

Assessing the Ecological Restoration of Motutapu Island, New Zealand

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Abstract

Motutapu Island has undergone much restoration in attempt to restore the island into a functioning ecosystem. With the eradication of pests from the island, it is now possible for birds and other vegetation to thrive. Motutapu Island is unique since it incorporates restoration with prehistoric Maori archeological sites and a working pastoral farm. Though a lot has been accomplished, weeds threaten to take over. Cattle on the island also pose a threat by destroying or preventing some of the natural revegetation of the island. The island is a place where rare and endangered species of birds can take refuge but further steps could be taken to establish a working ecosystem. Restoring the wetlands will help increase diversity and introducing invertebrates, reptiles, and amphibians will help establish a better ecosystem. To allow diverse vegetation to thrive off the nutrient-rich volcanic soil, compaction by cattle should also be avoided. Incorporating these factors into the island's restoration will further facilitate the goal of establishing a working ecosystem on the island

Introduction

Much of New Zealand's natural flora and fauna have been destroyed due to colonization of the land and farming practices. With colonization and farming practices, a large extent of the natural habitat for birds has been devastated. Additionally, the introduction of mammals to New Zealand causes both flora and fauna to suffer. New Zealand in its original state did not contain any native land mammals. Plants had mechanisms that protected them from birds and insects rather than from mammals. Plants contain mechanisms that can sense and respond to specific damage caused by insects. They are able to release chemicals that protect them from harm or draw predators to feed on the harmful organisms feeding off the plant (Freeman & Beattie, 2008). These defense mechanisms were specialized for interacting with birds and insects but not for land mammals. Native birds were also vulnerable, because did not perform defensive behaviors in order to protect themselves from land mammals. New Zealand has more species of flightless birds than any other country. Some of these flightless birds include the Takahe (which was once thought to be extinct until a small isolated population was found in the South Island), Kiwi, Kakapo, Weka and four different species of penguins. Most of these flightless birds still remain on the island today are classified as endangered or threatened (Terra Nature, 2012). Before land mammals were introduced, endangered or extinct species of flightless birds did not require flight for survival. The introduction of land mammals and some reptiles caused around forty-five native bird species of New Zealand to go extinct. Some six-hundred native species to New Zealand are classified endangered, vulnerable or rare (Clout & Saunders, 1995). These mammals have had a significant impact on the native flora and fauna. Much of the Auckland coast is home to islands far enough away from the coast to prevent pests from swimming to the islands. However, some pests have found their way to the island through human introduction.

Many pests can be removed from the offshore islands making them pest free unlike the mainland. With the realization of how detrimental the destruction of native flora and fauna has been to the ecosystem, many efforts are being made to restore the islands and conserve native wildlife. These offshore islands play a vital role in conserving many endangered species of plants, birds, vertebrates and invertebrates. They also have become important for restoration projects attempting to restore a dynamic ecosystem. This essay will assess the current state of Motutapu Island and determine the future success of the island while presenting recommendations to achieve this success.

Location and context

Motutapu Island is a 1500-hectare land mass located off the shore of Auckland, New Zealand in the Hauraki Gulf adjacent to Rangitoto Island (see Figure 1 in appendix). It is easily accessible by ferry from Auckland harbor and one of the oldest islands in the Hauraki Gulf. Motutapu is a much older island than Rangitoto, yet Rangitoto has had a significant impact on the history of Motutapu (Davidson, 1978). When Rangitoto erupted, a significant amount of ash covered the island of Motutapu. No concrete evidence is apparent as to when exactly Rangitoto last erupted. According to Nichol (1992), however, the most probable date of eruption of Rangitoto is sometime around the fifteenth century. The ash that blanketed Motutapu has provided fertile soil for growth and vegetation, but also smothered much of the natural vegetation at the time of the eruption. Before the Europeans settled the island in the mid nineteenth century, Motutapu was home to several prehistoric Maori tribes. Many archeological sites preserving prehistoric Maori artifacts are found on the island. The fertile soil from the volcanic ash was valuable for planting gardens throughout the island. Once the Europeans settled the island, they had a significant impact on it destroying much of the natural vegetation through using it for farmland. However, the prehistoric Maori also left their scars on the island by cutting down vegetation to make room for their gardens (Hayward, 1983). Wetlands were once present with a combined 29 km length of freshwater streams. It is important to restore the wetlands to the island because wetlands are becoming increasingly rare on the mainland. Before the destruction of much of the vegetation, palynological studies suggest that mixed broadleaf/podocarp forest was prominent on Motutapu. Extensive knowledge is known about the past fauna occupying the island; however, restoring the island back to pre-human times is unrealistic. Instead, restoring Motutapu to a working dynamic ecosystem has been the goal (Miller et al., 1994). Today, few trees are seen on the island with much of the island an ongoing pastoral farm with sheep and cows present on the island. A restoration program is attempting to restore parts of the island in conjunction with maintaining farming practices.

Present Situation

A key aspect to the success of Motutapu Island is the restoration of the wetlands. With the large amount of freshwater found on the island, it is an ideal spot for many freshwater species. Having wetlands also helps to increase the diversity of species throughout the island. In November 2011, red-finned bullies and native crayfish were released onto Motutapu. The wetlands also provide important pollution control. With the cattle dispersed throughout the island, the wetlands act as wastewater treatment

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preventing pollution from spreading into the ocean (Knight et al., 2000). To keep cattle from trampling the wetlands, fences have been established preventing the cattle from destroying them. While the cattle are prevented from trampling the wetlands, their presence still impacts the soil making revegetation harder. While Motutapu's neighbor, Rangitoto, is flourishing with vegetation, Motutapu lacks the growth that Rangitoto has experienced. The once wooded island has been replaced with pastures containing few forest remnants of phutukawa, tawapou, kohekohe, taraire, maho, puriri and kowhai. Several shrubs, Coprosma, Macropiper, and Hebe are also present on the island. This vegetation is at risk of extinction due to the current farming practices (Miller et al., 1994). With the forest fragmented, the fauna do not have many places to call home.

Currently, there are black shore skinks and fifteen species of land snails living on the island along with several species of birds including, fantail, grey warbler, silverevee and several species of seabirds (Miller et al., 1994). The eradication of invasive species such as possums, wallabies, stoats, feral cats and rabbits has successfully been accomplished through dropping bait and using traps (see Figures 2 and 3) on Motutapu (Griffiths, 2011). According to the Department of Conservation (2012), Motutapu is now a completely pest free island. With the eradication of many of these pest species, for the first time in over a hundred years, red crowned karkariki have been seen breeding on Motutapu. Karkariki were not released on the island but instead flew over from the nearby island of Motuihe and hope that bellbirds from the nearby Rakino Island may also find Motutapu a suitable home. In February 2012, the endangered shore plover was released and in June the bush bird popokatea/whitehead and more saddleback were released. The red-fronted parakeet, which were also released onto Motuihe Island, have been spotted on Motutapu, both banded and unbanded, suggesting wild parakeets now live on the island (Ortiz-Catedral & Brunton, 2010). With the success of the eradication of pests, in August 2011 takahe and saddleback were released onto the island. The eradication of pests on Motutapu enables revegetation to begin. Before, rabbits, rats and mice would eat young seedlings, flowers, buds and even bark. Now, many seedlings can be planted without worry of rodents destroying the young plants. It is unlikely that these pests will return to the island unless some find their way onto a ferry transporting people back and forth from Motutapu (Department of Conservation, 2012). With the removal of the pests from the island, many weeds have been able to freely spread throughout.

Rhamnus, a small evergreen tree that dominates the coastline, is found throughout the Hauraki Gulf and replaces native plants on Motutapu by smothering certain reforested areas. Birds spread the seeds and while grazing by stock helps to control the weed, the eradication of pests has allowed it to amply grow without control since there are fewer animals to feast on the plant (Fromont, 1997). Rhamnus along with other bird-dispersed weeds such as privet, honeysuckle and pampas grass threaten to take over due to how easily it can spread across the island. These weeds compete with the current native plants that have already been planted on Motutapu (Miller et al., 1994). It is hard to say the best method for controlling these weeds, but volunteers help with the weeding and are significant to the success of the restoration.

There are many options for visitors and volunteers on the islands. Several walks encompass the island with areas for picnicking, kayaking, viewing historic sights and bird watching all attract visitors. Volunteer opportunities routinely run with overnight options. The volunteers are essential to restoring the island. Without their help, much restoration could not be accomplished. The eradication of pests from the island was not an easy task, but volunteers were essential to setting traps and helping with bait

dispersal. Now, volunteers have the option to help with building and track maintenance, weeding, shoveling and mowing historic sites. Volunteers also plant trees along the island and school groups can 'adopt' a section of the land to maintain. The help from volunteers in controlling weeds is particularly important to the success of the restoration project. Motutapu, like Tiritiri Island has become an open sanctuary meaning that the island is open to public access and the public can visit and enjoy the island (Department of Conservation, 2012). Through being able to visit the island and take part in releases of rare species, it allows the public to actively participate in the conservation efforts and learn more about restoration. Motutapu is also an important place for Maori culture. Many prehistoric artifacts are found on the island and the public can access these artifacts. Being able to embrace New Zealand's heritage by visiting prehistoric Maori sites and also having access to rare species of birds brings a unique aspect to the island allowing New Zealand heritage and environment to come together in one place for visitors to experience (Miller et al., 1994).



Figure 1: Location map with a star at Motutapu Island

Retrieved From: Edbrooke et al., (2003) *Geology and geological hazards of the Auckland urban area, New Zealand, Quaternary International*.

Recommendations

For vegetation to grow efficiently, the soil is an important factor for determining the success of the vegetation. Motutapu provides very fertile land with the volcanic ash layers that cover the island. However, the island has been used as a pastoral farm since the Europeans arrived in the mid 1800's. With all the cattle on the island, the soil has become increasingly compact resulting in the reduced volume of pores contained in the soil. Seedlings are especially susceptible to compacted soil because they grow better in porous soil. Roots of vegetation cannot easily penetrate deep into the soil if the soil is too compact (Heneghan et al., 2008). Motutapu is home to 3500 sheep and 1000 cows. The pastoral farms on Motutapu are attempting to aid in restoration and view their farming practice as helping preserve many archeological sites from being destroyed from tree roots (Motutapu Restoration Trust, 2011). Keeping cattle out of the areas

being revegetated is important to prevent further compaction and destroying the newly vegetated areas. If the cattle are not controlled, they could destroy much of the restoration already accomplished and prevent further success of reforestation.



Figure 2: Bait being spread over Motutapu Island
Retrieved from: Department of Conservation. <http://www.doc.govt.nz/conservation/threats-and-impacts/animal-pests/restoration-projects/rangitoto-and-motutapu-islands-restoration-project/photo-gallery/>

Weeds like rhamnus, privet, honeysuckle and pampas grass are dispersed throughout the island by birds. These weeds have become increasingly hard to control with the eradication of pests. Many rodents on the island helped keep the weeds under control by eating the seedlings. With the eradication of these rodents, the weeds can grow much easier. However, the cattle on the island do play an important role in controlling the weeds. Without the cattle grazing on the weeds, volunteers would have a much harder time removing these weeds by hand. With the increasing dispersal of the weeds by birds, if they are not controlled, the weeds could smother much of the current planting of vegetation that has been done. However, some of these weeds do provide food for birds so adequate replacements of food for birds need to be planted before extensive weed control.

The introduction of many native species of birds such as the shore plover, the bush bird popokatea/whitehead and saddleback was important to the restoration plan of the island. Much attention has been drawn to these birds and the public can come to the island to experience many endangered species of birds. While birds have public appeal, reptiles, amphibians and vertebrates are also an important aspect to restoring the island. Yet, these organisms lack the public appeal that birds receive so there is less public importance for the conservation of these organisms (Dodd & Seigel, 1991). However, invertebrates, reptiles and amphibians have an important role in the ecosystem through providing nutrients for birds. Invertebrates also play an important role in the ecosystem through herbivory, predation, parasitism, mutualism, and competition, all of which help balance

out an ecosystem (Kellert, 1993). Without invertebrates and reptiles on the island, revegetation also risks failure due to the fact that invertebrates and reptiles are important pollinators (Miller et al., 1994). Introducing invertebrates, reptiles and amphibians back into the ecosystem will help maintain a more balanced ecosystem promoting the long-term success of Motutapu.



Figure 3: Stoa traps being lowered onto Motutapu Island
Retrieved from: Department of Conservation. <http://www.doc.govt.nz/conservation/threats-and-impacts/animal-pests/restoration-projects/rangitoto-and-motutapu-islands-restoration-project/photo-gallery/>

Assessment of project viability

The goal of the restoration plan is to restore the island back to a functioning ecosystem. Several other islands around Motutapu have been successful in their restoration plans including, Tiritiri Island, Mokohinau Island, and Motuihe. Most of their success is due to the fact that they are pest free with sufficient help from volunteers. With the eradication of pests, Motutapu is well on its way to reaching the goal of becoming a functioning ecosystem. Now, birds can thrive on the island and rare species like Karkariki and the red-fronted parakeet have found Motutapu a suitable home even. Motutapu is a unique island with the incorporation of a working farm, pre-historic Maori archeological sites and the restoration of the ecosystem. The archeological sites inhibit trees from being planted for fear of destroying the artifacts. However, with Motutapu being such a large island, the restoration should still be successful. Already, birds have re-established themselves onto the island. Removing pests from the island was the main factor for the success of the island. While the cattle on the island may ruin or limit the reforestation efforts, Motutapu can still be a functioning ecosystem. The continual efforts made by volunteers with planting vegetation on the island, is an immense help to establishing a functioning ecosystem. Cattle and volunteers help

control weeds that threaten to take over the land. The wetlands on the island provide freshwater systems that many reptiles, amphibians and freshwater fish can thrive in. These reptiles, amphibians and freshwater fish cannot be overlooked; they are also important to an ecosystem. Revegetating the island, introducing birds and weeding are just the first steps to developing the ecosystem. Now that these steps have begun, the establishment of reptiles, amphibians and freshwater fish is important to the success of the restoration. With help from volunteers with weeding and continual plantings, the island is well on its way of becoming a functioning ecosystem.

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