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

Fernando Cagua

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—the amount of disturbance a system can withstand without entering a regime shift[1].

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 globally and locally important for the maintenance of biodiversity and production of crops[2,3]; and 2) biotic invasions and defaunation, a significant component of human-caused global change for which New Zealand is particularly vulnerable[4,5].

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). In contrast with other locations, pollination networks in New Zealand are mainly composed by generalist species—plants that attract a wide range of pollinator species and pollinators that visit a wide range of plants[6,7]. My proposed research will help elucidate how this structural difference is reflected on the resilience and stability of New Zealand's pollination systems, particularly when original ecosystems have changed due to invasions. For instance, New Zealand flora is vulnerable to declines in pollination services[8], especially since pollination services have been distorted by the introduction of foreign bees[9], and the population depletion of native birds (like tuis and bellbirds)[10,11]. Understanding how biotic invasions interact with defaunation in ecological networks is a global priority, and essential for conserving, restoring and managing New Zealand ecosystems[8].

References

1.Holling, C. S. Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics* **4,** 1–23 (1973).

2.Bascompte, J. & Jordano, P. Plant-Animal Mutualistic Networks: The Architecture of Biodiversity. *Annual Review of Ecology, Evolution, and Systematics* **38,** 567–593 (2007).

3.Klein, A.-M. *et al.* Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B: Biological Sciences* **274,** 303–313 (2007).

4.Lövei, G. L. Global change through invasion. *Nature* **388,** 627–628 (1997).

5.Vitousek, P. M., D'Antonio, C. M., Loope, L. L., Rejmánek, M. & Westbrooks, R. Introduced species: A significant component of human-caused global change. *New Zealand Journal of Ecology* **21,** 1–16 (1997).

6.Heine, E. Observations of the pollination of New Zealand flowering plants. *Transactions of the royal society of new zealand* **67,** 133–148 (1937).

7.Primack, R. B. Insect pollination in the New Zealand mountain flora. *New Zealand Journal of Botany* **21,** 317–333 (1983).

8.Newstrom, L. & Robertson, A. Progress in understanding pollination systems in New Zealand. *New Zealand Journal of Botany* **43,** 1–59 (2005).

9.Huryn, V. M. & Moller, H. An assessment of the contribution of honey bees (Apis mellifera) to weed reproduction in New Zealand protected natural areas. *New Zealand Journal of Ecology* **19,** 111–122 (1995).

10.Anderson, S. H. The relative importance of birds and insects as pollinators of the New Zealand flora. *New Zealand Journal of Ecology* **27,** 83–94 (2003).

11.Robertson, A. W., Kelly, D., Ladley, J. J. & Sparrow, A. D. Efects Mistletoes of Pollinator Loss on Endemic New Zealand (Loranthaceae). *Conservation Biology* **13,** 499–508 (1999).