Empowering Mātauranga Māori to transform our understandings of freshwater management

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Abstract

Mātauranga Māori is a rich, complex knowledge system that informs kaitiaki and positions tangata whenua within the living system that is our whenua and wai. However, the underlying assumptions of colonial frameworks conflict with Te Ao Māori because they privilege economic growth, situate people as separate from land, and understand land as an ownable resource. I draw upon the concept of incommensurability to portray how globally dominant frameworks privilege western understandings throughout all societal structures of Aotearoa, continuing to marginalise indigenous peoples and their knowledge. I identify how these systemic effects impact mana whenua ability to carry out kaitiakitanga of waterways, and how these effects work to keep us disconnected from our whenua which is an integral aspect to our identity and realisation of cultural kawa and tikanga.

The Macroinvertebrate Community Index is a method scientists use to assess the health of waterways; this and other western tools are useful mechanisms to monitor the states of our waterways and generate knowledge. There are overlaps in conclusions drawn from MCI results and the Wai Ora Wai Māori tool in assessments of the Turitea and Mahuraunui streams, such as a positive relationship between native riparian forest and stream health. However, policies and scientific monitoring privilege western frameworks, which creates inadequate representation of Māori values in freshwater management. I suggest that our understandings of waterways as 'resources to be managed' needs to change so that we can draw from multiple baskets of knowledge; so communities can direct kaitiakitanga of their local wai and whenua; and so economic development can be viewed as an extra benefit to increasing the hauora of people and whenua, rather than being the driver of our behaviour. Decolonisation at the structural level is critical to the future health of our whenua and society. Mātauranga-led collaborations at the local scale can create social movement to contribute to decolonisation of social structures at national and global scales. Transformations in Ecology can also enable researchers to recognise how community values influence their research so they may become culturally, politically, and ethically motivated in their work.

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Table of Contents

Chapter 1: An introduction

E rere kau mai te awa nui mai i te kāhui maunga ki Tangaroa. Ko au te awa, ko te awa ko au.

The great (Whanganui) river flows from the mountains to the sea. I am the river, and the river is me.

1.1 Mātauranga Māori: A whakapapa of wai

The primordial parents Papatūānuku (earth mother) and Ranginui (sky father) were locked in an eternal, loving embrace – their many, many tamariki (children) held closely between them in darkness. In the small space between their parents, the tamariki grew weary of their confinement and wondered of a world of light. Frustrated, Tūmatauenga threatened to kill Papatūānuku (Papa) and Ranginui (Rangi) so that he and his siblings could be released. But Tāwhirimātea was content living in closeness with his parents and chastised his brother for threatening violence upon those who raised and nurtured him. Tāne Mahuta, dismayed by his siblings fighting, lay his back onto Papa and forced his parents apart with the strength of this legs. Tāwhirimātea was angered and claimed the now empty space between his parents as his domain. As he flew to his father, he called to his siblings that they and their tamariki would always feel his wrath for the pain they had caused Rangi and Papa. This is why some days are filled with hurricanes and bad weather. On other days when the weather is fine however, we are reminded of the times when Tāwhirimātea listens to his parents' advice to forgive his siblings.

Since the moment of separation Rangi has continued to yearn and cry for his beloved Papa. Defying the distance of their separation he weeps loving tears (ngā roimata aroha a Rangi) that fall as ua (rain) to his wife. The first raindrop to fall from Rangi became (Hine) Te Ihorangi, a poutiriao and parent of hundreds of types of rain and snow (Best, 2005). When ua reaches Papa it mingles with her life giving forces and flows across the earth as Te wai ū ō Papatūānuku (life-giving waters of Papatūānuku) into streams and rivers. Reciprocating Rangi's yearning, Papa sighs for her beloved, releasing her sacred gift of misty rain, she returns some of her life-giving waters to Rangi via evaporation. All living beings created by Tāne since Hine Te Ihorangi, remain connected to Papa; her wairua (soul/spirit) and manaaki (care and protection)

permeates life. For this reason, whenua returns to whenua. That is, placenta (whenua) is returned to Papa (whenua) to nurture her with the same manaaki with which she nurtures us. Life is imbued with Papa's mauri and we continue to be supported by her through wai (water[1]) until our death. Hence we as tangata whenua ***are*** the whenua, and are connected to the generations before us, generations to come, and all living things through Papa.

Saturated with the life-giving forces of Papa and Rangi's love, wai is also a force of prolific creation, and sometimes we can witness this in the physical manifestations of poutiriao[2] (guardian spirits); such as Hinewai who is the visual personification of light misty rain that may appear when Papa sighs. Poutiriao are simultaneously guardians, personifications, embodiments, and parents of parts of the natural world in which we live and belong to. In the life-giving wai of Papa swim Tuna (the freshwater eel) that sprung from Te Ihorangi, and as they swim from the freshwater to saltwater and back again it is the female guardians of freshwater and salt water, Hine-Parawhenuamea and Hinemoana, who care for them (Best, 2005). Thus, in Te Ao Māori the life-giving forces that interact to produce and sustain life are understood as being interconnected and interdependent, with each supporting and sustaining another.

Hine-Parawhenuamea is the poutiriao of freshwater that runs from springs in the whenua (sometimes flood waters). Her story varies between rohe, but she is the grandchild of Papa and Rangi, born to Tāne te Waiora (another personification of Tāne Mahuta) and Hine-tū-pari-maunga, the Mountain Maid (Moore & McFadgen, 2006). Parawhenuamea bore the waters of the earth running from the whenua (land) and forming the sea with Kiwa, the guardian of the ocean. She also birthed Rakahore (personification of rock) who went on to bear many tamariki (different types of rock and sand) with Hine-uku-rangi (clay). Each poutiriao is imbued with immense mauri that flows between them during their reciprocal interactions. The wai that is able to flow because of Rakahore's structure mingles with the wairua of Papa and also that of

[1] Throughout this research I will use the terms wai or water to indicate the cultural framework from which I am speaking. This will also be done with the terms whenua and land. Whenua and wai will be used when I am speaking to their relationships with tangata whenua. Water and land will be used when I am speaking to the colonialist framework that understands humans as "above/owners/users of" these natural 'resources'.

[2] Poutiriao is a term used for the ancient energies/guardians who regulate and protect the different realms/aspects of the universe. Poutiriao literally means "the pillars (pou) placed/dispersed (tiri) into the world (ao)".

Rakahore. He is protective over Papa and nurtures the offspring of Hinemoana, including shellfish and seaweed. Together, Rakahore and Papa imbue wai with the mauri and wairua that brings it to life. The personifications and personalities of these poutiriao are how we understand our world; as a living world of living beings, where Papa and Rangi's love proliferate complex life and relationships among people, poutiriao, plants, and animals.

Further down the whakapapa of Parawhenuamea is Rātā, the first person to cut a tree using an adze. Being a part of her whakapapa as a person shows relationships between water, rock, soil, and people (Moore & McFadgen, 2006). Tangata whenua are the first people (tangata) of the land (whenua). Descending from Papatūānuku and Ranginui, our knowledge of who we are in the world begins with creational stories that orient around and are transmitted through whakapapa – every person, animal, plant, natural element, and metaphysical being are connected through vast genealogical webs of connection that transcend time and space (Ngata, 2018). Rātā was a direct descendant of Parawhenuamea, who is a direct descendent of Papa. Entwined with the stories of Papatūānuku and Ranginui, from whom all living beings and ecosystems descend, tangata whenua whakapapa to our tūpuna, and through them to the maunga, awa, moana, and marae around which our early mana whenua first settled. Whakapapa not only denotes genealogy, but also grounds our place in the world as tangata whenua of Aotearoa.

In Te Ao Māori the whakapapa of wai is important because wai is analogous to the toto (blood) of Papa, flowing and pooling as the essence of all life. As Papa's wai is the essence of all life, so too is it the duty of women to maintain whakapapa, being the carriers of the life-giving waters of the womb; while men are tasked with protecting both women (the bearers of life) and whenua (land). Through our creation stories our connectedness with the whenua begins with the waters of the womb and at birth; as illustrated through the placenta being returned to the whenua after birth, and sharing the same word – whenua (placenta/land).

Mana whenua are the tangata whenua of a local area. They carry distinct mana and knowledge specific to their rohe, evident in tikanga and kawa[3] that cannot be translocated upon the practices of other hapū/iwi. For people, to carry mana is to carry pride in personal or communal growth that has been achieved through maintaining

[3] Kawa are the principles/reasons/understandings that direct why and what we do. Tikanga are the protocols/procedures/manners in which kawa are realised.

connections with your tūpuna, whenua, and the practices of kaitiakitanga fine-tuned over centuries. This means our identities, and sense of strength and power develop through practicing Mātauranga that is grounded in whakapapa to all other living beings. For non-human beings, their mana can develop with age and esteem, and can be felt by people. The links between people, the natural world, and non-human personifications are fluid, complex, and diverse. Our ability for complex creativity is visible in the oral histories through which immense amounts of information are condensed to inform us about the world we live in and our relationships with it. This complex creativity can be appreciated by western holism, which espouses ontological[4] relationships and connections across ecosystems and disciplines. This opens space for sophisticated collaborative relationships that can respond imaginatively to modern ecological social issues.

Water began as a physical manifestation of the love between Papa and Rangi. It is an essence of life, sustaining us, and connecting us to directly to Papa and Rangi. Thus, whakapapa is more than a mere tracing of genealogical heritage. Whakapapa transcends time and space to help us understand our contemporary relationships with all living beings. Through awareness of our past we are able to condense extensive amounts of knowledge in order to look to the future with manaaki whenua and manaaki tangata (Forster, 2019). Our understanding of these relationships grounds our own relationship with wai and whenua in Mātauranga Māori, and Mātauranga itself is embedded in wairua and the desire for Te Ao Marama (the world of light, a metaphor for knowledge).

This chapter represents an introduction to this research which is primarily conducted from a Māori woman's perspective. It can be seen as a whakapapa of understandings and ideas, embedded in my own experiences of growth and conflict as a Māori woman doing a Master's thesis in Ecology. My experiences in the Sciences have created internal conflict within me because curricula content and overarching structures of the university system fail to reflect my values developed from my lived experiences in Te

[4] Ontologies can be considered as the philosophical theories and understandings that revolve around the nature of realities, all that exists, and different entities within these realities. Our perceptions of our environments and ourselves as parts of these environments are embedded within, and directed by, these understandings. Epistemologies can be considered as both the philosophical fields revolving around the investigation into knowledge creation, as well as the positions people place themselves into that result in the generation of knowledge, and the unconscious assumptions that direct their perceptions of valuable knowledge.

Ao Māori. I draw on the notion of incommensurability (Tuck & Yang, 2012) to articulate the potentials of embracing different knowledge systems without continuing to appropriate any knowledges. Beginning with a whakapapa of wai, we can briefly discuss some of the mechanisms through which ongoing colonisation continues to marginalise tangata whenua in the education system and in everyday life. This is enabled by wider post-colonial societal structures that assume their own values and interests to be universal, privileging economic interests over the health of people and whenua. These structures maintain power by systemically positioning tangata whenua and Mātauranga Māori at the periphery of what is considered valuable to New Zealand's future, perpetuating the marginalisation of knowledge that resists assimilation and colonisation.

Our understandings of our place in the world and our relationships within all sorts of environments are shaped by the underlying values and assumptions of the framework which dominates all aspects of our lives in Aotearoa, including the study of Ecology. I recognise that the dominant colonial framework that marginalises indigenous knowledge is only a single western understanding and does not reflect the multitude of cultures and indigenous peoples. The dominant colonial framework is what I am referring to when I speak of the western world and western understandings. While the Crown and government recognise Kaupapa Māori values and tikanga as important aspects of the lives of tangata whenua, not enough is done to adequately reflect these values in policies and formal education in ways that encourage research and collaboration grounded in Kaupapa Māori values, and driven by the values of communities.

1.2 Mātauranga Māori: Relationships with whenua and wai

Mātauranga Māori is the entirety of all knowledge for tangata whenua (see Broughton & McBreen, 2015). Originating in Te Ao Māori, and sometimes including knowledge shared with us by other peoples, Mātauranga Māori grounds our understandings of who we are and our places in the world. Our knowledge was initially passed down through oral narrative, such as pakiwaitara, whakataukī, whakatauākī, maramataka, waiata, mōteatea, and pepeha. Contemporary technological advances have also made it possible to transmit knowledge globally through written and visual mediums, but traditional art forms, such as carving, tukutuku, and tā moko have also been used for centuries to visually portray Mātauranga. Modern art forms also expand

Mātauranga through the creation of new mechanisms to portray knowledge, and this knowledge remains grounded in oral narratives of creation and the proliferation of interconnected and interdependent relationships among all living beings.

Creation stories and knowledge systems similar to Mātauranga Māori can be found among other indigenous peoples, worldwide (Duarte & Belarde-Lewis, 2015; Galafassi et al., 2018). Other indigenous knowledge systems also have relationships with the colonial system which have resulted in the marginalisation of local people and their knowledge, in favour of scientific knowledge in many spaces. This practice of marginalising communities has detrimental implications where indigenous peoples are disconnected from their whenua and culture, from which, hindering their ability to practice their own forms of kaitiakitanga is an effect. Just as Māori[5] trace whakapapa to build their perceptions of the world, the philosophy of *Ruwe/Ruwar*—the interconnection between lands, waters, spirit, and all living things – of Ngarrindjeri people in South Australia has become implemented in law through the acknowledgement of aboriginal peoples as the sovereignty over their land (Muller et al., 2019). Like Mātauranga, these philosophies/frameworks enable us to acknowledge the consequences of our actions, and provide systems where restoration is possible, and prevention of negative impacts is prioritised. Ngarrindjeri people in South Australia were able to work with the State during the millennium drought to produce an innovative and temporary emergency solution that mitigated environmental impacts. Importantly, they had authority to negotiate with the State to minimise impacts to *Ruwe/Ruwar*, and create a panel of aboriginal and independent experts to advise the State about the removal of the emergency structures (Muller et al., 2019). Droughts, floods, and other disasters will become more frequent and intense with climate change (O'Brien et al., 2006), thus, collaborations between government agencies and kaitiaki groups could ensure mitigation of these catastrophic events, with outcomes that benefit both partners and communities.

In an era where environmental degradation and climate change are imminent threats to the survival of all living beings, work at both local and global levels is imperative for

[5] 'Māori' is an identity that is different from 'tangata whenua'. It emerged from early interactions with colonial settlers and became a collective identity for peoples who considered themselves tangata whenua but not singular. I purposefully use both identities in different contexts to acknowledge that when asked 'ko wai koe?' ('whose waters are you from?'), many of us identify ourselves not as Māori but as mana whenua, hapū/iwi, awa and whenua etc. See page 13 for further explanation.

change. At the local scale, transformations of individuals' attitudes and of social norms and practices could be reflections of changes in management systems that enable the implementation of responsive and adaptive solutions, grounded in Mātauranga (Galafassi et al., 2018). This is how change capable of prompting and informing global research for solutions, based in indigenous knowledge systems, occurs in institutions and political systems. Te Awa Tupua is an example of changes in legal understandings occurring through public pressure to better reflect the values of communities, and their responsibilities to te taiao as kaitiaki. However, it is likely that not enough time has passed to see transformation in local attitudes that reflect changes in management, especially considering the wider community's previous attitude toward the legal name change of Whanganui.

Kaitiakitanga is now a very well recognised and potentially overused phrase. Kaitiakitanga over waterways is based on generations of historical knowledge held by mana whenua. Experiences of living with/as whenua have enabled mana whenua to develop complex understandings of how healthy ecosystems felt, and of how the whenua has responded to changes in the past. People would observe and feel changes in our own wairua and in the wairua of poutiriao, indicating changes in the state of water between ora (good health) and pōhara (poor). Tohu (signs/indicators) may be sent/appear to announce that waterways are being impacted: a river in a state of ora depends not only on the quality and tohu of the water itself, but also the ora of the surrounding land. The Mātauranga that denotes interconnectedness between ourselves, wai, and whenua cannot be fully understood within western frameworks that assume different relationships between people and land and value different things. In colonial frameworks, humans are understood as being separate from and above the land, enabling these living systems to be regarded as 'natural resources' and become commodified. The colonial framework positioned themselves as being entitled to subdue, control, 'develop'[6], and own land because they were the 'superior, civilised race'.

[6] 'Development' implies a transformation of land for positive or beneficial purposes, however, what constitutes 'development' is contested – contingent and dependent on particular social, cultural, political values. Economic interests definitely value land development, but this often conflicts with Māori understandings of whenua. Furthermore, the concept of 'underdevelopment' creates conflict within me because it implies that the land has no value until it has been exploited and profited off.

Although water is currently not a legally quantifiable commodity, the status of waterways is a contentious topic because governments (and local councils) enable water to be bottled and exported, and monetary values can be placed on the processes of land development around water, mining, and diversion toward hydroelectric plants etc. There have been social pressures to recognise waterways as legal entities so that our interactions with them become more in line with Kaupapa Māori, but the Crown also has a history of declaring authority over waterbodies in New Zealand, such as the Foreshore and Seabed Act 2004 (repealed in 2011) that stated the Crown owned coastal water, foreshore, and riverbeds, and could grant parts of these areas into private ownership (Hickford, 2015). This type of legislature is contentious because it enabled governments and companies to legally dismiss Māori concerns, and it set a precedent that (the land under) water can in fact be owned. Practices in environmental management are dictated by those with decision-making authority and their values. In western land management, this is generally synonymous with the imposition of colonial assumptions that differentiate people as separate to land, and these assumptions are generally supported by western institutes and those who privilege western science (Muller et al., 2019). Authority and sovereignty of indigenous peoples challenges the power of those structures that allow systemic racism to continue (Muller et al., 2019). This is the process that needs to be disrupted with decolonisation of environmental management.

The globally dominant capitalist mentality of land and water as an ownable, exploitable resource is incommensurable with the whakapapa in which Mātauranga is embedded. Incommensurability means that the understandings behind these frameworks are so different that they cannot be considered ‘the same’, and their underlying assumptions or values from which concepts develop are often in conflict. They are differences that are distinct and cannot speak to each other, be aligned or allied (Tuck & Yang, 2012). People often to attempt to make commensurable incommensurable ideas by bringing concepts from one framework into another, but this cannot be done without silencing the values of one of those frameworks. There is space, however, for the values of one framework to also be considered valuable by another, and here collaborative efforts can ensue. For example, people often attempt to make commensurable sustainability and kaitiakitanga in ecological spaces. The concept of thinking and planning ahead and preventing over-harvesting are valued by both of these frameworks, but they are indeed incommensurable because the whakapapa behind kaitiakitanga conflicts with the whakapapa behind sustainability. Here, sustainability implies that we harvest from

populations or resources[7] in a responsible manner, but there is space for profiting off of these resources and assumptions that we ***should*** harvest at the maximum sustainable rate. This is incommensurable with Te Ao Māori because kaitiakitanga is not driven by economic values because we have different understandings of whenua and wai. Western notions of land as a resource are incommensurable with Māori (and other indigenous peoples') understandings of whenua because Mātauranga is embedded within whakapapa that emphasises the interconnectedness and reciprocal relationships between whenua and people. The anthropocentric understanding of land allowed settlers to identify native people and their intimate, ontological relationship with the whenua as bestial and unevolved; non-human, thus, they and their land could be exterminated and appropriated. The anthropocentricism that enables western frameworks to continue perpetuating understandings of living systems as natural 'resources' cannot speak to Māori frameworks.

If we are to address and remedy (and avoid reproducing) global environmental degradation that has resulted from anthropocentric pressures, before the point of no return, management processes must not continue to privilege the colonial framework that fragments and decontextualises knowledge. The colonial framework has paternalistic assumptions of people ***and*** land, and values economic growth more than the health of the land. Local and national decolonisation processes that result in successful ecological restoration may encourage other westernised countries to seek collaboration with their native peoples for complex, creative solutions to imminent global and local concerns. Co-management and collaborative relationships are not a one-size-fits-all situation, and Mātauranga from local areas must be privileged when addressing specific local concerns. However, knowledge and ways of understandings may be shared with other peoples when appropriate.

An integral aspect of Mātauranga Māori is kaitiakitanga. Kaitiakitanga is the way tangata whenua interact with and nurture the whenua, guided by Mātauranga that is passed down from tūpuna to uri (kin/descendant/s). Kaitiakitanga envelops all of the tikanga and kawa that pertain to the maintenance of connection with Papa, and the maintenance and respect of the tapu, mauri, and wairua in ecosystems. Tikanga and pūrakau/pakiwaitara (stories with lessons) are means by which knowledge is passed

[7] The concept of living systems as 'resources' conflicts with Te Ao Māori because it is premised on assumptions of land as a resource is that exists solely to sustain us. Te Ao Māori understands people as being one and the same as whenua and wai, not that we are above them, that they belong to us, or exists for us.

down, communicating the need to live sustainably and respect the taonga provided by Papa and Rangi. Tangata whenua have lived as/with[8] the whenua for centuries, developing awareness and practices of using natural resources sustainably so that future generations may continue to have access to those taonga (Mead, 2016). Kaitiakitanga of taonga was/is practiced in different ways by different mana whenua in response to the distinctive needs of wai in their rohe.

Kaitiakitanga of freshwater must be done with utmost respect. As freshwater is capable of imbuing mauri, it can physically and spiritually cleanse a person, moving them between states of noa and tapu (Ngata, 2018). It is present at births and deaths, the most sacred kawa. Different momo wai (types of water) with different physical, biological, and spiritual qualities are described with a range of kupu. The momo wai reflect the personalities of their poutiriao, where some have particular responsibilities and some are composed differently or have different mauri. For example, there is an enormous vocabulary of words used for 'riffles' that are used in different contexts, dialects, and different levels of tapu. Whakapapa maintained through oral narrative of the wai in a rohe allows kaitiaki to understand the relationships of the poutiriao who have been charged with caring for particular plants and animals. Thus, if they are intimately connected with the whenua and wai, they can recognise changes and have the Mātauranga to respond appropriately. Waters with different mauri must not be mixed, and various momo wai are used for distinct purposes (e.g. waikino – dangerous or polluted water, waikotikoti – water to assist with the cutting of hair, manowai – deep running water, waikarakia – water for ritual purposes, and waimāori – pure, mauri rich water for cleansing and ceremonial purposes). To interact with these types of water appropriately we felt (the mauri), listened, tasted, smelled, and observed in order to understand variations and differences (Ngata, 2018). Mana whenua could respond to changes in the mauri, and recognised the wairua in wai which meant it could only be used for a certain purpose, or not at all. Knowledge came from lived experiences as tangata whenua practicing tikanga, maramataka, and kawa. The state of mauri of wai around which mana whenua lived reflected the state of mauri of the people, and vice versa. Thus, for people to be living in a state of ora, so too must their whenua.

[8] I deliberately say 'as' and 'with' the whenua, rather than 'on', because we whakapapa to the land and are direct descendants of Papa, thus we *are* the whenua and wai (Mead, 2016). We share the whenua and wai with the living, those who have passed, and those who are yet to be born – and so must respect them as we would (do) our tūpuna and uri.

The ongoing connection of tangata whenua with whenua and wai contributes to hauora and a healthy body and sense of self. Also contributing to wellbeing is the ability to practice tikanga and kawa with mana – which is not complete without kai. Establishing settlements near water sources allowed tangata whenua to provide kai for whānau and manuhiri. However, when the idea of land ownership was introduced with the onset of colonisation in Aotearoa, the ability of tangata whenua to practice tikanga was severely diminished, and thus, so too was their mana and hauora. This framework comes from the western notion of anthropocentrism, where humans are 'above' the land, and the land is a resource to be owned, privatised, and exploited (Tuck & Yang, 2012; Te Aho, 2018). Once the Crown created laws grounded in this western anthropocentrism, settlers were able to conduct the land grabs that started the process of severing connections between tangata whenua and whenua. To cut off access to mahinga kai (sites to grow or procure food) and culturally significant waters prevents mana whenua from being able to properly follow tikanga and hurts their mana. This is important because severing connections with Papa and our tūpuna meant that there was less opportunity to live and breathe by the Mātauranga Māori from which kaitiakitanga grew. Aspects of the distinctiveness in tikanga and reo between different rohe began to be lost, western notions of a civilised society were forced upon kāinga, and the impoverishment of tangata whenua and whenua began. It meant ways of living were forever changed – tamariki were no longer taught to live in their own culture and the identity and mana of many generations to come were devastated.

1.3 The impacts of colonisation in Aotearoa

Pākehā ownership of land and economic incentives to export products meant that land-use intensified and many ecosystems have now been altered beyond restoration because of logging, wetland draining, and other such practices. The economic drivers behind this way of using resources were facilitated by the 'signing'[9] of the Treaty of

[9] The majority of the rangatira who signed Te Tiriti did not sign the Crown's English version of the Treaty. What they signed in Te Tiriti espoused completely different conditions and governance arrangements than the Treaty. However, Hobson signed the bottom of the English version as saying the Māori version was a literal translation, thus, the Crown assumed that the signatures collected counted toward the English Treaty. Hobson declared British sovereignty over Aotearoa 21 May 1840, before consulting with the British Government. He also declared the British had 'discovered'

Waitangi in 1840. Grounded in Eurocentric frameworks that assume human dominion over nature, land became legally redefined through the imposition of colonial systems in New Zealand[10] that structured people ***and*** land in hierarchical relationships. Because of the structural issue where these ideologies were put into practice through colonisation, Aotearoa was considered virgin land to be cultivated for expansion of trade and empire. Pākehā (descendants of British colonialists) ownership of land and water meant the interactions between the people living in Aotearoa and the natural 'resources' changed significantly from relationships that were dominant pre-colonisation, and this occurred relatively undeterred by Māori protest. In particular, the land-use changes to lowland wetlands in both the North and South Island have been so significant that only images of the rich, complex biodiversity that existed pre-colonisation can be recreated, never completely restored (Clarkson et al., 2018).

The colonisation of Aotearoa was driven by anthropocentrism and capitalism (Kohn, 2006), and another concept introduced to Aotearoa with colonisation was that of land as property (Barnes et al., 2018), where colonialist men held power to execute their will over land, Māori, ***and*** women. This created particularly oppressive, systemic conditions of multiple marginalisations for Māori women. Even today with the national recognition of tikanga, Māori and mana wahine values are held to a lesser importance than capitalist pursuits – commonly equated with progress (Barnes et al., 2018). In the Sciences and Freshwater Ecology, women are still facing discrimination. Downes and Lancaster (2019) discussed how the legacies of misogyny in university systems still affect women in Ecology today. They reported that, although the proportion of women entering university education in Australia and going on to become academics had increased in the last 100 years, the percentage of women in senior ranks had not substantially changed in 25 years. In New Zealand, men are more than twice as likely as women with similar experience to receive professor or associate professor ranks in universities; women who improve their research scores by more than men move up the ranks more slowly; and women are paid $400,000 less across their career than their male counterparts (Brower & James, 2020). According to Downes and Lancaster (2019) women in Ecology are disproportionately undertaking more empirical research

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the South Island and that every one of the Rangatira in the North Island had signed the Treaty, these statements were not true (Waitangi Tribunal, 2016).

[10] Aotearoa will be used when I am speaking to its relationship with tangata whenua. New Zealand will be used when I am speaking to how the country is perceived by and affected by the western colonialist framework.

than theoretical research[11], and women likely spend more time improving the quality of their work rather than focussing on quantity of publications. Women also cite their own publications less frequently than men. Downes and Lancaster (2019) argue that insufficient numbers of women in positions of authority in universities had, and has, the effect of lacking female voices in determining how (and whether) citation metrics (should) measure the quality or impact of research. They do not explicitly make connections between university structure (which caters to men being less likely to spend time caring for dependants), the disproportionate number of men in positions of power, and the paternalistic content of university curricula with continuing marginalisation of women's knowledge in education and management. The argument that they were 'incapable of complex thought' that was used to marginalise women was the same argument that marginalised indigenous communities. Tangata whenua understood that women were important creators of knowledge because their relationships with Papa and their experiences enabled them to perceive the world in different ways to men. However, the racist and paternalistic framework that was established in colonial Britain was brought to Aotearoa, and underscored the establishment of governance and social 'development'. This enabled (Māori ***and*** Pākehā) women's knowledge and voices to be excluded from participating in decision-making processes of governmental and tertiary institutions. Because men discouraged and denounced women from entering universities, it was only men's knowledge and values that contributed to the production of knowledge through research, and directed the content of university curricula to privilege paternalistic frameworks. The power that society continues to give colonial understandings enables the dismissal of indigenous cultural knowledge (and women's knowledge) in world institutes, and it is systemic (Reid et al., 2017). Decolonising society's overarching frameworks is critical for our future, because it will enable more sources of knowledge to participate in global and local conversations around ecological and social concerns.

Tuck and Yang (2012) are international indigenous writers addressing the detrimental effects of ongoing colonisation. They argue that although the specific impacts of colonisation differ locally, the end goal of colonial practices are to displace indigenous peoples as *the* sovereign authority over land; inserting settlers as the 'native' inhabitants without becoming the same as the 'uncivilised, savage' natives. Tangata

[11] This dichotomy is not something that seems natural to me given that neither type of research is realistically useful without the other. The fact that they are dichotomised nonetheless portrays the structural issue within the Sciences that decontextualises knowledge from its own background, human relationships, and knowledges.

whenua were seen as native people with a primitive civilisation because, like other indigenous cultures, our culture is embedded in ontological understandings of us descending from the whenua (Akena, 2012). Through many different paths, settlers undertake "moves to innocence". This is how the settler justifies his[12] claims to, and dominion over land, driven by the anthropocentric idea engrained in that western framework. He[13] believes he is more developed, more human, thus more deserving than any other groups of peoples (Tuck & Yang, 2012). From this mentality – where the settler is above nature and indigenous peoples – stems the view that the natural world is a resource.

Tangata whenua understand ourselves as being kaitiaki of whenua and wai and simultaneously a part of that whenua and wai. The 'Māori' identity allowed colonists to generalise the many hapū and iwi, before that we identified ourselves as tangata whenua and mana whenua. Colonisation manufactured the concept of 'Māori' as a collective identity borne from the colonial relationships and the signing of the Treaty of Waitangi and Te Tiriti o Waitangi in 1840. The identity came from early settler interaction asking "Who are you?" to tangata whenua, who replied "He māori mātou", "We are the normal/original". Before colonisation, iwi and hapū had no need to identify themselves as a collective group as they were immersed in the own societies all throughout the country. After colonisation, settlers began to collectively identify tangata whenua as 'Māori' to distinguish them from Pākehā (Howe, 2005). They gave little consideration to locally specific identities orientated around whakapapa connections of whānau/hapū/iwi. For example, although the signatories to Te Tiriti came from distinct rohe they have been portrayed as being the same, Māori; they were not the same, they were chiefs of distinct peoples. When signing Te Tiriti, Māori chiefs did not cede their authority over their people and territory to the Crown, but instead agreed to share governance. The Treaty, however, said they would be ceding their governance to the Crown, formalising colonialist systems and structures as legal (not in compliance with Te Tiriti), and enabling confiscation of Māori land by the Crown through title. This led to land wars, slaughters, and continuing nation-wide oppression of the Māori culture and language (Barnes et al., 2018; Ministry for Culture and Heritage, 2016). The consolidation of colonialist power through legislation allowed the settler agenda to be normalised and tangata whenua agendas and aspirations to be

[12] Systemic racism was exerted through the colonial assumption that women were lesser than men, enabling women to be prevented from owning land, among other things.

[13] I purposefully sex this pronoun.

supressed. The identification of 'Māori' allowed discrimination between the native people and British settlers, making it easier to disrupt our connection with the land and structurally embed colonialist understandings within language, society, and laws. The racism that became embedded within social systems in the 1900s allowed this ideology of living off the land instead of with the land to become embedded within law, land ownership, and resource management (Forster, 2019). The establishment of Pākehā law in Aotearoa by settlers has been described as a movement to minimise hapū/iwi mana and maximise their own (Salmond, 2014).

Colonial practices utilised western science to exploit natural resources. In and of itself, western science is not intrinsically exploitative; scientific research aims to understand parts of a systems of interest in as much detail as possible. The reductionist tendencies of western science have allowed many small parts of ecosystems to be studied and understood, and this knowledge may then be taken advantage of for economic purposes. Using science to further economic gains, colonisation has created land trauma on the massive scale that is seen today (Dickinson, 2009). Furthermore, by traditionally narrowing its focus to create deep, but isolated knowledge – science can inhibit western management approaches from understanding ecological issues as connected across landscapes and social systems (O'Sullivan, 1986). This restricted focus leaves little space for Mātauranga to direct the implementation of complex community values in management. Thus, collaborative management schemes that attempt to graft Māori values into a western framework fail to produce truly successful outcomes. Jacobson et al. (2014) called the New Zealand's government commitment to collaborative processes and policy experimentation perhaps the biggest improvements in the freshwater space, yet water quality continues to decline.

Goals for environmental management are based on the values of stakeholders and partners. When management is done properly, especially holistic sustainability-focussed management, it should take into account societal values. However, researchers trained in hard/pure sciences often have little experience incorporating societal values into management, and, in their endeavour to be objective and scientific, often struggle appreciating how different life experiences impact peoples' values (Ives & Kendal, 2014). Being raised in Te Ao Māori privileges understandings of connection between social and ecological concerns. Kaupapa Māori research is guided by the researcher's values, in which relationships with the whenua are intrinsic. Kaupapa Māori understandings of connectedness and kaitiakitanga enable Māori students who enter the Sciences to identify where these discussions and connections are lacking in

their western education, potentially creating conflict within themselves because the content and structure of their formal education does not reflect their lived realities.

1.4 Eurocentric frameworks continue to inhibit impactful collaborative management in environmental spaces

The eurocentrism embedded within the New Zealand justice system allowed Acts to be passed that prioritised economic gain over the conservation and protection of the environment. For example, rivers and streams were declared public drains under the Public Works Act 1889, and wetlands could be drained for agricultural production under the Land Drainage Act 1893 (Te Aho, 2018). Conservationists recognised the problems this mentality would pose to the unique environments of Aotearoa and future generations, so natural resource management began to be written into law. Even then, conservation in water management was not given any legal standing until the Water and Soil Conservation Act 1967 (Te Aho, 2018). Western-led management of freshwater as a resource was overseen by regional councils, generally at the catchment level and with minimal input from central government (Memon, 1997). Hapū/iwi were rarely (if ever) approached for their input in natural resource management, despite their protests and demands to be acknowledged as kaitiaki (Jefferies & Kennedy, 2009). Their right to have their values respected was not acknowledged in legislature until the Resource Management Act (1991) (RMA).

The RMA is the national policy to plan for future generations, focussing on minimum flow levels, riparian management, and air pollution control. It allows councils to set and assert maximum and minimum levels and standards for various aspects of management (Ruru, 2012). For people exercising functions under the RMA, the Act requires them recognise some Māori values, and attempts to promote collaboration by requiring consultation of local iwi in accordance with the principles of Te Tiriti. However, it does not ***require*** iwi participation or for iwi to be given authority in decision-making processes, nor does it enable iwi to veto decisions (Memon, 1997). It also places no value in local Mātauranga and tikanga held by different hapū and mana whenua. Thus, people changing or undertaking management plans can do this without the blessing of tangata whenua, and are not required to share membership or authority equally with mana whenua, despite the principles of the treaty (see Waitangi Tribunal, 2020).

Sustainability, conservation, and kaitiakitanga are becoming dominant themes in today's academic and public conversation. However, they have largely been framed as commensurable ideas, where kaitiakitanga is described as a 'holistic' framework (Paul-Burke & Rameka, 2015). Holism is a framework that is western in origin, but recognises the limits and problematics that can occur with reductionist and decontextualised thinking. It seeks to address these issues and their effects by considering the complex interconnections within whole ecosystems; and has space for ontological understandings of creation that inform us of our place in the world and our responsibilities to it. In the context of resource management, it means simultaneously considering complex understandings of social and ecological issues around sustainability (Hjorth & Bagheri, 2006). The logic behind attempting to make these two frameworks commensurable is the recognition of similarities between Mātauranga and western holism, which describe natural features and living beings as part of an interconnected system. Importantly, they both also recognise that people are parts of the natural world and that our relationship with the land must be reciprocally nurturing if we are to survive as a species. However, considering Mātauranga a holistic framework is a form of cultural appropriation. By doing this, the distinct (multiple) whakapapa of Mātauranga that make it disparate from holism are not recognised. It fails to recognise the specific goals of hapū/iwi in a modern context for the rejuvenation of Māori people and our culture, across all disciplines and walks of life. While holism does value in ontological relationships with the land, holistic frameworks themselves have not developed over hundreds of generations from these beliefs. Although holism does not actively perpetuate colonial understandings and assumptions, it has likely developed in response to the effects of these assumptions. Thus, holism shares a whakapapa with western science and cannot and should not be made commensurable with Mātauranga.

In saying that, people who come from a holistic approach can have similar goals to hapū/iwi, including restorations of ecosystems to resilient, functioning systems, and opening spaces for collaboration. Yet it must be recognised that ecosystem restoration and other goals are understood differently by these two frameworks. Tangata whenua understandings of a healthy ecosystem revolve around intimate relationships with its people and vice versa, whereas a holistic view may sometimes lean towards restoring the ecosystem to as close to pristine as possible and preventing human interaction (Ngata, 2018). This is also visible where certain species are valued by conservationists in a different way than they are to tangata whenua. For example, the kererū (kuku, kūkupa, kokopa, *Hemiphaga novaeseelandiae*) is not

threatened/endangered, but is a keystone species and so has legal protection from being hunted as game. In Te Ao Māori, they are taonga, kaitiaki, taniwha, and also an important kai (a 'resource'), thus could be responsibly harvested following tikanga. Holistically they are valued as an important part of a wider system, and so receive protection, but they are understood in this way as well as kai in Te Ao Māori. A holistic approach to sustainable management generally follows the idea that we must protect and conserve 'resources' (which itself is an idea that is incommensurable with Te Ao Māori) so that we may continue to view them as profitable commodities, and exploit them in a sustainable manner. This contrasts with Kaupapa Māori understandings that we must look after the whenua and wai so we may be healthy as a people (Durie, 1999), and that economic interests do not dominate our values and drive behaviour.

When you attempt to integrate values and tikanga into a western framework their mana is reduced because they cannot be fully understood, and therefore, cannot be practiced in their entirety. This is especially true when our education systems portray Kaupapa Māori education as optional and peripheral to 'real' education, reinforcing the assumption that Mātauranga is not as valuable to our country's future as western sources of knowledge and knowledge generation. Failure to respect and value the whakapapa behind Māori knowledge is a systemic effect of ongoing colonisation. Attempting to make relevant, ***wanted*** information and concepts commensurable with westernised systems enables the privileging of western sources of knowledge as ***the most*** informative and valuable, and continues to inhibit true transformation within education systems. The western world has a history of cherry-picking values from indigenous cultures and attempting to indoctrinate them incompletely into settler frameworks (Akena, 2012). The potential for researchers and communities to enter into collaborative relationships is restricted by the continual enabling of social and environmental agencies to take advantage of, and cement, disconnections between indigenous peoples, their culture, and whenua.

The western framework that is guided by anthropocentrism and privileges western science is the one that has become dominant over all others, and what I am referring to when I talk about 'western' frameworks. While what I am calling 'the western framework' is not the only western way of thinking, as a result of the privilege this particular framework has experienced in its history, it is often valued as the only 'valid' science across many disciplines, or the standard to which other knowledge must be validated (Walker, 2003). Growing global social awareness of climate change problems has opened space for collaborative relationships between mana whenua and

Pākehā at the local scale. These parties recognise that the reductionism and fragmentation which drives theoretical research can hinder our ability to respond to challenges unmet by our ancestors, and to develop complex and creative solutions to address contemporary ecological issues. Kaitiakitanga – and all of its whakapapa – needs to be recognised by government systems as a valid framework that cannot be appropriated. It needs to be informed by tangata whenua aspirations (many of which align with Pākehā goals) and managed by Māori/with Māori consent to be seen out as tikanga intends. All disciplines across Aotearoa could benefit from this decolonising approach in the wake of significant climate disasters, but this demands that Mātauranga Māori should not be put into western baskets of knowledge.

1.5 Impacts of the dominating framework

Since the Forests Act (1921), economic values of post-colonial governments drove the intensification of the forestry and agriculture industries and influenced policy-making. Mitigation approaches, rather than avoidance, were considered acceptable management practices and legislature allowed organisations to opt for this approach (Levack, 2006). Language in the RMA allows this to continue happening, because it offers the choice of avoiding, remedying, or mitigating adverse effects of land development. Companies are able to gain resource consents and continue to exploit natural resources for economic gain by stating the intent to mitigate (make less severe) impacts on the land. Recent freshwater policy reforms, while providing some benefits for real freshwater clean-up, also privilege mitigation and remedial approaches to water clean-up rather than focussing their efforts and budgets to addressing sources of pollution. For example, horticulture and vegetable growing (major fertiliser users and thus sources of nutrients) are completely excluded from new legislation, as are national bottom lines for dissolved nitrogen levels and fish attributes that recommended by freshwater advocates and scientists (Forest and Bird, 2020; Morton, 2020). While these are just some issues concerning freshwater health, government organisations and legislature are able to dismiss ecologist recommendations and mana whenua concern because post-colonial systems and structures privilege economic profit over long-term ecological integrity.

By the 1990s, land-use intensification in Aotearoa, specifically eutrophication from over use of fertiliser in forestry and agriculture sectors, was identified as creating huge problems for stream health (Quinn et al., 1997; Memon, 1997). Eutrophication

(excessive nutrient levels usually resulting from run-off) is a huge problem in streams with catchments dominated by agricultural land use. The fertilisers added to pasture to increase productivity are generally nitrogen and phosphorous based, nutrients that are naturally limiting (occur in very low levels) in Aotearoa's stream. When these nutrients accumulate in agricultural streams (that generally experience increased sunlight as a result of vegetation removal) the frequency and intensity of algal blooms increases; depleting dissolved oxygen levels, preventing benthic flora from receiving enough sunlight, and destroying habitat for stream fauna (Death et al., 2018). These symptoms of declining stream health pose huge issues for conservation, where native species communities and stream ecosystems lose ecological integrity, and the finite resource that freshwater is becomes polluted and unusable. For tangata whenua it degrades mahinga kai sites and habitat for kai species, but it also poisons the mauri of the wai, thus impacting the mana of mana whenua and furthering the corruption of the relationship between kaitiaki and Papa. In many cases, mana whenua are not able to access these streams as they lie within privatised land (McIntrye et al., 2001; Stewart-Harawira, 2020), and/or they are not approached for input in restoration efforts (see Ruckstuhl et al., 2014); cementing the disconnection.

Climate change issues and other extreme ecological degradations have pushed society to seek new creative solutions and immediate action. Pākehā and Māori both have frameworks that aim to establish a good future for generations to come, but the differences in origin, development, and implementation must be acknowledged, understood, and respected. Western science has informed western sustainability models and western holism for management purposes, and there are instances where western scientific tools can be a useful for kaitiakitanga. There is knowledge within Mātauranga Māori that has arisen from research in a similar way that western scientific methods are developed. For example, experimentation over time with different types of plants and traps created the whakaweku. This is an artificial habitat created by bundling native plants together, usually mānuka (*Leptospermum scoparium*) or bracken fern (which has many Māori names including rarauhe, rārahu, rahurahu, rarauwhe, manehu, tākaka, and mārohi, *Pteridium esculentum*), to catch kōura (freshwater crayfish which also has multiple Māori names, *Paranephrops planifrons*). With experimentation tangata whenua developed whakaweku, which are still used as a more accessible, low-cost, and efficient method to collect representative samples of kōura populations than western methods, such as minnow traps and electro-fishing. This kind of experimentation is something that is utilised by fundamental research. However, just as Kusabs et al. (2018) did in their study contrasting whakawheku

efficiency with other methods, there is an underlying assumption that 'real' (western) science needs to evaluate and validate Mātauranga to confirm its value to management. Scientists engaging in restoration efforts with communities help to implement management plans by considering the values and aspirations of stakeholders to inform decision-making. Values are an intrinsic component of applied research and adaptive management, and negotiating these values in ways that benefits community aspirations is similar to Mātauranga because it does not divorce peoples' experiences from ecological concerns in the same way that (supposedly) value-neutral fundamental research and hard/pure sciences do. The western idea that water and land are resources to be exploited is only one of many western ways of thinking, and recent collaborative management schemes recognise the necessity for holistic thinking, and value traditional knowledge to inform decision-making to implement successful and efficient management approaches.

Adaptive management (AM) is a western framework that creates conservation schemes where goals are guided by the values of stakeholders. These goals determine which measures and practices should be optimised, and this drives behaviour (Gregory et al., 2012). AM is similar to Mātauranga in that it uses prior knowledge and structured decision making to reach long and short term goals. Furthermore, it attempts to explicitly predict how learning about the system (decreasing uncertainty) will improve long-term conservation outcomes (Williams, 2010). AM recognises the advantages that come with having multiple perspectives, in terms of the ability to pull from multiple knowledge sources to increase capacity for the creation of imaginative, complex solutions for best management. It also recognises the challenges faced when multiple stakeholders have contrasting values. However, my experience with university education in the Sciences is that hard sciences, like Ecology, fail to teach students about the significant part that social and political values (especially the dominant economic values of post-colonial governments) play in determining which stakeholders' values direct management decisions when there is conflict. Soft or applied sciences, such as Conservation Biology, better educate students in the complexities of negotiating contrasting values. Nonetheless, like Ecology, it does not demonstrate to students how the values and assumptions of overriding social systems direct their education; pushing indigenous knowledges to the periphery of what is considered valuable knowledge, and divorcing political, ethical, and cultural concerns from research in an effort to reduce researcher bias.

Reducing researcher bias is considered a good thing, and can indeed be useful when utilising scientific tools. However, objectivity itself is a value of the western framework; and marginalising Kaupapa Māori so that students learn to be objective is an important step in enabling the current framework to remain in control of the direction in which education systems evolve. Treating Ecology and Conservation Biology as distinct subjects is itself an effect of a system that fragments knowledge. In Te Ao Māori, ecological concerns, biological concerns, and conservation are not separate from each other or the health of the people; and, critically, economic values do not drive decisions affecting any of these aspects of kaitiakitanga. Keeping Te Ao Māori at the periphery of 'valuable' education enables universities to continue producing researchers who are not politically driven. When conservationists use AM frameworks, they can approach it with a holistic mindset that allows collaborative relationships to be formed. Yet, teaching Kaupapa Māori alongside western science would enable the production of researchers whose understandings of research are not divorced from their own values; who are equipped to participate in community and Mātauranga-led collaborative partnerships; and who demand social movements that result in the decolonisation of overriding frameworks for real ecological and social transformation.

Recent collaborative projects have used AM to undertake more effective conservation efforts. The Waikato River has been collaboratively managed by Waikato-Tainui iwi and the local council since 2009, and is an exemplar of the AM approach. Local waterways were in desperate need of better management and policy because mana whenua had been disconnected from the river's kaitiakitanga, resulting in the severe diminishment of the Waikato river's mauri. Surrounding farmland pollution combined with privatisation and anthropogenic changes to the flow regimes, including diversion, abstraction, and the erection of hydro-electric dams, created many problems. These impacts included: bank and bed erosion; drowning of culturally significant sites; decreased access for mana whenua; rapid algal growth; degradation of mahinga kai and biodiversity; barriers to migration; and breakdown of food chains (Jones, 2015). These many interacting factors drove the decline of the Waikato to a point where the water was and still is considered unsafe to drink. Community concern for poor water quality led to the establishment of the Waikato River Authority (WRA), an organisation made up of iwi and Crown appointees in equal membership, to restore and protect the long-term health of the river. Outlined objectives include active community inclusion, restoration of all aspects of the relationship between iwi and the river including tikanga and kawa, as well as restoration and avoidance of further biophysical and ecological impacts (Jones, 2015). Since the establishment of the AM collaboration, over $38

million has been given to projects to restore and improve many aspects of the health of the Waikato and many other waterways (see Waikato Regional Council, 2019).

1.6 Toward equal management

It is now widely recognised that problems we encounter with water management are interconnected with other issues – such as urban development, air pollution, and landscape management – and that solutions to freshwater crises lie at the landscape scale and across disciplines (Maxwell, 2015). This recognition has led to many cases where government and community organisations seek collaborations to share knowledge and enact large-scale management plans. In New Zealand, this can be seen where some government and research organisations are actively engaging with mana whenua and creating management plans together, addressing Kaupapa Māori values including the uplifting of mauri, increasing whānau/hapū ability to access mahinga kai sites, and wider communal respect of Kaupapa Māori values, kawa, and tikanga. In this context, sustainability also recognises the need for interchange across different branches of science and humanities. There are a few prime examples of this approach in Aotearoa so far, including the WRA, and their work has driven home the importance of collaborative efforts.

Unfortunately, rather than challenging ideologies that espouse ownership over the natural world, sustainability models may inadvertently reproduce underlying colonial ideas through different practices. For example, underlying assumptions of land and water as resources to be exploited persist in the ways researchers may seek to manage resources 'sustainably'. Anthropocentric sustainability conflicts with Mātauranga because the framework behind anthropocentrism views water and land as resources and commodities, while Kaupapa Māori does not privilege the commodification of whenua and wai. Attempting to graft Kaupapa Māori values into New Zealand's existing education, justice, ecological, and health systems is a form of settler appropriation and does not espouse true decolonisation. For example, Massey University considers itself a Tiriti-led university, but in my experience the 2018-2022 Strategy feels a bit like a façade. The school actively flaunts its minority students to show diversity, sometimes opens meetings with karakia, has applied Māori translations and phrases to signage and in the media, yet the content of its curricula in the Sciences is based predominantly within the historically privileged Eurocentric framework. Many scientific researchers come out of Massey, and, even though their

values and aspirations may lie within understandings of a healthy whenua, their education can leave them unequipped to effectively engage with communities and mana whenua; especially when communities have different understandings of their relationships with the whenua, and so envision outcomes different than what might be standard for researchers' understandings of sustainability.

Western holistic resource management and kaitiakitanga are both guided by values that are underpinned by understandings of interconnected relationships. These values influence how particular frameworks perceive their environments, and enables them to develop ethics and principles so stakeholders may take responsibility for actions (Harmsworth & Awatere, 2013). Holistic resource management frameworks are similar to kaitiakitanga in that they both recognise complex abiotic and biotic relationships and understand that the well-being of the people is directly affected by the well-being of their natural environments (Paul-Burke & Rameka, 2015). Where the two frameworks differ is in the understanding of whakapapa, and how the whakapapa of Mātauranga has resulted in complex, creative customs and interactions with whenua and wai. Furthermore, kaitiakitanga is intrinsically the right and responsibility of tangata whenua, but kaitiakitanga of a local area must not be transplanted onto the kaitiakitanga of other mana whenua in a different rohe. In contrast, holism could be utilised by any peoples, anywhere, which is not appropriate for kaitiakitanga. When scientists recognise that their understandings are limited when their learnings are guided by only one framework, they are also able to understand how the lasting effects of colonisation are still impacting hapū/iwi life. The willingness of western-trained researchers to enter spaces where holism and kaitiakitanga talk to each other provides the opportunity for impactful discussion. Expert knowledge of scientific tools and technologies can contribute to Mātauranga-led kaitiakitanga, enhancing the prospect of beneficial, effective outcomes.

Fighting and petitioning for the Crown to acknowledge injustices suffered through Treaty violations paved the way for the Treaty of Waitangi Settlements. With their settlements, many hapū/iwi gained the ability to conduct and fund their own research and conservation programmes, as well as exercise some power to demand decision-making authority and institutional change. Community focus and participation is key to kaitiakitanga, and recent embracing of Māori values has allowed restoration projects to take community-centred entire-system approaches that are responsive to the needs and values of iwi (Allen et al., 2011). Embracing Māori values also led to the germination of collaborative relationships between hapū/iwi and government

organisations, with equal membership and authority in management teams (Taiepa et al., 1997). This allowed more perspectives and ideas to be heard, and mana whenua witnessed active effort by the Crown to recognise and value their position as kaitiaki. Yet Māori knowledge is still marginalised, and approaching iwi with pre-conceived ideas of how to manage whenua continues to promote eurocentrism. The easy adoption of 'token' decolonisation (such as Massey University's recent additions of Māori names and phrases) is how colonialist frameworks attempt to reconcile settler guilt and complicity, instead of doing the hard work for the outcome of more meaningful alliances (Tuck & Yang, 2012)

Recent holistic co-management projects have begun good work towards ecosystem restorations, advocating for higher, more stringent water quality standards, and prioritising community engagement for ongoing ecosystem health. However many large-scale collaborations, such as the Department of Conservation's (DoC) Arawai Kākāriki wetland restoration programme (AKWRP), fail to properly acknowledge distinctions between kaitiakitanga their own understandings of holistic sustainable resource management. Attempting to make kaitiakitanga and holism commensurable, many papers (and researchers/managers) focus on the incorporation of aspects of Mātauranga into western management systems (Crow et al., 2018). The AKWRP values and strives for community participation and the restoration of ecological functionality across many interacting elements, which are important aspects of kaitiakitanga although they are understood differently. Yet, although they promote and support Mātauranga, it seems that the institutionalised assumptions of what is considered valuable and effective conservation have determined what strategies to implement, and guided their vision of what is considered adequate protection and conservation of these wetland habitats. For example, in their 2019 brochure, they catalogue their successes and plans for the future, such as control of pests and invasive species, increasing habitat for rare and threatened native animals and plants, and a call to action to address nutrient inputs from the surrounding land of a significant lake. DoC states that scientists and wetland managers are coming together to develop goals and best practice guidelines for these restoration efforts, privileging scientific tools and knowledge to inform their decisions (Department of Conservation, 2020). They do this seemingly without the input of mana whenua and definitely without sharing authority. Their strategies and updates do not state or imply that mana whenua's specific values or goals have directed their conservation efforts, that local Mātauranga is equally as valued as scientific knowledge to fill gaps and inform management decisions, nor does it recognise and attempt to uplift the intrinsic

connections between communities and their whenua on levels deeper than simply biophysical interactions. These actions satisfy the RMA's principle of partnership, but many Māori researchers argue that this type of behaviour is not enough, and furthermore, that management strategies can disrespect the tapu of shared knowledge when not used as it was intended (Gooder, 2018).

An example of recognition of Kaupapa Māori values within our colonial system is recent legislature giving legal personhood to environmental features. Recognition as legal identities meant that aspects of Māoridom have been introduced into the colonial system, where laws are a domineering force behind all social settings. It meant the natural features already seen as living beings by tangata whenua have the same legal rights as people and companies, and are able to sue those who harm them (Collins & Esterling, 2019). This gives Te Ao Māori hope that transformation of systems and structures which privilege capitalism and colonial understandings can occur. While it's presently useful to incorporate Mātauranga into law to enable tangata whenua to enact and practice kaitiakitanga through legal provisions, it is problematic that hapū/iwi need to have their values written into legislature for them to be recognised and implemented. Moving through the legal system can be a time-consuming process that is costly in energy and money, and even then, when indigenous people use academic or conventional language to address these systems, the beneficiaries of colonial frameworks continue to silence us (see Moreton-Robinson, 2006). Creating legislature that reflects Māori values, such as legal personhood, can work to reinforce the dominance of colonial structure, rather than decolonise them, and there may be consequences for Te Ao Māori that we currently cannot anticipate or envision.

After 140 years of Māori petitioning, in March 2017 Te Awa Tupua (Ruru, 2018) bill was passed by Parliament recognising the Whanganui awa as a living entity in the eyes of the law with the same rights and responsibilities as a person. Te Urewera (once a national park) was also given the same status in 2014 as part the of the Tūhoe settlement, and the Taranaki maunga followed in December 2017. From the late 1800s into the 1900s, the Crown mined the Whanganui river bed and established a steamer service on the river, without iwi consultation. This destroyed eel habitat and fisheries and degraded the river's tapu and ecological quality (New Zealand Government, 2017). Its rapids were dynamited for easier tourist canoeing, its headwaters diverted for a hydroelectric scheme that decapitated the natural flow of the upper reaches, and the city's effluent was drained into the river mouth (Warne, 2020). It is abhorrent to tangata whenua not only to mix wai with different mauri and from

different catchments, but to mix it with human waste (Ruru, 2018). The Whanganui awa and its surrounding land and mountains are considered tūpuna of its people and have always been considered living beings and taonga by Ngāti Hau. While the Crown issued apologies and settlements for its violations of the Treaty, the hurt inflicted upon their tūpuna can never be fixed or undone.

Intergenerational trauma caused by the ongoing effects of colonisation is a global phenomenon that many indigenous communities continue to experience. Research has shown that indigenous communities tend to be over-represented in negative economic and social statistics; including abusive environments, jail, poor mental-health related statistics, and suicides (Reid et al., 2016). Here in Aotearoa the trauma of land confiscations, suppression of language, war, attacks, rapes, slaughters, and unlawful arrests (Ministry for Culture and Heritage, 2016; Ministry for Culture and Heritage, 2014) has ruptured generations of hapū/iwi connectedness with the land and led to the manifestation of extensive physical and social isolation between communities. The perpetuation of a traumatic colonising environment (Reid et al., 2016) continues to undermine Māori culture and harm the mana of Māori whakapapa and future generations. I believe this is important to understand because the mamae experienced by our tupuna and the decline in freshwater ecosystem health today are interconnected issues that contribute to reduced ora and mauri of many tangata whenua in contemporary contexts. Community engagement and authority in restoration projects is critical to large-scale environmental revitalisation, and it is also integral for resurgences of kaitiakitanga and local Mātauranga and reo.

Opening space for the western world to appreciate and embrace Māori values is a fundamental first step in moving toward hapū/iwi-led freshwater management, and toward policies that better enable hapū values and their understandings of living systems to be privileged (Harmsworth & Awatere, 2013a). However, researchers engaging in land management often continue to privilege western science as the most valid/informative/relevant source of knowledge because their training has taught them to do so. Some underlying paternalistic assumptions and values of western science, such as objectivity and publication output and peer review[14], can silence indigenous

[14] The quality of research can be measured by citations metrics, which have been identified as disadvantaging some researchers. Furthermore, it is generally more desirable for researchers to publish large quantities of papers in international, high-impact journals. Some effects of this will be discussed in Chapter 3. In many cases, those who speak out against colonialist structures receive backlash as the system attempts to frame them as aggressive and insubordinate to justify its assumptions that

(and women's) knowledge when it is not linked to scientific publications, even if it may realistically produce equally good or better predictions (Walker, 2003). Research from non-western cultural perspectives is seldom published in mainstream academia because this knowledge is rooted in indigenous epistemology and creation-stories that cannot be 'validated' by science. This creates problems for indigenous people wishing to publish in the academic community, as well as non-academics wishing to take part in co-management scenarios, where their understandings must be distorted to fit into western paradigms. Walker (2003) connects all scientific knowledge, including western knowledge, with cultural bases, yet the western world conducts itself as though their own cultural frameworks are universal. Furthermore, universities award Science degrees after three years with little or no discussion of underlying philosophies and cultures, and of how their monocultural curricula can act to marginalise *other* knowledge. Directed by the assumption that their own framework is universal, research organisations are enabled to impose their own values and assumptions onto others, and direct discussions towards outcomes that suit their own needs/values.

By privileging western science as the standard to which other knowledge sources must be validated, rather than recognising it as one of many knowledge sources valued by communities, resource management in its current dominant form inhibits Mātauranga Māori from entering the ecological space (Robb, 2014). While the RMA and the principle of partnership articulated by the Treaty requires iwi consultation, many non-government agencies were, and still are, predominantly Eurocentric in both membership and approach (Taiepa et al., 1997). Tangata whenua have argued that by permissing freshwater legislature with no explicit statement requiring equal decision-making authority, the government is failing to comply with the intentions of Te Tiriti (Harmsworth & Awatere, 2013b). In practice, many organisations undertaking restoration/management projects can possibly conduct their iwi consultations with pre-determined plans and goals, and take action after only a single (required) consult. Current legislature enables this to happen, and it has the effect of keeping power within Euro-dominated agencies that privilege colonial assumptions of land ***and*** people, inhibiting the decolonisation of social and environmental spaces. Movement away from agency-centred management approaches and towards local and national community-led kaitiakitanga enables navigation of knowledge to occur through multiple stakeholders' perspectives and visions for the future (Allen et al., 2011).

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indigenous peoples' capacity to speak is predicated on the system's goodwill (see Moreton-Robinson, 2006).

Mātauranga Māori is still advancing and the knowledge produced by that system continues to expand with lived experiences of tangata whenua today. The country we live in today is different from what was experienced by our tūpuna, with different a/biotic systems and needs, but the lesson of careful, purposeful care is still relevant to the way which we must use Mātauranga today (Ngata, 2018). Origin stories still support our interconnected relationships with the whenua, asserting the importance of kaitiakitanga. For the values of kaitiakitanga to be practiced effectively, and modern solutions to freshwater issues to progress towards community-centred action, the western sustainability model must continue to be decolonised in freshwater management and across social-environmental spaces. Decolonisation will allow resource management to continue to move away from capitalism-driven, top-down, single-agency approaches.

1.7 Contextualisation of Mātauranga and Te Reo Māori

Tangata whenua relationships with Papa are guided by understandings of nurturing and healing, and community responsibility to listen to the needs of our poutiriao direct our behaviour. "*Te toto o te tangata he kai, te oranga o te tangata he whenua: Food supplies the blood of human beings, but the welfare of humans is based on land*" (Mead, 2016). Decolonisation of government agencies and policies will induce transformative change and invigorate Te Ao Māori, of which the land is an integral part. Today all people of the world face global ecological crises, as well as distinct local crises, and spaces for collaborative relationships have begun to be opened. We must change how we understand our place in the world toward being a part of the world, and complex solutions to freshwater issues need to be grounded within indigenous knowledge worldwide – i.e. where we don't 'manage resources' just to continue to exploit them for our own purposes, but instead we care for them so they may care for us. Te Ao Māori understandings of the behaviours, personalities, wairua, and mauri of wai can help society reconnect with Papa, and re-establish nurturing relationships with whenua and wai that are directed by positioning ourselves within these living systems, instead of separate from/above them. When our world becomes healthy again, living and future Māori and Pākehā alike will benefit. The recognition of potential benefits of co-management systems in recent years has opened spaces for Kaupapa Māori values to inform and lead restorative efforts. This can be most effective and beneficial when indigenous communities have decision-making authority and environmental

management is community-centred. However, there are many communication challenges that occur when western-trained researchers engage with mana whenua and the wider public. Some of the friction that occurs with this could be alleviated with the recognition that Mātauranga cannot be incorporated into a western framework. We cannot continue attempting to make two incommensurable ideas commensurable in social and environmental settings. While sustainable models based on western holism have begun to rejuvenate natural systems and bring awareness to the general public around anthropocentric impacts on the earth, we as a society cannot continue to privilege colonial frameworks. Furthermore, we need to learn to question the effectiveness of "resource management" as it currently is understood in order to prevent continuing exploitation of our living systems that's enabled by overarching capitalist values if we are to avoid reproducing and exacerbating the crises we are currently experiencing.

The purpose of this study is to clarify the importance of working across disciplines and make progress towards decolonising environmental, social, educational, and legal spaces. This involves, but is not limited to, the recognition of how our language permits colonial assumptions of people and land to direct our behaviour, and also expressing the critical part that local Mātauranga and reo play in revitalising Te Ao Māori and changing how we, as a society, understand our relationships with the whenua and wai. When these changes occur we can create collaborative relationships where freshwater restoration is effective, and future generations grow up respecting the history and progress of our land and native culture, confident in their identity and place in the world.

In the next chapter I use the MCI index – a common western method for assessing stream health – to assess the anthropogenic impacts on two feeder streams of the Manawatū. Many western indices focus on one or a few aspects of stream health and extrapolate the results to infer the health of the entire system, and until recently, few management schemes utilising western indices used in New Zealand incorporate factors important to iwi and hapū. I will quantify differences in the invertebrate community composition between sub-habitat types, including riffles, runs, and pools between sections of streams in different environments, and between the two streams as wholes.

The third chapter discusses the importance of contextualised knowledge in contemporary freshwater management, and how our language continues to position tangata whenua and their Mātauranga as peripheral to the 'real' interests and values of

our country. I planned to collect kupu awa (Māori descriptors of freshwater) to learn about more ways of understanding waimāori and to aid in communications between Pākehā and Māori communities. I did create a collation of these kupu, however, it became a less pivotal part of this research than originally anticipated because I realised that collating kupu māori in this way decontextualised them from their whakapapa and specific contexts. I also discuss the existence of multiple kinds of language barriers, and the effects and misunderstandings they can have on (potential) collaborations when left unaddressed. Furthermore, this chapter identifies how the current content and structure of curricula in tertiary education in the Sciences fails to prepare researchers for real-life collaborations by positioning Mātauranga as peripheral to the 'real/valuable' knowledge.

The fourth chapter explains how I conducted surveys of these streams using a Māori-value-based stream assessment created by Awatere et al. (2017), with some extra questions to inform us of how the surveyors identify healthy ecosystems in Te Ao Māori. I will look for overlap between the results of the invertebrate samples and Mātauranga surveys and how the more 'holistic' survey and kupu awa can identify areas for improvement missed by the more reductionist MCI survey.

Chapter 2: Stream health assessments using the Macroinvertebrate Community Index

Hāhā te whenua, hāhā te tangata.

Desolate the land, desolate the people.

Freshwater macroinvertebrates (animals visible to the naked eye that do not have backbones) are an essential part of riverine and lake ecosystems. As larvae, they break down organic matter and are primary food sources for other insects and spiders, fish, birds and even bats. In Aotearoa there are over 200 identified species of stream invertebrates ranging in length from less than 1 mm to over 10 cm long with diverse body forms (NIWA, 2016; Department of Conservation, 2019) habitat preferences, and diets. Stream invertebrate communities in Aotearoa differ from those overseas where the communities here are overly represented by browsers (feeding on fine particulate organic matter and grazing stone-surface organic layers), and large particle detritivores (shredders) are underrepresented (Winterbourn, Rounick, & Cowie, 1981). There is also no distinct breeding season (Towns, 1981), likely because of the temperate climate, steep topography, and evergreen forests which introduce organic matter into the freshwater systems year-round resulting in a constant food source.

Marine and freshwater systems and their macroinvertebrate communities have been essential to the lives of tangata whenua for centuries. Kōura/kēwai (freshwater crayfish), kākahi/kāeo/torewai (freshwater mussel), and pāua (abalone) are kai species of invertebrate, and smaller species provide food for other mahinga kai. Many of these kai species are slow-growing and relatively long-lived, therefore, a healthy, flourishing community with strong whakapapa indicates healthy ecosystems. European colonisation has introduced many threats to freshwater ecosystems including pests, urbanisation, agriculture, and deforestation. Urbanisation led to the physical alteration of water ways, and in changing/preventing the way water courses run (through damming, channel straightening, bank armoring, removal of vegetation, and other such manipulations), it has destroyed water quality and invertebrate habitat. Intensive agriculture is a major source of nutrients, pesticides, and fine sediment input into catchments, streams, and rivers – increasing algal growth, smothering plant and animal life, and degrading habitat (Ramezani et al., 2016). In many cases it is the

combination of different anthropogenic effects that have the worst impact on freshwater health (Joy & Death, 2013).

Waterways have either hard or soft bottoms/substrates, influencing the type of invertebrates likely to be present. Burrowing invertebrates such as oligochaete worms will be more abundant in soft substrates, whereas stoneflies (Plecoptera) and mayflies (Ephemeroptera) will likely be more abundant in fast flowing, hard-bottomed streams. A single stream may have many types of sub-habitats – areas with different substrates, riffles, deep pools, and so forth – with different types of invertebrates occupying those sub-habitats to which they are better adapted. Mayflies, caddisflies (Trichoptera), and stoneflies, collectively known as EPT taxa, are generally sensitive to pollution and so cannot live in streams severely affected by anthropogenic change. Different genera and species of stream invertebrates, even within the same family, can have different tolerances to pollution. Hard-bottomed reaches in remnant/regenerating native ngahere (forest) and sub/alpine areas tend to have more diverse invertebrate communities with higher percentages of EPT taxa as they have experienced fewer human impacts, but water quality in these areas will still be affected by any upstream catchment land use (Quinn et al., 1997). Soft-bottomed streams may have naturally lower percentages of EPT taxa because their body forms are generally more adapted to live on/between rocks, and many graze algae off of rock surfaces.

The Macroinvertebrate Community Index (MCI) was introduced in 1985 in Taranaki to assess organic enrichment of hard-bottomed streams using pollution-tolerance in invertebrates as a measure of stream quality (Stark, 1998). Macroinvertebrates were initially given scores assessing their pollution sensitivity by a weighting procedure based on the relative percentage occurrence of taxa at three different sites with different enrichment statuses. A score of one being tolerant of severe pollution and 10 being extremely sensitive to pollution; the scores of less common and recently added taxa have since been assigned by professional judgement (Stark & Maxted, 2007). The MCI method can be used over time to observe changes in community composition using presence-absence data with a constant sampling scale, but relative abundances are not taken into account (Stark, 1993). The MCI method has been validated in the scientific community and is a commonly used method of indexing stream health across New Zealand. Clapcott et al. (2012) compared 14 indicators and suggested that the MCI metric was useful for suggesting stream ecological integrity at the national scale because their data included many stream types and exhibited significant responses to land use gradients. It is often used in conjunction with other measures of stream

health, such as the Shannon-Wiener index, percentage of EPT taxa, species diversity, chemical and dissolved oxygen content, riparian vegetation diversity, and variants of the MCI – quantitative (QMCI) and semi-quantitative (SQMCI). The MCI is more sensitive to water enrichment than the QMCI and SQMCI, but the QMCI takes into account abundance and the SQMCI requires less sampling effort – so the variants are more sensitive to subtle community composition changes over a period of time (Stark, 1993).

Whitehead (2018) reported that stream MCI scores over the years 2013-2017 were highest in mountainous areas and those dominated by native forest land cover, as well as those in DoC estate, denoting excellent and good stream health; and lowest in low-elevation alluvial areas dominated by intensive agricultural land use and urban land cover, suggesting poor and fair stream health. The predicted MCI scores also suggested that stream health would be poor to fair in where land cover was dominated by exotic forest and low-intensity agriculture, for example in the Central Otago, southwest Canterbury, and the Rotorua Lakes-Lake Taupo areas. While this was only one of nine water quality variables used to create spatial models of water quality, it supports the statement made by Joy & Death (2013) that the best habitat for native fish exists far inland at high elevations, yet the natural distributions of Aotearoa's largely diadromous fish populations exhibit highest abundance and richness near the coast in unimpacted waterways. Where the potential for greatest native fish diversity exists is where rivers are in the most impacted states and worsening (Whitehead, 2018).

Clapcott et al. (2012) found that removal of native vegetation was the dominant land-use change variable to affect the MCI and %EPT. They suggested that some indicators do not follow linear response patterns, and the combination of anthropogenic affects are not always simply additive but are complex. Furthermore, the results of biological indices that have been used to infer the health of ecosystems can be impaired when the majority of the catchments experience agricultural land-use. Western holism is a framework that has developed to understand ecosystems as a whole rather than reducing a landscape to the sum of its parts, however, parts of an ecosystem may still be treated and studied in isolation from the whole.

Holism is proving to be a very useful tool in helping people from a traditionally reductionist scientific background understand how indigenous communities see themselves as existing within an ecosystem and descending from the land itself. I distinguish western holism from Mātauranga Māori because, although there are some similarities in land management and kaitiakitanga that have evolved from the

understanding that all things are connected, the frameworks themselves have different whakapapa. Mātauranga is the accumulated knowledge that has evolved and is still evolving from all tangata whenua of Aotearoa. It has developed from the culture which in turn developed from the understanding of how our people came to be, descending from Papa and Rangi and the longing of their tamariki to be part of Te Ao Mārama (the world of light). Holism has roots with a different people so it cannot be made to appear as the same thing as Mātauranga, nor should it be implied that Mātauranga is a type of holism. It is a strength of Mātauranga Māori to have a whakapapa that strives for light and knowledge, and that is something the must be respected and protected from western appropriation.

For this study I wanted to describe the overlap between western and Kaupapa Māori methods of indexing stream health. The MCI and EPT metrics are typical measures used by councils and non-government organisations that privilege western frameworks for indexing stream health. Like many scientific methods, they are reductionistic in that they measure a single aspect of an entire ecosystem, the macroinvertebrate community composition, in order to infer the health of that system. Kaitiakitanga considers many interactions that influence stream health, including physical, biotic, and spiritual relationships. However, there is also ecological research that focusses on much larger scopes, from ecosystems up to global scales. I used multiple measures of stream health based on invertebrate community composition to extrapolate more information than a single measure would; researchers and communities conducting holistic land management also utilise knowledge from many tools, sources, scales, and disciplines to inform their decision-making processes. It is important to note though, that the underlying values and assumptions of those with decision-making authority determine which knowledge is considered, and directs their behaviour in the conduction of research, monitoring, and action.

I collected benthic macroinvertebrate samples to quantify community composition and identify differences in inferred stream health between four sample sites. In the fourth chapter I will assess the similarities and differences in results from the macroinvertebrate data and stream surveys using Māori values. The four sample sites were within the Turitea stream (Palmerston North) and the Mahuraunui stream (Norsewood) (Figures 2.1, 2.2). Within each stream I sampled a more physically variable stretch of river within forest (heterogenous) (Figure 2.3) and a less variable stretch in a pastural land (homogenous) (Figure 2.4). There were different types of sub-habitats within these stretches including runs, riffles, and deeper pools, so I also

tested for differences in community composition between similar sub-habitats in the different stretches. I suspect the heterogenous Mahuraunui stretch of river will have the most diverse community composition with a higher percentage of EPT taxa and a higher MCI score – all indicating better water quality. I expect the measures to suggest better stream health in the Mahuraunui than Turitea, and heterogenous over homogenous.

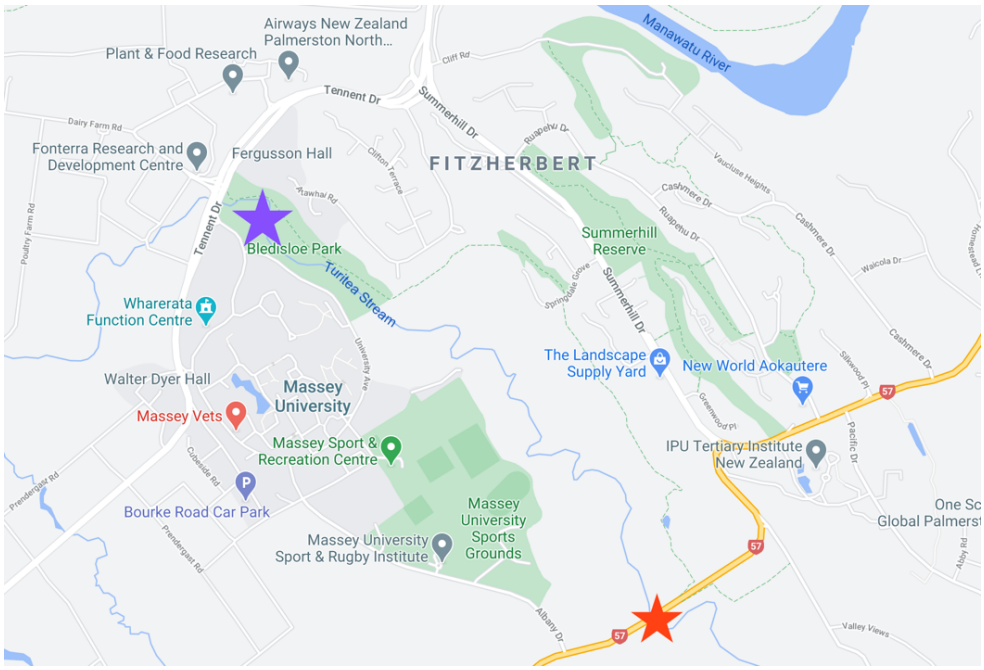

Figure 2.1: Turitea Stream, Palmerston North. The purple star shows the approximate position of the heterogenous sampling sites and the red star shows the approximate position of the homogenous sampling sites (Google Maps, n.d.).

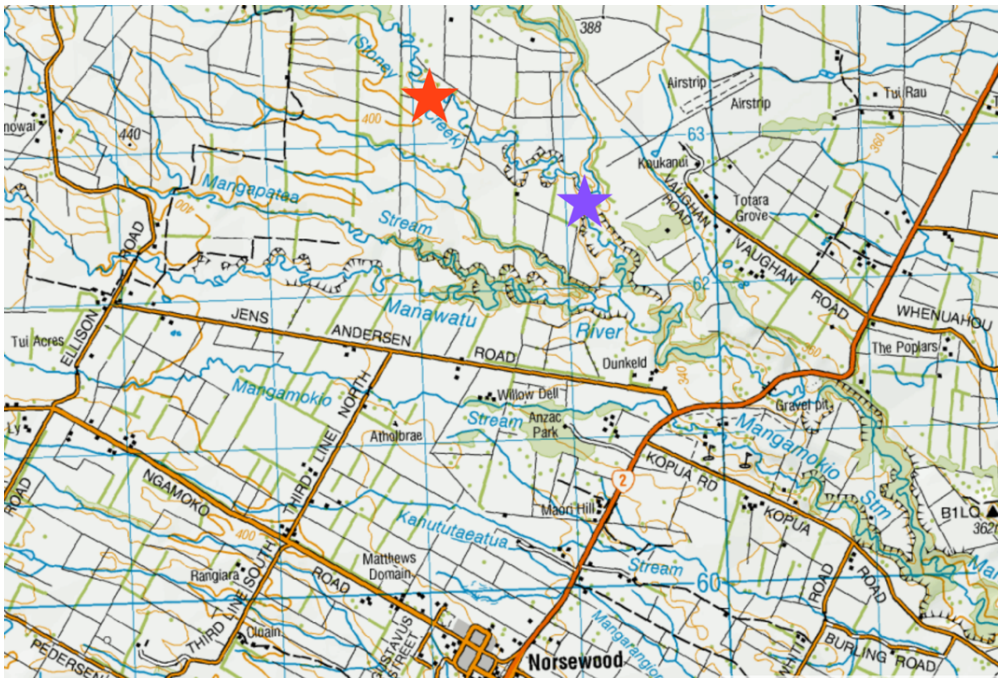

Figure 2.2: Mahuraunui stream, Norsewood. The purple star shows the approximate position of the heterogenous sampling sites and the red star shows the approximate position of the homogenous sampling sites (NZ Topo Map, n.d.).

Figure 2.3: An example of a heterogenous stretch of stream within a forested area. Photo: S. Hills

Figure 2.4: An example of a homogenous stretch of stream within pasture. Photo: S. Hills

2.1 Methods

People of Rangitāne settled around the Turitea stream, and several culturally significant sites remain, including the kāinga of Mokomoko, Te Kuripaka Pa, and Karaka Grove – a remnant of a stand of karaka (*Corynocarpus laevigatus*) trees near the mouth of the stream which was an important food source (Massey University, 2016). Originating in the northern Tararua Ranges where surrounding land is mainly native ngahere and scrub with some pasture and connecting pine (*Pinus radiata*) plantations (Allen, 2010), Turitea is now dammed in its upper reaches to hold a reservoir for Palmerston North's water supply. Turitea (elevation: 620-115m, annual low flow: approximately 33L/s) also flows through a second dam, water treatment plants, agricultural land, and the Massey University grounds before flowing into the Manawatū river in Palmerston North city.

The Mahuraunui stream (also known as Stoney Creek) is on the opposite side of the Tararua/Ruahine ranges from the Turitea stream and is part of the river system that feeds into the aquifers under the Ruataniwha plains. It runs approximately parallel with the Makāretu river, and confluences with the Mahurauiti stream before feeding into the Manawatū just North of Norsewood. The iwi Rangitāne also had hapū and marae establish around these rivers, which now run through multiple areas of private agricultural land. Eel over-harvest was a significant settler impact experienced by Ngāti Mārau and Ngāi Te Rangitotohu hapū in this catchment. The Mahuraunui is shorter than the Turitea and has less tributaries, but there are still patches of native ngahere through which this stream runs, perhaps because they are present on steep cliffs along some parts of the stream banks. The heterogenous stretch of the Mahuraunui runs next to Te Kehou pā, which has important history for the mana whenua, directly before it intersects with the Mahuraunui stream. There are people buried at Te Kehou from the time they lived at this kāinga in peace, likely extending the tapu of the area to the stream.

There are no available measures of the Mahuraunui flow rate, elevation, or other basic descriptors, but I chose these streams because they are reasonably comparable in width (roughly 3-4 m average at the time of sampling), depth (≤1.3m at the deepest points at time of sampling and ankle deep in the riffles), and flow. They have similar natural ecologies (although the Mahuraunui has some areas of steep cliffs along its banks), have been impacted by similar land use changes and water extraction at the catchment level, and both feed into the Manawatū. Sampling from the different environments (homogenous and heterogenous) within the two streams allows for comparison between the four reaches, rather than comparing between two tributaries that experience different environments being on opposite sides of the ranges.

Stream invertebrate sampling (see Stark, 1985 for kick-sampling technique) was conducted over several days from 3 May to 20 June 2019, between the hours of 10:00 and 16:00 on fine days. Sampling was done using a kicknet with a 0.1m^2 metal quadrat in front of the net to ensure the same area was sampled each time. I tried to keep kick sampling effort the same across samples by kicking with similar force and for about 10 seconds at each sample site. Each stretch of stream was a series of connecting sub-habitats (riffles, runs, pools, and one side stream) so I took five kick samples from each sub-habitat when present. I took the samples from down-stream up, approximately even distances apart from the bottom to the top of each sub-habitat. The entire five kick samples were emptied from the net into a 500mL pottle filled

roughly 1/3 with stream water and 2/3 with 90% ethanol, and the net carefully checked for any remaining invertebrates. I combined five kick samples into a single pottle so I could get a better representation of the sub-habitat as I didn't consider them to be independent. Small cobbles within the quadrat were also checked for invertebrates in crevices not dislodged by the kick sample. Each pottle was labelled with the date, stream, homogenous or heterogenous, site number, and sub-habitat type.

Samples were taken from as many different sub-habitats as possible within an approximately 300 m stretch of stream in each homogenous and heterogenous stretch of both the Turitea and Mahuraunui streams. The Turitea stream offered fewer sub-habitats because of anthropogenic impacts that made the substrate more homogenous in both composition and depth, resulting in longer runs separated by fewer riffles and deep pools. Heterogenous sites were those within bush that hadn't experienced the same extent of channel straightening, riparian vegetation removal, and other anthropogenic effects – and so were more variable. In both streams the heterogenous stretches were downstream from the homogenous stretches and so would still experience anthropogenic effects from their upstream catchments.

I defined pools as areas of slower moving water, deeper than the runs and generally against a bank where the stream bends (Figure 2.5). Riffles were shallower areas of faster moving water, broken and aerated over rocks and cobbles (riffles are generally where invertebrate samples are taken for scientific studies) (Figure 2.6). Runs were lengths of any depth of water between riffles, without broken water and sometimes including bends in the river (Figure 2.7). There was one sample collected from a side-stream, which was a small, shallow run flowing away from and then back into the main channel, with a small riffle just before the confluence. The five kick samples were taken along the length of this small side stream, from both the run and riffle features.

Figure 2.5: An example of a pool. Photo: S. Hills

Figure 2.6: An example of a riffle. Photo: S. Hills

Figure 2.7: An example of a run. Photo: S. Hills

At least six pottles (30 kick samples) were collected from each stretch of stream (Figure 2.8). I was able to collect more from the Mahuraunui stream as there was more variability within both stretches than in the Turitea stream. The sample sites were given codes with letters (indicating the sites and whether homogenous or heterogenous) and a number (indicating sampling order, with 1 being the most downstream site). For example, t-a1 referred to the Turitea heterogenous first site whereas m-b6 referred to the Mahuraunui homogenous sixth site. By emptying pottles into a white tray, invertebrates could be collected and identified to the level required to obtain an MCI value, i.e. some invertebrates needed to be identified to genus while others only needed to be identified to order or family. The abundance of each taxa along with its MCI score was entered into an Excel (version 1908 (Build 11929.20606)) datasheet to calculate the MCI value of each sample site as well as its habitat type, stretch, and stream. The percentage of EPT taxa, Shannon-Wiener index (sometimes called the Shannon-Weaver Index (See Peet, 1974; Spellerberg & Fedor, 2003), and taxa richness (the number of different groups of organisms identified to taxonomy levels required to obtain their MCI values) were also calculated.

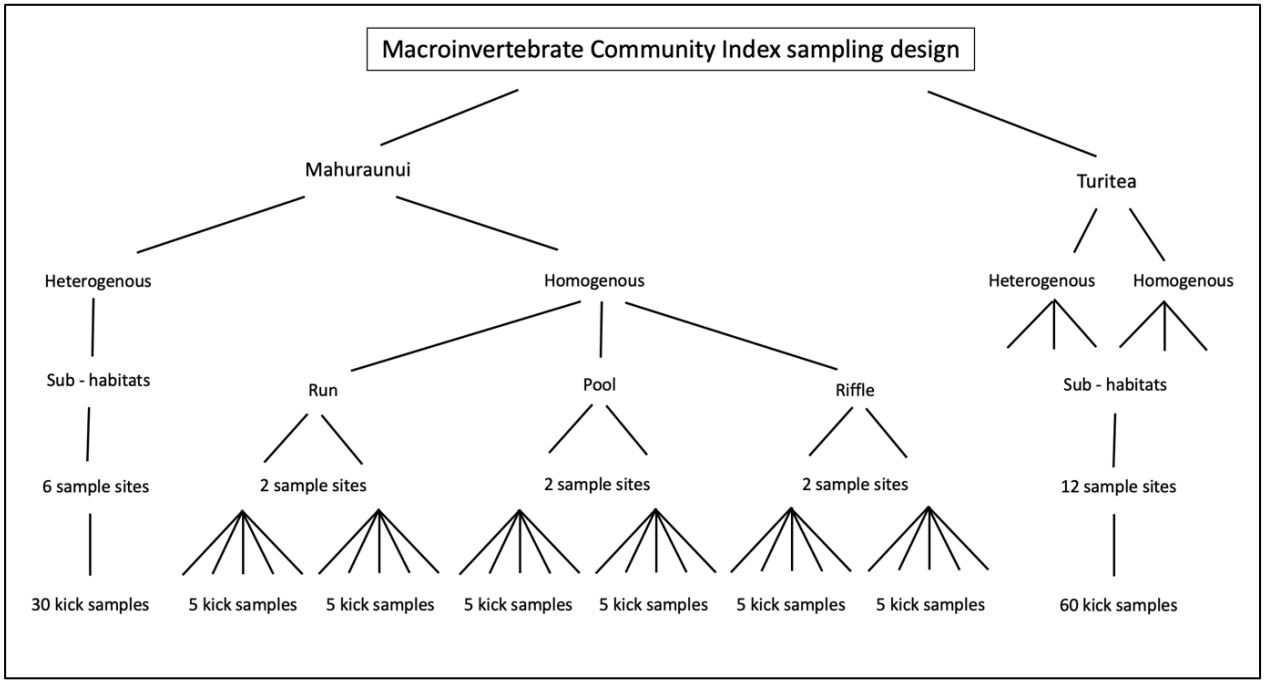

Figure 2.8: Diagram of Macroinvertebrate Community Index sample design.

Using R Studio (version 3.6.1 (2019-07-05)) I first fitted a general linear model (GLM) where the explanatory variables were stream (Mahuraunui or Turitea), environment (homogenous or heterogenous in each stream), and sub-habitat type (pool, river, or run); and the response variable was the MCI score to determine if there were significant effects. I then used the GLM t-test with each/any significant explanatory variable against the response variables.

2.2 Results

The Mahuraunui stream was more physically variable than the Turitea stream and as such I was able to sample from more sub-habitats and thus have a larger sample size, with nine pottles (45 kick samples) from the heterogenous stretch and eight (40 kick samples) from the homogenous stretch.

I first determined that the residuals of the stream data were approximately normal after fitting the GLM. The Turitea stream was of lower quality according to the mean values for all of the different measures of stream quality (Table 1). The biggest differences were in the %EPT taxa and MCI scores, where the Turitea samples were dominated by non-EPT taxa. The MCI index suggests excellent ecological condition when the score

is greater than 119, good when between 100-119, fair when between 80-99, and poor when lower than 80. The Turitea stream was of poor water quality according to the MCI index, whereas the Mahuraunui stream was of excellent water quality. The Turitea was also less diverse according to the measures of diversity, taxa richness and the Shannon-Wiener Index. The Shannon-Wiener index suggested the Mahuraunui stream was twice as diverse as the Turitea, and it considers evenness so it is a more robust measure of diversity than species or taxa richness alone.

Table 1. Mean values of the five response variables against stream and environment explanatory variables. Sub-habitat type was not included in this table as it was deemed not to have an effect on any response variable. There is also not a significant difference between the environments in either stream.

Stream	**Environment**	**Abundance[1] ± SE**	**Taxa richness ± SE**	**Shannon-Wiener index ± SE**	**%EPT ± SE**	**MCI index ± SE**
Mahuraunui	Overall	800.9 ± 130.5	21.9 ± 0.9	2.2 ± 0.1	76.1 ± 2.6	124.6 ± 2.0
	Heterogenous	709.1 ± 190.8	23.6 ± 1.3	2.4 ± 0.2	72.4 ± 3.6	127.9 ± 1.9
	Homogenous	904.1 ± 181.8	20.1 ± 1.0	2.0 ± 0.1	80.3 ± 3.5	121.0 ± 3.4
Turitea	Overall	375.2 ± 81.3	11.2 ± 1.0	1.0 ± 0.1	6.6 ± 1.9	78.7 ± 1.5
	Heterogenous	362.5 ± 113.5	11.5 ± 1.0	1.1 ± 0.2	9.3 ± 3.2	79.6 ± 0.9
	Homogenous	387.8 ± 127.0	10.8 ±2.0	1.0 ± 0.2	3.9 ± 1.8	77.7 ± 2.9

[1] Total number of invertebrates

Each stream's MCI kick sample data followed approximate normal distributions and I assumed the effects of each explanatory variable were parallel i.e. that the effect of being heterogenous is the same for Turitea and Mahuraunui and so on for each variable. The GLMs suggested that the stream variable was the only explanatory variable with an impact on all three response variables (Shannon-Wiener index, MCI index, and %EPT). The Turitea had significantly lower MCI scores (estimate = -58.624,

t-value = -15.62, p-value < 0.005), %EPT (estimate = -70.037, t-value = -19.38, p-value < 0.005), and Shannon-Wiener scores (estimate = -1.151, t-value = -6.39, p-value < 0.005).

The most abundant species across every Turitea sample was the *Potamopyrgus* mud snail. There were seven taxa that were the most prevalent across the Mahuraunui samples: the *Coloburiscus* and *Deleatidium* mayfly larva, the *Elmidae* riffle beetle larvae, and the *Aoteapsyche*, *Pycnocentria*, *Olinga*, and *Pycnocentrodes* caddisfly larvae. There were seven taxa present in Turitea samples that were absent in Mahuraunui samples: *Acroperla* stonefly larvae, *Oecetis* and *Pycnocentrella* caddisfly larvae, Isopoda, Sigara waterboatmen, Sphaeriidae fingernail clams, and the *Zelandotipula* cranefly larva. All of these have MCI scores of ≤ 6, except for *Pycnocentrella* (which has an MCI score of 9 and of which there was only one specimen), and the most abundant of these was the fingernail clam with eight individuals. There were seventeen taxa present in the Mahuraunui samples that were absent from the Turitea samples. Most of these taxa, except for Hirudinea, Hexatomini, *Triplectides*, and Ephydridae, are more vulnerable to pollution with MCI scores of ≥ 6.

2.3 Discussion

Lower MCI scores suggest higher nutrient enrichment and sedimentation levels associated with agricultural land use, and sedimentation levels tend to be higher in catchments dominated by pastural land than those with native vegetation (Canning & Death, 2019). The Turitea stream sites both had lower MCI scores than the Mahuraunui sites, suggesting the Turitea stream is more impacted by agricultural land use than the Mahuraunui. I expected that the pastural nature of the homogenous sites in both streams would lead to higher levels of sedimentation in those stretches than in their heterogenous counterparts, resulting in lower MCI scores in the homogenous stretches of stream. This hypothesis was not supported by the data, perhaps because the MCI scores of all four sites reflected sedimentation and nutrient enrichment in the wider catchments, rather than a decrease in sedimentation levels in heterogenous sites. Both heterogenous sites were down stream of the homogenous, thus there is potential for excess sediment from homogenous sites to be pushed downstream, but both Turitea sites had more visible sediment than either of the Mahuraunui sites. The heterogenous and homogenous sites in both streams were separated by roughly 1 km,

however all four sites were close to the mouth of the streams where they converge with the Manawatū, so the pollution tolerance of the macroinvertebrate communities at these sites may have been more representative of the cumulative effects of land use experienced by the entire tributaries before those points. The %EPT scores also suggest that the Mahuraunui stream is healthier than the Turitea, where both sites in the Mahuraunui had macroinvertebrate communities with roughly seven times higher percentages of EPT taxa. This suggests that the Mahuraunui has better habitat for the generally more pollution-sensitive EPT taxa, and communities in the Turitea are dominated by pollution-tolerant non-EPT taxa because the habitat is suitable for them but not for pollution-sensitive macroinvertebrates.

The apparent insignificant difference between the sub-habitat types may have been because the MCI was specifically designed for riffles. However, I did collect certain invertebrates from the runs and pools that were not present in riffles, such as the burrowing mayfly (*Ichthybotus*) and water scavenger beetle (*Berosus*). Therefore, I do think that sampling from the different sub-habitats gave a better picture of diversity which is an important factor to consider when aiming to restore and protect native ecosystems. Not only is diversity itself important to consider, but also biotic integrity, where the animals that make up the biodiversity of an ecosystems are appropriate to those ecosystems. There are streams in Aotearoa that have naturally low abundances of EPT taxa even when they are in pristine condition or have been only slightly affected by anthropogenic pollutants (Quinn et al., 1997), which is why the history and native state of a system is important to understand in restoration projects. Mana whenua can provide this information in many cases, especially in areas where there has been little history of western monitoring. Western scientific monitoring has created helpful and specific databases for the purpose of monitoring biodiversity changes, and importantly, these databases often document aspects of ecosystems in more detail than traditional knowledge systems – stream macroinvertebrate communities being an example of that. These are areas where knowledge stemming from western science can aid restoration projects guided by Mātauranga. Western knowledge systems can also assist monitoring programmes that are essential to restoration projects.

The fact that EPT taxa and pollution-sensitive taxa are present in high abundances in both the homogenous and heterogenous stretch of the Mahuraunui stream suggests that the stream has not experienced detrimental impacts from surrounding agricultural land and still has potential to be restored and rejuvenated. Neither kōura (*Paranephrops planifrons*) nor kākahi (*Echyridella menziesi*) were (visibly) present in

the Mahuraunui stream, despite invertebrate communities being a rich food source for koura, and memories of the kai being present in the area in recent history and still present in the close but larger Makāretu. Brown (2009) studied kōura populations in the lower North Island and found that communities could still be found in pastoral streams but their densities, growth rates, longevity, and habitat requirements were different to those than when in streams with native vegetation cover. Their presence declined with trout presence and increased suspended sediment, but despite land use change having little observed effect on population presence and distribution, existing models and stream measurements are not accurate in predicting kōura presence. Brown's (2009) findings suggested vegetation (macrophytes, bryophytes, or leaf litter) within the stream had a positive correlation with kōura presence, which had been used as a predictor. However, he also suggested other factors, including more environmental features (such as waterfalls), stream depth, complexity of habitat and stream bed composition (which I have called heterogeneity), and wintertime equilibrium temperature were important factors influencing koura presence when there may be trout. I am unsure if there are predators, such as trout and eel, present in the Mahuraunui stream that would cause the absence of this kai species, but as Brown (2009) suggested, there may be more interacting environmental factors, independent of agricultural impact, that may contribute to a lack of these kai species.

The Turitea stream macroinvertebrate community composition suggested there were more negative land use impacts than in the Mahuraunui, as the Turitea was dominated by pollution-tolerant taxa, such as *Potamopyrgus*, and was less diverse. However, the results from these biological indices may have been impaired by land use, as suggested by Clapcott et al. (2012). They reported that loss of native vegetation cover at the catchment level decreased the ecological integrity of streams, but importantly, that many other factors associated with loss of catchment vegetation cover interacted in complex ways to lead to not only changes in biotic community composition, but also stream metabolism, nutrient cycling, and downstream availability of resources. They suggested that when assessing land use change at low levels of urbanisation, the %EPT metric was sensitive to cumulative changes; but that non-biotic metrics, such as *NOx* and $\partial^{15}N$ of primary consumers, were more sensitive to land use intensity when 60% of indigenous vegetation of the catchment had been removed. Much of the Turitea catchment experiences agricultural land use, so perhaps using biological indices in conjunction with non-biological indices to index the health of the Turitea would give a more holistic assessment.

Holistic frameworks are important knowledge systems that can aid in community engagement and portray the importance of monitoring and cultural knowledge in restoration projects. They can help people with a weak concept of whakapapa understand how many factors interact to influence the health of the people and their whenua and wai. Holistic frameworks can tell us how soil condition affects ground water, and groundwater flows into rivers; that the substrates in rivers and water quality affect invertebrate and plant communities, which in turn affect vertebrate communities in and out of the water. There are many other systems, such as nutrient cycling and microbial organic material breakdown systems, that impact these factors and build the ecosystems that mana whenua have come to be a part of and understand in their own ways. Knowledge of how waterways behaved and looked generations ago still lives within our people, and this knowledge is important to embrace as we create goals for restoration. In many cases, how mana whenua experienced the world years ago is what the wider community would also love to experience.

If I had more time to go through kick samples, I would have sorted each sample individually rather than combining five samples in order to increase sample size and perhaps pick up more subtle differences between the environments and sub-habitats. By combining five samples into one I still counted all of the invertebrates, but I only had to separate the invertebrates from the debris and gravel in my tray once rather than five times. I do believe though that the data I collected from these streams were representative of the impacts of at least one factor that causes a decline in stream health – agricultural land use. From visual observation the Turitea had more fine sediment in its beds which quickly became suspended in the water column when I conducted my kick-samples. Sedimentation and nutrient enrichment are significant pollutants of rivers resulting from agricultural land use, but the Turitea is also dammed (and so has less water flowing through it to flush away sediment) and runs next to an old dump on Massey University land that also may affect the downstream macroinvertebrate communities. There were many more native fish in the Mahuraunui that I had to remove from my net, and hapū were still obviously connected with those tributaries – positive measures of stream health not considered by the MCI or %EPT metrics.

The Mahuraunui stream had more diverse macroinvertebrate communities which is good for maintaining biodiversity. However, diversity alone is not a good measure of stream health and may not be a priority for mana whenua. According to the MCI, %EPT, and Shannon-Wiener indices, the Mahuraunui stream macroinvertebrate

comminutes were dominated by pollution-sensitive taxa, as well as having higher biodiversity. This suggests the Mahuraunui is the healthier of the two streams, as the invertebrate communities were less negatively impacted by land uses, specifically agricultural land use. There was no significant difference in the measures of stream health between environments or sub-habitats, both within and between streams, but there was evidence that taking samples from different sub-habitats increased the invertebrate diversity in the samples. While mana whenua are those most knowledgeable in losses to biodiversity when anthropogenic change occurs, these metrics are helpful tools that can aid in documenting species-specific changes to ecosystems. Tangata whenua can use these tools and the tools' whakapapa to understand when and where they'd be beneficial to use alongside traditional methods of monitoring. Understanding these aspects of scientific tools will help tangata whenua understand how the colonialist framework, dominant in our society, continues to impact us and our way of life. Colonial understandings (of land as a resource) were formally embedded within legal systems, enabling land confiscation and all the resulting hurt experienced tangata whenua and the whenua (of which we are a part). There were negative anthropogenic impacts on the land resulting from tangata whenua settlement, such as fire-clearance of bush and the extinction of the moa. However, the anthropogenic impacts resulting from colonisation and colonist values have caused significantly more catastrophic consequences. The social injustices and mamae that was, and is still, imposed upon the native people and culture of Aotearoa are simultaneously experienced by the people and the whenua. We are the whenua and wai. With the acceptance of western holism in the scientific community, colonialist frameworks are recognising that there are limitations in the reductionism of these scientific tools, as well as benefits. Once it understands the routes through which colonialist frameworks have impacted ecosystems and social systems, spaces open for learning from other cultures, experiences, and values. If we are going to survive, we must change how we as a people understand and conduct land management, and prevent the capitalist, colonial framework from continuing to destroy our taonga, reo, tikanga, and kawa. This will mean prioritising the health of our waterways and people and ecosystem restoration above the economic gain in intensive agriculture (Alexander, 2020).

Chapter 3: Our language influences and is influenced by how we perceive the world

Nāu te rourou nāku te rourou, ka ora ai te iwi.

With your basket and my basket, the people will thrive.

The beginnings of this chapter were formed with my introduction to the richness of wai. Central to Te Ao Māori are the understandings that wai behaves in different ways based on its mauri and its relationships with surrounding whenua and Poutiriao. We, as tangata whenua, are a part of the living system of wai that nourishes the earth, and we ourselves are wai. Our lived experience with the land informed our understandings of the relationship between ourselves and wai, and from our lived experience developed tikanga around how to use (or not use) wai from certain places. For example, waikotikoti (water to assist in the cutting of hair) is very tapu and must not be used for any other general use. The head and hair are the most tapu parts of the body, and so water that immerses this part of the body must itself be tapu, so as to not degrade the tapu of the head and hair. Immersing your body in wai moves and connects your own mauri with that of that wai, and the experiences of our tūpuna feeling these relationships created the mātauranga that is still passed down today. How they learned to understand wai influenced their interactions with wai itself, with kai from that wai, and with the rest of the world. Those teachings are passed from kaumātua to tamariki through physical experience and oral histories. Relationships between tangata whenua and wai involved stories of taniwha living in the depths that would eat children who mistreated a place's tapu, or who would act as guardians in times of need. Mātauranga remains contextualised in our own lived experiences, and in the histories and whakapapa of our people, and tikanga and kaitiakitanga maintain these relationships.

I've received 'formal' education in Te Reo and Te Ao Māori since I was young, but I was born into a time where the effects of colonisation meant that most of my education in Te Ao Māori was contexualised in schooling environments. I learned about kaitiakitanga, pepeha, the relationship between whakataukī and mātauranga etc. in isolation from my own roots and whānau – the things that give these concepts meaning. Like many other rangatahi across multiple generations, I learned reo in a

classroom of 20 other kids, from a teacher whose whakapapa was not the same as my own, and largely from books. Learning in this manner left holes in my understandings of Te Ao Māori that should have been filled with contextual knowledge from my own wai, whenua, and history. It is important for us as tangata whenua to learn about ourselves from our own people. My schooling did however, force me to learn in, and about, both worlds. I learned about our dominant school culture, about my culture, and how these had been impacted by colonisation, but I learned about it in a way that was individualised, instead of communal and interconnected.

I was told stories of how life used to be for my tūpuna, and even my mother's generation in my waters and marae. My nana used to swim the Whanganui awa from bridge to bridge. It was a fairly clean source of kai until the city council discharged raw sewage into it. After that, many of my mother's generation were kept away from the water around the city, instead they were taken upriver, beyond the city to swim. In time, the wider community recognised the health impacts to people and the awa, and their resistance led to the requirement for waste water treatment. Since then, there has been clean-up efforts in and around the river, and I was allowed to wade in the water – although my mother still wouldn't let me swim in the awa near the city, so like her, I was taken upriver. Although many people travelled up river to swim and still do, hopefully with Te Awa Tupua the water will soon be clean enough to swim along its entire length.

These experiences are not unique to my family, but sharing these stories is how we keep Te Ao Māori alive, and discussing the consequences of our own actions implants responsibility for our taonga into our tamariki, so that the same mistakes may not occur again. Tangata whenua and many Pākehā knew that discharging of human waste into waterways was abhorrent, but these memories directly reflect how colonial relationships with land and water are engrained within social systems, and how these systems impact tangata whenua, and wider communities. Discharging sewage into rivers was considered best practice by colonials at the time and councils had the power to make this decision without input from mana whenua and the wider community. Sewage treatment happened because of resistance from the community due to health concerns. Yet, if councils had asked the community and mana whenua and valued their opinions in the first place the river would not have been subjected to the level of pollution that it was. This is because Māori understandings of waterways' mauri, mixing waters with different types of mauri, and the mauri-diminishing qualities of human waste prevented them from mixing excrement directly with water, especially

waterways from which kai was collected. These memories demonstrate how communal resistance can create transformation in policy and correct societal injustices, but they also reflect how the imposition of colonial frameworks and oppression of indigenous peoples created these injustices in the first place.

My whānau planted seeds so that I would understand the importance of contextualised learning and knowledge. Through physical experiences I learned how to feel the mauri in interactions between my own and others' wairua, and how to make sense of it. Linguistically, wairua could embody the two waters from male and female that create life, and it could also denote the spiritual and physical waters that combine to bring physical embodiment. These concepts both arise from the separation of Rangi and Papa, whose tears and sighs of mists mix to create the wai-rua (two waters) that gives life. Our mauri connects us to other beings, seen and unseen, and as such, our interactions with other people are not only at a physical level but also on a spiritual level. This includes the wairua of our tūpuna and learning to listen to and understand this exchange in mauri plays an important role in learning to listen the whenua. Connectedness between us and our world has always been emphasised to me by my whānau, and my understandings of the complexity of these relationships developed from experiences that were contextualised in Te Ao Māori. However, ongoing colonisation meant that I missed out on opportunities to learn about myself and my culture from kaumātua in more traditional settings, due to the dominance of colonialist frameworks which directed the progression of my education in particular ways. I will never be able to learn reo from my kuia in her dialect or hear her karanga, or learn how to gather from local mahinga kai from my kaumātua. Like so many of my generation, I will likely never be able to experience things such as these as a result of the ongoing effects of colonialism and neoliberal capitalism. We have been forced to learn and experience the world in a way that is foreign and promotes disconnection and individualism, and overriding social forces enable this to continue. Although I do not have to face the explicit violence and injustices faced by our tūpuna, myself and many of my generation have missed out on things that are inherent to Te Ao Māori and that we should be entitled to experience. Generations of Māori since colonisation have fought for our taonga tuku iho, and it is because of their resistance that we have retained our culture and language, and the rejuvenation we are seeing today is possible. Our tūpuna's resistance kept our culture alive, but the structural/systemic injustices we continue to face are violent effects of ongoing colonialism.

Before colonisation, Te Reo Māori was rich and rooted in local environments, experiences and histories. It is contextualisation that makes kaitiakitanga so valuable to communities, and it is what cultivated the richness of reo used to describe and understand the different behaviours and mauri of wai. Communities were established and flourishing as a result of the living relationships between whenua and tangata whenua, and local mātauranga and tikanga allowed tangata whenua to build relationships with the land in many different kinds of environments. Harvesting from various taonga according to local tikanga enabled tangata whenua to trade within and between local communities, iwi, and internationally. Harvesting was directed by the condition of mahinga kai and the people. If the whenua – and by connection, the people – needed to recuperate, rāhui may be placed, or harvesting may only occur at certain times of maramataka so that the mauri of the area may be replenished, allowing it to again support abundant life. It is the understanding of our environments as living and connected that created the abundant and rich vocabulary within Te Ao Māori. As changes in mauri, season, mana, and age occurs, so too do the relationships between us and our taonga. The reo reflects these changes, and the richness of kupu and understandings are tools to teach younger generations how to respect the wairua of living beings, and what to expect from these changes.

As well as allowing us to better connect with our whenua, these understandings created social forces that prevented the commodification of taonga tuku iho. Respecting whenua and wai as living beings and feeling the mauri from Papa that radiates through all life, engrained within tangata whenua the responsibility to care for our whenua so that it may never be depleted. Te Awa Tupua is an example of how our relationship with wai may lead periods of change from within Mātauranga Māori frameworks, and how our developing knowledge and relationships have the potential to create better situations for entire communities as well as mana whenua. Over time the entire Whanganui community was likely affected by the pollution of the river. Even though it affected people differently due to differences in understandings of our relationship with it, it was transformed from a place that provided food and activity to a place that had to be avoided. This transformation is in complete opposition with many peoples understandings of what a river should be. The Te Awa Tupua Act begins to enable hands-on management of the river by Māori to revitalise the awa in a way that is appropriate to Te Ao Māori. A benefit of this approach is in the potential to reconnect mana whenua with the wider community, and for the entire community to reconnect with a healthy river which will support social and ecological life.

Understandings of our connectedness with the living whenua are absent in capitalist frameworks and because of this, social forces enabled the injustices of colonisation and commodification of parts of the environment to occur in Aotearoa. Driven by capitalist assumptions of land as a possession to be 'owned' and 'traded', colonialism depended on the suppression (and ideally, the eradication) of existing indigenous peoples, knowledge, cultures, and languages (Tuck & Yang, 2012). Engrained in capitalism is the idea that you can 'own' land, but colonists could not own land where indigenous people were flourishing and communities had strong relationships with each other and the land. So, to gain control over the land, colonists had to supress the people, beginning with land 'sales' and confiscations of the land, slaughtering of mana whenua, and then moving to suppression of reo and Māori culture and practices through schooling systems.

The purpose of this chapter is to contribute to the communication of how important contextualised knowledge is when we consider our ecological relationships and our social structures. Local tangata whenua knowledge is critical to local ecological concerns, and there is potential for conservation driven by this Mātauranga to inform and guide national management in ways that addresses both local and global concerns. However, to prevent continual systemic subjugation and dismissal of indigenous peoples and their values we must change how our society views Mātauranga Māori and other indigenous knowledge as being of lesser value than that which is produced by western frameworks. If we can change overriding social structures that perpetuate this positioning of Māori communities and their knowledge as peripheral to the 'real' interests and values of our country, spaces will open for mana whenua, communities, and researchers to come together and implement solutions for better ecological relationships.

3.1 The background of the colonial framework that directs New Zealand's education systems and recent policies requiring the consideration of the principles of the Treaty

The schooling system brought to Aotearoa with colonists was initially based on religious teachings. While it was established to accelerate settlement and educate settler children, it was also utilised as a means of assimilation; to bring Māori into 'civilisation' (Consedine & Consedine, 2001). When the schooling system was first established in Aotearoa, tangata whenua were using it as another tool to teach tamariki

Kaupapa Māori through reading and writing in Te Reo Māori. These practices benefitted tangata whenua and impeded colonial aspirations for Māori children to be taken away from the 'demoralising' and 'savage' influences of pā communities and to be assimilated into a European civilisation (Walker, 2004). In 1867 the Native Schools Act was established, marking the formal beginnings of efforts to legally exercise the cultural invasion of Māori communities by State schools, later followed by corporal punishment for the use of Te Reo in schools. The alien culture of schools combined with the diminishment of Māori identity and personal worth acted to further disconnect mana whenua from their whenua and culture (Walker, 2004). Despite the many interacting factors resulting directly from colonisation that act to dispossess, impoverish, and subjugate tangata whenua, there is still willingness in these communities to make meaningful use of tools, especially in scientific realms. Kaitiakitanga varies between rohe but the understanding that we need to care for Papatūānuku remains at the heart of Te Ao Māori. When utilising western tools, tangata whenua remain conscious not to appropriate or try to assimilate this knowledge in the same manner that the Crown has done and continues to do with Mātauranga.

If settlers were to commoditise natural resources unimpeded by Māori concerns they first needed to establish colonial systems and structures as socially dominant, whilst marginalising Māori knowledge and ways of being as the 'other' (Salmond et al., 2019). This required the suppression of indigenous peoples, knowledge, and language. The subjugation of indigenous peoples ways of life required the disruption of their connection with land and water; and this was enabled by the religious assumptions in Genesis which assert that man was given rights to subdue and have dominion over every living thing (Salmond et al., 2019). It was this understanding that drove capitalism and the motivated colonial expedition, and it was through existing discourses of racism and elitism that enabled colonists to frame indigenous peoples within that which should be subdued. Populations of tangata whenua were too large for colonists to decimate upon arrival like they had done to other indigenous communities. For many reasons resulting from colonisation, tangata whenua became a minority population, a fact that was considered a feat by many settlers who desired their 'superior' race to supplant Māori populations (Consedine & Consedine, 2001). The existing (social) class system present in England at the time of colonisation enabled the suppression of indigenous knowledge through institutionalising racism in all levels of schooling and society. For example, by teaching topics that met western needs and concerns settler children were receiving education that furthered their intellectual needs and opened opportunities they may not have had access to in Britain. In

contrast, while their ancestral lands were being confiscated and their people, language, and culture were subjugated, Māori girls learned homecare skills and Māori boys learned labouring skills. This was done to create a supplementary labour force, where Māori who were positioned as lower class, could be educated into becoming compliant law-abiding, manual workers who would assimilate into settler society and an English-speaking world (Consedine & Consedine, 2001). The initial practice of Māori who were using schools as tools to continue teaching Kaupapa Māori was abolished through the implementation of legal Acts of suppression. In time many other Acts were passed that ensured tangata whenua would continue to become more and more dispossessed and marginalised, despite these processes being in direct conflict with the principles of Te Tiriti.

While generations of Māori of children experienced oppression throughout their upbringing, generations of Pākehā children were brought up in a system that provided them with privileges not previously accessible in colonial Britain. Western understandings of people and the natural world, and of civilisation being something attainable only by assimilating and acting in accordance with western ideals created paternalistic relationships between settlers and tangata whenua. After the establishment of a colonialist hegemony within Aotearoa's communities, Māori children received beatings in school for speaking the reo, and Māori families experienced horrendous injustices and racism. Through their relationships with Māori, some Pākeha came to recognise and challenge the racism and oppression of Māori. However, social forces, such as the dominance of capitalism, enabled their concerns to be pushed to the periphery and the social mistreatment of tangata whenua continued. Social structures created a manual workforce that Māori were expected to populate because they were discouraged and prevented from entering institutions such as universities. It may have been the case that settlers were expected to make up some part of the working class, but their circumstances likely contrasted with Māori because they had more opportunities to attend university and take up positions of power with decision-making authority. Many tangata whenua recognised benefits that learning and speaking English would have in enabling social participation otherwise inaccessible to those who only spoke reo. Thus, many tangata whenua facilitated the education of their tamariki in western curriculum by speaking only English in their homes, hoping that it would give their children greater access to education and make it easier for them to avoid violent repercussions of oppressive law. In addition to the beatings Māori children received for speaking reo, the disconnect between Māori children and their native language had dire inconceivable consequences because it

discouraged tangata whenua from maintaining their language and culture (Consedine & Consedine, 2001). Without the reo and accompanying tikanga, stories contextualised in Te Ao Māori and their deeper meanings were passed down to fewer and fewer Māori children. This created generations of Māori competent in the proceedings of the western world, but with incomplete connections to their own culture. This practice rewarded systemic oppression and cemented the extensive role that the education system plays in perpetuating oppression of Te Ao Māori.

Tangata whenua were simultaneously losing their culture through many different mechanisms and being forced to become second class citizens in a foreign society. The introduction of the Native School System was underpinned by assumptions of Māori as 'noble savages' that could be indoctrinated into a civilised society following fragmentation from their land and culture. However, because it was also assumed they were not capable of abstract or complex thinking, education focused on training Māori in manual work desirable to a civilised society; all of which was taught through the medium of the English (Bishop, 2005). Furthermore, these schools did not teach the subjects required to gain entrance to university, thus excluding Māori from the possibility of engaging with the economic and political hegemony whatsoever. These circumstances, in conjunction with the impoverishment of land and resources (remembering these factors both arise from the same colonial framework), perpetuated the systemic positioning of Māori in the lower-class, working laborious, low paid jobs. The education system was used to further alienate tangata whenua from their land and culture so that the colonial society could pursue control of primary means of production in New Zealand. With the recent recognition of tangata whenua and their interests as important to New Zealand's future, action within priority investment areas and under the RMA require the consideration of the principles of the Treaty – and to an extent, Kaupapa Māori. Parts of Kaupapa Māori, such as caring for the land and looking to the future, are valuable concepts for these policies, but Kaupapa Māori can only be valued to an extent by these legislative frameworks because underlying capitalist values conflict with Te Ao Māori. These policies attempt to address the inequities that still exist between Māori and non-Māori. However, they still privilege the deficit-thinking that was used to justify colonial injustices over tangata whenua in order to continue to position tangata whenua as a minority culture in New Zealand, with no real intention of relinquishing their power and authority.

3.2 Commodifying Mātauranga

Since colonisation, many tangata whenua have sought tertiary education in an effort to gain social capital required to participate in local decision making. Often they seek tools and knowledge that have weight in the western world so that they may be heard when they speak about continuing injustices faced by Māori communities. In my own experience talking with Māori inside and outside of academia, many recognise that having a post-graduate qualification enables your opinions and ideas to be heard by academic communities and governing bodies. The takeaway from these conversations is not that Māori don't value traditional knowledge in its own right, but that gaining the social capital of a Masters and/or PhD enables mana whenua to be *heard* in conversations where historically their voices have been dismissed or they have been prevented from engaging. Overriding systems continue to position formal university education as more capable of informing decision-making processes than Mātauranga (Jacobson & Stephens, 2009). This can potentially create distrust in communities in the ability of education systems to listen when tangata whenua speak, and enable schools to continue teaching the same Eurocentric content and reinforcing the monocultural social structures that are unwelcoming to Māori students. Post-graduate qualifications can place Māori in unique positions where they have the ability to engage in both sides of the conversation, however, tertiary education does not readily provide tools for indigenous communities to instigate real decolonisation because it itself does not recognise the need for decolonisation. If Māori voices are to be heard and acted upon in resource management and academia, there is pressure on them to demonstrate that they are capable of participating in and understanding western modes of knowledge production. In these spaces, it is not the wealth of life experience or generations of connection to the whenua that enables them to be heard, it is the proven competence in 'real' (western) science.

This further facilitates the dismissal of Māori knowledge as peripheral and inapplicable to the current hegemony, and it also establishes paternalistic systems as dominant over Te Ao Māori (which values women's knowledge and experiences), ultimately dismissing it. Part of Māori life is caring for whānau and community. University structure and support is generally designed to cater to full-time study. However, those caring for tamariki or elderly whānau – generally women – are unable to enrol full-time. The lack of support for these students (and potential students who do not enrol full-time for this exact reason) has impacted the retention of female Māori academics and resulted in a scarcity of role models. Again, this is a reflection of the colonialist

framework embedded within our schooling systems – historically, a woman's place was not considered to be within universities, and so them and their knowledge was oppressed. Universities not being set up to cater to women with dependents has critically resulted in a shortfall of environmental management conducted through the perspective of Māori women (Roa et al., 2009).

Tangata whenua have always resisted the colonisation of our people and our Mātauranga. The current system recognises that ecological crises and social issues we are facing hold bleak prospects for our future, and that the current system alone is not adequate to create solutions that prevent the reproduction and furthering of these conditions. To change the trajectory of our future we, as a people, need to imagine innovative solutions, and this requires the opening of spaces where knowledge systems can speak to each other. There are spaces where this has begun to happen which has put pressure on governmental policy-makers to respond. However, the outcomes are often not what are envisioned by communities and are not effective because the response of western institutions to the call for Mātauranga to be recognised as a valid knowledge system has been to carve out space within existing curriculum. Relationships between tangata whenua and Pākehā have enabled discussions to be had with governmental bodies and their resistance be heard and acted upon. These discussions and growing community concern for the global ecological circumstances have prompted the current overriding knowledge system to re-categorise Māori knowledge and attribute it with a desirable value.

Vision Mātauranga (VM) is a governmental policy from the *Ministry of Business, Innovation and Employment (MBIE)* that was implemented to increase Māori engagement and capability. While the intent is to be applauded, the underlying assumptions and implementation of this policy is problematic. In practice, the engagement is conditional on the assumption that pre-determined values of economic growth are shared between parties, and the effect of this policy and the RMA's consideration of Treaty values is to act as a sort of tick-box activity that tokenises and commodifies Mātauranga. This occurs because the existing framework maintains colonial authority over knowledge production by opening space within *existing* systems. Indoctrinating Māori values into colonial frameworks reinforces the positioning of Mātauranga as peripheral/supplemental to the 'real' values of the Crown's New Zealand. For example, Massey University has been in the process of putting Māori names on buildings, signage, and course titles in an effort to appear more welcoming to Māori students and as if they are pursuing Māori success. However, the content

and structure of its curricula are not altered in respect of these name changes. In VM, this is visible with the positioning of economic growth alongside sustainability and health. In Te Ao Māori, economic growth in its current form directly conflicts with the health of the whenua, and thus the health of the people. If colonial frameworks were actually capable of listening to Māori values and relinquishing authority over their own knowledge to tangata whenua, these concepts would not be framed as commensurable, and Māori could decide what concerns to prioritise and how to approach them. Portraying *some* Māori values as capable of existing in, and being meaningful to the current capitalist hegemony, but requiring 'unlocking', is a reiteration of colonial power to define and categorise valuable and legitimate knowledge. Histories of classifying indigenous knowledge as problematic and as hindering national advancement justified 'legal' suppression of Mātauranga. Now, these policies *assume* that the 'unlocked' knowledge of tangata whenua will have the same cultural concerns for sustainability and economic growth as the Crown – further validating the paternalistic colonial relationships that exclude indigenous knowledge.

Policies like VM and Te Tiriti have an important place in ensuring that Kaupapa Māori remains embedded in our movement into the future across all sectors of life. In fact, on the MBIE website they recognise that the successes (and thus failures) of Māori are New Zealand's successes (and failures). However, currently the language used in policies continues to enable Māori values to be undercut. For example, the mission statement of VM is "To unlock the innovation potential of Māori knowledge, resources and people to assist New Zealanders to create a better future" (Ministry of Research, Science, and Technology, 2007). This implies that Māori knowledge is not innovative and is not useful for our future without external intervention from MBIE and MRST. Mātauranga is innately innovative because its complexity arises from contextual experiences and understandings of ourselves as a part of our environments – i.e. environmental changes require us to react with centuries-old techniques or to use Mātauranga to make innovative decisions. Despite the western world now recognising that there is value within indigenous knowledge, it positions indigenous knowledge as if it exists in a deficit because tangata whenua do not use their knowledge in a way that is driven by economic growth as its first priority. Thus, the western world won't/can't *hear* tangata whenua even when they speak to western ideas of sustainability.

When communities call for Mātauranga to be recognised as a valid knowledge system, the response of western institutions has been to carve out space within existing curriculums. Within the 'Humanities' for example, the establishment of Kaupapa Māori

education has enabled the creation of kaitiaki positions where Māori students can receive help in a way that is familiar to them. However, kaitiaki are not normal or common occurrences throughout the whole institution, nor are they given support outside of the Humanities, and Kaupapa Māori is not at the core of any other scope of university education (Pihama & Lee-Morgan, 2018). In the environmental sciences, curricula speak to the importance of sustainability and the concept of kaitiakitanga that are recognised by VM as being critical to our future, but the content and structure of these courses are still not grounded in Kaupapa Māori. Jarring contrasts between a monocultural, alienating environment and their lived realities contributes to low levels of achievement in Māori student populations (Wilson et al., 2011). While these actions may appear to be an adequate response to the problem of low rates of Māori engagement and success in tertiary institutions, the effect has been to contain and isolate Kaupapa Māori research as an adjacent to supplement already established 'essential' curriculum.

In support of actions such as the establishment of Kaupapa Māori within the Humanities, the government now provides specific funding for theses published in Te Reo Māori. Unfortunately, and perhaps as an effect of generations of exclusion, there is a lack of Māori speakers who are qualified to mark theses written in te reo, as well as a lack of supervisors who understand and are inclusive of Kaupapa Māori (Pihama & Lee-Morgan, 2018). Despite the monetary incentive for universities, a lack of active support from university systems across all subjects creates situations where students are seldom able to submit in te reo and focus on Kaupapa Māori. Universities will gladly reap the benefits of having research published in te reo, but university systems are not in a position to actively support these students, let alone encourage research to be grounded in Mātauranga. An effect of a lack of support for these students is that the intent of VM is not achieved in tertiary systems, and our classifications of 'valuable' knowledge do not experience pressures that precede transformation.

Establishing Kaupapa Māori education within the Humanities should support the rejuvenation of Te Ao Māori, but in reality these actions can have other unanticipated effects. For researchers like myself who happen to be conducting Kaupapa Māori research but are located in a school outside of the Humanities (my research sits within the School of Ecology), our studies and day-to-day life occur in isolation from Māori peers and Māori staff because they are so underrepresented in the Sciences – especially in postgraduate Ecology education. My own university experience was, and is still is, extremely difficult because I've had no one I could relate to and no one to talk

to who had similar life experiences to me. My supervisors support me because they empathise with me, but their life experiences have been so different to mine that they cannot understand and relate to the things that I struggle with. Not having a support network at university made it extremely challenging to complete my undergraduate degree, and my postgraduate experience has been even more painful. It is only made worse when people within the department challenge my research's position as not belonging in Ecology; ignorant to the issues raised in this research being exactly what ecologists need to hear so that we may change how we understand and teach environmental sciences. These things put pressure on my supervisors to advocate for something they know is necessary but do not fully understand, and places pressure on researchers like myself to engage with mana whenua at local levels but face being spread thin because we are few and far between. Pushing Mātauranga to the periphery of 'real' university education creates researchers and research that is constrained by assumptions of western knowledge. When these researchers enter the real world their understandings are handicapped by the assumption that western research should be treated as the dominant knowledge source, continuing to exclude Māori from environmental spaces and discourage them from studying in the Sciences.

Once students reach university, the dominance of western knowledge and cultural practices has meant that many Māori do not complete their degrees. There are many aspects to university life that isolate Māori students, including location away from whānau, large class sizes with little personal interaction with lecturers, privileging western sources of knowledge and processes, and small populations of Māori. Monocultural practices and curriculums make Māori students feel alienated when they reach university because of the discontinuation of culture – students find it difficult to engage and remain true to themselves in environments that do not reflect their lived realities (Wilson et al., 2011). Low rates of Māori retention in tertiary institutes was recognised as an issue and led to the implementation of scholarships and groups targeted at Māori completion of undergraduate degrees. VM was also implemented by MBIE as a policy framework meant to assist Māori success in research and science, yet the language of the policy continues to encourage the decontextualisation of Mātauranga, and frames it as a resource that requires external intervention so it may be useful for New Zealand's growth.

Hegemonic colonial understandings of the world are reinforced at tertiary institutions. Despite the requirement for state-funded universities to acknowledge the principles of the Treaty, Māori, and Māori women specifically, are underrepresented in university

student and staff populations, especially in senior roles (Kensington-Miller and Ratima, 2015). This itself is a reflection of the colonialist framework embedded within schooling systems, where patriarchal and racist values of the colonialist framework have historically determined what knowledge counts as 'valid', ultimately dismissing indigenous knowledge, and women's knowledge specifically. Pre-colonisation, Māori women were bearers of life as well as warriors, teachers, and carers. Their intimate connection with Papa meant their knowledge and mana was immensely valued in everyday life, but with the initial establishment of schooling systems within Aotearoa, patriarchal views intersected with racism creating particularly exclusionary circumstances for Māori women. Privileging this framework cultivated monocultural and monosex schooling environments, where indigenous women especially were subjugated, or discouraged from entering these environments. As a result, there has been a lack of opportunity for national and local growth as Māori within universities doing research that is directed by Kaupapa Māori (Kensington-Miller and Ratima, 2015), and a particular lack of Kaupapa Māori research done by Māori women in the Sciences.

Recognising the need for more Māori involvement in tertiary education, many scholarships and funds have been introduced to advance Mātauranga and support Māori students. However, these funds can actually undermine Māori research and community-centeredness by requiring excellence that is measured by western post-colonial constructs. Many policies that direct research and environmental engagements state that the principles of the Treaty must be considered. However, the requirement to recognise the principles of the Treaty is, by its very nature, a violation of Te Tiriti o Waitangi. The Treaty and Te Tiriti are two different documents that were written to recognise and implement two different ways of life and sets of values. Te Tiriti demands that tangata whenua remain kaitiaki and retain rangatiratanga in their whenua, and this requires tikanga and Te Ao Māori be at the forefront of decisions affecting whenua and tangata whenua. The Treaty dismissed and subjugated Māori people and Māori knowledge, so to recognise the principles of this document is to further colonial practices in our overriding systems. If the intention is to recognise the principles of Te Tiriti, this statement in itself has no meaningful value because the principles of Te Tiriti are either 'recognised' and dismissed in accordance with a colonial framework, or their values are shared but cannot be incorporated into an incommensurable system.

Roa et al. (2009) discussed the unintentional impacts that hegemony has on the quality, scope, and volume of Māori research. Firstly, funds created under governing bodies that are directed by VM and the RMA, such as the Performance Based Research Funding model (PBRF), fail to actively progress Māori research in a manner that actually caters to Māori. Although the PBRF is not targeted at Māori specifically, the considerable monetary support has the potential to change how research is understood by supporting eligible Māori whose research focus is grounded in Kaupapa Māori. When funds such as the PBRF give support to research that is already a minority with university systems, it emphasises the need for research *for* Māori, by Māori. This type of support has the potential to disrupt the hegemonic dominance of monocultural practices, and dismantle overbearing modes of knowledge production, ultimately opening space for other knowledge frameworks, including Kaupapa Māori, to flourish. However, instead of supporting research that is considered excellent or necessary by Māori, it has focussed the direction of Māori research toward the production of large quantities of publications in international journals (with high impact factors), and away from cross-cultural/cross-discipline research that's published in local journals (Roa et al., 2009). Channelling publications toward peer-reviewed international journals rewards generic (non-place-based) research over Mātauranga generated by (local) mana whenua. At the local scale, research is relevant and applicable, and indigenous knowledge can contribute to the production of new knowledge and solutions to modern problems, especially where mana whenua have generations of knowledge of local ecological conditions and concerns. Rewarding and encouraging international publication can contribute knowledge to address global environmental concerns, such as (climate change). However, this also has the potential to further decrease the relevance that Te Ao Māori has in universities, and discourage the undertaking of research that is valued by Māori communities (Roa et al., 2009).

Co-authorship and cross-discipline relationships are valued by tangata whenua as they align with values of interconnectedness and community-centeredness, and reiterate the connected nature of hauora and kaitiakitanga. However, this type of work is not actively encouraged by universities, and university culture and mentorship can instead stimulate sole-authored research (Roa et al., 2009). Sole-authorship can be seen as promoting whakahīhī (pride in a vain/arrogant/narcisstic manner), but furthermore, the social capital of being an 'expert' conflicts with Te Ao Māori because, in a post-colonial framework, expertise is assumed to be situated with those who have received formal education ahead of those with lived material experience. I also feel that the term

‘expert’ potentially denotes someone who is able to learn from their own research, but who cannot learn from someone else who is not also considered an expert. This is particularly applicable to my own research in the Sciences. My research not only offends some people who are well versed in scientific fields because of its Kaupapa Māori focus, but will likely fall on deaf ears of those who privilege western frameworks and methods of knowledge production, even if the privilege is subconscious. This work has already been dismissed as “not a Master’s of Science” because other scientists have learned that science must be constrained within one knowledge system. Furthermore, my research was aided by mana whenua who have ‘expert’ knowledge of their rohe, but not all of them had received formal education. It is for this exact reason that this type of research is necessary and must be heard, so that we may decolonise our way of thinking and create space for other knowledge systems to communicate with each other and create new, innovative solutions to modern environmental and social issues.

Kensington-Miller and Ratima (2015) discussed the importance of acknowledging the differences (what I have called the incommensurability) within universities that exists between Pākehā methods of mentorship and teaching, and tuakana-teina (tuakana-taina) mentorship. In contemporary Pākehā mentorships, outcomes driven by a culture of competitive individualism are valued, and Māori are expected to either assimilate into this framework or constantly compete with the differing intellectual aspirations and world views of the dominant culture. In academia, those researchers who publish sole-authored articles in high-impact international journals are attributed with higher social capital because they are considered experts in their fields. However, in Te Ao Māori, to portray knowledge as your own is to decontextualise it from the people and the whenua from which that knowledge was learned. The people from which knowledge is learned are considered guardians of that knowledge, but it is not uncommon for tuakana-teina roles to switch and for the student to teach the teacher something new. Although university lecturers/professors learn from students on occasion, the dominant method of lecturing is foreign to Te Ao Māori because it forces students to learn about concepts outside of the environment in which that knowledge came to be. Although it is understandably difficult for universities to provide hands-on teaching for large classes, lecturing is a process that makes university culture difficult for Māori students because of the jarring contrast between lived experience with tuakana-teina relationships and the dominant competitive individualism culture (Bishop, 2005).

Kensington-Miller and Ratima (2005) suggested a tuakana-teina group, conducted by Māori for Māori, as a mechanism to support both Māori student and staff by encouraging āwhinatanga (to assist in kind), tino rangtiratanga (self-determination and cultural pride), and whakawhānaungatanga in the context of Kaupapa Māori. Tuakana-teina relationships are inherent in Māori culture, both parts are equally important and require trust from each other. A tuakana's role is to convey knowledge and listen to the needs of the teina, and teina's role is to listen and learn from their tuakana, and at times to challenge or re-think ideas. These relationships flourish with the use of reo and are centred on the preservation of mana [hapū], through manaakitanga (generosity), utu (reciprocity) and aroha (love). Individual gains are considered a positive by-product of community and cultural development that results from tuakana-teina relationships (Kensington-Miller & Ratima, 2005). While we need spaces such as these for Māori development through privileging reo and Mātauranga, a key point addressed by Kensington-Miller and Ratima is the benefit of collaborating ideas and entering spaces where people have mutual understandings.

3.3 Westernised policies and social structures continue to dismiss Māori communities and their Mātauranga

It is a concern of Māori communities that researchers may approach co-management with the view that knowledge is only useful and valid if it is testable by scientific method. This preconception is continuously validated by the imposition of science onto kaitiakitanga by both government and non-government researchers and organisations, often despite the opposition of mana whenua (Moller et al., 2009). Insistence to use science as the primary method (with the exception of a few cherry-picked Māori values) that measures, defines, and judges sustainability takes away from Mātauranga and it takes partnership and participation out of communities. Kaitiakitanga is reliant on community relationships, behaviour, and responsibility. Although these things can also be a positive result of community awareness brought about by researching local sustainability, the social frameworks that privilege western science also work to subjugate community voice, detracting from the importance of contextualised local knowledge. Previous experiences of researchers dismissing Māori knowledge may initially hinder potential co-management relationships between communities and researchers. However, once relationships are established, persistently working through conflicts and keeping decision-making authority within community-led projects

will broaden Pākehā researchers' understandings of conservation and holism and earn the trust of Māori communities. Community-led sustainability and resource-management efforts flourish as a result of these trusting relationships, ultimately leading to change within people that can strengthen research and promote a change in culture.

Genuinely reciprocal partnerships will incorporate the feedback of mana whenua and Mātauranga experts in the same manner they would scientific peer-review (Moller et al., 2009). Usually it's kaumātua who hold local Mātauranga within communities, and although they may be novices in scientific theory, method, and specialist language, it is them who pass down innate and contextual knowledge of practical expertise. This knowledge is overlooked by society when searching for solutions to sustainability, but enabling community knowledge of local areas to lead resource management can stimulate new perspectives that may lead to better freshwater policy (Whaanga et al., 2018).

In the majority of partnerships and projects guided by the Resource Management Act (RMA), stakeholders take advantage of the inexplicit language that allows Māori values to be undercut. Although the RMA requires the 'consideration' of Māori values, the language we use in research management facilitates assimilation and grafting of aspects of the Māori culture into an already established westernised framework. Critically, as has been discussed earlier in this research, western frameworks and Mātauranga frameworks are incommensurable. Kaupapa Māori concepts cannot be brought into an incommensurable system without losing the contextual substance that gives them strength. In continuously cherry-picking concepts from Te Ao Māori that it deems commensurable with existing western systems, the post-colonial system re-indoctrinates the dismissal of Mātauranga. Firstly, attempting to integrate certain aspects that seem 'fitting' into a western framework forces Mātauranga to speak through a foreign system (Memon & Kirk, 2012), a system that cannot comprehend Mātauranga in its entirety. Western frameworks section and decontextualise knowledge, and cherry-picking concepts from other knowledge systems is a literal example of this. Secondly, choosing *some* concepts ultimately dismisses *every other* concept as not warranting of respect. Mātauranga is predicated on understandings of interrelated and interconnected relationships between the physical and the spiritual, and also between knowledges and their whakapapa. Thus, all Mātauranga has importance and concepts cannot be fragmented from their whakapapa the same way universities divide schools of knowledge. Hearing and respecting only some ideas

from Kaupapa Māori has the effect of treating these concepts like tick-box statements, without having to make real changes to the system that attempts to make them commensurable.

Although kaitiakitanga and conservation come from different whakapapa, there is space where the two can come together to address shared concerns. Partnerships can form from shared desires for better resource management, however, concepts from Te Ao Māori cannot be assimilated into western frameworks without severing them from their whakapapa and diluting their mana. In regarding these concepts as 'honourable' but failing to give power to the framework from which this knowledge originates, post-colonial organisations continue to take away from opportunities that could result in true change towards substantial sustainability and kaitiakitanga over the unique biodiversity of Aotearoa (Memon & Kirk, 2012). This is essential for Aotearoa because continuous window dressing of economic drivers as beneficial, and the subjugation of indigenous peoples and their knowledge is what led us to this point of global environmental collapse.

Constraining Māori research within the Humanities essentially facilitates the practice of studying Māori people themselves, as was conducted on our ancestors and their remains, not about learning in a Māori way (Roa et al., 2009). It frames Kaupapa Māori research as not relevant or helpful to any system outside of the Humanities, and diminishes understandings of connectedness between ourselves, our communities, and our world. Furthermore, promoting publication in international journals in the way that PBRF does can decrease opportunities available for local and applied scholarship, which can be critical for local ecological concerns. As traffic is channelled away from mana whenua involvement, not only will local research will be seen as less relevant and necessary (Roa et al., 2009), but possibilities for collaborative community-researcher relationships at local scales may be inhibited. This could potentially undermine the intent of VM that seeks a better future through the engagement of Māori, and it could also mean that support systems and support staff for Māori entering into study remain fragmented and under-resourced.

3.4 Co-management in ecological spaces

Barriers to participation and engagement between Māori communities and sole western trained scientific researchers as a result of the effects of ongoing colonialism

can include: distrust by Māori due to histories of land confiscations and knowledge subjugation; a lack of understanding and/or prioritisation by researchers of tikanga and Te Ao Māori because of the institutionalisation of western ways of thinking; and disconnects in language regarding Te Reo and English and specialist language, but also differences in how we talk about our understandings of environmental issues. Barriers to engagement in modern co-management can negatively impact projects aimed at conservation and revitalisation and can also affect (and be affected by) Māori unsuccessfully completing degrees at university. The intergenerational trauma experienced by generations of Māori since colonisation has led many Māori to be distrustful of Pākehā organisations, and their first instinct in the face of an opportunity for external influences to come into their communities and land may be to shut it down. The mamae experienced by our tūpuna is something that is not forgotten in Māori communities. So in many cases, preventing external influences from coming into certain areas can ensure that whenua with immense mana and tapu may continue to be held in such states. Refusal or hesitance to engage with researchers must not be confused with a lack of understanding of conservation and biodiversity issues as a result of post-colonial impacts and climate change.

The effects of ongoing colonialism manifests distrust and negative connotations of scientific research within Māori communities. Researchers can be daunted or unsettled by the prospect of entering into Māori communities to engage in partnerships for fear of feeling alienated, especially in new settings such as marae (Moller et al., 2009). However, this problem doesn't begin in communities, it began with the normalisation and institutionalisation of western knowledge systems and the dismissal of Mātauranga. Researchers learn to enable these systems to privilege western frameworks by practicing in their research the marginalisation of community concerns and resistance to assimilation. It is this 'doing' of colonialism that causes conflict with communities, where they become the loci for blame when unwilling to engage with researcher-driven research. It is respectful that Pākehā without knowledge of local tikanga are guided by a member of mana whenua into these situations, but it's also important to recognise that those who respectfully initiate relationships *within* communities are more likely to be trusted and have Mātauranga shared with them. When it becomes clear to mana whenua that Pākehā researchers are genuinely motivated to assist community-led conservation, then collaborative space opens where ideas and skills may be shared. Relationships last when they have been built by talking and listening, kanohi-ki-te-kanohi (face-to-face), and by treating the whenua with respect when doing hands-on mahi. When disseminating their research,

researchers must also include communities/mana whenua as authors of the knowledge, setting and maintaining the precedent within academic communities that Mātauranga is a valid knowledge source and that contextualised knowledge must be used in environmental management.

In freshwater co-management it's necessary for community members to learn to use and understand scientific terms and phrases that are applicable to projects they are involved in, but if researchers expect Māori to do this then researchers must also be expected to learn and use key Māori terms and concepts. This can cause the planning and relationship building processes to be lengthened, but in Te Ao Māori these relationships and long-term vision are at the heart of kaitiakitanga. Howitt (2001) places deeper importance on the relationship that language has in understanding and articulating the world around us than on terminology itself. The way we speak can limit our perception, and make concepts that are innately important in *other* languages and cultures invisible. Critically in resource management, the way that post-colonial authorities spoke about the importance of economic export for New Zealand's success laid the foundation for western frameworks to undercut Māori values. We as tangata whenua do not talk about ourselves as separate to ecological issues, in fact we directly relate the health of our whenua to our own because they are one and the same. Although society has recently placed weight in including Mātauranga in many systems, the way we as a society still talk about Māori people and Māori knowledge continues to exclude them as the 'other', and prevents us from actually making real progressions toward better ecological and social systems. The western world is often surprised when indigenous people are articulate and knowledgeable in specialist language, the racist undertones of this assumption being that the *other* should not attain the same level of western education as the settler. This arises from the belief that English superior over indigenous languages, which are not as complex or useful. This assumption persists in our society when our language and knowledge is still positioned as peripheral to what matters, and when these are disconnected from local context and Te Ao Māori they can become commoditised. Furthermore, referring to water, land, and air as natural resources denotes the assumption that they exist solely to sustain us and be exploited, and dehumanises them as the living beings that Te Ao Māori understands them as.

Harvesting from freshwater and saltwater mahinga kai has been severely impacted for 50 years due to species decline as a result of commercial practices which hapū have no control over. The inability to harvest enough kai to feed whānau and pā directly

impacts the mana of communities, but deeper cultural impacts are often overlooked by Eurocentric worldviews. Severe depletion of traditional kai and impositions of harvest bans prevented mana whenua from collecting kai in traditional ways; and without the ability to exercise kaitiakitanga by practicing locally specific skills and nurturing Mātauranga, much of our traditional knowledge was lost and therefore not passed on to future generations (Dick et al., 2012). Rāhui can occasionally be placed over mahinga kai in response to tohu, and can also be placed in sequential patterns over time or permanently. However, in some places, rāhui that have been in place for long periods of time have been exacerbated by post-colonial impacts. Severe causes of environmental decline introduced by settlers created environments where mana whenua have been unable to harvest from mahinga kai whatsoever. Without opportunities to practice traditional harvesting, there is less opportunity for knowledge transmission, and the methods through which knowledge is passed, including specific kupu and local karakia and contexts in which they must be used, can be lost. Younger generations may have missed opportunities to collect, prepare, and eat kai from traditional harvest sites and visit tapu areas, and as a result of our relationships with the whenua being cut we can become less aware and responsive to the changes of poutiriao. The privileging of western science in conjunction with these missed opportunities to practice tikanga could have disastrous effects on the transmission of Mātauranga. Specialised local knowledge may be lost and Mātauranga Māori itself may become restricted to places where mana whenua fight to keep it alive, or fragmented, continuing to grow only within certain 'boxes' deemed valuable by Eurocentric hegemony, such as knowledge of populations that can be harvested 'sustainably'[15] for economic growth. Knowledge of these sites can be retained by kaumatua and from them we hear stories and histories of local people, practices, and mahinga kai. It is through this type of oral transmission that Mātauranga may be kept alive by traditional means. As the generations who are yet to become kaumātua, what we learn now determines what knowledge will be taken into the future and by what sets of values we function as a society. Therefore, we must learn from the experiences of our tūpuna and kaumātua now, as well as the teachings of tertiary education, to inform decision-making across all branches of society. This demands that education institutions be decolonised, and for Māori in the sciences to be surrounded by their own

[15] Remembering that sustainability and economic growth cannot occur simultaneously in Te Ao Māori. Here Māori values operate under the conditions of a dominant western framework, Mātauranga does not have the authority to direct how its knowledge is understood or implemented.

culture and teachings, as well as those of other cultures including but not limited to those of the western world.

Moller et al. (2009) conducted a cross-cultural research partnership centred around the harvesting of seabirds, and found that many different opinions of scientific research exist within communities. These communities are well aware of declines in seabird chick harvest, however, negative experiences with scientific researchers and western organisations and companies in the past have led some communities to be unwilling to engage with researchers again. Like other communities, the mātauranga and rangatiratanga of these people had been marginalised so that economic interests could be manifested through the colonial system in which they are prioritised (Memon & Kirk, 2012). While some organisations hunt economic gain by seeking to control fisheries, capitalist values are embodied in other manners as well, such as in the social capital of writing a thesis. Pākehā researchers have an important place in re-establishing community kaitiakitanga because their social capital gives them the unique ability to speak to and be heard by other scientific researchers in advocating the importance of Mātauranga to shared ecological concerns. However, this can only occur when their priorities are aligned with the community concerns, and their actions do not perpetuate the dismissal of mana whenua and their Mātauranga.

Many Pākehā are not familiar with local tikanga and can ask for a member of mana whenua to guide them onto marae and into their whenua, the same way people from distant tūrangawaewae[16] must be informed of their hosts' tikanga beforehand. However, what concerns many tangata whenua most is not familiarity with local customs, although is it important to abide by and respect these tikanga, but rather, that researchers will give no weight to concepts like rāhui, mana, and tapu (Moller et al., 2009). To come into sacred land, either through invitation or ignorance, and trample upon the mana of that whenua by acting outside of tikanga is abominable, and it is even worse to give no importance to how those actions affect the people of that land. This is why it is critical for Pākehā researchers to understand concepts like these, and that can only be done by teaching these core values of Te Ao Māori alongside the core objectives of fundamental and applied research.

Applied research is guided by values and is how many researchers and organisations make decisions, especially when there are multiple stakeholders. This means it is

[16] The place where one belongs/has a right to stand and reside through whakapapa and kinship.

useful to inform management concerning larger scopes and landscapes and different types of environments, but it can be limited in that it requires complex, widely applicable theories, and often precise, refined research can be too costly. Fundamental research in contrast is theoretically value-neutral. In avoiding researcher bias it can be useful for conducting small-scale testing to inform applied research. For example, a researcher may conduct fundamental research to test the levels of dissolved nitrogen and phosphorous in the streams in an area. In principle, the methods used to conduct these tests must be unbiased and therefore the results can give us objective data about nutrient level that we can then use to make informed decisions about fertilise use and land-use in surrounding areas. However, interpreting the results from this type of test is itself dependent on values. Research demonstrates that too much fertiliser use in surrounding lands can cause algal blooms in waterways that suffocate aquatic life (Morgenstern & Daughney, 2012; Joy, 2015). However, while many people agree that we should not immediately mine and exploit the land for all it's worth, what constitutes too much fertiliser has become a contentious issue. Some arguing that we should maintain current fertiliser use levels so we may continue to make a profit now so our children will experience financial comfort, but others argue that current fertiliser use needs to be extremely reduced so that many generations to come will experience ecological comfort, which is a bigger and more critical concern than profit.

Ecology is a science that looks to understand relationships of organisms and their environment through fundamental research, but the drivers behind this research are value-laden. If we change the way we understand Ecology, we can enable students to receive better education that involves applied and fundamental research, and teaches them how to negotiate the many (sometimes conflicting) values of stakeholders. It may also allow researchers to be more community-driven, rethinking our understandings of communities as extending beyond individual sections of land and boundaries. This type of thinking may allow non-Māori researchers to better empathise with Māori communities, and enable researchers to identify where they can assist communities in carrying out kaitiakitanga by utilising western tools and knowledge. If we change the way we understand Ecology, we also open space for our ideas and values to become more transparent in our work. Already students who enter Environmental sciences make this choice based on personal values, but currently, Ecology curriculum does not encourage students to be culturally, politically, and ethically motivated in their work to create social movement. Insufficient support in tertiary education to teach students to think in this way could be a contributor to the self-censorship and research suppression

experienced by Ecologists (see Driscoll et al., 2020). Using Mātauranga alongside western knowledge could enable students to expand their understandings of fragmented fundamental research, and consider how applied and fundamental research, as well as cultural and political concerns, inform management decisions.

In many cases, Māori communities may be willing and eager to engage with scientific research to gain more understanding of the ecology of taonga species. Mana whenua often embrace western tools when they can help educate local communities about things important to local whakapapa and to Te Ao Māori. One interviewee of the Moller et al. (2009) project expressed interest in learning about the life and activities of tītī (sooty shearwater, *Puffinus griseus*) outside of their breeding season. These kinds of knowledge may have been held by their tūpuna in previous times but may have been lost as an effect of colonisation fragmenting their relationships with whenua and wai. However, the interviewee clarified that it was not the place of researchers to validate with science the knowledge that she and her tūpuna had around the lives of tītī within breeding season on their manu (family birding territories), nor the rāhui placed centuries ago on harvesting outside of mid-March to late-May. This clarification was important for her because an assumption that is perpetuated in scientific teachings is that indigenous knowledge can be insightful but must be contrasted against 'real science' so it may be validated/to determine its truth (Jacobson & Stephens, 2009). This sentiment is echoed throughout my research because of its importance to co-management success. This treatment of Mātauranga again comes from the notion that colonisers were the 'superior race' and were entitled to subdue every living thing, so continuing to class western science as the standard to which all other knowledge must measure is ongoing colonisation of tangata whenua and their knowledge.

As well as learning more about taonga species' ecology outside of their own wāhi, mana whenua may also be interested in research that assists with their own understanding of kaitiakitanga, especially in relation to specific modern issues that our tūpuna did not experience. They may also direct researchers toward areas of particular concern, knowing that scientific research holds more weight in the eyes of many organisations who manage land and resources. While it is not ideal that organisations external to local communities have influence over mahinga kai, building reciprocal relationships between communities and researchers can aid in the development of community driven research, which can contribute to the task of decolonising resource management assumptions and practices.

As required by tikanga, kanohi-ki-te-kanohi relationships must be created before any conservation plans are made. This means that researchers must approach tangata whenua without the intention of controlling projects and interfering with kaitiakitanga. They must understand that their place is not determine what happens or doesn't happen on sacred land, nor to 'validate' Mātauranga – it is valid knowledge in of itself. From the Moller et al. (2009) co-management project came almost a 100% community support for the research into conservation of tītī. This occurred because mana whenua retained control over harvesting tikanga from the outset, and researchers proved themselves for years to be independent from government organisations and focussed solely on gathering information that would benefit kaitiakitanga and conservation of the taonga species. Mutual trust and respect was built over years and is essential to this long-term relationship and others. Māori researchers who are knowledgeable in western education and Kaupapa Māori have the ability to navigate these relationships and sets of values with more ease than non-Māori researchers, but they too will find it easier to do this when education institutes are no longer dominated by monocultural assumptions of teaching and curriculum. Engaging with communities in a way that is directed by Kaupapa Māori has the potential to create feedback loops, where education systems' teaching and curricula transform because the underlying assumptions of those entering and managing these systems are influenced by real-world experiences. This is why communal and societal responsibility for our whenua is crucial for social transformation as well as ecological transformation.

3.5 Te Reo Māori and Te Ao Māori rejuvenation relies on contextual understandings of local mātauranga and whakapapa, and supporting mana hapū/mana whenua

When I began this research, part of it was also supposed to involve the creation of a spreadsheet containing kupu surrounding waimāori (freshwater). Te Reo Māori is vital to the transmission of cultural values and Mātauranga, and learning and speaking one's native language is imperative to growth, wellbeing, and the ability to empathise with other indigenous cultures. However, reo must be learned and used appropriately. In the context of waimāori, this meant that even though I was interested in learning about all the kupu I had found, collating them into a spreadsheet took them out of context, and directly comparing them to English translations was appropriation of the mātauranga behind them. It was suggested that creating such a spreadsheet would

aid in the communication between Pākehā researchers and Māori communities when discussing freshwater management. While I appreciated the potential for improved communication and understanding, it also created conflict within me; people should not be learning reo from spreadsheets like this, especially not reo that should only be used in certain places or for special processes. Instead, reo should be learned how it has always been learned, kanohi-ki-te-kanohi and with tuakana-teina relationships. By creating this spreadsheet, even with the intention to learn from my research and create something useful to others, I was 'doing' the decontextualisation that I have resisted during my training at university.

Critical to the quality of language revitalisation is that society invests not only in language immersion within institutions (Timutimu et al., 2009), but also supports language regeneration in traditional settings, such as on marae and within homes. Here kupu and reo surrounding freshwater kaitiakitanga may be learned *in* local waters where Te Ao Māori ways of teaching and knowledge production are privileged. This is where the ability to practice kaitiakitanga and understand concepts critical to local tikanga is fostered in youth within familiar environments. Furthermore, those passionate about freshwater kaitiakitanga may learn about the rich vocabularies and understandings behind the reo of their hapū/iwi. For example, 'arawaru' is an onomatopoeic word describing the sound of running water that can be considered to be a lament for the dead, and in Whanganui, Arawaru is also a type of eel. Te Arawaru is also a poutiriao who (with Kaukau) brought cockles and other molluscs into existence, which later were given into the care of Hine-one. For Rangitāne, Te Arawaru holds importance as it was the name given to Central Normal School in 1999, named after a significant peak in the Tararua Ranges symbolising the eight-pointed star Whetu Marama. In old times, great fires lit atop this peak would signal the communities in the wider Rangitāne region that an urgent meeting needed to be held. Ngāti Kahungunu people regard Te Arawaru (a son of Rangi and Papa) as someone who was involved with the arrival of the ruru (*Ninox novaeseelandiae*) on earth and in the ngahere. Stories and histories such as these contribute to how we understand our place in the world in different parts of the country. This contextual information is important to pass on to young generations so that their practical and spiritual interactions with the living world remains mindful of cultural values, those who have come before them, and those who will come after them. Community-led approaches proactively emphasise intergenerational language recovery and transmission through action (Timutimu et al., 2009), and offers the opportunity for new speakers to learn the reo from their grandparents and community elders, which is critical to protecting local dialects and

knowledge. Although I won't discuss it in this research, involvement with community reo rejuvenation and being in close proximity to youth could benefit kamātua greatly, as a sense of purpose and cultural pride is woven within the health of the hinengaro (O'Leary & Were, 2017).

An important impact of colonisation upon Te Reo Māori is how the works of prominent Pākehā led to the generic use of names outside of the rohe in which they originated, often silencing or failing to recognise the importance of nuance related to locally specific variants (Wehi et al., 2019). An example of this is the tūī (*Prosthemadera novaeseelandiae*) – this name has likely become commodified because of the value in its pronounceability, thus 'tūī' has become recognised nationally but its other name, kōkō, is seldom used. Furthermore, variants such as kōpūrehe, kouwha, kōkōtaua, and kōkōuri that denote season and sex of tūī (Wehi et al., 2019; Best, 1977) are also rarely used. These variants have been pushed to the periphery of usage because they have less value to dominant Eurocentric frameworks; it could be argued that examples like this have not been dismissed because they still exist in advanced contexts, but the commodification of the language has forced these variants and others, that were previously used naturally depending on season etc., to exist only in isolated or advanced settings. Yet the English language also uses variants like this to understand stages of being, for example an infant, toddler, adolescent, adult, and elderly. Māori names and their variants give information about the , age, seasonality, sex, and activities and calls of living beings, including waterways. Although these qualities and environments may be similar among rohe, the names for a single species or even group of species can vary considerably due to dialectal differences and whakapapa – this can be seen in the huge variety of names than many native birds have between rohe. The pīwaiwaka (fantail, *Rhipidura fuliginosa*) is a well-known example of how variable names can be, with 19 recorded variants of the name. Wehi et al. (2019) discussed the importance of using and supporting appropriate dialectal names for native birds in both public and scientific contexts. They considered different mechanisms to repopulate public discussions and scientific reporting with rohe-appropriate Māori names – highlighting that communities are interested in the whakapapa behind how Māori bird names came to be and hunger for revitalisation of Te Ao Māori, even if they are unsure which version of a name to use.

The nuances of these names again highlights the richness that exists in Te Reo Māori and in Māori understandings of our world. Communities may be interested in learning about the whakapapa of this knowledge to have deeper awareness of contextualised

relationships in their rohe, and to recognise that mana whenua's experiences with environmental and cultural changes and difficulties can inform future relationship building between community and research/government organisations. The disuse of terms like these in social and ecological settings is an effect of the imposition of western understandings onto Mātauranga. Not only have western understandings of peoples' relationships with 'natural resources' and living organisms determined how we legally interact with the whenua in everyday life, but English and Latin names are more established in social and academic conversation. It's fairly common knowledge that plants and animals are given scientific names that are usually Latin or stem from Latin words, and these scientific names aid in communication. However, the dominance of these imposed names may limit our communicative abilities at local and global levels because their dominance potentially also comes from the underlying assumption of western knowledge being more 'legitimate/valuable/superior', that pushes indigenous knowledge and language to the peripheries of important legislative and social participation. It is important that we also value Māori names and their whakapapa in all of these contexts, because the richness of information and experiences that give rise to these names can communicate valuable ecological information, and help to re-contextualise our perceptions of the natural world in a Māori way, that is not commodified or directed by capitalist or individualist values.

The names given to bodies of water and the behaviour of water as it flows within them also developed from experience and whakapapa. Tangata whenua recognised similar patterns of water behaviour as they moved between rohe. It's possible that over time people learned how water flowing from one area to another interacted differently in particular areas and the kupu and language changed to reflect this expansion in understanding. These processes of language evolution in response to new understandings are important in the whakapapa of local dialect and mātauranga, and from this knowledge creation local kaitiakitanga could flourish. The use of Māori names in public and scientific contexts is important because they often convey information when the name is broken down into its smaller parts. Many rivers were given names descriptive of their environments or their characteristics, such as the Moawhango river in the Rangitikei, whose name was given because the sound of the water rapidly flowing between steep cliffs resembled the deep, hoarse (whango) call of the moa. Names would also appear as contractions of short phrases or deeper meanings, often with roots in local history and stories of atua and taniwha, or in the ecology of wildlife in and around the water. These descriptions are important in contemporary settings because they give us opportunities to re-explore and re-connect

with histories and knowledge of local areas. For example, the name of the Moawhango river tells us that the geography has remained fairly stable over time, and that people living here were likely here when moa were common and conspicuous if the similarity between their call and the sound of this river was pronounced. The calls of the moa are something that we will never be able to experience now, and formal education can never give us this experience. However, examples such as these denote the richness that exists in te reo and the complex relationships between mana whenua and their tūrangawaewae; we must learn to understand how important this kind of knowledge is if we are to better understand how an area's past will impact its circumstances now and its conservation and rejuvenation in the future.

Many mispronunciations and misspellings of names have occurred in Aotearoa as a result of settlers' ignorance of local histories and whakapapa, and this has produced conflict among and within communities. Ignoring the important part that language plays in understanding our environments also led councils (who were European in both membership and enterprise) to incorrectly spell Māori names/words in formal legislation, as was seen in the Turitea valley and Whanganui (wrongly called Tiritea and Wanganui). When spelt wrongly, these words have no meaning and their use perpetuated the oppression of tangata whenua and hapū values. When spelled correctly, Turitea means clear, bright water and Whanganui means large harbour/bay. In 2006, 55.4% of Whanganui voters voted in the referendum to change the name, with the majority of them rejecting the proposal. In 2009, the government ruled to allow both spellings of Whanganui to be considered 'correct' by Crown agencies in an attempt to appease hapū asking for the name to be respected as well as the voters who voted against the name change, with the expectation that the 'h' would be included by Crown agencies over time. These actions were justified by the courts as constituting democracy. However, in the views of tangata whenua, the referendum was to keep them 'in their place' as a small and insignificant part of the community (Waitangi Tribunal, 2015), and recognising both spellings as correct facilitated the continuing dismissal of Te Ao Māori. Mariana Waitai believes that those who continue to refuse the correct spelling "refuse to acknowledge tangata whenua status, cultural beliefs and values. They continue to maintain the colonial assumption that the only history for [the Whanganui] region began with the late arrival of the forebears and the only culture and values of importance are their own imposed beliefs and structures." (Waitangi Tribunal, 2015, p. 21).

The insistence of mana whenua and communities to reimplement the correct spellings displayed responsibility and connection to those whenua. However, further ignorance of dialectal features led to widespread dismissal and mispronunciation. Many people in Whanganui opposed the change in spelling with the argument that "that is how it's always been… that's how it sounds, why change it?" (see Sachdeva, 2015). In the Whanganui region, the dialectal way to pronounce the 'wh' sound is with an aspirated 'h', whereas in many other dialects the 'wh' makes a hard 'f' sound. This is why the word whanga is pronounced as 'w(h)anga' in the Whanganui rohe. The typo arose when settlers mistook the sound as hard 'w' when asking tangata whenua the name of the rohe. The conflict that has come about in contemporary times is an effect of settlers having the authority to determine what constitutes important knowledge, to define Māori language and knowledge, and of tangata whenua not having the social power to correct them. The many misspellings of Māori place names resulted from settlers interpreting our language, but if mana whenua actually had the authority over our own language that the Crown claims we do, the social structures and legislation in place would have been meant there was no hesitance or refusal to correct these misspellings once mana whenua spoke out to correct them. The confusion around pronunciation was a result of an initial act of ignorance by settlers, but this has been exacerbated by disconnections of mana whenua from the whenua. Even after mana whenua spoke to the importance of pronunciation in reconnecting people with the whakapapa of the rohe, arrogance within the community enabled people to insist on using the incorrect spelling. Arrogance and ignorance contributed to the majority of Whanganui voters voting to keep the incorrect spelling, and this circumstance works to continue silencing and marginalising the knowledge and histories of mana whenua. Tangata whenua have always pushed councils to recognise the rights they have over their own language and dialects, yet only recently have councils really begun to listen to their concerns. The history of Whanganui's name is an example of how hard mana whenua/mana hapū must work and how much time and effort they have to exert to be heard. While we cannot easily change the attitudes and actions of those who are arrogant, community education and seeing councils actively support mana whenua's intentions to bring Te Ao Māori back into the hearts of the community can help guide and inform others so that we may prevent the ongoing silencing of tangata whenua and Te Ao Māori.

Local dialects and tikanga developed from histories of living as mana whenua, and in many cases we are still having to look to kaumātua who are the only ones to retain local Mātauranga. Dick et al. (2012) conducted many interviews around the coast of

the North Island and found similar experiences echoed throughout many different communities. Kaumātua remembered times when their mahinga kai were plentiful and healthy – and so too were their cultures and peoples – until their whenua and ways of life were damaged by the effects of Eurocentric hegemony. As is the case with many kupu Māori, some freshwater kupu exist with dialectal variants and others exist purely locally, only to be used and understood in local contexts with local historic information. Although many kaumātua lost the ability to practice tikanga at their mahinga kai and within their communities, those lessons are not lost while kaumātua continue to share their knowledge with younger generations.

The success of kōhanga reo, kura kaupapa, and wharekura can be attributed to the culture and methods of teaching that are extensions of traditionally Māori ways of being. Teaching roles were originally given to kaumātua while parents undertook the administrative duties of early kōhanga reo, and this system reflected the communal efforts that were prevalent pre-colonisation, where entire villages raised children (Leoni, 2011). Kaupapa Māori is at the heart of teaching and revitalising Te Ao Māori, and the positive involvement of whānau continues to help negate negative socio-economic pressures that can impact students' educational success (Leoni, 2011). In kōhanga environments only Te Reo Māori is spoken, and at the heart of the reo is tikanga and culture. A specific benefit of kaumātua involvement within kōhanga, and later kura and wharekura, is that it likely aided in maintaining the transmission of local knowledge and dialect between generations that may otherwise have been lost.

Similarly to how local dialects are maintained through kaumātua involvement in education, their sharing of experiences and knowledge of broader cultural tikanga and practices is important for reviving our whenua ***and*** our connection with it. As Māori, researchers, and members of communities, we must also seek their knowledge at local scales for kaitiakitanga of freshwater systems. Reo is vital to understandings of the behaviour of local river systems and the transmission of this knowledge, and kaumātua influence in freshwater kaitiakitanga is critical to changing the way communities understand rivers as a part of the people rather than as resources and possessions. While it is important that general understandings of our relationships with poutiriao be taught alongside freshwater management at broader scales, society must support the yearning for younger generations to be able to learn about their local waters and reo within their own communities and in traditional marae environments. These contextual experiences promote responsibility and empathy for these living systems by teaching that we are one with our waters – ko au te awa, ko te awa ko au.

When rangatahi are able to learn within more traditional environments they are better able to recognise what is missing from their formal educations. The mauri of wai, the way their waters interact with their environments, and the particular types of life they support are understandings that are at the heart of kaitiakitanga. Local mātauranga evolves over time as experiences and errors create relationships between mana whenua and wai that inform kaitiaki how to protect, support and safely harvest from wai. Part of the Mātauranga of waterways that is not part of the western understandings of water are the names given to the different ways water behaved within systems and what they may be used for. There are names that may be used only in certain contexts or areas, while others may be more general across rohe and waterways. The English translations of many kupu awa may mean the "same" thing and denote a generic understanding of water. For example hōpua/kōpua, kōpiha/koropiha, kōpukanapanapa, kōroto, and papawai are all kupu that when translated into English mean pool or deep pool, but these kupu are not interchangeable because they have different meanings that should be used in different contexts or rohe. Education in Te Ao Māori within our own hapū creates better understandings of the richness of contexts and meanings behind these kupu, and the realisation that western understandings of water are not commensurable with our own. However, in many areas it's likely these kupu awa are missing in modern kaitiakitanga contexts due to the ongoing effects of histories of oppression.

The part of this reseach that involved collating kupu (see Appendix) was done with the intention to share kupu with others interested in freshwater kaitiakitanga. These descriptive freshwater kupu would have assisted in how kaitiaki reacted to, and interacted with, the behaviour of poutiriao within their rohe. I hope that those who understand the contextualised meanings emerge to re-enliven the reo of kaitiakitanga and re-envisage modern freshwater management in a decolonised system. I also hope that trustful and respectful relationships between mana whenua and research/government institutes evolve so that both parties are able to approach the other and contextual experiences and memories may be shared. This type of knowledge sharing can help create spaces where people from all walks of life can come together where shared values and goals for the future drive community kaitiakitanga.

3.6 Colonial understandings of language can create tension between Māori and non-Māori speakers

Just as no conservation scheme can be applied to every scenario, Te Reo Māori and tikanga cannot be taught as a generic blanket course. In order to prevent the standardisation of Te Reo, which risks reducing the complexities of knowledge and experience to simplified forms, local communities must be supported so that they may teach their own dialects, histories, and tikanga to new generations of speakers. Although there are still few first-language Māori speakers, the proportion of fluent Māori is increasing as a result of community commitment to reviving the language, and the success of community-driven kōhanga reo and kura kaupapa (Mahuta, 2011)[17]. With the confidence to speak in one's native language and with one's own dialect will come the confidence to complete tertiary education not only in Te Reo, but from a perspective that privileges the complexities and diversities of Mātauranga Māori.

In many cases, the interface between specialist language used in western science and Te Reo is a real cause for conflict. Scientific writing encourages concise and explicit portrayal of information, partly through the use of specialist terms. Simplification for ease of communication and brevity is also something that occurs in Te Reo Māori, for example, when I was younger my mum would tell me I couldn't go swimming in the river because it was paru (dirty). I knew that it was 'paru' because of the city's history of treating it as a sewage canal, but rivers also became paru after heavy rain and during flooding; in this context, paru means that suspended sediment and slips cause the water to become cloudy, making it dangerous to swim. Rather than seeing value in similarities between the complexities of specialist language and kupu Māori, racist preconceptions continue to dismiss this type as language as dumb, inapplicable, or inadequate. Conflict can arise when communities have little or no understanding of scientific terms and can become overwhelmed when expected to read highly technical articles (Moller et al., 2009), especially when researchers themselves expect that they will not (have to) learn anything from these partnerships. Further to this, mana whenua

[17] Another important effect of colonisation is the privilege that non-Māori experience which creates greater ease of access, not only to university, but also to be able to take Te Reo classes and learn about Kaupapa Māori. While it is a good thing that Pākehā wish to learn more about the culture of Aotearoa, many Māori cannot learn about their own culture in this manner (even though it's something they are entitled to and should be learning naturally) because they do not have the means and/or are too busy just trying to survive. Decolonisation of social and educational structures means this privilege needs to be recognised.

may find it tedious and irrelevant to read papers that they actually do not value because the information portrayed in said papers must itself be considered independent and unbiased, and must also source information from independent and unbiased sources. In Te Ao Māori, the reputability and applicability of any information and knowledge you share is often determined by the community and people from which it was learned (Moller et al., 2009). Personal experience with any information is also an important indicator of if/how to replicate that knowledge in different environments. While philosophy of science explains why it is important to understand and avoid bias, taking this understanding of knowledge production into Māori communities with the expectation that this is how research will be done marginalises the complexities and whakapapa of local community knowledge.

Barriers exist in both Te Ao Māori and the sciences that prevent certain terms or concepts from being fully understood by the other framework when full comprehension requires contextual or lived experience. This creates space where the two frameworks can share similar ideas or recognise certain qualities as similar to something they know from their own framework. However, these discrepancies must be respected as belonging to the one whakapapa and not integrated or absorbed by the other system[18]. An example of this is the many times I have seen the term 'mauri' be appropriated by non-Māori. They have tried to liken the understanding of the mauri of water to the calm or serene feeling that one gets when looking over a scenic lake or hearing the crashing of a moving river. I appreciate that Pākehā have the desire to understand what the term means by comparing it to a feeling that they know and value, but simplistic translations can have the effect of undermining the complexities of Māori knowledge as well as Māori authority over their own knowledge. It can be quite insulting when someone who isn't Māori tries to explain *to you* what this inherently Māori concept is and how they know it.

Community and mana whenua ownership of conservation projects means that Kaupapa Māori values can drive planning and decision-making, particularly the understanding that we must act appropriately now so that future generations and our whenua may flourish. There are iwi and Māori organisations that utilise Mātauranga

[18] Space must remain open for Māori to use western tools where it facilitates their own understandings, and for western-trained Māori researchers to return home and use this knowledge to help inform decision-making, guided by Kaupapa Māori. It could be argued that in using these tools for Kaupapa Māori purposes to adapt to contemporary concerns, the knowledge becomes part of the modern whakapapa of Mātauranga.

explicitly for the purposes of economic growth. However, there are strategies for Māori economic development, like those outlined by Ngā Pae o te Māramatanga (Smith et al., 2015), that seek economic development in ways that privilege community hauora and do not reproduce colonialist assumptions of 'development'. Economic gain within community-defined cultural parameters can contribute to informing concerns affecting people globally. The whakapapa of modern kaitiakitanga includes the decolonisation of systems that continue to marginalise indigenous knowledge and peoples. Co-management projects guided by community concerns simultaneously work to decolonise the way that we as a nation understand our relationships with the land, and decolonise the structures that society has put in place to keep tangata whenua in socially and economically marginalised positions. This is something that is important for colonised countries worldwide to understand, so that indigenous communities may be heard and wider communities can do work that needs to be done to address global concerns. Language barriers can draw out time frames and create larger workloads for both sides of co-management partnerships. This may initially seem like a disadvantage, but the extra time spent together working to better understand each other's views is a good start to establishing better well-rounded relationships. These relationships are critical to local and global ecological concerns, and the way we as a society understand the impact that colonisation has on dominating, appropriating, and exploiting indigenous knowledge is essential to addressing these concerns. As such, the way we *speak* about Kaupapa Māori and indigenous knowledge and the policies we create that continue to undercut tangata whenua and their values are just as important to change as the we approach specialist/simplified language in co-management partnerships.

The RMA requires consent holders to act in accordance with the Treaty of Waitangi and to consult with iwi and recognise their relationship with water. This language allows consent holders to ultimately act against Māori values if they are 'considered' to disagree with other factors influencing decisions. Crown agencies have the power to do this because even when Māori stakeholders are given 'equal' decision-making power, in the event of disagreement the Crown has overall decision-making authority (Davies, 2015). This inherent reluctance to actually share power cements the pre-existing framework of the 'other's' values as less worthy in any co-management arrangement, and establishes the ongoing effects of colonialism that determines what/whose knowledge counts as valuable at local and national scales. In co-management projects, indigenous communities are still expressing disappointment that western paradigms and processes still dominate indigenous frameworks; therefore, all

parties must be happy with their position and authority in these partnerships from the outset (Davies, 2015). In community-led projects, this can mean that governance arrangements deviate from what has previously been considered 'normal' and that stakeholders enforce stricter water quality limits or standards than those set by government organisations.

Just as important as what is said in policies is what isn't said, and, specifically, what they assume or is implied. Although water ownership is a widely debated topic in New Zealand and the Crown has not explicitly stated that there is a form of ownership over it, there is an underlying assumption that *someone* does own water because that follows on from the colonial assumption that 'civilised' people are entitled to own and control what we now consider natural resources (Salmond et al., 2019). The fact that this topic is debated, even when iwi/hapū are identified as having innate 'authority'[19] over water, implies that, were the voices of tangata whenua silenced enough, water would indeed be readily commoditised. The language that we use when we frame 'ecosystem services', 'natural resources', and 'freshwater' as things that are in the interest of humans to preserve follows from the utilitarian assumption that waterways are there to serve human purposes; and, according to Salmond et al. (2019), the process of abstracting, enclosing, quantifying, and pricing is exactly what leads to the commoditisation of 'the commons'. These processes occur without consultation of tangata whenua, and ultimately denies the need for reciprocity between ourselves and Papa that is an assumption of Te Ao Māori. Importantly, Salmond et al. (2019) recognise that freshwater policies such as the RMA and the National Policy Statement for Freshwater Management attempt to reconcile two different frameworks with no recognition of the power imbalance that continues to marginalise tangata whenua and their knowledge.

Through colonial exclusion, hapū planning for environmental management has existed outside legislative frameworks (Davies, 2015). The biggest benefits to conservation may finally occur when hapū/Māori researchers and non-Māori researchers share values and aspirations for Aotearoa, and when Kaupapa Māori directs our interactions with Papatūānuku. Community aspirations for local and national transformation may

[19] Tangata whenua do not consider themselves to have 'authority' over whenua and wai, but often use this word when communicating with Crown organisations because 'authority/dominion' over resources is a concept they understand. Mutual Kaupapa Māori relationships of caring and being cared for by Papa is not an assumption that is commensurable with capitalist frameworks, but Crown organisations recognise that tangata whenua should have a say in what happens to the whenua.

be directed by cultural and political values, and may also overlap with researcher aspirations for conservation projects. Giving the same support to social and cultural outcomes as we do to economic outcomes can contribute to achieving better community hauora as defined by local cultural parameters. An aspect of this is for governmental organisations to hold Mātauranga Māori in the same esteem as scientific research. This goes back to our rourou in the whakataukī at the beginning of this chapter. In Te Ao Māori, the health of the whenua is intrinsic to the health of the people, and many whakataukī are lessons to direct how we treat our whenua, or they stem from Mātauranga derived from our interactions with the whenua. The rourou (baskets) themselves are metaphors for sharing knowledge and resources, but 'nāu te rourou, nāku te rourou' is an instruction that tells us how to live and collaborate, and is a lesson in the generation of knowledge so that the people and whenua may be healthy. Te Reo Māori is a tool that communicates rich understandings of the world and our place in it because this knowledge has developed from contextualised experiences over many generations. If we live by the guidance to share our baskets of knowledge we will be able to pull from these baskets to inform decision-making and to generate new knowledge more relevant to contemporary ecological and social conditions. However, we cannot pull from all of these baskets until we decolonise social structures to allow all types of knowledge to participate. We as a society must understand how systemic oppression and continuing colonisation still affect communities to this day, and that the environmental issues we face are not separate to health, legislative, social, and educational concerns. Education and legislative systems must support Māori communities to teach within their own communities according to their own tikanga and histories. This is important to preserve the diversity of local Mātauranga and enable rangatahi to cultivate their sense of self surrounded by their own culture and language. When researchers or other members of the community enter these spaces they must establish mutual understandings and trust so that tikanga tuku iho (familiar customary practices) may guide decision-making and sharing of knowledge; and successful working relationships, friendships, and environmental practices can develop. Although there may initially be distrust because of long histories of injustices, this can be replaced by supportive relationships when non-Māori approach hapū with proper respect and etiquette and communities lead conservation and freshwater restoration and management. Ideally, universities, research institutes, and Crown organisations will become spaces where hapū and Māori researchers can come to, knowing that they will be heard and receive help in ways that are appropriate for them; this is enabled because we as a society would frame Kaupapa Māori understandings of our relationships with our whenua and wai as critical to our future.

Policies such as Vision Mātauranga have the potential to increase Māori participation in the Sciences, especially if university culture transforms to enable different knowledge systems to participate in the education of young researchers. More engagement in these spaces could increase the ability of tertiary institutes to create collaborative relationships and produce researchers that have better understandings of the complexities of real-world scenarios. This would enable researchers to utilise knowledge from different baskets and engage with communities more efficiently so that effective, complex solutions to contemporary ecological concerns can be generated and implemented.

Chapter 4: Kaupapa Māori stream surveys to briefly compare and contrast with MCI surveys

E kore a Parawhenuamea e haere, ki te kore a Rakahore.

Parawhenuamea would not flow if it were not for Rakahore.

Parawhenuamea (Poutiriao of freshwater), Te Pūtoto and Tuamatua (bedrock) are the tamariki (children) of Hine-tū-pari-maunga and Tāne. Rakahore is the personification of all rock, and his whakapapa[20] varies between stories. In one version, he is the child of Tuamatua and Takoto-wai (who is Te Pūtoto's daughter), but in another story he is the child of siblings, Te Pūtoto and Parawhenuamea. Te Pūtoto (pū = source, toto = blood) lives within the hearts of volcanoes and is the source of red magma. He fathered all taniwha (supernatural beings) and mokopeke (lizards), who live in the habitat created by the descendants of Parawhenuamea and Tuamatua.

Taniwha have long and complicated histories with tangata whenua. Many were and are the original kaitiaki of waterways in Aotearoa. All taniwha have substantial mana and can take the forms of many different creatures to move through different habitats. Typical forms can include birds, whales, reptiles, crayfish, to appear as humans, and even types of winds. Some hapū/iwi tell stories of taniwha who guided their waka to Aotearoa from Hawaiki, and made homes in Aotearoa's harbours and rivers. These taniwha are regarded as kaitiaki, continuing to watch over people travelling to and from coasts. They are respected by tangata whenua, who recite appropriate karakia when passing by and often leave a koha (gift). Some taniwha, such as Whāngaimokopuna, desired the company of people and would stay near them, others however, would kidnap women to be their wives. There are many stories of different taniwha eating people, often prompting groups of tangata whenua to hunt them in retribution. Taniwha might eat people as punishment for breaking or disrespecting the tapu (sacredness) of areas near rua taniwha (taniwha's lair), and some taniwha, such as Tutae-poroporo who avenged the death of a person he was fond of, discovered a liking for human flesh. Other taniwha hated people and so would eat them. When taniwha were helpful and protective over their people, mana whenua regarded them as kaitiaki. The tenacity

[20] In this context, whakapapa refers to genealogy.

and aggressiveness with which they protect their homes resonates in tangata whenua, who became kaitiaki in their own right. Powerful chiefs who were recognised as embodying the characteristics of taniwha could be referred to as such.

To become a kaitiaki is to be someone who takes up the responsibilities of caring for or protecting something/someone. This concept is something that occurs in the day to day lives of tangata whenua, and in fact, many hapū and communities did not use the term 'kaitiaki' in everyday conversation (Malcom, 2020). These mana whenua may have had a different name for people in these positions, such as hunga tiaki (that has a similar notion in Te Arawa as kaitiaki has come to have in contemporary environmental settings), or they may have different names denoting kaitiaki in different contexts, such as ahi kā, who is the kaitiaki of the marae. For this research I specifically talk about taniwha, kaitiaki, and kaitiakitanga associated with wai. Kaitiakitanga, as it has come to be understood in contemporary contexts, denotes not only a single person, but a people who fiercely protect their kāinga, like those taniwha. Kaitiakitanga is not something we choose to do as if it makes no difference either way, it is something that is innate within peoples who have strong connections with their whenua, and something that guides our interactions with the environment because of understandings of our connections with Papa and Rangi. We resonate with the behaviours and personalities of our poutiriao, and these understandings that are intrinsic to Te Ao Māori direct behaviours that reinforce connectedness between us and everything else.

4.1 Information from tikanga and pūrākau is contextualised in local Mātauranga

Rangitāne o Manawatū have many stories about the birth of the Manawatū and its tributaries, and the kaitiaki that dwell in them. Okatia was an ancient taniwha who became a huge tōtara tree. Taller and mightier than any other tree, Okatia rested upon the Puketoi ranges before the people of Rangitāne settled in the Manawatū. At this time, the east and the west were separated by a huge wall of mountainous rock, the Ruahine range. Okatia had only known the stillness of Tāne, but had heard tales of moana (ocean, sea) crashing and breaking on the shore. He became restless and yearned to travel to the moana to see it for himself. When his curiosity became too much, Okatia pulled his roots from the ground. Crashing over sideways he slid down the hillside, crushing everything in his path. Rocks, dirt, and tiny ferns became wedged

between his branches, and the deep canyon gouged in the earth behind him filled with water. The moana called to Okatia with an urgency he had not known before, spurring him to crash into mountains without considering their size, causing the rock to quake. With more determination, Okatia again crashed into the rock, fracturing it apart. He forced his way into the crack, widening it as he was pushed through by the water building up behind him. Battered and numbed with pain, he meandered his way to the sea, eventually creating the river mouth at Okatia[21] beach where he entered the sea with a pained, frenzied delight. Behind him, Te Āpiti (Manawatū Gorge) and the Manawatū awa were created.

Another taniwha, Whāngaimokopuna, affected the beds of the Manawatū awa. Unlike most other taniwha, he was like a pet to the Ngāti Rākau people of Motuiti marae near Te Awahau, Okatia. They spoiled him with the best cuts of tuna[22], but when the elders went away the tamariki were left to care for him. Unlike their elders, the tamariki kept the best cuts of tuna for themselves; giving Whāngaimokopuna only heads. Angered, Whāngamokopuna grabbed one of the boys and ate him. When the elders returned, Whāngaimokopuna spat up the boys remains. The elders became furious, causing Whāngaimokopuna to flee from their anger. He travelled inland until he could no longer hear the moana, settling at Taikoria[23] (tai = sea, kore-a = no more). Eventually he continued up through Te Āpiti, cutting through some hills instead of following the river the longer distance around them. This left behind a steep cliff that later became a defence of the Raikapua pā. He continued to the source of the Mangapuaka stream in the Whangai Range (now named after him), which had previously been occupied by another taniwha, Te Horearua. Whāngaimokopuna still lives in those hills, and when Rangitāne people from the lower Manawatū visit Dannevirke, he weeps for his old friends, creating mists that descend over the Raekatia mountain.

The reciprocal relationship between Parawhenuamea and Rakahore gives life to taniwha. Were it not for the mauri flowing between them, taniwha and other creatures in their care would be lost. Thus, taniwha protect their kāinga and places/things that are tapu, to maintain the mana and mauri within these systems and to protect them from negative repercussions that may result from interactions with external forces.

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[21] Now commonly called Foxton.

[22] Eel, of which there are at least 109 varieties (Gordon, Horton, & Harris, 2018).

[23] Another instance where the Māori name, Taikorea, has been subjugated by colonialist frameworks, causing the spelling of the name to change in legislature to something that does not reflect the original meaning of the word.

Many taniwha and mokopeke can be incarnations or personifications of fierce and dangerous atua, carrying their own tapu that needs to be handled properly (Roberts, 2012). They can act as tohu of tapu areas across Aotearoa, and there are many stories of taniwha creating, inhabiting, and guarding waterways. The whakapapa of these taniwha remembered by mana whenua of Rangitāne o Manawatū allows them to recognise the presence and wairua of taniwha as tohu in the systems of which they are kaitiaki. Some rangatira with significant mana had special and intimate relationships with taniwha, and were capable of calling upon their kaitiaki in times of need. Lasting relationships between kaitiaki-mana whenua and kaitiaki-taniwha allowed rohe-specific Mātauranga to develop, and the ora of people to remain linked with (and synonymous with) the ora of whenua and wai.

Kaitiakitanga over waterways is embedded in generations of historical knowledge held by mana whenua. Experiences of living with/as whenua have enabled them to have complex understandings of how healthy ecosystems felt, and of how the whenua has responded to changes in the past. People would observe changes in tohu (signs/indicators) indicating changes in the state of water between ora (good health) and pōhara (poor). A river in a state of ora depended not only on the quality and tohu of the wai itself, but also the ora of the surrounding whenua. After all, wai and whenua are interconnected and unable to be fully understood without consideration of the relationships between them. Hence, a tohu indicating the declining health of ngahere may be observed before visual changes in the tohu of the wai itself appear. For example, together, a healthy ngahere (forest) with abundant kawakawa (*Piper excelsum*) and a healthy community of tuna (eel) could signify a river system in a state of ora. However, a decline in the abundance of a tohu species, such as the kererū (*Hemiphaga novaeseelandiae*), could indicate the ngahere was moving into a state of māuiui (illness/disorder), and soon the water would be also affected. Western measures, such as the MCI index, can appreciate how changes in a tohu community may represent wider ecosystem changes. However, it is important to realise that tohu may not only be presented as obvious changes in individuals and/or species, but that taniwha regularly appear as tohu. Also, wider ecosystem changes are understood differently by western frameworks and Mātauranga, and can have different consequences on the peoples' relationships with the whenua. Often taniwha will appear before an environment experiences any negative symptoms. Their presence and wairua can speak to mana whenua indicating something awry, and their messages are welcomed and regarded with gravity.

In many cases, tohu were plants and animals used for kai or rongoā (medicinal purposes), and the decline of these tohu were some of the first indicators of a suffering system. Any observed negative changes in a tohu species should be remedied before the health of the whenua, and the mana whenua, move into a state of auē (grief). Kai is essential to tikanga and to completing many kawa. Sharing kai frees people from tapu (state of restriction), as well being a time to enjoy sustenance and companionship. Hence, the mana of a mana whenua is diminished when they are unable to produce a substantial haukai (feast) from their local mahinga kai to feed manuhiri (Ngata, 2018). Western frameworks can also appreciate the inability to produce kai as a measurable decline in ecosystem health, however, it cannot understand the severe consequences this has on the mana and wairua of tangata whenua. When we have feed our manuhiri, we honour our tūpuna and the skills they refined over thousands of years of caring for the earth and acting as one with each other and the whenua. Continuing these practices enhances all aspects of waiora; including physical and mental health, and the health of our relationships.

Maintaining the health and mana of the people began with harvesting these species in accordance with proper tikanga and kawa. Kawa are the principles and protocols that dictate why we must practice tikanga. Tikanga are practices that may vary between rohe, their realisations are embedded deeply within social contexts, both formal and informal. For example, the kawa of hongi is to share breath and exchange wairua in a gesture that signifies peace and ora; to share two hongi is a tikanga practiced in some rohe to greet the reciprocator and then their tūpuna. When we practice kaitiakitanga according to proper tikanga and understand the importance of the kawa behind those tikanga, we will not only be rewarded with abundant kai, but these practices also enhance our mana and relationships as iwi kāinga (local people, hosts), lets the wairua of our tūpuna flow into our relationships, and maintains the mauri of mahinga kai (site to grow or procure kai) and wider living systems.

4.2 Physical application of Mātauranga

The mauri of an ecosystem changes with the ora and is also impacted by events such as death and disease. In the creation of the universe, the original seed was filled with mauri, urging its shoot to emerge and experience life. Every living being as well as wind, rocks, mist, soil, and other parts of the land have mauri, and in Te Ao Māori, these too are living parts of our world. Mauri is the force that binds spiritual and

physical components of all things and is the capacity for life (Hikuroa, Slade, & Gravley, 2011). When actions external to the system negatively impact it, the mauri can be weakened which can potentially result in the separation of the physical from the spiritual (Morgan, 2006). This separation can kill a living being or cause the loss of capacity to sustain and support life. Polluting wai to the point of mauri mate severs links between the wai and all those it supports.

Water is experienced in many forms, including waimāori (freshwater), waitai (saltwater), kohu (mist), huhuka (froth), in people, and in kai. Within these different systems there are many embodiments of wai that interact differently with their environments and their mana whenua. In Te Ao Māori, our identity revolves around wai and to be in a state of (wai)ora is for all the wai inside a person/peoples/ecosystem to be held in a good state of mauri, and be appropriately tapu or noa (to be free from extensions and restrictions of tapu). Even in people there are different wai, such as toto (blood), waters of the womb, and Hine te iwaiwa and Hine te ngiangia (the waters of the brain). This can be seen in the equivalent meanings of the phrase 'Ko wai mātou' meaning 'who are we?' and also 'we are water'. It is from the action of Tāne te Waiora (Tāne of the life-giving waters) separating Papa and Rangi that waimāori flows; and the mauri that radiates from Papa, through Hine Parawhenuamea allows us to live on the Earth.

Wai has many natures and behaviours that respond to stimuli. It communicates its needs as a living being and our ability to comprehend the needs of the wai depends on the strength of connections we have with it (Ngata, 2018). It is this relationship of caring for the whenua so the whenua may care for us that is embedded within the core of kaitiakitanga and must be maintained. A waterway is healthy when: kai species have a strong whakapapa; kai is abundant and accessible for mana whenua collection through proper tikanga; the mauri of the waterway is vibrant and flourishing; and the biological integrity is intact. For kai to have strong whakapapa entails sufficient recruitment, mauri ora of the relationships between Parawhenuamea, Rakahore, and their descendants that create habitat, and a functional foodweb where the poutiriao charged with the manaakitanga of plants/animals maintain balance. From these principles, Awatere et al. (2017) developed Wai Ora Wai Māori to assess mahinga kai sites and to manage the health of freshwater systems.

Wai Ora Wai Māori was developed in Waikato-Tainui using locally relevant tohu and terms, such as hauanga kai (mahinga kai). Importantly, while these measures are specific to this rohe, they are embedded in widely held Kaupapa Māori values and

practices, meaning it is responsive to appropriate tohu and can be adapted to reflect needs/goals of hapū in other rohe. Developed through Kaupapa Māori approaches to knowledge production (by Māori, for Māori, with Māori), it offers hapū and communities a scientific tool where all members, including non-Māori, can work collaboratively to address ecological issues in ways that are meaningful to mana whenua. This is immensely important to this research because these kinds of tools and this way of creating knowledge opens spaces for collaborative efforts between academics and communities. The potential for real ecological and social benefit is huge when Kaupapa Māori leads to the decolonisation of oppressive frameworks and privileged knowledge. Wai Ora Wai Māori keeps decision-making power and standards and limitations within hapū and community determination; and there are processes and measures that can be appreciated by western-trained researchers. Community determination of kaitiakitanga transfers social power from those who have historically been the suppressors to those who's knowledge and culture has been subjugated. While this is important to bring Kaupapa Māori out of the periphery where the post-colonial hegemony has positioned it, it also means that researchers and hapū can more easily approach each other to discuss shared concerns, without the assumption that science and western frameworks will continue to be positioned as the framework that has the authority to determine what knowledge counts as valuable.

Researchers with scientific backgrounds may have experience eliciting expert knowledge, especially for imminent conservation issues when there is a lack of data (Martin et al., 2012). However, they often do not have experience respectfully engaging with Māori peoples and settings, nor a complex understanding as to why they may be met with distrust and hesitation. I believe the most critical aspect of Wai Ora Wai Māori is its potential to create space where researchers and hapū can engage collaboratively in a setting that privileges Te Ao Māori and the whakapapa behind kaitiakitanga. The intention to help create effective conservation projects and the tools and knowledge carried by scientists can be valued by hapū in settings that do not undermine their position as kaitiaki, nor the validity of their knowledge.

Expert elicitation encourages the minimisation of bias and ideally results in knowledge that can be incorporated into models to inform management (Martin et al., 2012). It aims to reduce self-serving expert judgements through scrutinising expert knowledge the same way the academic community may scrutinise methods of data collection and data itself. Importantly, western expert elicitation places value in lived experience as well as knowledge that results from research and formal education. This gives me

hope that western-trained researchers with a heart for conservation will be willing to approach mana whenua and will respect knowledge that is shared with them. However, in attempting to reduce bias and self-serving behaviour, researchers may ostracise mana whenua who have immense knowledge in the kaitiakitanga of their whenua if they appear to show bias against the colonial system and the knowledge that it produces. The specific histories of colonisation and extensive mamae it created cannot be dismissed, nor can its continuing effects on Māori be ridiculed as irrelevant to conservation issues. Often important Kaupapa Māori values cannot be quantified or incorporated into models, and so may be dismissed as irrelevant, tokenised, or attempted to be made commensurable with western framework. Memon and Kirk (2012) recognised that, even with recent efforts by the government to address colonial injustices, the dominant colonial framework still excludes indigenous knowledge. This materialises in ecological governance and management issues through the marginalisation of indigenous 'authority' and values in favour of economic interests that are incommensurable with Te Ao Māori; and in conservation with the pursuit of, and reliance on, scientific knowledge. Continual privileging of western understandings is enabled by the underlying assumption that indigenous knowledge is peripheral to 'real' scientific knowledge because *other* peoples are not capable of complex thought. We continue to privilege this framework which gives it more social power, enabling the dismissal of Mātauranga and other global indigenous knowledges. Continuing to privilege this framework perpetuates the silencing and exclusion of local knowledges and understandings of the world, and prevents spaces from opening where meaningful collaboration can occur.

Wai Ora Wai Māori identifies three taha (domains) – wairua (metaphysical), whānau (social), and kikokiko (biophysical) – each with two uara (attributes) that are measured either with āe/kāo or on a scale. Te taha kikokiko (under the attribute 'kai is safe to eat') can include multiple measures of different taonga species, for example the condition of kāeo/kākahi, tuna, and īnanga. The assessments are done by multiple assessors around different hauanga kai sites, giving scores that are then aggregated and averaged. Hapū and communities can set distinct ranges representing states of ora from excellent to poor, and where the final scores fall within this scale can inform stakeholders how hauanga kai sites have been impacted by anthropogenic change and restoration efforts. This tool in conjunction with western scientific measures can facilitate the introduction of more stringent water quality and harvest standards, based on common goals for ecosystem and mahinga kai restoration. I personally have reservations about attaching numerical measurements to Kaupapa Māori values that

aren't biophysical, such as mauri and whānaungatanga, because it attempts to make commensurable Kaupapa Māori concepts with ecological measures. In theory, ecological knowledge is value-neutral, and this conflicts Te Ao Māori understandings of these concepts in which our values are innate. However, I appreciate that Māori researchers and hapū can use scientific tools for their own purposes, especially when methods like these make communication easier between scientific researchers and the general public. Expert elicitation is a protocol used by scientific researchers (and can also Māori gather knowledge in a similar manner), and here it prioritises local Mātauranga and oral histories of mana whenua. By balancing scientific method with Kaupapa Māori in this way, it makes communication with non-Māori easier by denoting a sense of relativity and connectedness that Pākehā may not be familiar with, and it gives community the authority to determine their own goals and implement action.

Traditional knowledge held by mana whenua around mahinga kai is important to support the findings of the assessment tool, especially knowledge of natural ebbs and flows in abundance of taonga species. Oral history is the way in which Mātauranga has been passed down for centuries. Whakatauākī[24], whakataukī, karakia, whakapapa, pūrākau (narratives containing philosophical thought and worldviews), and mōteatea are some mechanisms through which this knowledge is carried. These mechanisms rely on language use for transmission; and often require historical, linguistic, and cultural context to understand the deeper meanings behind phrases (Whaanga et al., 2018). Reo is critical for hapū-led kaitiakitanga because its use in formal and informal settings promotes the decolonisation of social structures without actually having to argue for it – its use simply privileges Te Ao Māori. By directing kaitiakitanga through a Kaupapa Māori lens we dismantle the post-colonial hegemony. The complexities and layers of cultural transmission embed histories, traditions, senses of belonging and place in the world, and the drive to seek a higher level of knowledge in local kaitiakitanga. Through oral history, which requires reo, we collect information about tikanga that directly impacts how mana whenua interact with waterways. Language keeps cultures like Te Ao Māori alive, but oral tradition and cultural practices are often overlooked or undervalued as informed perspectives in spaces dominated by western frameworks. We need these *other* knowledges to direct how we as societies interact with our whenua if we aim for the simultaneous ora of our whenua and of all peoples.

[24] Whakatauākī are proverbs or quotes where the source is known. Whakataukī are proverbs or quotes from an unknown source

Addressing the incommensurability of colonial frameworks and Te Ao Māori is important to this thesis because it encourages decolonisation of freshwater 'management', focussing on spaces where traditional ecological researchers and tangata whenua can collaborate to develop community-centred, long term kaitiakitanga. Recent co-management plans and collaborative efforts in Aotearoa aim to give decision-making authority back to mana whenua, but often this occurs on the premise of incorporating Māori values into an existing management scheme that is western in origin (Memon & Kirk, 2012), rather than developing Mātauranga-led plans. The effects of colonisation can only be properly addressed when settlers critically revisit their own history and relationships with *others* to appreciate that their understandings are shaped by self-legitimising colonial ideologies (Huygens, 2011). Thus, restructuring monocultural hegemonies absolutely requires Pākehā to speak within their own circles, as indigenous allies, encouraging non-Māori to *hear* counter-narratives and recognise their own ignorance and complicity; specifically that colonial ideologies have an effect of naturalising indifference to *others'* experiences while espousing while espousing cultural values of justice and human rights (Huygens, 2011). This also occurs in natural resource management where science-trained researchers espouse values of objectiveness and data collection, dismissing cultural values of contextualisation and knowledge transmission through oral history.

This study aims to approach freshwater quality assessments from a Mātauranga perspective and identify areas where western monitoring methods can be beneficial to community/hapū-led restoration schemes and kaitiakitanga. This varies from standard resource management because the values that drive outcomes are directed by different whakapapa; where kaitiakitanga sees living systems of which we are a part and our behave as such, resource management sees commodifiable resources and espouses 'sustainable' exploitation of them. The hope for this kind of research is ultimately for the decolonisation of social structures, enabling our understandings of 'natural resource management' to transform in a way that values knowledge from many sources and puts into practice values directed by Te Ao Māori. Historically, post-colonial social structures and their underlying assumptions and values have enabled western-dominated organisations to maintain sole decision-making authority and prioritise economic gain over ecological health. Privileging economic gain over the health of people and whenua conflicts with Te Ao Māori, and many researchers and communities from different backgrounds are intensely advocating for this prioritisation to change if we are going to create substantial societal change to mitigate climate change and other environmental degradation. This work advocates for spaces to open

where communities and researchers from different backgrounds can come together to create and implement innovative, complex solutions to contemporary ecological and social issues, and force transformations of dominant societal structures.

4.3 Whakapapa of sites

The tikanga kaihaukai occurred in times of peace when hapū would visit each other to maintain good relationships and social connections. During visits, mana whenua would honour their manuhiri by providing extravagant feasts. If the manuhiri (visitors) could not reciprocate with an extravagant feast when it came time for them to host, they offered land instead. The Mahuraunui stream flows through a block of land called Rākautātahi near Norsewood, which was given to the chief, Te Whatu-i-āpiti, by another chief, Te Angiangi, when he could not reciprocate in kind with the cultural practice of kaihaukai (H. Morris, personal communication, February 14, 2020). Later, when Te Whatu-i-āpiti was an old man at the time of another kaihaukai (called Uaua Tamariki (The sinews of youth)), food was procured by younger chiefs, including Hikarerepari, Rangiwhakaewa. The Rākautātahi block was given to Hikarerepari as a gift for his role in gathering food (called whakaaraara raumati).

On the Rākautātahi block there are a few pā (kāinga, settlement), three are along the Mahuraunui stream, which is relatively short. The history of hapū movement as accounted by mana whenua is important to know as it is a part of the whakapapa of not only the people, but the land. The first pā (kāinga), belonging to Hikarerepari, was called Tawhitinui, containing a whare named Tawhirirangi. In time, this whare was lifted and moved to the second pā, named Te Koru, belonging to Tūtaua. When a mate urutā (flu epidemic) hit Te Koru, many people died. As a result Te Koru and the whare Tawhirirangi were deemed kino (bad/unliveable) and Tūtaua moved the people to Te Kehou; the pā tūwatawata (fortified) at the confluence of the Mahuraunui and Mahurauiti streams. A new whare, Tawhirirau, was built at Te Kehou. Upon the death of Tūtaua, the whare was passed to his son, Rangitotohu. Rangitotohu stayed at Te Kehou for many years. He saw his tamariki and mokopuna born at Te Kehou, but when Te Āmio Whenua (war party of Waikato and Tūwharetoa) was moving through Hawke's Bay, his people migrated to the Manawatū (ca. 1850). People had been buried at Te Kehou from the time of settlement, but when peace was restored 16 years later the people did not return to Te Kehou kainga; instead returning to other areas of the Rākautātahi block.

The history of the movements of mana whenua across this whenua is important because it contextualises the connection the Mahuraunui stream and the people in their experiences. To my knowledge, all of these kāinga are situated within what have become privatised sections of farmland, and the whare removed. The mate urutā (flu epidemic) and urupā may have changed the mauri of the waterways in this land and altered how mana whenua interact with the wai; but the severing of connections, first by Te Āmio Whenua and then by land privatisation, has had significant impacts on contemporary interactions with the wai. As such, some of the history and knowledge of this particular waterway's kaitiakitanga may have been lost from the forefront of mana whenua's expertise. However, Te Kehou is still part of the current conversation between mana whenua, local environmental groups, and landowners. There are efforts to re-introduce the Mahuraunui and Mahurauiti streams to local kaitiakitanga through community visits to the water and pā, and teaching the histories so that they may plan for the future. Land privatisation has created challenges that are not unique to these mana whenua, but the restoration of these connections is important to mana whenua, and this reconnection will ultimately benefit the health of the people and the whenua. Also of importance to the whakapapa of these mana whenua were the new connections and relationships generated though migrations to other areas of the Manawatū. One group of mana whenua moved to Motuiti (Okatia), giving them important connections with the kaitiaki Whāngaimokopuna who migrated from Okatia to Mangapuaka (Dannevirke), which is another stream that's important to hapū in this area.

The Turitea stream flows from the northern end of the Tararua Ranges, through Aokautere before its confluence with the Manawatū. Aokautere is a suburb in Palmerston North named after the Rangitāne chief, Te Aokautere, whose people settled in the fortified pa, Te Motu-a-Poutoa (named after the tupuna, Poutoa, and now known as Anzac Park), and Te Kuripaka (Matheson, 1986). Te Kuripaka is situated near the mouth of the Turitea stream, near the kāinga, Mokomoko, which was a site of horticulture and trade for hundreds of years before being abandoned after an attack (Palmerston North City Council, 2020). The name Turitea means clear or bright water, presumably given due to its purity as a result of most, if not all, of its catchment originally being covered in native bush.

Gordon et al. (2018) identified the Turitea stream and the He Ara Kotahi walkway as a valuable place with important history enabling Māori to express their cultural world view with a focus on reconnection between the mana whenua and the whenua. The

confluence of the Turitea and Manawatū has become a primary site to reconnect kaitiaki with their wai, and increase community responsibility for the waterways and whenua through education around the enduring relationship between tangata whenua and tuna. Valuable aspects of the Turitea identified by Gordon et al. (2018) include: its mauri, aquatic biodiversity, being the main water supply for Palmerston North, and an area for recreational activities and fishing. However, land use in its immediate surroundings and its reduced flow means that it is sensitive to, and assimilates, high levels of pollution.

I had four assessors complete a Kaupapa Māori survey in the same areas as the four stream sites where I conducted my MCI surveys (Figure 4.1). In addition to this, I also asked mana whenua about the history of hapū movements around these two streams and what individual experiences of the stream systems they had to inform me of historic and recent anthropogenic impacts on the waterways. I aimed to compare the results from the two types of surveys in order to describe the overlap between the western and the Māori-value led methods of assessing stream quality. I expected the results from both surveys to suggest the homogenous Turitea site was in the worst health, and the heterogenous Mahuraunui site was in the best health. I also expected the Kaupapa Māori assessment to consider the mauri/health of the entire ecosystem when assessing stream health, whereas the MCI surveys consider only macroinvertebrate community composition. This could have meant the assessors identified plants used for kai or medicinal purposes, native bird populations, the smell of the water, and other such observations to influence their perception of the ora of the stream. I also expected that the surveyors' assessments of stream health would be contextualised in the whakapapa of the areas, as well as their current connection with mana whenua and wider communities; and that they would use quantitative information and scientific tools, such as the MCI, to help inform, but not direct, their assessments.

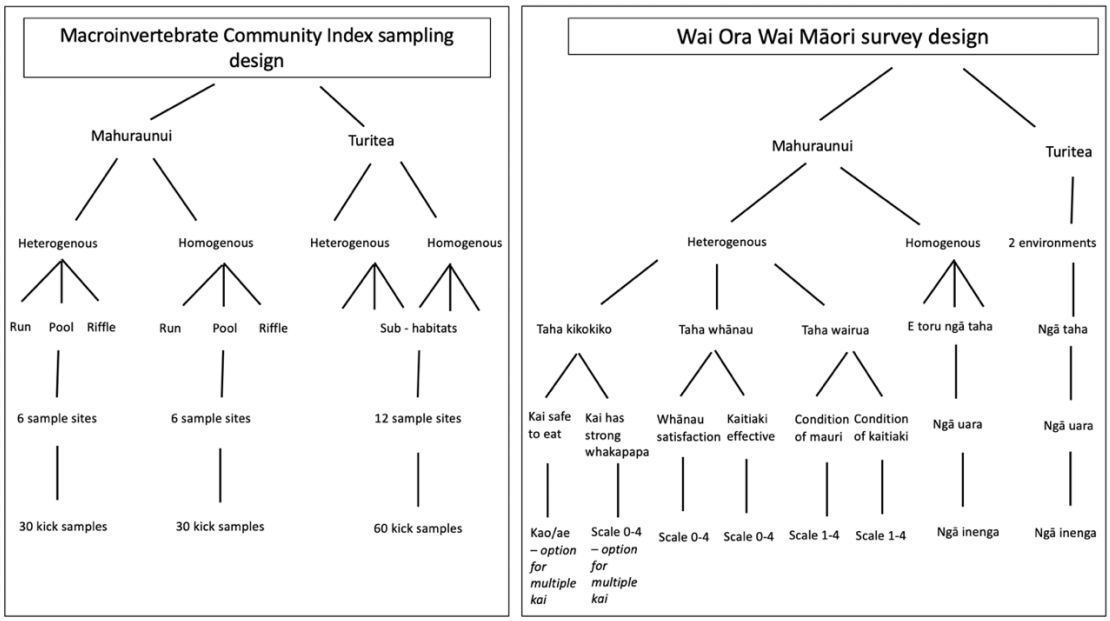

Figure 4.1: Survey designs comparing the MCI kick sampling design and the Wai Ora Wai Māori survey designs.

These surveys were conducted on the 23 January 2020 between the hours of 10:00 and 17:00. All of the four surveyors were affiliated with Rangitāne and live in the wider Dannevirke area. The five of us drove to the Mahuraunui sites first, where some oral history of the area was given by a member of the Ngāti Mārau hapū, we then completed the surveys and travelled to the Turitea stream to do the same. The assessors were given the same questionnaire to complete at all four sites, I did provide a brief oral history of the recent changes to the Turitea stream, as the surveyors were not familiar with this area.

The survey followed the same outline as in the Awatere et al. (2017) tool, where the two uara of each of the three taha were considered. The sites received points ranging from 0 to 4 for each answer based on different aspects of stream health. The scores for each complete site survey were aggregated and averaged, with the lowest possible score being 2 and the highest 21. I based the final site states, from excellent to poor, on the suggested band widths provided by Awatere et al. (2017) – where a final score from 17-21 suggested excellent mahinga kai site health, 12-16 suggested good health, 7-11 suggested fair health, and 2-6 suggested poor health. In addition to this tool, I left space for additional comments, and also asked three extra questions. I asked if the site was culturally significant and how, and what, if any, goals did mana whenua have for the awa and site. I asked what hapū relevant tohu (indicators) of human induced changes were present, e.g. mahinga kai affected, bird life altered, water body changes.

Finally, I gave 27 Māori descriptors of freshwater attributes that may have been applicable and asked if any were relevant or if they had other kupu awa they would use to describe the water and system.

4.4 Results

Both the Turitea and Mahuraunui homogenous sites scored poor ratings according to the average scores of the Kaupapa Māori mahinga kai assessment, with scores of 2.5 and 6.5 respectively. The Turitea and Mahuranui heterogenous sites were both fair sites according to the Kaupapa Māori assessment, with scores of 10.5 and 8 respectively. Significant loss of tuna communities was a tohu of negative change in the Mahuraunui, as well as the access issues and reduced ability of mana whenua to practice manaaki whenua (caring for the earth). Changes in the water course itself, including reduced flow and riparian vegetation removal, were also signs of anthropogenic change. Both streams were much shallower and flowed more slowly during this survey than when I collected my stream invertebrate samples.

We could not say for sure what hapū relevant tohu would suggest anthropogenic impacts in the Turitea as our assessors were not familiar with the history of the stream. The assessors agreed that the stream would likely have been important to mana whenua historically, given its closeness to the Manawatū and how different the flow would have been before it was dammed. The smell and the sound of the water were factors that influenced the perception of the mauri of both streams, as did the presence of weeds and exotic plant and animal life. There was an abundance of native seedlings and native birds in Bledisloe Park (Turitea heterogenous site), and tohu plant species, such as kawakawa and rongoā, were abundant and in good condition. The accessibility of both sites of the Turitea were noted by the assessors as potentially important factors for the ability of future generations to reconnect with the whenua. The assessors didn't engage with kupu descriptors as much as I thought they might have.

4.5 Discussion

At the Mahuraunui heterogenous site, there were blackberries (*Rubus fruticosus*) and plenty of native vegetation. Here the mauri of the water itself was in the best condition of all four sites. The water was clear, had a nice sound, didn't smell bad, and the fish and invertebrate life in the water was visible. The mauri of the entire site, however, was considered to be in poorer condition than in Bledisloe Park because of its disconnection with mana whenua. Although the landowners were more than happy for us to access the stream, at certain times of the year the track to Te Kehou is planted with crop, making it inaccessible by car. This would make it hard for mana whenua to carry out restorative efforts around the stream, and impossible for tamariki and kaumatua to visit Te Kehou and the Mahuraunui stream when crops are growing. Access is critical to te taha whānau and te taha wairua for kaitiaki to effectively practice tikanga and collect kai, and for mana whenua to reconnect with the whenua, water, and their taniwha/kaitiaki/tipua. The heterogenous sites in both streams had various tohu indicating their mauri was still intact, despite anthropogenic impacts. This means both heterogenous sites would have the potential for environmental restoration and to uplift and, be uplifted by, community hauora.

While these two sites received the same 'fair' rating, the Turitea heterogenous site scored higher than the Mahuraunui site, disagreeing with the results of the MCI survey where the Turitea was of poorer ecological condition. This also didn't support my hypothesis that both surveys would agree that the Mahuraunui heterogenous site had the best health. In Bledisloe Park, at the Turitea heterogenous site, the assessors observed fruiting kawakawa/rongoā, plenty of native seedlings and mature plants, and tūī (*Prosthemadera novaeseelandiae*) and fantails (*Rhipidura fuliginosa*). These tohu suggested the mauri of the ngahere in Bledisloe Park was in a better condition than the rest of the sites, and its accessibility and presence within university grounds could provide a good place for people to learn about Māori healing and reconnection with Tāne Mahuta in a modern setting. The surveyors did state the stream alone at this site could have been described as "mauri noho due to pollution from the urban environment"; meaning there is still mauri within the stream, but its life-giving capabilities had been diminished. In the context of Mātauranga Māori it is important to consider the mauri of the entire ecosystem. The rejuvenation of the stream would move the mauri of the system from a state of mauri oho/piki (improving/expanding) towards mauri ora (flourishing).

As the Turitea assimilates different kinds of pollution, especially close to its confluence with the Manawatū, this would require significant changes to the land use in the wider

catchment and community education. The dams, bank-straightening, run-off from the university and agricultural land, possible continuing leaching from an old dump on Massey land, and run-off from main roads crossing the stream are all substantial sources of pollutants and changes to the nature of the Turitea stream. The 'Urban Eels: Our Sustainable City' initiative (Gordon et al., 2018) has begun to make progress towards rejuvenating the Turitea, through highlighting the relationship between tuna and mana whenua. Importantly, the initiative grounds its goals and monitoring in Māori tikanga, including placing a rāhui on an area targeted for restoration, revitalising the transmission of knowledge through oral history, and emphasising the importance of mauri. 'Urban Eels' focusses its efforts near the mouth of the Turitea which unfortunately cannot become as healthy as possible while upstream land-uses remain unchanged. It is important that mouths of rivers and large tributaries, such as the Turitea, receive restorative attention as they often act as habitat and passage for juvenile tuna and many native fish moving inland from the sea. However, if upstream land-use is addressed and managed properly, the river mouths could experience more beneficial change than if restorative efforts are focussed solely at their mouths, where essentially the 'sum' of all catchment land-use impacts are felt.

Understandings generated from western scientific research have contributed to better public understandings of the relationships between dissolved nutrients, sunlight, and vegetation. That is, with riparian vegetation removal, more sunlight can enter streams and encourage algal growth if there is increased levels of dissolved nutrients. Although our tūpuna did not face the same land-use concerns resulting from fertiliser use as we are currently facing, mauri and ora of rivers are positively influenced by healthy forests and native vegetation and tohu, as portrayed by the participants' observations. The understandings that healthy lowland rivers rely on healthy ngahere are reflected in both baskets of knowledge. While this is just a simplified portrayal of a single aspect of the interconnected relationships between wai and whenua, it is an element of freshwater restoration that both knowledge systems can speak to and engage with to inform communities and collaborate to create plans that meet community needs.

Both assessments agreed that the Turitea homogenous site was in the worst health of the four sites. There were some rows of young harakeke (*Phormium tenax*) along its banks suggesting recent riparian planting efforts, yet one of the assessors described the mauri of this site as lonely and unloved. Every aspect of this site had been impacted negatively by surrounding land use: the waterway itself, the bird life, the riparian vegetation, and any possible mahinga kai. The close proximity to the road,

bridge crossing overhead, and nearby agricultural land were factors described by assessors as being “unconducive to any aspect of mauri piki (increasing condition)”. Despite being extremely accessible to the public, the surrounding Massey University land may create obstacles for community restoration efforts. It is possible, however, that restoration of areas as accessible as this could become a priority if catchment land-use becomes moderated by hapū-led kaitiakitanga.

I wasn’t able to get in contact with hapū to ask about the history of mana whenua movements around the Turitea and any existing goals for restoration, despite living in Palmerston North. I found some information online about post-colonial relationships with the stream, mostly since the erection of the original dam in 1907, and very little history of the stream pre-colonisation. There appears to be a disconnect in the contemporary rangatiratanga with the Turitea stream, and the histories of mana whenua. This uncoupling itself is a significant factor affecting te taha wairua and te taha whānau in the Kaupapa Māori tool, and reflects losses of intimacy between mana whenua and whenua and wai. Connections with the wai are reduced with a lack of physical proximity after privatisation, main road construction, establishment of the university; and spiritual intimacy is reduced when mana whenua are unable to carry out cultural practices and care for their whenua once their physical connections are severed. One of my supervisors is mana whenua of the Rākautātahi land (Dannevirke/Norsewood) so was able to connect me with potential assessors and provide me with oral history of the area. From this initial contact, I was able to create relationships expanding beyond this research which is something that I was unable to do in Palmerston North. The creation of networks like this is not specifically addressed by Wai Ora Wai Māori, but it is a concept important to Te Ao Māori; that hapū and whānau support and share information with each other to strengthen and maintain relationships, and potentially enhance kaitiakitanga.

The use of this tool was slightly different from how it was intended. Wai Ora Wai Māori is supposed to be used where there was/is mahinga sites, but I did not have appropriate information about specific mahinga kai along these streams. However, I do think it was appropriate to use the tool in this context because the results were conducive of the intended outcome; to describe overlaps between a western and a Kaupapa Māori tool for assessing stream health. While mahinga kai are specifically assessed by Wai Ora Wai Māori, they will only flourish if the entire ecosystem is in a state of ora, especially sites in the lower reaches of catchments, like that focused on by ‘Urban Eels’. I believe the most important aspect addressed by Kaupapa Māori tools

that is not considered by the MCI index is the intimacy of connection between mana whenua and wai. Tools grounded in Mātauranga Māori understand 'unobservable' concepts that contextualise ecosystem health and kaitiakitanga in the experiences of the people. They make no distinction between the ora of a people and the ora of their whenua; they are one and the same. Kaitiakitanga involves both recognising and responding to changes in environments (including people), and use whakapapa, their local understandings of the behaviours of their poutiriao/kaitiaki/taniwha/tipua, and listen to wairua when it speaks to inform decisions. This is where the capabilities of tools grounded in western frameworks are deficient in 'measuring' stream health, especially when they extrapolate conclusions from very few sources of information.

Science attempts to understand systems by creating hypotheses that are empirically testable, and conservation/management usually requires data be appropriate for fitting to models. Research is often driven by the mindset that knowledge which cannot be quantified or measured is unsatisfactory or insignificant until it can be tested[25]. Yet indigenous frameworks place extreme value in elements that simply cannot and should not be empirically measured. The Wai Ora Wai Māori tool incorporates numerical values in order to communicate the movement of Māori values and ecosystem rhythms along scales of mate (dead/death) to ora (flourishing), rather than existing in distinct stages. The numerical results of Wai Ora Wai Māori assessments are similar to the MCI index, in that where the result falls within a range indicates a general idea of ecosystem health. The understanding of the MCI metric is impoverished compared to the Wai Ora Wai Māori, because it only accounts for enrichment and sedimentation as forms of pollution. Wai Ora Wai Māori accounts not only for biophysical changes to (individual) kai species that anthropogenic pollutants create, but also for pollutants of Te Ao Māori. These include loss of reo (language) and whānau/hapū connectedness to Papa and our tūpuna; 'unobservable' elements such as mana, mauri, and tapu; and the importance to tikanga that distinct mana whenua knowledge has, which will be lost if not taught and practiced. These conceptual differences lead indigenous knowledge and kaitiakitanga to be considered peripheral to the 'real' information that science can give us, and thus be undervalued in western management. Western scientific tools

[25] William Thompson (Lord Kelvin) was a Scottish, mathematician, engineer, and physicist who made significant contributions to science and influenced scientific thought. He said that "when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge but you have scarcely, in your thoughts, advanced to the stage of science."

may lack emphasis on these elements of kaitiakitanga, but they have an important place in advising management partners about specific pollutants of local waterways, so that collaborative efforts can create responsive and appropriate plans. Although aspects of Mātauranga have developed from 'research' (testing knowledge to improve understanding); I would argue that to consider indigenous knowledge as 'science', if only empirically testable and modellable information is valuable, would be to diminish the mana of Mātauranga itself.

The collaborative management in Waikato is a great start to the process of restoring relationships between tangata whenua and whenua, but more needs to be done to improve the relationship between tangata whenua and the Crown. Dingfelder (2016) thoroughly researched co-management case studies and found some important reoccurring themes. Three of these I consider to be fundamentally important to this research. Firstly, it is important to tangata whenua for relationships between them and Crown organisations to be established ***before*** freshwater planning is initiated. To this day the government engages inconsistently with hapū/iwi; their release of the report 'Our Freshwater 2020' without consultation of hapū, iwi, or dedicated Māori organisations was criticised by chairperson of Te Wai Māori, Lisa Te Heuheu, as simply "not good enough" (Te Wai Māori, 2020). The current language of the RMA allows consents to be granted to organisations who approach iwi for a single consultation, even when meetings occur without the intention to perceive or accommodate hapū/iwi values, and those consents can be granted without (and irrespective of) hapū/iwi approval (see Ruru, 2011). Furthermore, organisations often understand their responsibilities to the interests and values of Māori communities, but a lack of political commitment and capacity enables minimal to no iwi consultation to occur regarding consents and Māori values to be undercut (Jefferies & Kennedy, 2009). Entering initial hapū/iwi consultations with the intention to develop management plans together and under equal partnership portrays respect. It also signifies willingness and desire to commence successful, lasting relationships developing from open conversations and mutual trust and respect. However, once these relationships are established, there has been difficulty reconciling western and Māori worldviews and values in planning processes (Dingfelder, 2016). Incommensurability lies at the core of these disagreements. Mātauranga cannot be wholly integrated into western frameworks. This happens because Māori values lose their mana when people attempt to integrate them into an incommensurable existing western framework. Māori values and history must be recognised and respected across disciplines.

Secondly, both parties must value the face-to-face and broader partnerships. By 'face-to-face', I mean to seriously listen to and value the opinions of those partaking in discussion. However, by the term 'broader' I am denoting the partnerships that may be less obvious to those from a scientific background, but innate to an indigenous participant. That is, once a researcher begins a partnership with tangata whenua representatives, they also create partnerships between themselves and the mana whenua as a whole, their tūpuna, their hapū, and (more obvious) their iwi. To respect these broader partnerships is to recognise that we as Māori are not a singular voice, that our goals lay in long-term time frames, and to respect that mana whenua must live in managed areas and management decisions will impact not only everyday life, but also ability to carry out tikanga.

Thirdly – governance arrangements matter. Membership and influence of stakeholders in decision-making groups will affect the ultimate perspective of management plans. Whether a western or Mātauranga Māori framework is privileged will impact movement into future socio-ecological scenarios. Will we actively decolonise resource management and wider social constructs, or will we as a society continue to operate under the belief that colonisation and Eurocentrism were gifts that all Māori should be thankful for as they 'progressed' our 'civilisation' (Smith,1999)?

A promising theme across these case studies was governments recognising the special relationships between tangata whenua and the Crown, and recognising that iwi/hapū are partners in kaitiakitanga of freshwater restoration ***and*** planning processes (Dingfelder, 2016). If we are to change freshwater management for the better, we need to accept and embrace the oral history of kaitiakitanga and its tikanga; continuing to open spaces for collaboration across disciplines. The ora of our people is innately connected to the ora of our waterways; so the prosperity of the Māori culture, Māori people, and our way of life must lie at the heart of kaitiakitanga and freshwater management. Ngata (2018) highlights this when differentiating between kaitiakitanga and conventional perceptions of conservation that lean towards pristine, unaffected ecosystems. She asked tangata whenua how they know when the whenua and wai is in a state of ora – their answers unwaveringly incorporated their relationships with the land.

'Our freshwater 2020' highlights the impacts climate change and pollution have on our vulnerable waterways and acknowledges that our wellbeing and economic prosperity relies on healthy ecosystems (Ministry for the Environment, 2020). It also acknowledges the relationship between freshwater and "Māori tribal identity", yet failed

to actually be directed by the knowledge of Māori or engage in discussion with hapū/iwi or Te Wai Māori about key focusses, such as the īnanga case study. Smith (1999) discusses the globalisation of western knowledge and culture, generally called universal knowledge, constantly reaffirming its own view of itself as the "centre of legitimate knowledge, the arbiter of what counts as knowledge and the source of 'civilized' knowledge". This failure by the government to act upon the principles it preaches is an example of this reaffirmation. We must see decolonisation of education institutions and policy systems to highlight important Kaupapa Māori values if we are to create a sustainable future before we reach the point of no return. Te Wai Māori Trust (2020) advocates for the primary consideration of tangata whenua Mātauranga when it comes to understanding the relationships and interactions between people and Papa. Tangata whenua understand that to uphold our roles as kaitiaki we talk about our peoples' wellbeing, the ora of our culture, and the ora of our waterways as one and the same (Ngata, 2018). Decolonisation of environmental policy will allow focus to shift from within our own lifetimes to a timeframe that considers many generations to come; this can begin with public education creating pressure to force policy changes.

In February 2017, policy changes were made to the National Policy for Freshwater Management 2014 that introduced various targets and considerations. These amendments came about after public outrage at the conditions of New Zealand's waterways; led by activist movements, such as the 'Choose Clean Water Campaign'. Public pressure on the then National government exposed questionable allocation of resources, where the government's intent was to make the state of Aotearoa's freshwater appear better than it was, rather than actually improving it (Knight, 2018). Although the amendments made were not as profound as what was envisioned by campaigners, it proved that public pressure can force governments to make U-turns in policy. Social movements can force governments to investigate how they exercise ongoing colonisation through reproductions of underlying assumptions and values of New Zealand's post-colonial social structure. Governmental agencies continue to produce lacklustre freshwater policy reforms that offer no considerable or radical benefits for the future of our waterways, or for tangata whenua partnership and decision-making authority. Continuing to privilege economic interests over the health of the whenua will be lethal for every-living being. Decolonisation of capitalist social structures will enable tangata whenua to equally share decision-making authority, and direct the creation of policies that privilege Mātauranga and Kaupapa Māori which enforce reciprocal relationships between ourselves and our whenua.

Under the decolonising framework perhaps we should discard the term 'resource management'. I believe that in lumping land, air, and water together as resources that should be managed, we continue to denote natural features as parts of a system separate to ourselves. We as tangata whenua are part of the system embraced by these taonga – they are living, they are our tūpuna. Directing our interactions with waterways from a Mātauranga framework will allow local mana whenua to reinvigorate their kaitiakitanga with local knowledge and whakapapa, and provide spaces for local reo and specific taniwha/kaitiaki to again move to the forefront of kaitiakitanga where they may have been lost from contemporary management. This understanding starkly contrasts against the western understandings of natural features as resources, but continuing to refer to them as such suggests they are present only as a means for our survival and exploitation. This understanding is incommensurable with Kaupapa Māori, whose values and whakapapa cannot be integrated into existing western frameworks. Further to the inability to make these whakapapa commensurable, understanding natural resources as ownable and exploitable is unsustainable and will drive every living thing on this Earth to extinction. Equal membership with tangata whenua and non-Māori in councils and non-government organisations will open spaces for creative collaborations to occur, where knowledge is pulled from multiple sources to make decisions that most benefit communities and future generations. Collaborative engagements can also enable the perspectives of women and younger generations to become prominent in spaces where they have previously been excluded or dismissed.

The Eurocentrism that has become embedded in ***every*** aspect of everyday life in Aotearoa must be given no further privilege, and decolonisation must be actively sought and applied if we are to prevent freshwater systems from permanently succumbing to the anthropogenic pollution that has been inflicted upon them. Decolonisation must occur across all disciplines, and it begins with the recognition that Mātauranga Māori cannot be integrated into existing Eurocentric frameworks. Our whenua and wai stand the greatest chance of restoration and protection once environmental policies are directed by kaitiakitanga, and rohe-appropriate tikanga becomes the norm. In Palmerston North and Dannevirke, local whakapapa and taniwha are not lost entirely from contemporary education in Te Ao Māori, and the mauri of the Turitea and Mahuraunui streams have substantial potential to be restored. The tenacity with which tangata whenua are demanding restoration of our waterways and transformations to wider societal structures is reflective of the aggression with which taniwha protect their homes. Our relationships with Hine Parawhenuamea and other poutiriao are critical to maintaining the mauri of wider livings systems and

cultivating new Mātauranga. Large-scale changes to catchment land use will best provide restorations along the entire lengths of our waterways, creating more spaces for communities to experience the calmness and grounding that healthy wai provides.

Chapter 5: A conclusion and mihi to the future

Mā te wāhine, mā te whenua, ka ngaro te tangata.

Without women, without land, the people will perish.

Also speaks to the essential role wāhine have through whenua (childbirth), and that we as a people are as connected to the whenua as a child is to its mother in her womb. These special bonds must be nurtured and protected (Stevenson, 2018).

Mātauranga Māori is a rich knowledge system encompassing national and local knowledge generated (and – some argue – incorporated from other sources and transformed for our own purposes) by tangata whenua. Te Reo Māori has been a tool to orally transmit local knowledge across generations, rooted in complex understandings of our position in the world and our relationships with poutiriao and taniwha.

The Treaty of Waitangi legally enabled colonialists to position tangata whenua, their values, and knowledge outside of what was considered valuable to the norms of British civilisation. The assumptions of Genesis that positioned men as having the power and rights to subdue every living thing were embedded within the social structure of colonial Britain. Countless colonial injustices severed connections of many tangata whenuas' connections, to each other, to their reo, and to their whenua, through legislature and violent land grabs. The underlying assumptions of the post-colonial social structure (that positioned people as separate to the land) enabled tangata whenua values and ways of life to be subjugated, and many forms of legislature to be passed that privileged capitalist goals over the health of the whenua. The 'Māori' identity was created to group together mana whenua, making it easier to discriminate them from the settlers, thus facilitating subjugation of the Māori culture and people (Consedine & Consedine, 2001). The Māori identity gave no consideration to the many distinct peoples and knowledge systems that exist(ed) in Aotearoa, and subjugation of local Mātauranga and tikanga was progressed by the institutionalisation of racism in education systems and society. Capitalism drove colonisation of Aotearoa and other countries (Barnes et al., 2018), and also brought to Aotearoa the class system that was/is dominant in the western world. Multiple discriminations have created exceptionally exclusionary circumstances for Māori women, and Aotearoa has been/is

still being pillaged for resources considered valuable and commodifiable by colonialists. Tangata whenua have always resisted colonisation of their whenua and knowledge, one of the earliest portrayals of this being the many signatures on Te Tiriti and not the Treaty.

The dominance of Eurocentric agencies and understandings enabled our interactions with the whenua to shift from local understandings of kaitiakitanga to land/resource management (Barnes et al., 2018). Many forms of kaitiakitanga directed our interactions with whenua and wai, all grounded in Kaupapa Māori values and informed in different rohe by the whakapapa of mana whenua. However, with legislation, land titles, and the severing of connections between mana whenua and whenua, colonialists had the power to determine how to use, 'develop', and exploit their land, separate from historical tikanga and the values of tangata whenua and wider communities (Barnes & McCreanor, 2019). The expansion of the agriculture industry and intensification of its processes has created some of the most detrimental pollutants to whenua, wai, and the atmosphere; with multiple mechanisms contributing to hypertrophication and increasing greenhouse gases, destruction of habitat, and water abstraction (Baskaran et al., 2009; Pinares-Patiño et al., 2009). These factors and pollutants interact and impact many different relationships with poutiriao, animals, plants, and taonga, leading to decreasing/loss of life-sustaining capacities of waterways and soil. Even now with expansive research, awareness of the necessity of sustainable land management, technological development, and community and organisational outspokenness against current land-use practices, the capitalistic values that drove land-use intensification are still privileged by government departments and legislature. As a result of environmental pollution, overharvesting of resources, poor harvesting practices (e.g. trawling), and cultural and financial impoverishment, many tangata whenua are now unable to collect kai, connect with Papa, or support their whānau and communities in traditional ways that benefit their mana and enhance local tikanga.

Universities in New Zealand were established under a paternalistic framework that considers itself and its assumptions universal. This has been particularly damaging for indigenous people because it facilitates the dismissal of their concerns. Access to tertiary education was made extremely difficult (impossible for a very long time) for women and indigenous peoples in Aotearoa and other colonised countries, and because of this there are lasting legacies that exclude *other* sources of knowledge. For example, Kaupapa Māori education is treated as supplementary, optional, and peripheral to the main focus of education. Situating Mātauranga and cultural values

outside of the main focus of education creates isolating environments for Māori students, and this isolating culture carries on through to tertiary education. Our education systems need to change so that young generations are receiving education from many sources of knowledge from a young age, rather than being immersed in a monocultural schooling experience. This will allow current and future researchers and teachers to privilege different sets of values to direct policy-making and our interactions with the whenua in a way that does not reproduce the effects of colonialist frameworks.

An effect of ongoing colonisation is that mana whenua and their Mātauranga have been, and still are, predominantly situated as peripheral to the 'real' knowledge capable of informing decisions and directing education, in favour of scientific knowledge. In response to local and global concerns, New Zealand's dominant framework has recognised that there is value in Mātauranga Māori and certain Kaupapa Māori concepts. However, environmental policies continue to undermine mana whenua's authority to carry out their own kaitiakitanga. Very few conservation and environmental mitigation/protection agencies and schemes direct their research and ventures from Kaupapa Māori perspectives, failing to privilege the values and goals of mana whenua and their Mātauranga. In many cases, the extent of Kaupapa Māori education in the Sciences, and wider schooling systems, attempts to graft Māori values into pre-existing post-colonial frameworks through the use of tokenistic Māori translations/phrases/kupu, rather than encouraging students to conduct research from a Kaupapa Māori perspective. Mātauranga cannot be valued in its entirety by colonial frameworks because their understandings of people and land are incommensurable. Furthermore, Vision Mātauranga (VM) may actually perpetuate the marginalisation of Mātauranga by premising engagements with tangata whenua on the assumption that the desire for economic growth is shared, and that spaces should be opened within existing colonial frameworks to accommodate knowledge generation. In practice, this assumption that Mātauranga should be commodified to facilitate pre-determined values (Barnes et al., 2018) also produces exclusionary conditions for tangata whenua by assuming Mātauranga Māori should be verified by new empirical evidence. By attempting to assimilate Mātauranga into a western framework, education institutes continue to reproduce the dominance of western scientific knowledge. In many cases the goals and aspirations of researchers and communities overlap, but capitalist values that are embedded in our social structures continue to prevent real transformation that would allow space for equal, successful collaborations that address local and global environmental and social concerns.

Ecology is a form of science which has developed to try to understand interactions between organisms and their environments. In real-life land management and conservation issues, ecologists are employed to conduct research and inform decision-making processes. However, additionally to *other* knowledges being marginalised by post-colonial frameworks, scientists often experience modifications and suppression of their research by government and industry employers (Driscoll et al., 2020). Globally dominant capitalist frameworks protect their political and economic interests by pressuring information about environmentally damaging policies and activities to be suppressed, downplayed, masked, or misleading to recipients and the public. This will be extremely damaging to the future of our whenua, as well as the hauora of future generations who are left to deal with irreversible environmental deterioration as a result of decisions made by past and current governments. There is still time for social movements that force changes in underlying values of social structures which can be driven by collaboration between researchers and communities. This will require movements and research to be driven by political, cultural, and ethical values. Intergenerational mamae is not something that tangata whenua separate from their kaitiakitanga and activism. It is a reality for us that is exacerbated by the racism embedded in systemic social issues. However, with education in Te Ao Māori, Te Reo Māori, the histories of mana whenua, and reflection of the normalisation of dismissing Māori concerns and Mātauranga, Pākehā researchers can more successfully enter and support community-led conservation in ways that privilege local Mātauranga and tikanga.

Furthermore, students awarded Ecology degrees are often inadequately prepared to negotiate multiple values/perspectives and knowledge sources, especially those grounded in Te Ao Māori which are deficiently taught in the Sciences. Workplace tensions and wider societal disservices that result from active pressure to exclude scientific and cultural knowledge demonstrates a conflict of values between incommensurable frameworks. Historical subjugation of women's knowledges also conflicts with Te Ao Māori. The paternalistic social structure and content of universities has contributed to ongoing underrepresentation of Māori, women, and especially Māori women in high ranking positions. Without these knowledge sources in Ecology, the way researchers manifest their research in the real-world can be negatively influenced, and curricula content continues to perpetuate marginalisation of *other* knowledge. Lacking participation of *other* knowledge can enable fragmentation of knowledge within the Sciences, and fundamental research to be separated from applied research and management. Ecology in its current state is useful for informing management as it is

currently understood. However, if we change our understandings of Ecology at the structural level, researchers can become politically, ethically, and culturally motivated to expand their research to benefit communities and engage with their social and environmental concerns in ways that are meaningful to those communities. This can contribute to transforms in our current understandings of whenua and wai as resources. Teaching researchers how wider societal values influence their research can enable social movement to force structural change that stops the privileging of economic interests over ecological and social concerns.

Environmental sciences speak to the importance of sustainability and kaitiakitanga which are also recognised by VM. However, this is contentious because the concepts are not synonymous. The content of Environmental science courses is still premised on colonial understandings of land as a resource, rather than being grounded in Kaupapa Māori understandings in the way kaitiakitanga is. Mātauranga does not fragment and isolate knowledge, and the jarring contrast between lived realities and the culture and content of university, specifically in the Sciences, can contribute to low rates of success for Māori students. These factors combine to produce conditions where the intentions of VM are not achieved in tertiary systems, and the way we understand and classify the value of knowledge is not pressured to change. Reducing Ecology to a value-neutral discipline disconnects it from its philosophical histories (and whakapapa), and inhibits its students from comprehending wider, complex relationships that are innate in Mātauranga. This environment, that simultaneously perpetuates assimilation and marginalisation of cultural knowledge and ways of life, creates internal conflicts within Māori students, myself included, that makes university life and education extremely difficult to complete, especially with disconnected or small support systems. I identify Ecology as a discipline that should not separate applied from fundamental research, for they cannot meaningfully contribute to real environmental and social improvement without each other.

Many non-Māori researchers and ecologists appreciate Mātauranga frameworks, and recognise that structural transformations led by Mātauranga offer potential for changes in our understandings that result in effective environmental rehabilitation. However, Ecology in its current form grafts Kaupapa Māori values and concepts into its content, teaching students that assimilation of Māori values into pre-existing management plans, grounded in an incommensurable framework, is acceptable. This mentality is dominant in collaborative conservation scenarios, and works to maintain power imbalances without admitting they exist. Te Ao Māori understandings of our

relationships as many peoples ***and*** as whenua/wai disrupt current neoliberalist social values that situate economic gain as the primary interest of society. Tangata whenua understandings of knowledge generation enables tools from different knowledge sources be utilised to aid in knowledge creation to inform decisions around contemporary environmental/social issues.

The MCI and other western scientific tools are valuable mechanisms to facilitating our understandings of sources of pollution, their impacts, and how they can be addressed. They provide specific information about relationships within ecosystems, and the data and information gathered by them can be easily recorded for monitoring purposes and shared with wider communities. Scientific tools also enable researchers to communicate internationally in collaborative engagements to share experiences, successes and failures. Environmental concerns that are shared globally provide opportunities for marginalised communities to strategically create alliances; share knowledge embedded in similar relationships with Papa and experiences of colonisation; develop techniques and solutions to address sources of anthropocentric pollution; and contribute to social movements forcing transformations within overarching social structures. Kaupapa Māori measures of assessing stream health are embedded in understandings of connectedness and relationships between poutiriao and kaitiaki, and the health of the whenua is intrinsically tied to the health of the people. The globally dominant mentality that commodifies natural 'resources' conflicts with many indigenous understandings of people and whenua, but increasing global awareness of imminent environmental catastrophes has opened spaces for communities and researchers to collaborate. Local innovative projects have resulted from these collaborations that aim to address local effects of anthropogenic change, however, global structural change needs to occur to disrupt the sources of these effects.

Historical knowledge and whakapapa of an area is critical to understanding how the whenua may react to negative changes ***and*** restorative efforts. Community responsibility is critical for kaitiakitanga to maintain and uplift the hauora of the whenua (and so the people) because the very nature of kaitiakitanga espouses caring for our tūpuna (the whenua) and each other. However, mana whenua understandings of whenua and wai are not adequately represented in the Sciences. In kaitiakitanga of rivers and waterways, kupu describing the behaviours, habitats, mauri, and tapu of water can inform mana whenua about how and when to use different kinds of wai, and how the wai may sustain life. Te Reo Māori and Mātauranga Māori espouse

connectedness and reciprocal relationships between tangata whenua and Papa, thus, assessments of river health rely not only on observations within waterways themselves, but also of the wider living systems and catchments. Wai Ora Wai Māori is a tool that mana whenua can utilise to survey stream health using values important to them, including 'unobservable' pollutants to Te Ao Māori, such as disconnect between mana whenua and whenua, loss of reo, and impacts upon the mauri and tapu of living systems. From my participants' surveys it was clear that kupu describing freshwater behaviours was less relevant to their assessments of stream health than their observations of the wider areas and their general whakapapa. Addressing interacting sources of pollution that have diminished the mauri of mahinga kai and waterways, and impacted to the mana and hauora of communities, may be more immediately relevant to contemporary kaitiakitanga than engaging with kupu māori. The apparent decrease in relevance of kupu to kaitiakitanga may also be an effect of colonisation upon Te Reo Māori. VM was implemented to assist Māori success in research and science, yet our reo, a critical aspect of our identity, is not adequately represented in scientific assessments of river health, and Matauranga is often overlooked as an informed management perspective (Whaanga, 2018).

Western scientific research was critical to disrupt/disprove widely held beliefs of our world, and change the direction of knowledge creation from that which originated under the assumptions of Genesis to knowledge creation originating within an objective framework. Scientific tools, research, and knowledge are valuable components that will contribute to societal progression toward, and functioning under, relational frameworks underpinned by principles of complex interconnectedness, community wellbeing, and cultural identity. Moving forward our navigation of many societal values will be critical to the hauora of our whenua and people. Our governments recognise the desperate and worsening state of our waters, so how can collaborations and social movements be framed in ways that influence societal responses to the sources of these problems? Legislative acknowledgements have potential to act as vehicles for mana whenua to uphold kawa, but do they realistically translate into means for tangata whenua to protect their tūpuna from pollution and abstraction when social structures privilege conflicting values? Legal personhood enables hapū/iwi to speak for the taonga's interests through westernised systems, emphasising the health of the river rather than economic interests (Stewart-Harawira, 2020; Morris & Ruru, 2010). If this type of legislation and the recognition of the principles of Te Tiriti are to set a precedent for the government's commitment to Te Ao Māori, how can our generations ensure that this commitment is absolute? This is also true for the dominant culture of education

systems. So how do we balance objective research and value-laden sources of knowledge to address contemporary freshwater concerns without reproducing colonialist assumptions or appropriating any framework? It is possible that Mātauranga-led restorative projects can be informed by western scientific tools and knowledge, and in freshwater ecology, we must change how we speak about our whenua and wai. This could mean reconstructing our understandings of 'resource management', literally and in application. How do we share knowledge from all of our baskets now so that we may reconnect with Papa and encourage researchers to be politically and culturally motived?

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Appendix

Kupu	English	See also and extra info
āniwaniwa	deep water	Rainbow / pou (te) āniwaniwa - back post of meeting house to support back wall
arawaru	sound of running water	eel – Whanganui / *onomatopoiea*
āria	deep water between two shoals	stretch of water suitable for working a net
au	current	
au kaha	strong current	
au mārire	gentle current	
au taha	side current	
haemanga	streamlet	
hākekakeka	brown, slimy, moss-like growth in stagnant or slow-running water	
hawai	watercourse, rivulet, channel in a stream, irrigate	Hāwai / Giant Bully, black kokopu - Lake Taupo, bullhead
hawai	shallow of swamp, lagoon	
hawe	bend in river	
hiku	headwaters	hikuawa
hikutau	head of river, valley	end of a season
hikuwai	source of stream, reservoir	
hīrere	gush, torrent, waterfall	
hīwai	open water in swamp	
hīwawā	babble, purl	Teoteo / shallow water, brook
hōkikitanga	headwaters	Hei te wā e tā ai, ka hui ki roto ki ngā awa ririki ki ngā hōkikitanga ki te whakawhānau. *At the times when they are resting, they gather in the small streams and the headwaters to spawn.*
Honu	freshwater	Hōhonu / turtle
hōpua	pool, puddle	
huhuka	foaming	
hukitau	headwaters, head of valley	
kahu o te wai	water surface	
Kare (Tainui)	ripple	pōkare
karetai	ripple across surface	
Kātao (Rarawa)	water	mātao - cold
kautawa	tributary	
kōawa	canal, narrow gully, watercourse	
kōhuhū	spring, well up of water	Black matipo
kōhuhutanga	source of stream	

kohuwai	greenish moss-like growth in slow-running fresh water	
kōmanawa	spring	
kōmingomingo	whirlpool	
kōmiro	whirling current	
kōngutu	mouth of river	
kōpiha	pool	koropiha
kōpikopikotanga	winding, meandering	
kōpua	deep pool	Netted bag to hold the stones forming the karihi, or sinker, of a fishing net
kōpua kānaenae	deep dark hole in river	
kōpukanapanapa	deep pool	
kōripo	eddy, whirl, swirl	
kōroto	deep lake or pool	
Korou (Rarawa)	river, channel	
kōwarowaro	having high, steep banks	
kōwhitiwhiti	leaping, dancing of water	Watercress / to shell (pipi etc)
kuikuinga	streamlet	
kuinga	source of stream, small stream	
kūitinga	narrow	
kūkūpango	riverbed	
kupere	flowing swiftly	
kūtere	flow together	
maero	channel	
manawa whenua	deep underground spring	
manga wai	stream, brook, rivulet	
manowai	deep running water	
māpunapuna	rippling	māpuna
māringiringi	flow little by little	
mata o te wai	surface of water	
mātāpuna	source of river	
matatiki	spring of water	
mimi	creek	
mongi	Water, liquid	ngongi
mote	water	probably only a local substitue when the word wai had been rendered tapu
ngā rau matatiki	strong gushing spring	
ngāwhā	geothermal	
ngutu awa	river mouth	
orowaru	sound of rippling water	
oruoru	rough, broken water	
pāhīhī	flow in driblets	
pākihikihi	shallow	
pāpaku	shallow	

papawai	pool	pāpāwai - fish basket, fern root
pārua	pit/depression beside a stream for receiving eel when caught with a bob	
pātere	flow freely	
pāti	shallow, shoal	
pī	source, headwaters of stream	
Pininga (Ngāi Tahu)	stream which disappears underground	
pīpipi	shallow	
popohe	rough water	
Pūaha (Waikato)	river mouth	
pūau	river mouth, rapids, ripple	
pūheke	flow	
puia	hot spring	
pūkaki	source, confluence of rivers	
pukenga	floodwaters	
puna	spring	
pūngarungaru	rippling, wavy	
rauiri	eel weir	
rere	flow	
ripo	whirlpool, eddy	
rire	deep	
rua	hole in bank where eel dwell	
tāheke	rapids	
takere o te awa	riverbed	
tārere	flow copiously	
tāwaha	rivermouth, lake outlet	
teretere	flow	
tōhihi	puddle	
toiremi	strong current	
tuki	central passage for water in eel weir	
wahapū	mouth of river	
wai	water	
wai māori	freshwater	
waiariki	hot springs, healing water	
waiere	waterfall	
waihoroi	water for washing	
waiinu	drinking water	
waikarakia	water used to say karakia over thing or person	
Waikaukau (Tūhoe)	waters	
waikawa	acidic, sour, rancid slow moving water	
waikino	polluted water	

waikotikoti	water to assist with cutting of hair	
waimakariri	cold water	
waimarino	still water	
waimate	slack water, or water that has lost its mauri	Taimate / may have been used in places of contamination and tapu, historic battles, dead, damaged or polluted water, where water has lost the power to rejuvenate itself or other
wainuku	groundwater	
waiparu	clouded water	
waipuke	flood	
waipukepuke	water whipped by the wind to form peaks	
waipiro	odourous water	
waipuna	spring	
waitai	seawater	
waitapu	tapu water	
wai tawaka	channel, canal	the water in which the tawaka (mushroom) was cooked / tawaka- to be grooved, channelled / tāwaka – male kākā
waitohi	areas of pure water	Tohi - to initiate, baptise using water
waiunu	drinking water	
waiwhakaika	specific ceremonial waters for the embedding of knowledge	
wai whakaheke tūpāpaku	water burial sites	
Wei (Rarawa)	water	
whaiawa	riverbed	
whakaipurangi	source of a stream	
whakarētō	deep	
whakaroto	still water, no current	
whakatakere	riverbed	
whanga	stretch of water	
wheuri	deep	
whirowhiro	eddy, whirl, swirl	dabchick/little grebe
wīwī	Make a rippling sound	