Ecology Field Course

Ecology Degree Programme

University of Otago

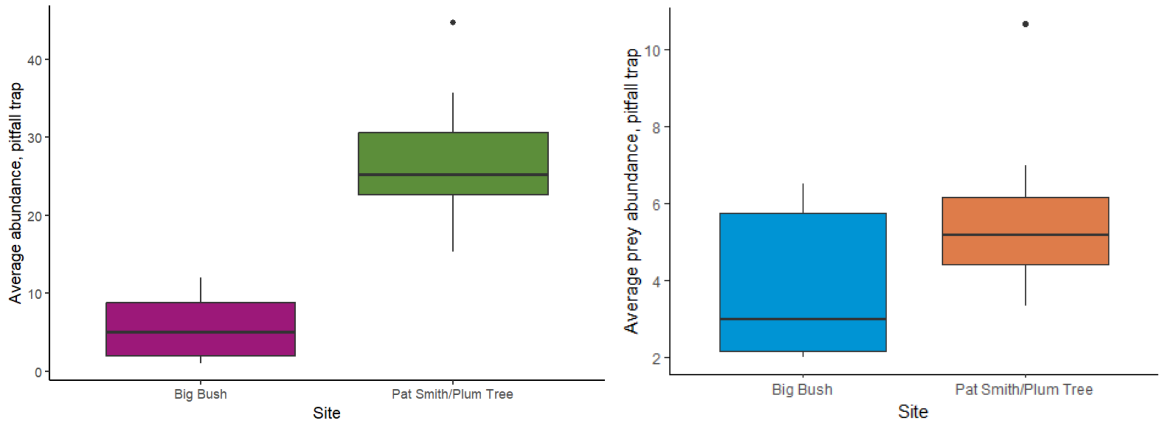
This document contains abstracts from projects carried out by undergraduate Ecology students on Rēkohu Wharekauri Chatham Island from 23 January to 3 February 2023.

Each of the 8 projects was carried out by a group of 2 or 3 students. They wrote up their reports independently, so there are 2 or 3 abstracts provided for each project. The abstracts are each accompanied by a figure showing some of the main results of the study. If you would like to read a full report, or discuss past or potential future projects, please contact the course coordinator, Dr. Travis Ingram (travis.ingram@otago.ac.nz). For more information about the Ecology Degree Programme, visit https://www.otago.ac.nz/ecology/index.html

Project 1: Student 1 – Emma Ahlezon

Assessing invertebrate communities for potential prey and ecosystem health at candidate Black Robin (*Petroica traversi)* reintroduction sites

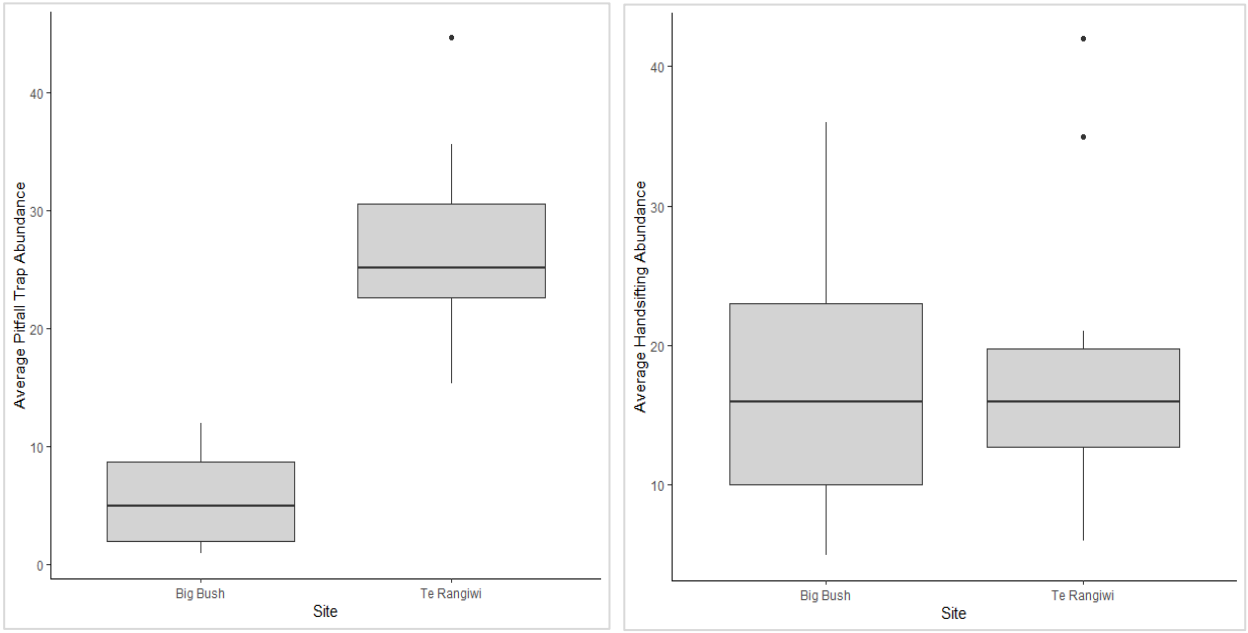
Abstract: The role soil invertebrates play in the terrestrial ecosystem as direct bioengineers is crucial for the whole ecosystem, however they do not get as much attention as they deserve. Their further role as part of the food web for more characteristic animals such as Black Robin (*Petroica Traversi*) might however assist conservation efforts. The aim of this study was to investigate the abundance and diversity of the overall terrestrial invertebrate community composition as potential prey for Black Robin. Thirty-six pitfall traps and twenty leaf litter hand sifting samples were taken from two sites on Rēkohu Wharekauri Chatham Island, resulting in sixteen group classifications of which seven could potentially act as Black Robin diet. The site Big Bush has a higher diversity and more variety whereas the other site Pat Smith/Plum Tree seemingly has a higher invertebrate abundance, findings which are valuable ecosystem indicators. This research also suggests that further studies are required for a better understanding of Black Robin diet to be able to better utilize the invertebrate composition findings in this study.



Project 1: Student 2 – Erin Drummond

A comparison of suitable Chatham Island Black Robin (*Petroica traversi*) habitat on Rēkohu/Wharekauri/Chatham Island, with an emphasis on invertebrate abundance and diversity

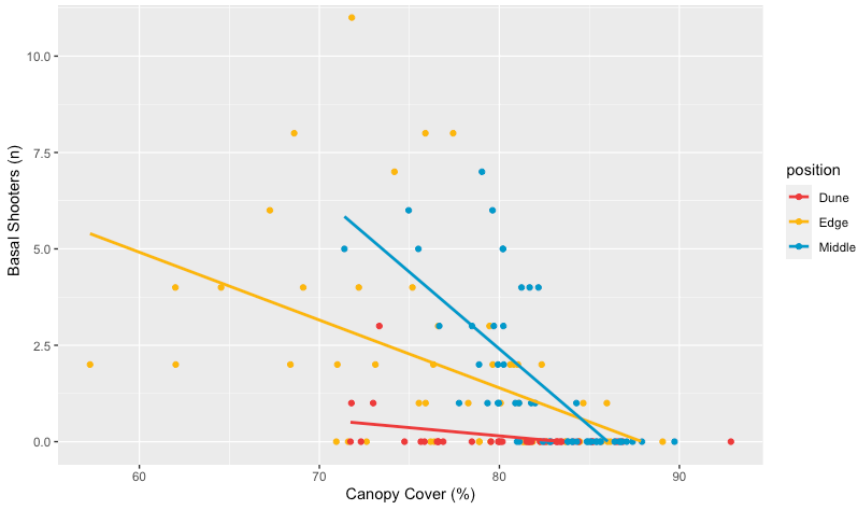
Abstract: Rēkohu/Wharekauri/Chatham Island was once home to the insectivorous Chatham Island black robin that is now no longer found there. Their reintroduction to Rēkohu has been supported by a number of site assessments. The project aim was to provide information on invertebrate abundance and diversity within two highly scored sites from these assessments. The prediction was that the higher scoring site 'Big Bush' would have higher values than the other site 'Te Rangiwi'. Methods included ten sampling locations of pitfall traps and leaf litter sifts at each site. Invertebrates were counted and identified to the lowest possible classification. The results indicate that there are differences between the sites. Big Bush had higher heterogeneity and diversity, however Te Rangiwi had greater absolute abundance. However, these results are subject to change in space and time. Knowledge of close relatives suggest that prey quality, competitor density and small habitat fragments could limit black robin fitness. For each site within their current state, these inferences present opportunities and challenges for the black robin. There are multiple opportunities to apply these insights in preparation for their potential reintroduction in the future.



Project 2: Student 1 – Rose Somerville

Assessing the response of Kōpi to a reduction in canopy cover on Rēkohu, Wharekauri, Chatham Island

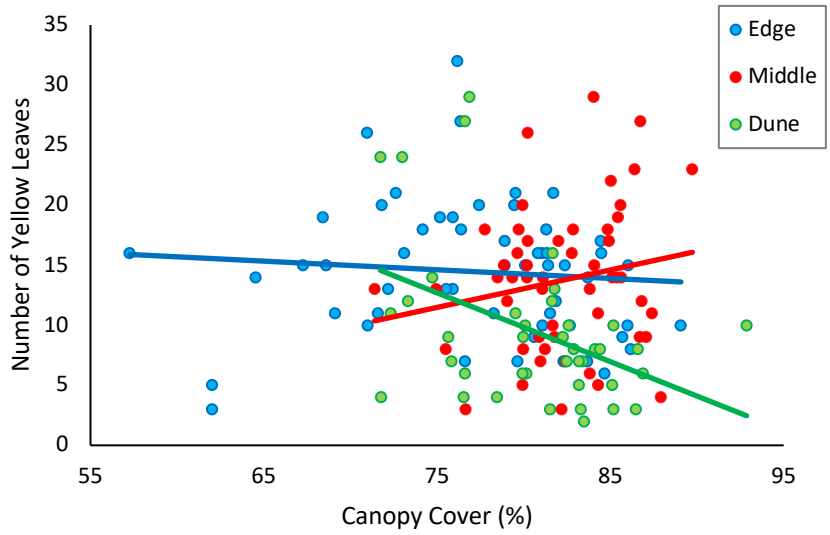
Abstract. The connection between forests and people is embedded in Moriori culture. Kōpi trees were introduced, cared for, and managed by early settlers of Rēkohu and continue to be held in great significance by descendants. There are four remaining groves on the island, and the erosion of the groves' canopy has indirect consequences to tree health. Delamination of bark, and loss of rākau momori are the primary concerns for members of the Hokotehi Moriori Trust. This study aimed to observe a pattern between variation in canopy cover and tree position in Rotorua kōpi grove. Furthermore, the results of the vegetation survey were used to isolate relationships between reduced canopy cover, number of basal shoots, and intensity of fungal infection. Results provided by this observational study showed lower canopy cover (%) on the edge of the grove coincided with highest average number of basal shooters and yellow leaves.



Project 2: Student 2 – Sophie Whittall

Conserving an Ancient Forest: Investigating tree health in response to canopy cover loss within the Rotorua Kōpi Reserve of Rēkohu (Wharekauri/Chatham Island)

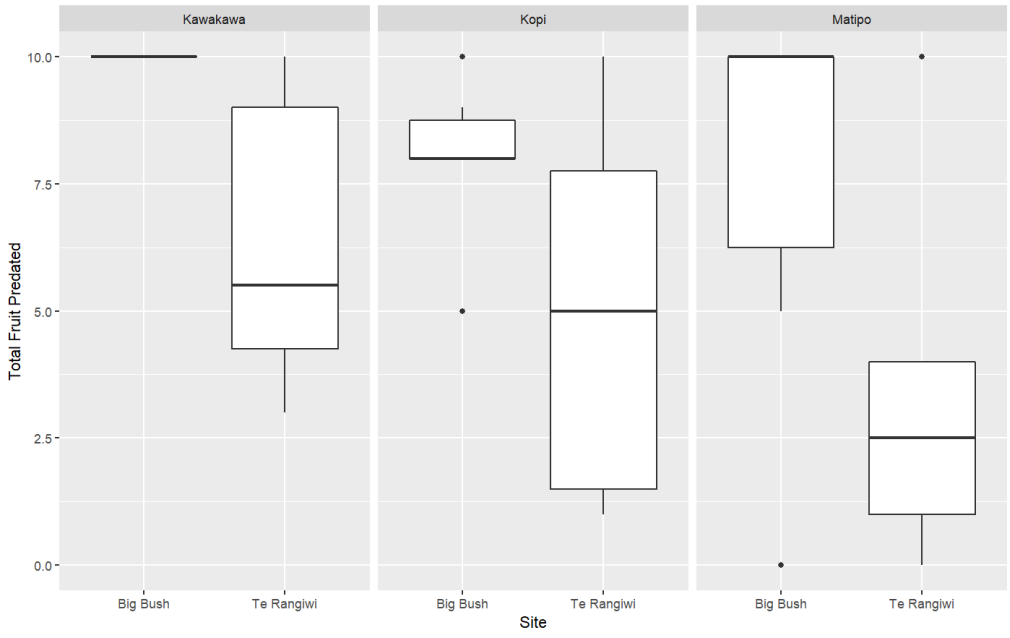
Abstract: For Moriori, their people and the kōpi tree (*Corynocarpus laevigatus)* are deeply connected. Kōpi were traditionally cultivated in groves on Rēkohu (Wharekauri/Chatham Island) as a source of food, shelter, fuel, and spirituality. Today, the remaining groves hold immense importance to the Rēkohu community. Historic deforestation has caused extensive canopy loss through wind exposure and edge effects, impacting kōpi health. The aim of this study was to investigate patterns of percent canopy cover and potential indicators of kōpi health (basal shooters and fungal prevalence) in different areas of Rotorua Reserve. This was investigated through an observational study that involved collecting data from 147 trees. As expected, the edge was most impacted by edge effects with the lowest percent canopy cover, highest number of basal shooters and yellow leaves. In general, we observed that trees with a lower percent canopy cover had more basal shooters and were more vulnerable to fungal infection. However, these relationships change in different areas of the forest, because of an interaction between percent canopy cover and tree position. Overall, this research aims to support the Hokotehi Morori Trust, Department of Conservation, and the Rēkohu community.



Project 3: Student 1 – Benjamin Carson

Exploring post-dispersal fruit predation at two sites on Rēkohu Wharekauri Chatham Island

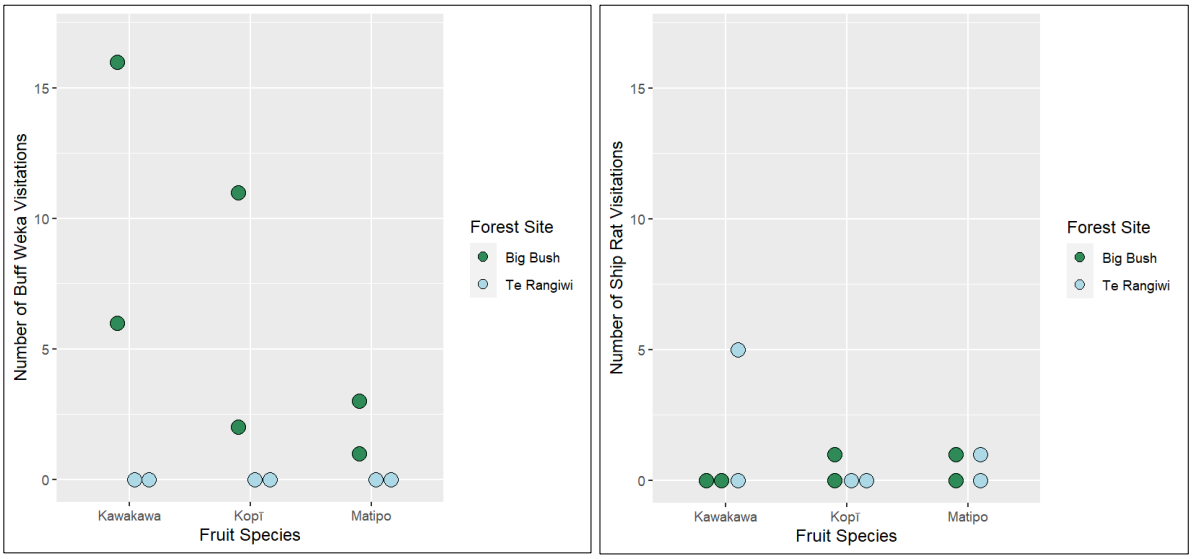
Abstract: Ecosystem restoration can be undertaken to benefit species conservation; invasive post-dispersal seed predators can change plant communities and impact restoration. Big Bush and Te Rangiwi were deemed the most biologically suitable sites for a Chatham Island black robin translocation on Rēkohu Wharekauri Chatham Island, motivating our study on seed predation at these sites. We exposed fruits of three common species, kawakawa, kopi, and matipo, to fruit predators overnight, to determine traits preferred by predators and whether predation rates differ between sites. We placed fruit on the forest floor overnight and recorded how many were removed, displaced, or damaged; we used trail camera footage to identify fruit predators. Between the three species, we found a difference in predation rates, with kawakawa appearing to have a higher rate; we also found that fruit predation rates at Big Bush were higher than at Te Rangiwi. Weka and ship rats visited fruit depots repeatedly, suggesting they may be important fruit consumers; whether they predate upon seeds of the three species requires further investigation. Our study identifies aspects of seed predation in Chatham Island forest ecosystems and how this might affect restoration trajectories for species conservation.



Project 3: Student 2 – Mahina Walle

Post-dispersal predation on three fruit species at Big Bush and Te Rangiwi on Rēkohu Wharekauri Chatham Island

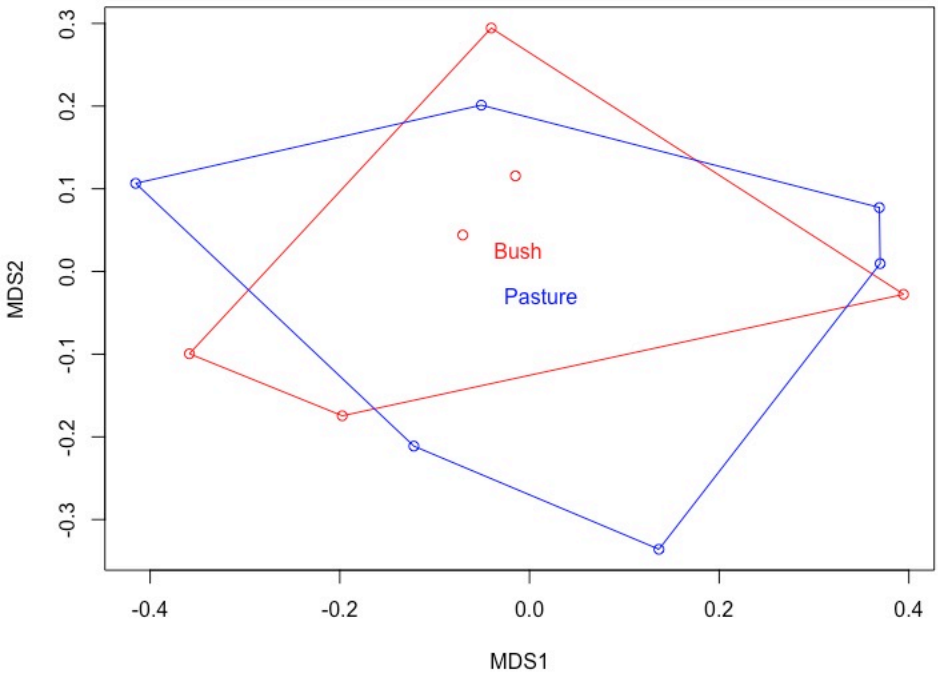
Abstract: Black robins are genetically vulnerable and only occur on two island populations, at carrying capacity, to the SE of Rēkohu Wharekauri Chatham Island. The suitability of translocation sites on Rēkohu, including Big Bush and Te Rangiwi, is being considered in order to increase population survival. This study will assess habitat suitability by investigating fruit predation on kawakawa, kopī and matipo at Big Bush and Te Rangiwi, as well as predator presence at each site. The hypotheses are 1) that predation will differ between fruit species as predators likely have existing fruit preferences, and 2) Te Rangiwi will have lower predation levels as existing predator control is being undertaken at this site. Ripe kawakawa, kopī and matipo fruit were placed out at both forest sites to investigate predation, while trail cameras and chew cards were used to determine predator presence. There was a significant difference in predation between fruit species ($p = 0.005$), and Big Bush had significantly higher levels of fruit predation than Te Rangiwi ($p = 3.61 \times 10^{-8}$). Five introduced mammalian predators (ship rats, possums, mice, goats and hedgehogs), and the endemic buff weka, were recorded. In conclusion, predators would need to be controlled before black robins could be translocated to either Big Bush or Te Rangiwi.



Project 4: Student 1 – Thomas Chapple

How coastal sand dune ecosystems are influenced by vegetation behind them

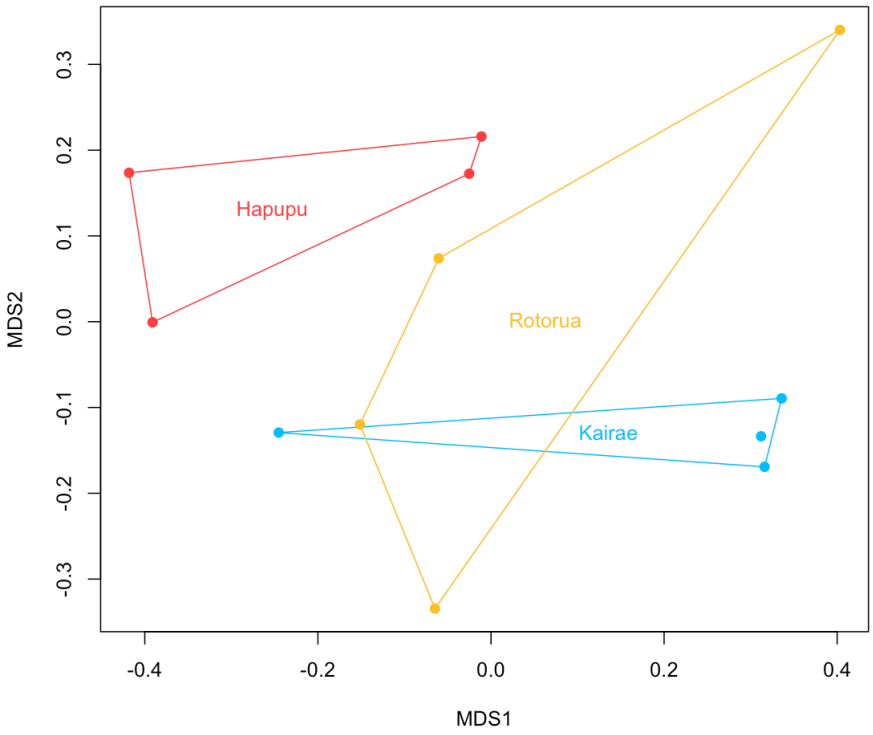
Abstract: The plant communities of coastal sand dunes maintain their physical structure and so are crucial to the roles of these dunes as a barrier, protecting land from the ocean, and as a habitat for many unique species. In Aotearoa New Zealand and Rēkohu Wharekauri Chatham Island, these plant communities have been heavily damaged by European settlers and the introduction of *Ammophila arenaria* (Marram grass). Our study aimed to provide information for selecting potential ecosystem restoration sites on Rēkohu, by comparing the plant community in areas of dune backed by forest to areas backed by farmland. We expected a signficant difference in overall community composition between these two areas, with higher diversity of native plants in areas backed by forest and higher diversity of introduced plants in pasture areas. To investigate this, we collected percentage cover data for each of the plant species present across the different areas of these dunes. We found that dune backing was not associated with any signifcant difference in overall community composition, native plant diversity, or introduced plant diversity. We concluded that the vegetation behind coastal dunes on Rēkohu did not need to be considered when selecting restoration sites.



Project 4: Student 2 – Hamish Doogan

Does dune-backing influence plant community composition in dune ecosystems on Rēkohu Wharekauri Chatham Island

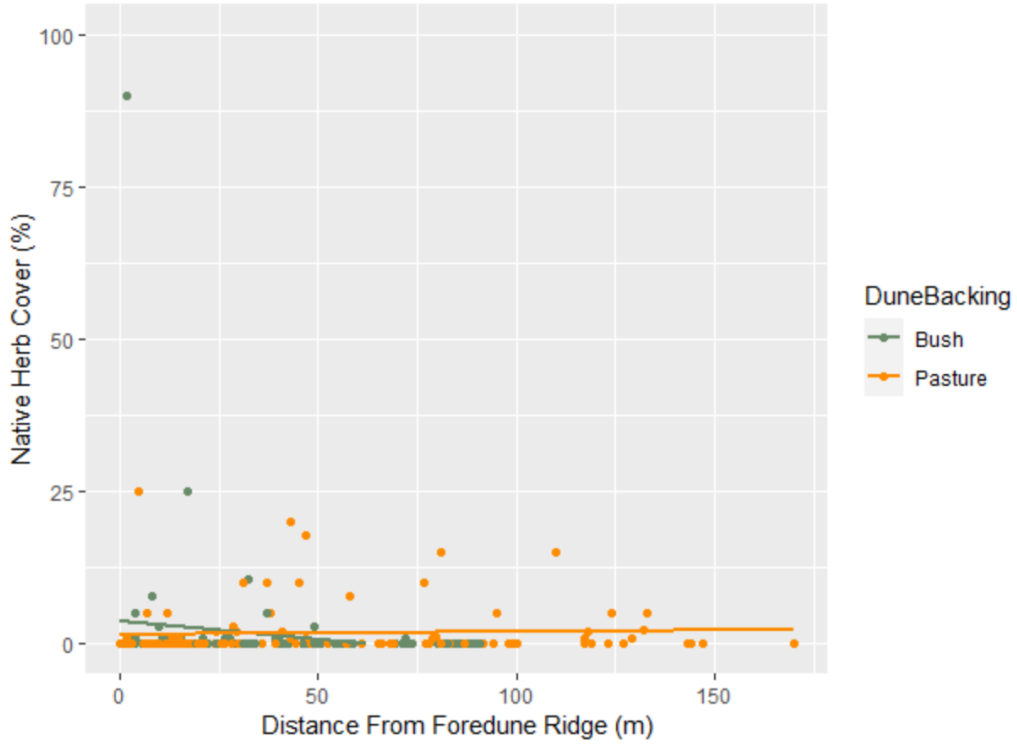
Abstract: Coastal dune ecosystems are globally important systems. They often support a high amount of biodiversity whilst providing a range of different ecosystem services including freshwater production and flood protection. Despite dune ecosystems' importance in both biodiversity and ecosystem services, globally, dune systems are facing serious pressures which put the future health and function of these systems at risk. While the impact of habitat loss behind the dune ecosystems due to urbanization and human development has been relatively well studied, there is a lack of literature addressing the effects of replacing natural ecosystems with agricultural pastureland behind the dune systems. It is largely unknown if changes in dune backing influence the plant communities within the dune system itself. This study aimed to identify potential differences in community composition between two different dune backing types on Rēkohu by comparing dune communities backed with agricultural pastureland against dune communities backed with native forest. Our results showed dune backing does not have an effect on community composition within the dune ecosystem. While unexpected, this may have some positive implications for Rēkohu dune systems, as future conservation projects may not need to consider dune-backing when planning potential restoration strategies and future conservation projects need not be limited to remnant forest fragments



Project 4: Student 3 – Cameron McMillan

Dynamics of Forest Remnants and Description of Sand Dune Vegetation Along the Northeast Coast of Rēkohu, Wharekauri, Chatham Island

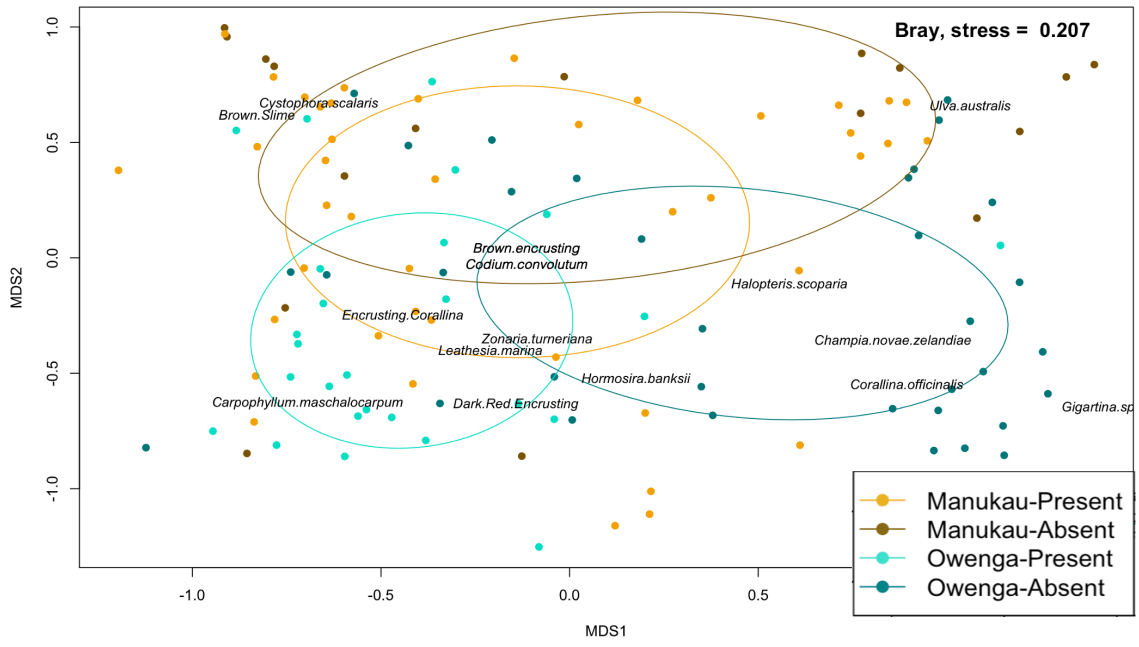
Abstract: Coastal sand dunes form essential barriers between the sea and land providing many important ecosystem services. Despite this, they are currently under high stress from anthropogenic overdevelopment and the imminent threat of sea level rise. Being ecogeomorphic systems, vegetation plays a large role not just in the composition of the plant community but also in the geomorphology of the coastline. The aim of this study was to describe the sand dune vegetation along the northeast coast of Rēkohu Wharekauri Chatham Island, and observe any possible effects of natural (forested) and developed (pasture) backing. Twelve transects were run across three sites with eighteen quadrats randomly placed along each with abundance of each species present estimated as a percentage cover. Overall analysis of the data showed non-significant difference in composition between bush and pasture backed dunes. Further analysis, accounting for significant differences between sites provided insight into the difference of marram grass (*Ammophila arenaria*) and native herbaceous plants between bush and pasture. The plant community of this dune is proposed to be shaped by both *A. arenaria* and the introduced weka (*Galliralus australis*) as a vector for seed dispersal, although more comprehensive analysis may be beneficial as to the extent of these factors.



Project 5: Student 1 – Jack Flett

The Rocky Relationship of Fishing Pressure on Pāua and how it Impacts Algal Community Structure on Chatham Island.

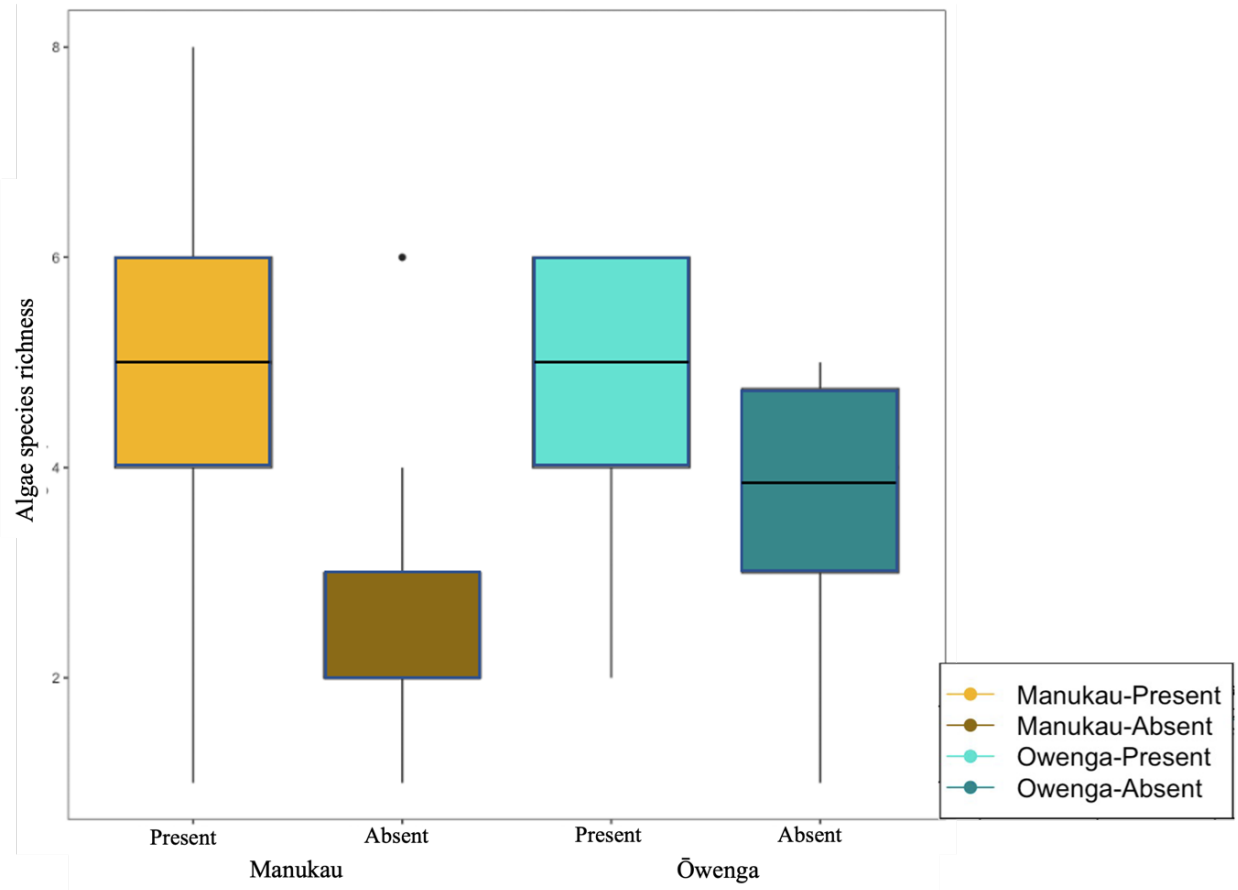
Abstract: The rocky intertidal zone is a culturally and economically important ecosystem for humans, especially on islands such as Chatham Island, Wharekauri, Rēkohu. The health of these systems has been diminishing globally from numerous factors, including fishing pressures. This study aims to investigate the effect harvesting pāua has on algal community structure within these ecosystems. It was hypothesised that there would be a difference in algal community structure between a site under fishing pressure and a protected site. The areas sampled were Manukau Point, under protection from harvesting via a rāhui (prohibition), as well as Owenga, a public access site for harvesting. Two species of pāua were the focal organisms: *Haliotis iris* and *Haliotis australis*. An observational study was conducted to determine the algal percentage cover, algal species richness, and algal community structure at both sites in the presence and absence of pāua. It was found that both pāua presence or absence and site location significantly affected algal percentage cover, algal species richness, and algal community structure. Site location did not have a significant impact on algae species richness. This suggests that harvesting influences algal community structure, which could provide insight for mainland New Zealand, where overharvesting has occurred resulting in species populations decreasing.



Project 5: Student 2 – Suzannah Press

Ecosystem function of pāua in relation to algae community structure within intertidal rocky shores on Rēkohu, Wharekauri, Chatham Island

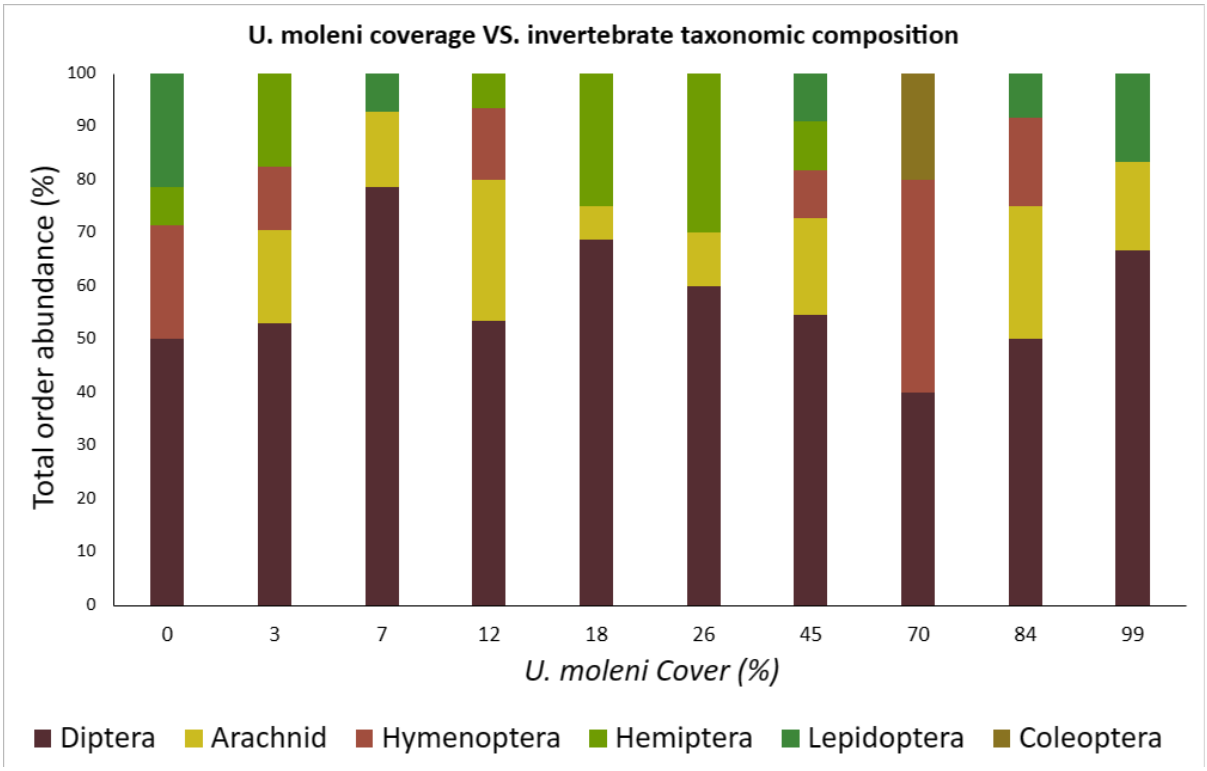
Abstract: The current study focused on the ecosystem function of pāua in relation to algae community structure within the intertidal rocky shores of Rēkohu, Chatham Islands. Observations of the decline in total pāua biomass as well as depletion in some areas have been reported in recent years. Results from observational survey of rocky shores found significant differences in algae community structure in areas of pāua presence or absence at two different sites: Ōwenga and Manukau. At both sites, pāua presence was associated with an increase in algae species richness. The role of pāua as a keystone species like other marine grazing molluscs within intertidal ecosystems that provide similar ecosystem services as pāua, and the importance of the disturbances caused by pāua grazing, are discussed. The absence of pāua was seen to be associated with a lower level of algae species diversity, thus, further declines in total pāua biomass may continue to lead to a decrease in algae diversity on Rēkohu.



Project 6: Student 1 – Brittany Loft

Effects of chilean guava on Rēkohu restiad bog ecology

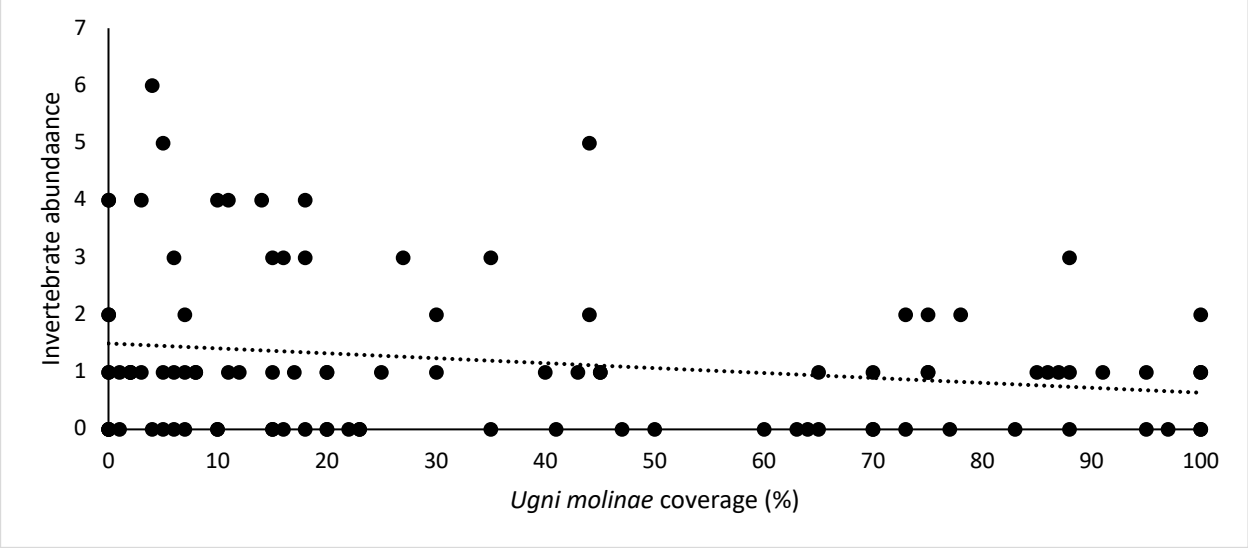
Abstract: Invasive flora in native environments can impact the ecology and diversity of native communities. Presence of exotic plants can cause changes to the physiology and morphology of naturally occurring plants. Competition stressors can affect native plant interactions with other organisms due to bottom-up controls. An observational study was conducted in a Rēkohu restiad bog to investigate potential ecological impacts of the invasive species *Ugni molinae,* by exploring its influence on the native rush species *Sporodanthus traversii.* Hypotheses were; (1) With an increase in the cover of *U. molinae* within *S. traversii* tussocks there would be an effect on growth of the rush. (2) With an increase in the cover of *Ugni molinae* within *S. traversii* tussocks there would be an effect on the invertebrate communities of the rush. 100 *S. traversii* tussocks with differing percentages of *U. molinae* growing throughout them were sampled. Sweep net collection methods were used to collect invertebrate community data, and morphological data was taken by measuring the heights of both plant species. Increase in cover of *U. molinae* within *S. traversii* tussocks was associated with higher growth of both plant species, and with lower invertebrate abundance. *S. traversii* ecology has wide reaching ripple effects on restiad bog ecology, due to bottom-up controls that vegetative species have on the wider food web. The occurrence of *U. molinae* would negatively influence restiad bog ecology and native biodiversity through possible competitive stressors it exerts onto *S. traversii*.



Project 6: Student 2 – Dylan Soutar

The effect of an invasive myrtle on restiad bog development on Rēkohu Wharekauri Chatham Island

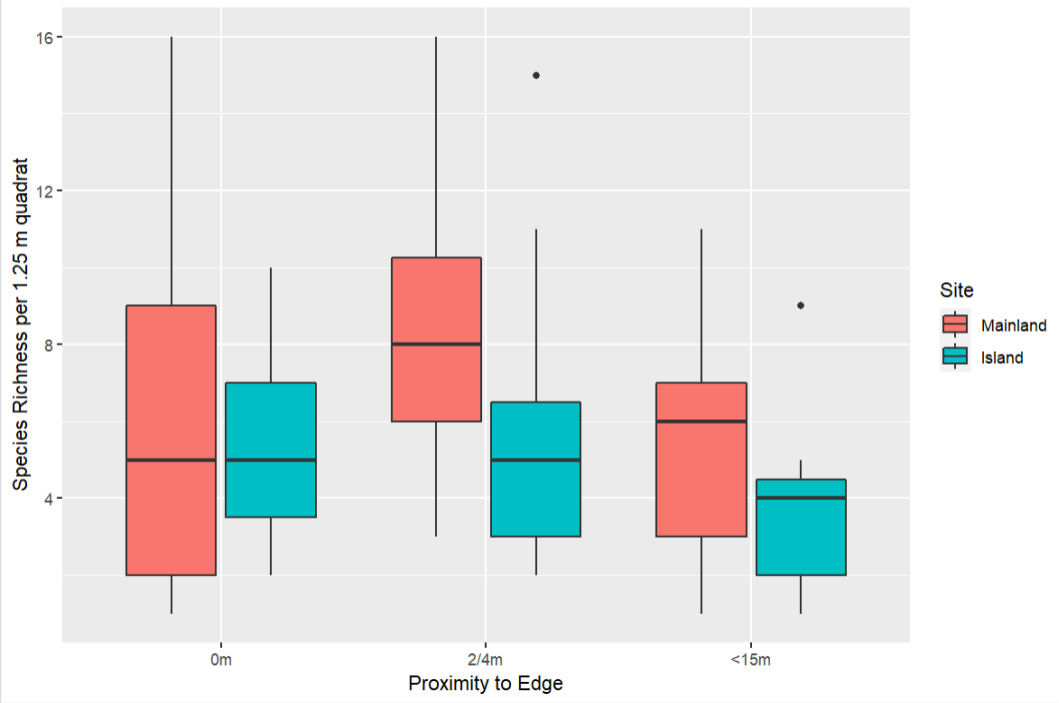
Abstract: Invasive species are a major threat to the functioning and biodiversity of ecosystems worldwide, and their impacts on peatlands, such as restiad bogs on Rēkohu Wharekauri Chatham Island, are thoroughly understudied. This paper examined the effect the invasive myrtle *Ugni molinae* had on the ecology of an endemic rush species *Sporadanthus traversii* in a restiad bog on Rēkohu. An opportunistic sampling method was employed utilising sweep netting to assess the impact of varying coverage of *U. molinae* on the invertebrate community and plant community structure of *S. traversii*. The results show that *U. molinae* is exerting multiple effects on the ecology of *S. traversii.* The most significant effect was observed in the maximum height of *S. traversii,* which increased with a higher foliage cover of *U. molinae.* Total invertebrate abundance significantly declined with an increase in foliage cover of *U. molinae.* More specifically, the abundance of Diptera significantly declined, alongside observed decline in Hemiptera, Hymenoptera, Lepidoptera and Arachnid. Taxonomic composition of invertebrates within *S. traversii* also changed with an increase of *U. molinae.* The results indicate that *U. molinae* is possibly competing with *S. traversii* as well as reducing and changing the invertebrate communities associated with the endemic rush. This is reason for concern due to the ecological significance of restiad bogs, alongside the fact that *S. traversii* is a foundation species in restiad bog development on Rēkohu.



Project 7: Student 1 – Clara Hardy

Plant Species Richness on Limestone Outcrop Edges on Rēkohu Wharekauri Chatham Island

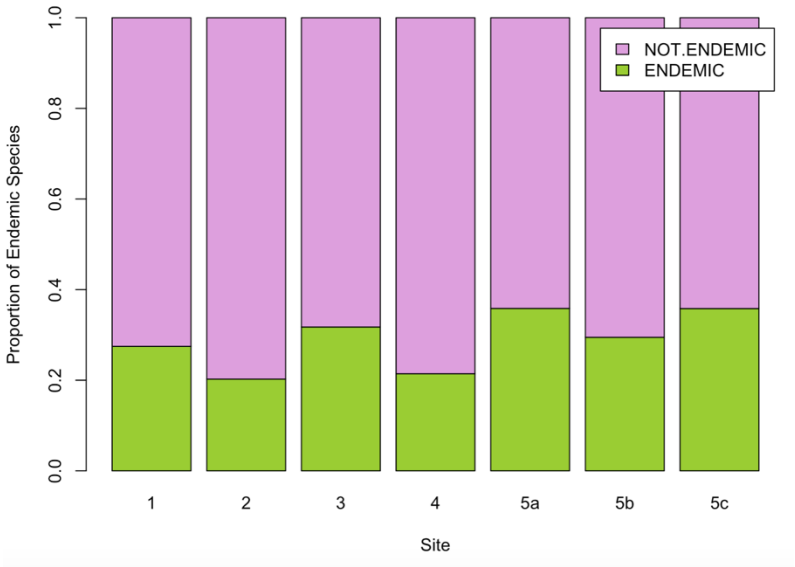
Abstract: Vegetation on Rēkohu Wharekauri Chatham Island is threatened by biodiversity loss because of land modification and grazing pressure. This study focused on determining if species richness differs on limestone outcrop edges on Rēkohu mainland compared to Motuhinahina Island. A comparative observational study was carried out by surveying four limestone outcrops along the western coast of Te Whanga Lagoon and three sites on Motuhinahina. Two hypotheses were tested. The first hypothesis was that limestone outcrop plant species richness differs on Te Whanga Lagoon mainland and Motuhinahina. The results support this hypothesis. Additionally, the most prominent mainland species was the exotic pasture grass *Holcus lanatus,* and on Motuhinahina it was the indigenous *Muehlenbeckia australis*. The second hypothesis was that limestone outcrop plant species richness differs moving inland from the high-water mark of Te Whanga Lagoon, Rēkohu. The results support this hypothesis. Overall, this study expands upon knowledge of the unique Rēkohu vegetation on limestone outcrops to inform those working with the ecosystem.



Project 7: Student 2 – Grace Wilton

Plant Species Richness Across Limestone Outcrops in the Chatham Islands

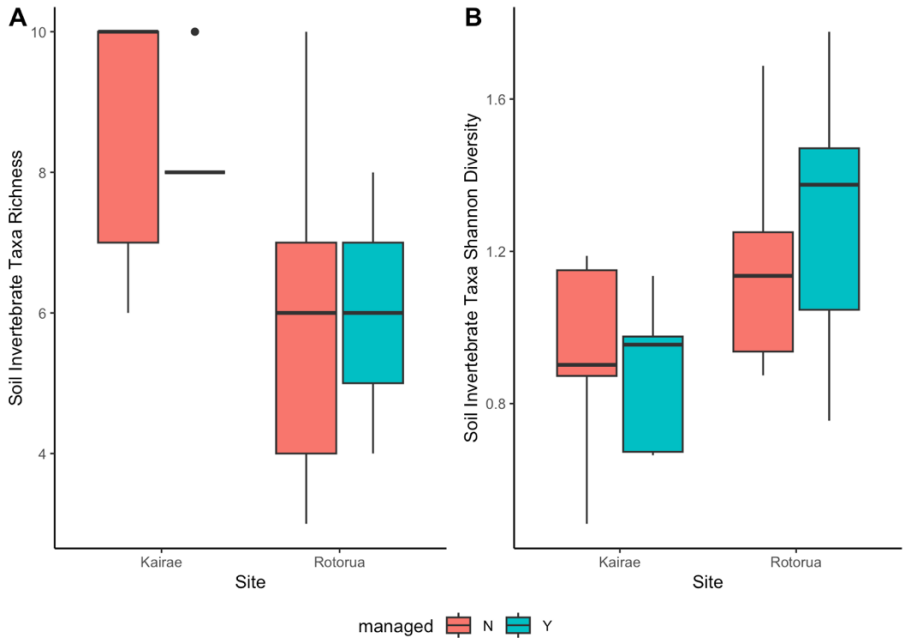
Abstract: Biodiversity loss is threatening the provision of ecosystem functions and services. The protection of biodiversity in hotspots such as the Chatham Islands/Rekohu is vital to maintain global resilience to environmental change (World Conservation Monitoring Centre, 1994). Factors affecting plant communities on Rekohu must be understood in terms of biodiversity factors such as species richness, endemism levels, and functional trait diversity to ensure focussed and effective conservation efforts (World Conservation Monitoring Centre, 1994) (Ferreira de Lima et al., 2020) (Gooden & French, 2014) (Oliver, et al., 2015). This study analysed how plant communities on mainland Rekohu and Motuhinahina varied in terms of species richness to gain insight into the impacts of grazing pressure, island biogeography, and edge effects on biodiversity factors. Despite very subtle differences in species richness and endemism levels, mainland and island locations were distinct and had different proportions of species from different growth forms. This suggested that different influences are driving the functional trait diversity of plant communities at each location but the effect of those influences on overall species richness and endemism proportions evens out. This highlights the complexity of factors contributing to biodiversity and provides a great example of the need to look further than species richness when considering the impacts of a pressure on ecosystem resilience.



Project 8: Student 1 – Lily Harvey

Does the management of Kopi groves on Rēkohu (Chatham Island) influence soil invertebrate communities?

Abstract: Soil invertebrates play crucial roles in terrestrial ecosystems and can influence productivity and tree health. Agroecosystems can alter the diversity and richness of soil invertebrate communities and lead to biotic homogenisation. Kopi groves on Rēkohu are important agroecosystems with great cultural value, yet are threatened due to natural and anthropogenic impacts. Soil invertebrate communities in kopi groves with ongoing management will be compared to those that are no longer actively managed to give insight into how the ecosystems are functioning and whether management is altering invertebrate diversity, richness and abundance. Two kopi groves; Kairae and Rotorua were studied and methods included hand sorting leaf litter and soil. Community composition, diversity, richness and abundance data was compared between sites and management type. No significant differences in average richness and diversity were observed between management type at either site. Only Talitridae (decomposer) and Araneae (predator) abundance differed with management type, with greater abundance at Kairae managed compared to Kairae unmanaged. Unmanaged areas of both sites had a greater number of total taxa found than managed areas. Overall, management types at each sites had similar soil invertebrate communities which shows ecosystem function and kopi tree health are not likely being greatly impacted.



Project 8: Student 2 – Max McKellar

Effect of forest management on the soil invertebrate communities of kopi forests on Chatham Island

Abstract: Soil invertebrate diversity and abundance significantly affect soil suitability for plant growth, and consequently, the condition of trees in forests. On Rēkohu Wharekauri Chatham Island, the kopi trees of the culturally important kopi forests are displaying degrading health. Management by removing competing seedlings may result in low plant diversity and subsequently reduce soil invertebrate diversity and abundance. This low abundance and diversity of soil invertebrates may in turn degrade the condition of the few tree species still present in the managed areas. We investigated whether the management of kopi forests influences the diversity and abundance of soil invertebrate communities, by comparing soil samples of invertebrates from managed and unmanaged areas of two kopi forests. The results show that there was no difference between the soil invertebrate communities at managed and unmanaged sites. Therefore, kopi forest management may not negatively impact on soil invertebrate communities. The distribution of mulch in managed areas may substitute for nutrients provided by living plants, allowing similar invertebrate communities to persist in the managed and unmanaged areas. However, further research is needed to fully understand the effects of management on soil invertebrates, and to understand the ecological causes for the poor condition of kopi trees.