaches I aim to contribute to our understanding

of how to predict and prevent these undesirable shifts, and importantly how to recover from them. With your support, I will tackle fundamental, globally important, ecological questions that are of especial relevance for New Zealand's natural heritage and agricultural sector.

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