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 Takahē (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 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 European settlers 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...
This vegetation is at risk of extinction due to the current farming experienced. The once wooded island has been replaced with pastures containing few forest remnants of piwakawaka, tawapou, korekore, taniko, mahou, pukori and kowhai. Several shrubs, Coprosma, Macrocarpa, and Hakea are also present on the island. This vegetation is at risk of extinction due to the current farming practices (Miller et al., 1994). While 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, silvereye and several species of seabirds (Miller et al., 1994). The eradication of invasive species such as possums, wallabies, stoats, ferel cats and rabbits has successfully been accomplished through dropping ball 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 Motuhe and hope that belbirds from the nearby Rakino Island may also find Motutapu a suitable home. In February 2012, the endangered shore bird was released and in June the brown falcon was released. Many 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 begun to freely spread throughout the island. A new green tree that dominates the coastline, is found throughout the Hauraki Gulf and replaces native plans on Motutapu. With the removal of certain beaches and areas. Birds spread the seeds and while grazing by stock helps to control the weeds, the eradication of pests from the island has become increasingly difficult to control with the eradication of pests. The continual efforts made by volunteers have been successful in their restoration plans including, removing pests from the island allowing New Zealand heritage and environment to come together in one place for visitors to experience (Miller et al., 1994).

The eradication of pests from the island was not an easy task, but without their help, much restoration could not be accomplished. With the eradication of pests, Motutapu is well on its way to reaching the goal of becoming a functioning ecosystem. Cattle and volunteers help to establish a functioning ecosystem. The continual efforts made by volunteers may ruin or limit the reforestation efforts, Motutapu can still be a unique place. Motutapu is a unique island with the incorporation of many native species of birds such as the shore bird, the brown falcon, 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 the eradication of pests, Motutapu is well on its way to reaching the goal of becoming a functioning ecosystem. With the eradication of pests, Motutapu is well on its way to reaching the goal of becoming a functioning ecosystem. With the eradication of pests, Motutapu is well on its way to reaching the goal of becoming a functioning ecosystem. With the eradication of pests, Motutapu is well on its way to reaching the goal of becoming a functioning ecosystem. With the eradication of pests, Motutapu is well on its way to reaching the goal of becoming a functioning ecosystem.
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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