How do mānuka and kānuka partition early-successional environments?

Leptospermum and Kunzea species (mānuka and kānuka) are the most widespread pioneer trees in New Zealand, mānuka in particular ranging from coastal to alpine environments throughout the country (Wardle 1991). Both are used for essential oil production, and mānuka has assumed great economic importance as a honey producer. mānuka and/or kānuka are both well-dispersed, and are often the first woody plants to colonize sites disturbed by fire or landslides (Payton et al. 1984; Smale et al. 1997; Perry et al. 2010). Accordingly, they are widely planted to establish the initial forest cover in restoration projects (Todd et al. 2009; Laughlin & Clarkson 2018).

When mixed stands of mānuka and kānuka establish on a recently exposed surface, the former is usually outcompeted within a few decades, owing to the greater maximum height and longevity of kānuka (Wardle 1991). However, sometimes one or the other species is scarce or absent in early-successional stands, and it is unclear which environmental factors determine which of the two becomes the dominant initial colonist in natural successions. Kānuka has been regarded as associated with drier and more fertile environments than mānuka (Burrows 1973; Wardle 1991), yet the composition of early-successional communities on individual landslides is difficult to predict. As soil depth and presumably nutrient availability tend to be greatest in the downslope deposition zone of landslides (e.g. Dai & Lee 2002), longitudinal partitioning of landslides between mānuka and kānuka is also a possibility.

We will examine environmental partitioning between mānuka and kānuka on 24 recent (post-1970) landslides throughout New Zealand, across a wide range of igneous, sedimentary and metamorphic rock types. These sites have been pre-selected for a chronosequence study of mycorrhizal succession, as part of Marsden project 20-UOW-041. We will use PRS® ion exchange probes to measure nutrient availability at our sites, burying the probes in November, and retrieving them in January-February. Akaike Information Criterion will then be used to identify the most parsimonious combination of climate and soil variables predicting the balance between mānuka and kānuka, as well as testing the hypothesis of longitudinal partitioning of individual landslides. Fieldwork will be carried out in conjunction with the Marsden project fieldtrips.

Resolving this question would constitute a significant contribution to our understanding of how New Zealand’s native tree species coexist on landscapes by partitioning environmental heterogeneity. Accordingly, we envisage submitting our findings to a peer-reviewed international journal. Our findings will also help optimize decisions about restoration planting, enabling restorationists to choose the species most likely to quickly re-establish a forest canopy in a given environment.

Student Skills:
- Plant identification skills
- Knowledge of NZ flora and ecology
- Ability to work in a field team
- Good verbal and written communication skills
- Physical fitness - there is a lot of hiking
- Data management and analysis
- GIS skills (ideal but not essential)
- R coding skills (ideal but not essential)

Project Tasks:
- Measure abundance of mānuka, kānuka and other tree species at the sites
- Help insert (and later recover) PRS® ion exchange probes to measure nutrient availability at the sites, to assess soil nutrient availability
- Access online sources of geological and climate data for the sites
- Analyse relationships of mānuka and kānuka abundance with environmental variables
- Contribute to write-up of the research
- Develop a final research poster
EXPECTED OUTCOMES:

- Student’s Research Poster (as per clause 6 of the Scholarship regulations)
- The student will experience working in a field team
- The student will gain field research skills
- The student will enhance their knowledge of the diversity and dynamics of indigenous forest ecosystems
- The student will enhance their science writing skills, with coaching from the chief supervisor
- Results will be submitted to a peer-reviewed science journal