

Beyond the dollar: Carbon farming and its alternatives for Tairāwhiti
Māori landowners

By

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A thesis submitted to the Victoria University of Wellington in
fulfilment of the requirements for the degree of Doctor of
Philosophy

Victoria University of Wellington 2021

School of Geography Environment and Earth Sciences

Environmental Studies Programme



Abstract

This research explores landowner preferences for various land use options suitable for Māori land in Te Tairāwhiti, on the East Coast of the North Island of Aotearoa-New Zealand (henceforth Aotearoa). A particular emphasis is placed on the applicability and feasibility of native forest carbon farming within the New Zealand Emissions Trading Scheme (NZ ETS) and opportunities, barriers and risks associated with this land use. Alongside this focus, is a wider investigation into the socio-cultural, environmental and economic co-benefits Māori landowners associate with traditional and emerging land uses in Te Tairāwhiti. This study uses a transformative research approach that is rooted in the spirit of kaupapa Māori research.

Some 90 percent of Māori land in Te Tairāwhiti has severe limitations which restrict land use options to plantation forestry or pastoral farming for most landowners. A response to these limitations, and a land development option favoured by government agencies, and the academy, is for 'unproductive' Māori land to be retired into permanent native forest carbon sinks – a solution frequently proffered as a positive means to address national climate change commitments and local environmental and socioeconomic issues. Whilst these objectives, and the land use preferences of Māori seemingly converge, the wider history of land loss and alienation influences perceptions of fairness and equity for Māori landowners who may feel pressured by the lack of attractive land use options to establish permanent carbon sinks, which can effectively constrain land use options for future generations.

Through case study analysis of a Māori sheep and beef farming incorporation participating in the NZ ETS, this study suggests an economic case for carbon farming in Te Tairāwhiti. However, institutional and socio-cultural barriers hinder the participation of Māori landowners in the NZ ETS. The second focus of this thesis has been an investigation into how native forest carbon farming is viewed

when compared to other novel and existing land uses suitable for Māori land in the Waiapu catchment (a highly erodible catchment in Te Tairāwhiti).

Interviews with key informants were employed to curate a set of land use options for Māori landowners to appraise, using multi-criteria analysis, at two wānanga. Four land use models were created for appraisal by 16 Māori landowner participants. The strength of association between a co-benefit and a land use was collectively deliberated upon in each of these models, and ratings were assigned to reflect this association. These ratings have aided in assessing the wider value of land uses for Māori in the region.

The results from this research indicate an overwhelming preference for native forests when compared to other suitable land uses. Native forests are most closely associated with environmental co-benefits (erosion control, water quality, biodiversity and withstanding and limiting climate change) and social and cultural co-benefits (skills development, employment, reconnecting with the land, and self-determination/autonomy). The strong performance of native forestry stands in stark contrast with other land uses under consideration such as exotic forestry (*Pinus radiata* within the study scenario) and sheep and beef farming which occupy the majority of 'productive' land in Te Tairāwhiti. Exotic forestry and sheep and beef farming are associated with few benefits beyond employment and skills development. There is also a clear perception in the quantitative and qualitative data that these uses disconnect Māori landowners from their land and reduce the ability of communities to be self-reliant.

Interestingly, other novel land uses under consideration such as perennial horticulture (including blueberries, macadamia nuts and apples), medicinal cannabis and hemp, and hunting and tourism were also valued more than exotic forestry and sheep and beef farming. These results indicate that existing land uses, sometimes implemented without express input from local communities, are now the least preferred land uses. In addition, novel and untested land uses such

as medicinal cannabis and hemp, which do not exist at any scale in the region, are preferred over existing uses - even when there is scant evidence of success at any scale.

These results push back at the prevailing Pākehā dominated orthodoxy, which has existed from the early days of colonisation and holds that monoculture land uses, for profit above all else, are best suited to the land and the people. It is clear, from this study, that Māori landowners wish to move back to a vibrant multi-faceted land use regime – exemplified by diversity over homogeneity – that characterised the pre-colonisation Māori economy. This research accordingly introduces and explores a value articulating process that increases understanding of the aspirations and values of Māori landowners, and can assist Māori in progressing their land use futures.

Acknowledgements

This thesis can by no means be solely attributed to me. It is the product of many people, who over the years, have helped to shape my thinking and steer me in the right direction. I never intended to do a PhD, and it is with some surprise that I find myself 'here' at the tail end of seven years of tertiary study. I will now attempt to thank some of the people and institutions who helped me along the way.

I must of course begin by sincerely thanking all of my research participants. Volunteering your time and energy in participating in this research is something I am very thankful for. I would also like to acknowledge the financial support of the NZIF Foundation, Motu Economic and Public Policy Research and the Whakatane District Historical Society.

I feel immensely privileged to have attended Whakatane High School, and my experiences at this school have equipped me with the tools to attempt to tackle a topic of this magnitude. I would like to acknowledge Brett Donaldson, Sue Rapley and Lauren Crowe for nurturing my natural curiosity and providing so much encouragement during my teen years. I would also like to acknowledge my 'Wellington mums' – Sheena, Kathy, Trish and Rochelle at Fire and Emergency New Zealand (also John and David) who employed me and looked out for me when I was finding my feet in Wellington. It is much appreciated.

I am proud to have attended Victoria University of Wellington. I have been fortunate to have some amazing experiences and meet some inspiring people along the way. The support and collegiality within our School of Geography of Environment and Earth Sciences whānau is second to none. I have had support to attend the American Association of Geographers and New Zealand Geographical Society conferences which were both incredible opportunities to share my research and connect with others. Opportunities to tutor and lecture have also been a great part of the ride. My involvement with the Postgraduate Students

Association has also been a challenging and fulfilling component of my PhD experience.

I must of course thank the amazing postgraduate friends I have met along the way. The folks of CO102a – Ria, Chantal, Rachel and Nicola – you guys made the long days and nights that much more bearable. The 3pm quiz was often the highlight of my day and I have missed our weekly baking and average daily chat since you all rudely left. Special thanks goes to Nicola for putting up with me talking at her all year. Thanks also to the latter denizens of CO102a - Jerry, Katy, Elaine, Sylvie and Aaron – thank you for continuing with the quiz and accepting me into your masters whānau! I must also thank Amber and Ed who have been excellent office mates in CO104. Thanks also to Issie who was hugely supportive during my studies. Big thanks to Joey for showing me what not to do in the final stages of a thesis, but also for being a great mate over the years. Special thanks must also go to Pascarn who has been a huge support over my PhD, and one of the main reasons why I have got to the end in such good spirits.

I am immensely grateful for the support I received from Manu Caddie who was instrumental in setting me down this path of study and providing so much assistance along the way. Thanks also to Pia Pohatu who has been so patient and kind and also helped me to explore my genealogy in Te Tairāwhiti. To Nikki Searancke, you are so much more than a participant in this research. It was your kindness and openness that has allowed me to tell this story. I am so grateful for that opportunity. Thanks also to David Hall and Stephen Flood for the feedback on my research proposal, and Vicky Mabin for the patience in teaching me the basics of multi-criteria analysis.

I am so grateful to my supervisors, Becky Kiddle and Ralph Chapman. Becky, thank you for the kindness you have shown me over the course of these studies. I am so indebted to you for all the support you have given me over the last few years. It was your suggestion that I convert my masters into a PhD. It has sure been one

hell of a ride, and I am so fortunate to have had you helping me out along the way. Ralph, you are an entirely unflappable character and have provided constant reassurance and a calming presence throughout this journey. I have learnt so much from your musings and chats over coffee. Thanks a bunch.

I am lucky to have an incredibly supportive family. I am glad to knock my Aunty BD off her perch as the only Dr. Mercer in the family. I hope we can co-exist peacefully. Thanks to Nik, Chels, Joshie, Charlie and Viv and all my aunts and uncles scattered around New Zealand, Australia and America. My brother, Robbie. I am in constant admiration of the way you live your life and I will always try and take a leaf out of your book. Proud of you bro. My parents, Mairi and Geoff. Your quiet confidence and light touch with Robbie and I has been amazing. I hope we have done you proud. We are both so lucky to have such kind, loving and inquisitive parents. Thanks for everything.

To Celia, thank you for being such an amazing partner during the course of this research. Thank you for your unfailing support and kindness. You are *so* easy-going – and for that I am grateful. Beware, this thesis is quite chatty.

I dedicate this thesis to my grandparents. Firstly, to Ian and Joy, who I was unable to develop a relationship with. Secondly, my Nana Shirley, who is my best mate and constant companion. I cannot thank you enough for all the love and care you have given to me over the years. My Grandad Eric, it saddens me deeply that you aren't around to see this thesis in its final form. My thoughts are with you always.

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List of acronyms

1BT	One Billion Trees Programme
AbCF	Aboriginal Carbon Fund
DOC	Department of Conservation
ECFP	Erosion Control Funding Programme
GDC	Gisborne District Council
LINZ	Land Information New Zealand
LUC	Land Use Capability Index
MfE	Ministry for the Environment
MPI	Ministry for Primary Industries
NWR	Nga Whenua Rahui
NZ ETS	New Zealand Emissions Trading Scheme
NZFS	New Zealand Forest Service
NZETR	New Zealand Emissions Trading Register
PCE	Parliamentary Commissioner for the Environment
QE2	Queen Elizabeth II Trust

Glossary of Māori terms

Ahi kā	Keeping the home fires burning – denoting continuous occupation in an area
Awa	River
Hapū	Sub-tribe
Iwi	Tribe
Kaitiaki	Guardians/stewards with kaitiakitanga responsibilities
Kaitiakitanga	Guardianship and active stewardship of resources
Karakia	Prayer
Kaupapa	Topic or plan for discussion
Kīngitanga	‘King movement’ to confront the Crown
Kūpapa	Māori loyal to the Crown during the New Zealand Wars
Mahinga kai	Area of cultivation or source of sustenance
Mana whenua	Rights and power derived from authority over land
Māoritanga	Māori culture, practices and beliefs
Mātauranga	Knowledge and understanding
Maunga	Mountain
Mauri	The life force of all living and non-living entities
Mamae	Pain or hurt

Ngāhere	Bush or forest
Ngāti Porou	A Māori tribe with traditional governance over areas of the north-eastern coast of Aotearoa's north island
Pā	Traditional Māori fortified village
Papatūānuku	Earth mother
Pātaka kai	Food storage
Pepeha	Speech delineating whakapapa and geographic locality one comes from
Pōwhiri	Ceremonial welcome typically onto a marae
Ranginui	Sky father
Raupatu	Confiscation
Rohe	Boundary or territory
Rongoā	Traditional medicines and remedies
Rūnanga	An assembly of people tasked with governance
Tangata whenua	People of the land
Taonga	Treasure with social, cultural and environmental dimensions
Te ao Māori	The Māori world
Te reo Māori	The Māori language
Te Tiriti o Waitangi	The Treaty of Waitangi

Tikanga	Customary values and practices
Tuna	Eel
Tūrangawaewae	A place where one has the right to stand and belong through whakapapa
Urupā	Cemetery
Wāhi tapu	Sacred places of significance
Waiata	Song
Wānanga	A meeting with discussion and deliberation
Whaikōrero	Formal speech
Whakapapa	Genealogy and relationship between people and the natural world
Whakautaukī	Proverb or significant saying
Whānau	Family
Whānau	Family grouping
Whenua	Land

Definitions taken from Māori Dictionary Online: <https://maoridictionary.co.nz/>

1 Introduction

Māori land is estimated by Kingi (2008b) to constitute 5.6 percent (1,515,071ha) of the total land mass (26,930,097ha) in Aotearoa New Zealand. A large proportion of this land (both customary and freehold land) is classified as undeveloped and uneconomic (Carswell et al., 2002; Harmsworth et al., 2010; Kingi, 2008b; PwC, 2013). The East Coast region (Te Tairāwhiti) of the North Island contains approximately 16 percent of the total Māori land in Aotearoa and this land is often covered in mixed age 'scrub' (largely mānuka and kānuka) or gorse (Carswell et al., 2002; Harmsworth et al., 2002), leading some to describe such land as 'unproductive' or 'idle' (Barnard et al., 2012).

Māori land in Te Tairāwhiti has a variety of capability constraints, and evidence indicates that Māori landowners have historically struggled to profitably manage this land under pastoral agriculture or exotic forest regimes (Carswell et al., 2002; Funk et al., 2014). The limitations of Māori land resources in Te Tairāwhiti will be discussed in greater depth in later sections, yet, put simply are the result of a series of complex historical factors which has largely limited land use optionality to pastoral farming or forestry (Cortés Acosta, 2019; Harmsworth et al., 2010; Kingi, 2008b).

One response to these limitations, and a land development option often pushed by government agencies is for unproductive and/or marginal Māori land to be retired into carbon forests, where carbon is 'farmed' as trees grow and sequester carbon throughout their lifecycle. Sub-options here include permanent native forest carbon sinks, where the trees are not harvested; and harvested (but replanted) carbon forestry. These related options are frequently proffered as a positive land development solution addressing both national climate change commitments and local environmental and socioeconomic issues.

Significant areas of Māori owned land in Te Tairāwhiti (Funk et al., 2014) and Aotearoa (Harmsworth et al., 2010) are estimated to be eligible for carbon farming. Carbon farming is regulated by the New Zealand Emissions Trading Scheme (NZ ETS) and is defined by Funk (2009, p. 9) as “any land use in which landowners capture economic benefit from carbon sequestration”.

Establishing native forest¹ carbon sinks on areas of ‘marginal’ and ‘unproductive’ land may be perceived as an attractive land use option for Māori due to a variety of economic and non-economic co-benefits. Carbon credits generated through native afforestation on Māori land may be an attractive prospect to land owners, and especially so if the credits attract a market premium when direct bilateral relationships are established with emitters (Hale & Kerr, 2019; Pohatu et al., 2019). Moreover, land entered into the NZ ETS can be supported through funding mechanisms designed to facilitate afforestation such as the One Billion Trees Programme (1BT), and in Te Tairāwhiti, the Erosion Control Funding Programme (ECFP). In Te Tairāwhiti, carbon farming is a low cost land use option because it has low upfront capital requirements (particularly when utilising managed reversion), compared to pastoral land use options for example, and native forests regenerate relatively quickly, particularly when there are nearby seed sources (Carswell et al., 2002; Harmsworth et al., 2010).

¹ In this thesis, unless indicated otherwise, ‘native forest’ refers to indigenous forests with no intent to harvest. Likewise, ‘plantation forestry’ refers to 25-30 year rotations of the exotic radiata pine (*Pinus radiata*), which is the dominant commercial forestry species in Aotearoa. As in the 2019 report of the Parliamentary Commissioner for the Environment, this convention is adopted to reduce the need for repeat descriptions of forest type. It is acknowledged that alternatives exist.

Other economic co-benefits include an ability to earn returns from mānuka and kānuka honey and plant extracts, alongside other associated native pharmaceutical derivatives and selective native timber harvest (Awatere et al., 2018; Carver & Kerr, 2017; Funk et al., 2014; Funk & Kerr, 2007; Tuahine, 2018). Evidence in the literature indicates that income from so-called unproductive or marginal pastoral land can benefit local Māori communities (Carswell et al., 2002; Carver & Kerr, 2017; Funk et al., 2014; Funk & Kerr, 2007). Carbon farming has the potential to create jobs – in land surveying and planting, fencing, pest and weed control – which stimulate the regional economy and grow prosperity in Te Tairāwhiti (Carswell et al., 2002; Carver & Kerr, 2017; Funk & Kerr, 2007; Harmsworth et al., 2010).

The environmental benefits of continuous-cover native forestry on erosion prone land are well understood and include a variety of positive ecological aspects such as improved landscape resilience to flood risk; improved biodiversity outcomes; increased ability for growing and access to medicinal plants; and improved water quality in upland streams (Carswell et al., 2002; Porou et al., 2012). The social and cultural benefits to local communities (including increased use value of the land for hunting and fuel collection) are harder to quantify but an annuity from land previously not providing returns may retain and attract whānau back ‘home’, and may foster closer connections to ancestral land that has been restricted due to pastoral agriculture or plantation forestry (Barnard et al., 2012; Pohatu et al., 2019; Warmenhoven et al., 2014).

1.1 The research context - Te Tairāwhiti

This research has focused on Te Tairāwhiti – ‘the coast where the new sun shines.’ In official terms it is the Gisborne District. This focus has been borne out through an in-depth investigation of the Waiapu catchment – a highly erodible catchment within the region with acute environmental pressures that have strained communities and affected livelihoods in the area. Te Tairāwhiti (835,550ha) has

two sub regions: Poverty Bay to the south and East Cape which runs north of Gisborne around the easternmost point of Aotearoa. The region is characterised by rugged mountainous terrain with the Raukumara mountain range delineating the western boundary and the southwestern boundary abutting the western edge of Te Urewera National Park. Te Tairāwhiti stretches from Potikirua in the north at East Cape, with the southern border at the Mohaka river – south of Wairoa. The region runs inland to Matawai, and south to Tuai at Lake Waikaremoana (GDC, 2008a).

Te Tairāwhiti has been described as a fragile landscape which does not support the needs and aspirations of Ngāti Porou (Barnard et al., 2012) and is one of the most materially deprived areas within Aotearoa (Atkinson et al., 2014). The corporatisation and partial privatisation of the New Zealand Forest Service between 1985 and 1990, natural disasters (Cyclone Bernie and Bola), and the degradation of natural capital through erosion and sedimentation within the Waiapu catchment and wider region have likely contributed to ongoing processes of rural depopulation and resulting losses of human and social capital with “associated reduced community functioning, strength, reduced wellbeing, reduced cultural identity and expression, loss of services, and economic marginalisation” (Porou et al., 2012, p. 254). These complex processes have further reduced connection between residents and their whenua (land), likely resulting in reduced physical and spiritual capacity needed by communities to meet their physical, cultural, emotional, intellectual and spiritual needs (Porou et al., 2012).



Figure 1: Gisborne - Tairāwhiti District (Māori Land Court, 2019)

The region, seen in Figure 1, relative to the rest of Aotearoa, has a low population density with the majority of the population clustered in Gisborne, and the remainder living in small (<1000 total population) settlements such as Ruatōria (henceforth, Ruatōrea – which is the original spelling), and coastal settlements such as Tokomaru Bay, Tikitiki, Tolaga Bay (Uawa) and Te Araroa. The population of the Gisborne District at 30 June 2017 was estimated by Statistics NZ (2017) to be 48,500 with Gisborne holding a population of 36,600.

1.1.1 Land cover of Te Tairāwhiti

Like the vast majority of Aotearoa, Te Tairāwhiti was extensively deforested over the course of human habitation – with the most extensive and severe instances occurring after colonisation and land alienation by Pākehā settlers in the 19th and early 20th centuries (Harmsworth et al., 2002). Data from Statistics NZ and the Ministry for the Environment (MFE) (2019), as seen in Figure 2 for the period 1996-2012, indicates that the dominant land cover in the region is exotic grassland (42%), indigenous forest (22%) and exotic forest (21%).

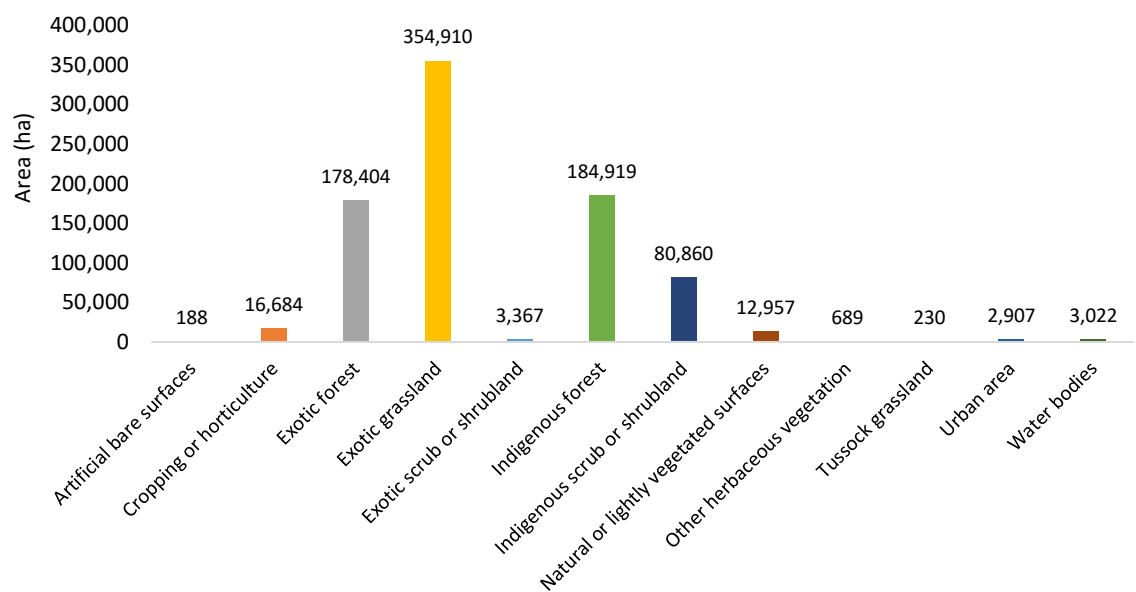


Figure 2: Te Tairāwhiti (Gisborne District) land cover (ha) at 2012 (Statistics NZ & MFE, 2019)

When viewing Figure 3, the land cover change between 1996 and 2012 is visible, and the large swing from a catchment solely dominated by exotic grassland to one with a significant proportion of exotic forests is clear. Whilst the data from Statistics NZ and MFE (2019) only covers the period 1996-2012, it is important to note that this changing land use pattern has been occurring since the mid-20th century, when severe weather events such as Cyclone Bernie and Bola caused

widespread and severe erosion in the region, necessitating blanket reforestation to treat erosion prone areas (Barnard et al., 2012).

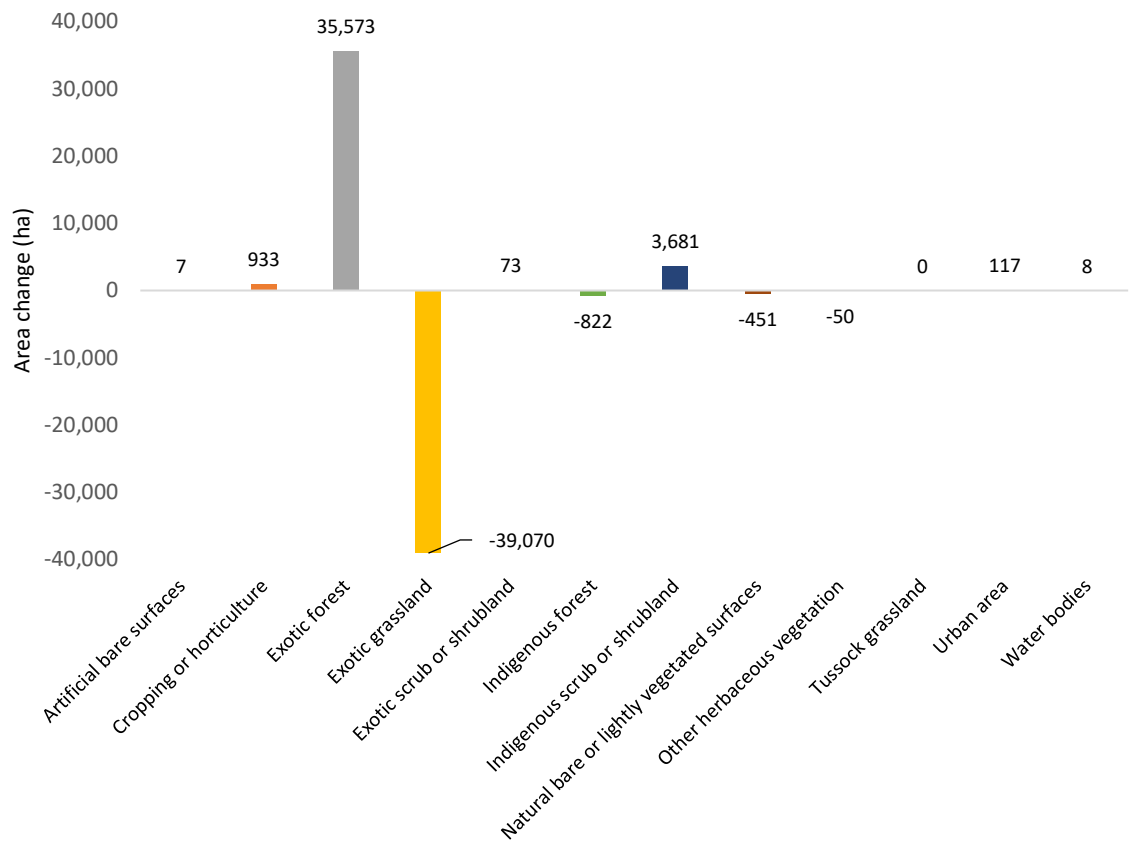


Figure 3: Te Tairāwhiti (Gisborne District) land cover change (ha), 1996-2012

1.2 Characteristics of the Waiapu catchment

Te Tairāwhiti is the location of this PhD study; however, to give a more granular focus to the issues, a smaller area, the Waiapu catchment, seen in Figure 4, has been explored in depth. The reasons for this are two-fold. There exists a significant body of literature on the biophysical aspects of this catchment (Funk et al., 2014; Harmsworth et al., 2002; Scion, 2012) – most notably on the serious and persistent erosion problems. Also, to a lesser extent, a body of social science research has been undertaken with the communities who inhabit the Waiapu catchment, and contend with the multiple impacts of erosion, climate change and

land use change (Harmsworth & Warmenhoven, 2003; Warmenhoven et al., 2014).

Moreover, the Waiapu catchment can be seen as a microcosm of pressures at a national level for afforestation by owners of marginal land - 60-90 percent of Māori owned land would fit this classification (Harmsworth et al., 2010) - through local and central government schemes such as the One Billion Trees Programme (1BT), and more mature schemes such as the Erosion Control Funding Programme (ECFP) and the New Zealand Emissions Trading Scheme (NZ ETS). Beyond these external pressures and incentives are the traditions and values Māori landowners hold and rely upon to make land use decisions. Together, these factors have created the unique history of land use change in the Waiapu catchment. The Waiapu catchment is also a prescient area of inquiry for personal reasons as I have familial connections to the area through the work of my Great Grandfather who assisted Māori landowners in the development of their land midway through the 20th century. This connection will be expanded upon in future sections.

1.2.1 Biophysical characteristics

The Waiapu River catchment (175,800ha) exists in a dynamic tectonic and climate setting (Warmenhoven et al., 2014) and is described by Harmsworth et al. (2002) as being highly degraded and modified, and exhibiting a serious erosion problem. A combination of factors predisposes the Waiapu catchment to gully erosion; these are outlined by Marden et al. (2011, p. 22) as follows: tectonic influences (e.g., earthquakes, uplift rates), geologic influences (rock type, degree of faulting and crushing), a climate influenced by tropical cyclones, and the recent clearance of vegetation from steep slopes. The Waiapu catchment was extensively deforested between 1890 and 1930 for development of pastoral agriculture (Warmenhoven et al., 2014). Before deforestation of the Waiapu catchment, over 80 percent of land cover comprised native forest – mainly podocarp broadleaf and beech (Awatere et al., 2018). Deforestation of the native forest cover contributed

to an exacerbation of high natural rates of erosion, and extensive gully erosion commenced within two decades of this rapid land cover change (Rosser et al., 2012).

The western edge of the catchment abuts the Raukumara Forest Park. Here relief (in the geomorphological sense) is severe ranging from 500m to 1500m whilst the middle and lower part of the catchment are 'hilly', typically between 100m and 500m, with a variety of river terraces and flood plains at sea level (Harmsworth et al., 2002). There are numerous prominent natural features in the Waiapu catchment, with Maunga Hikurangi as the most significant (1750m), with Aorangi (1272m), Wharekia (965m) and Taitai (677m), to the north and north east, and Whanakao (1618m) to the north-west of Hikurangi (Awatere et al. 2018).

The Waiapu river (~130km) is formed by the confluence of the Mata and Tapuaeroa rivers, which themselves originate in the Raukumara range to the west of the Waiapu catchment (Barnard et al., 2012). Gully erosion accounts for 49 percent of suspended sediment in the Waiapu river which has an estimated output of ~35 Mt/yr (Hicks et al., 2011). The remaining sediment is derived from other erosion processes such as landslides, earthflows, sheetwash, stream bank erosion and river-bed degradation (Warmenhoven et al., 2014). In 2008, sediment yield was estimated at 24 Mt/yr – testament to the severity and rapidity of erosion in this catchment. For comparison, the sediment output of the Waiapu River is nearly ten times more than the Manawatu River which has one of the highest sediment yields in the world (Rosser et al., 2012).

Deforestation of the catchment as described by Rosser et al. (2012, p. 4) has led to “the destabilisation of hillslopes, and the development of extensive gully erosion, earthflow and slump failures, and shallow landslides.” The majority of sediment is generated on open pastoral land, and in combination with severe weather events, contributes to the aggradation of river channels which increases flood risk in low lying areas and townships (Rosser et al., 2012). Several extreme

driven by limited employment opportunities) from the Waiapu catchment and wider region have had, and will continue to have, a significant impact on the social cohesion and resilience of communities in the Waiapu catchment (Warmenhoven et al., 2014). In turn, this has led to significant concerns regarding the loss of intergenerational transfer of mātauranga Māori (Māori knowledge) and whakapapa (genealogies) and the maintenance of marae through ahi kā (keeping the home fires burning) (Warmenhoven et al., 2014).

The Waiapu catchment has been described as a fragile landscape lacking the ability to support the needs and aspirations of Ngāti Porou (Porou et al., 2012). Porou et al. (2012) draw linkages between the material deprivation of those living in the Waiapu catchment and a series of environmental, social and economic shocks which have occurred over the previous two centuries. These shocks, it is argued, “have had impacts on the wellbeing of Ngāti Porou in the catchment and appear to have played a contributory role in the current low socio-economic profile for the area and a degradation of cultural values of importance to Ngāti Porou” (Porou et al., 2012, p. 256). The Waiapu catchment has significant disparities when compared with the rest of Aotearoa in regard to health, unemployment, housing and low household income (Harmsworth et al., 2002).

However, it is important to note that those living in the Waiapu catchment do not see themselves as deprived or ‘poor’ – in fact the opposite is the case. Evidence indicates that despite serious environmental and economic shocks in the area, community members exhibit high degrees of resilience (Warmenhoven et al., 2014). Proximity to whānau, and the rich local and cultural identity, exemplified by a unique ‘East Cape’ lifestyle, typify positive perceptions of wellbeing, and are seen to be more important than more established markers of wellbeing such as the New Zealand Deprivation Index (Warmenhoven et al., 2014).

Most whānau in the Waiapu catchment operate within the formal and informal economy, and utilise diverse income streams and employment as a key livelihood

strategy (Warmenhoven et al., 2014). This can be seen in hapū where members have multiple jobs that are often seasonal and part-time, and through which they supplement what is often precarious employment, with goods generated through gardening, hunting, fishing and trading within the community (Kingi, 2008b; Warmenhoven et al., 2014). Like many rural Māori communities, those in the Waiapu remain 'land rich, but cash poor' (Warmenhoven et al., 2014).

Ngāti Porou identity is intrinsically tied to the Waiapu catchment and is exemplified by the following whakataukī (proverb): *Ko Hikurangi te maunga, ko Waiapu te awa, ko Ngāti Porou te iwi* (Hikurangi is the mountain, Waiapu is the river, Ngāti Porou is the tribe). Likewise, a whakataukī regarding the Waiapu River is recorded in Barnard et al. (2012) – "*Hoake taua ki Waiapu ki tatara e maru ana*" – let us shelter under the thick matted cloak of Waiapu (Reedy, 2018). The Waiapu River is of "great spiritual, cultural, physical and economic significance to Ngāti Porou, and the poor health and depletion of resources in the catchment is of great concern" (Harmsworth et al., 2002, p. 2). The Waiapu River historically provided ample sustenance to those living in the area, such as mussels, fresh and salt water fish, tuna (eel) and facilitated transport of people and resources (Barnard et al., 2012). The degradation of the river, and wider catchment has hampered the ability of the Waiapu River to provide adequate sustenance and amenity, and also habitat for other valued plant, fish and animal species (Barnard et al., 2012).

Recognition of the poor state of the Waiapu River and the wider catchment has led to a partnership between Ngāti Porou and the Crown to reverse these trends. A Memorandum of Understanding (MoU) between Te Rūnanganui ō Ngāti Porou, MPI (Ministry for Primary Industries) and GDC (Gisborne District Council) was signed in 2014 that recognises the relationship between the health of the river, the health of the land and the health of the people (Warmenhoven et al., 2014). The MoU provides a co-management framework for restoration of the Waiapu catchment over 100 years with a focus on programmes with desired outcomes for 'Healthy Land', 'Healthy Rivers' and 'Healthy People'. Another programme to

address erosion, the Erosion Control Funding Programme (ECFP) in the Waiapu catchment, will be addressed in a following section.

1.2.3 Land use change in the Waiapu catchment

As mentioned, the Waiapu catchment was deforested with the specific aim of developing sheep and beef stations in the area. The implications of this, including the processes by which deforestation and alienation of Māori land took place will be explored in more depth in section 2.1.3. In 1840, aside from native forest which was the dominant land cover in the Waiapu catchment, there existed scrub and coastal forests in the lowland areas and numerous areas of horticultural cultivation by Māori who had extensive settlements throughout the Waiapu River valley (Harmsworth et al., 2002; Rau, 1993). Harmsworth et al. (2002, p. 3) outlines the changing land use patterns in the Waiapu catchment:

The land-use pattern has progressed from native forest and marae cultivation, to reduced native forest, extensive pastoralism with sheep and beef, to dairying on lowland areas, to a return to sheep and beef, extensive planting of exotic forests and limited cultivation on the flats.

At present exotic forestry (mainly *Pinus radiata*) constitutes 26 percent of land area in the Waiapu catchment with approximately 37 percent in pasture (of which half is erosion prone hill country). Native forest (lowland and highland beech, broadleaf and various podocarp species) is generally located in mountainous areas, with smaller areas near lowland rivers, constituting 21 percent of the Waiapu catchment. Scrub, which includes mānuka and kānuka, makes up 12 percent or so of land within the Waiapu catchment (Awatere et al., 2018). Data from 2002 as seen in Table 1 provides an indication of the land use change in the Waiapu catchment between 1840 and 2002 (Rosser et al., 2012). Since 2002, there have been further increases in pasture and exotic forest plantations, despite

the reservations of many of those who are living in areas where these land use changes are taking place (Barnard et al., 2012; Tomlinson et al., 2000).

Table 1: Comparison of land cover in 1840 and 2002 (all types of natural forest at 1840 grouped together) (Harmsworth et al., 2002 as cited in Rosser et al. 2012)

Vegetation type	1840 land use		2002 land use		Change in share (%)
	Area (ha)	% of Waiapu catchment	Area (ha)	% of Waiapu catchment	1840-2002
Pasture	0	0.0%	59,917	34.6%	34.6%
Natural Forest	165,759	95.6%	44,540	25.7%	-69.9%
Exotic Forest (<i>Pinus radiata</i>)	0	0.0%	38,769	22.4%	22.4%
Scrub	6,619	3.8%	21,749	12.5%	8.7%
Cropland	?	?	362	0.2%	0.2%
Exotic Forest (other)	0	0.0%	277	0.2%	0.2%
Alpine Grass-Herbfield/Tussock	1,013	0.6%	232	0.1%	-0.5%
Shelterbelts/Deciduous hardwoods	0	0.0%	206	0.1%	0.1%
Built-up Area	0	0.0%	38	0.0%	0.0%
Coastal Sand and Gravel	21	0.0%	8	0.0%	0.0%
Vineyard	0	0.0%	3	0.0%	0.0%
Water/River	?	?	5,576	3.2%	0.2%
Other	0	0.0%	1,713	1.0%	1.0%

Total	173,412		173,390		
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1.2.4 Exotic forestry in the Waipapu catchment

Attempts to control gully erosion at a farm level had proved increasingly ineffective within the Waipapu catchment by the 1960s (Marden et al., 2011). The increasing cost of stabilising gully erosion on-farm ultimately led the Government to purchase large tracts of eroded pasture land in the headwaters of the Waipaoa, Ūawa and Waipapu catchments for reforestation (Marden et al., 2011). What commenced was a substantial reforestation programme comprising largely of radiata pine (*Pinus radiata*), and Douglas fir (*Pseudotsuga menziesii*) between 1961 and 1985 with over 40,000 ha of exotic forests established (Marden et al., 2011). A second wave of reforestation occurred in the early 1980s after further damage to pastoral hill country from a succession of severe weather events, culminating with Cyclone Bola in 1988 where 300-900mm of rain fell over a 5 day period (Marden et al., 2011). By 1997 ~135,000 ha of erosion prone pastoral land was reforested (Marden et al., 2011).

Whilst erosion control was a significant impetus for the increase in exotic forests in the Waipapu catchment, exotic forest planting has occurred in conjunction with other economic factors such as a general reduction in profitability of sheep and beef farming over the latter part of the 21st century (Tomlinson et al., 2000). The place of exotic forestry in the region is often contentious due in part to the environmental impacts of clear-fell forestry on steep land, lower than expected returns, a shift to seasonal contracting employment, poor health and safety conditions for workers (and the general public from logging trucks), and the deterioration of roading infrastructure (Barnard et al., 2012; Tomlinson et al., 2000; Warmenhoven et al., 2014). There is also, however, a recognition that exotic forestry has an important role in the sequestration of carbon to meet

climate change commitments, and as an agent of erosion control (Awatere et al., 2018; Marden & Rowan, 1994; Tomlinson et al., 2000; Warmenhoven et al., 2014).

1.2.5 The Erosion Control Funding Programme

The establishment of the Mangatu forest in the 1960s, for the purposes of erosion control, was one of the earliest government led reforestation initiatives aimed at limiting erosion in the Waiapu catchment (Rosser et al., 2012). The Mangatu forest began in the headwaters of the Waipaoa catchment before stretching north into the Waiapu catchment (Rosser et al., 2012). The 'East Coast Project' was spawned from the establishment of a 1963 committee tasked with providing recommendations for soil conservation and erosion control in the Poverty Bay-East Cape region (Rosser et al., 2012). The New Zealand Forest Service (NZFS) was tasked with purchasing and afforesting land in the headwaters of erosion prone catchments, whilst also maintaining productivity of the land, establishing production forests and promoting economic and social development (Rhodes, 2001; Rosser et al., 2012).

After the partial corporatisation of the NZFS in 1987-88, the East Coast Project was superseded in 1988 by the East Coast Project Conservation Forestry Scheme. By this time 36,100 ha of land had been afforested by the NZFS under the previous scheme, yet 110,000 ha of highly erodible land remained untreated. Following the devastation of Cyclone Bola, the newly corporatised NZFS was allocated \$8m over five years to establish protection forests (excluding the Waiapu catchment) with no dispensation for pruning or thinning costs (Rosser et al., 2012). The East Coast Project Conservation Forestry Scheme was phased out in 1993 at which time 13,578 ha of forest had been established at a rate of about 2700ha/year (Rosser et al., 2012).

The Erosion Control Funding Programme (ECFP) was established in 1992 to subsidise the plantation of protection forestry in the aftermath of Cyclone Bola

(Rosser et al., 2012). The ECFP superseded the East Coast Project Conservation Forestry Scheme and had a broader mandate to not only solve the Gisborne District's erosion problems, but also to provide employment, stimulate regional development and recognise the environmental needs on different properties (Rosser et al., 2012).

The ECFP targets a variety of Land Use Capability units, but more generally – any land susceptible to erosion by gullyng, slumping, or earthflows (Rosser et al., 2012, p. 69). The ECFP has undergone numerous reviews related to the range of eligible tree species, the nature of 'target land' and the clearance (or not) of indigenous tree species (Rosser et al., 2012). The upfront grant rates available to landowners changed after the ECFP's 2014 review: landowners are now eligible for 70 percent of a project's total cost after successful planting and monitoring over one year (Ashton, 2015). An ECFP grant funds establishment costs (site preparation/maintenance), fencing, planting and ongoing maintenance of the plantation site (MPI, 2018). Funding from the ECFP was discontinued in 2018, and the scheme is slated for disestablishment in 2020 with grants' continuing to be paid out until 2028. It is understood that landowners in Te Tairāwhiti wishing to access funding for afforesting erosion prone land beyond 2020 can use funding from the One Billion Trees Programme.

1.3 The New Zealand Emissions Trading Scheme

A central government scheme of direct relevance to this research is the New Zealand Emissions Trading Scheme (NZ ETS). The NZ ETS was introduced under the Climate Change Response (Emissions Trading) Amendment Act 2008 and has been strengthened by the recent passage of the Zero Carbon Act. At the time, the NZ ETS was the first ETS in the world which covered all economic sectors and – in principle – all major greenhouse gases (GHGs) over time (Leining & Kerr, 2018). In fact, as implemented over at least its first decade, it has not covered agricultural GHGs, so the claims of those propounding its uniqueness have been questionable.

Emission trading works by sending price signals to producers, consumers and investors that encourage the reduction of GHG emissions (Leining & Kerr, 2018). The NZ ETS is Aotearoa's principal policy mechanism, even if an ineffective one to date, to ensure the country's domestic climate change commitments under the United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement are fulfilled (Leining & Kerr, 2018). Emissions of GHGs carry an environmental cost that has not been adequately accounted for in economic transactions, and emissions trading systems are one way, alongside others such as a carbon tax, to seek to better account for this cost by disincentivising such emissions in obligated sectors of the economy (Simmons & Young, 2016). Those sectors with obligations under the NZ ETS (i.e. those sectors that emit GHGs) are required to purchase New Zealand Units (NZUs), each of which represents one tonne of CO₂e (CO₂ or an amount of another GHG equivalent to one tonne of CO₂), and surrender these to the government (Leining & Kerr, 2016). NZUs are also issued to those who undertake activities which remove GHGs from the atmosphere. In Aotearoa, this means foresters who plant 'additional forests' that satisfy the NZ ETS forest land criteria. NZUs accrued by foresters can be sold on the New Zealand Emissions Trading Register at a price determined by the market (Leining & Kerr, 2016).

In principle, a 'cap' is placed upon the total amount of allowable emissions, and an amount of emission units equal to the level of the cap is issued by the Government (Leining & Kerr, 2016). In practice, the cap is flexible, because obligated market participants can buy NZ ETS units from forest owners or from international sources; in other words, the supply of units is not fixed.

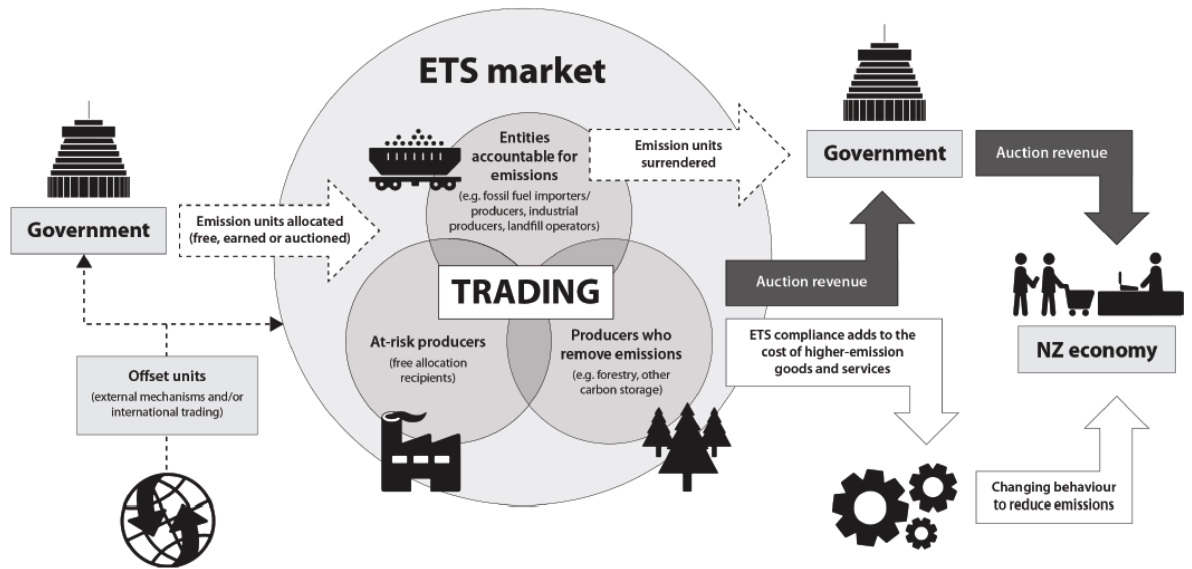


Figure 5: Schematic detailing the production and trading of NZUs within the NZ ETS (Leining & Kerr, 2018)

Therefore, whilst there is provision under the relevant legislation for an emissions cap, the NZ ETS currently does not have an effective cap on emissions (Leining & Kerr, 2018). Since 2015, the NZ ETS has also been a domestic-only system, having been de-linked from international markets following an inundation in 2011 of cheap Emission Reduction Units (ERUs) of dubious provenance (Simmons & Young, 2016).

Sectors of the economy participating in the NZ ETS include forestry, liquid fossil fuels, stationary energy, industrial processes, synthetic gases and waste. Agriculture was initially slated for introduction into the NZ ETS in 2013; however, this was indefinitely deferred under the National government in 2015 (Leining & Kerr, 2016). As of 2018, the NZ ETS applies unit obligations to about 51 percent of Aotearoa's gross emissions as the other 49 percent are from agriculture. In 2019, a decision was announced by the Labour-led coalition government, that agricultural GHGs will enter the NZ ETS in 2025, although the sector has an opportunity to develop alternative 'practical ways' to measure and price

emissions at the farm level, separate from the NZ ETS, and the sector will also be given a 95 percent initial discount on emissions coverage (Coughlan, 2019).

The forestry sector was the first participant in the NZ ETS, joining on 1 January 2008. The NZ ETS rules around forestry are defined by the Ministry for Primary Industries (MPI) as follows:

- forest land has at least one hectare of forest species;
- has, or is likely to have tree crown cover of forest species of more than 30 percent in each hectare;
- has an average width of tree crown cover of at least 30 metres.

The NZ ETS distinguishes between two types of forest land: 1) land that was not forested at 31 December 1989 is classified as ‘post-1989 forest land’² and 2) land that was forested before 1 January 1990 is ‘pre-1990 forest land’ (MPI, 2015b)³. Pre-1990 forest land must participate in the NZ ETS, and faces harvesting liabilities if deforested (i.e. the carbon is assumed to be ‘lost’ to the atmosphere upon harvest and this carbon deficit must be repaid in the form of NZUs surrendered to the Government) (MPI, 2015b). Post-1989 forest land is voluntarily entered into the NZ ETS through planting of exotic or native forests, or by allowing an area of land to regenerate into native forest.

² Post-1989 forest land can also be ‘forest land’ at 31 December 1989 but was deforested between 1 January 1990 and 31 December 2007; or: was pre-1990 forest land that was deforested on or after 1 January 2008, and any NZ ETS liability has been paid (MPI, 2015b).

³ Pre-1990 forest land can also be ‘forest land’ on 31 December 2007; and or contained predominantly exotic forest species on 31 December 2007 (MPI, 2015b).

1.4 Land Use Capability System

The Land Use Capability (LUC) system has been used in Aotearoa to help inform sustainable land development and management on individual farms, in whole catchments, at the district, region, and the national level since 1952 (Lynn et al., 2009, p. 7). The LUC system comprises two components, the first being the Land Resource Inventory (LRI) which includes an assessment of physical factors (rock type, soil, landform, slope, erosion severity and type and vegetation cover) deemed critical for the long-term use and management of land (Lynn et al., 2009). The LRI then informs the LUC classification which categorises land into eight classes determined by an assessment of factors such as climate, the effects of past land use, and the potential for erosion as seen in Figure 6. The overarching objective of the LUC system is to maintain and increase the productivity of Aotearoa's primary sector through sustainable land management and further, to provide a land management assessment technique suitable for local and central government policy developers and land use practitioners and planners (Lynn et al., 2009).

Increasing limitations to use	LUC Class	Arable cropping suitability†	Pastoral grazing suitability	Production forestry suitability	General suitability	Decreasing versatility of use
	1	High ↓ Low	High ↓ Low	High ↓ Low	Multiple use land	
	2					
	3					
	4					
	5	Unsuitable	Low ↓ Unsuitable	Low ↓ Unsuitable	Pastoral or forestry land	
	6					
	7					
	8					
			Unsuitable	Unsuitable	Conservation land	

Figure 6: Basic LUC system which details increasing limitations to use and decreasing versatility of use from LUC class 1 to LUC 8 (Lynn et al., 2009, p. 9)

Nationally, about 80 percent of Māori land is between LUC 5 and 8 inclusive, which indicates moderate to severe land use capability constraints (Harmsworth et al., 2010). This land is generally only suitable for sheep and beef farming or forestry land uses. Within Te Tairāwhiti, as seen in Figure 7, about 88 percent (163,614ha) of Māori land is LUC 6-8 which as evidenced by Figure 6 is only suitable for pastoral or forestry land uses, and at the extreme end – LUC 8 – conservation land (PwC, 2013). Versatile, multiple use land – LUC 1-4 – constitutes only about 11 percent (21,406ha) of Māori freehold land in Te Tairāwhiti (PwC, 2013). Reliable LUC information for the Waiapu catchment is available but was not able to be accessed within the timeframe of this project. However, it is likely a high proportion of land with severe land use constraints may be found there due to the erosion and severe relief in the area (Rosser et al., 2012).

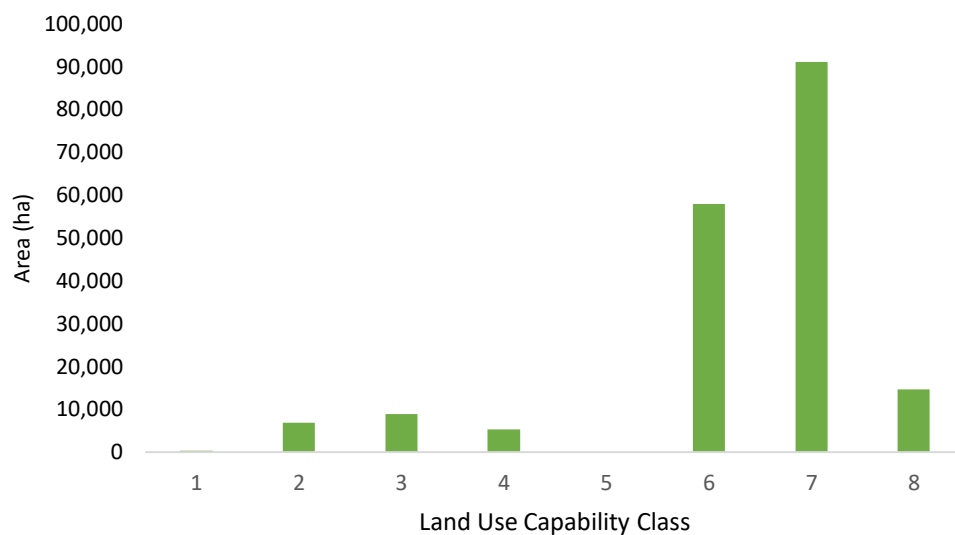


Figure 7: Proportion of Māori freehold land by LUC for the Gisborne District (PwC, 2013)

1.5 Carbon farming in Te Tairāwhiti – the Nuhiti Q case study

The literature suggests a case for reforestation of the Waiapu catchment based on ecological considerations such as erosion control (Awatere et al., 2018;

Warmenhoven et al., 2014). Thus, one focus of this research has been to explore a type of afforestation desired by a variety of stakeholders - that is, carbon farming native forests. Permanent native forests are seen by many as the best possible remedy to widespread, severe and persistent erosion in the Waiapu catchment and wider region, and a land use which provides an economic return from 'undeveloped' land (Awatere et al., 2018; Barnard et al., 2012; Harmsworth & Warmenhoven, 2003; Warmenhoven et al., 2014). There is also a clear need to rapidly increase the amount of permanent and rotational forest land to sequester GHG emissions and limit dangerous climate change (Hall, 2017; Kazaglis et al., 2017). Yet, there remains significant debate as to the preferred makeup of afforestation in Aotearoa amongst academics, public servants, tangata whenua, foresters, environmentalists and other concerned stakeholders (Collins, 2019; Salmond, 2019); that is, should we rely on exotic forest species such as *Pinus radiata* or native forests comprising diverse species of flora?

A core component of this thesis is an exploration of the previously mentioned issues regarding the development of Māori land through native forest carbon farming. This investigation centred on a Māori landowning incorporation, Nuhiti Q, which farms sheep and cattle at Anaura Bay (due south of the Waiapu catchment) in Te Tairāwhiti. Nuhiti Q retired large areas of regenerating native farmland from active pastoral production and entered the NZ ETS in 2009. This entry was in part facilitated by Craigmore Sustainables, who guaranteed finance which enabled the Incorporation to overcome financial barriers associated with co-funding an ECFP grant. In total, ~600 ha of post-1989 reverting farmland entered the NZ ETS alongside 70 ha of eucalypts. Nuhiti Q offer illuminating insights into the experience of a Māori landowner participating in the NZ ETS with a majority mix of post-1989 native forest species. The following paragraphs provide introductory information to the Incorporation. Chapter 4 presents the Nuhiti Q case study in greater depth.

Nuhiti Q is a sheep and beef farming incorporation that was incorporated in 1987. The farm is managed under the Te Ture Whenua Māori Land Act 1993 and includes 1265 ha of Māori freehold land, and the Nuhiti Reserve (1140 ha), the latter being leased to the Department of Conservation (DOC). In addition to these corpus lands, Nuhiti Q leases 286 ha, known as Waipare and Arerowhangairongo, from the Crown and leases another 220 ha from its Māori owners on Waiau Road, providing a total effective pastoral area of over 900 ha. Prior to this consolidation the governance structure administering the landholdings was an Ahu Whenua Trust. The land has historically been run as a mixed sheep and beef station with current stock levels consisting of 3,200 breeding ewes and 180 breeding Hereford cows. Nuhiti Q is a coastal farm with some 8km of coastline.

Nuhiti Q is administered by a management committee of seven shareholder members, who sit for a three-year cycle and meet quarterly. Nikki Searancke (henceforth 'Nikki') has been on the committee since 2009, is the current chairperson and has held the role since 2014. The Incorporation has ~890 shareholders with some living in the Gisborne District, but the majority living in other parts of Aotearoa and overseas. The location of Nuhiti Q can be seen in Figure 8.

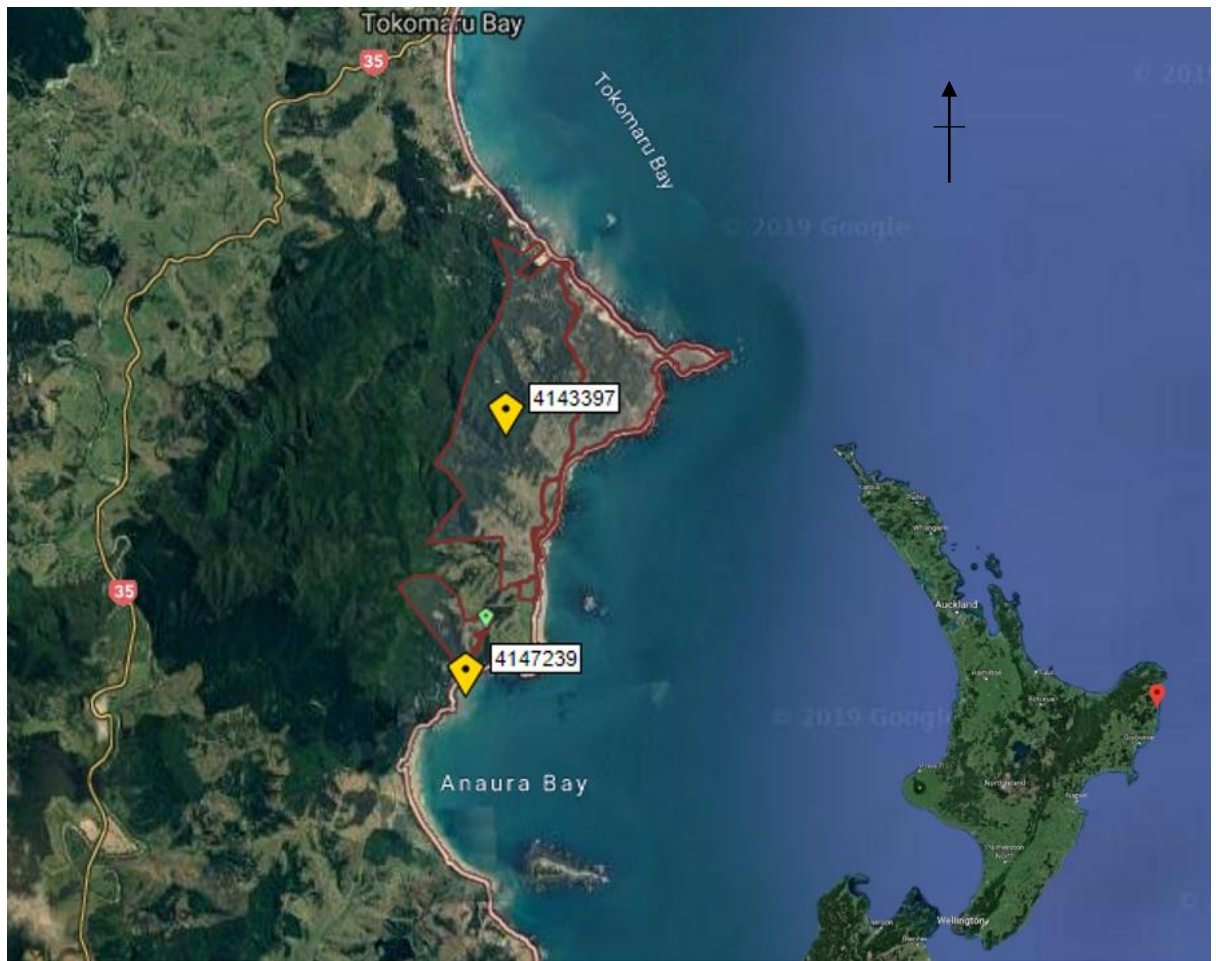


Figure 8: Location of Nuhiti Q (Māorilandonline.govt.nz & Google Earth)

The landscape of Nuhiti Q is characteristic of many large sheep and beef stations in the region – with mountainous terrain, and high incidence of erosion. Incidentally, Nuhiti Q is also vulnerable to droughts in summer and erosion after extreme weather events. The severe gradient of much of Nuhiti Q’s farmland has rendered the corpus lands predominantly unsuitable for the finishing of stock. Thus, Nuhiti Q largely breeds stock and makes use of a lease block to finish the remainder.

Table 2 provides an indication of the capability constraints of the farm as over 95 percent is LUC 6-8 indicating that the vast majority of Nuhiti Q’s land faces moderate to severe land use limitations.

Table 2: Land use capability index for Nuhiti Q freehold land
(whenuaviz.landcarereasearch.co.nz)

Land use capability	Area (ha)	Percentage of farm
LUC 8	56.26	5%
LUC 7	729.9	68%
LUC 6	273.46	25%
LUC 4	8.32	1%
LUC 3	6.51	1%

1.6 Rationale for research

Land use decision making for Māori is inherently complex (Boast, 2008; Pool, 2015), and within the Waiapu catchment and Te Tairāwhiti, land use decision-making in the post-colonial period has by and large been driven by non-Māori (Beckwith, 2007; Edwards et al., 2018; Harmsworth, Warmenhoven, Pohatu, & Page, 2002; Warmenhoven et al., 2014), whether explicitly through outright alienation, or implicitly through a variety of bureaucratic and legislative instruments (Boast, 2008; Pool, 2015; Walker, 2009). The local consequences of land use planning by those who do not fully understand the history and characteristics of the Waiapu catchment are widespread, with economic, social and environmental dimensions. It is therefore desirable that those who live in the Waiapu catchment are able to appraise potential land uses with full information and determine those land uses that correspond with their aspirations, ultimately seeking to reaffirm Māori notions of mana motuhake and kaitiakitanga in the process.

Regardless of the actual land use preferences of Māori landowners in the Waiapu catchment, or the values associated with traditional and emerging land uses, there is a perception amongst policy makers and concerned stakeholders that

carbon farming permanent native forests is a land use ideal for Māori landowners in Te Tairāwhiti (Awatere et al., 2018; Warmenhoven et al., 2014). These assertions ignore the fact that little grounded research has occurred which directly ascertains Māori landowner experiences of carbon farming within the NZ ETS, or for that matter the significant intergenerational risks if future generations of landowners wish to withdraw from the NZ ETS once earned NZUs have been sold by landowners. There is also little solid research which directly explores the land use preferences of Māori landowners in the Waiapu catchment and wider Tairāwhiti region beyond (Awatere et al., 2018; Harmsworth et al., 2010). Whilst the aforementioned papers explore land use preferences of Māori landowners, they have approached these issues solely using a lens of climate change or erosion mitigation.

The pressing need to rapidly afforest, and the suitability of Māori land to afforestation of either rotation or permanent exotic or native forest crops can mean that many Māori landowners may feel unduly pressured into retiring land into forestry without a broader understanding of the precedent this may establish and or the broader implications of this land use decision. Beyond this, it seems there is limited awareness of how this increased afforestation will fit in with existing land uses in the Waiapu catchment. There has also been little clarity to date as to what species Māori landowners would prefer to see dominating planting regimes (if afforestation is desired) – will they be exotic species for quick carbon sequestration and erosion control benefits or the much slower growing native species for equally good erosion control and carbon sequestration, but over a longer time period?

For these reasons, the following research questions are posed:

- Research question 1: What does experience to date tell us about the opportunities, barriers and risks for Māori landowners engaging in carbon farming as a land use within New Zealand's Emissions Trading Scheme?

- Research question 2: In light of the findings from addressing research question 1, what are other feasible land use options within Te Tairāwhiti, and what is valued by Māori landowners about these land use options in comparison with carbon farming?
- Research question 3: In light of the values ascribed to different land uses highlighted in wānanga with Māori landowners, what significance do these findings have for Māori land use decision making in Te Tairāwhiti?

The methodology of this mixed methods research utilises tenets of Kaupapa Māori Research (KMR) with a transformative epistemology to address these research questions. As research with a transformative approach, the underpinning philosophy of this PhD has been to collaborate as much as possible in the research design and outputs with those who live in the Waipapu catchment. The Nuhiti Q case study is predominantly based on a series of interviews with the chairperson of the incorporation, Nikki Searancke, and others familiar with the case. The research technique used to elicit the benefits Māori landowners associate with land uses is multi-criteria analysis (MCA) – an approach which has been called a value articulating institution (Vatn, 2009), and is well suited to participatory valuation approaches where both monetary and non-monetary values are important (Belton, 1990; Belton & Stewart, 2010; Mabin & Beattie, 2018).

2 Literature-based review of land use change in Aotearoa and Te Tairāwhiti

This chapter explores key themes evident in the history of land use change in Aotearoa. It focuses on Māori land from the pre-colonial era to today. It examines factors affecting land owners in Te Tairāwhiti specifically and explores the legacy of earlier colonisation events on more recent patterns of land use. The role of carbon farming as a land use in the region is then critically explored, with an emphasis on the opportunities, barriers and risks for Māori landowners engaging in carbon farming. Critical gaps in current knowledge are identified.

2.1 Land cultivation in Aotearoa on Polynesian arrival

Māori migrated in successive waves from East Polynesia to Aotearoa with earliest settlement dated at 1280 AD (Wilmhurst et al. 2008). This migration followed wider trends of Polynesian migration from South East Asia into Western Polynesia, and then Eastern Polynesia whose inhabitants Māori directly descend from. Ethnological and archaeological evidence suggests that the Society Islands, the Cook Islands and the Austral Islands are the homeland from which the ancestors of Māori migrated south west to what is now known as Aotearoa New Zealand (King, 2003). Māori tradition holds that successive migrations were made from a land known as Hawaiki, and it has been suggested these migrations likely began as a result of over-population and food shortages (King, 2003). Māori introduced Polynesian species of rat and dog, and also a number of plants suitable for cultivation in Aotearoa – notably, the kumara, yam, taro, ti kōuka and gourd (King, 2003). Yet other crops such as the paper mulberry (used in clothing) could not grow as ubiquitously in the different climatic regimes of Aotearoa as in Polynesia, which necessitated utilisation of new crops, such as harakeke (flax) (Firth, 1973). The ability to adapt to changing geographic, climatic and socio-political circumstances were key to the survival of not only the early Polynesian

voyagers but also their descendants who had to contend with the multiple challenges of European colonisation (Belich, 2001; Clydesdale, 2007; King, 2003).

King (2003) identifies three periods over which East Polynesian Island culture evolved into a distinct (but not homogeneous) Aotearoa Māori culture: the colonial, transitional and tribal periods. The colonial period (up to ~14th and 15th centuries AD) of Māori settlement and society should not be thought of as a period characterised by nomadism and 'hunting and gathering', but rather by the establishment of settlements and technologies that would allow Māori to flourish in later years (King, 2003). King writes of Māori in this period as occupying a home base where tool production and cultivation of the kumara and other plant species would take place. This would be supported by a series of 'satellite stations' i.e. areas where certain activities such as foraging for shellfish or moa hunting would take place at specific times of the year. This period came to an end by necessity as the big game which early Māori relied on became scarce and in some cases extinct (King, 2003). This led to a reliance on other smaller species of bird (kiwi, weka, kereru, tui etc.) and it is hypothesised that the extinction of the moa led to the development of a more sustainable hunting and gathering ethic (King, 2003). Another response to the extinction of moa was the greater reliance on gardening as a significant food source in all but the lower reaches of the South Island. Alongside this, the transitional period also saw foraging of the 'raw foods of the forest' take on greater importance in the daily lives of Māori. The hearts of the nikau palm and cabbage tree, amongst seasonally available berries and drupes (such as those from the karaka tree) further supplemented the diets of Māori (King, 2003).

A confluence of factors precipitated the shift of Māori society into the 'transitional phase' (14th and 15th centuries). This, King (2003) argues, was a period when distinctly East Polynesian art forms and motifs began to transition into what would now be clearly identifiable as that of Māori. Further, increasing time spent in an individual locality fostered conditions where culture and customs

developed, and Māori settled in more defined geographical areas or territories and formed larger associations based on kinship (King, 2003). As Māori society transitioned from one characterised by a semi nomadic lifestyle to an increasingly sedentary one, the advantages employed by large groups of Māori would have allowed larger tribal groupings to dominate specific areas, eventually subsuming those still living semi-nomadic lifestyles (King, 2003). Māori settlements were located most extensively in Northland, the Bay of Plenty, Te Tairāwhiti and Waikato in the North Island and in the top of the South Island (but only sparsely in the lower half of the South Island) due to favourable growing conditions afforded by the temperate climate.

2.1.1 Extensive and intensive methods of land management

The Māori economy in the pre contact period relied upon land, sea, river, lake, swamp and wetland resources – “a tapu, food rich labyrinth of waterways, forest and swamp” resources (Park, 1995, p. 39). The utilisation of these resources broadly falls into what Belich (2001) describes as intensive or extensive use. The ‘extensive’ sub-sector of the Māori economy relied upon seasonal or sporadic hunting, gathering and fishing (Pool, 2015). This method of providing sustenance relied upon the land being used extensively so as not to over-capitalise upon important food stocks. Thus, a considerable area of land or water was needed for these activities, frequently conducted seasonally (Pool, 2015). The ‘intensive’ sub-sector of the Māori economy primarily involved intensive horticulturalism, of kumara, gourd and taro. Māori became increasingly adept at cultivating the kumara within its known ecological bounds (becoming increasingly marginal in the central North Island and the South Island) (Pool, 2015). This intensive horticulturalism relied upon land being periodically cleared (through burning which also fertilised the soil), cultivated, and then left fallow for a number of years to regenerate the soil before the process began again.

Any goods or resources that Māori could not harvest, cultivate or produce in their own rohe were traded with other iwi in extensive trade networks throughout and between the North and South Islands (Firth, 1973; King, 2003; Pool, 2015). Belich (2001) asserts that alongside the cultivation of domestic crops, Māori frequently cultivated wild plants that had a practical purpose, whether for sustenance e.g. the cabbage tree (tī kōuka), or plants used for crafts, such as flax (harakeke). This, Belich (2001) contends, negates the hunter-gatherer hypothesis of Māori in the pre-contact era, and instead offers variant hypotheses of Māori as hunter-gardeners, hunters, gardener-hunters and gardeners.

Māori were early contributors to the widespread deforestation that occurred across Aotearoa with human arrival (predominantly through use of fire) (Belich, 2001; King, 2003; Park, 1995; Pool, 2015). This undoubtedly contributed to the extinction of many species. Yet, much lowland forest with 'slow-growing, fruit-bearing trees, such as kahikatea, mataī and hīnau, was kept intact because this rainforest was often a better source of food than cultivated land or second-growth vegetation" (Park, 1995, p. 47).

There are also significant regional variations in the ways different iwi produced food and materials and managed their land. Iwi from regions with temperate climates such as those in Northland, Te Tairāwhiti, Bay of Plenty, Nelson and Taranaki relied heavily upon horticultural production, whilst those iwi located inland or in regions with less hospitable climates engaged far more in 'hunting and gathering' (Pool, 2015). Seasonal variation in temperature and precipitation dictated what production activities were conducted where, how and when (Firth, 1973). Almost all iwi extensively utilised fresh and salt water fish or eel stocks, and this was an important, or even a dominant component of sustenance (Firth, 1973; Pool, 2015).

2.1.2 Māori environmental worldviews

The relationship between Māori and the natural environment has developed from Polynesian origins over the course of centuries of settlement in Aotearoa into a distinctly Māori environmental ethic. The genesis of this worldview lies in a union between the living and non-living aspects of the natural world and inhabitants of Aotearoa who are believed to descend from Ranginui (the Sky Father) and Papatūānuku (the Earth Mother) (Mead, 2016). This genealogical relationship is referred to as *whakapapa* and denotes an intimate relationship with the land, where Māori are seen as direct descendants of Papatūānuku, and thus all aspects of the living environment, conferring a responsibility to act as stewards of the land from which they descend (Harmsworth & Awatere, 2013).

It is easy to romanticise the relationship between Māori and other Indigenous peoples with the natural environs they inhabit. Indeed, the idea that Māori were a model of 'ecological prudence' (Belich, 2001; King, 2003; Park, 1995; Pool, 2015) has come under pressure in recent years as evidenced by "Moa butchery grounds and rubbish heaps with now extinct birds' bones at the bottom but little more than shellfish at the top" (Park, 1995, p. 318) and evidence of the extent of forest clearance with fire. Yet there is also much evidence to establish the contrary such as 19th century paintings and sketches by early European settlers which depict healthy forest and swamp environments in proximity to Māori settlements (Park, 1995).

Whatever the case, the management and use of land amongst Māori was, and continues to be, vastly more communal in nature than European notions of land use and management characterised by individual ownership. In pre-contact Māori society, the core social and quasi-economic organisation was the *whānau* or extended family (King, 2003). Within this grouping, *whānau* members shared ownership of, and responsibility for, maintenance of their individual dwellings. *Whānau* generally formed independent work groups to gather resources for

consumption (Clydesdale, 2007; Consedine, 2007). However, at certain times of the year larger hapū groupings would undertake tasks such as sowing, harvesting and processing kumara – a process governed by strict tapu (Belich, 2001; King, 2003). Hargreaves (1963, p. 101) describes the intensive use of Māori land, or pre-European agriculture as “a type of shifting cultivation based on a subsistence crop economy. Fields were cultivated until the returns declined, when the area would be abandoned, and new "plantations" won from the forest or second-growth bush and fern land by burning.”

Cassels (1972) in his locational analysis of the human-nature relationship that had developed in Aotearoa offers a view of how pre-contact Māori managed their immediate landscape. Cassels discusses a northern Waikato environment comprising nine resource zones: clearable land (wet and dry) in forest, fern or kumara crops, poorly drained kahikatea forest, peat swamp or raised bog, steep land podocarp forest and navigable lake, river and streams. Māori sites of settlement were located near water, and clear preferences emerge for settlement near forests and fern land as opposed to croppable soils (Cassels, 1972). Cassels infers that Māori existed most comfortably in the ‘edges’ between resource zones through manipulation of the natural environment due to a recognition that species abundance was most dense in these areas. The richness of resources located in forest edges, and the edges between other resource zones exemplifies how Māori could blend intensive and extensive ‘land management’ and place themselves centrally within their landscape, ensuring minimal environmental impacts.

With reference to utilising a landscape of ‘edges’ the practices of the Muaūpoko iwi of Horowhenua is detailed by Park (1995). He notes that they recognised berries grew mostly on the outskirts, rarely in the centre of the forest, and thus, “over centuries left patches of old-growth forest intact, and opened up and cultivated others” (Park, 1995, p. 184). This consciousness of edges, it is argued, allowed Muaūpoko to move from one fruitful forest to another (Park, 1995) and

reinforces the evidence detailed in Cassels (1972). Like many other Indigenous societies, Māori depended on a limited resource catchment, and incentives to nurture and develop the biodiversity of indigenous flora and fauna through landscape manipulation were significant, and closely entwined with moral and religious belief systems (Park, 1995).

Further, within the Māori environmental worldview, all aspects of the natural world are imbued with mauri, described by Harmsworth and Awatere (2013, p. 276) as “an internal energy or life force derived from whakapapa ... sustaining all forms of life. It denotes a health and spirit, which permeates through all living and non-living things”. The mauri of natural features or environs can be damaged through pollution and environmental degradation and conversely, be restored through actions which restore the vitality of an environ (Harmsworth & Awatere, 2013). Mauri and whakapapa are key to understanding the Māori environmental worldview. It is believed that mauri and whakapapa bind all facets of creation together, whether divine, natural, living or non-living (Mead, 2016).

The direct genealogical relationship through whakapapa between Māori and the natural world, descending from Papatūānuku, confers an obligation for Māori to treat the natural environment as though it were a family member (Mead, 2016; Reid, 2005). This relationship is often exemplified by the fundamental concept of kaitiakitanga, defined as “guardianship, preservation, conservation, fostering, protecting and sheltering” the environment (Marsden & Henare, 1992, p. 66). Māori have a responsibility to act as kaitiaki which:

... entails an active exercise of power in a manner beneficial to the resource.... illustrated by humans providing benefit to the ecosystem and natural resource, through for example guardianship and sustainability, and means that the ecosystem or resource is sustained, if cared for, and can then provide benefit back to humans. (Harmsworth & Awatere, 2013, p. 281).

This brief description of the Māori environmental worldview illustrates the holistic understanding Māori hold of the environment, and their place within it drawn from key values such as whakapapa, mauri and kaitiakitanga. Hirini Moko Mead (2016, p. 275) further elaborates upon the importance of land to Māori:

Undoubtedly land provides a place for one to stand. This is inherent in the concept of tūrangawaewae, a place for the feet to stand; where one's rights are not challenged, where one feels secure and at home.... The net effect of various cultural bonding mechanisms and traditional tikanga practices was to develop a relationship with the land. This relationship is about bonding to the land and having a place upon which one's feet can be placed with confidence. The relationship is not about owning the land and being Master of It, to dispose of as the owner sees fit. The land has been handed down the whakapapa line from generation to generation and the descendant fortunate enough to inherit the land does not really 'own' it. That person did not buy it. The land cannot be regarded as a personal asset to be traded.

2.1.3 European colonisation of Aotearoa

The first meeting between Māori and Europeans occurred in 1642 near what is now known as Golden Bay, involving the Dutch navigator Abel Janszoon Tasman and Ngāti Tumatakokiri. It was an isolated and disastrous first meeting between Māori and non-Māori (owing to the deaths of Dutch and Māori during this encounter). The next meeting would not recur until the arrival of Captain James Cook in 1769 some 127 years later. From the late 18th century, contact between Māori and Pākehā became less sporadic, with the first wave of settlers being largely transient, and employed in extractive industries such as whaling and sealing, gold mining or flax and timber harvesting (King, 2003). Belich (2009, p. 180) defines the colonisation of Aotearoa by those within the Anglo-Commonwealth as “a dominant group of migrants whose purpose has been to

build self-sustaining nations, independent and different from the imperial metropole, yet paradoxically imitative of it". To understand the changing land use patterns within Aotearoa it is important to examine the motivations which drove Europeans to leave their countries and colonise a country far away from their own.

The pattern of colonisation seen in Aotearoa is unique, but followed a similar process to that of other 'Anglo settler-colonies' such as Canada, Australia and the United States of America (Pool, 2015). This pattern was typified in Aotearoa by contact with missionaries, traders and colonial administrators before ultimate cession to the Crown in 1840 (Pool, 2015). Colonisation and landscape change could not in many instances be separated. Colonisation of Aotearoa was driven by religion and desires to bring 'civility' and 'modern industry' to the 'noble savages of New Zealand' (Park, 1995). Yet, the transition from a forested to a grassed landscape was also seemingly driven by a fervour over and above that of landscape change for the purposes of generating a return from a virgin landscape. Sir Walter Buller is quoted as describing a transition of forest to English grasses as a law of nature, and a process that has occurred throughout the world and 'must inevitably happen' alongside the 'aboriginal race' giving place 'to a more highly organised, or, at any rate, a more civilised one' (Park, 1995, p. 213).

Beyond this, Crosby (2004) details three prerequisites to the *Europeanisation* of a country; firstly, land of a quality and quantity to pique the interest of Europeans with their particular species and systems of land use; secondly, the arrival of these species and land use processes in sufficient quantities to overwhelm pre-existing species and processes; and thirdly, willingness on the part of Indigenous populations to engage in new forms of land management and partake in trade with colonising Europeans. Notions of European and settler superiority had profound implications for the social, cultural and economic relationships between Māori and the British at first contact and into the present day. Pool (2015, p. 22) writes of the British as being driven by a range of motivations (to colonise) "which,

in sum, perhaps veered towards the humanitarian, although that attitude comprised a self-righteous belief, reinforced by Christian zeal, that it was their destiny to save Natives from their barbarities”. Other European colonists saw colonisation in competitive terms – as a natural Darwinian process of niche expansion whereby a successful invader supplants an existing culture (Park, 1995).

2.2 Introduction of monocultural land use techniques pre-Treaty of Waitangi

The early stages of European colonisation of Aotearoa were often characterised by mutual advantage, as Māori quickly saw the benefits afforded by “domesticated food plants, clothes, metal and ideas” and these desires were reflected in European interest in “timber and flax” (Park, 1995, p. 57). Early contact between Māori and Pākehā in the late 18th and early 19th centuries was typified by Māori maintaining hegemony and autonomy over their resources (King, 2003). Yet by the end of the 19th century, the balance dramatically shifted to favour the colonising Pākehā. This section details how, in particular, the colonisation of Aotearoa rapidly changed how Māori engaged with their land – from a diverse landscape of managed ‘edges’ and areas of cultivation to one of monoculture agricultural and silvicultural regimes, and the resultant impact on Māori land in the present.

The Māori productive economy changed in a number of ways after contact with Pākehā. By 1839, European colonisation of Aotearoa had significantly affected the manner in which Māori managed their land, in particular their approach to agriculture (Hargreaves, 1963). These changes to agricultural practices were most pronounced north of Auckland, whilst acculturation was less pronounced in the isolated areas of the North Island and areas such as the Bay of Plenty and Te Tairāwhiti (Hargreaves, 1963). Major changes to land use are detailed by Hargreaves (1963, p. 103):

1. The introduction of new crops, of which the potato was of most significance, and to a lesser extent, wheat, maize, vegetables and fruits.
2. The introduction of new and more efficient agricultural implements.
3. The acquisition of the pig, and to a limited extent, other livestock (cattle, sheep and poultry).
4. The existence of a market for surplus agricultural production which meant a change from a wholly subsistence to a partly commercial economy.
5. The beginnings of other changes, most of which reflected the above-mentioned factors, which include changes in farming methods, dietary habits, and the breaking down of tribal authority and the influence of tapu.

New food crops (potato, pumpkin, maize, corn, wheat etc.) and animal species (initially pigs and eventually goats, sheep and cattle) supplemented domestic consumption and then circulated into the formal and informal economy (Clydesdale, 2007; Consedine, 2007; Firth, 1973; Hargreaves, 1960; Pool, 2015). Alongside this, iron tools (hoe, spade and fishing hooks) and European building materials were incorporated into the Māori productive economy, with some, such as the spade, greatly improving the efficiency of horticultural endeavours (King, 2003; Pool, 2015). Pool (2015) contends that by 1814, Māori were utilising European crops that they had an affinity for, and combining these with new found technologies for domestic and international trade. Lambert (2011) posits that Māori adapted their land use skills and crop choices to meet the needs of the market, and were responsive to the economic opportunities arising as a result of new produce.

This is exemplified by the rapid spread of the potato as a staple food crop throughout Aotearoa. It had a high yield, was easy to cultivate, nutritious and was able to be harvested more frequently than kumara. Hargreaves (1960) estimates the potato had superseded the four main Māori crops (kumara, taro, gourd and yam) by 1835, and this new crop spread inland far quicker than the movements of settlers. Other commodities which previously had no monetary value such as

kauri spars and flax were highly sought after by European settlers in the 18th and 19th centuries (before accessible stocks were exhausted) (Belich, 2001; King, 2003; Pool, 2015). Yet aspects of traditional practices still remained at the fore in the early 19th century, with Māori eschewing the use of manure for fertiliser, and instead relying on their system of leaving land fallow before burning and using the ash as fertiliser (Pool, 2015).

The addition of new crops and technologies brought by European settlers and adopted by Māori began the transition away from wholly Māori directed land management regimes. Although the uptake of European technologies, crop cultivars and food species began slowly at first, their introduction started the inevitable transition between a land management system that was based upon centuries of tikanga, into a hybridised version of Pākehā-Māori land management (for example, continuing to cultivate and consume traditional wild foods such as fern root and karaka berries (Hargreaves, 1963)). By the beginning of the 20th century it was exceedingly rare throughout Aotearoa for Māori to engage wholly with the land in a manner that their forebears had done.

2.2.1 Pervasiveness of European models of land use post Treaty of Waitangi

For two decades following the signing of the Treaty of Waitangi, the Māori economy was vibrant and hybridised (Pool, 2015). In this period, Māori land management was characterised by a combination of traditional ‘extensive’ land use practices (utilising forest and water resources still in Māori control) alongside greater usage of European crops and land use practices beyond potato cropping (Hargreaves, 1960; King, 2003; Pool, 2015). The potato exemplifies some of the rapid changes to Māori society post contact with Pākehā (what Pool (2015) describes as ‘clip-ons’ to the core economy) – yet, other crops such as maize and wheat began to be cultivated more widely by Māori – more so because of a Pākehā desire to buy such produce than as an addition to their diet (Hargreaves, 1960). By the 1830s the extractive industries which characterised the early Māori

economy post-contact were being usurped by 'clip-ons' to the core economy and a shift to exporting products of a more intensive brand of agriculture (Pool, 2015).

From the early 19th century onward, in addition to the traditional cropping techniques being modified with European crops and tools, as noted above, animal agriculture began to increase in importance, again largely due to the value settlers ascribed to livestock (Hargreaves, 1960). These changes in land use and farming practices generated a shift from a subsistence bartering economy to a cash economy (Belich, 2001; Consedine, 2007; King, 2003; Pool, 2015). By some accounts, the 1850s were the 'golden age' of Māori agriculture (Hargreaves, 1960). The participation of Māori in the cash economy had immediate material benefits for those iwi who traded produce and livestock domestically and internationally (e.g. consignments of potato and wheat to New South Wales) (King, 2003). There was significant investment by iwi in the immediate period after signing the Treaty of Waitangi, in coastal shipping, flour mills and canoe trading to service growing settlements such as Auckland. Wheat and potato were the key crops which Māori produced for export. Provincial flour mills were established with government support in the northern Waikato, Bay of Plenty and Taranaki (Hargreaves, 1960). Between 1846 and 1860 there were an estimated 37 flour mills established by Māori in the Auckland hinterland (Hargreaves, 1960). Participation in a cash economy also had the effect of drawing Māori (particularly young men) to paid seasonal work away from their rohe to peripheral employment on sheep stations or road building and bush clearing. This process further weakened reliance on systems of Māori land management (Pool, 2015).

The success of many North Island iwi with cash-based horticulture which characterised the post Treaty of Waitangi era quickly dissipated from the 1860s (Hargreaves, 1960). From the 1850s, significant pressure was placed upon the Aotearoa government to provide land for settlers to develop and farm (Belich, 2001; Pool, 2015; Walker, 2009). Many Pākehā settlers resented the fact that many areas of land in Māori ownership lay 'idle' or 'run down' and subsequently

resented Māori for not making this land available for sale (Clydesdale, 2007). Concurrently, awareness increased amongst Māori regarding the detrimental impact of colonisation and the loss of land which formed the basis for their identity and wealth (Walker, 2009). Growing tensions over land led to clashes between Māori and Pākehā in Waitara, Taranaki in 1860. This conflict eventually developed into pan-iwi conflict with the Crown. The New Zealand wars (1860-1872) significantly disrupted key places of production across the country, namely Taranaki, Waikato, and the Bay of Plenty which further limited the ability of Māori to compete on a level field with their Pākehā counterparts – especially when considering the impact of punitive land confiscations which followed these conflicts.

Beyond the New Zealand Wars, Pool (2015) identifies other factors which contributed to a decline in Māori agriculture such as the rapid increase in the rate of land alienation, which will be discussed in the following section. Other factors contributing to this downturn include growing exposure to a globalised economy and fluctuating commodity markets, diminishing returns from ever smaller areas of land due to confiscation and an inability to follow traditional cropping processes alongside challenges in competing with better located and capitalised Pākehā ventures (Hargreaves, 1960; King, 2003).

From the 1860s, throughout Aotearoa, pastoral agriculture began to supersede horticulture. Aotearoa was always envisioned as a country well suited to pastoralism – ‘an English farm in the Pacific’.⁴ A wool boom in the 1870s and the ever increasing share of land owned by Pākehā allowed for sheep farming to expand steadily throughout the North Island: sheep farming was well established in Otago, Canterbury and Marlborough from the mid-19th century (King, 2003). As

⁴ Quote by Harold Macmillan, British Prime Minister 1957–1963. Cited in PCE (2019).

fertile lowland areas became more scarce there was pressure to develop marginal land into farmland (PCE, 2019). The land loss experienced by Māori unquestionably contributed to the changes in Aotearoa’s land cover from one dominated by indigenous vegetation to a landscape of exotic pasture (Hargreaves, 1960). Yet, Māori were not excluded from the developing pastoral economy. By 1886, Māori landowners both individually or within tribal collectives farmed ~100,000 sheep and ~40,000 cattle (Hargreaves, 1960). This progress is evidenced in Table 3.

Table 3: Distribution of rural assets, 1901, Māori and Pākehā (Pool, 2015, p. 279)⁵.

	Māori	Pākehā	% Māori
Improved land (Acres)			
Sown Grass	78,269	11,081,912	0.7
Other Crops	27,649	765,051	3.4
Grain	10,021	721,325	1.4
Total	115,939	12,568,288	0.9
Stock (numbers)			
Sheep	317,436	19,355,195	1.5

⁵ Data taken from *Census 1901*, 'Appendices, Māori Census', Table v, 'Land Cultivated and Livestock held by Māori'; Pākehā, Appendices to census, Tables iii and vi, in 'Land and Livestock'. *CES-U* = cattle-beast equivalent stock-units (1 head of cattle =4 sheep =3 pigs). The data on particular animals are numbers, not stock-equivalents (Pool, 2015, p. 279).

	Māori	Pākehā	% Māori
Cattle	36,943	1,256,580	2.9
Pigs	57,642	250,975	18.7
CES-U (index)	135,514	6,179,137	2.1
Population (numbers)	45,549	770,313	5.6

2.2.2 Impact of widespread land alienation on land management patterns

Land alienation was instrumental in changing Māori land management patterns, and as a tool of colonisation, severely impacted Māori and their ability to uphold their traditions and customs. There were three major instruments of land alienation in the colonial period – Crown Purchase, confiscation and the Native Land Court (NLC) (Pool, 2015). Around 231,075 ha of Māori land was deemed to be purchased legitimately before the signing of the Treaty of Waitangi (Ward, 1997b). However, the vast majority of Māori land was ultimately ‘lost’ in the period after 1840. The ability for the Crown to purchase land was legitimised by the Treaty of Waitangi, and relied upon the legal theory of pre-emption, whereby only the Crown could extinguish ‘customary title’ (Boast, 2008). Crown purchase, as an instrument of land alienation, involved Māori land being acquired voraciously until around 1865 (Pool, 2015). Around this time, punitive land confiscations affecting iwi throughout Aotearoa took place for minor indiscretions during conflict between Māori and the Crown (King, 2003; Pool, 2015). A third phase of land alienation also began in the 1860s through the establishment of the Native Land Court which directed that all Māori land titles be individualised to better allow the transfer of land from Māori to Pākehā.

Law directly pertaining to, and in effect, legitimising the alienation of Māori land was crafted wholly by the legislature, with the courts playing a secondary role

(Boast, 2008). Boast (2008) states that statutes pertaining to Māori land can be organised into three clusters. The first encompasses the Native Lands Acts 1862, 1865 and 1873. Secondly, there are the various Acts pertaining to the alienation and administration of Māori land; for example, the Land Act 1882 is one of the better known of these statutes and introduced a raft of new land tenures which provided for the protection of public rights in the countryside (Pool, 2015). Finally, there are statutes which established systems for land surveying, registration and the role of the state as the guarantor of land titles which began with the Land Transfer Act 1870. At the present time, statutes such as Te Ture Whenua Māori Act (1993), the Land Act (1948) and the Land Transfer Act (1952) structure Aotearoa's land law and provide for all administration of Māori land (Boast, 2008).

The legislation legitimising land confiscations by the Crown was contained in the New Zealand Settlements Act 1862 (Walker, 2009). This legislation was designed to target the growing Kingitanga movement, and reify the legitimacy of Crown rule and the ability of the Crown to act as the sole agent through which land could be traded (King, 2003). Although the legislation targeted those engaged in armed conflict with the Crown, little distinction was made between 'loyal' or 'rebel' Māori (Walker, 2009). Confiscated land was then eligible to be used in the establishment of further settlements, largely by former military servicemen (Walker, 2009). Land confiscations arising as a result of military action resulted in around 1,200,000 ha (4.4% of Aotearoa's total land) being confiscated, mainly in the King Country, Taranaki, Te Tairāwhiti and the Bay of Plenty (Walker, 2009). However, evidence compiled in Ward (1997b) puts land lost to confiscation (less land returned by the Crown) at 997,145 ha.

The Native Land Court (NLC) was established by the Native Lands Act 1862 and 1865 with the express purpose of making Māori land accessible for settlement and to legislate for assimilation (Walker, 2009). The aims of the NLC were thus twofold; to make available the remainder of land under Māori ownership for settlement and colonisation, and further, to break up Māori social and political

systems to facilitate assimilation into the Pākehā population (Pool, 2015). Henry Sewell, the Justice Minister at this time is quoted in 1870 (Phillips & Hearn, 2008) describing the aims of the court as:

The other great object [of the NLC] was the detribalisation of the Māoris – to destroy, if it were possible, the principle of communism which ran through the whole of their institutions, upon which their social system was based, and which stood as a barrier in the way of all attempts to amalgamate the Māori race into our social and political system. It was hoped that by the individualisation of titles to land, giving them the same individual ownership which we ourselves possessed, they would lose their communistic character, and that their social status would be assimilated into our own.

The NLC followed the principles of English law and provided for the conversion of communal landholdings into individual titles, effectively making it easier for Pākehā to purchase land (King, 2003). Boast (2008, pp. 5–6) contends that “the Native Land Acts of 1862–65 revolutionised Māori land tenure, converting it from a customary tenure governed by Māori customary law to a kind of freehold grant governed by common law and statute”. The NLC required any landholding, regardless of its size to have no more than 10 owners who would ‘own’ the block as trustees for their wider hapū or iwi (King, 2003). All deliberations and judgements had to be heard in court, so many claimants had to travel vast distances, and incur significant debts whilst awaiting the outcome of their case (Pool, 2015). In many instances, debts incurred in the NLC process required Māori to sell land they had successfully defended which contributed to the ongoing process of land alienation (King, 2003; Pool, 2015; Walker, 2009).

The NLC was highly successful in alienating Māori land. In conjunction with confiscation, Crown Purchase and pre-Treaty purchases, Ward (1997b) estimates that 88 percent of remaining Māori land was transferred to Pākehā by 1910.

Although land confiscation (raupatu) achieved significant publicity and was (and arguably still is) a political flashpoint between Māori and the Crown, the proportion of land lost through confiscation pales in comparison with that lost under the bureaucracy of the NLC (Pool, 2015). Confiscation was largely limited to areas where Māori were engaged in direct conflict with the Crown, whereas Boast (2008) argues that the NLC operated across the land, even in areas where widespread Crown purchases had already been achieved; essentially it affected every iwi and every region. A further factor is that under the NLC, Māori land alienation was disingenuously presented as an instrument of public administration (Pool, 2015). Alienation under the guise of bureaucracy or the judicial system continued to affect Māori well into the 20th century, through other instruments such as the Public Works Act legislation from the 1870s onwards (for railway lines, air fields and roads), the taking of Māori land under war time provisions or the sale of land by the Māori Affairs Trustees (Pool, 2015).

Table 4: Proportions of Māori land (ha) by district at 1860, 1890, 1910, and 1939 (Ward, 1997b).

Total district area		1860		1890		1910		1939	
District	Total hectares	hectares	%	hectares	%	hectares	%	hectares	%
Auckland	1,699,997	981,516	57.7	405,820	23.9	310,843	18.3	88,408	5.2
Hauraki	331,300	297,473	89.8	122,465	37.0	38,595	11.6	2,890	0.9
Bay of Plenty	586,199	586,199	100.0	246,371	42.0	183,490	31.3	122,258	20.9
Urewera	410,499	410,499	100.0	347,096	84.6	285,863	69.6	47,060	11.5
Gisborne-East Coast	857,598	857,598	100.0	466,601	54.4	326,183	38.0	183,212	21.4
Waikato	985,598	897,954	91.1	166,542	16.9	117,275	11.9	13,348	1.4

Total district area		1860		1890		1910		1939	
Volcanic Plateau	1,012,098	1,012,098	100.0	638,803	63.1	406,676	40.2	203,787	20.1
King Country	988,998	935,751	94.6	801,380	81.0	457,658	46.3	131,479	13.3
Whanganui	541,499	491,016	90.7	259,720	48.0	212,867	39.3	108,155	20.0
Taranaki	803,399	767,931	95.6	221,673	27.6	110,358	13.7	8,118	1.0
Hawke's Bay Wairarapa	2,440,396	1,268,558	52.0	630,343	25.8	425,733	17.4	140,766	5.8
Wellington	1,101,998	862,204	78.2	388,648	35.3	248,954	22.6	76,023	6.9
Northern South Island	1,361,398	0	0.0	0	0.0	42,889	3.2	0	0.0
Southern South Island	138,618	0	0.0	0	0.0	90,889	65.6	0	0.0
Chathams	72,626	0	0.0	0	0.0	29,494	40.6	0	0.0

By 1910, throughout Aotearoa Māori had lost the most fertile and desirable areas of their landholdings. This is particularly evident in Table 5, where areas with gentler topographical features saw the most extensive land alienation with Māori in Waikato and Taranaki retaining 12 percent and 14 percent of their land at 1910, with 0.30 km² and 0.37 km² per capita respectively. This contrasts markedly with land retained by Māori in the Urewera (72%) and Gisborne-East Coast (38%) districts with 1.95 km² and 0.45 km² – largely a result of intense topographical features characterising these areas. However, as demonstrated in Table 4, the proportion of land retained by Māori in all areas declined dramatically between 1860 and 1939 as the legacy of the Crown purchase, confiscations, the NLC and other instruments continued to alienate Māori land. What land was retained by Māori had steeper, more rugged terrain, was less fertile and generally far harder

to farm productively than land in Pākehā hands (Pool, 2015). By 1920, Department of Native Affairs figures presented in Boast (2008) indicate that Māori owned 1,937,508 ha, of which 153,781 had been continuously occupied by Māori.

Table 5: Land still in Māori ownership (%) at 1910: North Island Waitangi Inquiry districts grouped by dominant topographical characteristics (Ward, 1997b).

Districts	% still Māori	Sq. Km per Cap. (Māori only)
Predominantly rolling or limited local relief		
Waikato	12.0%	0.30
Taranaki	14.0%	0.37
Mixed, steeper land and flatter		
Auckland-Northland	18.0%	0.26
Hauraki	12.0%	0.18
Bay of Plenty	31.0%	0.47
Hawke's Bay-Wairarapa	17.0%	1.54
Wellington	23.0%	0.84
Mainly intense local relief		
Urewera	72.0%	1.95
Gisborne-East Coast	38.0%	0.45
Volcanic Inland Plateau	40.0%	1.62
King Country	47.0%	1.29
Whanganui	40.0%	1.28
North Island	27.0%	0.67

2.2.3 Patterns of Māori land use in the Waiapu catchment and Te Tairāwhiti

Māori settlements were well populated and widely dispersed throughout the Waiapu valley until the 1880s and residents of these settlements enjoyed a high standard of living in comparison with other Aotearoa regions (Harmsworth et al., 2002; Rau, 1993). Native forest was the dominant land cover within the Waiapu catchment pre-colonisation with Harmsworth et al. (2002) estimating that at 1840, native forest constituted 80-90 percent of the Waiapu valley with coastal areas to the east of the Waiapu River covered in scrub and coastal forest as a result of land clearance and burning. Lower lying fertile lands close to the coast and river mouth were the focus of extensive cultivations of kumara and taro, whilst proximity to the sea allowed for harvesting of fish and shellfish and proximity to dense indigenous forest provided an abundance of resources and sustenance (Beckwith, 2007). Mackay (1949), citing evidence from early settler interactions with Māori, details the ubiquitous horticultural practices of Te Tairāwhiti Māori which were productive, highly organised and maintained. He cites Captain James Cook and his botanist Joseph Banks (1769), who among others, commented on the pre-colonial horticultural practices which consisted of sweet potatoes “planted on small hills, some in rows and others in quincunx, and all laid out most regularly in line”, cocos and a variety of cucumber (MacKay, 1949, p. 124). Mackay (1949, p. 127) further cites evidence that in 1840, at Te Araroa, there existed substantial acreage set aside for cultivations of such crops as “potatoes, kumaras, taro, maize, melons, pumpkins, cabbage, onions and other vegetables”.

The arrival of Pākehā settlers in the mid to late 19th century precipitated what was initially a gradual, but ultimately rapid land use change from diverse indigenous forest to a landscape dominated by monocropping (maize and wheat) and dairy farming on the river flats (Harmsworth et al., 2002; Rau, 1993). Between 1890 and 1930 the Waiapu catchment, like Te Tairāwhiti, was developed extensively for pastoralism which began with large scale forest clearance and then burning

(Harmsworth et al., 2002). Harmsworth et al. (2002) contend that this landscape change is one which is replicated throughout the wider Tairāwhiti region and has resulted in widespread erosion and sedimentation throughout the catchment. Landscape change in the region was encouraged by successive governments through provision of fertilizer subsidies, discounted loans, tax breaks for land development and a guaranteed minimum livestock price for farmers (Harmsworth et al., 2002). The combination of incentives and subsidies which stimulated rapid landscape change in an area that is characterised by geological instability and was already susceptible to erosion events (Marden et al., 2012) further limited the catchment's ability to cope with high intensity rainstorms and flooding (Harmsworth et al., 2002).

Māori within the Waiapu catchment, and Te Tairāwhiti more broadly, did not lose as much land proportionally as other iwi throughout the North Island as indicated by Table 5 (Ward, 1997b). This was in part due to Ngāti Porou acting as kūpapa (Māori loyal to the Crown) during the Land Wars of the 1860s and also likely due to the isolation, and severity of geographic relief around the East Cape (King, 2003). As noted earlier, before Pākehā contact, Māori living in and around the Waiapu catchment managed an extensive landscape of 'edges' (Park, 1995) and utilised an array of forest, estuarine, river and ocean resources (Beckwith, 2007; Harmsworth et al., 2002). Likewise, there is significant evidence of intensive horticultural practices in the pre and post contact era (Hargreaves, 1960; MacKay, 1949). Upon increasing contact with European settlers, Ngāti Porou, as with many other iwi throughout Aotearoa, traded extensively with Europeans. Initially these trades relied upon commodities from extractive industries (flax, timber etc.) but from the 1820s and 1830s there is evidence of many iwi, including Ngāti Porou, trading the products of intensive agriculture – chief of which was potato but also wheat and other introduced crops (Pool, 2015).

Throughout the remaining half of the 20th century, Ngāti Porou saw a steady erosion in the amount of land remaining in Māori ownership through confiscation,

Crown Purchase and the operation of the Native Land Court (Ward, 1997b), as discussed above. By 1908 Ngāti Porou had lost well over half of their land, and with land underpinning the Tairāwhiti economy the economic potential of Māori landowners in the region was severely tested (Ward, 1997b). The trauma of colonisation coupled with the loss of land, further shifted most iwi away from traditional land use practices by the middle of the 19th century. Ngāti Porou were no exception. In areas of land remaining under Māori control, the Waiapu catchment and surrounding areas saw increasing cash horticulture activity for trade with Pākehā and from the 1870s, due to a decline in return from the wheat industry, increased sheep farming in the Tairāwhiti hill country (Sorrenson, 1996). Ngāti Porou were some of the earliest adopters of pastoral sheep farming through the efforts of leaders such as Rāpata Wahawaha and Mōkena Kōhere on open country in the late 19th century (Kingi, 2008a). Ngāti Porou sheep farming did not flourish until the interventions of Apirana Ngata who envisioned a more cohesive approach to sheep farming which included a model for incorporation of Māori land that was initially informal, but then underpinned nationally by legislation (Sorrenson, 1996). Ngata introduced contemporary farming methods and helped with the provision of finance to the Union of Ngāti Porou Farmers which saw an increase in sheep numbers from 52,786 in 1900, to 132,356 in 1909, up to an estimated 500,000 in 1927 (Kingi, 2008a). Ngata also saw merit in Ngāti Porou participating in dairy farming, which saw flat land previously used for horticulture transitioned into dairy land (Kingi, 2008a).

[2.2.4 A focus on pastoral agriculture to combat colonisation](#)

The poor quality of land left in Māori hands, and the difficulty landowners faced earning a return from this land in a cash-based economy began to receive more substantial attention from the Crown after 1900 (Pool, 2015). This is particularly evident in Te Tairāwhiti where Sir Apirana Ngata devoted substantial attention to reform of the Māori land tenure system, initially with Ngāti Porou as a private individual, but throughout Aotearoa in his capacity as an MP and Cabinet Minister

between 1905 and 1943 (Sorrenson, 1996). Ngāti Porou were more fortunate than other iwi in that they retained a large portion of good quality farming land (flats and hill country) (Sorrenson, 1996). Ngāti Porou began converting areas of their land to sheep stations from the 1880s (King, 2003). As a person of stature within Ngāti Porou, Ngata began to expand the pastoral operations of Ngāti Porou through more intensive farming practices, investment in modern equipment and expansion of their sheep flock (Sorrenson, 1996). Experiments at the local and regional level regarding the incorporation of Māori land were also deemed to be successful (Sorrenson, 1996). It was these experiences within Te Tairāwhiti that formed the basis for nationwide land reform that characterised his time in Parliament as a member of Cabinet responsible for Māori land councils (1909-1912) and as Minister of Native Affairs (1928-1934).

Ngata identified a number of problems, that if overcome, would be key to unlocking the potential of Māori land and in so doing, improve the economic circumstances of Māori whilst contributing to social and cultural revival (Walker, 2009). Ngata saw prosperous rural communities steeped in Māori culture but with foci on pastoral agricultural production as providing the best opportunity to recover from the trauma of conflict, land alienation and colonisation (King, 2003). It was believed by Ngata and other eminent Māori in the 1930s that living on “one’s own land was the best way of preserving whānau and hapū life, and that in most areas farming, especially dairy farming, offered the best means of retaining traditional family and community links” (King, 2003, pp. 470–471). The fragmentation of Māori land had increased rapidly since individualisation of Māori land under the passage of The Native Lands Act 1862 (Kingi, 2008b). Māori landowners had few effective options to administer the now cumbersome land management arrangements foisted upon them, and compounding this issue, accessing finance to develop these lands. Beginning in Te Tairāwhiti, from 1903, Ngata experimented with consolidation of land blocks into contiguous land holdings beginning with the Waipiro and Mangatu blocks and then other non-

contiguous Ngāti Porou landholdings (Sorrenson, 1996). These blocks would also be administered by incorporated committees (King, 2003). Ngata recognised that Māori landowners could not effectively develop and administer their lands without access to finance. Whilst acutely aware of the dangers of indebtedness, provision was made for Ngāti Porou landowners to access finance through establishment of the Waiapu Farmers' Co-operative Company. These schemes were largely limited to lands in Te Tairāwhiti and Te Urewera until the mid-1920s, when, with the encouragement of the Native Land Court, other iwi began to adopt these schemes (King, 2003). Ngata “was determined to demonstrate that with skill, leadership and management, Māori could farm their land as successfully as Pākehā” (Sorrenson, 1996).

These experiments proved fruitful at a regional level and would form the basis for wider land reform at a national level. Ngata was elected to Parliament after winning the Eastern Māori seat in 1905. An early appointment, in 1907, was sitting on a commission (ultimately known as the Stout-Ngata Commission) to investigate and report on the best methods for bringing unoccupied and unimproved Māori land into production (New Zealand Waitangi Tribunal, 2004, p. 449). The Commission was critical of the Government’s use of pre-emption to purchase Māori land below its market value and recommended iwi with little remaining land should have this land reserved (Sorrenson, 1996). The Commission highlighted the urgent need for government assistance to be given specifically to Māori for the development of their land (New Zealand Waitangi Tribunal, 2004). Whilst there was provision for assistance to farmers through the Advances to Settlers Act 1894, such measures were designed for individual landowners, thus making such schemes irrelevant for the majority of Māori landowners (New Zealand Waitangi Tribunal, 2004). To quote Ngata himself: “so great was the prejudice against the Native title, [that] very few were able to secure assistance from that source [Advances to Settlers Act 1894]” (Ngata, 1931, p. 183).

The entirety of Ngata's vision for the development of Māori land could not be realised until he rose to the position of Minister of Native Affairs in 1928. His efforts were realised in the Native Land Amendment and Native Claims Adjustment Act with the broad purpose of the Act outlined in section 23(1) as 'better settlement and more effective utilisation of Native land or land owned or occupied by Natives, and the encouragement of Natives in the promotion of agricultural pursuits and of efforts of industry and self-help'. Ngata saw the consolidation and development of Māori land through use of modern management techniques as vital to halting the rapid alienation of Māori land. This was particularly important as between 1912 and 1928 when Ngata was on the opposition benches, Māori land holdings were reduced from 3 million hectares to 1.8 million hectares through direct Government policy – predominantly through the various Public Works Acts (of the 1.8 million hectares, it was estimated that about 300,000 ha was unsuitable for development, and 300,000 ha was leased to Pākehā farmers) (King, 2003).

The Act provided for advances of public money for clearing and developing Māori farms (up to three fifths of the value of the property), to be repaid through later agricultural production. Through development and consolidation of Māori land assets, Ngata envisioned such schemes as reconstituting iwi land bases and providing a springboard for social and cultural revitalisation through investment in marae, sporting and cultural activities (King, 2003). These schemes, contends Ward (1997b), were important in ensuring rural Māori communities were both economically viable and culturally secure.

2.3 Māori land 'ownership' and Te Ture When Māori Act

Before the introduction of systems of land deed or title and registration with the Native Land Settlement Act 1862, customary Māori land tenure was grounded in cosmological beliefs. As such, the relationship between Māori and land was characterised less in terms of 'owning' land, and more in terms of 'belonging'

which acknowledged land as permanent and human life as transient (Kingi, 2008b).

Kawharu (1977) identifies five ways in which Māori established land ownership:

1. Taunaha whenua – land claimed during exploration and discovery.
2. Take ahi kā – land ownership confirmed by continuous occupation ‘maintaining the lighted fires’.
3. Take tipuna – ancestral rights to land drawn from take ahi kaa.
4. Take raupatu – rights to land through conquest and confiscation.
5. Take tuku – rights to land through gift.

Instructions were issued to the government of Aotearoa in 1846 after the signing of the Treaty of Waitangi in 1840 to establish a land court which would bring Māori land under English common law (King, 2003). As discussed, this was achieved through the establishment of the Native Land Court through the Native Lands Act of 1862 and 1865. Section 23 of the Native Lands Act 1865 allowed for a certificate of title to be issued to no more than ten owners, which hastened alienation by speeding up the land codification process (Kingi, 2008b). Entire iwi could 'own' title to a block of land, but the block must be larger than 2000ha. Large areas of iwi land were divided into smaller allotments below the 2000 ha threshold, so this practice of division in conjunction with the proviso had the effect of fragmenting tribal land (Kingi, 2008b). Compounding this was the fragmentation of land ownership, a process created by descendants of those who were registered to a land title being given equal share to this land. This resulted in increasing division of land title into uneconomic portions (Boast, 2008; Kingi, 2008b; Pool, 2015).

“The systematic process of confiscation and individualisation led to the current situation where the remaining land held under group or collective ownership constitutes a very small proportion of New Zealand’s total land area. The large

numbers of owners registered against the land titles have produced a difficult situation that requires expensive and cumbersome management structures to administer the owners' interests" (Kingi, 2008b, p. 137).

Today, Māori land is governed by the Te Ture Whenua Māori Act 1993 (TTWM). Under the TTWM there are three categories of Māori land (Harmsworth, 2003, p. 9):

- Māori freehold land: Land that, with very few exceptions, has not been out of Māori ownership. The Māori Land Court determines whether land is Māori freehold land.
- Māori customary land: Land held by Māori in accordance with tikanga Māori. It has not been transferred into freehold title by the Māori Land Court, nor ceded to the Crown. Before 1840, all land was Māori customary land. Today, the exact amount is unknown but is believed to be extremely small.
- General land owned by Māori: Land owned by five or more people, where the majority of the owners are Māori.

It is generally stated that Māori land comprises ~5.6 percent (1,515,071ha) of Aotearoa's total land mass (26,930,097ha) (Kingi, 2008b), yet other estimates place Māori landownership as low as 3 percent (Harmsworth, 2003). There are 3,262,879 ownership interests across all land blocks (27,456 in total) and the average size of Māori land blocks is 51.05 ha with 105 owners (Māori Land Court & Office of the Chief Registrar, 2019). The correct term for Māori land is 'Māori freehold land' which distinguishes this land from the remaining two categories which constitute a minute proportion of Māori land. The purpose of the TTWM Act, as defined in the preamble, is to reform the laws relating to Māori land in accordance with the principles of the Treaty of Waitangi, to recognise that land is taonga tuku iho (of special significance to Māori people) whilst working to promote the retention of land in the hands of its owners, their whānau and their

hapū, and to protect wāhi tapu whilst promoting land retention and utilisation⁶. In order to meet these objectives, there are strict rules protecting Māori land from further alienation (including leasing and sales) (Durie, 1998).

The TTWM Act provides for a number of management structures which are detailed in Table 6. The administrative structures available to Māori landowners under the TTWM, whilst cumbersome, are an attempt to streamline the administration and development of Māori land whilst promoting land utilisation and retention. Historically, this has been difficult due to challenges in building consensus amongst high numbers of landowners (including absentee landowners) and balancing the interests of major and minor shareholders on often small land blocks which have poor access and may be geographically isolated or non-contiguous land holdings (Kingi, 2008b). Underlying these issues are the poor quality and marginal nature of much Māori owned land as the majority of land best suited to agricultural production was sold or confiscated in the 19th and early 20th centuries (Kingi, 2008b).

⁶ Preamble of Te Ture Whenua Māori Act 1993.

Table 6: Types of administration structures for Māori land and Māori Land Court districts (Māori Land Court, 2019).

Management structure details						
Rohe	Māori Incorporations	Ahu Whenua Trusts	Māori Reservations	Whenua Tōpū Trusts	Pūtea Trusts	Other Trusts
Taitokerau	15	518	588	1	0	14
Waikato-Maniapoto	16	962	296	4	1	30
Wairariki	28	1570	552	8	1	56
Tairāwhiti	63	978	273	5	0	31
Tākitimu	5	396	113	4	0	14
Aotea	23	837	366	10	0	23
Te Waiponamu	10	430	136	2	0	27
Total	160	5691	2324	34	2	195

Ahu Whenua Trusts and Māori reservations predominate in most regions, including Te Tairāwhiti. The Māori trustee is also a significant player in the administration and development of Māori land. As outlined in the Māori Trustee Act of 1953, the Māori Trustee acts as the sole agent for owners of Māori land without an ownership structure (Kingi, 2008b). The Māori Trustee was originally designed to support Māori landowners in managing their land by focussing on governance concerns, owner coordination, improving land productivity and expense management⁷. This role is now assisted by an independent organisation

⁷ For more information see here: <https://www.tetumupaeroa.co.nz/about-us/history/>

– Te Tumu Paeroa – and together, these entities administer 100,000 ha of Māori land on behalf of nearly 100,000 owners. Te Tumu Paeroa is often appointed by Ahu Whenua trusts to administer land on their behalf. As a result of the legislation that the Māori Trustee operates under, there have been criticisms that the Trustee is too risk averse and slow to take up novel land use options, instead continuing to support land uses which may run counter to the preferences of the landowners.

2.3.1 A proliferation of uneconomic and marginal land blocks in Te Tairāwhiti and throughout Aotearoa

As noted, land remaining in Māori ownership after alienation was generally of poorer quality than that in Pākehā hands. Land remaining in Māori ownership was disproportionately located in the most inhospitable mountainous parts of the North Island. This land was also geographically fragmented and many Māori land blocks were isolated and without road access as they were surrounded by other land blocks (Ward, 1997b). These challenges were compounded by fragmentation of ownership within uneconomic land blocks across Aotearoa, and many land blocks were punitively taxed with the owners unable to access finance for land development (Pool, 2015). By 1911, 100 percent of Māori were still living rurally and dependent on subsistence farming (Pool, 2015). At this stage, Māori controlled around 12 percent of Aotearoa whilst constituting ~6 percent of the general population as seen in (Pool, 2015). For all intents and purposes, at the beginning of the 20th century, the vibrant Māori economy was ‘dismembered’, with Māori businesses destroyed through a combination of conflict, punitive confiscations and taxes, and quasi-legal judicial processes resulting in what Pool (2015) describes as an ‘underdevelopment trap’.

Throughout the 20th century, Aotearoa continued to live up to its description as ‘an English farm in the South Pacific’, and pastoral farming became a major export earner with a revered place in the national psyche. However, this prosperity and

status did not apply to the vast majority of Māori landowners. Over time, it became abundantly clear that much Māori land was too marginal for effective agricultural production, and was much more vulnerable to climate, market and policy volatility. By 1939 the process of migration by Māori to urban centres had begun and would continue in earnest throughout the 20th century with the most significant outflows occurring in the 1950s and 1960s (King, 2003). It seems, as Ward (1997a, p. 115) contends: “they [Māori], like most New Zealanders, wanted to live in reasonable comfort rather than struggle on marginal farms; they wanted well-paid jobs, good housing, and other opportunities in the towns”.

Economic factors such as a fall in wool prices from the mid-1950s (attributed to competition from synthetic textiles), the oil shocks of the 1970s and Britain’s entry into the European Economic Community in the same decade culminating with the removal of agricultural subsidies in 1984 had detrimental impacts on Māori landowners (PCE, 2019). Small dairy units developed through Apirana Ngata’s schemes were uneconomic by the 1950s (King, 2003). In Tairāwhiti, severe weather events and droughts made pastoral farming on marginal hill country an even more difficult proposition, and much land was abandoned, reverting into native or exotic scrub and forest species (Barnard et al., 2012). Ward (1997a) notes that Māori communities have tended to look back on Ngata’s development schemes with a sense of frustration. It is clear that one of the main obstacles to Ngata’s vision was the dearth of quality land available “to support small holders in reasonable prosperity” (Ward, 1997a, p. 111), but another was slowness in adapting to long-term market price signals.

The failure of many farms that were developed with assistance from Ngata’s and other government schemes across Te Tairāwhiti arose as a result of economic and environmental trends throughout the 19th and 20th centuries combined with factors, such as poor land quality, detailed in preceding sections. These trends coincided with an increasing emphasis by local and central government on reforesting degraded, erosion prone land to arrest increasing sediment output in

rivers throughout Te Tairāwhiti (Awatere et al., 2018; Harmsworth et al., 2002; Marden et al., 2012). Afforestation using exotic species began in the early 1960s with the establishment of the Mangatu forest, and planting spiked again after extreme weather events caused widespread erosion in the 1980s (Marden et al., 2011).

Māori throughout Aotearoa are today significant owners of forestry assets which are wholly owned by Māori trusts and incorporations, or leased to the Crown or private entities (PCE, 2019). Many of these forests are formerly Crown owned, and have been transferred into Māori ownership to settle historic breaches by the Crown of its Treaty obligations (PCE, 2019). Because Māori land in Te Tairāwhiti was generally of a poor quality, and vulnerable to erosion, much of these lands was targeted for exotic afforestation by successive governments and latterly, private forest companies. Whilst there are no doubt important benefits offered by the exotic forestry industry around employment and economic returns from marginal land, communities throughout Te Tairāwhiti have, in time, discovered the significant negative environmental impacts associated with exotic forests over their life cycle (Harmsworth & Mackay, 2010). Beyond this, exotic forests, much like sheep and beef farms, have proved vulnerable to fluctuations in return due to the connection to global commodity markets (King, 2003).

Māori landowners in Te Tairāwhiti have gone through a cyclical pattern of changes in land management since colonisation of Aotearoa, and more often than not development has been out of Māori hands (Barnard et al., 2012; Harmsworth & Warmenhoven, 2003; Warmenhoven et al., 2014). The pre-contact economy was vibrant and relied upon extensive use of river, ocean, estuarine and forest 'edges' alongside intensive horticulture in suitable areas (Park, 1995). The arrival of Pākehā with Captain Cook in 1769 precipitated a gradual change in land use patterns which began with the introduction of the potato and other crops such as wheat and maize, but also revolutionised Māori land management with European agricultural implements and livestock and participation in a cash-based economy

(Belich, 2001; King, 2003; Pool, 2015). The changes inspired by these factors cannot however be seen in isolation from the broader devastation wrought by colonisation and land alienation.

Access to new technologies and crops, and domestic and international trading markets at times benefited Ngāti Porou and other Māori throughout Aotearoa until the beginning of the New Zealand Wars of the 1860s – yet, greater loss of land (which underpinned the Māori economy) and a loss of traditional knowledge, impacts of disease and other factors of colonisation severely hampered Māori entrepreneurship in Te Tairāwhiti and throughout Aotearoa (Pool, 2015; Sorrenson, 1996). The pressure from these factors was such that, in the final three decades of the 19th century as land alienation in violation of the Treaty of Waitangi continued apace, and previously profitable export markets such as flax fibre, potato, maize and wheat declined, Ngāti Porou landowners sought to respond by participating more extensively in the pastoral farming sector.

The change in land use driven by leaders such as Apirana Ngata saw widespread deforestation of hill country and then, from the 1920s, dairy farming on the Waiapu river flats. Yet, these new land uses were not immune from the vagaries of domestic and international markets. With fluctuating commodity prices, the poor quality of land remaining in Māori ownership and structural constraints faced by Māori landowners – such as access to credit – limited the viability of these land uses for many individual Māori landowners, Māori trusts and Incorporations. The viability of pastoral farming in the Waiapu catchment and Te Tairāwhiti would also be severely tested by increasing erosion throughout the 20th century, and other processes such as post-WW2 urban migration and later, economic shocks in the 1970s and economic reforms of the 1980s.

Leading up to the present, the last major land use change process, occurring throughout the latter half of the 20th century in Te Tairāwhiti, was widescale afforestation of exotic tree species on marginal farmland – driven by the New

Zealand Forest Service, and then private forestry companies (Barnard et al., 2012; Harmsworth & Warmenhoven, 2003; Tomlinson et al., 2000). There were afforestation spikes in the 1960s and 1980s in response to erosion, and perceptions of greater profitability and community benefits (such as employment) offered by the forestry industry (Awatere et al., 2018; Tomlinson et al., 2000).

Over time, then, the make-up of land use in Te Tairāwhiti has shifted from the extensive and intensive pre-contact economy, to sheep and dairy, and thence to exotic forestry, all of them monocultural 'Pākehā' land use regimes. These changes have been supported at times by Māori leaders such as Ngata, seeking to recover from the dispiriting conditions of the late nineteenth century. More recently, the changes have been driven by successive governments which have prioritised successive land management regimes, irrespective of mātauranga Māori input and suitability for local conditions.

Some have argued that government policies have precipitated a series of social, environmental and economic shocks to the people of Te Tairāwhiti (Barnard et al., 2012). But this is an incomplete analysis. An alternative view is that varying land uses have been promoted over time, without due attention to local conditions and longer-term sustainability. They have typically proven disappointing, both environmentally and socially, and even economically as trade conditions have changed. Over the decades, Māori have adapted to Pākehā legal constraints and incentives, albeit sometimes with difficulty and have struggled economically in the face of the low productivity of the remaining land and difficulties in terms of access to infrastructure. Impediments created by imposed land ownership structures and governance have also contributed to these difficulties. Against this backdrop, we now turn to examining Māori responses to the opportunity to undertake carbon farming.

2.4 Carbon farming in Te Tairāwhiti and the Waiapu catchment

Te Tairāwhiti has been described as a fragile landscape lacking the ability to support the needs and aspirations of Ngāti Porou (Porou et al., 2012), in one of the most socio-economically deprived areas within Aotearoa (Atkinson et al., 2014; Barnard et al., 2012). In recent years, the corporatisation and partial privatisation of the New Zealand Forest Service between 1980 and 1990, natural disasters (Cyclone Bernie and Bola), and the ongoing degradation of natural capital within the Waiapu catchment and wider Te Tairāwhiti region has likely contributed to processes of rural depopulation and resulting losses of human and social capital with “associated reduced community functioning, strength, reduced wellbeing, reduced cultural identity and expression, loss of services, and economic marginalisation” (Porou et al., 2012, p. 254). These processes have further reduced connection between residents and their whenua (land), making it more difficult for communities to meet their physical, cultural, emotional, intellectual and spiritual needs (Porou et al., 2012).

The advent of the carbon market, a particular neoclassical economic instrument designed to place a price on carbon emissions as a response to the growing and urgent problem of climate change, and in so doing reward foresters for sequestering carbon, might be expected to elicit mixed feelings among Māori in general, and among Māori landowners in Te Tairāwhiti in particular. It would be surprising if at least some Māori did not view this latest Pākehā policy innovation and its associated commercial propositions with some scepticism or even suspicion, given their experience with the various farming ‘innovations’ which Māori have seen over the last 150 years. Other Māori may have concerns about becoming locked into a system in which land use is constrained over long periods. These issues are explored in the next sections.

Some commentators have called for investigations into the ideological aspects of carbon markets (Stephan & Paterson, 2012) and these calls may be related to the

historical Māori experience of land management. Māori are estimated to own 5 percent of land in Aotearoa (Durie, 1998) with interests largely in pastoral farming, forestry and tourism (Harmsworth et al., 2002; Insley & Meade, 2008). However, the effects of colonisation, land confiscation and processes of economic and social marginalisation for Māori have created difficulties in developing and managing land (LINZ, 2004). Together these processes result in Māori freehold landowners in Tairāwhiti facing difficulties managing land which in many instances has significant invasions of native and exotic plant species (Carswell et al., 2002; Porou et al., 2012).

Establishing forest sinks on areas of marginal and unproductive land may be perceived as an attractive land use option for some land blocks due to a variety of potential economic and non-economic co-benefits. A large proportion of Māori land within Aotearoa is classified as undeveloped and uneconomic (Carswell et al., 2002; PwC, 2013). This land is frequently covered in mixed age 'scrub' (mānuka and kānuka) and this is particularly evident in Te Tairāwhiti (Harmsworth & Warmenhoven, 2003; Scion, 2012). This type of land may offer the most attractive opportunity for Māori landowners to begin carbon farming. Carbon farming's attractions as a land use option are due to its low upfront capital requirements and because it promotes native forest retention and development (Carswell et al., 2002).

Anecdotal evidence suggests that the expense and effort required to convert 'reverting' land back into conventional uses (e.g. sheep and beef farming) may have become insurmountable relative to the economic returns, in many cases. Carbon farming permanent native forest as a land management strategy may be more desirable for the reasons just mentioned, and also because it may serve to provide social, cultural and economic benefits now and into the future. However, as discussed, the pattern of Māori land ownership may act as a barrier to carbon farming. The following sections explore the literature on the opportunities and

barriers relating to Māori landowners in the Waiapu catchment and wider Te Tairāwhiti region participating in Carbon farming in the NZ ETS.

2.4.1 Carbon farming

As noted earlier, carbon farming can be defined as “any land use in which landowners capture economic benefit from carbon sequestration” (Funk, 2009, p. 4). In the context of Aotearoa, farmers growing forests are credited with generating ‘New Zealand Units’ (NZUs) under the NZ ETS. Doing so with native forestry allows for the accrual of a variety of associated environmental, cultural and social co-benefits alongside financial gain from the earning and sale of NZUs (Carswell et al., 2002, 2003; Carver & Kerr, 2017; Funk, 2009; Funk et al., 2014; Funk & Kerr, 2007; Harmsworth & Mackay, 2010). A crucial part of native forest farming for carbon is fencing and preventing the intrusion of livestock into the eligible area, and controlling pests (invasive animal and plant species) (Carswell et al., 2003; Carver & Kerr, 2017). Landowners and owners of forestry rights are eligible to claim NZUs as forest grows on their land, sequestering carbon in the process (Carver & Kerr, 2017; MPI, 2015b). However landowners face liabilities under the NZ ETS if there is any reduction in carbon stock on forestry land through deforestation, harvesting or grazing (Carver & Kerr, 2017; MPI, 2015b). Afforesting with native trees, or encouraging reversion to native species on eligible post 1989 land offers local co-benefits while allowing Aotearoa to make progress in fulfilling domestic and international climate change commitments (Carver & Kerr, 2017).

Carbon farming through native forest regeneration or reversion (where reforestation occurs naturally) appears to be particularly suitable for Te Tairāwhiti. The rapid spread of mānuka into pasture throughout Tairāwhiti is well documented (Carswell et al., 2002, 2003; Carver & Kerr, 2017; Davis et al., 2009; Funk, 2009; Funk et al., 2014; Funk & Kerr, 2007). Native regeneration is relatively inexpensive, and often close to zero cost – other than the costs of fencing, pest

and weed management – as in marginal areas of farmland there is no opportunity cost (Carver & Kerr, 2017). However, active native restoration (through planting) can cost ‘tens of thousands’ per hectare (Carver & Kerr, 2017). Additionally, Te Tairāwhiti has favourable biophysical factors for native forest regeneration “...including rapid regrowth rates, [and] large area of eligibility” (Funk, 2009, p. 4), and nearby seed sources and high rainfall (Carswell et al., 2003).

Co-benefits associated with carbon farming native forests

At present, the benefits of increasing native forestry appear to be reasonably well understood in terms of the environmental and ecological benefits available (Carswell et al., 2003; Carver & Kerr, 2017; Funk, 2009; Funk et al., 2014; Harmsworth & Warmenhoven, 2003; Scion, 2012). However, also important yet ultimately subjective and difficult to quantify are the social benefits that may arise from income derived from carbon farming or associated community and cultural benefits stemming from environmental and ecological conditions more attuned to Māori values and perspectives. There is preliminary research in this area (Harmsworth et al., 2010); however much more work is needed to conceptualise and understand the wider benefits.

Over a longer time scale the ability of native forestry to improve water quality and biodiversity, reduce sediment loading in waterways, and reduce erosion may prove to be invaluable (Funk, 2009; Funk et al., 2014; Funk & Kerr, 2007; Hall, 2017; Hall et al., 2017). Erosion control and continued access to traditional medicines and food for local Māori are also difficult to quantify in dollar terms; however the benefits are likely to be significant (Barnard et al., 2012; Harmsworth et al., 2002; Porou et al., 2012). Residents of the Waiapu catchment and wider region typically use native forests as a source of recreation in the form of hunting and tramping, but also through the provision of rongoā (medicine) (Stephens et al., 2005). Increases in native forestry represent an opportunity to increase this important source of recreation and customary practice for Māori as well as

providing a variety of positive outcomes including aesthetics, conservation, recreation, community engagement and the fulfilment of kaitiakitanga – stewardship (Carver & Kerr, 2017). The non-economic benefits from native forestry may make carbon farming an attractive proposition, as Funk et al. (2014, p. 9) posit: “If the cultural value of forests is high among owners – as is evident among many Māori landowners – then native forest reversion might be taken up broadly”.

One of the most significant opportunities that carbon farming native forestry may offer Te Tairāwhiti is in addressing large scale erosion issues. The Tairāwhiti region is susceptible to severe erosion with 50 percent of land in the district classified as severely eroded (GDC, 2008b). This is partly due to the nature of the soils, and partly due to the land use history of the Waiapu catchment and is similar in the wider Te Tairāwhiti region, (Harmsworth & Warmenhoven, 2003; Scion, 2012).

The Waiapu catchment is considered to be highly degraded and modified, severely affecting the ability of Ngāti Porou to meet their social and cultural needs (Harmsworth et al., 2002). There is also evidence from Ngāti Porou who attribute a decline in mahinga kai (food gathering places) to removal of native forest (Harmsworth et al., 2002). Evidence in Funk et al. (2014, p. 9) states: “in erodible catchments, increasing forest area may reduce sediment loading to streams, improving water quality and freshwater habitat, as well as reducing peak flows and sediment transport downstream, which affect infrastructure such as bridges and roads”.

Alongside environmental benefits at the local scale, national and global environmental benefits are evident through carbon sequestration. There are national benefits from creating a large carbon reservoir in Te Tairāwhiti and consequently contributing to meeting national emission reduction targets (Carver & Kerr, 2017). Modelling presented in Funk et al. (2014) shows that the Gisborne District has the technical capacity to store between 204.2 and 348 t CO₂e per ha

with the area-weighted mean after 70 years being about 275 t CO₂e per ha. The authors temper this by arguing that Gisborne District reforestation cannot be thought of as a panacea for Aotearoa's climate obligations, yet it does have extensive capacity to create forest sinks that can reduce Aotearoa's *net* emissions into the future (Funk et al., 2014). Sequestration from the Rarakau Rainforest Conservation Project in Southland was presented by Weaver (2016) to be 3.3 t CO₂e/ha/year. Weaver (2016) argues that if this was scaled up to the rest of eligible Māori-owned forestry, the annual carbon sequestration would equal 658,536 t CO₂e/year. This returns from this potential sequestration is a useful question to pose when considering how to value the global benefits of carbon sequestration. A literature on the social cost of carbon suggests that the global social value of avoiding one tonne of carbon emitted may be up to NZD \$600 per tonne (Ricke et al., 2018) and at the very minimum, NZD \$150 per tonne (Pindyck, 2016).

Utility of Indigenous knowledge and expertise in mitigating climate change

The notion of common but differentiated responsibility, a key principle of the United Nations Framework Convention on Climate Change, and explored by Gerrard (2012) recognises historical differences in terms of the contribution to environmental problems by different populations and their respective differences in capacity and ability to address these problems (Gerrard, 2012). Gerrard argues that non-Indigenous Australians have derived greater economic benefit from, and contributed more to environmental degradation than Indigenous Australians. A similar situation is evident in Aotearoa with non-Māori generally experiencing greater prosperity and significant economic advantage (Durie, 1998; Porou et al., 2012; Walker, 2009). Moreover, the land management practices of non-Māori have generally caused a greater share of environmental degradation (Harmsworth et al., 2002; Harmsworth & Warmenhoven, 2003). This is particularly evident in Te Tairāwhiti where extensive pastoralism and exotic forestry has degraded an environment that was comparatively healthy and well managed in pre-colonial

times (Barnard et al., 2012; Porou et al., 2012). As such, valuing Indigenous responses to climate change, and recognising the knowledge and capability of Indigenous peoples to respond to environmental issues is an essential component of common but differentiated responsibility.

A global focus on the impacts of, and responses to, climate change creates an opportunity for a paradigm which promotes Indigenous peoples' knowledge, landholdings and practices that offer potential solutions to climate change (Gerrard, 2012). Policy responses and strategies to address climate change create an opportunity to couple traditional practices with economic and social development (Gerrard, 2012; Robinson et al., 2011). Gerrard (2012, p. 141) states that:

Indigenous people have a 'special interest' in climate change and government responses to the impacts and effects of global warming. This interest is attributable not only to their unique physical and spiritual relationships with land, water and associated ecosystems (which gives rise to a particular vulnerability to climate change) but also to the specialised ecological and traditional knowledge they hold, which is relevant to finding 'best fit' solutions to climate change".

With regard to opportunities, carbon markets and associated payment for ecosystem services schemes (PES) allow Indigenous landowners to, in principle, develop projects that provide co-benefits alongside carbon sequestration (Robinson et al., 2016). However, realising and appraising co-benefits when developing carbon offset projects has proved challenging (Howe et al., 2014; Robinson et al., 2016). These projects can only deliver Indigenous co-benefits if the knowledge and connection between Indigenous people and the environment is acknowledged, accepted and respected (Robinson et al., 2016).

Robinson et al. (2016) state that Indigenous communities must be given the opportunity to articulate the benefits they seek to obtain through a carbon removal project. Furthermore, such schemes should focus on the “reflexive and active human-environment relationships that ‘service’ one another” (Robinson et al., 2016). An Indigenous carbon farming project known as the Aboriginal Carbon Fund (AbCF) is an innovative carbon trading system that acts as a conduit between Aboriginal Australians and the voluntary carbon market. It will be explored in the following section.

Global examples of Indigenous carbon farming: the Aboriginal Carbon Fund

The AbCF is a not for profit company established in 2010 with the intent of creating a sustainable carbon industry for Aboriginal landowners in Australia and offers a potential model for similar developments in Aotearoa. The stated aim is to build wealth for traditional landowners with social, cultural, environmental and economic co-benefits through the ethical trade of carbon credits with corporate Australia, government agencies and international bodies (AbCF, 2017). Carbon farming projects in Australia are overseen by the Australian Government Clean Energy Regulator (CER), which recognises 35 carbon abatement methodologies (McMurray et al., 2019). Savanna burning is a traditional aboriginal practice that has co-evolved alongside Australia’s ecology and is born out of a close connection with the natural environment that has grown over many thousands of years (Dore et al., 2014). Traditionally, savanna fires were lit in cooler months (May, June and July) to reduce the incidence of larger uncontrolled wildfires in hotter months through the removal of combustible fuel (grasses, leaves, and branches etc.) (McMurray et al., 2019). Thus the practice aims to enable a greater overall stock of carbon to be stored in vegetation on the land. There is evidence that these managed fires are an important component of ecological management, whilst also facilitating important traditional cultural practices such as bush craft, sharing of traditional knowledge and hunting and gathering (AbCF, 2017).

Recently, savanna burning has become commodified, as registered carbon abatement projects are eligible to accrue Australian Carbon Credit Units which can be traded within Australia through Government auction within the Emission Reduction Fund (ERF) or the voluntary market. There are 78 savanna burning projects across Northern Australia, with one third of these being administered by Aboriginal rangers (McMurray et al., 2019).

Whilst the abatement of carbon emissions is a significant global benefit, the local benefits accrued through carbon farming for remote Aboriginal communities are considered to be the primary benefit. McMurray et al. (2019, p. 149) contend that “in the context of remote Northern Australia carbon farming is seen as a means to an end rather than an end in itself”. This is in part due to the ‘core-benefit’ perspective, part of the AbCF’s philosophy. Usually, carbon/GHG removal is considered the main benefit of any carbon abatement project. Yet, for the AbCF, carbon abatement is considered a secondary benefit, with ‘core-benefits’ including social, cultural and environmental dimensions.

Social core-benefits can include increased social capital from community members working together on projects and developing greater confidence, self-worth and control over the finances of their communities – all of which are increasingly seen as critical factors to create rebound from the inter-generational trauma and harm afflicted by colonisation (McMurray et al., 2019). Cultural core-benefits through savanna burning allow for protection and rediscovery of customary sites, the ‘re-learning’ of traditional practices subverted by colonisation and western land management practices and improved spiritual well-being-from being connected to country. Marmot (2011) argues there are significant health benefits from aboriginal cultural practices, as being ‘on country’ leads to more active lifestyles with greater addition of physical exercise and access to nutritional traditional ‘bush tucker’ (Marmot, 2011). Environmental core-benefits revolve around the protection of flora and fauna from uncontrolled wildfires, and maintaining country ‘the right way’, whilst also controlling exotic

flora and fauna pest species. The benefits of the AbCF for both buyers and suppliers of carbon credits can be seen in Table 7.

Table 7: Benefits of the Aboriginal Carbon Fund (AbCF, 2017, p. 4)

Producers	Buyers
Up-front payment for carbon credits above government rates	A secure pipeline of carbon credits established to meet the buyer's carbon requirements now and into the future
A secondary payment based on profit share from final sale	A core-benefit story presented to facilitate marketing to purchasers' commercial clients
Unique core-benefits achieved by the project are valued and promoted	Independent verification of social, economic, cultural, environmental, health, political/self-determination core-benefits
Project's proponents do not need to use third parties to source buyers	Access to a variety of projects selling carbon credits in many locations throughout Australia
Independent verification of social, economic, cultural and environmental co-benefits building on international community development models	A cost effective 'one-stop-shop' to meet: Reconciliation Action Plans, Corporate social responsibility goals, UN Sustainability Development Goals
Projects are professionally marketed at no cost to producers	

Despite the success of international Indigenous carbon agglomerates such as the AbCF, there remain numerous challenges and barriers for Māori landowners to even enter the NZ ETS, despite the dearth of quality land, and evidence of economic benefits. In light of this, the next section will explore the literature on barriers pertinent to Māori landowners in Te Tairāwhiti engaging in carbon farming.

2.4.2 Barriers to carbon farming

Governance issues

Māori land governance bodies do not approach land development in purely economic terms. Social and cultural objectives may take precedence and economic benefits may follow as part of these objectives (Funk, 2009), ultimately taking into account a broader spectrum of issues than those emphasised by non-Māori land owners (Patterson, 2011). Alongside the TTWM Act, the Māori Land Court and Māori Trustee was identified by Funk (2009, p. 110) as a potential barrier to carbon farming for Māori landowners. Funk argued that “short-term, renewable commitments or temporary sequestration options may be alternatives that will find easier approval in the Māori Land Court”. Carbon farming could be deemed as long-term or permanent alienation of land (Funk, 2009). This would mean that the TTWM Act provisions would restrict the granting of leases and mortgages over land (Insley & Meade, 2008) with the requirement that 75 percent of landowners consent to the changed land use. Māori governance cannot easily be equated with non-Māori notions and objectives of property management. A ‘Māori’ approach to land management incorporates collectivism and communal, intergenerational ownership and long-term thinking all of which have relative strengths and weaknesses in comparison with non-Māori land governance structures (Insley & Meade, 2008). Insley (2010, p. 26), in his study of climate change opportunities for Māori landowners contends that:

...there is very strong interest in the emergent business opportunities that may arise out of new climate change policy, it would be fair to say that none of the organisations interviewed actually have the capability to seriously take on these new business opportunities directly. Across each of the organisations interviewed, none had dedicated personnel or capabilities to directly take on any new innovation investigation or related business case for each new business opportunity... no business

has a current dedicated resource to formally follow up on each or any of the new business opportunities... for these new business opportunities to be more formally developed and applied there will have to be ongoing, deliberate and systematic building up of capabilities within Māori organisations in order to determine how to practically turn the current strong interest identified in this study into real projects on the ground.

It is not the objective of this research to critique the way in which Māori land is governed. Rather, it is to highlight how regulatory and institutional factors affecting Māori land ownership may hinder the ability of Māori landowners to engage in novel land uses such as carbon farming.

Social and cultural norms

Patterson (2011) found that social and cultural norms also act as a barrier for Māori landowners deliberating over carbon farming as a land use. Although a relatively small number of owners actually administer the land, there is still difficulty achieving consensus, compounded by inter-generational disagreements over the best land use (Patterson, 2011). “Older Māori generations believe that clearing land to graze animals was the best use of land, while current circumstances may lead younger generations to see forest preservation as a benefit for both the environment and the owners” (Patterson, 2011, p. 440). Funk and Kerr (2007) highlighted the strongly held belief that future generations have the right of self-determination and Māori landowners are thus hesitant to commit those generations to specific land uses in perpetuity.

Customary Māori property systems and conceptions of the meaning of property result in a mismatch of ideology, where Western notions of property governance and administration dominate and underpin forest carbon credit systems (Funk, 2009; Patterson, 2011) and the framing of the NZ ETS (Insley & Meade, 2008).

Policy makers have faced difficulties in designing markets for ecosystem services that cater to the needs and aspirations of Indigenous landowners (Murdiyarto et al., 2005).

Describing this, Patterson (2011, p. 443) states that “a prerequisite to Indigenous landowner participation in forest carbon credit markets may be not only a clear definition of land tenure, but a definition of tenure that fits into prevailing Indigenous conceptions of what property means”. It is important to recognise that although carbon farming may appear to be the most profitable land use for Māori in Te Tairāwhiti (Funk et al., 2014), Māori have different drivers and aspirations for land development and management (Barnard et al., 2012; Insley & Meade, 2008). As a result, complicated Māori land governance structures and the decision-making processes with these, may make the already complicated NZ ETS eligibility and administrative requirements more difficult.

Access to capital

As already noted, the legal conditions that regulate transfers of Māori land are highly restrictive and serve to protect Māori land from alienation, yet also restrict Māori landowners from accessing credit (Funk, 2009). Although the TTWM Act protects Māori land, it also acts as an economic and institutional barrier for Māori landowners wishing to enter the carbon market.

Porou et al. (2012) present evidence that reserving Māori land for environmental purposes is broadly supported amongst Māori in Te Tairāwhiti, but long-term covenants such as those typically involved in carbon farming are ‘risky’ due to the length of time involved. The ability of Māori to enter land into the NZ ETS is argued by Insley and Meade (2008) to be constrained relative to non-Māori land given the transaction costs and complexities related to the ownership and use of Māori land. This, and the complexity of aspects of the NZ ETS such as land eligibility

requirements (Carver & Kerr, 2017), may be the main reason for the low degree of uptake of carbon farming under the NZ ETS by eligible landowners (Hall, 2017).

Māori landowners face significant barriers in accessing capital to invest in carbon farming, largely as a result of the TTWM Act and directives regarding the alienation of Māori land (Insley & Meade, 2008). The TTWM Act allows Māori their right to self-determination without the threat of foreclosure from banks, allowing Māori landowners to exercise decisions over a far longer time scale than many non-Māori landowners (Funk, 2009). However this means Māori landowners suffer from 'liquidity constraints' and cannot capitalise upon and invest quickly in changing markets which may improve profitability (Funk, 2009; Insley & Meade, 2008), and limits landowners to land uses with low upfront costs and capital outlay which frequently correspond with poor profitability over time (Patterson, 2011). In Te Tairāwhiti, this usually means land is leased for grazing or forestry.

Difficulties raising capital are highlighted by Insley and Meade (2008, p. 14) who argue that Māori land "is often of low productive potential and hence security value, is small and often poorly located, is not surveyed (and hence titled), and has a relatively large number of owners (increasing over time as succession rules pass ownership to each new generation)". Lenders are hesitant to lend to these entities due to fears of being unable to realise their asset value in the event that a loan cannot be repaid (Insley & Meade, 2008). Related barriers to Māori land development may be fragmentation of development efforts, longer developmental timeframes and higher transaction costs, compounded by more complicated ownership structures and possible non-economic land development drivers that differentiate Māori and non-Māori land (LINZ, 2004) .

Economic barriers

Patterson (2011) discusses the prohibitive transaction and administrative costs Māori landowners incur when entering carbon trading markets. The expensive

inventory, inspection, and certification process is exacerbated by small land parcels having multiple owners (Harmsworth & Baisden, 2005; Insley & Meade, 2008; Patterson, 2011). It can be time consuming and difficult achieving consensus amongst communal landowners, and if the land block is small (e.g. under 100 ha) and non-contiguous, these challenges deepen (Patterson, 2011). These transaction costs appear to dissuade landowners from entering carbon markets especially if carbon farming is not the most profitable land use (Funk, 2009). Patterson (2011) further suggests that aggregation of land blocks into a carbon trading entity could act to address these issues and reduce prohibitive transaction costs.

Funk (2009) notes that converting marginal land into forestry and out of other modes of production may restrict the ability to change land uses if an alternative is desired by the landowner in the future. How this lack of flexibility is viewed is an important cultural as well as economic question, and will be discussed further in this study.

Funk et al. (2014) state that the attractiveness of carbon sequestration for landowners will likely depend on the value of carbon credits and other incentives alongside the ability to benefit from other management activities (erosion control and biodiversity restoration, and sale of mānuka honey and other native pharmaceutical derivatives). Weaver (2016) argues that it is an exceedingly difficult challenge identifying and protecting public goods (native forestry ecosystem services, contributions to domestic climate change commitments), and, furthermore, effectively compensating individual landowners for providing these public goods. Fluctuations in the carbon price and poor confidence in the NZ ETS reinforces the difficulties landowners face in making decisions regarding entering the NZ ETS (Hall, 2017; Weaver, 2016). Economic modelling in Funk (2009) suggest that carbon farming would be the most profitable land use for 50 percent of eligible landowners in the Gisborne District if the NZU price were consistently \$30 per tonne, or more.

In regard to the Rarakau Rainforest Conservation Project, Weaver (2016) discusses profitability challenges arising from low demand and unit prices. This evidence is paralleled by modelling presented in Funk, (2009) which finds that carbon market stability can play an important role in determining the uptake of carbon farming by landowners on the Te Tairāwhiti. Increases in the value of other products from sheep and beef farming may also act to limit participation in carbon farming (Funk, 2009).

Information barriers

Carver and Kerr (2017) highlight barriers to entry into carbon farming as arising due to landowners' lack of understanding of the NZ ETS and its opportunities, rules and associated technical and administrative requirements, and risks. It was found that the NZ ETS was perceived to be too complex for landowners who may be busy with the day to day running of their business (Carver & Kerr, 2017). Funk et al. (2014) note the Gisborne District's large land area (835,000ha), small population (44,460) and comparative isolation from the rest of Aotearoa, arguing that this has led to physical isolation and isolation from marketplaces. This isolation is also reflected upon in Funk (2009) who highlights potential difficulties connecting rural landowners to carbon brokers and general information regarding the NZ ETS. There is also a lack of independent expertise with specific knowledge regarding carbon farming in Te Tairāwhiti, e.g. on how to structure an agreement or contract, how to comply with administrative and regulatory requirements, and offering impartial advice (Funk, 2009). Insley and Meade (2008) argue that deficits in information provision and managerial expertise act as a barrier to entry into the NZ ETS.

Institutional barriers

The validation of land as eligible for entry into the NZ ETS is an issue identified in the literature and interviews conducted to date. Carver and Kerr (2017) discuss

the lack of a definitive classification of land that is pre-1990/post-1989 forest land as a barrier. The burden of proof is on the landowner to prove the eligibility of their land to enter the NZ ETS (Carver & Kerr, 2017), and MPI as the regulator takes a cautious approach when validating applications to enter the NZ ETS (B. McKinlay, personal communication, 2017). The uncertainty over how stringent the application process may be puts off potential investors (Carver & Kerr, 2017). Presenting land use data at 1 January 1990 may also be a constraint for landowners in general (Insley & Meade, 2008). The process of establishing native forestry through managed reversion or assisted planting is relatively simple, yet the rules governing the production and validation of carbon credits are complex (Funk, 2009). Moreover, in interviews with landowners in Te Tairāwhiti, Funk (2009) found that many landowners did not know the eligibility status of their land, nor the costs and procedures that would be incurred in order to enter the ETS.

The growth and sequestration rates of exotic forestry are relatively well known. There are detailed tables that outline the growth rates of exotic species such as *Pinus radiata* throughout Aotearoa and by region – however, by comparison, MPI has one ‘look up table’ for native species that covers Aotearoa as a whole (Carver & Kerr, 2017). This appears to be a significant barrier as growth rates will differ markedly between regions, and landowners may feel disadvantaged by the application of a standard rate. Also, landowners may be hesitant to commit to this land use when the science of sequestration and associated earning potential is uncertain (Carver & Kerr, 2017).

Native forests are well protected in Aotearoa under the Forests Act 1949, the New Zealand Forest Accord 1991 and the Resource Management Act 1991 (RMA). These pieces of legislation may reduce the attractiveness of afforesting with native forest species if a possible change in land use may be desired in the future (Karpas & Kerr, 2011). Carver and Kerr (2017) present evidence that forest owners are distrustful of government NZ ETS policy and are hesitant to commit to a land

use that operates on a 20-30 year time horizon. Funk et al. (2014) support these findings, arguing that scientific, policy and market uncertainty that have contributed to dramatic fluctuations in the NZU price makes landowners cautious when considering entering land into the ETS. Funk (2009) presents evidence that uncertainty in the price of carbon is a significant barrier to investment, which is linked to the functioning of domestic and global carbon markets.

Insley and Meade (2008) argue that ETS-related penalties and restrictions on land use may constrain and raise the risk of land forfeiture for Māori landowners and thus serve as a barrier to entering land into the ETS. Landowners can address potential carbon stock losses and sequestration reversal liabilities through risk management tools such as forest insurance, credit reserves or cash investments (Funk, 2009). However, this may prove difficult for Māori landowners who may face issues accessing insurance or investing in other areas to cover liabilities due to limited cash flow or liquid assets (Funk, 2009). With the NZ ETS, participants must repay any units (e.g. purchasing new units and surrendering these) that were issued if land is withdrawn from the NZ ETS (MPI, 2015b). Clearly, this is to incentivise landowners to retain forests. Nevertheless, repaying units may be increasingly costly if unit prices have risen, limiting the options for a landowner in future, and represents an intergenerational risk for future landowners.

Related economic opportunities

A key economic opportunity mentioned throughout the literature is the ability to earn multiple revenue streams from the same land holding under a native carbon farming regime (Carswell et al., 2003; Carver & Kerr, 2017; Funk et al., 2014). The potential revenue from carbon credits can be supplemented in the initial and latter stages of development through a variety of subsidies at the central and local government level. These policy initiatives offer compensation / subsidies to landowners (with conditions) reflecting ecological and other benefits generated by changes in land management practice (Funk, 2009). An example is the ECFP

(Erosion Control Funding Programme), a fund administered by the MPI through which landowners are eligible for up to \$1,500/hectare for establishing forests (native and exotic) on erosion prone land (MPI, 2018). However, the ECFP is region specific, and only available to landowners in the Gisborne district. It is slated for discontinuation after 2020. A new mechanism is the One Billion Trees Programme (1BT) which provides upfront payments of up to \$4,000/hectare for an indigenous mix (with additional top ups for planting on erosion prone land, fencing or ecological restoration partnerships). There is funding available for wholly mānuka and kānuka plantations (\$1,800/ha), natural indigenous reversion (retiring land and managing it to achieve tree cover: \$1,000/ha) and exotic plantations (\$1,500/ha) (Te Uru Rakau, 2018).

Other subsidies available to prospective landowners are associated with biodiversity co-benefits. These funds are administered by the Department of Conservation (DOC) and include the Queen Elizabeth II Trust (QE2), Ngā Whenua Rahui (NWR), the Biodiversity Condition Fund, and the Natural Heritage Fund (Carver & Kerr, 2017; Funk, 2009). These programmes target areas of land with moderate to high conservation value, providing funding to fully cover these costs or towards to fencing, pest control and biodiversity management (Funk, 2009). Modelling presented in Funk et al. (2014) shows that when supplementary revenues from public subsidies are added to the incentives in the carbon farming system, the total area of land the model estimates to be convertible to carbon farming on the Te Tairāwhiti increases markedly. Perceived 'negative' impacts from retiring land into native forestry could be mitigated by investing carbon farming revenue into intensification of production on other areas of land (Funk et al., 2014).

Other economic opportunities associated with carbon farming arise as a result of increased afforestation in Te Tairāwhiti. Mānuka honey and other derivatives are frequently mentioned in the literature as sources of additional income (Carswell et al., 2003; Carver & Kerr, 2017; Funk et al., 2014; Hall, 2017). Mānuka honey is

a well-established commodity in Aotearoa and abroad, and its economic contribution to Te Tairāwhiti is evident (Funk, 2009; Harmsworth & Mackay, 2010; Insley & Meade, 2008). The high value of mānuka honey has made beekeeping sustainable and can supplement income in the early years of carbon farming when carbon sequestration rates are low (Funk, 2009, p. 30). Less well known, however, is the potential for pharmaceuticals, nutraceuticals and biofuels to supplement revenue from carbon farming (Hall, 2017). As stated by Carver and Kerr (2017, p. 17): “there is limited information about these other opportunities, and we are not aware of instances where they have been commercialised in a successful and ongoing manner”. Other sources present evidence that the Aotearoa natural products sector has significant growth potential (Coriolis, 2011; Crowe Howarth, 2014; Harmsworth et al., 2002), and it is expected that the value of Aotearoa natural biotechnology and native pharmaceutical derivatives will continue to rise even if they cannot be capitalised upon immediately (Crowe Howarth, 2014). Weaver (2016) is more sceptical and argues that alternative income streams for forest owners only address opportunity costs marginally, acting as a sweetener for landowners already committed to carbon forestry. Finally, tourism is another income source with potential for growth, although quantifying the potential revenue derived from tourism as a result of increased afforestation may be difficult (Funk, 2009). The complementarities between carbon farming and nascent added value industries such as novel honeys, eco-tourism, selective logging, under-story cropping and bioactives have significant potential to create sustainable, permanent employment.

2.5 Research gap and research questions

Currently, it is widely assumed that carbon farming is a positive land use choice for Māori landowners in Te Tairāwhiti, a land use which concurrently supports the international and domestic imperative to reduce carbon emissions through sequestration or abatement of carbon intensive activities. However, it is not

known with any clarity what the land use preferences of Māori are, and further to this, how carbon farming permanent native forestry is valued when compared to possible alternatives. It is also important to conceptualise the co-benefits and risks arising from carbon farming for Māori landowners as this may aid landowners when making land use decisions.

The literature review has indicated that there is a *prima facie* economic case for carbon farming as a land use in Te Tairāwhiti. The economic opportunities are evident, yet the ability for Māori landowners to enter the NZ ETS and earn income through carbon farming has been limited to date. It is expected that at least some Tairāwhiti Māori landowners will wish to capture this economic benefit through carbon farming. However, the wider benefits and risks associated with carbon farming are less clear at this stage. There is frequent mention in the literature of carbon farming having a variety of positive co-benefits for the wider community, yet the existence of these co-benefits is not empirically established, nor is an appropriate framework through which to conceptualise and measure these co-benefits. Accordingly, an initial aim of the present research is to identify and analyse the considerations and barriers which have relevance across the wider sphere of Māori land development in order to better understand the perspectives of Māori landowners and other stakeholders. This understanding may also serve to inform land use decision making by landowners in relation to carbon farming.

By evaluating the co-benefits likely to arise for Tairāwhiti Māori landowners through carbon farming following a wider investigation into the values ascribed to land uses suited to Māori land in the Waiapu catchment and Te Tairāwhiti, the present study can improve understanding of the wider value of carbon farming. Landowners in Te Tairāwhiti may gain a better understanding of the wider benefits and/or risks carbon farming may bring to their locality when compared with other land uses. A second benefit is giving purchasers of carbon credits a clearer view of how their purchasing power may help landowners and the wider

community engaged in carbon farming. The perceived risks associated with 'locking up' land in forestry can also be better understood.

This research is expected to contribute to the body of knowledge around Māori land use in the following ways:

1. Identifying and analysing economic, social and governance/cultural barriers Māori landowners face in regard to carbon farming (including entering their land into the ETS);
2. Understanding Māori perspectives on the benefits and disadvantages of carbon farming, when compared with potential land use alternatives
3. Understanding better how Māori landowners may conceptualise the values they hold regarding suitable land use options and their associated co-benefits, including carbon farming permanent native forest.

2.5.1 Research questions

To reiterate, the specific research questions are:

- Research question 1: What does experience to date tell us about the opportunities, barriers and risks for Māori landowners engaging in carbon farming as a land use within New Zealand's Emissions Trading Scheme?
- Research question 2: In light of the findings from addressing research question 1, what are other feasible land use options within Te Tairāwhiti, and what is valued by Māori landowners about these land use options in comparison with carbon farming?
- Research question 3: In light of the values ascribed to different land uses highlighted in wānanga with Māori landowners, what significance do these findings have for Māori land use decision making in Te Tairāwhiti?

3 Methodology

3.1 Introduction and rationale

Exploring the values and benefits that Māori landowners associate with land uses is an inherently complex area of inquiry. To account for such complexity a mixed methods research approach has been chosen, and the rationale for this approach is situated within a number of recent pieces of research. Quantitative research exploring Māori land use preferences in the Waiapu catchment in Harmsworth et al. (2010) and qualitative approaches such as that seen in Porou et al. (2012) offer valuable insights to issues broadly similar to this research. Yet the strength of mixed methods research in providing strong qualitative descriptions of the impact of land use change and the values Māori landowners associate with particular land uses, reinforced by quantitative information around future erosion and climate change, as seen in papers by Warmenhoven et al. (2014), Lyver et al. (2017) and Awatere et al. (2018), has motivated this study's choice of mixed method research as an effective approach. This research has been approved by the Victoria University of Wellington Human Ethics Committee (ID: 0000024728).

Mixed methods research employs qualitative and quantitative approaches to the collection and analysis of data, which can lead to a fuller and deeper understanding of a research phenomenon (Creswell & Plano Clark, 2017; Johnson et al., 2007). Qualitative techniques typically focus on the collation and interpretation of narrative information as opposed to numerical information under a quantitative approach (Teddlie & Tashakkori, 2009). Mixed methods approaches assume that, together, diverse data sets provide a superior understanding of the problem at hand (Creswell & Plano Clark, 2017). The mixed methods definition which guides this research is taken from Johnson et al. (2007, p. 123):

Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration.

Mixed method approaches to research are increasingly seen as valuable due to an ability to compensate for weaknesses in either quantitative and qualitative methodologies (Johnson et al., 2007). Aside from being undertaken using a mixed methods research approach, this study utilised a transformative paradigm conducted within the spirit of Kaupapa Māori Research (KMR). This approach has primarily comprised qualitative case study analysis and multi-criteria analysis (MCA) of land use options undertaken in late 2018. The case study has focussed on Nuhiti Q, and provides an overview of the opportunities, barriers and risks for Māori landowners engaging in carbon farming as a land use. The primary methods of data collection for the case study have been semi-structured interviews and document analysis undertaken between 2016 and 2018. Thematic analysis has been used to analyse all qualitative interview data. Data collection for the MCA has adhered to the principles of KMR and participatory action research.

With regard to the MCA, semi-structured interviews with key informants were employed to collect data in early-mid September 2018. This data was then considered by participants of the MCA wānanga (held in November 2018), who could include or exclude (alongside generating their own data) any alternative land use options or criteria for consideration. VISA (Visual Interactive Sensitivity Analysis) has been the primary software utilised for MCA data analysis and presentation.

3.2 Methodology and epistemology

3.2.1 Research approach

Given the Māori focus of this research, I have sought to adhere to the principles of Kaupapa Māori Research (KMR). KMR methodologies have developed in response to a long history of intrusive and extractive research conducted upon Māori by non-Māori (Bishop, 1998; Jahnke & Taiapa, 1999; L. T. Smith, 1999). This history of problematic and sometimes violating research, and its subsequent impact upon Māori, mimics the experience of many other Indigenous peoples throughout the world at the direction of non-indigenous people who, through positivist approaches, attempted to distil, define and record aspects of Indigenous culture and language for consumption within the Western academy (L. T. Smith, 1999). Bishop (1998, p. 200) describes this as “a tradition of research that has perpetuated colonial values, thereby undervaluing and belittling Māori knowledge and learning practices and processes in order to enhance those of the colonisers and adherents of neo-colonial paradigms.” Whilst research has on the whole been conducted within the cultural preferences of the Western academy, and its preoccupations with deductivist approaches focusing on neutrality and objectivity. Recent epistemological advances in the social sciences (Creswell, 2017; L. T. Smith, 1999) have re-centred the rights of research participants, and their concerns regarding “who has control over the initiation, procedures, evaluations, construction, and distribution of newly defined knowledge” (Bishop, 1998, p. 200).

Responding to the history of extractive research, where Pākehā set the research agenda and developed traditions of research responding to the concerns of the researcher as opposed to Māori participants (Bishop, 1998), are many who now acknowledge that research with Māori and other Indigenous peoples should be conducted in ways which are sensitive to the needs of the community, conducted with transparency and sensitivity (Bishop, 1998; Jahnke & Taiapa, 1999; L. T.

Smith, 1999). It is now more widely recognised that much research conducted under Pākehā (Western) academic traditions has maintained oppressive structures and value systems (Bishop, 1998, p. 200), and has sometimes led to distortions of Māori beliefs and practices, where Māori experiences and knowledge may be commodified and appropriated by external ‘experts’ who may misrepresent findings (Tolich, 2002).

KMR methodologies developed in response to these historical challenges and provide a robust framework through which to conduct research within te ao Māori. At its core, Smith (1999) defines KMR as research “for Māori, by Māori” that is “concerned with regaining control over Māori knowledge and Māori resources” (Cram, 2001, p. 37). KMR developed in conjunction with (and likely a result of) a number of other factors, namely, te reo Māori revitalisation, alongside a Māori cultural renaissance in the 1970s and 1980s (following rapid urbanisation post World War Two) and wider political consciousness alongside the establishment of the Waitangi Tribunal (Bishop, 1998; G. H. Smith, 1997). Practitioners of Kaupapa Māori Research seek to ‘create the moral and ethical conditions and outcomes which allow Māori to assert greater cultural, political, social, emotional and spiritual control over their own lives’ (G. H. Smith, 1997, p. 476). This precept is central to this study, focusing as it does on land use options available to Māori.

The emphasis on research ‘by Māori and for Māori’ can place Pākehā in a complicated position when endeavouring to conduct research adhering to the principles of KMR and within te ao Māori. This condition has been termed by Tolich (2002, p. 176) ‘Pākehā Paralysis’, denoting the inability by “Pākehā to distinguish between their role in Māori-centred research and their role in research in a New Zealand society, which involves Māori among other ethnic groups”. The fraught history of research on Māori by non-Māori, and in recent decades, the pushback against this, has left many Pākehā unwilling to engage in Māori research and in instances, actively excluding Māori participants from

research (Tolich, 2002). A more explicit characterisation of Pākehā paralysis is offered by Hotere-Barnes (2015, p. 3):

Emotional and intellectual difficulties that Pākehā can experience when engaging in social, cultural, economic and political relations with Māori because of: a fear of getting it wrong; concern about perpetuating Māori cultural tokenism; negative previous experiences with Māori; a confusion about what the 'right' course of action may be.

Hotere-Barnes (2015, p. 5) discusses how anxieties revolving around 'getting 'it' wrong, or being challenged by different Māori (and some Pākehā) about the position of Pākehā in Māori research' can imbue a sense of political and cultural discomfort. It is argued that a level of Pākehā paralysis is not 'a bad thing'. Instead, it can be an important constituent of the iterative cycle of reflexivity which researchers must undertake – particularly when working outside of places of Pākehā hegemony, which 'requires a degree of letting go and being comfortable with discomfort emotionally and intellectually' (Hotere-Barnes, 2015, pp. 6–8).

There is a view that Pākehā cannot conduct independent research within te ao Māori using a KMR paradigm (Tolich, 2002), and instead that Pākehā must align themselves alongside 'principles' of KMR. Yet, the place of Pākehā within KMR remains contested. Academics such as Smith (1999, p. 184) contend that "kaupapa Māori is Māori research exclusively." Others such as Bishop and Glynn (1992) argue that there is room for Pākehā researchers and their expertise, yet only with an 'empowering methodology' and strict guidelines which support bicultural research objectives. It was initially envisaged that this research would be conducted under a KMR paradigm, yet, in light of the aforementioned literature it was decided that this research would be undertaken 'within the spirit of KMR' whilst adhering to the principles of KMR through a transformative research epistemology. Through this research I attempt to adequately respond to the challenges posed by those such as L. T. Smith (1999) and G. H. Smith (1997) in

undertaking KMR-aligned research as a Pākehā but, in doing so, not positioning myself fully within the KMR framework – as I do not believe I have the cultural competency or understanding of te ao Māori to accept such a challenge in its entirety.

Hotere-Barnes (2015) also includes a series of directives which researchers should comply with when conducting research using a KMR paradigm: (1) Value one's cultural identity, (2) Recognise the politics and use of te reo and tikanga Māori, (3) Be comfortable with complexity, (4) Sustain the self, (5) Commit to evolving and long-term relationships (for an in-depth discussion of these points see Hotere-Barnes (2015, pp. 10–12). L. T. Smith (1999, p. 173) puts forward a series of questions for non-Māori researchers to answer when researching Māori:

1. Who defined the research problem?
2. For whom is this study worthy and relevant? Who says so?
3. What knowledge will the community gain from this study?
4. What knowledge will the researcher gain from this study?
5. What are some likely positive outcomes from this study?
6. What are some possible negative outcomes?
7. How can the negative outcomes be eliminated?
8. To whom is the researcher accountable?
9. What processes are in place to support the research, the researched and the researcher?

Many of these questions have been answered in the preceding chapters, but some points merit further discussion. Regarding the first point, this research was initially co-designed with Hikurangi Enterprises, a Māori social and economic development enterprise located at Ruatōrea. As the focus of the research project has evolved, I have continually engaged with three close connections ('my advisers,' two of whom are Māori) who are deeply connected to the Waiapu catchment and wider region, who have critiqued my approach and given guidance

and support as to how this research is conducted. It is to these 'advisers' that I am chiefly accountable, as they have taken time to introduce me to research participants, read research drafts, and supported me when I was 'on the ground'. Equally as importantly I am accountable to the landowners who agreed to participate in my MCA study, and it is to these landowners that the knowledge produced in this research belongs. Likewise, any negative outcomes of this study will likely revolve around my inadvertently misrepresenting the values and perspectives of my MCA participants. These risks have been minimised by feeding my research back through hui and further wānanga in Ruatōrea and gaining further insights by checking in with research participants that I have represented their thoughts correctly. Outcomes are likely to emerge at a policy/planning level: it is hoped that central and local government will gain deeper insights into the land use values and preferences of Māori landowners and can better cater to these preferences through existing funding mechanisms and targeted funding.

The focus of this research on carbon farming was initially shaped by contacts in Te Tairāwhiti, who facilitated contact with Nuhiti Q. The chairperson of Nuhiti Q and I then co-designed the case study, in a process where we clearly outlined expectations of each other and remained reflexive throughout the course of the sub-study. Throughout the research process, I endeavoured to constantly assess my positionality within the research. In this process, I gradually became uncomfortable with the exclusive focus on carbon farming to the neglect of an assessment of other land uses.

This led to a reshaping of the project arising in conjunction with the academic process of conversion from a master's to a PhD project. The larger project set out to investigate the wider values and benefits Māori landowners held or perceived in relation to applicable land uses in Te Tairāwhiti and the Waiapu catchment. This latter and major aspect of the research was wholly participatory, as all data on carbon farming collected by myself and presented for consideration at the MCA wānanga could have been excluded at any stage, and participants had the option

to include any other land use alternatives or benefits they deemed important. The valuation methodology (multi-criteria analysis) was chosen due to its ability to remain reflexive and responsive to the desires of research participants (Carnoye & Lopes, 2015). The results have in turn been fed back to the MCA participants for further feedback and reflection.

3.2.2 Transformative epistemology

Transformative research approaches arose as a response to positivism and the limitations of positivist assumptions, and theories that did not adequately represent marginalised individuals and groups within society nor necessarily represent a variety of cultural perspectives on dominant neoclassical or neoliberal economic discourses (Creswell, 2013). Mertens (2010) contends that academic inquiry is strengthened when coupled with a political change agenda to address inequities and oppression. Furthermore, a transformative approach addresses important contemporary issues such as “empowerment, inequality, oppression, domination, suppression and alienation” (Creswell, 2013, p. 9).

Transformative approaches to research commonly (but not necessarily) contain an action agenda for reform that can create tangible change which can ultimately benefit research participants in the research process (Creswell, 2013). Without an aspiration to political transformation, this characterisation applies to the current study largely by gathering better information about the land use preferences of Māori landowners so as to assist Māori to develop knowledge and tools to make land use decisions with an empirical information base. A transformative approach can prioritise collectivity and active engagement in all areas of research by participants who have initiated the research process (Bishop, 1998). In particular the study will centre Māori worldviews and perspectives and acknowledge the place and status of Māori within Aotearoa (Pere, 1983).

Specifically, as a Pākehā researcher undertaking research in the area of Māori development, and in the spirit of Kaupapa Māori Research, the aspiration of this research is to accurately represent and to help articulate the preferences and needs of the community in a world where land use options are rapidly changing, and where the preferences of this particular Māori community may not be understood outside the community in question, and yet are likely to be of considerable interest to wider district and national communities.

3.2.3 Positionality

Addressing and contending with one's positionality as a researcher is a key tenet of transformative, and KMR approaches. Positionality acknowledges researcher biases and subjectivity in the research process asserting that race, gender, class, sexual orientation, religion, age and the intersections between these (Tisdell, 2012) may all impact on the way we design, undertake and analyse in the research process. As Tisdell (2012, p. 333) states: "given one can never get completely outside of one's positionality, objectivity is viewed as impossible". The positionality of the researcher and how this influences power relationships and the production of knowledge has been acknowledged as a key aspect of geographical inquiry since the 1980s (Rose, 1997). As a Pākehā researcher conducting research primarily focused on Māori land and economic development I am acutely aware of these position-related issues and potential power relations (Bishop, 1998; Hotere-Barnes, 2015; G. H. Smith, 1997; L. T. Smith, 1999).

England (1994) discusses the need to acknowledge the underlying motivations for research as this can influence the researcher-participant relationship but also the resultant analysis of the data. My interest in a topic focussing on the 'use' of Māori land likely stems from my experience growing up in the Eastern Bay of Plenty. Throughout primary and secondary education in Whakatāne and Ōhope, there was attention to te reo Māori, Māori lore, tikanga, waiata, karakia and mātauranga. At intermediate school I was the only Pākehā student in an

immersion class in te reo. It is these facets of my life which I suspect has helped me not feel 'paralysed' when researching an aspect of te ao Māori.

I have always had an interest in farming and the primary sector. Many summers were spent working on family friends' farms, often in Te Tairāwhiti. Much of my academic focus during my undergraduate studies focussed on sustainability issues in the primary sector. In the first trimester of my master's degree, I took a paper with Dr. Rebecca Kiddle, on Māori environmental and resource management. This course led me to draw linkages among my interests, and I was able to develop a thesis topic in conjunction with Manu Caddie, who was at that stage the General Manager of Hikurangi Enterprises.

Coupled with the motivations for research, acknowledging how the researcher is perceived by participants is paramount (Tisdell, 2012). Perceived 'stereotypes' can include but are not limited to characteristics of education, social class, youth, ethnicity and gender. My positionality is influenced by being a heterosexual, middle class, Pākehā male. Beyond this, my familial connections to Te Tairāwhiti have also influenced my position within this research. Although I personally have not had a close association with Te Tairāwhiti, my family on my father's side has had extensive involvement in the primary sector over a number of decades. My father attended Gisborne Boys High School and operated a shearing gang in the region before farming at Matawai. My paternal great grandfather, Everard Morice, lived and worked in Ruatōrea for many years in the post-World War Two era. He was a farming supervisor for Māori land in the area, under what was then called the Native Affairs Department, with responsibility for developing Māori land primarily into productive sheep and beef farming units. He was fluent in te reo Māori and from what I can gather from conversations with my family, was well respected in the area. This likely also contributed in part to a strong 'Morice' presence in Ruatōrea. I am a member of the Pākehā line of the Morice whānau, who descended from a Reverend George Morice. There are Māori and Pākehā lines of descendants from his brother, and numerous Morices' still live in the area.

My 'whakapapa' has likely been one of the factors which has led to my acceptance within the local Māori community, and through the course of my research I have met distant relatives and learned about my place within the region.

My familial history in Te Tairāwhiti has been a motivating factor in exploring land use in the region, and in particular approaching a related issue, the appropriate use of Māori land. Everard Morice was no doubt enacting policy objectives of the day; however, widespread deforestation and development of pastoral agriculture in the region under the guidance of institutions such as the Native Affairs Department and Māori land development schemes promulgated by Sir Apirana Ngata were no doubt intended to bring Māori into the 'productive' Western economy. Whether this was truly beneficial or not in the long run requires a detached perspective to assess. The economic and environmental impact of land clearance and 'development' into pastoral agriculture has been considerable and this impact lingers to this day. Compounding this, as Robertson (2019) articulates, are social and cultural impacts resulting from land degradation by '*people who had no ancestral connection to the land and importantly, no understanding of how it behaves*'. Contending with my familial history has, viewed in this light, been a key part of addressing my positionality within this research, and it is these factors which have influenced my relationship with research participants. As such, in my role as a researcher I continue to be aware of my positionality and the power dynamic of research processes (Tisdell, 2012), reflecting on this through regular meetings with my supervisors and advisors from Hikurangi Enterprises Ltd who actively engage with landowners 'on the ground'.

I have felt confident that if I surrounded myself with a suitable supervisory team and advisors 'on the ground', and by adhering to the principles of KMR and PAR, that the research could be conducted safely and effectively for all those involved. This is not to say that there have not been times when I have felt discomfort or been critiqued for my role as a researcher in this field. The research process has invariably taught me many things about engaging with Māori in an academic

capacity. Often it has been the subtle/nuanced aspects of relationship management that I have overlooked – such as distributing a draft manuscript to a government agency that one of my participants had a poor relationship with. This incident resulted in a late-night conversation to resolve the issue. At other times I have been ‘dressed down’ when there have been misunderstandings regarding the scope and purpose of my research -- for example, when advertising for research participants. Over the course of this research I have learnt that a sense of humility and honest acceptance of discomfort are some of the attributes I have had to work on when researching within te ao Māori.

Hotere-Barnes (2015) suggests constantly assessing how, as Pākehā participating in research with Māori, the potential pitfalls of our involvement both individually and as a member of an institution of the Western academy can influence the process and outcomes of a given research project. It is argued that working outside Pākehā dominated spaces requires a degree of letting go and being comfortable with discomfort emotionally, culturally and intellectually. To me, engaging with Māori communities and conducting research that is reflexive and prioritises Māori concerns is a profound journey of being uncomfortable as a Pākehā in a Māori world. For me, I was confident that my limited experience in te ao Māori predating my university studies had equipped me reasonably well for research in Ruatōrea. Yet, nothing can quite compare to the feelings of being an impostor when you are sitting on the paepae, preparing to whaikōrero, rubbing your sweaty palms together and hoping intensely that you don't forget part of the whakataukī in the korero or pepeha. My experience learning te reo at Te Wānanga o Aotearoa, and the vestiges of reo and tikanga I could remember from my early years in Whakatane certainly helped in these situations. Yet whilst I only spoke in te reo at pōwhiri two times directly as part of my research it was an opportunity for me to show respect to those who I was working with and engaging in the research and to continue to build relationships.

I found that the feeling of discomfort at being a Pākehā in a profoundly Māori world as opposed to a Pākehā one was key to ensuring that I conducted my research in appropriate ways and that I was reflexive throughout the research journey. I also feel privileged to be working with Māori communities when considering the history of Māori distrust of many 'external' researchers.

The research process has taught me that there is such a fine line Pākehā researchers must tread when working with Māori communities, and this is something that I and my supervisors have had to negotiate throughout the research process. As an outsider, I have been wary of being critical of some aspects of the way Māori land is currently managed, such as issues to do with the management structures of Māori landowning entities and how these can sometimes work against efficient decision making etc. It needs to be acknowledged that the administrative structures through which Māori must administer their multiply owned land have been imposed by colonising powers. As such, these structures operate under Western paradigms that subvert mātauranga whilst forcing Māori organisations to fit into colonial/Western systems that are at odds with the way that Māori land was traditionally managed (see Kingi, 2008 p.134 for a detailed exploration of this issue). The numerous impacts of colonisation have served to decrease capacity amongst some Māori whānau and hapū to manage their land. This proved difficult to sensitively discuss, as at times I felt I was doing a disservice to Māori by not directly addressing some of the issues and barriers raised in the course of my thesis, so that these might be considered in academia and policy making circles. Using iterative cycles of feedback has been an invaluable part of the research process, in terms of striking a balance between critiquing aspects of the Māori land use decision making process in light of the history of colonisation, and identifying structural barriers which inhibit efficacious land use decision making.

3.2.4 Case studies

Case studies are where the researcher analyses a case (an activity, system, process, programme for one or more individuals) in-depth (Creswell, 2017). Case studies have clear boundaries, and are characterised by the researcher collecting information through a variety of methods over a sustained period (Creswell, 2017; Yin, 2009). Case study research is an appropriate methodology to conduct when the 'how' and 'why' of a particular circumstance or instance is not clear (Yin, 2009), and further, when a phenomenon is best understood by examining the context through which it is located (Creswell, 2017).

Stark and Torrance (2005, p. 33) contend that case study research "seeks to engage with and report the complexity of social activity in order to represent the meanings that individual social actors bring to those settings and manufacture in them." In line with the transformative and KMR approach underpinning this research, a case study approach has been chosen for its ability to 'understand and describe' as opposed to 'theorise' and 'analyse' (Stark & Torrance, 2005).

Due to the dearth of studies in the literature of Māori landowners participating in the NZ ETS, the Nuhiti Q case study provides in-depth inquiry instead of a generalisation of theory over multiple settings (Stark & Torrance, 2005). Semi-structured interviews

Semi-structured interviews have been used to generate data for the Nuhiti Q case study and the multi-criteria analysis (MCA). This interview design was chosen as the questions retain a basic structure, yet allow for fluidity in the interview format that gives flexibility for the interviewer and interviewee (Dunn, 2010). This method of interviewing couples well with a transformative approach as the interviewee shapes the interview, and is acknowledged as the holder of knowledge (Valentine, 2005). Furthermore, Valentine (2005, p. 111) contends that the flexibility of semi structured interviews allows interviewees to "construct

their own accounts of their experiences by describing and explaining their lives in their own words". The Nuhiti Q case study was constructed through a series of eight interviews conducted in 2017 and 2018 with four participants in Gisborne.

3.2.5 Thematic analysis

A thematic analysis has been undertaken of the qualitative interview data from the Nuhiti Q case study, and key informant interviews. Thematic analyses aid in identifying, analysing, and reporting patterns (themes) within data (Braun & Clarke, 2006, p. 6). Thematic analysis is a key qualitative analysis methodology which is used across a wide variety of disciplines and a range of epistemological stances (Nowell et al., 2017), allowing a researcher to 'reflect reality' and 'unpick reality' (Braun & Clarke, 2006). The theoretical freedom of thematic analyses has allowed for a flexible and useful research tool permitting a rich and detailed account of complex data (Braun & Clarke, 2006).

Braun and Clarke (2006) indicate that there are six useful steps to take in order to conduct a thorough thematic analysis. These are summarised in Table 8 below. Themes within the data can be identified in two primary ways using a thematic analysis – an inductive 'bottom up' approach or a deductive 'top down' approach (Braun & Clarke, 2006). Inductive approaches code data without fitting the data into pre-existing research frames, whilst deductive approaches have particular foci which can lead to a less rich description of the overall data – but more in-depth analysis of data in certain areas (Braun & Clarke, 2006). Braun and Clarke (2006) also differentiate between semantic and latent thematic analyses. A semantic analysis has been used in this study as 'surface level' interpretations of the data are appropriate, and there is little need to look beyond what a research participant has said (Nowell et al., 2017), as long as the context is understood.

An inductive approach to thematic analysis was best suited to the key informant interviews as the purpose of these interviews was to generate data for the MCA

and was not constrained by a particular focus. However, analysis for the Nuhiti Q case study was suited to a deductive approach due to the specific research question guiding the interviewing process. Transcripts were coded by hand and entered into MS Word for further analysis.

Table 8: The six phases of thematic analysis (adapted from Nowell et al. (2017), and Braun and Clarke (2006))

Phases of Thematic Analysis	Description of the process
Familiarising yourself with your data	Transcribing data, reading and re-reading data and noting down initial ideas.
Generating initial codes	Upon familiarity with the data, develop coding framework and begin to code relevant features across the data set, and collate relevant data for each code.
Searching for themes	Organise codes into relevant themes and collate relevant data within these themes.
Reviewing themes	Generate a ‘thematic map’ of codes and review with team members.
Defining and naming themes	Define ‘the essence’ of each theme and ongoing analysis to refine themes where necessary.
Producing the report	Final stage of analysis where ‘vivid examples’ are chosen to provide a concise, coherent and logical account (with context) of the data. Relate extracts back to literature and research questions in the scholarly report.

3.2.6 Introduction to multi-criteria analysis

To explore the wider question of land use preferences and co-benefits in Māori land use decision making I have used multi-criteria analysis (MCA). This is a useful decision support tool, because the economy and human activity are intrinsically linked to the environment and decision making surrounding the allocation of natural resources and the resolution of stakeholder interests frequently causes

conflict (Gamper & Turcanu, 2007). Decision support tools used in public policy issues concerning the environment are commonly CEA (cost-effectiveness analysis), CBA (cost-benefit analysis), contingent valuation methods (CVM) and MCA (multi-criteria analysis) (Gamper & Turcanu, 2007; Parks & Gowdy, 2013; Vatn, 2009). These decision support tools are identified by Vatn (2009) as value articulating institutions (VAIs), where each tool has its corresponding strengths and weaknesses. Carnoye and Lopes (2015) emphasise that value-articulating institutions (VAIs) are sets of rules which frame the valuation process, i.e. who is involved, how preferences are elicited and presented and what is data. Carnoye and Lopes (2015) argue that use of this framework defines three issues in environmental valuation: problems of a cognitive, normative or composition nature (Vatn, 2009).

Widespread reservations about neoclassical economic valuation methods have intensified over time (Carnoye & Lopes, 2015; Parks & Gowdy, 2013; Reed, 2008; Vatn, 2009). Brown and Gregory (1999) argue this is in part due to the reliance by economists on valuation methods which quantify or place a dollar value on a person's willingness to pay (WTP) or willingness to accept (WTA) a loss, for example in regard to ecosystem degradation. The prevalence of WTP valuation techniques dominate CVM and this is problematic because degradation of an ecosystem should be measured as a loss, which necessitates the use of WTA as the appropriate CVM typology (Parks & Gowdy, 2013). However, WTP measures are dominant within CVM, and this has led some to conclude that the total value of negative environmental impacts is underestimated (Brown & Gregory, 1999).

Criticism of CVM has led to wider questioning of the use of CBA in ecosystem evaluation and appraisal (Parks & Gowdy, 2013). Critics such as De Groot, et al (2006) believe that when ecosystems are valued through CBA methodologies, their true value is significantly underestimated. CBA valuation assumes that monetary value can be ascribed to the object or entity under valuation, and that these values are derived from an individual's WTA or WTP (Vatn, 2009). Further

to this, Kumar (2010, p. 162) highlights issues with individuals' WTP or WTA, which "...assumes that people: hold these values in advance or can easily generate them; have sufficient information and understanding of what they are valuing; can decide (alone) on the values they attribute to ecosystems; behave according to the cost-benefit rule; value consistently; [and] value according to individual rationality". The assumption that all values are commensurable or compensable under CBA is often incompatible with preferences regarding the value of ecosystems or the intrinsic values of nature (Parks & Gowdy, 2013; Vatn, 2009). Moreover, the focus on individual preferences within CBA may be problematic when considering environmental issues or public commons. Vatn (2009) questions the emphasis on individual preferences for collective problems within CBA. This, Vatn (2009) argues, is why VAls which focus on (social) consensus building and deliberation as opposed to (individual) utility maximisation may be preferable to CBA.

CBA methodologies focus on identifying individual preferences and maximising 'utility', whilst other VAls such as MCA are concerned with reaching consensus and/or finding reasonable and justifiable solutions to a conflict (Vatn, 2009). MCA has evolved as a response to the aforementioned critiques of monetary based valuation techniques. By its nature, MCA considers criteria that are multidimensional and allows for handling of criteria that are incommensurable (Martinez-Alier et al., 1998; Vatn, 2009). One of the key factors which strengthens the appeal of MCA is the emphasis placed upon the decision making process, and the partnership between the decision analyst, stakeholders and interest groups (Beierle, 2002). The emphasis on problem definition, incommensurability and stakeholder engagement within MCA lends itself well to participatory research approaches. Stakeholder participation within environmental decision making has been increasingly sought after when dealing with complex and dynamic environmental problems (Carnoye & Lopes, 2015; Reed, 2008). Environmental valuation and decision making is frequently a fraught process, with complex

problems and a variety of interested or competing stakeholders (Reed, 2008). This has necessitated the development of transparent decision making processes, that are not only flexible but also accessible and inclusive of diverse knowledges and values (Reed, 2008).

CEA, CVM and CBA have traditionally dominated decision making processes in public policy and economic analyses (Vatn, 2009). Yet many disciplines and areas of inquiry emphasise evaluating the 'intangible' outcomes of a system or process such as social equity, identity and the value of nature as opposed to only the economic aspects (Chapman et al., 2017; Parks & Gowdy, 2013). MCA is one value articulating institution through which stakeholders consider and appraise a range of criteria before ascribing values and scores to each 'option' (Chapman et al., 2017; Munda, 2006; Vatn, 2009). This process ultimately aids in realising a richer picture of the value of a proposal or system for stakeholders. Although almost all decisions or problems considered on a daily basis include multiple criteria, we rarely need to employ a formal or structured approach to aid in the analysis of this decision (Belton & Stewart, 2010).

Key features of multi-criteria analysis

MCA methods can be thought of as integrative evaluative methods where information regarding the performance of different options or decision alternatives is considered through scoring against criteria. This scoring process is utilised in conjunction with a weighting process which combines subjective judgements about the relative importance of the criteria against other criteria within the decision-making context (Saarikoski et al., 2016, p. 1). If the problem is one that can be structured by involving a collection of alternatives (choices, actions, strategies or alternative units) that can be tested against a number of relevant criteria, then the MCA approach can be suitable to address the problem at hand (Mabin & Beattie, 2018).

Vatn (2009) emphasises that MCA values and integrates criteria that are difficult to commensurate in monetary terms. This statement is further qualified by Martinez-Alier, Munda, & O'Neill (1998) who state that criteria suited to an MCA are multidimensional and the MCA method allows for incommensurable criteria to be better handled. MCA is often used in environmental resource management when the monetary value ascribed to a project or process is seen as subjective, or secondary to other objectives (Vardakoulias, 2013) or when multiple value systems and objectives cannot be easily quantified, or are difficult to measure monetarily (Gamper & Turcanu, 2007). Extensive stakeholder involvement is a core component of the MCA process, and a key factor which can strengthen the quality of decisions, consequently fitting well with the aims of this research (Beierle, 2002). Gamper & Turcanu (2007) argue that the true value of MCA arises due to its ability to elicit preferences more directly, and the ability to engage and collaborate with affected stakeholders within the decision-making process.

Belton and Stewart (2010, p. 213) define MCA as a collection of formal approaches to help individuals or groups explore “decisions that matter” in a way which takes explicit account of multiple, usually conflicting, criteria. Further elaboration is given in Belton and Vickers (1990, p. 319) with MCA described as “...best suited to the problem of choosing a preferred alternative from a set of well-defined alternatives, or to indicate a preference ordering over such a set of alternatives.”

It is not the goal of MCA to find a ‘right answer’ – instead, the goal of the MCA process is for the decision maker to develop a greater understanding of the problem at hand so that they can typically make a more informed decision. Belton (1990, p. 54) discusses key facets of an MCA process:

Multiple criteria approaches seek to take explicit account of multiple, conflicting criteria in aiding decision making;

The principal aim is to help decision makers learn about the problem situation, about their own and others' values and judgements, and through organisation, synthesis and appropriate presentation of information, to guide them in identifying, often through extensive discussion, a preferred course of action;

The most useful approaches are conceptually simple and transparent;

The process leads to better considered, justifiable and explainable decisions.

Multi-criteria analysis problem design

Belton (1990) distinguishes two different types of MCA problems: evaluation and design problems. Evaluation problems typically involve the evaluation of, and choice between, a discrete set of defined alternatives, whereas a design problem is concerned with identifying a preferred alternative from a potentially infinite set of alternatives through a defined set of constraints (Belton, 1990). The type of problem that the decision maker(s) is confronted with (either evaluation or design) determines the type and construction of the resultant MCA process. The aim of this research is twofold: firstly, to elucidate Māori landowners' land use preferences (and the values associated with these land uses) within Te Tairāwhiti, and to highlight how and what Māori landowners value about carbon farming permanent native forest (and how this compares with other land use alternatives). Thus, the problem this research seeks to address is evaluative in nature as there is a discrete number of land use options suitable for Te Tairāwhiti. Furthermore, this research seeks to evaluate how and why these land uses are valued when compared with carbon farming permanent native forests.

It is also important to consider what type of MCA approach can feasibly be implemented as this will have a significant bearing on the understanding and engagement of participants, and the robustness of the results. In the present study, the evaluative component of the MCA was completed in conjunction with a large hui in Ruatōrea in early November 2018. After a series of presentations in

the morning and early afternoon, participants of the hui were given the opportunity to attend several workshops, of which this MCA process was one (see section 6.1 for a more detailed discussion of the hui and wānanga). Time constraints were foreseen to be a significant factor which could potentially limit the efficacy of the MCA. As a result of this, a number of decisions were made to ensure that the MCA process would be as expeditious and successful as possible.

Firstly, it was decided that the MCA process should be designed to run smoothly, and ensure that participants were engaged and enjoyed the process, therefore staying until the conclusion of the process. Secondly, it was decided to remove unnecessary complexity from the process in terms of introducing and discussing the methodology, and to streamline the implementation. Pilot studies conducted mainly with postgraduate students in October 2018 found that the provisional MCA design was perceived as too complicated and confusing by participants, particularly if the background and methodological foundations were explained. With these considerations and constraints in mind, the final MCA variant selected was of the Multi Attribute Value Theory (MAVT) type. The rationale for this decision is discussed in greater depth in the following sections as well as a comparison with other similar approaches.

Theoretical approaches to multi-criteria analysis

MCA problems that are evaluative in nature are best addressed with certain MCA approaches. As described in Belton (1990) these are approaches which employ an aggregate value function or 'black-box' outranking methods. Aggregate value functions have been principally developed in the USA whilst outranking methods have principally been developed in Western Europe, notably France and Belgium (Belton, 1990). A key proponent of outranking methods is L. T. Saaty, who in a 1980 paper pioneered the development of the Analytical Hierarchy Process (AHP). The AHP is one of the most widely used outranking techniques used to organise and analyse complex decisions and is an effective tool to compare quantitative

and qualitative data within the same problem. The performance of a variable (e.g. a land use 'option') against various criteria is elucidated through a series of pairwise comparison matrices which compares each element on an upper level with the value of the element directly below this level with respect to the overall goal (Saaty, 2008). The intensity of preference between alternatives within the decision matrix indicates the preferability of a given alternative.

MAVT has been acknowledged as an effective approach for deriving scores and weights within an MCA (Belton, 1990). Similarly, to AHP, in MAVT the problem is constructed into a value tree, with the left-hand side of the value tree indicating the ultimate goal. The tree is then broken down into criteria and sub-criteria that contribute to this goal. Criteria are scored on a global or local interval scale before receiving a weighting, which indicates the relative importance of a criterion in regard to an alternative (Mustajoki et al., 2011). Whilst MAVT is praised due to its systematic and transparent way of modelling problems, it is often limited by the time needed to process and interpret the importance weights and scores (Mustajoki et al., 2011). Other criticisms include the perceived simplicity of the approach; however it can be argued that this is one of the strengths of the approach as MAVT facilitates a simple and transparent approach that serves as a robust basis by which to justify a decision (Belton, 1990). The key components of MAVT are evaluations of each option with respect to the criteria (scoring) and determination of weightings which represent the relative importance of each criterion (Belton, 1990).

Multi Attribute Utility Theory (MAUT) was considered but rejected. It differs from most aggregate value function approaches as the risk and uncertainty associated with a decision are factored into the evaluation (Belton, 1990). However, the complexity associated with this approach was considered prohibitive for the present study, given that the MCA process needed to be both simple and streamlined (Belton, 1990). Moreover, a criterion which represents elements of

either risk or uncertainty can be added to the MAVT value tree and considered in conjunction with other criteria.

The AHP is another alternative form of MCA. Whilst the AHP is a rigorous approach and effective at deriving weightings for criteria within the problem, it differs from aggregate value approaches in one key area. The AHP rejects the notion that all alternatives are comparable, instead assuming that the decision makers are unwilling or unable to compare some options (Belton, 1990). Similarities between MAVT and AHP include the hierarchical structuring of the criteria within the evaluation process, which allows for many criteria to be considered at once. In the present study, whilst the land uses under consideration may differ markedly, the decision makers can compare each land use option against the others. Further, the high number of pairwise comparisons required by the AHP would add considerable time to the MCA process and would be inappropriate considering the time constraints of this research. Similarly, whilst it might be fruitful to incorporate risk explicitly into the evaluation process in the way offered in MAUT, the complexity afforded by this approach would not fit within the scope of this research. As it is assumed that all land uses can be compared with each other, an aggregate value approach, and MAVT in particular, was chosen as most suitable for this MCA.

VISA decision making software

Ensuring that the decision-making process is transparent and follows a formal procedure is often a key requirement for decision makers and concerned stakeholders (Mabin & Beattie, 2018). Further, a transparent, replicable process ensures that any decision can be well justified if accountability, transparency and a robust formal procedure are desired by the decision maker(s). Under these conditions, the MCA process can be enhanced using decision support software. A software package VISA (Visual Interactive Sensitivity Analysis) provides the means through which a facilitator or decision analyst can develop, organise and

synthesise information as a decision support tool, and can provide a means by which a decision can be justified and explained (Belton, 1990; Mabin & Beattie, 2018). VISA is able to automatically perform calculations whilst allowing user interaction and editing throughout all stages of the evaluation process (Mabin et al., 2001). It employs a simple weighted multi-attribute value function that incorporates a hierarchical structure of criteria as well as allowing for an interactive visual sensitivity analysis (Mabin & Beattie, 2018).

VISA was chosen because it can perform the core components of MAVT, i.e. the scoring and weighting of criteria, and the ability to perform sensitivity analyses in order to illustrate the robustness of results (Mabin et al., 2001). The key strengths of VISA are its simplicity and transparency particularly when compared with outranking methods such as the AHP. However, Belton and Vickers (1990) contend that the simplicity of VISA also exposes the model to criticism. Belton and Vickers (1990) argue that part of the criticism arises as a result of the significant emphasis placed upon the decision maker(s) to evaluate the alternatives with a satisfactory degree of accuracy. The authors further caution against blindly following the results of any VISA analysis. As VISA provides a complete ranking of all alternatives under consideration (in contrast with partial-ranking approaches such as PROMETHEE and ELECTRE), the onus falls on the decision maker to explore why and how two alternatives may have similar scores (Belton & Vickers, 1990). The use of sensitivity analyses mitigates this potential difficulty in part. Whilst VISA does not incorporate some of the more sophisticated analytical and evaluative tools of other models, if it is used as an aid rather than 'a route to finding a non-existent *right-answer*' it is a flexible tool with well-known strengths and limitations to explore a range of inquiries (Belton & Vickers, 1990).

3.2.7 Structure of multi-criteria analysis

The core components of an MCA involve the identification of alternatives (options), identification of criteria and the evaluation of results. Figure 9

illustrates other key areas of an MCA and highlights the iterative nature of such a process (Belton & Vickers, 1990).

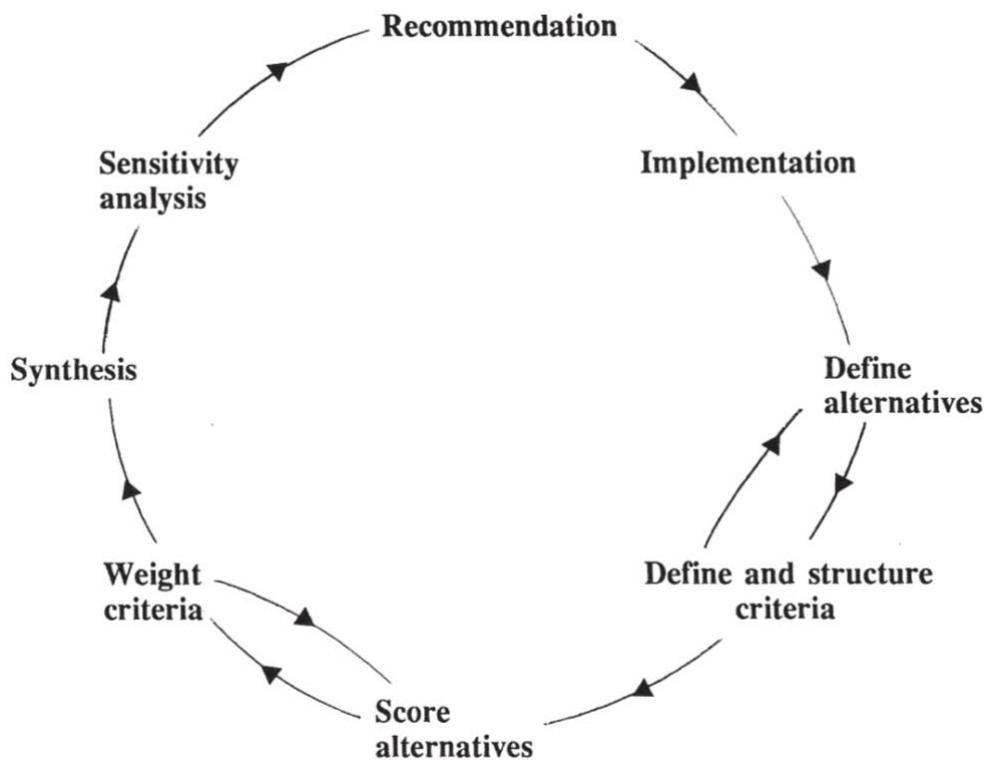


Figure 9: The main components of an MCA (Belton and Vickers, 1990)

Goodwin and Wright (1998) expand on Figure 9, to illustrate the main components of an MCA as below; each point will be discussed in greater depth in the following sections:

- Identify the decision maker(s) and define and structure the problem;
- Define the alternatives (the possible courses of action);
- Define criteria which are relevant in describing or measuring the alternatives:
- Assign scores to the criteria in relation to their performance against a given alternative;

- Determine weights for each of the criteria under consideration in order to reflect the importance of each criterion when compared against others;
- Synthesise the results and make a preliminary decision;
- Perform sensitivity analyses to determine how robust the provisional decision is once changes are made to the scores and weights;
- Interpret the sensitivity analysis and results before making a final decision.

Identification of problem and decision makers

The decision makers for this research approach are Māori freehold landowners in the Waiapu Catchment who are interested in the land use decision making process. The identified problem regards the dearth of public knowledge as to what the land use preferences of Māori landowners in Te Tairāwhiti are, and further to this, how carbon farming permanent native forestry is valued by these actors when they compare it to other possible land use alternatives. Anecdotal evidence and evidence within the literature has indicated that there are a variety of co-benefits associated with carbon farming permanent native forests within Te Tairāwhiti (Carswell et al., 2002, 2003; Carver & Kerr, 2017; Funk et al., 2014; Harmsworth & Baisden, 2005; Tuahine, 2018). Ascertaining what these co-benefits are, why and how they are valued, and how much is key to understanding land use planning into the future.

Identification of alternatives

The next step of an MCA is to identify relevant alternatives that can help to address the problem at hand. In some cases, the alternatives will be obvious; however, it may also be that there are too many alternatives to choose from and these may need to be reduced to a manageable set in order to ensure efficiency in the MCA process. Belton and Vickers (1990, p. 321) suggest ways to reduce the number of alternatives: screening those that do not meet a pre-specified level on a set of criteria, or by selecting a representative set of alternatives either through

consultation with stakeholders or the literature, or by determining a few critical criteria for evaluation and selecting alternatives which perform best according to those criteria. However, it should be noted that the greater the number of alternatives included, the greater the amount of time that needs to be spent collecting supplementary information for the decision makers, and if the criteria set is also substantial, the evaluation will be much more time consuming.

This research seeks to affirm calls to centre and enhance public and stakeholder involvement in the design and implementation of an MCA, particularly by utilising participatory and deliberative methodologies advocated by Carnoye and Lopes (2015) and Kindon et al., (2007). Carnoye and Lopes (2015, p. 6) state that deliberative methodologies are effective when coupled with participatory processes such as MCA because they allow for collective reflection on the problem at hand and allow for the chosen indicators to be adapted to the needs and wills of the participants involved, while fostering their understanding of the various dimensions of the problem under consideration. This research heeds this call by using a two-tiered stakeholder/decision making process that is applied for both the selection and inclusion of alternative land uses and criteria within the MCA. Alternative land use options were identified through interviews with key informants familiar with the environmental and socio-cultural characteristics of the Waiapu Catchment and wider Tairāwhiti, the history of land management and land use in Te Tairāwhiti, the characteristics of Māori land in Te Tairāwhiti and associated constraints and opportunities for Māori landowners. In total, I conducted 15 key informant interviews in early-mid September 2018, and transcribed these interviews. The interviews were semi-structured in nature, and an interview schedule was followed.

Identification of Criteria

The identification and definition of alternatives (in this study alternative land use options) is usually an iterative process (as indicated in *Figure 1*) that may not be

finalised until the end of the MCA process. Criteria are predominantly identified through key informant interviews. Because the MCA follows a participatory and deliberative methodology (Carnoye & Lopes, 2015; Kindon et al., 2007; Martinez-Alier et al., 1998), the participants are given the opportunity to include or exclude any of the criteria or alternatives (providing consensus can be achieved) throughout the MCA. After criteria have been identified a value tree is constructed, where the higher level criteria progressively decompose to greater levels of detail (Belton & Vickers, 1990). These criteria are organised under three themes: social and cultural benefits, environmental benefits and economic benefits.

Upon construction of a value tree it is necessary to evaluate whether the selected criteria will be effective at assessing the performance of the alternatives (Keeney and Raiffa (1976) provide a thorough description of the characteristics of an effective value tree). It is also important to ensure that any two criteria do not measure the same attribute as this can lead to 'double counting' the same effect (Mabin & Beattie, 2018). Moreover it is also important to ensure the criteria satisfy a condition known as (preference) independence, whereby any trade-off a decision maker is willing to make between two criteria is not contingent on the value of any other criterion (Belton, 1990). If preference independence cannot be achieved, criteria can be redefined by further decomposition (Belton & Vickers, 1990).

Scoring the alternatives

Scoring refers to the process whereby the value of each alternative is assessed in respect of the various criteria (Belton & Vickers, 1990). Once the decision makers are in a position where the problem, its alternative course of action and the criteria of the problem are known and considered, it is necessary to have a scoring system that allows evaluation of the performance of the alternatives in respect of the criteria (Mabin & Beattie, 2018). By assigning scores to the criteria the

participants and decision makers can indicate and reflect upon the importance of each alternative in respect of the criteria (Mabin & Beattie, 2018). An MAVT MCA uses an interval scale for scoring alternatives against the criteria. VISA supports global and local interval scales and also qualitative scales.

A local interval scale is defined by the alternatives which are under evaluation (Belton, 1990). An alternative which performs the best on a specific criterion is given a score of 100 whilst the alternative that scores the worst on that criterion is given a score of 0 (Belton, 1990). The remaining alternatives are given scores within the 0-100 continuum relative to their performance against the best and worst performing alternatives. A global scale gives reference to a wider set of possibilities where the end points are assigned to the best and worst alternative that can be thought of (Belton, 1990). The intermediate alternatives are then scored in relation to these two high and low performing alternatives. It is important to match the potential scoring scale with the type of data being used. If quantitative data is being used then global and local scales can be used (Mabin & Beattie, 2018). Qualitative data is best suited to a local interval scale or a qualitative scale. Local scales can at times be easier to establish as there is no need to peg alternatives to external reference points; however, if further alternatives are added, the scale will potentially need redefinition.

Determining the scores for alternatives can also differ depending on the criteria under consideration. Criteria can be scored through an informal process such as subjective scaling whereby the criteria are directly assigned values (Belton, 1990). This process relies upon group discussion and consensus building and is frequently an iterative process as the model may need restructuring depending on the participants' perceptions of the problem and evidence at hand (Belton, 1990). A more formal approach named direct rating is discussed by Goodwin and Wright (1998). With direct rating, the most important criterion is assigned a value of 100 with all other criteria assessed in regard to this benchmark. Direct rating is most

useful where criteria cannot be easily represented by quantifiable variables (Belton, 1990).

Where criteria can be well represented by quantifiable values, a formal approach suitable for scoring is the value function approach. A value function requires decision makers to identify the best and worst performing alternatives in respect of a criterion (Goodwin & Wright, 1998). After this, a midpoint (that may or may not be represented by the value of a certain alternative) needs to be found between the best and worst performing alternatives. After the midpoint value has been settled on, the 'quarter point' values need to be found – that is the values halfway between the best and worst performing alternative and the midpoint (Goodwin & Wright, 1998). The value function can be used for scoring other alternatives that have not been considered in relation to a certain criterion.

The criteria included in this MCA are broad, including economic, environmental and social and cultural criteria. There are few similarities between the characteristics of particular criteria and finding a common scale to score criteria as disparate as erosion control, market resilience and employment was difficult. Moreover, within the abovementioned constraints of the hui, a simple and user-friendly approach to scoring the alternatives was necessary. It was decided that a qualitative local interval scale would be constructed building upon a Nga Pou Herenga (Core Values and Principles) and KMR scoring methodology adapted by Awatere et al. (2018). The scoring scale was a 1-5 continuum with a statement associated with each numerical value requiring a subjective judgement through consensus building by the MCA participants. Deliberation over the values, including intermediate values, was a significant part of establishing the robustness of the scoring. This is further discussed in chapter 6.

Weighting the alternatives

The process of assigning weights to criteria indicates the relative importance of each criterion in relation to those criteria within the same family (e.g. the family of environmental criteria). These weights are essentially trade-off values indicating how much decision makers would be prepared to 'give up' for an improvement in another criterion (Belton & Vickers, 1990).

One such method, considered for this study, but rejected, is the swing weight method. The first stage of this process begins by ranking the criteria in order of significance. The decision maker is also asked to compare a change (or swing) from the least-preferred to the most preferred value on one criterion in comparison with a similar change in another criterion (Goodwin & Wright, 1998, p. 29). The decision maker is, in addition, asked to imagine all criteria within a particular family at their least-preferred levels; and then asked to elevate one of the criteria from its least to most-preferred level: this criterion is now assigned a weighting of 100 (Goodwin & Wright, 1998). Following this, the remaining criteria undergo a similar process so that the ranking of importance becomes evident. The criteria below the top ranked criterion are now assessed in relation to the top ranked criterion. This is achieved by asking the decision maker to compare, in regard to the top ranked criterion, how much a swing from its least to most-preferred performance level is to an equivalent swing with the 2nd ranked criterion (Goodwin & Wright, 1998). After indicative weights have been identified, the weights are normalised (Goodwin & Wright, 1998). The swing weight methodology is effective in providing a quantification of the importance of the criteria (Goodwin & Wright, 1998).

The swing weight methodology is one of the more widely mentioned in the literature. However, it was not known how 'user friendly' this weighting methodology would be for the MCA participants within the identified constraints of the hui. An earlier pilot study helped to clarify the weighting process. One of

the key conclusions drawn from this pilot was how confusing the swing weighting methodology was. Considering this was feedback given by a cohort of academic staff and postgraduate students, it was deemed inadvisable to continue using this method at the MCA hui. It was ultimately decided that the weighting methodology used in Mabin et al. (2001) would be adapted to suit the purposes and constraints of this MCA. When weighting the criteria and in the discussions surrounding this process, participants were encouraged to debate the merits of each criterion by considering its intrinsic importance, its level of discrimination against other criteria and to achieve consensus on the final weightings (Mabin et al., 2001). The process was as follows: participants were first asked to rank the criteria in order of importance; they were then given a hypothetical scenario where they had '100 percentage points' to allocate over criteria within a family. In effect, participants allocated normalised weightings to the criteria which ensured the methodology was sound, yet still followed a smooth, understandable and user-friendly process.

Synthesis of Results

VISA offers a number of ways through which to present the results of an MCA. Key analytical tools are the thermometer and profiles charts where the performance of all alternatives can be ascertained. These tools provide the simplest means through which to identify which alternatives perform best, which have significant strengths and weaknesses and which alternatives are good all-round (Mabin & Beattie, 2018). However, when a more in-depth inquiry is needed, the x-y plot is another tool which can investigate the relative attractiveness of an alternative and whether there are any trade-offs between criteria particularly in an input/output or cost/benefit setting (Mabin & Beattie, 2018). Where an understanding of the influence of particular criteria on the selection of alternatives is sought, weighted profiles can be generated highlighting the influence of the most important criteria. Of course, the

construction of the MCA model and the problem at hand will undoubtedly influence the analysis conducted and its outcomes.

The process of finding the best outcome can be summarised (Belton, 1990) in a simple mathematical model as:

$$V_i = \text{SUM}_j(w_j v_{ij}) \text{ where:}$$

V_i is the value (overall evaluation) of option i

w_j is the weight assigned to criterion j , such that

In other words, once the v are determined ('scored') via the deliberative process, the weights add to 1 for each i

and the scores are weighted, the overall V_i can be calculated.

It is necessary to reiterate that an alternative with the highest score may not in fact be the best solution as its performance on key criteria may not be as good as expected. There may be alternatives that collectively perform well and lie upon what Goodwin and Wright (1998) term the 'efficiency frontier', an area where alternatives achieve a certain level on a number of desirable criteria. However Belton (1990) cautions against falling into a 'linearity trap' where any alternative not on the efficiency frontier are excluded in favour of others that perhaps represent a more balanced option for the decision maker (Mabin & Beattie, 2018).

Sensitivity analysis

Upon synthesis of the results it is important to ascertain how robust the choice of a particular option or 'alternative' is to changes, uncertainties or errors in the data (particularly in the weights) (Goodwin & Wright, 1998; Mabin & Beattie, 2018). This is achieved through a sensitivity analysis where a decision maker can effectively see what is influencing a decision and whether the model is working as it should. Mabin et al. (2001, p. 52) give further insight into the role of sensitivity analyses "...The normal use of sensitivity charts is to indicate how large a change in weights is needed before a particular option scores best: often the change required is simply too big to be realistic. Or sometimes the favoured option does

come out on top, and the question then becomes, how close is the second place-getter, or what are the key drivers?”. VISA presents these sensitivity analyses visually on a sensitivity graph. If the decision maker is still unsure of a course of action, or conversely of the validity of the results, more changes can be considered and potentially made to the value tree structure and through reassessment of the option scores or the criteria weights (Mabin et al., 2001). The combination of these techniques ultimately gives the decision maker confidence in the decision through greater understanding of the input data and how this data behaves when adjusted (Goodwin & Wright, 1998).

Interpretation of results and final decision

Goodwin and Wright (1998) query at what point do we decide a decision model is adequate and that no further refinements or revisions are required? It is worth considering this question, particularly before making a final decision, as there can often be a significant difference (for the decision maker) between the *intuitive* versus the *analytic* result of an MCA. In exploring this issue Goodwin and Wright (1998, p. 37) refer to a set of theoretical axioms of an MCA which make a series of implicit assumptions about the decision maker’s preferences. They are as follows:

Decidability: The decision maker can decide what is the most preferred option out of option A and B.

Transitivity: If the decision maker prefers option A to B, and prefers option B to C then if transitivity applies, option A is preferred over option C.

Summation: If the decision maker prefers option A to B and option B to C then the strength of preference of A over C must therefore be greater than the strength of preference of A over B (or B over C).

Solvability: If the decision maker is asked to define a preferred value between the *best* and the *worst* scores against criterion *i*, for a given option A, then it is implicitly assumed that such a value exists, and that the decision maker can identify this value.

Finite upper and lower bounds for value: When assessing values, this assumes that option A is not *so* wonderful and option B is not *so* terrible that values of plus/minus infinity would be assigned to these options. Instead, a finite scale with defined end points is used for assessing value.

If in the scenario referred to by Goodwin and Wright (1998) these axioms hold, then it can be assumed that the model has been well constructed, and the results are acceptable to the decision maker. However, it may also be the case that a new set of axioms can be generated that better suits the decision problem, and if the decision maker behaves in accordance with these axioms it cannot be argued that the rejection of any result is irrational (Goodwin & Wright, 1998). In the present study, the outcomes were such (in particular, comfort with the scoring of the options) that the decision makers did not articulate a need to define a new set of axioms.

With a reasonable, practical understanding of the evaluative process, in the present study, the decision makers were felt to be able to provide sufficient evaluative information to allow robust results to be synthesised and sensitivity analyses performed. When making a final evaluation of a preferred alternative (option), it is important to consider the alternatives that seem to be clear winners in comparison with those alternatives that are close in their final scores (Mabin & Beattie, 2018). Any results should be presented simply, and avoid too much detailed information so as to be transparent and comprehensible (Belton & Vickers, 1990).

Heuristics

Literature concerning the decision-making process is of use in the interpretation of results from the MCA. Exploring how a decision is made, and what influence any external factors (beyond that of the information supplied in the MCA) played in the decision-making process is important to consider. In principle, this is a very large sphere of investigation, as decision making is both complex and heterogeneous. However, the study of heuristics can offer some immediately applicable insights into the more common ways in which complex decision-making challenges are made more manageable by participants.

Heuristics, as described by Bazerman and Moore (2009) are simplifying strategies or 'rules of thumb' we use to cope when making both simple but more often complex decisions. Heuristics implicitly direct our judgements, and whilst commonly a useful cognitive tool, overuse of heuristics can lead to poor decisions (Bazerman & Moore, 2009). The logic behind our use of heuristics is that losses in decision quality are generally offset by time saved in the decision making process (Bazerman & Moore, 2009).

The concept of *systems thinking*, as interpreted by Bazerman and Moore (2009), is an explanation for why we use heuristics to make decisions. Systems thinking was developed by Daniel Kahneman and Amos Tversky in a 1984 paper *Choices, Values, and Frames* (Kahneman & Tversky, 1984). System 1 and 2 thinking are two distinct decision-making processes. System 1 thinking refers to our automatic, fast, effortless, intuitive thinking, and is often emotional (Stanovich & West, 2000). By contrast, System 2 thinking is much more slow, measured and logical (Stanovich & West, 2000). Generally, System 1 thinking is sufficient for most decision making situations, as the reason for this cognitive functioning is to streamline the multiple and inconsequential decisions we make every day (Bazerman & Moore, 2009). Ideally, System 2 thinking would be used for

important decisions with serious ramifications, and a more measured explicit approach better matches these situations (Bazerman & Moore, 2009).

System thinking and heuristics have been drawn upon in this study to help explore and explain the decision-making processes behind the stated land use preferences of Māori landowners in the MCA wānanga. This is because often, System 1 thinking is used in places where System 2 thinking should be used. This is not anyone's fault; rather, evidence shows that the more rushed and busy we are when making decisions, the more likely it is that System 1 thinking dominates our decision making (Bazerman & Moore, 2009). Literature surrounding heuristics and system thinking is often concerned with notions of rationality (the decision making process that is logically expected to lead to the optimal result, given an accurate assessment of the decision maker's values and risk preferences), expediency, efficiency and logic in business decision making – where the 'right/optimal' decision is desired (Bazerman & Moore, 2009, p. 4). Whilst this research is interested in the decision making processes of Māori landowners when assessing land uses in the Waiapu catchment, the focus is not on exposing 'poor decisions' in the MCA; rather, it is to use an understanding of heuristics (and their associated biases) as an explanatory tool through which to explore and interpret the MCA results.

There are a range of heuristics which are relevant to decision making in an MCA. The availability heuristic relates to the tendency of people when making decisions to assess the likelihood of an event using information readily available in the memory (Tversky & Kahneman, 1973). The availability heuristic is most evident, and important to a decision making process when striking events are readily imagined and easily recalled (Bazerman & Moore, 2009). The representative heuristic is drawn from the inclination of decision makers to be influenced by existing and accepted traits of a person/decision/land use and using these readily held beliefs as a lens through which to judge the new decision (Bazerman & Moore, 2009). The confirmation heuristic stems from the predisposition for

people to readily accept ‘favourable information’ that confirms currently held beliefs, and consequently, to be suspicious or critical of any information that conflicts with these beliefs (Bazerman & Moore, 2009). Table 9, below, provides an indication of biases that stem from the aforementioned heuristics (Bazerman & Moore, 2009, p. 40):

Table 9: Heuristics and biases relevant to analysis of the MCA (adapted from Bazerman and Moore, (2009, p. 40))

Bias	Description
Biases arising from the Availability Heuristic	
Ease of recall	Individuals judge events that are more easily recalled from memory, based on vividness or recency, to be more numerous than events of equal frequency whose instances are less easily recalled.
Retrievability	Individuals are biased in their assessments of the frequency of events based on how their memory structures affect the search process.
Biases arising from the Representativeness Heuristic	
Insensitivity to base rates	When assessing the likelihood of events, individuals tend to ignore base rates if any other descriptive information is provided—even if it is irrelevant.

Inensitivity to sample size	When assessing the reliability of sample information, individuals frequently fail to appreciate the role of sample size.
Misconceptions of chance	Individuals expect that a sequence of data generated by a random process will look "random," even when the sequence is too short for those expectations to be statistically valid.
Regression to the mean	Individuals tend to ignore the fact that extreme events tend to regress to the mean on subsequent trials.
The conjunction fallacy	Individuals falsely judge that conjunctions (two events occurring) are more probable than a more global set of occurrences of which the conjunction is a subset.
Biases arising from the Confirmation Heuristic	
The confirmation trap	Individuals tend to seek confirmatory information for what they think is true and fail to search for disconformity evidence.
Anchoring	Individuals make estimates for values based upon an initial value (derived from past events, random assignment, or whatever information is available) and typically make insufficient adjustments from that anchor when establishing a final value.
Conjunctive and disjunctive-events bias	Individuals exhibit a bias toward overestimating the probability of conjunctive events and underestimating the probability of disjunctive events.
Overconfidence	Individuals tend to be overconfident of the infallibility of their judgments

	when answering moderately to extremely difficult questions.
Hindsight and the curse of knowledge	After finding out whether or not an event occurred, individuals tend to overestimate the degree to which they would have predicted the correct outcome. Furthermore, individuals fail to ignore information they possess that others do not when predicting others' behaviour.

This chapter has detailed the research methodology employed in this study. The study utilises evaluative research methodologies to assess, in a novel application of these techniques, the values Māori landowners associate with land uses. A value articulating institution, multi-criteria analysis, which prioritises participatory and deliberative group-based value judgements, is used to generate scores and weightings which represent the relative strengths of association of land use options, based on their benefits and co-benefits in the Waiapu catchment. This MCA methodology sits against the backdrop of a case study of a Māori landowning incorporation which has illuminated a number of practical issues associated with carbon farming. The mixed methods approach to this research complements the transformative research design, the key feature of which is a research process emphasising an action orientation and co-design that centres the mātauranga and experiences of the participants. The underlying desire, as a non-Māori researcher, has been to work within the 'spirit of kaupapa Māori methodology'. The following chapter will present the results of quantitative and qualitative aspects of the multi-criteria analysis, and that of the case study.

4 Results part 1: the Nuhiti Q case study

4.1 Introduction to Nuhiti Q

Nuhiti Q had faced severe erosion over (and predating) the history of the incorporation, and this had severely impinged upon the viability of the Incorporation's core business, sheep and beef farming. Thus, a decision was made to retire the most unproductive erosion prone areas of the farm into native forest and enter the New Zealand Emissions Trading Scheme (ETS) which was achieved in 2012. The reversion of farmland to native forest under the NZ ETS provides an opportunity to improve social, economic and environmental outcomes for Māori landowners in Te Tairāwhiti. However, the opportunities for and barriers to applying this land management option on Māori land more broadly are relatively unknown at this stage. This chapter explores these unknowns by presenting the results for a case study of a Māori landowning Incorporation in Anaura Bay, which retired 600 ha of pastoral land and entered the NZ ETS in 2009. This land use choice was coupled with a direct bilateral partnership with an emitter (Gull NZ) in 2016.

Nuhiti Q is one of the first non-forestry Māori landowning entities to enter New Zealand's ETS using eligible post-1989 native forest regeneration. This decision was made because a multitude of factors have limited the viability of the farming unit and the management committee recognised that a change in land use strategy was needed. Loosely defined, these challenges are biophysical, financial and socio-cultural and their imposition is a result of internal and external factors. This case study expands upon a series of challenges faced by Nuhiti Q, follows the decision-making process of the management committee when scoping the NZ ETS, and critically analyses the wider opportunities, barriers and risks for Māori landowners participating in the NZ ETS including engaging in direct bilateral relationships with emitters.

The Nuhiti Q case study⁸ data collection consisted of eight interviews conducted over 2017 and 2018, document analyses and numerous informal conversations. The interviewees provide diverse perspectives to Nuhiti Q’s participation in the NZ ETS and direct relationships with an emitter. The interviews were designed to provide a summary of Nuhiti Q’s participation in the NZ ETS, their direct relationship with an emitter alongside a general overview of opportunities, risks and barriers for Māori landowners entering the NZ ETS. The dates of each interview and the codes ascribed to each interviewee can be seen in Table 10. A timeline of this case study can be seen in appendix A.3.

Table 10: Nuhiti Q case study interviewees, dates of interview and codes

Name and role	Date of interview	Code
Nikki Searancke – chairperson, Nuhiti Q.	6/7/17, 7/7/17, 16/2/18, 29/9/18	NS17a, NS17b, NS18a, NS18b
Bryan McKinlay – forestry consultant, Eastern NZ Forestry Ltd.	6/7/17, 16/2/18	BM17, BM18
Kerry Hudson – advisor to the Gisborne District Council (soil conservation).	16/2/18	KH18
David Bodger – general manager of Gull New Zealand Ltd.	12/9/17	DB17

⁸ The fieldwork for this case study forms part of a three year project (405423): “Testing the New Zealand ETS to facilitate native forest regeneration on Māori land” funded by the Ministry of Primary Industries through the Sustainable Land Management and Climate Change Research Programme. This research was conducted in partnership with Motu Economic and Public Policy Research and Hikurangi Enterprises Ltd. A series of video interviews conducted by myself for the project can be seen at <https://waro.nz/nuhiti-q-story/>.



Figure 10: Nuhiti Q (Ashton, 2016)

4.1.1 Background information

Nuhiti Q was incorporated in 1987 and is managed under the Te Ture Whenua Māori Land Act 1993. The incorporated lands include 1265 ha of Māori freehold land, and the Nuhiti Reserve (1140 ha), which is leased to the Department of Conservation (DOC). Nuhiti Q leases a further 286 ha, which yields a total effective pastoral area of over 900 ha. The Incorporation has historically had to contend with a number of factors which have challenged the viability of its farming operation. Whilst the management committee has always been aware of the limitations to the farming operation as a result of erosion, in 2009, the management committee was becoming increasingly cognisant of the fact that large areas of the landholding, and in particular coastal areas of the farm, would need to be retired from pastoral farming. Productivity losses as a result of erosion and the need to fund a large fencing programme were cited as some of the key reasons why a retirement programme was introduced, and there was recognition

that ‘we couldn’t farm our way out of it’ (NS17a). A significant portion of the land that needed to be retired was NZ ETS eligible post-1989 regenerating native forest. So began an investigation into land retirement options.

We then looked to other things. My background had really been in policy, so I had a fair idea that it’s possible we could do an ECFP (Erosion Control Funding Programme) grant as well as carbon farming. NS18a

Land retirement was also necessary because stock on the farm had to roam significant distances to feed, which left them in poor condition when they were sent to market. Nikki referred to areas within the farm that were growing numerous rare native flora species and stands of pūriri trees that held particular cultural significance. There was also a recognition that managing the land as it had been done in the past would not ensure it would endure as a viable business unit for future generations. The multitude of issues ranging from cultural and social to environmental and economic helped the Nuhiti Q management committee to seriously consider land retirement and entry into the NZ ETS.

So, we had a balance sheet issue, eroding equity, and we had a land issue, eroding land. So, what does that tell you in the end? It says to you change is imminent. And plan for it. NS17a

4.1.2 Increasing erosion and native reversion

In interviews conducted with Nikki there were many instances given, over the Incorporation’s history, where large scale erosion events ‘flattened fence lines’, ‘killed stock’ or allowed stock to escape (NS17b). The majority of land farmed by Nuhiti Q has had a degree of erosion vulnerability, and 300-500 ha of Nuhiti Q’s freehold land was classified as highly erodible by the Gisborne District Council and required some form of treatment (planting or retirement) (BM17, NS17a).

...whatever we did to our land was not suiting, treating the land. And if we didn't treat the land the way it should be treated by what it was telling us, it wasn't working. So, erosion had sped up at an alarming rate. We had trees come down in slips from the back country. No, it was unsustainable, we lost stock, stock went down in erodible slips, or disappeared into the bush. Fencing was difficult to maintain because in that country you have storms and fencing comes away. NS18a

For 30-40 years the Incorporation and its managers had fought against the reversion of mānuka and kānuka in the marginal, northern and coastal areas of the farm. Figure 11 provides a general indication of the land cover on Nuhiti Q (this data has been aggregated and generalised by Manaaki Whenua and is to only be used as a broad guide), and whilst this data has been generated after large areas of the farm have been retired, there have always been incursions of mānuka and kānuka.

...farming land that keeps reverting, well you spend an awful lot of money chopping it down and battling it and two years later, its back. So, there were just enormous losses, and we couldn't endure that.

NS17b

Costs incurred by removing mānuka and kānuka on a biennial basis, and the limited return from these blocks led the management committee to more seriously consider permanent retirement of these areas. Once the management committee was aware that the regenerating and erosion prone areas of the farm were likely eligible for funding under the ECFP and entry into the NZ ETS the case for large scale retirement became more feasible.

Farmers always talk about the land talking to you, and this land wasn't talking to us, it was shouting at us - do something! And that was what made us work really quickly to do the fencing and retire it. NS17a

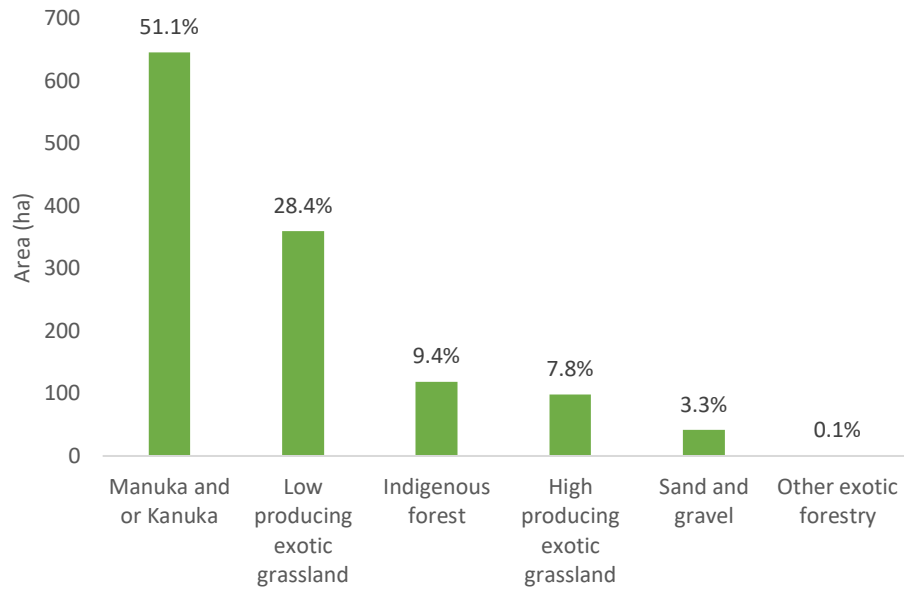


Figure 11: Land cover of Nuhiti Q's freehold land (data from: whenuaviz.landcareresearch.co.nz last updated February 2019)



Figure 12: Erosion prone coastal block - Nuhiti Q (Searancke, N., n.d.)

4.1.3 Fencing and other financial considerations

When Nuhiti Q was incorporated in 1987, significant debt (in the hundreds of thousands of dollars) incurred from rates non-payment for the northern blocks was taken on by the newly formed incorporation. Thus, servicing this debt (alongside pre-existing debt) was a major fiscal challenge for Nuhiti Q, and until the introduction of the NZ ETS, had restricted their ability to ‘take on more risk’ or make different land use decisions (NS18b).

Before the introduction of the NZ ETS, the opportunity cost of retiring the most marginal and erosion prone areas of the landholding was deemed too high. Yet, at the same time, these areas of the farm were likely earning a negative return and the shareholders still ‘expected their land to be farmed’ (NS17a). These realities put the management committee of Nuhiti Q in an unenviable position whereby the shareholders expected their land to be farmed traditionally, the bank still required payment, but 400-500 ha of the farm was unprofitable.

We were facing major restrictions; we’d already made redundant two permanent staff. We clearly were always over budget and we were running at losses so we could have just simply decided to shut down part of the farm and farm what we called the finishing block, but we decided that that was not sustainable in the eyes of our shareholders.

NS18a

A further pressure was the expenditure required to maintain and establish fencing across the station. When Nikki rose to become chairperson of Nuhiti Q, fencing across the station was in a ‘poor condition, and non-existent in other areas’ (NS17a), and there was recognition that a significant fencing programme was needed.

Fencing was difficult to maintain because in that country you have storms and fencing comes away. We were finding that unsustainable,

and so to build fencing, you don't have the money instantly, you have to wait to get seasonal funding. So that in itself was becoming unsustainable too. It was eroding our equity. NS18b

The core objective of the fencing programme was to achieve 'better stock management outcomes' (NS17a) and to have smaller paddocks. However, the large capital outlay needed to achieve these objectives was beyond Nuhiti Q at the time of consideration (2009-2010). Necessity ultimately saw Nuhiti Q seek a joint venture partner in Craigmore Sustainables (a farming and forestry investment firm) and participate in both the ECFP and NZ ETS.



*Figure 13: Coastal block post retirement and fencing programme - Nuhiti Q
(Searancke, N., n.d.)*

4.1.4 Social and cultural pressures

Biophysical and fiscal challenges were also compounded and exemplified by a number of social and cultural pressures. As a Māori incorporation the management committee has to balance a number of competing objectives when managing their vested lands. Nikki is a member of the Ferris whānau who descend from Wakarāra (born 1675 AD), a local chief who held land from Nuhiti Q to Anaura and inland to Tauwhareparae now incorporated as Nuhiti Q. Nikki draws a distinction between the current administration of the land and the influence of her forebears:

As a family, we descend from my great grandfather Ta Rerewihi. He was an innovator. For him it was more important to protect the waterways, look after the water sources and the bush, because that is how he was raised. He was that person that preserved the reserve, and did minimal farming although he was a farmer, and to that end he was also saying to us, 'this is who we are, and this is why we have to protect this land'; he wasn't saying 'this is who we are, this is what we have to do, we've got to go farming', it's as simple as that. NS17b

Throughout the interviews Nikki made frequent mention of the intergenerational legacy of the land use decisions that have been made, the 'whānau pressure to not muck it up' (NS17b), and the desire for the land to flourish and 'endure for future generations' (NS17a). The management committee of Nuhiti Q have also adopted a 100-year strategy to guide the decision making of future generations.

I've got 890 shareholders. Small compared to many other land incorporations but, you know, I think about every one of those shareholders and hope that their descendants and mine will inherit the 100 year strategy and work with it and implement it because you know I can only implement the beginning of it, which we've done over the last

5-6 years, the rest will be for them. And I feel confident that they will, that they see Nuhiti as their ancestral land, it was hard fought over - Wakarāra chased every other invader away and we descend from him. So, we have to follow suit and keep the land for the owners and the beneficiaries of Nuhiti. NS18a

Once the decision to retire land had been made by the management committee, Nikki believes Nuhiti Q went further in their retirement programme than other land-owning entities may have. This was largely a result of the strong cultural and environmental ethic of the management committee.

...we took our fencing back to the next headland and we gave up a lot of prime grazing land, and that grazing land was probably growing some really rare plants, and I just didn't have any longer the feeling that we should be allowing stock in there. And we have this rare native puha, and even the mānuka and particularly the other species, we have big stands of cabbage trees... you can't have stock in areas like that if you want the bush to survive. It was something that we didn't think twice about... It was a decision [about] saying. Well, look, that stand of trees is worth preserving. To do that we have to fence back here. NS17b

The location of wāhi tapu sites in areas that had traditionally been farmed also factored into the decision-making process when considering land retirement.

In that stand of trees, there are a lot of wāhi tapu sites. We had already done the surveying back in the 80s, because the land belonged to these people who are the descendants of the original owners. Because that's handed down to you, you have got to ensure the land is protected at all those sites, including all the burial grounds, which are numerous - are protected. NS17a

Whilst the wider shareholder base was aware of, and supportive of, the land retirement programme there were still some challenges and pushback from those who wished the land was still farmed in a ‘traditional’ sense.

If you wanted to retire more land you would have to reduce your stock footprint. It wouldn't go down with our shareholder base who are traditional farmers. NS17b

4.2 Challenges faced by Nuhiti Q before land retirement and NZ ETS entry

4.2.1 Joint venture with Craigmores Sustainables Ltd.

Bryan McKinlay (henceforth ‘Bryan’) had worked in the Gisborne District from 1995 for what was formerly known as the Ministry of Forestry (now Te Uru Rakau – Forestry New Zealand). In this role, Bryan was involved in the administration of Māori lease forests and the ECFP. Following this, Bryan worked for Ngāti Porou Whanui Forests, the Ministry of Agriculture and Fisheries (now MPI) and latterly, Craigmores Forestry and Craigmores Sustainables. Through these roles, Bryan became aware of the erosion and cash flow issues faced by Nuhiti Q. His employer at the time, Craigmores Sustainables, was seeking to invest in forestry throughout the North Island. This resulted in five forestry joint ventures with Māori landowners in Te Tairāwhiti. One was Nuhiti Q.

A joint venture between Craigmores Sustainables and Nuhiti Q has been critical for Nuhiti Q’s success in their retirement programme, and their subsequent entry into the NZ ETS. The following sections explore the challenges Nuhiti Q faced accessing government subsidies, and the role Craigmores Sustainables played in supporting Nuhiti Q.

4.2.2 Erosion Control Funding Programme

Through the ECFP, grants are made available to landowners to afforest erosion prone land in the Gisborne District. The entry of Nuhiti Q into the ECFP was

facilitated by Bryan who was aware that Nuhiti Q had a significant area of erodible coastal land that was classified as overlay 3a (a classification which requires effective tree planting or reserve fencing (MPI, 2018)) and deemed 'regional target land' by the Gisborne District Council (GDC).

I was aware that Nuhiti had a stretch of eroding land over the coast, and it was eligible for the ECFP reversion funding. It's overlay 3a, and regional scale target land so it met the criteria, which would have attracted grant money. However, to get the grant it needed to be fenced, retired and placed under a 50-year covenant. Each of those issues presented their own little challenge or barrier to Nuhiti – to retire it from their traditional farming use, required buy-in from the farm manager and the stock manager and I guess a change of mind-set, to retire it from farming in an effective way required a fence which is going to be 100 grand of fencing or more, and Nuhiti didn't have the capital at the time to do that. BM17

The 'coastal block' was eligible for funding through the ECFP. However, in 2011 the ECFP policy required 50 percent of a project's total cost to be paid by the landowner upfront. This sum was then repaid retrospectively once a five-year review had been passed. This requirement within the ECFP that 50 percent of a project's funding has to be supplied upfront was a significant financial barrier to Nuhiti Q's entry into the ECFP and ultimately the NZ ETS.

We had to build the fence. And then we had to wait 5 years for the final amount. That was a big barrier. That was something that was stopping particularly Māori landowners from entering the scheme [ECFP]. NS17a

In addition, any land entered into the ECFP was placed under a 50-year covenant, a requirement Bryan and Nikki likened to 'alienation' (NS17b; BM17).

So, the 50-year covenant also provided a lot of challenges to Māori landowners in terms of governance and also that whole thing of 50 years is almost getting pretty close to alienation of land. So, it's not that attractive or not that palatable to Māori landowners.

BM17

Nuhiti Q required ECFP funding in order to finance the fencing programme to satisfy the ECFP stock exclusion requirements. Planning for the retirement programme began in 2011 between Bryan as a representative of Craigmore Sustainables and Nikki as the representative of Nuhiti Q. There was initially 150 ha of land slated to be retired from active farming. However, upon further consultation it was decided that a larger section of land (~600ha) would be retired and also entered into the NZ ETS. There were significant costs associated with the retirement programme for Nuhiti Q to contend with.

Due to poor cash flow, which inhibited Nuhiti Q 'paying for' the fencing upfront (as stipulated by the ECFP), both Bryan and Nikki had to 'think outside the box' in order to satisfy the ECFP entry requirements. After consultation with the Nuhiti Q management committee, it was decided in 2011 that Craigmore Sustainables would act as the guarantor in order to facilitate Nuhiti Q's ECFP application. This joint venture granted Craigmore Sustainables a 10-year forestry right under an Afforestation Grant Scheme style agreement whereby Craigmore Sustainables planted 70 ha of Eucalypts and owned the carbon credits generated by these Eucalypts for the first 10 years before this right was ceded back to Nuhiti Q.

...after several meetings with Nuhiti Q it was agreed Craigmore would fund the fence, Nuhiti Q would get the ECFP grant in their pocket and over time Craigmore would get paid via some carbon credits. So, as we developed it a bit more, it was agreed Craigmore would plant 50 odd ha of eucalypts up there, and they have a 10-year joint venture with Nuhiti Q, where they receive carbon credits for 10 years. BM17

It was agreed that Craigmere Sustainables would initially fund the fencing programme (estimated at ~\$200,000) which allowed Nuhiti Q to access ECFP funding for the 320 ha coastal land block. The 320 ha coastal land block entered the ECFP and the NZ ETS whilst a 280 ha inland block was entered into the NZ ETS but not the ECFP. This partnership between Nuhiti Q and Craigmere Sustainables allowed three projects to begin simultaneously. A 6km fencing project was initiated on Nuhiti Q's land for both the inland and coastal block, ~600 ha of post-1989 reverting farmland was retired and entered the NZ ETS and 70 ha of eucalypts were planted.

Yet, Nuhiti Q's ability to access ECFP funding and enter the NZ ETS does not detract from the numerous problems with the ECFP. The ECFP is a classic 'top down' governmental approach to subsidising and incentivising land use changes and the numerous reviews and policy adjustments reflect the fact that the success of the scheme has been limited (Edwards et al., 2018). The 2016 review of the scheme has unquestionably removed one of the largest barriers faced by Māori landowners.

The ECFP has traditionally [required that the] landowner must do the work and then government will reimburse them six months later after they've inspected the work and the trees are established and fenced and stock are removed. Well, great - nine times out of ten the Māori landowner has not been able to fund that work themselves, so they've then had to say okay we'll do this scheme, but we need to find a joint-venture partner first. BM18

4.2.3 Ngā Whenua Rāhui

Another public subsidy accessed by Nuhiti Q was Ngā Whenua Rāhui (NWR), which is a contestable Ministerial fund administered by the Department of Conservation (DOC). NWR provides funding for Māori landowners to facilitate

voluntary protection of indigenous ecosystems (DOC, n.d). NWR was established in 1991, and seeks to enable, facilitate and support activities directed at the protection of indigenous ecosystems whilst guaranteeing the rights guaranteed to Māori landowners under Te Tiriti o Waitangi (DOC, n.d). The fund specifically seeks to protect indigenous forests, wetlands, tussock lands and coastal dune ecosystems.

The Nuhiti Q management committee vested the 'Nuhiti reserve' to DOC under Section 77a of the Reserves Act 1977 in 1988. Nuhiti Q and DOC manage the Nuhiti reserve (1140ha) under a 99-year cross lease, established in November 1988. The Nuhiti reserve forms the western border of the farm and is home to a unique highland forest containing numerous waterfalls, wetlands and streams at an altitude of 500 metres. The reserve is fringed with beech forests, large stands of karaka and the rare kowhai ngutu-kaka. Numerous ancient pā and urupā lie within the reserve.

The Nuhiti reserve borders both actively farmed and retired areas. Nikki asserts that DOC did not fulfil their contractual obligations in maintaining the fence of the Nuhiti reserve. As such, when planning for the whole of farm fencing programme commenced in late 2010, it became apparent that DOC would not fund these repairs – so other avenues of funding had to be sought out.

Ngā Whenua Rāhui was specifically used to repair the DOC fence. We knew that if we wanted a farm that would protect our stock – our stock would remain within the farm, the fence line that contractually DOC was supposed to look after – we had to fix it. NS18b

There were challenges accessing NWR funding, as the fencing project that Nuhiti Q required was outside the scope of what NWR funds. Nikki describes the challenges accessing funding as largely political in nature:

Nga Whenua Rahui mainly concentrated on working with landowners on small wetlands and what you would call unique sections of bushland that should be retired and fenced off, not necessarily on farmland. The type of project we had, it only stayed its course because the local DOC office understood the predicament between us and the Department of Conservation [nationally]. So, they came in to assist financially. NS17b

Nuhiti Q vested an additional 282 ha in the reserve and NWR funded two-thirds of the required fencing programme. Similar to the ECFP, a recurrent barrier emerges in that the landowner has to provide funding for a programme upfront and is reimbursed after certain milestones are achieved (often one to five years later). For many cash strapped Māori landowning entities, the inability to access finance is a significant and often insurmountable barrier.

Nuhiti Q's land retirement programme ultimately required 6km of fencing, with much of the required capital funded upfront by Craigmore Sustainables. Funding was also sourced through the ECFP and NWR, with Nuhiti Q providing any remaining capital. The total project cost was estimated to be in excess of \$200,000, with ~600 ha of highly erodible (and regenerating native forest) land consequently entered into the NZ ETS. As discussed, the financial barriers were significant, and would likely have been insurmountable without a joint venture partner in Craigmore Sustainables.



Figure 14: Fencing programme funded through joint ventures with Craigmore Sustainables and Gull NZ - Nuhiti Q (Searancke, N., n.d.)

4.3 Rationale for NZ ETS entry

Bryan introduced the Nuhiti Q board to the NZ ETS as an option to further offset the opportunity cost of land retirement. The NZ ETS was relatively unknown to Nikki in 2010/2011. Yet it was a land use option that deserved consideration because it offered a financial return from land retired from pastoral production. Scoping the NZ ETS was largely the domain of Nikki, with the wider management committee not actively involved.

What we understood about the NZ ETS was that it was another market led approach to management of land that we could use our native vegetation as part of it. We knew Bryan, he used to work for Ngāti

*Porou Whanui Forests, he worked for MPI, and we knew a little about
Craigmore. NS17b*

An important factor which contributed to Nuhiti Q entering the NZ ETS was a desire by the management committee to ensure that Nuhiti Q was resilient and able to withstand policy changes, particularly if agriculture entered the NZ ETS. Nikki cited concerns regarding the future of the NZ ETS, as during the first interviews in July 2017, the Green Party of Aotearoa New Zealand was campaigning on removing the NZ ETS in favour of a flat \$40 emissions tax. Uncertainties around what (if any) future liabilities Nuhiti Q may have incurred under this policy change were a key factor in the decision to participate in the NZ ETS (NS17b; BM17).

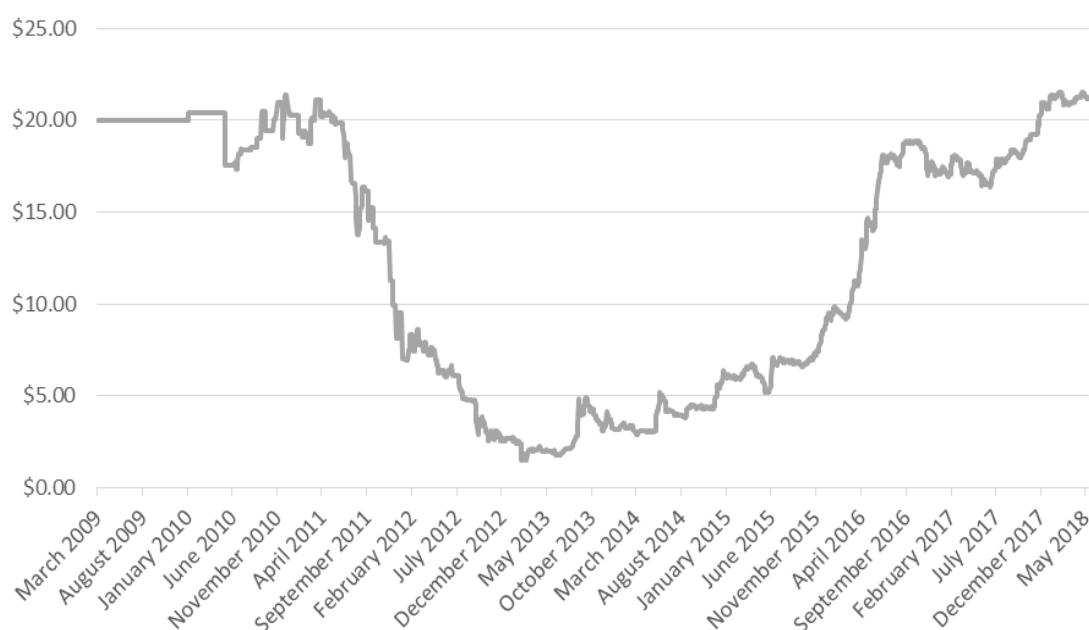


Figure 15: NZU Spot Price 09/03/09-21/05/18 (CommTrade Carbon, 2018)

4.3.1 NZ ETS entry

Nuhiti Q entered the NZ ETS in 2009 and was eligible to receive a backdated NZU entitlement. The first instalment was 32,000 NZUs upon entering the NZ ETS and the second instalment was 12,000 NZUs. Their annual entitlement at year 2017

was 6,000 NZUs. Nuhiti Q held onto their initial backdated entitlement of NZUs for the next four years as the NZU price fell in 2013. Nuhiti Q had debts that needed to be serviced, and pressure from their bank resulted in the sale of 32,000 NZUs in 2016 for ~\$9.00/NZU.

4.3.2 Gull New Zealand partnership

In 2016 Nuhiti Q sold 12,000 NZUs to Gull NZ, a direct bilateral partnership brokered through an external party, Carbon Match NZ. This partnership is another intriguing element of Nuhiti Q's participation in the NZ ETS. Whilst Nuhiti Q were one of the first non-forestry Māori land owning entities to enter the NZ ETS, to the best of my knowledge, this direct relationship between an emitter and a Māori landowner is also a first. Another intriguing aspect of this partnership was the concentration by Gull NZ on the non-monetary benefits provided by the partnership with Nuhiti Q, and the 'extra good' (DB17) this relationship could provide for Māori landowners.

Nikki began negotiating with Gull NZ in 2016. The main point of contact Nikki had with Gull NZ was an accountant in their financial department and throughout the negotiation process, there was no face to face contact; only online and telephone contact. The contract used between the two parties is a standard Carbon Match contract template (seen in appendix 0); with the only difference being that the payment period was extended from an instantaneous trade to an instalment in 2017 and an instalment in 2018. During the interview process, both parties were extensively pressed as to whether they were comfortable with the agreement and contract, and both responded positively with no issues identified either in the contract template or the final agreement. The only area where there was disagreement was in negotiating the price per NZU. When questioned how both parties agreed on a price per NZU; Nikki stated:

I put to them that I wanted \$19.00 (per NZU), very quickly they came back and said no they wouldn't go with \$19.00, I mean they probably had better knowledge than I did as to where the price was going to go – I mean it's hung around \$17.00, it did go up to \$18.00 earlier this year but it's pulled back, in fact it slid down to \$16.50 They dug their heels in a little bit and said to me no they will stick at \$18.00 and I got them to \$18.40 [sic]. NS17a

The forward contract between Gull NZ and Nuhiti Q was signed on July 20, 2016. The agreed price per NZU was \$18.40 for the two year contract period. At this time the NZU price was \$18.10⁹ (at 21 July 2016) and beginning to level out after rising fairly consistently between early March and late June 2016. There are two transfer dates within the Carbon Match contract: 30 April 2017 and 30 April 2018. Following the signing of this agreement, at the first transfer date, the NZU spot price was \$17.15 (1 May 2017). At the second transfer date the NZU spot price was \$21.50 (30 April 2018). As indicated in Table 11 the fluctuations in the NZU spot price resulted in Nuhiti Q receiving \$11,100 less from their NZUs by forward trading with Gull NZ than if they had sold them on the market ('NZETR') at the given transfer dates.

Table 11: Net impact on Nuhiti Q from selling NZUs at forward contract price (data from <https://www.commtrade.co.nz/>)

⁹ NZU price information from CommTrade Carbon – (<https://www.commtrade.co.nz/>)

Transfer dates / revenue	NZETR spot price	Forward contract price
First sale: 30 April 2017 (6000 NZUs)	\$17.15 (1 May 2017)	\$18.40
Revenue subtotal:	\$102,900	\$110,400
Gain to Nuhiti Q from selling at contract price		+\$7,500
Second sale: 30 April 2018 (6000 NZUs)	\$21.50 (30 April 2018)	\$18.40
Revenue subtotal:	\$129,000	\$110,400
Gain to Nuhiti Q from selling at contract price		-\$18,600
Total:	\$231,900	\$220,800
Net revenue impact on Nuhiti Q from forward contract sales		-\$11,100

4.3.3 Gull NZ partnership

An intriguing element of Nuhiti Q's partnership with Gull NZ was the decision to forward trade NZUs. For Nuhiti Q, it was important to have certainty surrounding their cash flow. Forward trading their NZUs would guarantee the capital to complete the fencing project. Price certainty was also desired to counter the fluctuation seen in the NZU spot price leading up to 2016.

Well once again that was a numbers game, because we were in this consolidation time frame of doing two things, one was we had done all the fencing, we knew that our stock numbers were stable. So, when I added all of that up, I decided that even though I didn't have any good intelligence [on the future NZU price] I'd err on the side of caution and really go looking for [price] certainty. NS17b

Gull NZ were also content to have price certainty in the NZU transfer price. However, the 12,000 NZUs traded form a small portion of the estimated 500,000 units that Gull NZ needs to surrender annually.

If the opportunities are there we're open to novel ways of us sourcing carbon, I believe we were a lot more open to that than the major oil companies so yeah when there's an opportunity to get carbon and do some good, get carbon in a different way yeah, then we'll definitely look at it. DB17

Gull NZ went outside their usual NZU procurement process when they entered a forward trading contract with Nuhiti Q, as the majority of their NZUs are purchased without the development of a relationship with the NZU supplier. Further to this, the 12,000 NZU partnership with Nuhiti Q is a small part of Gull NZ's overall NZ ETS liability. The contract was signed in 2016 and Nuhiti Q forward sold 12,000 NZUs at \$18.40 which brought in \$220,800 between 2016 and 2018.

Nikki believes the narrative Nuhiti Q was able to create was one of the key reasons why they were able to partner with Gull NZ, and consequently receive an acceptable NZU price. Nikki further recognised that it was an endeavour by Gull NZ to be more creative and innovative in their involvement in New Zealander's lives. Gull NZ are blunter in their assessment of the partnership and are happy to support initiatives such as this into the future as they have an ongoing liability

under the NZ ETS. Gull NZ are willing to engage in similar partnerships as with Nuhiti Q and would consider proposals seriously.

The aim of the partnership was well, we wouldn't be in the partnership if we didn't have a liability under the NZ ETS. So, we have that liability, we need to meet it and then you get into it what's the easiest, what's the best way to meet it? Is it to do something that's a wee bit unusual and put money directly back into a local community or is it to just go to the broker and say, 'give us the bloody best carbon you can get'. I guess that's where we sit there, we say okay, hey, here's a small piece that we can do some extra good with and that's where we got to. The drivers were the NZ ETS to begin with but then our own company morals after that ... we didn't set into it to find it as corporate responsibility but I think this is the best you can do, you've actually gone out and said hey this is something we've got to do as part of doing business now what's the best way to implement that for the communities. DB17

4.3.4 Diversification strategy

The multitude of pressures faced by Nuhiti Q has led the management committee to diversify the Incorporation's income and move away from sole reliance on sheep and beef farming. The diversification strategy has three components: carbon farming, mānuka honey and macadamia orcharding. A lease agreement was signed with NZ Mānuka Ltd in 2015 granting rights over the harvesting of mānuka honey and an ability to develop future projects planned to produce mānuka oil and further plantations (Ashton, 2016). Nuhiti Q is able to earn dual income from its retired land, as much of the NZ ETS eligible land is regenerating mānuka stands with apiculture opportunities, and the harvesting of mānuka oil in more accessible areas.

We are not a multi-million dollar venture, we do not turn over millions of dollars, we only turn over 750k-800k per year in revenue. And we are going to increase that using our diversification programme, given the landscape that we have, it would be foolish to do anything other than stock it at its present levels. Even then we possibly have too many livestock on the farm. But we keep it at that, because we want to maintain our equity in the farm and our surpluses. NS17a

Alongside the mānuka honey and oil opportunities, which have in part been facilitated by Nuhiti Q's NZ ETS entry is the establishment of a 5 ha organic macadamia orchard. Some 2000 trees in total have been planted, with planting beginning in March 2017 and the first crop expected to be harvest ready in early 2019. The macadamia trees have been sourced locally from Torere Macadamias with a variety of different cultivars suitable for the climatic conditions on Nuhiti Q.

So, we had a little bit of flat land, and we decided we would fence that off and that would be allocated for the trees. But originally, we had decided we would only grow 500 trees, but we expanded it to 2000. And it was based on what we knew to be the cost of not only establishing the orchard, but also the market returns. And we knew that roughly about 140-160 tonnes of macadamia are imported from Australia to New Zealand every year. So, we knew that we could access two markets both offshore and domestic. NS17b

The diversification strategy is an integral component of Nuhiti Q's 100 year strategy. The management committee also intends to participate in ecotourism (bird watching and horse trekking) in the future in order to strengthen and consolidate the incorporation so as to ensure profitability for future generations. Diversification has allowed Nuhiti Q to remain profitable outside of the cattle

market months (April and May) and the lamb season in November/December (Ashton, 2016).

4.4 Barriers and risks for Māori landowners participating in the NZ ETS

4.4.1 NZU price

As previously discussed, historic fluctuations in the NZU price were seen by all interviewees as being a large barrier to entering the NZ ETS. As seen in Figure 15, between 2008 and 2011 the NZU spot price fluctuated between ~\$17 and ~\$21. However, after international ERUs¹⁰ of dubious provenance and quality flooded the NZETR in early 2011, the NZU price fell from ~\$20 to ~\$0.35. This fall seriously impacted confidence in the scheme (Simmons & Young, 2016).

Well, will the NZ ETS be here post the next election? Will the carbon price be viable next week, next month, next year - for the life of your forest? So there's some real crystal ball stuff here and I certainly don't have the answers to them so we have to sit down with the landowners with the incorporation or with the trustees and really go through some of those factors and make them fully aware of what could happen, what the risks could be but likewise what the benefits could be. BM18

This barrier appears to be deterring landowners from participating in the NZ ETS because they do not have confidence, they will earn a sustainable return, especially if they hold on to NZUs and see them depreciate. However, Nikki has suggested that Nuhiti Q would have entered the NZ ETS eventually, regardless of the NZU price, as the opportunity to earn income from land that was going to be

¹⁰ Emission Reduction Unit (ERU) representing 1 tonne of CO₂ issued under a Joint Implementation project within the Kyoto Protocol.

retired, yet was still rateable, far outweighed the potential for minimal returns from land in cattle and sheep. For many landowners entering the NZ ETS using native species as opposed to exotic species, the potential for environmental benefits (biodiversity and water quality gains, improved soil retention and slope stability etc.) are seen in both the literature and interviews as making carbon farming a more attractive land use. However, as Bryan indicates, for some Māori landowners, these environmental benefits may not be realised if the carbon price is not high enough.

The carbon price always has impact on both environmental benefits and gains as well as financial certainty. Yeah, you know through a period when the carbon price is two dollars or less it's very hard for those other benefits to come through. Doing the environmental project also has some costs and someone needs to wear those costs and when the carbon price is two dollars it's pretty hard to get anyone to come forward and wear those costs. BM18

Further to this point, if environmental values are not core to the land management strategy of a landowning entity the potential for significant environmental gains cannot be realised if the carbon price either does not make the project viable (i.e. not covering costs of fencing, pest control, consultant fees etc.), or the expected return is not high enough. Beyond this, Bryan does not see a rationale for 'wholesale' carbon farming whilst the NZU price is at ~\$25.

It's hard to see a real justification for carbon farming at the moment on your better land. Where you have the appropriate land the highest and best land use should always come through. And in many cases that will be either dairy farming in the appropriate areas, sheep and beef farming, cropping, commercial forestry in some areas, and then perhaps there's some areas which are then suited for a long term forest crop maybe a different exotic species like a redwood or a eucalypt and native

trees in the areas which have poorer access, and could tie in with bee keeping etc. BM17

4.4.2 Financial concerns in relation to Māori land

When considering commercial forestry investors, and other entities wishing to form joint ventures with Māori landowners, informants indicated that legislation governing Māori land may make 'outside' investors hesitant to form new joint ventures because they cannot purchase the land. As Māori freehold and customary land is inalienable, banks typically only lend against the value of stock, which is then used as collateral. These factors contribute to the hesitancy amongst financial institutions to lend to Māori landowners.

Māori land can't be used as collateral, banks will load penalties against you in the form of high interest rates. Possibly they wouldn't give us the seasonal funding that we actually want in dollar terms, because they secure your stock, so the value of your stock is what they use against your loans. NS17a

Well any bank is risk averse with Māori land because they can't sell it. All they can do is take the stock. And that has happened even in modern times on the coast... So, in our case we have some general land, and we put that up for security along with the value for the stock. NS17a

Historic difficulties accessing finance has led to much Māori land existing in a state of 'underdevelopment' (Kingi, 2008b). This underdevelopment is perpetuated by difficulties accessing subsidies and grants to develop this land, as many schemes require an upfront payment with retrospective reimbursement once milestones have been met. This was clearly evident with Nuhiti Q, who did not have the cash reserves to afford upfront payments and would not have been able to access ECFP funding had it not been for Craigmere Sustainables acting as the Guarantor.

We didn't just rely on a bank loan; we were lucky we were using our carbon credit bank to bring Craigmores alongside of us. Now Craigmores assisted us with the majority of our fencing. We wouldn't have got the money from the bank without Craigmores. We would never have been able to finish that fencing; it was just too big a project. But we had to go into that scale of the project, we couldn't just do 100 ha here and 50 ha there because of the country and where we had to fence and then we embarked on another fence line and that was even worse. We used NWR and ourselves for that. Because by then we had built the first fence line and we were in the NZ ETS. I would never encourage anyone to do it the way we did it. NS17b

It was evident, therefore, that Māori themselves held concerns about the risks involved in financing large outlays such as extensive fencing off of blocks to meet the requirements of carbon farming.

4.4.3 Management structures of Māori land

The structures of governance Māori organisations are mandated to use may also hinder land use decision making processes (particularly around novel ones such as carbon farming). For Nuhiti Q, Nikki was instrumental to the success of these projects due to her ability to construct a positive relationship with Bryan of Craigmores Sustainables to share information and overcome the many obstacles associated with NZ ETS entry.

*The committee as a whole – carbon farming didn't register with them. They didn't know what it was. Climate change was something in the future,
and it may happen to us, it may not happen to us.
So, they were not as engaged as what I was. NS18a*

For Nikki, the management structure of a land block can determine whether or not landowners consider alternative land uses or are successful in their pursuit of novel land uses such as carbon farming. A distinction is drawn between the management structures of incorporations and ahu whenua trusts.

The biggest barrier is around the management structures that are running these lands. It's easy for incorporations because we have to have a committee, and that's it -- we are running the property. But there would be a lot of other landowners that aren't, they are just trusts, probably with one trustee, and the other trustees are deceased. So, what's that person going to do? Nothing. They have probably leased it out to the next-door farmer for grazing. NS17a

Many of them wouldn't have secretaries or accountants and are coming out of long term perpetual leases. They wouldn't have the structure -- they wouldn't be GST registered. They wouldn't have an IRD number. These are all barriers. So, when you want to enter the NZ ETS, what is normal business is not normal it's another hurdle to climb over. NS18a

When these constraints are coupled with other factors such as absentee landowners, the small size of a land block and its current land use (or lack thereof) the 'do nothing decision' is often easiest (BM17). Building governance capability amongst Māori landowners is seen as key to addressing this issue. Supporting 'local champions' was also seen as important to overcoming some of the barriers around the lack of awareness of the NZ ETS and providing advice on how to overcome barriers to entry. Finding a strong leader who is tireless and unrelenting is key to Māori landowners entering the NZ ETS. This is true of Nikki, and she states so herself.

Bryan will tell you that, I just didn't give up. I look back now and think now, ohh would I do anything different? [laughter] probably yes. Ahh yes, right Nikki don't be on this committee don't even start [laughter].

But I should tell you about the makeup of the committee. We had my mother, two cousins - really close Ferris whānau, and an aunty. So, guess what, they were watching me, if I didn't do it right – Oh dear. Whanau pressure. Even though they didn't say anything to me at the time, they were all looking at me in the committee meeting room, what else was I going to do. I couldn't turn up to the next committee and report... and they would say well that's where you were last committee.... well ohh no. I was committed. NS17a

For Nikki, information about the eligibility of Nuhiti Q's land, uncertainty about the NZ ETS admission process and other difficulties accessing subsidies all proved to be large barriers – and were largely overcome by a persistent approach, and the support of an external party. Many Māori landowning entities do not have the luxury of either.

[4.4.4 Land use path dependency and lack of independent consultants](#)

It was acknowledged that the exotic forest industry is an economic boon and major land use for the region (BM17; BM18; KH18). This could potentially act as a barrier to new indigenous planting/reversion on post exotic forestry land as there may be landowner expectations to continue the forestry cycle. For some blocks, exotic forestry may be the highest value land use, and for landowners whose primary motivation is profit maximisation, this may lead to a continuation of exotic forest plantation cycles. Coincidentally, if the carbon price continues to rise, this could also lead to increased afforestation of exotic tree species to capitalise on the superior short-medium term carbon sequestration.

Land use path dependency is a central barrier to the uptake of novel land uses such as carbon farming. For many landowners in Tairāwhiti, farming or forestry are predominant, and what landowners are most comfortable with, even if they earn poor returns. Proving that carbon farming native forests is a viable land use,

with added ability to provide a sustainable financial return above those of existing land uses is a key challenge to mitigating land use path dependency. This must also be considered in tandem with deliberation among the wider landowner base.

There's a wider issue of trustees or management committees who act on behalf of multiple owners - do those owners support what they're doing? Yes, they have the mandate to make the decision on behalf of those owners, but they need to be I think pretty well aware of the owners' general feeling towards this type of land use. BM18

Land use path dependency is most often abetted by agricultural and forestry consultants, local government and industry and the expertise of supporting industries (e.g. banking, accountancy and legal). These factors lead to difficulties for Māori landowners accessing independent advice regarding carbon farming. MPI cannot help to verify proposals, so many are forced to go to other forestry consultants to independently verify another's proposal – an often expensive proposition.

The consultant or the advisor might be acting on behalf of the investor like say Craigmore for instance and they will approach Nuhiti, or another Māori land block, they will say hey this proposal looks good, but we need some independent advice to go and review this. There are very few people they can actually approach, because most lawyers and accountants don't understand it because it's not their field of expertise and likewise they can't even actually go and ask MPI for advice on it, because they have to be impartial so it's actually very hard for them to find some good advice, so they end up having to go to another consultant in that field who potentially will charge them a lot of money for reviewing someone else's proposal. BM17

Nikki referred to the fact that her bank manager had little awareness of the NZ ETS and was not satisfied that it was a viable land use option. An interesting point to note is that ANZ, who Nuhiti Q banks with, has questioned Nikki each year as to where the money from the NZ ETS (~\$100k) has come from. This has obviously significantly helped Nuhiti Q's bottom line, yet according to Nikki the bank does not see it as a viable income source, and instead would have preferred that money from the NZ ETS was reinvested into the core farming business.

But I also think banks have let down their clients too. I mean even our bank the ANZ has absolutely no idea what I'm doing. They don't understand it, all they know is 100k or thereabouts arrives in the bank. And they've not even been interested in learning about it in my financial reports to the bank. NS17b

When diversifying away from forestry and sheep and beef farming, it is important to consider the risks associated with carbon farming (as with any land use). Bryan (Craigmore Sustainables) sees native forest carbon farming existing best as part of a mosaic of other land uses, where a permanent carbon forest exists in a marginal or inaccessible part of a farm. Another point made in conjunction with this is the risk to Māori landowners of carbon farming at too large a scale. If accumulated NZUs are sold, this incurs a carbon liability which is registered on the land title until sufficient NZUs are procured to offset the liability (which would then allow a change of land use) (MPI, 2015b). In this case the intergenerational economic risk associated with carbon farming may be too high for many landowners, as steady improvements in the NZU price means this potential liability will rise as demand for and the price of NZUs increases in the future.

So one of the liabilities is certainly the risk of if the forest is harvested or cut down there's a carbon loss so you can be liable for the amount of units that you've actually been awarded for that forest...other risks I guess is knowing or having some certainty of - is this a land use decision

that future generations will support. Often decision-making authority for Māori land is a generational type thing and then different members will join the committee or become trustees and they effectively have to work with decisions made by former generations so yeah, it's certainly a risk they need to consider. BM18

Tied in with this risk is whether or not an NZ ETS registered forest is insured against pestilence or fire damage as a landowner will be liable for any reduction in carbon content. In Nuhiti Q's case, their NZ ETS registered forests are not insured, and there is not extensive pest control undertaken. Whilst Nikki does not acknowledge this as an important issue, it is undoubtedly a risk, particularly considering the increased wildfire risk under changing climatic conditions. Bryan acknowledges that carbon farming should be relegated to areas of the farm that are best suited to that land use. Ideally, carbon farming of native forests would be relegated to 'the worst gully', or 'worst corner of the block' (in traditional farming terms). This approach should supplement a strategy whereby the best economic value land use is applied to the greatest area within the landholding. Bryan refers to native reversion as 'niche', and best applied as a complement to other land uses on for example a sheep and beef farm in the more inaccessible areas and tied in with beekeeping.

The risk would be potentially having native on too many areas, and once its reverting to native, it's harder and harder for a subsequent land use change should the owner say 'hey we want to go back to farming, hey we want to clear that land, or we want to clear that native for exotic forestry'. That's not so much an environmental risk, it's a commercial land use risk. BM17

It was perceived that Māori landowners are not given adequate information regarding opportunities or risks associated with carbon farming and this is reflected in poor levels of NZ ETS participation. Many Māori trusts or

incorporations will be familiar with the challenges raised in Nuhiti Q's journey. Learning about this example in addressing and responding to their challenges and opportunities is key to better engaging other landowners with similar land use circumstances and histories. On the one hand, Nuhiti Q's challenges are very clear cut – the land was not holding up to traditional land use/s, and the management committee needed to diversify and forge a new path. On the other hand, other landholdings may not be faced with such severe limiting factors (erosion, poor fencing, capital constraints etc.) and so there may not be the same impetus to change. All these factors need to be considered when assessing whether the NZ ETS is the right fit for a Māori landowning entity.

4.4.5 Mistrust of government

Mistrust of the Crown and other central and local government institutions is still a notable factor that must be considered in the land use sphere in Tairāwhiti. Community members have 'long memories' and remember hard times suffered after disbanding of the New Zealand Forest Service, and the economic reforms of the 1980s (Porou et al., 2012). This sentiment is compounded by decades of infrastructural neglect and government economic interventions with little success in the region (NS17a; BM17). Māori landowners are inherently cautious when making land use decisions due to the quantum of factors under consideration i.e. kaitiakitanga, preferences of current and future generations and employment opportunities/profitability etc.

Coupled with this is the inflexibility of some schemes such as the Permanent Forest Sink Initiative (PFSI), which require a covenant of 50+ years to be placed upon any land entered therein. Although the PFSI has been disestablished, the early covenant requirements may be responsible for limited uptake by Māori landowners. For many Māori landowners, having a covenant of 50 years is akin to land alienation, and would be a very difficult hurdle to overcome (BM17; BM18).

You've got the PFSI, which again sounds like a great idea for permanent forest but really troublesome for Māori land with things like permanence clauses, things like 99-year harvest restrictions and whatnot and for most Māori landowners they view that as akin to alienation and they've been doing a lot of time getting away from 89 and 99-year leases and to go and then sign something like that is really difficult, it takes the decision making, I guess authority away from the next generation and it's yeah, not looked upon very favourably at all.

BM18

4.4.6 Complexity of the NZ ETS

The complexity of the NZ ETS has long been identified as a barrier for participation by Māori landowners (Funk, 2009). In Tairāwhiti, the accessibility of advisors/consultants is limited and frequently unaffordable, and knowledge about the NZ ETS at the community level (and often local government level) is minimal. The MPI requirements for landowners entering the NZ ETS are particularly difficult for governance entities such as Ahu Whenua trusts to navigate, because frequently there are oftentimes 'sound management structures' (NS17a), nor the capability and capacity amongst decision makers to navigate the technical and administrative requirements of determining land eligibility and negotiating the bureaucracy of MPI (BM17; BM18). Once a decision to participate in the NZ ETS has been reached – the first step is determining whether any land is eligible. This is frequently a fraught and difficult process.

Another hurdle or obstacle is whether their land is eligible or not. They [Māori landowners] might have some rough land out the back and 'I'd like to retire it because it's difficult to farm', but then they find out halfway through the process once they've spent some time effort and money that it's not actually eligible and it's very hard to get that

process clear or have it hundred percent confirmed from anyone in authority prior to the actual formal application process. BM18

Nuhiti Q were trying to enter into the NZ ETS as post 89 reversion, We have the 1988 post [Cyclone] Bola photography - it shows it as clear land, and MPI are putting very large circles around areas saying ineligible, ineligible, because of the 1990 land eligibility, and it's like well, what more proof do they need? So that can be a frustrating process, if there is any shade of grey in terms of the eligibility process, it seems to be when in doubt throw it out, throw it out then you the landowner provide us more evidence so we can put it in. BM17

Beyond difficulties concerning land eligibility, other barriers emerge when verifying identities and administering and signing the paperwork required by the EPA to open an NZETR account.

Particularly for Māori land there's, just [the problem of] marrying up the governance structure and the decision-making process through to the actual application forms. Making sure everything is signed, making sure the signatures from every trustee are there, making sure that the signatures and the IDs for those trustees match the titles held by the Māori land court or the certificate of title because nine times out of ten they are different. Then people provide a driver's license as ID, but they'll have a different name to the land title. The middle names have to exactly match and so often they're different and landowners' sort of haven't been exposed to things such as the Māori land courts or the Māori land system. Almost every single block you go to you'll have people where, names on an ID or a land title don't exactly match and that's very hard to then marry that up it's a lengthy and costly process. They'll often then need to get a JP declaration or something from a lawyer confirming who they are and they often just throw up their

hands and say this is too difficult so that is one issue for Māori land and it's not just confined to the NZ ETS it's just it's something you have to deal with on everything they do. BM17

Costs associated with entering the NZ ETS were articulated as an additional impediment for under-capitalised landowners. In particular, Nikki identified costs associated with surveying, consultancy and application fees. Evidence in the literature outlines the technical difficulties that Māori landowners may face in assessing the eligibility of land to be registered in the NZ ETS as post-1989 forest land. However, Nikki and Bryan didn't mention the technical requirements per se, mainly the fixed costs associated with validation of native regeneration as a barrier. However, both identified the rigidity of the NZ ETS application system administered by MPI as a deterrent and barrier for Māori landowners.

So, when you want to put in a new block of land you have to pay application fees, definitely the replotting costs \$5500, and these are all requirements under the NZ ETS. The process is complicated, its complex, I don't begin to understand it. I think the law itself is restrictive and complicated, so all these processes that you have to go through as an existing NZ ETS participant are erroneous and costly. So, there are a series of challenges and hoops that make it very difficult. Most managers of Māori land would say I haven't got time for this I'm not pursuing it. NS17a

Once land has been entered into the NZ ETS, there is a requirement for voluntary emissions returns to be filed every five years and as Bryan indicates, this may pose issues for landowners.

They need to physically claim the units every year via a voluntary emissions return which is filed with government or at a minimum once every five years it's compulsory that they do a mandatory return filed

with government which effectively tracks that carbon growth over the five-year period commitment. It's often hard to find with owners and not just Māori owners but they may enter the scheme in year one sort of full of gusto by year five or six down the track to still have that same enthusiasm for the scheme can be a bit hard particularly if in those intervening years there's been no money from it because the carbon price is too low and then all of a sudden the enthusiasm is not there and then they might miss a key date or don't quite comply with some of the requirements. BM17

4.4.7 Complexity of public subsidies

As previously discussed, local and central government funding programmes such as the ECFP, 1BT, QE2 and NWR were acknowledged as being complicated for Māori landowners. All have different eligibility requirements, differing funding rates and requirements for the landowner (around fencing, or provision of finance).

So, you've got four schemes and then all of a sudden landowners are confused. there's too many different schemes, too many different acronyms and they think 'hey, how does this all tie together?' not necessarily through any fault of government or all the people who designed the schemes they all have their place but for the Māori landowner whose say, core business is not forestry it can be quite hard for them to understand. BM18

The programmes are also administered by multiple funding agencies and offer funding for different things, and for many Māori landowners, these can be time consuming and confusing to decipher.

They are all different, it makes it hard for Māori landowners to understand them. Queen Elizabeth 2 (QE2) land, generally, is pre 90

bush so it doesn't work, with the AGS you can't enter the NZ ETS for the first 10 years, ECFP you can enter the NZ ETS and get the ECFP grant, NWR you can get some money for fencing and pest control, and can enter the NZ ETS so it's just that thing of they are all different funds for their own different purposes and the NZ ETS becomes an add on to them, so I guess it's just hard for the Māori landowners to understand them, they don't know the acronyms they don't understand them and you know they require a consultant or a professional advisor on their behalf to understand those things. BM17

Kerry Hudson sees the role of local government in administering a scheme such as the ECFP, as making it as simple as possible for landowners to complete tasks such as paperwork which are often considered to be onerous.

My experience with the ECFP – if the paperwork is simple and you can do it in a couple of pages and get it back to the landowner, that's what they are after. You need to make it as simple as possible. The carbon could be like that or even on the same form that would make it a lot more accessible. KH18

4.4.8 Policy uncertainty

Nikki cites policy uncertainty regarding the NZ ETS as a major concern regarding whether or not Nuhiti Q would enter the NZ ETS. Since its introduction in 2008, the NZ ETS has been reviewed multiple times and its policy settings have also been tweaked over this period (much like the ECFP) (Leining & Kerr, 2016). An inability to have clarity regarding the longevity of the NZ ETS and its policy settings was regarded by Nikki and Bryan as a barrier for Nuhiti Q and other landowners in general.

So what I've always said to my committee is that we are able to earn income off the NZ ETS at the moment, if it changes, if there is a policy

change by a new government, and we have to pay a carbon tax, we are in a better position than those farms who haven't explored or joined the NZ ETS. Why? Because we can demonstrate that we are probably carbon neutral. I know we are not carbon neutral, but we are along way down the trail from farms east and west, north and south of us. NS17a

Particularly around the NZ ETS if there has been more certainty over the previous ten years, we would have seen more uptake from Māori land but there have been some major question marks around it. And some major, market - carbon price impacts on the back of that and so there's been some uncertainty there. The do-nothing decision is often the easiest and the wisest in some cases. BM17

Policy certainty was a key theme which came up frequently in the interviews. Long term policy signals are key to giving landholders and investors' confidence in the NZ ETS. This risk is also apparent for emitters and suppliers. The length and opacity of the 2015 NZ ETS review has also made stakeholders nervous (BM17).

4.4.9 Institutional and legislative barriers

Beyond policy and price uncertainty - the administrative process landowners must go through in order to determine eligibility to enter the NZ ETS was found to be difficult and onerous.

MPI wouldn't come and check anything. You'd have to make an appointment, and then they would say we will make an appointment and send an email and months would go by before they would get back. That's not very good when you want a reasonable answer on it. I virtually just stopped talking to MPI and went to Kerry [Hudson]. NS17b

This difficulty was compounded by a high turnover of staff at the local MPI offices in Gisborne, and an inability for regional MPI and GDC staff to deal with queries

and issues regarding the eligibility of land or general administrative queries. Nikki feels that landowners have not been adequately supported when considering entering the NZ ETS:

MPI seem to change their staff like they change their clothes. One minute you'll be talking to so and so, next minute there is a name you've never heard of. It takes ages to get appointments. NS17a

It's worth noting, the staff at MPI are not difficult, they are trying to help, but they are working within the legislation they've got. Legislation is a barrier. BM17

Most of the detailed information about the NZ ETS is generally better known in central offices of the government, so at regional level it takes time to get different pieces of information, according to Bryan and Nikki.

4.5 Opportunities for, and benefits associated with, Māori landowners participating in the NZ ETS

4.5.1 Forward contracting

Bryan and Nikki see merit in forward contracts being used as a template into the future. This offers two-fold benefits to landowners: (1) the landowner gets certainty that x-amount of money is going to be delivered, and (2) they can use this injection of funds to finance necessary infrastructure such as large-scale fencing in Nuhiti Q's case. In Bryan's words;

It was just a matter of the parties understanding each other, in that sense the likes of an emitter who's prepared to tie into some longer-term agreements with a forest grower, be it commercial or exotic forest or say indigenous reversion. Just gives them some time frame security, and some price security, I guess. BM17

It was all designed to give certainty. If the price dropped away in these 2 years, we would still have the Gull contract, and in fact it had dropped away a little bit when I did the transaction this year, and they still paid it at that price which was 18.40. NS17b

4.5.2 Native forest reversion

When areas of Te Tairāwhiti are excluded from grazing they are able to revert very quickly which gives landowners an economic advantage in establishing native carbon forests in comparison with other areas of Aotearoa (Carswell et al., 2003). Many landowners will likely be eligible to claim a backdated entitlement of credits from 1990 as happened in Nuhiti Q's case. Because little capital is expended with native reversion, more could be spent on supplementary planting to stimulate reversion – ultimately making the most of schemes such as 1BT or the ECFP.

I'd say that Nuhiti presented everyone with another way forward. Let's go into regeneration, if you haven't got the money to plant intensively into your back country or your cleared country, just let it automatically regenerate. BM18

4.5.3 Wider on-farm benefits

Bryan and Nikki agree that when marginal land is retired, remaining areas can in turn be managed more effectively and intensively, which in Nuhiti Q's case has improved the overall profitability of the land.

LM: After you partnered with Gull, are you getting more from the stock you already have?

NS17b: We are – we have. Which wasn't what we went into it for. We went into it to do the fencing because we have a fencing programme.

LM: Ok, so you only went into it for the fencing and this is just a random externality?

NS17b: It was. Yeah. I suppose the question would be, if we didn't have Gull would we be in the same position?

The retirement of marginal areas within the landholding using funds secured through the two joint ventures with Craigmore Sustainables and Gull NZ reduced the area of land actively farmed, resulting in a number of improvements for the stock in regard to their condition before the works, and lambing/calving percentages.

We now know that with a smaller farm with smaller acreage, in fact the stock are in better condition, with the same stock numbers - we haven't reduced them, and we can see from the production level how well those stock are doing from being on a smaller platform and not walking so far. NS17a

We were always under 100 percent with lambing and calving, whereas we have been able to in the last two years get above that because of our fencing programme. It was important to get up to 110-115 percent in our country. NS17a

To further illustrate the greater resilience of Nuhiti Q's core business, Nikki discusses how the consolidation process undertaken as a result of the Gull NZ partnership improved the quality of stock allowing for the incorporation to better endure a drought in 2016.

There are a lot of gains now that we have used the Gull contract. We weathered the drought that we just had. Our stock were in good condition to go to the ram, and to the bull. So those are the measurements, that's progress – that's significant. Whereas before if we had a drought, we would be selling. But all our breeding stock, they

are in very good condition. When we scanned the ewes, they were all carrying twins and triplets – that’s unheard of in our country, so we actually sold some of our 5 year old ewes that were carrying twins, we got a huge price for them. NS17b

The Nuhiti Q farm manager has recognised that having certainty of income from the forward contract between Nuhiti Q and Gull NZ allowed for the farm to undertake risks that would not have been considered otherwise.

4.5.4 Carbon collectivisation and joint ventures

Bryan and Nikki see merit in Māori landowners partnering together to form a carbon collective. This has benefits of reducing costs such as consultant and broker fees and proving land eligibility whilst also more evenly allocating risk across the ‘collective’. Through collectivisation there is more opportunity to achieve the scale of sequestration and production of NZUs desired by emitters and would more easily facilitate partnerships of the kind seen between Nuhiti Q and Gull NZ. The benefits of this approach are twofold: (1) the corporate partner can market the greater good of their carbon purchasing by emphasising the wider co-benefits associated with NZU production of this nature and, (2) the Māori landowners can have access to capital which can be used in other areas of the business. This approach can lead to a market premium for carbon credits produced through a ‘Māori Carbon Collective’ and serve the interests of both parties better than if the NZETR was solely used.

Nuhiti could stand alone - it didn’t need to amalgamate with the landowners around it but clearly there are landowners who should amalgamate probably into groups of no more than 5 or 6. To come to that size which I think is the optimum size which is probably around 1000 ha or 1000-1500 ha and on the coast north of us that’s not an imposition that’s probably ideal. NS18b

Nikki was also cognisant of the fact that seeking out a smaller emitter/ joint venture partner would be better suited to the type of carbon credits Nuhiti Q was retailing.

I also knew that if we were to start developing a relationship with an emitter there is only a certain class of the emitters in NZ, the oil companies, airlines, and well there would be one or two smaller operators but you wouldn't really want that size of units. NS18a

Much of the participation in the NZ ETS in Te Tairāwhiti has been by large forestry companies, and because so few Māori landowning entities are carbon farming – there exists opportunities for joint venture partnerships between emitters and Māori landowners. A further opportunity tied in with leveraging the wider benefits associated with production of NZUs by Māori landowners using indigenous forest species is the concept of a 'double indigenous carbon credit'.

5 Results part 2: qualitative data for multi-criteria analysis

As set out in the Methodology chapter, the purpose of the key informant interviews was to generate an initial suite of alternatives and criteria for Māori landowners to evaluate at the multi-criteria analysis (MCA) wānanga in Ruatōrea in early November 2018. In total, 15 key informant interviews were held in early-mid September 2018. The interviews were semi-structured in nature, and an interview schedule was followed. For confidentiality reasons, names are not included in Table 12.

Table 12: Participant code names and interview dates for MCA alternative and criteria identification

MCA scoping interviews		
Key informant code name	Occupation	Date of interview
E1 (academic)	Academic	6/9/18
E2 (land use practitioner)	Land use practitioner and investment manager	11/9/18
E3 (forestry 1)	Manager – forestry and land use company	7/9/18
E4 (local government 1)	Local government programme manager	7/9/18
E5 (NGO)	Manager – NGO	14/9/18
E6 (local government 2)	Local government - executive	6/9/18
E7 (independent researcher 1)	Independent Researcher	7/9/18
E8 (land governance)	Land incorporation – chairperson	5/9/18
E9 (independent researcher 2)	Independent Researcher	20/9/18

E10 (forestry 2)	Company director – forestry and carbon farming	10/9/18
E11 (CRI 1)	Crown research institute – researcher	12/9/18
E12 (CRI 2)	Crown research institute – researcher	11/9/18
E13 (CRI 3)	Crown research institute – researcher	4/9/18
E14 (CRI 4)	Crown research institute – researcher	4/9/18
E15 (forestry 3)	Manager – forestry and land use company	16/2/18

These interviews contributed to establishing the MCA component of this research. Whilst the interview schedules focussed most extensively on ensuring practical land use alternatives and criteria were considered, a variety of other topics pertinent to this research were covered. A thematic analysis was undertaken to draw out key themes relevant to this area of inquiry.

It was evident that key themes to be investigated in more depth included specific co-benefits, and the extent and nature of these co-benefits as identified by the key informants. Another key theme of interest was barriers faced by Māori landowners in making land use decisions alongside wider issues and considerations of relevance to land use decision making in the Waipapu catchment. The themes are discussed here in turn with an identifying code ascribed

to each quotation. Quotations have been lightly edited for clarity.

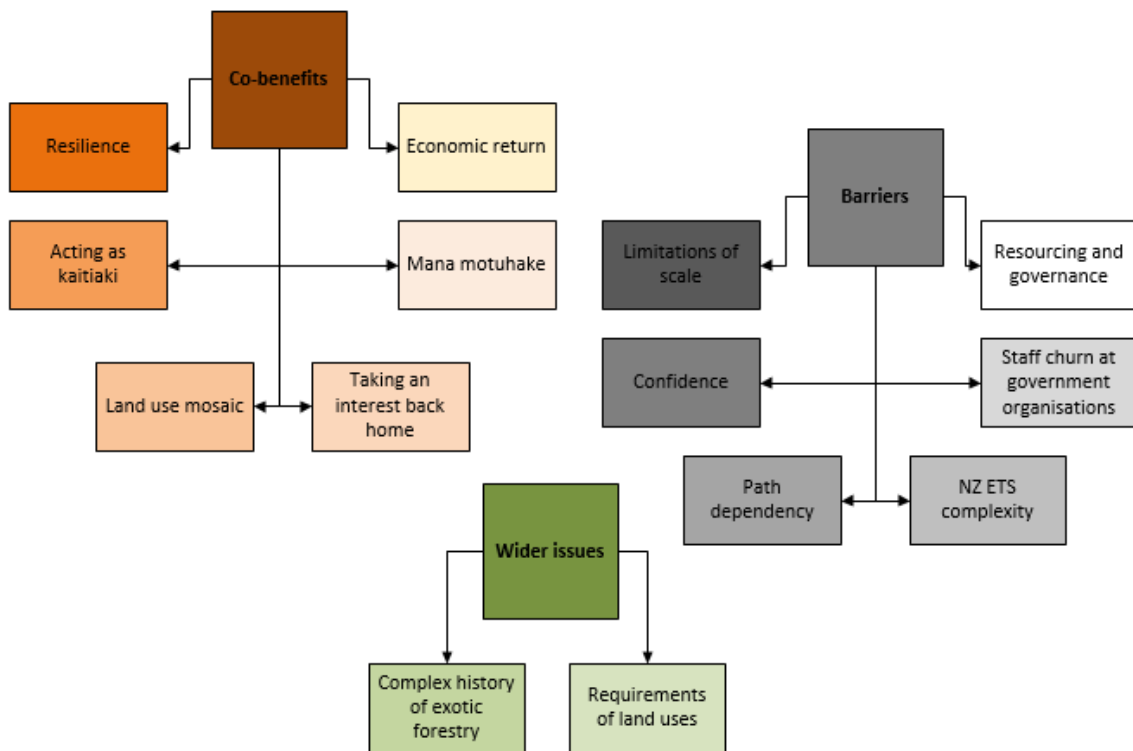


Figure 16: Key informant interview outcomes: mind map of key themes and sub-themes related to the MCA

5.1 Co-benefits identified by key informants

5.1.1 Resilience

When the key informants were interviewed, a recurrent theme was the notion of resilience, and its importance to many areas of life for those living in the Waipapu catchment. The ability to be self-sufficient has, and continues to be, a key element for Ngāti Porou and this was reflected in comments made by most of the interviewees. The ubiquity of this co-benefit indicates that land use decisions are frequently made whilst considering potential impacts upon the resilience of the community.

This is quite a unique community, I mean, one of the things we haven't touched on here is the degree of subsistence economy... forestry is important for carbon and wood and employment, but people hunt in those forests. I was doing an interview back in the day where some of the women were saying, yeah, I chose my husband based on whether he can put food on the plate, you know, it's a long way from Gisborne and supermarkets. E13 (CRI 3)

Another example of resilience, but distinct from what is directly produced via a land use (i.e. hunting, gathering firewood, rongoā Māori etc within native forests) is detailed by participant E6 (local government 2) who also discusses some of the key areas of contention when conceptualising land use from a Māori or Pākehā worldview:

And so they used to say our land is not productive... it actually provides the deer, the pigs, the eels for the home and for the marae and for our guests and so it was actually a productive unit in their [Māori] eyes as part of the natural animal kingdom and that – and maybe a few kōuka [cabbage] trees – and that is a delicacy in Māoridom as well. They use that and they chop the mānuka for wood and so that heats the fires and keeps the home fires burning and being warm etc. So, in the Māori context land has always been productive and in European, government and council eyes they say ahh man that land needs to be productive. E6 (local government 2)

Alongside the benefits afforded by the ability to gather resources and hunt for sustenance within forests, is utility (water, electricity etc.) and infrastructure resilience. Another dual benefit related to the resilience of communities is the attractiveness of self-sustaining/resourcing communities to iwi and hapū who have left the rohe.

How do you design your land so that your remote communities have got food security because if a bore [water] shuts down and all we've got are cows that produce milk – we are going to starve and if anything happens to isolated communities they have got to be in a position to be able to have a range of food and so this is a concept that is readily understood by Māori communities, there is the export oriented production which is fine but to be able to build a resilient community or have infrastructure that encourages people to come back you've got work there so that there are schools and clinics and hospitals etc. so people are actually self-sufficient in their communities. E12 (CRI 2)

Moving away from a monoculture system of land use was also seen as essential to building and sustaining the environmental resilience of the Waipapu catchment. Resilience was conceptualised as the degree to which landowners could endure changes in market and climate conditions.

...we need to have a diverse economy in terms of species and products because otherwise it's killing us, it's killing our roads and having a big impact on communities and it's also having a big impact on the environment. Forestry is here to stay and we need to develop a sustainable mosaic of land uses which actually is resilient to changes in economic pricing and climate change and one of the things that is a problem with clear fell [plantation forestry] is that it is really unresilient [sic] to climate activity. E4 (local government 1)

5.1.2 Taking an interest back home

The frequency with which 'taking an interest back home' was cited as a land use co-benefit reflects the disconnect many Māori both in the Waipapu catchment and throughout Aotearoa feel in relation to their land. For many Māori landowners, whether land is managed and administered by a farming incorporation, planted

in exotic forest or in 'non-productive' use – there are still substantial feelings of disconnect. 'Taking an interest back home' was discussed as being a benefit afforded by a change in land use patterns that inspires or motivates whānau living outside the Waiapu catchment to take an active interest in the land use decision process back home.

...what we've seen is that drive to, you know, get people back into the rohe, back onto the land. You know, people talk a lot about the ahi kaa, keep the home fires burning, the need to identify from place and the more families, the more people you can get, the more skills that they can get back in the communities too. E13 (CRI 3)

The notion of ahi kaa, or keeping the home fires burning, symbolises continuous occupation of an area and land in an area. Drawing on notions of disconnect from whānau land, for many, the prevalence of exotic forestry or corporatised farming operations often means that landowners do not have the ability to access their land at their liberty. This in effect means (metaphorically) the home fires are not lit, signalling a lack of occupation and connection to the land. Land use in the Waiapu catchment is more and more being considered in terms of its ability to reconnect landowners with their land and in turn, realise the flow-on benefits from this reconnection.

*So, we have to look beyond the current [land use] models and really get smart about how we can still bring about the benefits – but for me it [a land use] has to reconnect our people, and we are all over the place and we don't have that connection and we are still paying for it too. E9
(independent researcher 2)*

The perspective of participant E9 (independent researcher 2) is reinforced in the following quotations, where land use is conceptualised as more than just an economic or biophysical decision. It is contingent on the skills and abilities of the

communities to actualise the decision, and also for a land use to provide benefits to those who make those decisions in a synergistic relationship:

When you think about land use you've got to think about communities as well and that's part of the problem with the way people are perhaps approaching these things, it tends to be siloed. So [let's not] think about what to do with the land without thinking who's going to do it and how's that community going to be attractive to some really smart people to live in. E1 (academic)

In the Waiapu catchment, there is a focus on not thinking of land use in isolation, but as a matter that is no longer distinct from wider social, cultural or environmental processes. These decisions are now being seen as existing at the heart of those processes, and with considerable ability to provide positive or negative benefits.

...but I think this holistic approach [means] that we plant a crop, we manage it so we can live there and our whānau can come back and we can say we can encourage these other things, school, marae, governance structure, etc. that come out of that and really maintain culture and society through contemporary land use change really. E7 (independent researcher 1)

There is also recognition that decisions need to be made whilst considering how land use contributes to the functioning of communities.

Watching a lot of the younger generation, you know, they come home and they're dying to be at home, but you can't find it. It's pretty hard to get a good job on the coast. So, the question of land use as well, have you made it attractive so that people have a good living and a good life? It's not just the money. It's whether there are services and facilities available for the kids, good education, and all those things. You have to

look at the whole system functioning as well, otherwise it just doesn't happen. E1 (academic)

The frequency with which engagement, or decisions regarding a land use are required, is also thought to have a considerable bearing on the degree to which landowners are connected, and therefore interested in their land. It was also noted that for whānau living outside the rohe, land uses which require a higher frequency of decisions on an annual basis may better engage landowners living outside the rohe to connect with their whenua – even if they do not have intentions to return home.

You don't have to live at home to take an interest, getting all the second and third generations living elsewhere and giving them a reason to come back and sit on a trust board or a land board then they have a reason to take interest and if something is happening on that board that is new and not just sheep and beef farming which is almost like a black art it is very hard to understand what's going on in the farm. But with horticulture or aquaculture in the gullies then you will get their attention, that's all you need. People will come back for the weekend, or four or five times a year, the working bees – it breathes life back into the communities. Whereas if it's carbon farming, why would I come home for you to tell me how much the trees are growing this year? LIDAR does this now. The more complicated industries that are more dynamic, things can go wrong – it actually draws people back in and that's where forestry has been a bit hard on the coast because there's [just] a bit of pruning and thinning - it's too easy to say the trees are the trees and let's all go to the beach. When it's harvesting it's hard to get people engaged again. Horticulture is an annual crop, I think that's what's important - it makes people pay attention, makes people get more engaged with things, it's much more tangible. Yeah, I'd almost say that, in terms of the complexity and short term nature of the cycles, that

livestock and dairy is the ultimate one with a daily cycle, everyday there is milk in the vat so people pay attention every day and then livestock which is semi-annual, you do the lambs at a certain point in time and you might kill a few cows in the winter – it's [a] part year [process] and you still pay attention. Then you have horticulture, which is once a year, how is the crop looking? How did the harvest/pruning go? You sort of have 4 or 5 things that happen during the year but once a year you come together and go right, how were the results? And you get to know the business really well. Forestry is once every 25 years. You are more and more disconnected and then carbon forestry is 100 years. So how can you hold anyone's attention for 100 years? And a way to engage effectively in an industry. And so, it's as much about keeping people's attention and the next generation's attention. E2 (land use practitioner)

The notion of experiential benefits was mentioned by participant E9 (independent researcher 2), as a way to deliver non-monetary benefits to shareholders of a land block. In this case, instead of a small dividend, honey produced by beehives on the land would be proportionally distributed to landowners. This was also mooted as being more beneficial than a monetary benefit as the landowners would become directly connected to the whenua 'through the fruits of the land':

I am interested in how we deliver benefits to our landowners, and for me it will be around honey say. I would love to give them a pot of honey, I don't want them to just get a royalty from the honey 50c or \$100 or whatever, that's the nature of the benefits. To me we will get more from a pot of 500g honey, which in the Ruatōrea supermarket that would cost \$18 or \$20 for 500g of non UMF [unique mānuka factor] honey, so rather than us giving \$20 as a divvy I would rather us give them kānuka or native floral honey off our farm... So, I see it as building a relationship around the fruits of our land. And I think it is something to be proud of, and they might say this is honey from our

whenua on the coast – I'd rather us have benefits like that... It will suit their livelihoods and lifestyles, but I know there will be an integrity to the benefit. I reckon spiritually, psychologically that will have a positive impact on them rather than just an efficient way of distributing a benefit. E9 (independent researcher 2)

5.1.3 Acting as kaitiaki

Another underlying theme recurrent in the key informant interviews was a desire to transition towards more environmentally sustainable land uses. This theme was not universally expressed as 'environmental sustainability' – instead, it was frequently discussed in terms of landowners fulfilling their obligations as kaitiaki. These discussions focussed on the environmental benefits of native forests, a land use that often came up unprompted when discussing kaitiakitanga.

But they [Māori landowners] can protect their areas of significance. They can protect the water resources; they can protect the land and they can probably make more from 4 ha of really good quality land on a 200 ha block than they could farming the whole block with beef, and keep it in native forest. E7 (independent researcher 1)

Fulfilling obligations as kaitiaki by ensuring that land management practices are 'environmentally sustainable' was not limited solely to protecting sites of natural and cultural significance – there was also a recognition that by protecting the land, the people are also protected as a return can be earned into the future.

How do we utilise our land so that we can exist and live but then, are we leasing that land or using that land sustainably so future generations can use it as well? So those are the two most important things for us as land managers. E3 (forestry 1)

The environmental benefits afforded by native forests were mentioned frequently in the key informant interviews. This was not because interview participants were sought out that would advocate for native forests; rather, there is very clear evidence in the literature that permanent forests need to be established in the most erodible areas of the Waiapu catchment (Awatere et al. 2018).

*If it's permanent native forestry, you are going to increase the water holding capacity of the soil, you're going to reduce sedimentation to streams, you're going to increase climate resilience, you're going to increase water supply during a drought because your water holding capacity is greater in your soil so it can drip feed your rivers. E10
(forestry 2)*

The gains to wider ecosystem services from afforesting in native forest species were also seen as numerous:

Biodiversity returns and other associated ecosystem services like carbon storage through to water retention, mitigating erosion – all those biodiversity benefits and gains along with increasing populations of macro fauna, insects, birds and the like. E11 (CRI 1)

5.1.4 Mana motuhake

Drawing on the previous theme of 'acting as kaitiaki' is another related Māori principle - mana motuhake. For participant E11 (CRI 1), restoring indigenous forest cover and reacquainting those living in the Waiapu catchment with the mātauranga and tikanga surrounding the rongoā of indigenous forests offers intergenerational cultural benefits for Ngāti Porou.

So, if you ask someone from Ngāti Porou, 'Can you name 10 indigenous plants?', they might struggle to name three. So, we've just lost that

knowledge, mātauranga Māori. Tikanga Māori will be able to be revitalised and with it there's customs and practices around knowledge of the ecosystem as well as knowledge of utilising these ecosystems for utilitarian benefit whether it is for pātaka kai, mahinga kai, accessing food to accessing fibre and timber. That I think is probably the biggest benefit in my mind but that's a very long term goal. That's an intergenerational one. E11 (CRI 1)

Considering the history of deforestation by European settlers, and rapid land use changes into pastoral sheep and beef stations, it is unsurprising that many wish to take charge of land use decision making:

I think there is a big drive about the desire to be in charge of their [Māori] own destiny and that probably is one of the strongest things I see. E4 (local government 1)

Mana motuhake is also conceptualised as existing at the hapū level, where the boldness of land use decisions and the potential diversity in land uses is seen as an important factor in the resilience and strength of communities within the Waipapu catchment.

So, I want our people to do what they want to do. And if it's different, that's OK and even if it's different to the 'new black' so to speak, that's ok too. I don't want us [Māori landowners] to fall into the same trap of just following everyone else and actually we might want to do something else. Well, my family's aspiration might be a bit different to another and that's cool, I just want each whānau to feel empowered and enabled enough to follow through with what they want to do. That's where I really want us at, and well, is it hemp? It's definitely showed our older generations who are gatekeeping, that there is a myriad of ways to achieve mana motuhake; you don't have to have one

industry that's going to employ us all and all of that crap. So that's where I want us, I want us to get back to our richness. E9 (independent researcher 2)

Participant E2 (land use practitioner) posits that new land use opportunities will likely be horticultural crops that can be farmed at a smaller scale than traditionally practised in the Waipau catchment:

It's probably the existing ones [land uses] but it's totally different: honey, timber, meat. But the new one will be horticulture going forward 15 years. And that's in places where you didn't think it was possible. There is lots of great land around. People only talk about Pukekohe etc because that is where the big parcels of 200 ha contiguous horticultural land [are]. Take Katikati for example, you'd say it's steep and broken up, but everyone has found a crop that can grow there. At a 1 ha scale. Those avocado blocks are one hectare, two hectares and on their own on a per hectare basis they are amazing. E2 (land use practitioner)

Corresponding to mana motuhake, another theme that was referenced by various key informants was the sense of cultural identity drawn from different land uses – most notably native forestry.

Planting native forests improves the biodiversity for that area and at the same time, provides those cultural benefits that are sometimes economic, sometimes environmental but also, I think by having that forest, that ngāhere there, it promotes a certain sense of identity. At the moment our identity is sort of a mix, 'we are sheep and beef farmers', and that probably might shift. So, I think it helps promote cultural identity but then also probably will help promote better connectedness between people and the local ecosystem because a lot of our tikanga and our practices were founded upon those types of

ecosystems - the ngāhere based ecosystem. Unfortunately, I think for Ngāti Porou it has been lost as a result of clear felling, firstly the indigenous trees back in the late eighteen hundreds, or the early nineteen hundreds. E11 (CRI 1)

5.1.5 Economic benefits

The potential economic benefits, including economic resilience, afforded by land uses cannot be ignored. Whilst it is clear that Māori landowners consider numerous non-monetary factors when making land decisions, what is also clear is that the financial return of a land use is also of paramount importance for many landowners.

*I think the role of kaitiaki is key and I see that Māori land decisions are always trying to achieve multiple objectives, so there are commercial, employment and some sort of local kaitiaki on their land objective. E4
(local government 1)*

Considering the intergenerational outlook of Māori landowners, crops, whether forest related or not, may be more beneficial if there are multiple uses associated with these.

So to really make it fly for Māori it is finding those trees and carbon crops which have multiple uses and one day you can hope that with a long term view, that it's more beneficial with a multiple use scenario because who's to say honey will go through the roof and carbon will collapse. E2 (land use practitioner)

Forest species with multiple uses are seen as contributing to economic and climate resilience. A parallel was drawn between this resilience and the desires of landowners to return to their land.

Financial has to be one that is really, important. It's kind of enabling whānau to live on the block, come back to, and enabling a bit of schooling. So, more focus on education, and yeah, that's to some degree based on a reasonable financial return [from a land use]. E7
(independent researcher 1)

5.1.6 Land use mosaic

Another distinct theme arising from the key informant interviews was the opportunities seen in developing a mosaic of land use options within a single landholding. Whether this was to make use of high value native timber species, permanent carbon forests, mānuka honey and grazing in other areas – there was a lot of merit seen in developing diverse income streams that retain and utilise the land according to its capabilities, whilst also providing market and climate resilience.

If Māori landowners were to plant a really high valued timber, then you can transition from pasture and then bypass clear cut plantation forestry and go into single tree removal, high value forestry. You have to wait about two generations. Māori land may be suitable because they're often more patient than Pākehā landowners. E10 (forestry 2)

Māori landowners generally apply a much lower discount rate to their land use decisions, which makes native timber a much more attractive proposition (native forestry has a significantly longer rotation than with exotic forestry). Participant E2 (land use practitioner) affirms this notion, and sees value in forming a mosaic of mānuka and high value native timber species:

Mānuka honey is a big one. As much accident, as a lot of our undercapitalised Māori entities haven't had the capital to cut scrub and beat it. All of a sudden, the scrub is valuable. Now it has a carbon value as well. There is no reason why you can't plant larger trees amongst it

to provide a more sheltered environment for the bees but also later timber value and more carbon value in amongst it. E2 (land use practitioner)

However, when considering the benefits of mānuka honey as a valuable and emerging land use, it is noted that the financial benefits of mānuka honey can conflict with other aspirations regarding employment as outlined by participant E3 (forestry 1).

There are just big concerns about the job density of beekeeping but there is certainly a place for it – even if we can get some extraction facilities and jobs further down the train. What I know of beekeeping – it's just one beekeeper who can manage 400 hives and at best one hive per hectare so you're talking a 4-500 hectare landmass for one job. That's the concern, how do we restore our communities with that sort of job density. E3 (forestry 1)

Participant E3 (forestry 1) believes that perceptions around how to manage the land, and what a land use should provide are changing for Māori landowners. In some instances, this may centre on aspirations regarding employment and income.

Land use options have to tick that sustainable land use box, employment, and income. So how do they do those things with their land? How they do that is changing. It was farming, now its forestry, a lot of our landowners are still thinking forestry because they will have some forests on their land, some farming operations, and some areas where they can get honey so they are looking at multiple land use options and not putting all their eggs in one basket, type of thing. E3 (forestry 1)

Or, landowners are looking at what combination of land uses is best suited to the characteristics and capabilities of their land. This sentiment was echoed by a number of the key informants.

The question for us is what are the new forest species of the future that take into account honey, carbon and timber and ecological benefits like soil stabilisation. That's the trick and all these changes are going to lead us to have more patchwork farms. E2 (land use practitioner)

I think it is mixed use forestry, I haven't had any experience with planted rewarewa but there would be some indigenous forest crops to put amongst it. Totara as well. But no, I think mixed use forests, mānuka oil and kānuka oil as well. So, finding these tree species we can work with and I think mānuka will be at the centre but finding others and it's less about the science and more about the biological interdependence of the trees. E2 (land use practitioner)

It may also seem that the land use preferences of Māori landowners, and the values that are associated with these land uses are also congruent with changing land management practices in Aotearoa. Environmental pressures spurred by climate change are becoming more prevalent, and the ways in which landowners mitigate and adapt to these pressures is one of the key land management challenges of the 21st century. Te Tairāwhiti may be seen as an interesting microcosm of these issues, and how the region adapts to these pressures can be an informative case study for Aotearoa.

The thinking and tools have to change, that's the first thing, diversified forests; the second thing is steep land that is in grass, the meat industry in New Zealand is at a point now where it is ready to admit to itself that it is at a point of change. The sustainability of hill country farms is around having mixed trees, and this includes tree crops as well but also looking at land suitable for alternative plant based protein. E12 (CRI 2)

The characteristics of Māori land in the Waiapu catchment are such that forestry of any sort is likely the only land use suitable for those areas. When considering the perceived environmental impacts of exotic forestry, there are clear opportunities for new forest species and afforestation techniques as evidenced by the following quote from participant E2 (land use practitioner).

So, I personally think that mixed use forests on hill country, as an exotic indigenous mix. I think carbon is going to be a boon for the Māori economy, but it could also be a Trojan horse, the biggest trap the economy falls into. E2 (land use practitioner)

There are clear opportunities with diverse forest species alongside and the added benefits of carbon sequestration. Yet there remain significant risks to carbon farming; chief of which is locking in the land use (an intergenerational liability) along with carbon price volatility. Thus, a cautious approach to carbon farming may be advisable. Participant E2 (land use practitioner) outlines their perspective on this issue.

Now all of our joint ventures with landowners have been around planting out the worst part of that property. It comes down to what is the best use for that land, not wholesale carbon farming. And so I think you don't look at it on a per hectare basis, you look at it on an economic unit basis and in all cases there has been an economic unit that has said we aren't making any money from farming that block, can you show us another land use. And that's when carbon farming comes in, you don't need to harvest the trees you don't need big infrastructure in there, and so you can plant the back 50 hectares and as long as you keep the goats out for the first two-three years it's very low risk and it enables people to change the fence lines and focus more on the land you have. It's about land use, the right land use for the right type of hectare you've got. E2 (land use practitioner)

Whilst the benefits of carbon farming as a land use were universally acknowledged by the key informants, participant E10 (forestry 2) does not believe the economic case for native forest carbon farming is evident (unless passive afforestation is utilised).

The problem of indigenous forest carbon economics is that they don't work unless with those Māori landowners, the forest is planting itself and they are just getting a passive income from no effort - relatively low, or no effort. But if you want to reforest with effort carbon finance won't do the job if it's indigenous species because of the slow growth rates. We promote and deliver a middle path of a combination of exotic hardwoods. So, eucalypt or oaks, elders or beech with a combination of tree lucerne and natives to create a native forest, but with an exotic nursery crop. And it does drive the carbon economics into the black, it creates a positive internal rate of return and a net present value often above a discount rate. E10 (forestry 2)

Participant E15 (forestry 3) reinforces the sentiments of participant E10 (forestry 2) who also does not see the case for carbon farming on better quality land, but instead as suitable in areas inappropriate for other high value land uses:

It's hard to see a real justification for carbon farming at the moment on your better land. Where you have the appropriate land the highest and best land use should always come through. And in many cases that will be either dairy farming in the appropriate areas, sheep and beef farming, cropping, commercial forestry in some areas, and then perhaps there's some areas which are then suited for a long term forest crop maybe a different exotic species like a redwood or a eucalypt and native trees in the areas which have poorer access, and could tie in with bee keeping etc. E15 (forestry 3)

These issues are also evident with permanent carbon forestry where, to a degree, there is less productive employment associated with the upkeep and maintenance of a carbon forest.

For carbon, you don't get a return for a long period of time. So how do you support people? Well with a farm you can kill a sheep or beef. Yeah, you can physically support people, as more people engaged in activity day by day on cycles. E12 (CRI 2)

Shifting to a system where land uses are considered holistically in regard to their wider benefits to landowners, and the land over the long-term is considered to be a positive move.

What we need is to break the cycle and work at smaller scales. It's time to open up beyond grass and pine trees – and carbon gives us that ability, but at the moment we haven't done the work on alternative species of tree. We need to put a commercial research view to what are these other trees for these land types, and that's the biggest value from a Māori perspective is the whenua should be there forever, it sustains everyone for all generations into the future and that is the most precious taonga and so why are we not using it in this way and the beauty of that is they are not constrained by the five year view, they look at what is the best use of that land forever. That's so refreshing because you are beyond the typical shareholder cycle. Just the basic question of what is the best use of land for the health of that whenua.
E2 (land use practitioner)

5.2 Barriers faced by Māori landowners progressing land use aspirations

A related area of focus for this research was an investigation of barriers which may inhibit Māori landowners in making land use decisions and realising them. In keeping with the transformative approach to this research, an attempt has been

made to identify proactive solutions to the barriers many Māori landowners face in making land use decisions.

5.2.1 Limitations of scale

For novel land uses to operate successfully in the Waiapu catchment, a stumbling block has traditionally been the barriers of isolation, biophysical limitations, decision making processes and capability constraints. A further issue which compounds these barriers is an inability to capitalise upon economies of scale. Participant E10 (forestry 2) discusses some of the constraints associated with the nascent mānuka honey industry:

So mānuka honey is a good solution. Um, but if it is a solution at scale, it needs processing infrastructure at scale. Producing lots and lots and lots of mānuka honey, but not having enough processing [infrastructure] to process it is an industrial bottleneck that needs to be fixed through, I would argue, government investment in processing to support that so people aren't also having to just go with Comvita [large honey processor]. I think going independently can create a much more diverse export market. E10 (forestry 2)

Whilst there are obvious opportunities for Māori landowners with the mānuka honey and oil industry, the previous quotation highlights constraints in the Waiapu catchment and wider region more generally. The issue of processing (which would also be relevant for kiwifruit, avocados, medicinal cannabis and blueberries etc.) is salient, and would likely need external investment to make these ventures viable. The crowdfunding campaign by Hikurangi Cannabis Company indicates the level of capital necessary to build modern processing facilities (in this case, medicinal cannabis) (Reidy, 2018). Key informants have posited that more success may be seen amongst landowner collectives within the Waiapu catchment.

But the hard conversation is, you know, we could do something in the Waiapu catchment saying you should be doing kiwifruit. But unless these ten land blocks do kiwifruit together, they're not going to have the commercial scale and then the hard thing is to have the resource, to go and get to those 10 land blocks sit down with them and say, look, if you did your 50 hectares, here you use your 20 hectares - we're going to have a scale where we can have a packing plant. And trying to get everyone to work together, it would be the challenge. E3 (forestry 1)

The gap between the land use aspirations of Māori landowners and the investment necessary to achieve these aspirations may prove to be too difficult to overcome individually.

So, if we want to add value, if you want to move towards an economy that's more added value focused there needs to be support structures that come from central government agencies or from iwi or hapū agencies that help promote that supply chain integration. E11 (CRI 1)

The importance of transport should not be understated given the isolation of the Waiapu catchment. Road quality is poor throughout Te Tairāwhiti, and the region is also geographically isolated from the larger commercial centres and land transport routes within Aotearoa. It was mentioned anecdotally that this is why high value horticultural crops haven't been widely produced in the area. These sentiments are echoed by participant E7: "And of course, transport's a huge thing now, that coastal shipping is gone". Limitations in capacity and capability are often the result of the size of a landholding. Participant E15 (forestry 3) posits that smaller Māori land blocks need support to overcome challenges of size and scale.

With smaller Māori landowner blocks with no scale or without a strong management structure the key challenge there would be leadership. Finding a real key strong leader who could champion that activity and

not only drive it through but also ensure that the respective land blocks/landowners are well informed. E15 (forestry 3)

Whilst the following quotation from participant E15 (forestry 3) relates to carbon farming, there is a clear indication of the challenges many Māori landowners face in making land use decisions, especially with limited governance capability.

Scale definitely matters. Structure, without it, you can't achieve anything. I am dealing with another block, similar opportunities to Nuhiti Q, but they haven't had a governance structure, they have been trying to implement one. They are having some difficulties with that internally and they could have had these exact [same] income streams such as Nuhiti Q, starting five, six, eight years ago, but as we speak today, they haven't been able to execute any of them because of their governance. E15 (forestry 3)

5.2.2 Confidence to make bold land use decisions

Tied in with constraints of scale is what might be termed a lack of confidence on the part of the key informants. Evidence from the key informants and literature indicates that past land use decisions have a disproportionate impact upon future land use decisions. A decision to change land uses initially requires confidence to make the decision, and then also to draw upon financial and human capital in order to ensure that a land use change is implemented successfully. For many Māori landowners these barriers are significant and sometimes unachievable.

People [Māori landowners] do have aspirations for the land and part of the point we're trying to make, is that if they are to achieve those aspirations and you know, it's quite a full community - they don't hold a lot of finance, you've got shared ownership. Lots of barriers, in the way from actually taking the next step on. E13 (CRI 3)

The decision-making process for multiply owned Māori land as stipulated in the Te Ture Whenua Māori Act is complicated, and often cumbersome and also results in limited ability to access finance. Yet, there is an increasing desire by the private sector to partner with Māori for a variety of reasons.

The way the investment market is moving, there is more demand to work with indigenous groups, corporate social responsibility, triple bottom line, social license to operate etc. I think what's missing is the organisation and the confidence and the ability of many smaller undercapitalised [hapū] - not in terms of balance sheet capital, but in terms of operational and experience capital. Now they don't have that human capital there to say right we are going to go out and talk to the New Zealand Super Fund about this project – you know, where do you start? E2 (land use practitioner)

Participant E2 (land use practitioner) also cites examples of Māori landowners overcoming the issues of 'confidence':

Confidence is key. You can solve the capital issue if you are confident by going to the market and saying we will go to the market etc. etc. We see that in Te Kaha, where those entities have got together and built the kiwifruit industry with the Queen Street farmer. E2 (land use practitioner)

Yet, as participant E11 (CRI 1) indicates, the willingness on behalf of external organisations to partner with Māori can be frequently met with suspicion and scepticism. Likewise, local and central government organisations are also met with suspicion.

They [landowners] are not going to listen to you and me. Some of them might, but they'll still see us as outsiders. I know there's a bit of a tension with the people who actually prefer expert advice versus the

advice of their people. It just all depends on what the context, is for that particular society, so I think that's the challenge for policy, when trying to implement something, is that it has to be responsive to the dynamism within communities. E11 (CRI 1)

The desire for self-sufficiency and autonomy is strong, and solutions and projects initiated from within the Waiapu catchment are likely to achieve greater buy-in. For external organisations to attain success in the Waiapu catchment, much more emphasis needs to be placed upon effective and intensive consultation and project co-design to gauge the perspective of interested stakeholders before formal processes can begin. Yet, there are still numerous risks associated with breaking the land use status quo:

It's exciting that we are thinking in a way we used to think, where we can control by our input what our outcomes might be. But even still, I have a fear that everyone will go en-masse into an industry because everyone else is. Our community is poor and there are things we trade off in the blink of an eye because of that poverty, and it's a mental poverty and because of the material poverty there is another aspect of mental poverty or slavery basically - so I want our people to do what they want to do. E9 (independent researcher 2)

Participant E9 (independent researcher 2) details what is at stake and the risks for Māori when 'daring to dream':

We need to figure out a way to investigate options and make decisions but not to forget to dream the dream, because we have got a lot to make up for. We have lost so much, it's eroding so much, the land, and us, we have got to be brave enough to dream and not get too scared not to dream. It's hard work, there's a lot to work through and it's really complex but we have to navigate the way through, and I think our

people have to find other ways to measure success by. Money is the easy way, but livelihoods for me are more valuable but it's so vulnerable we have to be daring but keep it all together and not get too carried away. Let's not lose more in the process but let's not be paralysed by blah blah blah... [sic] E9 (independent researcher 2)

5.2.3 Path dependency of land uses

A barrier related to the confidence of landowners to make bold land use decisions is the capability and capacity of individuals and organisations/governance entities within the Tairāwhiti region. This is related in no small part to the preferences, abilities and experience of land use consultants in the region, but also the institutions and peripheral industries which support the status quo land uses (local government, lawyers and accountants etc.).

Historically landowners have relied on accountants and consultants who tell you what they know. If you ask a dairy consultant what to do with the land, they will say put a dairy farm in. Path dependency. Same with forestry consultants, they will say Pinus radiata has the best economics.

E12 (CRI 2)

The extent to which path dependency has influenced land use in the Waiapu catchment is difficult to accurately assess. However, there is considerable agreement across the key informant interviews that previous land use practices have had a substantial influence on current practices.

The only advice given is from those who have been doing it for years which is, basically, clear all the bush and do pastoral sheep and beef farming and put some more fertiliser on and it will be bog standard farming the way we have been farming the east coast for 50 years. Which is really depressing actually, and it must be really hard for

landowners who want some different advice because they have got nowhere to go. E4 (local government 1)

It is also important to consider the role of Te Tumu Paeroa when ascertaining what has had more impact on land use path dependency in the Waiapu catchment:

*They [Te Tumu Paeroa] are a huge player, they hugely influence the way Māori land is used - they have to protect it from damage or from threats of it becoming insolvent really. So, they are very risk averse and they tend to go with the existing players and of course the corollary of that is that there's not much room for innovation always. E7
(independent researcher 1)*

Participant E5 (NGO) provides an indication as to how Te Tumu Paeroa (the Māori Trustee) can slow down the land use decision making process and contribute to path dependency.

One of the other challenges is with Te Tumu Paeroa administering it [a land block], and just the delays. It's been a couple of months since I've asked them to call a meeting of shareholders to make decisions and they get worried about the current leaseholder and they are busy with other things and it just hasn't happened. Whereas if the whānau is just in charge of the block, we could say tomorrow, no more cows in there.

E5 (NGO)

Participant E4 (local government 1) provides more detail as to how Māori landowners could be influenced by land use path dependency:

We need more people out talking to landowners. And particularly in Tairāwhiti when you are low on capacity and capability in the advice arena. We have very few consultants who provide land management advice – we can't provide advice with our staff, so most of the

incorporations – part of the way they are set up is they will have an advisor who could be from [company withheld] or [company withheld] - the only two places they will come from, and they will provide advice as to what they should be doing on their farm and advising the trustees. Those people have been providing the same advice for the last 50 years, so they have not been providing innovative advice around doing things differently. E4 (local government 1)

Participant E11 (CRI 1) posits that these issues have to be overcome by developing the land use knowledge and capability within the Waiapu catchment:

I really like that idea around local entrepreneurs and really supporting those people in order to be able to make the transformative change within their communities. I think society, or the government needs to provide support mechanisms around them in order for them to help really catalyse change in those communities because people are not going to listen to outsiders, they are not going to listen to you and me.

E11 (CRI 1)

Whilst some land uses offer minimal benefits to landowners, there is still hesitancy to engage in carbon farming or other nascent land uses because of perceived barriers to entry. This may not be because of an inherent distrust of new land uses, it could also be related to distrust of outsiders contributing to the land use decision making process, and the influence of social norms surrounding land use.

...my grandfather my father ran this farm and we spent hours cutting down scrub so when you come in advocating for you know we need to plant mānuka and rewarewa and all this, there's resistance a lot more...

'yeah, what are you talking about, tree hugger?'. E11 (CRI 1)

Another compounding issue of multiple ownership is the conflict that can arise within a Māori land trust or incorporation. Whilst members of a trust or incorporation may aspire to a land use change, these aspirations may be stymied by conflict within this landowning entity.

Looking at ways to make land use decisions easier for land blocks where there are hundreds of owners is certainly a difficulty. It's not a barrier but it doesn't make things any easier than going to a family who own a big block, and all you talk to is that one family rather than talking to multiple families. And then quite often you'll have the odd trust where one trustee doesn't like another trustee because of historical family issues, and therefore because they don't like that trustee, they won't sign anything that that trustee wants to. I guess it is a barrier it just needs a lot more resources to get them the information to allow them to make informed decisions. E3 (forestry 1)

5.2.4 Complexity of the NZ ETS

The NZ ETS was also a key area of discussion, and a recurrent theme within these discussions were the complexities associated with entry. These sentiments reinforce what has been a key finding in the Nuhiti Q case study. If Māori landowners wish to enter the NZ ETS and carbon farm, the barriers are numerous and complex:

The ETS is quite complicated as well. We were doing several meetings at several whānau houses around the coast and despite some of our best efforts to describe the concept of 'someone is going to pay you for air', they still don't believe it and some of them probably still don't believe it as we pay the money into their account. Trying to sell something to someone that they don't believe in is hard as well. E3 (forestry 1)

Entering the ETS, the protocols of signing, for an entity like Nuhiti Q to make it work you have to have signatures from the appropriate management committee, common seal for a trust, you have to have signatures of the trustees plus the requisite IDs that go with that. That's got to be repeated both with the contract of the private company, the forestry right or contract - however you are going to secure that deal, it's got to be repeated with MPI to get the land registered and applied for an annual return. So that's either got to be Nuhiti Q doing that or via an interested party consent form signing their rights away for a company to do that on their behalf, so again interested party consent form – more signatures, more IDs. And then you have got the actual side of the NZEUR they've got to actually set up a carbon account under that, and again you've got the same signing protocols etc. So, you actually have some protocols so for people on the trust or on the committee who are not 100 percent au fait with the understanding of how it works, they are just bamboozled by the amount of paperwork, 'what am I signing this for? I signed something last week?', 'Oh the same people need something else, and now because your name is different on the driver's license to the title, now you need a statutory declaration countersigned by a JP or a lawyer'. It's just too difficult and too time consuming so many of them unless the money at the end of it is huge, they go what's the point? E15 (forestry 3)

Participant E3 (forestry 1) and participant E15 (forestry 3) further elaborate on these difficulties and explain how the decision-making process for some trusts or incorporations can inhibit or stymie entry into the ETS:

...trying to get our blocks into the ETS to start with, there are some trusts with 6-8 trustees, and you are having to get every trustee to sign or get statutory declarations. When that trustee is not present it's just so time consuming...and if we had to charge out our time

and weren't owned by our landowners and had to charge that out at commercial rates then most of the landowners would have been selling their carbon to pay for our time. It's not a barrier but it doesn't make things any easier than going to a family who own a big block and all you talk to is that one family rather than talking to multiple families. E3 (forestry 1)

Overall, Māori have probably been quite reticent to enter, because the ETS has been difficult, has been confusing it has been political, so it's had a lot of changes and there has been again to enter Māori land into the ETS, its typically not one person that can make a decision, sign the forms and then act on it. Typically, it involves four, five, six trustees on a block to agree and sign or an incorporation, management committee discussion and approval. E15 (forestry 3)

The hardest part about getting it into the ETS is things like signatories, does that block have a management structure? Good governance structure? An established committee, decision making authority? And can they act quickly with things like, as simple as it sounds, signatures and IDs, to get through the sometimes-onerous signing stages that government requires. E15 (forestry 3)

Fluctuations in the NZU price were also theorised as being a significant barrier to further engagement by Māori landowners in the ETS, and this was borne out by both the key informant interviews and the Nuhiti Q case study.

I guess it [the NZ ETS] just hasn't been around for a long time and were a lot of people know about it [sic]. I think certainly some people were a bit dismissive of it when the price has plummeted to \$2 but I guess, I've stood in front of 70-80 people who are owners of one land block and tried to explain it to them and I've had them shake their head

and look at me and say, 'I don't even know what you're talking about.'

E3 (forestry 1)

Scale is also important when considering whether to enter the ETS:

Scale is important. Yeah, it's hard because you have some fixed costs for things like ETS registration, some fixed costs for voluntary emissions returns for claiming your units, fixed costs with consultancies and management etc. It's really hard to make it pay on small blocks. E15

(forestry 3)

5.2.5 Changing staff at central and local government

A lot of the perceived complexity of the NZ ETS may be seen to be a result of a lack of continuity in support staff at central and local government institutions such as the MPI and the GDC. This could be lack of awareness of the nature of communities in the Waipuu catchment:

I think that's probably where you know central government in Wellington fails a lot of the time. You've got officials who don't really know the communities and [are] unsure as to what's going to work in those communities. E11 (CRI 1)

High staff turnover in government appears to hinder building and retaining connections between stakeholders in the Waipuu catchment, and their regulatory counterparts in Gisborne or Wellington.

I think that probably the challenge for policy and legislation is to be able to recognise that communities are unique in different areas. So, Whakatane has probably got their issues which is going to be more unique or different to Ruatōrea and Gisborne because of the people that are there. They might share some similar qualities but then there's always going to be some different characteristics. Because of the

history, because of the values and drivers in those areas. One of the issues is capability because the public sector generally goes through a high turnover and so you lose that experience. So, over the years I've been talking the same thing to different public officials from the same department. It's like oh man! Is anyone recording this? Are you actually recording this? E11 (CRI 1)

Participant E13 (CRI 3) shares the frustration of participant E11 (CRI 1):

I see that flux, the flux on the government side because you know, relationships are critical and when you've got constant churn [in staff] and then having to keep on saying, but the guy three times ago, actually agreed that we're going to do it like this, you know, and then there's changes. A new person comes in 'and I'm going to do it like this', and Māori just think this is a waste of time. E13 (CRI 3)

So, whilst changing staff levels and capability are a natural part of any workforce, lack of institutional memory in government can have significant impacts on what land use decisions Māori landowners make, and their relationships with regulators, be it at central or local government level. Participant E13 (CRI 3) expands upon this, noting the value of bridging social capital:

You have something called bridging social capital, so you have the social capital, that works at this level, helping to work together and then you've got the bridges that take you into the decision making space into MPI and MFE, and those connections - there are not many of them and you only need a couple of people to leave the catchment area and that is a complete separation. There's no conduit... The more you can build those connections in, the more resilient and more connected the community is. E13 (CRI 3)

5.2.6 Resourcing and governance

Drawing on previous themes of confidence, capability and capacity is a recognition by the key informants that the limited resources available to Māori landowners disadvantage them against other entities wishing to develop their land. One such issue identified is the systems of governance that Māori land must operate under.

You have the landownership and the lack of resources, the actual policies in place that are not hyper friendly, and you have to wrestle with the governance boards and stuff. Everything is western structures of decision imposed [sic]. E14 (CRI 4)

Participant E13 (CRI 3) remarks upon the pressures placed upon those who hold substantial roles in the community and the stresses placed upon these community members (another finding that has reinforced that found in the Nuhiti Q case study).

The barriers facing those people, like [name withheld] and [name withheld] they have families and they have multiple roles in the community, they have governance roles, and some of the governance requirements on Māori are Pākehā constructs on Māori. E13 (CRI 3)

Those Māori landowners who have stature in their communities are drawn upon considerably, and for many in the Waiapu catchment, physical and communication infrastructure is limited, compounding many issues.

This is a community which is basically not far from a subsistence community, with very limited resources and the internet often goes down alongside some other very basic things. E13 (CRI 3)

Participant E11 (CRI 1) considers information asymmetries as contributing to distinct disadvantages for Māori landowners considering land use options:

There's a lack of people on the ground and probably a lack of financial support. Governance is huge in terms of capability as well as the actual institutions being in place. Also, access to finance and the institutional arrangements in place, that is, the capability and the asymmetric information so with respect to knowing what you have is an asset. So, what is the potential, and then what are the opportunities and then how do you realise those opportunities or get into it? E11 (CRI 1)

The constraints on Māori landowners in regard to their land use decision making process are evident. However, numerous development opportunities exist for Māori landowners, as it is becoming more common to develop partnerships. But these are constrained by conservative decision making in the past, and an intergenerational outlook:

*There is growing pressure for Māori landowners to want and expect more [from land use] and the thing is, I believe that Māori land blocks are quite well positioned to respond to both opportunities and challenges. A lot of them don't have debt, through prudent borrowing or the inability to borrow so that means they have done what they can with what they've got. Others have borrowed but they have done that because it's not their land, it's not their money, they are custodians, they are doing it on behalf of past owners and future owners. So, there is a different story and there is an inherent conservatism behind it. People have criticised that in the past by saying Māori landowners are conservative. Well - it is what it is because it is not their own money it's not their own land and they are going to be judged by future generations. So, it's one of those things that is a check on behaviour. What you don't want is to go down in your tribal history as someone who has f****d up. So, there is an inherent conservatism but that isn't always a bad thing. So, when you look at some of these entities, they have also diversified as well. E12 (CRI 2)*

Another salient viewpoint is the consideration that needs to be given to any benefits derived by whānau who have kept the home fires burning, possibly taken a lead in land use decision making and implementation and that of the whānau living away from their land:

But by far and away the vast majority [of shareholders] don't live anywhere near the land or have anything to do with it and I think there's a cultural sort of spiritual connection probably, and maybe that provides some benefit in terms of their psychological wellbeing, knowing that they've got a tūrangawaewae somewhere, but the practical day to day reality is that they don't have anything [to do] with it. Yet, many of them expect a financial return from it, if nothing else and then there is this potential tension between that financial return and what actually happens on the land and what's good for the land and the ecosystems and then the whānau that live around. I haven't seen any good work on those sort of dynamics and relationships, but it's important to kind of distinguish different stakeholders and potentially to privilege some over others. E5 (NGO)

5.3 Wider land use issues and considerations

The remaining themes that will be discussed in the coming section do not easily fall into either 'barriers' or 'co-benefits' yet they are salient and important to this research. The following themes concern particular land uses such as forestry, land use mosaics or overarching themes such as the wider needs of land use in Te Tairāwhiti.

5.3.1 The complex history of exotic forestry in Te Tairāwhiti

A significant proportion of exotic afforestation in the Waiapu catchment was to treat erosion prone land following deforestation and severe weather events. Participant E3 (forestry 1) draws a parallel between a perception that local and

central government have played a significant role in supporting the exotic forest industry and dissatisfaction amongst Waiapu catchment communities.

A lot of our landowners see their kids and grandkids drifting off to Gisborne and bigger cities, and a lot are concerned with how do we reverse that, so we have created an exotic forest/production forest industry on the coast but we have only done half the job. We have planted the forest but haven't put in the associated infrastructure to go with it and that's why it hasn't been a continued success, its good when things are good like they are at the moment, but when Asia coughs we are in pretty bad trouble back here because we are just trading a commodity; we've got a large distance to transport our product to the market, we don't have wood processing facilities, we don't have a way to utilise wood waste and so previous governments and landowners attempted to establish an industry as an alternative to farming but probably only did half the job because the infrastructure didn't come as well. E3 (forestry 1)

What was uniformly clear in the key informant interviews is the dissatisfaction community members feel in regard to commercial forestry. This also stems from a perception that promises made at the time of afforestation have not been realised.

The East Coast communities have been disappointed by forestry industry promises. You know, jobs and building rural communities, being environmentally sustainable etc. The communities have found out that it's environmentally sustainable whilst it's growing but as soon as you cut it down there are huge problems. Roads are under pressure; harvest residue gets washed into rivers so it's understandable that East Coast communities are a bit gun-shy about forestry. E12 (CRI 2)

Whilst there has always been dissatisfaction with the environmental outcomes associated with exotic forestry, these have come to the fore within the past five years. Environmental degradation (such as the Tolaga Bay event) foment public discontent with the exotic forest industry. However, the industry is a key employer in the region.

They [Māori landowners] want us to do everything we can to stop [forestry slash impacting communities] it but we are not saying we can stop it because this is what happens when you get 200ml plus rain in a short space of time. The hills move and no one can stop that. We still see slips in native forests but not to the extent that we see on exposed farmland and forest lands post-harvest. There would be less of an impact on a permanently forested space, but how do we get employment? E3 (forestry 1)

Participant E3 (forestry 1) then highlights the juxtaposition between periodic environmental degradation and the long-term benefits of employment.

Is the Uawa [Tolaga Bay] event happening every now and again, but hundreds of jobs created, better than the Uawa event and a handful of jobs? Are the social impacts of people not employed and on benefits, drinking, smoking, drug using, more harmful than having to tidy up some flood mess? E3 (forestry 1)

The community level impacts of forestry were also drawn out in the key informant interviews. The following quotation is relevant to the wider debates surrounding the role of forestry in Aotearoa at the moment, especially considering increased afforestation under the 1 Billion Trees Programme.

I think part of the problem with the growth of forestry is that it became an alternative land use - but it's episodic. So, you plant, then they used to trim, now half the time they don't. And so, there would be some

ongoing maintenance and then harvest 30 years or 25 years later. So that's not actually great for sustaining communities. Whereas farming was very good for that because you know, not only did you have ongoing work but you also had food that you could, if you wanted to have a feed at the marae, you killed chooks or cattle or whatever. And there was always food available, from the local farms. And so, then when it used to work like that people would go out diving, you know, kill a beast or chooks and you have a big feast, without having to actually pay for it. So, the transformation has been huge and not very healthy really for the community. E12 (CRI 2)

These are still significant considerations regarding permanent cover carbon forestry. One of the most significant issues is the impact upon employment. There is initial employment associated with preparation of the plantation site, pest control, fencing and periodic site maintenance up to year five. This again highlights the juxtaposition between environmental benefits such as erosion control and financial return alongside the dearth of other equally important benefits such as employment.

That is the key factor with us as well. How do we look after our people? We have to give them jobs – that's why our forests were established – to protect the land, use the land but create employment for the people and that is the concern about just protecting the land with permanent tree cover. Where does the employment come from? It may come in 100-150 years' time when the trees mature, but what does that mean for the next three or four generations of people? E2 (land use practitioner)

5.3.2 Requirements of land use options

The land use decision making process doesn't necessarily exist in a vacuum for Māori, who may consider land uses across a broader range of criteria such as environmental benefits but also, amongst others, financial return, intergenerational equity and retention/utilisation of the land. This potentially makes the land use decision making process more complicated and nuanced than for non-Māori landowning entities.

It's [land use decisions] not just about economics. It's not just about a Western view, it's about restoring the land, it's about feeding the people. It's about the next generation and looking after the land for them. It's about honouring the past. E13 (CRI 3)

Participant E3 (forestry 1) recognises the competing objectives Māori landowners must balance in their land use decision making processes.

So, they [Māori landowners] are looking for an alternative way to use their lands, to sustainably provide employment for their whānau and protect it for the future generations and that is what most people want to do with their lands. E3 (forestry 1)

Participant E15 (forestry 3) sees the relationship between Māori and environmental sustainability as existing in competition at times, and for some Māori landowners, the financial return from a land use is more important than other factors.

It really is a matter I think of the financial side being viable, so it helps drive or assist the other decisions. If the finance is not there it's hard to get people purely thinking about saving the environment unless it's actually going to give them a financial benefit. E15 (forestry 3)

Although participant E1 (academic) cautions against carbon farming at scale, the parallels between this land use and other peripheral benefits are drawn.

Māori are much more likely to change tack if they can see an array of opportunities, not just one. Carbon farming is really good, but I wouldn't ever try and build the whole economy around it because you probably can't. And, that's why you can say; if you do carbon farming, you can also do x, y, z, and you can do honey, you could do the aquaculture because the harbours are cleaner you could have much better fisheries.

E1 (academic)

The Waiapu river is ever present in the decision-making process for Māori landowners in the catchment. Participant E11 (CRI 1) expands upon the state of the Waiapu river and how this relates to the identity of Māori landowners in the area:

At the moment our identity is sort of a mix 'we are sheep and beef farmers' and that probably might shift, it probably will shift especially if we want to improve the well-being of the Waiapu river. The Waiapu at the moment is probably in a sorry state in terms of being one of the most sedimented rivers in the country if not the most sedimented river and as a result has a lack of biodiversity in that river as well. That used to be the lifeblood of Ngāti Porou in terms of being a mahinga kai source, a source of food, a pātaka kai, a food basket now there's no reliance on that river because it's difficult to support life in it. E11 (CRI 1)

6 Results part 3: Synthesis of multi-criteria analysis results

6.1 Identification of alternatives and criteria

Data for consideration at the MCA wānanga was extracted from the key informant interviews which were discussed in the previous chapter. The entire suite of land uses identified in the MCA scoping interviews is visible in Table 13 and which key informants mentioned them.

Table 13: All land uses identified by key informants in MCA scoping interviews

MCA scoping interviews		
LUC	Land use	ID
1-2	Kiwifruit	E3, E4, E6, E7
1-2	Kumara	E9, E7
1-2	Watermelon	E7
1-2	Maize	E9, E7
1-2	Squash	E7
1-2	Sweetcorn	E7
1-2	Dairy farming	E7
1-4	Blueberries	E3, E4, E2, E7
1-4	Medicinal Cannabis	E3, E12, E5, E6, E7

MCA scoping interviews		
LUC	Land use	ID
1-4	Grapes	E7
1-4	Macadamias	E4, E7, E10
1-4	Walnut	E7, E10
1-4	Chilean hazelnut	E7, E10
1-4	Hemp	E4, E13, E1, E5
1-4	Avocado	E4, E2, E7
1-4	Persimmon	E4
1-4	Pomegranate	E7
1-4	Feijoa	E4
1-4	Tamarillo	E7
1-4	Modern apple varieties (Fuji or Envy)	E4
1-4	Fig	E7
1-4	Aquaculture	E7, E1
4-6	Terracing/intensive steep land horticulture	E12

MCA scoping interviews		
LUC	Land use	ID
5+	Kanuka (timber, carbon and honey)	E4, E2, E14, E1, E5, E6, E7, E15
6+	Native timber forestry (tōtara, kauri, rewarewa, pūriri, kahikatea, rewarewa, mataī)	E2, E12, E13, E14, E11, E5, E10, E15
6+	Exotic forestry (<i>Pinus radiata</i> , eucalyptus, Douglas-fir, macrocarpa, cypress, sequoia)	E2, E13, E9, E15
6+	Permanent native forest carbon farming	E9, E2, E11, E5, E10, E15
All LUC classes	Sheep and beef farming	E4
All LUC classes	Manuka honey and oil	E2, E4, E12, E6, E3, E14, E13, E9, E11, E5, E7, E10, E15
All LUC classes	Tourism	E2, E8, E9, E7
All LUC classes	Agroforestry	E14
All LUC classes	Bioactives (kānuka extracts)	E1, E5, E11
All LUC classes	Rongoa farming (kawakawa, koromiko, harakeke)	E11, E5

Refining the land uses into a useable suite that could be evaluated within the time constraints of the MCA process was a critical element in the design of the MCA. Consideration was given to a) those land uses that were mentioned most frequently in interviews b) the discussion surrounding said land use and c) land uses that occupied a range of LUC classes. Because some of the most frequently cited land uses could not be developed on 'steep land' (medicinal cannabis/hemp, blueberries, macadamias etc.) it was deemed prudent to include two land use models for consideration which encompass land uses suitable for flat and steep land. The parameters of each land use model have been dictated by the Land Use Capability Index (LUC).

The first land use model is a 'flat land' model, the parameters of which are determined by the LUC system as any land use suitable on land of LUC 1-4. This land is multiple use land with limitations to arable cropping from LUC 2 onwards. The second land use model is a 'steep land' model with the parameters dictating any suitable land use between LUC 5 and 8. This land is only suitable for pastoral or forestry uses and at LUC 8 there are few productive uses beyond mānuka honey and permanent carbon forestry. In the Gisborne District (te Tairāwhiti) 163,614 ha of Māori freehold land is LUC class 6 and above, with 21,406 ha between LUC 1 and 4 (PwC, 2013).

Because over half of the catchment would only be suitable for pastoral or forestry land uses it was necessary to include two land use models, which would allow participants to evaluate heterogeneous land uses. However, it must be noted that only a small proportion of this land would actually be suitable for some of the 'flat land' use alternatives that have been suggested by the key informants. The majority of land would only be suited to those land uses able to be employed on land up to and including LUC 6, typically steep land. However, it is important to ascertain how and why Māori landowners value land uses suitable for flatter land as the results may be transferable to localities where the LUC constraints are not so severe. The suite of land uses settled on for Māori landowners to consider at

the MCA wānanga is shown in Table 14. A detailed description of each land use can be seen below.

Table 14: Land use alternatives identified before MCA wānanga

Model 1: flat land	Model 2: steep land
Native forestry: mānuka, kānuka, tōtara	Native forestry: mānuka, kānuka, tōtara
Exotic forestry	Exotic forestry
Sheep and beef farming	Sheep and beef farming
Perennial horticulture: blueberries, apples and nuts	
Medicinal cannabis and hemp	
Cropping: kumara	
Cropping: maize	

6.2 Description of alternatives

As mentioned, the alternatives considered within the MCA wānanga were chosen due to the number of times they were mentioned in interviews, wider discussions with the supervisory team and consultation of the literature. The fact sheets that the MCA participants used to guide their evaluations (seen in appendix A.9) were created for each alternative (barring any that were added in the initial stages of each model). Three of the land uses are amalgamations of somewhat distinct land uses. These will be discussed in turn.

Numerous native forest species were mentioned by the key informants which had a variety of different purposes and uses. Mānuka (honey and oil), kānuka (honey and oil), timber species (tōtara, kauri, rewarewa, pūriri, kahikatea, rewarewa, mataī) and native forest carbon farming were all suggested. It was eventually

decided that an amalgamated native forest land use would be created which incorporates mānuka, kānuka and tōtara (including carbon farming). When the growth of a typical native forest in Te Tairāwhiti is considered, growth typically begins with incursions of mānuka and kānuka, dense stands of which form, before being eventually succeeded and shaded out by larger podocarp species (Carswell et al., 2002). Throughout this growth cycle there are opportunities to extract various forms of honey, oil, timber and carbon (Funk & Kerr, 2007). Mānuka and kānuka are understandable inclusions due to the frequency with which they were mentioned by key informants and their abundance in the Waiapu catchment. Settling upon a representative native tree species proved to be more difficult as a variety were mentioned by the key informants. Consideration was given to a native tree species about which there was adequate information (economic and market, biophysical and other risks) that could be used in a factsheet to inform the MCA participants. Totara ultimately satisfied these requirements.

Different varieties of perennial food crops were also some of the land uses most frequently cited. As such it was decided that in lieu of including a variety of different perennial land use options for evaluation, a representative grouping would be created. It was eventually decided that the statement of the perennial food crop alternative would incorporate apples, blueberries and macadamia nuts. It was important to mention species of nuts, fruit and berries, and the crops chosen either existed in the region or had a history there (Awatere et al., 2018; Porou et al., 2012). At the time of the wānanga, medicinal cannabis was legal to cultivate with a Ministry of Health licence, as was hemp; however, there were and still are significant restrictions placed upon the production and consumption of these plant species. They have been grouped together because of legal uncertainties surrounding cultivation, and also because they are closely related, requiring similar tending and care throughout the growing cycle. Detailed descriptions of each land use alternative can be found in the fact sheet at appendix A.9.

6.3 Description of criteria

The process for including criteria (co-benefits) for consideration within the MCA followed a process similar to that for the land use alternatives. Whilst reference was given to the number of times a certain co-benefit was mentioned (seen in appendix A.6), consideration was also given to generating criteria that would be readily understandable and familiar to the participants. The initial raw list of criteria was deemed too long, so refinement was necessary. This occurred in a number of ways. Firstly, co-benefits that could be combined and presented as one criterion were reorganised and grouped. An example 'taking an interest back home', 'regaining access to the land', 'cultural identity', 'strengthening of marae', 'acting as kaitiaki' and 'self-determination' were combined to form the criterion 'reconnecting with the whenua'. It is important to note that the refined criteria do not always comprehensively represent those co-benefits which have been combined under one 'banner'. However, ensuring the creation of a manageable suite of criteria was essential to this process. Alongside the combination of some co-benefits, it was also necessary at times to tease out those co-benefits which were too broad for participants to make informed decisions on. An example of this is 'sustainability' which was split into 'erosion control', 'water quality' and 'biodiversity'. Whilst the previously mentioned criteria were not specifically mentioned in the context of a co-benefit associated with a land use, they were frequently discussed throughout the key informant interviews, and evident in literature surrounding the Waiapu catchment. A first draft of the criteria to take to the MCA wānanga was circulated among key informants who had indicated they were interested in participating further in the MCA. This feedback was considered and used to further refine a list of criteria to take to the wānanga. The relationship between those co-benefits initially identified by the key informants and the final list of criteria (and descriptions – appendix A.8) that was taken to the MCA wānanga is seen in appendix A.7.

6.4 Description of multi-criteria analysis steps

6.4.1 Flat Land Model 1

The first model relates to what is termed 'flat land' and investigates what benefits Māori landowners associate with land uses suitable *only* for flat to rolling land (LUC 1-4), and why. For this model, wānanga participants were shown a photo of flat to rolling land (with limited land use constraints) containing pockets of mixed scrub and native forest, in order to simulate an environment representative of the flatter areas within the Waiapu catchment. The photos for the land use models were only designed to prime participants and not used as accurate representations of landscapes within the Waiapu catchment. Flat land model 1 had 7 participants and was held on 8/11/18. Participants deliberated for 2 ½ hours.

6.4.2 Steep Land Models 1, 2 and 3

The second model relates to what is termed 'steep land' and investigates what benefits (and why) Māori landowners associate with land uses suitable *only* for steep to severe land (LUC 5-8). Note these LUC classes are much more prevalent (and therefore representative) across the Waiapu catchment than the land considered in the flat land model. This model only incorporated land use alternatives that are actually applicable and suited to the steeper topography of LUC 5-8 land. Therefore, the land uses under consideration were limited to sheep and beef farming, native forestry, and exotic forestry, plus any extra additions made by wānanga participants. To begin, participants were shown a photo of rolling hill country rising to steep slopes, with pockets of mixed scrub and native forest so as to simulate as closely as possible the sort of environment seen in the steeper parts of the Waiapu catchment. The steep land models were held on the second day of the hui (9/11/18) and participants took 2 hours to make their deliberations (three participants participated in both days of the wānanga, giving

16 total unique participants). M2 ST1 and M2 ST2 had five participants whilst M2 ST3 had 2 participants.

6.4.3 Identification of the alternatives

As no pre-emptive criteria were applied to the MCA, the alternatives initially included in the deliberation process were the same as those discussed in section 6.1. However, a new alternative land use option, ‘hunting and tourism’, was added during the wānanga deliberation process, for the steep land model. The land use alternatives under consideration are as follows:

Table 15: Land use alternatives applying to the two models

Model 1: flat land	Model 2: steep land
Native forestry: mānuka, kānuka, tōtara	Native forestry: mānuka, kānuka, tōtara
Exotic forestry	Exotic forestry
Sheep and beef farming	Sheep and beef farming
Perennial horticulture: blueberries, apples and nuts	Hunting and tourism
Medicinal cannabis and hemp	
Cropping: kumara	
Cropping: maize	

6.4.4 Identification of criteria

Alongside the alternative land use options, criteria for assessment were predominantly identified in scoping interviews with experts. However, in some instances, criteria that were not mentioned in the interviews but were evident

within the literature were also included. The provisional selection also drew on external feedback from selected key informants (see chapter 5). Because this MCA follows a participatory and deliberative methodological approach, participants were given the opportunity to include or exclude any of the criteria or alternatives (providing consensus could be achieved) throughout the MCA. For the purposes of this research, criteria have been organised under three themes: ‘social and cultural’ benefits, ‘environmental’ benefits and ‘economic’ benefits.

The value tree produced, before the MCA wānanga, is presented in Figure 17. This includes the original criteria that were introduced to participants of the wānanga before any additions or exclusions were made. When discussing each model, the finalised value tree was presented to the group involved, before any presentation of results.

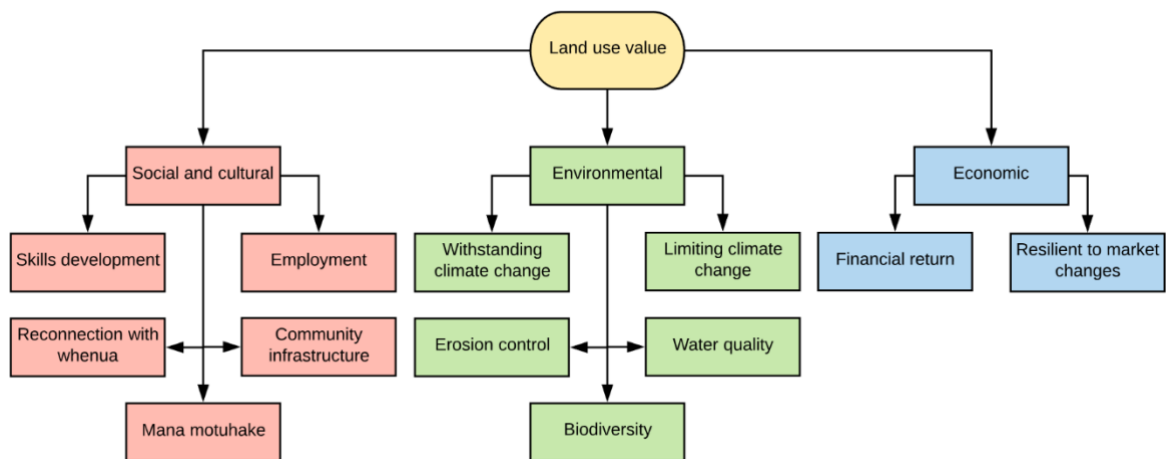


Figure 17: Criteria and criteria groupings, for assessing land use options, identified pre-wānanga

6.4.5 Scoring of the alternatives

The criteria included in this MCA are broad, and there are few similarities between some – hence, finding a common scale to score criteria as disparate as erosion control, market resilience and employment was difficult. Moreover, within the abovementioned constraints of the wānanga, a simple and user-friendly approach

to scoring the alternatives was necessary. It was decided that a qualitative local interval scale would be constructed, building upon the Ngā Pou Herenga (Core Values and Principles) and kaupapa Māori research (KMR) scoring methodology adapted by Awatere et al. (2018). The scoring scale was a 1-5 continuum with a statement associated with each numerical value requiring a subjective judgement arrived at by consensus among the MCA wānanga participants.

All land use options were scored on a five-point local interval scale. The five-point (1 = weakest contribution, 5 = strongest contribution) ordinal qualitative scoring scale used is as follows:

- **Pai rawa (5):** Land use option contributes strongly to and enables this benefit.
- **Pai (4):** Land use option supports and enables this benefit.
- **Āhua pai (3):** Land use option sometimes contributes to this benefit
- **Pōhara (2):** Land use option rarely supports or contributes to this benefit.
- **Aue (1):** Land use option does not support or contribute to this benefit.

6.4.6 Weighting the alternatives

It decided that the weighting methodology used in Mabin et al (2001) would be used but varied to suit the purposes and constraints of this MCA. When weighting the criteria and in the discussions surrounding this process, participants were encouraged to debate the merits of each criterion by considering its intrinsic importance and its level of discrimination against other criteria, and to achieve consensus on the final weightings (Mabin et al., 2001).

Whilst the final weighting method chosen may not be as mathematically transparent as the swing weight method discussed in Belton (1990) and Goodwin and Wright (1998), it has the advantage of having been adopted by and adapted to the constraints of the wānanga. The process was as follows: participants were first asked to rank the criteria in order of importance; and they were then given a

hypothetical scenario where they had '100 percentage points' to allocate over criteria within a criteria grouping or 'family'. This involved some minor mathematical calculations for the participants as they allocated these 100 points across any given criteria family. An example the 'economic' criteria family could be: 60 points given to 'resilient to market changes' and 40 points to 'financial return', indicating the greater importance attached to the former relative to the latter.

In other weighting methods posited in Belton, (1986, 1990) the order of importance is first ascertained, and the weights ascribed to individual criteria are given as number weights; and the final weightings are derived by normalising these initial weights. So, in effect, the weights used in the present study are pre-normalised. The participants allocated these 100 points over the criteria (whilst ensuring the sum of the points stayed as 100). This weighting process ensured the methodology was sound yet still a smooth, understandable and user-friendly process.

The initial land use alternatives and decision making criteria for the MCA were obtained through a series of interviews (detailed in the previous section) with 'key informants' in early August 2018. I selected these key informants with input from my supervisory team. The criteria for selecting key informants included having an intimate knowledge of land management and land use planning in Aotearoa, but specifically in Te Tairāwhiti and ideally, the Waiapu catchment. Further, it was preferred that the key informants had a rich understanding of Māori history and culture in the Waiapu catchment. Knowledge of the land use changes that had occurred post colonisation was also an important selection factor. The key informants also had preferably to understand the varied challenges (e.g. governance capacity and finance) Māori landowners face in making land use decisions. Whilst few key informants fulfilled all of the selection criteria, there was enough coverage across all criteria for the results of the initial interviews to be considered acceptable.

For these reasons key informants were approached and interviewed from a variety of areas and included: local government representatives (1), executive members of local government (1), crown research institute researchers (4), academics (1), land management practitioners (5), NGO representatives (1) and landowners with extensive governance experience (2). For the purposes of this research, these key informants have been categorised as such, but the reality is that there is considerable overlap in roles and responsibilities (particularly for those living in the Waiapu catchment). Table 16 presents the codes assigned to the key informants.

Table 16: Participant code names and interview dates for MCA alternative and criteria identification

MCA scoping interviews		
Key informant code name	Occupation	Date of interview
E1 (academic)	Academic	6/9/18
E2 (land use practitioner)	Land use practitioner and investment manager	11/9/18
E3 (forestry 1)	Manager – forestry and land use company	7/9/18
E4 (local government 1)	Local government programme manager	7/9/18
E5 (NGO)	Manager – NGO	14/9/18
E6 (local government 2)	Local government - executive	6/9/18
E7 (independent researcher 1)	Independent Researcher	7/9/18
E8 (land governance)	Land incorporation – chairperson	5/9/18
E9 (independent researcher 2)	Independent Researcher	20/9/18

E10 (forestry 2)	Company director – forestry and carbon farming	10/9/18
E11 (CRI 1)	Crown research institute – researcher	12/9/18
E12 (CRI 2)	Crown research institute – researcher	11/9/18
E13 (CRI 3)	Crown research institute – researcher	4/9/18
E14 (CRI 4)	Crown research institute – researcher	4/9/18
E15 (forestry 3)	Manager – forestry and land use company	16/2/18

The interviews began with the key informants giving an overview of their work history or research/advocacy in this area. Following this, the land use history in the Waiapu catchment and wider Te Tairāwhiti was discussed including the influence this has had on current land management and utilisation within the rohe. Key informants were then asked to identify the predominant land uses in the Waiapu catchment, and then current or emerging land uses that would suit the characteristics of Māori land in the Waiapu catchment. Key informants were also asked to identify broadly, what benefits Māori landowners may hope to attain through a land use decision and what risks could be associated with these decisions. The full interview schedule can be seen in appendix A.2.

6.5 Results of the MCA models

The inputs (weights and, ultimately, scores) for the alternative land use options were calculated using the VISA software designed for MCA, and the overall score for each land use option is represented here as the ‘land use value’. The following sections discuss the initial results by first presenting the finalised value trees, then investigating the overall scores of alternative land use options and how the alternatives performed against each family of criteria. The performance of the alternatives against the criteria is presented. Sensitivity analyses conclude the analysis of the initial results for each model. A reflection on the final scores of land uses in the MCA process (based on hand written notes from facilitating the

wānanga and post-wānanga analysis of the MCA data) can be seen in appendix A.11 and A.12.

6.5.1 Flat Land Model 1 (M1 FL1):

Figure 18 shows the value tree for model 1 (M1 FL1), which applies to flat land. M1 refers to ‘model 1’ and ‘FL1’ refers to ‘flat land model 1’. Under the ‘economic’ family of criteria, a new criterion, ‘self-reliance’, has been added (for a discussion of this see appendix A.11).

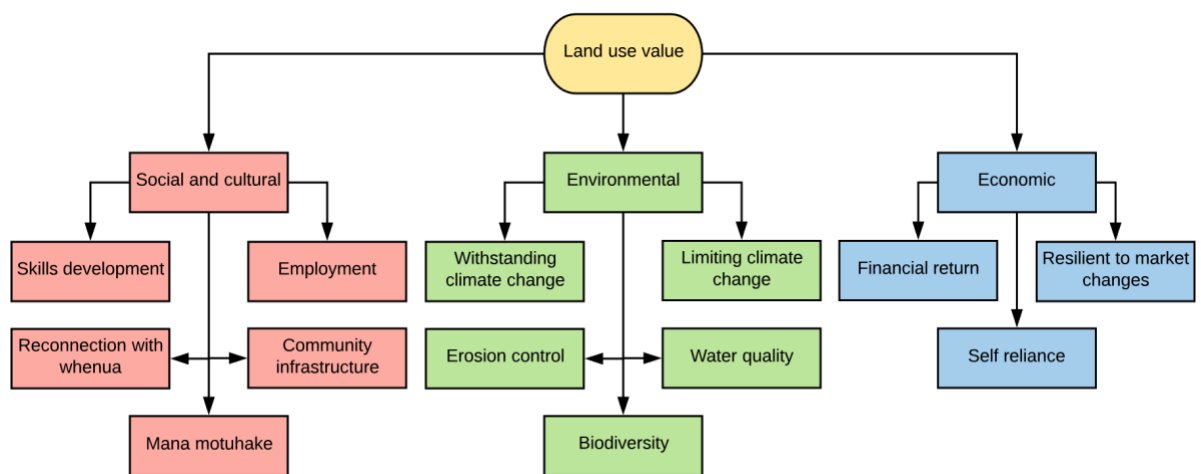


Figure 18: Model 1 (M1 FL1) value tree

Figure 19 shows the overall scores of the seven land use options under consideration in M1 FL1. 100 is the best possible score, whilst 0 is the worst possible score. It is immediately clear that ‘native forestry’ outperforms all other options with a score of 100. The options closest in score to ‘native forestry’ are ‘perennial horticulture’, ‘medicinal cannabis and hemp’ and ‘kumara cropping’ with respective scores of 91, 86 and 73. The presented overall scores fall into two groups, with the second/lower group comprising ‘maize cropping’ with the lowest possible score of 1, ‘exotic forestry’ on 25 and ‘sheep and beef farming’ on 31.

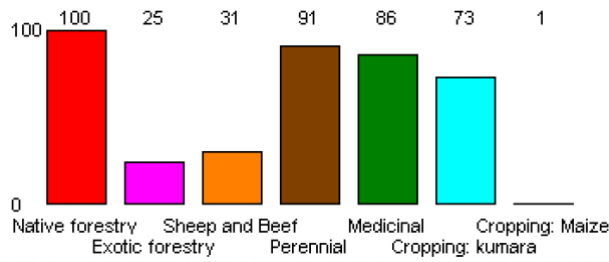


Figure 19: Aggregation of performance weightings and scores for 'land use value' (M1 FL1)

At this stage, it is important to assess how the options perform against the first level criteria under consideration. Figure 20 demonstrates that the performance of some of the previously high scoring options does not hold up across all of the first level criteria. Indicative of the perfect score accorded to 'native forestry' in Figure 19, 'native forestry' scores highest in Figure 20 across all three of the 'social and cultural', 'environmental' and 'economic' criteria families. Likewise, 'maize cropping' continues to score poorly with only a low score under 'social and cultural' criteria before showing the lowest scores on the remaining two criteria families. It is interesting to note that whilst 'exotic forestry' scores poorly on 'economic' and social cultural criteria, it outperforms 'medicinal cannabis and hemp', 'kumara cropping', 'sheep and beef farming' and 'maize cropping' on 'environmental' criteria. 'Sheep and beef farming' continued to perform poorly, being the third lowest ranked alternative under 'social and cultural', tied third worst on 'environmental' criteria and tied last on 'economic' criteria with 'maize cropping' and 'exotic forestry'. Overall, the top and bottom ranked options ('native forestry' and 'maize cropping') showed consistent scores, whilst there was more variation against the 'environmental' criteria family for 'perennial horticulture', 'maize cropping', 'kumara cropping' and 'exotic forestry'.

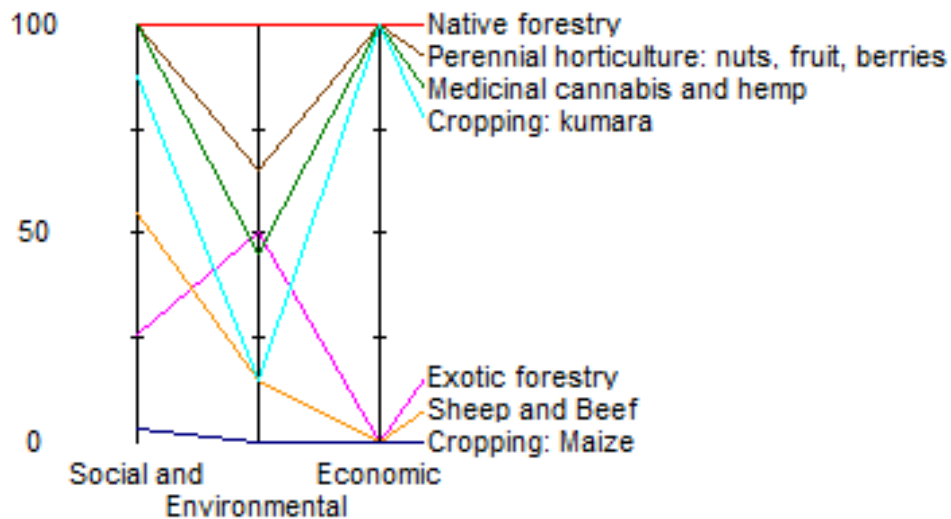


Figure 20: Performance of alternatives on first level criteria (M1 FL1)

So-called X-Y plots reveal how scores are distributed, and whether scores in terms of criteria families are well or poorly correlated. The X-Y plots allow decision maker(s) to see whether there are any trade-offs between criteria, showing any correlation (or lack of it) between criteria plotted on the x and y axes. Figure 21 displays the X-Y plots for the first level criteria (i.e. the criteria families). It clearly highlights the extreme polarisation of benefits that Māori landowners within this model associate with the land use options under consideration. Beginning with the ‘environmental’/‘economic’ X-Y plot, we can see the dominance of ‘native forestry’ on both the ‘economic’ and ‘environmental’ axes. The X-Y plots reinforce the picture already discussed above, with ‘maize cropping’, ‘sheep and beef farming’ and ‘exotic forestry’ showing zero scores on ‘economic’ criteria but ‘sheep and beef farming’ and ‘exotic forestry’ scoring moderately in terms of the ‘environmental’ criteria family.

A similar pattern can be seen from the ‘social and cultural’/‘economic’ quadrant in Figure 21’s X-Y plot, with ‘exotic forestry’ and ‘sheep and beef farming’ scoring marginally better on ‘social and cultural’ criteria (‘sheep and beef farming’ is viewed as offering reasonable social and cultural value). This pattern offers a strong contrast to the remaining land use options which all cluster tightly in the

upper range for both criteria families ('social and cultural', and 'economic'), although 'kumara cropping' scores marginally less well against 'social and cultural' criteria than does medicinal cannabis/hemp. Note that the red and brown points for 'native forestry' and 'perennial horticulture' are eclipsed in this plot.

A more differentiated distribution occurs on the 'environmental'/ social cultural X-Y plot. Here some of the trade-offs between criteria are evident. 'Kumara cropping' scores highly on 'social and cultural' criteria but poorly on 'environmental' criteria. 'Sheep and beef farming' scores marginally lower on 'social and cultural' criteria, but again poorly in environmental terms. 'Maize cropping' scores very poorly on both criteria families, while 'perennial horticulture' is scored mid-way on 'environmental' criteria, yet very high for 'social and cultural' criteria.

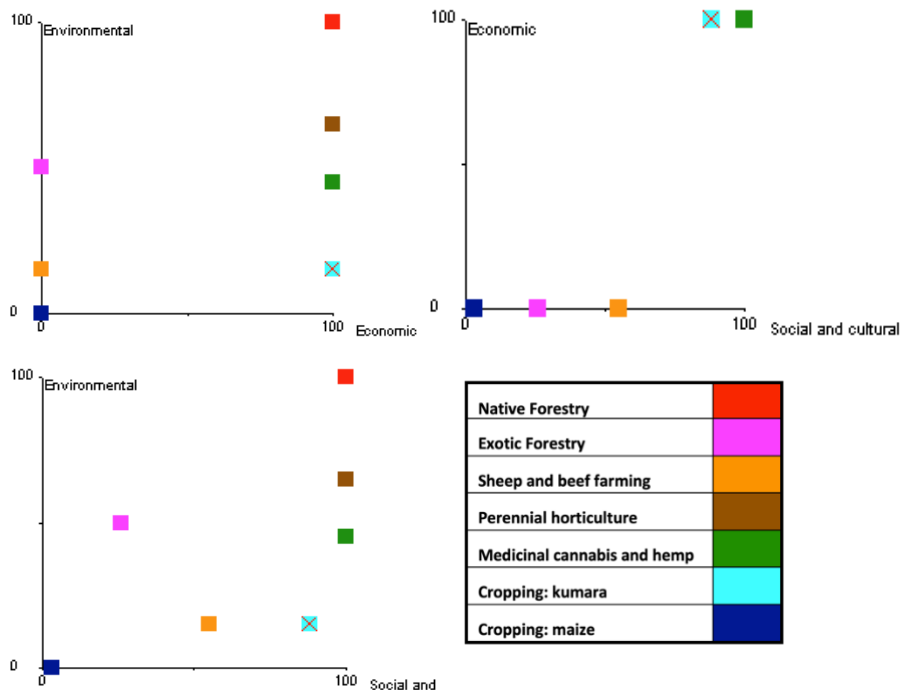


Figure 21: X-Y plots showing the distribution of land use options' performance against the three criteria families (M1 F1)

After exploring the performance of the options in terms of the first level criteria (criteria families) the next stage of analysis in evaluating the initial results was to investigate the performance of the options against the individual criteria. Figure 22 shows some interesting results regarding the performance of some of the poorer scoring alternatives. As indicated above in Figure 21, in environmental and social-cultural respects 'exotic forestry' and 'sheep and beef farming' performed considerably better than their overall score may indicate. 'Exotic forestry' received top scores against the criteria of 'employment' and 'skills development' which indicates an implicit acknowledgement of the industry as one of the largest employers in the wider region. Interestingly, 'exotic forestry' received a score of 2 (out of 5) on the criterion 'reconnection with whenua'. 'Sheep and beef farming' also scored consistently on 'social and cultural' factors, receiving a score of 5 for 'skills development' but only 3 for 'employment' which indicates the waning of 'sheep and beef farming' as a significant employer in the region, yet still acknowledging the highly skilled nature of the industry. 'Maize cropping' continues to score poorly, with a score of 2 on 'skills and development' the only registration of any benefit for this land use. 'Native forestry', 'perennial horticulture', 'medicinal cannabis and hemp' and 'kumara cropping' received top scores on all criteria for 'social and cultural' values with the only outlier from this grouping being 'kumara cropping' with a score of 3 for 'community infrastructure'.

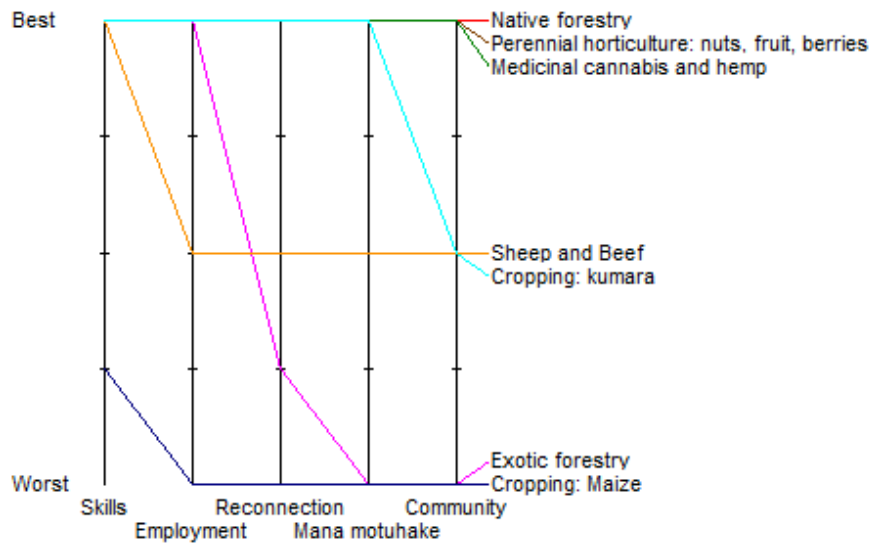


Figure 22: Performance of alternatives on 'social and cultural' criteria (M1 FL1)

Concerning the 'environmental' criteria shown in Figure 23, once more, 'native forestry' and 'maize cropping' received consistent top and bottom scores respectively. There is much more variation in scores amongst the remaining land use options. On the criterion 'limiting climate change', 'perennial horticulture' and 'exotic forestry' received scores of 3 each, and 'kumara cropping' a score of 1. 'Sheep and beef farming' interestingly received a score of 2 for 'limiting climate change' indicating a misplaced belief that 'sheep and beef farming' can somehow limit climate change, rather than contribute to it. The top score for 'kumara cropping' is a 3 for 'water quality' while the remaining sub-criteria scores are mainly 1. 'Perennial horticulture' receives scores of 4 for 'erosion control', 'water quality' and 'biodiversity'. 'Medicinal cannabis and hemp' receive scores of 1 for 'withstanding climate change' and 'limiting climate change' and a peak score of 5 for 'water quality', but a slightly lower score of 4 on the 'biodiversity' criterion.

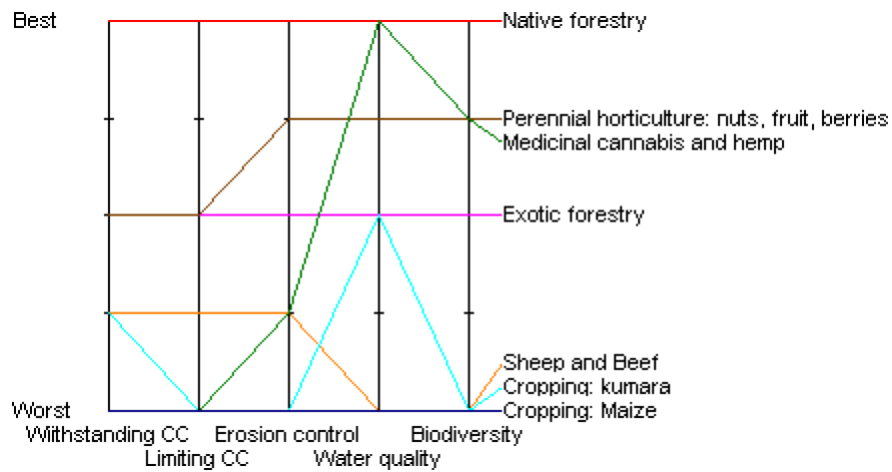


Figure 23: Performance of land use alternatives on 'environmental' criteria (M1 F1)

Figure 24 further highlights the extreme polarisation of the alternatives amongst 'economic' sub-criteria. 'Native forestry', 'perennial horticulture', 'medicinal cannabis and hemp' and 'kumara cropping' are perceived to offer comparably high benefits as they top score on 'financial criteria', 'resilience to market changes' and 'self-reliance'. These results are in stark contrast with the poor performing alternatives ('exotic forestry', 'sheep and beef farming' and 'maize cropping') which received scores of 1 on all 'economic' criteria.

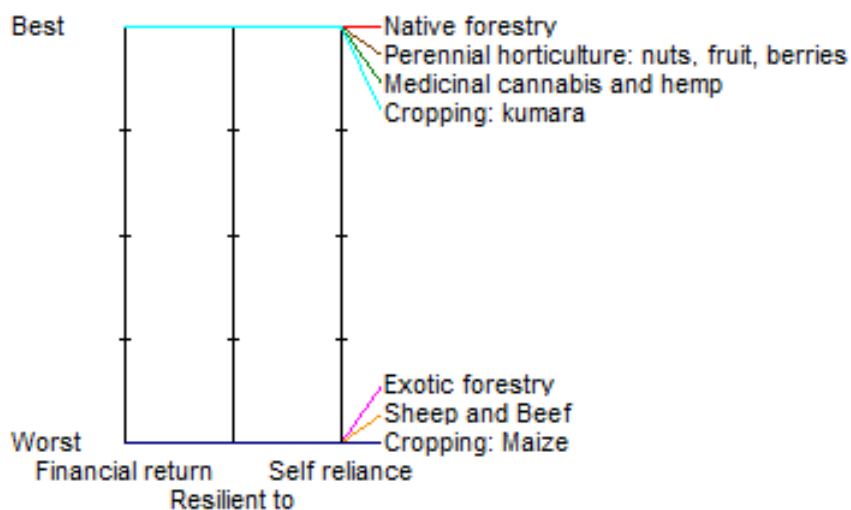


Figure 24: Performance of alternatives on 'economic' criteria (M1 FL1)

Analysis of the results has reinforced the land use alternatives which are clear ‘winners and losers’. ‘Native forestry’ was given perfect scores of 5 across all sub-criteria whilst ‘maize cropping’ was given the lowest scores (bar a moderate score on skills development). The other stable, high performing alternatives were ‘perennial horticulture’ and ‘medicinal cannabis and hemp’. The only dips in score for these alternatives were on ‘environmental’ sub-criteria. ‘Kumara cropping’ also consistently scored well, but less so than ‘perennial horticulture’ and ‘medicinal cannabis and hemp’ on ‘environmental’ criteria. ‘Sheep and beef farming’ and ‘exotic forestry’ consistently scored poorly across all sub-criteria, with ‘sheep and beef farming’ performing better on ‘social and cultural’ criteria whilst ‘exotic forestry’ performed better on ‘environmental’ criteria. It is interesting to note that the alternatives which scored very well are those not widely in use within the region, whilst those performing poorly are generally land use alternatives currently in use. The next part of this chapter reports on a sensitivity analysis of the results.

6.5.2 Sensitivity analysis M1 FL1

The purpose of sensitivity analyses is to assess how robust an option is to changes in the data, and in particular, the criteria weights (ratings given to criteria to indicate their relative importance against each other). An initial stage in any sensitivity analysis is to determine whether the model is working as it should be expected to (Mabin & Beattie, 2018). This can largely be determined by adjusting the weights on criteria and assessing how the score of an option changes in response.

VISA allows a user to produce sensitivity graphs which indicate what effect a change in weight will have on an alternative across all criteria. Figure 25 displays the sensitivity graphs for the land use alternatives in terms of the overall criterion ‘land use value’. The dashed line indicates the weighting given to the criteria during the MCA wānanga. Beginning with the ‘economic’ sensitivity graph it can

be noted that the results are reasonably insensitive to changes in the weights. If the 'economic' weighting is increased the result is further polarisation of scores amongst the 'leader' and 'laggard' alternatives. The alternatives displayed on the 'social and cultural' sensitivity graph is, for the most part, relatively insensitive to a change in weighting. This graph indicates that with a weighting increase the scores of 'medicinal cannabis and hemp', 'native forestry', 'perennial horticulture' and 'kumara cropping' significantly increase. Interestingly the importance of 'sheep and beef farming' increases as well, passing 'exotic forestry' at a weight of ~0.4. Unsurprisingly 'exotic forestry' and 'maize cropping' remain static with little discernible change in score with a change in weight.

'Perennial horticulture', 'medicinal cannabis and hemp' and 'kumara cropping' all exhibit decreases in score as the weight increases on environment, as shown in the 'environmental' sensitivity graph. 'Sheep and beef farming' decreases more gently and is surpassed by 'exotic forestry' which rises steadily. These results are unsurprising considering the poor results 'sheep and beef farming' received on 'environmental' criteria and the erosion control and climate change benefits associated with 'exotic forestry'. 'Exotic forestry' ultimately becomes the third most important criterion if the weighting is moved to its maximum level.

The sensitivity analysis results also show how changes in the weights affect the second level criteria. These sensitivity analyses (and those of the other three models) and commentary can be seen in appendix A.10.

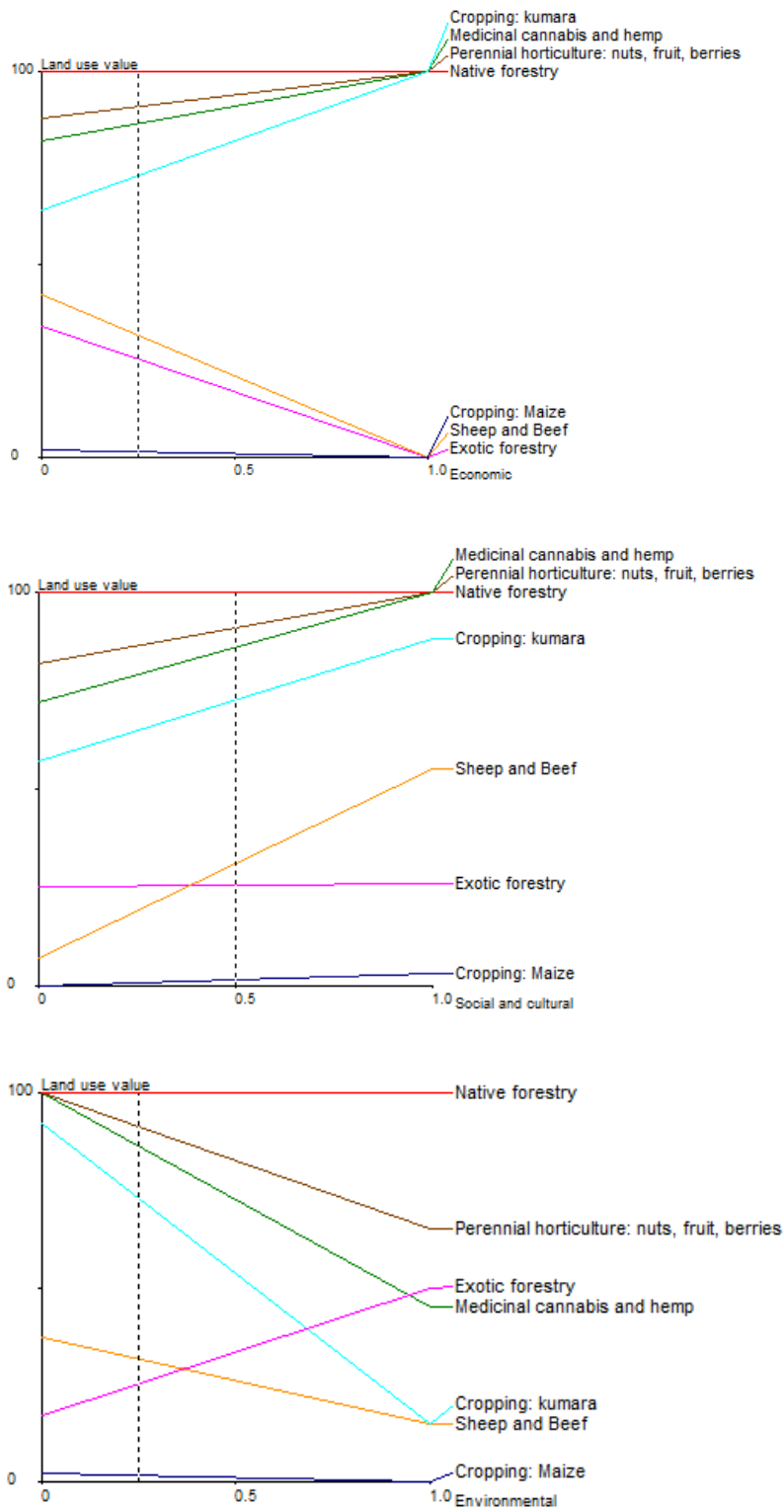


Figure 25: Sensitivity graphs showing the effects on overall scores of weight changes on first level criteria (economic, social-cultural, and environmental, respectively) for M1 F1

6.5.3 Steep Land Model 1 (M2 ST1):

Extra criteria added by the participants of the first steep land model (M2 ST1: M2 refers to 'model 2' and 'ST1' refers to 'steep land 1') can be seen in Figure 26. 'Knowledge and awareness' and 'Te Ao' (Te Ao Māori) have been added to 'social and cultural', whilst 'self-reliance' has also been added to the 'economic' family of criteria. For an in-depth explanation of these criteria see appendix A.10.

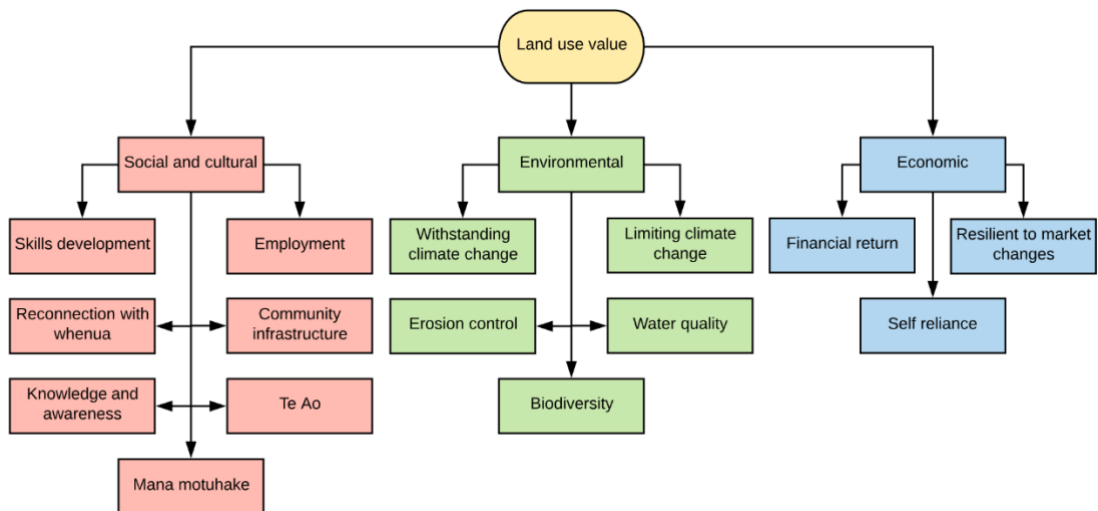


Figure 26: Model 2 (M2 ST1) value tree

There are three fewer land use alternatives evaluated in M2 ST1. The participants of this model deliberated about, and built consensus for, the inclusion of an additional land use option: 'hunting and tourism' into the MCA. Including more land use options for consideration in an MCA model evidently yields more information for a decision maker. However, in the context of this study, those land use options which are available for use on (what this study has classified as) 'steep land' in the Waiapu catchment are limited. This serves to further highlight the difficulties, and dearth of options, Māori landowners face in making land use decisions. Figure 27 highlights that once more 'native forestry' outscores the remaining alternatives. 'Sheep and beef farming', 'exotic forestry' and 'hunting and tourism' are clustered reasonably close together with overall scores of

between 45 and 50. This indicates that, of these three, no alternative conclusively outperforms the others. The clustering seen in Figure 27 is much more evident amongst the less preferred alternatives than the diversity of scores in Figure 19.

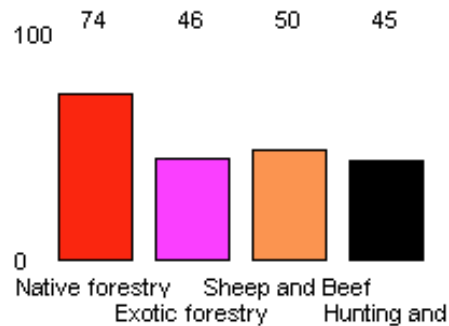


Figure 27: Aggregation of performance weightings and scores for 'land use value' (M2 ST1)

Figure 28 reveals the similarity in scores for all alternatives on 'social and cultural' criteria. Here, 'sheep and beef farming' outscores 'native forestry'. However, this is not reflected in 'environmental' criteria, as 'native forestry' significantly outperforms all other alternatives. Under the 'economic' family of criteria the gap between 'native forestry' and the other alternatives (which are tightly clustered) diminishes slightly.

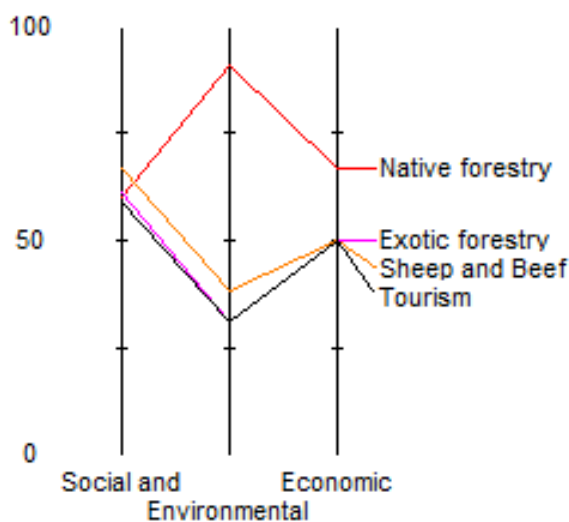


Figure 28: Performance of alternatives on first level criteria (M2 ST1)

Figure 29 gives a greater impression of the trade-offs evident between the first level criteria as represented by X Y graphs. Areas of correlation between criteria families can be seen foremost on the 'economic'/'social and cultural' X Y graph. Whilst 'native forestry' marginally outperforms the other alternatives on 'economic' criteria, there is little difference between the alternatives for 'social and cultural' criteria. This relationship is not repeated for the remaining two X Y graphs as 'native forestry' significantly outperforms the other alternatives on 'environmental' criteria. This indicates the presence of trade-offs in benefits between alternatives when environmental criteria are under consideration.

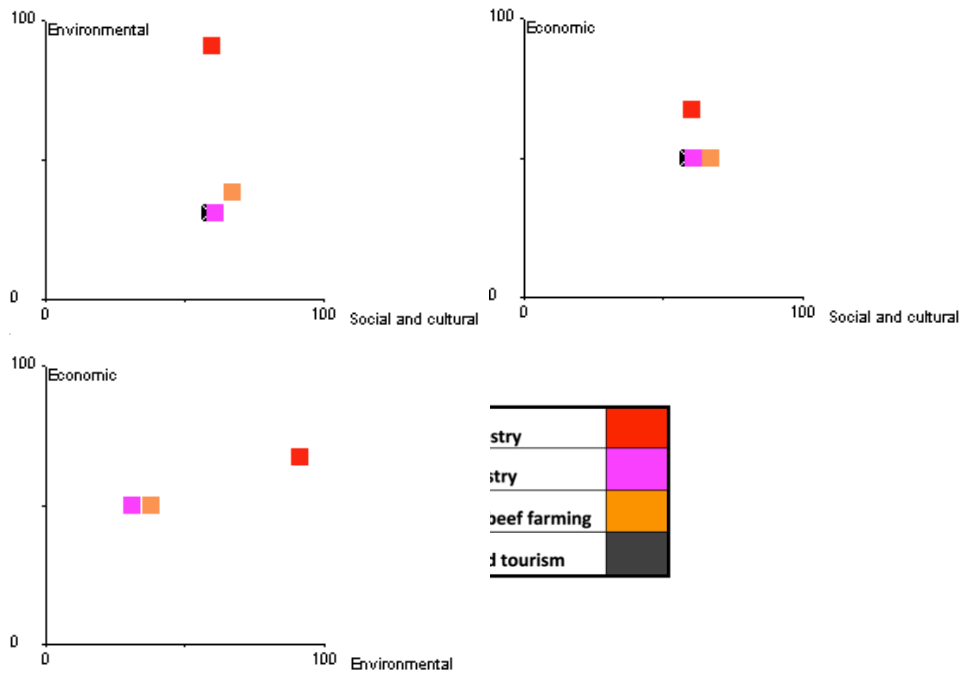


Figure 29: X-Y plots showing the distribution of land use options' performance against the three criteria families (M2 ST1)

A number of illuminating results emerge from comparing land use alternatives against the sub-criteria (within each criteria family). Figure 30 details similarities in the scores ascribed to alternatives across all of the 'social and cultural' sub-criteria. Of the four alternatives, 'sheep and beef farming' scores well, more consistently than the others. Another point of interest is the performance of 'exotic forestry', which shares similar scores with 'sheep and beef farming' and is only outperformed on the 'skills development' sub criterion. This can be seen as another tacit nod to the role of these industries as significant employers in the Waiapu catchment. In stark contrast with M1 F1, 'native forestry' scored in a relatively mediocre fashion, and only differentiated itself from 'hunting and tourism' on the 'community development' sub-criterion. Unfortunately, across all alternatives, no distinction was given between the scores assigned to the additional sub-criteria 'te ao' and 'knowledge and awareness' with scores of 4, meaning that these sub-criteria did not help in discriminating between land use options.

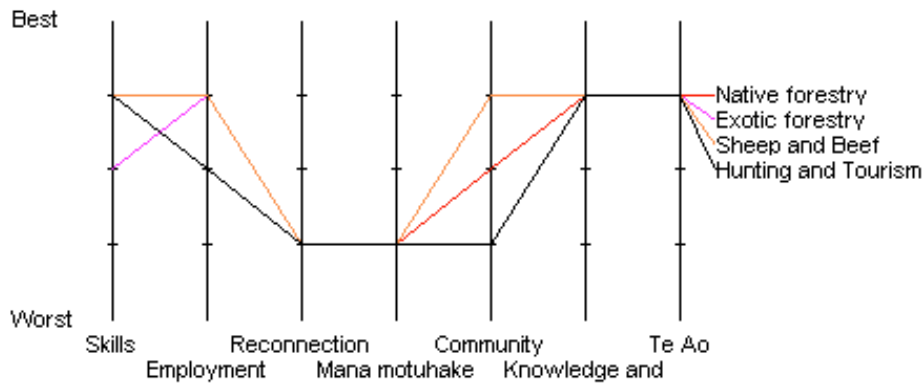


Figure 30: Performance of alternatives on 'social and cultural' criteria (M2 ST1)

Figure 31 draws attention once more to the dominance of 'native forestry' over other alternatives on 'environmental' criteria. 'Native forestry' achieves scores of 5 across all sub-criteria except 'erosion control' and 'withstanding climate change'. Of the other alternatives, 'sheep and beef farming' could be considered to be one of the poorest performing alternatives. Yet 'hunting and tourism' received low scores on the climate change criteria and 'biodiversity'. 'Native forestry' and 'exotic forestry' both achieved scores of 4 for 'erosion control' which indicates the recognition of 'exotic forestry' as an important erosion control tool, and more interestingly one that is on par with 'native forestry'. Another curious score is that of 'exotic forestry' on at least one of the climate change criteria. Considering the superior sequestration potential (in the short-medium term) of exotic forest species, conventional wisdom would assume this would result in a score higher than 2 for 'limiting climate change'.

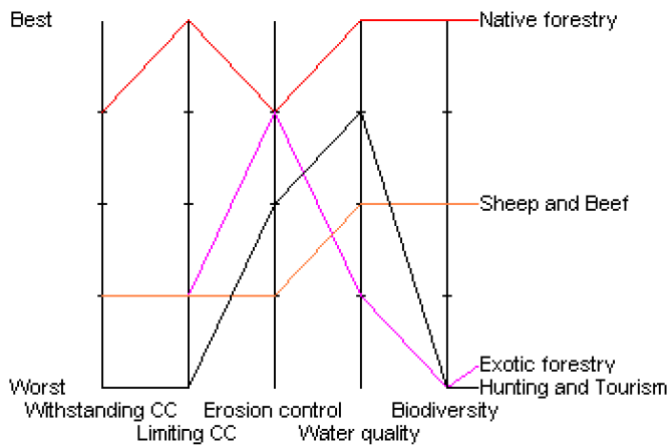


Figure 31: Performance of alternatives on 'environmental' criteria (M2 ST1)

The homogeneity in scores as seen in Figure 30 is also reflected in Figure 32. 'Sheep and beef farming' and 'hunting and tourism' both received scores of 3 across all sub-criteria, reflecting modest confidence in the ability of these land use alternatives to provide adequate economic returns. Not surprisingly, 'native forestry' was best reflected on 'self-reliance' and 'resilient to market changes' yet received the worst score under 'financial return'. 'Exotic forestry' scored well on 'financial return' and predictably poorly under 'resilient to market changes'.

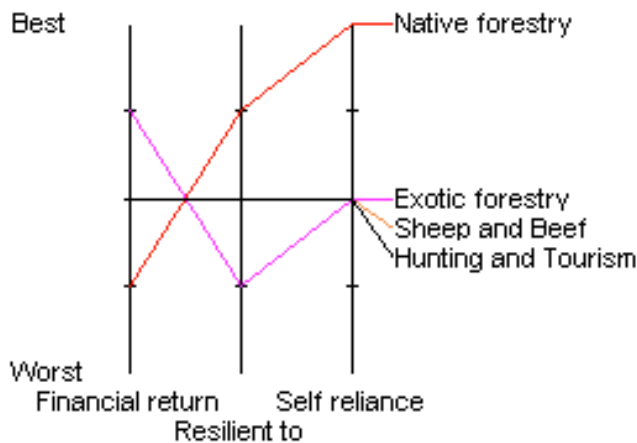


Figure 32: Performance of alternatives on 'economic' criteria (M2 ST1)

The analysis of sub-criteria for M2 ST1 has shed more light on those benefits most readily associated with the reduced set of land use alternatives under

consideration. Whilst 'native forestry' seemed to be clearly dominant when looking at the bar chart and thermometer, its success largely rests on its performance on 'environmental' criteria; and to an extent, 'economic' criteria. 'Native forestry' did not outscore any of the other alternatives on 'social and cultural' criteria. Of the other three alternatives; 'sheep and beef farming' could be considered the marginally better performer as it scored well on 'social and cultural' criteria but poorly on 'environmental' criteria. 'Exotic forestry' and 'hunting and tourism' can be considered as middle options as they were never extensively dominated by 'native forestry'.

6.5.4 Sensitivity analysis M2 ST1

Sensitivity analyses for the first level criteria in relation to the 'land use value' are depicted in Figure 33. Beginning with the 'social and cultural' graph, it is evident that as the weight increases the importance of 'native forestry' diminishes steadily and meets the clustering of 'exotic forestry', 'hunting and tourism' and 'sheep and beef farming' around a ~0.8-~0.9 weighting. The inverse of this relationship is evident when viewing the 'environmental' sensitivity graph. The relatively flat lines on the 'economic' sensitivity graph indicate that for economic criteria, the alternatives are robust and exhibit little sensitivity to a change in weight.

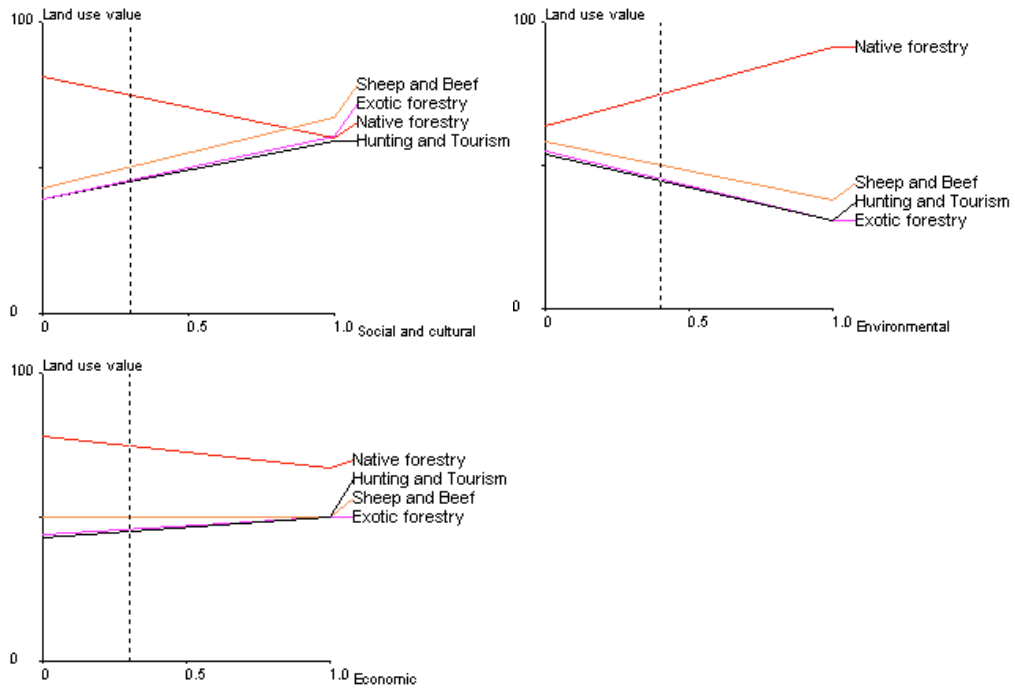


Figure 33: Sensitivity graphs showing the effects of weight changes on first level criteria in relation to overall scores (M2 ST1)

6.5.5 Steep Land Model 2 (M2 ST2):

The value tree for M2 ST2 (as seen in Figure 34) differs from that of M2 ST1 as the sub-criterion 'te ao' has not been included in the 'social and cultural' criteria. Barring these additions, the value tree is identical to that of M1 F1, but with three fewer land use alternatives under consideration.

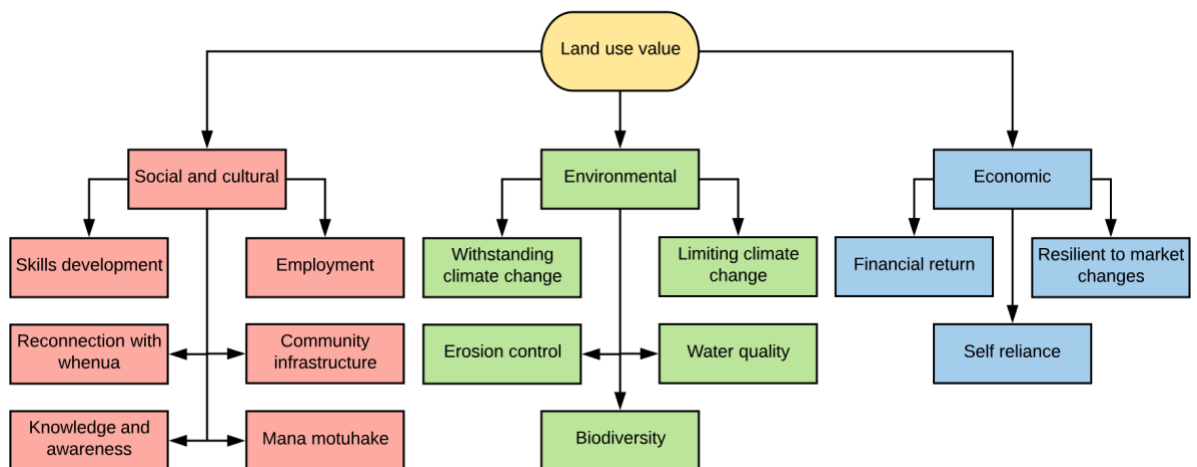


Figure 34: Model 2 (M2 ST2) value tree

Figure 35 shows the overall scores of the alternatives in M2 ST2. Keeping in sync with the results of the previously discussed models – ‘native forestry’ is the clear leader with an overall score of 91 and ‘hunting and tourism’ is closer with a score of 71. ‘Sheep and beef farming’ and ‘exotic forestry’ are clearly poor performers with respective scores of 31 and 27.

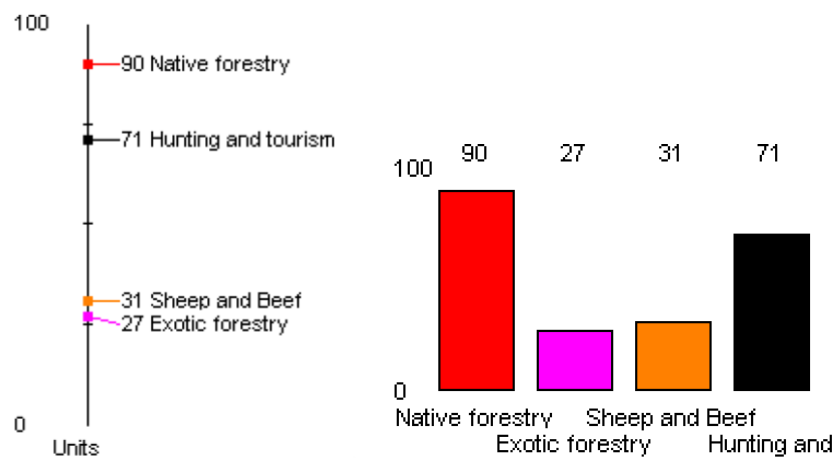


Figure 35: Aggregation of performance weightings and scores for 'land use value' (M2 ST2)

The performance of the alternatives over the first level criteria for M2 ST2 can be seen in Figure 36. ‘Native forestry’ receives a near perfect score for ‘social and cultural’ criteria, a perfect score for ‘environmental’ criteria and a similar score with that of ‘hunting and tourism’ under ‘economic’ criteria. ‘Hunting and tourism’ meanwhile scores well under ‘social and cultural’ yet experiences a dip in performance associated with ‘environmental’ criteria – however this score significantly surpasses that of ‘sheep and beef farming’ and ‘exotic forestry’. ‘Sheep and beef farming’ received scores around the midpoint for ‘social and cultural’ criteria and ‘economic’ criteria, yet steeply declines with a score of 0

under 'environmental' criteria. The score trajectory of 'exotic forestry' is such that it receives the lowest scores for 'social and cultural' and 'economic' criteria.

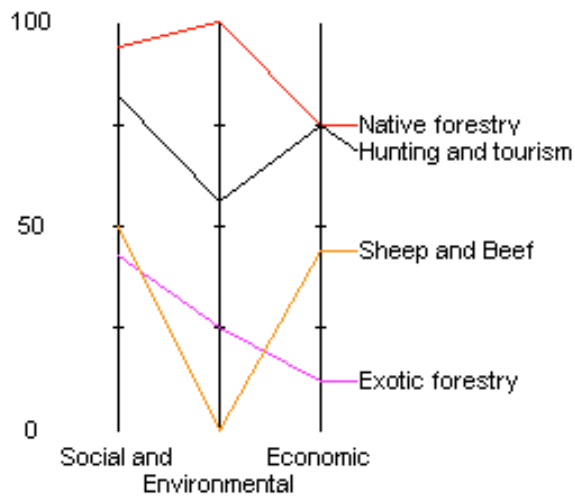


Figure 36: Performance of alternatives on first level criteria (M2 ST2)

The X Y plots seen in Figure 37 will now be consulted in turn to investigate whether any trade-offs are evident between criteria. Across the three X Y plots, there is little notable clustering indicating to a decision maker that trade-offs are present between alternatives. As evident in Figure 36, 'sheep and beef farming' and 'exotic forestry' score poorly on all criteria. The opposite is seen with 'native forestry' and 'hunting and tourism', barring 'hunting and tourism's environmental performance.

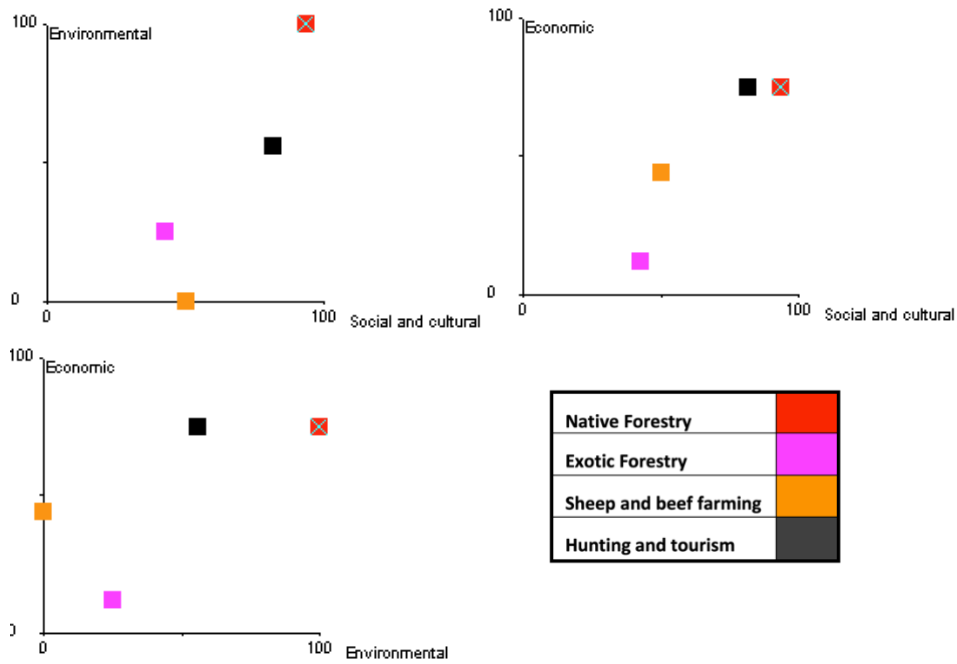


Figure 37: X-Y plots showing the distribution of land use options' performance against the three criteria families (M2 ST2)

The criteria of 'social and cultural' as seen in Figure 38 will now be discussed in turn. All alternatives receive a score of 4 and above for 'skills development'. The high scores for previously poorly ranked alternatives such as 'exotic forestry' continue into 'employment', whilst 'hunting and tourism' and 'sheep and beef farming' receive scores of 3 under this sub-criterion. 'Hunting and tourism' and 'native forestry' are seen to provide the most benefit in relation to 'reconnection with the whenua' and 'mana motuhake' whilst comparatively, 'exotic forestry' scores very poorly on those criteria. 'Sheep and beef farming' scores fairly consistently with 3s and 4s, but out of all the alternatives scores the worst for 'community infrastructure' with a 2. 'Hunting and tourism' scores consistently well with the only poor scores (relative to the others) on 'employment' and 'community infrastructure'.

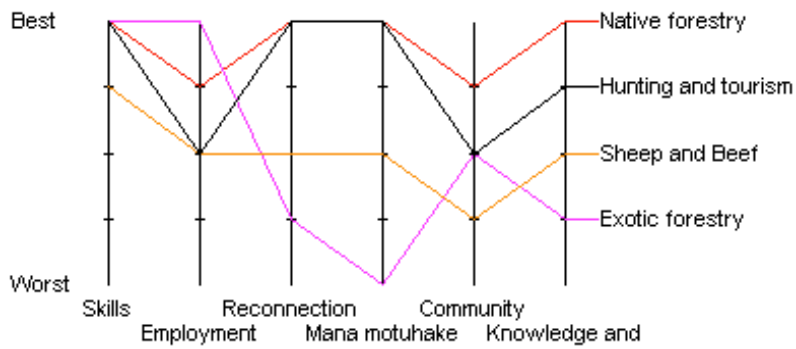


Figure 38: Performance of alternatives on 'social and cultural' criteria (M2 ST2)

The score disparities evident in the previous models is further evident in Figure 39. 'Native forestry' receives scores of 5 across all sub-criteria which can be seen to reflect the participants absolute confidence that 'native forestry' can cope with and address climate change but also provide erosion control and biodiversity benefits. At the other end of the spectrum lies 'sheep and beef farming' which receives scores of 1 across all the criteria. 'Exotic forestry' initially scores reasonably well with scores of 3 for 'withstanding climate change' 'limiting climate change' and 'erosion control'. However, the performance of 'exotic forestry' drops to scores of 1 for 'water quality' and 'biodiversity'. 'Hunting and tourism' scores consistently with 3s across all criteria and a 4 under 'biodiversity'. 'hunting and tourism's scores under biodiversity are an implicit recognition that this industry is largely tied to the health and abundance of native forests.

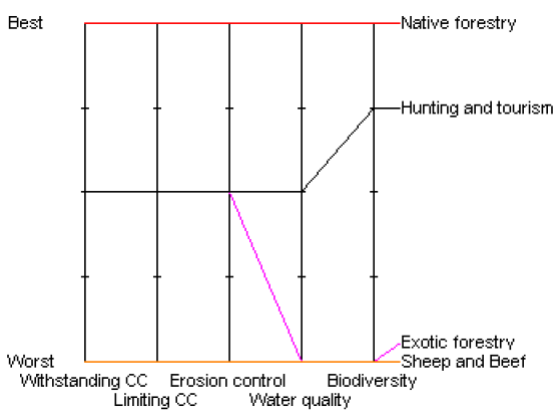


Figure 39: Performance of alternatives on 'environmental' criteria (M2 ST2)

Figure 40 exhibits the performance of the alternatives on 'economic' criteria. From the outset it is clear that none of the alternatives score highly on 'financial return'. 'Exotic forestry' has scores of 1 under 'resilient to market changes' and 'self-reliance', whilst 'sheep and beef farming' receives respective scores of 2 for those criteria. 'Native forestry' and 'hunting and tourism' both rise to a score of 5 under 'self-reliance'.

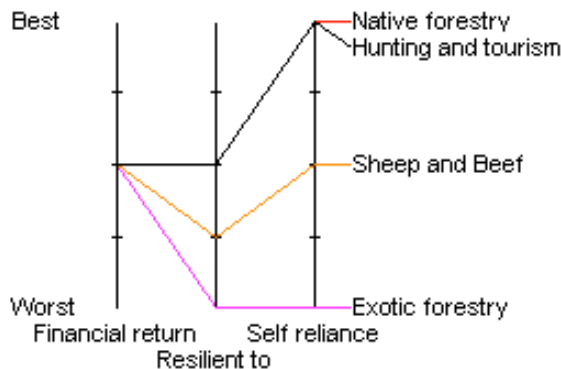


Figure 40: Performance of alternatives on 'economic' criteria (M2 ST2)

6.5.6 Sensitivity analysis M2 ST2

Figure 41 details sensitivity analyses for the first level criteria of M2 ST2. When examining the 'social and cultural' graph, it is clear that the alternatives are all mildly sensitive to a change in weight and experience increases in importance accordingly. Barring 'exotic forestry' (which shows is robust under changes in weight) the remaining alternatives show increasing levels of sensitivity to a weight change under the 'environmental' criterion. The importance of 'native forestry' increases marginally with an increase in weight whilst the importance of 'hunting and tourism' and 'sheep and beef farming' falls. At a ~0.4 weighting the overall performance of 'sheep and beef farming' falls below that of 'exotic forestry'. However, when looking at the 'economic' sensitivity graph it is clear that the current weighting has allowed for the importance of 'sheep and beef farming' to marginally surpass 'exotic forestry' which is more sensitive to a weight increase. 'Native forestry' shows sensitivity to a change in weight under 'economic' and its

importance decreases. The opposite is the case for 'hunting and tourism' and whilst it is less sensitive than 'native forestry', its importance in regard to the overall land use value increases marginally.

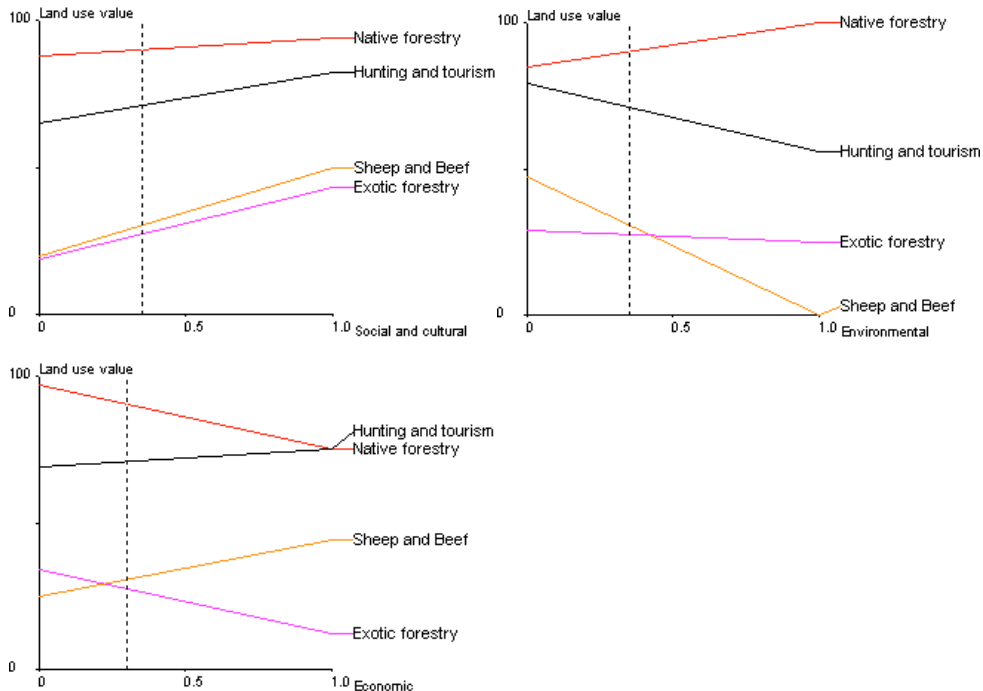


Figure 41: Sensitivity graphs showing the effects of weight changes on first level criteria in relation to overall scores (M2 ST2)

6.5.7 Steep Land Model 3 (M2 ST3)

The value tree for M2 ST3 is presented in Figure 42. The participants of this model elected to exclude evaluating the additional criteria that other models had included in their evaluative process and instead opted to consider the original criteria as seen in Figure 17.

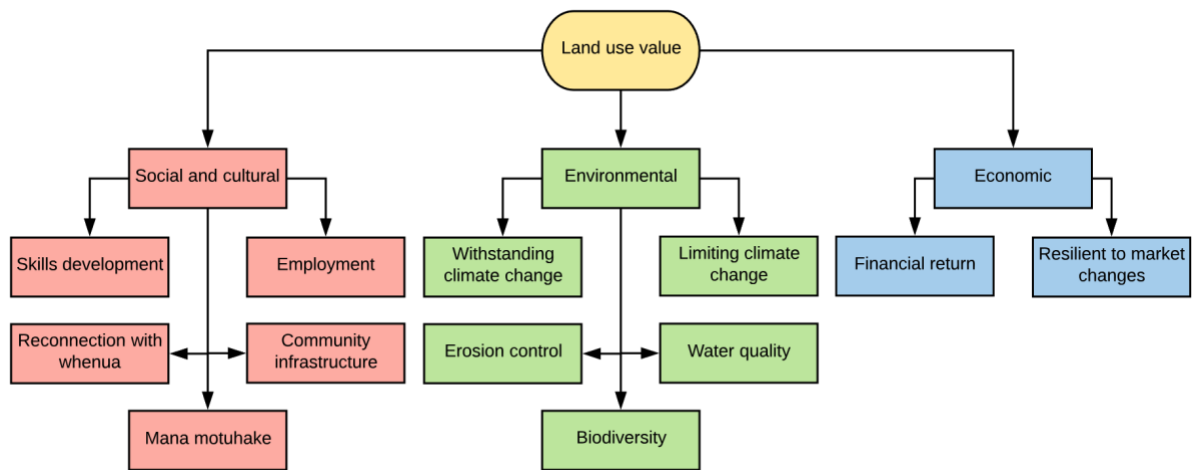


Figure 42: Model 2 (M2 ST3) value tree

In keeping with the general trends of the three previous models, Figure 43 shows that 'native forestry' (with a score of 88) clearly dominates the other alternatives. 'Hunting and tourism' comes a distant second with a score of 60. 'Exotic forestry' and 'sheep and beef farming' are clustered towards the lower end of the scale with respective scores of 35 and 29.

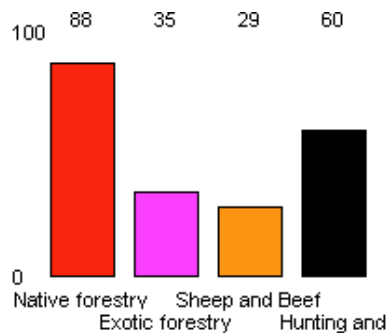


Figure 43: Aggregation of performance weightings and scores for 'land use value' (M2 ST3)

The overall land use values for M2 ST3 are presented in Figure 44. Predictably, 'native forestry' outscores the other alternatives on the 'environmental' criteria, and also on the 'social and cultural' criteria. 'Hunting and tourism' scores poorly on 'environmental' criteria, reasonably well on 'social and cultural' and achieves the top score under 'economic'. 'Sheep and beef farming' and 'exotic forestry'

score poorly across the three criteria. ‘Sheep and beef farming’ outperforms ‘exotic forestry’ on ‘social and cultural’ but falls rapidly on ‘environmental’ and ultimately receives the worst score for ‘economic’. Whilst ‘exotic forestry’ does not score particularly highly – it is reasonably consistent across all criteria.

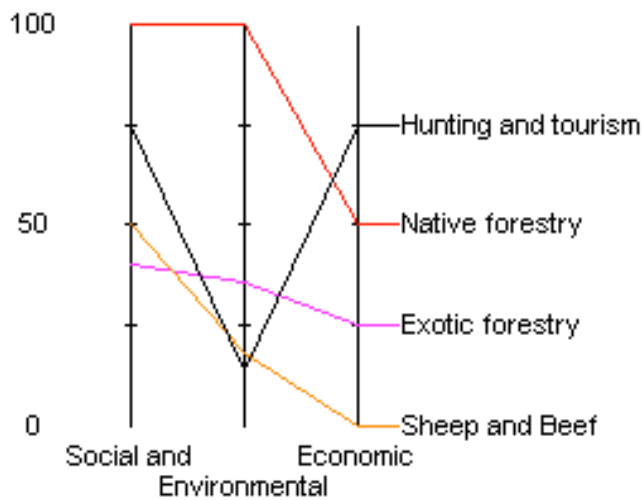


Figure 44: Performance of alternatives on first level criteria (M2 ST3)

The X Y plots visible in Figure 45 explore in greater depth the relationships and trade-offs between the alternatives on the first level criteria. When looking at the ‘social cultural/economic’ X Y plot it could be likely that ‘hunting and tourism’ would be considered to be the best performing alternative as its performance is not too removed from ‘native forestry’ under ‘social and cultural’, yet it performs better under ‘economic’. The ‘environmental/ social and cultural’ X Y plot highlights the utter dominance of ‘native forestry’ on these criteria – whilst the other alternatives cluster together towards the lower end of the environmental axis and upper-middle ‘social and cultural’ axis. The remaining X Y plot compares the ‘environmental’ and ‘economic’ criteria. ‘Native forestry’ would more than likely be seen as the efficient alternative under both of these criteria as it performs reasonably well under ‘economic’ (losing out to ‘hunting and tourism’), yet significantly outperforms all alternatives under ‘environmental’. The difference in performance between ‘native forestry’ and ‘hunting and tourism’

under the 'environmental' criteria is far greater than the difference between 'native forestry' and 'hunting and tourism' under the 'economic' criteria. Once more 'sheep and beef farming' and 'exotic forestry' are clustered towards the lower end of either axis, with 'exotic forestry' performing slightly better on both criteria.

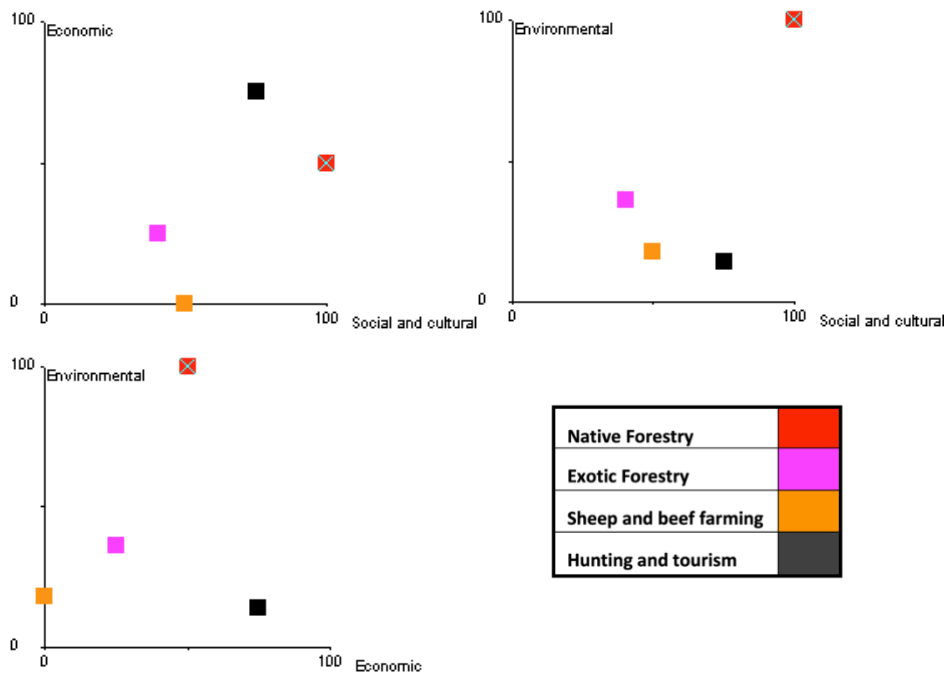


Figure 45: X-Y plots showing the distribution of land use options' performance against the three criteria families (M2 ST3)

A recurrent theme throughout the evaluation process across all the models is how uniform the assigned scores are for the alternatives within a criteria family. This is reflected in the 'social and cultural' profile chart as seen in Figure 46. 'Native forestry' received scores of 5 across all 'environmental' sub-criteria. 'Hunting and tourism' and 'sheep and beef farming' also saw no variation in the assigned scores, with respective scores of 4 and 3. 'Exotic forestry' scored well in regard to 'skills development' and 'employment', yet this performance was not sustained with respect to 'reconnection with the whenua', 'mana motuhake' and 'community infrastructure'.

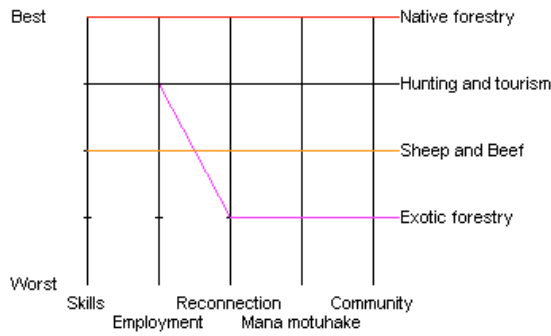


Figure 46: Performance of alternatives on 'social and cultural' criteria (M2 ST3)

Figure 47 details the performance of the alternatives on 'environmental' criteria. Predictably, 'native forestry' receives perfect scores of 5 across all the sub-criteria. This result is reflected in many ways across the other models. Under 'withstanding climate change' and 'limiting climate change' 'exotic forestry' receives scores of 4 yet falls to a score of 3 under 'erosion control' and 1s on the remaining sub-criteria. 'Hunting and tourism' and 'sheep and beef farming' receive remarkably similar scores, particularly across the initial three sub-criteria yet falling to a 1 on 'water quality', and for 'hunting and tourism' a 1 on 'biodiversity'. 'Sheep and beef farming' receives a score of 2 for 'biodiversity'.

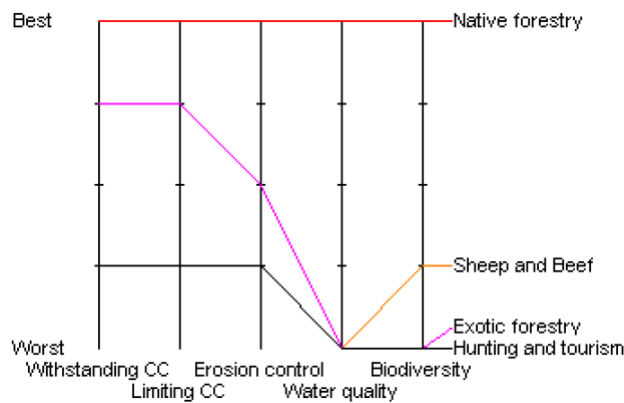


Figure 47: Performance of alternatives on 'environmental' criteria (M2 ST3)

Figure 48 details the 'economic' profile chart, and the uniformity in scores can be clearly seen once more. 'Hunting and tourism' receives a score of 5 for 'financial return' whilst 'native forestry' receives a score of 3, 'exotic forestry' a score of 2

and 'sheep and beef farming' a score of 1. Under 'resilient to market changes' 'hunting and tourism' falls to a score of 3 and the remaining alternatives all receive scores consistent with the 'financial return' sub-criterion.



Figure 48: Performance of alternatives on 'economic' criteria (M2 ST3)

6.5.8 Sensitivity analysis M2 ST3

The sensitivity graphs for the first level criteria in relation to the 'land use value' are presented in Figure 49. With an increase in weight to ~ 0.7 the importance of 'sheep and beef farming' surpasses that of 'exotic forestry' which is less sensitive to a weight change under 'social and cultural'. 'Native forestry' and 'hunting and tourism' are also moderately sensitive to a weight change under 'social and cultural' and their importance correspondingly increases. 'Hunting and tourism' is shown to be very sensitive to a weight change under 'environmental' and its overall performance falls rapidly, eventually falling below 'exotic forestry' at ~ 0.6 and 'sheep and beef farming' at ~ 0.9 . The importance of 'native forestry' increases moderately under 'environmental'. 'Native forestry' is shown to be the most sensitive to an increase in weight for the 'economic' criterion, and its importance falls below 'hunting and tourism' (which rises moderately) at around a ~ 0.6 weighting. 'Exotic forestry' and 'sheep and beef farming' both show

sensitivity to a weight increase and their importance falls under the ‘economic’ criterion.

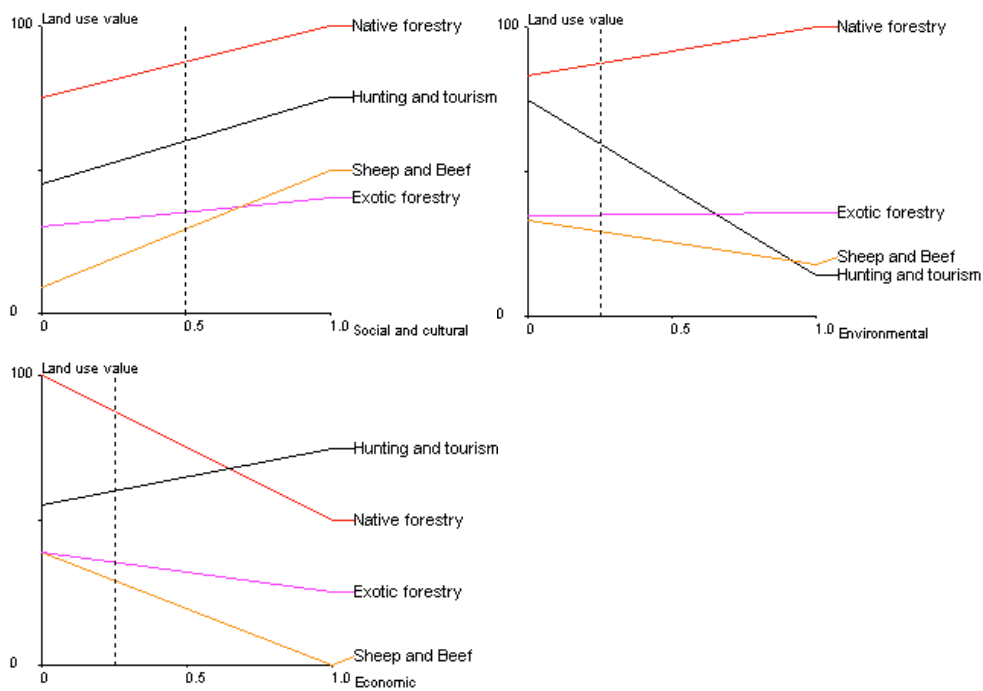


Figure 49: Sensitivity graphs showing the effects of weight changes on first level criteria in relation to overall scores (M2 ST3)

6.5.9 Summary and conclusion of MCA results

This chapter has detailed findings from three streams of research. The Nuhiti Q case study was conducted in 2017 and provided a grounded case study which detailed the experience of a Māori landowning entity participating in the NZ ETS. This study has highlighted the circumstances of the Incorporation and the rationale for retirement of land into permanent native carbon forests. The case study has further detailed the opportunities, risks and barriers pertinent to Māori landowners when considering transitioning to carbon farming as a land use.

The key informant interviews in the qualitative component of the MCA generated data for use in the quantitative component of the MCA and detailed wider land use issues in Te Tairāwhiti and the Waiapu catchment. The MCA results highlight

the values Māori landowners associate with existing and emerging land uses. Native forestry was shown to be overwhelmingly preferred across a number of land use models – largely to the detriment of sheep and beef farming and exotic forestry. The MCA also highlighted that emerging land uses such as medicinal cannabis and hemp are associated with more socio-cultural, environmental and economic benefits than existing land uses such as sheep and beef farming. The following chapter frames these findings in the context of the wider literature and also explores the significance of these results for land use decision making in the Waipua catchment.

7 Discussion

Whilst it is clear that carbon farming native forests is a land use advocated for Māori landowners by external institutions, there has been little empirical work to date assessing Māori landowners' preferences for carbon farming as a land use, and further, how this land use option is valued when compared with other existing or novel land uses. This research further investigates what characteristics of various land uses in the Waiapu Catchment are valued by Māori landowners, and why (Warmenhoven et al., 2014). Accordingly, it has utilised a novel approach of grounding the inquiry in a case study of a Māori sheep and beef farming incorporation (Nuhiti Q) which entered the NZ ETS, using regenerating native forests on the erosion prone, marginal areas of Nuhiti Q's farmland to sequester carbon. In keeping with the transformative action research approach to this study and the tenets of Kaupapa Māori Research (KMR), the findings of the Nuhiti Q case study have informed the second component of this PhD research.

In contemplating the results of the Nuhiti Q case study, and reflecting on the literature concerning land use change in Aotearoa, it became clear that the research was at risk of perpetuating a long and chequered history in the Waiapu catchment (as with many areas of Aotearoa) whereby an external advisor, researcher or government analyst would interpret the evidence about optimal land uses in ways that neither align with the values of the hapū or wider community nor, in fact, necessarily suit the characteristics of land in the Waiapu Catchment. This recognition was underlined by wider themes encountered throughout the research process regarding climate equity and justice, climate policy uncertainty, and the need for wider consideration to be given to the role of indigenous peoples in mitigating and adapting to climate change (Gerrard, 2012).

Furthermore, within the Aotearoa context, attention needs to be given to issues of fairness and equity when considering the choice by Māori landowners to enter (or otherwise) post-1989 forests into the NZ ETS. Issues of fairness and equity

arise in part because of the history of land alienation and confiscation at the hands of colonists. The land historically alienated by Pākehā through various legitimate and illegitimate means was in large part the low lying, easily accessible and fertile land. Māori currently retain little of such land, and own a disproportionate share of the steeper, marginal land in Aotearoa. This constrains the land use options available to them (Harmsworth & Mackay, 2010).

These themes have informed the approach taken in the second half of this study, whereby I have sought to ascertain the wider land use preferences and views about the benefits associated with a variety of different land uses by Māori landowners, before offering back any findings about land use choices or planning. Therefore, the first component of this research has focused exclusively on carbon farming as a suitable land use, and the second component has focused on wider land use issues so as to assist with the land use planning process. At all points, I have refrained from offering external advice about the ‘best’ options for Māori landowners in the Waiapu catchment. I have also been careful to be transparent about the method of analysis of options which I adopted, in order to ensure that Māori landowners have been entirely comfortable with the processes involved. This approach is consistent with Vatn’s ‘social human’ perspective, rather than the ‘rational economic man’ approach more commonly seen in economic analysis of investment options¹¹.

The results to be discussed here are firstly, those of the Nuhiti Q case study, and second, the qualitative results of the MCA study (key informant interviews), followed by the quantitative component of the MCA study. Results are discussed within the context of existing research on the Waiapu catchment. The MCA

¹¹ See Vatn (2015) for a more detailed explanation of the differences between a social human perspective and the ‘rational economic man’.

methodology used is also critically appraised, with conclusions drawn as to its applicability in drawing out and deliberating on values associated with land uses. Alongside discussing the limitations of this research approach, the contributions of this research to wider social scientific understanding of the value Māori landowners associate with various land uses are considered and areas of future research suggested.

7.1 Opportunities, barriers and risks for Māori landowners under the NZ ETS

7.1.1 Nuhiti Q's participation in the NZ ETS

The opportunities and barriers highlighted in the literature align, to an extent, in Nuhiti Q's experience participating in the NZ ETS. Nuhiti Q, as represented by the chairperson Nikki Searancke, are firm in their belief that entering the NZ ETS and retiring unprofitable areas of the farm was critical to the continued success of the Incorporation. The pressures faced by Nuhiti Q are typical of those faced by the vast majority of Māori landowning entities in Te Tairāwhiti. Over 95 percent of Nuhiti Q's land is classed as LUC 6, 7 or 8, which indicates moderate to severe land use capability constraints. The omnipresent threat and impact of erosion was a factor which stretched the capacity and limited the profitability of Nuhiti Q before and after the incorporation of other whānau-affiliated land blocks. Difficulties accessing capital beyond a seasonal bank overdraft left Nuhiti Q in an 'underdevelopment trap' (Tímár, 2011), where capital for intensification or diversification of the core farming business was exceedingly difficult to access – a situation aptly summed up in the following quotation:

So, we had a balance sheet issue, eroding equity, and we had a land issue, eroding land. So, what does that tell you in the end? It says to you change is imminent. And plan for it. NS17a

The large acreage and poor quality of much of Nuhiti Q's land pre-retirement led to stock being of a 'poor quality' before being sent to the freezing works. Adding

to this, the undercapitalisation of the Incorporation meant areas of fencing were in states of disrepair and stock were able to escape both before and after erosion events which ‘flattened fence lines’. The impact of erosion and challenges with profitability faced by Nuhiti Q are a local reflection of wider regional processes of erosion (Awatere et al., 2018; Barnard et al., 2012; Warmenhoven et al., 2014) and liquidity constraints on, or under capitalisation of, Māori land owning entities at a national scale (Kingi, 2008b; Tímár, 2011).

Compounding the economic and environmental challenges of Māori land management in Te Tairāwhiti are the need to manage the interests and expectations of the shareholder base. Kingi (2008b) discusses what can often be a tension between majority and minority shareholders, with the latter often having the ability to outvote the former. This can often lead to risk averse, conservative land use decision making. A related concern, particularly when advocating novel land uses such as carbon farming, is that the shareholding base or management committee can be sceptical about land uses which differ from the status quo. For Nuhiti Q, the opportunity cost of land retirement was considered too high before the advent of the NZ ETS, and the shareholding base expected all areas to be farmed.

This was a challenge Nuhiti Q had to contend with, and the merits of land retirement and NZ ETS entry relative to sheep and beef farming had to be explicitly put to the management committee and shareholding base at AGMs. Whilst exotic forestry and sheep and beef farming have been prone to environmental and economic shocks, they remain significant employers in the region, and many of Nuhiti Q’s shareholders will have been directly employed in one of those industries. Considering that Nuhiti Q’s core business is sheep and beef farming, there was an understandable desire that the Incorporation focus on the core business and not move into unknown land uses.

The decision to retire land and enter the NZ ETS was not simply a reaction to environmental and economic pressures. There was a clear element of forward planning to address a number of factors such as endurance of the landform, protection and maintenance of wāhi tapu areas and ensuring carbon neutrality if and when agriculture was brought into the NZ ETS. A key underlying factor appeared to be ensuring the Incorporation was resilient, not as an end in itself, but to limit vulnerability and promote sustainability. Resilience was seen not only in the sense of sustaining the land, but also from a financial perspective to ensure that the Incorporation was profitable into the future. There is very little awareness of the NZ ETS amongst Māori landowners in Te Tairāwhiti, and the establishment of new native forests in the region is primarily driven by desires to advance kaitiakitanga objectives by improving the quality of water, resilience of the land and access to rongoā and other customary resources (Pohatu et al., 2019).

When queried specifically about the social and cultural co-benefits offered by native forests, Nikki Searancke did not frame the decision to enter the NZ ETS as key to providing these co-benefits. But it did factor into this calculus. The decision was centrally framed around ensuring the land endures, i.e. an *environmental* and *cultural* rationale, and more importantly as an opportunity to retire the most unproductive areas of the farm but nevertheless earn an income from these areas. Ensuring carbon neutrality was also an important factor. However, ensuring profitability of the Incorporation was the primary motivation, with socio-cultural and environmental co-benefits alongside.

Nuhiti Q is unusual in a sense as there is a strong and engaged management committee, actively involved in the governance of the Incorporation. The Incorporation employs between four and five full time farm workers and has been an established farming incorporation since 1987. Whilst Nuhiti Q has certainly had its share of difficulties, these may not be representative of the wider group of Māori landowning entities in the Waiapu catchment and Te Tairāwhiti. Nuhiti Q

probably occupies a median space between extremes of capacity and capability. In Te Tairāwhiti there are highly successful sheep and beef farming entities such as Whangara farms (incorporation of Whangara B5, Pakarae A and Tapuwae Whitiwhiti - north of Gisborne¹²) and Mangatu Incorporation (incorporation of tens of land blocks west of Gisborne and throughout Te Tairāwhiti) which both farm thousands of hectares, alongside diversified agribusiness, viticultural and silvicultural interests. At the other end of the spectrum are numerous land blocks with no governance entity, no road access, significant rates debt, uncontactable/unknown shareholders or land dominated by exotic pest plants such as gorse which conspire to make any land development decisions exceedingly difficult and fraught (Harmsworth et al., 2010; Kingi, 2008b). Thus, the experience of Nuhiti Q, at the time it was attempting to enter the NZ ETS, is unlikely to be representative of other Māori landowning entities.

7.1.2 Importance of capability to engage with bureaucracies

The diverse skillset of Nikki Searancke was considered an instrumental factor by other interviewees in Nuhiti Q's successful navigation of the technical and administrative requirements associated with determining land eligibility status, accessing ECFP funding and forming a joint venture partnership with Craigmore Sustainables. Nikki Searancke is a trained accountant and has a work history in policy development, and whilst she expressed frustration at difficulties entering the NZ ETS and accessing external finance, these endeavours were ultimately successful. It remains unclear whether Nuhiti Q would have been able to make it into the NZ ETS without Nikki Searancke at the helm, let alone Māori land blocks

¹² <https://farmersweekly.co.nz/section/other-sectors/on-farm-story/farming-by-the-numbers>

with no management structure, or governance members with the requisite skillset to negotiate the opaque bureaucracy of government agencies.

Nuhiti Q is likely the exception and not the rule. A joint venture partnership with Craigmore Sustainables was critical for the capitalisation of a large scale fencing project which was essential to satisfy NZ ETS stock exclusion requirements. The expertise that Nuhiti Q was able to draw on through the partnership with Craigmore Sustainables was critical to effectively navigating the application process for the Erosion Control Funding Programme (ECFP), and then the NZ ETS. Whilst the challenges associated with those processes would not have been insurmountable, they smoothed the way for Nuhiti Q and made participation in the NZ ETS more feasible.

7.1.3 Merits of direct relationships with NZU buyers

One of the key aspects of Nuhiti Q's participation in the NZ ETS that made this a useful case study has been the partnership with Gull NZ, and the ability of Nuhiti Q to achieve a better price than that on the spot market, with the NZUs sold to Gull NZ. This relationship highlighted the importance of Nuhiti Q as a case study, as they were not only the first of the first Māori NZ ETS participants utilising regenerating post-1989 forest land but appear to have been amongst the first to form a relationship of this kind. Employing a forward contract was also a novel approach to ensure surety of income for Nuhiti Q, and surety of NZU supply for Gull NZ. Nuhiti Q were able to secure a 75c price premium on the first tranche of credits forward traded to Gull NZ at 1 May 2017. Yet when the price at the second transfer date at 30 April 2018 is considered, the forward contract - which was signed in 2017 – saw Nuhiti Q receive \$3.10c less than the spot price at that time, resulting in \$11,100 less revenue than if NZUs had been traded at the NZU spot price on the NZ ETS market.

There are positive and negative aspects of this contractual relationship, as Nuhiti Q were able to effectively market the 'greater good' associated with carbon credits produced using native forests on indigenous, ancestral land which Gull NZ used in a press release and social media. It is however surprising that Gull NZ did not market this relationship beyond a press release at the time (see appendix A.5). Similarly, whilst the General Manager of Gull NZ was supportive of the approach and the partnership and was content to explore similar partnerships with Nuhiti Q and other Māori landowners, he admitted that the bulk of Gull NZ's carbon procurement would be through the spot market at lowest cost. Gull NZ saw the partnership with Nuhiti Q as more a reflection of the company's ethical stance than as a core component of their overarching corporate social responsibility goals. However, it was stated that, where possible, Gull NZ will seek to *'look to the better good they can do for the communities they operate in'* (DB17).

These results fall in line with recent research by Hale and Kerr (2019) which indicated a preference by some emitters to buy NZUs from Māori land owners if adequate quantity is ensured. Multi-year contracts of the sort established between Nuhiti Q and Gull NZ are not favoured by other emitters, because of a lack of standardisation in contract format, and uncertainty in future NZU price or NZ ETS policy (Hale & Kerr, 2019). The forward contract which provided NZU price certainty for both parties in 2017 ultimately worked against Nuhiti Q at the second transfer date due to the increase in NZU price; but the spot price could have fallen. Forward contracts are likely best suited to suppliers when the NZU price is fluctuating or could fall in the future. Thus, these contracts may become more uncommon in the future if the NZU price continues to steadily rise and suppliers are more content to hold on to their NZUs and trade on the market when it suits them.

7.2 Considerations pertinent to Māori landowners engaging in carbon farming

Some barriers Māori landowners may contend with when entering the NZ ETS were not relevant for Nuhiti Q. As indicated in the literature, a lack of governance capacity and capability can inhibit the efficacy of the land use decision making process (Harmsworth et al., 2010). Evidence indicates that 58 percent of Māori landowning entities have no governance structure (Māori Land Court & Office of the Chief Registrar, 2019), and other evidence indicates that for those that do, land use decision making can be a time consuming and difficult process (Dell, 2017). Likewise, decision makers may be unaware of the opportunities offered by carbon farming on their ‘marginal’ land and/or the eligibility status of their land (Pohatu et al., 2019). They may also be dissuaded by costs, and perceptions regarding the complexity of the NZ ETS (Funk et al., 2014; Patterson, 2011). Yet, for Nuhiti Q, a well-resourced and engaged management committee – spearheaded by Nikki Searancke – overcame this challenge. It is expected that this may not be the case for other Māori landowning entities – in particular, those without a clear governance structure, or ahu whenua trusts managing small areas of isolated land.

Risks identified in the literature regarding the provision of NZUs are also relevant in the case of Nuhiti Q. When supplying NZUs through sequestration there are always environmental risks from fire, pestilence or storm damage that can reduce the carbon stock in a forest, which renders a landowner liable to buy and surrender units to cover the amount of carbon lost (MPI, 2015b). This risk can be reduced by purchasing insurance. In the case of Nuhiti Q, this action was not considered necessary. Other risks for Māori landowners, particularly when using native forests for carbon farming, is that of the trees not sequestering carbon at rates indicated in national ‘look up tables’ provided by MPI. If landowners are unaware of the sequestration rates of native trees as opposed to their exotic

counterparts (natives sequester at roughly 1/3 the rate of exotic trees) the returns may be disappointing and unsatisfactory in the short term (Carver & Kerr, 2017).

Landowners themselves need to have some familiarity and comfort with the carbon market, its drivers and likely future prospects, especially given trajectories and uncertainties in climate change developments (Kunreuther et al., 2014). They also need to be able to access high quality financial advice. For example, on current indications (abstracting from the shorter-term effect of Covid-19), the price of carbon will keep rising, probably faster than many market interest rates, which could suggest not selling in the short term any carbon units earned from afforestation, but waiting until the price of units rises, and where necessary borrowing against that future price for urgent capital needs. Another more fundamental risk is the potential overexposure of Māori landowners to the NZ ETS, and the restrictions that carbon farming places on future generations of landowners, which could become tightly constraining if land use changes are desired. This will be expanded upon in depth in latter sections.

Reaching a decision to participate in the NZ ETS is a costly and often convoluted process for Māori landowners. Information asymmetries no doubt play a part in this process, with evidence indicating that there is a lack of awareness of the multivariate opportunities, risks and barriers offered by carbon farming (Cortés Acosta, 2019; Pohatu et al., 2019). Another significant issue for Māori landowners, when considering carbon farming, is the cost associated with entry. Tuahine (2018) indicates that the NZ ETS application fee required by MPI is \$562.22, but this does not include costs associated with determining land eligibility (through a forestry consultant or otherwise). Ongoing costs will be incurred if the forest is larger than 100 ha – beyond this level the Field Measurement Approach must be used to determine the carbon stock in the forest. However, the most significant and onerous cost in the case of Nuhiti Q and likely any other landowner retiring farmland into the NZ ETS is ensuring that the forest is stockproof, and the fencing is of an adequate standard to ensure this. Beyond these tangible factors are the

intangibles, such as the scepticism with which many view a novel land use, or the general mistrust of government land development policy in this area (Barnard et al., 2012).

Where there is a disconnect between the perspectives of participants in this research and that of some other recent literature (see for example: Pohatu et al., 2019) is around the reasons why landowners choose to engage in the NZ ETS. Bryan McKinlay and participants [E2 land use practitioner] and [E10 forestry 2], indicate that for Māori landowners, it has been difficult to sell the environmental benefits of native reversion if there is no financial benefit behind it. Yet, Pohatu et al. (2019) find that for some Māori landowners, carbon revenue from native forest carbon farming is a bonus with environmental and kaitiakitanga benefits as the key benefits.

The present study suggests that the imperatives and values of the landowning entity around what is expected in regard to returns from the land, and how environmental co-benefits are weighed against economic returns, are critical factors when looking at the participation of Māori landowners in the NZ ETS. Another relevant factor appears to be the historic profitability of the landowning entity, and what expectations shareholders have regarding continuation or change of the core business model. For those landowners who have never earned a sustainable return from their land, carbon farming may be a much more attractive proposition as it offers a variety of co-benefits and a return over and above that which was previously earned. Yet for the larger more established Māori incorporations who have a profitable history in a certain land use such as sheep and beef farming or exotic forestry, there may be fewer incentives, or a reduced appetite amongst the management committee and wider shareholding base to carbon farm native forests, unless faced with strong pressures, such as erosion in the case of Nuhiti Q.

7.3 Nuhiti Q's participation in the NZ ETS and its wider relevance

It would seem that the largest barriers to the participation by Māori landowners in the NZ ETS, and developing joint venture partnerships such as with Craigmore Sustainables and Gull NZ, is the often isolated nature of some Māori land, together with under-resourced (both in terms of human and monetary capital) land management structures (Insley, 2010). In Te Tairāwhiti, a considerable amount of Māori land is eligible for entry into the NZ ETS; however, landowners are hesitant to access opportunities offered through this scheme. These predominantly include scepticism about an untried/untested land use borne out of decades of mistrust in local and central Government policy in land development (Porou et al., 2012). Beyond this, decision makers for the landowning entity may be simply unaware of the opportunities afforded by the NZ ETS or, alternatively, aware of the opportunities but dissuaded by perceptions of the complexity or risks of the scheme.

Alongside all these challenges there are also cultural imperatives for Māori landowners, to ensure that the land is managed in such a way as to ensure it endures for future generations. Yet, it was made clear throughout the interviews in the Nuhiti Q case study that Nuhiti Q continues to be a farming incorporation. The shareholders expect the land which has been vested with the Incorporation to be farmed – and indeed, Nikki Searancke made frequent mention of her ancestors, and their farming ethos, which has led to a desire to continue farming the land in such a way as to manage, and balance, the variety of pressures.

Through the formalisation of a 100 year plan, Nuhiti Q had set out goals to ensure the farm is maintained, consolidated and built upon for the betterment of current and future generations. To ensure this was the case, the Incorporation had to accept a degree of environmental degradation through erosion – an inevitability for all *pastoral* land in Te Tairāwhiti. This reality conflicted with other desires amongst the management committee and shareholding base, that Nuhiti Q

remain an area of land of particular cultural significance for Ngāti Wakarāra and to ensure that wāhi tapu are protected. While resolving these tensions, Nuhiti Q remains in an unenviable position where economic imperatives still conflict, to an extent, with environmental and socio-cultural imperatives – a commonplace situation for many landowners (Harmsworth et al., 2010; Kingi, 2008b). However, it would be misguided to assume that the proud farming tradition of Nuhiti Q, and of contemporaneous Māori landowning entities, does not factor into future land use decisions, or to assume that nothing can be done to ease conflicts among goals. For the management committee of Nuhiti Q, farming in a sustainable manner suitable for the characteristics of their land meant not applying synthetic fertiliser, ensuring riparian margins around waterways are maintained, stocking animals at low levels on the steepest and erosion prone areas of the farm, and fencing off wāhi tapu areas. These actions achieved dual purposes; satisfying the competing demands of shareholders; honouring the legacy of their forebears and maintaining the core business to satisfy the bank and shareholders.

Yet, the land Nuhiti Q farms simply could not sustain continued pastoralism across the entire landholding. The Incorporation is fortunate in the sense that the advent of the NZ ETS offered an opportunity to rebalance competing imperatives by offsetting the opportunity cost of removing land from pastoral production. The most degraded areas of the farm could be retired (freeing up resources and employees to concentrate on more profitable areas of the farm) but still earn an income from the sale of NZUs, and the increase in native bush protected the landform and wahi tapu, stimulated biodiversity and vastly reduced incidents of erosion and fencing maintenance.

It can therefore be argued that, by entering the NZ ETS and carbon farming native forests, Nuhiti Q has moved to rebalance the demands and imperatives of the Incorporation and the wider shareholding base. Partnerships with Craigmore Sustainables and Gull NZ have contributed to the success of a large scale fencing programme and ensured that the land vested in the Nuhiti Q Incorporation can

endure for future generations. Beyond this, further diversification of the Incorporation's core business has led to investment into an organic macadamia orchard and a lease agreement with a mānuka honey company to ensure Nuhiti Q's income is more resilient to fluctuations in sheep and beef markets. Diversification has also occurred alongside intensification of the better quality, less erosion prone land, which has led to better quality stock which command a higher price at market. The increase in native bush is confidently expected to protect the landform and wāhi tapu, stimulate biodiversity and vastly reduce incidents of erosion and fencing maintenance. Income from NZUs, mānuka honey, macadamia nuts and sheep and beef has led to a more economically resilient incorporation, but also seen significant environmental and socio-cultural co-benefits that, whilst difficult to measure monetarily, have helped to bolster Nuhiti Q's reputation amongst its shareholders and as a forward thinking leader amongst Māori landowners in the region and throughout Aotearoa.

7.4 Values Māori landowners attach to land use options

Table 17 reiterates the land use alternatives identified through this wānanga and MCA process. Key informants in the process were sought from a variety of fields (land management, Māori land administration, local council, forestry etc.) so that they would be able to suggest a broad and representative set of novel and existing land use options.

Table 17: Land use alternatives considered by participants for flat and steep land: two MCA models

Model 1: flat land	Model 2: steep land
Native forestry: mānuka, kānuka, tōtara	Native forestry: mānuka, kānuka, tōtara
Exotic forestry	Exotic forestry
Sheep and beef farming	Sheep and beef farming
Perennial horticulture: blueberries, apples and nuts	Hunting and tourism
Medicinal cannabis and hemp	
Cropping: kumara	
Cropping: maize	

NB: These two columns represent two separate multi-criteria analysis exercises. Model 2 developed into three distinct sub-models.

7.4.1 Overwhelming preference for native forestry

A surface level synthesis of the findings across all four of the MCA models indicates that Māori landowners in the Waiapu catchment overwhelmingly prefer ‘native forestry’ as a land use (see also Figure 51, Figure 52, Figure 53), whether for flat or steep land. This is largely because ‘native forestry’ is associated most strongly with environmental benefits such as ‘erosion control’, ‘biodiversity’ and ‘water quality’. This land use alternative was also most closely associated with the social and cultural benefits of ‘reconnection with the whenua’, ‘mana motuhake’, ‘skills development’, and ‘employment’. Moreover, as the sensitivity analyses presented for each model indicate, the preferred land use alternatives across the four models were remarkably robust and exhibited little sensitivity to changes in weighting. The following sections discuss the performance of the other land use alternatives together, and all criteria groupings. Due to the significant polarisation

seen in the scoring of alternatives by one group (Flat land model 1), the results are discussed with reference to decision making theory (heuristics and biases).

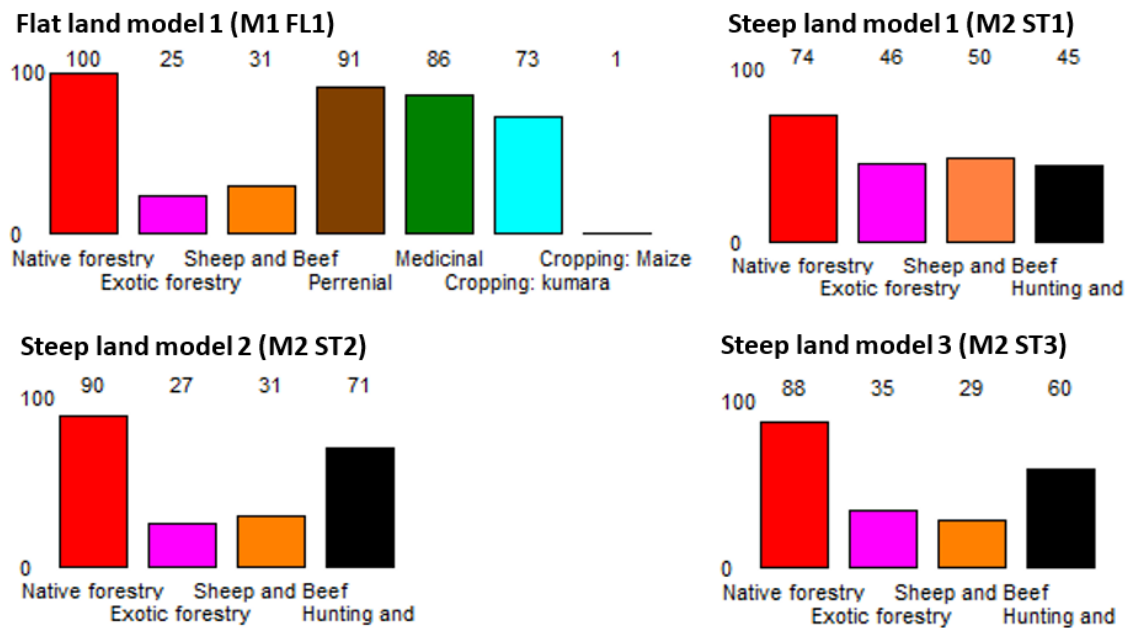


Figure 50: Aggregate 'land use value' scores for all four models (incorporating environmental, social-cultural and economic scores) for M1 FL1 and M2 ST1-3. NB: 'Hunting and' refers to 'Hunting and tourism'.

When the land use alternatives are evaluated against 'social and cultural' criteria across all of the models, as seen in Figure 51, a clear pattern is evident. 'Exotic forestry' is well regarded for its 'skills development' and 'employment' benefits, but across all models its performance falls for 'reconnection with the whenua' and 'mana motuhake'. Two models, steep land model 1 and 2, saw the performance of 'exotic forestry' score high in terms of the benefits of 'community infrastructure' and 'knowledge and awareness', yet this was not seen in flat land model 1 or steep land model 3. To a lesser extent, 'sheep and beef' follows a similar pattern across the models as it performs relatively well on 'employment' and 'skills development', before tapering off to a middling score for the remaining 'social and cultural' benefits. However, in steep land model 1, the performance of 'sheep and beef' in terms of 'reconnection with the whenua' and 'mana

motuhake’ was considerably poorer than in the other models. This scoring appears to contradict findings from the key informant interviews, in particular, that land uses such as sheep and beef farming can act to reconnect landowners with their whenua if the management structure involves input from the wider shareholding base, and regular seasonal decisions [E2 land use practitioner]. This finding is explored in greater depth below.

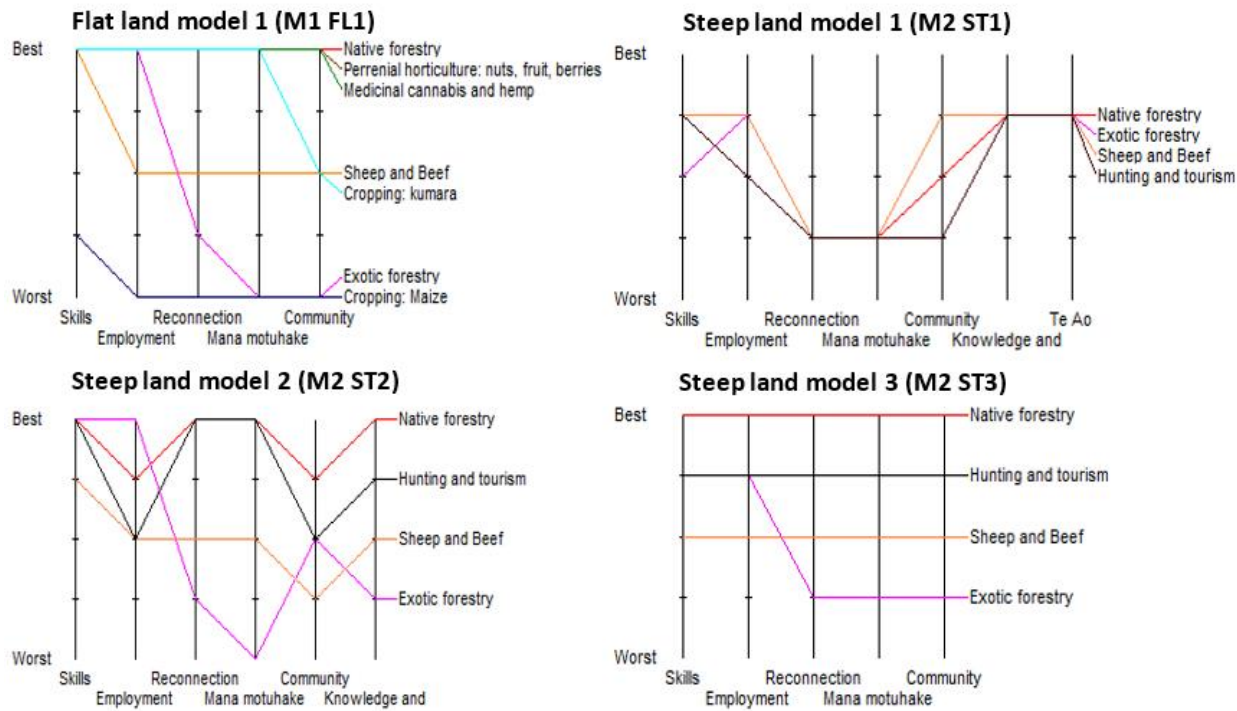


Figure 51: Comparative performance of land use alternatives across all models on ‘social and cultural’ criteria

It is only for the ‘steep land models’ that ‘hunting and tourism’ was considered as a land use alternative. In the steep land models, ‘hunting and tourism’ generally performed well on ‘skills development’, before falling away on ‘employment’. It is difficult to be definitive about the importance of ‘hunting and tourism’ across the three steep land models, as results on two of the models (steep land model 1 and steep land model 2) diverge, with steep land model 3 showing similar performances across the whole range of benefits.

Data from MBIE indicates that whilst the Gisborne East Coast district is a tourism destination, it has one of the smaller shares of the tourism market in Aotearoa¹³. Further exploration of tourism websites relevant to Te Tairāwhiti region indicates that many of the tourism operators are well established in the region and largely offer experiences around Gisborne (historical tours, diving, cycling, vineyards etc.¹⁴) Tourism opportunities further north of Gisborne are not as well established. An investigation of various tourism websites catering to the Waiapu catchment/East Cape indicates organised tourism is largely centred around climbing Maunga Hikurangi, and adventure tourism such as mountain biking and horse trekking. There is also emphasis placed upon tours of historical buildings and monuments – but this caters more to the scenic tourism market, capitalising upon the natural scenery on offer.

Whilst there was evidence of hunting being offered as a tourism venture, this was often offered by ‘out of town’ firms, who had access to hunting blocks in the Waiapu Catchment and wider Tairāwhiti region. Undoubtedly tourism and, to a lesser extent, hunting (paid guiding or access to hunting blocks) have growth potential, but there is little evidence that these ‘land uses’ are so far ‘taking off’. Perhaps boosted by association with the high scores ascribed to relatively new land use alternatives such as ‘perennial horticulture’, and ‘medicinal cannabis and hemp’, ‘hunting and tourism’ has received high scores, but it seems there may be

¹³ Annual tourism spend grouped by territorial authority, region, and country of origin and product category. Accessed at: <https://www.mbie.govt.nz/immigration-and-tourism/tourism-research-and-data/tourism-data-releases/monthly-regional-tourism-estimates/latest-update/annual-tourism-spend-grouped-by-ta-region-country-of-origin-and-product-category/>

¹⁴ Tourism information from: <https://tairawhitigisborne.co.nz/visit/culture-and-historic/tours-and-experiences/>

an element of bias in the scores. This will be discussed in greater depth in later sections.

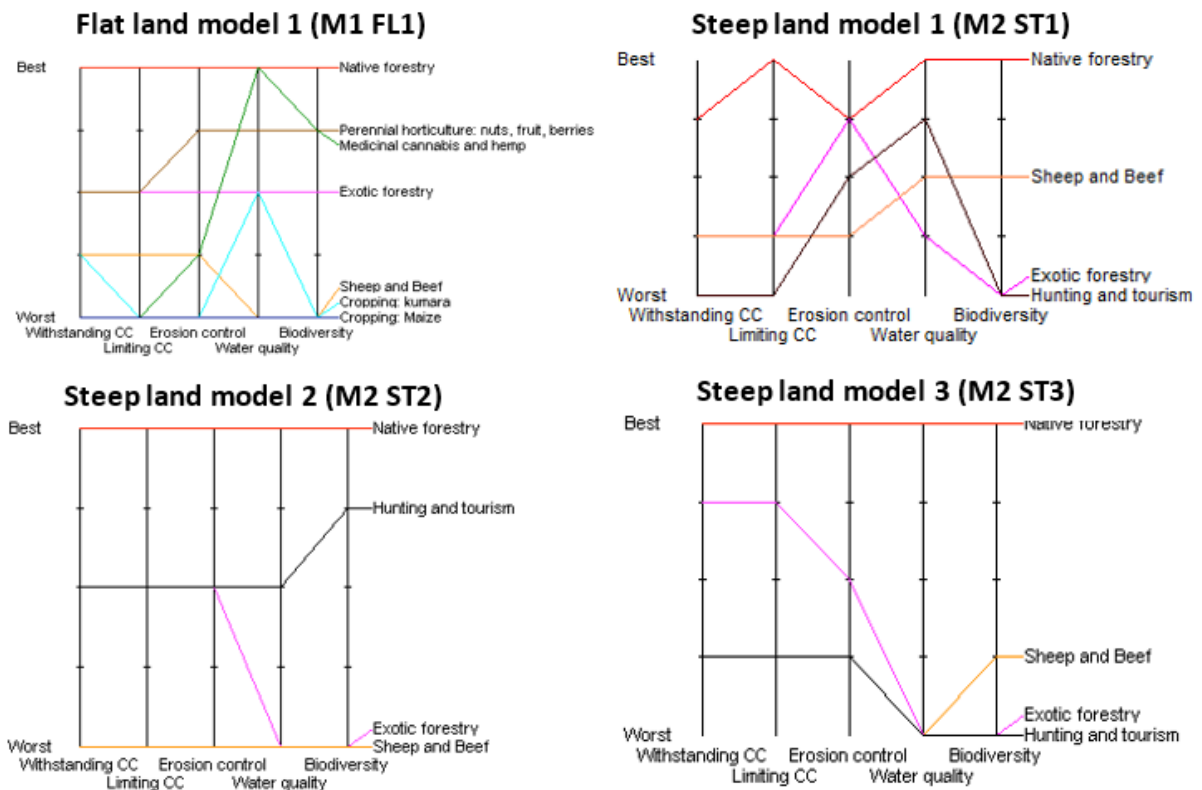


Figure 52: Comparative performance of alternatives across all models against 'environmental' criteria

When the land use alternatives across all models are compared against 'environmental' criteria (seen in Figure 52) there are fewer obvious similarities across models, compared to the similarities shown in Figure 51. What is however clear is that 'sheep and beef' consistently performs most poorly in all models across all 'environmental' criteria. This is unsurprising when the geophysical characteristics of the Waiapu catchment are considered.

Land use changes from a catchment dominated in its entirety by native forest (Awatere et al., 2018), to one where pastoral sheep and beef farming dominated hill country and dairy farming dominated lowland areas, has led to the formation

and deepening of numerous gullies (across the Waiapu catchment and wider Tairāwhiti region) now unprotected by native bush cover. This has further led to more extensive and severe erosion, gullying, slope failure and a serious decline in the health of the Waiapu river and its tributaries (Awatere et al., 2018; Harmsworth et al., 2002; Harmsworth & Warmenhoven, 2003; Warmenhoven et al., 2014). As mentioned, much of the *Pinus radiata* afforestation (beginning in the 1960s with further government led efforts in the late 1980s post-Cyclone Bola) was initiated to treat and protect erosion prone land in the area, yet this land use change has itself led to numerous environmental issues (described in previous sections). Considering this history of land use degradation resulting from land use change in the Waiapu catchment it is unsurprising that participants across all models have consistently scored 'sheep and beef' poorly on all 'environmental' criteria.

A similar argument can be made for 'exotic forestry'. However, one interesting point to note is the poor performance of 'exotic forestry' on the two climate change criteria. It was expected that the superior short-term sequestration potential of exotic forest species would see 'exotic forestry' better reflected in terms of these criteria than perhaps any others. Yet the environmental degradation perceived to arise from exotic plantation forestry in the region will have no doubt influenced these middling to poor scores. Further to this point is the variable rating of exotic forestry in terms of 'erosion control'. Whilst widespread afforestation of *Pinus radiata* was a response to earlier, and poorly considered, land use change, there is clear evidence that exotic afforestation has worked to arrest erosion across the region (Marden et al., 2012). Old growth permanent native forests unquestionably have superior erosion control potential (Marden & Rowan, 1994), yet the fast-growing nature of exotic tree species means they are also a useful tool in highly degraded areas (Marden & Rowan, 1994). It was expected the performance of 'exotic forestry' across all models would be one of the best regarded under 'withstanding climate change', 'limiting

climate change' (concerning carbon sequestration potential) and 'erosion control'. Yet this was not the case. Possible reasons why this may be the case will be discussed in greater depth later in this section.

'Hunting and tourism' exhibits little consistency against environmental criteria across the steep land models. This could potentially arise because of the vagaries surrounding this land use, and potentially different interpretations of the activity. When this alternative was introduced it was generally related to forestry (both exotic and native) for both hunting and tourism opportunities. However, the relationship between a land use such as 'hunting and tourism' and environmental benefits is more intangible than the others under consideration.

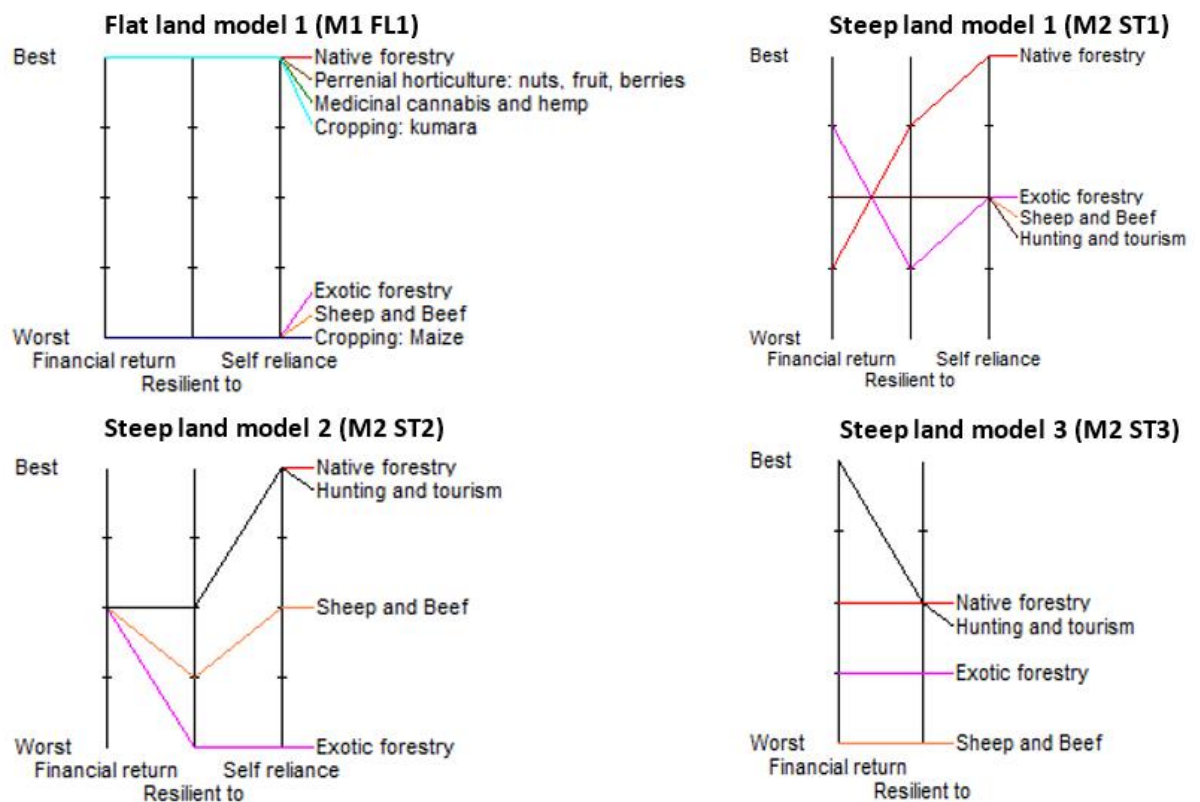


Figure 53: Comparative performance of alternatives across all models on 'economic' criteria. NB: 'Resilient to' stands for resilient to economic fluctuations

Figure 53, focusing on 'economic' criteria, also shows a 'mixed bag' in the performance of the alternatives in the steep land models. What is clear is that participants, particularly in steep land model 1 and 2 associated 'native forestry' with a high degree of 'self reliance' (steep land model 3 did not include this benefit in the evaluative process). Interestingly, whilst the 'financial return' of most land use alternatives in steep land model 1 and steep land model 2 were perceived as mediocre, 'exotic forestry' scored well in terms of this economic benefit. Perhaps this is indicative of the payments received by landowners after harvesting, or a reflection of the revenue afforded by the rapid carbon sequestration by exotic forests. 'Exotic forestry' and 'sheep and beef' scored poorly across all models in terms of the 'resilient to market changes' criterion but this may be a recognition of Aotearoa's exposure to fluctuations in global commodity markets for harvested wood products, and wool or sheep/cattle meat (Tomlinson et al., 2000). The performance of 'hunting and tourism' across the different models varies significantly but the pattern suggests that, at least in some instances, participants view 'hunting and tourism' as offering a relatively good 'financial return' and a moderate degree of resilience to market changes.

7.5 Heuristics and biases relevant to the performance of land uses in MCA models

Patterns of and biases in thinking can help in interpreting the deliberations of the groups involved in the MCA process, and their conclusions on the overall performance of each model (Bazerman & Moore, 2009; Kahneman, 2011). It was evident to me and the MCA co-facilitator that two of the MCA groups deliberated in a way that could be characterised as System 1 ('fast') thinking, as these groups provided near instantaneous answers to most judgements needed in respect of a land use alternative and its benefits (see conclusions on land use alternatives for flat land model 1 and steep land model 3). Consequently, these groups made their judgements more quickly than the remaining groups and it was in these

groups that the highest degrees of polarisation between land use alternatives was seen (Figure 50). The remaining two groups, steep land model 1 and steep land model 2 both took a longer period deliberating, and consequently, it seems, were less polarised in their views about the overall performance of the land use alternatives, and also amongst the various criteria families. These groups are hypothesised to have predominantly engaged in System 2 ('slow') thinking (an introduction is provided in section 3.2.7).

Clues as to why this may be the case can be seen in the make-up of the four groups in the MCA wānanga. Flat land model 1 (7 participants) comprised exclusively people who lived in the Waiapu catchment (barring the Pākehā local government observer) and were deeply embedded in the local community. Collection of employment data was not a part of this study, but it was clear that all participants of flat land model 1 had spent the majority of their lives (employed, unemployed or retired) in the locality and wider region. It is likely that this close connection with the land, and other community members, and a lifetime experiencing land use change and development in the area had significant bearing on their collective perception of certain land uses, in particular 'sheep and beef farming', 'exotic forestry' and 'maize cropping'. There was next to no disagreement when participants of flat land model 1 suggested ascribing low scores to all of these land uses, and if anything, some of the participants had to argue for higher scores for certain benefits such as 'employment'. Conversely, with nascent land uses such as 'medicinal cannabis and hemp', 'kumara cropping' and 'perennial horticulture', there was a high level of optimism about these land uses – even though there is scant evidence that these land uses are commercially successful in the Waiapu catchment. Instead, the dichotomous pattern in scoring likely lies in deep-seated negative feelings regarding the poor performing alternatives with the opposite being true for the high performing alternatives. This relationship will be explored later in the discussion.

The steep land model 3 group also exhibits polarisation in scores similar to that of flat land model 1. The two participants of this group were the oldest participants of the MCA. Both men were in their 70s and indicated that they had been employed in farming for the majority of their working lives. When pressed as to why they had given certain scores or weightings, these two participants easily described historical aspects of sheep and beef farming, or the development of exotic forestry in Te Tairāwhiti and their views on a variety of different topics of relevance to the research. In these discussions, the two participants had consistently negative views about 'exotic forestry' and 'sheep and beef farming' and were very clear in their belief that 'native forestry' should be the dominant land use alternative in the region. The main reasons for this view were the soil erosion associated with 'sheep and beef farming', the post-harvest residue – 'slash' – from clear-felled plantation forestry, and the poor economic returns from these land uses. It is hypothesised that these participants had well based and firmly held beliefs about the positive and negative aspects of the land uses in question, and no reconsideration was evident during the evaluative process. All deliberations were made quickly, and there was no disagreement from either participant, nor any desire to vary any scores when I or the MCA co-facilitator provided an opportunity to do so.

7.5.1 System 1 and 2 thinking

As discussed, the other two groups (steep land model 1 and steep land model 2) are hypothesised to have engaged in System 2 ('slow') thinking in their deliberations. It is not entirely clear why these models show less polarisation than the others. Perhaps the size of the groups has an influence – steep land model 1 and steep land model 2 both had five members whilst flat land model 1 had seven, and steep land model 3 two. More likely influential, however, is the make-up of participants in the groups. Steep land model 1 had two dominant members with tertiary qualifications who had spent a recent period working outside the Waipua catchment yet retaining strong links 'back home'. These participants extensively

deliberated every single judgement, and their results ultimately gave a lower weighting to 'native forestry' and a higher rating to 'sheep and beef farming' and 'exotic forestry' than that seen in the other models. It is possible that the time spent away from the area had allowed for more experience with other land uses including those under consideration. Looking at the results for the economic criteria across flat land model 1 and steep land model 3, the groups apparently using System 1 thinking were much more inclined to score 'exotic forestry' and 'sheep and beef' poorly on 'financial return'.

Examples of the limits of System 1 thinking are readily visible in flat land model 1 when viewing the overall performance of the alternatives on 'environmental' criteria (Figure 52), and comparing scores of 'exotic forestry' against 'perennial horticulture' and 'medicinal cannabis and hemp'. Whilst 'perennial horticulture' and 'medicinal cannabis and hemp' no doubt provide 'water quality' and 'erosion control' benefits, it is difficult to argue that these surpass the ability of 'exotic forestry' or 'native forestry' to stabilise steep slopes and reduce sediment discharges, except in the relatively short period after exotic forestry has been felled. It is likely disingenuous to say that 'perennial horticulture' has equivalent carbon sequestration potential to that of 'exotic forestry' (represented by the criterion 'limiting CC').

Further, in flat land model 1, the scores assigned to land uses against 'economic criteria' (seen in Figure 53) exhibit the highest incidence of polarisation across all the MCA models. In facilitating the MCA wānanga, we placed significant emphasis upon the provision of accurate, objective financial information regarding the potential returns from the land uses under consideration, even though these figures were qualified with a warning that they were estimates, and not likely representative of actual returns. However, the fact sheets were not widely consulted in either of the wānanga, and it seems that the participants assigned scores more in line with their own perspectives of the land use under consideration rather than using the fact sheets as informative aids to base their

decisions on. This could be problematic, because there is very little reliable economic information available regarding 'perennial horticulture' and 'kumara cropping' for Te Tairāwhiti, and even less for 'medicinal cannabis and hemp'. So, whilst these 'unknowns' were overwhelmingly favoured over the 'knowns' ('sheep and beef farming', 'exotic forestry' and 'maize cropping') the basis of the 'economic' judgements made seems to have been more gut feeling than objective evidence or experience.

As mentioned, the participants in the steep land model 2 group also took considerable time assigning scores and weights – partly because of a scoring system devised amongst themselves, but also because of extensive debates over every judgement. These participants held deep connections in the area, having lived in the community for many years. This may be why, for this group (in contrast to the conclusions of the steep land model 1 group), 'native forestry' so significantly outperforms the other alternatives under consideration ('sheep and beef farming' and 'exotic forestry' perform much less well): possibly these participants were less likely to see the positive and negative aspects of the land uses under consideration.

To sum up, it seems that the quick emotional responses as a manifestation of System 1 thinking may have had a direct bearing on the resultant scores of a number of land use alternatives, chiefly 'native forestry', 'sheep and beef farming' and 'exotic forestry' – but also, in the flat land model, land uses such as 'perennial horticulture', 'medicinal cannabis and hemp', 'kumara cropping' and 'maize cropping'. These results can be further interpreted using heuristic theory. Whilst the results appear to be influenced by cognitive biases that does not mean that these results are incorrect or wrong in any way – after all, these are simply subjective scores assigned to land uses in a hypothetical scenario.

7.5.2 Ease of recall bias (availability heuristic)

Alongside economic and socio-cultural issues, perceptions of the environmental impacts of exotic plantation forestry may also explain its poor performance in the MCA process. When exploring the environmental externalities of the exotic forest industry and its performance across all models of the MCA, it is useful to also consider the availability heuristic (the ease of recall bias). The ease of recall bias is defined by Bazerman and Moore (2009, p. 41) as “individuals judging events that are more easily recalled from memory, based on vividness or recency, to be more numerous than events of equal frequency whose instances are less easily recalled.” Recent events such as that in Uawa (in the Gisborne district) on Queen’s Birthday weekend 2018 (Rishworth, 2019), where extreme rainfall washed post-harvest forestry residue (‘slash’) off slopes, clogging up rivers, impacting private property, farmland and public infrastructure before being deposited onto the Uawa beach, would have factored heavily in the decision making processes of participants of the MCA. Whilst this was a recent and visceral event, it was by no means isolated or unique (Awatere et al., 2018; Barnard et al., 2012; Edwards et al., 2018; Tomlinson et al., 2000).

As discussed in more depth in previous sections, the rapid deforestation of Te Tairāwhiti beginning in the late 18th century led to an increased incidence of erosion, which only worsened over the century and in the worst instances, developed into ‘untreatable’ slips (Marden et al., 2012). Waves of government-led treatment of erodible land in Te Tairāwhiti (through exotic afforestation) began in the 1960s, with another spike in afforestation in the 1980s after Cyclones Bernie and Bola (Marden et al., 2012). After the partial privatisation of the New Zealand Forest Service in the 1980s, many thousands of hectares of formerly state-owned forests were privatised. The new forest owners had little mandate to account for the environmental externalities associated with clear-fell harvesting of these forests, and what has resulted in the Waipuu catchment and

wider Te Tairāwhiti has been persistent, periodic occurrences of slash washing off deforested slopes in high rainfall events.

There is mounting dissatisfaction about exotic forestry amongst community members in the Waiapu catchment (Newton & Espiner, 2019; Rishworth, 2019; Salmond, 2019; Tomlinson et al., 2000). In the light of this, it is believed the availability (ease of recall) heuristic is a significant factor which has influenced the performance of exotic forestry in the MCA wānanga we conducted. The availability heuristic reflects respondents' assessment of the probability or frequency of an event and the degree to which these events are 'available' in recent memory (Bazerman & Moore, 2009; Tversky & Kahneman, 1973). Like other judgement heuristics, the availability heuristic relies upon processes of substitution. For example, when we report the size, range or impact of a stimulus/event our judgement is influenced by the ease with which similar instances come to mind (Kahneman, 2011). Bazerman and Moore (2009, p. 9) underline this by stating that "an event that evokes emotions and is vivid, easily imagined and specific will be more available than an event that is unemotional in nature, bland, difficult to imagine, or vague."

Heavy media coverage of the environmental impacts of exotic forestry (see for example Rishworth (2019)), most recently in 2018 as a result of the Uawa event, alongside the lived experiences of those impacted by the forestry slash and the anger displayed at the wānanga and on social media, makes a strong case for the ease of recall factor affecting the rating performance of 'exotic forestry' in the MCA models. Another factor which may have influenced this performance is general community perceptions of forestry (Tomlinson et al., 2000), negative perceptions of the health and safety record of the industry (including trucking) and the use of external contractors throughout the plantation cycle (Porou et al., 2012). Interestingly, negative sentiment regarding the adverse impacts of 'exotic forestry' abuts the positive employment and skill development benefits of the industry, and the relatively high importance weighting on the sector across all

models. Participant [E3 forestry 1] noted that the ‘Uawa event’ happening *“every now and again but hundreds of jobs created is better than no Uawa event and a handful of jobs”* and questioned whether *“...the social impacts of people not employed, and on benefits, drinking, smoking, drug using, [is] more harmful than having to tidy up some flood mess.”*

A similar point can be made about the severe erosion caused on pastoral stations in the wake of Cyclone Bernie and Bola (and numerous extreme rainfall events in the preceding years). These large-scale erosion events capture the imagination, are visceral and are reflected in the performance of these land uses. Beyond visceral events such as erosion are ongoing characteristics of sheep and beef farming, such as poor profitability for this region’s hill country sheep and beef farming relative to the rest of the country¹⁵, and possibly a feeling of disconnection from the land – or that this land use is unsuitable for the characteristics of land in the Waiapu catchment. Paradoxically, widespread exotic plantations were established as a result of the erosion caused by extreme weather events such as Cyclone Bola on pastoral land, and there is no doubt that these plantings have halted and in many cases reversed gully formation, and prevented steepening or new erosion (Marden et al., 2012). But this land use practice has spawned new environmental and socio-cultural impacts that coalesce with those issues already present.

7.5.3 Affect heuristic

There are clear winners and clear losers among the land use options rated by the flat land model 1 group. ‘Native forestry’, ‘perennial horticulture’, ‘medicinal

¹⁵ Economic returns for hill country, hard hill country and intensive finishing farms for the East Coast are visible at: <https://beeflambnz.com/data-tools/benchmarking-tool>

cannabis and hemp’ and ‘kumara cropping’ outperform ‘exotic forestry’, ‘sheep and beef farming’ and ‘maize cropping’ across all criteria – and this relationship is immediately evident in Figure 50. It comes as no surprise that these land uses performed so poorly in the MCA when the wider impacts associated with their introduction to the Waiapu catchment are taken into consideration. Not surprisingly, given the adverse impacts of these land uses over the years, and accumulated experience and awareness of those impacts, landowners in the Waiapu catchment are decisive in identifying certain land uses as comparatively undesirable. This may translate into positive and negative affects. The affect heuristic is likely to have had a strong influence on the dichotomy identified above.

Slovic et al. (2002) use the psychological notion of ‘affect’ – that is our instinctual reaction to stimuli, defined by feelings of “goodness” or “badness”. Simply put, the affect heuristic holds that decision makers often have an automatic response to many choices, and that this response may in some cases be at odds with the reasoning one might undertake when undertaking a complex decision (Bazerman & Moore, 2009). Kahneman (2003) contends that the affect heuristic is a manifestation of System 1 thinking, and this may be useful in interpreting the results for flat land model 1 and steep land model 3. This is because these models, as previously mentioned, were hypothesised to be based to some extent on System 1 thinking, and the greatest polarisation of performance amongst the alternatives was seen in those models. Whilst there is no doubt that land uses such as ‘exotic forestry’ and ‘sheep and beef farming’ are the cause of multiple environmental problems, their performance across all MCA models, whilst not unexpected, was generally poor. These land uses have caused significant environmental degradation (Awatere et al., 2018; Porou et al., 2012), but the harms they have caused are also offset to an extent by their providing a large proportion of employment in the Waiapu catchment, and contributions to the

local economy (Barnard et al., 2012; Tomlinson et al., 2000; Warmenhoven et al., 2014).

Sheep and beef farming, in particular, owes its introduction as a land use in the Waiapu catchment to the large-scale deforestation and land clearance of the late 19th and early 20th centuries (Marden et al., 2012). Such farming was initially developed by Pākehā settlers, who cleared native vegetation, doing a great deal of ecological damage in the process, and established large runholdings (Harmsworth et al., 2002). Historically, these stations employed multiple people within a hapū, and whilst pastoral farming was a foreign way of ‘utilising’ or ‘managing’ land, Māori were required (as in many other ways throughout colonisation) to adapt to new realities caused by the arrival of Pākehā (Hargreaves, 1963; King, 2003).

In time, these farms provided employment and allowed for the development of different ‘Pākehā’ skills. Hapū frequently worked on a station together, and whilst the new way of engaging with land was no doubt foreign, there was still a strong connection to the land through the very process of engaging with it on a day-day basis. As key informants in this study, such as participant [E2 land use practitioner], have indicated, land uses which force landowners to make multiple land use decisions are often ones which precipitate ongoing engagement with the land – and this reinforces the connection to the land. So, on the one hand, sheep and beef farming has been a significant employer, and a means by which hapū can provide sustenance on the marae, yet participants in this study show considerable ambivalence and sometimes negativity about its overall performance in the MCA models.

Other factors may contribute to this ambivalence. One is the erosion problems caused by open pasture in a geologically unstable environment. Another may be the hardship faced by landowners after the removal of agricultural subsidies in the 1980s (Barnard et al., 2012) and the declining profitability of farms on land

that was never suited to pastoralism. Another could be a sense that sheep and beef farming runs counter to Māori land use aspirations in the Waiapu catchment. Or, it could be a reaction to imposed colonial ideologies and a desire for mana motuhake? As Robertson (2019) stated at the 2019 Environmental Defence Society Conference, it may reflect “the disastrous impact of colonial ideology where Māori knowledge was considered inferior to [that of] people who had no ancestral connection to the land and importantly, no understanding of how it behaves.” There is no doubt that concern about erosion (and associated reductions in water quality and land degradation), and economic hardship deriving from the boom and bust cycles of pastoral farming have factored into the performance of sheep and beef farming.

As with sheep and beef farming, the MCA ratings of exotic forestry are also understandable. Whilst sheep and beef farming offers a modicum of steady engagement with the land (in that multiple land use decisions/engagement with the land is required on a week to month basis), this is by no means the case with exotic plantation forestry. For many Māori landowners in the Waiapu catchment, land has been leased to forestry companies on multi-decade leases (B. McKinlay, personal communication, 2017). There were promises during the stages of afforestation that this industry would support local communities through greater employment opportunities, and greater returns from their land. The poorer than expected returns from harvested timber has shown this to be incorrect (Warmenhoven et al., 2014). Due to the exposure of Aotearoa’s timber exports to fluctuations in global prices, many of the benefits promised by forestry companies have not materialised - either in the form of employment or income (Porou et al., 2012). Much of the forest maintenance and harvesting is now undertaken by contractors, who move in contracted staff for planting, thinning, pruning and harvesting. Compounding these difficulties is the fact that many Māori landowners are unable to access their land, whether for recreational purposes,

harvesting/foraging, or hunting, without prior approval of the forestry company, in many cases ostensibly for health and safety reasons (Tomlinson et al., 2000).

As mentioned, the affect heuristic can also be used in the interpretation of the results for flat land model 1, for both 'sheep and beef farming' and 'exotic forestry'. Kahneman (2011, p. 140) posits that the affect heuristic 'simplifies our lives by creating a world that is much tidier than reality'. Evidence shows that individuals with a negative disposition to a certain decision element are less likely to independently consider the risks and benefits of a decision, especially under time pressure (Finucane et al., 2000). This can lead to a higher degree of negative perception than would be typically evident without time pressure (Finucane et al., 2000). Potentially the time pressure of the MCA wānanga, together with accumulated negative experiences, led to fewer benefits being associated with 'sheep and beef farming' and 'exotic forestry' and more with 'native forestry' and, speculatively, with 'medicinal cannabis and hemp'. Such associations are relevant to the responses seen in the MCA models, but most notably flat land model 1 and steep land model 3. Or, as Slovic et al. (2002, p. 400) suggests, we make judgements, in reference to an 'affect pool' which contains all the 'positive and negative tags consciously or unconsciously associated with the representations'.

Kahneman (2003) suggests that the majority of our judgements are guided by an affective and emotional process that occurs before any higher-level reasoning takes place. What is likely is that the negative perceptions of 'exotic forestry and 'sheep and beef farming' have had a significant bearing on the deliberation process for all the MCA models. In addition, although space and time preclude an in-depth discussion, it can be said is that there is a notable optimism felt by many in the community towards the development of a medicinal cannabis and hemp industry in the Waiapu catchment and wider region. Whilst Te Tairāwhiti has had a strong history and association with cultivation of cannabis for the illicit market, there are increasing calls by entities such as Hikurangi Enterprises for Te Tairāwhiti to become an integral component of the legal market, and utilise the

so called 'black market' skills of those in the region to spearhead the legal medicinal and recreational industry in Aotearoa, contingent dependent on the outcome of a referendum at the 2020 General Election (Walters, 2019). A similar situation is evident with the development of a hemp industry – hemp is becoming increasingly recognised as a crop with a variety of benefits as a nutritional food source and a sustainable, durable fibre commodity with a number of uses.

Yet the regulatory environment for these crops is still uncertain. One can apply for a Ministry of Health licence to cultivate medicinal cannabis and, again, the 2020 referendum may validate personal consumption of cannabis. It is assumed this will open markets for hemp cultivation for both personal and medicinal use. Meanwhile, regulations regarding the cultivation of hemp are loosening even if the opportunities to legally cultivate 'medicinal cannabis and hemp' so far remain limited (Ridout, 2020).

In the context of this research, the affect heuristic is particularly interesting. Land use alternatives such as 'exotic forestry' and 'sheep and beef farming' have obviously provoked overwhelmingly negative responses amongst the participants of all the MCA models, whilst the opposite is the case for 'native forestry' and, for flat land model 1, 'medicinal cannabis and hemp'. Evidence presented in previous sections highlights how the environmental degradation and economic instability associated with 'sheep and beef farming' and 'exotic forestry' have contributed to negative perceptions of these land uses in the Waiapu catchment. Yet, the good performance of 'medicinal cannabis and hemp' can also be partly explained by another heuristic, optimism bias.

7.5.4 Optimism bias

The strong rating of 'medicinal cannabis and hemp' by the flat land model 1 group was further recognition of the optimism many have for these crops as of high value with employment and skills development benefits. Whilst there is evidence

of respectable market returns (Chivers, 2019) there is little evidence of this potential within the Waiapu catchment. It is expected that there is an element of optimism bias in expectations regarding the future success and viability of 'medicinal cannabis and hemp', and also 'perennial horticulture', 'kumara cropping' and 'hunting and tourism'.

Optimism bias is also referred to as the planning fallacy and is thought to be one of the most significant cognitive biases in terms of its consequences to decision making. Kahneman (2011, p. 255) defines the planning fallacy as our inherent tendency to view the world as more benign than it actually is and to value our attributes as more favourable than they really are – all of which fosters optimistic overconfidence. Our tendency to be optimistic may have practical origins, as for many, the day to day machinations of life are demanding, with success and life satisfaction often tantalisingly out of reach. Thus, an optimistic outlook allows us to cope with adversity and continue striving despite setbacks (Kahneman, 2011). The planning fallacy is frequently discussed in the context of construction projects, and the optimistic completion estimates given by project designers that rarely come to fruition (Buehler et al., 2002).

Buehler et al. (2002) suggest that people place excessive confidence in their specific plans about a future project, and in doing so, are prone to underweighting general distributional information, and this combination leads to a tendency for overly optimistic predictions. This could be the case in the strong ratings performance for certain land uses for flat land model 1 (and 'hunting and tourism' in the steep land models) in the face of (or absence of) limited empirical evidence outlining demonstrated success and viability of these land uses. As discussed, the land use fact sheets endeavoured to provide accurate projections of current and future economic returns, alongside a variety of risks associated with each individual land use alternative. This information included a note with the following disclaimer:

“The economic returns presented are indicative only. Please do not think of these estimations as accurate representations of current or future prices, as climate and market changes significantly impact prices. Average prices have been sought from multiple sources and the figures should be used only as a rough guideline. For some species there are gaps in the evaluation because information has not been forthcoming because of confidentiality issues or lack of data. These land uses may also be limited by scale and infrastructure constraints in the Waipua catchment or wider region.”

This disclaimer did not seem to influence materially the deliberations, and where there was reasonably detailed information, in the case of ‘sheep and beef farming’ and ‘exotic forestry’ as opposed to ‘medicinal cannabis and hemp’, ‘kumara cropping’ and ‘perennial horticulture’, the former land use alternatives still scored poorly in the face of unknowns regarding the latter.

7.6 Significance of land use preferences for Māori land use decision making in Te Tairāwhiti

7.6.1 Land use path dependency in the Waipua catchment

One of the key findings of this research, apart from the respondents’ preferences for ‘native forests’, is the clear preference for novel land uses over existing land uses. In effect, those land uses (perennial horticulture, kumara cropping, hunting and tourism etc.) which are not widely in use are desired more than the existing ones. Reflecting upon these results, it was clear that one of the underlying factors in these results, beyond heuristics, was a desire to shake off land use path dependency. The notion of path dependency in relation to land use in the Waipua catchment was initially brought up by participant [E12 CRI 2]:

Historically landowners have relied on accountants and consultants who tell you what they know. If you ask a dairy consultant what to do with

the land, they will say put a dairy farm in – path dependency. [It is the] Same with forestry consultants, they will say Pinus radiata has the best economics. East Coast communities have been disappointed by forestry industry promises – jobs and building rural communities, [being] environmentally sustainable etc. They have found out it's environmentally sustainable whilst it's growing but as soon as you cut it down there are huge problems.

Path dependency is an economic or social phenomenon which can help explain continued use of a product or practice based on historical preferences for, and sometimes technological 'lock-in' to, such uses. One interpretation of path dependence is simply where 'current and future states, actions, or decisions depend on the path of previous states, actions, or decisions' (Page, 2006, p. 88). Various institutions, organisations and technologies are argued by Martin and Sunley (2006) to be maintained by ideologies and norms, which serve to lock in decisions (or paths). It is argued the outcomes of path dependent processes or systems 'evolve as a consequence of the process's or system's own history' (Martin & Sunley, 2006, p. 301). One particular strand of path dependency theory, technological 'lock-in', is useful in the exploration of this research. David (1985, p. 344) discusses technological 'lock-in' as contingent on three primary factors: technical interrelatedness; economies of scale; and the quasi-irreversibility of investments/sunk costs.

In the context of land use decision making this generally means the propensity of current land uses to have an undue influence on future land uses. This is often not an obvious problem, as in many cases those land uses which are employed in an area may be 'the highest and best land use' (Hall, 2018) due to farmer sensitivity to climatic or geographic factors. Yet in areas such as the Waiapu catchment, it is becoming evident that the dominant suite of land uses (sheep and beef farming and exotic forestry) are unsuitable either because of their environmental impacts over a series of decades (Awatere et al., 2018; Harmsworth et al., 2002) or their

social and economic impacts over similar periods (Warmenhoven et al., 2014). It is clear that those land uses dominating the Waiapu catchment and Te Tairāwhiti are in many places, unsuitable for the characteristics of the land, and more importantly may not suit those people living in these areas (Porou et al., 2012; Tomlinson et al., 2000; Warmenhoven et al., 2014). Research such as that by Tomlinson (2003; 2000) has charted the dissatisfaction many who live in Te Tairāwhiti feel towards the exotic forest industry. Likewise, Warmenhoven et al. (2014) and Harmsworth et al. (2002) have provided further empirical evidence for other regions of the dissatisfaction many Māori feel towards both sheep and beef farming and exotic forestry.

Land use path dependency, or lock-in, is posited by participants [E11 CRI 1] and [E12 CRI 2] to be one of the key barriers to adopting land uses that differ from the status quo. This was seen to be a result of social norms, and the capacity and capability of the workforce and associated industries in the Waiapu catchment and wider Tairāwhiti area. Hall (2018) argues that for many, diversifying land use production systems is desired, yet our institutions are unable to help landowners achieve these outcomes. Instead, “what is more often affordable, or practicable, or feasible, is to simplify and standardise the land and to maximise its financial functions” (Hall, 2018, p. 17). The conservatism of Te Tumu Paeroa (the Māori trustee which administers and manages Māori land on behalf of landowners) was also seen as contributing to land use path dependence and inhibiting the decision-making process through administrative delays. The land use advice from primary industry consultants external to the Waiapu catchment and Māori communities was clearly identified as hindering Māori from engaging in novel land uses.

When looking at the historic context of land use change in the Waiapu catchment, Pākehā settlers were demonstrably pastoralists, and cleared bush so sheep and beef farming could become the predominant land use (Harmsworth et al., 2002). These settlers likely had little experience or desire to manage land in other ways, which ultimately led to those dominant land uses in Great Britain becoming the

dominant land use in Aotearoa. Similarly, after the severity of land erosion in the Waipua catchment and wider region was recognised, widespread exotic afforestation commenced initially under the New Zealand Forest Service and, more recently, under private companies (Barnard et al., 2012). *Pinus radiata* became the dominant commercial forestry species from the early 20th century (Marden et al., 2011), and profitable plantation cycles are contingent on clear felling large swathes of forest in a short period. As discussed, the environmental impacts of clear fell regimes are significant, especially in erodible steep hill country such as the Waipua catchment. Yet the entire exotic forestry industry appears to be ‘locked-in’ to clear fell harvesting, even though it is evidently contrary to the preferences of many throughout Te Tairāwhiti (Langer & Tomlinson, 2003; Tomlinson et al., 2000). This apparent lock-in may be a matter of long-term leases and contracts, experience of the workforce, cost, technological and possibly other factors.

In the Waipua catchment and wider Te Tairāwhiti region, environmental degradation arising from pastoral farming in the form of erosion is widespread and pervasive (including in coastal and near shore marine zones), and has led to devastating economic and social impacts over time (Porou et al., 2012; Warmenhoven et al., 2014). Similarly, plantation forestry, which is known to be an effective erosion control treatment option (Marden et al., 2011; Marden & Rowan, 1994), has its own negative environmental, health and economic impacts – whether in the form of pine pollen inflaming allergies of the local populace, sediment and slash run-off choking waterways and damaging public and private infrastructure, or the health and safety record of the industry and the damage wrought upon local roads – or vehicles and their occupants – by logging trucks (B. McKinlay, personal communication, 2017). In addition, negative features include the precarity in economic returns and employment, which are also relevant to sheep and beef farming.

Beyond those evident factors are those that are more intangible – such as the hurt that still lingers from colonial land confiscations and widespread native vegetation clearance for the establishment of large pastoral run holdings. Ngāti Porou have a deep understanding of the land that has been disrupted by a colonial mindset that is argued to persist today and subverts mātauranga Māori in favour of western knowledge systems. Natalie Robertson (2019) holds that:

Māori experience the world as a complex, relational space/place matrix, where all things are holistically connected through whakapapa, genealogical and kinship networks. In this system land and the people are connected relationally.... The dispossession of our lands for subsequent erasure of native forest, our waterways and food sources is an erasure of indigenous ways of being and therefore an erasure of us and all our relations.

The impacts of colonial ideologies regarding land use decision making are tangible in many instances, but when explored in relation to how Māori had historically engaged with land, and their values and knowledge systems regarding suitable use of land, the issues become increasingly complex. What is tangible is that land erosion in the catchment is intense: the Waiapu river has one of the highest suspended sediment outputs in the world, with Te Tairāwhiti being one of the most severely erosion-prone regions in Aotearoa, and the Waiapu catchment is the most severely eroded within the region (Marden et al., 2011). Erosion and sedimentation is worst on open pastoral country, with no trees to bind the soil (Marden & Rowan, 1994). It is also known that under ‘clear fell’ harvesting regimes, heavy rain events force forestry ‘slash’ off hillsides and into streams, rivers and beaches throughout Te Tairāwhiti. Both pastoral and exotic forestry land uses, largely for commodity exports, have shown significant fluctuations in returns over many decades with associated fluctuations in levels of local employment (PCE, 2019). These factors can be considered alongside the Waiapu catchment’s record of having one of the highest levels of material deprivation in

Aotearoa. It would not be unreasonable to draw a connection between that deprivation and the undermining of mātauranga Māori, and the undermining of Māori ways of engaging with the land in favour of 'colonial ideologies', widespread environmental degradation and fluctuations in profitability. Moreover, in this context, it is not surprising that there is scepticism about the land use advice that has been offered to Māori in Tairāwhiti in the past.

7.6.2 Relevance of Nuhiti-Q study

The decision by Nuhiti Q to enter the NZ ETS with a significant block of land created a strong precedent in terms of demonstrating that alternative, valuable and sustainable land use options exist. An exploration of this in relation to broader themes of Māori landowner participation in the NZ ETS was presented earlier in this discussion. The next section of this discussion reviews the significance of this case study in relation to the results of the key informant interviews, which provided valuable data for the MCA wānanga, and also in relation to the results of the four MCA models.

The *economic* basis for carbon farming native forests in Te Tairāwhiti is well known, with research by Harmsworth et al. (2010) arguing that 80 percent of Māori land in the area would be best suited to this land use. Recent research by Funk et al. (2014) identified 379,000 ha of NZ ETS eligible land in Te Tairāwhiti where, over 70 years, regenerating native species on 102,951 ha would likely generate economic revenues in excess of sheep and beef grazing. The economic rationale underpinning this research as seen in the literature review has been reinforced by the Nuhiti Q case study, interviews with key informants and the results of the MCA. There was a clear finding that for Māori owned land with regenerating native forest in Te Tairāwhiti, or for marginally profitable farming operations in erodible hill country, that the most attractive option, if the land is deemed ETS-eligible and the landowners are motivated to pursue profitable land use options, is to retire this land and enter the NZ ETS. Participants in the MCA on

the whole saw native forests as providing a good level of ‘economic’ benefits, although this rating was lower than those scored against ‘social and cultural’ and ‘environmental’ criteria.

Moreover, the **cultural** rationale as identified in the literature (Porou et al., 2012; Warmenhoven et al., 2014) was reflected in the results of this research. Nuhiti Q’s decision to enter the NZ ETS was made in large part because the business-as-usual scenario of pastoral farming had severely impacted upon the landform through erosion, in areas which held numerous wāhi tapu sites, and was of paramount importance to those whānau who vested their land within the Incorporation. Granted, this decision was also driven by the option to earn income from retired lands, but a decision to enter the NZ ETS using regenerating native forests was just as important for the cultural and environmental imperatives guiding the Incorporation. Further, the key informants saw native forests as allowing landowners to better act as kaitiaki and reconnect with their land through better access to rongoā Māori, and the mātauranga associated with native forests. Native forests were also seen to facilitate mana motuhake, or self-determination if driven by Māori as a response to the legacy of colonial intervention in land use change over many decades. Participants of the MCA across all four models also associate native carbon forests with social and cultural benefits to a degree far in excess of other land uses – but particularly those already dominant in the region (sheep and beef farming and exotic forestry).

The **environmental** rationale for carbon farming native forests is perhaps the most persuasive and most significant result vis a vis the literature, in relation to biodiversity, erosion control, improvements in water quality and other environmental aspects (Awatere et al., 2018; Carswell et al., 2002). Recent research by Awatere et al. (2018) has highlighted the increasing severity of erosion in the Waiapu catchment under different climate change scenarios, which could only be arrested by widespread afforestation with native or exotic tree species. Harmsworth et al. (2010) also saw carbon farming as a significant

business opportunity for Māori landowning entities in the face of pressures from climate change, whilst also providing numerous environmental benefits. Both of these studies reached conclusions broadly compatible with those of the present study, but the present study highlights, firstly, the considered views of Māori landowners, and second, the perceived superiority of native forest species for environmental (as well as cultural) reasons. MCA participants categorically saw native carbon forestry as providing the most environmental benefits to the Waipapu catchment. These results stand in stark contrast with views of exotic forestry and sheep and beef farming, which on the whole, are now seen by local Māori landowners as some of the worst performing land use alternatives in regard to the provision of environmental benefits.

When considering the broader suitability of carbon farming across Te Tairāwhiti, some key informants were conflicted as to whether or not carbon farming is suitable for Māori land in all instances, and to what extent Māori landowners should participate in the NZ ETS. There was no disagreement that, for the most degraded, marginal erosion-prone land (which Māori in the Tairāwhiti and Waipapu catchments disproportionately own) carbon farming of native forests was seen as an attractive land use option with potential for greater economic returns than other options, alongside provision of numerous important co-benefits. Yet for some key informants such as Bryan McKinlay and participant [E2 land use practitioner], carbon farming was suggested as a complement to other land uses, and a best use in the worst performing or most inaccessible areas of a landholding. However, participant [E2 land use practitioner] also further considered that the NZ ETS could be a Trojan horse for the Māori economy in regard to the serious risks of landowners 'locking' up productive pastoral land and, after selling accrued NZUs, facing large carbon liabilities if they decided to leave the NZ ETS. One key informant referred to this circumstance as akin to land alienation.

Yet there was clear agreement that, for many Māori landowners with land previously considered 'idle' or 'unproductive', i.e. the land was dominated by regenerating native forest, there is an attraction in the money to be made through carbon farming, given the eligibility status of much Māori land. However, others participant [E3 forestry 1] queried whether carbon farming could offer as many employment benefits as that of other land uses. This concern is consistent with the high weighting given to employment and skills development by participants in the MCA.

7.7 Summary of issues concerning development of Māori owned land in the Waiapu catchment and Te Tairāwhiti

7.7.1 Barriers to participation in novel land uses

Whilst it was not a core component of this research to look at barriers to the decision making process of Māori landowners, it would be negligent not to discuss the wider context of land management in Te Tairāwhiti, introduced in section 1.1 – particularly as this was frequently discussed by MCA participants and the key informants. A barrier that was clear at all stages of field work was Māori landowning entities – be they ahu whenua trusts or incorporations (or entities administered by TTP) -- inhibiting the decision-making process. This was seen by the key informants as most often being a result of under-resourcing of the entity. Some decision makers were seen as having inadequate expertise and confidence to make informed and innovative land use decisions. In other cases, decision makers did not have the time to go beyond merely administering the land block and investigating novel land use options; and/or faced difficulties achieving consensus amongst shareholders as to how to proceed with a land use decision. The present study's incidental findings in this regard are consistent with in-depth exploration of these issues (Dell, 2017).

A related concern was an inability of Māori landowners to access finance in many instances. This challenge arises from and is embodied in the restrictions placed upon alienating Māori land under the Te Ture Whenua Māori Act as Māori land. That is, it cannot be alienated, (sold, transferred to general title, or forfeited as collateral) without a decree from the Māori Land Court. This can mean that financial institutions are hesitant to lend to multiply-owned Māori freehold land as the land cannot be used as collateral against default. So whilst the value of Māori owned land may be high, many landowners can only borrow against the value of their livestock (or other assets such as equipment) (Kingi, 2008b). This in effect has put many Māori landowners in an 'underdevelopment trap' (Tímár, 2011).

A related issue noted in the literature by Warmenhoven et al. (2014) and seen also in the present study is that Māori landowners in the Waiapu catchment were at a distinct disadvantage (in the context of land use decision making) compared with others in Aotearoa due to physical isolation, poor communication (reliable internet and cell phone reception) and lack of civil infrastructure and tenuous social capital connections between local government and communities. Further, community members with expertise in land use management and planning have major pressure placed upon them to represent the wider community, and not make mistakes when striving for change. Information asymmetries regarding awareness of land use options were seen to be a significant barrier to landowners realising the full benefits from their asset, for example by being able to convert their land to its best possible use. Further to the previous point, we noted in the present study the complexity associated with participation in schemes such as the One Billion Trees Programme (1BT), the Erosion Control Funding Programme (ECFP) and the NZ ETS – and investigating the relative merits of novel and untested land uses (such as perennial horticultural options) and developing a business case for consideration by the wider body of landowners. This result reflects earlier findings in the literature that Māori landowning entities did not

have dedicated resources or staff to address new opportunities from the NZ ETS (Harmsworth et al., 2010).

The lack of confidence to experiment with change in land uses is recognised in this study as another key constraint on Māori landowners. Māori landowners have been described as being risk averse and conservative, and reluctant to attempt novel land use approaches – especially when considering the intergenerational outlook of Māori landowners (and a reluctance to make a mistake) and in many cases, being unable to access finance. Yet, in the present study, this barrier was found to be tempered, in the view of some key informants, by the investment market and the private sector beginning to look favourably upon and prioritise partnerships with Māori for corporate social responsibility reasons or to address quadruple bottom line goals. As noted above, isolation and underinvestment in the Waiapu catchment is seen to have contributed to an inability for Māori landowners to easily capitalise on their asset or develop economies of scale. For novel land uses (such as kiwifruit) to have success in the Waiapu catchment, amalgamation was seen by the key informants as necessary to achieve the commercial scale necessary to make these endeavours successful – the same can be said for native forest carbon farming at a region-wide scale. The present study underlined the increasing recognition that Māori landowners needed support from external organisations such as local and central government or the private sector to overcome constraining factors.

The present research has highlighted a preference by Māori landowners for native forestry, and these preferences seemingly align with the afforestation goals of central and local government schemes such as 1BT, the ECFP and Ngā Whenua Rāhui (NWR). However, it remains to be seen whether the institutions who administer these schemes have the competency, resources or willingness to facilitate the participation of Māori landowners. Complicated and evolving grant systems such as the ECFP's were found in the present study to be a contributor to limited uptake by Māori of opportunities in the NZ ETS. This is a finding reflected

in the literature (Edwards et al., 2018). The ECFP and 1BT can also be seen as a two-edged sword, providing financial support whilst tempting Māori landowners into what could be a sub-optimal land use choice which curtails future land use options. The high turnover of public servants at the Gisborne District Council (GDC) or the Ministry for Primary Industries (MPI) is also seen as a barrier which stymies support for Māori landowners. Relationships are paramount in te ao Māori and a high staff turnover is seen to constrain the development of meaningful connections. There were also concerns about the lack of awareness and cultural competency of some staff at regulatory institutions, and this was associated with a distrust amongst landowners of external organisations, whether they were governmental or in the private sector.

7.7.2 Risks of land use change in the Waiapu catchment

If native carbon forestry is preferred, there remain risks if current landowners sell NZUs, and future landowners wish to change land use in future – incurring high costs to purchase equivalent NZUs to those that were sold. This potential future cost is unknown, but the NZU price is expected to continue to increase (Carver & Kerr, 2017; Tuahine, 2018; Weaver, 2017). To manage these risks, it is imperative that landowners seek and receive good advice about the risks and timing of selling and buying in the carbon market, and of course about future land use aspirations. For example, the risks can be reduced if not all NZUs earned are sold, but some are held to reduce the cost of any possible future deforestation decision. Any decision to enter the NZ ETS and sell accrued NZUs can, as indicated, limit options in the future and leave land in a committed state. This risk is more evident where lower LUC land is entered into the NZ ETS, as this land has greater land use optionality. Landowners would therefore need to be more certain about the merits of ‘locking it up’, with commensurate loss of optionality, than in the case of, say, hill country land of lower value.

A related concern conveyed by some key informants was a risk that, in striving to break away from path-dependent land use management structures and participate in novel land uses such as native forest carbon farming, and in the event that such ventures fail, landowners could 'lose' more than has already been lost through colonisation. Loss in this sense is relative: the worst the loss could be in the case of carbon farming would not be the loss of opportunity to do something more profitable with the land, but rather the price, at the time, of NZUs. That is, the most landowners could lose is the value of carbon credits they would have to buy on the market if they decided to convert from forestry to a non-forestry option such as pastoral farming. Yet this could be very expensive if the price of carbon continues to rise. In Nuhiti Q's case their bank required them to sell some accrued NZUs to service debt obligations. Many other undercapitalised Māori landowners may face similar pressures and might also find it difficult to surrender sufficient NZUs in order to change land uses, if previous tranches of NZU credits had already been sold. However, it needs to be underlined that going into native forest carbon farming does not require the *sale* of the credits earned: they can be held in perpetuity.

Across all MCA models, employment and skills development were seen to be some of the most important land use benefits. Yet within the exotic forestry industry, employment is usually minimal ('low-density'), and frequently of a precarious nature. The episodic nature of activity in the exotic forestry sector is regarded by most research participants as concerning and Māori landowners are thought to have become more disconnected from their land because of this. It was also thought that this would be a similar situation if more permanent carbon forests are established, although the employment impact might depend to some extent on the nature of the carbon forest, its upkeep requirements and other features of the forest.

It seems ironic that land cover change i.e. deforestation in the past has been shown to be wholly inappropriate, and now a significant land cover change – a

shift back to reforestation of the landscape -- is deemed necessary to partially mitigate anthropogenic climate change and other environmental pressures. Some of that climate change is a consequence of former land use change, such as conversion to dairying. Yet the desire and push from many quarters for reforestation, be it exotic or native species, is also laden with controversy and will have both short- and long-term effects. For some Māori and Pākehā, there is dismay at 'productive pastoral land' being 'blanket' reforested and it is contended that this 'hollows out' rural communities, while in the case of exotic forests contributing only a modicum of employment over the plantation cycle (Harrison & Bruce, 2019). Many in the present study also expressed concern about the environmental damage associated with clear felling of exotic forestry at harvest time. Some of the same reservations are expressed about native forests, and whilst the present research has shown that for a sample of Māori landowners in the Waiapu catchment, native forests are associated with a variety of environmental, socio-cultural and economic co-benefits, there were few employment benefits mentioned by informants with regard to native forests. This contrasts with employment being consistently given high importance scores in the study. Whilst there are numerous cultural benefits provided by native forests, the question becomes what is more important: employment (and other associated benefits) or cultural and environmental values that have for so long been detached from land uses in the Waiapu catchment? Of course, there will always be unforeseen impacts of land use changes be they in the short or long term but the Waiapu catchment offers a case that exemplifies the trade-offs, while in addition showing how an attempt to reverse historic changes through reforestation may create new forms of disruption.

Harrison and Bruce (2019) have conducted a recent study on large scale exotic afforestation in rural communities centred on Wairoa, a settlement about two hours south of the Waiapu catchment. The small township of Wairoa has experienced recent large scale land use change from sheep and beef farming to

exotic carbon forestry (Newton & Espiner, 2019). Their analysis has reinforced some of the employment concerns expressed by key informants in the present study. It was found that over a 30 year cycle, a plantation forest earning returns from carbon and timber would generate two local jobs per 1000 ha (rising to five jobs per 1000 ha at harvest), as opposed to seven for sheep and beef farms. Beyond employment, the authors estimate, per 1000 ha, that exotic forestry would add \$4.3m at harvesting to the Wairoa economy. However, this fell to \$107,000 per year between harvests as opposed to \$316,000 for sheep and beef farms over the same area and time period (Harrison & Bruce, 2019). Whilst these results are not entirely comparable to the findings of the present research, as the authors focused exclusively on rotation exotic forestry, they still hold relevance, as exotic forest species sequester up to three times more carbon per ha than native species, over a 30 year period¹⁶ (MPI, 2015a), and are more economically attractive to some for this reason. Also, as there is likely no harvesting revenue from native carbon forests, and fewer maintenance jobs, the economic returns and employment benefits will likely be less than for sheep and beef farming, and exotic forestry.

With permanent native carbon forests, the employment benefits are often given as a key reason why landowners should engage with this land use (Funk & Kerr, 2007). There would evidently be employment in regard to fencing, pest control, planting and site and track maintenance – yet, this initial employment would dissipate over time except for pest control and periodic fence maintenance. Granted, if there is an established mānuka crop (a form of native forest), then

¹⁶ Evidence in Kimberley et al. (2014), contends that beyond age 20, carbon sequestration in native forest plantations can approach that of the main exotic species. However, carbon sequestration plateaus after 60 years for native plantations.[But doesn't it plateau at about 30 years for the relevant exotic species?!]

there are associated apicultural employment opportunities, and if native bioactive extracts find a market, and suitable species are planted, then there would be other employment opportunities. However, a permanent native forest that has succeeded into a mature forest has little employment opportunities, as it involves no pruning or harvesting and little necessary forest maintenance. So in this instance, the modest relative employment benefits of a permanent native carbon forest need to be weighed against those of other land uses, and weighed against the other co-benefits (erosion control, water quality, amenity value, rongoā, mana motuhake etc.) that native forests provide over other land uses.

7.8 Options for Māori land use planning in Te Tairāwhiti and the Waiapu Catchment

7.8.1 Carbon cooperatives and the Aboriginal Carbon Fund

In terms of how to best address some of the concerns outlined above, the Aboriginal Carbon Fund provides a useful case study. The fund facilitates an income stream for Aboriginal landowners from a customary land use practice through the sale of three types of carbon credits which give varying degrees of benefits to customary landowners and farmers alongside an economic premium. This is a significant development, and offers the potential for indigenous communities to earn income from customary practices alongside verifiable 'core-benefits' (including carbon sequestration) (McMurray et al., 2019). Facilitating the growth of, and protecting, native forestry in Aotearoa can be argued to be a customary practice for Māori, and investigating how a framework similar to the AbCF can apply to an Aotearoa case would be useful for the development of a Māori carbon economy and the prosperity of Māori in the Waiapu catchment and Te Tairāwhiti.

For Māori landowners, a similar core-benefit framework could be instrumental in creating a case for the greater worth of NZUs produced on Māori land using native

forest species. NZUs with an 'Indigenous carbon premium' could support such Māori programmes as re-education and centring of mātauranga concerning the traditional practices and knowledge of native forests, or the superior environmental outcomes arising from native forests, supporting Māori landowning entities to better assist their landowning base to pursue new commercial opportunities predicated on native forests, or supporting these landowners to invest and diversify into other businesses or commercial opportunities. Further, firms and other organisations with a desire to offset voluntarily, or a need for mandatory NZ ETS units, could purchase NZUs with verified 'core-benefits'. This could well be at a market premium. In the voluntary domain, it is plausible that companies would identify this 'greater good' premium in order to better market their company to customers, employees, and others in their industry.

However, it is important to note that while a few of the co-benefits would accrue to the landowners, such as improved amenity, most others such as improved biodiversity and greater soil stability represent a public good, the benefits of which would accrue to the public at large and which in principle should be rewarded by the government. It is likely that the market cannot fully realise the true societal benefits of permanent native forest NZUs, and there is a strong economic case for the government to provide further financial assistance either in the form of afforestation grants, or by guaranteeing a financial premium per 'indigenous carbon credit' above the market determined price (Hall et al., 2017). A more arguable proposition is that if Māori landowners can earn a market premium on these NZUs, this might to an extent recompense Māori for the harm and suffering inflicted as a result of colonisation and land alienation, and the subversion of their mātauranga regarding land management.

7.8.2 Alternative forestry regimes

Because forestry of some sort is desired, and much of Māori land in Te Tairāwhiti is suited to this land use, it is prudent to look at alternative forestry models which utilise native timber species (with associated co-benefits) and offer good returns with minimal environmental degradation at harvest. It is evident from the key informant interviews and the MCA models that the key perceived problems associated with 'exotic forestry' revolved around the environmental degradation at harvest, and the so-called 'window of vulnerability' post-harvest. It is not clear, however, whether dissatisfaction with exotic forestry is also a manifestation of a preference for native over exotic tree species. The timber harvesting element of 'native forestry' was predicated on selective harvesting of high-value, slow growing native species such as tōtara. It may be that forestry is seen as desirable, but it is mainly the way in which forestry is practised in Te Tairāwhiti (i.e. a clear fell harvesting regime) that causes dissatisfaction. Exotic forestry will continue in the region, so employing alternative forest models, as advocated by Hall (2018), and ensuring that harvesting has minimal adverse impacts may be a wise approach.

One such option is continuous cover forestry - a forestry system commonplace in much of Europe where an uneven-aged stand of trees is managed under a selective harvest regime, with gaps in the forest occupied by self-seeded or planted trees (Hall, 2018). Whereas *Pinus radiata* is generally a low value commodity, a continuous cover forest approach would better suit high value native or exotic tree species, due to the higher harvest costs under this regime. If managed effectively, a continuous cover forestry approach could provide sustainable year-round employment with minimal levels of environmental harm (Barton, 2005; Hall, 2018).

7.8.3 Sustainable land use mosaic

The notion of a land use mosaic was discussed at length in the present study by the key informants. Having mixed forest species on land is thought to allow for diverse income streams but can also contribute to the resilience of a landholding. Further, merit was seen in moving away from viewing land use as a binary (yes/no) construct, with one land use occupying the entire land holding or none at all. This concept draws parallels with ways in which Māori historically engaged with the land – utilising various portions of a landscape intensively or extensively, gardening, hunting and harvesting a variety of forms of sustenance (Hargreaves, 1963; Pool, 2015). It is a reasonable inference that land uses with diverse income streams are more attractive to landowners and may potentially yield further positive co-benefits. In most instances, this was conceptualised by the key informants as mixed-use forestry (e.g. planted rewarewa for timber and honey, interspersed with kawakawa/mānuka/kānuka for commercial bioactive purposes and rongoā Māori).

Hall (2018) draws on this notion through contrasting a ‘Siloed World’ with an ‘Interwoven World’ when discussing land use in Aotearoa. The Siloed World, it is argued, is one where land use is compartmentalised, and in Aotearoa, with pastoral agriculture, exotic commercial forests and conservation forests broadly dominating land use. These land uses are responsible for 95 percent of land use in Te Tairāwhiti (Statistics NZ & MFE, 2019), and 92 percent of productive land uses across Aotearoa as a whole (MFE, 2018). An ‘Interwoven World’ is a theoretical world in which a variety of land uses merge and intermingle to create a diverse palette of land uses across Aotearoa, beyond the monoculture regimes which dominate today.

The underlying concept of the ‘Interwoven World’ has potential to assist in moving away from path dependent land use planning systems and into a system driven by synergies between what is best for people who inhabit particular

spaces, and the spaces themselves. Whilst the concept of a sustainable land use mosaic may not mesh entirely with the 'Interwoven World', they are broadly comparable. Path dependent land use systems are driven by institutions but also by culture, and our national history and experience of pastoralism may play heavily into continuation of a largely siloed world. Hall (2018, p. 17) aptly justifies moves towards a land use system comprising a 'land use mosaic' or 'interwoven world': although "the Siloed World is well-aligned with short-term economic growth, it is in many ways misaligned with a long-term prosperity that is founded upon a favourable balance of social, environmental and economic outcomes."

The key informants were consistent in advocating for a granular land use approach where multiple land uses could occupy a single landholding. Nuhiti Q likely did not see their diversification strategy as contributing to a 'land use mosaic' or being a constituent of 'The Interwoven World' – instead, diversifying away from sheep and beef farming was seen to be justified in terms of improving the resilience of the Incorporation. In the interviews with key informants, it was evident that moving beyond a short term view and assessing what is the best land use for the health of the land and the health of the people was seen as a key paradigm shift that external organisations and in some cases Māori landowners must make in order to ensure the greatest benefits are realised. A local social enterprise, Hikurangi Enterprises Ltd, is an example of an organisation which is seriously investigating alternative land use options and moving away from path dependent patterns by looking at medicinal cannabis and industrial hemp

farming, native forest carbon farming, and pharmaceutical extracts from kānuka and mānuka oil¹⁷.

Reconnecting Māori landowners with their land was seen to be a key land use co-benefit at all stages of the MCA. Land uses which require more interaction and decisions on an annual basis were seen to be most effective in creating an interest in what is happening 'at home'. Diverse land use systems have been seen as deepening a sense of connection with the land. Moreover, a land use mosaic was seen as important to contributing to various forms of resilience, and this applied to land uses strengthening the ability for those in the Waipapu catchment to exist outside the formal economy through capability building and skills development, or in terms of greater facilitation of hunting and gathering. Resilience was also thought of in terms of the ability of land uses to withstand current and future environmental pressures such as erosion and extreme weather events, inevitably increasing with climate change. Having less reliance on sheep and beef farming or exotic forestry through diverse land uses was linked to economic resilience.

7.8.4 Central government funding mechanisms for land development

There is provision within the 1BT programme for joint ventures between the Crown and landowners to establish forests, although it is expected this will predominantly be exotic forests (Te Uru Rakau, 2018). Joint ventures may be attractive as they open up access to much needed capital for Māori landowners. However, the experience of Nuhiti Q has indicated that a lack of capital is often a

¹⁷ Hikurangi Huataukina Trust administers Hikurangi Enterprises Ltd and supports community-led economic development in the communities between Waipiro Bay and Rangitukia on the East Coast of the North Island of New Zealand. <https://hikurangi.enterprises/about/>

factor which inhibits Māori landowners being able to actualise their land use decisions around forestry. Further proposed reforms around the NZ ETS (new permanent forest activity and average carbon accounting) could improve the experience of landowners once they have entered the NZ ETS, yet there is scant evidence that factors which make entry into the NZ ETS difficult for Māori landowners have been addressed at this stage. Beyond changes to the NZ ETS, the 1BT programme offers an attractive funding avenue for Māori landowners who might desire to actively afforest their lands (yet, there will still be arguments that this funding may contribute to further 'locking up' of land). There is provision within the 1BT programme for funding native afforestation (Te Uru Rakau, 2018). Other recently announced avenues of funding to support the development of Māori land includes the Whenua Māori fund, launched in 2016, which provides access to \$56 million in funds for Māori freehold landowners developing under-utilised land from scratch, or establishing governance/management structures and supporting diversification strategies (Dunlop, 2019). Another tranche of funding (\$100 million) has been allocated to Māori landowning entities from the Provincial Growth Fund. This funding is for Māori landowners who are already utilising their land, but cannot access extra capital to increase productivity or diversify their core business (RNZ, 2019). Both these sources of funding help to support Māori landowners to access much needed capital and support the development of strong governance committees. Yet, for some landowners, partnerships with the Crown may not be desired and joint ventures with non-governmental organisations may be more desirable. This is where the success of Nuhiti Q's experience of partnering with Craigmore Sustainables and Gull NZ shows promise.

It is also important that knowledge about the Nuhiti Q case study is shared through channels that are familiar to Māori landowners in Te Tairāwhiti, in a balanced, unbiased manner. Many landowners will be hesitant to enter the NZ ETS as it involves an entirely different approach to land management from that

typically practised in Te Tairāwhiti. Creating a carbon farming cooperative (potentially with seed funding from the Provincial Growth Fund or MAPIP)¹⁸ in Te Tairāwhiti that leverages the point of difference Māori landowners have in carbon farming native species on Māori owned land might be a good way of creating the economies of scale required to enter the NZ ETS with lower cost and risk. As noted above, it would have the supplementary benefit of being attractive to large emitters interested in direct bilateral partnerships which can lead to a market premium when co-benefits are explained and marketed (Hale & Kerr, 2019).

7.9 Policy conclusions on using carbon farming as a development opportunity for Māori

Participants in this research identified that explaining and promoting the NZ ETS would be an important activity; this is a finding which reinforces existing research by Harmsworth et al. (2010) and Warmenhoven et al. (2014). Further to this, there seem to be capacity constraints at local GDC and MPI offices. It was therefore also deemed pertinent to share such information through channels that are familiar to Māori landowners in Te Tairāwhiti, in a balanced unbiased manner and by those that are trusted within Māori communities. However, as noted, many landowners will be hesitant to enter the NZ ETS as it involves an entirely different approach to land management from what is typically practised in Te Tairāwhiti.

¹⁸ Māori Agribusiness Pathway to Increased Productivity (MAPIP) Programme. <https://www.mpi.govt.nz/funding-and-programmes/maori-in-the-primary-industries/maori-agribusiness/maori-agribusiness-pathway-to-increased-productivity-mapip-programme/>

Interviewees with experience in land management and forestry such as Bryan McKinlay, and participants [E2 land use practitioner], [E3 forestry 1], [E5 NGO] and [E10 forestry 2] took the view that the NZ ETS is not landowner friendly, and this is particularly true for under resourced or undercapitalised Māori landowners, who in many instances likely do not have the time, capacity or resources to negotiate with the relevant officers at local government level or officials in MPI. It is fundamental that clear and understandable information about the benefits (and costs) of the NZ ETS is provided by government agencies to better inform land use decision-making. The provision of this information is key not only for landowners, but for local government, banks, and those providing independent advice to landowners. A key finding of this study reflected in Awatere et al. (2018) and Warmenhoven et al. (2014) is the need to support 'local champions' and those with experience in the NZ ETS (such as Nikki Searancke) to act as role models for other interested landowners. Moreover, building governance capacity within for those managing trusts and incorporations is also important to overcoming these barriers. In 2017, during the early stages of the Nuhiti Q case study, there was agreement that the GDC was aware of the NZ ETS, but the GDC was often seen as not having the capability or the capacity to adequately offer impartial advice to potential participants and also tie in the benefits of carbon farming with region specific erosion control schemes such as the ECFP.

7.10 Reflection on the strengths and limitations of this research

All research comes with limitations, and this study is no exception. In regard to this research, limitations are related to the number of case studies, methodological decisions regarding the MCA, and the structure of the MCA wānanga. Because this research began as a master's research project which was then expanded into a PhD, there are certain areas of this research which could have been approached differently. Most significantly, further case studies of

Māori landowning entities participating in the NZ ETS may have bolstered the carbon farming conclusions of this research. However, instead, investigation of a broader spectrum of land use options served to strengthen and widen the research. Focusing entirely on carbon farming would have made the mistake that other 'outsiders' to the Waipau catchment have made, in assuming certain land uses are best suited to Māori land. Instead, this thesis explored the assumption that carbon farming is a valuable land use that suits the characteristics of Māori land in Te Tairāwhiti, considering its environmental benefits and its financial benefit. The risks and barriers associated with this land use alongside other land use options have been explored at length.

A limitation of the present study relates to methodological aspects of the MCA. In order to ensure the scoring and weighting process was as efficient as possible so as not to hold up the wider wānanga, decisions were made after a pilot study to expedite these aspects of the MCA process. Instead of using the most robust possible weighting method such as the 'swing weight method' promulgated by Belton (1990), a 'pre-normalised' weighting method (discussed in section 3.2.6) was developed that ensured the core methodological requirements were met, and participants were able to complete judgements efficiently. Another limitation identified during data analysis was the uniformity of scores for certain land uses, but particularly for high and low scoring alternatives such as 'maize cropping' and 'native forestry'. Requiring participants to score a land use against each criterion in turn as opposed to assessing each land use individually against a criterion may have increased uniformity in the resultant scores.

The co-facilitator and I also found it difficult to find a good balance between challenging the participants about the weightings and scores given to land uses and accepting their conclusions. The strength of MCA is its deliberative and participatory elements, yet it appeared that some of the scores were unrealistic, e.g. 'medicinal cannabis and hemp' and 'exotic forestry' receiving similar scores for 'erosion control'. The concern was that if we challenged participants too

forcefully on their determinations, the MCA would lose its legitimacy. Yet, conversely, there was a risk of results losing legitimacy because of the polarisation evident in some results. However, the strength of the MCA results also lies in the fact that despite polarisation in two of the four models, the results are markedly similar, with 'native forestry' the best performer and existing land uses all performing poorly.

This research has only been able to explore a limited range of the benefits that Māori landowners associate with land uses. These were identified through consultation with key informants and it is clear that a number of other benefits exist that are worthy of testing but were unable to be assessed in this research. This may be because they were very specific, or only mentioned by a small number of key informants. In some cases, co-benefits mentioned were amalgamated into broader agglomerates that were assessed.

Identifying co-benefits at a 'key informant' level may also be a limitation of this research. By and large the key informants who participated in this research worked in the research sector, consulting or other professional industries and most lived outside Te Tairāwhiti. Surveying landowner participants to identify co-benefits may have widened the net and allowed for a more diverse set of land use co-benefits to be identified.

An obvious limitation of this research is the fact that it has been carried out by a non-Māori. This would seem to directly contradict the positions held by epistemological theorists such as Smith (1999), that kaupapa Māori research (KMR) research is 'by Māori and for Māori'. I have however made careful efforts to conduct this research within the spirit of KMR, while acknowledging that as a Pākehā, I cannot truly conduct KMR. It is also acknowledged that I may be seen as being in a position of power as I instigated the research and interpreted and wrote up the results. My positionality was acknowledged in section 3.2.3 and my position as a middle class Pākehā male undoubtedly influenced how I was

perceived. I often felt that landowners looked upon me as an expert, and I endeavored to remain as neutral as possible when answering queries.

The transformative approach of this research can be justified as the Waiapu catchment and wider region has numerous land use challenges and adopting an action-oriented research paradigm to remedy these problems is warranted. The use of MCA to elucidate the benefits Māori landowners associate with land uses is also considered a valid choice that supports the objectives of transformative and KMR approaches. The participatory and deliberative aspects of this particular value articulating institution adheres in many ways to requirements set out by Bishop and Glynn (1992) to use an 'empowering methodology'. I regularly kept in contact with 'advisors' in Te Tairāwhiti to ensure that my research approach was critically appraised throughout, and I received valuable advice from my advisers as to how to conduct myself in the field. Yet it may be that the best test of these methodological considerations will lie in the perspectives of the participants in this research.

As one cannot "get completely outside of one's positionality" (Tisdell, 2012, p. 333) it has been a useful exercise to reflect on how I have responded to and developed alongside this research. I am aware of my naivety in approaching this research project when it was in its infancy. For example, some of the lines of questioning I tried to pursue early on attempted to unearth differences between the usage and capability of Māori and Pākehā land and those in charge of those land blocks. I now see that this is unhelpful, as it may enflame perceived differences between Māori and Pākehā in regard to land use. I also found that the journey of actively learning te reo Māori, being 'comfortable with being uncomfortable', and connecting with numerous research participants whom I hold in the utmost esteem was immensely fulfilling. At a personal level, learning about my familial connections to Te Tairāwhiti through the course of this research also added another layer of depth to the research process, and I am proud to have

connected and formed relationships with previously unknown distant relatives in the region.

8 Conclusion

This study has explored drivers of Māori land development in Te Tairāwhiti, on the East Coast of the North Island of Aotearoa. Land uses in this area are currently dominated by exotic forestry and sheep and beef farming. This situation has arisen because historically, both implicitly and explicitly, the actual land use preferences of Māori landowners have been largely ignored. Instead, Māori land has been not developed to its full potential due to its quality, it being tied up in long term leases to external parties and perceptions that exotic forestry and sheep and beef farming are the only suitable land uses for Māori land in the area. For a novel land use such as carbon farming this history is relevant, particularly as indications are that Māori landowners are becoming disillusioned with current land uses.

Against the background of these historic patterns, the aims of the research were twofold: to explore the experience of a Māori landowning entity participating in the NZ ETS using native forest species; and secondly and more broadly, to investigate how other considerations, particularly co-benefits associated with land use options applicable to Māori land in the region, are valued when compared to those arising from native forest carbon farming.

In relation to the first aim, an early component of this research involved analysing the merits of Nuhiti Q, a Māori farming incorporation, retiring a significant portion of their landholding into a permanent native carbon forest. Nuhiti Q also entered into a carbon farming partnership with a carbon dioxide 'emitter' and fuel supplier, Gull NZ. This case study investigated the genesis of this partnership and the wider risks, barriers and opportunities for Māori landowners entering the NZ ETS and engaging in carbon farming as a land use. This investigation provided insights into the applicability of carbon farming and practicalities relevant to Māori landowners in Te Tairāwhiti when entering the NZ ETS and implementing native, mixed or exotic planting regimes in order to gain a carbon-based return.

The findings from this case study have informed the main part of this study. This has involved an assessment of how and why Māori landowners in Te Tairāwhiti value the co-benefits associated with a range of different land uses including carbon farming native forests as against conventional and emerging land uses such as exotic forestry, sheep and beef farming and cannabis and hemp farming. This study utilised novel research methodologies to assess these values. A value articulating institution, multi-criteria analysis, which prioritises participatory and deliberative group based value judgements, was used to generate scores and weightings which represented the strength of association between land use options and their benefits and co-benefits in the Waiapu catchment. The mixed methods approach to this research complements the transformative research design which emphasises action oriented, co-designed research that centres the mātauranga and experiences of the participants. The underlying desire, as a non-Māori researcher, has been to work within the ‘spirit of kaupapa Māori methodology’.

8.1 Context provided by the literature

Through the course of colonisation initially, and then latterly through bureaucratic and economic means, the diverse ways Māori had engaged with and managed their land was disrupted and largely swept aside. These changes had demonstrably negative effects for the people and landscapes of Te Tairāwhiti. Large purchases and confiscations of land from the mid-late 19th century through racist judicial and legislative instruments, which favoured the colonisers, was part of the Pākehā social and economic hegemony which Māori were ill-prepared to resist and have struggled to shake off since. Pākehā extensively alienated lower-lying fertile land, leaving Māori in Te Tairāwhiti and throughout Aotearoa with a disproportionate share of marginal, non-economic land blocks with multiple owners under a poorly conceived system of ‘private ownership’. These changes were particularly pronounced in the Waiapu catchment, where Pākehā seized the

mandate to initiate land use change and did so with vigour. Rapid deforestation occurred in the area in the late 18th, and early 19th centuries. This aggravated already high levels of erosion in the geologically dynamic area and has afflicted the area with the some of the highest sedimentation in the country, and the Waiapu river, the life blood of Ngāti Porou, with severe sedimentation issues.

The Waiapu catchment consequently saw different waves of monoculture land uses dominate the majority of Māori and Pākehā land alike. Initially there was sheep and beef farming. However, when the environmental degradation associated with this land use increased and coincided with falling returns, another widespread land use change occurred rapidly (and with minimal input from Māori in the area). Land was converted into exotic plantation forestry, dominated by *Pinus radiata*. This land use change arrested some of the pressing erosion in the area, and effectively treated severely degraded land, yet it has been likened to ‘papering over cracks’: erosion in areas such as the Tapuaeroa and Mangatu catchments had evolved into ‘untreatable gullies’. Further, exotic forestry came with a host of environmental issues which largely centre around the risk of forestry slash being swept off hillsides in heavy rain events when the land is left barren and unprotected post-harvest. There are other glaring issues associated with commercial forestry in the region – chief of which is the poor health and safety record of the industry, the wildly fluctuating returns from harvested timber, barriers to Māori accessing ancestral land and the poor levels of employment which has increasingly shifted to contract work.

Because of the previously mentioned issues, Te Tairāwhiti has for some time been identified as a region suitable for carbon farming native forests on steep erosion prone land where pastoral farming has been marginal for some years. As Funk notes, ‘native tree species quickly invade pastures with low grazing pressure, and indigenous Māori land owners often struggle to profitably manage large areas of communally owned land’ (Funk et al., 2014, p. 1). The justification for carbon farming in this area has been largely based on analyses in Funk et al. (2014) and

Harmsworth et al. (2002) who identified large swathes of Māori land as suitable for this land use. The rationale for carbon farming native forests at a wide scale on Māori land in the region often hinges on erosion control benefits through reduced sediment loading to waterways and downstream improvements in freshwater quality and habitat, and improved biodiversity outcomes. Other evidence indicates that native forests provide a number of important socio-cultural co-benefits. Chief among these is the provision of rongoā Māori, and continued access to traditional medicines and food whilst also allowing for recreation. The economic potential of carbon farming native forests has traditionally been thought of as a significant motivator for Māori landowners to either afforest their land or enter eligible forested areas of land into the NZ ETS.

Although a variety of opportunities have been identified for Māori landowners to participate in the NZ ETS, to date there has been little participation by Māori landowners. This research has not only sought to explore carbon farming native forests, but also to go beyond this to investigate how Māori value the advantages and disadvantages of a broader suite of land uses.

The transformative potential of research can often be overstated, and the usage of transformative research epistemologies may be in name only. This conundrum goes to the core of what it means to do transformative research in te ao Māori. The extensive legacy of extractive research conducted 'on' (not 'with', 'in partnership', or 'supporting') Māori participants has meant that for many, the academy, and academic research methods are a source of mamae. Māori are rightly careful with their mātauranga, and cautious about what outsiders are allowed to share in this knowledge. Unsurprisingly, this also strikes at the heart of what it means to do kaupapa Māori research - that it is, as detailed by Smith (1999); research "for Māori, by Māori". So how can a Pākehā from the academy, and outside of Te Tairāwhiti expect to give effect to the transformative objectives through the course of this research?

Given this research was conducted ‘within the spirit of kaupapa Māori research’ through a transformative epistemology it is critical to interrogate how exactly this research is transformative. How will this help the communities I have been working alongside? How will this research be disseminated amongst the public? Through what mediums? How will this relationship develop in the future?

To begin, the most critical aspect of the research process were the development of genuine and respectful relationships with the participants of this research. This was done in two ways. Firstly, I was introduced to local community members who had partnered with academics in other research projects and were well trusted within Te Tairāwhiti and the Waiapu catchment. Secondly, at the invitation of these contacts I participated in a number of hui between 2016 and 2018 where I introduced myself, my connection to the region and my intended course of research. Hui in 2016 and 2017 allowed me to establish connections with future participants, and begin to scope the project and ensure that the ‘transformative’ research I intended to conduct was actually going to be transformative for the participants themselves.

It is also critical to consider how I will work to continue the transformative goals of this research. Whilst I am proud of the participative and deliberative research that has been conducted, it remains to be seen whether the research participants share in this enthusiasm. Sharing the findings of this research with community members in te Tairāwhiti is an incredibly important part of the process. As part of the Waro project, a ‘wrap up’ hui will be organised to share the findings of the Waro project, and I will share the key findings from this research also. Yet hui may not be the most efficient avenue to share this research. Through this research I have produced a series of Youtube videos highlighting the Nuhiti Q case study, these are easily shared and have been disseminated throughout relevant Te Tairāwhiti Facebook groups. Traditional academic publishing also offers opportunities to share these findings and stimulate further interest into foci of this research. Furthermore, publication in non-traditional formats such as in the

news media, or dedicated Māori news outlets such as E-Tangata, Radio Waatea and Māori TV. Yet I believe the most important thing for myself is to deepen the personal relationships I have been fortunate to make with participants in the region and work to assist Te Tairāwhiti Māori landowners wherever they see a place for someone with my skill set and commitment to the region. That to me is the most important aspect of transformative research – giving back to those who have given so much to you.

To conclude, my years long commitment to building and maintaining relationships into the future with te Tairāwhiti community members shows my commitment to transformative research approaches. Moreover, my commitment to disseminating the research through multiple avenues should allow the research to achieve its goal of having a transformative impact for Te Tairāwhiti Māori landowners.

8.2 Summary of findings

The research approach employed has led to a number of new findings about the land use preferences of Māori landowners in the Waipau catchment. These will now be discussed in turn.

8.2.1 Nuhiti Q case study

A case study of a large Māori land block in Te Tairāwhiti – Nuhiti Q allowed me to understand the barriers and opportunities experienced by existing carbon farming operations. This aspect of the research was solely qualitative in nature and centred on a number of semi-structured interviews with the chairperson, Nikki Searancke, and other stakeholders with intimate knowledge of the partnership.

Environmental and economic challenges steered the Nuhiti Q block towards land retirement, yet the advent of carbon farming presented an opportunity to offset

the cost of land retirement with revenue earned from sales of New Zealand Units under the NZ ETS. This research has also shown that the decision to opt for carbon farming has allowed Nuhiti Q to rebalance a number of conflicting imperatives. It provided a stable revenue stream, while assuring the management committee and wider body of landowners that retirement of actively farmed areas was a prudent course of action to ensure the continued resilience of the Incorporation itself, and also one that would protect numerous areas of cultural significance for the hapū and lead to increased prosperity for future generations.

A decision was made to retire the most unproductive erosion prone areas of the farm into native forest (alongside existing areas of reversion), and enter the NZ ETS, which was achieved in 2012. This was facilitated through an innovative partnership with Craigmores Sustainables. The land (about 500ha) which Nuhiti Q entered into the NZ ETS was eligible post-1989 regenerating native forest land and this was supplemented with an additional 70 ha planted in exotic Eucalyptus species. The revenue from payments under the NZ ETS for the carbon sequestered has been invested in intensifying the remaining pastoral areas, and establishment of a macadamia orchard alongside the leasing of mānuka honey apiculture rights. These diversification decisions have increased the economic and environmental resilience of Nuhiti Q whilst safeguarding taonga for the benefit of current and future generations of landowners.

Much Māori land is deemed 'marginal' and would be eligible for entry into the NZ ETS; despite this, Nuhiti Q's entry is unusual, and although successful, met substantial challenges and risks along the way. This highlights the future work needed in order to improve engagement between government agencies such as MPI, and local government and other stakeholders to be able to support landowners through the processes of determining eligibility, establishing NZ ETS register accounts and filing mandatory emission returns. It is uncertain whether Nuhiti Q would have been able to enter the NZ ETS without a joint venture partner in Craigmores Sustainables, but it is clear that Craigmores provided valuable advice.

Nuhiti Q's success in participating in the NZ ETS may be unusual rather than an anomaly, and other Māori landowners in the region and throughout Aotearoa may draw from this case study and build greater resilience into their land management through native afforestation and the various benefits associated with such a land use choice.

8.2.2 Qualitative and quantitative findings from multi-criteria analysis

A central finding from the multi-criteria analysis component of this research is that the land use preferences of Māori landowners in the Waiapu catchment are generally for native forests. These preferences broadly fall in line with the objectives of central and local government regarding afforestation through the One Billion Trees Programme (1BT) and the Erosion Control Funding Programme (ECFP). Native forests are most closely associated with various environmental co-benefits (erosion control, water quality, biodiversity, and withstanding and limiting climate change) and also social and cultural benefits (skills development, employment, reconnecting with the land, and self-determination/autonomy).

Exotic forestry is associated with employment and skills development benefits, and also its ability to limit and withstand climate change. Yet, exotic forests are poorly thought of in regard to water quality, biodiversity, financial return and market resilience. There is also a clear finding in both the quantitative and qualitative data collected that exotic forests disconnect Māori landowners from their land and reduce the ability for communities to be self-reliant. Similarly, the other predominant land use in the region, sheep and beef farming, is seen as performing poorly – most notably on environmental and economic co-benefits, although better performing on co-benefits such as skills development and employment. Māori landowners were much more likely to associate co-benefits with novel and untested land uses such as medicinal cannabis and hemp, kumara cropping and perennial orcharding. Whilst these land uses are only suitable for small areas of Māori land in the region, the degree to which co-benefits were

associated with these land uses in comparison with sheep and beef farming and exotic forestry indicates dissatisfaction with the status quo.

It seems reasonable to conclude that the negative historical experiences associated with sheep and beef farming and exotic forestry, together with the affect heuristic and the ease of recall bias (cognitive biases, in the former, associated with 'positive or negative feelings' towards a land use, and in the latter, expectations that easily recalled recent events will likely occur in the near future) can explain the ratings of the high and low performing land use alternatives; and a degree of optimism bias can help explain ratings of those land use alternatives that performed exceedingly well in the face of little evidence. This may suggest future success (or at least community buy-in) if medicinal cannabis and hemp, kumara cropping and perennial horticulture, are developed in future in the Waiaapu catchment.

Whilst these results may indicate a preference for emerging land uses over other existing ones such as sheep and beef farming and exotic forestry, the results are unsurprising when considering the broader history of land loss, and the subsequent land use changes that occurred in the decades and centuries from colonisation (and the complex environmental and socio-cultural impacts of these processes). What is clear is that current preferences are the result of a complex set of historical factors. One of these is land use path dependency; the others include the structures by which Māori landowners have managed their land; and others relate to how Māori landowners can access capital for further investment – and the associated pressures placed upon Māori to engage in certain land uses. For an outsider, it is perhaps easier to stand back and look at these issues dispassionately – noting the poor scores of such land uses as sheep and beef and exotic forestry. Yet these poor scores cannot be ascribed simply to biases, even if biases play a role. Ratings are more likely to be tied to cultural experiences, cultural imperatives and values.

Interviews with key informants generated data for consideration by landowners at the multi-criteria study wānanga. Broadly, the key informants agreed on the substantive land use opportunities and barriers unique to Māori landowners in the Waipapu catchment. Resilience of the landform and better potential in terms of governance of the landowning entity were considered to be important co-benefits, alongside others which included reconnecting landowners with their ancestral land and a greater emphasis on land uses which further kaitiakitanga objectives and promote mana motuhake. The key barriers identified that inhibit Māori landowners from determining and actualising their land use futures are thought to be in part due to the path dependency of industries and services in the region, poor connectivity between local and central government and Māori landowners (or their representatives) and a conservative decision making disposition – leading to hesitancy to make bold land use decisions. This can also arise in part due to capability constraints of those in governance positions or dysfunction within governance committees.

Funding mechanisms designed by local and central government were thought to be appropriate mechanisms by which to encourage Māori landowners to enter the NZ ETS but poorly tuned policy settings such as requirements to equally co-fund any project, in earlier iterations of the ECFP, and onerous bureaucracy have impeded involvement. In addition, the study's key informants acknowledged there is little awareness of the NZ ETS or ECFP amongst eligible landowners.

There was uniform acknowledgement that there are environmental issues associated with exotic forestry, yet the severity of these issues was disputed. Some key informants saw merit in the employment benefits of the exotic forestry industry and considered that these outweighed periodic bouts of environmental degradation. The episodic nature of activity in the exotic forest sector was seen to be an important issue, and Māori landowners are thought to have become more disconnected from their land because of the associated dearth of continuing employment. It was also thought by some that this dearth would intensify if more

permanent carbon forests are established, as there would be even less long-term employment. There was a perception that promises made by the exotic forest industry at the beginning of plantation cycles had not been realised, which has contributed to dissatisfaction on the part of Māori landowners. Permanent native forest carbon farming was seen as best existing in highly degraded areas of farmland and best suited as a complement to other land uses.

8.2.3 Contribution to knowledge

Through exploration of carbon farming, and the various considerations (particularly co-benefits) associated with a range of land uses in the Waiapu catchment and Te Tairāwhiti, this research has produced a number of findings of interest to environmental studies and geography. These will be discussed in turn. The first outcome of this research was documenting one of the first non-forestry Māori landowning entity's entry into and participation in the NZ ETS. As the Nuhiti Q case study has demonstrated, the Incorporation has withstood myriad threats to its viability, chief amongst them land erosion, given that the costs associated with erosion were slowly becoming insurmountable. Entry into the NZ ETS offered capital to invest in fencing, and capital to further diversify the landholding into a more resilient Incorporation. This case study has provided a vivid picture of the barriers Māori landowners face in entering the NZ ETS, whilst also outlining how a decision such as NZ ETS entry can also improve the viability of Māori landowning entities with areas of NZ ETS eligible land. This study has also highlighted the risks associated with carbon farming – some of which are general across all landowners, while some are unique to Māori landowners - such as the intergenerational equity issues about carbon farming.

The second key outcome is answering calls in Warmenhoven et al. (2014) and Funk (2009) to explore the specific values and benefits Māori landowners ascribe to certain land uses. There has been much discussion about Māori having affinity with native forests for a myriad of reasons. This research has sought to explore

exactly how much certain co-benefits of native forestry (across environmental, economic and socio-cultural dimensions) are actually valued, why, and how these values relate to the values of other alternative land uses. By empirically qualifying the benefits Māori landowners in the Waiapu catchment associate with certain land uses, policy makers, researchers and industry will have more awareness of what Māori landowners see as the future of land use in the region, and more generally, what is most valued in land uses.

The third academic outcome relates to the use of MCA in quantitatively identifying the strength of association between particular land uses and land use co-benefits. To the best of our knowledge, this may also be the first instance of multi-criteria analysis being usefully employed in the context of land use decision making in Aotearoa. The participatory and deliberative elements of MCA lend themselves well to research concerning Māori issues or with Māori participants due to the focus on extensive stakeholder engagement, iterative methodological process and direct input from participants into project design and exploration of the resultant data. These attributes of MCA should be considered by those designing future studies in this area. Social science techniques have been used to collect sensitive case study information and core land use information from the key informants, who – given the history in the area – are not always predisposed to divulge this information. When this is coupled with robust data from the MCA the results become more compelling to a broader audience.

8.3 Recommendations for further research

The Nuhiti Q case study offers a unique and substantive view of a novel land use choice made by a Māori landowning entity, that responds to calls by authors such as Stephan and Paterson (2012, p. 550) to investigate how emissions reductions “*are produced, commensurated and commodified*”. Yet, there remain many other aspects of Māori landowner participation in the NZ ETS. For many landowner participants of this research, the economic benefits of native forests are not as

important as other benefits. Yet, for some landowners, Māori and Pākehā alike, the potential economic returns factor heavily into any assessment of land use change. For most, the lookup tables provided by MPI¹⁹ are relied upon for generalised sequestration rates (and therefore a rough estimate of return from carbon revenue). There are detailed region-specific sequestration rates for a range of exotic species – yet, for native species there exists only one table for the whole country. Having region specific data would likely better reflect how native species compare against exotic species and could potentially shift investment helpfully.

There is also a need to explore how non-economic values can be better incorporated into the NZ ETS. Afforestation, and particularly native afforestation, provides an array of benefits which accrue to the landowner, local communities and Aotearoa as a whole (if considering carbon sequestration). At present, the landowner is only rewarded for carbon sequestration when in reality an array of benefits are provided to the aforementioned parties. Designing NZ ETS policy that accurately prices the entirety of benefits (beyond just carbon sequestration) provided by native forests could work to better incentivise native afforestation in the right areas, and more importantly, better reward landowners for the provision of socio-cultural and environmental benefits and the avoidance of economic harm. This would be a fruitful area of future inquiry.

Future research could also investigate other areas of Aotearoa where Māori have eligible post-1989 forest land. This research could explore whether the motivations of drivers of native afforestation for carbon farming are similar, and further, whether some barriers to (and risks thereof) participation in the NZ ETS are unique to those landowners in Te Tairāwhiti, or comparable across the

¹⁹ See: MPI, (2015a) 'A Guide to Look-Up Tables for Forestry in the Emissions Trading Scheme'.

country. Because Māori own a disproportionate share of marginal land, having region specific case studies may better inform landowners who are considering native forest carbon farming as a land use.

8.4 A final future area of research could explore the experience of different indigenous peoples from around who have participated in emissions trading schemes. Such a study could also seek to explore how First Nation values are incorporated into such schemes (if at all). The evidence from Australia and Aotearoa can help to inform these inquiries – however, tying the Australasian indigenous experience in with evidence from other jurisdictions could build an important store of knowledge regarding the opportunities, barriers and risks for indigenous peoples partaking in emissions trading – and seek to support others considering these endeavours. Conclusions

This research set out to explore the opportunities, barriers and risks Māori landowners face when exploring and participating in the NZ ETS. There was little existing research in this area and the Nuhiti Q case study helped to fill this gap. Yet, in the course of this research, the dismal history of land use management and planning in the Waiapu catchment at the hands of non-Māori became abundantly clear. It was thus imperative that the views, perspectives and values of Māori landowners needed to be at the centre of any assessment of land use in the area.

The degraded state of Māori land in the Waiapu catchment and Te Tairāwhiti led many in academic and policy making circles to suggest native forest carbon farming as a land development panacea. At face value it would seem these assertions have merit given the connection between Māori and native forests, and the potential for greater economic returns from their land. This may be true for one large and well governed Māori Incorporation at the centre of this study, and also, a broader cross section of Māori landowners, but not for the reasons

that may be expected. Although native forests are associated with economic returns on par with and in excess (in two models) of sheep and beef farming and exotic forestry this research has indicated that the actual value of native forests lies not in their potential to offer lucrative returns through sale of NZUs under the NZ ETS, but as a manifestation of their intrinsic value which exist across a spectrum of socio-cultural and environmental benefits. These far surpass any offered by traditional land uses. Yet, there are risks and barriers to participation in the NZ ETS. A key barrier is 'locking in' carbon farming as a land use if NZUs are sold at today's prices (~\$25 per tonne). It would be significantly more expensive to repurchase the same quantity of NZUs even five years in the future, due to expectations of an increase in the carbon price. Native forest carbon farming may suit the objectives and values of the current generation of landowners, but it is unknown whether future generations will share these values.

Beyond these factors, it is clear that native forest carbon farming, for much Māori land in the Waiapu catchment and Te Tairāwhiti, is a valid and sensible land use option. Not because of the economic returns, but because of the plethora of environmental and socio-cultural benefits that landowners in this study associate with it. This is also a land use that is desired by those living within the rohe, a not so insignificant fact that can address the legacy of land use decisions made by those who have no connection to, and have not lived in Te Tairāwhiti, and may not appreciate the socio-cultural and biophysical characteristics of the Waiapu catchment.

These results push back at the prevailing Pākehā dominated orthodoxy, which has existed from the early days of colonisation and holds that monoculture land uses, for profit above all else, are best suited to the land and the people. It is clear, from this study, that Māori landowners wish to move to a vibrant multi-faceted land use regime – exemplified by diversity over homogeneity – that coincidentally characterised the pre-colonisation Māori economy. Blending cultural values with land use decisions with the support of government institutions will allow current

and future generations to flourish on ancestral land, build resilience into the regional land use regime and better contribute to the local economy. By harking back to the ways of old, landowners in the Waipuu catchment and Te Tairāwhiti can build resilience and sustainability into their land use regimes and move confidently into the future.

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Appendices

A.1 Human ethics approval



Thu 25/05/2017 9:11 a.m.

researchmaster-help@vuw.ac.nz

A Human Ethics application has been approved. 0000024728 Automated Email, Do Not Reply.

To john.Overton@vuw.ac.nz
Cc: ohopeeio@gmail.com

Dear Head of School or delegate,

A Human Ethics application has been approved for a researcher in your School. The application details are below. You have online access to this form through ResearchMaster here: <https://rme.vuw.ac.nz/RMENet/>.

Application ID: 0000024728

Application title: The Emissions Trading Scheme: Applicability, practicality and feasibility in Tairāwhiti/East Coast.
Researcher: Leo Mercer

It is best to use either Internet Explorer or Safari to access the system.

Thank you

ResearchMaster

*****This is an automated email. Do not reply to this email address*****

Queries for the central Human Ethics Committee can be sent to ethicsadmin@vuw.ac.nz

Pipitea Ethics subcommittee queries can be sent to: pipitea-hec@vuw.ac.nz

Psychology Ethics subcommittee queries can be sent to: wendy.ward@vuw.ac.nz

Information Management subcommittee queries: vanessa.venter@vuw.ac.nz



Wed 27/06/2018 8:50 a.m.

researchmaster-help@vuw.ac.nz

A Human Ethics application has been approved. 0000026194 Automated Email, Do Not Reply.

To

Cc ohopeleo@gmail.com

Dear Head of School or delegate,

A Human Ethics application has been approved for a researcher in your School. The application details are below. You have online access to this form through ResearchMaster here: <https://rme6.vuw.ac.nz/RME6/>.

Application ID: 0000026194

Application title: Beyond the dollar: carbon farming and its cobenefits for Tairāwhiti Māori landowners

Researcher: Leo Mercer

It is best to use either Internet Explorer or Safari to access the system.

Thank you

ResearchMaster

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Information Management subcommittee queries: vanessa.venter@vuw.ac.nz

A.2 Interview schedules and participant information and consent forms

Information sheet for Nuhiti Q case study participants



The Emissions Trading Scheme: Applicability, practicality and feasibility in Tairāwhiti/East Coast.

INFORMATION SHEET FOR PARTICIPANTS (third party)

Thank you for your interest in this project. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to take part, thank you for considering my request.

Who am I?

My name is Leo Mercer and I am a Masters student in Environmental Studies at Victoria University of Wellington. This research project is work towards my Thesis.

What is the aim of the project?

This project will explore a contemporary carbon farming partnership forged between a Māori landowning incorporation: Nuhiti Q Inc. and Gull New Zealand operating within the Emissions Trading Scheme (ETS). There are few partnerships of this nature in New Zealand, and the inclusion of Nuhiti Q in the ETS offers a great chance to investigate the complexity of this arrangement. The aim of the project is to investigate the construction of partnerships between those that emit, and those that offset carbon emissions with a particular focus on Māori landowners interested in planting native trees on their land in Tairāwhiti/East Coast. Case study analysis will be used to explore the opportunities and barriers for Māori landowners becoming involved in the ETS. The findings of this research will be disseminated at a community and regional level throughout Tairāwhiti/East Coast.

This research has been approved by the Victoria University of Wellington Human Ethics Committee 0000024728.

How can you help?

If you agree to take part I will interview you at a location of your choosing. I will ask you questions about your involvement in the ETS, and your perspectives of carbon farming partnerships between Māori landowners and private companies. The interview will take between 1-2 hours. I will record the interview and write it up later. You can stop the interview at any time, without giving a reason. You can withdraw from the study by contacting me at any point before 1/8/17. If you withdraw, the information you provided will be destroyed or returned to you.

What will happen to the information you give?

The research is not confidential and you will be named in the final report, unless you indicate otherwise.

What will the project produce?

The information from my research will be used in my master's Thesis.

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

- choose not to answer any question;
- ask for the recorder to be turned off at any time during the interview;
- withdraw from the study before 1/8/17;
- ask any questions about the study at any time;
- receive a copy of your interview recording;
- read over and comment on a written summary of your interview;
- agree on another name for me to use rather than your real name;
- be able to read any reports of this research by emailing the researcher to request a copy.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either:

Researcher:

Name: Leo Mercer

Email address: leo.mercer@vuw.ac.nz

Supervisor:

Name: Rebecca Kiddle

Role: Lecturer in Environmental Studies

School: School of Geography Environment and Earth Sciences

Phone: 021 124 2522

Rebecca.Kiddle@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Victoria University HEC Convener: Associate Professor Susan Corbett. Email susan.corbett@vuw.ac.nz or telephone +64-4-463 5480.

Consent form for Nuhiti Q case study participants



The Emissions Trading Scheme: Applicability, practicality and feasibility in Tairāwhiti/East Coast.

CONSENT TO INTERVIEW

This consent form will be held for [2] years.

Researcher: Leo Mercer, School of Geography Environment and Earth Sciences, Victoria University of Wellington

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- I agree to take part in an audio recorded interview.

I understand that:

- I may withdraw from this study at any point before 1/8/17 without giving any reason, and any information that I have provided will be returned to me or destroyed.
- The information I have provided will be destroyed 2 years after the research is finished.
- Any information I provide will be kept confidential to the researcher and the supervisor. I understand that the results will be used for a Master's thesis and a summary of the results may be used in academic reports and/or presented at conferences.
- I consent to information or opinions which I have given being attributed to me or my organisation in any reports on this research: Yes No
- I would like a copy of the transcript of my interview: Yes No
- I would like a summary of my interview: Yes No
- I would like to receive a copy of the final report and have added my email address below. Yes No

Signature of participant: _____

Name of participant: _____

Date: _____

Contact details: _____

Interview schedules for Nuhiti Q case study participants

The Emissions Trading Scheme: Applicability, practicality and feasibility in Tairāwhiti/East Coast

Date: 6/7/17

Location: Gisborne

Interviewer: Leo Mercer

Interviewee: Bryan McKinlay

Introductory questions:

Tell me about your experience working in the forestry sector in New Zealand.

1. In your opinion is carbon farming under the ETS a viable land management option for Māori land owners?
 - a. What role do you expect forestry to play on the East Coast in the future?
 - b. Do you believe landowners on the East Coast are keeping abreast of changing land management strategies?
 - c. In your experience has entering the ETS been successful for Māori land owners?
2. Do you see potential for growth in this area on the East Coast?
 - a. How do you think the scale of carbon farming with native species can be increased on the East Coast?
 - b. Should the scale be increased?
 - c. What is the most cost effective technique to stimulate native afforestation in your experience?
 - d. Do you identify any environmental risks associated with an increase in native forestry in the district?
 - e. Can you identify any environmental benefits that an increase in native forestry may provide for the district?
3. What do you identify as the main risks for both emitters and suppliers alike?
 - a. What do you consider to be the main benefits for emitters when partnering with Māori organisations within the voluntary market?
4. What are the main benefits and opportunities for Māori landowners becoming involved in the ETS or PFSI?
 - a. With particular relevance to your experience with Nuhiti Q, what do you consider when dealing with an application to enter the ETS?
 - b. Have you had experience with other Māori landowners wishing to enter the ETS either before or after your involvement with Nuhiti Q?
 - i. If so – what were the similarities and differences with these cases?

Contractual questions:

Were you privy to any of the contractual negotiations?

If so, what do you identify as the main liabilities Nuhiti Q has under this contract or the ETS?

- What insurance arrangements have been made to cover their liabilities under the ETS?
- What contingency planning have you done in the event that credits cannot be delivered – or the purchaser falls through?
- How does the scale or size of a land block, coupled with its management structure influence its ability to function under the ETS?
- Did you feel that Nuhiti Q or Gull had to compromise on areas of the contractual negotiations?
- Can you identify any areas of this agreement that might create difficulties for Māori as opposed to Pākehā land owners?
- Why did they agree to forward sell the credits?
- How was a set price agreed for the carbon credits? Where you privy to this?

ETS focussed questions:

- How do you believe the needs and aspirations of Maori landowners can be better incorporated into the ETS?
 - o Should they?
- What do you think motivated Gull to partner with a Māori landowner reforestation with native species, when theoretically they could have purchased cheaper credits on the compliance market?

Considering the majority of retirement on Nuhiti Q has occurred in native species, why was the ETS chosen over the PFSI?

- What are the key economic barriers landowners face when entering the ETS?
- Are these different for Māori or Pākehā landowners?

Policy/regulatory questions:

What are the main regulatory or technical barriers landowners face when entering the ETS?

- Are there barriers that are unique to Māori or Pākehā landowners?

What is your opinion of the current public subsidies available to prospective landowners wishing to enter the ETS?

- In your experience do landowners on the East Coast have difficulty accessing public funding subsidies such as the ECFP?
- In your experience, have other public subsidies associated with biodiversity protection been utilised in conjunction with carbon farming?

- Do you see any potential in a different form of carbon credit that recognises indigenous restoration?
- What is your perspective of the EBEX21 system?
- Did you encounter any difficulties validating that regrowth is post 1989?

What is your opinion of the _____:

- ECFP?
- PFSI?
- QE2/NWR?
- Paris Climate Accord?

Does local and central government planning/policy factor into your decision making when working with clients?

- Do you believe central government is doing enough to support Maori landowners wishing to enter the ETS? – if not, how can they better tailor support for Maori landowners?
- Do you believe local government is doing enough to support Maori landowners wishing to enter the ETS? – if not, how can they better tailor support for Maori landowners?
- Do you believe Maori and Pākehā landowners face similar challenges when wishing to enter the ETS?
- Do you believe the protection of native forestry under the NZ forests Act, the NZ Forest Accord and the RMA act to make landowners less willing to allow native forestry on their land as it may reduce the long run option value of their land?

In your opinion, what is working well within the ETS?

- What isn't working well within the ETS?
- Do you believe the ETS is accessible to New Zealanders? Can the lay person understand it?
- As a policy tool, how can the ETS help to facilitate more carbon farming amongst Maori landowners?
- Does policy and regulatory uncertainty concerning the ETS influence the way landowners make land use decisions?
- How can the ETS better cater to the needs and aspirations of Maori land owners?
- Do you have any comments to make concerning the review of the PFSI?
- Do you have any comments to make concerning the review of the ETS?

The Emissions Trading Scheme: Applicability, practicality and feasibility in Tairāwhiti/East Coast

Date: 6/7/17, 7/7/17

Location: Gisborne

Interviewer: Leo Mercer

Interviewee: Nikki Searancke

Introductory questions:

What is your role in the farm and how many years have you been in that role?

When was the governance structure (i.e. trust, incorporation, company or partnership) constituted for this land?

- How is the governance structure organised? (A description of the actors that are involved in the decision process, for instance: number of trustees or committee members)
- Describe the nature of the shareholders – what is the differentiation between local and remote shareholders?
- Who is involved in the decision-making process of the farm management and how?
- How did the management committee view entering the ETS?
- Are the shareholders supportive of the moves taken by the management committee? Concerning the ETS?

What are your current goals and visions for the land? If possible, give reference to specific dates and areas within the landholding.

- Do you expect these to change in the future? If so, what are your future goals for the land?
 - o What may influence future land management decisions?
- Are there land management practices that you would consider incompatible with these goals?
- Can you describe to me the previous land management practices, giving specific dates and areas within the landholding?
- How do the needs and aspirations of future generations factor into the decision making process? Or where they factored into this process at all?
- As one of the only East Coast farms to develop into this area – does the management committee feel a sense of pride or leadership?
- Do you believe as a landowning incorporation you are staying abreast of changing patterns of land use?

What factors are the most relevant for managing this farm successfully? Rate 1 for being not important, 5 to very important.

- Cultural importance. Guardianship, protection and retaining the land in the continuous ownership and control of the hapū
- Physical considerations. Balance among development, conservation and restoration
- Political involvement. Representing and protecting the interest of hapū
- Social contribution. Providing employment and funding community projects
- Generating utility and financial surpluses.

What motivated you/the management committee to investigate carbon farming as a land use option?

Did the damage and erosion resulting from cyclone Bola influence this decision?

How has this partnership helped the management of the wider farm?

Do you consider Nuhiti Q's involvement in the ETS a success?

- Using hindsight, would you make any decisions differently?
- Would you recommend entering the ETS to other landowners in similar circumstances?
- Do you believe your Nuhiti Q's strategy is viable for other East Coast landowners?
- What about throughout New Zealand?
- How does the scale or size of a land block, coupled with its management structure influence its ability to function under the ETS?

Economics:

Before partnering with Gull, what were the greatest costs Nuhiti Q incurred in its current management practices? i.e. rates, property taxes

- What practices derived the greatest revenue before the partnership with Gull?
- Where did the majority of major investments lie? i.e. machinery, equipment, fencing, infrastructure

In the era after partnership with Gull – have the makeup of costs faced by Nuhiti Q changed significantly?

- What practices now derive the greatest revenue?
- Has the distribution of major on farm investments changed significantly?
- At this stage – can you determine whether the carbon farming partnership with Gull can be seen as a success?

Diversification was mentioned by yourself as a development strategy in a 2016 article in the Gisborne herald. How did this arise?

- What motivated you to diversify Nuhiti Q in this manner?
- Talk me through the diversification strategy for the farm.
- What are the challenges yourself and the management committee have faced in implementing this strategy.
- Have the benefits of this diversification strategy been realised?

What is your opinion of the _____:

- ECFP?
- PFSI?
- QE2/NWR?
- Paris Climate Accord?

Contractual questions:

Can you talk me through the contractual negotiations? How did Nuhiti Q and Gull establish a contract acceptable to both parties?

- Where there a variety of contracts options presented?
- Did you feel that Nuhiti Q or Gull had to compromise on areas of the contractual negotiations?
- Can you identify any areas of this agreement that might create difficulties for Māori as opposed to Pākehā land owners?
- Why did you agree to forward sell the credits?
- How did you agree on a set price for the carbon credits?

What are the main liabilities you have under this contract?

- What insurance arrangements do you have to cover your liabilities under the ETS?
- What contingency planning have you done in the event that credits cannot be delivered – or the purchaser falls though?

Do you see any synergies between the development of environmental capital and human capital?

Have values such as kaitiakitanga factored into this decision making process?

Is the connection you have with the land cultural or productive? Do these values exist together, do they clash at all? Are they compatible?

ETS focussed questions:

Talk me through how you as a prospective supplier partnered with an emitter. Who advised you on this process? Where does a prospective supplier search for an emitter? What lessons can you share about this initial process?

- Can you identify the reasons why you partnered with Gull? Were other emitters interested in a partnership?
- What do you think motivated Gull to partner with a Māori landowner reforesting with native species, when theoretically they could have purchased cheaper credits on the compliance market?
- Back in 2011, Gull New Zealand was a New Zealand owned company. Did this factor into your decision making when considering a suitable partner?

- Has your perspective of Gull New Zealand and your willingness to partner with them into the future changed at all now that they are not New Zealand owned?

Considering the majority of retirement has occurred in native species, why was the ETS chosen over the PFSI which caters more towards permanent native reversion.

- From the perspective of a supplier, does the ETS work for you?
- How has MPI supported the work Nuhiti has done?
- Was it important to have outside input into planning surrounding the feasibility of entering the ETS?

Has your potential future GHG liabilities under the ETS (assuming agricultural emissions are eventually included in the ETS) factored into this decision?

Policy/regulatory questions:

Has external funding been drawn upon to help in Nuhiti Q's entrance into the ETS?

- If so, where did this funding come from?
- If so, where was the majority of this spending allocated?
- Was there funding that you could not access?
- Do you have any comments concerning the allocation of funding?
- Did you encounter any difficulties validating that regrowth is post 1989?

Does local and central government planning/policy factor into your decision making?

- Do you believe central government is doing enough to support Maori landowners wishing to enter the ETS? – if not, how can they better tailor support for Maori landowners?
- Do you believe local government is doing enough to support Maori landowners wishing to enter the ETS? – if not, how can they better tailor support for Maori landowners?
- Do you believe Maori and Pākehā landowners face similar challenges when wishing to enter the ETS?

In your opinion, what is working well within the ETS?

- What isn't working well within the ETS?
- Do you believe the ETS is accessible to New Zealanders? Can the lay person understand it?
- As a policy tool, how can the ETS help to facilitate more carbon farming amongst Maori landowners?
- Does policy and regulatory uncertainty concerning the ETS change the way you plan and make land use decisions?
- Do you have any comments to make concerning the review of the PFSI?
- Do you have any comments to make concerning the review of the ETS?

The Emissions Trading Scheme: Applicability, practicality and feasibility in Tairāwhiti/East Coast

Date: 12/09/17

Location: Auckland

Interviewer: Leo Mercer

Interviewee: Dave Bodger

Introductory questions:

Talk me through the process of partnering with Nuhiti Q.

Can you identify the factors that lead to the partnership with Nuhiti Q?

- Positive contributions to New Zealand society
- Māori economic development
- Regional development

Have you had any conversations with other Māori landowners in regards to ETS contracts?

ETS questions:

Was the aim of this partnership to facilitate native regeneration and progress corporate social responsibility goals, or to meet your liabilities under the ETS?

- Do you have any preference between purchasing carbon units that support native forests or exotic plantations?

Why did you partner with Nuhiti Q and pay a higher NZU price to support native reforestation, when you could have purchased cheaper credits from other suppliers?

- Does Gull view this partnership as successful from a marketing perspective?
- Does Gull view this partnership as a successful form of corporate social responsibility?
- Have Gull use this partnership in any way for marketing or communication with stakeholders?

Was there internal pressure to partner with other suppliers in order to achieve a cheaper unit price?

Does Gull have confidence the ETS or a similar offsetting mechanism will be in place long-term?

Do you think the ETS is an efficient tool to reduce greenhouse gas emissions or conversely do you think it allows emissions to continue increasing?

- Would you prefer an alternative mechanism (either because it would reduce your costs and/or reduce emissions)?
- If so, what alternative would you prefer?
- Are you hoping to keep actively participating in the ETS on the East Coast in the future?

How many NZUs does Gull need to purchase annually?

- Is this projected to change markedly in the future?
- Are you planning to establish similar agreements with other groups?

Contracting questions:

Would any variations in contract content make similar agreements more attractive in the future?

- How did you agree on a set price for the carbon credits?
- Can you identify any liabilities Gull has under this contract?

In the event that the supplier fails to fulfil their obligations under the contract, what contingency planning have you done?

Concluding questions:

Does Gull view this partnership as highly successful, moderately successful or unsuccessful?

- Why?
- If you made similar deals in the future, would you prefer long contracts of at least 5 to 10 years or short-term contracts at 1-2 years?

What has the response been from Gull shareholders to this partnership?

Did potential co-benefits for Nuhiti Q and/or the wider East Coast community factor into the decision to enter this partnership?

Now that Gull is no longer New Zealand owned, does the company still have the same commitment to partnering with landowners such as Nuhiti Q?

The Emissions Trading Scheme: Applicability, practicality and feasibility in Tairāwhiti/East Coast

Date: 16/2/18

Location: Gisborne

Interviewer: Leo Mercer

Interviewee: Kerry Hudson

Introductory questions:

1. Can you please tell us your name, who you work for, and how long you have been in that role as well as any other relevant work experience?
 - a. What experience do you have regarding the Emissions Trading Scheme within the Gisborne District?
 - b. Do you see any opportunities for landowners to engage in the Erosion Control Funding Programme and Emissions Trading Scheme?
2. In your opinion is carbon farming within the Emissions Trading Scheme a viable land management option for Maori land owners?
 - a. What role do you expect exotic forestry to play on the East Coast in the future?
 - b. What role do you expect exotic forestry to play on the East Coast in the future?
 - c. In your experience has entering the Emissions Trading Scheme been successful for many Maori land owners?
2. In your opinion, as a land use, how does carbon farming native forest compare with sheep and beef farming or exotic forestry?
 - a. Do you think carbon farming can compete with or complement existing land uses on the East Coast?
 - b. What is your perspective on the viability of carbon farming permanent native forestry as opposed to exotic plantations or indigenous reversion amongst plantings of exotic species? Have you seen any examples of the latter?

3. What do you think are the main benefits and opportunities for Maori landowners becoming involved in the Emissions Trading Scheme?
 - a. Have you had experience with Māori landowners wishing to enter the ETS?

ETS focussed questions:

1. What trends are you seeing with marginal land on the East Coast?
 - a. How much evidence have you seen that Māori landowners are aware of carbon farming opportunities?
2. In your experience, do landowners need external help to enter the Emissions Trading Scheme?
 - a. What role can the GDC play with landowners when entering the Emissions Trading Scheme?
 - i. (education, funding, expert advice, etc.)

Policy/regulatory questions:

1. What are the main regulatory or technical barriers landowners face when entering the Emissions Trading Scheme?
 - a. Are there barriers that are unique to Māori landowners?
 - b. How do you think these barriers can be overcome?
2. What is your opinion of the current public subsidies available to prospective landowners wishing to enter the Emissions Trading Scheme?
 - a. In your experience do the majority of Māori landowners on the East Coast find it easy to access public funding subsidies such as the Erosion Control Funding Programme? If not, how could that situation be improved?



***Beyond the dollar: carbon farming and its alternatives for Tairāwhiti
Māori landowners***

INFORMATION SHEET FOR PARTICIPANTS

Thank you for your interest in this project. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to take part, thank you for considering my request.

Who am I?

My name is Leo Mercer and I am a PhD candidate in Environmental Studies at Victoria University of Wellington Within the School of Geography Environment and Earth Sciences. This research project is work towards my Thesis.

What is the aim of the project?

This project builds upon research conducted as part of my Master's research which explored the risks and benefits of a carbon farming partnership forged between Nuhiti Q Inc. and Gull NZ. This research highlighted an economic case for Māori landowners to engage in carbon farming (using native forest species) as a land use; however, there also exist a variety of barriers which limit the ability of Māori landowners to participate in the Emissions Trading Scheme. My PhD research expands upon these findings by exploring the wider land use preferences of Tairāwhiti Māori landowners, and what these landowners value about carbon farming and its associated cobenefits when compared with potential land use alternatives. By exploring the cobenefits associated with certain land uses, and assessing the significance of these values, it is hoped that more informed land use decisions can be made. It is my aim to provide a clearer picture of the benefits provided by a variety of potential and current land uses that can better cater towards the needs of present and future generations. These research objectives will be completed through semi structured interviews, case study analysis and Multi Criteria Analysis. The findings of this research will be disseminated at a community and regional level throughout Tairāwhiti/East Coast.

This research has been approved by the Victoria University of Wellington Human Ethics Committee _____.

How can you help?

If you agree to take part I will interview you at a location of your choosing. I will ask you questions about your involvement and experience in Māori land development and management, your experience assessing land use options for Māori landowners. The interview

will take between 30 minutes – 1 hour. I will record the interview and write it up later. You can stop the interview at any time, without giving a reason. You can withdraw from the study by contacting me at any point before 1/12/18. If you withdraw, the information you provided will be destroyed or returned to you.

What will happen to the information you give?

The research is not confidential and you will be named in the final report, unless you indicate otherwise.

What will the project produce?

The information from my research will be used in my PhD Thesis, conferences and academic publications.

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

- choose not to answer any question;
- ask for the recorder to be turned off at any time during the interview;
- withdraw from the study before 1/12/18;
- ask any questions about the study at any time;
- receive a copy of your interview recording;
- read over and comment on a written summary of your interview;
- agree on another name for me to use rather than your real name;
- be able to read any reports of this research by emailing the researcher to request a copy.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either:

Researcher:

Name: Leo Mercer

Email address: leo.mercer@vuw.ac.nz

Supervisor:

Name: Rebecca Kiddle

Role: Lecturer in Environmental Studies

School: School of Geography Environment and Earth Sciences

Phone: 021 124 2522

Rebecca.Kiddle@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Victoria University HEC Convener: Dr Judith Loveridge, email hec@vuw.ac.nz, phone (04) 463 6028.



***Beyond the dollar: carbon farming and its alternatives for Tairāwhiti
Māori landowners***

CONSENT TO INTERVIEW

This consent form will be held for [2] years.

Researcher: Leo Mercer, School of Geography Environment and Earth Sciences, Victoria University of Wellington

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- I agree to take part in an audio recorded interview.

I understand that:

- I may withdraw from this study at any point before 1/12/18 without giving any reason, and any information that I have provided will be returned to me or destroyed.
- The information I have provided will be destroyed 2 years after the research is finished.
- Any information I provide will be kept confidential to the researcher and the supervisor. I understand that the results will be used for a Doctoral thesis and a summary of the results may be used in academic reports and/or presented at conferences.
- I consent to information or opinions which I have given being attributed to me or my organisation in any reports on this research: Yes No
- I would like a copy of the transcript of my interview: Yes No
- I would like a summary of my interview: Yes No
- I would like to receive a copy of the final report and have added my email address below. Yes No

Signature of participant: _____

Name of participant: _____

Date: _____

Contact details: _____

Interview schedule for MCA key informants

Beyond the dollar: Carbon farming and its alternatives for Tairāwhiti Māori landowners

Date:

Location:

Interviewer:

Interviewee:

Introductory questions

Kia ora, thank you for participating in my PhD research. To begin with could you talk about your experience and involvement in the management of Māori land development to date. Specifically:

1. Can you please outline your experience or engagement with Māori landowners looking at land use options? Do you have experience with landowners looking at land development options?
2. Can you outline the specifics of this/these projects i.e. area of NZ, type of project, characteristics of this project
3. As you see them, what are the key trends with Māori land in Tairāwhiti?
4. Do you think there are certain land uses which may be more compatible with the physical characteristics of Māori land within Tairāwhiti?
 - a. Are there land uses which may or may not be more compatible with Māori values?

Land use options

1. What do you think are suitable land use options for Māori landowners in Tairāwhiti to engage with, thinking about their fit with characteristics of Māori land in Tairāwhiti?
2. What are the benefits you would associate with these land uses? Please list the principal benefits associated with each land use individually.
3. What are the risks associated with these land uses? Please list the main risks you would associate with each land use.
4. What would you consider to be the main barriers to participation in these land uses?
 - a. Are these a particular issue for Tairāwhiti?
 - b. Are these a particular issue for Māori, rather than Pākehā, landowners?
5. Would you be able to indicate which land use could be expected to generate the greatest income in the short term (up to 10 years), and in the long term?
6. Sometimes there are clear economic benefits associated with a particular land use. What sort of priority should such economic factors be given, compared to other factors such as social, cultural or environmental ones?

Concluding questions

1. Are there particular considerations that Māori landowners need to take into account when considering land use options?
 - a. Should Māori land be developed?
 - b. Are 'Western' notions of land development compatible with Māori notions of land development and management?
 - i. If not, how are they different?

Land use	Benefit	Risk



***Beyond the dollar: carbon farming and its alternatives for Tairāwhiti
Māori landowners***

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My name is Leo Mercer and I am a PhD candidate in Environmental Studies at Victoria University of Wellington Within the School of Geography Environment and Earth Sciences. This research project is work towards my Thesis.

What is the aim of the project?

This project builds upon research conducted as part of my Master's research which explored the risks and benefits of a carbon farming partnership forged between Nuhihi Q Inc. and Gull NZ. This research highlighted an economic case for Māori landowners to engage in carbon farming (using native forest species) as a land use; however, there also exist a variety of barriers which limit the ability of Māori landowners to participate in the Emissions Trading Scheme. My PhD research expands upon these findings by exploring the wider land use preferences of Tairāwhiti Māori landowners, and what these landowners value about carbon farming and its associated cobenefits when compared with potential land use alternatives. By exploring the cobenefits associated with certain land uses, and assessing the significance of these values, it is hoped that more informed land use decisions can be made. It is my aim to provide a clearer picture of the benefits provided by a variety of potential and current land uses that can better cater towards the needs of present and future generations. These research objectives will be completed through semi structured interviews, case study analysis and Multi Criteria Analysis. The findings of this research will be disseminated at a community and regional level throughout Tairāwhiti/East Coast.

This research has been approved by the Victoria University of Wellington Human Ethics Committee _____.

How can you help?

If you agree to take part I will facilitate a wananga where you and other landowners from Tairāwhiti will collaboratively discuss and compare a variety of land use options. As a group you will then help to choose what cobenefits are most important to you from each land use

alternative, before collaboratively ranking these cobenefits against each other to create a set of weights which can be used to indicate the 'value' of each land use. The wananga will take between 1-2 hours. I will facilitate the wananga alongside my supervisor Becky Kiddle. I will record parts of the process, and also make notes throughout and write it up later. You can stop and leave the wananga at any time, without giving a reason. You can withdraw from the study by contacting me at any point before 1/12/18. If you withdraw, the information you provided will be destroyed or returned to you.

What will happen to the information you give?

The research is not confidential. However, you will not be named in the final report, unless you indicate otherwise.

What will the project produce?

The information from my research will be used in my PhD Thesis, conferences and academic publications.

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

- choose not to answer any question;
- ask for the recorder to be turned off at any time during the wananga;
- withdraw from the study before 1/12/18;
- ask any questions about the study at any time;
- receive a copy of my notes on the wananga and all material produced;
- agree on another name for me to use rather than your real name;
- be able to read any reports of this research by emailing the researcher to request a copy.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either:

Researcher:

Name: Leo Mercer

Email address: leo.mercer@vuw.ac.nz

Supervisor:

Name: Dr. Rebecca Kiddle (senior lecturer)

School: School of Geography Environment and Earth Sciences

Phone: 021 124 2522

Rebecca.Kiddle@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Victoria University HEC Convener: Dr Judith Loveridge, email hec@vuw.ac.nz, phone (04) 463 6028.



***Beyond the dollar: carbon farming and its alternatives for Tairāwhiti
Māori landowners***

CONSENT TO INTERVIEW

This consent form will be held for [2] years.

Researcher: Leo Mercer, School of Geography Environment and Earth Sciences, Victoria University of Wellington

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- I agree to take part in a wananga using Multi Criteria Analysis.

I understand that:

- I may withdraw from this study at any point before 1/12/18 without giving any reason, and any information that I have provided will be returned to me or destroyed.
- The information I have provided will be destroyed 2 years after the research is finished.
- Any information I provide will be kept confidential to the researcher and the supervisor. I understand that the results will be used for a Doctoral thesis and a summary of the results may be used in academic reports and/or presented at conferences.
- I consent to information or opinions which I have given being attributed to me or my organisation in any reports on this research: Yes No
- I would like a summary of the wananga findings: Yes No
- I would like to receive a copy of the final report and have added my email address below. Yes No

Signature of participant: _____

Name of participant: _____

Date: _____

Contact details: _____

<i>Personal information</i>	<p>Address (for koha):..... Occupation:.....</p>																												
<i>Whenua Information</i>	<p>1. Please discuss the whenua you are a kaitiaki and/ or decision-maker for? Name of whenua:..... Location:..... Area (size):.....</p> <hr/> <p>How is your land currently being used? Tick all boxes that apply</p> <table style="width: 100%; border: none;"> <tr> <td style="padding-right: 20px;">Forestry</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Pastoral Farming (Sheep/ Beef)</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Honey</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Cropping</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Native regeneration</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Other e.g. papakainga</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table> <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 80%;">Can you estimate the percentage of your whenua that fits into each of these categories?</th> <th style="width: 20%;">Percentage</th> </tr> </thead> <tbody> <tr> <td>Steep LUC 6-8</td> <td></td> </tr> <tr> <td>Rolling LUC 4-5</td> <td></td> </tr> <tr> <td>Flat LUC 1-3</td> <td></td> </tr> </tbody> </table> <hr/> <p>2. What is the governance structure?</p> <table style="width: 100%; border: none;"> <tr> <td style="padding-right: 20px;">Maori land incorporation</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Ahu Whenua Trust</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>No entity</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Other</td> <td></td> </tr> </table>	Forestry	<input type="checkbox"/>	Pastoral Farming (Sheep/ Beef)	<input type="checkbox"/>	Honey	<input type="checkbox"/>	Cropping	<input type="checkbox"/>	Native regeneration	<input type="checkbox"/>	Other e.g. papakainga	<input type="checkbox"/>	Can you estimate the percentage of your whenua that fits into each of these categories?	Percentage	Steep LUC 6-8		Rolling LUC 4-5		Flat LUC 1-3		Maori land incorporation	<input type="checkbox"/>	Ahu Whenua Trust	<input type="checkbox"/>	No entity	<input type="checkbox"/>	Other	
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No entity	<input type="checkbox"/>																												
Other																													

A.3 Nuhiti Q case study timeline

Date	Event
July 1987	Ferris family incorporates land and surrounding whanau affiliated land blocks creating Nuhiti Q
November 2009	Nikki Searancke joins Nuhiti Q management committee
2010 - 2011	Consultation begins with GDC, MPI and Craigmore Sustainables Ltd. regarding retirement of eroding areas of coastal land and ECFP funding
August 2011 – February 2012	'3 projects' initiated: 6km fencing project, 70 ha eucalypt plantation, 500 ha native reversion entered into the NZ ETS
February 2012	NZ ETS entry confirmed (44,000 backdated NZU entitlement issued)
June 2015	32,000 NZUs sold at ~\$9.00
June/July 2016	Negotiations begin with Gull NZ to forward trade 12,000 NZUs through Carbon Match
July 2016	Agreement signed between Nuhiti Q and Gull NZ forward selling 12,000 NZUs at \$18.40 in 6000 NZU instalments in 2017 and 2018
April 2017	First instalment of 6000 NZUs traded on 30 Apr 2017
April 2018	Second instalment of 6000 NZUs traded on 30 Apr 2018

A.4 Contract between Nuhiti Q and Gull NZ



CARBON MATCH CONFIRMATION & STANDARD SALE AND PURCHASE TERMS

Seller	Seller	Proprietors of Nuhiti Q
	Notice Address	searanckenikki@yahoo.com
	Seller's NZEUR Account	NZ-9490
	Payment Account (ie Seller's bank account)	06-0869-00734588-001
Buyer	Buyer	Gull New Zealand Limited
	Notice Address	lyndseyc@gull.co.nz
	Buyer's NZEUR Account	NZ-1810
Both	Unit Type (as defined on the NZEUR Website)	NZU (Delivery 30 April 2018)
	Unit Quantity	6,000
	Unit Price (NZD)	\$18.40
	Purchase Price (Total Trade Value in NZD)	\$110,400.00
	Carbon Match Trade ID	8644
	Match Date and Time	20 Jul 2016 15:38:08
	Transfer Date	30 Apr 2018

CARBON MATCH CONFIRMATION & STANDARD SALE AND PURCHASE TERMS

Seller	Seller	Proprietors of Nuhiti Q
	Notice Address	searanckenikki@yahoo.com
	Seller's NZEUR Account	NZ-9490
	Payment Account (ie Seller's bank account)	06-0869-00734588-001
Buyer	Buyer	Gull New Zealand Limited
	Notice Address	lyndseyc@gull.co.nz
	Buyer's NZEUR Account	NZ-1810
Both	Unit Type (as defined on the NZEUR Website)	NZU (Delivery 30 April 2017)
	Unit Quantity	6,000
	Unit Price (NZD)	\$18.40
	Purchase Price (Total Trade Value in NZD)	\$110,400.00
	Carbon Match Trade ID	8643
	Match Date and Time	20 Jul 2016 15:37:40
	Transfer Date	30 Apr 2017

A.5 Press release signalling partnership between Gull NZ and Nuhiti Q Inc.



Media Release September 2016

Gull partners with Nuhiti Q Inc. to restore the coastal headland of Nuhiti, Gisborne

Gull New Zealand has joined forces with Nuhiti Q - Wakaraara Iwi to help with the restoration of Nuhiti Reserves which suffered erosion and flooding during Cyclone Bola in March 1988.

Under an initial two-year agreement Gull will purchase 12,000 units of Nuhiti Q Inc's carbon credits at today's price, totalling just over \$220,000, which will be put towards fencing repairs and Manuka trees.

Since launching the native regeneration scheme on the East Coast in 2010, Nuhiti Q Inc has managed to retire stock from the land, stopping cows and sheep from grazing, as well as fence and plant over 500 hectares of land, helping to control erosion along the 8km of coast Nuhiti owns.

Karl Mischewski, Retail and Sustainability Manager of Gull says the company is delighted to partner with Nuhiti Q Inc and do their bit to act as ethically and sustainably as possible.

"When it comes to sustainability in the fuel industry, we have always been ahead of our time; this is evident in our market offering of sustainable products, and the supportive role we play in our community."

Gull is committed to minimising its impact on the environment and in addition to the regeneration project the company undertakes a range of initiatives to address this issue.

- ENDS -

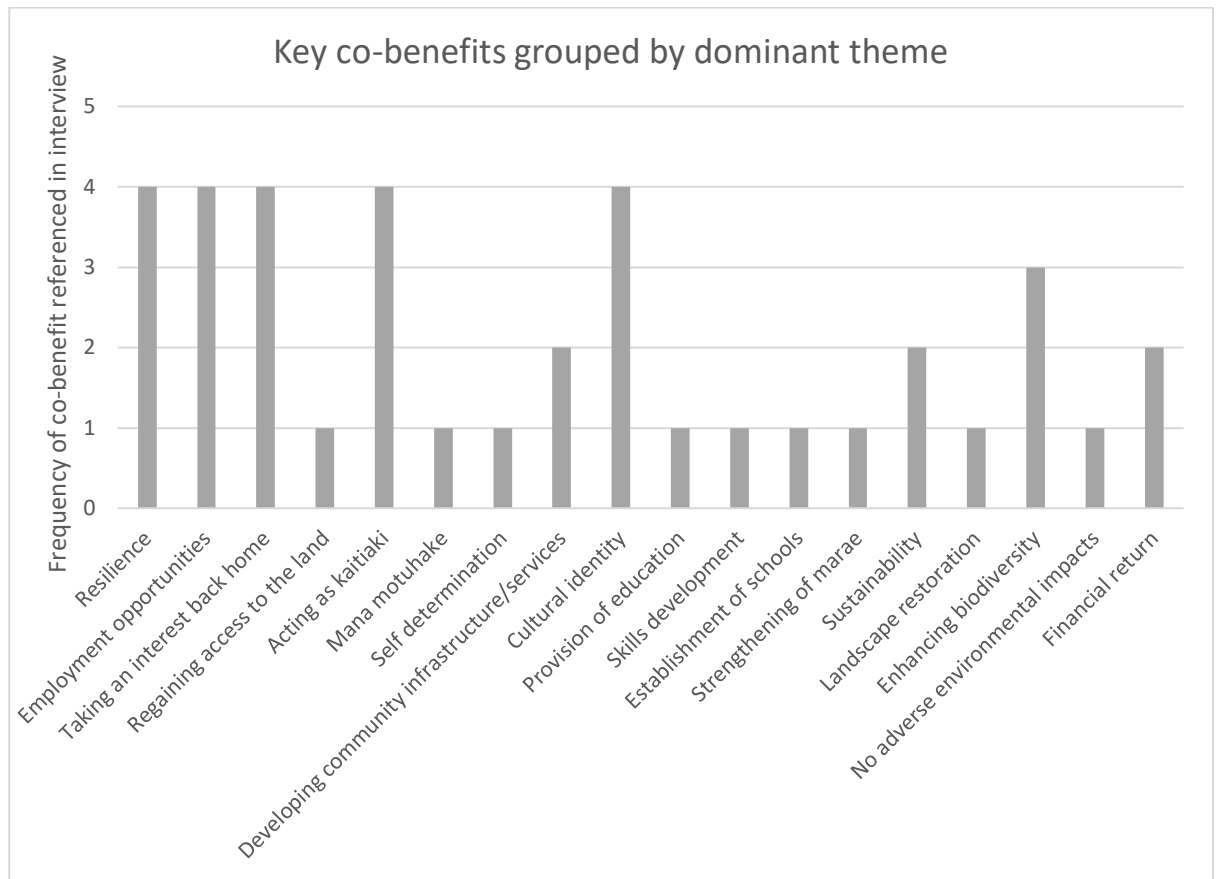
For further information please contact:

Laura Holt, Brand Manager, Gull New Zealand, +64 21 901 980
Amy Woollett, MKTG, +64 21 073 8665

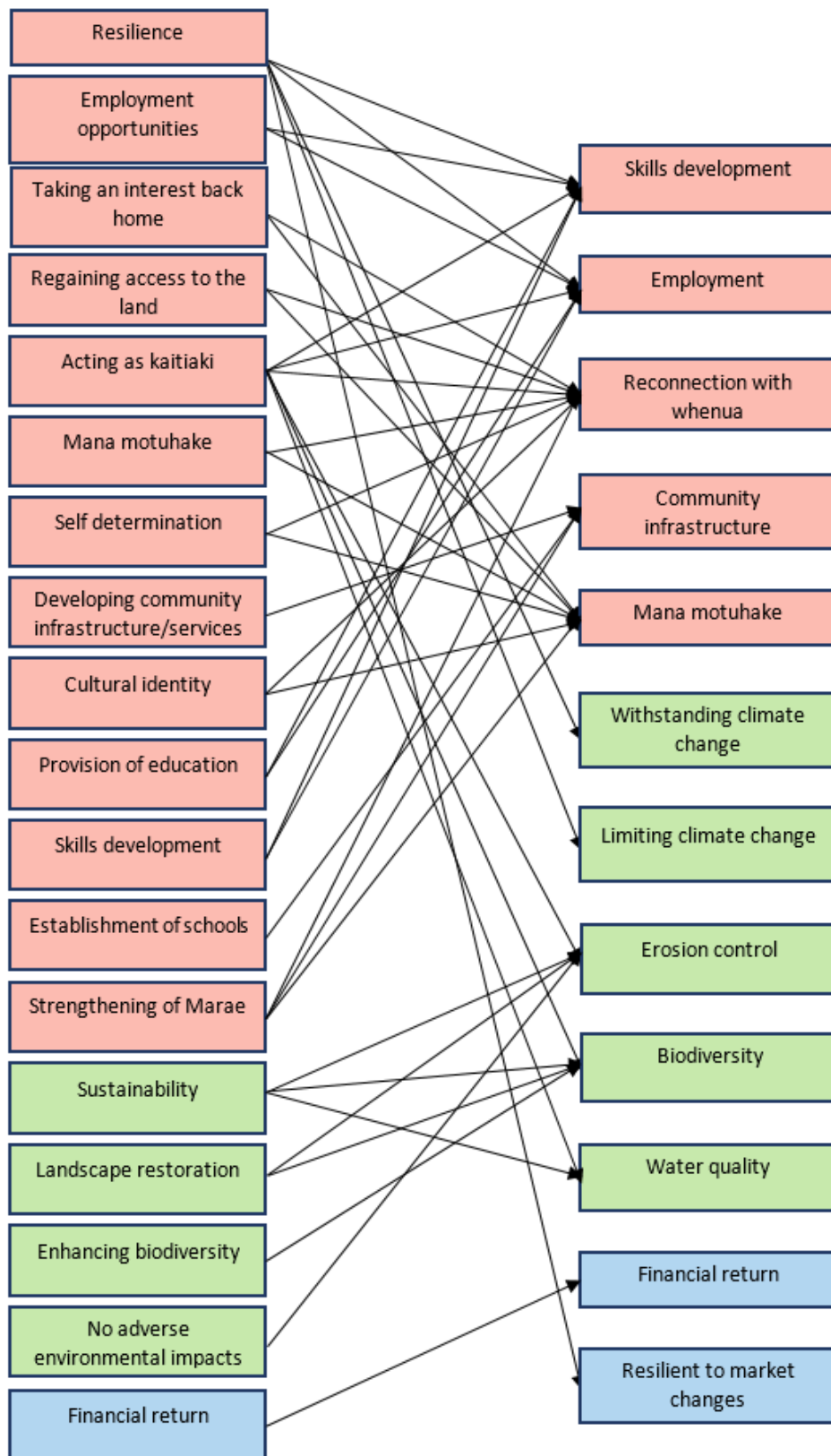
About Gull

Gull New Zealand is the independent, family owned oil company credited with keeping the fuel market competitive and delivering fuel savings to the Kiwi motorist. It offers real choice for motorists in an extremely competitive market. The company is a first mover, introducing innovative new products to the New Zealand energy market. These include low sulphur diesel and New Zealand's first biofuel, Gull Force 10. Both fuels brought environmental benefits to motorists well ahead of the opposition. Gull's "Drive Thru" outlets - with lower cost to develop and no staff on site - are another New Zealand first, bringing further value to the consumer. Gull has over 70 retail outlets. Including Night 'n Day Foodstores, independent Gull sites, marina installations and 24 Drive Thru sites. Geographically retail outlets span between Waipapa and Masterton. For more information visit www.gull.co.nz

A.6 Co-benefits grouped by dominant theme and frequency mentioned



A.7 Co-benefits identified by key informants and associated criteria



A.8 Description of and basis for MCA criteria

Criterion	Description
Skills Development	<p>Employment and the ability to develop diverse skill sets are key benefits for those living within the Waiapu catchment. These are key objectives of the MOU between Ngāti Porou and the Crown (MPI, 2014). Educational and vocational training opportunities in Te Tairāwhiti are a key component of the continued wellbeing of those living in the rohe. Exotic forestry and sheep and beef farming are not thought to offer adequate skill development opportunities in the face of a changing climate and economy in Tairāwhiti (Warmenhoven et al., 2014). Thus, any land use that allows for the development of diverse skillsets contributes to greater resilience for those living in the Waiapu catchment can be considered a benefit.</p>
Employment	<p>Similarly, to 'skills development' employment is a key outcome supported by the 2014 MOU between Ngāti Porou and the Crown. Ensuring that there are sustainable, well-paying jobs for those living in the Waiapu catchment is also seen as key to ensuring greater wellbeing and prosperity for those living in the rohe. Historically, employment in the Waiapu catchment has centred on work in stock farming (and related work), fencing, scrub cutting, forestry, vineyards, horticulture and road-works (Barnard et al., 2012). Whilst the exotic forestry industry is a significant employer in the region, the health and safety record of this industry is poor, and anecdotally, levels of employment initially promised have not eventuated (Tomlinson et al., 2000). The benefits afforded by employment was also one of the co-benefits mentioned most frequently in the key informant interviews. Diverse employment options ensure there is resilience built into communities within the Waiapu catchment to the inevitable fluctuations of the sheep and beef and exotic forestry sector (Tomlinson et al., 2000; Warmenhoven et al., 2014).</p>
Reconnection with the whenua	<p>Reconnecting with the whenua was a criterion that was not mentioned many times specifically by the key informants, but it was a criterion which came up in interviews with participants at the MCA wananga. There are strong feelings within those living in the Waiapu catchment that land uses such as exotic forestry or sheep and beef farming (even if operating on land leased from Māori landowners) physically excludes Māori from their whenua (Barnard et al., 2012). Health and safety considerations are often used by farming incorporations or forestry leases to deny access to trustees and shareholders of land blocks. Whilst</p>


	<p>reconnection with the whenua is an entirely subjective criterion and may provoke different responses amongst different groups of Māori landowners, the overarching feelings of disconnect from land is reasonably uniform for both urban and rural populations (Dell, 2017). Therefore, a land use in the Waiapu catchment that connects landowners with their whenua can be considered to a benefit.</p>
<p>Community infrastructure</p>	<p>The disestablishment of entities such as the New Zealand Forest Service had significant impacts on those living in the Waiapu catchment (Barnard et al., 2012). The widespread employment provided by the New Zealand Forest Service provided structure to communities within the Waiapu catchment and other rural areas dependent upon forestry as a key employer. Employment in forestry provided families with stable, well-paying jobs and the benefits of this filtered into other areas of community life, contributing to the health of marae, schools and sporting institutions amongst others (Warmenhoven et al., 2014). Flows of people out of the Waiapu catchment alongside environmental and other stresses has reduced the ability of community institutions to play key roles in the Waiapu catchment. A positive response to these processes is the strengthening of community institutions which provide cohesion for those in the Waiapu catchment and contribute to the social capital of those in the rohe (Warmenhoven et al., 2014). Encapsulating this as a benefit attributed by a land use was difficult – but for the purposes of this research a proxy of ‘community infrastructure’ was used, whereby, any land use that contributes to the development or strengthening of infrastructure such as sports clubs, hunting and fishing clubs, marae, community organisations, NGOs etc would be considered a benefit.</p>
<p>Mana motuhake</p>	<p>Mana motuhake is loosely defined as a concept analogous with sovereignty, authority or autonomy (Harmsworth et al., 2002). Harmsworth et al. (2002) assert that mana motuhake is a fundamental principle of being Ngāti Porou, and one which confirms the identity of Ngāti Porou people. Within the context of this research it was conceptualised as a co-benefit of a land use whereby a degree of autonomy (be it social, cultural or economic independence) or authority can be achieved over and above that offered by the status quo. Given the interwoven understanding of spiritual, biophysical and human health for Ngāti Porou, and Māori more broadly, any land use which allows for Māori to act as kaitiaki and fulfil obligations under this ethic, can contribute to the development of mana motuhake (Harmsworth et al., 2002).</p>

Withstanding climate change	<p>Climate change was not mentioned explicitly in the key informant interviews and was discussed most in terms of the resilience of those living within the Waiapu catchment to changing weather patterns and incursions of pest species. The vulnerabilities of the catchment have been extensively covered in Awatere et al. (2018) where climate change was shown to increase erosion and sedimentation. So, whilst the ability to withstand climate change wasn't a key factor of the key informant interviews it was deemed an important criterion for landowners to consider and gain an insight into. Especially given the history of extreme weather events in Tairāwhiti and the expectation that under a changing climate the Waiapu catchment will be warmer, dryer and windier with increased climatic extremes (Warmenhoven et al., 2014). Therefore, land uses which are resilient to current and future climate conditions are beneficial to Māori landowners within the Waiapu catchment.</p>
Limiting climate change	<p>This criterion has been designed to assess whether and by how much the ability for some land uses to limit change (through sequestration, destocking etc.) is seen as being beneficial for Māori landowners in the Waiapu catchment. There are arguments that efforts to limit the effects of climate change by finding efficiencies within, or changing land uses can be thought of as being congruent with Māori principles such as kaitiakitanga and whakapapa - ethics that emphasise environmental stewardship, care and connection to the land (Harmsworth & Awatere, 2013). The potential benefits seen by limiting the impacts from climate change are particularly salient considering the close linkages between Māori and the primary sector, a sector which is vulnerable to climate change (King, et al., 2010). Whether an obligation to limit climate change through land use decisions were thought of as important is a key benefit of interest to this research, or whether this is seen as beneficial.</p>
Erosion control	<p>The Tairāwhiti region is one of the most erosion prone regions in New Zealand, and the Waiapu catchment is considered to be significantly degraded with some of the highest erosion and sedimentation rates globally (~35Mt per year (Edwards et al., 2018)). The impact of erosion on communities, livelihoods and infrastructure throughout the region has been extensively documented (Awatere et al., 2018; Marden et al., 2012; Scion, 2012; Warmenhoven et al., 2014). Erosion control as a co-benefit has been conceptualised in this study as a benefit afforded by any land use (or change of practice) which can achieve outcomes such as improving slope stability, reducing soil loss or lessening sedimentation of water ways.</p>

Biodiversity	<p>Native flora and fauna in Te Tairāwhiti, like many areas of New Zealand has been significantly affected by the introduction of non-native plant and animal species (Trotman & Papuni, 2017). At 1840 the Waiapu catchment had ~80 percent coverage in native forest and in the present day ~21 percent of native forest cover remains (Awatere et al., 2018). Like the wider Tairāwhiti region, the majority of indigenous forest in the Waiapu catchment is located on private land, therefore making the challenge of improving biodiversity outcomes more difficult than in the conservation estate for example (Trotman & Papuni, 2017). For the purposes of this study, a biodiversity benefit would be a change in land use or land use practice which creates conditions whereby the abundance and viability of different populations of native flora and fauna improve over and above the baseline.</p>
Water quality	<p>The deterioration in water quality has been another substantial issue for communities within the Waiapu catchment. Water quality has been affected by sediment deposition, which has in turn negatively affected freshwater aquatic life within the river and marine life when the sediment is deposited at sea (Scion, 2012). Alongside sedimentation, land is frequently lost to river bank erosion, forestry slash is carried into waterways and effluent and nitrate run off from farming operations is a source of diffuse pollution (Warmenhoven et al., 2014). A deeply held aspiration amongst communities within the catchment is that the Waiapu river and its tributaries are once more an abundant source of food and drinking water (Warmenhoven et al., 2014). Therefore, this benefit is conceptualised as any improvement in water quality given by a land use change or change in land use practice over and above current levels.</p>
Financial return	<p>Currently, (and when looking at land use through an economic lens) much land in the Waiapu catchment is classified as unproductive, and when using current land use practices often earning minimal returns, and in many cases negative returns (Funk et al., 2014). Improving the financial returns from current or other land use practices may also act to improve socio-economic conditions for those within the Waiapu catchment (Carswell et al., 2002). Ensuring sustainable and profitable land management is a key programme outcome as stipulated by the 2014 MOU between Ngāti Porou and the Crown. Therefore, this benefit has been conceptualised how the return from different land uses is valued.</p>
Resilient to market changes	<p>Like 'financial return', the resilience of land uses to market fluctuations is a key outcome referenced in the MOU between the Crown and Ngāti Porou. The MOU aspires to support land</p>

	<p>uses that maximise economic and social returns, and are resilient to commodity price changes (MPI, 2014). Tairāwhiti and the Waiapu catchment have been affected causally by variable commodity prices, particularly in the farming and forestry sector (Warmenhoven et al., 2014). Whilst commodity prices will always fluctuate, ensuring that the vulnerabilities and exposure of landowners within the Waiapu catchment is limited to the greatest practicable degree is a key benefit for Māori landowners. This benefit has been conceptualised as such.</p>
Extra criteria identified by participants at wananga	
<p>Knowledge and awareness</p>	<p>This criterion was put forward by participants of the second wananga. The inclusion of ‘knowledge and awareness’ is a response to a belief by one group of participants that for a lot of landowners there is limited knowledge or awareness of non-traditional (sheep and beef farming, exotic forestry) land uses, and in turn, the associated benefits potentially afforded by these land uses. Thus, the group of participants argued that the first step to realising some of the benefits under consideration is to have knowledge and awareness of the of land uses which could potentially be employed by Māori landowners. It was never explicitly detailed how this ‘knowledge and awareness’ would be attained, but it was explained in such a way that early adopters of nascent land uses (native forest carbon farming, medicinal cannabis and hemp etc.) would spread information about these new land uses, contributing to uptake by other landowners.</p>
<p>Te Ao</p>	<p>The benefit ‘Te Ao’ was conceptualised by the participants of one steep land model as representing the Māori cultural belief system. The connection with the environment is seen as paramount and central to Māoritanga (Mead, 2016). Reciprocity, guardianship and ethics of sustainability govern many areas of te ao Māori, and particularly in regard to the relationship with the physical environment (Harmsworth & Awatere, 2013). The participants referenced the rapid land use change and associated environmental degradation in the Waiapu catchment post colonisation - and saw ‘Te Ao’ as a benefit gained by applying more Māori principles to land use and management. The participants saw Te Ao as distinct from ‘Mana Motuhake’, and more related to Māori beliefs and customs. For those participants that included this benefit, it has been conceptualised as such.</p>
<p>Self reliance</p>	<p>Self-sufficiency in relation to economic independence is seen as an important element of Ngāti Porou life. Whilst the Waiapu catchment has some of the highest deprivation in New Zealand,</p>

many do not see themselves as materially deprived (Atkinson et al., 2014; Barnard et al., 2012). In fact, self-reliance and the ability to have a degree of economic independence is seen as a key pillar of Ngāti Poroutanga (Warmenhoven et al., 2014). The ability to hunt, fish and gather sustenance and also build and repair all manner of infrastructure and machinery is seen as a key strength for communities within the Waiapu (Warmenhoven et al., 2014). However, these skills are thought to be in decline. 'Self-reliance' as a benefit has been conceptualised as the result of a land use change or practice which increases or builds upon the ability for those living in the Waiapu to have economic independence, self-reliance and resilience both in the formal and informal economy.




VICTORIA
GOVERNMENT OF VICTORIA

Land use option fact sheet
November 8th and 9th 2018 - Ngata Memorial College Ruatourea

Exotic forestry: *Pinus radiata*ⁱ

Pinus radiata is a species of pine native to California. Radiata pine was introduced to New Zealand in the mid to late 19th century, and extensive commercial planting was undertaken in the early 20th century. Radiata pine is a versatile and hardy species and has been planted extensively throughout New Zealand. It can tolerate coastal sands, heavy clays, gravels and volcanic ash depositsⁱⁱ. Whilst radiata pine is versatile, it is intolerant of excessive water, soils of high fertility (high nitrogen levels) and excessive wind exposureⁱⁱⁱ. Of New Zealand's exotic forest species, radiata pine accounts for 93% of the harvested volume and 94% of the export value with Douglas fir, Eucalyptus species and cupressus species making up the remainder^{iv}.

As a result of extensive erosion caused by Cyclone Bola (and predating Cyclone Bola), radiata pine was extensively planted to stabilise the most erosion prone areas and provide permanent forest cover. This planting regime was supported by the Erosion Control Funding Programme (ECFP) with grants to establish forest cover on erosion prone land. Radiata pine is the most prevalent species in the Tairāwhiti and there is an estimated ~60,000 ha of harvestable timber (age 21+) in the region^v. The plantation cycle for pinus radiata occurs over a 25-30 year period, with average harvest age 29 years^{vi}. After harvest, sawn timber is processed for use in framing and building, pulp and paper or exported raw. Radiata pine can be established on any land class, however in the Waiapu catchment is predominantly (although not exclusively) grown on LUC 5+.



Possible social and cultural benefits	Possible economic returns	Potential employment
<p>There are social benefits derived from exotic forestry due to the employment benefits in planting, harvesting and processing. However over a 28 year time period, employment is low in comparison with seasonal crops, therefore connections with the land and resultant social and cultural benefits may be reduced.</p>	<p>Generalised costs/ha for radiata forestry over a 28 year harvest cycle are around \$4310. Net returns/ha (including carbon at \$25/NZU and timber depending upon log price) is \$20,700 - \$30,700 which equates to a net return/ha of \$740 - \$1098ha^{vii}. This is reinforced with other evidence indicating net returns in the Waiapu catchment from pinus radiata of \$795/ha^{viii} over a 28 year cycle.</p>	<p>Forestry employment initially centres around the propagation of seedlings, transport, site preparation (weed and pest control, track clearance and maintenance) followed by planting, forest maintenance (pruning, thinning, pest and weed control) and harvesting. Processing provides another employment stream.</p>

Possible risks

Extreme weather events, particularly after the clear felling of a forest pose a risk to streams, land and infrastructure downstream of a cleared forestry site.

Extreme weather events and potential fires are more likely as a result of climate change.

Market risks are also present: fluctuations in the raw log price or harvesting costs can occur.

The time between harvests, 25-30 years, means a significant period without a steady ongoing cash flow.

1

Fact sheet prepared by Leo Mercer

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ⁱ Image retrieved from: <http://www.nzwood.co.nz/forestry-2/radiata-pine/>

ⁱⁱ NZFFA, 2007: http://www.nzffa.org.nz/farm-forestry-model/resource-centre/information-leaflets/nzffa-guide-sheets-2007/nzffa-guide-sheet-no-1/#Site_Selection

ⁱⁱⁱ NZFFA, 2017

^{iv} MPI, 2016 'How valuable is that plant species? Application of a method for enumerating the contribution of selected plant species to New Zealand's GDP': <https://www.nzfoa.org.nz/resources/file-libraries-resources/technical/594-value-of-plants-mpi-report-october-2016/file>

^v NZFOA, 2016: https://www.nzfoa.org.nz/images/stories/pdfs/Facts_Figures_2016_%C6%92a_web_version_v3.pdf

^{vi} NZFOA, 2016: https://www.nzfoa.org.nz/images/stories/pdfs/Facts_Figures_2016_%C6%92a_web_version_v3.pdf

^{vii} Personal communication with Charteris, C. October 2018

^{viii} Palmer, M. 2018

Hemp and Cannabisⁱ

Hemp (*Cannabis sativa*) is an annual cultivated crop suited for growth in temperate zones globally. Hemp originated in Central Asia and dispersed globally due to its varied uses. Licences to grow hemp were first issued in New Zealand in 2001, and legislation introduced in 2006 set conditions for the growth and sale of hemp cropsⁱⁱ. Hemp differs from cannabis as it is non-psychoactive (<.35% THC content). Hemp is a low-input crop, generally requiring no fungicides or pesticides and grows best in sandy loam with good drainage and requires an average of 65mm in monthly rainfall throughout the growing season. There are few known pest problems aside from birds when the hemp crop is harvestableⁱⁱⁱ. Hemp can operate on a 120 day plantation cycle and when grown outdoor is planted in October/November and harvested late February/March. Hemp can be grown intensively in glasshouses (producing higher yields but with a higher capital outlay) or in the open. Hemp is cultivated for hurd (pulp used in paper production and construction), bast fibre (rope and textile manufacturing) and seeds (hemp seed oil, flour and meal).



Cannabis (*Cannabis sativa*) is currently only allowed to be grown with a licence from the Ministry of Health for scientific research. However legislation (the Misuse of Drugs (Medicinal Cannabis) Amendment Bill) is expected to be passed by March 2019 to allow for commercial production of medicinal cannabis^{iv}. Until legislation is passed there are uncertainties surrounding the exact regulations which will control the production and supply of medicinal cannabis. Cannabis requires similar inputs to that of hemp, and medicinal grade cannabis can be grown intensively indoor, or outdoors. Cannabis flowers, leaves, stems, and seeds contain psychoactive chemical compounds known as cannabinoids that are known to have medicinal applications^v. When grown outdoors, hemp and cannabis are best suited for flat to rolling land up to LUC 4; however on certain sites, this can be exceeded but careful consideration needs to be given to harvesting logistics. Indoor growth is limited to LUC 1 land.

Possible social and cultural benefits	Possible economic returns	Potential employment
<p>Hemp and medicinal cannabis crops are seasonal crops and require preparation of the plantation site, planting, weed control and harvesting. Land uses where multiple decisions are needed per year can provide social benefits and connect landowners with the whenua^{vi}.</p> <p>As hemp and medicinal cannabis are non-native species, cultural benefits are not deemed high.</p>	<p>Establishment costs for hemp are unknown, however it is expected that net returns of \$4000-5000/ha can be expected under expected law changes^{iv}.</p> <p>Preliminary evidence indicates that gross returns for an indoor medicinal cannabis crop (1000 plants per ha) could be up to \$1,350,000/ha per annum (with glasshouse establishment costs of \$1,200,000)^{vi}. Preliminary evidence indicates gross returns for an outdoor crop of medicinal cannabis (1000 plants per ha) could be up to \$950,000/ha per annum (with establishment costs of \$25,000). However these figures should be viewed with great caution as the industry is not legal or regulated yet, and the regulation compliance costs could be significant – and the actual revenue will more than likely be significantly lower once legislation passes.</p>	<p>Employment related to hemp and medicinal cannabis growing is clustered on nursery growing, planting, tending, pruning, <u>weed</u> and pest control. Harvesting and processing are other areas of employment, and can include transportation, processing (packaging, handling, sorting), and marketing/wholesaling.</p>

Possible risks

The legislation relating to medicinal cannabis is still in development. It is not known with any certainty what the final regulations will be, and what conditions will be imposed upon growers.

Market risks are also present: fluctuations in the raw prices of these products may impact the success of the industry. Pre regulation profit estimates are unlikely to hold once medicinal cannabis has been regulated.

As climate change contributes to global warming and changing climatic regimes, droughts and other extreme weather events are likely to occur more frequently which may make hemp and medicinal cannabis cultivation difficult in many areas.

Pests and diseases are significant risks.

Security of the crop throughout the plantation cycle is important; maintaining security could be costly.

Fact sheet prepared by Leo Mercer

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¹ Image retrieved from: <https://mountainx.com/living/wncs-industrial-hemp-growers-reflect-on-experimental-first-season/>

² Misuse of Drugs (Industrial Hemp) Regulations Act 2006

³ Midlands Seeds: <https://www.midlands.co.nz/seed/our-products/hemp-seed-products>

⁴ Waiapu Investments Limited: <https://hikurangienterprise.files.wordpress.com/2018/04/wil-im1.pdf>

⁵ Palmer, M. 2018: 'Tataranui A1D2B2B Land use options: feasibility study and strategic plan'

⁶ Personal communication with Charteris, C. August 2018.

⁷ Midlands Seeds, cited in: <https://www.stuff.co.nz/business/farming/101608388/law-changes-may-triple-hemp-plantings>

⁸ Palmer, M. 2018

Cropping: Kumaraⁱ

The kumara (*Ipomoea batatas*) is a herbaceous perennial vine from which the tuberous root is produced for consumption. The kumara is a derivative of the larger family of 'sweet potatoes' which originate in tropical areas of the Americas. Māori initially introduced kumara to New Zealand from East Polynesia, and these early cultivars were supplemented by other cultivars introduced by Pākehā settlers. Currently there are four varieties of kumara grown in New Zealand; the orange (beauregard), red (owairaka), gold (toka toka) and 'purple dawn'.



Currently over 90% of kumara are grown in Northland, and in particular, around Dargaville. Kumara are sown between August and December depending on the cultivar and area. However as kumara are intolerant of frost, planting should occur when frosting danger has passed. Kumara thrive in temperatures around 24°C and grow poorly, or cease to grow at all, when temperatures dip below 17°Cⁱ. Kumara grow best in soils that are free draining, rich in organic material and have a hard soil base to stop their roots running. Dry frost free summers are required for optimum yieldsⁱⁱ. Kumara are harvested in February, March and April and can be stored for supply throughout the year. They have historically been grown in the Waipua catchment and wider Te Tairāwhiti region, and any surplus was traded, particularly after the arrival of Pakeha^{iv}. Changing land use patterns within the catchment has meant little kumara is commercially produced. Kumara are best suited to growing on fertile, rolling to flat land within the Waipua catchment up to LUC 2-3.

Possible social and cultural benefits	Possible economic returns	Potential employment
As kumara can be considered a 'native' plant, and was produced long before Pākehā settled New Zealand, the cultural benefits are higher than with other species due to this longstanding connection. Further, kumara is a seasonal crop and require preparation of the plantation site, planting, weed control and harvesting. Land uses where multiple decisions are needed per year can provide social benefits and connect landowners with the whenua ^v .	A wet summer will mean kumara can retail for \$10-12/kg, whilst a dry summer means kumara can retail for \$6-8/kg. Returns per ha for kumara have been difficult to determine. Evidence from a Northland grower in 2010 indicated that gross returns/ha can be \$48,000 ^{vi} . Evidence from 2011 indicates gross returns/ha can be \$57,000 ^{vi} . However it is not known what the labour, harvesting and processing costs are, nor the raw price per kg. Therefore net returns/ha are not known.	Employment related to kumara cultivation is initially limited to kumara shoot production before planting, weed control, and watering. Harvesting and processing are other areas of employment, and can include transportation, processing (packaging, handling, sorting), and marketing/wholesaling.
Possible risks		
Accurate market information relating to potential yields is very difficult to locate. Without accurate cost information – kumara cropping economically risky.		
Market risks are also present: fluctuations in the raw prices of these products may impact the success of the industry.		
As climate change contributes to global warming and changing climatic regimes, droughts and other extreme weather events are likely to occur more frequently which may make hemp and medicinal cannabis cultivation difficult in many areas. Wet weather and cool temperatures during summer seriously impacts kumara yields.		
Pests and diseases are significant risks.		
Current lack of scale and an associated lack of infrastructure create difficulties in capitalising upon economies of scale.		

Fact sheet prepared by Leo Mercer

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¹ Image retrieved from: <http://www.podgardening.co.nz/kumara.html>

² Northland Kumara: http://kumarabox.co.nz/?page_id=104

³ MPI, 2016 'How valuable is that plant species? Application of a method for enumerating the contribution of selected plant species to New Zealand's GDP': <https://www.nzfoa.org.nz/resources/file-libraries-resources/technical/594-value-of-plants-mpi-report-october-2016/file>

⁴ Beckwith, J. 2007: Tīkapa: archaeological and ancestral landscape

⁵ Personal communication with Charteris, C. August 2018.

⁶ Biostart, 2010: <http://biostart.co.nz/case-studies/vegetables/increase-kumara-yields/>

⁷ Biostart, 2011: <http://biostart.co.nz/case-studies/vegetables/increased-kumara-yields-3/>

Maizeⁱ

Maize (*Zea mays*) is an arable crop grown throughout New Zealand. It is predominantly used for animal feed, either as grain maize or as maize silage. The maize grain industry is largely concentrated in the North Island, with significant areas of cultivation in Waikato, Bay of Plenty, Gisborne, Hawke's Bay and Manawatu-Wanganuiⁱ. Alongside production for animal feed, maize can also be processed into maize flour, starch and maize oil. In 2016/2017 maize was the second most abundant crop in the Waiapu catchment behind pastureⁱⁱⁱ. Maize is a durable crop, and does not require large amounts of pesticide use or irrigation. Nitrogen fertiliser is often needed to kick-start growth after sowing.



Weed pressure needs to be kept down to ensure good growth. Maize is generally tolerant to dry conditions, but severe drought can limit yield. Conversely, maize is intolerant of water logged soils and excessive periods of water logging will significantly impact crop yield^v. Maize grows over summer and for best results is sown in September and October. Paddocks need to be disced and harrowed before sowing for optimal yields^v. Maize is generally harvested (depending on location of crop and growth) between March and June in the Tairāwhiti region^{iv}.

Maize cropping is best suited on flat to rolling land, and in the Waiapu catchment is located on and adjacent to floodplains on LUC 1-2^{vi}.

Possible social and cultural benefits	Possible economic returns	Potential employment
Maize cropping is important in the Waiapu catchment and wider region and contributes to the local economy, employs local community members alongside offering dividends to their shareholders. However, maize cropping is a seasonal land use that does not employ many workers, and may not connect hāpu with their whenua as much as other permanent land uses. As maize is not a native plant species, it is not assumed to have high cultural benefits ^{vii} .	Evidence indicates that maize can return \$1750/ha (gross margin) with establishment costs of \$1500/ha ^{viii} .	Employment associated with maize cropping is often low as it is traditionally sown and harvested by agricultural contractors using trucks and tractors, so local employment opportunities are limited (even when local contractors are used).

Possible risks

The main leaf diseases of maize are common rust, eyespot and northern corn leaf blight. Severe infection can reduce yields by 30%. Only in very disease prone conditions (warm and humid, together with a hybrid of lower disease resistance) will the application of fungicides be economically beneficial. Pest insects include the Argentine Stem Weevil (ASW) the Greasy Cutworm and Black Beetle. These pest diseases and insects can be controlled by insecticides and herbicides, however this adds extra cost to the cultivation and has negative environmental impacts^{ix}.

Excessive use of nitrogen fertiliser can cause water pollution.

Market risks are also present: fluctuations in prices for these products impact the viability of this industry.

As climate change contributes to global warming and changing climatic regimes, droughts and other extreme weather events are likely to occur more frequently which may make maize farming uneconomic in some areas.

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¹ Image retrieved from: <https://dahuti.co.nz/agriculture/>

² Miller and Roskrige, 2013 'The New Zealand Arable Industry'

³ GDC, 2016: 'Crop Survey Report'

⁴ DairyNZ, 2009: https://www.dairynz.co.nz/media/443166/growing_maize_on_dairy_farms.pdf

⁵ Pioneer Seeds, 2015: https://www.pioneer.co.nz/assets/publications/maizegrain/2015/Maize_for_Grain_Catalogue_2015.pdf

⁶ Pioneer Seeds, 2015: <https://www.pioneer.co.nz/maize-grain/product-information/farm-profiles/the-ferkins-family.html>

⁷ Awatere et al. 2018: 'Climate Resilient Maori Land'

⁸ Personal communication with Charteris, C. August 2018.

⁹ Palmer, M. 2018: 'Tataranui A1D2B2B Land use options: feasibility study and strategic plan'

¹⁰ DairyNZ, 2009: https://www.dairynz.co.nz/media/443166/growing_maize_on_dairy_farms.pdf

Native forest: mānuka, kānuka and totaraⁱ

Mānuka (*Leptospermum scoparium*) is a woody plant species which grows prolifically throughout New Zealand. Mānuka can tolerate wet soils, wind, and soils of poor fertility but is intolerant of shade. Mānuka is a 'prolific shrub species' and is one of the first species to regenerate on cleared land. It has numerous medicinal and environmental benefitsⁱⁱ, and its honey and essential oils have been successfully marketed. There is value in monofloral and multifloral mānuka honey, and the essential oils extracted from mānuka foliage.

Kānuka (*Kunzea ericoides*) is a tree species of the *myrtle* family abundant through the North Island and northern South Island of New Zealand. Alongside mānuka, kānuka can survive in environmentally challenging conditions but is intolerant of wet soils. Kānuka can tolerate frosts, drought conditions and soils of poor fertility. Mānuka and kānuka are some of the first species to recolonise cleared land, and are excellent soil stabilisers. Whilst the commercialisable properties of kānuka lag behind that of mānuka, there is potential in kānuka essential oil, honey and timber.



The longevity of mānuka (up to 60 years) and kānuka (up to 300-400 years) on regenerating land differs depending on climatic and site characteristics. When colonising cleared land, mānuka initially forms dense scrub, before being outcompeted by kānuka which ultimately succeeds to a mixed species native forest. An example of a larger tree species which grows through this canopy is totara (*Podocarpus totara*), a podocarp species endemic to New Zealand. Totara is tolerant of dry soils, and intolerant of poorly drained soils and can regenerate prolifically on cleared land if there is an adjacent seed source and limited trampling by stockⁱⁱⁱ. Totara has potential to be sustainably utilised for timber through selective harvesting of planted stands, or, selective harvesting of reverting 'wild' specimens. The growth rates of totara vary significantly between regions, however, rotation cycles are estimated to be in the range of 60-100 years with 60 years considered the minimum rotation period^{iv}.

Mānuka, kānuka and totara grow well on all LUC classes; but in the Waiapu catchment, are most prolific in areas above LUC 6.

Possible social and cultural benefits	Possible economic returns	Potential employment
<p>As these tree species are native the cultural benefits are deemed to be higher than other species due to their ability to provide rongoa Māori, and areas for recreation and hunting.</p> <p>Native forestry operates on a multi-generational time scale and employment density opportunities are not as high as for other seasonal land uses. This may mean that whānau living away from te Tairāwhiti may not connect with the whenua as readily with those living within Tairāwhiti^v.</p>	<p>Estimates for gross returns for kānuka oil is \$600/ha^{vi}.</p> <p>Mānuka, kānuka and totara are eligible to earn New Zealand Units (NZUs) also known as carbon credits within New Zealand's ETS, if the forest satisfies conditions for 'forest land'. At 10 years, carbon sequestration is 40.2t/ha, at 30 years 257.5/ha and at 50 years 323.4t/ha. The current NZU price is ~\$25/t.</p> <p>Wholesale totara can retail between \$1200/m³ and \$3800/m³ depending on the grade, quality and finish of the processed timber^{vii}. 'Carropate' prices are difficult to find due to the small size of the native timber forestry industry.</p> <p>Planted mānuka is assumed to cost \$1239/ha (with \$1300 AGS grant) and profitable at year 7^{viii}. For a mānuka honey beehive yielding on average 23kg per year, the net return can be ~\$250/hive^{ix}. In Tairāwhiti much of the mānuka is established, so there are no planting costs.</p>	<p>It is difficult to accurately present the employment density for totara forestry as it is small compared with the exotic forest industry. However, there will be similar jobs to that of the exotic forest industry, likely in nurseries, transport, and maintenance and harvesting.</p> <p>Processing can potentially be achieved if logs are harvested within Tairāwhiti.</p> <p>If production of kānuka oil was scaled up, and processing industries were built in the Waiapu catchment, a factory would employ between 20 and 40 full time workers harvesting and extracting the oil^x.</p> <p>One beekeeper (mānuka honey) can manage 400 hives, and if we are assuming there is 1 hive/ha, there is a ~400ha area for one job^{xi}.</p>

Possible risks

Risks legislative uncertainty regarding native timber harvesting, the ETS, or definitions of what constitutes 'mānuka honey' or oil.

Market risks are also present: fluctuations in the raw prices of these products may impact the success of the industry.

Climate change is likely to increase the prevalence of adverse weather events conditions.

Current lack of scale and associated infrastructure creating difficulties to capitalise upon economies of scale.

Native forest establishment is variable (taking into account nursery costs, transportation, labour, pruning etc.) and can range from \$5,000-\$60,000/ha, however \$20,000 is thought to be a reasonable estimate¹. This is considerably more expensive than exotic forestry.

The main challenge to developing a viable kānuka oil industry is the lack of research concerning the potential oil yields from different species, or the varying chemical composition of kānuka and resultant changes in oil yield associated with age or location. There is ongoing research in New Zealand investigating the medicinal potential of kānuka, and how to optimise oil production². This is also evident in the mānuka oil industry.

Intense competition from multiple beekeeping operations can limit the mānuka honey yield in an area and lead to hive threats

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¹ Image retrieved from: www.landcareresearch.co.nz/_data/assets/pdf_file/0017/43910/maori_values_native_forest.pdf

² Palmer, M 2018: 'Tōtaranui A1D2B2B Land use options: feasibility study and strategic plan'

³ Retrieved from Tane's Tree Trust

⁴ Steward et al, 2014 – cited in Tuahine, 2018

⁵ Personal communication with C Charteris and P Pohatu (August, 2018)

⁶ Palmer, M. 2018

⁷ Wholesale prices at Sawmill Direct, retrieved from: <http://sawmilldirect.co.nz/category/native-timber-pack-lots/>

⁸ Manuka Farming New Zealand (2017): <https://www.manukafarming.co.nz/wp-content/uploads/Session-1-How-Much-Can-I-Make-from-Plantation-Manuka.pdf>

⁹ Quoting Victor Goldsmith, Ngati Miere Honey Ltd. Retrieved from: <http://woodnet.co.nz/wp-content/uploads/2014/05/Tree-Grower-May-2014-Manuka.pdf>

¹⁰ Caddie, M. 2017: Retrieved from: <https://hikurangi.enterprises/2017/04/01/hikurangi-announces-three-clinical-trials/>

¹¹ Personal communication with Williams, D. August 2018

¹² Tuahine, H. 2018: 'Supporting native plantation forestry in the NZ ETS: Combining revenue from carbon, native timber, and co-benefits'

¹³ Palmer, M. 2018: 'Tōtaranui A1D2B2B Land use options: feasibility study and strategic plan'

Perennial food crops: blueberries, apples and macadamiaⁱ

Blueberries (*Cyanococcus*) are the berries of a perennial fruiting shrub. Three varieties are grown nationally and the **Rabbiteye** is most suited to the Tairāwhiti climateⁱⁱ. Blueberries can be grown intensively in glasshouses which can produce higher yields (but with a significantly higher capital outlay) or outdoors. Blueberries are intolerant of wet conditions, and need plenty of sunlight. When mature, blueberries are relatively tolerant of frost (however flowers are vulnerable to frost in spring) and resistant to wind. They favour slightly acidic soils (at least 3% organic contentⁱⁱⁱ), with an optimum pH level considered to be 4.8.



Blueberries are generally harvest ready at years 4-5^{iv} and can fruit for up to 50 years. Berries are harvested throughout summer with some cultivars fruiting between November and December and others from February to mid-April^v.

Apples (*Malus pumila*) are the fruit of a perennial fruiting tree. Apples grow best on soils that are well drained, fertile and have good water retention^{vi} and need a certain degree of winter chill and heat during summer to fruit well. Apples are expected to grow well in the Waipū catchment depending upon site and climate characteristics^{vii}. Apples are vulnerable to frosts when budding in spring, and severe weather events when fruiting. Apples are harvested late summer between February and May. Apples are mainly used for eating raw, cooking and processing (juice, cider etc.). It can take between 5-6 years to reach harvesting capacity and trees can consistently yield commercial apple quantities for ~20 years^{viii}.

Macadamia (*Proteaceae*) is a perennial nut tree, which produces the macadamia nut. The macadamia is a tropical rainforest tree and sensitive to excessive wind, frosts below 4°C, and waterlogged soils. Macadamia trees grow best in soils rich in organic matter, need shelter when young, and depending on the site, irrigation^{ix}. Modern macadamia cultivars are generally propagated by grafting, and can produce nuts with 2-4 years, with full production from year 15 and may continue to bear nuts for over 60 years^x. The nuts are generally ready for harvest in late May/early June, however harvesting can continue until November in areas^{xi}.

Blueberries, apples and macadamia's grow well on flat to rolling land up to LUC 4, however on certain sites, this can be exceeded but careful consideration needs to be given to harvesting logistics.

Possible social and cultural benefits	Possible economic returns	Potential employment
<p>Perennial food crops require seasonal maintenance such as pruning, weed control and harvesting. Non-mechanised harvesting of these crops is very labour intensive, as is processing. Land uses where multiple decisions are needed per year can provide social benefits and connect landowners with the whenua^{xii}.</p> <p>As these perennial trees are non-native, cultural benefits are not deemed high – however provision of kai is important.</p>	<p>Establishment of a blueberry crop in a glasshouse can be ~\$260,000/ha^{xiii}, whilst a non-intensive crop can be ~\$50,000/ha^{xiv}, however both are scale, site and context dependent. Returns per ha vary. However, assuming an 80/20 split of fresh and frozen berries for an orchard producing 10 tonnes/ha gross returns of \$100,000-\$130,000 can be expected^{xv}.</p> <p>Establishment costs for an apple orchard are around \$100,000/ha, however this is scale, site and context dependent^{xvi}. Gross annual returns for general (non IP) apples can reach \$20,000/ha, whilst IP varieties can reach between \$35,000/ha and \$75,000/ha^{xvii}.</p> <p>Establishment costs for Macadamia nuts is estimated to be \$17,500/ha^{xviii}. Potential annual gross returns (after licensing, establishment and processing) for macadamia nuts at year 5 is \$14,850/ha and at year 15, \$74,100/ha^{xix}.</p>	<p>Producing perennial food crops provides similar areas of employment. Initially there is nursery propagation, planting, tending, pruning, weed and pest control and harvesting often requires intense concentrated employment. Further employment is associated with further processing such as packaging, grading, sorting, handling, freight and wholesaling^{xxi}.</p>

Possible risks

Blueberries have shallow fibrous roots, and as such can be susceptible to wind throw and fungal diseases such as *Phytophthora* in poorly drained soils^{xxi}. Pest species such as leaf rollers, scale insects and grass-grub affect the bushes, but can be controlled with insecticides. Birds are also a pest which eat ripe berries before and during harvest. Bird netting can address this issue^{xxii}.

Apples need a certain number of winter chill days to fruit well, this may present a challenge in the Waiapu catchment, and with changing climate conditions. Irrigation is needed for apples, and there will be extra costs establishing irrigation if none is present. Multiple pest insects predate upon apple and other *pitfruit*, and this requires biological or chemical pest control.

Pest species such as the Guava Moth and Green Vegie Bug are the two major insect pests facing **macadamia** growers within New Zealand. The roots are shallow and trees can be blown down in storms. They are also susceptible to *Phytophthora* root disease.

Market risks are also present: fluctuations in the raw prices of these products may impact the success of the industry.

Climate change is likely to increase the prevalence of adverse weather events conditions.

Current lack of scale and associated infrastructure creating difficulties to capitalise upon economies of scale.

Fact sheet prepared by Leo Mercer

Disclaimer: The economic returns presented are indicative only. Please do not think of these estimations as accurate representations of current or future prices, as climate and market changes significantly impact prices. Average prices have been sought from multiple sources and the figures should be used only as a rough guideline. For some species there are gaps in the evaluation because information has not been forthcoming because of confidentiality issues or lack of data. These land uses may also be limited by scale and infrastructure constraints in the Waiapu catchment or wider region.

ⁱ Image retrieved from: www.landcareresearch.co.nz/_data/assets/pdf_file/0017/43910/maori_values_native_forest.pdf

ⁱⁱ Blueberries New Zealand: <https://www.blueberry.co.nz/index.php/about/growing-blueberries>

ⁱⁱⁱ Rotorua Land Use Directory, 2018: <https://landusenz.org.nz/blueberries/>

^{iv} Rotorua Land Use Directory, 2018: <https://landusenz.org.nz/blueberries/>

^v Rotorua Land Use Directory, 2018: <https://landusenz.org.nz/blueberries/>

^{vi} Palmer, M. 2018: '*Totaranui A1D2B2B Land use options: feasibility study and strategic plan*'

^{vii} Palmer, M. 2018

^{viii} Palmer, M. 2018

^{ix} Retrieved from 'New Zealand Macadamia Society': <http://www.macadamia.co.nz/growing-macadamias>

^x Palmer, M. 2018

^{xi} New Zealand Macadamia Society

^{xii} Personal communication with Charteris, C. August 2018.

^{xiii} Palmer, M. 2018 (citing a confidential industry source): '*Totaranui A1D2B2B Land use options: feasibility study and strategic plan*'

^{xiv} Rotorua Land Use Directory, 2018: <https://landusenz.org.nz/blueberries/>

^{xv} Rotorua Land Use Directory, 2018: <https://landusenz.org.nz/blueberries/>

^{xvi} Palmer, M. 2018 (citing confidential industry source)

^{xvii} Palmer, M. 2018

^{xviii} Palmer, M. 2018

^{xix} Palmer, M. 2018 citing Torere Macadamias

^{xx} Palmer, M. 2018

^{xxi} MPI, 2016 '*How valuable is that plant species? Application of a method for enumerating the contribution of selected plant species to New Zealand's GDP*': <https://www.nzfoa.org.nz/resources/file-libraries-resources/technical/594-value-of-plants-mpi-report-october-2016/file>

^{xxii} Palmer, M. 2018

^{xxiii} Rotorua Land Use Directory, 2018: <https://landusenz.org.nz/blueberries/>

Sheep and beef farmingⁱ

Sheep and beef farming has historically been, and currently is an important industry for New Zealand, te Tairāwhiti and the Waiapu catchment. After the arrival of Pākehā settlers to Tairāwhiti in the early-mid 19th century, native bush was extensively cleared to establish sheep stations for meat and wool production. These land use changes were part of broader trends in the development of New Zealand's pastoral economy, where production of wool (and latterly meat with the advent of refrigerated shipping) was destined for export to Great Britainⁱⁱ. Sheep and beef farming has been encouraged by successive governments through provision of fertilizer subsidies, discounted loans, tax breaks for land development and a guaranteed minimum livestock price for farmers.



Once the land was cleared, fences were erected, and yards were constructed - sheep and beef farming became a significant industry in the Waiapu catchment and Tairāwhiti. Pākehā farmers owned and ran large pastoral stations which employed a subset of the local population in peripheral industries i.e. fencing, shearing, shepherding, mustering and transportationⁱⁱⁱ. Māori landowners also converted land, or were encouraged to enter the pastoral economy in the 19th century. Apirana Ngata's numerous Māori land development schemes saw much land in the Waiapu catchment enter into sheep and beef production, partly as a means to limit the alienation of 'idle' land, but also to ensure the prosperity of Māori communities and to show that Māori could farm just as well as their Pākehā counterparts. Between 1890 and 1930 the Waiapu catchment, like the wider Tairāwhiti region, was developed extensively for pastoralism which began with large scale forest clearance and then burning^{iv}. This landscape change has historically been a significant economic driver for Tairāwhiti, but has also contributed to wide spread erosion and sedimentation throughout the catchment^v. Sheep and beef farming is suitable for all LUC classes, however in the Waiapu catchment is predominantly located on LUC 4+.

Possible social and cultural benefits	Possible economic returns	Potential employment
Sheep and beef farming entities in the Waiapu catchment contribute to the local economy, and employ local community members alongside offering dividends to their shareholders. Whilst sheep and beef farming may be problematic in some areas, there are significant social benefits from the employment and income provided. Land uses where multiple decisions are needed per year can provide social benefits and connect landowners with the whenua ^{vi} .	For hard hill country in the East Coast region, provisional/ha profit (before tax) 2017/2018 is \$205. Forecast 2018/2019 income/ha is \$200 ^{vii} .	Sheep and beef farming is a significant employer in the Waiapu catchment. Direct employment includes farm management, shepherding, labouring, shearing, machining and transportation. Indirect employment includes the processing of meat and wool.
	For hill country in the East Coast region, provisional/ha profit (before tax) 2017/2018 is \$219. Forecast 2018/2019 income/ha is \$205 ^{viii} .	
	For intensive finishing farms in the East Coast region, provisional/ha profit (before tax) for 2017/2018 is \$281. Forecast 2018/2019 income/ha is \$265 ^{ix} .	
	On the steepest erosion prone land net returns can be as low as \$20/ha or negative ^x .	

Possible risks

The wool price has fallen by up to 50% since highs in 2015/2016 and wool prices often do not recoup shearing fees^{xi}.

Market risks are also present: fluctuations in prices for these products impact the viability of this industry.

Widespread erosion in the Waiapu catchment has made it difficult to profitably farm some areas. The unstable geophysical nature of the Waiapu catchment means soil is lost in high rainfall events, and fences are often damaged.

As climate change contributes to global warming and changing climatic regimes, droughts and other extreme weather events may occur more frequently which may make sheep and beef farming untenable in many areas.

Pests and diseases are significant risks that sheep and beef farmers must contend with.

Potential future carbon taxes/charges may raise on farm costs.

Fact sheet prepared by Leo Mercer

Disclaimer: The economic returns presented are indicative only. Please do not think of these estimations as accurate representations of current or future prices, as climate and market changes significantly impact prices. Average prices have been sought from multiple sources and the figures should be used only as a rough guideline. For some species there are gaps in the evaluation because information has not been forthcoming because of confidentiality issues or lack of data. These land uses may also be limited by scale and infrastructure constraints in the Waiapu catchment or wider region.

¹ Image retrieved from: <https://teara.govt.nz/en/photograph/17344/herefords-and-merinos-being-mustered>

² Pool, I. (2015): 'Colonization and development in New Zealand between 1769 and 1900'

³ MacKay, J. 1949 'Historic Poverty Bay And The East Coast'

⁴ Harmsworth, G., Warmenhoven, T., Pohatu, P., & Page, M. (2002): 'Waiapu Catchment Report: Maori community goals for enhancing ecosystem health'

⁵ Harmsworth et al. (2002)

⁶ Personal communication with Charteris, C. August 2018.

⁷ Beef and Lamb NZ: <https://beeflambnz.com/data-tools/benchmarking-tool>

⁸ Beef and Lamb NZ: <https://beeflambnz.com/data-tools/benchmarking-tool>

⁹ Beef and Lamb NZ: <https://beeflambnz.com/data-tools/benchmarking-tool>

¹⁰ Palmer, M. (2018): 'Tataranui A1D2B2B Land use options: feasibility study and strategic plan'

¹¹ Wool price retrieved from: <https://www.interest.co.nz/Charts/Rural/wool-prices>

A.10 Sensitivity analyses for second level criteria

Flat land model 1 (M1 FL1)

To begin sensitivity analyses on the 'social and cultural' criteria are displayed in Figure 54. Beginning with 'skills development', it is evident that 'medicinal cannabis and hemp', 'perennial horticulture', and 'native forestry' all received top scores (a trend repeated on all 'social and cultural' sub-criteria) a change in weight will not affect the scores these top ranked criteria will receive. Moreover, it is evident that a weight increase leads to score increases for all alternatives, including 'maize cropping'. This result indicates the importance of 'skills development' for landowners within the Waiapu catchment.

Moving onto the 'employment' sensitivity graph, 'exotic forestry' is shown to be very sensitive to changes in weight, whereas 'kumara cropping' is moderately sensitive and rises much more slowly. The importance of 'exotic forestry' surpasses 'sheep and beef farming' at a weighting of ~ 0.5 . 'Sheep and beef farming' and 'maize cropping' are relatively insensitive to weight changes. Moving to the 'reconnection with whenua' sensitivity graph, the shallow lines for 'sheep and beef farming', 'exotic forestry' and 'maize cropping' indicate an insensitivity to weight changes. Similar trends are seen with 'mana motuhake', as 'sheep and beef farming' shows a moderate downward trend whilst 'exotic forestry' declines sharply. The 'community infrastructure' sensitivity graph reveals the sensitivity of 'kumara cropping' and 'exotic forestry' with the remaining alternatives insensitive to weight changes. Overall it can be noted that the sub-criteria for 'social and cultural' criteria are most sensitive to changes in the 'skills development' criterion, and least sensitive to changes of weight on the 'reconnection with whenua' sub-criterion.

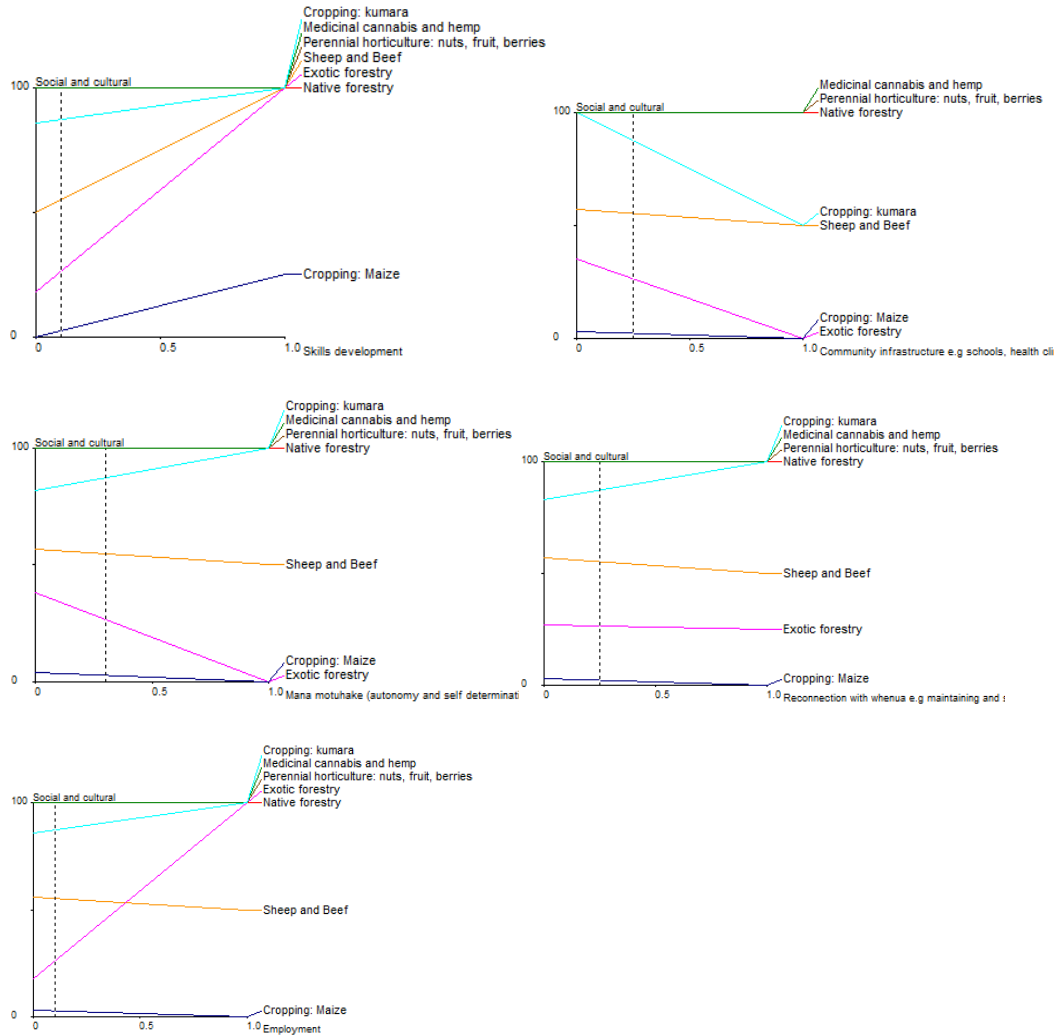


Figure 54: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'social and cultural' criterion M1 F1

Figure 55 displays the sensitivity graphs for the sub-criteria of the 'environmental' criterion. Continuing the trend throughout M1 FL1, 'native forestry' and 'maize cropping' as a result of their respective top and bottom scores are not affected by any changes in weight. Another consistent trend throughout all sensitivity graphs of Figure 55 is 'exotic forestry' and its remarkable insensitivity to any change in weight; with a constant flat line across all analyses. 'Perennial horticulture' is moderately sensitive to changes in weight across all sub-criteria, with modest decreases in importance across the climate change related sub-criteria ('withstanding climate change' and 'limiting climate change'), and modest

increases in regard to 'erosion control', 'water quality' and 'biodiversity'. Across the climate change related sensitivity graphs the importance of 'perennial horticulture' declines moderately as the weight increases. The same relationship can be seen with 'medicinal cannabis and hemp' which declines slowly under 'withstanding climate change' but shows a steep decline in the 'limiting climate change' graph. 'Medicinal cannabis and hemp' are most sensitive to increases in the 'water quality' weighting and its importance surpasses 'exotic forestry' with a slight increase in weight, and 'perennial horticulture' with a weighting of ~0.5. 'Maize cropping' will also surpass 'exotic forestry' and 'perennial horticulture' with an increase of weighting assigned to 'biodiversity', but it is less sensitive under this sub-criterion.

'Kumara cropping' and 'sheep and beef farming' express minor sensitivity to changes in weights across all 'environmental' sub-criteria. 'Kumara cropping' is most sensitive to weight increases of the sub-criterion 'water quality'. Overall, the alternative most sensitive to changes in weighting was 'medicinal cannabis and hemp' with sharply improved results under 'biodiversity', 'water quality' and 'limiting climate change'. The 'environmental' sensitivity graphs differed from that of the 'social and cultural' sensitivity graphs as there is less clustering at the upper end and more clustering of alternatives around the mid-levels of importance. There are no significant outliers amongst the sensitivity graphs of Figure 55 – although 'exotic forestry' expressed zero sensitivity to changes in weight.

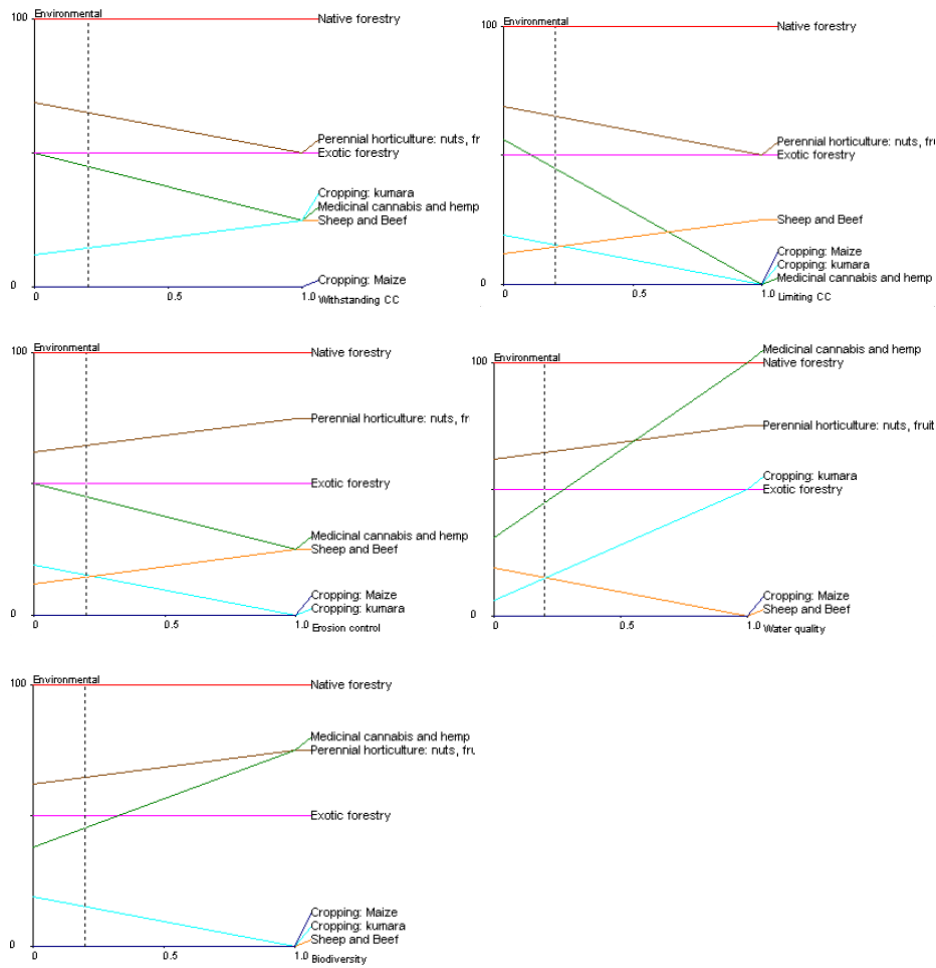


Figure 55: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'environmental' criterion M1 F1

The sensitivity graphs shown in Figure 56 once more highlight the significant polarisation evident in the responses to the benefits associated with 'economic' sub-criteria. As is evident in Figure 56, for 'financial return', 'resilience to market changes' and 'self-reliance' participants of M1 FL1 showed clear preferences for 'kumara cropping', 'medicinal cannabis and hemp', 'perennial horticulture' and 'native forestry' and little preference for 'maize cropping', 'sheep and beef farming' and 'exotic forestry'. The flat lines at opposing ends of the scoring scale indicate that these scores show complete insensitivity to any changes in weights.

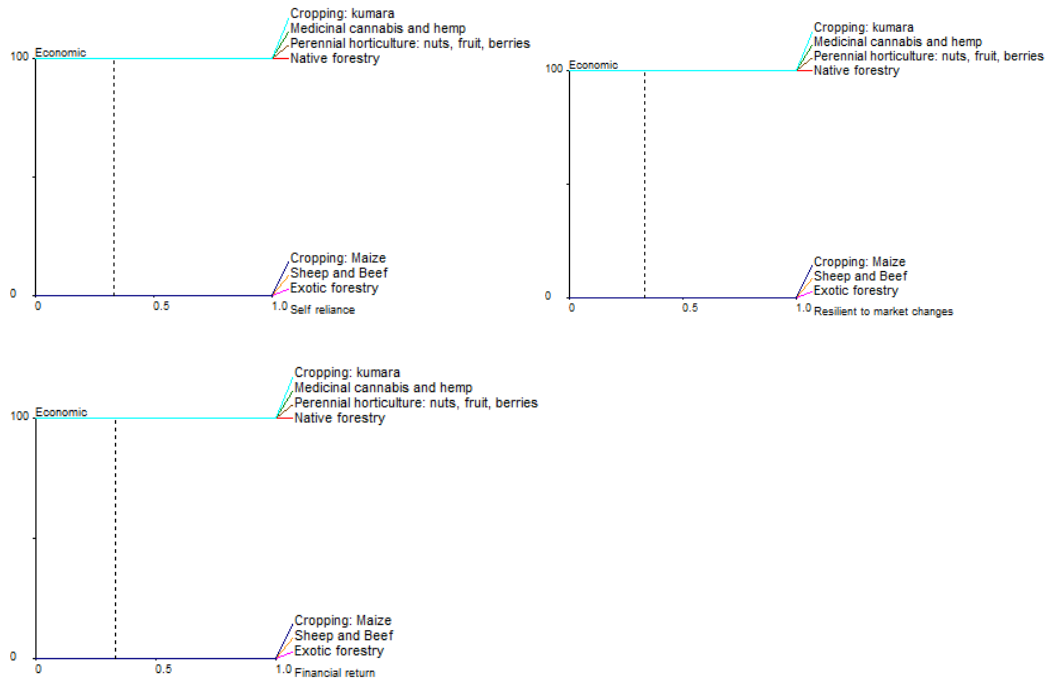


Figure 56: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'economic' criterion

Steep land model 1 (M2 ST1)

Examining the sensitivity graphs for the 'skills development' sub-criteria, in Figure 57, 'hunting and tourism' is most sensitive to a change in weight and its importance increases accordingly. 'Sheep and beef farming' also increase in importance under 'skills development' but not as rapidly. 'Exotic forestry' and 'native forestry' are clustered together tightly and exhibit minor sensitivity to a change in the weights as their importance diminishes marginally. Moving onto the 'employment' sub-criterion, the importance of 'hunting and tourism' diminishes slowly with an increase in weight whilst the remaining alternatives also increase marginally. For 'reconnection with whenua' and 'mana motuhake'; all the alternatives behave similarly and express sensitivity to a change in weight as their collective importance diminishes. The inverse is true for 'te ao' and 'knowledge and awareness' as the alternatives' collective importance rises slowly, however, these are not as sensitive to a change in weights. The final sub-criterion

‘community infrastructure’ reveals a disparate relationship between the alternatives as ‘hunting and tourism’ shows substantial sensitivity to a change in weight with a reduction in importance. ‘Native forestry’ is relatively robust yet shows a small decrease in score.

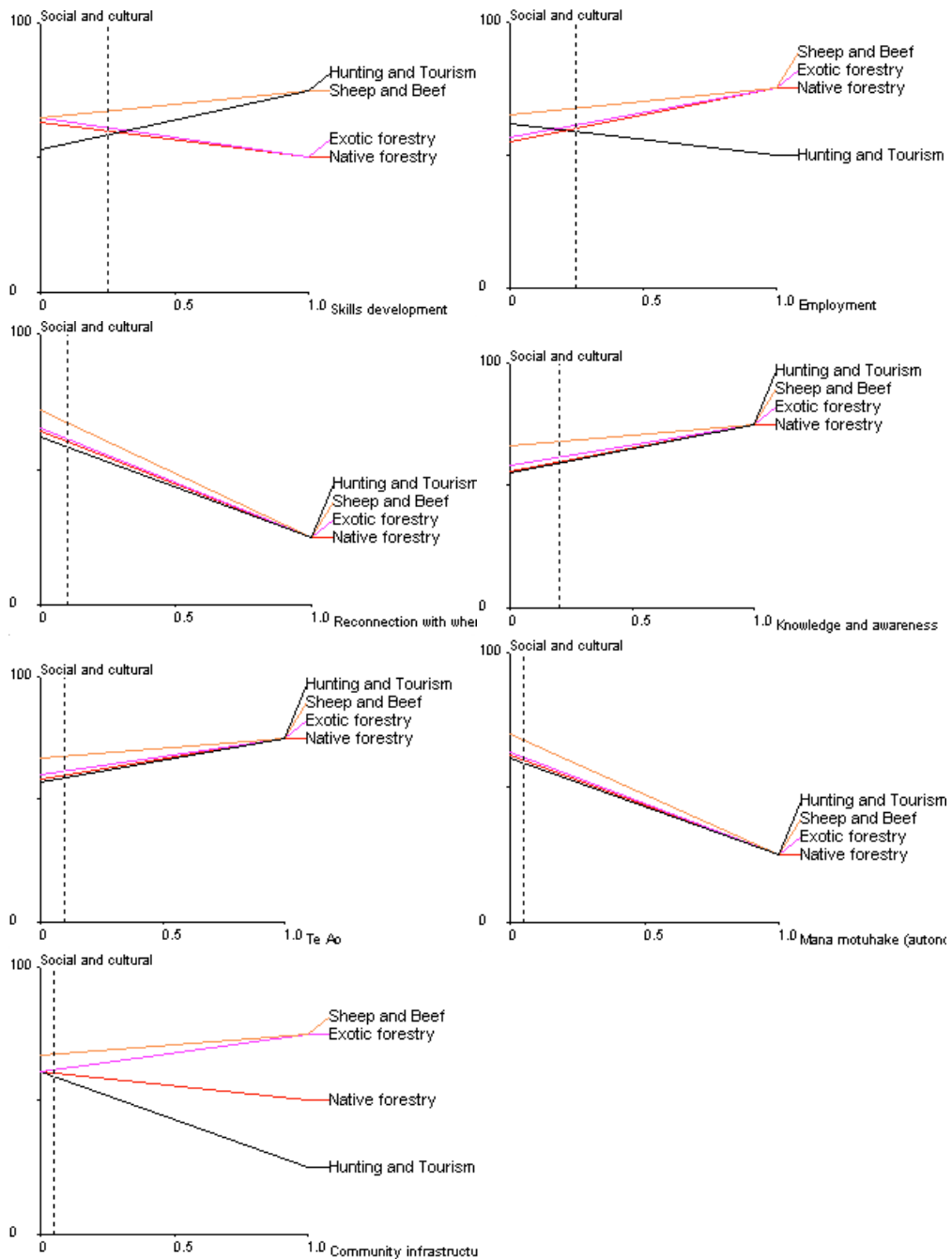
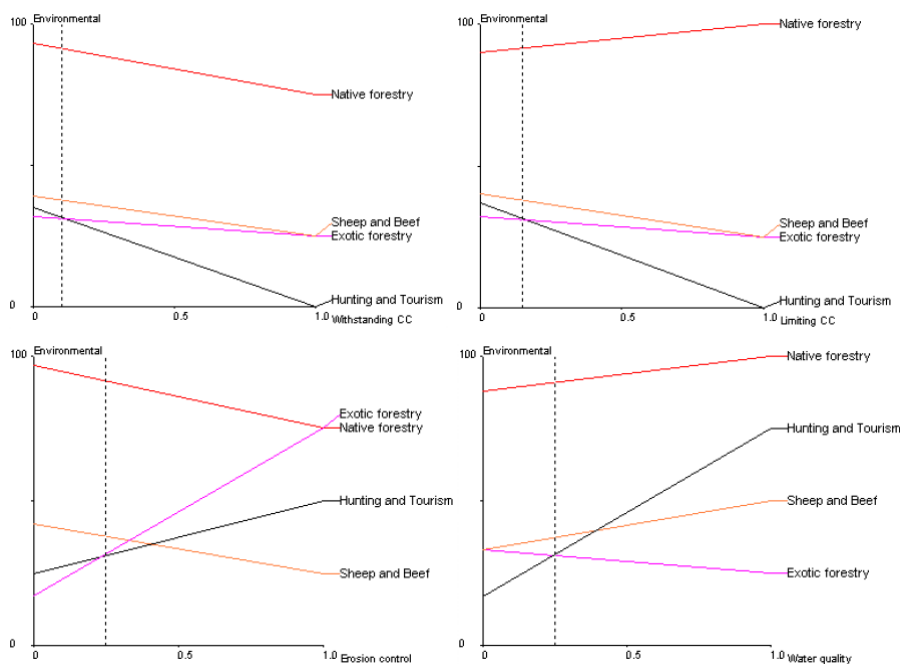


Figure 57: Sensitivity graphs showing the effects of weight changes on sub-criteria for the ‘social and cultural’ criterion M2 ST1

Figure 58 details the sensitivity graphs for the 'environmental' sub-criteria. The alternatives assessed on the climate change related sub-criteria show minimal sensitivity to a change in weight barring 'hunting and tourism', which sees a reduction in score. Under 'erosion control', 'exotic forestry' is shown to be most sensitive to a change in weight and its importance increases rapidly, surpassing 'hunting and tourism' and 'sheep and beef farming' and meeting 'native forestry' (which sees a reduction in importance). 'Hunting and tourism' displays a large rise in importance under 'water quality' (surpassing 'sheep and beef farming' and 'exotic forestry' with a small weight increase). Under the 'biodiversity' sub-criterion, as the weight increases, the relative of importance of 'hunting and tourism' and 'exotic forestry' decrease significantly. When looking at trends across all the sub-criteria, 'sheep and beef farming' and 'native forestry' show less sensitivity to changes in weight for the 'environmental' sub-criteria than 'exotic forestry' and 'hunting and tourism'.



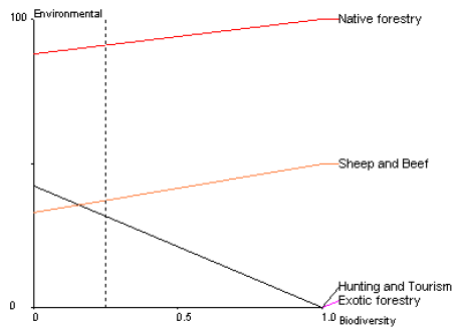


Figure 58: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'environmental' criterion M2 ST1

Figure 59 exhibits the sensitivity graphs for the 'economic' criteria. It is immediately clear that 'hunting and tourism' and 'sheep and beef farming' exhibit no sensitivity to weight changes across all criteria. 'Native forestry' is seen to be strongly sensitive to changes in weight and its importance under 'financial return' dips dramatically alongside a change in weight and its importance falls below all sub-criteria at a ~0.6 weighting. However, under 'self-reliance' 'native forestry' is equally as sensitive, yet its importance improves rapidly. 'Native forestry' shows less sensitivity to weight changes under 'resilient to market changes'. Barring 'self-reliance' where 'exotic forestry' exhibits no sensitivity to weight changes, the importance of 'exotic forestry' increases under 'financial return' whilst the inverse is the case on 'resilient to market changes'.

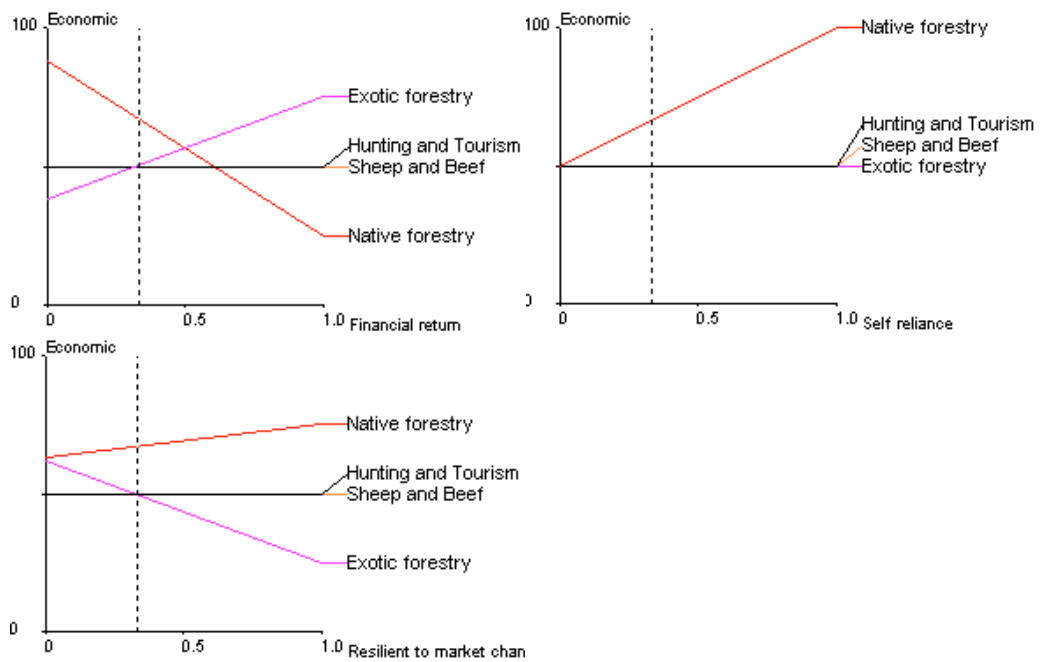


Figure 59: Figure 25: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'economic' criterion M2 ST1

After analysing the sensitivity graphs for M2 ST1 it is obvious that the alternatives are most sensitive to weights changes on 'environmental' sub-criteria. Little variation in importance was evident under 'social and cultural' indicating that overall, alternatives were insensitive to changes of weight under these sub-criterions. 'Sheep and beef farming' were insensitive to changes in weights across all sensitivity graphs. 'Exotic forestry' was inconsistent in its robustness – particularly under 'environmental' criteria where large positive and negative swings were evident.

Steep land model 2 (M2 ST2)

The first round of sensitivity analyses for the sub-criterions of M2 ST2 is visible in Figure 60. Beginning with 'sheep and beef farming', it is evident that this alternative shows minimal sensitivity to any change in weight under the 'employment', 'reconnection with whenua' and 'knowledge and awareness' criterions. Under the 'community infrastructure' criterion, 'sheep and beef

farming' shows mild sensitivity to a change in weight and its importance falls with an increase in weight. A contrasting relationship is evident under 'skills development' and unsurprisingly (considering the multifaceted skill set needed within the sheep and beef industry) a weight increase leads to an improved score. The same can be said for 'exotic forestry' which is more sensitive to a weight increase under 'skills development' and 'employment' (becoming the most important alternative if the weighting surpasses ~ 0.7) which shows the importance of exotic forestry as an employer in the Waiaapu catchment. 'Exotic forestry' is considerably sensitive to weight increases for 'reconnection with whenua' and its importance is shown to diminish significantly. 'Native forestry' is relatively robust across the 'social and cultural' sub-criteria, however, under 'employment' and 'community infrastructure' minor sensitivity is evident alongside a small decrease in importance. 'Hunting and tourism' is also generally robust to any weight changes, however; similarly, to 'native forestry', sensitivity is exhibited under the 'employment' and 'community infrastructure' sub-criteria which results in a minor decrease in importance.

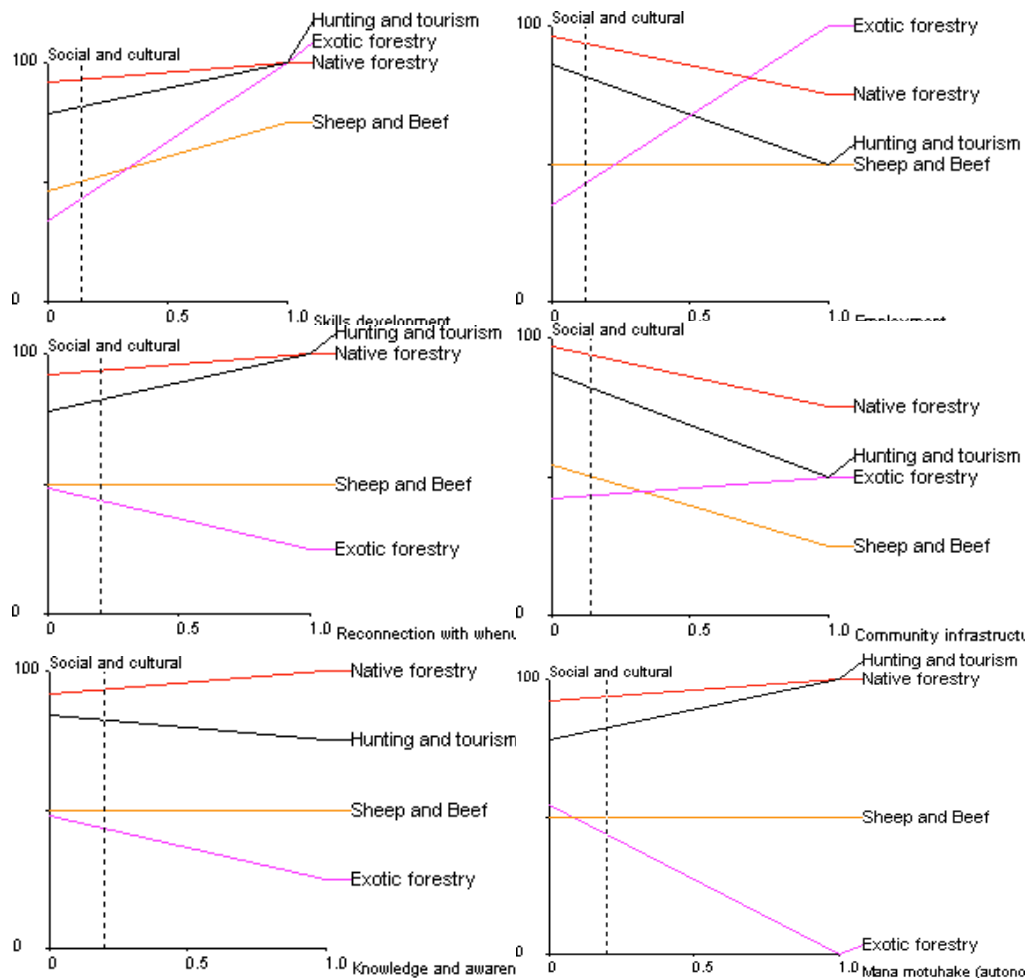


Figure 60: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'social and cultural' criterion M2 ST2

Sensitivity analyses for the 'environmental' sub-criteria are presented in Figure 61. Across all the graphs it is evident that 'native forestry' and 'sheep and beef farming' are both entirely insensitive to a change in weights and both occupy levels of importance at opposing ends of the y axis. Beginning with 'hunting and tourism', it is noticeable that for 'withstanding climate change', 'limiting climate change', 'erosion control' and 'water quality' little sensitivity is exhibited but a slight decrease in importance is noted. For 'biodiversity', 'hunting and tourism' sees an increase in score. 'Exotic forestry' holds a similar relationship across the first three criterions. Yet, 'exotic forestry' sees importance increases. For 'water

quality' and 'biodiversity' with an increase in weight, the importance of 'exotic forestry' declines moderately.

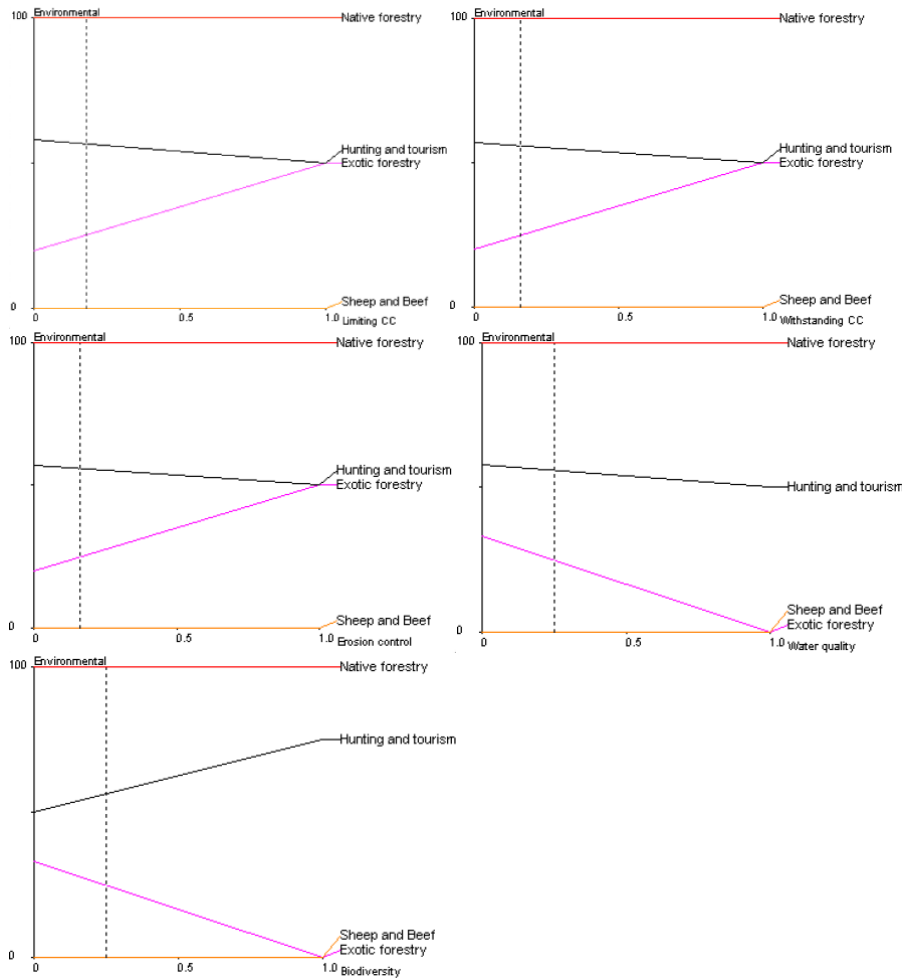


Figure 61: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'environmental' criterion M2 ST2

Figure 62 exhibits the sensitivity graphs for 'economic' sub-criteria. 'Hunting and tourism' and 'native forestry' have been scored the same and consequently, their relationship is identical across all criteria. These two alternatives both express sensitivities to changes in weighting across all the sub-criteria. For 'financial return' and 'resilient to market changes' an increase in weight results in a moderate decrease in importance. The opposite is the case for 'self-reliance', where 'hunting and tourism' and 'native forestry' increase in importance and

show much more sensitivity to a weight change. ‘Sheep and beef farming’ is relatively robust, and little change is evident on ‘financial return’ and ‘self-reliance’. ‘Sheep and beef farming’ is more sensitive to a change in weight under ‘resilient to market changes’ and its importance subsequently decreases more significantly. ‘Exotic forestry’ is sensitive to weight changes under ‘financial return’ and its importance consequently rises sharply. However, for ‘resilient to market changes’ and ‘self-reliance’ this alternative is still reasonably sensitive, and its importance decreases.

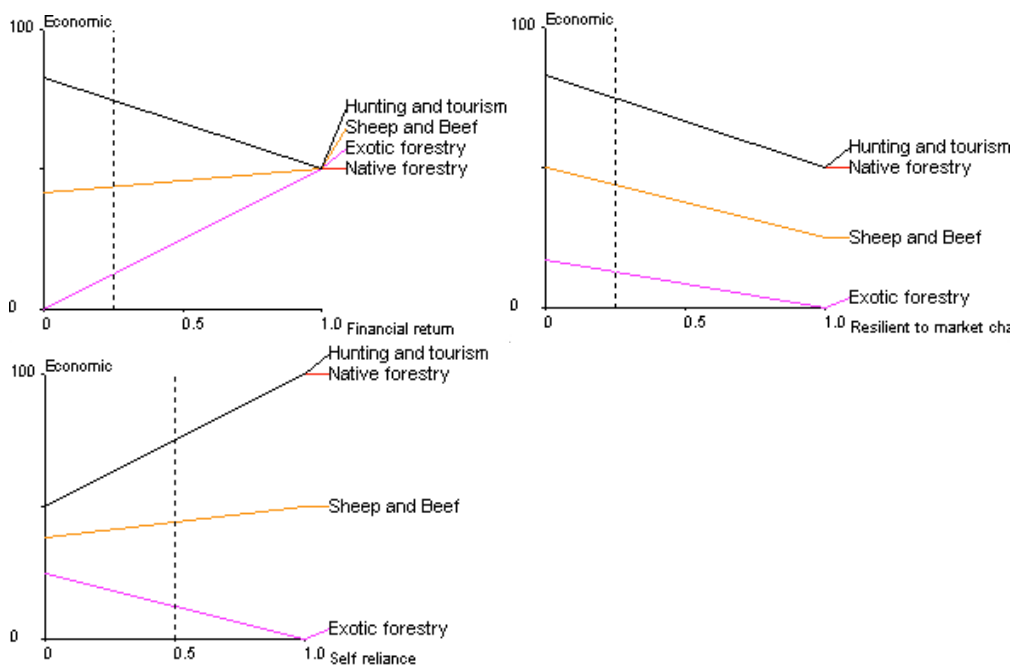


Figure 62: Sensitivity graphs showing the effects of weight changes on sub-criteria for the ‘economic’ criterion M2 ST2

There is considerable polarity amongst the scores of the sub-criteria, particularly under ‘environmental’ and ‘economic’ criteria. ‘Exotic forestry’ is seen to provide the most benefits regarding ‘skills development’ and ‘employment’, but scores very poorly on mana motuhake and reconnection with the whenua. None of the alternatives were perceived to offer a respectable financial return, and all scored poorly as a result. Overall, ‘native forestry’ and ‘hunting and tourism’ justified their high initial scores and performed consistently across all sub-criteria and

expressed little relative sensitivity to weight changes. 'Sheep and beef farming' was also a consistent scorer and was robust to most weight changes. 'Exotic forestry' was the more erratic alternative for M2 ST2 and showed the most sensitivity to weight changes across all sub-criteria.

Steep land model 3 (M2 ST3)

Figure 63 displays the sensitivity graphs for the 'social and cultural' sub-criteria in M2 ST3. As a result of the similarities in scores for 'native forestry', 'hunting and tourism' and 'sheep and beef farming' their importance does not change when the weight is varied for any of the criteria. This however is not the case for 'exotic forestry'. Under 'skills development' and 'employment' the importance of 'exotic forestry' rises and at a ~0.5 weighting surpasses 'sheep and beef farming'. For the remaining three sub-criteria the importance of 'exotic forestry' diminishes as the weight increases showing mild sensitivity to a weight change.

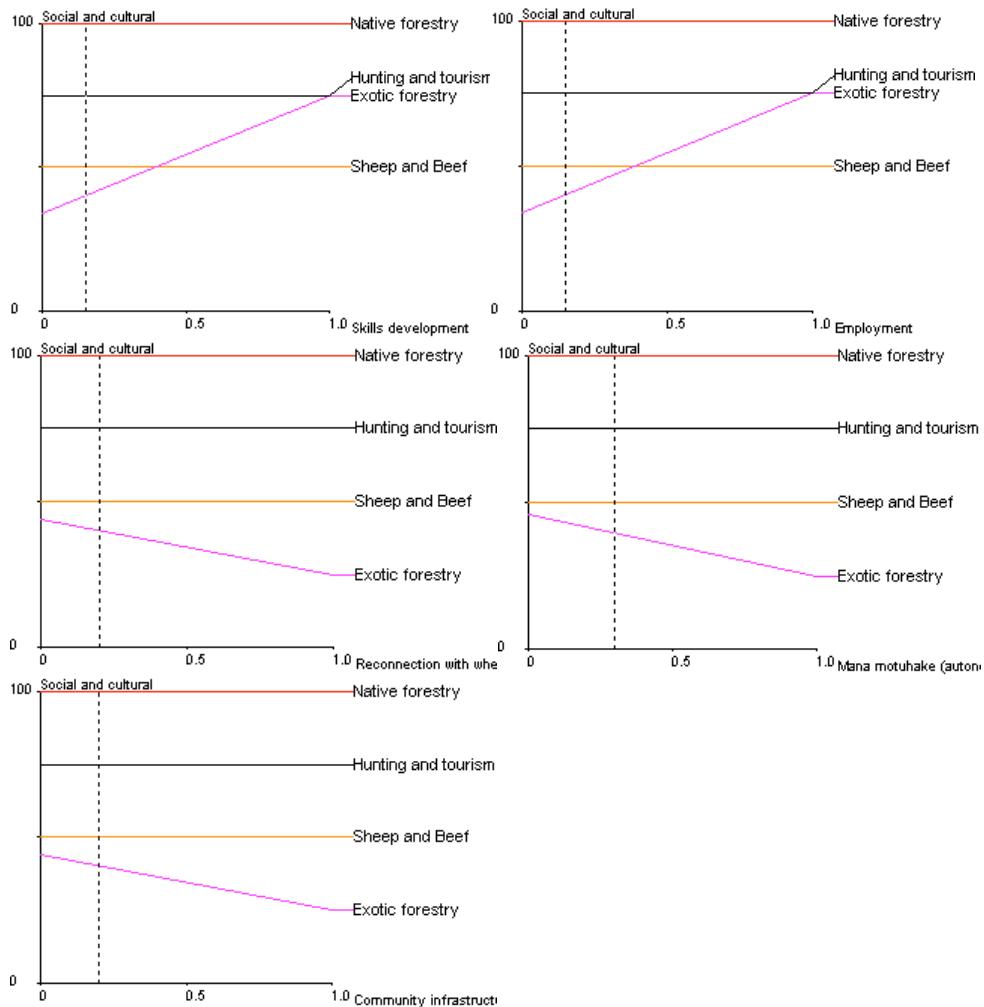


Figure 63: Sensitivity graphs showing the effects of weight changes on sub-criteria for the 'social and cultural' criterion M2 ST3

The robustness of 'native forestry' is further evident in Figure 64, where its importance and dominance doesn't change across any of the criteria. The remaining alternatives can be more sensitive, in particular 'exotic forestry'. Across the sensitivity graphs for 'limiting climate change', 'withstanding climate change' and 'erosion control' a similar relationship is evident for all alternatives with modest increases in importance (but no reordering of importance). Under 'water quality' 'hunting and tourism', 'sheep and beef farming' and 'exotic forestry' all decline in importance, with the ordering of importance staying constant. Under 'biodiversity' a change in importance occurs for 'sheep and beef farming', and

with a weight increase, it surpasses the importance of ‘exotic forestry’ at a weighting of ~ 0.5 . ‘Hunting and tourism’ and ‘exotic forestry’ decline in importance with no overlap under ‘biodiversity’.

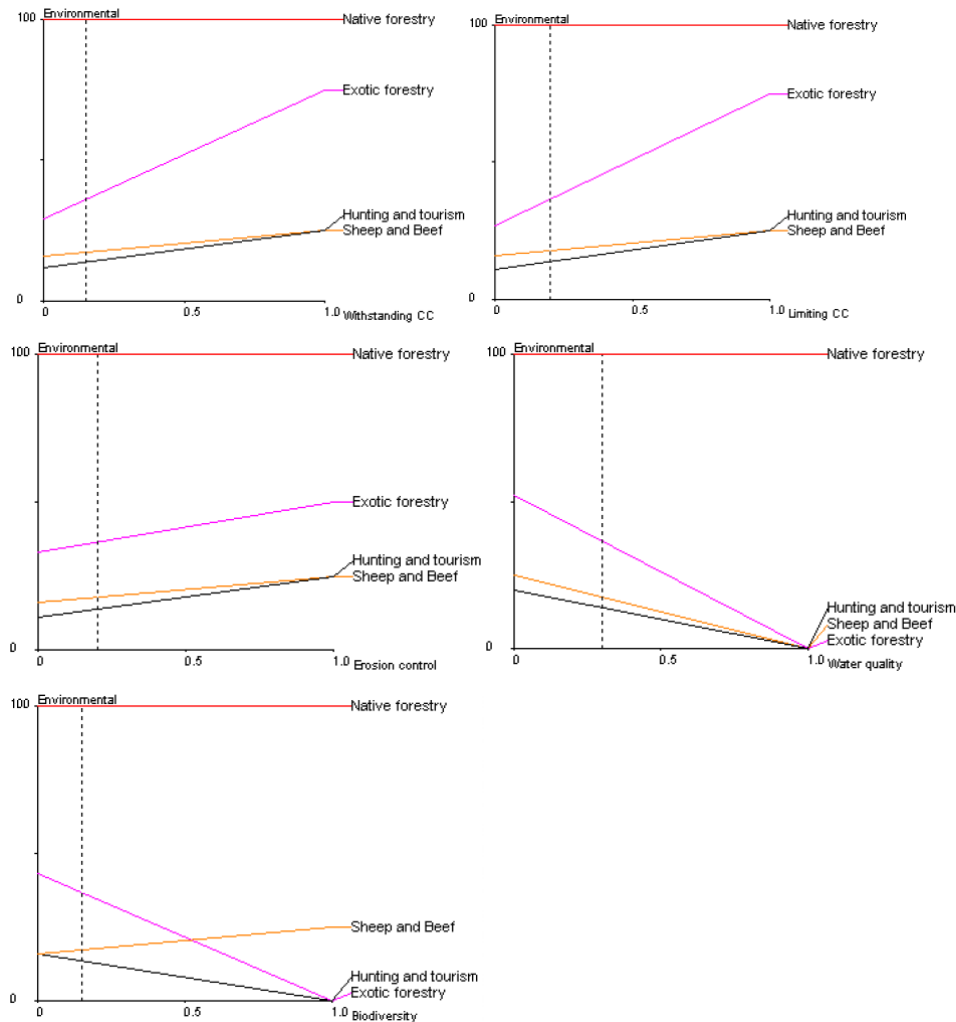


Figure 64: Sensitivity graphs showing the effects of weight changes on sub-criteria for the ‘environmental’ criterion M2 ST3

Figure 65 shows the sensitivity graphs for the ‘economic’ sub criteria: ‘financial return’ and ‘resilient to market changes’. As Figure 61 indicated, there is significant homogeneity in the scores given to the alternatives on these sub-criteria. As a result, ‘native forestry’, ‘exotic forestry’ and ‘sheep and beef farming’ are robust and experience no change in importance alongside a weight increase. However, ‘hunting and tourism’ is sensitive to an increase in weight and

for ‘financial return’ shows an increase in importance and a corresponding decrease in importance under ‘resilient to market changes’ of a similar magnitude.

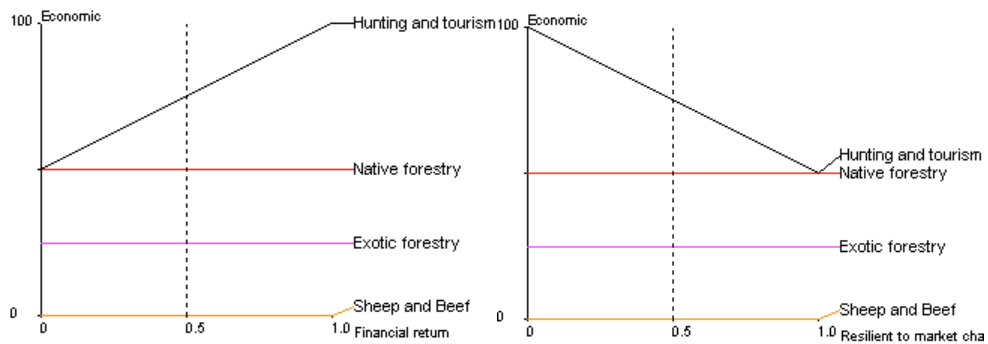


Figure 65: Sensitivity graphs showing the effects of weight changes on sub-criteria for the ‘economic’ criterion M2 ST3

Of the four models, M2 ST3 exhibited more homogeneity in the scores assigned to the four alternatives. It was resoundingly clear that ‘native forestry’ was the most preferred land use alternative as it received perfect scores for all sub-criteria except ‘economic’ ones. ‘Hunting and tourism’ was also a dominant alternative, but its performance was erratic at times, only scoring consistently well under ‘social and cultural’. This result differed from the other models and perhaps the implicit link between ‘hunting and tourism’ and native forestry wasn’t as evident in M2 ST3. There was significant score homogeneity across all alternatives. This was most evident under the environmental categories. ‘Exotic forestry’ had high performing spikes, particularly under the climate change related ‘environmental’ sub-criteria, and under ‘skill development’ and ‘employment’. ‘Sheep and beef farming’ was best regarded under ‘social and cultural’ sub-criteria but generally performed across all sub-criteria. The results for M2 ST3 can be considered robust as there are only minor examples of a change in importance corresponding with an increase in weight.

A.11 Reflection on the dynamic of Flat Land Model 1

The first wananga took 2 ½ hours on the 8/11/18 and 7 participants took part. Whilst the ages of participants were not taken, there was a diverse age range with the youngest estimated to be in their early 20s, and the eldest in their 70s. One of the participants at the first discussion was a librarian and in effect helped to drive the discussion and steer the discussion back to the problem under consideration when participants got off topic. All the participants were Māori landowners, however, there was a local government representative who attended the wananga as an observer. This participant did not directly influence the scoring or weighting process, but in effect acted as a co-facilitator by steering the conversation and querying the responses and statements made by other landowners, helping them to justify their position and stimulate further discussion. All the participants at this model had a good understanding of the land uses under consideration. The only area where there was confusion, was in the flat land example where the word 'perennial' needed explanation.

At times some participants were quiet during the process, whilst others dominated. All participants held shares in Māori land, and were knowledgeable and informed about the land uses and benefits under consideration. The participants were also informed about the environmental, and socio-economic issues evident within the Waiapu catchment and wider Tairāwhiti region and passionate about addressing these issues. Near the beginning of the first wananga the participants were invited to include or exclude any of the alternatives under consideration. This resulted in a minor discussion, but the participants were happy to continue with the supplied alternatives. This however was not the case when I queried whether any benefits should be included or excluded. The participants resolutely agreed that self-sufficiency/self-reliance was a key benefit associated with land uses. It was agreed that this benefit would be placed under the 'economic' benefit family under 'self-reliance' as any measure of self-reliance

afforded by a land use offers a degree of economic independence and this continues to be a key tenet of Ngāti Poroutanga (see Warmenhoven et al., (2014) for more information).

The participants spend a lot of time considering how to conceptualise the ability of exotic forestry to withstand climate change and how to consider it when scoring the alternatives. This situation arose because participants were confused as to how this could be considered i.e. at what stage of the rotation cycle would the ability for exotic forestry to withstand climate change be scored. It was decided in this workshop that exotic forestry would be considered as 'trees in the ground' or with 'roots in the ground'. Regarding the other land use alternatives under consideration, there was no considerable consternation as to how the other land use alternatives would be considered in relation to its ability to withstand climate change or limit climate change. Like this conceptual issue, another that arose was whether crops were assumed to be organic. Particularly for perennial food crops, participants needed to clarify amongst themselves whether this land use is assumed to be organic. It was eventually decided that perennial food crops were to be considered as farmed organically, and consequentially, this influenced how the participants scored the land use.

The time constraints of research participants was a significant issue that had to be contended with. As the wananga was held in the afternoon, after a full day of presentations, participants were at times not fully focussed and keen to head home with one participant leaving 1 ½ hours into the wananga. As such, the participants attempted to rush through the scoring for the land uses at the bottom of the scoring sheet. However, the co-facilitator and I (Rebecca) slowed this down and queried some points.

The youngest member of the workshop was very knowledgeable about cannabis and hemp production. This can in some part explain why these land uses scored quite well in some areas where it would may not have been expected such as

biodiversity or water quality. This participants knowledge helped to raise the scores for hemp and cannabis, as some of the other participants were sceptical about its potential benefits.

At times when participants were confused about a particular benefit or land use, and the debate and discussion had stopped, myself or the co-facilitator would pose an example or an open question to stimulate the discussion. This generally worked well and gave the participants something to discuss. Whilst the local government representative was a research participant, the role this participant played was helpful due to their moderating influence on the deliberation process. An example of this was querying the perceived benefits of crops such as hemp which were initially given a ranking of 5 for erosion control and biodiversity (a score comparable with that of native forestry), with gentle questioning and statements the participants realised that these scores were likely not representative of the actual erosion control potential of hemp and cannabis and revised the scores accordingly.

As previously mentioned cannabis has been cultivated illicitly in Tairāwhiti for many decades, and there is a lot of enthusiasm for cannabis and hemp as potential crops for Tairāwhiti, particularly considering the pending cannabis referendum and the advocacy work undertaken by a local NGO: Hikurangi Enterprises Ltd with aims of creating a medicinal and recreational cannabis industry (pending legislative developments) in Tairāwhiti. As such, the potential benefits afforded by cannabis and hemp are well known and these land uses have considerable support from the community. Cannabis and hemp were initially given scores of 5 across the board when first considered by the participants. The co-facilitator and I queried the participants about why these scores were given and appealed for justifications for these scores.

Accordingly, native forestry was given scores of 5 across all benefits. Native forestry was the first land use to be considered and the participants spent a longer

time out of all land uses considering this land use. Whilst native forestry received scores of 5 across all benefits, the participants were definitive in their scoring. The co-facilitator and I queried the participants as to whether the scores should hold after other land uses were scored. I was interested in why the financial returns for native forestry had scored so high and the participants related this to income from mānuka honey, potential bioactive extracts and returns from the sale of NZUs. Participants recognised that whilst there are markets for some native forest products i.e. kānuka bioactives, these are contingent on the successful development of intellectual property. The sequestration rate of native forests is considerably lower than exotic forests in the short term, however the participants expected carbon prices to rise. Thus, the high scores for financial returns are largely related to potential future returns, and from the results one can infer that the financial returns from native forest products/goods are more important than that of other land uses.

[A.12 Reflection on the dynamic of steep land model 1, 2 and 3](#)

The second wananga took 2 hours and was held on the second day of the hui 9/11/18 with 12 participants taking part (three of these participants also participants in the first wananga). The age range of participants was similar to that of the first wananga with two participants in their 70s/80s. The 2nd wananga was considerably larger than the first and was held in the school hall of Ngata Memorial College. The wananga began as one group, but early on it was decided by the co-facilitator and I to split the wananga into two groups of five (M2 ST1 and M2 ST2) and one group of two (M2 ST3), in order to improve the efficiency of the deliberation process. A contributing factor to this fragmentation was a discussion regarding the inclusion or exclusion of any extra alternatives. Participants in M1 FL1 were happy with the alternatives on offer and did not see fit to add any other alternatives to the MCA. However in the second wananga, there was concerted discussion regarding whether or not 'hunting and tourism' should be added as an

alternative. This was ultimately agreed upon by all participants of the second wananga, but it indicated that dividing the wananga up into different groups was necessary to improve efficiency, but also provide greater depth of data.

When queried about whether any other benefits needed to be added into the MCA, myself and the other co-facilitator began by mentioning that at the first wananga the participants agreed to include 'self-reliance' as an economic benefit. This spurred a discussion which ultimately led to M2 ST1 and M2 ST2 including 'self-reliance' as an economic benefit. There was considerable deliberation and discussion regarding whether or not the 'Māori worldview/belief system' was represented well enough by the existing benefits. M2 ST1 argued that this shortfall could be rectified by including a benefit – 'te ao' as a proxy for the Māori belief system, yet distinct from 'mana motuhake' and other social and cultural benefits. Ultimately 'te ao' was only taken up by M2 ST1, as M2 ST2 believed 'te ao' was not important on its own and preferred to think of the Māori worldview as part of 'mana motuhake'. M2 ST3 neglected to include 'te ao'.

Another benefit that some members felt was important, but not included was referred to as 'knowledge and awareness'. This benefit was distinct from, but related to employment as the participants believed that wider benefits associated with a land use could not be attained if landowners did not have prior knowledge and awareness of a land use. 'Knowledge and awareness' was ultimately included by M2 ST1 and M2 ST2. At this stage of the MCA process (~30 minutes in) it was decided that the larger 12 person group would split into the aforementioned smaller groups. Because the larger group could not achieve 100 percent consensus on the addition of different benefits it was decided that each group, would choose to include those benefits they saw as important and wished to consider as part of the MCA. Whilst this has led to the data from the second wananga across the three groups not partnering, there are valuable conclusions to be drawn from this.

One of the two groups of five (M2 ST1) took a considerable amount of time during all stages of the deliberation process. Two of these participants lived locally (with one having recently moved back from Australia), and the other lived away from the Waiapu catchment – but had grown up in the area, and had strong links to the area still. Two of these participants also indicated they had postgraduate university qualifications and had work experience in the public sector (resource management and planning) and academia (plant biology). This group debated at length the assignment of every weight and score and made frequent queries about procedural matters or how a benefit or alternative should be interpreted. It is hypothesised that time spent out of the catchment has led to certain alternatives such as ‘sheep and beef farming’ and ‘exotic forestry’ scoring higher across a range of benefits than M2 ST2 and M2 ST3 which were dominated by participants who lived in the rohe. Whether this is because these participants had less direct experience with the negative aspects of the aforementioned land use alternatives (which all other participants intimated to me and Rebecca) is a moot point. Further, the degree to which the post graduate education and employment in areas that potentially provided a broader overview of the issues under consideration is also another interesting area to explore.

Similarly, M2 ST2 took the process very seriously by debating each point thoroughly and querying the facilitators frequently. Further to this, M2 ST2 devised (unprompted) their own collaborative scoring and weighting system whereby each group member assigned scores and weights to all of the benefits under consideration and then drawing on these initial figures, discussed what their final group score would be. All participants of this model were drawn from the Waiapu catchment and were deeply aware of the issues at hand and had strongly held convictions as to the benefits associated with the presented land uses. One participant was a tutor at a local polytechnic and had participated in the wananga on the prior day. The remaining two participants of M1 ST2 held leadership roles in the community and were deeply embedded in community

initiatives and environmental/community action research. The embedded nature of the participants in M1 ST2 in the community, and their affinity with environmental/land use issues, and Māori land governance/diversification may have led to the poor scoring of benefits associated with 'sheep and beef farming' and 'exotic forestry'.

M2 ST3 contained the oldest two members of wananga two with both men in their 70s/80s. One of the members of M2 ST3 had participated in wananga one and had a good understanding of the MCA process. As such, M2 ST3 required little assistance, however it was observed that relative to M2 ST1 and ST2, there was a lesser amount of sustained discussion. Both participants of M2 ST3 were farmers throughout their working life and were still involved in land management and governance of whanau land, and were thus deeply familiar with 'sheep and beef farming'. This expertise was also relevant to 'exotic forestry' where the participants were able to retell the entry of the exotic forest industry into the Waiapu Catchment and wider Tairāwhiti region. Like M1 ST2, because these participants had so much firsthand experience with one of the land use alternatives under consideration – this likely significantly influenced the resultant scores assigned to 'exotic forestry' and 'sheep and beef farming'.

In regard to the group dynamics, it was not as easy to be present for each discussion and understand group dynamics as myself and the co-facilitator had to rotate between all three groups. Whilst there was a dictaphone placed near M2 ST1, finer points of discussion were missed across all groups – and similar in-depth knowledge and nuance was missed when compared with the first wananga. Concerning the behaviour of individual group members – there were two very passionate and knowledgeable participants in M2 ST1 who dominated the conversation when compared with the remaining three group members. The five members of M2 ST2 were all engaged and interested, and the deliberation seemed to be equitably shared amongst all group members. The older men in M2 ST3 did not engage widely with the wider wananga, did not raise any queries and

required little assistance. Similarly, with the first wananga, participants found it difficult to conceptualise climate change and at 'what stage' it should be thought of as.