The Environmental History of Manaaki Mai, Banks Peninsula

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Abstract

Andrea and Paul Hass-Dahl, owners of Manaaki Mai, are interested in learning about the environmental and cultural history of the land. They wish to protect it for future generations to enjoy and want to look at covenants as an option to do so. The research question proposed was:

What are the conservation values of Manaaki Mai and how can covenants be most effectively used to protect these conservation values?

A literature review was conducted on the conservation values of Manaaki Mai. The methodological process consisted of secondary data analysis, a stream survey, a geomorphic map and rock samples taken from the site. The results of the data describe the environmental history of the farm through the conservation values it holds. These values are shown through visual media as a website and video. Information on covenants and their alternatives were discussed in order to find a suitable solution on how to best protect the land for future generations.

1.0 Introduction

Manaaki Mai is located at 99 Port Levy Road, Purau, Banks Peninsula. The farm was recently bought by Andrea and Paul Hass-Dahl, who were fascinated with the beauty of the land.

Manaaki Mai has important conservation values relating to the geology, ecology and cultural history of the land. One significant feature is an old paper road that travels through the property. This is believed to have been used by early Europeans when they arrived in the area. There is also evidence of an old pub along the bank of the river, indicating further historical significance of the land. Andrea and Paul wish to protect Manaaki Mai for future generations to enjoy and wish to learn about what role covenants could be used in order to achieve this.

A literature review on the conservation values of Manaaki Mai was completed to gain an understanding of the importance of these values. The results of this research aim to discuss ways of protecting Manaaki Mai for future generations to enjoy. Covenants have been identified and discussed as well as alternatives to covenants. This is to provide the community partners numerous options as to the best way to protect the land.

1.1 Methodology

A combination of primary and secondary data was used during the research project. Primary data included a stream survey and the collection of rock samples from the site. Equipment was borrowed from the Biology Department to conduct the stream survey, which was conducted along the whole length of the stream. The recorded biota is discussed in the ecological section of the report. Rock samples were collected to determine the mineralogy to show the geological variation present. A geomorphic map was also completed to show the landforms which cover Manaaki Mai. Secondary data analysis was used to collect additional information on the geological, ecological and cultural values of Manaaki Mai and their significance.

2.0 Ecology

2.1 Overall Farm Ecology

Manaaki Mai encompasses volcanic bluffs, native forests, and silver tussocks, all of which have inherent natural value from providing habitat for organisms to encouraging further regeneration of native plants in the area. Currently the farm is home to native trees such as kānuka, podocarp hardwood, kōwhai, lacebark and many more (Head, 2019). Silver tussocks and native forest thrive on the many sunny slopes of the farm while the shady areas are mostly limited to the native forests. Various species of native and exotic birdlife can be found on the farm as well as some small lizards whose evidence of passing such as droppings and deceased bodies were observed, these included the Southern Grass skink, McCann’s skink, the Jewelled gecko, and the Canterbury/Waitaha gecko. Given the habitats supported by the

farm being suitable for 4 lizard types commonly found on the Banks Peninsula, the chance of all common species living on this site is probable. The birdlife on the farm can be seen without any extensive searching, it consists of, but is not limited to, fantails, silvereyes, grey warblers, bellbirds, and kereru. These birds are found throughout the entire farm, however, population density was highest in the native forest. Macroinvertebrates in the stream comprises a portion of the lower trophic levels for both birds and lizards to feed on (Head, 2019).

The regenerating areas on the farm are highly representative of low-land dry forests that historically covered the Banks Peninsula (Wilson, 2013). Some non-native species are also found throughout the farm, such as periwinkle, which dominates a large patch of land on the farm, is shade tolerant, and can compete at ground level with other native undergrowth when the native forests encounter it (Head, 2019).

The farm has been retired from stock, however, sheep and goats from the neighbouring farm trespass where the fencing is inadequate. These animals will have a negative influence on regenerating native species of plants as their eating habits are relatively unbiased, especially the goats. As a simple guideline to utilise for the continual regenerative nature of the fauna and flora on the farm, some weeding of exotic species such as the periwinkle. Another key aspect is establishing robust fencing along the exterior boundaries should help with native plant regeneration.

2.2 Stream Survey

The stream had a diverse bottom from sediment-rich areas to stones and gravel. The broader stream environment also differs significantly throughout the extent of the stream's reach on the property. The upper reaches of the stream are covered by native bush overhead with limited grasses or other undergrowth. Further down the native bush stops and is replaced by grasses with various trees, including kowhai, kanuka and willow, spread sparsely along the banks at varying distances from the stream. The farm doesn't currently graze stock of any kind and doesn't appear to have any unnatural riparian margins. Only two areas along the stream are currently being used for crossing. No man-made structures are associated with

these areas so taxa migrations will not be affected. The localised disturbance associated with each crossing will have minimal effects of the stream health.

Animal carcasses in the stream and an inlet from a neighbouring farm appear to be the main negative influence on the stream. These can lead to undesirable nutrient and sediment enrichment while also increasing pathogenic presence in the immediate and, to a lesser extent, the down-stream area. Secondary data from an independent ecological survey of the farm shows that with higher elevation the health of the stream improves. This data was used to calculate an overall macroinvertebrate Community Index (MCI) score. Appendix 1 shows a summary of the data, using the equation proposed by John Stark (Stark, 1985) to evaluate stream health based on the number and type of macroinvertebrates with respect to their tolerance levels, an overall and cross-sectional MCI score can be calculated. Using an average tolerance value representative of each type of macroinvertebrate subclass, where stoneflies are an eight while the snails, worms, and slugs are a two. The overall MCI score of 130 out of a possible 200 was calculated for the entire reach of the stream on the property. The equation set by John Stark with which this value was derived is as follows:

$$20 * = \sum ai / S$$

This equation uses ‘ai’ to represent the nth taxon and its associated tolerance while ‘S’ is the total number of taxa in the sample, this system as shown here is from a standard method used by the Department of Conservation (DOC) for evaluating stream health (Grey, 2013). The adjacent farm has an outlet that enters the stream between sites 7 and 8 (Appendix 2), with the community partner’s worries that it might contain contaminants of various sorts, two additional MCI scores that separated those sites above and below were calculated. Above the inlet, the MCI score was 154 while for the samples taken below the inlet, the MCI score was 57. An MCI score below 80 is considered poor quality water while anything above 120 is considered clean water (Grey, 2013). Both primary and secondary observations of the stream labelled the portions directly below the inlet to be less transparent than the water above this inlet. These observations fit with the data gathered from the streams lower reaches as snails and worms have high tolerance to stream beds coated in sediments.

3.0 Geomorphology

Land sliding is one of the most important hazards of the area with the loose steep slopes covered in sandy soil prone to giving way. The sediment is saturated with water due to the many springs that surface on the slope and fill the pore spaces. This combined with periods of excess rainfall led to a large number of slips due to oversaturation resulting in loss of friction in the sediment (Summerfield, 2014). Slumping is a type of landsliding where cohesive blocks of soil and rock slide down a slope, most commonly only partway, and remain cohesive after sliding (Marshak, 2015). Historically the area is noted to be highly prone to landsliding and slumping (Stapylton-Smith, 1993). A map of the areas with the highest landsliding risk and descriptions of why those sites were chosen can be seen in appendix 3.

4.0 Geology

4.1 History

Banks Peninsula sits on top of the remains of four volcanic systems: Lyttleton, Akaroa, Mt. Herbert and Diamond Harbour (Dwyer, 2014). The farm and surrounding area have the greatest lithological diversity on the peninsula. The ridges observed are composed of lava flows from Lyttleton, Akaroa and Mt. Herbert volcanic complexes and hold a great range of volcanic history (Christchurch City Council, 2007). These volcanic complexes are discussed in depth in the website.

4.2 Mineralogy

For each rock type described below, there is a more detailed analysis in Appendix 4. Photo 1 shows a sample of a boulder that was located on the bluff of the farm. This rock is unique as it is from a trachyte dike, which are common around Banks Peninsula (Dorsey, 1988). The rock mainly consists of alkalic feldspar, plagioclase and quartz. This indicates there is a dike (a sheet of magma that has intruded an already existing rock and cooled) in the vicinity of the farm.

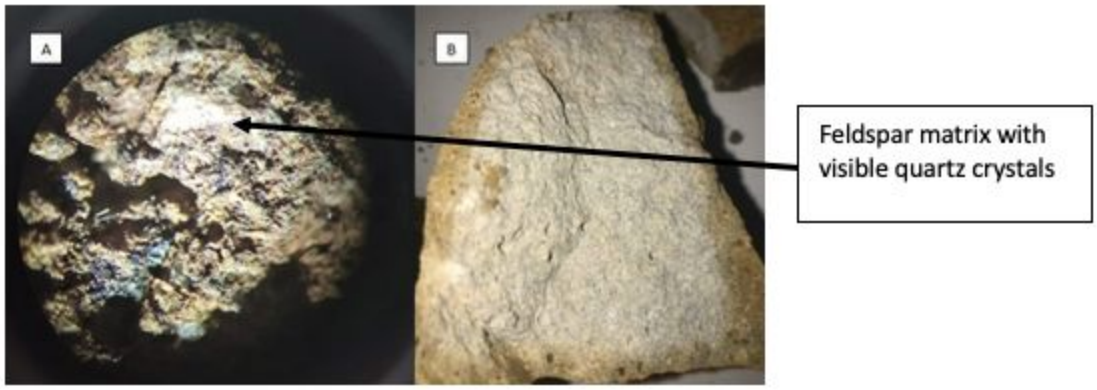

Photo 1.

Photo 2 shows a volcanic tuff rock, this forms after high quantities of ash are deposited and consolidated after an eruption. Within the sample there were also some volcanic tephra pieces within the rock. The rocks powdery and soft texture, and red oxidised colour indicate this.

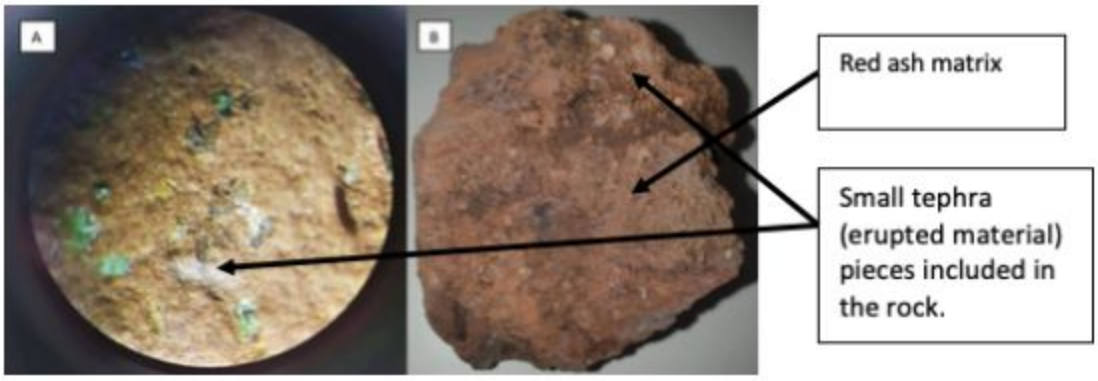

Photo 2.

Photo 3 and 4 show basaltic porphyritic rocks similar to the majority of the boulders looked at on the farm. Porphyritic is a rock that has large crystals. In the samples there are feldspar, amphibole and quartz crystals present.

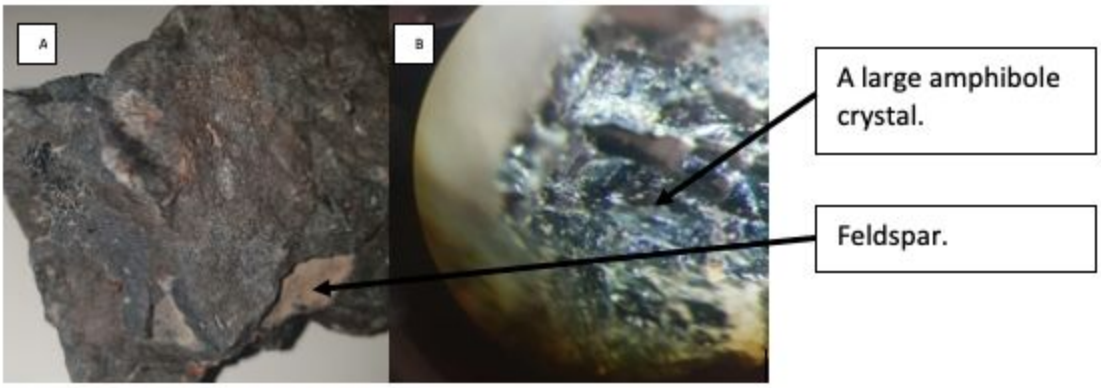

Photo 3.

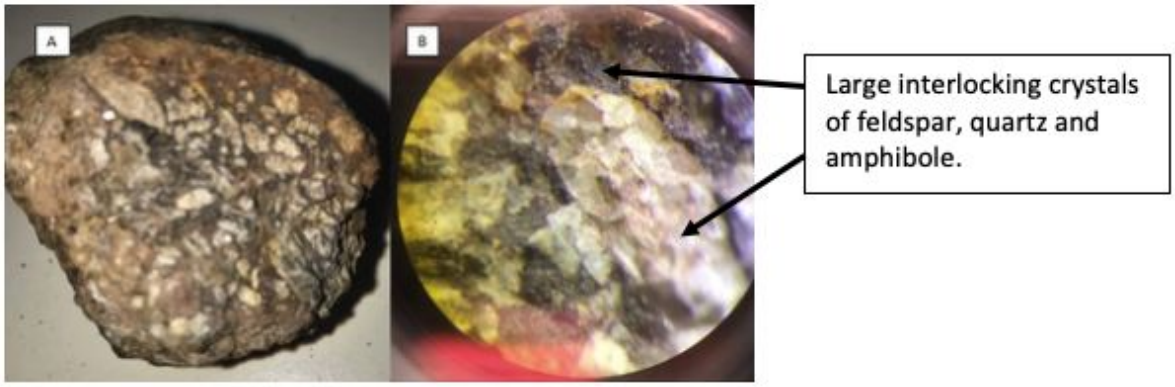

Photo 4.

The large variety of rocks present on the farm indicate it is located in one of the most geological diverse areas of the Banks Peninsula (Miskell, 2007). There is potential for the farm to contain rocks from any or all of the volcanoes that originally formed the Banks Peninsula, as well as potential volcanic dykes. To identify which specific volcanic centre the rocks are from, further chemical or isotope analysis would need to be carried out.

4.0 Cultural Significance

4.1 Māori history

Purau is rich in Māori history, perhaps dating back to moa-hunting ancestors (Ogilvie, 1970, p. 14). The Ngātimāmoe tribe were the first Māori inhabitants of Banks Peninsula, however, they were displaced from the Peninsula by the Ngāi Tahu, a more powerful tribe from the north (p. 21). The hills of Purau often feature in Māori poetic myths. Above Purau lies one of the chief pās of the Puru

Paiareke, Te Pohue or the Rhode's Monument. When covered with mist, the skyline of Purau is said to be a "hill of the fairies" (p.20). This is the story of the Maid of the Mist, explaining the lone cloud which can sometimes be seen descending the face of the Monument. Ogilvie (1970) explains that in 1700, when Ngāi Tahu and Ngātimāmoe came to battle, the Ngāi Tahu leader Moki noticed a young chief, Puketapu, was missing. Puketapu had thrown his cloak over a beautiful Ngātimāmoe maiden and took her to Purau Bay. Ngāi Tahu tribesman were ordered to follow Puketapu, kill the girl and return Puketapu to be reprimanded. Before the maiden died from a strike to the head, she said to Puketapu "If you reside at Purau I will appear to you on a misty day in the form of a cloud" (p. 21).

Kawakawa can be found planted in various places of our community partner's property. Our community partners are familiar with the traditional medicinal powers of the kawakawa plant, which was often used to create a herbal tonic. Andrea and Paul also suspect that the singular cabbage tree (shown in Photo 5) planted by what is deemed to be the original dwelling site may have been purposely planted there. Māori have long used cabbage trees as a source of food, clothes, fibre and medicine. Cabbage trees were also planted to mark trials, boundaries, urupā (cemeteries) and births (Department of Conservation, N.D.).

Photo 5: a singular cabbage tree suspected to be planted by Māori

4.2 Pakeha heritage

4.2.1 Greenwood family home

The Greenwoods, who settled Purau in 1843 are regarded as the first permanent European settlers in Lyttelton Harbour. The Greenwoods did not bring any rights to freehold in the South Island, and simply squatted in Purau. The Māori originally objected to their squatting but eventually leased them all the land on the south side of Port Cooper and Gebbie's Valley and back to a line from Kaituna to Port Levy. The yearly rent was seven blankets and some printed calico (Acland, 1946). The attitude of the Greenwoods towards the Māori's claim for rent or payment of their land was uncompromising and caused resentment among the Māori people. The Greenwoods have been described as straight-forward and honourable men, but had difficulties with the Māori people and the station hands (Ogilvie, 1970). In 1844, Edward Shortland, "Protector of Aborigines", visited Purau and helped resolve the dispute with local Māori about the Greenwoods' leasing of the land (Beaumont, Carter & Wilson, 2014).

The Greenwoods' original home is said to have resided on Andrea and Paul's property. Shown in Photo 6, the Greenwoods' original home lay on the hillslope. Stapleton talks of how the "earlier site is now marked by fragments of cobblestones and rock foundations all covered in periwinkle" (Ogilvie, 1993). Similarly, Ogilvie (1990) states that the Greenwoods built a "substantial weatherboard house high up one of the gullies below Mount Evans, close to native bush and running water and well clear of the Māori settlement by the beach". Photo 9 - 15 show the flattened land, periwinkle and cobblestones that exist today at what is suggested to be the Greenwoods' original homestead. The land is flattened, showing where the original foundations may well have been built and close to native bush and running water, as suggested by Ogilvie. The Greenwoods' home also provided the setting for the first documented robbery in New Zealand committed by the "Blue Cap" Gang in 1846 (Ogilvie, 1990).

Photo 6. A picture of Greenwoods' original homestead from Stapleton's book.

Photos 7 – 8. Greenwoods' original homestead site in 2019.

Photos 9 - 10. Flattened land at a second site below the Greenwoods' original home.

Photos 15 - 16. Cobblestone retaining wall at the second site.

4.2.2 Paper Road

A paper road, or unformed legal road is a "parcel of land that has been legally designated as a road but has not been formed" (NZ Walking Access Commission, 2019). From a legal perspective, a paper road is just as legitimate as a permanently formed main road. For several decades from the mid 19th century, travel on land around Banks Peninsula was subordinate to travel by sea. Nevertheless, walking and bridle tracks were formed and used from the early years of European settlement of the Peninsula (Beaumont, Carter & Wilson, 2014). Banks Peninsula is home to many paper roads across private land. The Banks Peninsula District Council has authority over all unformed legal roads.

Andrea and Paul proudly maintain some of approximately 56,000 kilometres of paper roads in New Zealand. Some landowners may not know a paper road exists of their land and some refuse to acknowledge the right of public access. Fortunately, our community partners are open to the idea of public access and wish to encourage the use of the paper road, enabling locals and others to experience the sights their farm has to offer. The paper road that runs across their land splits off from Purau Port Levy Road and leads over the Purau-Port Levy saddle, connecting with Wharf Road, Port Levy.

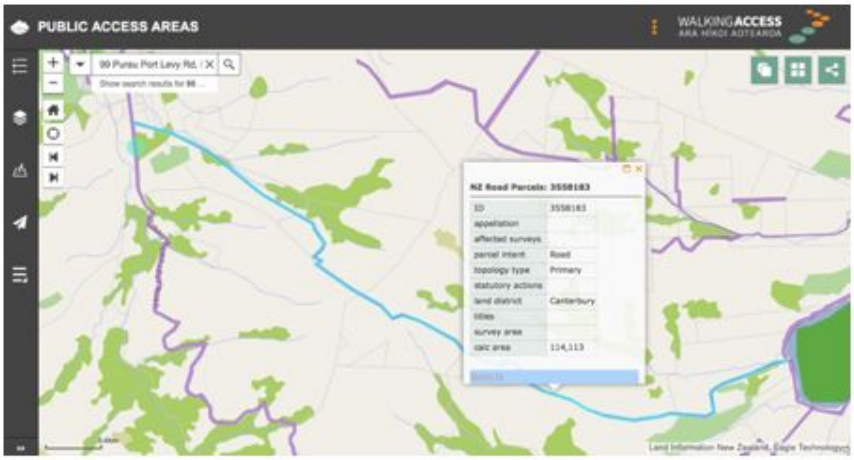

Image 1. The paper road that runs along our community partner's farm (shown in blue). Source: NZ Walking Access Commission (9 January 2019).

Andrea and Paul's paper road could well have been a tributary to the "Purau Line", a graded walking track which was initiated by the newly elected Provincial Government in the 1850's. Almost immediately dubbed the "bridal trial", the road was taking traffic by 1858. The track ran at a regular gradient from Purau beach, past the Greenwoods' original house and just west of the Rhodes Monument, and then climbed to the summit ridge of the Peninsula at a saddle between the Kaituna and Port Levy Valleys. The track then left the Purau-Port Levy Saddle, going east along the summit ridge, past Mounts Fitzgerald and Sinclair until it connected another track cut in 1843. Ogilvie (1970) also makes note of a road built to Port Levy in the 1890s which rose up at the head of the Bay and over the crest between Little Hill and the Rhodes Monument.

5.0 Covenants

A covenant is a legal agreement between the landowner and the covenanting agency which requires landowners to manage the land for conservation purposes and specifies how the property's natural values will be protected (e.g., where fencing is needed and whether public access will be allowed). The landowner retains ownership and the covenant is registered against the title, usually in perpetuity. A covenant is binding on future owners (Department of Conservation, N.D.; Banks Peninsula Conservation Trust, N.D.). The covenanting agency may provide specialist advice and financial assistance to the landowner, usually for surveying, legal and fencing costs (Department of Conservation, N.D). The land and all things relating to the land in the future will comply with a set of rules and regulations set at some time by the landowner at the time and the covenanting agency. The values comply with sustainable land-use practices and any form of activity deemed undesirable by the landowners at the time of covenant commencement can be limited (Covenants, Conditions and Restrictions, 2012). In this way will the community partners will be able to place the land under any diverse or simplistic protection strategy they desire. With almost 70% of New Zealand in private ownership, protecting private land is critical for conservation, especially for the reversal of the decline in indigenous biodiversity (QEII National Trust, N.D).

5.1 Alternative Methods of Protection

5.1.1 Public Reserve

Creating a public reserve is done to conserve some inherent value on the land whether cultural, social, and even biodiversity/natural such as a threatened species or area. These reserves are often non-profit areas, however, with walks/treks installed that don't interfere with the inherent values trying to be protected, the area can be economically self-sustaining (Reserves Act Guide, 2004).

5.1.2 Māori Land Trusts

Multiple forms of Māori land trusts exist that cover many situations such as the pūtea trust where for non-economical purposes individuals under the pūtea umbrella can pool their land and associated interests together. The whānau trust is one where ancestral land can be preserved by combining the shares of related landowners to stop individual shareholders from making decisions about the land (Māori Land Trusts, N.D).

5.1.3 Outstanding Natural Landscapes

Labelling an area as an outstanding natural landscape (ONL) enables it to be incorporated into plans for the area that considers its title granted protection. The title, ONL places an area under a form of general protection that restricts the activities allowed on the land in favour of conserving the values associated with it (NRC, 2014).

5.1.4 Cultural Heritage Site

As a cultural heritage site, this block of land could fall under the protection of the Heritage New Zealand Pouhere Taonga Act 2014 (Heritage New Zealand). This protection is for those natural areas, artefacts, and architecture linked to human activities before 1900. Heritages under this form of protection do not act in perpetuity (Heritage New Zealand, N.D).

5.1.4 Land Donation

Land can be donated to various agencies such as the Wildlife Land Trust, Conservation Volunteers, Forest and Bird NZ as well as local councils and the New Zealand Government. Donating land can be an effective means of securing land for conservation values. However, the conservation values and measures will then be at the discretion of another.

5.1.5 One Billion Trees Programme

The One Billion Trees Programme, implemented by the New Zealand Government, aims to double the current planting rate to reach one billion trees planted by 2028. The programme hopes to diversify New Zealand's existing land uses rather than see large-scale land conversion to forestry. $240 million is available in the One Billion Trees Fund for landowners, organisations and community partners to plant trees (Te Uru Rākau: Forestry New Zealand, 2019).

5.2 Covenants and the Banks Peninsula Conservation Trust

Although our community partners are set on securing a covenant over their land in the future, it is important to understand why the legal protection of a covenant is the most suitable method of protection for our community partners and their property. A covenant is a legally binding document and exists in perpetuity, thus disregarding ownership changes (QEII National Trust, N.D.). For Andrea and Paul, leaving behind a property full of indigenous flora and fauna for the benefit of future generations lies at the heart of their conservation values.

As at March 2019, the Banks Peninsula Conservation Trust (BPCT) has 71 covenants legally protecting 1,460 hectares of land. To establish a covenant, a land survey, fencing of the area, an ecological survey and undertaking of the legal requirements to register the covenant on the land title must occur. Landowners retain full ownership of their land and the BPCT provides advice on management through an ecological management plan developed for each covenant (Banks Peninsula Conservation Trust). A BPCT covenant is a particularly suitable method for our community partners due to the location of their property. A covenant issued with BPCT will provide special measures for conservation due to their existing and well-founded knowledge about Banks Peninsula's important ecological and scenic assets.

5.3 Conditions for the Covenant

A covenant document describes location, conservation values, what is permitted and what is not permitted, and the landowner's and the covenanting agency's responsibilities. A management plan associated with most covenants will include an ecological assessment,

maintenance regime, monitoring plan and any variations to the covenant (Banks Peninsula Conservation Trust). General maintenance, such as fencing, and implementation of regional requirements remain the responsibility of the landowners with support from the trust where appropriate.

For Andrea and Paul's covenant, we recommend that beneficial conditions include:

- Protection of indigneous flora and fauna
- Adequate fencing should be maintained to limit unwanted stock from neighbouring land
- Prohibition of stock grazing
- Prohibition of mass removal of indigneous flora and fauna
- Prohibition of subdivision

6.0 Package of Information

One of our partner's desires was to be given a "package of information" which they could share with guests and younger generations. To do so, we chose a video and website because of their engaging and interactive nature. The website can be accessed here: https://manaakifarm.weebly.com and screenshots of the website can be seen in appendix 5. Weebly was used to create the website as time constraints meant learning code from scratch was not feasible. Weebly has an easy-to-use format which made the process of designing the website easier. The integration of information into a cohesive story-like format for readers was inspired by John McPhee's *Rising from the Plain*s.

The website includes an interactive map, created to increase engagement and show where the sites discussed on the website were situated, as well as provide a brief summary of the key points of those spots. The process of creating the interactive map was challenging, combining Google Earth Pro, ArcGIS Desktop and ArcGIS online to create the layers in formats able to be embedded in the website. Some challenges were not solved, including how to include photos in the popup boxes. Despite seeking help from ArcGIS Online help, and GIS staff at the University of Canterbury, this feature was not able to be included, which decreased the visual value of the map.

The video summarises our findings and displays the beauty of Manaaki Mai. It can be accessed by this link https://www.youtube.com/watch?v=clUFOvLvJ9M&t=9s

Photo 17. Screenshot of the video which is viewable through the link.

8.0 Limitations

Several limitations occurred during research that limited the group's progress. First, during the site visit it was discovered that there were few in situ rocks. This meant that a geological map was unable to be completed. Hand samples from the rocks at the site were collected to infer the volcanic group that the rocks originated from, however time and equipment restraints meant this was not possible.

Secondly, as the community partners were overseas for the latter half of the project it made it difficult to get in contact with them for further information we required. As the research site is located within private property, we were not able to travel to the site without consent from the community partners. This made it difficult to collect further information.

Lastly, the amount of time we had to complete the project made it difficult to collect accurate and comprehensive primary data such as the stream survey. The community partners have hired a contractor to collect data on the streams ecology, however we were unable to gather the results in time for the submission.

9.0 Conclusion

Manaaki Mai has important conservation values relating to the geology, ecology and cultural history of the land. The research we undertook on the geology of the area is insufficient to make a definitive finding. We recommend further professional research to develop in this area. The ecology on the farm is seen as being closely linked to what is estimated to have been found in the wider Banks Peninsula area as a whole before settlers arrived. Conserving and encouraging the future establishment of this ecology will add value to the land. The most significant finding of the cultural history was connecting the ties to the past, especially considering Purua's original homestead once resided at Manaaki Mai. Purau is also rich in Māori history. After collating the results and information, we created a video and a website in order to fulfil our community partner's desire for a "package of information" they can share with future generations. We have found that the best way to protect Manaaki Mai would be through a covenant. This is also what our community partners have said is their most ideal option. Since covenants act in perpetuity, establishing a covenant would allow for the continuous protection of the area for future generations to enjoy.

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Appendices

Appendix 1: Ecology Data

Stream Macroinvertebrate Sample data are shown in Table 1 below. This shows how many sites were tested along the reach of the stream within the property (16) and the variety of organisms found.

Site	Stonefly	Caddisfly	Mayfly	Snails	Worms	Slugs
1				1		
2				1	2	
3					2	
4	1					
5						
6						
7						
8						
9						
10	1					1
11	1					
12						
13	1					
14	6					
15	10					
16	1					

Appendix 2: Ecology calculations

Equations for calculating overall MCI score followed by that for above then below MCI score from the data in Appendix 1:

Overall: 20 * (((20*8) + (7*2)) / 27) = 130

Above: 20 * (((19*8) + (1*2)) / 20) = 154.3

Below: 20 * (((1*8) + (6*2)) / 7) = 57

Appendix 3 - Geomorphology

Geomorphology mapping in Google Earth resulted in the identification of multiple areas which have a higher risk of landsliding. There are several reasons for identifying these areas as listed below.

- The presence of springs saturating the soil in or above the selected area
- Area of steeper slope from previous landslides eg just above and below an old landslide scarp.

The red polygons in the photo below represent areas of highest landsliding risk identified in this project.

Appendix 4 - Mineralogy and Rock Types

- **Rock 1** - Trachytic Lava

Structure: Well rounded boulders on highest ridgeline of the farm.
Texture: Aphanitic to porphyritic texture. Very fine-grained but some large visible phenocrysts. Some small vesicles 1-5mm.
Composition: 70% matrix, 30% phenocrysts.

Mineral 1: The fine-grained matrix is likely to be plagioclase feldspar and makes up 70% of the rock.

Mineral 2: Some visible quartz crystals present about 5-20mm in length. Roughly 30% of the rock.

Locations: highest ridgeline of the farm.

- **Rock 2** - Volcanic Tuff

Structure: Rounded, boulders non in-situ.
Texture: Red-brown very powdery tuff, very fine-grained. Poor to moderate indurated.
Composition: 70% groundmass, 25% phenocrysts

Mineral 1: Amphiboles: Black shiny rectangles 5% of the rock, average size 1-2mm

Mineral 2: Plagioclase: most common of the phenocrysts, making up 20% of the rock. Range of sizes from 1mm to 1.5cm.

Locations: Close to the hut porch by the track, several boulders scattered along the lower reaches of the track

- **Rock 3** - Amphibole-rich basaltic lava flows

Structure: Well rounded non-in-situ boulders close to the edge of the stream and buried.

Texture: Porphoritic

Composition: 5% phenocrysts and 95% groundmass

Groundmass: Dark grey, fine-grained, much of the groundmass appears to have cleavage, therefore lots of plagioclase and amphiboles with cleavage and volcanic glass making up the groundmass.

Mineral 1: Olivine- rusted brown bubbly mineral with no cleavage, -2 cm in size, less 1% of the overall composition

Mineral 2: Amphiboles- Black shiny elongate rectangular, with two clear planes of cleavage, up to 1.3cm long, less than 1% of the overall composition

Mineral 3: Plagioclase- White grey rectangular mineral, cleavage present up to 1.7 cm long and 0.5 cm wide, less than 1% of the overall composition

Locations: Top and bottom areas of the stream, boulder by the garage.

- **Rock 4** - Pyroclastic Breccia

Structure: rough uneven lumpy surface.

Texture: Breccia. Large crystals and fragmented rocks cemented together by a fine-grained ashy matrix. The rocks exposed on the outside are rounded from weathering after lithification, but the fragments inside are mostly angular.

Composition: 70% phenocrysts, 30% matrix

Mineral 1: Amphiboles. Black shiny rectangle mineral. 10% of rock, average size 1-5mm.

Mineral 2: Plagioclase feldspar. Grey and white rectangular mineral. The most common mineral and makes up 40% of the rock. 1-20mm in length.

Mineral 3: Quartz. The second most common mineral, breaks in conchoidal fracture. Makes up 20% of the rock. 1-5mm in length.

Locations: Parts of the bluff, in-situ, Sections of the bluff outcrop

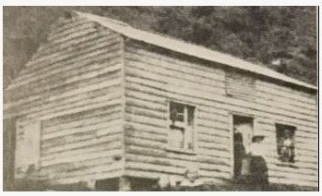
There are many variations on the rock types described here present on the farm, and we were unable to sample all of the boulders. Most of them looked similar on the outside due to moss and lichen cover so more rock types may be present on the farm that were not identified.

Appendix 5 - Website

These photos and corresponding text represent the information displayed on the website.

Home Page:

Out on the volcanoes of Banks Peninsula, hidden in the green valley of Purau, overlooking the blue waters of Lyttelton, is a small farm. This farm is called Manaaki Mai, which means we care, we cherish, and we sustain. Manaaki Mai is a very special place, with historical importance being the site of the first farm on Bank's Peninsula, and cultural importance as the old route between Koukourārata Marae in Port Levy and Lyttelton harbour and Te Wahapū (Heathcote-Avon Estuary). The rich ecology of the farm has significantly increased through the regeneration of native species across the area, from fantails, bellbirds and kererū to the growing stands of podocarp forest and kānuka, and insects. Much of the geology of the surrounding area is represented in the jumble of large boulders in the central gully, transforming the stream into a series of waterfalls and rock pools. This is a place of beauty, a place of tranquility. This is a place of history and significance to us all, for its place in the past, and the part it has to play in the future as a natural paradise.



HISTORY

Manaaki Mai includes many interesting historic sites such as the site of the first farm on Banks Peninsula. Click on the heading above for more information.

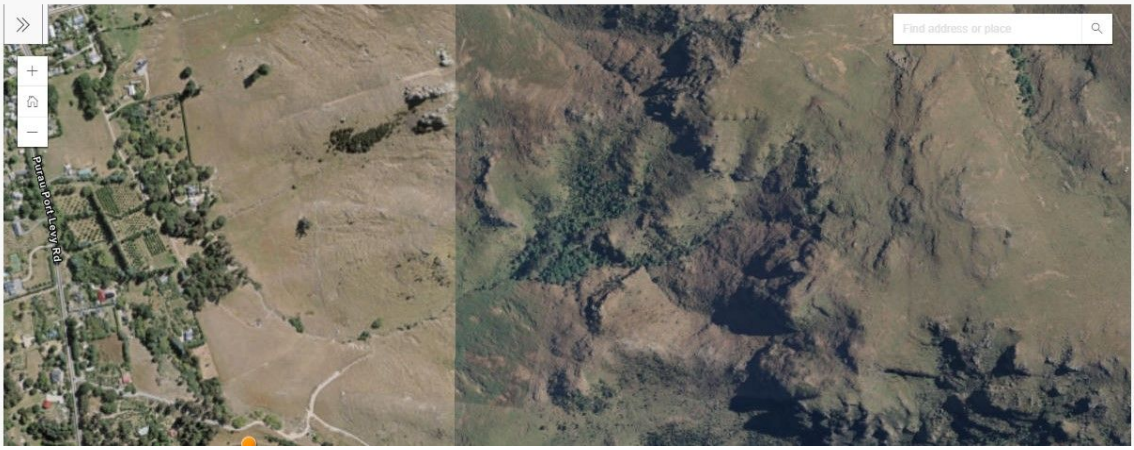
GEOLOGY

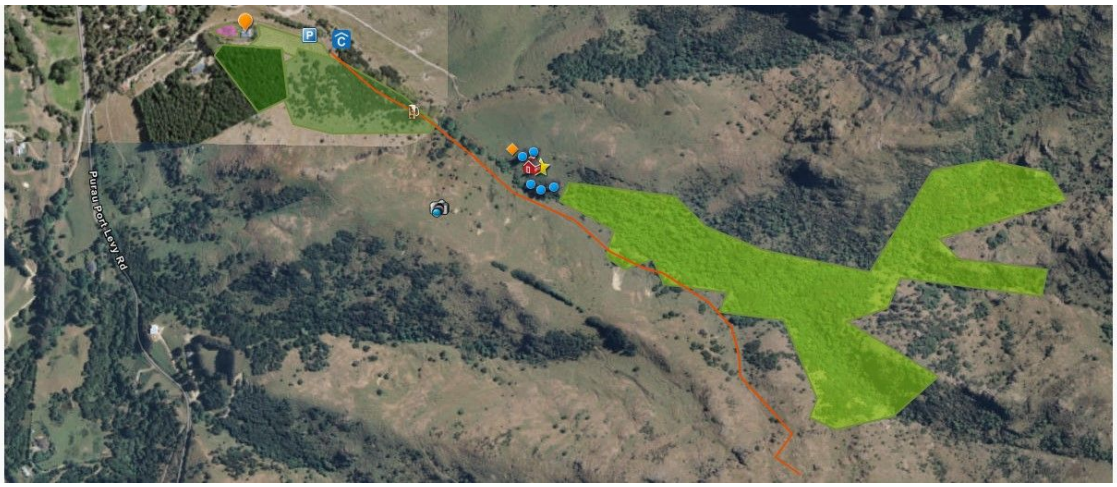
There are many interesting rock types present at Manaaki Mai, due to its fascinating volcanic history. Click on the heading above for more information.

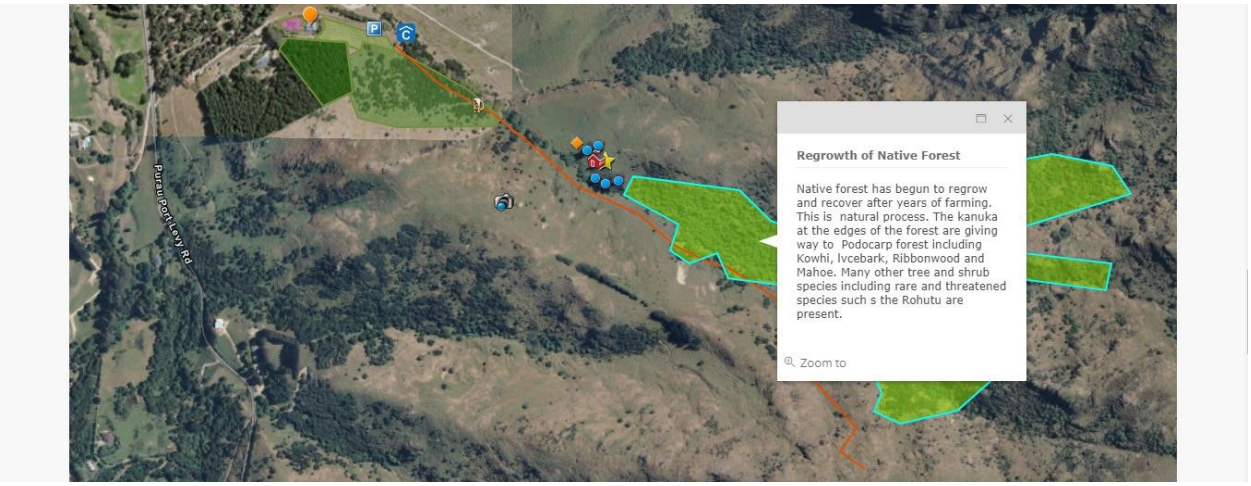
ECOLOGY

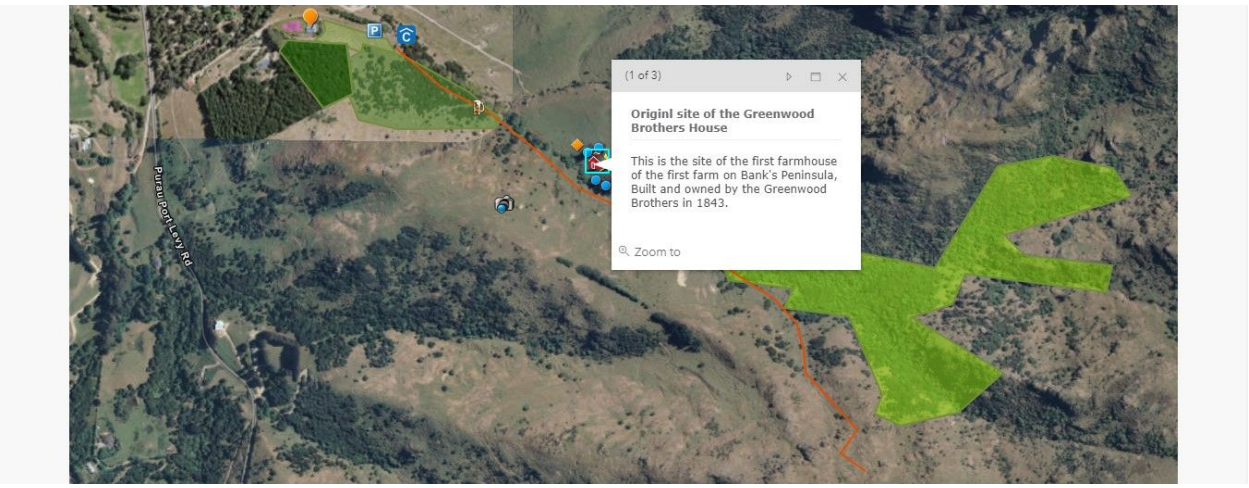
Regrowth of native forest along with recolonization of bird and insects has led to diverse ecology present on the property. Click on the heading above for more information.

Interactive Map: Click on the icons and coloured shapes to see more information about sites on the farm.









Geology Page:

GEOLOGY

Banks Peninsula sits on top of the remains of four volcanic systems: Lyttelton, Mt. Herbert, Akaroa and Diamond Harbour (Dwyer, 2014). The farm and surrounding area have the greatest geological diversity on the Peninsula. The ridges observed are composed of lava flows from the Lyttelton, Mt. Herbert, Akaroa and Diamond Harbour volcanic complexes and hold a great range of volcanic history (Christchurch City Council, 2007; Livermore, 1999). Below is general history of some of the volcanic complexes which contribute to the rock types in the area.

Figure 1: This is an aerial photo of Banks peninsula. The Lyttelton and Akaroa volcano remains are visible as eroded circular bays. Lyttelton is the northern remains and Akaroa are the south eastern remains. Christchurch is visible to the the north.

Lyttelton Volcanic complex

Lyttelton Volcanic Complex formed in the Late Miocene between 11 – 9.7 Ma and is composed of primitive and intermediate lavas that have included lahar and pyroclastic deposits
(McKenzie, 1995; Hampton, 2010). The cone was formed during periods of mostly gentle lava dominated eruptions with some explosive activity (McKenzie, 1995). The total erupted volume is estimated to be 350 kilometers cubed (Livermore, 1999). During the initial eruptions, lava flows erupted in a discontinuous fashion along basement rocks of andesites, torlesse and rhyolites (Sewell, 1985). Erosion is thought to have occurred over a 2 million year period during the Miocene, with further erosion occurring within the past 2.5 Ma due to sea-level fluctuations (Hughes, 2002).

There are two main centers for the Lyttelton Volcano. These centers are referred to as Lyttelton 1 and Lyttelton 2. Lyttelton 1 formed between 11 – 10.4 Ma and consisted of a steep volcanic cone made of lava, ash and volcanic debris called tephra. Lyttelton 2 formed between 10.4 – 9.7 Ma and is of similar composition to Lyttelton 1. It is believed that Lyttelton 1 eroded prior to the eruption of Lyttelton 2. Both volcanoes have been intersected by basalt to trachyte dykes, which are vertical sheets of un-erupted magma (Hampton, 2010; Shelley, 1987).

Mt Herbert Volcanics

The Mt Herbert Volcanic Group is the second oldest of the system, being active between 9.7 – 8 million years ago. The volcanic center began from the vents of the main Lyttelton crater before moving south-east and is believed to be the intermediate stratigraphic stage in volcanic activity between Lyttelton and Akaroa (Hampton, 2010; Sewell, 1985). Approximately 100 cubic kilometers of lava and volcanic material was erupted from the center (Livermore, 1999). The rocks are somewhat alkaline, with a combination of basaltic lava flows, plugs, pyroclastic and epiclastic deposits (Sewell, 1985).

Akaroa Volcanics

Akaroa is the biggest of the volcanic remains of Bank's Peninsula, making up ~2/3 of the Peninsula. The Akaroa Volcano was active between 9 – 8 million years ago, with the volcanic center located 20 km south-east of Lyttleton 1 (Sewell, 1985). Activity occurred simultaneously with the Mt Herbert Volcanic Group for some time. Approximately 1200 kilometers cubed of lavas and other volcanic material was erupted from the centre (Hampton, 2010). The rocks are typically alkaline, with a combination of basaltic to trachytic lavas and other volcanic components forming the cone and erupted materials. Previous research has shown that there are two phases of construction: an Early Phase and a Main Phase. The primary difference between the two phases is that the early phase contains a combination of lava flows, volcanic ash and trachytic rocks while the main phase contains solely lava flows (Dorsey, 1988).

Diamond Harbour Volcanics

This is the youngest group of volcanics on Banks Peninsula after the Akaroa Volcanics finished, 7-5.8 million years ago. Like the Mt Herbert group, the Diamond Harbour volcanics are found on the flanks of the remains of the Lyttelton Volcano.

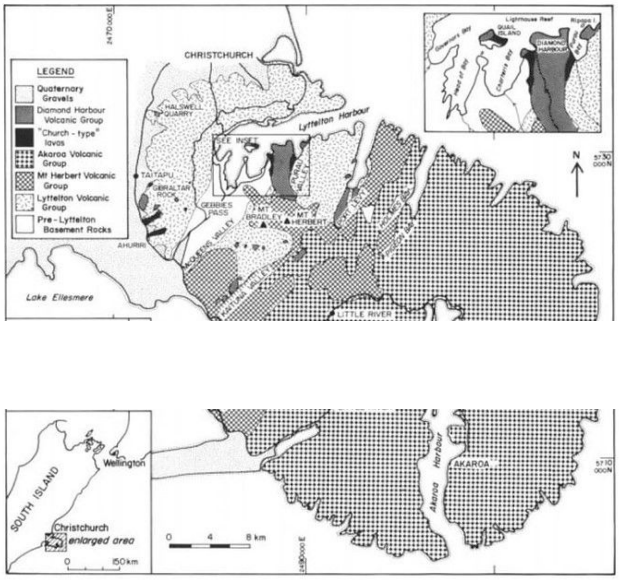
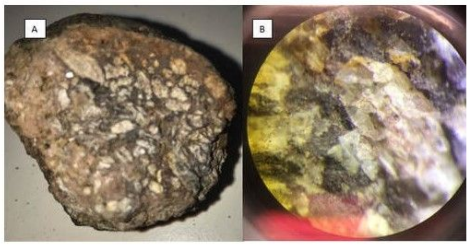


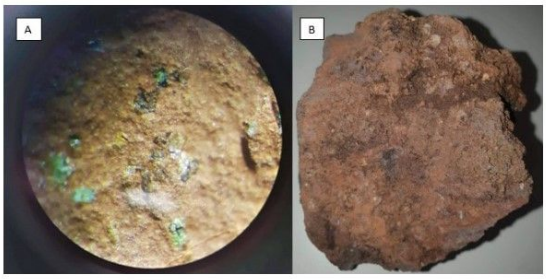
Figure 2: This is a geologic map of Banks Peninsula simplified to the four largest volcanic groups present. It was sourced from Sewell, 1988

ROCK TYPES PRESENT

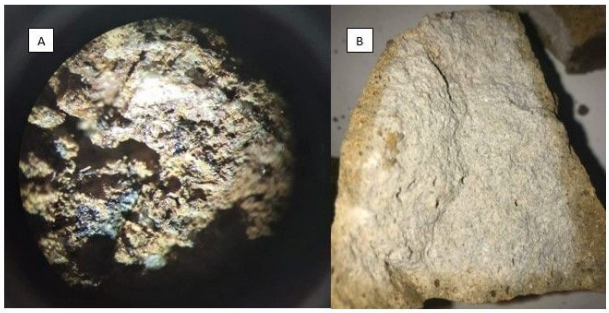
There were not sufficient outcrops to create an order of eruptions, however there was a huge variety of rocks present on the property, representing multiple eruptive events. There is at least seven distinct rock types on the property found so far, with the potential for more. Below are some images of rock samples collected, with some information on their characteristics.



This is a basaltic lava which has a texture called porphyritic. This is when there are large crystals in otherwise fine grained bedrock. Image A is of the rock, image B is using a standard microscope.



This is a volcanic tuff rock made of volcanic ash which has consolidated. There are also larger pieces of tephra within the rock. Image A shows the rock under microscope and image B shows the entire rock.



This rock is suggested to originate from a trachyte dike around the area as it very different from any other surrounding rocks. Quartz and feldspar is present and it has a vesicular texture. Image A under the microscope shows some of these minerals and B shows a section of the rock.

Figure 6: Boulder morphology itself varied significantly, as some were boulders of lava such as Boulder C, and some were pyroclastic units containing large boulders and ash, such as Boulder A. Pyroclastic flows are flows of hot ash and volcanic debris. These are extremely fast and deadly.

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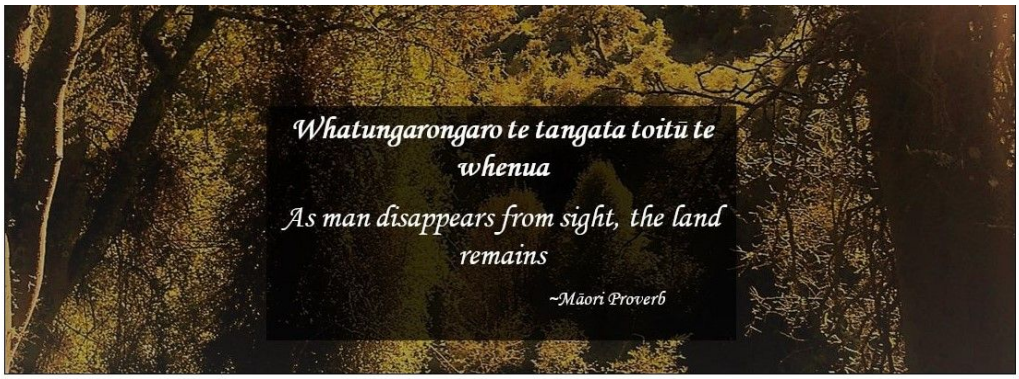
Ecology Page:

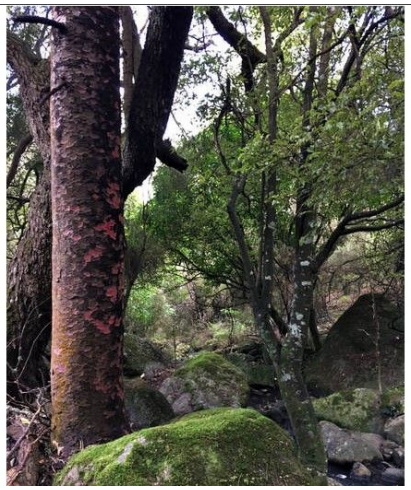
MENU MANAAKI MAI

HOME GEOLOGY ECOLOGY CULTURE HISTORY TOURISM OPPORTUNITY

Manaaki Mai has rich diversity of plants, birds and insects present. This includes introduced species such as macadamia, apple, apricot and walnut trees and an olive grove. Perhaps the most valuable part of the farm however, is the growing native podocarp forest recovering cross the south eastern part of the farm. This beautiful and diverse section of forest is expnding and will continue to do so in the future. This page will introduce some of the amazing ecology present at the farm.

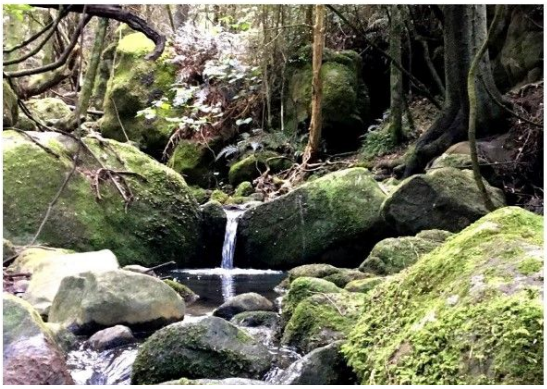


The greater Banks Peninsula area boasts a substantial ecological diversity supported by a large collection of different terrains and environments. Much of what once dominated the Banks Peninsula in terms of vegetation and wildlife has been destroyed and changed over New Zealand's short history, what remains of the original ecosystems has begun to regenerate in many locations in and around Banks Peninsula. Paul and Andrea's slice of heaven inland from Purau Bay exhibits exceptional diversity of land forms and associated ecosystems. From volcanic bluffs to the native hardwood forests and silver tussock between, a multitude of life exists in various forms. Exotic species also contribute to the diverse ecosystems supported on the farm as a whole, resulting in vibrant and flourishing life.



On the volcanic bluffs, native lizards such as the southern grass or McCann's skink and both jewelled and Canterbury/waitaha gecko species have been seen indicating their addition to life on the farm. The native forests are composed mostly of kānuka, kōwhai, podocarp and lacebark among many others. This collection of trees occupy various areas on the farm with some stretched being disconnected from each other. Each portion of forest has been steadily growing with full regeneration seeming probable in the years to come. These forests host a multitude of native and exotic bird types which form a key component of the overall ecosystem on the farm.

The bird life on the farm can be seen without extensive searching and consists of, but is not limited to, pīwakawaka, silvereyes, grey warblers, bellbirds, and kererū. These birds are found throughout all of the environments on the farm with more in the forested areas. These creatures provide a beautiful melody and flitting company across the farm.



Running through the higher reaches of the farm's forested sections is a stream that meanders down the length of the farm. Despite varying water quality, the stream is home to a host of freshwater invertebrate life, including; stonefly, caddisfly and mayfly species. This stream is characterized by cascading waterfalls splashing into rocky pools and is under the cover of various tree species for most of the length of the farm.

Exotic vegetation such as the willows that border parts of the stream, the periwinkle that dominates a portion of uncovered farmland and the gorse seen dotted throughout the farm are all part of the farm and will remain as such until full regeneration of native species has occurred. Until that time, Andrea

these species to ensure the farm continues on its utopian trend. An olive grove along with walnut trees and an orchard of fruit and nut trees adds to the diversity and provides yummy snacks.

The farm has been retired from stock and although the occasional animal slips in through a portion of damaged fencing, the farm is seeing the benefits of not having animals nibbling at vegetation and disturbing the stream's bank integrity. Pest control for possums and other pests is being undertaken using traps and hunting methods. This is helping protect the forest regrowth and encourage bird life.

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Māori History Page:

MĀORI HISTORY

Purau is rich in Māori history, perhaps dating back to moa-hunting ancestors (Ogilvie, 1970, p. 14). The Ngātimāmoe tribe were the first Māori inhabitants of Banks Peninsula, however, they were assimilated by the Ngāi Tahu, a more powerful Iwi from the north (Ogilvie, 1970, p. 21).

The hills of Purau often feature in Māori poetic myths. Above Purau lies one of the chief pāof the Puru paiareke, the reckon of Te Pohue or the Rhode's Monument. When covered with mist, the skyline of Purau is said to be a "hill of the fairies" (Ogilvie, 1970, p.20).

This is the story of the Maid of the Mist, explaining the lone cloud which can sometimes be seen descending the face of the Monument.

In 1700, when Ngāi Tahu and Ngātimāmoe came to battle, the Ngāi Tahu leader Moki noticed a young chief, Puketapu, was missing. Puketapu had thrown his cloak over a beautiful Ngātimāmoe maiden and took her to Purau Bay. Ngai Tahu tribesman were ordered to follow Puketapu, kill the girl and return Puketapu to be reprimanded. Before the maiden died from a strike to the head, she said to Puketapu "If you reside at Purau I will appear to you on a misty day in the form of a cloud" (Ogilvie, 1970).

Cloud covered tops of Bank's Peninsula. Sources from https://www.gang-gang.net/nomad/NZ/NZ20.htm

MEDICINAL AND EDIBLE PLANTS

Kawakawa can be found planted in various places of Manaaki Mai. Several plants on the frm have traditional medicinal powers for example the kawakawa plant, which is often used to create a herbal tonic. It is said to have antibacterial properties and draw out infection.

A lone cabbage tree grows alongside the banks of the creek running through Manaaki Mai. The cabbage tree is planted by what is deemed to be the original dwelling site may have been purposely planted there. Māori have long used cabbage trees as a source of food, fibre and medicine. The leaves were woven into baskets, sandals, ropes, raincoats, and other items. Cabbage trees were also planted to mark trials, boundaries, urupā (cemeteries) and births (Department of Conservation).

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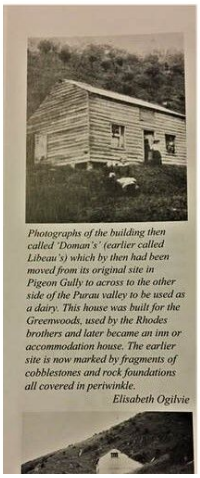
Pakeha History Page:

Manaaki Mai is historically significant for Banks Peninsula, and New Zealand as a whole.
The history is explored in this section, including the original owners of the area, why they sold the property, the creation of the Old Port Levy road, and the subsequent buildings.

PĀKEHĀ HISTORY

The first Pākehā owners

The Greenwood Brothers, who settled Purau in 1843, are regarded as the first permanent European settlers in Lyttelton Harbour. The Greenwoods did not bring any rights to freehold in the South Island, and simply squatted in Purau. The Māori originally objected to their squatting but eventually leased them all the land on the south side of Port Cooper and Gebbie's Valley and back to a line from Kaituna to Port Levy. The yearly rent was seven blankets and some printed calico (The Early Canterbury Runs: Containing the First, Second and Third (New) Series, 1946, p. 332). The attitude of the Greenwoods towards the Māori's claim for rent or payment of their land was uncompromising and caused resentment among the Māori people. The Greenwoods have been described as straight-forward and honourable men, but had difficulties with the Māori people and the station hands (Ogilvie, 1970, p.27).


Photographs of the building then called 'Doman's' (earlier called Libeau's) which by then had been moved from its original site in Pigeon Gully to across to the other side of the Purau valley to be used as a dairy. This house was built for the Greenwoods, used by the Rhodes brothers and later became an inn or accommodation house. The earlier site is now marked by fragments of cobblestones and rock foundations all covered in periwinkle.
Elisabeth Ogilvie

The Original Farmhouse

The Greenwoods' original home is said to have resided on Andrea and Paul's property. Shown in photo to the left, the Greenwoods' original home lay on the hill slope. Stapleton (1993) talks of how the "earlier site is now marked by fragments of cobblestones and rock foundations all covered in periwinkle". Similarly, Gordon Ogilvie (1990) states that the Greenwoods built a "substantial weatherboard house high up one of the gullies below Mount Evans, close to native bush and running water and well clear of the Maori settlement by the beach" (Ogilvie, 1990, p. 51).

The photo to the left shows broken pieces of an old glass handmade bottle. This was found at the site of the original Greenwood brothers house site. This is clearly handblown with a thick uneven rim and several small flaws. There was a glass bottle factory in Lyttelton at the time of the Brothers occupation, however there was not enough pieces of the bottle

to check the crest.

The photos below show the periwinkle and cobblestones that exist today at what is suggested to be the Greenwood's original homestead. The land is flattened, showing where the original foundations may well have been built, and close to native bush and running water, as suggested by Ogilvie.

Periwinkle covering the site of the original homestead on the site. There are said to be broken cobbles beneath the periwinkle however the thick bushes makes identification without clearing the area impossible.

This is leaning cobblestone wall placed in a steep bank to stop erosion of the banks. The grass hides lot of the wall.

This is a suspected site of shed/barn used for storing gear and feed, housing animals and milking. The cobble wall is just below the person taking the photo.

The Greenwood's home also provided the setting for the first documented robbery in New Zealand committed by the "Blue Cap" Gang in 1846 (Ogilvie, Banks Peninsula: Cradle of Canterbury, 1990, p. 51). The members of the gang posed as workers and went round the farms doing small jobs to gain familiarity of them before robbing them. The Greenwood's was the first place robbed, and this is suspected to be one of the leading factors why the Greenwood Brothers sold the farm less than a year later (Bulovic, 2013).

The Greenwoods were one of several British families who settled on the Peninsula and took up land agreements with local iwi (p. 70). In 1844, Edward Shortland, "Protector of Aborigines", visited Purau and helped resolve the dispute with local Māori about the Greenwoods' leasing of the land (Beaumont, Carter & Wilson, 2014, p. 155). George and Robert, brothers of W.B. Rhodes, who came to the Peninsula as a whaler, purchased Purau from the Greenwoods, held on Māori lease in 1847. The Rhodes then leased and later purchased large areas of the Peninsula. They took up their first pastoral license in Purau and by the time they sold Purau to H.D. Gardiner in 1874 the property was held in both freehold and leasehold (p. 72). In 1980, the then Purau Estate was divided into three farms, Fern Glen, The Kaik and Purau Station, for Gardiner's three sons.

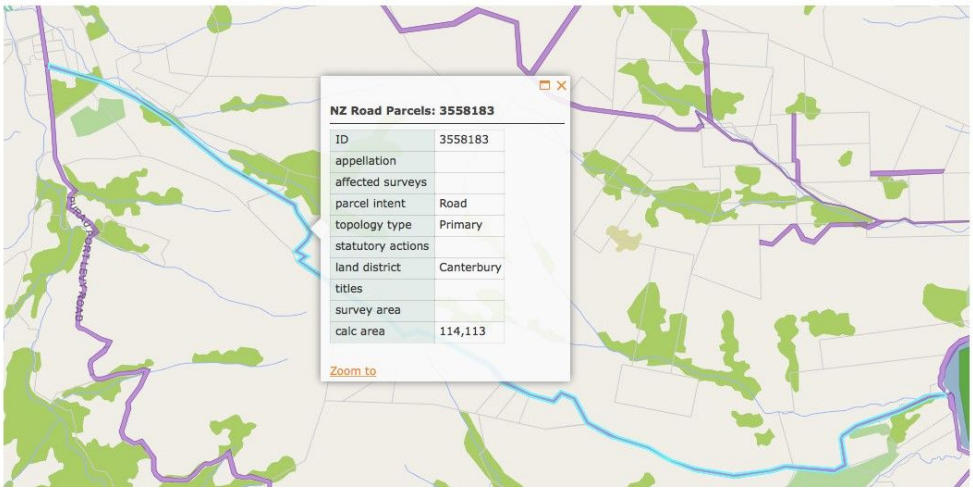
PAPER ROAD

For several decades from the mid 19th century, travel on land around the Peninsula was subordinate to travel by sea. Nevertheless, walking and bridle tracks were formed and used from the early years of European settlement of the Peninsula (Beaumont, Carter & Wilson, 2014, p. 247). A paper road, or unformed legal road is a "parcel of land that has been legally designated as a road but has not been formed" (NZ Walking Access Commission, 2019). In this regard, "formed" means physically constructed and includes gravelling, metalling, sealing or permanently surfacing the road. From a legal perspective, a paper road is just as legitimate as a permanently formed main road.

Andrea and Paul proudly maintain some of the approximately 56,000 kilometers of paper roads in New Zealand. Some landowners may not know a paper road exists of their land and some refuse to acknowledge the right of public access. Fortunately, the current owners are open to the idea of public access and wish to encourage the use of the paper road, enabling locals and others to experience the sights their farm has to offer. The paper road that runs across their land splits off from Purau Port Levy Road and leads over the Purau-Port Levy saddle, connecting with Wharf Road, Port Levy. Andrea and Paul can point out the zig-zagged scar in the land over the Purau-Port Levy saddle which they believe to be the paper road and the track which Māori used for trade and transport.

This is one of the right side boundary stakes of the paper road.

Most paper roads came into existence during original subdivision of land by the Crown in the 19th century for sale to European settlers. During subdivision, surveyors made provision for roads to enable access to the land being sold. Planners, often based in London, tried to work out where roads would need to go in the future to ensure that farms, logging projects, and towns would not be interrupted by private land. However, many of those roads were never formed. Banks Peninsula is home to many paper roads across private land. The Banks Peninsula District Council has authority over all unformed legal roads.



A Bar on the paper road 🍺

The Greenwoods' house eventually served as accommodation for travelers using the Old Port Levy Paper road. Eventually a bar was made to 'water' travelers on their journey. The suspected site for this includes several old steps, corner beams for a building and a rose bush just outside the far beam. The area is very small, however, it looks like significant erosion has occurred below the site in the creek due to changes in the river flow potentially because of blockages upstream.

This is one of the steps found at the suspected site of the bar on the Old Port Levy road. There are large heavily rusted iron nails holding the plank in place.

This is the far post with the remains of rose bush beside it. This is the only rose seen on the farm from our observations.

This image is taken beside the beside one post towards the other post. The step can just been seen in the pathway 1/3 way up the image where the path splits into two.

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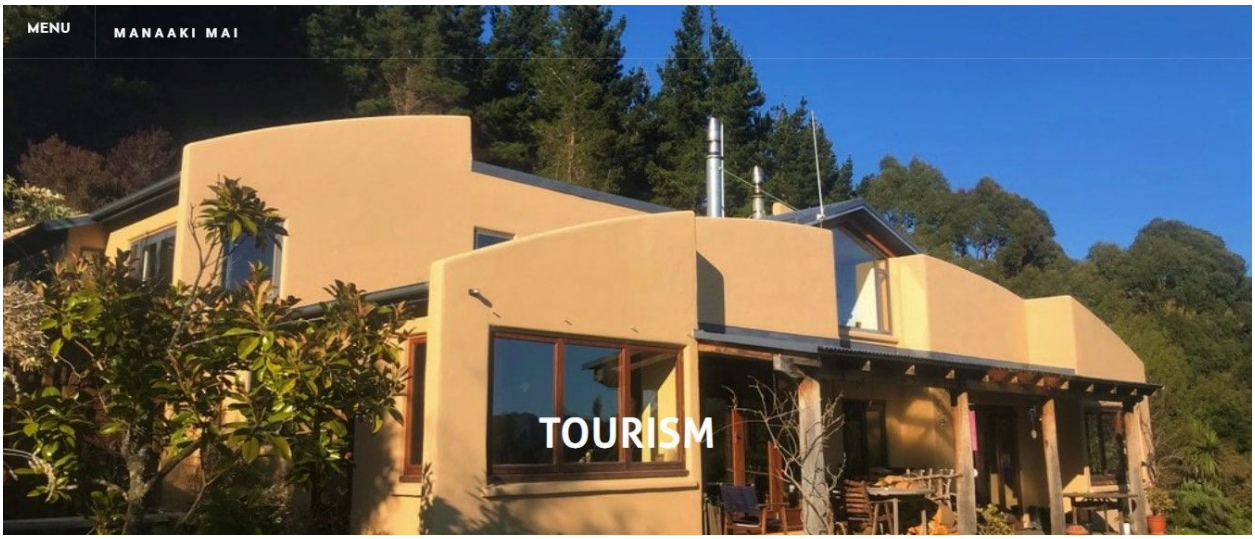
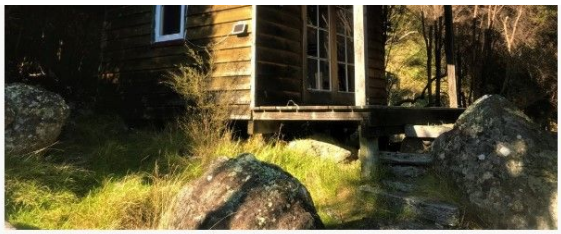
Tourism Page:



MANAAKI LODGE

Manaaki Mai currently has a Bed and Breakfast operating on the property, allowing guests to enjoy stunning views, birdsong and a lovely area with historical and ecological significance.

CLICK HERE TO VISIT THE LODGE BOOKING SITE FOR MORE INFORMATION



SECLUDED HUT IN THE BUSH

This is another option for visitors who want extra privacy or wish to be closer to the bush. Electricity is provided from small solar light, and candles are provided. There is an outdoor bath available to use as well (not just the creek, it's a real

VIEWS FOR ALL

There are stunning views in every direction to enjoy. To the north is the glistening blue waters of Lyttelton harbour. Lyttelton's lights reflect on the water at night, mirroring the stars in the sky above, not effected by city lights. To the east is craggy hills, to the south, the

tub!)

regenerating native forest. To the west is long valley edge full of geologic wonder, surrounded by yellow gorse.

Tours using the paper road

This can be an overnight trip starting with walking the old Port Levy paper road over the hills, down to Port Levy itself. There is then potential for a waka trip cross the port to the Koukourārata Marae.

Cultural tours

Cultural tours showing historical sites and ecology including Māori myths and legends, ecology, and the historical use of medicinal and edible plants. This could be a day trip option.

Bush craft education

This is an opportunity for community members to engage in the natural environment, learn about plants both native and exotic, the legends and uses surrounding them including medicinal and edible.

Currently, geologists in New Zealand are trying to gather enough information for Bank's Peninsula to be classed as a geopark. This will give it protection under the indigenous, local, regional and/or national legislation for protecting geological land formations with significance to an area (UNESCO Global Geoparks, 2017). The approach taken to identify an area as being a geopark pulls the community together from both local and regional levels in order to ensure all views are heard and the best method for proceeding is be obtained. Some of the standards involved with a geopark such as the area having to have geological heritage of international value might be a stumbling block for Manaaki Mai.

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